

Dwarf minke whales in the Great Barrier Reef

CURRENT STATE OF KNOWLEDGE

May 2002



Cover photo: Alastair Birtles, CRC Reef

Dwarf minke whales were first recognised as a distinct form in the mid 1980s and there is still little known about them. They attracted attention in northern Great Barrier Reef waters because they regularly approached close to boats and swimmers.

While many countries have banned programs where visitors can swim with whales, a swim-with-whales industry has developed in waters of the northern Great Barrier Reef based on the voluntary approaches of dwarf minke whales.

To ensure the encounters have a minimal impact on the whales, research is being focused on learning more about the dwarf minke whales and their interactions with swimmers.

A lack of knowledge about basic aspects of the biology and behaviour of these inquisitive visitors to the Great Barrier Reef presents many unique challenges for marine park managers, dive industry operators and their clients as well as researchers. The interactions between humans and whales must be managed so that they are ecologically sustainable.

Whales and dolphins

Whales, dolphins and porpoises are mammals that are classified in the order Cetacea. There are at least 85 species of cetaceans throughout the world; new species are still being described. More than 30 species are likely to occur in Reef waters. There are two groups of large whales; toothed whales and baleen whales.

Toothed whales

Most of the whales found in the waters of the Great Barrier Reef are toothed whales. These include the coastal Indo-Pacific humpback dolphin *Sousa chinensis* and Irrawaddy dolphin *Orcaella brevirostris*, the widespread bottlenose dolphins *Tursiops truncatus* and *T. aduncus*, spinner dolphins *Stenella longirostris* and large dolphins such as the short-finned pilot whale *Globicephala macrorhynchus*, false killer whale *Pseudorca crassidens* and, more rarely, the killer whale *Orcinus orca*.

Baleen whales

Minke whales *Balaenoptera acutorostrata* and *B. bonaerensis*, like the humpback whale *Megaptera novaengliae*, belong to a group of whales which lack teeth. They have 215 - 325 baleen plates that hang from either side of the roof of the mouth. As a minke whale opens its mouth to feed, its pleated throat expands like a pelican's pouch to engulf schooling fish or euphausiids ("krill"). When the throat is compressed, water is forced out between the baleen plates, trapping the food against a sieve formed by the bristles along the inner edge of each baleen plate.

Minke whales

Until recently, it was thought that there was a single, variable species of minke whale throughout the world's oceans. The 'true' minke whale *Balaenoptera acutorostrata* is known only from the Northern Hemisphere. It has a characteristic white band across the middle of the flipper. The Antarctic minke whale *B. bonaerensis* is found mostly in the Southern Hemisphere. It lacks the white band on the flipper and has a light to dark-grey shoulder.

Photo: Alastair Birtles, CRC Reef



The dwarf minke whale has a white shoulder and flipper base with a very dark grey patch on the throat.

The dwarf minke whale is known only from the Southern Hemisphere. It has a white shoulder and flipper base, with a dark-grey tip on the flipper. Unlike the Antarctic minke whale, it has a large dark patch extending onto the throat. Female dwarf minkes are on average about two metres shorter than Antarctic minkes (in baleen whales, the female is larger than the male). The largest dwarf minke whale that was accurately measured was 7.8 m long; adults weigh 5–6 tonnes.

Both Antarctic and dwarf minke whales are found in Great Barrier Reef waters. However in six years of surveys, only one Antarctic minke whale has been seen in the northern Great Barrier Reef (compared with up to 200 dwarf minke whales per season).

Studies of the morphology, skeletal structure, colour patterns and genetics of the dwarf minke whale indicate that it is more closely related to the Northern Hemisphere minke whale than it is to the Antarctic minke whale. It is probably an as yet un-named subspecies of *Balaenoptera acutorostrata*.

Hunting

Commercial whaling targets the Northern Hemisphere minke whale in Norwegian waters. The Antarctic and north Pacific minke whales are the object of scientific whaling research by Japan, with about 400 and 100 whales respectively taken from each species each year.

Dwarf minke whales were taken during commercial whaling in South African waters until this ceased in 1975. Sixteen dwarf minke whales were taken in the Japanese research whaling program but since 1993, no takes have been reported to the International Whaling

Commission. If commercial whaling were to resume in the Southern Hemisphere it would target Antarctic minke whales. It is possible that some dwarf minke whales would also be taken incidentally.

Biology

Distribution

Dwarf minke whales are found in the waters of South Africa, Australia, New Zealand, New Caledonia, Vanuatu and the east coast of South America. They have been recorded from all states of Australia (except Tasmania) but not yet from the Northern Territory. On the Great Barrier Reef, dwarf minke whales have been recorded from north of Lizard Island to the Swains Reefs. This may reflect the distribution of vessels more than the actual distribution of the whales.

Between December and March, most sightings of the dwarf minke whales are in sub Antarctic waters (58° - 60°S) to the south of Australia and New Zealand. They are occasionally found close to the ice edge (at 65°S).

Between March and October, dwarf minke whales are seen in the northern Great Barrier Reef, with about 80% of sightings in June and July. Whether this reflects the actual abundance of the whales or only that part of the population that is more likely to interact with vessels is unknown.

Age and breeding

The life span of dwarf minke whales is unknown. Other minke whales live for 50–60 years. The life span is calculated by counting the number of layers in a waxy plug near the eardrum. The layers are thought to be deposited each year.

Dwarf minke whales reach sexual maturity at about 6.5 m long when they are probably about 6–8 years old. Based on what is known about other minke whales, dwarf minke whales probably have one calf each year. It is about 2 m long at birth. Minke whales suckle their young with a rich milk that contains about 30% fat (human milk has about 4% fat). Calves are probably weaned after 5–6 months; the shortest period reported for any cetacean.

Small calves of dwarf minkes are recorded in Australian waters from May to July. Usually, only one or two cow and calf pairs are seen per season in northern Great Barrier Reef waters. This suggests either that these waters are not a major nursing area or that cows with calves do not regularly approach vessels there.

Gender

In many toothed whales, the male is much larger than the female or has a different body or fin shape. Male and female dwarf minke whales are not so easily separated. Their gender can be determined by the shape and position

of the genital slit. In males, the slit is further forward and obviously separated from the anus. In females, the genital slit is close to the anus and there are mammary slits on either side of it.



Photo: Alastair Birtles, CRC Reef

This female whale has the genital slit close to the anus (right, near tail). The navel (centre) and throat pleats (left) can also be seen.

Feeding

The great whales, such as blue and humpback, undertake regular migrations between higher latitudes (where they feed) and lower latitudes (where calves are nursed). During their stay in subtropical and tropical waters, they feed little and apparently subsist on energy reserves laid down at high latitudes.

It is not known whether migration of dwarf minke whales follows this pattern. They are known from sub Antarctic waters during December to March and whales taken there have been feeding on open-ocean lantern fishes and krill. Dwarf minke whales have never been seen feeding on the northern Great Barrier Reef. With their

much smaller size, dwarf minke whales cannot lay down energy reserves to the extent of their larger relatives. It is possible that while they are in the tropics, they feed opportunistically in the open ocean.

Speed and diving

Dwarf minkes are highly manoeuvrable and can jump from the water like a dolphin. They can swim in bursts at 12 knots but cannot maintain this speed. They have been seen repeatedly circling a vessel that was cruising at 8.5 knots.

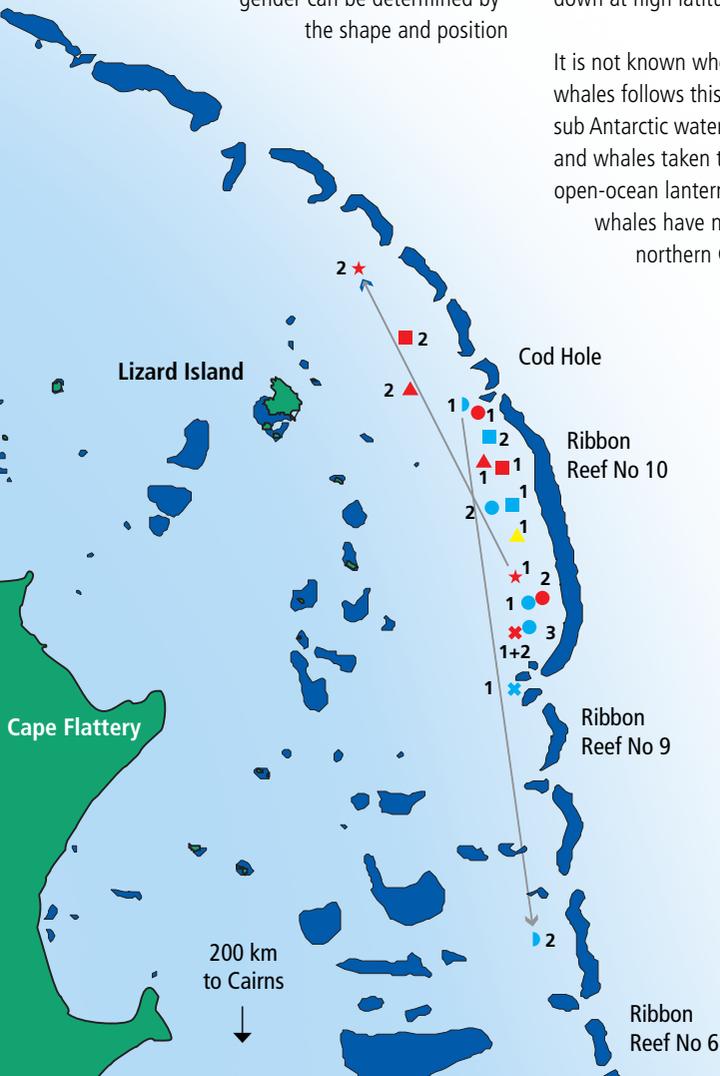
Like all mammals, minke whales have to breathe. Their paired nostrils (blowholes) are on the top of the head. Dwarf minke whales usually surface only once with a smooth arching of the back, then dive for periods from 0.5–12 minutes.

Toothed whales such as the bottlenose whale *Hyperoodon ampullatus* and sperm whale *Physeter macrocephalus* can reach depths of 1.5–2 km. Most baleen whales are relatively shallow divers, remaining in the upper 100–200 m of water. Dwarf minke whales have been seen swimming at 20–40 m depth and one dwarf minke whale was recovered from a net set in 140 m of water off the South American coast (although it is not certain that the whale was trapped at that depth).

Sounds

Minke whales, like all baleen whales, lack the system of air sacs and sound-generating 'phonic lips' in the forehead region above the skull, that are found in toothed whales, such as dolphins. In minke whales, the sounds probably come from the larynx, although none of the baleen whales have vocal cords.

Dwarf minke whales produce sounds between 50–9400 Hz, which are within human hearing range of 18 Hz–20,000 Hz. The most characteristic sound made by the whales is a mechanical-



Location of selected whales seen repeatedly through 1999-2001

Individual whales	Year of sightings	Distances travelled (km) and time (days)
● Old Pucker	■ 1999	Longest distances
■ Cockatoo	■ 2000	→ ★ 40 km north in 2 days
× Multi MM Scar C	■ 2001	→ ● 60 km south in 19 days
▲ Wiggly Nape Streak		
★ Shark Attack		
● Tail Tinsel		
	Numbers (1–3) next to symbols show order of within-year sightings.	Distances of 0–20 km
		● in 13 days ● in 17 days
		■ in 7 days ■ in 2 days
		× in 7 days
		▲ in 7 days

sounding call that has three rapid pulses and a longer trailing note. They also produce a series of pig-like grunts, moans and belches.

There is no evidence that any of the minke whales can produce very high frequency (100,000 Hz) signals that dolphins make and use for fine-scale echolocation. The lower frequency sounds made by dwarf minke whales might help them locate large structures e.g. reefs. The intense sounds travel long distances in water and may help whales stay in contact even when they are far out of visual range.

Predators

Because of their large size, most species of adult baleen whales appear to be rarely attacked by sharks. However, dwarf minke whales may be more regularly attacked by large sharks such as the tiger or great white. Dwarf minke whales have been seen with scars from shark attacks as well as tooth rake marks that may be from killer whales or false killer whales. The relatively small calves would be particularly vulnerable to shark attack.

The open ocean cookie-cutter shark *Isistius* sp. could be considered a 'micro-predator'. It can reach 0.5 m in length and regularly feeds on mid-water fishes and squids that it swallows whole. The cookie-cutter shark also feeds on large oceanic fishes, whales, dolphins, turtles and elephant seals. The teeth of the lower jaw act as a unit and can gouge a plug of blubber, leaving a distinctive oval scar. Dwarf minke whales have been re-sighted inside the Ribbon Reefs of the Great Barrier Reef with a new oval scar (see map), suggesting that in the intervening days between sightings they had been in open waters of the Coral Sea.

Parasites and hangers-on

The barnacle *Xenobalanus* sp. embeds itself on the trailing edge of the tail fin (flukes) and, occasionally, on other fins of dwarf minke whales. Several dozen barnacles can attach in a row along the hind edge of the tail fin, giving the appearance of a dark, tattered fringe. As with other barnacles, they probably filter food from the water.

Pennella sp. is a highly modified parasitic copepod crustacean, which can look like a piece of fishing line or a tag, hanging from the skin. It grows up to nearly 0.3 m in length and is the largest copepod in the world. The copepod embeds its head in the blubber of the whale and feeds on its blood and inflamed tissue.

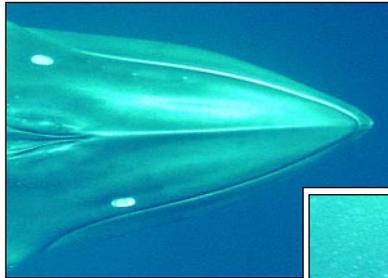


Photo: Alastair Birtles, CRC Reef

Above: Fresh oval scars on head of whale, probably from cookie cutter shark.
Right: Old healing scars on flank of "Old Pucker", a whale seen repeatedly (see map).



Photo: Alastair Birtles, CRC Reef

Remoras *Echeneis naucrates* are occasionally seen attached to dwarf minke whales, although the whales actively try to avoid them.

Recognising individuals

The colour patterns of dwarf minke whales are the most complex patterns of any baleen whale. They are different on each side of the whale and can be used with the position of the scars as a natural tag to identify individuals.

Researchers use underwater photographs and digital video showing both sides of the whales to help them identify individual whales. This enables researchers to study the distribution, social groupings, residency times and patterns of movement of the dwarf minke whales. It is also helping researchers to study the potential for cumulative impacts on the whales from the growing number of vessels that are involved in swim-with-whales activities.

Re-sightings

In the Northern Hemisphere (40°–50° N), some minke whales return to mid latitudes each year while some may stay in the area throughout the year.

Within a season in the northern Great Barrier Reef, about 100 dwarf minke whales are usually identified, of which 15–20 are seen two or three times in a six-week period (see map). Whales have been re-sighted at the same location more than two weeks later, while others have been re-sighted both north and south of their original location. In the same season, the greatest distance between sightings was 60 km and longest time between sightings was 19 days.

Four dwarf minke whales have returned to the same area (between Lizard Island and Ribbon Reef 10) after one or two years (see map). Three of the four whales were female. This is the first time that minke whales have been shown to show site fidelity in low latitude waters.

Although dwarf minke whales are seen along the entire east Australian coast, it is possible that there are several discrete populations that return to specific locations from year to year. It is important to determine the proportion of whales that regularly return to the same sites on the northern Great Barrier Reef. This will help determine the potential for impacts of the swim-with-minke whales activities.

Whales in an encounter

When a vessel is moored near a reef, the most common approach is by a single dwarf minke whale. However, groups of 12 whales have been seen at some sites such as Pixie Reef and the Lighthouse Bommie, behind Ribbon Reef 10.

In open water, more whales are usually seen in encounters. During one drift for 18 km, 25 whales were seen, although they were not all present at the same time. In open water, the whales that first approach the vessel may stay in contact throughout the encounter, and others join in for varying lengths of time.

The whales which approach vessels in the Great Barrier Reef vary in size - from calves smaller than 3 m long to adults estimated to be longer than 8 m. Many of the whales are less than 6 m long and would be juveniles or just maturing.

The composition of a group of whales that contact a vessel changes over days and weeks. This is also the case for other baleen whales where the only stable association is between cow and calf. However, certain dwarf minke whales have been seen together during more than one sighting and it is possible that there is a loose social structure within groups of whales.

Photo: Alastair Birtles, CRC Reef



Belly presentation

Photo: Stan Kielbaska



Jaw gape

Photo: Alastair Birtles, CRC Reef



Headrise

Photo: Filip Nicklin, Minden Pictures



Breach

Behaviour

It is only possible to speculate on the meaning of the following behaviour of dwarf minke whales.

Headrise and spyhopping - Headrise is when the whale's snout rises from the water. If the head is raised further, exposing the eye, it is called a spyhop. Both behaviours are probably to enable the whale to look at surface activity.

Breach - at least half of the whale (and sometimes the whole whale) leaves the water in a spectacular leap. Breaches are usually oblique and the whale often lands back in the water belly up.

Bubble blast - an explosive cloud of bubbles is released from the blowhole. When the whale releases a stream of bubbles as it swims, this is called a bubble trail. Neither behaviour appears to be consistently directed at swimmers or vessels.

Belly presentation - the whale rolls on its side and exposes its belly towards a swimmer, the vessel or other whales. The whale may continue to roll onto its back or undertake a full 360° roll.

Jaw gape - the mouth is opened, exposing the baleen plates and water flows into the mouth expanding the throat pouch.

Jaw clap - has been rarely seen. The jaws are brought together with a loud crack. This may be a sign of excitement or aggression.

Speeding-up, veering away - these are signs that the whale has been disturbed.

Swimming with whales

On the Great Barrier Reef, people may swim with whales in Commonwealth waters (which extend from mean low water in the Great Barrier Reef Marine Park) only if the whales initiate the encounter. Regulations govern people's behaviour during an encounter.

In permitted tourism programs, the crew should provide a detailed briefing to ensure that passengers are fully aware of the regulations and procedures for swimming with whales. Both passengers and crew must make sure that the activities occur on the whales' terms. Whales are large, wild animals and should be treated with respect.



Snorkellers holding a rope in open water.

Photo: Alastair Birtles, CRC Reef

In the following guidelines for swimming with dwarf minke whales, the points in bold are part of Australian legislation and are mandatory:

- **Never swim towards a whale.** Under Australian Government regulations, it is forbidden for a swimmer to approach closer than 30 metres to a whale. However, if whales come closer than 30 metres to a swimmer, the swimmer is not in breach of regulations.
- **Do not touch or make physical contact with the whale.** Touching a whale could transfer disease, scare away the whale or cause injury (to both people and whales).
- Be predictable in your location (whales tend to approach closer when movements are predictable). Hold a rope, especially in open water where safety is a concern. If approached by a whale while scuba diving, hold a safety chain/ bar or mooring line when available.
- Enter and exit the water quietly.
- **Avoid all rapid movements while in the water.**
- Take care when entering or leaving the water - seas may be rough and entry and exit can be potentially dangerous.
- Use a wet suit but not a weight belt.
- Lie parallel to the surface, i.e. with legs up (whales tend to dive deeper under a snorkeller who is hanging vertically in the water).
- The use of snorkel is recommended.
- Take photographs using natural light. The effects of multiple electronic flashes on whales is potentially disturbing.

Future research

There is still much to learn about dwarf minke whales and their interactions with swimmers. Researchers are focusing on improving interpretation for visitors, measuring the effectiveness of management guidelines and regulations in ensuring interactions with the whales are ecologically sustainable, and learning more about minke whale behaviour. Other research priorities are to continue to identify whales using photographs and video which will

help assess any cumulative impacts of tourism on the whales. To help understand whether crucial aspects of the life history e.g. mating, may be impacted by swim-with-whales activities, more information is needed about the sizes of the whales (and thus, maturity). This information is being gathered using underwater video and a portable range finder which determines distance from the whale and thus field of view in the video.

How you can help

- Ensure that you are prepared for swimming with whales. Being close to a large, wild animal is a powerful experience. Be prepared by reading the guidelines, attending pre-dive briefings and following instructions from the crew. This will minimise impact on the whales and enhance your experience.
- Participate in approved research being conducted on board e.g. filling in questionnaires, making behavioural observations on the interactions with whales.
- Supply copies of your photographs or video together with the date, time and location of the sighting. This can help by adding new whales to the catalogue of identified individuals or by documenting a re-sighting of a previously identified whale. The information helps to build knowledge of the whales' movements.



Bubble blast

Photo: Alastair Birtles, CRC Reef

The Minke Whale Project is a joint initiative of researchers at James Cook University, the Museum of Tropical Queensland and *Undersea Explorer*. The research has been supported by the live-aboard dive boats through the Cod Hole and Ribbon Reef Operators Association. It has been partially funded through a Natural Heritage Trust grant, through the Marine Species Protection Program of Coast and Clean Seas. Additional funding was provided by CRC Reef Research Centre Ltd.

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Ensuring the future of the world's coral reefs

CRC Reef Research Centre Ltd is a knowledge-based partnership of coral reef researchers, managers and industry. Its mission is to plan, fund and manage world-leading science for the sustainable use of the Great Barrier Reef World Heritage Area.

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- Association of Marine Park Tourism Operators
- Australian Institute of Marine Science
- Great Barrier Reef Marine Park Authority
- Great Barrier Reef Research Foundation
- James Cook University
- Queensland Department of Primary Industries
- Queensland Seafood Industry Association
- Sunfish Queensland Inc.

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Established and supported under the Australian Government's Cooperative Research Centres Program