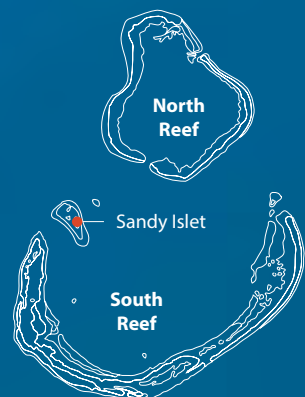




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Turtles

Turtles may swim over 1000 kilometres to reach tiny Sandy Islet at Scott Reef, where they will lay several clutches of eggs before again returning to their foraging grounds.



Sandy Islet is a tiny spit of white sand in the vast blue expanse of the Indian Ocean. Aside from a few rocky outcrops, this unvegetated island is the only part of Scott Reef that is consistently above the high water mark. It is so small that a person can walk around it in less than half an hour, yet its existence is vital to the turtles that visit its shores to nest. Each summer, dozens of turtles make their way to the islet where they excavate shallow sandy nests to deposit large numbers of eggs. Several weeks later, hatchlings emerge and the young turtles make their way into the ocean. They may eventually return to the Sandy Islet as adults, to lay their own eggs.

Nesting season arrives

Each summer, many green turtles make the long swim to Sandy Islet to lay their eggs. The islet is unusual in that it lacks the rocks, vegetation or other obstacles that usually limit turtles nesting on a beach. As a result, they are able to move freely across the entire sand cay. In fact, turtles can be fussy about where they place their nests, and have been observed roaming across the sand but then returning to the water without nesting.

The turtles clearly show preferences for certain nesting areas on Sandy Islet – but these choices sometimes lead to disaster. During peak season, turtles will often excavate an existing nest while digging, killing the now-exposed eggs. In crowded conditions, some turtles may also dig below the tide line, where the nest becomes flooded by seawater and the eggs do not survive.

Since early 2006, when turtle monitoring began at Scott Reef, hundreds of green turtles (*Chelonia mydas*), and a single hawksbill turtle (*Eretmochelys imbricata*), have been observed nesting at Sandy Islet. During eight surveys, researchers have tagged more than 490 female green turtles, mostly during summer nesting seasons from late November to February.

The surveys revealed that the number of nesting green turtles at Sandy Islet varies markedly from one year to the next. During the summer of 2005–2006, for example, the average number of turtle tracks counted per night was 16 during peak nesting periods. In contrast, during the peak nesting period in 2008–2009 there were substantially more tracks – 53 per night in December 2008 and 72 per night in January 2009. The total nesting population of green turtles at Scott Reef was estimated at between 389 and 1476, but further studies are required to produce a more accurate estimate. The green turtles that nest at Scott Reef, and at Browse Island almost 200 kilometres to the east, form a separate group within the world's populations.

Scientists believe the number of turtles nesting at Scott Reef each year is influenced by a range of factors, including sea surface temperatures, fluctuating oceanographic and climatic conditions, and even the condition of feeding grounds hundreds of kilometres away.

Turtle nesting at Sandy Islet

Mature green turtles (*Chelonia mydas*) leave their feeding grounds and swim hundreds of kilometres to lay eggs on Sandy Islet at Scott Reef. By the time the eggs hatch, the adults have already started the long journey back to their nearshore foraging areas. The emerging hatchlings swim into the open ocean, where they remain for several years before eventually travelling to the feeding grounds as sub-adults. When they are 20–50 years old, some will return to Sandy Islet as mature adults to continue the cycle of life.

Females emerge from the water and haul themselves up the beach to nest at night. Once a suitable site is found, the turtles dig for hours before laying around 100 eggs into the nest. Exhausted, the females then make their way back to the water.

Turtles mate in the shallows near Sandy Islet.

At Scott Reef, a female may lay up to five clutches of eggs during a single summer. Between each nesting, she rests for several days in the inter-nesting habitat adjacent to Sandy Islet.

Sandy Islet is distinguished by a now-derelict weather station, which was operational between 1970 and 1995.

Between their nest and the open ocean, the hatchlings are at risk of being consumed by predators, such as birds and fish.

The tiny hatchlings must dig their way out of the deep sandy nests, before heading instinctively to the water and swimming towards the relative safety of the open ocean.

Green turtles (*Chelonia mydas*) are widely distributed throughout the tropical and sub-tropical regions of the world's oceans. They are by far the most common species of turtle at Scott Reef and, since 2006, researchers have recorded hundreds of nesting females on Sandy Islet.



Each night during summer, many turtles dig carefully-positioned nests across Sandy Islet. Two to three months later, the hatchlings dig themselves free of the nest and instinctively head towards the waterline. The hatchlings begin their life alone, as their mothers have already left for feeding grounds hundreds of kilometres away.

New beginnings, old haunts

Turtles undertake a massive journey to reach Scott Reef and lay their eggs. The female green turtles that nest on Sandy Islet return, on average, every three to six years and lay up to five clutches of eggs in that season. Clutches can contain more than 100 eggs – a huge energy investment for the mother. Within the nests, about 75 per cent of hatchlings are incubated successfully and emerge from their eggs.

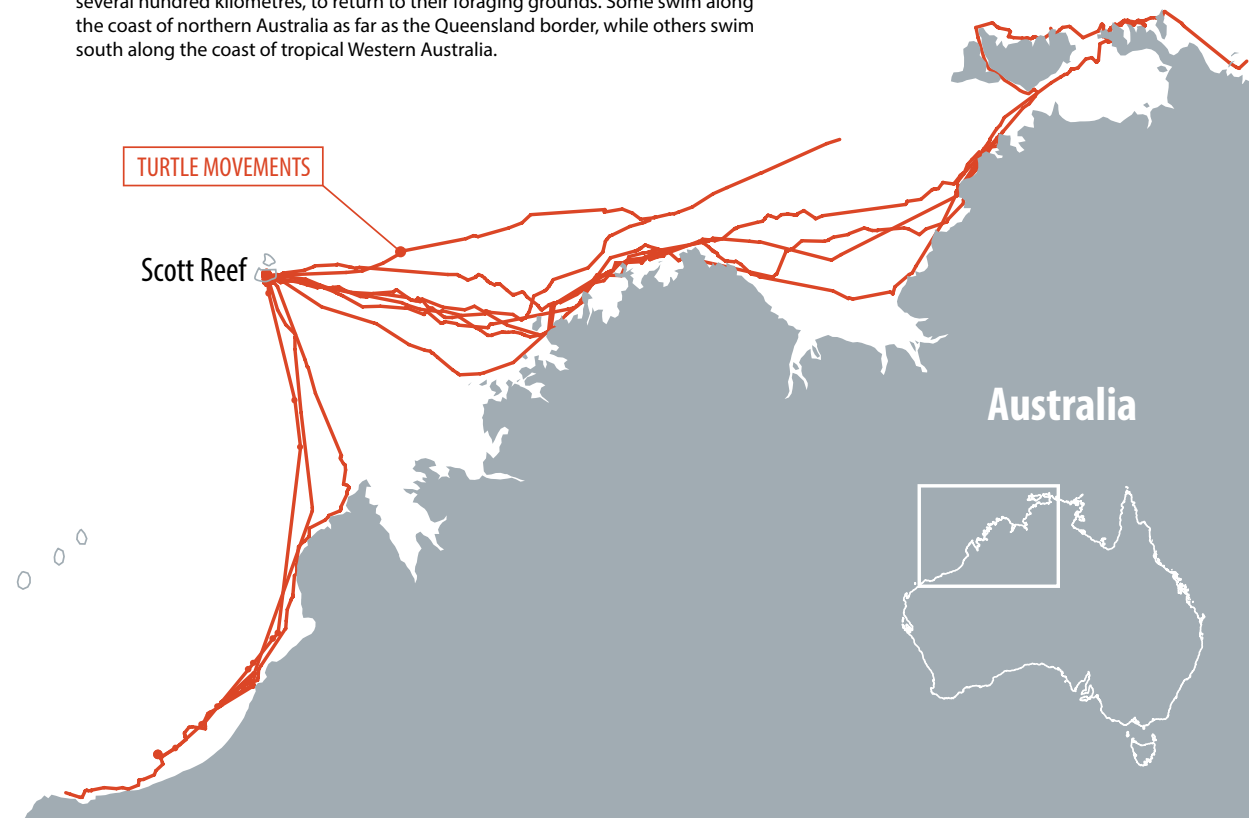
However, turtles cannot always rely on Sandy Islet as a safe repository for their eggs. Small and low-lying, the island is susceptible to the effects of tides, currents, waves and storms. In March 2004, cyclone Fay caused extreme waves and storm surges that eroded Sandy Islet, reducing its size by approximately one-third. Many eggs incubating on the island at this time may not have survived and, in the aftermath of the cyclone, nesting space was at a premium.

After laying a clutch of eggs, females return to the sea and spend around 10 days recuperating before returning to the beach to dig another nest and fill it with more eggs. Using direct observations and satellite tags to track the adult turtles' movements, researchers discovered that most females remained in shallow water less than three kilometres from Sandy Islet during the inter-nesting period.

Once the female turtles have finished depositing all their clutches of eggs into carefully constructed nests, they travel much further afield. Satellite tags attached to 12 female green turtles showed they were capable of moving quickly over large distances in search of foraging grounds. Some turtles headed north-east from Scott Reef to coastal waters in the Northern Territory, while others travelled south, reaching the Western Australian coast and continuing towards the Pilbara. While being tracked for an average period of 78 days, all female turtles travelled at least 490 kilometres, and some over 1000 kilometres, at an average speed of two kilometres per hour.

As their mothers reach the foraging grounds, newly hatched green turtles emerge from the nests on Sandy Islet and swim away from Scott Reef into the deeper waters of the open ocean. They will spend up to 20 years foraging at sea, eating pelagic species like jellyfish, before returning to reef habitats as sub-adults. Another decade is spent in shallow foraging grounds, which are generally reef areas with ample supplies of seagrass and algae. Compared with other reefs, including nearby Ashmore Reef, very few sub-adult turtles are seen at Scott Reef, probably because it lacks the extensive seagrass and algae beds that turtles feed in. At sexual maturity (20–50 years old), the turtles may make another long journey back to Scott Reef, where they mate and lay their eggs on Sandy Islet. The eggs hatch, hatchlings emerge, and the cycle continues.

After laying their eggs on Sandy Islet, the female turtles swim for months, covering several hundred kilometres, to return to their foraging grounds. Some swim along the coast of northern Australia as far as the Queensland border, while others swim south along the coast of tropical Western Australia.



Turtle hatchlings emerge from their sandy nests after incubating for 7–12 weeks. They make their way to the ocean and swim for deeper waters, completely independent and relying purely on their instincts for survival.





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Whales and Dolphins



Every year, thousands of whales undertake migrations along the coast of Western Australia, from the food-rich Southern Ocean to their breeding grounds in the warmer waters of the Indian Ocean. Fishers and sailors have long known that during these epic voyages the enormous mammals track up the edge of the continental shelf, passing Scott Reef, where they occasionally stop to mingle with their dolphin relatives. Until recently, many important details about the whales' presence in the region were a mystery. Now, after years of careful work, including painstaking aerial surveys, satellite tagging, and the strategic deployment of noise loggers to record the animals' calls, scientists have a more complete understanding of whale movements in the region of Scott Reef.

Perseverance, ingenuity and technology

A major challenge for scientists studying Scott Reef is how best to describe the vast numbers of organisms that accumulate on and around the reef. But when it comes to whales, scientists confront a different obstacle. These giants are such infrequent visitors that monitoring must be carried out over large scales of space and time. Research teams working at Scott Reef have overcome this obstacle with a combination of perseverance, ingenuity and technology.

Long aerial surveys are used to record the location of whales on their annual migration. Trained spotters fly low over the ocean, searching for hours at a time to catch sight of a whale breaking the surface to breathe, slapping the water with its fins, or launching into the air. Spotters also search for 'whale footprints' – tell-tale disturbances on the sea surface that are evidence of a whale having recently passed by.

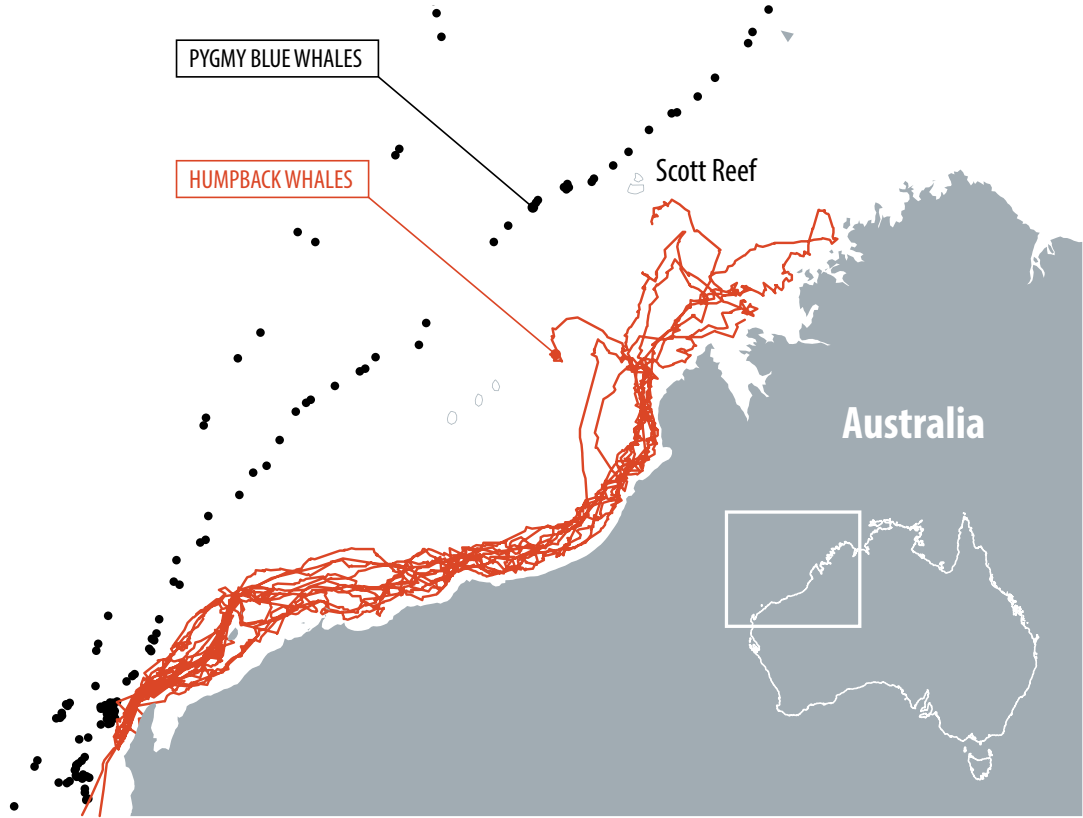
Accurately describing the migration path taken by whales over thousands of kilometres requires a different approach. Satellite tags are used to track the whales' long journey. Each time a tagged whale surfaces, its position is beamed to an orbiting satellite and back again, a process that is repeated over many months.

Perhaps the most innovative technique for whale monitoring at Scott Reef has been the use of underwater noise loggers – recorders specifically designed to capture the sound of whale songs. Analysing the particular frequencies of sound allows scientists to identify the species of whale from up to 50 kilometres away, and to distinguish their songs from the sounds of fish and other background noises. Those other background noises can include human activities, such as ships, seismic surveys and exploratory drilling, and even illegal dynamite fishing.

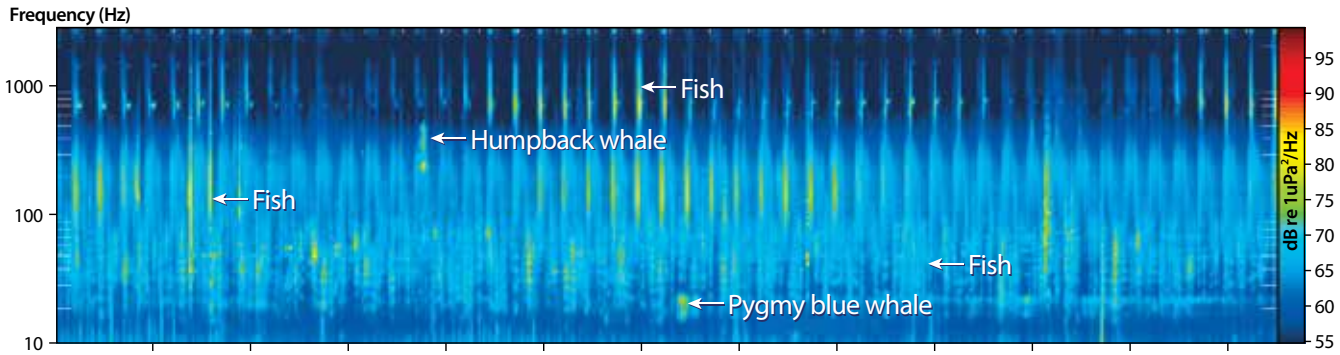
The combination of these techniques has revealed the presence of at least five species of whales in the Scott Reef region, including large whales on their annual migrations. Species of whales and dolphins recorded to date include humpback whales (*Megaptera novaeangliae*), pygmy blue whales (*Balaenoptera musculus brevicauda*), Bryde's whales (*Balaenoptera edeni*), false killer whales (*Pseudorca crassidens*) and dwarf minke whales (*Balaenoptera acutorostrata*).



Long flights that systematically cover vast distances are necessary to find evidence of whales on their annual migration. Observers may spot disturbances remaining on the ocean's surface or, more obviously, whales surfacing to breathe or breaching impressively.



Humpback whales (*Megaptera novaeangliae*) and pygmy blue whales (*Balaenoptera musculus brevicauda*) were tracked during their migration using satellite tags. Most humpback whales stay close to the Western Australian coast, but some visit Scott Reef in small groups. Pygmy blue whales, heading north past Scott Reef, mostly travelled alone or in pairs.



Underwater noise loggers recorded fish sounds, whale songs and other background noises. Loggers can capture the sounds of whales up to 50 kilometres away, and researchers are able to identify different whale species by the frequency of their calls.

Humpback whales

Humpback whales migrate annually, moving between summer feeding grounds in Antarctica and tropical breeding aggregations in winter. Past whaling activity nearly wiped out the Western Australian humpback population, but after reaching an estimated low of 1000 individuals the population had recovered to approximately 22,000 in 2008, with scientists projecting that numbers will continue to rise.

Noise loggers have been used to monitor the movement of male humpback whales at Scott Reef, as it is thought that the females do not sing. According to the loggers' recordings, males were present in low numbers both in South Reef's lagoon and around the outside of Scott Reef from late June to early October each year. During this period, aerial surveys were also conducted to investigate their movement through the region.

Between July and October 2009, scientists conducted five aerial surveys between Scott Reef and the Dampier Peninsula, north of Broome, recording 90 adults and nine calves in 83 groups. Ten additional aerial surveys between June and October 2010 recorded 93 adults and five calves in 73 groups. Most of the humpbacks stayed close to the Kimberley coast, giving birth in the Camden Sound area, with total numbers estimated at 13,000 during the northern migration.

Around Scott Reef in 2009, researchers recorded 12 adults and two calves. Six of the sightings were 5–20 kilometres to the west of the South Reef, while eight of the sightings were within the South Reef lagoon or immediately to the east of the South Reef. In 2010 there were confirmed sightings of nine adults and two calves within the area.

Humpback whales grow to approximately 15 metres in length, and spend summers feeding in Antarctica before migrating north in winter to breed. Both adult and calf humpback whales have been observed visiting Scott Reef. Humpbacks are baleen whales and feed predominantly on small crustaceans called krill.

Pygmy blue whales

Blue whales, the largest living animals, are found in all the oceans of the world. In Australia, there are two recognised subspecies, the true blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus breviceuda*). Despite its name, the pygmy blue whale is only a few metres shorter than the true blue whale, growing up to 25 metres in length. Of the two southern subspecies, only the pygmy blue whale has been observed in the region around Scott Reef.

Noise loggers set along the coast of Western Australia have detected an annual migration of pygmy blue whales past Exmouth, the Montebello Islands and the Scott Reef region. These whales passed Scott Reef heading south between October and January, and again between April and August as they swam north.

Pygmy blue whales tend to pass to the west of Scott Reef, closer to the edge of the continental shelf, and prefer to travel alone or in small groups. For example, most (78 per cent) of the calls recorded around Scott Reef between 2006 and 2009 were from lone whales, with a much smaller number of calls from a pair of whales (18 per cent) or from a group of three or more whales (four per cent).

Scientists have not seen large groups of pygmy blue whales travelling through the Scott Reef area. During 40 days of intensive vessel surveys between Scott Reef and the mainland from June to November 2008, researchers saw just one pygmy blue whale heading north, and six moving south. Of the southbound whales, five were in the channel between North and South Reef, while one was about 50 kilometres to the west of Scott Reef. The northbound whale was observed approximately 200 kilometres to the east of Scott Reef.

Pygmy blue whales grow to approximately 25 metres in length and, like humpbacks, spend summers feeding on krill in temperate waters before migrating north to spend winter in the warmer waters of the Indian Ocean.

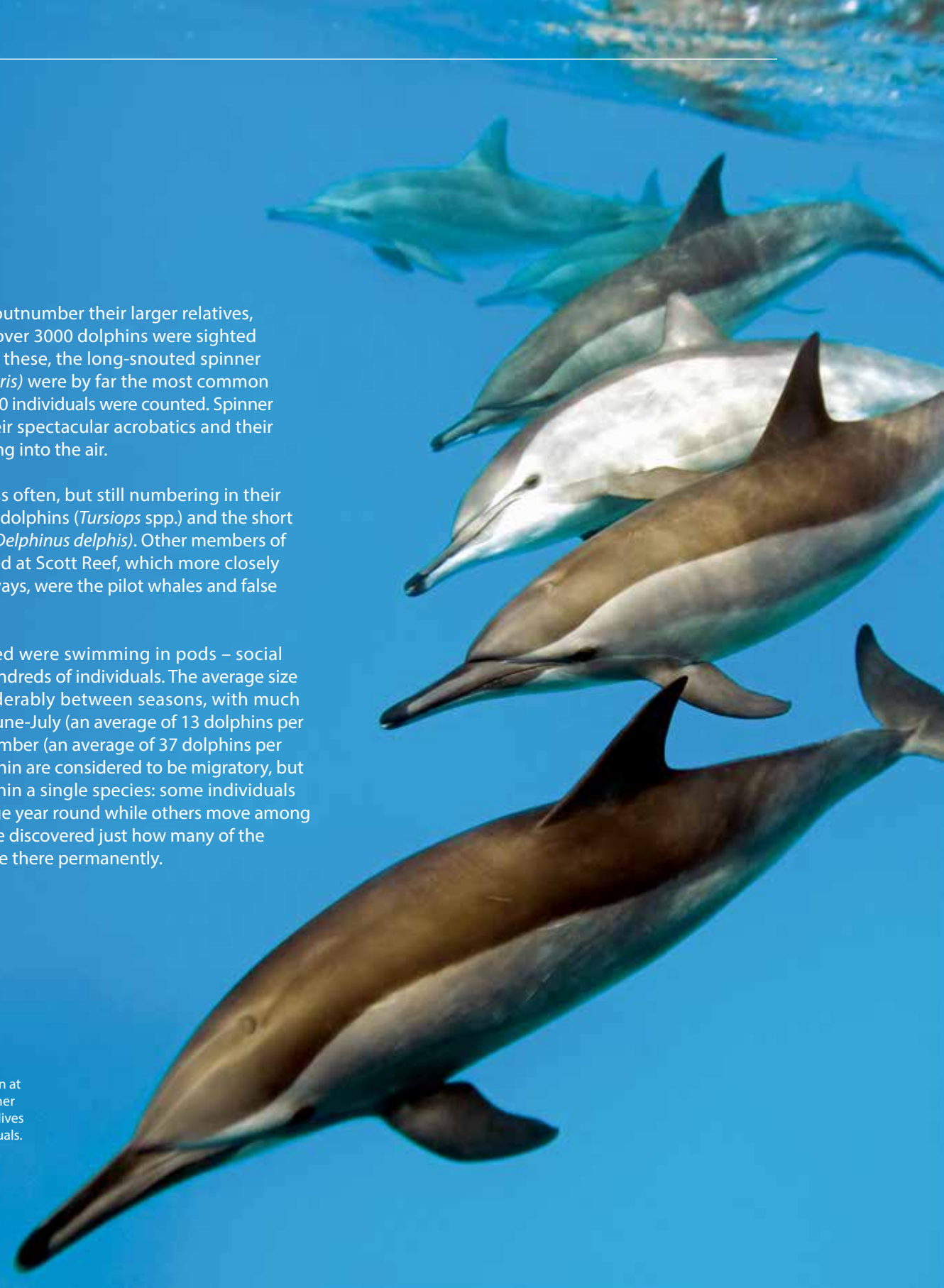
Dolphins

Dolphins at Scott Reef far outnumber their larger relatives, the great whales. In 2008, over 3000 dolphins were sighted from at least 10 species. Of these, the long-snouted spinner dolphins (*Stenella longirostris*) were by far the most common and conspicuous – over 1000 individuals were counted. Spinner dolphins are known for their spectacular acrobatics and their ability to rotate while leaping into the air.

Species of dolphin seen less often, but still numbering in their hundreds, were bottlenose dolphins (*Tursiops* spp.) and the short beaked common dolphin (*Delphinus delphis*). Other members of the dolphin family observed at Scott Reef, which more closely resemble whales in many ways, were the pilot whales and false killer whales.

Most dolphins encountered were swimming in pods – social groups that can contain hundreds of individuals. The average size of the group varied considerably between seasons, with much smaller pods seen during June-July (an average of 13 dolphins per pod) than in October-November (an average of 37 dolphins per pod). Some species of dolphin are considered to be migratory, but patterns can vary even within a single species: some individuals stay within their home range year round while others move among wider areas. It remains to be discovered just how many of the dolphins at Scott Reef reside there permanently.

The most common species of dolphin at Scott Reef is the long-snouted spinner dolphin (*Stenella longirostris*), which lives in pods of up to hundreds of individuals.



At least 10 species of dolphin inhabit Scott Reef. They are conspicuous both because of their abundance and their amazing capacity for acrobatics, in and out of the water.