

**'It looks like a giant tadpole,'**

Peter Gill muses aloud as our light aircraft banks steeply to give us a better view of the extraordinary sight in the sea beneath us.

Indeed it does: from 500 metres up, it's not just the distance between us that makes this massive iridescent blue whale look tadpole-like, but the fact that it has just surfaced from a feeding dive and has rolled side-on.

'Its huge pleated white throat pouch – large enough to hold eight cars and reaching half the length of its body – is bloated with the 50 cubic metres of water it has just gulped in,' Gill explains.

Peter Gill is a marine biologist funded by Environment Australia to study what is believed to be the latest whale species to undergo a resurgence in Australian waters.

'Now it will slowly force all that water out through the baleen plates in its mouth,' he says.

The plates are like stiff, feathery combs attached to its upper jaw. They filter out the thousands of krill it has just taken in with all that water.

'Then it will scrape off the krill with its tongue and, voilà, that's breakfast, lunch and dinner for a bluey!'

Krill are prawn-like crustaceans that form extensive swarms, which we can see from the air as fuzzy rusty-brown patches dotted around in the sea.

**Blue whales travel**

**faster and farther**

**than once thought.**

**Bob Beale joins a**

**posse of scientists**

**intent on catching up.**

Blue whales feed almost exclusively on these tiny animals and an adult may consume several tonnes of krill a day.

That great appetite is needed to maintain a body that may exceed 150 tonnes in weight – equivalent to about 2000 people – and 30 m long.

Of course, everything about blue whales is big, big, big. Its heart is the size of Volkswagen 'beetle' car and can weigh almost 500 kilograms, which it needs to

be to pump more than six tonnes of blood around its massive body.

'I'm awed by them,' Gill says. 'I've worked with other whale species, but there's something about blues that sets them apart. They're so laid-back and such magnificent animals. It's their sheer size as well.'

His favourite 'bluey' fact is that its tongue alone may weigh four tonnes, about the same as a full-grown African elephant.

As we shake our heads in wonder at yet another extraordinary vital statistic concerning these enormous animals (see story on page 20), Gill logs the exact map coordinates of our giant tadpole and we fly on in search of more.

We are doing a systematic aerial survey just off the coast of Portland, western Victoria. It's a clear, sunny day with little wind, ideal for whale-spotting because the absence of breaking waves makes it easy to

# blue moves





Whale spotting. Peter Gill's recent studies suggest that special local conditions attract blue whales to the Portland area from December to May. Periodic south-easterly winds drive warm surface water away from the coast and colder, nutrient-rich deep water wells up to take its place, fuelling the growth of krill.



Men in Zodiacs are no match for a whale. Despite sighting at least six whales during two days on the water, few chances emerged to fire the high-powered crossbow armed with a satellite tag. Relative to the size of the whale, the tag itself is comparatively no larger than a hair follicle is to a human. The one tag that was fired snapped on impact with the whale's tough skin.

see the splashes of whitewater that signal a surfacing whale.

Even from this altitude – chosen so as not to unduly disturb the whales with our engine noise – we can also see the sudden burst of white spray, or blow, that shoots nine metres into the air when the whales exhale from their twin blowholes.

In three hours of flying we are lucky enough to count 17 individuals, clustered mainly in two localities within 20 nautical miles of the coast near Portland and across the South Australian border. One was surface-cruising less than 150 m offshore, visible to anyone on the clifftops around Portland's Cape Nelson lighthouse.

These sightings alone are unusual enough, considering it wasn't until the mid-1990s that an International Whaling Commission research voyage noted small numbers of blue whales off Portland and near Rottnest Island, Western Australia, that scientists were even aware of their existence.

Gill's recent studies suggest that special local conditions attract blue whales to the Portland area from December through to May each year. Periodic south-easterly winds drive warm surface water away from the coast and colder nutrient-rich deep water wells up to take its place. It is those nutrients that fuel the growth of krill swarms.

'Eight years ago there was no indication that anything special was happening here,' Gill says. 'Five years ago blues were regarded as 'rare visitors' in Australian waters, occasionally seen off the New South Wales coast near Eden in mid-spring and occasionally near Rottnest Island.

'Yet crayfishermen around here say they've been seeing them for years but didn't know they were anything special. They don't tend to go home and ring the museum to report that they've seen whales. They're common as muck as it turns out!

'Jokes aside, though, it does seem that there may be hundreds of blues in Australian waters. But it's hard even getting a handle on the numbers. I'd say that 40–100 whales use this area each summer. But then again the dimensions of the area they use keep growing the further afield we look.

Blue whales are naturally marked with distinctive pigment patterns which enable recognition of individuals, so that life histories and movements can be tracked.

Peter Gill

## In three hours of flying we are lucky enough to count 17 individuals, clustered mainly in two localities within 20 nautical miles of the coast near Portland and across the South Australian border.

'They can move fast as well, travelling 200–250 nautical miles in a day. They could reach WA from here in under 10 days, so their range could well extend to Rottneest.'

A diverse Australian research team led by Rob McCauley of Curtin University recently confirmed with aerial surveys and underwater sound recordings that blues are frequently found near Rottneest Island.

'It's not anywhere near the numbers found in the Portland region, but I'd say there are 30–40 here at any given time,' McCauley says.

Those whales are not seen often. He believes they are feeding on deep schools of krill associated with unusual local ocean conditions.

The south-flowing Leeuwin Current passes at right angles over the Rottneest Trench, a vast sea-floor canyon cutting

through the continental shelf and running west at right angles to the coast. In the space of just a few kilometres, the canyon falls away from 200 m to 1000 m deep.

There's some evidence – based on characteristic sound recordings – that blue whales seen off southern Indonesia are part of the Australian population, Gill points out. If so, their winter breeding grounds may be there. Mother and calf pairs are sometimes seen near Portland, though presumably the births take place elsewhere.

'It's really hard to get solid information about them because the ocean is so large and these whales can travel so far and so fast,' he says.

To tackle that problem, Australian researchers want to attach transmitters to some of the whales and follow their movements by satellite. That's why we're doing the aerial survey, to increase our chances

of finding and tagging a few blue whales from boats.

A United States team, led by marine mammal researcher Bruce Mate, already has had some success with satellite tagging over the past decade with blue whales found off the Californian and Mexican coasts.

That has revealed that blues travel much farther and faster than scientists ever thought, searching for the fertile marine upwelling zones that support krill. Unlike humpback whales, it's now known that blues may feed continuously throughout the year and use their great speed to move rapidly between feeding grounds.

'They are like a streak,' says Mate, who directs the Marine Mammal Program at Oregon State University. 'They can't afford to waste a lot of time in low-density food zones, so they really move from one high productivity area to



## Feeding the wide-mouthed whale

BLUE whales are the largest animals known, either living or extinct. Their scientific name is *Balaenoptera musculus* and in the Southern Hemisphere it's thought – subject to scientific debate – that two subspecies exist.

They are *B. musculus intermedia*, the 'true' blue whale (found only in Antarctic waters), and the slightly smaller *B. musculus brevicauda*, or pygmy blue whale (found only in the Southern Hemisphere, particularly in the Indian Ocean).

Blue whales are bluish-grey, mottled with whitish spots and have white undersides.

Females calve every two to three years. Newborns emerge tail-first and are about six metres long at birth, following a 12-month gestation period.

They grow rapidly – at peak rates they can gain up to three kilograms in weight an hour and consume up to 90 kg a day of fat-rich breast milk – to reach 16 m by the time they are weaned at about seven months. They mature sexually at between five and 10 years old. Adult males often grow to about 25 m and females up to 30 m.

Blue whales typically cruise at 5–30 kilometres an hour when migrating, but can reach speeds of almost 50 km/h when being chased. They can dive for up to an hour at a time and may descend to depths of more than 300 metres. Their social groupings are usually small, involving only pairs or a few individuals.

Blue whales have no vocal chords, so their repetitive, rumbling calls are made by vibrating nasal air sacs. The sounds are of such low frequency that they are infrasonic – mainly inaudible to human ears – but they are extraordinarily loud. The loudest blue whale calls reach 188 decibels and can be detected hundreds of kilometres away.

All blue whales are classified as endangered. The original Southern Hemisphere population is estimated to have been about 225 000. Following severe over-hunting by commercial whalers in the 20th Century, their current population numbers are highly uncertain, but are thought to be in the few thousands.

Above: Two adult blue whales are dwarfed by a swarm of krill, *Nyctiphanes australis*, on which they are feeding. The animal on the left has just swum through an 'arm' of the swarm, while on the right, the swarm appears to be backing away from the approaching blue whale.

They have been internationally protected since 1965, although illicit catches by Soviet whalers are known to have continued at least into the 1970s and perhaps into the 1980s.

They undertake extensive seasonal migrations between warm but unknown breeding grounds and colder feeding grounds. Northern and Southern Hemisphere populations do not mix.

The migration paths of blue whales, however, are obscure and do not obviously follow coastlines or oceanographic features.

They have been recorded in all Australian state waters.

Main sources: *Environment Australia*, *Worldwide Fund for Nature*.



... this capacity to feed year-round may explain why blue whale blubber is a mere 12 cm thick. Humpbacks need much thicker blubber to provide energy reserves when they winter without feeding for many months in tropical waters.

another.' One animal migrated more than 16 000 kilometres.

Although those Northern Hemisphere whales move south from high-latitude colder waters to low-latitude warmer waters during winter, they do not follow strict mass migration patterns and individuals may linger whenever and wherever they find adequate sources of food, Mate says.

Even his subjects' winter destination and likely calving area – a region off Central America called the Costa Rica Dome – is a fertile upwelling site extremely rich with krill.

Gill says this capacity to feed year-round may explain why blue whale blubber is a mere 12 cm thick. Humpbacks need much thicker blubber to provide energy reserves when they winter without feeding for many months in tropical waters.

Gill is well aware that it is only thanks to satellite tracking technology that it has been possible to glean such information from such elusive animals.

Basic though it is, the satellite data will help to reveal where and when blue whales are to be found in important feeding and breeding areas.

The blues off Portland and Rottnest Island must deal with busy shipping traffic, and several significant underwater noise issues face them as well: marine seismic exploration for oil and gas near Portland and Navy sonar and submarine testing near Rottnest.

The US Navy was blamed last year for mass beachings of whales in the Bahamas when post-mortems revealed that some of those whales had suffered severe ear trauma.

Gill hopes that a better grasp on the lives and movements of the Australian blue whales will not just fill an information gap, but help to avoid such conflicts with human activities.

With that in mind, our team of researchers, volunteers and Victorian Department of Natural Resources and Environment (DNRE) observers spent the

next two days following our aerial survey on an exhausting and frustrating effort to find our quarry and put some satellite tags in place.

On the first day we drive to Southend, in South Australia, to launch our two sturdy Zodiac inflatable power boats.

The weather is good and as we head out into a calm sea it's soon clear that this is a fertile area for marine life. Quizzical Australian fur seals, cavorting dolphins and diving seabirds are plentiful.

'When things get hot out there, they get really hot. The whales are out here just feeding, feeding, feeding for six months straight,' Gill says.

Nick Gales, a veterinarian and a principal research scientist with the Australian Antarctic Division, makes an odd sight as he stands at the front of the leading

A blue whale raises its tail high as it begins a feeding dive. Blue whales may feed anywhere between the surface and depths of 300 m. They may remain submerged for 20 minutes or more.



Peter Gill



## Master scooper

ONE of the more unusual pieces of equipment aboard the research boats was the mother of all pooper-scoopers: a long-handled fine mesh net used to gather floating samples of whale faeces.

Nick Gales and colleagues have attracted international attention with their recent development of a method of testing the faeces and detecting the DNA of a whale's last meal, its gut parasites and even cells from the gut lining of the animal itself. The tests will be applicable to many other marine animals as well. Gales argues that this technique, which has been submitted for scientific publication, will make redundant Japan's alleged need to kill more than a 1000 whales of various species each year.

'I think this will prove to be a scientifically valid and perfectly workable alternative to killing whales to find out what they've been eating,' Gales says.

At the latest International Whaling Commission meeting in May, Japan disputed the new test, contending that it was not acceptable because whale faeces was difficult to collect and analysis of actual stomach contents gave better information about the quantities and proportions of prey types in a whale's diet.

'It may be difficult to collect whale poo but it's difficult to collect a whale stomach as well,' Gales says,

He says refinements of the technique will in due course provide greater discrimination of prey types and already allows some quantitative analysis of diet.

*For more about this research see 'Gene sleuths get behind the whale', in Ecos 111.*

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pursuit boat. He is harnessed to a pole and carries a high-powered crossbow, which will be used to embed the tags into the whales. Special permission has been obtained to approach the whales close enough to do so.

The arrow loaded into the crossbow is tipped with a grey cylindrical object with a cone-shaped point.

'We've put a lot of time and effort into developing that,' Gales explains.

'The actual transmitter is embedded into the tag, which is made of the same moulded bone cement used in surgical procedures.

'We mix it with an antibiotic to prevent infections, and it is sterilised and stored that way until it's ready to use.'

Gale managed to obtain some blue whale blubber from a dead animal on which to test-fire the tags, but he knows the acid test will come in the field. The arrow should deliver the tag and release it on impact, leaving only the transmitter wedged into the blubber.

'Nothing actually mimics shooting into a whale,' Gales says. 'You think you've got it right then you go out into the field and run into problems and it's back to the workshop. The one tag we were able to get in at Rottneest only worked for a week.'

As a veterinarian, Gale has no ethical qualms about firing the tag into a whale. He's done this before with other species and most recently, with only partial success, on one of the Rottneest blues. Relative to the size of the whale, the tag itself is comparatively no larger than a hair follicle is to a human.

But he is mindful that getting close enough to a whale to do so can be fraught with hazards.

'Humpbacks are easier to tag because they're far more abundant, but they're not as laid-back as the blues. A humpback will kick sideways if it thinks the boat's getting too close, which is fair enough I guess. It does make it a bit hairy for the boat crew, though.'

His words ring true a few hours later when we chase down our first blue whale and see one at close quarters, about 15 km offshore. It's only a youngster, Gill says, travelling for some reason in company with a young fin whale, so it will be left alone.

Even so, it's a wondrous sight. Its great blue-grey back seems to take forever to slide up out of the sea. It glistens in the sun and its gusty blow is loud and strong, like a puffing steam train. Perched atop its back is a dorsal fin so small that it seems laughable, as though it could never help to steer such a large beast.

Then a magical visual change occurs: as it submerges the grey hue of its skin is instantly transformed into the iridescent blue we saw from the air. How this optical trick occurs is a scientific mystery, but it's now unforgettably clear to this writer how the whale got its common name.

An hour or so later we come across a cruising pair of mature blues. They follow a pattern of surfacing and blowing several times then diving for several minutes and emerging unpredictably. The trick is to guess well enough where they'll come up.

After a series of wrong guesses, we eventually get it right. The whales surface nearby and Ian Westhorpe, a DNRE fisheries officer, steers the boat parallel to them and at a signal from Nick Gales suddenly cuts in close to the nearest whale.

In the heart-thumping few seconds available to him, Gales coolly raises and aims the crossbow and fires off a shot. The arrow zips through the air and hits the animal's glistening flank. But our elation quickly turns to dismay. When the arrow is retrieved it reveals that the whale's skin is so tough that the tag has snapped in half on impact.

As it turns out, that was the one and only chance Gales had to deploy one of the tags. We spent many hours searching





A blue whale starts to blow as it surfaces. The tall, columnar blow of blue whales made them easy for whalers to find.

for and finding at least six more whales that day and off Portland the next day, but only once was the pursuit boat able to get close – but not close enough – for Gales to fire off a shot.

‘Makes you wonder how men in rowing boats with hand-held harpoons ever managed to hunt whales in the old days,’ Gales ruefully observes afterwards. ‘It’s back to the workshop for the tags and back to the sea at a later date to try again.’

The whole experience is a sobering reminder of why so little is known about blue whales and why the tagging work could uncover not just scientific riches, but valuable practical information to assist in the conservation of these special marine mammals.

Despite their great size and elusiveness, blue whales are vulnerable to a number of predators. Killer whales and probably great white sharks are capable of killing blue whales that are young or weak.

Experience has shown, however, that their most dangerous predator is us, Gill says. In the space of just 60 years or so, commercial whaling in the Southern Hemisphere almost rendered blue whales extinct.

Considerable uncertainty still exists about their numbers, and most populations in the world’s ocean basins are not monitored. Reliable surveys of a few – especially, the northern Atlantic and northern Pacific populations – show strong signs of sustained increase over the past 20 years, according to Dr Jay Barlow, a marine mammal specialist with the US Government fisheries service.

Those now seen at Portland and Rottnest Island may well be the vanguard of a Southern Hemisphere recovery. Official records note only 35 sightings of blue whales in Victorian waters between 1887 and 1999. Two-thirds of those occurred after 1987.

‘I think it’s safe to say that it is quite likely the number of blue whales in Australian waters is increasing, but of course we can’t really be sure,’ Gales says.

Yet human activities might still pose direct and indirect dangers.

If commercial whaling resumes, for example, so might pirate whaling. Large-scale krill harvesting could deplete vital food supplies for a number of whale species. Chemical contaminants washed into the sea could affect whales or their

prey. Noise pollution, whether it be from shipping, scientific experiments, military tests or even whale-watching tour boats, could also become significant, Gill says.

Clearly, much more needs to be known about these mysterious mariners before we can be sure that they will recover, and stay that way.

**Abstract:** Little is known about the movements, feeding and breeding patterns of blue whales, the largest animal in the world. Satellite tagging could reveal valuable practical information to assist in their conservation. A systematic aerial survey of blue whales is being conducted off the coast of Portland, western Victoria, to increase scientists’ chances of finding and tagging blue whales from boats. Successful satellite tagging would help them to track the whale’s migration, but the tags are difficult to embed in the whales’ thick skin. The whales visit Portland from December to May each year, where ocean conditions favour the growth of krill swarms. Similar conditions attract them to Rottnest Island off WA. These Australian populations may be the vanguard of a Southern Hemisphere recovery from whaling, and may have links to populations in Indonesia.

**Keywords:** whales, blue whale, wildlife surveys, animal tracking, tagging.