

World-First Fish World



At the time of its construction 27 years ago, Kelly Tarlton's incorporated a novel form of acrylic shaping. Images courtesy of Kelly Tarlton's Antarctic Encounter and Underwater World.

Aquaria have been popular since the first public aquarium opened at London Zoo in 1853. New Zealand's first public aquarium, the forerunner of the National Aquarium of New Zealand, opened in Napier in 1956. But the jewel of New Zealand's public aquaria is Kelly Tarlton's Underwater World in Auckland. Located beside the Waitematā Harbour only a short drive from the bustle of Queen Street, Kelly Tarlton's is more than just a high quality tourist attraction. It is also an engineering marvel, and a showpiece for technical innovation and Kiwi ingenuity.

When Kelly Tarlton's opened in January 1985, it was the product of 10 months' construction and many years spent developing a concept that is now a blueprint for undersea aquaria worldwide. They say necessity is the mother of invention, and for Kelly Tarlton – a world-class diver and undersea explorer blessed with an abundance of Kiwi ingenuity – the idea of turning a pair of obsolete sewage storage tanks into a public aquarium was never going to stall for lack of funds.

Mr Tarlton's idea was to construct a transparent acrylic tunnel

for use under water, to allow the public to experience a typical Hauraki Gulf volcanic reef as divers do, rather than viewing it more remotely from outside a flat-sided glass tank. Set in a trench at the base of the aquarium, the 110-metre-long tunnel takes visitors through two aquatic worlds, one filled mainly with shark species and the other with schooling fish. Together the two former wastewater tanks can hold up to 2,000 marine creatures, with the "predator" tank alone holding 3.8 million litres of seawater.

There were no plans to follow, as building a tunnel for the purpose Mr Tarlton had in mind had never been done before. Furthermore, although tunnel sections could be prefabricated overseas, the cost of importing them was prohibitive.

Making his own plans, Mr Tarlton decided to import enormous, flat, 70-millimetre-thick acrylic sheets from Germany – some weighing as much as one tonne. He developed and refined a method to heat and shape the acrylic into the tunnel sections he envisaged by testing the process on small pieces of acrylic in his home oven. He then cut the large acrylic sheets into the dimensions he needed, before heating and curving them into the desired arch-like shape.

The next challenge was to fit the tunnel sections together inside the tanks. The sections were lowered into place in a pre-determined order then joined together and sealed with a special fish-friendly sealant. A constant supply of fresh sea water is pumped from the adjacent harbour into the tanks. The result: the world's first transparent underwater tunnel.

The project also involved constructing artificial concrete reefs and caves to provide a naturalistic home for the more than 1,800 marine creatures selected from local coastal waters to inhabit the facility. In addition, mechanical services and water-filtering equipment were specifically designed and built to meet the project requirements.

When Kelly Tarlton's first opened, the public walked through the acrylic tunnel. Now, however, visitors are transported through on a travelator. Kelly Tarlton's was one of the first to transport people in this way, but as with the acrylic tunnel design, people-mover conveyor systems are now *de rigueur* at aquaria worldwide.

Traditionally, aquaria were constructed from flat or curved glass, or acrylic panels sealed together to form a box-like or cylindrical tank. The first acrylic acid was created in 1843, and by 1877 German chemists had discovered the polymerisation process that produces polymethyl methacrylate, which was trademarked as Plexiglass in 1933. By 1936, acrylic safety glass was being produced.

The main disadvantage of acrylic glass is its brittle nature, although it tends to break into large pieces rather than shatter. Many attempts have been made to mitigate this flaw, including adding rubber to improve its strength. It is also susceptible to scratching, although it can be repaired relatively easily by polishing or heating the surface of the material. Scratch-resistant coatings are sometimes added.

The advantage of acrylic glass is that it is strong and lightweight, with a density less than half that of true glass. In addition, it has higher impact strength than glass. But as aquarium tanks increase in size, the transparent panels need to increase in thickness (and weight) to resist the increasing pressure on them. As a result, larger aquaria are not only more costly but more difficult to construct.

Glass and acrylic differ in the way they refract light, which creates differences in the types and amounts of distortion people experience when viewing fish inside glass and acrylic

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tanks. Because acrylic has almost the same index of refraction as water, light is bent only once or twice. As a result, fish in an acrylic aquarium appear only slightly misplaced from their true position, and are seen at their true size and colour. Glass, however, has a different refraction index from water, so in a glass tank light is bent four times as it passes through the air/glass and glass/water boundaries and back again. Consequently, fish in a glass tank can appear significantly misplaced (depending on the thickness of the glass), and are not quite true in colour and size. At Kelly Tarlton's, although the tunnel is acrylic, the tunnel sections' shape means fish in the tanks are seen one third smaller than their true size.

Besides the original two-tank aquarium, Kelly Tarlton's now

houses a colony of penguins in an Antarctica exhibit (opened in 1994) and Stingray Bay (opened in 2004), which features a giant 350,000-litre open-topped acrylic tank that is 2.6 metres deep at its deepest point.

Kelly Tarlton's celebrated its 25th anniversary in 2010 with the launch of a Marine Wildlife Trust. The Trust's objectives are to rescue sick or injured marine wildlife, and to educate the public about the importance of caring for our marine environment. These are two aims Mr Tarlton had in mind when he visualised a walk-through aquarium back in the 1980s, which his underwater world has already gone a long way to achieve.

✉ WRITER Karen Wrigglesworth

The aquarium tunnel, Kelly Tarlton's Antarctic Encounter & Underwater World.



**KELLY TARLTON:
NEW ZEALAND MARINE ARCHAEOLOGIST AND WORLD-FAMOUS DIVER (1937 TO 1985)**

In the 1970s Mr Tarlton undertook the first of many diving expeditions off Mahia Peninsula, near Gisborne, where the 1897 wreck of the *Tasmania* lay buried under 32 metres of sand. Mr Tarlton also recovered hundreds of items of Rothschild jewellery, which can be seen at the Shipwreck Museum in Waitangi.