

Thinking outside the box

Underwater robotics startup Boxfish Research is enabling deepsea exploration with the Boxfish ROV and the Boxfish 360 underwater vision systems, which can handle the harshest marine conditions in the world. Sophie Boladeras dives deep with co-founder Ben King who has taken the technology to Antarctica and beyond.



Boxfish co-founder Ben King with the Boxfish ROV underwater drone in Antarctica this year.

Hundreds of metres below the Antarctic ice, the light of a foreign object pierces the darkness, illuminating a world of elusive creatures. The vast depths, teeming with life, provide a stark contrast with the all-encompassing white of the ice and sky above. Here, a team of researchers clad in bright red jackets break the monotony of the landscape as they huddle around a monitor.

Waiheke resident Ben King controls the Boxfish ROV, an advanced underwater drone

enabling the team to view this extraordinary underwater scene.

Since 2016, underwater robotics company Boxfish Research has developed two vision systems to reveal marine environments with unprecedented clarity. A random encounter between Ben and his two co-founders led to the creation of the Boxfish ROV and the Boxfish 360.

“It was a chance meeting between myself and the two other guys at Lake Pupuke on the

North Shore,” Ben tells me at the Boxfish workshop in Orakei.

“I had a longstanding interest in underwater exploration and wanted to get a bit more experience, so in my spare time I built a little remotely operated vehicle (ROV) from a kit-set.”

Ben went to test the underwater drone at Lake Pupuke and it just so happened that on the same day, at the same time, two other marine drone enthusiasts who had also built

“I didn’t think what I was doing at the time was super ambitious; it was something fun to do which nobody else was doing.”
- Boxfish co-founder Ben King.

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ROVS using the same kitset were there.

“We were all equally disappointed with the performance of the little kitset that we had bought and we packed them up and never used them again,” says Ben.

However, the three engineers got chatting and Ben suggested they have a go at building a unique one themselves.

“Co-founders Craig Anderson, Axel Busch and I sat down and started looking into it. What we initially created was the most difficult incarnation of an underwater robot that we could come up with.”

That was almost five years ago and the company has now made a name for itself in New Zealand and around the world.

“A lot of the early cameras were built on Waiheke, and we did a lot of testing in a friend’s pool in Onetangi and diving at Matiatia and around the north side of the island,” says Ben.

This January, Ben had the opportunity to test Boxfish technology in some of the harshest conditions in the world. Equipped with the Boxfish ROV and the Boxfish 360 underwater vision systems he travelled to Antarctica with Dr Regina Eisert and a team from the University of Canterbury.

“In Antarctica, we launched the Boxfish ROV from a helicopter,” he says.

“Not literally, but we were able to easily transport it by air in the helicopter and then deploy it from the ice edge, which wouldn’t be possible with other vehicles of the same capability.”

Dr Eisert and her team developed a research programme in 2013 to provide scientific knowledge to support a Marine Protected Area (MPA) in the Ross Sea.

“We have to show ongoing evidence that the MPA is doing what it’s supposed to do,



Ben King and Tom Arnold at the pressure ridges near Scott Base in Antarctica. Photo Regina Eisert

“One thing I realised two years into my research was that staring at whales from the surface is like staring at the feet of people walking on the street if you’re living in a basement flat. I was like, no, these guys live in the water and we need to look at them in the water.”

- Dr Regina Eisert

and I’ve been looking into some focal species including toothfish and Type C killer whales,” she tells me.

“One thing I realised two years into my research was that staring at whales from the surface is like staring at the feet of people walking on the street if you’re living in a basement flat. I was like, no, these guys live in the water and we need to look at them in the water.”

But diving in sub-zero Antarctic waters presents a multitude of challenges, which is where the Boxfish ROV came into play for Dr Eisert and her team.

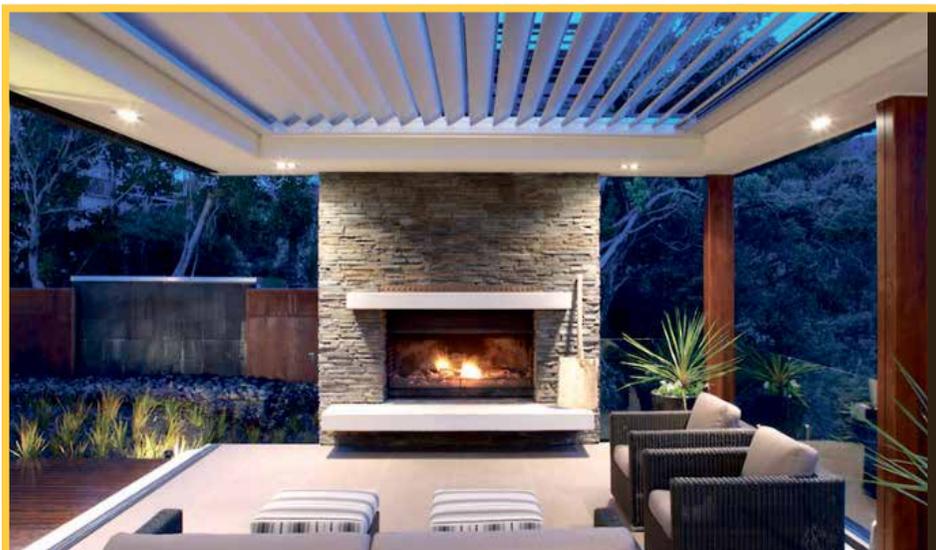
“I have colleagues in Germany who work for a large research institute and who have euros coming out of their ears. They have a very expensive ROV, but you have to have a



Boxfish technology is being used around the world to gain information about marine life.



Ben King with the Boxfish 360 at the workshop in Orakei.



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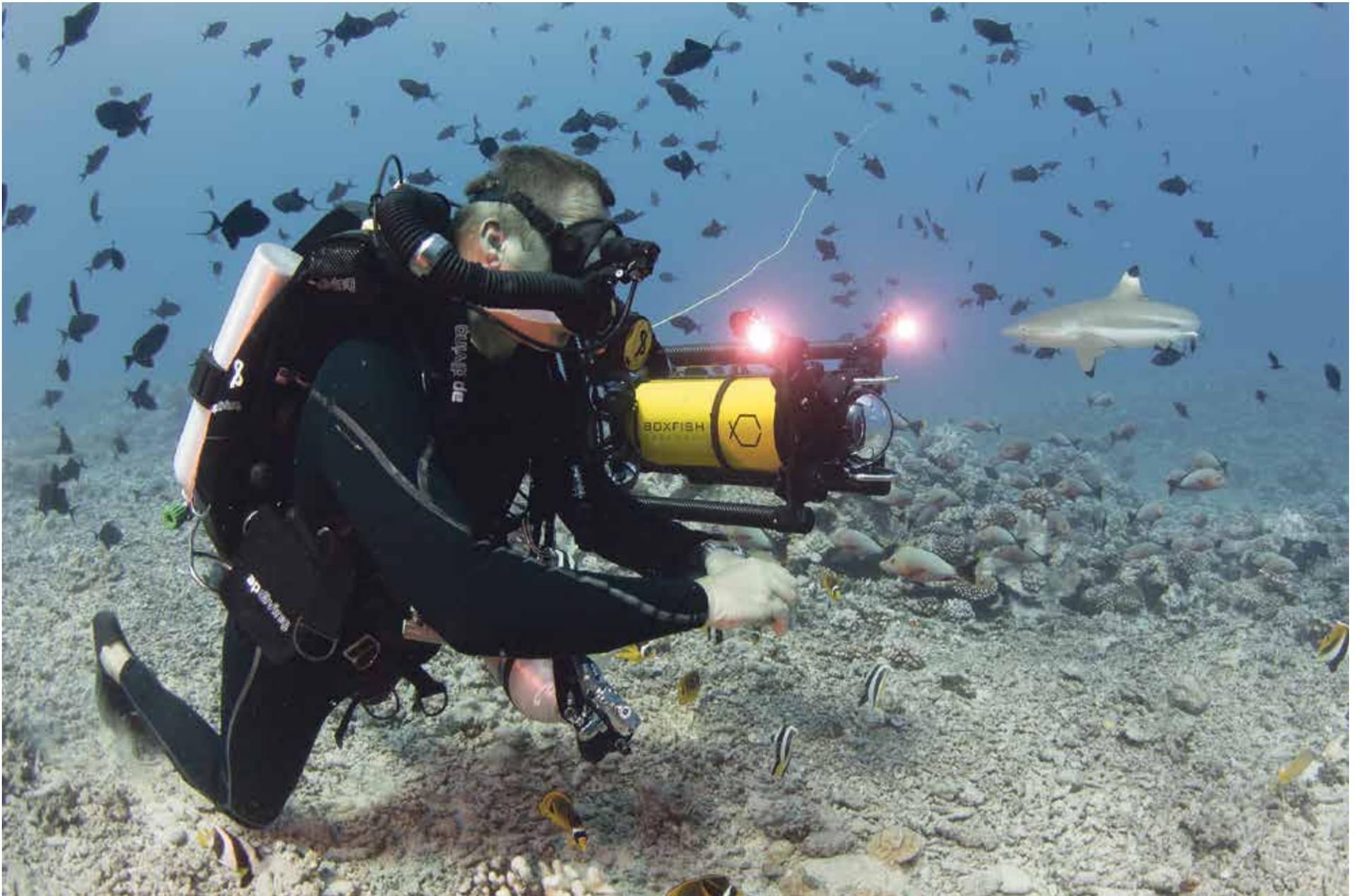


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Capturing a vibrant underwater scene with the Boxfish ROV in Tahiti. Photo Rodolphe Holler, Tahiti Private Expeditions

“You walk over the ice, and it all looks completely dead, then you drop the ROV into the water, and it’s like a jungle down there. The seafloor is just teeming with biodiversity, and seals are flitting around the camera.”

- Dr Regina Eisert

ship and a winch to launch the bloody thing, and after you finish with it, it has to be in the shop for six months or so.”

“The benefit of the Boxfish ROV is that it has top-of-the-line performance and it’s light and usable.”

Dr Eisert says everybody on the trip was blown away by the incredible abundance of life on the seafloor.

“It was animals, on top of animals, on top of animals,” she says.

“You walk over the ice, and it all looks completely dead, then you drop the ROV into the water, and it’s like a jungle down there. The seafloor is just teeming with biodiversity, and seals are flitting around the camera.”

Dr Eisert’s research team is planning to utilise the Boxfish ROV again for a trip in January 2020.



Co-founder Ben King was chuffed to accompany a team of scientists to Antarctica and to use the Boxfish ROV to support their research.



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Also on the Antarctica trip this year was postdoctoral research fellow with Fisheries and Oceans Canada, Dr Andrew Wright.

“We were looking for additional evidence of toothfish predation by killer whales and also to record their sounds so that in the future people can track their wider movements in the region using remote passive acoustic monitoring,” he says.

The team was able to get images and 4K resolution footage of killer whales with pieces of toothfish in their mouths, and Dr Wright says the Boxfish ROV showed a lot of promise.

“In future, it will allow us to get deeper under the ice, increasing our odds of seeing foraging. It’s also a wonderful tool for promoting our research and the Marine Protected Area.”

Through the use of the Boxfish ROV, the team captured uncompressed HD video which was live streamed back to their base on the ice on a 17-inch monitor. As well as the ROV, the Boxfish 360 spherical camera was dangled off the edge of the ice, capturing immersive video content.

“We are enthusiastic about how much we achieved,” says Ben.

“We didn’t have any technical issues to slow us down, and we got some amazing footage of seals, penguins, and killer whales.”

Ben built the ROV prototype in the spare room of his flat.

“I didn’t think what I was doing at the time was super ambitious; it was something fun to do which nobody else was doing. Between Craig and myself we have a lot of technical expertise, and we like a good challenge.”

The other co-founder of the start-up, Axel, left the company a couple of years ago and the team is currently made up of eight staff members. Co-founder Craig looks after control systems, software, electrical and



The Boxfish ROV control station at the Poor Knights Islands in Northland. Photo Boxfish

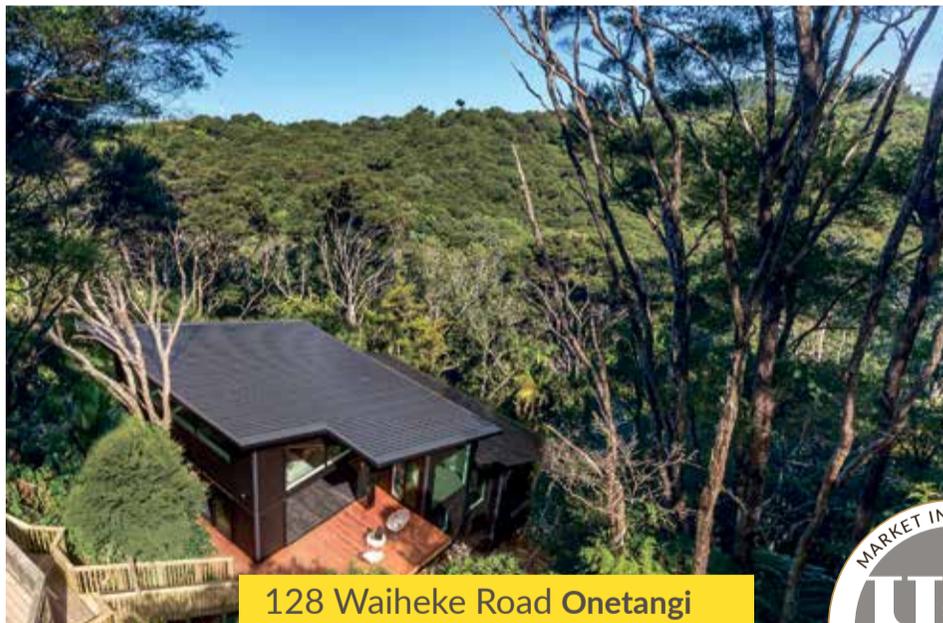
electronic development. According to the Boxfish website, he’s a technical genius, which isn’t hard to believe. Craig built an internet service provider, Internet ProLink NZ, from the ground up and by 1997 it was the number one ranked ISP by Consumer New

Zealand.

Ben, who has lived on Waiheke for three years, studied mechanical engineering and has a background in biomedical technology which saw him build equipment for organ transplants and heart attack treatments.

“I dreamt of doing what I’m doing now for a long time,” he says.

“I worked for so many years with medical professionals, and I had this dream of applying the same sort of technical innovation to field science or something in the outdoors.



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“I worked for so many years with medical professionals, and I had this dream of applying the same sort of technical innovation to field science or something in the outdoors. Underwater exploration was always interesting to me since there’s so much unknown.”
- Ben King

Underwater exploration was always interesting to me since there’s so much unknown.”

The Boxfish team sold their first 360 camera about two years ago, and their first ROV sale was in September 2018. Because they’re in the early stages of selling the product, the team’s recent focus has been on marketing and accessories.

“There’s a lot of demand from our early customers and enquiries from people who want additional features like sonar imaging, better navigation or a ‘grabber’ for picking things up off the ocean floor,” says Ben.



The Boxfish ROV in Tahiti. Photo Rodolphe Holler, Tahiti Private Expeditions



The Boxfish ROV captures another incredible underwater scene in Tahiti. Photo Rodolphe Holler, Tahiti Private Expeditions

The range of applications for Boxfish technology is vast, and it’s being used by different organisations to sample gas from underwater volcanoes, collect coral samples and to measure gas exchange in sponges.

“There are so many things that people want to do underwater, and this technology is allowing them to do that for a lower cost than would usually be possible.”

The National Institute of Water and Atmospheric Research was the first Boxfish ROV customer and the institute uses the drone primarily for monitoring invasive species. In February, Boxfish Research made its first sale in Japan to distributor Cosmos Shoji. Wealthy individuals are also getting involved in Boxfish technology.

“We sold one to a superyacht owner,” Ben tells me.

“It’s currently in Tahiti – the person who is operating it is a videographer and photographer. He’s using it for exploring all kinds of things and has captured some incredible underwater images.”

When I meet Ben in Orakei, he tells me the team has just sold their fourth ROV and is flat-out trying to get going with the production, which will take about two months to



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complete. The ROV will be used around the world for exploration and conservation activities. There's also an ROV currently deployed in waters around Papua New Guinea exploring what could be the remains of Amelia Earhart's aeroplane. The research team Chasing Earhart has been spearheading Project Blue Angel, whose goal is to investigate the wreckage, which was found off the coast of Buka Island in 2018. This island was directly in Earhart's flight path, and it's possible that the wreck is that of her Lockheed Electra 10E.

"We've also been talking to the BBC for months," says Ben of other exciting projects in the works.

"They're really interested, so we'll see how that goes."

Ben says one reason Boxfish technology is quickly gaining traction is that other companies aren't making such lightweight cameras with high image quality.

"This has been our focus; we designed it specifically for good video capture. Our active stabilisation system, which is propri-



The Boxfish ROV was deployed on the Antarctic ice by helicopter as part of a research expedition this January.

"Being in New Zealand so far from international buyers and markets is hard. We are trying to tackle that in many ways to get the word out and establish relationships with distributors so we can capture a worldwide audience."
- Ben King

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etary to us, allows it to be really stable so it can do manoeuvres you wouldn't normally be able to do with a vehicle like this, which makes it unique."

Aluminium, carbon fibre, acrylic polyethylene, stainless steel and copper parts are

sourced for the cameras from all over the world, while all assembly and testing is carried out in New Zealand.

"The biggest challenge is finding enough hours in the day and stay on top of things," says Ben.

"There have been some technical challenges. Trying to run a startup is difficult, and we haven't had much support from government agencies – we funded it all ourselves."

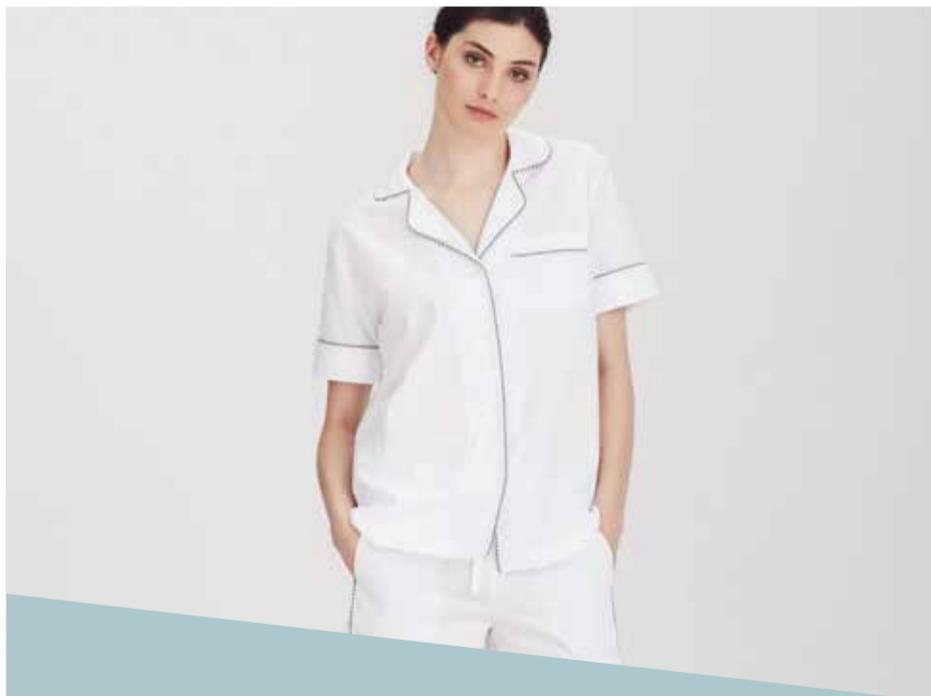
Another challenge for the team is location. "Being in New Zealand so far from inter-

national buyers and markets is hard. We are trying to tackle that in many ways to get the word out and establish relationships with distributors so we can capture a worldwide audience," Ben tells me.

"But we think we're on the right track." •



The K070 team, aka Team Whale at the helipad at McMurdo Station. Tom Arnold (field trainer), Dr. Andrew Wright (scientist), Dr. Regina Eisert (scientist), Kurt Schierning (pilot) and Ben King. Photo Boxfish Research



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