
LAKE ROTOITI CATFISH INCURSION: SOMETHING NEW OR THE EMERGENCE OF AN OLD PROBLEM?

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Brendan is a Professor in freshwater ecology based at the University of Waikato in Hamilton. His research is in freshwater fish ecology, quantification of fish abundance, and responses of native fish communities to invasive fish. Brendan uses stable isotopes to investigate aquatic food webs, and otolith microchemistry to examine fish life histories.

TRANSCRIPT

Kia ora everybody. I have been involved in pest fish research, control and generally understanding their life history and what we might do about them. For a number of years I have been called in by Bay of Plenty Regional Council to help with the catfish problem and I ask, 'Is this something new or the emergence of an old problem?' I suggest that maybe we have been waiting for this in Rotoiti but hoping that it would not happen.



Slide 2 shows Rotoiti and Otaramarae, Okere Inlet, Te Weta Bay, Southern Geothermal and Okawa Bay which are slightly isolated for a very particular reason.



One of my subthemes is a compelling story involving novel fishing methods. In 1993 a single catfish was presented to the Department of Conservation. Its origin was a trailer sailer parked in Motuoapa Bay in Taupo overnight, driven to Rotoiti, launched the next day on the public boat ramp at the Okere Inlet and a juvenile catfish fell out of the hollow trailer

Catfish in Lake Rotoiti

- **1993:** Single catfish presented to DOC.
 - Trailer-sailer parked in Motuapa Bay, Lake Taupo overnight
 - Launched in Rotoiti the next day - public ramp Okere Inlet
 - Juvenile catfish fell out of hollow trailer frame
 - Exhaustive search by divers found no catfish in the lake
- **2004:** Electrofishing survey by UoW in Te Weta Bay response to possible catfish nests (NIWA divers)
- **2009:** Large dead catfish found washed ashore in Okawa Bay
- **2015:** Owners of Lake Rotoiti hot pools report live catfish.
- **2016:** Live capture by weed harvester in Te Weta Bay.



Photo: Don Atkinson

frame. It was very much alive and kept in a tank for six months or so. An exhaustive search by divers, days after that boat was launched, failed to find any sign of catfish so everyone mopped their brow and figured that was the end of the story.

In 2004 NIWA divers found some depressions in the bed of Lake Rotoiti and we were called in to look for catfish with the electrofishing boat that we operate at University of Waikato. We did a general survey where we could fish; much of it is too deep for the boat. We focussed on Te Weta Bay as an obvious place but found no catfish. Just lots of bullies, smelt, goldfish and a few trout.

In 2009 a large catfish was found dead and washed ashore at Okawa Bay. (Above slide) The spade gives an idea of size, about 450mm. But was it really from the lake or did someone pull our leg? Jennifer Blair did some otolith microchemistry analysis on that very smelly fish exhumed after being buried for a week or three and in the end it could not be exclusively establish where it came from, but it did not look like from Taupo or the Waikato. It was reflective of Rotoiti water but we could not conclusively say with one fish.

In 2015 the owners of Lake Rotoiti Hot Pools reported a live catfish and in 2016 a novel fish collection device, a weed harvester in Te Weta Bay hauled ashore a catfish. That initial discovery caught two catfish within 30 minutes.



The incursion response began immediately. They set 21 20mm mesh fyke nets in Te Weta Bay baited with cheese and sardines. The next slide indicates green triangles, nets that caught catfish, the red triangles show nets that were set but did not catch catfish and they caught 52. The bad news was that catfish were there, and the majority of the catch were juveniles less than 100mm. The incursion response was activated which meant that further fishing and netting was focussed at the western end of the lake.



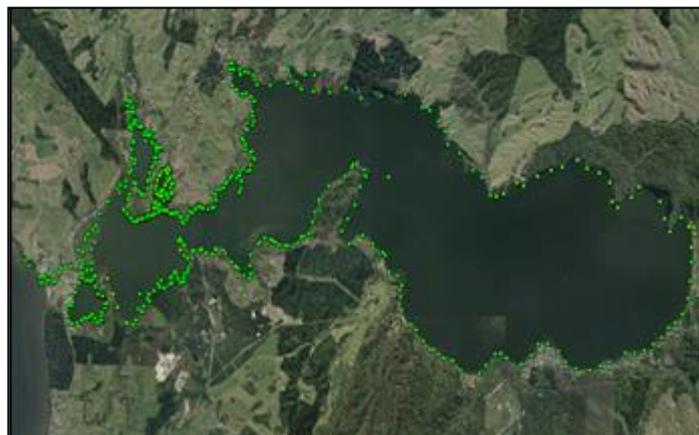
So Houston we have a problem.

The Bay of Plenty Regional Council Biosecurity staff and communications informed all key stakeholders and there was unanimous support for action. They wanted to know how they could support or be involved and what the Council was going to do. They made it clear they expected success.

But they had some questions –

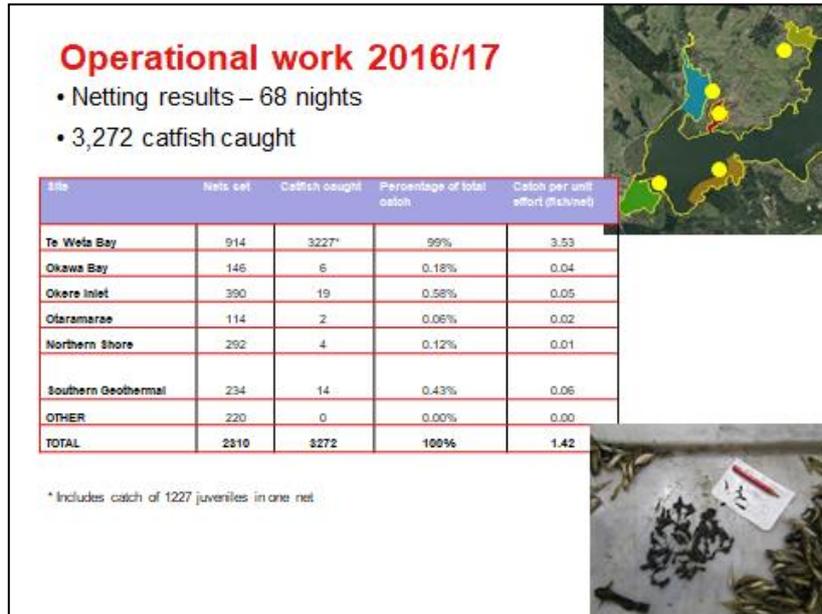
- How come the catfish were not discovered earlier?
- What are the impacts of catfish on koura, trout and water quality in the lakes of the region?
- Are there impacts of any eradication or surveillance work on other species?
- Are they in other lakes?
- What is the likelihood of eradication?

All great questions with no clear answers at this point. This incursion response was epic in scale and nets were set widely around Rotoiti. We used the electrofishing boat in Rotorua along the shoreline, through the Ohau Channel and then extensively in Rotoiti. We fished 29 kilometres. We caught one catfish in Te Weta Bay, which was no surprise.

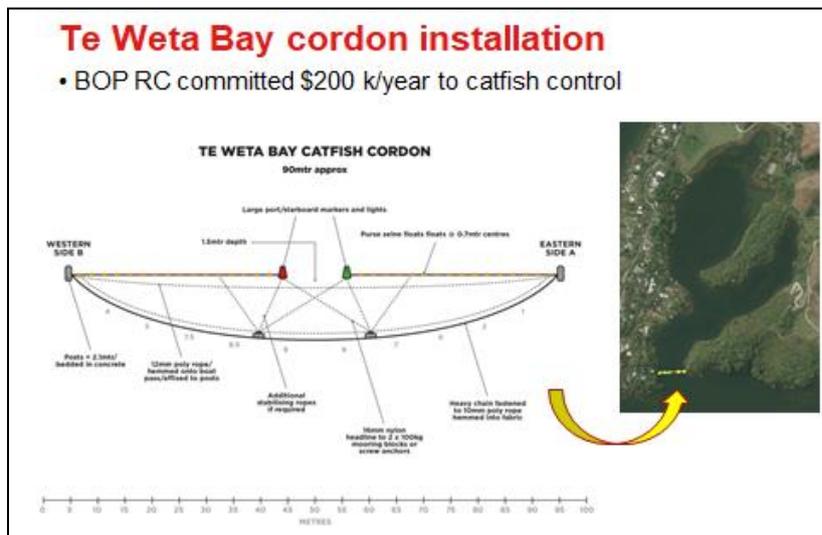


The boat is not the ideal tool for catfish. It is not great for a species on the lake bottom. Between April and July 2016 there were 34 net nights, 770 nets set and the entire lake surveyed. A total of 390 catfish were caught, 381 from Te Weta Bay, showing that was the focus of the problem. (Slide 9) This operational work continued through into 2017 and the large yellow dots show where catfish were found, mostly in Te Weta Bay. So 3,227 catfish were hauled out of Te Weta Bay, 99% of the total, 1,227 catfish out of one net which were

14mm tadpole-like babies. This was disturbing but there were low catches outside of Te Weta Bay including Okawa Bay and Okere Inlet.



One major plus of the eradication programme was its being well-funded. Bay of Plenty Regional Council committed \$200,000 a year for catfish control and the catfish incursion response team deployed a 90m cordon across the mouth of Te Weta Bay. Although catfish had been seen outside, it seemed sensible to contain them within Te Weta Bay. The V in the middle of the cordon is for boats to come in and out. It was installed in April 2017 and seen as a first step to contain the problem.



These pictures (next page) show that it is easy for boats to navigate through. The cordon goes right down to the bed and after a little bit of retrofitting is working beautifully and staying in place.



Catfish were introduced in 1877 to the Auckland region. They are nocturnal bottom feeders and eat a diverse range of food and prefer a shallow, weedy habitat in lakes and rivers, tolerant of high and low temperatures and low dissolved oxygen. They are a significant threat to koura and are throughout the Waikato River system including Lake Taupo. We have done some previous work there and understand some of their life history. They are tolerant of pollution and are sexually mature at 2 years of age and about 220mm long. Their peak gonad development is in September.

Catfish diet in Lake Taupō

- Kōura can be over half of the diet of adults

PREY ITEM	PERCENTAGE OF STOMACHS CONTAINING ONE OR MORE FOODS			
	WEEDY BOTTOM		ROCKY BOTTOM	
	50-149 mm	>250 mm	50-149 mm	>250 mm
Snails	27	25	13	12
Damselfly larvae	-	13	-	4
Caddisfly larvae	30	7	36	-
Zooplankton	15	-	-	-
Chironomid larvae	24	8	23	4
Koura	-	15	4	64
Fish	3	9	-	8
Detritus	-	12	4	2
Plant material	1	11	18	6

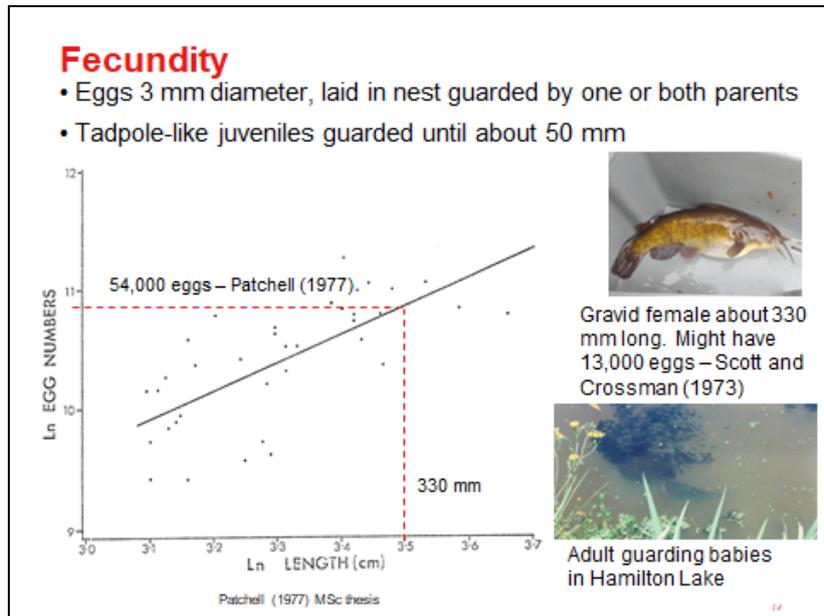
Barnes and Hicks (2003)

In Taupo, Grant Barnes did some work for his Masters looking at guts from hundreds of fish, which is a challenge to any student. He found that koura on rocky bottoms were larger but smaller on weedy bottoms. Catfish up to 150mm had a low consumption of koura but once they get large, about 250mm or so, about 60% of their diet can be koura. This could be because the koura like those rocky habitats too so the catfish and koura have more interaction in those particular places. Koura consumption was less of a problem on weedy bottom, probably because there are fewer koura.

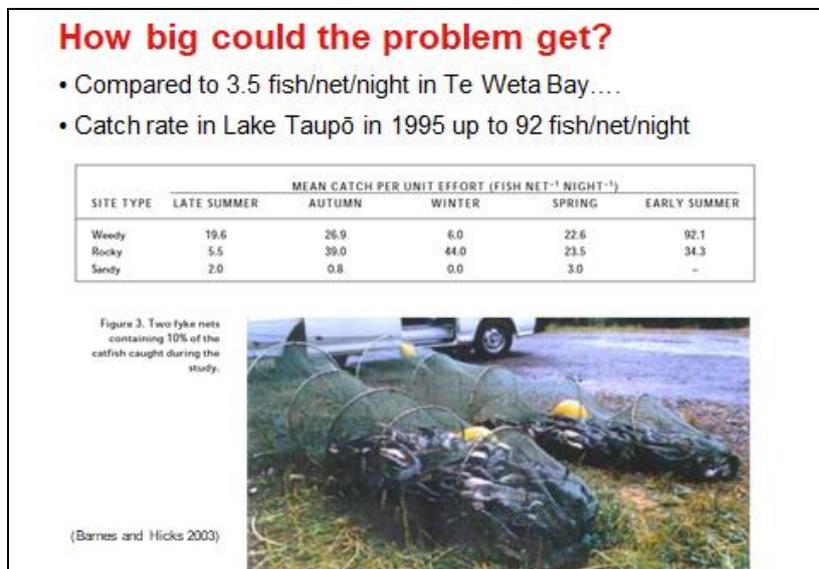
The next slide shows a picture of a gravid female from Rotoiti, about 330 mm long. They have a lot of eggs. I struggled to get the exact fecundity but it might be quite variable in the species, so it may be worth looking at in the Rotoiti population. A Canadian source suggests that a fish that size might have 13,000 eggs. Graham Patchell, for his Masters at the University of Waikato, related egg numbers to size and suggested if extrapolated it might be more like 54,000 eggs. That is a big difference, we do not really know but it is a lot of eggs either way. It is too many eggs to release into the waterways.

They are very good parents, which is unusual among fish, as most turn around and eat their young. Catfish will do that but mostly they guard the nest. In the photo below there is a parent guarding its school of young, keeping away predators and herding them nearby.

When the young are 50mm or so they disperse and take up life on their own without the parents to help.



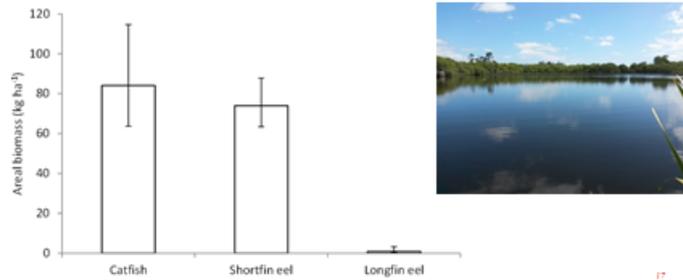
The graph above shows length on the X axis and frequency of Lake Rotoiti catfish. Juveniles are the most numerous class and through January, February, March, April and June grow very rapidly compared to any other catfish, growing about half a millimetre a day at least through the summer/early autumn period. It shows they have a good food supply, which is not surprising given that there are not many in the system yet.



How big could the problem be? The average catch in Te Weta Bay was 3.5 fish per net per night. In 1995 in Lake Taupo, where fish had been for at least 15 years, Grant Barnes caught up to 92 fish per net per night. Numbers of fish per net per night vary seasonally, highest in early summer in weedy habitats. We have got a handle on it, Rotoiti's catfish population is much lower and we would like to keep it that way.

Lake Milicich, Waikato

- 2-ha peat lake 2.3-m maximum depth
- Mark-recapture population estimates
- 732 catfish (169 kg, 88 kg/ha), 776 shortfin eels (149 kg)
- Mean 12 catfish/net/night, max 65 catfish/net/night
- Removed 24% of the catfish with 20 nets set for 1 night



We did one of the first mark-recapture studies on catfish in New Zealand in Lake Milicich, Waikato, a 2ha peat lake, 2.3m deep. Fyke netting is really effective for catching catfish and eels. The mark-recapture population estimates were about 732 catfish and 776 short fin eels, roughly equal, but catfish weighed more because they are larger. Eels are long and skinny. That is about 88 kilos per hectare in a small lake, a very high density. However, the mean catch rate was 12 catfish per net per night, maximum 65. It all shows what happens when catfish are allowed to dwell in one place for a length of time. Although they are abundant in Rotoiti the catch rate is still considerably less. The good news for Lake Milicich is that we removed 24% of those catfish with 20 nets fishing in one night. It also showed that the biomass of the catfish at 88 kg/hectare compared to the shortfin eels at about 70 kg/ha.

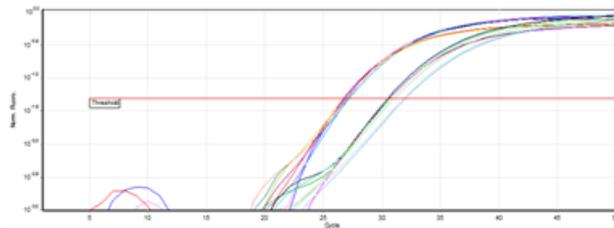
We have made remarkable progress because of the huge commitment from Bay of Plenty Regional Council. Continued systematic control of catfish by netting is seen as extremely important. We are about to launch an acoustic tagging study using a tag that releases a small electronic sound picked up by a series of receivers under water. That will show if the catfish are moving out of Te Weta Bay despite the cordon. We will see if we can pick up catfish anywhere else.

Temperature measurement could also be useful. I think catfish like Te Weta Bay because it is warmer than the rest of the lake, but we have no evidence because we have not measured the temperature. Every time they set nets now they measure temperature then we can tell if there is any relationship between catches and temperature. We can also do this by remote sensing measuring the water temperature from satellite images, something we are looking into.

eDNA is a high sensitivity detection method. We have a project and funding for a proposal to begin an eDNA development protocol for catfish. The upward curve in the next slide shows amplification of koi carp, each line shows a water sample that we have taken out the DNA and the curves show that the DNA is amplified. The sooner they come up the more DNA and there is a quantitative element to it. It is a real problem. Catfish are wide spread and are not going away unless we take them out. They have the ability to spread further so it is very important work.

Future work

- Remarkable progress, huge commitment from BOP RC
- Continued systematic control of catfish by netting
- Acoustic tagging to show movement
- Temperature measurement – remote sensing?
- eDNA – high-sensitivity genetic detection
- Upward curves show amplification (= koi carp)



I would like to acknowledge that it is a huge effort and we have only just begun. Shane Grayling has done a lot of work as the leader of the Biosecurity Team and his contractor, Geoff Hewitt, built and installed the cordon and we could not have done it without him. I take my hat off to him and to Bay of Plenty Regional Council, thank you for your funding commitment and for releasing Shane to do his MSC.

Thank you.

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