Comparative boat electrofishing surveys of Lake Waahi in 2007 and 2011

CBER Contract Report 117

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Genesis Energy

by

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Executive summary

We conducted boat electrofishing surveys of Lake Waahi, which is located to the west of Huntly and flows into the Waikato River. The purpose of this was to repeat surveys that took place on 7 March 2007 and 26 March 2011 concerning the density and distribution pattern fish species within the lake. Due to wind and possibly low water clarity, catch rates were lower in 2011 than those found in 2007 as we only caught 108 fish in 2011 compared to 493 in 2007. Species composition included three native species and five introduced species. Native species caught were common smelt, common bully and shortfin eel and introduced species were perch, rudd, goldfish, catfish and koi carp, gambusia were also sighted but not captured.

Water temperatures were 24.5°C in 2007 and 20.6°C in 2011. Specific conductivity was 422.8 μS cm^{-1} in 2007 and 344.8 μS cm^{-1} in 2011. Black disc measurement was 0.2 m in both 2007 and 2011. We fished 5,117 m in length and an area of 20,468 m^2 from a total of 20 sites across the two years. Due to the lower catch rates in 2011 compared to 2007 a greater area was fished in 2011 (12,652 m^2) than in 2007 (7,816 m^2). Native species collected included common smelt (11), common bully (21) and shortfin eel (191). The introduced species were koi carp (30), perch (31), rudd (28), catfish (27) and goldfish (262). Mosquitofish were observed but not captured during these surveys.

Total fish densities were notably lower in 2011 (0.85 fish 100 m^{-2}) compared to 2007 (6.31 fish 100 m^{-2}). Common bully, catfish, goldfish, koi carp, rudd, shortfin eel and common smelt densities were all lower in 2011 compared to 2007. Perch were the only species found to have increased in density between 2007 and 2011. Of particular note were the more than 10-fold reductions in goldfish and shortfin eel densities. Associated with the decrease in fish density was a decrease in biomass, with all species biomass decreasing between 2007 and 2011. However, the mean weight for all species except perch did increase between 2007 and 2011.

1. Introduction

Genesis Energy contracted the Centre for Biodiversity and Ecology Research (CBER) to conduct a boat electrofishing survey of Lake Waahi, Huntly on March 2011. This survey repeated the methods of one that had been previously carried out in March 2007. The purpose of the 2011 survey was to compare fish abundance of Lake Waahi between the two fishing periods.

2. Methods

We used a 4.5 m-long, aluminium-hulled electrofishing boat with a 5-kilowatt pulsator (GPP, model 5.0, Smith-Root Inc, Vancouver, Washington, USA) powered by a 6-kilowatt custom-wound generator. Two anode poles, each with an array of six stainless steel droppers, created the fishing field at the bow, with the boat hull acting as the cathode.

Surveys were conducted on 7 March 2007 and 23 March 2011, fishing 10 sites located at similar positions in the eastern half of Lake Waahi (Table 1; Figure 1). The survey sites chosen for electrofishing were based on attempting to survey as diverse a range of habitats as possible while attempting to maximise catch rates based on previous boat electrofishing experience. All sites were fished with the GPP set to high range (50-500 V direct current) and a frequency of 60 pulses per second. We adjusted the percent of range setting of the GPP to 30% to give an applied current of 4 amps root mean square. We assumed from past experience that an effective fishing field was developed to a depth of 2-3 m, and about 2 m either side of the centre line of the boat. We thus assumed that the boat fished a transect 4 m wide, which was generally consistent with behavioural reactions of fish at the water surface. This assumption was used to calculate the area fished from the linear distance measured with the onboard global positioning system. All sites where fished with a consistent effort of 10 minutes. Fish collected were weighed to the nearest gram and fork length measured to the nearest millimetre. Electrical conductivity was measured with a YSI 3200 conductivity meter and horizontal water visibility was measured using a black disc.

3. Study site

Lake Waahi (NZMG 2697928E, 6402845N) is located to the west of Huntly township. At 522 ha it is the third largest lake in the Waikato Region and has suffered from high levels of suspended sediment entering the lake, originating from both pastoral and mine drainage. It has a maximum depth of 5 m with a single outflow to the Waikato River regulated by a rock weir. The lake had extensive beds of the macrophyte *Egeria densa* but these collapsed in 1978 and the lake has had no submerged macrophytes since this time. The littoral zones consisted mainly of willow (*Salix* sp.), raupo (*Typha orientalis*), rush (*Baumea* sp.), open pasture, and bare bank. The water quality is currently classified as super-eutrophic, but is expected to improve following the cessation of inputs from coal mining activities.

4. Results

Water temperatures were 24.5°C in 2007 and 20.6°C in 2011. Specific conductivity was 422.8 μS cm^{-1} in 2007 and 344.8 μS cm^{-1} in 2011. Black disc measurement was 0.2 m in both 2007 and 2011. Total fish caught from both surveys was 601 of these 493 were caught in 2007 and 108 in 2011. Species captured included three native and five introduced species in 5,117 m of fished length or an area of 20,468 m^2 from a total of 20 sites. Due to the lower catch rates in 2011 compared to 2007 a greater area was fished in 2011 (12,652 m^2) than in 2007 (7,816 m^2). Native fish species caught included common smelt (11), common bully (21) and shortfin eel (191). The introduced species were koi carp (30), perch (31), rudd (28), catfish (27) and goldfish (262) (Table 2). Mosquitofish were observed but not captured during these surveys.

Total fish densities were notably lower in 2011 (0.85 fish 100 m^{-2}) compared to 2007 (6.31 fish 100 m^{-2}). Common bully, catfish, goldfish, koi carp, rudd, shortfin eel and common smelt densities were all lower in 2011 compared to 2007 (Table 2). Perch were the only species found to have increased in density between 2007 and 2011. Of particular note were the more than 10-fold reductions in goldfish and shortfin eel

densities (Table 2). Associated with the decrease in fish density was a decrease in biomass, with all species biomass decreasing between 2007 and 2011 (Table 3). However, the mean weight for all species except perch did increase between 2007 and 2011 (Table 3).

Table 1. NZ map grid (NZMG) locations of 10 sites in Lake Waahi that boat electrofished in March 2007 and March 2011.

A. 2007

		Start postion for fishing		End position for fishing	
Site	Habitat	NZMG Easting	NZMG Northing	NZMG Easting	NZMG Northing
1	Open water, raupo	2698380	6400856	2697912	6401089
2	Open water, raupo	2697904	6401090	2697728	6401193
3	Rush, grass	2697734	6401208	2697648	6401437
4	Rush, grass	2697653	6401481	2697797	6401666
5	Willow, open water	2697834	6401688	2698013	6401785
6	Willow, open water	2698035	6401774	2698190	6401907
7	Willow, open water	2698196	6401901	2698323	6402026
8	Willow, open water	2698327	6402049	2698245	6402083
9	Open water, raupo	2698227	6402074	2698108	6402140
10	Open water, raupo	2698092	6402141	2698008	6402205

B. 2011

		Start postion for fishing		End position for fishing	
Track	Habitat	NZMG Easting	NZMG Northing	NZMG Easting	NZMG Northing
1	Open water, raupo	2698538	6401075	2698539	6401034
2	Raupo	2698525	6400953	2698481	6400882
3	Open water	2698424	6400983	2698516	6401351
4	Raupo, willow	2698236	6401919	2698277	6402008
5	Raupo, willow	2698246	6402077	2698174	6402022
6	Rush, grass	2698003	6402204	2697858	6402240
7	Rush, grass	2698616	6401771	2698685	6401906
8	Rush, grass	2698935	6402112	2699008	6402203
9	Grass, rock	2699233	6402999	2699367	6402973
10	Willow, open water	2699401	6402861	2699389	6402847

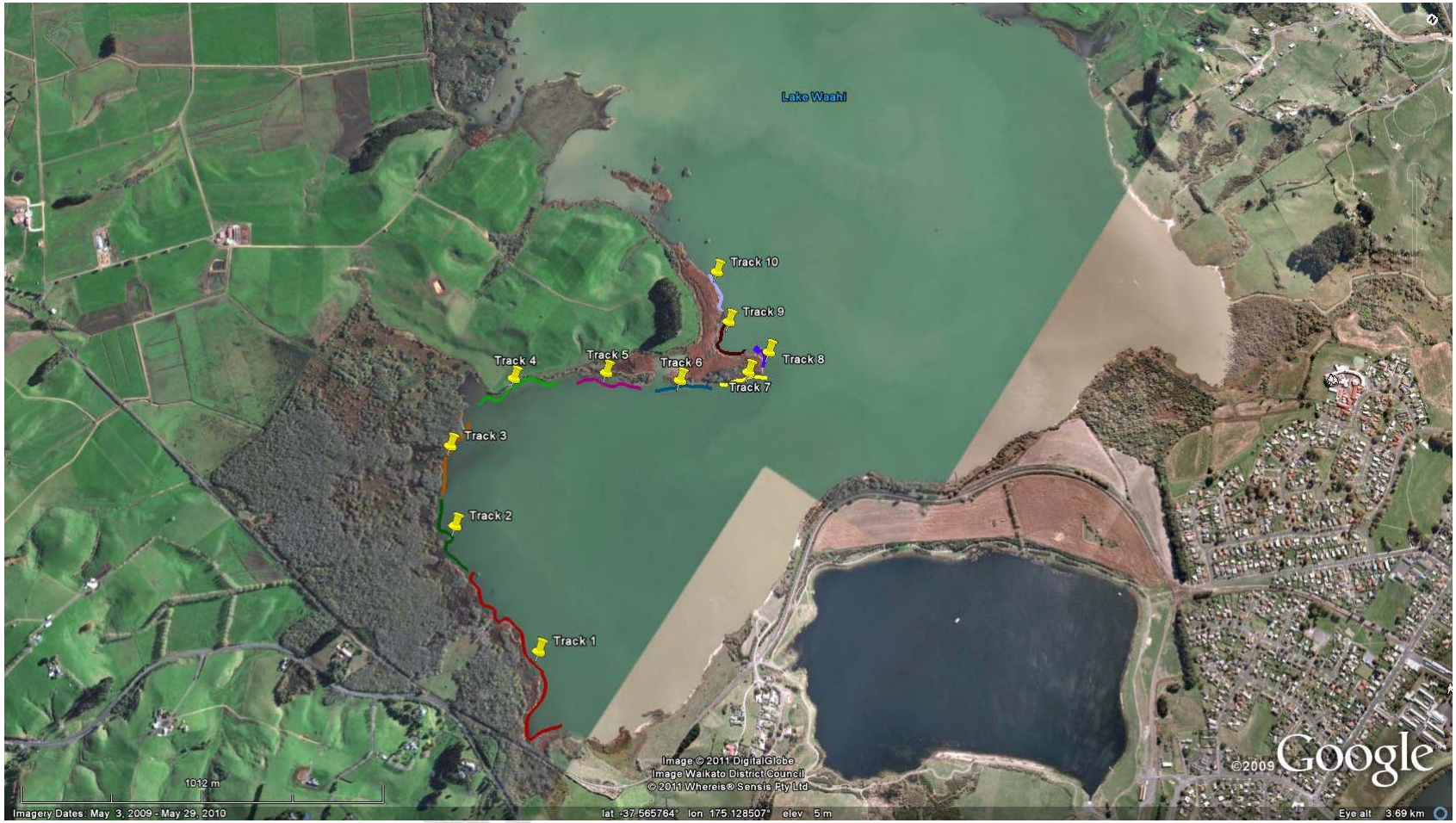

Figure 1. Sites fished on 7 and 23 March 2007 in Lake Waahi. Site codes correspond to locations in Table 1A.

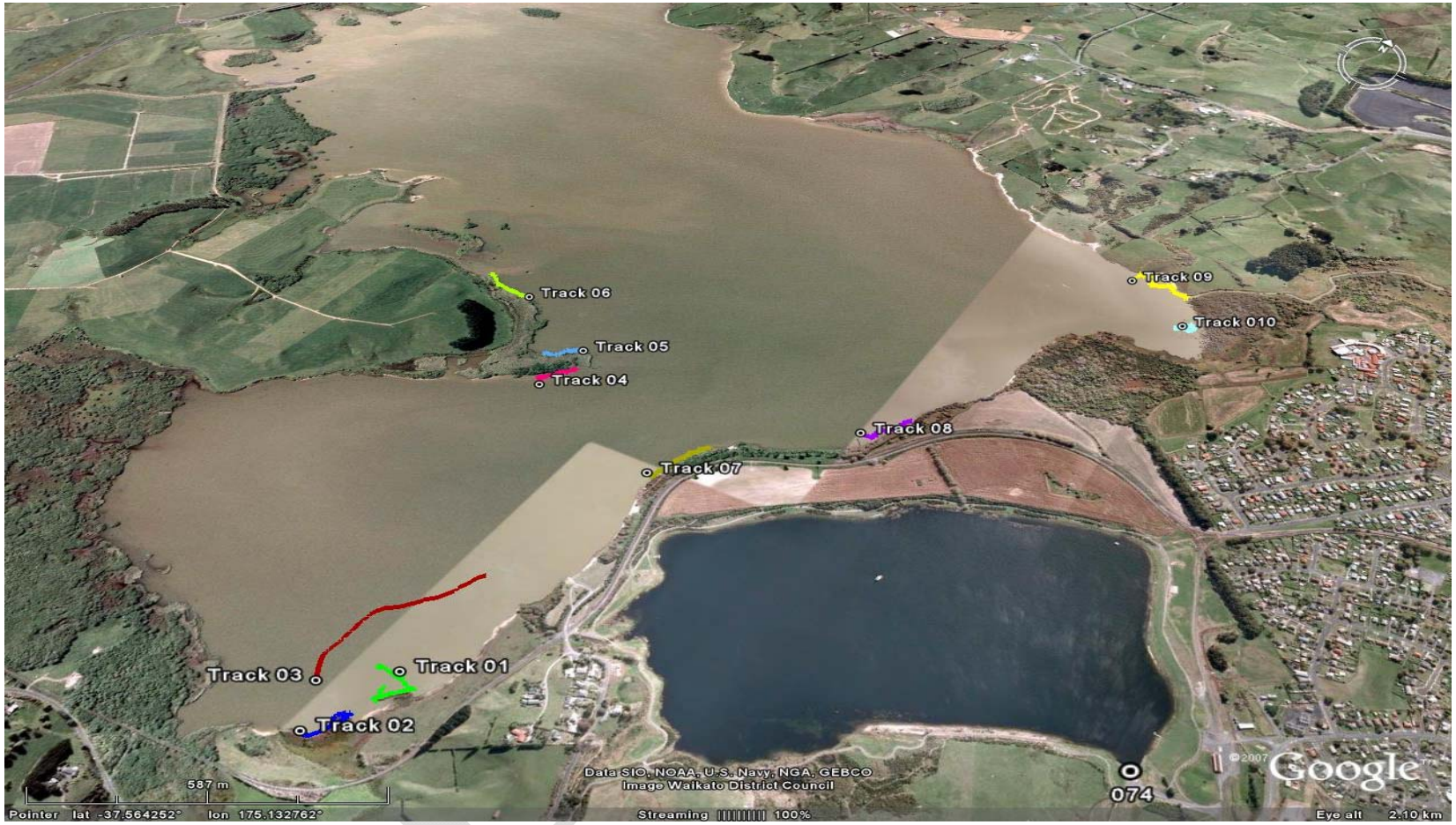

Figure 2. Sites fished on 23 March 2011 in Lake Waahi. Site codes correspond to locations in Table 1B.

Table 2. Number of fish caught from each species and density of each species from two boat electrofishing surveys (ten 10-min fishing tracks in each survey) conducted on Lake Waahi in 2007 and 2011.

Species	Number of fish		Density (fish 100 m^{-2})	
	2007	2011	2007	2011
Common bully	21	0	0.27	0
Catfish	23	4	0.29	0.03
Goldfish	233	29	2.98	0.23
Koi	21	9	0.27	0.07
Perch	9	22	0.12	0.17
Rudd	19	9	0.24	0.07
Shortfin eel	158	33	2.02	0.26
Common smelt	9	2	0.12	0.02
Mean	493	108	6.31	0.85

Table 3. Biomass and mean weight of fish species captured during boat electrofishing of Lake Waahi in March 2007 and 2011.

	Biomass (g 100 m^{-2})		Mean weight (g)	
	2007	2011	2007	2011
Common bully	0.1	-	0.3	-
Catfish	68.2	12.5	231.8	395
Goldfish	526.7	88.8	176.7	387.3
Koi carp	165.0	104.3	614.3	1466.7
Perch	49.8	32.8	432.4	188.7
Rudd	13.6	9.4	56.1	131.8
Shortfin eel	95.3	23.2	47.2	88.9
Common smelt	0.5	0.1	4.5	4.8
Total	919.3	271.0		

Table 4. Area surveyed and density of fish caught by boat electrofishing at 10 sites in Lake Waahi in March 2007 and 2011.

	2007				2011			
Site #	Total distance fished (m)	Total area fished (m^2)	Density (fish 100 m^{-2})	Biomass g m^{-2}	Total distance fished (m)	Total area fished (m^2)	Density (fish 100 m^{-2})	Biomass (g m^{-2})
1	180	719	6.8	14.5	353	1,412	2.0	6.7
2	205	819	5.6	7.7	242	968	0.9	2.5
3	258	1,032	4.1	8.3	425	1,700	0.1	0.1
4	235	940	10.5	16.6	302	1,208	1.0	2.4
5	203	814	7.9	9.5	225	900	0.4	1.6
6	204	817	5.8	6.4	247	988	1.1	1.6
7	206	825	4.7	5.8	350	1,400	0.4	1.2
8	146	585	4.4	7.9	315	1,260	0.9	3.4
9	187	750	5.5	9.7	428	1,712	0.4	1.5
10	129	515	7.8	10.1	276	1,104	1.6	7.2
Total	1,954	7,816			3,163	12,652		
Mean	195	782	6.3	9.7	316	1,265	0.9	2.8

5. Conclusions

6. Acknowledgements

7. References