

Wairarapa Moana wetland baseline fish surveys 2013



Brown mudfish (*Neochanna apoda*) in Barton's Lagoon.

Prepared for

Wairarapa Moana Wetlands Group

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1. EXECUTIVE SUMMARY

- Six wetland waterbodies located in Wairarapa Moana have been selected to be restored and monitored as part of the Fresh Start for Freshwater Program. Fish are one of the variables to be monitored as indicators of restoration success, so in 2013 these wetlands were surveyed using a variety of techniques to explore two different habitat types – open-water and ephemeral.
- In total, 1503 fish (including five native species and four exotic species) were captured and identified. Of the large-bodied species, the most numerically dominant was the native shortfin eel, followed by the exotic perch. Of the small-bodied species, the most numerically dominant was the endemic common bully.
- In terms of presence/absence, the shortfin eel, common bully and brown mudfish were widespread, occurring in five out of six of the waterbodies surveyed. Longfin eel and inanga were less common, each occurring in only two of the waterbodies surveyed.
- In contrast to recent surveys, no longfin eels or koura were found in Barton's Lagoon and an additional two introduced species were recorded in this waterbody.
- Barton's Lagoon and Hayward's Lagoon contained apparently healthy populations of mudfish whereas the other sites contained low numbers and none were found at Boggy Pond. It is possible that the low numbers and negative results (including at sites where mudfish have been recorded previously) could be partially attributed to the severe drought which occurred during late summer/autumn this year, during which marginal habitat may have dried out too much and aestivation success been lowered
- All small bodied species captured were native, however in terms of large bodied species, Hayward's Lagoon had the highest proportion of native species (96%), while Boggy Pond had the lowest (52%).
- The two healthy mudfish populations that were recorded during this survey were both located in habitats dominated by mature exotic trees which have recently been sprayed with herbicide in an eradication attempt. Concern exists for these populations given the

likely negative effects that tree removal will have on the habitat currently available in these areas (e.g. loss of habitat heterogeneity caused by large root structures, increase of water temperature and fluctuation magnitude from loss of shading and loss of leaf inputs which contribute to creating hospitable substrate). An additional concern exists for the population found in the Wairio Block as stock are currently allowed full access to the wetland they are occupying.

- The relatively large numbers of longfin eels found at Hayward's Lagoon are likely a result of access restrictions to eelers which are imposed by the landowner. This species is declining throughout New Zealand and Hayward's Lagoon – due to its privately-owned status – is likely functioning as one of very few informal longfin 'reserves' in the Wairarapa Moana area.
- Human intervention into flow level and direction in the JK Donald Block could be having negative impacts on the mudfish population as it likely rouses aestivating fish at an inappropriate time i.e. during warm temperatures when predators are most active. In addition, future activities potentially planned for the Wairio Block involving creating open-water habitats may also have detrimental effects on mudfish populations.

2. RECOMMENDATIONS

- Repeat surveying should be conducted approximately every five-ten years as restoration progresses.
- Exotic fish removal initiatives should be implemented in Barton's Lagoon, to both gather data on the effects of various control regimes and to mitigate the negative impacts that introduced species are likely having on native species such as kōura.
- Informal protection of longfin eels by the Hayward's Lagoon landowner should be continued.
- It would be very useful, in terms of adaptive management, for 'before' data on brown mudfish populations to be collected prior to herbicide application where any pest tree removal may be scheduled in the future in order to help define the impacts of this activity on indigenous mudfish.
- It would be useful for open-water habitat in the Wairio Block to be surveyed when there is a future opportunity (i.e. when standing water is present). In addition, the restriction of stock from the paddock in which mudfish were found in the Wairio Block would be of benefit as the removal of grazing and trampling impacts would allow regeneration of larger vegetation types which would provide more suitable mudfish habitat than the grasses and rushes currently present.
- Future intervention in the flow patterns of water within the JK Donald Block for the sake of human recreation should take the needs of brown mudfish (an endemic, declining species) into account. Similarly, mudfish needs should be considered when planning any further open-water habitat creation in the Wairio Block.

3. BACKGROUND

Six wetland waterbodies located in Wairarapa Moana (Fig 1) have been selected to be restored and monitored as part of the Fresh Start for Freshwater Program. Fish are one of the variables to be monitored as indicators of restoration success. In order for monitoring to be useful, baseline data of an adequate standard needs to be collected prior to any restoration activities being carried out.

Wetland habitats can be divided into two broad categories in terms of fish: open-water/lagoon habitat and ephemeral habitats. These two habitats are usually home to distinct fish communities and adequate baseline surveying required that both these habitat types be included.



Figure 1. Six Wairarapa Moana wetlands in which baseline fish surveying was conducted in 2013. **A:** Barton’s Lagoon; **B:** Hayward’s Lagoon; **C:** the JK Donald Block; **D:** Boggy Pond; **E:** Matthew’s Lagoon and **F:** the Wairio Block.

4. METHODS

Currently no published standard methods exist in New Zealand for surveying open-water in wetlands, therefore the protocols for netting and trapping in wadeable streams¹ were referred to. The effort required by these protocols in terms of required numbers of nets and traps was either matched or exceeded during the present surveys. Mudfish surveying (ephemeral habitats) was conducted according to currently available protocols² and with the addition of fine-mesh fyke nets to maximise detection probabilities.

Open-water habitats were surveyed during autumn (April), when the high-stress, dry conditions of a typical Wairarapa summer had passed, but the water was still warm enough for fish to be active. Ephemeral habitats³ were surveyed during winter (July), when wetted habitat was abundant and mudfish were active. Open-water habitats were surveyed using 2 x 30m trammel nets (one 35 mm mesh and one 45 mm mesh), 20 x minnow traps (3 mm mesh) and 6 x fyke nets during one intensive net night (one fine mesh, 5 coarse mesh). Ephemeral habitats were surveyed using 20 x minnow traps (3 mm mesh) and 4 x fyke nets (all fine mesh, three with exclusion chambers) divided across two locations within each site during one intensive net night. In addition, a fine mesh pole sieve was used to sample for juvenile mudfish.

Species, numbers, minimum and maximum lengths, location, habitat and trap type captured in were recorded at each site. All equipment was comprehensively decontaminated between waterbodies following currently accepted protocols⁴.

5. RESULTS AND DISCUSSION

5.1. Overall

In total, 1503 fish were captured and identified. Five native fish species and 4 exotic fish species were found in the waterbodies surveyed (Table 1). Of the large-bodied⁵ fish

¹ Joy M, David B, Lake M (2013). New Zealand freshwater fish sampling protocols: wadeable rivers and streams. University of Massey, Palmerston North

² Ling N (2001). New Zealand mudfishes: a guide. (Jointly published) Department of Conservation, Wellington; University of Waikato, Hamilton

³ Ephemeral was defined in these surveys as areas which are generally separate from main waterbodies and that are dry for part of the year.

⁴ <http://www.biosecurity.govt.nz/pests/didymo/cleaning-specific#fishing>

⁵ Large-bodied fish were defined in these surveys as longfin eels, shortfin eels, perch, rudd, brown trout and goldfish (both juvenile and adult). Small-bodied species were defined as common bully, inanga and brown mudfish (both juvenile and adult).

species, the most numerically dominant was the native shortfin eel, followed by the exotic perch. Of the small-bodied species, the most numerically dominant was the endemic common bully. The shortfin eel, common bully and brown mudfish were widespread, occurring in five out of six of the waterbodies surveyed. Longfin eel and inanga were less common, each occurring in only two of the waterbodies surveyed.

Table 1. Presence/absence of nine freshwater fish species in Wairarapa Moana wetlands during baseline surveying in 2013. **Bold** denotes threatened species; * denotes exotic species. Only ephemeral habitats were surveyed in the Wairio Block due to insufficient standing water for open-water surveys.

Scientific name	Common name	Barton's Lagoon		Hayward's Lagoon		JK Donald Block		Boggy Pond		Matthew's Lagoon		Wairio Block	
		O	E	O	E	O	E	O	E	O	E	O	E
<i>Anguilla australis</i>	Shortfin eel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
<i>Anguilla dieffenbachii</i>	Longfin eel			✓		✓							
<i>Carassius auratus</i> *	Goldfish*	✓				✓		✓	✓	✓	✓		
<i>Galaxias maculatus</i>	Inanga		✓				✓						
<i>Gobiomorphus cotidianus</i>	Common bully	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
<i>Neochanna apoda</i>	Brown mudfish		✓		✓	✓				✓	✓		✓
<i>Perca fluviatilis</i> *	Perch*	✓		✓		✓				✓			
<i>Salmo trutta</i> *	Brown trout*	✓		✓		✓							
<i>Scardinius erythrophthalmus</i> *	Rudd*	✓						✓		✓			

5.2. BARTON'S LAGOON



Figure 2. Sites where baseline fish surveying was carried out in Barton's Lagoon in 2013. Yellow indicates open-water surveying which was carried out in autumn and blue represents mudfish surveying which was carried out in winter.

5.2.1. Open-water survey

The open-water site at Barton's Lagoon had hard substrate, clay, gravel and cobbles with occasional soft mud. Submerged and floating macrophytes were abundant (Fig. 3). This site was surveyed over 5-6 April and the species captured were shortfin eels (58), brown trout (7), perch (5), rudd (2), goldfish (1) and common bully (1) (Fig. 4).



Figure 3. The open-water site where baseline fish surveying was carried out at Barton's Lagoon in 2013.



Figure 4. Introduced brown trout (right), rudd (left bottom) and perch (left top) captured in Barton's Lagoon during baseline fish surveying carried out in 2013.

5.2.2. Ephemeral survey site A

Ephemeral survey site A was located at the eastern-most edge of the enclosed alder area. The water was shallow over a deep mud substrate. Rushes, grasses and some floating macrophytes were present. Submerged wood was common and the water was slightly tannin-stained (Fig 5). Mudfish were recorded in this area in 2009⁶. This site was surveyed over 21-22 July and the species captured were inanga (12), common bully (11), brown mudfish (5) and shortfin eel (3). Multiple size classes of mudfish were present, indicating that successful reproduction has occurred this season.



Figure 5. Ephemeral survey site A where baseline fish surveying was carried out at Barton's Lagoon in 2013.

5.2.3. Ephemeral survey site B

Ephemeral survey site B was located south east of the lagoon, in the low-lying areas on the left of the stop bank between the two waterbodies. Isolated pools of standing water were present among trees and grasses. The water was tannin-stained and shallow, the

⁶ Recorded in the New Zealand Freshwater Fish Database (NZFFD)

substrate was soft mud with a thick layer of leaf litter. No aquatic macrophytes were present (Fig. 6). This site was surveyed over 21-22 July and the species captured were brown mudfish (16) and shortfin eel (1). Multiple size classes of mudfish were present, indicating that successful reproduction has occurred this season (Fig. 7).



Figure 6. Ephemeral survey site B where baseline fish surveying was carried out at Barton's Lagoon in 2013.



Figure 7. A large range of brown mudfish size classes were present in the Barton's Lagoon ephemeral sites, including small juveniles as pictured here.

5.3. HAYWARD'S LAGOON



Figure 8. Sites where baseline fish surveying was carried out in Hayward's Lagoon in 2013. Yellow indicates open-water surveying which was carried out in autumn and blue represents mudfish surveying which was carried out in winter.

5.3.1. Open-water survey

The open-water site at Hayward's Lagoon had shallow-soft substrate, with shallow–deep (e.g. 0.2–1 m) water. Floating and submerged macrophytes were abundant (Fig. 9). This site was surveyed over 29-30 March and the species captured were shortfin eel (98), common bully (77), longfin eel (29), brown trout (4) and perch (1) (Fig. 10).



Figure 9. The open-water site where baseline fish surveying was carried out at Hayward's Lagoon in 2013.



Figure 10. Large longfin eels captured in open-water habitat in Hayward's Lagoon during baseline fish surveying in 2013.

5.3.2. Ephemeral survey site A

Ephemeral survey site A was located immediately east of the lagoon, in tannin-stained water of shallow-medium (e.g. 0.2–0.6 m) depth. Area was enclosed, with lots of large (sprayed) willows and some cabbage trees. Substrate was firm, submerged wood and leaves were abundant and emergent and floating macrophytes were common (Fig. 11). This site was surveyed over 5-6 July and the species captured were shortfin eel (14), brown mudfish (12) and common bully (2). Multiple size classes of mudfish were present, indicating that successful reproduction has occurred this season



Figure 11. Ephemeral survey site A where baseline fish surveying was carried out at Hayward's Lagoon in 2013.

5.3.3 Ephemeral survey site B

Ephemeral survey site B was located to the east of the lagoon in a fenced off area of trees and pasture grasses. The water was shallow and tannin-stained with firm substrate and abundant leaf litter (12). This site was surveyed over 5-6 July and the species captured were common bully (10) and brown mudfish (7) (Fig. 13). Multiple size classes of mudfish were present, indicating that successful reproduction has occurred this season.



Figure 12. Ephemeral survey site B where baseline fish surveying was carried out at Hayward's Lagoon in 2013.



Figure 13. Brown mudfish captured during 2013 baseline fish surveying in ephemeral site B at Hayward's Lagoon.

5.4 JK DONALD BLOCK



Figure 14. Sites where baseline fish surveying was carried out in the JK Donald Block in 2013. Yellow indicates open-water surveying which was carried out in autumn and blue represents mudfish surveying which was carried out in winter.

5.4.1. Open-water survey

The open-water survey site in the JK Donald Block was located in Big Lagoon, in shallow–medium (e.g. 0.2–0.6 m) water, with firm-soft substrate. Floating and submerged macrophytes were present (Fig. 15). Big Lagoon had previously been dry for some time - water from the Otakura Stream was diverted into this lagoon a few weeks before surveying was carried out. This site was surveyed over 31 April–1 March and the species captured were common bully (179), shortfin eel (43), longfin eel (10), brown trout (3), goldfish (2), perch (1) and brown mudfish (1) (Fig. 16).



Figure 15. The open-water site where baseline fish surveying was carried out in the JK Donald Block in 2013.



Figure 16. Large numbers of common bullies captured during 2013 baseline fish surveying in open-water habitat in the JK Donald Block.

5.4.2. Ephemeral survey site A

Ephemeral survey site A was located in the north-east quadrant of the block, just inside the gate with the Fish and Game sign. The water was tannin-stained and of shallow-medium depth, with lots of sprayed willows and some cabbage trees present. Floating, submerged and emergent macrophytes were also present and the substrate was firm-medium with leaves and submerged wood abundant (Fig. 17). Mudfish were recorded around this area in 2009⁷. This site was surveyed over 6-7 July and the species captured were shortfin eel (5), common bully (1). A kōura/freshwater crayfish was also captured at this site (Fig. 18).

⁷ Recorded in the New Zealand Freshwater Fish Database (NZFFD)



Figure 17. Ephemeral survey site A where baseline fish surveying was carried out in the JK Donald Block in 2013.



Figure 18. Freshwater crayfish/kōura captured during 2013 baseline fish surveying in ephemeral survey site A in the JK Donald Block.

5.4.3. Ephemeral survey site B

The ephemeral survey site B was located in the north-west quadrant of the block, among willows and cabbage trees. The water was tannin-stained and of shallow–medium depth (e.g. 0.2–0.6 m). The substrate was medium-firm and floating, submerged and emergent macrophytes were present. Leaves and submerged wood were abundant (Fig. 19). This site was surveyed over 6-7 July and the species captured were common bully (30), shortfin eel (10) and inanga (2). (Fig. 20).



Figure 19. Ephemeral survey site B where baseline fish surveying was carried out in the JK Donald Block in 2013.



Figure 20. Inanga captured during 2013 baseline fish surveying in ephemeral survey site B in the JK Donald Block.

5.5. BOGGY POND



Figure 21. Sites where baseline fish surveying was carried out in Boggy Pond in 2013. Yellow indicates open-water surveying which was carried out in autumn and blue represents mudfish surveying which was carried out in winter.

5.5.1. Open-water survey

The open-water survey site in Boggy Pond was of shallow–medium depth (e.g. 0.2–0.6 m), soft mud over hard clay (mud was medium–deep (e.g. 0.6–1.0 m). Raupo beds and mercer grass were present and floating and submerged macrophytes were abundant (Fig. 22). This site was surveyed over 25-26 April and the species captured were common bully (140), goldfish (10), shortfin eel (9) and rudd (1) (Fig. 23).



Figure 22. The open-water site where baseline fish surveying was carried out in Boggy Pond in 2013.



Figure 23. Goldfish (left) and rudd (right) captured during 2013 baseline fish surveying in open-water habitat in Boggy Pond.

5.5.2. Ephemeral survey site A

Ephemeral survey site A was located at the north eastern edge of the Boggy Pond area, just past the second stile behind the Kilmore lodge. The water was tannin-stained and of shallow to medium depth. Emergent macrophytes were present, as were grasses, rushes, cabbage trees mingimingi (Fig. 24). The substrate was firm with leaves and some submerged wood present. This site was surveyed over 12-13 July and the only species captured was shortfin eel (1).



Figure 24. Ephemeral survey site A where baseline fish surveying was carried out in Boggy Pond in 2013.

5.5.3. Ephemeral survey site B

Ephemeral survey site B was located on the left of the road, just past the main public access to Boggy Pond. The water was tannin-stained and shallow–deep (e.g. 0.2–1 m) and the substrate was medium-soft sediment. Floating and submerged macrophytes were present, as were raupo and rush species (Fig. 25). Mudfish were recorded here in 1997⁸. This site was surveyed over 12-13 July and the species captured were shortfin eel (3), common bully (2) and goldfish (1). No mudfish were captured at the ephemeral sites.

⁸ Recorded in the New Zealand Freshwater Fish Database (NZFFD)



Figure 25. Ephemeral survey site B where baseline fish surveying was carried out in Boggy Pond in 2013.

5.6. MATTHEW'S LAGOON



Figure 26. Sites where baseline fish surveying was carried out in Matthew's Lagoon in 2013. Yellow indicates open-water surveying which was carried out in autumn and blue represents mudfish surveying which was carried out in winter.

5.6.1. Open-water survey

The Matthew's Lagoon open-water site was shallow–very deep (e.g. 0.2 –1+ m), with very deep, soft mud substrate. Floating and submerged macrophytes were abundant (Fig. 27). This site was surveyed over 23-24 March and the species captured were common bully (362), shortfin eel (139), perch (33), rudd (1), and goldfish (9).



Figure 27. The open-water site where baseline fish surveying was carried out at Matthew's Lagoon in 2013.

5.6.2. Ephemeral survey site A

Ephemeral survey site A was located at the southern edge of the main waterbody, among the willows. The water was tannin-stained and was medium–very deep (e.g. 0.6–1+ m). The substrate ranged from medium-very soft, with leaves and submerged wood abundant. Floating macrophytes were common (Fig. 28). This site was surveyed over 13-14 July and the species captured were common bully (79), shortfin eel (30) and goldfish (2).



Figure 28. Ephemeral survey site A where baseline fish surveying was carried out in Matthew's Lagoon in 2013.

5.6.3. Ephemeral survey site B

Ephemeral survey site B was located well to the north of the main water body, across the paddocks, among willow and cabbage trees. The substrate was firm, with leaves and submerged wood abundant. The water was tannin-stained and medium-deep. Submerged and emergent macrophytes were common (Fig. 29). This site was surveyed over 13-14 July and the species captured were shortfin eel (8), goldfish (1), common bully (1) and brown mudfish (1).



Figure 29. Ephemeral survey site B where baseline fish surveying was carried out in Matthew's Lagoon in 2013.

5.7. WAIRIO BLOCK

(Only ephemeral habitats were surveyed in the Wairio Block, as insufficient standing water was present at the time of the other surveys.)



Figure 30. Sites where baseline fish surveying was carried out in the Wairio Block in 2013 (autumn open-water surveys were not carried out in Wairio due to insufficient amounts of standing water).

5.7.1 Ephemeral survey site A

Ephemeral site A was located just north of the main entrance gate at the south east corner of the block. The substrate was firm, the water was tannin-stained and of shallow-medium depth, and the predominant surrounding and submerged vegetation was grass with rushes also present (Fig. 31). This site was surveyed over 7-8 July and no freshwater fish species were found to be present. An Australian bell frog was captured at this site (gee-minnow trap).



Figure 31. Ephemeral survey site A where baseline fish surveying was carried out in the Wairio Block in 2013.

5.7.2. Ephemeral survey site B

Ephemeral survey site B was located in the middle of the block, in a large shallow wet area. The substrate was firm, the water was tannin-stained and the vegetation present was predominantly grass, with rushes also present (Fig. 32). This site was surveyed over 7-8 July and the only freshwater fish species captured was brown mudfish (5). Giant diving beetles (species not recorded) were also found at this site.



Figure 32. Ephemeral survey site B where baseline fish surveying was carried out in Matthew's Lagoon in 2013.

5.8. Summary of species present in Wairarapa Moana wetlands

Longfin eels were only found in Hayward's Lagoon and the JK Donald Block, whereas shortfin eels were found at all sites (except Wairio, which was not surveyed in open-water habitat) (Figs 33 and 34). Perch were abundant in Matthew's Lagoon and present in lower numbers in Barton's and Hayward's Lagoon (Fig. 35). Rudd were also recorded in high numbers in Matthew's Lagoon, and in lower numbers in Barton's Lagoon and Boggy Pond (Fig. 36). Brown Trout were most common in Barton's Lagoon and were also found in Hayward's Lagoon and the JK Donald Block (Fig. 37). Goldfish were present in high numbers in Matthew's Lagoon and Boggy Pond, as well as in lower numbers in Barton's Lagoon and the JK Donald Block (Fig. 38).

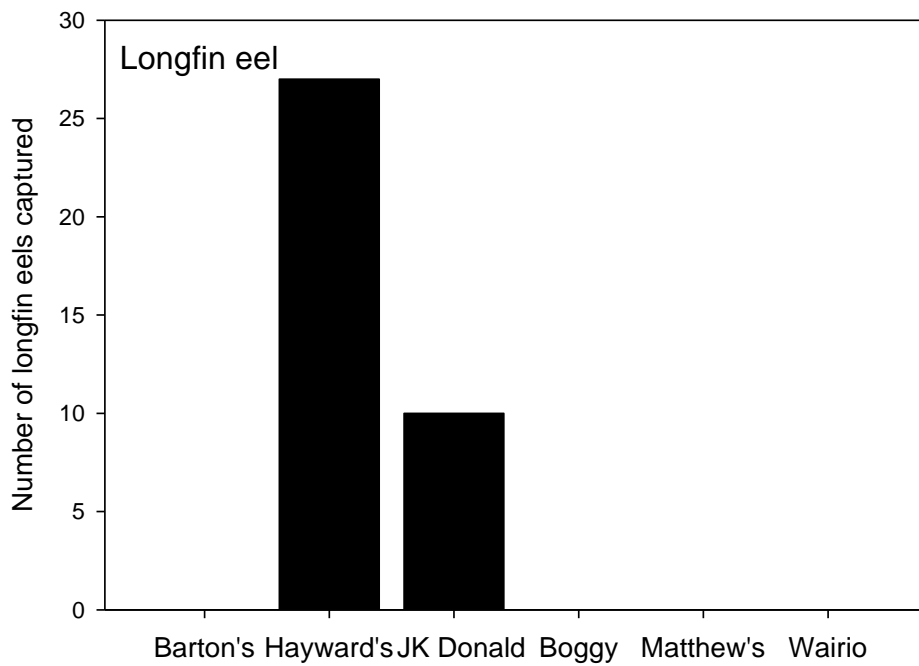


Figure 33. Numbers of endemic longfin eels captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

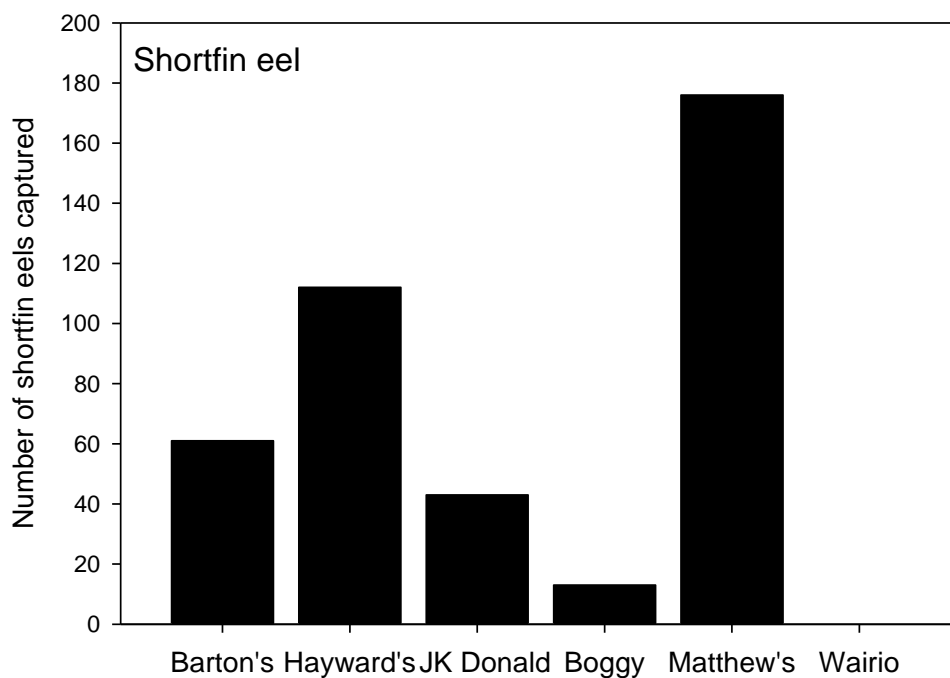


Figure 34. Numbers of native shortfin eels captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

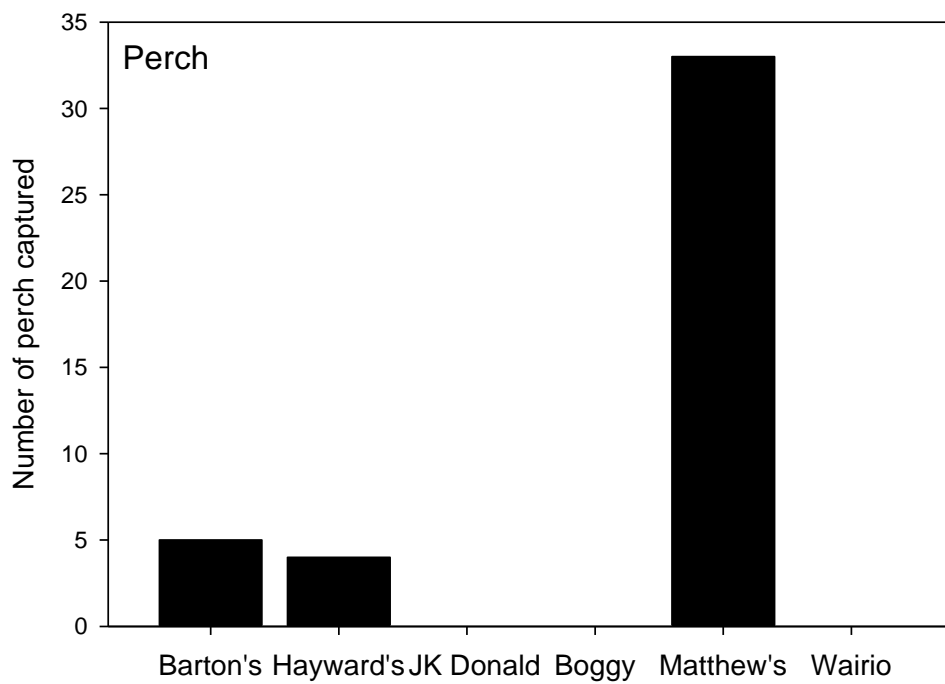


Figure 35. Numbers of introduced perch captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

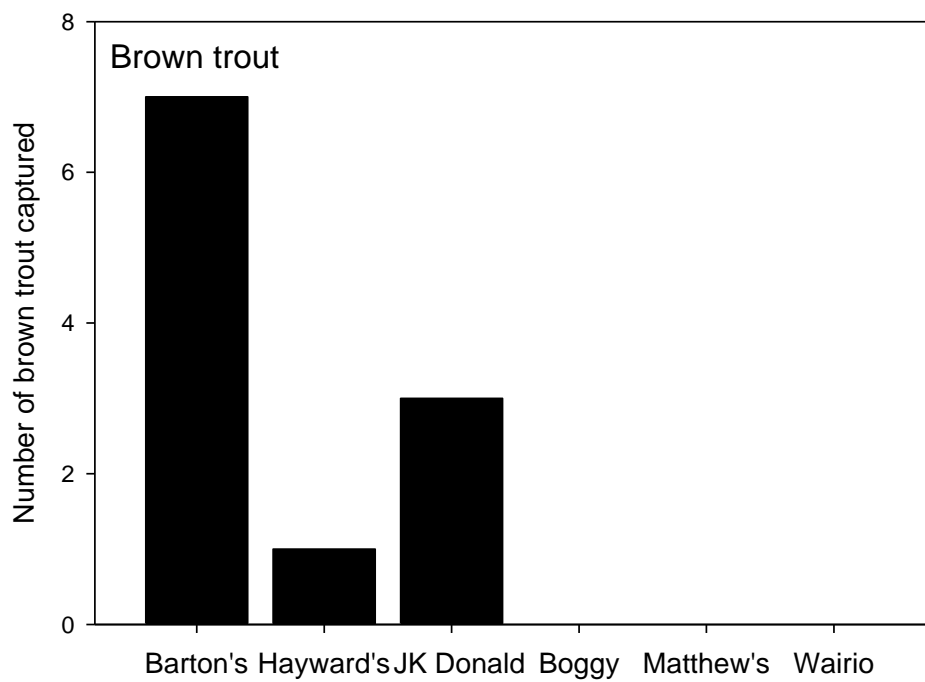


Figure 36. Numbers of introduced brown trout captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

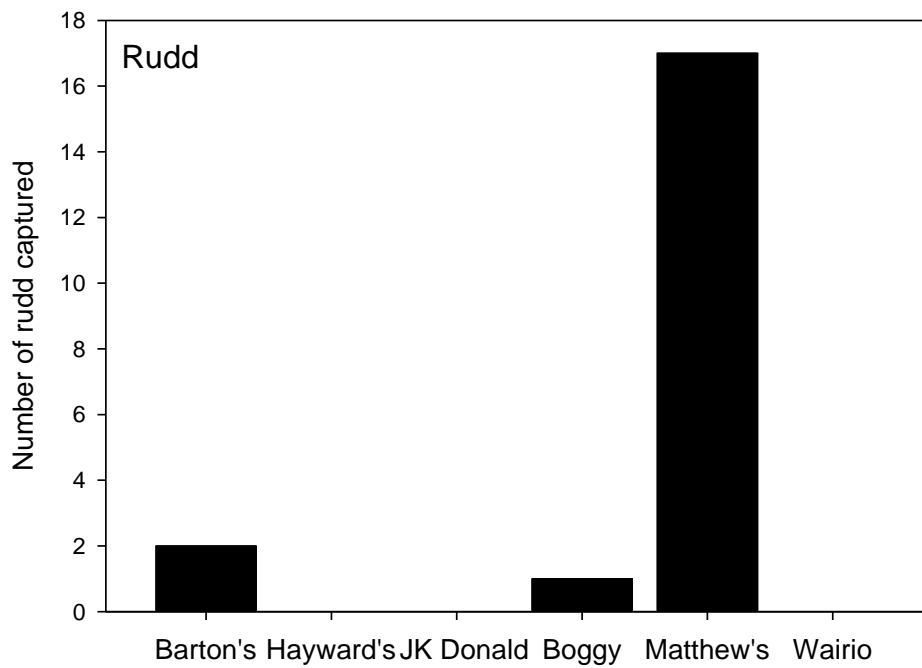


Figure 37. Numbers of introduced rudd captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

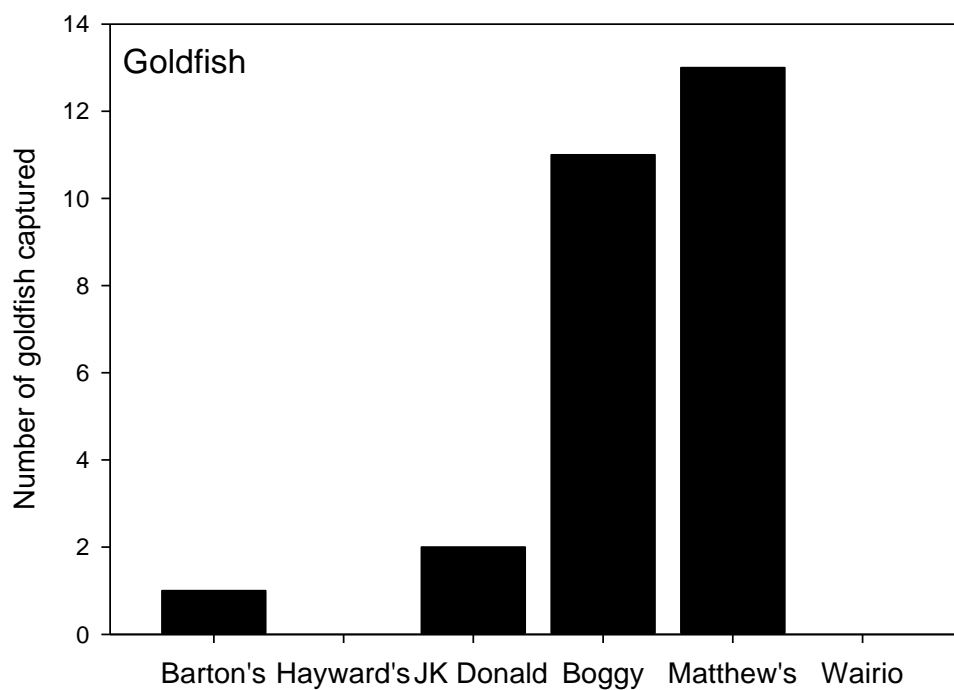


Figure 38. Numbers of introduced goldfish captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

With regard to smaller bodied species, common bullies were found at all sites (except Wairio) and were at their highest densities in the JK Donald Block (Fig. 39). Inanga were present in relatively high numbers in Barton's Lagoon and were also found in lower numbers in the JK Donald Block (Fig. 40), both of which are indicative of a frequent hydrological connection with Lake Wairarapa. Barton's Lagoon and Hayward's Lagoon contained apparently healthy populations of mudfish i.e. relatively large numbers with a range of size classes present (although still low numbers when viewed with a wider perspective⁹), whereas the other sites contained low numbers (with only a single individual present at each of the JK Donald Block and the Matthew's Lagoon ephemeral survey sites and none were found at the Boggy Pond sites; Fig. 41). It is possible that the low numbers and negative results (including at sites where mudfish have been recorded previously) could be partially attributed to the severe drought which occurred during late summer/autumn this year, during which marginal habitat may have dried out too much and aestivation¹⁰ success been lowered. Alternatively, low numbers could be a reflection of general habitat unsuitability at these sites. The high numbers caught at Barton's and Hayward's (as well as Lowe's Bush (T. Silbery Pers comm.)) show that the time of year these surveys were conducted was suitable for population detection.

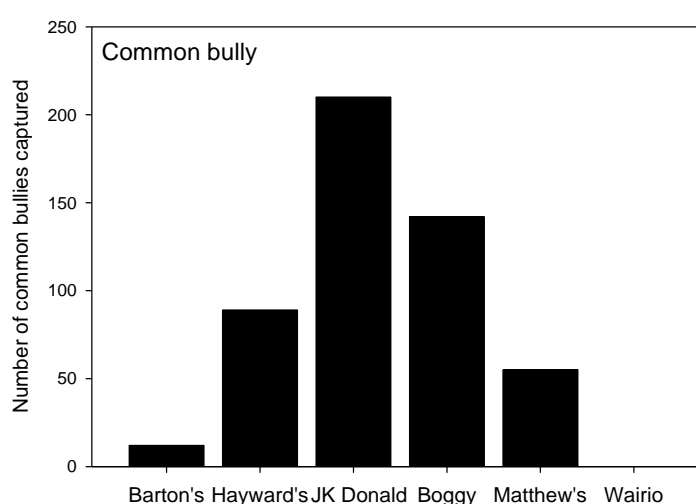


Figure 39. Numbers of endemic common bullies captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

⁹ Ling (2001) refers to a population of Northland mudfish as “locally abundant” when approximately 120 were captured across 15 gee-minnow traps (8 fish per trap). The densest population in Wairarapa Moana (at Barton's Lagoon) contained less than 1 fish per trap.

¹⁰ Aestivation refers to a physiological process undertaken by species like mudfish during periods when the surface water they are occupying dries up. An aestivating fish will bury itself in the substrate, surround itself in a mucous ‘cocoon’ and slow its metabolic rate. It will remain in this state until it is ‘roused’ by rainfall.

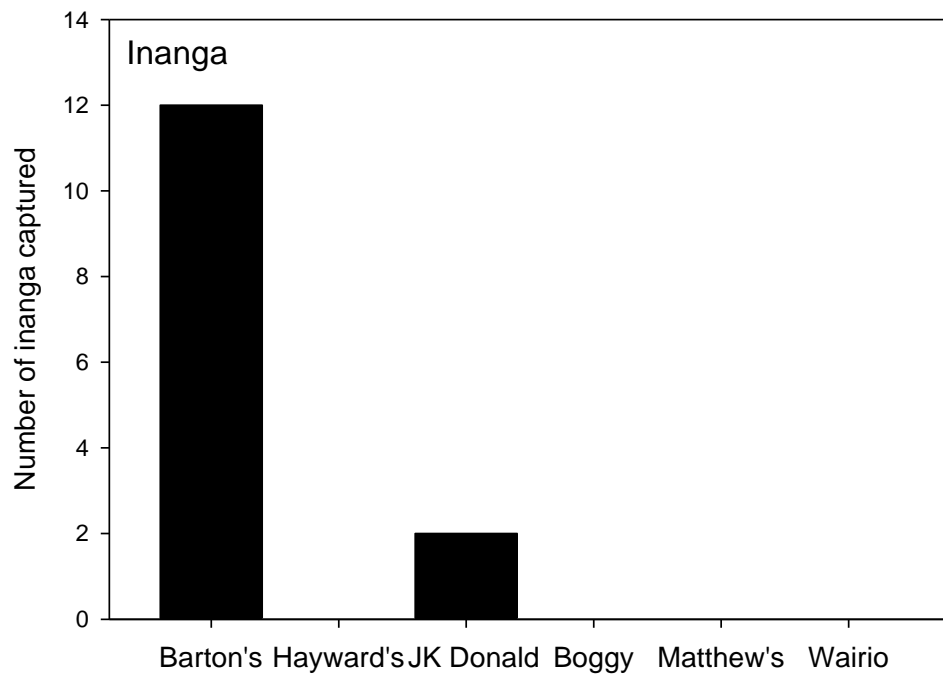


Figure 40. Numbers of native inanga captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

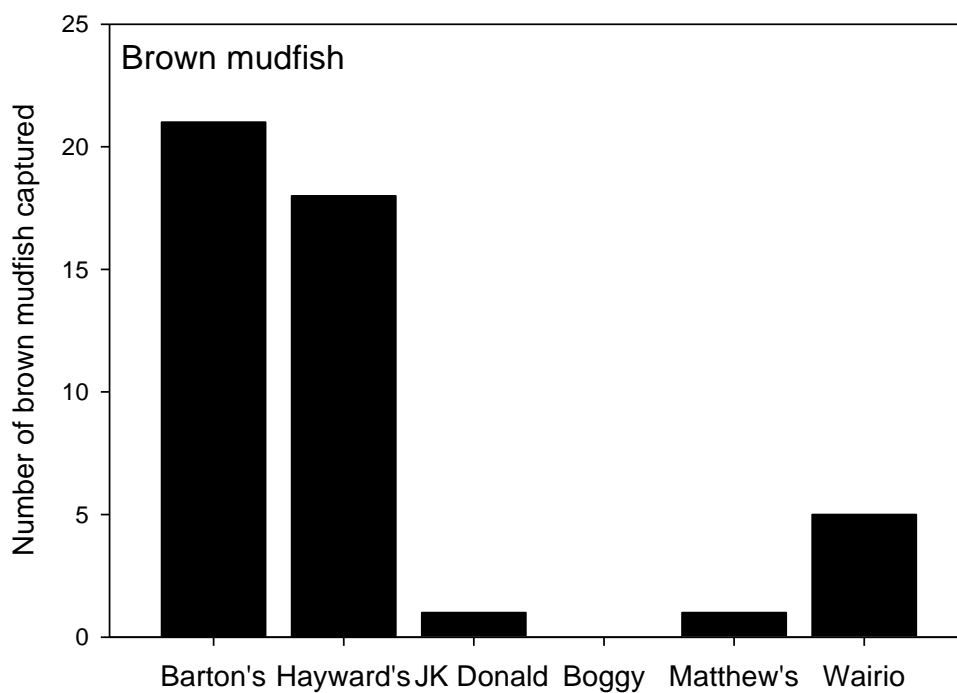


Figure 41. Numbers of endemic brown mudfish captured in six Wairarapa Moana wetlands during baseline fish surveying in 2013.

5.9. Community composition

In terms of community composition of large-bodied species, Hayward's Lagoon and the JK Donald Block were the most similar to each other, as were Boggy Pond and Matthew's Lagoon (although unusually high proportions of goldfish were present in Boggy Pond). Barton's Lagoon was similar to Hayward's and the JK Donald Block, apart from the lack of longfin eels recorded at this site (Fig. 42).

In terms of small-bodied species, the JK Donald Block, Boggy Pond and Matthews Lagoon were all similar and dominated by common bullies. Hayward's Lagoon also contained large numbers of common bullies, along with good numbers of brown mudfish. Barton's Lagoon contained relatively even proportions of common bullies, brown mudfish and inanga (Fig. 43).

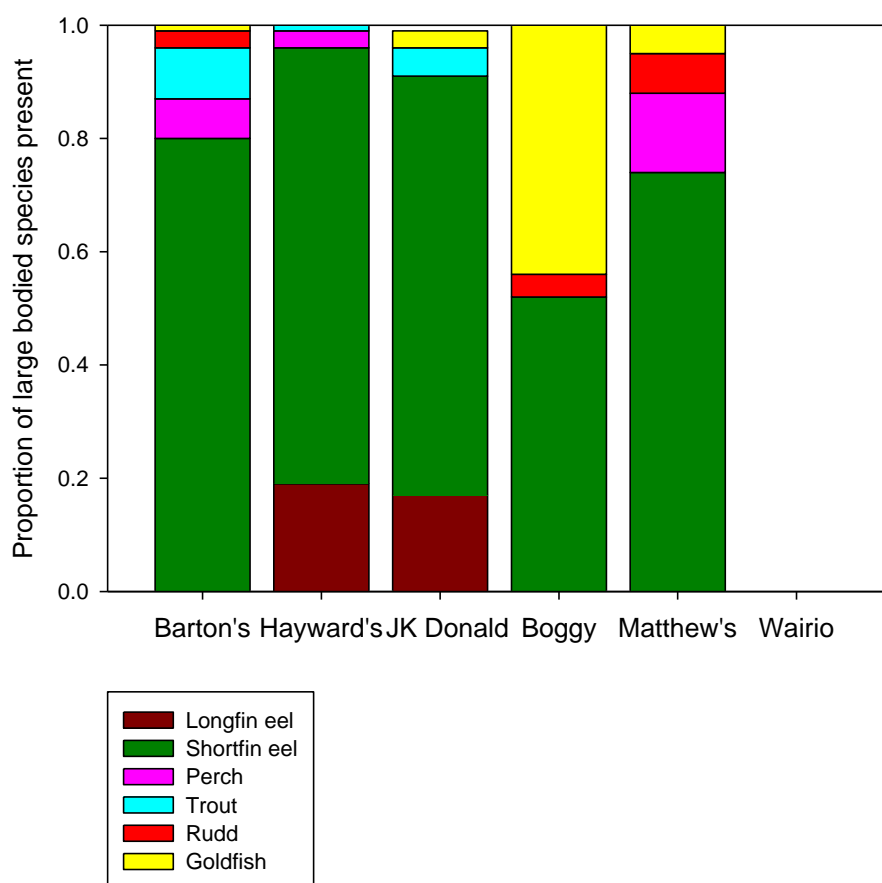


Figure 42. Fish community composition (large bodied species) in six Wairarapa Moana wetlands in which baseline fish surveying was carried out in 2013.

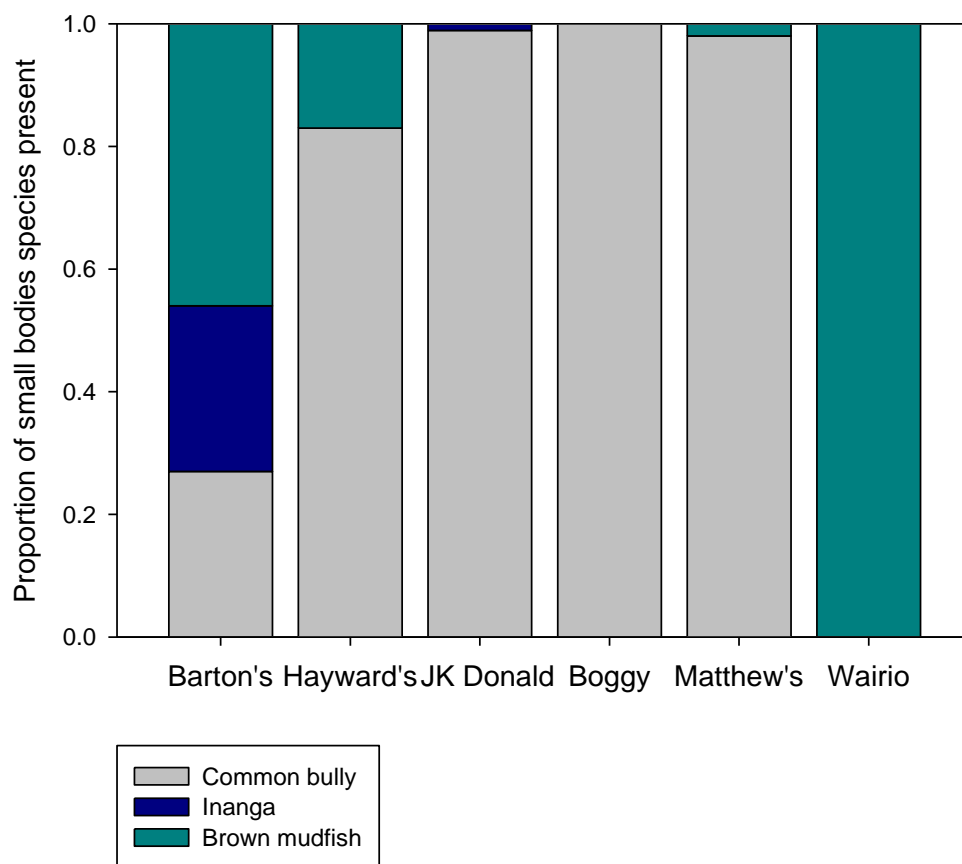


Figure 43. Fish community composition (small bodied species) in six Wairarapa Moana wetlands in which baseline fish surveying was carried out in 2013.

5.10. Nativeness

All small-bodied species (common bully, inanga and mudfish) were native, however there were both native and introduced large bodied species present in the waterbodies surveyed. Hayward's Lagoon had the highest proportion of native species (96%), while Boggy Pond had the lowest (52%). (Fig. 44).

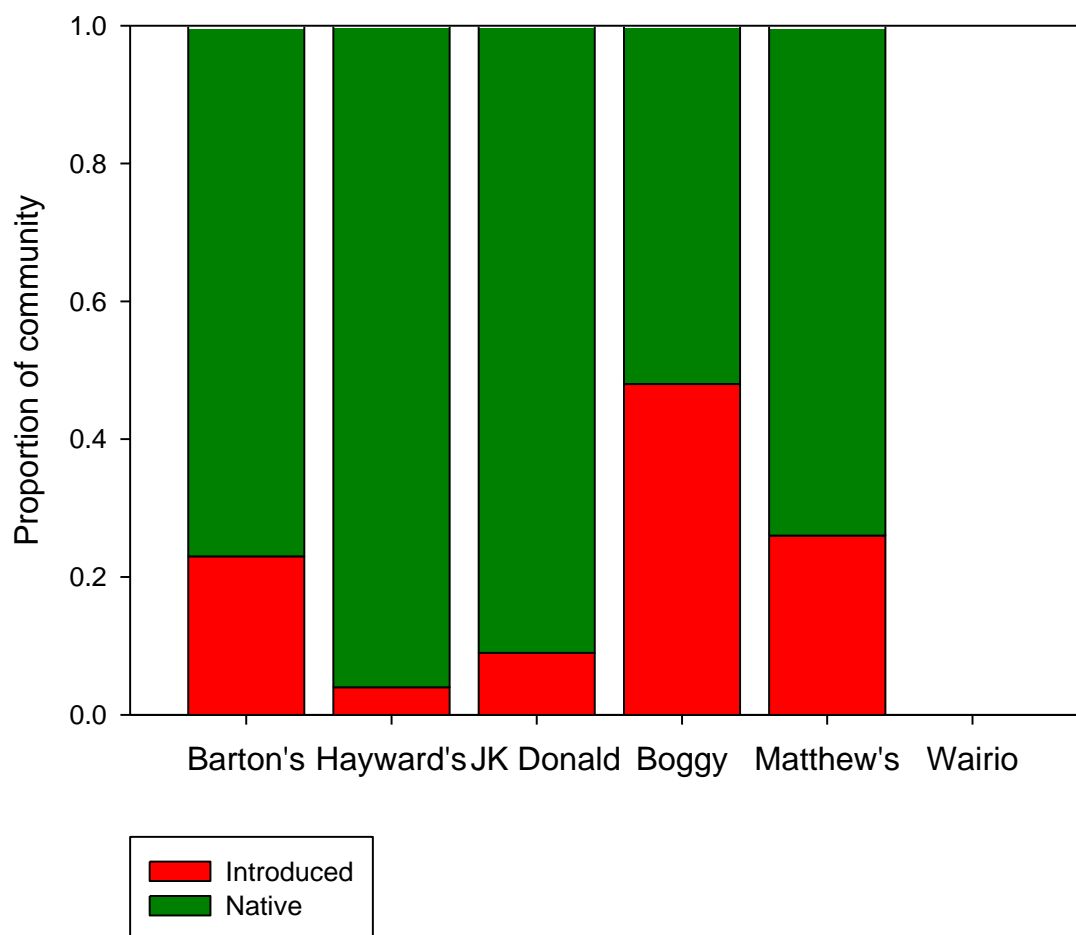


Figure 44. Proportions of native and exotic fish species found in six Wairarapa Moana wetlands during baseline fish surveying carried out in 2013.

5.11. ADDITIONAL COMMENTS

- Very low numbers of fish overall were captured in Boggy Pond, which could either be a reflection of the recent water level augmentation (i.e. a dilution effect), or possibly a result of illegal fishing of eels which may have occurred in the area this year (Tony Silbery, Pers comm).

Perch were not found in Boggy Pond, which contrasts with survey work conducted in 2010¹¹, during which a number of large perch were captured. It is possible that they are still present in low numbers that were not detected during this survey.

- No longfin eels were captured in Barton's Lagoon. This result was despite the netting effort being three times greater than that used during the survey work conducted in 2010, when a number of large longfins were captured. In addition (and also in contrast to 2010), no kōura were captured, despite the deployment of large numbers of traps targeted at kōura. The only evidence of kōura discovered in Barton's Lagoon was some remains present in the stomach of a large brown trout (Fig 45).



Figure 45. Remains of native smelt and kōura recovered from the stomach of brown trout captured in Barton's Lagoon.

¹¹ McEwan A (2010). Wairarapa Moana Fish Survey 2010. Report prepared for Greater Wellington Regional Council

- The two healthy mudfish populations that were recorded during this survey were both located in habitats dominated by mature exotic trees which have recently been sprayed with herbicide in an eradication attempt. Concern exists for these populations given the likely negative effects that tree removal will have on the habitat currently available in these areas (e.g. loss of heterogeneity caused by large root structures and loss of leaf inputs which contribute to creating hospitable substrate). In terms of adaptive management, it is unfortunate that no 'before' data on mudfish populations was collected prior to herbicide application and is recommended that this be done in any future areas where pest tree removal may be scheduled.
- Barton's Lagoon, Hayward's Lagoon and the JK Donald Block contained species that tend to be associated with relatively higher water quality (longfin eels and brown trout), while Matthew's Lagoon and Boggy Pond contained species that tend to be associated with lower water quality (shortfin eels and 'coarse' fish –perch, rudd, and goldfish).
- It would be useful for open-water habitat in the Wairio Block to be surveyed when there is a future opportunity (i.e. when standing water is present).
- The relatively large numbers of longfin eels found at Hayward's Lagoon are likely a result of access restrictions to eelers imposed by the landowner. This species is declining and Hayward's Lagoon – due to its privately-owned status – is likely functioning as one of very few informal longfin 'reserves' (i.e. no commercial or recreational extraction) in the Wairarapa Moana area.
- The ephemeral site where mudfish were found in the Wairio Block would benefit from restriction of stock access (cattle were shifted into the paddock, including the wetted area itself while traps were being cleared in the morning). The removal of grazing and trampling impacts would allow regeneration of larger vegetation types which would provide more suitable mudfish habitat than the grasses and rushes currently present. In addition, human creation of further open-water habitats within the block may have negative impacts on mudfish – populations which are occupying low-lying boggy areas (which are likely to be targeted for 'lagoon' creation) such as the population discovered during this survey are less likely to persist in created open-water habitat (due primarily to

the immigration of potential predators). It would be appropriate for future activities planned for the Wairio Block to take the needs of mudfish into account.

- Human intervention into flow level and direction in the JK Donald Block could be having negative impacts on the mudfish population. A brown mudfish was captured during open-water surveying in Big Lagoon (Fig. 46). It is unusual to find most species of mudfish (including brown mudfish) in waterbodies with permanent standing water, however the lagoons in the Wairio Block present an unusual situation as they are artificially managed to facilitate waterfowl hunting. Approximately two weeks prior to surveying, water from the Otakura Stream was diverted into Big Lagoon (which had previously dried up naturally during the summer months) by Fish and Game and the lagoon basin was filled up. Mudfish present would have been aestivating (the individual captured was skinny, indicating recent rousing) and this artificial ‘rainfall’ would have roused them to attempt to feed and reproduce at an inappropriate time i.e. during warm temperatures when predators are most active. Future intervention in the flow patterns of water within the JK Donald Block for the sake of human recreation should take the needs of brown mudfish (an endemic, declining species) into account.



Figure 46. A brown mudfish captured in Big Lagoon during open-water surveying when water was artificially redirected into the formerly dry lagoon basin.

6. ACKNOWLEDGEMENTS

Thanks to Paula and Ben Gillett for access to and assistance at the Hayward's and JK Donald Block sites. Thanks also to Tony Silbery for assistance with fieldwork and to Alton Perrie for support and review of this report.

7. APPENDIX 1. Raw data

BARTON'S LAGOON

Barton's Lagoon		5-6 April						
OPEN-WATER								
hard substrate, clay, gravel and cobbles with occasional soft mud. Lemna, azolla sparse; hornwort common, water celery sparse. Crispus common, other submerged and emergent macrophytes present								
species	length	trap type	trap number	notes		open-water summary		
brown trout	660	trammel	coarse			brown trout	7	
brown trout	500	trammel	coarse			perch	5	
brown trout	510	trammel	coarse			rudd	2	
brown trout	465	trammel	coarse			sfe	58	
brown trout	370	trammel	coarse			common	1	
perch	320	trammel	coarse			goldfish	1	
perch	280	trammel	coarse				74	
rudd	295	trammel	coarse					
brown trout	560	trammel	fine					
brown trout	530	trammel	fine					
perch	295	trammel	fine	contained smelt 85mm without tail				
perch	200	trammel	fine					
rudd	270	trammel	fine					
sfe	400	fyke	1	fine mesh				
sfe	300	fyke	1					
sfe	500	fyke	1					
sfe	300	fyke	1					
sfe	400	fyke	1					
sfe	300	fyke	1					
sfe	450	fyke	1					
sfe	300	fyke	1					
sfe	400	fyke	1					
common		fyke	1					
goldfish	15	fyke	1					
sfe	500	fyke	2					
sfe	500	fyke	4	fyke 3 mt				
sfe	500	fyke	4					

sfe	400	fyke	4					
sfe	500	fyke	4					
sfe	500	fyke	4					
sfe	400	fyke	4					
sfe	400	fyke	4					
sfe	400	fyke	4					
sfe	400	fyke	4					
sfe	400	fyke	4					
sfe	350	fyke	4					
sfe	800	fyke	5					
sfe	300	fyke	5					
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sfe	400	fyke	5					
sfe	450	fyke	5					
sfe	400	fyke	6					
sfe	800	fyke	6					
sfe	350	fyke	6					
sfe	450	fyke	6					

sfe	500	fyke	6					
perch	270	fyke	6					
EPHEMERAL								
21-22 July								
Site A								
eastern-most edge of alder area. Enclosed among large trees. Water shallow, over deep mud. Soft mud substrate, some floating macrophytes present (riccia). Sprayed rushes, grasses and trees. Submerged wood common, water not particularly tannin-stained								
fykes (3, all with exclusion chambers)							ephemeral summary	
sfe	3	350-600					sfe	4
common	5	25-85					common	11
inanga	12	30-90					inanga	12
							mudfish	21
sieve	none							48
minnows								
mudfish	5	30-90						
commons	6	30-70						
decapod shrimp	1							
Site B								
south east of lagoon, low-lying areas on the left of the stopbank between the waterbodies. Isolated pools of standing water among trees and sprayed grasses. Water shallow, substrate soft mud with thick layer of leaf litter. Water tannin-stained, no aquatic macrophytes present.								
fyke (1, without chamber)								
sfe	1	400						
mudfish	3	30-35						
sieve								
mudfish	1	25						
minnows								
mudfish	12	20-140						

HAYWARD'S LAGOON

Haywards		29th March - 30 March						
OPEN- WATER								
species	length	trap type	trap number	notes				
common		minnow	1	smallest common: 10mm; largest common: 40mm				
common		minnow	1					
common		minnow	1				open-water summary	
common		minnow	1				common	77
common		minnow	1				perch	1
common		minnow	1				trout	4
common		minnow	1				sfe	98
common		minnow	2				lfe	29
common		minnow	2					209
common		minnow	2					
common		minnow	3	bottom set				
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	3					
common		minnow	4					
common		minnow	5					
common		minnow	5					
common		minnow	5					
common		minnow	6					
common		minnow	6					
common		minnow	7					
common		minnow	7					
common		minnow	7					
common		minnow	7					
common		minnow	7					

common		minnow	7				
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common		minnow	9				
common		minnow	9				
common		minnow	9				
common		minnow	9				
common		minnow	9	no bullies in minnow 10 (bottom set)			
common		minnow	11				
common		minnow	11				
common		minnow	11				
common		minnow	11				
common		minnow	11				
common		minnow	12				
common		minnow	13	no bullies in minnow 14			
common		minnow	15				
common		minnow	16				
common		minnow	16				
common		minnow	16				
common		minnow	16				
common		minnow	16				
common		minnow	16				
common		minnow	17				
common		minnow	17				
common		minnow	17				
common		minnow	17				
common		minnow	18				

common		minnow	18	no bullies in min now 19				
common		minnow	20					
common		minnow	20					
common		minnow	20					
common		minnow	20					
common		minnow	20					
brown trout	490	trammel	coarse					
perch	295	trammel	coarse					
perch	360	trammel	fine					
perch	315	trammel	fine					
perch	215	trammel	fine	estimate - predated				
sfe	300	fyke	1					
sfe	300	fyke	1					
sfe	450	fyke	1					
sfe	300	fyke	1					
sfe	450	fyke	1					
sfe	500	fyke	1					
sfe	500	fyke	1					
sfe	400	fyke	1					
sfe	800	fyke	1					
sfe	400	fyke	1					
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lfe	350	fyke	1					
sfe	450	fyke	2					
sfe	800	fyke	2					
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sfe	600	fyke	2					

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sfe	700	fyke	3				
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sfe	400	fyke	3				
sfe	200	fyke	3				
sfe	500	fyke	3				
sfe	800	fyke	3				
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sfe	800	fyke	4				
sfe	850	fyke	4				
sfe	900	fyke	4				
sfe	700	fyke	4				
sfe	700	fyke	4				
sfe	700	fyke	4				
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sfe	800	fyke	4				
sfe	650	fyke	4				
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lfe	1200	fyke	4				
lfe	1000	fyke	4				
lfe	900	fyke	4				
lfe	800	fyke	4				
lfe	900	fyke	4				
lfe	850	fyke	4				
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sfe	650	fyke	6				
sfe	700	fyke	6				
lfe	900	fyke	6				
lfe	1000	fyke	6				
lfe	800	fyke	6				
EPHEMERA L							
5th July - 6 July							
Site A							

immediately east of the lagoon, shallow-med water depth, enclosed with lots of large sprayed willows, some cabbage trees. Water tannin-stained, substrate firm with submerged leaves and wood abundant

	10 minnows		number	size range			ephemeral summary
	adult mudfish		4	15-120			mudfish 19
	juvey mudfish		6				sfe 14
							common 12
	sieve						45
	juvy mudfish		1	15			
	2 fykes (both fine, one with exclusion chambers)						
	sfe		14	300-800			
	mudfish		1	(in one with exclusion chambers)			
	common bully		2	20-25	also in once with exclusion chamber		
Site B							

east of the lagoon in a fenced off area of trees and pasture grasses, shallow tainnin-stained water. Substrate firm and covered with leaf litter

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	10 minnows		number	size range				
	adult mudfish		4	90				
	common		1	30				
	sieve							
	0							
	2 fykes (both fine, both with chambers)							
	mudfish		3	80-100				
	common		9	30-40				

JK DONALD BLOCK

JK Donald		31 April - 1 March						
OPEN-WATER								
species	length	trap type	trap number	notes				
brown trout	630	trammel	coarse	set in uncleared stream (few days prior)				
brown trout	480	trammel	coarse					
brown trout	450	trammel	coarse					
goldfish	\	trammel	fine	set in lagoon; no length - heavily predated				
goldfish	\	trammel	fine	no length - heavily predated				
perch	\	trammel	fine	no length - heavily predated				
common bully		minnow	1	smallest 10mm; largest 70mm				
common bully		minnow	1					
common bully		minnow	1		open-water summary			
common bully		minnow	1			trout	3	
common bully		minnow	1			goldfish	2	
common bully		minnow	1			perch	1	
common bully		minnow	1			common	179	
common bully		minnow	1			mudfish	1	
common bully		minnow	1			sfe	43	
common bully		minnow	1			lfe	10	
common bully		minnow	1				239	
common bully		minnow	1					
common bully		minnow	1					
common		minnow	1					

bully								
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	4					
common bully		minnow	5					
common bully		minnow	5					
common bully		minnow	5					
common bully		minnow	5					
sfe	200	minnow	5					
common bully		minnow	6					
common bully		minnow	6	minnow 7 empty				
sfe	250	minnow	8	minnow 9 empty				
common bully		minnow	10	minnow 11 empty				
sfe	250	minnow	12	minnow 13,14,15 empty				
brown mudfish	30	minnow	16	minnow 17 empty				
sfe	250	minnow	18	minnow 19 empty				
sfe	300	minnow	20					
lfe	1200	fyke	2					
lfe	900	fyke	2					
lfe	700	fyke	2					
lfe	1100	fyke	3					
lfe	800	fyke	3					
lfe	700	fyke	3					
lfe	700	fyke	3					
sfe	800	fyke	3					
lfe	800	fyke	4					
lfe	800	fyke	4					

sfe	250	fyke	5				
sfe	300	fyke	5				
sfe	200	fyke	5				
sfe	550	fyke	5				
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sfe	650	fyke	5				
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sfe	300	fyke	5				
sfe	400	fyke	5				
lfe	400	fyke	5				
sfe	600	fyke	6				
sfe	700	fyke	6				
sfe	300	fyke	6				
EPHEMERAL							
6th July-7th July							

Site A								
water shallow-med depth, enclosed with lots of sprayed willows and some cabbage trees. Floating, submerged and emergent macrophytes present, substrate firm-medium, water tannin-stained, with leaves and submerged wood abundant								
fykes								
sfe	5	200-400		ephemeral summary				
common	1	30		sfe	15			
koura	1	25		inanga	2			
				common	32			
minnows					49			
common	1	20						
Site B								
water shallow-med depth, enclosed with lots of sprayed willows and some cabbage trees. Floating, submerged and emergent macrophytes present, substrate firm-medium, water tannin-stained, with leaves and submerged wood abundant								
fykes	(one with exclusion chamber - 0)							
sfe	10	80-300						
inanga	2	85						
commons	29	20-70						
minnows								
0								

BOGGY POND

Boggy Pond		25-26 April					
			thanks to T Silbery for assistance with fieldwork				
OPEN-WATER							
soft mud over hard clay (mud med - very deep). Azolla, lemna, ricciocarpus occasional; gornwort, crispus abundant; elodea common; charophyte sp rare; verges mostly dying willow, raupo beds present, some mercer grass and beggars ticks also present							
species	length	trap type	trap number	notes			
rudd	180	trammel	fine				
goldfish	270	trammel	coarse				
goldfish	270	trammel	coarse				
goldfish	260	trammel	coarse				
goldfish	210	trammel	coarse				
goldfish	10	minnow	1	10mm smallest, another size class 30 mm			
goldfish	10	minnow	3				
goldfish	10	fyke	1	fine mesh			
goldfish	10	fyke	1				
goldfish	30	fyke	1				
goldfish	30	fyke	1				
common		minnow	1	15mm smallest, 40mm largest			
common		minnow	1				
common		minnow	1			open-water summary	
common		minnow	1			rudd	1
common		minnow	1			goldfish	10
common		minnow	1			common	140
common		minnow	1			sfe	9
common		minnow	1				160
common		minnow	1				
common		minnow	1				
common		minnow	1				
common		minnow	1				
common		minnow	1				
common		minnow	1				

common		minnow	1				
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common		minnow	1				
common		minnow	1				
common		minnow	3				
common		minnow	3				
common		minnow	3				
common		minnow	3				
common		minnow	3				
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common		minnow	12			
common		minnow	12			
common		minnow	12			
common		minnow	13			
common		minnow	14			
common		minnow	14			
common		minnow	16			
common		minnow	18			
sfe	300	fyke	1	fine mesh		
sfe	500	fyke	3	note fykes 2 and 6 were empty		

[illegible]

common		fyke	1				
EPHEMERAL							
12-13th July 2013							
Site A							
Northeastern edge of boggy pond, just past the second stile behind the Fish and Game lodge. Water shallow to medium, tannin-stained. Emergent macrophytes present, grasses, rushes, cabbage trees and other shrubby one (ask Leon). Substrate firm with leaves and some submerged wood.							
2 fykes (one with exc chamber)							
sfe	1	600					
minnows and sieve		nothing					
Site B							
on the left of the road, just past the main public access to Boggy Pond. Water shallow-deep, tannin-stained. Substrate med-soft. Floating macrophytes lemna present, grasses, other submerged and emergent macrophytes present. Raupo common, rushes also present.							
2 fykes (both with exc chambers)				ephemeral summary			
sfe	3	400-500		sfe	4		
common	2	25-40		common	2		
goldfish	1	20		goldfish	1		
					7		
minnows nothing, sieve nothing							

MATTHEW'S LAGOON

Matthews Lagoon		23-24 March					
OPEN-WATER							
species	length	trap type	trap number	notes			
sfe	450	fyke	1	coarse			
sfe	400	fyke	1				
sfe	450	fyke	1		open-water summary		
sfe	500	fyke	1		sfe	139	
sfe	250	fyke	1		common	362	
sfe	400	fyke	2	coarse	goldfish	9	
sfe	500	fyke	2		perch	33	
sfe	300	fyke	2		rudd	1	
sfe	300	fyke	2			544	
sfe	350	fyke	2				
sfe	350	fyke	2				
sfe	600	fyke	2				
sfe	300	fyke	2				
sfe	300	fyke	2				
sfe	300	fyke	2				
sfe	300	fyke	2				
sfe	300	fyke	2				
sfe	300	fyke	2				
sfe	350	fyke	2				
sfe	500	fyke	2				
sfe	200	fyke	2				
sfe	300	fyke	2				
sfe	350	fyke	2				
sfe	350	fyke	2				
sfe	400	fyke	2				
sfe	450	fyke	2				
sfe	400	fyke	2				
sfe	300	fyke	2				
common		minnow	3	smallest common 5mm; largest 35m			
common		minnow	4				
common		minnow	4				
common		minnow	4				
common		minnow	6				

common		minnow	6				
common		minnow	7				
common		minnow	7				
common		minnow	8				
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common		minnow	8				
common		minnow	9				
common		minnow	9				
common		minnow	9				
common		minnow	9				
common		minnow	10				
sfe	300	fyke	4	fine			
sfe	300	fyke	4				
sfe	450	fyke	4				
sfe	700	fyke	4				
sfe	300	fyke	4				
sfe	450	fyke	4				
sfe	400	fyke	4				
sfe	400	fyke	4				
sfe	600	fyke	4				
sfe	500	fyke	4				
sfe	300	fyke	4				
sfe	300	fyke	4				
sfe	300	fyke	4				
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sfe	300	fyke	4				
sfe	300	fyke	4				
sfe	300	fyke	4				
sfe	300	fyke	4				
goldfish	130	fyke	4				
sfe	800	fyke	5	coarse			
sfe	300	fyke	5				
sfe	400	fyke	5				
sfe	400	fyke	5				

sfe	450	fyke	5				
sfe	400	fyke	5				
sfe	300	fyke	5				
sfe	450	fyke	5				
sfe	400	fyke	5				
sfe	300	fyke	5				
sfe	400	fyke	5				
sfe	300	fyke	5				
sfe	400	fyke	5				
sfe	300	fyke	5				
sfe	500	fyke	5				
sfe	500	fyke	5				
sfe	300	fyke	5				
sfe	500	fyke	5				
sfe	500	fyke	5				
sfe	400	fyke	5				
sfe	500	fyke	5				
sfe	400	fyke	6	fine			
sfe	300	fyke	6				
sfe	500	fyke	6				
sfe	400	fyke	6				
sfe	350	fyke	6				
sfe	500	fyke	6				
sfe	450	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	400	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	500	fyke	6				
sfe	500	fyke	6				
sfe	600	fyke	6				
sfe	650	fyke	6				
sfe	400	fyke	6				
sfe	400	fyke	6				
sfe	400	fyke	6				
sfe	300	fyke	6				
sfe	400	fyke	6				
sfe	200	fyke	6				
sfe	150	fyke	6				
sfe	300	fyke	6				
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sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
sfe	300	fyke	6				
goldfish	10 mm	fyke	6				
goldfish	10 mm	fyke	6				
commons		fyke	6		320 altogether		
perch	420	fyke	6				
perch	385	fyke	6				
perch	390	fyke	6				

perch	425	trammel	fine				
perch	400	trammel	fine				
perch	375	trammel	fine				
perch	350	trammel	fine				
perch	320	trammel	fine				
perch	285	trammel	fine				
perch	285	trammel	fine				
perch	275	trammel	fine				
perch	270	trammel	fine				
perch	230	trammel	fine				
perch	220	trammel	fine				
perch	235	trammel	fine				
rudd	280	trammel	fine				
rudd	265	trammel	fine				
rudd	300	trammel	fine				
rudd	260	trammel	fine				
rudd	260	trammel	fine				
rudd	315	trammel	fine				
rudd	280	trammel	fine				
rudd	255	trammel	fine				
rudd	250	trammel	fine				
rudd	230	trammel	fine				
rudd	235	trammel	fine				
rudd	280	trammel	fine				
rudd	260	trammel	fine				
rudd	295	trammel	fine				
rudd	270	trammel	fine				
rudd	200	trammel	fine				
goldfish	175	trammel	fine				
goldfish	200	trammel	fine				
goldfish	200	trammel	fine				
perch	420	trammel	coarse				
perch	370	trammel	coarse				
perch	415	trammel	coarse				
perch	400	trammel	coarse				
perch	380	trammel	coarse				
perch	360	trammel	coarse				
perch	340	trammel	coarse				
perch	380	trammel	coarse				
perch	300	trammel	coarse				
perch	420	trammel	coarse				
perch	405	trammel	coarse				
perch	420	trammel	coarse				
perch	420	trammel	coarse				
perch	340	trammel	coarse				

perch	370	trammel	coarse				
perch	325	trammel	coarse				
perch	305	trammel	coarse				
perch	280	trammel	coarse				
rudd	290	trammel	coarse				
goldfish	225	trammel	coarse				
goldfish	225	trammel	coarse				
goldfish	320	trammel	coarse				
commons		minnow	12				
commons		minnow	13				
commons		minnow	14				
commons		minnow	14				
commons		minnow	16				
commons		minnow	17				
commons		minnow	17				
commons		minnow	17				
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commons		minnow	18				
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commons		minnow	18				
commons		minnow	18				
commons		minnow	19				
commons		minnow	20				
commons		minnow	20				
commons		minnow	20				
commons		minnow	20				
commons		minnow	20				
commons		minnow	20				
EPHEMERAL							
13-14th July 2013							
Site A							
at southern edge of main waterbody. Water med-very deep, tannin-stained. Substrate firm-v soft, leaves and submerged wood abundant. Floating macros lemna and riccia common. Willows abundant							
2 fykes (one with exc chamber)					ephemeral summary		

sfe	16	250-700			sfe	38	
common	9	20-40			common	80	
goldfish	2	15-20			goldfish	4	
sfe	14	200-700	(no exc chamber)		mudfish	1	
common	2	30	(no exc chamber)			123	
minnows							
common	68	15-70					
sieve nothing							
Site B							
well north of the main water body. Substrate firm, leaves and submerged wood abundant. Water med-deep, tannin-stained. Submerged and emergent macros common. Willows and cabbage trees present.							
2 fykes (both exc chambers)							
sfe	8	300-600					
common	1	45					
goldfish	1	30					
minnows							
goldfish	1	30					
mudfish	1	90					

WAIRIO BLOCK

Wairio Block		7th -8th July					
open-water not surveyed due to lack of standing water at this site during timing of other open-water surveys							
EPHEMERAL							
Site A							
Just north of main entrance gate at south east corner of block. shallow-med water, vegetation predominantly grass, reeds/rushes also present. Substrate firm, water tannin-stained							
nothing (except bell frog!)							
Site B							
in the middle of the block, a large shallow wet area, mostly grass, also reeds/rushes. Tannin-stained water, firm substrate							
fykes	(one without exclusion chamber been removed from the water)						
mudfish	2	70-70			ephemeral summary		
					mudfish	5	
minnows							
mudfish	3	65-70					
	giant diving beetles here too.						