

**Lake Wairarapa Fish Surveying**  
**September 2009 – August 2010**



**Exotic perch with 11 native bullies removed from its stomach.**

Prepared for

**Wairarapa Moana Wetlands Group**

By

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**August 2010**

## Contents

|      |   |    |
|------|---|----|
| 1.1. | Executive summary.....                          | 3  |
| 1.2. | Recommendations.....                            | 4  |
| 2.   | Aim and scope of this study.....                | 5  |
| 3.   | Study area.....                                 | 5  |
| 4.   | Materials and methods.....                      | 6  |
| 5.   | Results and discussion.....                     | 7  |
| 5.1. | Overall.....                                    | 7  |
| 5.2. | Number of fish captured per sampling event..... | 14 |
| 5.3. | Nativeness.....                                 | 15 |
| 5.4. | Size distributions.....                         | 16 |
| 5.5. | Perch gender and reproduction.....              | 19 |
| 6.   | Acknowledgements.....                           | 21 |
| 7.   | References.....                                 | 21 |
| 8.   | Appendix.....                                   | 22 |

## 1.1 Executive summary

- Northern Lake Wairarapa was surveyed on 11 separate occasions across 2009 – 2010 using a 30m monofilament trammel net.
- A total of 357 fish were captured, representing 4 native species (including one threatened species - longfin eel) and 4 exotic species. Capture efficiency was high, with an average of 32 fish caught per net night.
- Indigenous biodiversity represented during this survey was extremely low – 97% of all fish captured were exotic species. The exotic perch was by far the most numerically dominant fish, followed by the exotic rudd and brown trout.
- Repeat sampling combined with comparisons with historical data indicate that the endemic black flounder population of Lake Wairarapa has undergone significant decline and this species now only exists as a population remnant. This is likely due to a combination of migratory access impairment, habitat degradation, competition from exotic fish and overharvest.
- Very high (20: 1) female: male perch ratios were present. Periodic gender identification shows that perch are spawning in Lake Wairarapa in late spring/early summer and indicates that males may be spatially separated from females except during spawning. This phenomenon could facilitate the application of more effective control regimes that are targeted to coincide with spawning time.

## **1.2 Recommendations**

- Continue periodic sampling at the northern Lake Wairarapa site to further strengthen existing datasets and provide additional baseline information on the population status of both native and introduced freshwater fish species. Regular sampling would also provide a mechanism for early detection of any new introductions of exotic species.
- Educate the public on the current status of native freshwater fish species in Wairarapa Moana, especially threatened species (e.g., longfin eels) and those with populations having undergone significant decline (e.g., black flounder).
- Serious consideration and discussion should be generated regarding the values associated with Lake Wairarapa, especially with regard to the goals of Wairarapa Moana. In this setting the restoration of indigenous biodiversity and the persistence of populations of exotic sports fish are incompatible.
- Control of exotic species and improvement of migratory access to Lake Wairarapa are imperative for restoration of the black flounder population. A moratorium on recreational floundering in Lake Wairarapa should be considered and any commercial harvest should be immediately curtailed.

## **2. Aim and scope of this study**

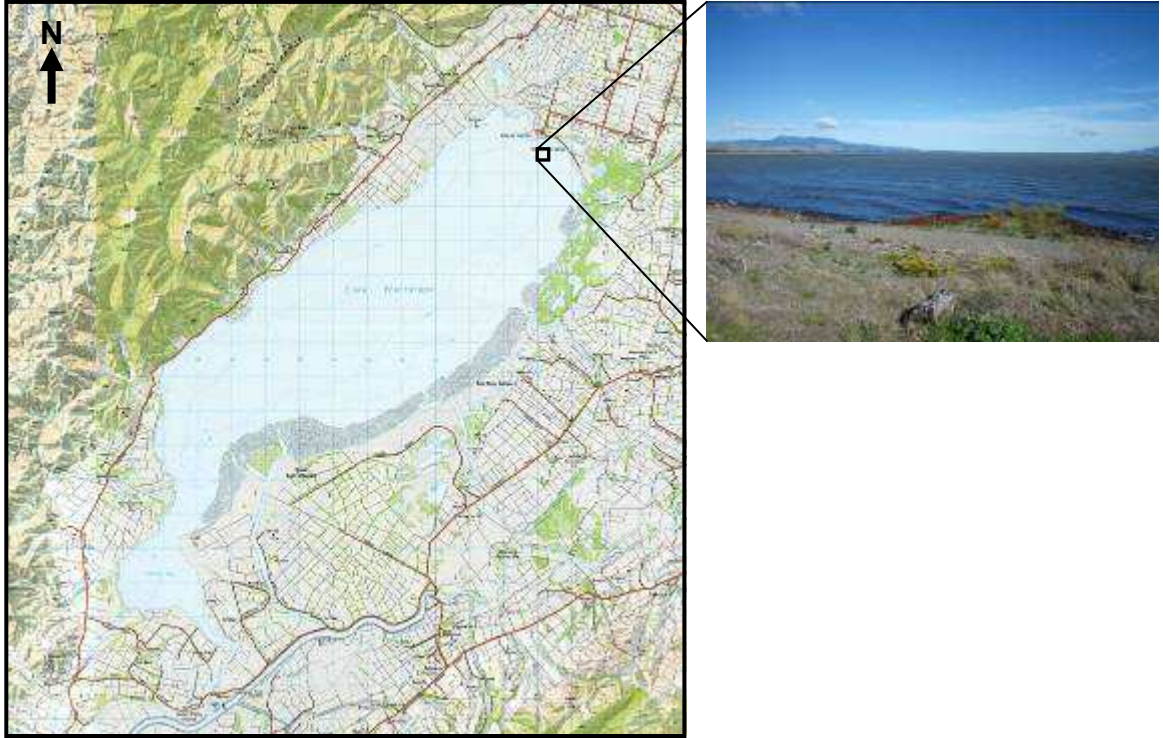
The present work aimed to provide information regarding fish communities in Lake Wairarapa, particularly with regard to seasonal changes. The collection of baseline data regarding species presence/absence, size distributions, community composition, spawning condition and temporal changes in all of the above parameters were all goals of this study.

## **3. STUDY AREA**

Lake Wairarapa is a large (18km long; 6km wide), shallow (mostly <2.5m deep) supertrophic lake located in the lower North Island, New Zealand. Historically, the Ruamahanga River flowed through both Lake Wairarapa and Lake Onoke – a system that contained extensive wetland areas and provided habitat and access for large numbers of diadromous<sup>1</sup> native fish species. As a flood-protection initiative completed in 1974, the Ruamahanga was diverted away from Lake Wairarapa and barrage gates were installed at the southern end of the lake. These changes appear to have severely affected the ability of many species to migrate and native fish populations in Lake Wairarapa have dramatically declined or been apparently extirpated as a result (Hicks 1993, McEwan 2009). In addition, exotic non-diadromous species have been introduced to Lake Wairarapa, creating further changes in the fish community. The northern end of the lake was selected for the present work (Fig. 1), due to ease of access and records of high numbers of fish catches (McEwan 2009).

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<sup>1</sup> Diadromous: an aquatic animal that completes part of its life cycle in freshwater and part in saltwater. New Zealand has a high proportion of diadromous species in its native freshwater fauna.



**Figure 1.** Map of Lake Wairarapa showing survey site at northern edge (with inset photo).

#### **4. MATERIALS AND METHODS**

For each survey, a 30m monofilament trammel net was set in the evening and retrieved the next morning. Most fish were euthanised using the iki method although those that were able to be removed from the net alive were returned to the water (e.g. flounder were usually only lightly tangled whereas perch and brown trout were heavily enmeshed and usually dead when the net was lifted. All rudd were euthanised as they are classed as a noxious species). All fish were measured to the nearest cm, weighed to the nearest gram and all perch were identified to gender if possible. Eleven individual surveys were conducted over 2009 – 2010: 14 September 2009, 18 October 2009, 21 November 2009, 4 December 2009, 16

January 2010, 20 February 2010, 20 March 2010, 5 May 2010, 25 June 2010, 14 July 2010 and 20 August 2010.

## **5. RESULTS AND DISCUSSION**

### **5.1 Overall**

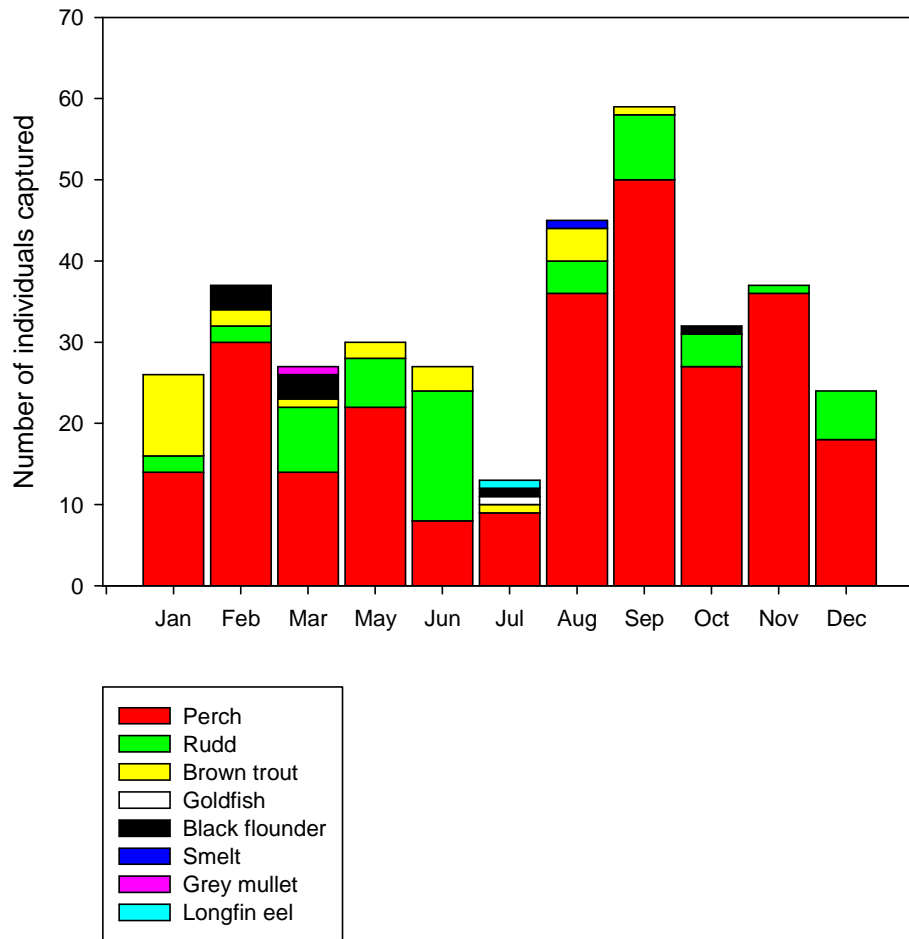
A total of 357 fish were captured across all sampling events, collectively representing 4 native species and 4 exotic species (Table 1). The highest number of fish caught in 1 sample was 59 in September 2009 and the lowest number was 13 caught in July 2010 (Fig.2). The species captured largely reflect the survey method (i.e., the monofilament trammel net is more likely to catch large-bodied fish species).

Making up 74% of all fish captured, the exotic perch (*Perca fluviatilis*: Fig. 3) was by far the most frequently encountered species, followed by the exotic rudd (*Scardinius erythrophthalmus*: Fig. 4), at 16%. The third most commonly encountered species was also exotic - the brown trout (*Salmo trutta*: Fig. 5) made up 7% and the native black flounder (*Rhombosolea retiaria*: Fig. 6) made up 2% of all fish captured. The exotic goldfish (*Carassius auratus*: Fig. 7), and the native common smelt (*Retropinna retropinna*: Fig. 8), longfin eel (*Anguilla dieffenbachii*: Fig. 9) and grey mullet (*Mugil cephalus*: Fig. 10) were represented by a single individual each.

**Table 1.** Fish captured at northern Lake Wairarapa during 11 evenly spaced sample events across September 2009 – August 2010. \* denotes exotic species.

| Scientific name                          | Common name    | Jan       | Feb       | Mar       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       | Total      |
|--|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| <i>Anguilla dieffenbachii</i>            | Longfin eel    | 0         | 0         | 0         | 0         | 0         | 1         | 0         | 0         | 0         | 0         | 0         | 1          |
| <i>Carassius auratus</i> *               | Goldfish       | 0         | 0         | 0         | 0         | 0         | 1         | 0         | 0         | 0         | 0         | 0         | 11         |
| <i>Mugil cephalus</i>                    | Grey mullet    | 0         | 0         | 1         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 1          |
| <i>Perca fluviatilis</i> *               | Perch          | 14        | 30        | 14        | 22        | 8         | 9         | 36        | 50        | 27        | 36        | 18        | 264        |
| <i>Retropinna retropinna</i>             | Common smelt   | 0         | 0         | 0         | 0         | 0         | 0         | 1         | 0         | 0         | 0         | 0         | 1          |
| <sup>∞</sup> <i>Rhombosolea retiaria</i> | Black flounder | 0         | 3         | 3         | 0         | 0         | 1         | 0         | 0         | 1         | 0         | 0         | 8          |
| <i>Salmo trutta</i> *                    | Brown trout    | 10        | 2         | 1         | 2         | 3         | 1         | 4         | 1         | 0         | 0         | 0         | 24         |
| <i>Scardinius erythrophthalmus</i> *     | Rudd           | 2         | 2         | 8         | 6         | 16        | 0         | 4         | 8         | 4         | 1         | 6         | 57         |
|  | <b>Total</b>   | <b>26</b> | <b>37</b> | <b>27</b> | <b>30</b> | <b>27</b> | <b>13</b> | <b>45</b> | <b>59</b> | <b>32</b> | <b>37</b> | <b>24</b> | <b>357</b> |





**Figure 2.** Community composition of fish captured at northern Lake Wairarapa during 11 evenly spaced sample events over 2009 – 2010.



**Figure 3.** Perch (*Perca fluviatilis*) captured at northern Lake Wairarapa. Also showing native smelt that was regurgitated during removal from net.



**Figure 4.** Rudd (*Scardinius erythrophthalmus*) captured at northern Lake Wairarapa.



**Figure 5.** Brown trout (*Salmo trutta*) captured at northern Lake Wairarapa.



**Figure 6.** Black flounder (*Rhombosolea retiaria*) captured at northern Lake Wairarapa.





**Figure 7.** Feral coloured goldfish (*Carassius auratus*) captured at northern Lake Wairarapa.



**Figure 8.** Large common smelt (*Retropinna retropinna*) captured at northern Lake Wairarapa.



**Figure 9.** Longfin eel (*Anguilla dieffenbachii*) captured at northern Lake Wairarapa.

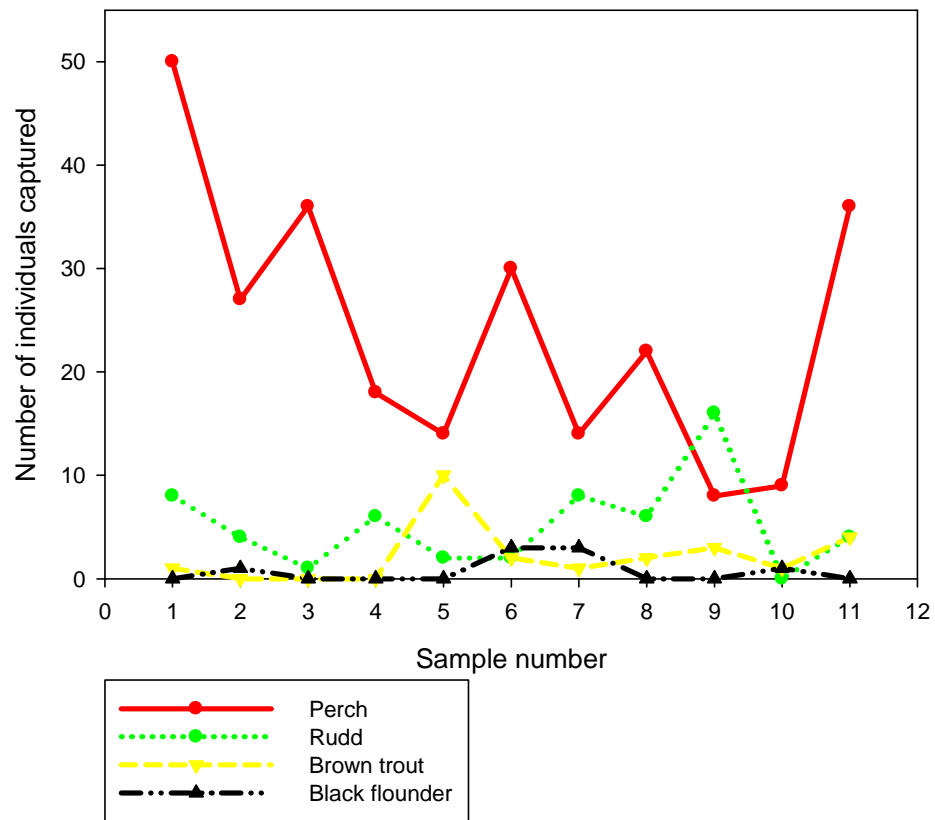


**Figure 10.** Grey mullet (*Mugil cephalus*).

## **5.2 Number of fish captured per sampling event**

Across all samples, each overnight survey with the 30m monofilament trammel net captured an average of  $24 \pm 4$  perch (mean  $\pm$  SE),  $5 \pm 1$  rudd,  $2 \pm 1$  brown trout,  $1 \pm$

0.5 black flounder and  $0.1 \pm 0.1$  each of goldfish, common smelt, longfin eel and grey mullet. No removal effect was observed on any of the four most representative species (perch, rudd, brown trout and black flounder: Fig 11). The number of perch captured with each successive survey appears to decrease slightly overall, but sample 11 again captured a large amount – further periodic sampling would be needed to determine whether successive removal was resulting in lowered capture rates however, in such a large waterbody as Lake Wairarapa, this seems unlikely.

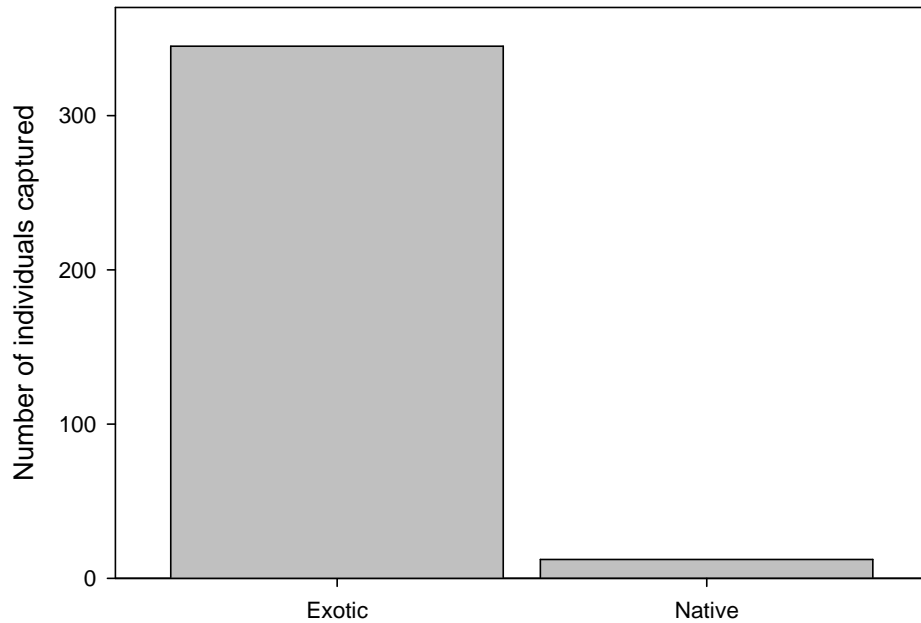


**Figure 11.** Number of perch, rudd, brown trout and black flounder captured during progression of repeat sample events.

### 5.3 Nativeness

Four native species were captured during the survey: black flounder, grey mullet, common smelt and longfin eel. The longfin eel is classed as a threatened species by the Department of Conservation. These four native species made up a small component of the total fish caught; of the 357 fish that were captured across all sampling events, 345 (97%) were exotic species (Fig 12). This is a clear sign that the indigenous biodiversity of Lake Wairarapa has been severely compromised.

The only native species caught on more than a single occasion was the black flounder, with 8 individuals captured across all sample events. Prior to the diversion of the Ruamahanga River, this species was so numerous that it supported a number of small commercial fisheries, reporting catches of 40-60 flounder per gill net night. Following the diversion, these numbers dropped to 15-25 flounder per gill net night up until 1988, then fell further to around 2-3 flounder per gill net per night in 1991 (Hicks 1993). This survey produced only 0.7 flounder per net night (0-3). These declines are likely due to migratory access impairment combined with habitat degradation, competition from exotic fish and overharvest. Urgent restoration initiatives combined with harvest restrictions (Yellow belly flounder are far more numerous in Lake Onoke (McEwan 2010)) are required if this species is to persist in Lake Wairarapa.

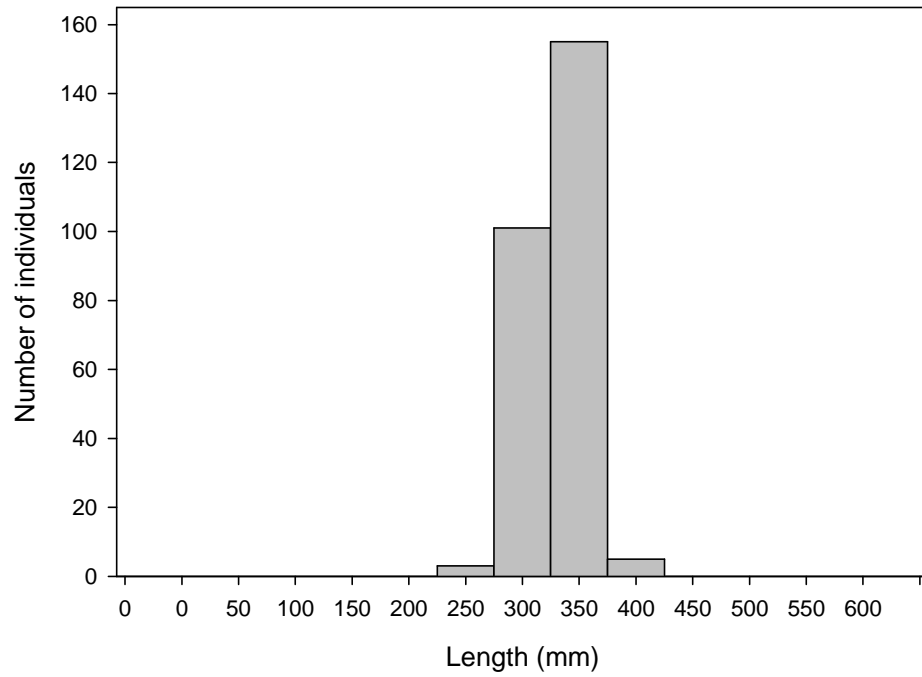


**Figure 12.** Number of exotic and native species captured across all samples.

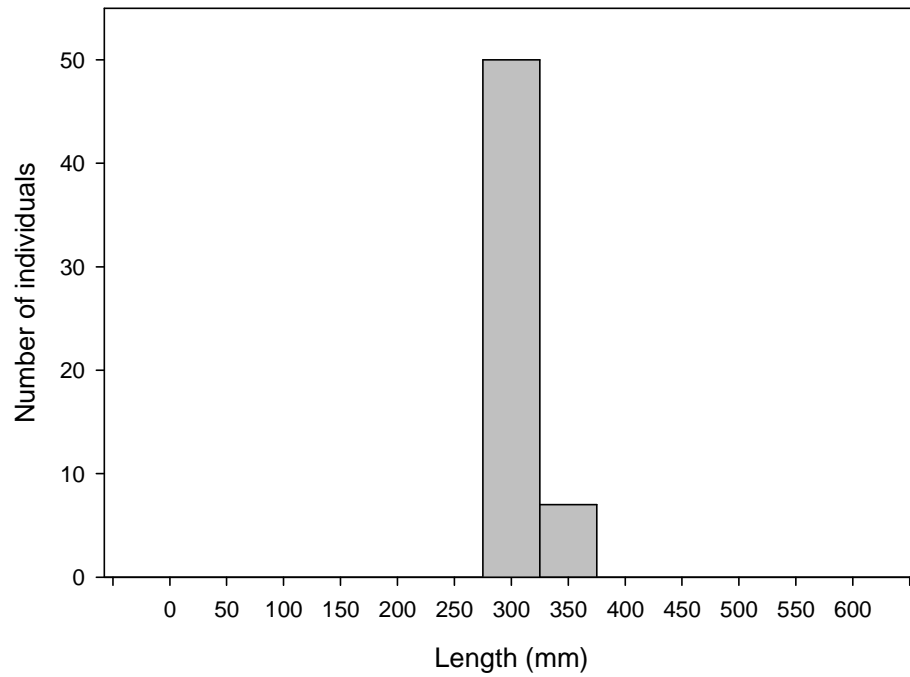
#### 5.4 Size distributions

Very narrow length distributions were apparent within the 4 most representative species (perch, rudd, brown trout and black flounder: Figs 13 – 16). Perch average length was  $310 \pm 1\text{mm}_{\text{TL}}$  (mean  $\pm$  SE); rudd average length was  $288 \pm 2\text{mm}_{\text{TL}}$ ; brown trout average length was  $463 \pm 10\text{mm}_{\text{TL}}$  and black flounder average length was  $262 \pm 19\text{mm}_{\text{TL}}$ . No outliers (especially small or especially large individuals) were captured. The lack of small fish is likely partly due to netting bias however other survey efforts in northern Lake Wairarapa as well as other parts of the lake (McEwan 2009; 2010) used alternative capture techniques (fyke netting, seine netting and gee minnow trapping), which also failed to turn up small individuals of these species. This indicates that small individuals are not present and this area provides habitat to adult specimens only.

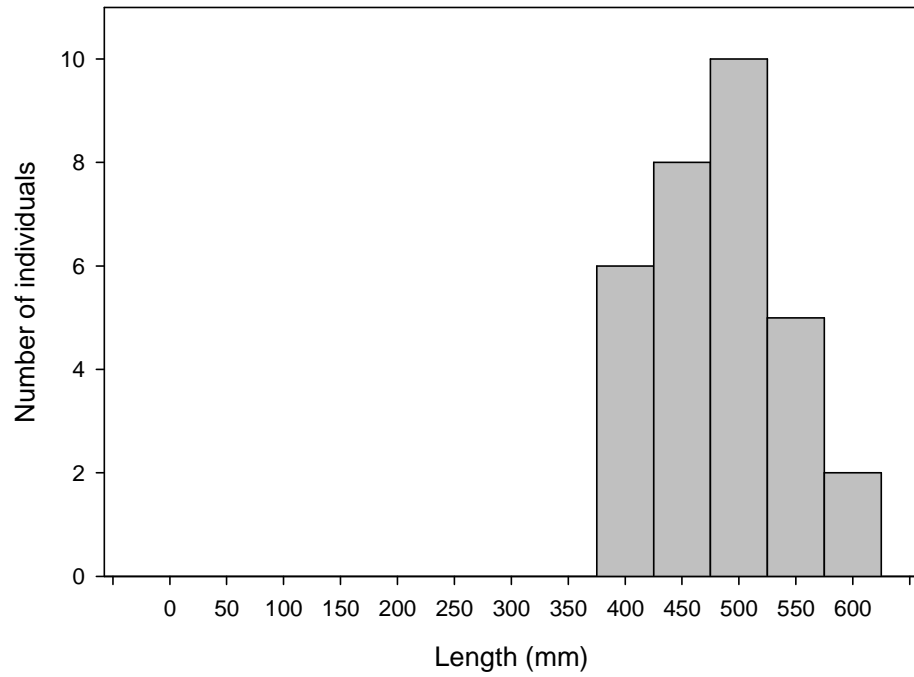




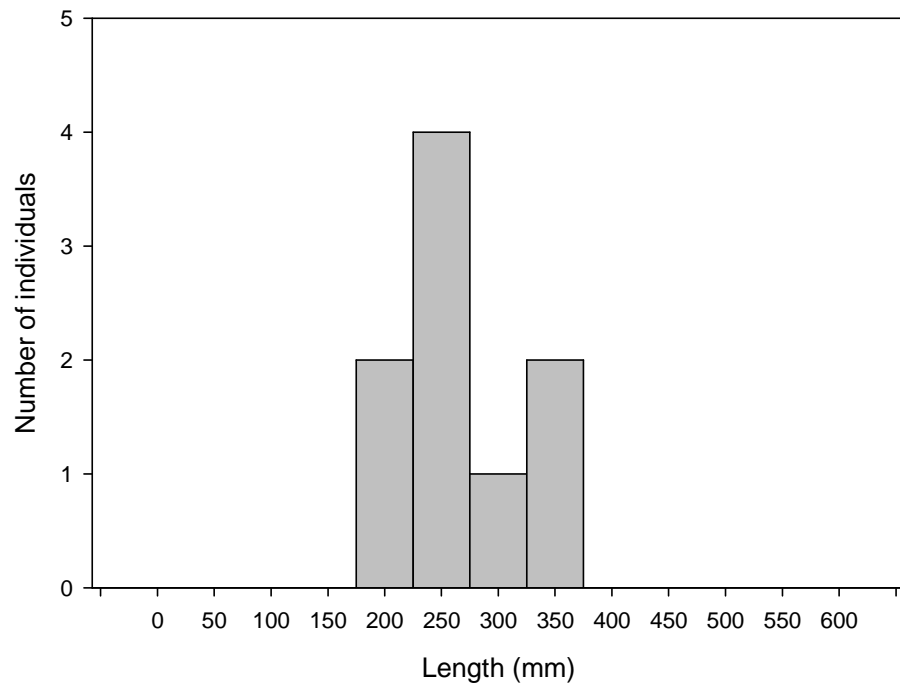
**Figure 13.** Length frequency distribution of perch captured across all samples.



**Figure 14.** Length frequency distribution of rudd captured across all samples.



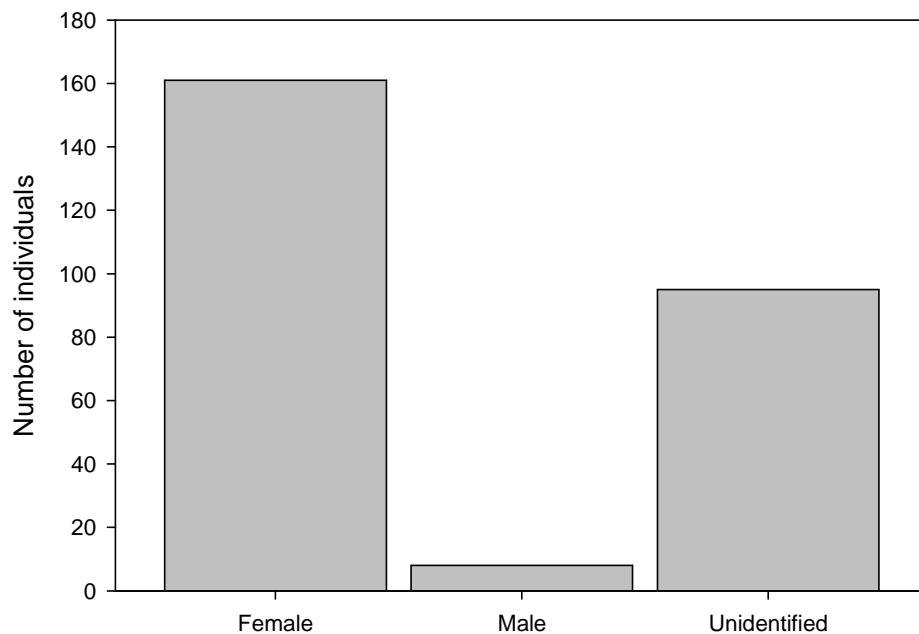
**Figure 15.** Length frequency distribution of brown trout captured across all samples.



**Figure 16.** Length frequency distribution of black flounder captured across all samples.

## 5.5 Perch gender and reproduction

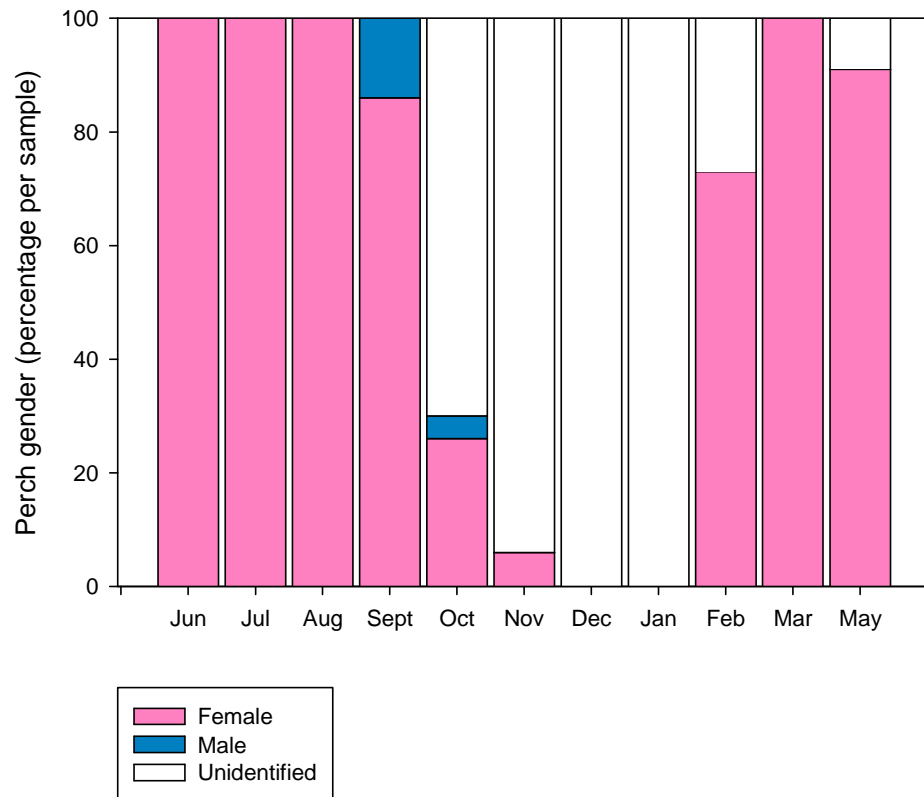
Of the 264 perch that were captured across all sampling events, 169 (64%) were able to be identified to gender. Of these, 161 (95%) were identified as female and 8 (5%) were identified as male (Fig 17). Male perch are known to have lower survival probabilities than females (McDowall 1990), thus established populations naturally contain more females than males. The male: female perch ratio in Lake Wairarapa indicated during this study is 1: 20 – far higher than the 1: 4 ratio reported in nearby Lake Pounui (Jellyman 1980).



**Figure 17.** Gender distribution of perch captured across all samples.

It is possible that a higher proportion of the unidentified individuals were males, however the remaining 95 (36%) unidentified individuals were predominantly captured during the period October to January inclusive (Fig 18). This, together with the fact that during the months in which all perch were able to be identified to gender 86 – 100% of those captured were females, indicates that sexing difficulty is

a result of post - spawning activity and the high female: male ratio is genuine. The numbers of perch that were able to be identified to gender clearly indicates a single annual spawning event taking place in late spring/summer. Additionally, and interestingly, of the 8 male perch captured across all sampling events, 7 (88%) were captured in September. During the 3 sampling events prior to this, all fish captured were easily identified as female. The remaining male was captured in October. These observations indicate that the sexes are spatially separated prior to spawning (the males may be predominantly occupying deeper water closer to the middle of the lake for example), then come together at the lake edges in spring. This could possibly present an opportunity for effective perch population control through intensive removal of the much rarer males through repeated netting during September. Such control could be effectively trialed in smaller water bodies (e.g. boggy pond on the eastern shore of Lake Wairarapa).



**Figure 18.** Gender of perch captured during each sampling event.

## **6. ACKNOWLEDGEMENTS**

I would like to acknowledge Alton Perrie for his extensive level of assistance with field work as well as report editing and the Department of Conservation Wellington/Hawkes Bay Conservancy for providing trammel nets used in field work.

## **7. REFERENCES**

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## 8. APPENDIX

### Data sheets

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 1                 |                  |                 |               |
| <b>COMMENTS</b> | 14th Sept 2009    |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 290               | 12               | 340.194         | M             |
| perch           | 280               | 12               | 340.194         | F             |
| perch           | 300               | 13               | 368.5435        | F             |
| perch           | 290               | 11               | 311.8445        | M             |
| perch           | 310               | 19               | 538.6405        | F             |
| perch           | 300               | 13               | 368.5435        | F             |
| perch           | 310               | 16               | 453.592         | F             |
| perch           | 330               | 18               | 510.291         | F             |
| perch           | 310               | 15               | 425.2425        | F             |
| perch           | 300               | 15               | 425.2425        | F             |
| perch           | 330               | 22               | 623.689         | F             |
| perch           | 310               | 17               | 481.9415        | F             |
| perch           | 310               | 16               | 453.592         | F             |
| perch           | 320               | 20               | 566.99          | F             |
| perch           | 310               | 15               | 425.2425        | F             |
| perch           | 310               | 14               | 396.893         | F             |
| perch           | 300               | 16               | 453.592         | F             |
| perch           | 300               | 13               | 368.5435        | F             |
| perch           | 290               | 13               | 368.5435        | F             |
| perch           | 300               | 15               | 425.2425        | F             |
| perch           | 340               | 20               | 566.99          | F             |
| perch           | 310               | 17               | 481.9415        | F             |
| perch           | 340               | 22               | 623.689         | F             |
| perch           | 280               | 13               | 368.5435        | F             |
| perch           | 320               | 21               | 595.3395        | F             |
| perch           | 320               | 17               | 481.9415        | F             |
| perch           | 290               | 14               | 396.893         | F             |
| perch           | 340               | 20               | 566.99          | F             |
| perch           | 300               | 14               | 396.893         | F             |
| perch           | 310               | 13               | 368.5435        | M             |
| perch           | 370               | 9                | 255.1455        | M             |
| perch           | 320               | 16               | 453.592         | F             |
| perch           | 300               | 13               | 368.5435        | F             |

|             |     |    |          |    |
|-------------|-----|----|----------|----|
| perch       | 310 | 15 | 425.2425 | F  |
| perch       | 270 | 10 | 283.495  | M  |
| perch       | 310 | 15 | 425.2425 | F  |
| perch       | 310 | 14 | 396.893  | F  |
| perch       | 300 | 13 | 368.5435 | F  |
| perch       | 330 | 17 | 481.9415 | F  |
| perch       | 310 | 13 | 368.5435 | M  |
| perch       | 290 | 13 | 368.5435 | F  |
| perch       | 340 | 21 | 595.3395 | F  |
| perch       | 310 | 16 | 453.592  | F  |
| perch       | 290 | 14 | 396.893  | F  |
| perch       | 310 | 14 | 396.893  | F  |
| perch       | 310 | 15 | 425.2425 | F  |
| perch       | 290 | 11 | 311.8445 | F  |
| perch       | 310 | 13 | 368.5435 | M  |
| perch       | 320 | 16 | 453.592  | F  |
| perch       | 290 | 11 | 311.8445 | F  |
| rudd        | 280 | 12 | 340.194  | M? |
| rudd        | 280 | 12 | 340.194  | ?  |
| rudd        | 270 | 12 | 340.194  | ?  |
| rudd        | 260 | 11 | 311.8445 | ?  |
| rudd        | 270 | 14 | 396.893  | ?  |
| rudd        | 260 | 11 | 311.8445 | ?  |
| rudd        | 260 | 12 | 340.194  | ?  |
| rudd        | 270 | 13 | 368.5435 | ?  |
| brown trout | 420 | 23 | 652.0385 | ?  |
| brown trout | 480 | 33 | 935.5335 | ?  |
| brown trout | 530 | 40 | 1133.98  | ?  |
| brown trout | 480 | 33 | 935.5335 | ?  |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 2                 |                  |                 |               |
| <b>COMMENTS</b> | 18th Oct 2009     |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 280               | 11               | 311.8445        | ?             |
| perch           | 310               | 17               | 481.9415        | M             |
| perch           | 290               | 11               | 311.8445        | F             |
| perch           | 300               | 14               | 396.893         | ?             |

|                |     |    |          |   |
|----------------|-----|----|----------|---|
| perch          | 270 | 12 | 340.194  | F |
| perch          | 300 | 15 | 425.2425 | ? |
| perch          | 280 | 11 | 311.8445 | ? |
| perch          | 280 | 12 | 340.194  | ? |
| perch          | 280 | 12 | 340.194  | F |
| perch          | 320 | 14 | 396.893  | ? |
| perch          | 290 | 12 | 340.194  | ? |
| perch          | 240 | 9  | 255.1455 | F |
| perch          | 280 | 11 | 311.8445 | ? |
| perch          | 290 | 12 | 340.194  | ? |
| perch          | 290 | 14 | 396.893  | ? |
| perch          | 310 | 14 | 396.893  | ? |
| perch          | 290 | 12 | 340.194  | ? |
| perch          | 310 | 14 | 396.893  | ? |
| perch          | 290 | 12 | 340.194  | F |
| perch          | 320 | 16 | 453.592  | ? |
| perch          | 280 | 13 | 368.5435 | F |
| perch          | 290 | 11 | 311.8445 | ? |
| perch          | 270 | 11 | 311.8445 | F |
| perch          | 280 | 12 | 340.194  | ? |
| perch          | 310 | 16 | 453.592  | ? |
| perch          | 320 | 15 | 425.2425 | ? |
| perch          | 300 | 11 | 311.8445 | ? |
| rudd           | 300 | 16 | 453.592  | F |
| rudd           | 290 | 17 | 481.9415 | F |
| rudd           | 260 | 12 | 340.194  | F |
| rudd           | 290 | 17 | 481.9415 | F |
| black flounder | 250 | x  |          | x |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 3                 |                  |                 |               |
| <b>COMMENTS</b> | 21st Nove 2009    |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 310               | 14               | 396.893         | ?             |
| perch           | 310               | 14               | 396.893         | ?             |
| perch           | 320               | 15               | 425.2425        | ?             |
| perch           | 290               | 12               | 340.194         | ?             |
| perch           | 290               | 12               | 340.194         | ?             |



|       |     |    |          |   |
|-------|-----|----|----------|---|
| perch | 310 | 16 | 453.592  | ? |
| perch | 310 | 14 | 396.893  | ? |
| perch | 300 | 14 | 396.893  | ? |
| perch | 310 | 14 | 396.893  | ? |
| perch | 310 | 14 | 396.893  | ? |
| perch | 310 | 14 | 396.893  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 310 | 16 | 453.592  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 310 | 13 | 368.5435 | ? |
| perch | 300 | 15 | 425.2425 | ? |
| perch | 310 | 16 | 453.592  | ? |
| perch | 300 | 13 | 368.5435 | ? |
| perch | 290 | 13 | 368.5435 | ? |
| perch | 300 | 13 | 368.5435 | ? |
| perch | 290 | 12 | 340.194  | ? |
| perch | 310 | 13 | 368.5435 | ? |
| perch | 300 | 16 | 453.592  | ? |
| perch | 310 | 12 | 340.194  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 310 | 12 | 340.194  | ? |
| perch | 260 | 9  | 255.1455 | F |
| perch | 280 | 13 | 368.5435 | ? |
| perch | 270 | 9  | 255.1455 | ? |
| perch | 290 | 14 | 396.893  | ? |
| perch | 330 | 18 | 510.291  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 290 | 12 | 340.194  | ? |
| perch | 310 | 15 | 425.2425 | ? |
| perch | 260 | 10 | 283.495  | F |
| perch | 300 | 14 | 396.893  | ? |
| rudd  | 270 | 12 | 340.194  | ? |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 4                 |                  |                 |               |
| <b>COMMENTS</b> | 4th Dec 2009      |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 310               | 14               | 396.893         | ?             |
| perch           | 310               | 14               | 396.893         | ?             |

|       |     |    |          |   |
|-------|-----|----|----------|---|
| perch | 320 | 16 | 453.592  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 290 | 12 | 340.194  | ? |
| perch | 320 | 18 | 510.291  | ? |
| perch | 290 | 14 | 396.893  | ? |
| perch | 270 | 10 | 283.495  | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 300 | 13 | 368.5435 | ? |
| perch | 310 | 16 | 453.592  | ? |
| perch | 330 | 19 | 538.6405 | ? |
| perch | 320 | 13 | 368.5435 | ? |
| perch | 320 | 16 | 453.592  | ? |
| perch | 330 | 18 | 510.291  | ? |
| perch | 340 | 19 | 538.6405 | ? |
| perch | 330 | 17 | 481.9415 | ? |
| perch | 300 | 13 | 368.5435 | ? |
| rudd  | 290 | 12 | 340.194  | F |
| rudd  | 280 | 13 | 368.5435 | F |
| rudd  | 270 | 11 | 311.8445 | F |
| rudd  | 270 | 11 | 311.8445 | F |
| rudd  | 270 | 11 | 311.8445 | F |
| rudd  | 290 | 13 | 368.5435 | F |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 5                 |                  |                 |               |
| <b>COMMENTS</b> | 16th Jan 2010     |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 320               | 14               | 396.893         | ?             |
| perch           | 310               | 14               | 396.893         | ?             |
| perch           | 310               | 14               | 396.893         | ?             |
| perch           | 310               | 15               | 425.2425        | ?             |
| perch           | 290               | 13               | 368.5435        | ?             |
| perch           | 320               | 18               | 510.291         | ?             |
| perch           | 300               | 13               | 368.5435        | ?             |
| perch           | 310               | 16               | 453.592         | ?             |
| perch           | 350               | 20               | 566.99          | ?             |
| perch           | 330               | 15               | 425.2425        | ?             |
| perch           | 310               | 14               | 396.893         | ?             |

|             |     |    |          |        |
|-------------|-----|----|----------|--------|
| perch       | 290 | 14 | 396.893  | ?      |
| perch       | 310 | 14 | 396.893  | ?      |
| perch       | 330 | 18 | 510.291  | ?      |
| rudd        | 300 | 15 | 425.2425 | Female |
| rudd        | 300 | 15 | 425.2425 | Female |
| brown trout | 500 | 41 | 1162.33  |        |
| brown trout | 510 | 49 | 1389.126 |        |
| brown trout | 500 | 44 | 1247.378 |        |
| brown trout | 510 | 45 | 1275.728 |        |
| brown trout | 420 | 30 | 850.485  |        |
| brown trout | 460 | 37 | 1048.932 |        |
| brown trout | 390 | 22 | 623.689  |        |
| brown trout | 450 | 28 | 793.786  |        |
| brown trout | 390 | 21 | 595.3395 |        |
| brown trout | 400 | 23 | 652.0385 |        |

|                 |                             |                  |                 |               |
|-----------------|-----------------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 6                           |                  |                 |               |
| <b>COMMENTS</b> | 20th Feb 2010 very calm day |                  |                 |               |
|                 |                             |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b>           | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 280                         | 12               | 340.194         | ?             |
| perch           | 340                         | 18               | 510.291         | ?             |
| perch           | 280                         | 11               | 311.8445        | ?             |
| perch           | 310                         | 14               | 396.893         | F             |
| perch           | 320                         | 17               | 481.9415        | F             |
| perch           | 310                         | 14               | 396.893         | F             |
| perch           | 320                         | 16               | 453.592         | ?             |
| perch           | 290                         | 11               | 311.8445        | F             |
| perch           | 300                         | 12               | 340.194         | F             |
| perch           | 210                         | 6                | 170.097         | ?             |
| perch           | 340                         | 20               | 566.99          | F             |
| perch           | 330                         | 14               | 396.893         | F             |
| perch           | 320                         | 15               | 425.2425        | F             |
| perch           | 310                         | 15               | 425.2425        | F             |
| perch           | 280                         | 11               | 311.8445        | ?             |
| perch           | 300                         | 15               | 425.2425        | ?             |
| perch           | 320                         | 16               | 453.592         | F             |
| perch           | 310                         | 15               | 425.2425        | F             |
| perch           | 300                         | 13               | 368.5435        | ?             |
| perch           | 330                         | 16               | 453.592         | F             |

|                |     |    |          |   |
|----------------|-----|----|----------|---|
| perch          | 290 | 10 | 283.495  | F |
| perch          | 290 | 13 | 368.5435 | F |
| perch          | 340 | 16 | 453.592  | F |
| perch          | 300 | 12 | 340.194  | F |
| perch          | 310 | 13 | 368.5435 | F |
| perch          | 330 | 16 | 453.592  | F |
| perch          | 320 | 14 | 396.893  | F |
| perch          | 340 | 17 | 481.9415 | F |
| perch          | 300 | 13 | 368.5435 | F |
| perch          | 320 | 14 | 396.893  | F |
| rudd           | 300 | 15 | 425.2425 | F |
| rudd           | 300 | 15 | 425.2425 | F |
| brown trout    | 420 | 29 | 822.1355 | F |
| brown trout    | 430 | 27 | 765.4365 | F |
| black flounder | 340 | x  |          |   |
| black flounder | 300 | x  |          |   |
| black flounder | 200 | x  |          |   |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 7                 |                  |                 |               |
| <b>COMMENTS</b> | 20th Mar 2010     |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 360               | 22               | 623.689         | F             |
| perch           | 300               | 12               | 340.194         | F             |
| perch           | 290               | 12               | 340.194         | F             |
| perch           | 340               | 17               | 481.9415        | F             |
| perch           | 310               | 16               | 453.592         | F             |
| perch           | 330               | 17               | 481.9415        | F             |
| perch           | 310               | 14               | 396.893         | F             |
| perch           | 320               | 16               | 453.592         | F             |
| perch           | 310               | 15               | 425.2425        | F             |
| perch           | 300               | 14               | 396.893         | F             |
| perch           | 320               | 16               | 453.592         | F             |
| perch           | 310               | 15               | 425.2425        | F             |
| perch           | 320               | 15               | 425.2425        | F             |
| perch           | 290               | 13               | 368.5435        | F             |
| rudd            | 290               | 13               | 368.5435        | ?             |
| rudd            | 310               | 15               | 425.2425        | ?             |
| rudd            | 280               | 12               | 340.194         | ?             |
| rudd            | 300               | 16               | 453.592         | F             |

|                |     |    |          |   |
|----------------|-----|----|----------|---|
| rudd           | 280 | 15 | 425.2425 | ? |
| rudd           | 290 | 15 | 425.2425 | ? |
| rudd           | 290 | 14 | 396.893  | ? |
| rudd           | 290 | 15 | 425.2425 | F |
| brown trout    | 450 | 32 | 907.184  | F |
| black flounder | 200 | x  |          | x |
| black flounder | 220 | x  |          | x |
| black flounder | 350 | x  |          | x |
| grey mullet    | 390 | 24 | 680.388  | ? |

|                 |                   |                  |                 |              |
|-----------------|-------------------|------------------|-----------------|--------------|
| <b>SAMPLE</b>   | 8                 |                  |                 |              |
| <b>COMMENTS</b> | 5th May 2010      |                  |                 |              |
|                 |                   |                  |                 |              |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>NOTES</b> |
| rudd            | 300               | 15               | 425.2425        | F            |
| rudd            | 280               | 13               | 368.5435        | F            |
| rudd            | 300               | 17               | 481.9415        | F            |
| rudd            | 290               | 13               | 368.5435        | F            |
| rudd            | 310               | 15               | 425.2425        | F            |
| rudd            | 280               | 12               | 340.194         | F            |
| trout           | 380               |                  |                 | ?            |
| trout           | 400               | 23               | 652.0385        | F            |
| perch           | 310               |                  |                 | ?            |
| perch           | 340               |                  |                 | ?            |
| perch           | 330               | 16               | 453.592         | F            |
| perch           | 330               | 31               | 878.8345        | F            |
| perch           | 330               | 17               | 481.9415        | F            |
| perch           | 340               | 18               | 510.291         | F            |
| perch           | 340               | 18               | 510.291         | F            |
| perch           | 320               | 14               | 396.893         | F            |
| perch           | 330               | 18               | 510.291         | F            |
| perch           | 300               | 11               | 311.8445        | F            |
| perch           | 320               | 15               | 425.2425        | F            |
| perch           | 300               | 12               | 340.194         | F            |
| perch           | 310               | 15               | 425.2425        | F            |
| perch           | 320               | 16               | 453.592         | F            |
| perch           | 330               | 18               | 510.291         | F            |
| perch           | 340               | 19               | 538.6405        | F            |
| perch           | 320               | 14               | 396.893         | F            |
| perch           | 320               | 15               | 425.2425        | F            |

|       |     |    |          |   |
|-------|-----|----|----------|---|
| perch | 340 | 17 | 481.9415 | F |
| perch | 330 | 18 | 510.291  | F |
| perch | 340 | 18 | 510.291  | F |
| perch | 300 | 12 | 340.194  | F |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 9                 |                  |                 |               |
| <b>COMMENTS</b> | 25th Jun 2010     |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 290               | 21               | 595.3395        | F             |
| perch           | 350               | 22               | 623.689         | F             |
| perch           | 330               | 16               | 453.592         | F             |
| perch           | 340               | 20               | 566.99          | F             |
| perch           | 320               | 14               | 396.893         | F             |
| perch           | 310               | 11               | 311.8445        | F             |
| perch           | 330               | 17               | 481.9415        | F             |
| perch           | 300               | 11               | 311.8445        | F             |
| rudd            | 310               | 16               | 453.592         | F             |
| rudd            | 340               | 20               | 566.99          | M             |
| rudd            | 290               | 13               | 368.5435        | F             |
| rudd            | 280               | 12               | 340.194         | F             |
| rudd            | 300               | 15               | 425.2425        | F             |
| rudd            | 290               | 13               | 368.5435        | F             |
| rudd            | 280               | 12               | 340.194         | F             |
| rudd            | 300               | 17               | 481.9415        | F             |
| rudd            | 290               | 12               | 340.194         | F             |
| rudd            | 280               | 12               | 340.194         | F             |
| rudd            | 280               | 12               | 340.194         | F             |
| rudd            | 290               | 14               | 396.893         | F             |
| rudd            | 310               | 18               | 510.291         | F             |
| rudd            | 280               | 11               | 311.8445        | F             |
| rudd            | 290               | 12               | 340.194         | F             |
| rudd            | 300               | 14               | 396.893         | F             |
| brown trout     | 380               | 21               | 595.3395        | M             |
| brown trout     | 430               | 17               | 481.9415        | ?             |
| brown trout     | 480               | 18               | 510.291         | ?             |

|               |    |  |  |  |
|---------------|----|--|--|--|
| <b>SAMPLE</b> | 10 |  |  |  |
|---------------|----|--|--|--|

|                 |  |                  |                 |               |
|-----------------|--|------------------|-----------------|---------------|
| <b>COMMENTS</b> | 14th Jul 2010. really high water, Onoke been blocked for a while. Half of net in deepest water had no fish. Very cold, heavy frost and ice present in wetlands. Mysid shrimp caught in net too |                  |                 |               |
|                 |  |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b>  | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 300  | 13               | 368.5435        | F             |
| perch           | 340  | 16               | 453.592         | F             |
| perch           | 300  | 10               | 283.495         | F             |
| perch           | 310  | 12               | 340.194         | F             |
| perch           | 300  | 12               | 340.194         | F             |
| perch           | 330  | 18               | 510.291         | F             |
| perch           | 300  | 11               | 311.8445        | F             |
| perch           | 340  | 16               | 453.592         | F             |
| perch           | 290  | 10               | 283.495         | F             |
| goldfish        | 210  | 8                | 226.796         | F             |
| brown trout     | 440  | 25               | 708.7375        | ?             |
| black flounder  | 250  |                  |                 |               |
| LFE             | 700  |                  |                 |               |

|                 |                   |                  |                 |               |
|-----------------|-------------------|------------------|-----------------|---------------|
| <b>SAMPLE</b>   | 11                |                  |                 |               |
| <b>COMMENTS</b> | 20th Aug 2010     |                  |                 |               |
|                 |                   |                  |                 |               |
| <b>SP</b>       | <b>TLENGTH mm</b> | <b>WEIGHT oz</b> | <b>WEIGHT g</b> | <b>GENDER</b> |
| perch           | 300               | 12               | 340.194         | F             |
| perch           | 320               | 16               | 453.592         | F             |
| perch           | 250               | 20               | 566.99          | F             |
| perch           | 330               | 18               | 510.291         | F             |
| perch           | 330               | 18               | 510.291         | F             |
| perch           | 330               | 16               | 453.592         | F             |
| perch           | 310               | 15               | 425.2425        | F             |
| perch           | 280               | 8                | 226.796         | F             |
| perch           | 290               | 11               | 311.8445        | F             |
| perch           | 300               | 11               | 311.8445        | F             |
| perch           | 330               | 16               | 453.592         | F             |
| perch           | 360               | 22               | 623.689         | F             |
| perch           | 360               | 24               | 680.388         | F             |
| perch           | 350               | 23               | 652.0385        | F             |
| perch           | 340               | 20               | 566.99          | F             |
| perch           | 360               | 20               | 566.99          | F             |
| perch           | 340               | 18               | 510.291         | F             |
| perch           | 300               | 12               | 340.194         | F             |

|             |     |    |          |   |
|-------------|-----|----|----------|---|
| perch       | 320 | 16 | 453.592  | F |
| perch       | 310 | 14 | 396.893  | F |
| perch       | 300 | 12 | 340.194  | F |
| perch       | 300 | 13 | 368.5435 | F |
| perch       | 300 | 12 | 340.194  | F |
| perch       | 310 | 14 | 396.893  | F |
| perch       | 320 | 14 | 396.893  | F |
| perch       | 320 | 15 | 425.2425 | F |
| perch       | 310 | 13 | 368.5435 | F |
| perch       | 330 | 20 | 566.99   | F |
| perch       | 300 | 12 | 340.194  | F |
| perch       | 300 | 12 | 340.194  | F |
| perch       | 300 | 14 | 396.893  | F |
| perch       | 310 | 16 | 453.592  | F |
| perch       | 300 | 12 | 340.194  | F |
| perch       | 290 | 11 | 311.8445 | F |
| perch       | 320 | 11 | 311.8445 | F |
| perch       | 320 | 16 | 453.592  | F |
| rudd        | 280 | 13 | 368.5435 | F |
| rudd        | 280 | 12 | 340.194  | ? |
| rudd        | 310 | 14 | 396.893  | F |
| rudd        | 330 | 20 | 566.99   | F |
| brown trout | 570 | 24 | 680.388  | ? |
| brown trout | 530 | 21 | 595.3395 | ? |
| brown trout | 480 | 18 | 510.291  | ? |
| brown trout | 470 | 25 | 708.7375 | F |
| smelt       | 130 |    |          |   |