Fall Walleye Index Netting at Pigeon Lake, Alberta, 2012

Fisheries Management
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Abstract
A total of 578 fish representing five species were caught during the Fall Walleye Index Netting (FWIN) survey. Walleye were the most abundant species in the FWIN nets accounting for 59% of the catch. Individual net catches were variable ranging from 25 to 54 walleye. The catch-per-unit effort (CPUE) for walleye was 39.9 fish·100m$^2$·24hrs$^{-1}$ (95% C.I. 34.1–45.1), which is more than double the Alberta mean of 18.6 fish·100m$^2$·24hrs$^{-1}$. Walleye total lengths (TL) (n=343) ranged from 111 to 566 mm and fish over 500 mm TL represented 32% of the catch. The majority of fish were in the 430 to 560 mm TL size category. There were 16 age-classes present (ages 0 to 15) and 92% of the walleye sampled were mature. Mean age-at-maturity was 5.4 for females and 3.3 for males. Females and males first matured by ages 5 and 3, respectively. Walleye reached a mean TL of 500 mm by age 6 and the growth curve suggests that the asymptotic average maximum body size ($L_{\text{ms}}$) was 517.1 mm TL.

Lake Whitefish was the second most abundant species caught in the FWIN nets and accounted for 35% of the catch. The CPUE for Lake Whitefish was 24.0 fish·100m$^2$·24hrs$^{-1}$ (95% C.I. 19.9–28.2). Lake Whitefish TLs (n=203) ranged from 113 to 606 mm and fish over 500 mm TL represented 65% of the catch. The majority of fish were in the 530 to 580 mm TL size category. There were 23 age-classes present (0 to 20, 24 and 26), with age-classes 1 and 15 being the most abundant. The rest of the age-classes all had a CPUE of less than three fish·100m$^2$·24hrs$^{-1}$.

The CPUE for Yellow Perch was 2.9 fish·100m$^2$·24hrs$^{-1}$ (95% C.I. 1.5–4.7). Yellow Perch TLs (n=25) ranged from 109 to 242 mm.

The CPUE for Northern Pike was 0.1 fish·100m$^2$·24hrs$^{-1}$ (95% C.I. 0.0–0.4). Only one Northern Pike was capture and had a TL of 661 mm.

Introduction
Alberta Environment and Sustainable Resource Development develops and implements strategies to sustainably manage fish populations and provide opportunities for harvest, when suitable. Monitoring is required to evaluate the effectiveness of these strategies and to develop alternate strategies where evidence supports change. During Fall Walleye Index Netting (FWIN) our objective is to estimate relative abundance, population structure and growth of Walleye ($Sander vitreus$), and in addition collect data on other species. Although FWIN is not designed specifically for managing and estimating abundance of other sport fish species, FWIN surveys have been useful as a tool in assessing and monitoring those populations as well. These data are essential to provide sustainable harvest allocations for sport fish, and provides insight into the current management strategies by comparing the results from previous FWIN surveys. This FWIN survey was conducted in September 2012 to determine abundance, structure, and reproduction (recruitment) of the Walleye population in Pigeon Lake. The data collected on Walleye was also used in determining tag licence allocations for harvest under the Special Fish Harvest Licence for the appropriate three Walleye size categories.
Methods

This FWIN survey was conducted from September 18 and 19, 2012. A comprehensive description of equipment and methodology can be found in the Manual of Instructions Fall Walleye Index Netting (FWIN) (Morgan 2002). The FWIN nets consisted of eight panels, 7.62 m in length and 1.83 m in height with stretched mesh sizes of 25, 38, 51, 64, 76, 102, 127, and 152 mm. Nets were set at 8 sites randomly selected and weighted by depth stratum. Nets were set for 24 hrs (± 3 hours) before being cleared of fish and reset at new locations. Set and pull times were recorded. Nets were set perpendicular to depth contours, and minimum and maximum depths were recorded. Net location were recorded in Universal Transverse Mercator (UTM) projection coordinates using the North American Datum 1983 (NAD 83) on handheld GPS units. Surface water temperature was also recorded at all net locations, and ranged between 12.9 and 14.0°C.

All fish species were kept for biological sampling. Catches were recorded by net location and mesh size. Net identification, date, mesh size, and count of each species of fish caught were recorded for each panel for catch-per-unit-effort (CPUE) calculations. All fish were measured for fork length (FL), and total length (TL) to the nearest millimetre, and weighed in grams, with individual data recorded on a sample envelope for each fish. Walleye, Lake Whitefish (Coregonus clupeaformis), Northern Pike (Esox lucius) and Yellow Perch (Perca flavescens) were examined for gender and maturity, and a bony structure was removed for ageing. Otoliths were collected from Walleye, Lake Whitefish and Yellow Perch and aged following criteria in Watkins and Spencer (2009). Cleithra were collected from northern pike and aged following the criteria in Mackay et al. (1990). Growth was described using the von Bertalanffy growth model in FAST 2.1 (Auburn University 2000-2001).

Relative abundance expressed as CPUE was calculated as number of fish caught·100m-2·24hrs-1 with 95% confidence intervals empirically determined by bootstrapping catches to 50,000 replications (Haddon 2001).

Interpretations of the walleye population status are based on criteria contained in the Alberta’s Walleye Management Recovery Plan (Berry 1995, Sullivan 2003) modified for FWIN (Watters and Davis 2004).

The raw data is stored digitally in the Fish and Wildlife Management Information System (FWMIS), project # 16538.

Results

A total of 578 fish representing five species were caught during the 2012 FWIN survey (Table 1). Walleye were the most abundant species in the FWIN nets accounting for 59% of the catch. Individual net catches were variable ranging from 25 to 54 walleye. The CPUE for walleye was 39.9 fish·100m-2·24hrs-1 (95% C.I. 34.1–45.1), which has decreased slightly from the 2011 CPUE of 41.2 fish·100m-2·24hrs-1 (95% C.I. 33.6–48.2) (Figure 1). The CPUE for walleye in Pigeon Lake is more than double the Alberta mean of 18.6 fish·100m-2·24hrs-1 (Figure 3). In 2012, Walleye TLs (n=343) ranged from 111 to 566 mm, and fish over 500 mm TL represented 32% of the catch (Figure 4). The majority of fish captured were in the 400 to 560 mm TL size category, which is slightly larger than the 390 to 520 mm TL size range encountered the previous year. A greater abundance of smaller (120 to 270 mm TL) and larger (> 540 mm TL) individuals were caught in 2012. In the most recent survey there were 16 age-classes present (ages 0 to 15), with five stable age-classes (> 3 fish·100m-2·24hrs-1) of 1, 5, 6, 9 and 14-year-olds. This is similar to the 2011 survey where 14 age-classes were represented, five of these being stable (4, 8, 12, 13 and 14-year-olds) (Figure 5). The most abundant age-classes were the 13-year-olds in 2011 and 14-year-olds in 2012, which represented 38% and 24% of the catch, respectively. The catch rate of Walleye from stockings in 1997, 1998 and 1999 (age 13, 14, 15) year-classes was 12.5 fish·100m-2·24hrs-1 and still account for 30% of the catch, which is a decrease of 81% (23.5 fish·100m-2·24hrs-1) from the previous year. In 2012, the mean Walleye age was 8.5 years and 92% of Walleye sampled were mature. Mean age-at-maturity was 5.4 for females and 3.3 for males. Females and males first matured by ages 5 and 3, respectively (Figure 6). Walleye reached a mean TL of 500 mm by age 6 and the growth curve suggests that the asymptotic average maximum body size (Linf) was...
517.1 mm TL, which is an underestimate because 27% of the sample had TL greater than the model predicted (Figure 7).

Lake Whitefish was the second most abundant species caught in the 2012 FWIN nets and accounted for 35% of the catch. The CPUE for Lake Whitefish was 24.0 fish·100m⁻²·24hrs⁻¹ (95% C.I. 19.9–28.2), which increased by 35% from 17.8 fish·100m⁻²·24hrs⁻¹ (95% C.I. 12.7–23.8) caught in 2011 (Figure 2). In 2012, Lake Whitefish TLs (n=203) ranged from 113 to 606 mm and fish over 500 mm TL represented 65% of the catch. The majority of fish were in the 530 to 580 mm TL size category. Lake Whitefish length frequency distributions closely resemble one another between years (Figure 8). In the most recent survey 23 age-classes were present (0 to 20, 24 and 26), with age-classes 1 and 15 being the most abundant. The rest of the age-classes had a CPUE of less than three fish·100m⁻²·24hrs⁻¹. This is similar to the 2011 data where 23 age-classes were also present (Figure 9).

The CPUE for Yellow Perch was 2.9 fish·100m⁻²·24hrs⁻¹ (95% C.I. 1.5–4.7), which increased slightly from 2.7 fish·100m⁻²·24hrs⁻¹ (95% C.I. 1.1–4.4) caught in 2011 (Figure 3). In 2012, Yellow Perch TLs (n=25) ranged from 109 to 242 mm. Yellow Perch length frequency distributions were similar in 2011 and 2012, with the exception of two larger fish (> 200 mm TL) caught this year (Figure 10).

The CPUE for Northern Pike was 0.1 fish·100m⁻²·24hrs⁻¹ (95% C.I. 0.0–0.4), which decreased from 1.5 fish·100m⁻²·24hrs⁻¹ (95% C.I. 0.1–3.4) caught in 2011 (Figure 3). In 2012, only one Northern Pike was captured and it had a TL of 661 mm. Northern Pike length frequency distribution between years cannot be compared due to the low sample size in 2012 (n=1) (Figure 11).

**Interpretation**

Stocking of Walleye in Pigeon Lake occurred most recently from 1994 to 1999 in order to re-establish a naturally reproducing population. Many of the Walleye being caught continue to be from the 1997, 1998, and 1999 stocking years, however, the proportion of the population that has been naturally recruited within Pigeon Lake is steadily increasing each year as is evident with the capture and presence of consecutive year-classes since the last stocking event. The population status classification for the Pigeon Lake Walleye fishery indicates a stable population, according to the criteria outlined in *Alberta’s Walleye Management Recovery Plan* (Berry 1995) and has remained at or near the highest reported FWIN Walleye catch rates annually from across Alberta. Of the 5 biological population metrics used as the criteria for classifying status of Walleye fisheries, modified for FWIN analysis (from Sullivan, 2003); 2 population metrics (catch rate and age-class stability) indicate a trophy population, one (age-class distribution) indicates a stable population and 2 (age at maturity and length at age) indicate a collapsed population (Table 2). Also, a stable age-class of 1 year-olds suggests that natural recruitment is occurring within the lake and can be supported by more than one age-class of mature individuals. This is consistent with the 2011 stable population status classification of the Walleye fishery within Pigeon Lake (Dick 2013).

The catch rate of Lake Whitefish over the past 10 years has fluctuated somewhat, but overall the trend has been increasing. Over the last three years catch rate has been steadily increasing along with presence of annual recruitment occurring. With a wide range of age-classes and high percentage of younger age-classes that is evidence of annual recruitment suggests a stable population.

The catch rate of Yellow Perch has shown signs of improvement and has increased by over doubling in the last two years. Although the low abundance of Yellow Perch likely suggests that the population is in a vulnerable-collapsed state, there is evidence and signs of recovery occurring.

The catch rate of Northern Pike has remained relatively low and unchanged (<2 fish per net) over the past ten years in Pigeon Lake. The low abundance of Northern Pike suggests that this population is and continues to remain in a collapsed state.
Table 1. Species catch summary by site, Pigeon Lake, September 2012

<table>
<thead>
<tr>
<th>Set Number</th>
<th>Lift Date (2012)</th>
<th>Stratum</th>
<th>UTM Easting</th>
<th>UTM Northing</th>
<th>Meridian</th>
<th>Soak Time (h)</th>
<th>LKWH</th>
<th>NRPK</th>
<th>SPSH</th>
<th>WALL</th>
<th>YLPR</th>
<th>Set Total</th>
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<tbody>
<tr>
<td>112C</td>
<td>18-Sep</td>
<td>Shallow</td>
<td>699231</td>
<td>5874025</td>
<td>-117</td>
<td>22.50</td>
<td>23</td>
<td>1</td>
<td>50</td>
<td>4</td>
<td>78</td>
<td></td>
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<tr>
<td>20D</td>
<td>18-Sep</td>
<td>Deep</td>
<td>691732</td>
<td>5882265</td>
<td>-117</td>
<td>22.92</td>
<td>17</td>
<td>1</td>
<td>47</td>
<td>4</td>
<td>69</td>
<td></td>
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<tr>
<td>67D</td>
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<td>Shallow</td>
<td>299308</td>
<td>5879293</td>
<td>-111</td>
<td>24.17</td>
<td>18</td>
<td>1</td>
<td>40</td>
<td>1</td>
<td>60</td>
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<tr>
<td>72B</td>
<td>18-Sep</td>
<td>Deep</td>
<td>695730</td>
<td>5878803</td>
<td>-117</td>
<td>23.17</td>
<td>25</td>
<td>1</td>
<td>41</td>
<td>2</td>
<td>69</td>
<td></td>
</tr>
<tr>
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<td>Deep</td>
<td>696175</td>
<td>5878627</td>
<td>-117</td>
<td>23.08</td>
<td>24</td>
<td>36</td>
<td>1</td>
<td>61</td>
<td></td>
<td></td>
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<td>Deep</td>
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<td>-117</td>
<td>23.33</td>
<td>36</td>
<td>50</td>
<td>9</td>
<td>95</td>
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<tr>
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<td>Deep</td>
<td>698267</td>
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<td>33</td>
<td>25</td>
<td>1</td>
<td>59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99A</td>
<td>19-Sep</td>
<td>Deep</td>
<td>299626</td>
<td>5876802</td>
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<td>24.00</td>
<td>27</td>
<td>3</td>
<td>54</td>
<td>3</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>

Species Total 203 1 6 343 25 578
Figure 1.  Walleye catch rates from the 2003 to 2012 Pigeon Lake FWIN surveys.

Figure 2.  Lake Whitefish catch rates from the 2003 to 2012 Pigeon Lake FWIN surveys.
Figure 3. Northern Pike, Spottail Shiner, White Sucker and Yellow Perch catch rates from the 2003 to 2012 Pigeon Lake FWIN surveys.
Figure 4. Mean Walleye catch rates with 95% CI from a representative sample of FWIN surveys from Across Central Alberta. The dashed line represents the mean provincial catch rate of 18.6 fish·100m⁻²·24hrs⁻¹. Collapsed, vulnerable, and stable catch rate ranges are indicated by red, yellow and green backgrounds. The Walleye catch rates from the 2003 to 2012 Pigeon Lake FWIN surveys are highlighted.
Figure 5. Walleye total length frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake.

Figure 6. Walleye age frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake. Mean ages were 10.2 and 8.5 years, respectively.
Figure 7. Age-at-maturity distributions for female and male Walleye from the 2012 FWIN survey on Pigeon Lake.
Figure 8. Total length-at-age for Pigeon Lake Walleye from the 2011 (\(L_{\text{inf}} = 491.2, K = 0.366, t_o = -0.779, R^2 = 0.99, \text{Prob} > 0.0001\)), and 2012 (\(L_{\text{inf}} = 517.1, K = 0.344, t_o = -0.745, R^2 = 1.00, \text{Prob} > 0.0001\)) FWIN surveys.
Table 2. Walleye stock classification for Pigeon Lake based on the 2012 FWIN survey results.

<table>
<thead>
<tr>
<th>POPULATION METRIC</th>
<th>POPULATION STATUS CLASSIFICATION</th>
<th>TROPHY</th>
<th>STABLE</th>
<th>VULNERABLE</th>
<th>COLLAPSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATCH RATE (FWIN)</td>
<td></td>
<td>High - &gt;30 walleye(100\text{m}^2\cdot24\text{h}^{-1})</td>
<td>High - &gt;30 walleye(100\text{m}^2\cdot24\text{h}^{-1})</td>
<td>Moderate: 15-30 walleye(100\text{m}^2\cdot24\text{h}^{-1})</td>
<td>Low: &lt;15 walleye(100\text{m}^2\cdot24\text{h}^{-1})</td>
</tr>
<tr>
<td></td>
<td>CPUE =39.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE CLASS DISTRIBUTION</td>
<td></td>
<td>Wide: 8 or more age classes (n=200); mean age &gt;9 years.</td>
<td>Wide: 8 or more age classes (n=200); mean age 6 to 9 years.</td>
<td>Narrow: 1 to 3 age classes; mean age 4 to 6 years; few old (&gt;10 years).</td>
<td>Can be wide or narrow; mean age 6 to 10 years.</td>
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<tr>
<td>AGE CLASS STABILITY</td>
<td></td>
<td>Very stable: 1 to 2 &quot;measureable&quot; (&gt; 3 walleye(100\text{m}^2\cdot24\text{h}^{-1}) age classes out of a smooth catch curve.</td>
<td>Relatively stable: 2 to 3 &quot;measureable&quot; age classes out of a smooth catch curve.</td>
<td>Unstable: 1 to 3 &quot;measureable&quot; age classes, with gaps in age classes.</td>
<td>Stable or unstable: 1 or fewer &quot;measureable&quot; age classes.</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>AGE AT MATURITY</td>
<td>Females: 10-20 years Males: 10-16 years</td>
<td>Females: 8-10 years Males: 7-9 years</td>
<td>Females: 7-8 years Males: 5-7 years</td>
<td>Females: 4-7 years Males:3-6 years</td>
<td>Females: 5.4 years Males: 3.3 years</td>
</tr>
<tr>
<td>LENGTH AT AGE</td>
<td>Very Slow 50 cm in 12-15 years</td>
<td>Slow 50 cm in 9-12 years</td>
<td>Moderate 50 cm in 7-9 years</td>
<td>Fast 50 cm in 4-7 years</td>
<td>500 mm TL reached at 6 years</td>
</tr>
</tbody>
</table>
Figure 9. Lake Whitefish total length frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake.

Figure 10. Lake Whitefish age frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake. Mean ages were 11.0 and 10.0 years, respectively.
Figure 11. Yellow Perch total length-frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake.

Figure 12. Northern Pike total length-frequency distributions from the 2011 and 2012 FWIN surveys on Pigeon Lake.
Literature Cited


