## Summer Sport Fishery Angler Survey at Gull and Snipe Lakes, Alberta, 2017

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## EXECUTIVE SUMMARY

High fishing pressure, coupled with slow-growing and late-maturing populations, has resulted in the overharvest of many of Alberta's sport fish populations, especially northern pike (Esox lucius) and walleye (Sander vitreus). To generate information required for the management of these species on Gull and Snipe lakes, we conducted a creel survey during the summer of 2017 (May 15 to August 31) to collect data on angling effort, catch rates, biological data, and other sport fishery demographics.

During the survey period, 1,831 anglers were interviewed at Gull Lake, and fishing pressure was estimated at $5.35 \mathrm{~h} / \mathrm{ha}(95 \% \mathrm{CI}=4.54-6.22)$. Total catch-per-unit-effort (CPUE) was 1.0 fish $/ \mathrm{h}$ and comprised $0.7 \mathrm{fish} / \mathrm{h}$ and 0.3 fish $/ \mathrm{h}$ for walleye and northern pike, respectively. Total yield of walleye was $2,631.7 \mathrm{~kg}(95 \% \mathrm{CI}=1,346.4-1,986.9)$ or $0.32 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.26-0.39)$. Total yield of northern pike was $2,218.4 \mathrm{~kg}(95 \% \mathrm{CI}=1,678.7-2,878.7)$ or $0.27 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=$ $0.21-0.35$ ). Walleye ranged in size from 274 to 643 mm fork length (FL; $\mathrm{n}=271$ ). Northern pike ranged in size from 408 to 855 mm FL ( $\mathrm{n}=109$ ). The greatest number of anglers resided in Alberta's major cities of Red Deer, Calgary, and Edmonton.

During the survey period, 567 anglers were interviewed at Snipe Lake, and fishing pressure was estimated at $1.0 \mathrm{~h} / \mathrm{ha}(95 \% \mathrm{CI}=0.8-1.2)$. Total CPUE was 0.6 fish $/ \mathrm{h}$ and comprised $0.1 \mathrm{fish} / \mathrm{h}$ and 0.5 fish/h for walleye and northern pike, respectively. Total yield of walleye was $463.4 \mathrm{~kg}(95 \%$ $\mathrm{CI}=307.2-662.0$ ) or $0.11 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.07-0.16)$. Total yield of northern pike was 419.0 kg ( $95 \% \mathrm{CI}=295.3-567.9$ ) or $0.10 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.07-0.13$ ). Walleye ranged in size from 349 to 645 mm FL ( $\mathrm{n}=57$ ). Northern pike ranged in size from 260 to 740 mm FL ( $\mathrm{n}=124$ ). The majority of anglers were local, from Grande Prairie and High Prairie.

Key words: northern pike, walleye, angler survey, Gull Lake, Snipe Lake.

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### 1.0 INTRODUCTION

High fishing pressure, coupled with slow-growing and late-maturing populations, has resulted in the overharvest of many of Alberta's sport fish populations (Sullivan 2003), including northern pike (Esox lucius) and walleye (Sander vitreus). Effective management requires an understanding of fishing pressure and harvest on lakes. In 2017, we conducted angler surveys on Gull and Snipe lakes to collect data on angler effort, sport fish catch, and harvest, to facilitate the development of management guidelines for the sport fisheries on these lakes.

### 2.0 STUDY AREA

### 2.1 Gull Lake

Gull Lake ( $52^{\circ} 32^{\prime} \mathrm{N}, 113^{\circ} 59^{\prime} \mathrm{W}$ ) has a surface area of $8,110.2 \mathrm{ha}$, a maximum depth of 27.0 m , and a mean depth of 16.5 m (Government of Alberta 2017). It is located in the Red Deer River drainage, about 25 km northwest of Red Deer, Alberta (Figure 1). There are several access points to Gull Lake including one provincial park, several private campgrounds, public boat launches, and private docks.


Figure 1. Map of Gull Lake showing the locations of the most popular access points. Inset map shows the location of the lake within the province of Alberta.

### 2.2 Snipe Lake

Snipe Lake ( $55^{\circ} 7^{\prime} \mathrm{N}, 116^{\circ} 46^{\prime} \mathrm{W}$ ) has a surface area of $4,211.6$ ha, a maximum depth of 6.1 m , and a mean depth of 3.9 m (Government of Alberta 2017). It is located in the Peace River drainage, about 30 km east of Valleyview or 270 km northwest of Edmonton, Alberta (Figure 2). There are a few access points to Snipe Lake, including two campgrounds, one municipal boat launch, and an improvised launch off a lease site.


Figure 2. Map of Snipe Lake showing all of the access points. Inset map shows the location of the lake within the province of Alberta.

### 3.0 MATERIALS AND METHODS

### 3.1 Access-point surveys

We conducted reduced-effort angler surveys on Gull and Snipe lakes from May 15 to August 31, 2017. We performed single access surveys on multiple access point lakes accompanied by ratio-of-use (ROU) surveys to obtain whole lake estimates (Pollock et al. 1994, Government of Alberta 2015). We selected our access survey location using area knowledge from Alberta Environment and Parks regional biologists of the most popular launch sites, and confirmed them after the first ROU surveys. We stratified surveys at both lakes into four temporal sampling units: weekdays and weekends, further divided into morning (08:00-15:00) and evening (15:00-22:00) units. To account for typical angler travel and effort around weekends, we classified Sunday evenings as weekday units and Friday evenings as weekend units. Of 218
possible survey units, we surveyed 52 (23.8\%) at Gull Lake and 54 (24.8\%) at Snipe Lake, excluding ratio-of-use surveys (Table 1.)

Table 1. Distribution of survey sampling effort among various sampling strata during summer angler survey at Gull and Snipe lakes, 2017.

| Lake | Stratum |  | Sampling effort <br> available of <br> sampling units |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Gull | Weekday | AM | Number of <br> units <br> surveyed | Percentage <br> coverage (\%) |  |
|  |  | PM | 76 | 12 | 15.8 |
|  | Weekend | AM | 73 | 13 | 17.8 |
|  |  | PM | 33 | 12 | 36.4 |
|  |  |  |  | 15 | 41.7 |
| Snipe | Weekday | AM | 76 |  |  |
|  |  | PM | 73 | 14 | 18.4 |
|  |  | AM | 33 | 13 | 17.8 |
|  |  | PM | 36 | 13 | 39.4 |
|  |  |  |  | 14 | 38.9 |

### 3.2 Ratio-of-use surveys

During ROU surveys, we interviewed anglers on the lake as they were randomly encountered by boat. We completed the same questionnaire during the shore and ROU surveys; however, during the ROU interview, we also asked anglers to identify their planned landing site. We then used the percentage of anglers landing at each access point to extrapolate estimates of the creel parameters to create whole-lake estimates. We stratified ROU surveys in the same way as the shore surveys. We conducted eight and nine ROU surveys at Gull and Snipe lakes, respectively, during the survey period (Table 2).

Table 2. Summary of ratio-of-use (ROU) surveys conducted at Gull and Snipe lakes, 2017.

|  |  | Number of ROU surveys |  |
| :---: | :---: | :---: | :---: |
| Day stratum | Time stratum | Gull Lake | Snipe Lake |
| Weekday | $08: 00-15: 00$ | 1 | 1 |
|  | $15: 00-22: 00$ | 2 | 2 |
| Weekend/holiday |  |  |  |
|  | $08: 00-15: 00$ | 3 | 3 |
|  | $15: 00-22: 00$ | 2 | 3 |

### 3.3 Angler interviews

For both lakes, we interviewed anglers upon completion of their trip. We asked a series of questions, including number of hours fished; number of fish of each species caught, harvested, and released; number of legal-sized fish released; and angler residency (Appendix 1). At Gull Lake we also asked whether anglers had purchased a special harvest license and if they had filled it or not (Appendix 2).

### 3.4 Biological fish data

When permitted, we sampled harvested fish and recorded fork length (FL; mm), total length (TL, mm), weight (g), sex, and maturity. We determined sex and maturity following Duffy et al. (2000). We collected aging structures, including otoliths from walleye and the left cleithrum from northern pike. We prepared otoliths following Watkins and Spencer (2009) and prepared cleithra following Mackay et al. (1990). Fisheries managers for both locations expressed that fin clips from test-angled fish would be unnecessary as they are an inaccurate method and they intend to perform test netting on both lakes during fall 2017.

### 3.5 Test angling

Because sport anglers at both lakes are required to release walleye and northern pike that are protected by size limits or special harvest license, no data were available for these protectedlength fish. To generate these data, we used test angling throughout the angler survey. We recorded the time spent angling, number of fish caught for each species, and FL and TL of all fish caught. To reduce handling time and fish stress, we did not weigh released fish. Instead, we estimated weight of protected-length fish using recent Fall Index Netting (FIN) data from the respective lakes. Biological data collected during test angling are listed in Appendices 3 and 4 for Gull and Snipe lakes, respectively.

### 3.6 Data management and analysis

Before analysis, we used length-weight plots to identify and omit outliers if measurement or recording error was suspected. We submitted angler survey data to the Government of Alberta for inclusion in its Fisheries and Wildlife Management Information System database.

We used bootstrapping to derive estimates and associated $95 \%$ confidence intervals (CI) for the number of anglers and for fish catch, harvest and release, following Sullivan (2004). We calculated angler catch rates as total ratio estimators, following Malvestuto (1983), and evaluated comparisons of angler success by calculating Gini coefficients and interpreting Lorenz curves, following Baccante (1995). Gini coefficients closer to zero indicate more even angler catch while coefficients closer to one indicate more uneven catch. We estimated release mortality by multiplying the estimated number of each species released by a release mortality rate of $5.3 \%$ based on previous studies by Alberta Conservation Association, following a multivariate analysis suggested by Reeves (2004). We calculated yield as the product of the average weight of harvested fish and the sum of estimated harvest, plus the product of the average weight of sub-legal fish (from the most recent FIN) and the sum of the estimated release mortality. A flow chart describing the steps used to calculate estimates is provided in Appendix 5.

We calculated illegal harvest as a ratio of observed illegal harvest and the predicted number of harvested fish to determine the rate of illegal harvest, following Sullivan (2002).

### 4.0 RESULTS

### 4.1 Gull Lake

### 4.1.1 Angler survey

We interviewed a total of 1,831 anglers during the survey. The greatest number of anglers resided in Red Deer (19.2\%), Calgary ( $17.7 \%$ ), and Edmonton ( $8.5 \%$ ); $53.8 \%$ of anglers were split between 50 other locations within Alberta. The remaining anglers ( $0.8 \%$ ) came from out of the province/country. Anglers fished for a total of $4,730.75 \mathrm{~h}$, catching 3,731 walleye and 1,369 northern pike, of which 74 walleye and 73 northern pike were harvested (Appendix 6). Of the
anglers, 232 held special harvest tags for walleye. The minority of anglers (42.9\%) fished with bait.

During ROU surveys, $36.8 \%$ of anglers launched at Aspen Beach Provincial Park (the creel site), followed by $9.9 \%$ at Sunset Bay, $9.4 \%$ at Stoner's Landing, and $9.2 \%$ at Meridian Beach. The remaining $34.6 \%$ of anglers launched from ten other sites. Based on angler interviews and ROU surveys, an estimated 17,436 anglers ( $95 \% \mathrm{CI}=14,828-20,247$ ) fished at Gull Lake for 43,382.8 h ( $95 \% \mathrm{CI}=36,844.7-50,469.7$ ) from May 15 to August 31, 2017. Total estimated angling effort within these dates was $5.35 \mathrm{~h} / \mathrm{ha}(95 \% \mathrm{CI}=4.54-6.22)$.

### 4.1.2 Walleye harvest and yield

Anglers harvested an estimated 580 walleye ( $95 \% \mathrm{CI}=411-776$ ) at a rate of $0.01 \mathrm{fish} / \mathrm{h}$ and released 29,000 fish $(95 \% \mathrm{CI}=23,953-34,629)$ at a rate of 0.67 fish $/ \mathrm{h}$. The total catch rate was 0.68 fish/h. Based on individual angler catch rates, the Gini coefficient for walleye at Gull Lake was 0.85 (Appendix 7). Of the released fish, we estimated that $1,537(95 \% \mathrm{CI}=1,270-1,835)$ likely perished as a result of hooking mortality. Total yield (harvest + release mortality) was $2,631.7 \mathrm{~kg}(95 \% \mathrm{CI}=2,142.4-3,197.9)$ or $0.32 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.26-0.39)$. No undersized walleye were harvested; however, one walleye was observed to be harvested without a tag. Biological data collected from sampled fish are listed in Appendix 8.

### 4.1.3 Walleye population structure

The length distribution of walleye harvested by anglers and those caught during test angling ranged from 274 to 643 mm FL ( $\mathrm{n}=271$ ), with most harvested fish between 525 and 600 mm FL and most test-angled fish around 450 to 475 mm FL (Figure 3). Age of harvested fish ranged from 4 to 18 years $(\mathrm{n}=54)$, with age 9 fish being the most prevalent (Figure 4 ).


Figure 3. Length distribution of walleye harvested by anglers and those caught during test angling at Gull Lake, 2017.


Figure 4. Age distribution of walleye harvested by anglers at Gull Lake, $2017(\mathrm{n}=54)$.

### 4.1.4 Northern pike harvest and yield

Anglers harvested an estimated 616 northern pike ( $95 \% \mathrm{CI}=413-884$ ) at a rate of $0.01 \mathrm{fish} / \mathrm{h}$, and released 12,418 fish $(95 \% \mathrm{CI}=10,186-14,982)$ at a rate of 0.29 fish/h. The total catch rate was 0.30 fish/h. Based on individual angler catch rates, the Gini coefficient for northern pike at Gull Lake was 0.77 (Appendix 7). Of the released fish, we estimated that 658 ( $95 \% \mathrm{CI}=413-884$ ) likely perished as a result of hooking mortality. Total yield (harvest + release mortality) was $2,218.4 \mathrm{~kg}$ ( $95 \% \mathrm{CI}=1,678.7-2,878.7$ ) or $0.27 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.21-0.35)$. Observed illegal harvest (harvested fish $<630 \mathrm{~mm} \mathrm{TL}$ ) of northern pike was $6.1 \%$ ( 3 of 49 fish). Biological data collected from sampled fish are listed in Appendix 8.

### 4.1.5 Northern pike population structure

The length distribution of northern pike harvested by anglers and those caught during test angling ranged from 408 to 855 mm FL ( $\mathrm{n}=109$ ), with most harvested fish around 625 mm FL and most test-angled fish between 525 and 600 mm FL (Figure 5). Age of harvested fish ranged from 2 to 14 years ( $n=49$ ), with most fish age 5 (Figure 6).


Figure 5. Length distribution of northern pike harvested by anglers and those caught during test angling at Gull Lake, 2017.


Figure 6. Age distribution of northern pike harvested by anglers at Gull Lake, 2017 ( $\mathrm{n}=49$ ).

### 4.1.6 Other sport fish

In addition to walleye and northern pike, anglers at Gull Lake caught four yellow perch (Perca flavescens) and two burbot (Lota Lota). One of the yellow perch was harvested.

### 4.2 Snipe Lake

### 4.2.1 Angler survey

We interviewed a total of 567 anglers during the survey. The majority of anglers resided in Grande Prairie (34.8\%) and High Prairie (18.5\%); 45.3\% of anglers were split between 36 other locations with Alberta. The remaining anglers (1.4\%) came from out of province. The minority of anglers ( $17.8 \%$ ) fished with bait. Anglers fished for a total of $1,078.75 \mathrm{~h}$, catching 118 walleye and 775 northern pike, of which 45 walleye and 24 northern pike were harvested (Appendix 9).

During ROU surveys, $44.8 \%$ of anglers launched at Snipe Lake Community Campground (the creel site), while $49.8 \%$ launched at the municipal boat launch. The remaining $5.4 \%$ of anglers launched from South Shore Resort or an improvised boat launch at a lease site. Based on angler interviews and ROU surveys, an estimated 1,910 anglers ( $95 \% \mathrm{CI}=1,577-2,271$ ) fished for

4,266.0 h ( $95 \%$ CI = 3,521.5-5,072.4) from May 15 to August 31, 2017. Total estimated angling effort within these dates was $1.01 \mathrm{~h} / \mathrm{ha}(95 \% \mathrm{CI}=0.84-1.20)$.

### 4.2.2 Walleye harvest and yield

Anglers harvested an estimated 242 walleye ( $95 \% \mathrm{CI}=157-351$ ) at a rate of $0.03 \mathrm{fish} / \mathrm{h}$ and released 473 fish $(95 \% \mathrm{CI}=303-686)$ at a rate of 0.06 fish $/ \mathrm{h}$. The total catch rate was $0.09 \mathrm{fish} / \mathrm{h}$. Based on individual angler catch rates, the Gini coefficient for walleye at Snipe Lake was 0.91 (Appendix 10). Of the released fish, we estimated that 25 ( $95 \% \mathrm{CI}=16-36$ ) likely perished as a result of hooking mortality. Total yield (harvest + release mortality) was 463.4 kg ( $95 \% \mathrm{CI}=$ $307.2-662.0$ ) or $0.11 \mathrm{~kg} / \mathrm{ha}$ ( $95 \% \mathrm{CI}=0.07-0.16$ ). Observed illegal harvest (harvested fish $<500$ mm TL ) of walleye was $2.4 \%$ ( 1 of 41 fish). Biological data collected from sampled fish are listed in Appendix 11.

### 4.2.3 Walleye population structure

The length distribution of walleye harvested by anglers and those caught during test angling ranged from 349 to 645 mm FL ( $\mathrm{n}=57$ ), with most harvested fish around 550 to 575 mm and most test-angled fish around 450 mm FL (Figure 7). Age of harvested fish ranged from 2 to 13 years ( $\mathrm{n}=37$ ), with most fish aged 9 (Figure 8).


Figure 7. Length distribution of walleye harvested by anglers and those caught during test angling at Snipe Lake, 2017.


Figure 8. Age distribution of walleye harvested by anglers at Snipe Lake, $2017(\mathrm{n}=37)$.

### 4.2.4 Northern pike harvest and yield

Anglers harvested an estimated 174 northern pike ( $95 \% \mathrm{CI}=96-271$ ) at a rate of $0.02 \mathrm{fish} / \mathrm{h}$, and released 3,994 fish $(95 \% \mathrm{CI}=2,928-5,242)$ at a rate of $0.49 \mathrm{fish} / \mathrm{h}$. The total catch rate was 0.51 fish/h. Based on individual angler catch rates, the Gini coefficient for northern pike at Snipe Lake was 0.86 (Appendix 10). Of the released fish, we estimated that 212 ( $95 \% \mathrm{CI}=155-278$ ) likely perished as a result of hooking mortality. Total yield (harvest + release mortality) was $419.0 \mathrm{~kg}(95 \% \mathrm{CI}=295.3-567.9)$ or $0.10 \mathrm{~kg} / \mathrm{ha}(95 \% \mathrm{CI}=0.07-0.13)$. No illegal harvest was observed. Biological data collected from sampled fish are listed in Appendix 11.

### 4.2.5 Northern pike population structure

The length distribution of northern pike harvested by anglers and those caught during test angling ranged from 260 to 740 mm FL ( $\mathrm{n}=124$ ), with most harvested fish between 550 and 575 mm FL and most test-angled fish in the 525 to 575 mm FL range (Figure 9). Age of harvested fish ranged from 3 to 9 years ( $\mathrm{n}=22$ ), with most fish aged 4 and 5 years (Figure 10).


Figure 9. Length distribution of northern pike harvested by anglers and those caught during test angling at Snipe Lake, 2017.


Figure 10. Age distribution of northern pike harvested by anglers at Snipe Lake, 2017 ( $\mathrm{n}=22$ ).

### 5.0 SUMMARY

### 5.1 Gull Lake

During the survey period, an estimated 17,436 anglers fished for $43,382.8 \mathrm{~h}$ at Gull Lake and captured 29,555 walleye and 13,030 northern pike, which equates to $5.35 \mathrm{~h} / \mathrm{ha}$ of fishing pressure and a catch rate of 1.0 fish $/ \mathrm{h}$.

### 5.2 Snipe Lake

During the survey period, an estimated 1,910 anglers fished for $4,266.0 \mathrm{~h}$ at Snipe Lake and captured 717 walleye and 4,108 northern pike, which equates to $1.01 \mathrm{~h} / \mathrm{ha}$ of fishing pressure and a catch rate of 0.6 fish $/ \mathrm{h}$.

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### 6.0 APPENDICES

Appendix 1. Angler survey form for Snipe Lake, 2017.


Appendix 2. Angler survey form for Gull Lake, 2017.


Appendix 3. Biological information collected from fish caught during test angling, Gull Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| NRPK | 113 | 690 | 713 |
| WALL | 114 | 506 | 531 |
| NRPK | 115 | 611 | 638 |
| NRPK | 116 | 507 | 530 |
| NRPK | 117 | 540 | 576 |
| WALL | 118 | 549 | 575 |
| NRPK | 119 | 504 | 537 |
| NRPK | 120 | 464 | 495 |
| NRPK | 121 | 558 | 595 |
| NRPK | 122 | 589 | 621 |
| NRPK | 123 | 536 | 572 |
| NRPK | 124 | 510 | 542 |
| NRPK | 125 | 512 | 541 |
| NRPK | 126 | 475 | 512 |
| NRPK | 127 | 556 | 591 |
| NRPK | 128 | 525 | 556 |
| NRPK | 129 | 654 | 692 |
| NRPK | 130 | 558 | 589 |
| WALL | 131 | 533 | 556 |
| WALL | 132 | 468 | 444 |
| WALL | 133 | 599 | 636 |
| WALL | 134 | 394 | 416 |
| WALL | 135 | 369 | 391 |
| WALL | 136 | 453 | 454 |
| WALL | 137 | 481 | 517 |
| WALL | 138 | 362 | 383 |
| WALL | 139 | 545 | 572 |
| WALL | 140 | 544 | 568 |
| WALL | 141 | 460 | 482 |
| WALL | 142 | 579 | 605 |
| WALL | 143 | 363 | 383 |
| NRPK | 144 | 592 | 611 |
| NRPK | 145 | 560 | 586 |
| WALL | 146 | 454 | 474 |
| WALL | 147 | 345 | 362 |
| WALL | 148 | 407 | 426 |
| WALL | 149 | 449 | 471 |
| WALL | 150 | 535 | 560 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| WALL | 151 | 367 | 387 |
| NRPK | 152 | 537 | 575 |
| WALL | 153 | 373 | 389 |
| WALL | 154 | 510 | 534 |
| WALL | 155 | 485 | 506 |
| WALL | 156 | 513 | 538 |
| WALL | 157 | 410 | 425 |
| WALL | 158 | 432 | 457 |
| WALL | 159 | 455 | 476 |
| WALL | 160 | 348 | 372 |
| WALL | 161 | 432 | 450 |
| WALL | 162 | 401 | 420 |
| WALL | 163 | 343 | 362 |
| WALL | 164 | 439 | 462 |
| WALL | 165 | 447 | 469 |
| WALL | 166 | 503 | 527 |
| WALL | 167 | 465 | 493 |
| WALL | 168 | 470 | 489 |
| WALL | 169 | 380 | 402 |
| WALL | 170 | 520 | 554 |
| WALL | 171 | 454 | 478 |
| WALL | 172 | 352 | 371 |
| WALL | 173 | 526 | 557 |
| WALL | 174 | 532 | 562 |
| WALL | 175 | 444 | 465 |
| WALL | 176 | 519 | 547 |
| WALL | 177 | 449 | 469 |
| WALL | 178 | 438 | 459 |
| NRPK | 179 | 593 | 625 |
| NRPK | 180 | 536 | 584 |
| NRPK | 181 | 532 | 561 |
| WALL | 182 | 551 | 579 |
| WALL | 183 | 354 | 375 |
| WALL | 184 | 438 | 463 |
| WALL | 185 | 491 | 516 |
| WALL | 186 | 432 | 459 |
| WALL | 187 | 390 | 419 |
| WALL | 188 | 449 | 472 |
| WALL | 189 | 289 | 308 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| WALL | 190 | 365 | 384 |
| WALL | 191 | 298 | 317 |
| WALL | 192 | 438 | 463 |
| WALL | 193 | 482 | 511 |
| WALL | 194 | 274 | 292 |
| WALL | 195 | 517 | 545 |
| WALL | 196 | 436 | 457 |
| WALL | 197 | 454 | 474 |
| WALL | 198 | 392 | 416 |
| WALL | 199 | 470 | 496 |
| NRPK | 200 | 470 | 499 |
| WALL | 201 | 465 | 490 |
| NRPK | 202 | 628 | 665 |
| WALL | 203 | 379 | 395 |
| NRPK | 204 | 622 | 660 |
| WALL | 205 | 531 | 555 |
| WALL | 206 | 530 | 555 |
| WALL | 207 | 530 | 565 |
| WALL | 208 | 537 | 568 |
| WALL | 209 | 442 | 463 |
| WALL | 210 | 361 | 380 |
| WALL | 211 | 393 | 416 |
| WALL | 212 | 311 | 330 |
| WALL | 213 | 446 | 479 |
| WALL | 214 | 410 | 445 |
| WALL | 215 | 493 | 518 |
| WALL | 216 | 473 | 502 |
| WALL | 217 | 276 | 294 |
| WALL | 218 | 457 | 483 |
| WALL | 219 | 337 | 358 |
| WALL | 220 | 293 | 300 |
| WALL | 221 | 366 | 390 |
| WALL | 222 | 436 | 464 |
| WALL | 223 | 582 | 615 |
| WALL | 224 | 443 | 466 |
| WALL | 225 | 550 | 573 |
| WALL | 226 | 478 | 506 |
| WALL | 227 | 404 | 427 |
| WALL | 228 | 432 | 459 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| WALL | 229 | 387 | 413 |
| WALL | 230 | 482 | 512 |
| WALL | 231 | 528 | 562 |
| WALL | 232 | 535 | 562 |
| WALL | 233 | 399 | 417 |
| WALL | 234 | 571 | 594 |
| NRPK | 235 | 589 | 621 |
| WALL | 236 | 443 | 469 |
| WALL | 237 | 545 | 569 |
| WALL | 238 | 470 | 495 |
| WALL | 239 | 542 | 573 |
| WALL | 240 | 424 | 442 |
| WALL | 241 | 414 | 441 |
| WALL | 242 | 299 | 321 |
| WALL | 243 | 375 | 396 |
| WALL | 244 | 478 | 514 |
| WALL | 245 | 484 | 506 |
| WALL | 246 | 419 | 444 |
| WALL | 247 | 433 | 466 |
| WALL | 248 | 381 | 402 |
| WALL | 249 | 450 | 473 |
| WALL | 250 | 450 | 480 |
| WALL | 251 | 430 | 454 |
| WALL | 252 | 334 | 349 |
| WALL | 253 | 352 | 370 |
| WALL | 254 | 364 | 387 |
| WALL | 255 | 344 | 364 |
| WALL | 256 | 540 | 565 |
| NRPK | 257 | 507 | 538 |
| WALL | 258 | 512 | 537 |
| WALL | 259 | 560 | 589 |
| WALL | 260 | 420 | 443 |
| NRPK | 261 | 552 | 585 |
| WALL | 262 | 527 | 553 |
| WALL | 263 | 410 | 430 |
| WALL | 264 | 440 | 463 |
| WALL | 265 | 355 | 374 |
| WALL | 266 | 435 | 456 |
| WALL | 267 | 558 | 586 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| WALL | 268 | 432 | 453 |
| WALL | 269 | 460 | 487 |
| WALL | 270 | 377 | 396 |
| WALL | 271 | 562 | 593 |
| NRPK | 272 | 558 | 585 |
| WALL | 273 | 376 | 394 |
| WALL | 274 | 430 | 452 |
| WALL | 275 | 430 | 456 |
| WALL | 276 | 383 | 402 |
| WALL | 277 | 385 | 408 |
| WALL | 278 | 360 | 380 |
| WALL | 279 | 390 | 415 |
| WALL | 280 | 359 | 376 |
| WALL | 281 | 412 | 431 |
| WALL | 282 | 550 | 575 |
| WALL | 283 | 458 | 484 |
| WALL | 284 | 312 | 327 |
| WALL | 285 | 460 | 481 |
| WALL | 286 | 400 | 424 |
| WALL | 287 | 424 | 447 |
| WALL | 288 | 500 | 530 |
| WALL | 289 | 590 | 512 |
| WALL | 290 | 374 | 395 |
| WALL | 291 | 386 | 420 |
| WALL | 292 | 432 | 456 |
| WALL | 293 | 435 | 460 |
| WALL | 294 | 472 | 497 |
| WALL | 295 | 562 | 591 |
| WALL | 296 | 600 | 633 |
| WALL | 297 | 395 | 415 |
| WALL | 298 | 530 | 560 |
| WALL | 299 | 453 | 474 |
| WALL | 300 | 371 | 393 |
| WALL | 301 | 533 | 563 |
| WALL | 302 | 477 | 509 |
| WALL | 303 | 467 | 492 |
| WALL | 304 | 388 | 409 |
| WALL | 305 | 435 | 463 |
| WALL | 306 | 530 | 556 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| WALL | 307 | 471 | 498 |
| WALL | 308 | 398 | 423 |
| WALL | 309 | 553 | 571 |
| WALL | 310 | 451 | 473 |
| WALL | 311 | 447 | 476 |
| WALL | 312 | 465 | 488 |
| NRPK | 313 | 570 | 603 |
| WALL | 314 | 426 | 453 |
| WALL | 315 | 383 | 405 |
| WALL | 316 | 471 | 497 |
| WALL | 317 | 363 | 384 |
| WALL | 318 | 427 | 449 |
| WALL | 319 | 361 | 382 |
| WALL | 320 | 354 | 373 |
| WALL | 321 | 511 | 534 |
| WALL | 322 | 463 | 489 |
| WALL | 323 | 643 | 677 |
| WALL | 324 | 444 | 472 |
| WALL | 325 | 393 | 417 |
| WALL | 326 | 457 | 486 |
| WALL | 327 | 453 | 480 |
| WALL | 328 | 449 | 472 |
| WALL | 329 | 375 | 396 |
| NRPK | 330 | 498 | 529 |
| NRPK | 331 | 475 | 495 |
| NRPK | 332 | 624 | 661 |
| WALL | 333 | 455 | 476 |
| WALL | 334 | 362 | 375 |
| NRPK | 335 | 601 | 636 |
| WALL | 336 | 302 | 326 |
| WALL | 337 | 356 | 377 |
| NRPK | 338 | 491 | 526 |
| NRPK | 339 | 576 | 608 |
| NRPK | 340 | 498 | 533 |
| NRPK | 341 | 650 | 684 |
| WALL | 342 | 322 | 341 |
| WALL | 343 | 403 | 423 |
| WALL | 344 | 427 | 444 |
| WALL | 345 | 505 | 531 |

Appendix 3. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :--- | :---: | :---: | :---: |
| NRPK | 346 | 725 | 760 |
| WALL | 347 | 355 | 366 |
| NRPK | 348 | 623 | 654 |
| WALL | 349 | 471 | 494 |
| WALL | 350 | 379 | 402 |
| WALL | 351 | 365 | 382 |
| WALL | 352 | 440 | 461 |
| WALL | 353 | 456 | 480 |
| WALL | 354 | 455 | 479 |
| WALL | 355 | 510 | 529 |
| WALL | 356 | 456 | 480 |
| WALL | 357 | 519 | 548 |
| NRPK | 358 | 540 | 585 |
| NRPK | 359 | 630 | 660 |
| WALL | 360 | 453 | 475 |
| WALL | 361 | 430 | 454 |
| WALL | 362 | 463 | 485 |
| WALL | 363 | 300 | 308 |
| WALL | 364 | 363 | 386 |
| WALL | 365 | 398 | 419 |

Appendix 4. Biological information collected from fish caught during test angling, Snipe Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| NRPK | 63 | 597 | 630 |
| NRPK | 64 | 529 | 555 |
| NRPK | 65 | 527 | 559 |
| NRPK | 66 | 515 | 551 |
| NRPK | 67 | 529 | 561 |
| NRPK | 68 | 639 | 676 |
| WALL | 69 | 419 | 439 |
| NRPK | 70 | 628 | 664 |
| NRPK | 71 | 569 | 598 |
| NRPK | 72 | 548 | 583 |
| NRPK | 73 | 572 | 606 |
| NRPK | 74 | 495 | 538 |
| NRPK | 75 | 558 | 587 |
| NRPK | 76 | 554 | 587 |
| NRPK | 77 | 515 | 542 |
| NRPK | 78 | 541 | 577 |
| NRPK | 79 | 514 | 544 |
| NRPK | 80 | 514 | 533 |
| NRPK | 81 | 572 | 604 |
| NRPK | 82 | 551 | 586 |
| NRPK | 83 | 550 | 586 |
| NRPK | 84 | 569 | 603 |
| NRPK | 85 | 557 | 590 |
| NRPK | 86 | 518 | 550 |
| NRPK | 87 | 504 | 533 |
| WALL | 88 | 451 | 477 |
| NRPK | 89 | 546 | 580 |
| WALL | 90 | 437 | 483 |
| NRPK | 91 | 580 | 619 |
| WALL | 92 | 589 | 616 |
| WALL | 93 | 457 | 485 |
| NRPK | 94 | 572 | 609 |
| NRPK | 95 | 623 | 660 |
| WALL | 96 | 615 | 649 |
| WALL | 97 | 349 | 370 |
| NRPK | 98 | 554 | 584 |
| NRPK | 99 | 511 | 542 |
| WALL | 100 | 527 | 556 |

Appendix 4. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| NRPK | 101 | 560 | 594 |
| NRPK | 102 | 524 | 556 |
| NRPK | 103 | 542 | 583 |
| WALL | 104 | 514 | 546 |
| NRPK | 105 | 470 | 508 |
| NRPK | 106 | 637 | 674 |
| NRPK | 107 | 526 | 559 |
| NRPK | 108 | 522 | 552 |
| NRPK | 109 | 537 | 569 |
| NRPK | 110 | 563 | 597 |
| NRPK | 111 | 500 | 533 |
| WALL | 112 | 486 | 505 |
| WALL | 113 | 577 | 586 |
| NRPK | 114 | 505 | 539 |
| WALL | 115 | 438 | 457 |
| NRPK | 116 | 530 | 564 |
| NRPK | 117 | 527 | 561 |
| NRPK | 118 | 540 | 572 |
| NRPK | 119 | 505 | 540 |
| NRPK | 120 | 506 | 538 |
| NRPK | 121 | 615 | 662 |
| NRPK | 122 | 543 | 570 |
| NRPK | 123 | 550 | 581 |
| NRPK | 124 | 558 | 584 |
| NRPK | 125 | 511 | 545 |
| NRPK | 126 | 545 | 577 |
| NRPK | 127 | 574 | 608 |
| NRPK | 128 | 641 | 680 |
| NRPK | 129 | 620 | 654 |
| NRPK | 130 | 522 | 547 |
| WALL | 131 | 519 | 545 |
| WALL | 132 | 620 | 643 |
| NRPK | 133 | 486 | 508 |
| NRPK | 134 | 577 | 619 |
| NRPK | 135 | 612 | 642 |
| NRPK | 136 | 509 | 540 |
| NRPK | 137 | 583 | 621 |
| NRPK | 138 | 510 | 540 |
| WALL | 139 | 450 | 481 |

Appendix 4. Continued.

| Species | Sample \# | Fork length (mm) | Total length (mm) |
| :---: | :---: | :---: | :---: |
| NRPK | 140 | 539 | 572 |
| NRPK | 141 | 550 | 594 |
| WALL | 142 | 480 | 509 |
| NRPK | 143 | 525 | 558 |
| NRPK | 144 | - | 553 |
| NRPK | 145 | - | 580 |
| NRPK | 146 | - | 536 |
| NRPK | 147 | - | 568 |
| NRPK | 148 | 531 | 552 |
| NRPK | 149 | 473 | 515 |
| NRPK | 150 | 561 | 589 |
| NRPK | 151 | 496 | 516 |
| NRPK | 152 | 528 | 565 |
| NRPK | 153 | 540 | 574 |
| NRPK | 154 | 542 | 579 |

Appendix 5. Flow chart outlining the process used to calculate a whole-lake estimate for a multi-access lake using ratio-of-use at Gull and Snipe lakes, during the summer of 2017. Solid lines represent values with no variance, and dashed lines represent data with variance. WD = week day, $\mathrm{WE}=$ weekend/holiday.

Effort Calculation


Yield Calculation


Appendix 6. Summary of information collected from anglers during the creel survey at Gull Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye. Note: * denotes ratio-of-use survey.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number of <br> anglers | Fishing <br> effort (h) | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $19 / 05 / 2017^{*}$ | 48 | 58.75 | 0 | 11 | 0 | 2 |
| $20 / 05 / 2017$ | 107 | 386 | 9 | 85 | 3 | 48 |
| $21 / 05 / 2017$ | 70 | 179 | 3 | 13 | 1 | 14 |
| $22 / 05 / 2017$ | 41 | 127.5 | 1 | 31 | 0 | 58 |
| $23 / 05 / 2017$ | 9 | 38 | 1 | 9 | 0 | 34 |
| $24 / 05 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $25 / 05 / 2017$ | 2 | 3 | 0 | 0 | 0 | 0 |
| $26 / 05 / 2017$ | 1 | 1 | 0 | 0 | 0 | 0 |
| $27 / 05 / 2017$ | 34 | 72.75 | 0 | 18 | 0 | 2 |
| $28 / 05 / 2017$ | 53 | 132.75 | 2 | 28 | 0 | 11 |
| $03 / 06 / 2017^{*}$ | 56 | 128.75 | 1 | 7 | 1 | 23 |
| $04 / 06 / 2017$ | 26 | 58.25 | 1 | 9 | 2 | 4 |
| $05 / 06 / 2017$ | 19 | 31.25 | 0 | 12 | 0 | 14 |
| $06 / 06 / 2017$ | 13 | 36 | 0 | 23 | 0 | 30 |
| $07 / 06 / 2017$ | 20 | 41.75 | 1 | 12 | 9 | 27 |
| $09 / 06 / 2017$ | 14 | 25 | 2 | 14 | 0 | 10 |
| $10 / 06 / 2017$ | 34 | 80 | 1 | 11 | 2 | 17 |
| $11 / 06 / 2017$ | 43 | 91.25 | 3 | 32 | 2 | 144 |
| $17 / 06 / 2017$ | 103 | 275.75 | 2 | 81 | 7 | 177 |
| $18 / 06 / 2017$ | 98 | 204.25 | 6 | 49 | 0 | 40 |
| $19 / 06 / 2017^{*}$ | 13 | 59 | 1 | 16 | 1 | 87 |
| $20 / 06 / 2017$ | 3 | 12 | 3 | 6 | 0 | 8 |
| $21 / 06 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $22 / 06 / 2017$ | 5 | 6 | 0 | 0 | 0 | 0 |
| $23 / 06 / 2017$ | 18 | 40 | 1 | 7 | 0 | 19 |
| $24 / 06 / 2017^{*}$ | 125 | 186.5 | 3 | 64 | 8 | 151 |
| $25 / 06 / 2017$ | 50 | 122 | 2 | 19 | 3 | 76 |
| $01 / 07 / 2017$ | 52 | 135.5 | 6 | 45 | 2 | 58 |
| $03 / 07 / 2017^{*}$ | 46 | 85.75 | 0 | 36 | 4 | 66 |
|  |  |  |  |  |  |  |

Appendix 6. Continued.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number of <br> anglers | Fishing <br> effort (h) | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $04 / 07 / 2017$ | 45 | 91.25 | 4 | 28 | 0 | 38 |
| $05 / 07 / 2017$ | 42 | 134.25 | 2 | 54 | 0 | 66 |
| $06 / 07 / 2017$ | 15 | 42.25 | 1 | 33 | 0 | 38 |
| $07 / 07 / 2017$ | 26 | 46 | 2 | 39 | 2 | 92 |
| $08 / 07 / 2017$ | 75 | 198.5 | 2 | 66 | 7 | 193 |
| $09 / 07 / 2017$ | 53 | 169.5 | 4 | 116 | 8 | 277 |
| $15 / 07 / 2017$ | 24 | 96.25 | 1 | 33 | 4 | 122 |
| $16 / 07 / 2017$ | 16 | 23 | 0 | 3 | 1 | 19 |
| $17 / 07 / 2017$ | 4 | 16 | 0 | 2 | 0 | 3 |
| $18 / 07 / 2017^{*}$ | 43 | 132.5 | 0 | 57 | 0 | 167 |
| $19 / 07 / 2017$ | 17 | 43 | 0 | 14 | 0 | 53 |
| $20 / 07 / 2017$ | 17 | 66 | 0 | 13 | 1 | 78 |
| $21 / 07 / 2017$ | 14 | 13.5 | 0 | 12 | 0 | 5 |
| $22 / 07 / 2017$ | 80 | 342.25 | 4 | 65 | 13 | 388 |
| $23 / 07 / 2017$ | 44 | 145 | 2 | 44 | 0 | 180 |
| $29 / 07 / 2017$ | 78 | 242.75 | 6 | 28 | 4 | 195 |
| $30 / 07 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $31 / 07 / 2017$ | 38 | 65 | 1 | 25 | 0 | 63 |
| $01 / 08 / 2017$ | 33 | 69 | 0 | 14 | 0 | 147 |
| $02 / 08 / 2017$ | 22 | 51.25 | 0 | 11 | 0 | 76 |
| $03 / 08 / 2017$ | 23 | 45.75 | 1 | 5 | 0 | 82 |
| $04 / 08 / 2017$ | 16 | 22.5 | 0 | 4 | 0 | 18 |
| $05 / 08 / 2017$ | 54 | 88.75 | 0 | 15 | 0 | 48 |
| $06 / 08 / 2017^{*}$ | 194 | 319.75 | 2 | 66 | 1 | 626 |
| $12 / 08 / 2017$ | 38 | 87.75 | 1 | 16 | 0 | 97 |
| $13 / 08 / 2017$ | 24 | 71.25 | 1 | 12 | 0 | 15 |
| $14 / 08 / 2017$ | 19 | 38.25 | 0 | 8 | 0 | 33 |
| $15 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $16 / 08 / 2017$ | 32 | 65.25 | 0 | 13 | 4 | 54 |
| $17 / 08 / 2017$ | 25 | 44.5 | 0 | 13 | 2 | 73 |
|  |  |  |  |  |  |  |

Appendix 6. Continued.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number of <br> anglers | Fishing <br> effort $(\mathrm{h})$ | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $18 / 08 / 2017^{*}$ | 44 | 102.5 | 1 | 33 | 0 | 166 |
| $19 / 08 / 2017$ | 48 | 114.25 | 1 | 23 | 0 | 69 |
| $20 / 08 / 2017$ | 63 | 162.75 | 0 | 26 | 1 | 41 |

Appendix 7. Lorenz curve and associated Gini coefficients for angler catch of walleye and northern pike at Gull Lake, 2017.


Appendix 8. Biological information collected from fish harvested by anglers during the creel survey at Gull Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye, $\mathrm{YLPR}=$ yellow perch.

| Species | Sample <br> \# | Fork length (mm) | Total length (mm) | Weight <br> (g) | Sex | Maturity | Age <br> (y) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| NRPK | 1 | 613 | 654 | 1,450 | F | Mature | 8 |
| NRPK | 2 | 680 | 719 | 1,870 | F | Mature | 7 |
| NRPK | 3 | 613 | 642 | 1,350 | M | Mature | 6 |
| WALL | 4 | 515 | 540 | 1,370 | M | Mature | 8 |
| NRPK | 5 | 623 | 660 | 1,600 | F | Mature | 5 |
| NRPK | 6 | 662 | 703 | 1,910 | F | Unknown | 5 |
| NRPK | 7 | 620 | 655 | 1,600 | F | Mature | 6 |
| NRPK | 8 | 610 | 641 | 1,250 | F | Mature | 7 |
| WALL | 9 | 637 | 665 | 2,240 | F | Mature | 14 |
| WALL | 10 | 634 | 667 | 2,570 | F | Mature | 15 |
| WALL | 11 | 582 | 605 | 2,010 | M | Mature | 9 |
| WALL | 12 | 524 | 587 | 1,930 | F | Mature | 9 |
| WALL | 13 | 534 | 560 | 1,590 | M | Mature | 7 |
| WALL | 14 | 557 | 583 | 1,850 | F | Mature | 9 |
| WALL | 15 | 556 | 581 | 1,730 | M | Mature | 7 |
| WALL | 16 | 528 | 562 | 1,510 | F | Mature | 9 |
| WALL | 17 | 513 | 538 | 1,640 | M | Mature | 18 |
| WALL | 18 | 542 | 572 | 1,540 | F | Mature | 9 |
| WALL | 19 | 517 | 540 | 1,690 | M | Mature | 10 |
| WALL | 20 | 501 | 525 | 1,400 | M | Mature | 13 |
| WALL | 21 | 516 | 540 | 1,370 | M | Mature | 8 |
| NRPK | 22 | 690 | 721 | 1,670 | F | Mature | 9 |
| NRPK | 23 | 748 | 791 | 2,950 | F | Mature | 8 |
| NRPK | 24 | 625 | 632 | 1,290 | F | Mature | 5 |
| NRPK | 25 | 611 | 647 | 1,470 | F | Immature | 4 |
| WALL | 26 | 542 | 571 | 1,540 | F | Mature | 8 |
| WALL | 27 | 526 | 610 | 2,050 | F | Mature | 8 |
| WALL | 28 | 589 | 615 | 2,090 | F | Mature | 9 |
| WALL | 29 | 534 | 562 | 1,640 | M | Mature | - |
| WALL | 30 | 526 | 553 | 1,840 | M | Mature | 9 |
| WALL | 31 | 597 | 613 | 1,840 | F | Mature | 9 |
| NRPK | 32 | 609 | 647 | 1,300 | F | Mature | 5 |
| WALL | 33 | 564 | 597 | 1,850 | F | Mature | 10 |
| WALL | 34 | 595 | 608 | 2,190 | F | Mature | 9 |
| NRPK | 35 | 675 | 708 | 1,690 | F | Mature | 9 |
| NRPK | 36 | 766 | 804 | 2,950 | F | Mature | 7 |
| NRPK | 37 | 539 | 571 | 980 | F | Mature | 2 |

Appendix 8. Continued.

| Species | Sample <br> \# | Fork length (mm) | Total length (mm) | Weight (g) | Sex | Maturity | Age <br> (y) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| NRPK | 38 | 582 | 620 | 1,450 | F | Mature | 3 |
| NRPK | 39 | 637 | 677 | 1,750 | M | Immature | 5 |
| NRPK | 40 | 646 | 689 | 1,580 | F | Mature | 8 |
| NRPK | 41 | 695 | 731 | 1,960 | F | Mature | 8 |
| NRPK | 42 | 855 | 895 | 4,200 | F | Mature | 9 |
| NRPK | 43 | 605 | 648 | 1,480 | M | Mature | 4 |
| WALL | 44 | 516 | 545 | 1,450 | M | Mature | - |
| NRPK | 45 | 724 | 768 | 2,300 | F | Mature | 7 |
| NRPK | 46 | 761 | 797 | 2,950 | F | Mature | 8 |
| NRPK | 47 | 620 | 658 | 1,350 | F | Mature | 5 |
| NRPK | 48 | 613 | 650 | 1,350 | F | Mature | 7 |
| WALL | 49 | 481 | 507 | 1,130 | F | Mature | 4 |
| WALL | 50 | 464 | 515 | 1,195 | F | Mature | 4 |
| NRPK | 51 | 588 | 617 | 1,250 | F | Mature | 5 |
| NRPK | 52 | 595 | 636 | 1,350 | M | Mature | 6 |
| NRPK | 53 | 686 | 731 | 1,890 | F | Mature | 6 |
| NRPK | 54 | 833 | 888 | 4,000 | F | Mature | 11 |
| NRPK | 55 | 605 | 641 | 1,150 | M | Mature | 9 |
| NRPK | 56 | 680 | 733 | 1,975 | F | Mature | 7 |
| NRPK | 57 | 673 | 713 | 1,500 | M | Mature | 10 |
| NRPK | 58 | 607 | 643 | 1,380 | F | Mature | 7 |
| NRPK | 59 | 662 | 701 | 1,670 | F | Mature | 6 |
| WALL | 60 | 518 | 545 | 1,560 | M | Mature | 9 |
| WALL | 61 | 540 | 568 | 1,630 | M | Mature | 9 |
| YLPR | 62 | 200 | 208 | 100 | M | Mature | - |
| NRPK | 63 | 644 | 686 | 1,640 | F | Mature | 5 |
| WALL | 64 | 517 | 545 | 1,460 | F | Mature | 9 |
| WALL | 65 | 629 | 654 | 1,860 | F | Mature | 15 |
| WALL | 66 | 620 | 651 | 1,730 | F | Mature | 17 |
| NRPK | 67 | 600 | 634 | 1,230 | M | Mature | 5 |
| NRPK | 68 | 613 | 650 | 1,440 | M | Mature | 5 |
| NRPK | 69 | 643 | 678 | 1,570 | F | Mature | 8 |
| WALL | 70 | 583 | 611 | 1,740 | F | Mature | 9 |
| WALL | 71 | 524 | 553 | 1,640 | M | Mature | 9 |
| WALL | 72 | 585 | 608 | 1,720 | F | Mature | 7 |
| WALL | 73 | 602 | 635 | 2,110 | F | Mature | 16 |
| WALL | 74 | 593 | 624 | 2,100 | F | Mature | 9 |
| NRPK | 75 | 644 | 685 | 1,610 | F | Mature | 6 |
| WALL | 76 | 577 | 600 | 1,820 | F | Mature | 9 |

Appendix 8. Continued.

| Species | Sample <br> $\#$ | Fork length <br> $(\mathrm{mm})$ | Total length <br> $(\mathrm{mm})$ | Weight <br> $(\mathrm{g})$ | Sex | Maturity | Age <br> $(\mathrm{y})$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WALL | 77 | 564 | 591 | 1,750 | F | Mature | 9 |
| NRPK | 78 | 666 | 707 | 1,670 | F | Mature | 5 |
| WALL | 79 | 537 | 555 | 1,690 | F | Mature | 9 |
| NRPK | 80 | 629 | 669 | 1,650 | F | Mature | 5 |
| WALL | 81 | 571 | 596 | 1,830 | F | Mature | 8 |
| WALL | 82 | 572 | 599 | 1,845 | F | Mature | - |
| WALL | 83 | 582 | 607 | 1,710 | F | Mature | 13 |
| WALL | 84 | 579 | 593 | 1,775 | F | Mature | 10 |
| WALL | 85 | 575 | 602 | 1,850 | F | Mature | 11 |
| WALL | 86 | 590 | 622 | 1,850 | F | Mature | 15 |
| WALL | 87 | 552 | 580 | 1,750 | F | Mature | 9 |
| WALL | 88 | 525 | 544 | 1,485 | F | Mature | 8 |
| WALL | 89 | 604 | 625 | 2,000 | F | Mature | 16 |
| WALL | 90 | 540 | 572 | 1,670 | F | Mature | 8 |
| WALL | 91 | 545 | 565 | 800 | M | Mature | 17 |
| NRPK | 92 | 638 | 687 | 1,480 | F | Mature | 5 |
| WALL | 93 | 475 | 502 | 1,170 | M | Mature | 5 |
| WALL | 94 | 543 | 570 | 1,530 | F | Mature | - |
| WALL | 95 | 505 | 533 | 1,500 | U | Unknown | - |
| WALL | 96 | 583 | 611 | 2,120 | F | Mature | 9 |
| NRPK | 97 | 691 | 721 | 1,910 | F | Mature | 8 |
| WALL | 98 | 485 | 511 | 1,100 | M | Mature | 7 |
| NRPK | 99 | 692 | 735 | 1,940 | F | Mature | 9 |
| NRPK | 100 | 620 | 659 | 1,355 | F | Mature | 5 |
| NRPK | 101 | 655 | 695 | 1,595 | F | Mature | 6 |
| NRPK | 102 | 775 | 815 | 2,940 | F | Mature | 14 |
| NRPK | 103 | 655 | 687 | 1,830 | F | Mature | 10 |
| YLPR | 104 | 205 | 214 | - | U | Unknown | - |
| WALL | 105 | 517 | 540 | 1,510 | M | Mature | 11 |
| WALL | 106 | 556 | 582 | 1,610 | F | Mature | 10 |
| WALL | 107 | 600 | 625 | 1,920 | F | Mature | 9 |
| WALL | 108 | 588 | 615 | 1,820 | F | Mature | 9 |
| WALL | 109 | 589 | 610 | 1,940 | F | Mature | - |
| WALL | 110 | 587 | 610 | 1,870 | F | Mature | - |
| NRPK | 111 | 632 | 673 | 1,300 | F | Mature | 6 |
| WALL | 112 | 500 | 524 | 1,400 | M | Mature | 9 |
|  |  |  |  |  |  |  |  |

Appendix 9. Summary of information collected from anglers during the creel survey at Snipe Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye. Note: * denotes ratio-of-use survey.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number <br> of anglers | Fishing <br> effort (h) | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $18 / 05 / 2017$ | 2 | 7.5 | 0 | 8 | 0 | 0 |
| $19 / 05 / 2017$ | 7 | 13.5 | 0 | 1 | 0 | 0 |
| $20 / 05 / 2017^{*}$ | 38 | 103 | 1 | 114 | 0 | 0 |
| $21 / 05 / 2017$ | 54 | 160.5 | 8 | 196 | 11 | 4 |
| $22 / 05 / 2017$ | 24 | 40 | 0 | 94 | 7 | 6 |
| $23 / 05 / 2017$ | 2 | 7.25 | 0 | 17 | 1 | 5 |
| $24 / 05 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $25 / 05 / 2017$ | 2 | 3 | 0 | 3 | 0 | 0 |
| $26 / 05 / 2017$ | 4 | 13 | 0 | 3 | 0 | 0 |
| $27 / 05 / 2017$ | 33 | 54 | 4 | 61 | 1 | 11 |
| $28 / 05 / 2017$ | 14 | 27.75 | 1 | 105 | 0 | 0 |
| $03 / 06 / 2017^{*}$ | 27 | 92.5 | 3 | 61 | 3 | 5 |
| $04 / 06 / 2017$ | 12 | 13.25 | 0 | 21 | 0 | 0 |
| $05 / 06 / 2017$ | 9 | 35 | 0 | 8 | 0 | 0 |
| $06 / 06 / 2017$ | 6 | 20.75 | 0 | 1 | 0 | 0 |
| $07 / 06 / 2017$ | 18 | 43 | 0 | 19 | 1 | 4 |
| $08 / 06 / 2017^{*}$ | 7 | 8.25 | 1 | 2 | 1 | 1 |
| $09 / 06 / 2017$ | 2 | 12 | 0 | 0 | 0 | 2 |
| $10 / 06 / 2017$ | 23 | 50.25 | 2 | 12 | 0 | 0 |
| $11 / 06 / 2017$ | 6 | 6.5 | 0 | 0 | 0 | 0 |
| $16 / 06 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $17 / 06 / 2017$ | 2 | 0.5 | 0 | 1 | 0 | 0 |
| $18 / 06 / 2017$ | 6 | 8 | 0 | 0 | 0 | 0 |
| $19 / 06 / 2017^{*}$ | 4 | 20 | 0 | 12 | 0 | 0 |
| $20 / 06 / 2017$ | 6 | 6 | 0 | 8 | 1 | 0 |
| $21 / 06 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $22 / 06 / 2017$ | 1 | 1.5 | 0 | 0 | 0 | 0 |
| $23 / 06 / 2017$ | 8 | 27 | 0 | 14 | 2 | 7 |
| $24 / 06 / 2017^{*}$ | 26 | 28.75 | 0 | 4 | 3 | 4 |
|  |  |  |  |  |  |  |

Appendix 9. Continued.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number <br> of anglers | Fishing <br> effort $(\mathrm{h})$ | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $25 / 06 / 2017$ | 5 | 20.5 | 0 | 10 | 1 | 0 |
| $30 / 06 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $01 / 07 / 2017$ | 25 | 27.75 | 2 | 2 | 2 | 3 |
| $02 / 07 / 2017$ | 64 | 106 | 1 | 22 | 2 | 7 |
| $03 / 07 / 2017$ | 4 | 2.5 | 0 | 0 | 0 | 0 |
| $04 / 07 / 2017$ | 9 | 19.75 | 0 | 5 | 1 | 0 |
| $05 / 07 / 2017$ | 20 | 37.5 | 0 | 17 | 4 | 7 |
| $06 / 07 / 2017$ | 8 | 18.25 | 0 | 21 | 3 | 8 |
| $07 / 07 / 2017$ | 38 | 57.75 | 3 | 15 | 2 | 2 |
| $08 / 07 / 2017^{*}$ | 51 | 89.75 | 3 | 13 | 1 | 4 |
| $09 / 07 / 2017$ | 24 | 43.5 | 1 | 7 | 2 | 4 |
| $15 / 07 / 2017$ | 6 | 3 | 0 | 0 | 0 | 0 |
| $16 / 07 / 2017$ | 6 | 3.5 | 0 | 2 | 0 | 0 |
| $17 / 07 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $18 / 07 / 2017^{*}$ | 9 | 20.25 | 0 | 4 | 1 | 0 |
| $19 / 07 / 2017$ | 9 | 16.5 | 0 | 5 | 1 | 0 |
| $20 / 07 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $21 / 07 / 2017$ | 3 | 1.25 | 0 | 0 | 0 | 0 |
| $22 / 07 / 2017$ | 4 | 6.25 | 0 | 0 | 0 | 0 |
| $23 / 07 / 2017$ | 2 | 1.75 | 0 | 0 | 0 | 0 |
| $28 / 07 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $29 / 07 / 2017$ | 36 | 70 | 0 | 2 | 0 | 2 |
| $30 / 07 / 2017^{*}$ | 20 | 29.5 | 1 | 1 | 0 | 1 |
| $31 / 07 / 2017$ | 2 | 2 | 0 | 1 | 0 | 0 |
| $01 / 08 / 2017$ | 11 | 14 | 0 | 0 | 0 | 0 |
| $02 / 08 / 2017$ | 10 | 12 | 0 | 1 | 0 | 0 |
| $03 / 08 / 2017$ | 4 | 12 | 0 | 0 | 1 | 0 |
| $04 / 08 / 2017$ | 9 | 5.25 | 1 | 0 | 0 | 0 |
| $05 / 08 / 2017$ | 7 | 6.5 | 1 | 0 | 0 | 0 |
| $06 / 08 / 2017^{*}$ | 21 | 11.25 | 0 | 1 | 0 | 0 |
| $11 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  |  |  |  |  |  |

Appendix 9. Continued.

| Date <br> $(\mathrm{d} / \mathrm{m} / \mathrm{y})$ | Number <br> of anglers | Fishing <br> effort $(\mathrm{h})$ | NRPK <br> harvest | NRPK <br> release | WALL <br> harvest | WALL <br> release |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $12 / 08 / 2017$ | 4 | 2 | 0 | 0 | 0 | 0 |
| $13 / 08 / 2017$ | 8 | 16.5 | 0 | 0 | 0 | 0 |
| $14 / 08 / 2017$ | 3 | 3.25 | 0 | 0 | 0 | 0 |
| $15 / 08 / 2017$ | 2 | 1.5 | 0 | 0 | 0 | 0 |
| $16 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $17 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $18 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $19 / 08 / 2017$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $20 / 08 / 2017$ | 4 | 10.25 | 0 | 2 | 0 | 0 |

Appendix 10. Lorenz curve and associated Gini coefficients for angler catch of walleye and northern pike at Snipe Lake, 2017.


Appendix 11. Biological information collected from fish harvested by anglers during the creel survey at Snipe Lake, 2017. Species codes: NRPK = northern pike, WALL = walleye.

| Species | Sample \# | Fork length <br> $(\mathrm{mm})$ | Total length <br> $(\mathrm{mm})$ | Weight <br> $(\mathrm{g})$ | Sex | Maturity | Age <br> $(\mathrm{y})$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WALL | 1 | 593 | 620 | 2,065 | F | Mature | - |
| WALL | 2 | 538 | 565 | 1,590 | M | Mature | 2 |
| WALL | 3 | 579 | 609 | 1,810 | F | Mature | 10 |
| WALL | 4 | 553 | 567 | 1,775 | M | Mature | 9 |
| NRPK | 5 | 610 | 650 | 1,380 | F | Unknown | 5 |
| WALL | 6 | 529 | 604 | 1,975 | F | Mature | 9 |
| WALL | 7 | 522 | 550 | 1,525 | F | Mature | 6 |
| WALL | 8 | 580 | 603 | 1,795 | M | Mature | 8 |
| WALL | 9 | 492 | 500 | 1,490 | M | Mature | 9 |
| WALL | 10 | 569 | 590 | 1,845 | M | Mature |  |
| NRPK | 11 | 545 | 581 | 1,040 | M | Mature | 4 |
| NRPK | 12 | 695 | 731 | 1,585 | F | Mature | 9 |
| NRPK | 13 | 556 | 588 | 900 | M | Immature | 4 |
| NRPK | 14 | 521 | 558 | 890 | F | Mature | 3 |
| NRPK | 15 | 561 | 583 | 1,065 | F | Mature | 3 |
| WALL | 16 | 556 | 588 | 1,530 | M | Mature | 10 |
| WALL | 17 | 513 | 554 | 1,630 | M | Mature | 10 |
| WALL | 18 | 540 | 569 | - | U | Unknown | - |
| WALL | 19 | 621 | 646 | 2,380 | M | Mature | 9 |
| WALL | 20 | 572 | 588 | 1,445 | M | Mature | 8 |
| WALL | 21 | 543 | 574 | 1,400 | M | Mature | 9 |
| WALL | 22 | 532 | 551 | 1,430 | M | Mature | 8 |
| WALL | 23 | 546 | 568 | 1,620 | F | Mature | 7 |
| WALL | 24 | 541 | 567 | 1,700 | M | Mature | 6 |
| NRPK | 25 | 535 | 564 | 960 | M | Immature | 4 |
| NRPK | 26 | 540 | 572 | 815 | M | Immature | 4 |
| NRPK | 27 | 593 | 665 | 1,390 | M | Unknown | 7 |
| NRPK | 28 | 533 | 572 | 985 | F | Immature | 5 |
| NRPK | 29 | 594 | 619 | 1,045 | M | Immature | 5 |
|  |  |  |  |  |  |  |  |

Appendix 11. Continued.

| Species | Sample \# | Fork length <br> $(\mathrm{mm})$ | Total length <br> $(\mathrm{mm})$ | Weight <br> $(\mathrm{g})$ | Sex | Maturity | Age <br> $(\mathrm{y})$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| NRPK | 30 | 470 | 508 | 705 | F | Immature | 3 |
| WALL | 31 | 540 | 560 | 1,660 | M | Mature | 8 |
| WALL | 32 | 586 | 605 | 1,995 | M | Mature | 9 |
| NRPK | 33 | 582 | 618 | 1,110 | F | Mature | 5 |
| NRPK | 34 | 580 | 615 | 1,210 | F | Mature | 5 |
| WALL | 35 | 562 | 583 | 1,760 | F | Mature | 7 |
| WALL | 36 | 625 | 649 | 2,165 | F | Mature | 8 |
| WALL | 37 | 531 | 558 | 1,445 | M | Unknown | 8 |
| WALL | 38 | 481 | 509 | 1,175 | F | Mature | - |
| WALL | 39 | 619 | 646 | 2,020 | F | Mature | 9 |
| WALL | 40 | 514 | 534 | 1,555 | F | Mature | 5 |
| NRPK | 41 | 547 | 584 | 1,140 | F | Immature | 4 |
| NRPK | 42 | 551 | 586 | 1,045 | M | Unknown | 5 |
| WALL | 43 | 573 | 600 | 1,875 | M | Mature | 9 |
| WALL | 44 | 625 | 644 | 2,170 | F | Mature | 10 |
| WALL | 45 | 434 | 454 | 910 | M | Immature | 4 |
| WALL | 46 | 614 | 639 | 2,445 | F | Mature | 6 |
| WALL | 47 | 570 | 594 | 2,045 | M | Mature | 9 |
| WALL | 48 | 579 | 608 | 1,965 | M | Mature | 9 |
| WALL | 49 | 603 | 634 | 2,050 | M | Mature | 8 |
| WALL | 50 | 611 | 632 | 2,310 | F | Mature | 7 |
| WALL | 51 | 581 | 605 | 2,230 | F | Mature | 10 |
| WALL | 52 | 645 | 668 | 2,270 | M | Mature | 13 |
| NRPK | 53 | 550 | 584 | 925 | M | Immature | 3 |
| NRPK | 54 | 555 | 592 | 1,040 | F | Immature | 5 |
| WALL | 55 | 481 | 505 | 1,330 | M | Mature | 5 |
| WALL | 56 | 571 | 585 | 1,830 | U | Unknown | 10 |
| NRPK | $56 b$ | 544 | 582 | 1,110 | F | Mature | 4 |
| WALL | 57 | 505 | 533 | 1,400 | F | Mature | 5 |
| WALL | 58 | 498 | 525 | 1,130 | F | Mature | 5 |
| NRPK | 59 | 505 | 536 | 910 | F | Mature | 4 |
|  |  |  |  |  |  |  |  |

Appendix 11. Continued.

| Species | Sample \# | Fork length <br> $(\mathrm{mm})$ | Total length <br> $(\mathrm{mm})$ | Weight <br> $(\mathrm{g})$ | Sex | Maturity | Age <br> $(\mathrm{y})$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WALL | 60 | 544 | 569 | 1,775 | M | Mature | 9 |
| NRPK | 61 | 565 | 600 | 1,230 | F | Mature | 4 |
| NRPK | 62 | 575 | 615 | 1,305 | F | Mature | 5 |

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## Canadà̀ Albertan sund Pames

