

NATIONAL CAPITAL COMMISSION  
COMMISSION DE LA CAPITALE NATIONALE


**Lac Kingsmere and Lac Mulvihill Largemouth Bass  
Removal Project  
2024 Report**

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## Background

Lac Kingsmere has had numerous evaluations of its biodiversity carried out over the last few decades. One such evaluation was recently conducted by the Canadian Museum of Nature (CMN; i.e., Ilves et al. 2021) which revealed the presence of the non-native species, Largemouth Bass (*Micropterus nigricans*; LMB; note – the Latin binomial for LMB was just changed from *M. salmoides*). The same study found sufficient evidence of population declines among Lac Kingsmere minnow species which jeopardizes the reproductive capacity of the lake's native freshwater mussels. For more information on the conditions surrounding the introduction of LMB to Lac Kingsmere, please refer to the preliminary report submitted to the Nation Capital Commission (NCC) by Laura Haniford and Kate LaChance in 2023 from the Fish Ecology and Conservation Physiology Lab (FECPL) at Carleton University. 

New to this year's study is the incorporation of Lac Mulvihill into the removal program. Mulvihill shares both a physical and historical connection to Kingsmere as the only lake connected to Kingsmere's outflow. Historically, the land underneath Mulvihill was purchased by the Mulvihill family and developed into a lake in 1948-49. Fearing the water supply to nearby Bridal Veil Falls would suffer, prime minister William Mackenzie Lyon King filed a lawsuit but passed away in 1950, ending the dispute. Lac Mulvihill remains today as it was when this dispute ended, and serves as part of the same Canadian cultural heritage as Lac Kingsmere. (City of Chelsea, 2024)

Contrary to Kingsmere, Mulvihill is not a privately owned lake and the NCC prohibits visiting individuals from swimming in the water (National Capital Commission, 2024). It is likely that the LMB invasion in Mulvihill is a direct consequence of the introduction (intentional or inadvertent) of LMB to Kingsmere. The small stream-dam connecting the two lakes is likely how

LMB, particularly juveniles, could be inadvertently introduced to Mulvihill. The species composition of both lakes are quite similar (Table 1) with the notable exception of predator fish being absent from Lac Mulvihill (Chapleau et al., 1997) until the introduction of LMB. Additionally, most minnow species are no longer present in Lac Kingsmere (Ilves et al., 2021) but are abundant in Lac Mulvihill. Only one minnow (a single creek chub; *Semotilus atromaculatus*) was observed in Lac Kingsmere throughout the entire sampling period.

## **Methods**

### **Site Description**

A research team from the FECPL at Carleton University began the initial assessment and removal of Largemouth Bass in May 2023 (Haniford and LaChance, 2023). These efforts were confined to Lac Kingsmere. Similar evaluation and removal efforts began in Lac Mulvihill (45° 29' 0"N, 75° 51' 17.7" W) by our team in May of 2024. Mulvihill is a much smaller and shallower lake than Kingsmere, with an area of 1.26 ha, an average depth of 1.12 m and maximum depth of 3.65 m (Chapleau et al., 1997). Similar to Lac Kingsmere, most assessment and removal efforts focused on shallow, littoral areas where snorkeling and seine nets are most effective. Apart from Kingsmere, Mulvihill is isolated from other water bodies. For a site description of Lac Kingsmere, please refer to Haniford and LaChance (2023).

### **Nesting Male Removal**

Snorkel surveys were conducted between May 14<sup>th</sup> and June 1<sup>st</sup> on both Kingsmere and Mulvihill lakes, with the goal of locating bass nests. Some nests are simply “scrapes” without eggs or adults that may or may not eventually become an active nest, whereas other nests are located when fish are actively spawning or afterwards where the parental male is engaged in parental care. Females decide which males/nests will receive eggs. After spawning (when

fertilization occurs), the females depart, leaving the male to provide sole paternal care for a period of three to six weeks (depending on water temperature). Male bass fan and guard eggs and then upon hatching stay with the offspring until they develop predator avoidance skills. If a male bass is removed before offspring have become independent, they quickly die (either by lack of oxygenation in egg stage or predation on eggs or larvae). As such, removal of nesting bass inherently leads to nest failure without having to remove offspring or damage the nest. Nests were tagged with a small PVC tile to help map the layout of nests in the lake and determine hotspots, and so that research anglers were able to spot the nests from a canoe. The ages of the eggs were estimated by the diver based on egg transparency and the reproductive capacities of the bass were estimated by measuring brood sizes, using procedures described in Siepeker et al., (2006). This information was used solely to ensure nesting bass were captured prior to the independent fry stage. Bass that were unable to be angled before hatching had the eggs removed via dipnet while keeping the nest habitat intact. No nesting bass were found in Lac Mulvihill during the two-week snorkelling period, nor were any sexually mature adults spotted throughout the summer.

### **General Fish Capture**

All fish captured throughout the 2024 sampling period were euthanized via cerebral percussion and composted by community members above the high water mark. Total length was measured (mm), and mass was weighed (g). When large numbers of young-of-the-year (YOY) were captured (sometimes exceeding ~6,000 in a day), the total length and mass were averaged from 10 individuals, and all individuals were batch-weighed. Additionally, if the captured fish was adult, or near-adult age (>10cm), they were cut horizontally from the urogenital opening to the

throat to determine their sex from their reproductive organs. Fish that had not yet reached sexual maturity were counted as juveniles.

Seine netting, minnow trapping, and angling were conducted continuously throughout the sampling period, with seine netting beginning July 1<sup>st</sup> to prevent overlapping with the minnow spawning season. Minnow trapping was discontinued in early July due to excessively low catch yield, as was the case in 2023 (i.e., less than ten LMB-YOY weighing 0.001 kg were captured, despite trying several different trap baits on both lakes). Community members continuously reported their catches of LMB and delivered the fish to our team for analysis, or reported the measurements and sexes themselves which were further approved by the FECPL team after transport. Fish caught by the community were delivered to our research team for disposal in accordance with our permits (see Appendix A). A fishing tournament was hosted on August 17<sup>th</sup> to make use of the large number of recreational anglers on the lake, as was successful in 2023.

## **Results**

### **Nest Monitoring and Targeted Angling**

Nests were confirmed on the basis of the presence of a defending male, whether or not eggs had been laid. No nests were found on Lac Mulvihill. A total of 6 confirmed nests were tagged throughout the 2024 survey period on Lac Kingsmere, and 11 scrapes were observed along the shoreline (Figure 2). Scrapes were temporarily tagged with PVC tile and monitored on each successive swim to ensure no bass claimed the scrape for spawning, but in no instance did that occur. All but one nest had their defending male successfully angled. Only the male of nest 518 could not be angled and offspring were removed via dipnet prior to hatching.

In total, 8 largemouth bass were angled from 6 confirmed nests and 11 scrapes were observed on Lac Kingsmere (nests 493 and 494 were witnessed to have multiple bass within the vicinity, with

nest 494 having four bass surrounding the nest). It is not uncommon for sub-adult bass to be “curious” and loiter around nests. Similarly, during the spawning period sometimes additional females visit males with the hopes of spawning. Our 2024 removal represents a 76% reduction in active nests spotted in Lac Kingsmere and a severe decrease in the reproductive capacity of the LMB population. This is especially significant as Haniford and LaChance (2023) only conducted snorkel surveys for two days as opposed to two weeks, so the possible reduction may be even greater if some LMB had nested after the surveys ended on May 26<sup>th</sup>, 2023. Given that a school of YOY were spotted and captured in 2024, it is important to note that we failed to detect at least one nest which was presumably in the very shallow and weedy areas of the marsh. All but one nest had their defending male angled, with the final nest being depleted of eggs by the diver on June 1<sup>st</sup>, 2024.

### **General Fish Capture**

The total biomass removed from the lake during the present field season was 36.10 kg divided between 4 age classes (Table 3). Seining was by far the most effective method of capturing bass, accounting for 76% (27.78kg) of the total biomass removed during the season. The total count of bass seined in the 2024 sampling period was estimated to be 9212 (Table 3). Seining, however, is very unlikely to catch adult bass. Angling (targeted angling, nest angling, and community angling) accounted for another 24% (8.07kg) of biomass removed. The total number of sexually mature bass angled was 18 (Table 3). The biomass removed via minnow traps was negligible as they were discontinued due to excessively low yield in 2023 and 2024. Additionally, LMB captured by the CMN was limited to three YOY. These data were excluded from calculations.

YOY and 1+ offspring were often discovered in numbers that were too large to reasonably count. As such, each time a batch of YOY and/or 1+ were captured, a sample of 10 individuals was

taken haphazardly with a dipnet, and measured (total length; mm) and weighed (batched weighed; g). The average weight of individuals belonging to YOY or 1+ offspring was used to back-calculate a count estimate of LMB removed (Table 3). The two age groups were distinguished based on total length using the von Bertalanffy (vBGF) growth curves reported in Haniford and LaChance (2023) for LMB in Lac Kingsmere. YOY were counted if their TL measured 40 – 65mm, and 1+ offspring were counted if their TL measured 66 – 100 mm). Juveniles were counted above a TL of 100mm until adult sexual maturity could be determined, at which point they were counted as adults.

### **Effort and Yield**

As LMB removal moves forward, our team is quantifying how our effort versus yield changes over time. It is expected that as the LMB population declines, more fishing time (i.e. effort) will be required to catch additional bass – a pattern we observed (Figure 1). The month of June saw a significant increase in the number of hours that were spent angling while still catching a limited number of bass. This is likely due to the extra hours that were spent teaching new volunteers/assistants how to angle for the first time (on occasion, a full day was spent transferring angling knowledge to new project participants). The hours that were spent angling in June were largely spent by new anglers that had little experience casting a rod and/or locating potential bass refuges. If the month of June is treated as an outlier, then our dataset shows a continued increase in the number of hours required to catch bass over the summer.

## Discussion

Eggs scores fell considerably below the moderate scores from the preliminary study last year.

Nests 512 and 582 had a defending bass but no eggs were laid before the male was angled (the presence of a defending bass was determined over multiple days if the mature bass consistently remained at his nest, regardless of spawning). Nests 494, 496, and 518 had eggs scores of 2, and only nest 493 had an egg score of 5. Notably, nest 493 was quite large in area and witnessed to have four bass loitering in the vicinity. A male and female were angled from this nest, after which point the remaining two bass could not be angled, and were not found around the nest thereafter. Predation depleted the nest within 2 days.

The nesting data from this year shows a marked reduction in the number of nests which likely correlates with a reduction in sexually mature LMB. In 2023, 64 sexually mature bass were angled between May 19<sup>th</sup> and July 4<sup>th</sup>. By contrast, only 18 mature LMB were angled this year between May 14<sup>th</sup> and August 17<sup>th</sup>, suggesting the reproductively active population severely declined since removal began. It is expected that the continued removal of adult LMB will result in an even lower number of nests in the summer of 2025.

Glochidia from *Elliptio complanate* and *Pyganodon grandis* were found on the gills of LMB, as they were found in the preliminary survey (Haniford and LaChance, 2023). However, no glochidia were observed to have completed their metamorphosis by the end of the sampling period. Although glochidia may be able to encyst on the gills of LMB, it is possible that some immune-related factor is preventing them from completing this stage of their life cycle. The CMN will continue to monitor this, however it should not be assumed or expected that LMB can support mussel reproduction.



Lake residents are encouraged to continue fishing recreationally after the summer and relaying the fish and measurements to the FECPL team for analysis. Next year, several modifications will be made to our core strategy to enhance our capture rates of LMB. We will be implementing standing canoe surveys in addition to snorkel surveys to decrease the chances of missing a nest. The divers will also be spending more time snorkelling the marshy area, where vegetation is thick, to ensure all nests located there are discovered. The initial trends seen between the preliminary study and the results of this year's removal are promising for the future of the Lac Kingsmere and Mulvihill ecosystems.

## References

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**Table 1. Species of fish observed at Lac Kingsmere and Lac Mulvihill**

*Catostomus commersonii* (C.c), *Culaea inconstans* (C.i), *Couesius plumbeus* (C.p), *Lepomis gibbosus* (L.g), *Micropterus nigricans* (M.n), *Notropis heterolepis* (N.he), *Notropis cornutus* (N.co), *Notemigonus crysoleucas* (N.cr), *Pimephales notatus* (P.n), *Pimephales promelas* (P.p), *Semotilus atromaculatus* (S.a), *Semotilus corporalis* (S.c), *Salvelinus fontinalis* (S.f), *Umbra limi* (U.l).

Author	Survey Year	C.c	C.i	C.p	L.g	M.n	N.he	N.co	N.cr	P.n	P.p	S.a	S.c	S.f	U.l	Total Species (Mulv)
Rubec (1975)	1970/1971	X†			X†		X†	X†	X		X†	X†		X		6
Canadian Museum of Nature (c2023)	1981/1982	X†	X		X†		X†			X	X				X	3
Chapleau <i>et al.</i> (1997)	1991/1992	X†		X	X†		X	X	†		X	X	*X	*X		3
Aiken <i>et al.</i> (2012)	2006/2007	X†			X†		X†	X	†		X†	X		X		5
Ives <i>et al.</i> (2021)	2021	*X			X	X					X	X		*X		-
Carleton University	2023	X			X	X	X				X			X		-
Carleton University	2024	X†			X†	X†	†		†		†	X		X		6

\* Not recorded in paper, but currently observed or listed by author in the Canadian Museum of Nature specimen collection

† Species observed in Lac Mulvihill. Note: Mulvihill lake was not assessed by Ilves *et al.* (2021) or Carleton University (2023).

**Table 2: List of all bycaught species by lake during the 2024 sampling period.**

Kingsmere	Catostomus commersonii	White Sucker
	Salvelinus fontinalis	Brook Trout
	Semotilus atromaculatus	Creek Chub
	Lepomis gibbosus	Pumpkinseed
	Elliptio complanata	Eastern Elliptio
	Pyganodon grandis	Giant Floater
Mulvihill	Semotilus atromaculatus	Creek Chub
	Notropis heterolepis	Blacknose Shiner
	Luxilus cornutus	Common Shiner
	Pimephales promelas	Fathead Minnow
	Catostomus commersonii	White Sucker
	Lepomis gibbosus	Pumpkinseed
	Chrysemys picta	Midland Painted Turtle
	Lithobates catesbeianus	American Bullfrog
	Lithobates clamitans	Green Frog

**Table 3: Count data plus estimates of age groups (and body size) acquired during removal efforts, by lake.**

<b>Kingsmere</b>	<b>Age Count</b>	<b>Average TL <math>\pm</math> SD (mm)</b>	<b>Average Mass <math>\pm</math> SD (g)</b>	<b>Gear Type</b>
YOY	6808	46 $\pm$ 6	1.6 $\pm$ 0.60	Seine
1+	1700	74 $\pm$ 4	4.8 $\pm$ 1.24	Seine
Juveniles	207	125 $\pm$ 31	27.0 $\pm$ 1	Seine
Adults	18	342 $\pm$ 44.23	603.0 $\pm$ 220	Angled
<b>Mulvihill</b>	<b>Age Count</b>	<b>Average TL (mm)</b>	<b>Average Mass (kg)</b>	<b>Gear Type</b>
YOY	57	54.6 $\pm$ 2.06	1.9 $\pm$ 1.4	Seine
1+	429	60.56 $\pm$ 6.16	4.8 $\pm$ 1.29	Seine
Juveniles	11	146.73 $\pm$ 20.71	480 $\pm$ 20.71	Seine
Adults	0	0	0	N/A

## **Appendix A: Permit Specifications**

In coordination with our permits provided by the NCC and the City of Chelsea, the following conditions were fulfilled.

### **Permit Specifications**

All work conducted during the current sampling period was permitted under Permit Number 25155-1 of the NCC (NCC file A7170-25155), in coordination with the regulations set by the City of Chelsea.

The methodology proposed for this work was approved by the Carleton University Animal Care Committee under the file number n°119114.

### **Permit Holder Responsibilities**

The relevant signature was provided by Dr. Steven J. Cooke.

- Permits were carried by students each day field work was conducted on either Kingsmere or Mulvihill lakes.
- This report has been submitted less than three months after our permit has expired.
- Fishing was conducted between May 14<sup>th</sup> and September 3<sup>rd</sup>, 2024.
- Exact geographic coordinates cannot be given. The small size of both lakes and the available equipment in the FECPL at Carleton University does not allow us to resolve the exact location each fish was caught on either lake. General capture coordinates were given for each lake.
- Equipment and methods have been described.
- Bycatch is listed in Table 2; biological data is described in the Tables and Figures, Results, and Discussion sections.

### **Bycatch (Table 2)**

Any bycatch was immediately returned to the water at the location of their capture. Participants were trained in relevant fish, reptile, and mussel ID prior to participating in removal.

- No captured specimen was sold, given, or consumed without written consent from the Ministry of the Environment, the Fight against Climate Change, and Wildlife and Parks (MELCCFP). Only LMB were extracted and disposed of under conditions specified by the NCC and the City of Chelsea for our removal project.

### **Live Specimens**

- Sunscreen and bug repellent was not used on the hands or arms of students without first washing off excess.
- Only the authorized gear of our QC permit was used by students from the FECPL. Data from the CMN was on occasion included in our results, as their team extracted LMB for their own research. The amount of bass acquired externally was negligible and not included in our calculations.
- All gear was removed within the same workday with the exception of minnow traps, which were removed within 6 or 20 hours (same day or next day) before being reset. This ended when minnow traps were discontinued due to excessively low catch yield.

### **Handling and Measurements**

- Specimens were transported from the site of capture to our measuring station in aerated lake water within 30 minutes of capture. Lake water was continually replaced every 10-15 minutes.
- Any specimen handled was euthanized (LMB) or released (bycatch) within a minute after identification.

- No photo identification was required over the duration of the sampling period.
- No species other than LMB were measured, weighed, or sexed.

### **Release**

- All specimens apart from LMB remained alive at release and handled with care.
- Freshwater mussels were, on occasion, found and immediately released.
- On occasion, LMB that were assessed by the Carleton University FECPL were transported to the CMN for the examination of glochidia. These data are counted in both teams' reports.

### **Dead Specimens**

- No untargeted specimen observed was dead or injured in either lake.
- LMB were all put to death via cerebral percussion.

### **Exotic Species**

- No invasive species apart from LMB were observed in either lake throughout the duration of the sampling period. This was determined using Table 1.

### **Cleaning of Equipment Between Lakes**

- No equipment was transferred between lakes with the exception of our seine net which was regularly cleaned under the regulations of our QC permit.

### **Access and Identification**

- No work was conducted in traffic areas. Any work on private property was approved by our stakeholders, Nancy and Jim Kyte.
- Capture devices were properly labelled throughout the sampling period.
- No modifications were made to the conditions of our approved permits.



## Appendix B: Lac Kingsmere Raw Data, by Date

Note: Batch data refers to a large number of YOY and/or 1+ that were batch-weighed, measured and later used to back-calculate count data.

Date	Lake	TL (mm)	Mass (kg)	Method	Sex
06-04-2024	Kingsmere	393	0.737	Angle	F
06-14-2024	Kingsmere	283	0.300	Angle	M
06-14-2024	Kingsmere	347	0.575	Angle	M
06-18-2024	Kingsmere	382	0.961	Angle	F
06-25-2024	Kingsmere	351	0.582	Angle	M
07-16-2024	Kingsmere	167	0.059	Angle	Juvenile
07-18-2024	Kingsmere	290	0.426	Angle	M
07-29-2024	Kingsmere	320	0.388	Angle	F
07-29-2024	Kingsmere	253	0.242	Angle	Juvenile
07-29-2024	Kingsmere	170	0.073	Angle	Juvenile
07-29-2024	Kingsmere	176	0.075	Angle	Juvenile
06-14-2024	Kingsmere	81	0.008	E-fish	Juvenile
06-14-2024	Kingsmere	65	0.004	E-fish	Juvenile
06-14-2024	Kingsmere	71	0.004	E-fish	Juvenile
07-29-2024	Kingsmere	150	0.047	Angle	Juvenile
07-29-2024	Kingsmere	182	0.091	Angle	Juvenile
07-29-2024	Kingsmere	166	0.064	Angle	Juvenile
07-29-2024	Kingsmere	148	0.046	Angle	Juvenile
07-29-2024	Kingsmere	175	0.070	Angle	Juvenile

07-29-2024	Kingsmere	124	0.030	Angle	Juvenile
08-13-2024	Kingsmere	142	0.038	Angle	Juvenile
05-17-2024	Kingsmere	340	0.538	Angled from nest	M
05-17-2024	Kingsmere	390	0.723	Angled from nest	F
05-21-2024	Kingsmere	357	0	Angled from nest	F
05-21-2024	Kingsmere	360	0	Angled from nest	F
05-21-2024	Kingsmere	356	0	Angled from nest	M
06-21-2024	Kingsmere	93	0.008	Minnow Trap	Juvenile
05-21-2024	Kingsmere	231	0	Angled from nest	M
05-21-2024	Kingsmere	369	0	Angled from nest	F
05-21-2024	Kingsmere	365	0	Angled from nest	M
06-28-2024	Kingsmere	380	0.906	Community Angle	F
07-01-2024	Kingsmere	364	0.775	Community Angle	F
08-08-2024	Kingsmere	160	0.063	Community Angle	Juvenile
08-17-2024	Kingsmere	281	0.324	Community Angle	M
08-17-2024	Kingsmere	161	0.057	Community Angle	Juvenile
08-17-2024	Kingsmere	190	0.084	Community Angle	Juvenile
08-17-2024	Kingsmere	179	0.072	Community Angle	Juvenile
08-17-2024	Kingsmere	195	0.092	Community Angle	Juvenile
08-17-2024	Kingsmere	180	0.076	Community Angle	Juvenile
08-17-2024	Kingsmere	181	0.075	Community Angle	Juvenile
08-17-2024	Kingsmere	173	0.061	Community Angle	Juvenile
08-23-2024	Kingsmere	182	0	Community Angle	Juvenile

06-25-2024	Kingsmere	Batch	0.210	Seine	YOY
06-20-2024	Kingsmere	81	0.007	Seine	Juvenile
06-20-2024	Kingsmere	89	0.007	Seine	Juvenile
06-20-2024	Kingsmere	75	0.005	Seine	Juvenile
06-20-2024	Kingsmere	87	0.007	Seine	Juvenile
06-20-2024	Kingsmere	83	0.006	Seine	Juvenile
06-20-2024	Kingsmere	96	0.011	Seine	Juvenile
06-20-2024	Kingsmere	91	0.008	Seine	Juvenile
06-20-2024	Kingsmere	107	0.014	Seine	Juvenile
06-20-2024	Kingsmere	93	0.008	Seine	Juvenile
06-20-2024	Kingsmere	87	0.008	Seine	Juvenile
06-20-2024	Kingsmere	87	0.007	Seine	Juvenile
06-25-2024	Kingsmere	107	0.013	Seine	Juvenile
06-25-2024	Kingsmere	102	0.012	Seine	Juvenile
06-26-2024	Kingsmere	Batch	0.221	Seine	YOY
06-26-2024	Kingsmere	105	0.015	Seine	Juvenile
06-26-2024	Kingsmere	88	0.008	Seine	Juvenile
06-26-2024	Kingsmere	102	0.013	Seine	Juvenile
06-27-2024	Kingsmere	Batch	0.011	Minnow Trap	YOY
06-27-2024	Kingsmere	86	0.009	Seine	Juvenile
07-02-2024	Kingsmere	94	0.010	Seine	Juvenile
07-02-2024	Kingsmere	190	0.092	Seine	Juvenile
07-02-2024	Kingsmere	105	0.015	Seine	Juvenile

07-02-2024	Kingsmere	167	0.062	Seine	Juvenile
07-02-2024	Kingsmere	127	0.026	Seine	Juvenile
07-02-2024	Kingsmere	116	0.020	Seine	Juvenile
07-02-2024	Kingsmere	102	0.013	Seine	Juvenile
07-02-2024	Kingsmere	115	0.015	Seine	Juvenile
07-02-2024	Kingsmere	110	0.015	Seine	Juvenile
07-02-2024	Kingsmere	118	0.022	Seine	Juvenile
07-02-2024	Kingsmere	105	0.014	Seine	Juvenile
07-02-2024	Kingsmere	101	0.013	Seine	Juvenile
07-02-2024	Kingsmere	89	0.090	Seine	Juvenile
07-02-2024	Kingsmere	102	0.014	Seine	Juvenile
07-02-2024	Kingsmere	114	0.018	Seine	Juvenile
07-02-2024	Kingsmere	114	0.014	Seine	Juvenile
07-02-2024	Kingsmere	93	0.009	Seine	Juvenile
07-02-2024	Kingsmere	101	0.013	Seine	Juvenile
07-02-2024	Kingsmere	103	0.014	Seine	Juvenile
07-02-2024	Kingsmere	106	0.015	Seine	Juvenile
07-02-2024	Kingsmere	91	0.010	Seine	Juvenile
07-02-2024	Kingsmere	104	0.014	Seine	Juvenile
07-02-2024	Kingsmere	92	0.009	Seine	Juvenile
07-02-2024	Kingsmere	95	0.010	Seine	Juvenile
07-02-2024	Kingsmere	102	0.013	Seine	Juvenile
07-02-2024	Kingsmere	81	0.007	Seine	Juvenile

07-02-2024	Kingsmere	90	0.009	Seine	Juvenile
07-02-2024	Kingsmere	95	0.010	Seine	Juvenile
07-02-2024	Kingsmere	89	0.008	Seine	Juvenile
07-02-2024	Kingsmere	115	0.019	Seine	Juvenile
07-02-2024	Kingsmere	99	0.011	Seine	Juvenile
07-02-2024	Kingsmere	112	0.015	Seine	Juvenile
07-02-2024	Kingsmere	131	0.030	Seine	Juvenile
07-02-2024	Kingsmere	105	0.016	Seine	Juvenile
07-02-2024	Kingsmere	103	0.013	Seine	Juvenile
07-02-2024	Kingsmere	103	0.013	Seine	Juvenile
07-02-2024	Kingsmere	115	0.020	Seine	Juvenile
07-02-2024	Kingsmere	114	0.019	Seine	Juvenile
07-02-2024	Kingsmere	112	0.018	Seine	Juvenile
07-02-2024	Kingsmere	90	0.008	Seine	Juvenile
07-02-2024	Kingsmere	109	0.015	Seine	Juvenile
07-02-2024	Kingsmere	87	0.008	Seine	Juvenile
07-02-2024	Kingsmere	109	0.016	Seine	Juvenile
07-02-2024	Kingsmere	105	0.014	Seine	Juvenile
07-02-2024	Kingsmere	111	0.017	Seine	Juvenile
07-02-2024	Kingsmere	107	0.014	Seine	Juvenile
07-02-2024	Kingsmere	175	0.074	Seine	Juvenile
07-02-2024	Kingsmere	119	0.022	Seine	Juvenile
06-28-2024	Kingsmere	Batch	0.358	Seine	YOY

07-03-2024	Kingsmere	129	0.032	Seine	Juvenile
07-03-2024	Kingsmere	124	0.029	Seine	Juvenile
07-03-2024	Kingsmere	112	0.014	Seine	Juvenile
07-03-2024	Kingsmere	106	0.016	Seine	Juvenile
07-03-2024	Kingsmere	94	0.012	Seine	Juvenile
07-03-2024	Kingsmere	114	0.018	Seine	Juvenile
07-03-2024	Kingsmere	115	0.014	Seine	Juvenile
07-03-2024	Kingsmere	125	0.026	Seine	Juvenile
07-03-2024	Kingsmere	119	0.021	Seine	Juvenile
07-03-2024	Kingsmere	116	0.022	Seine	Juvenile
07-03-2024	Kingsmere	136	0.036	Seine	Juvenile
07-03-2024	Kingsmere	117	0.022	Seine	Juvenile
07-03-2024	Kingsmere	118	0.024	Seine	Juvenile
07-03-2024	Kingsmere	120	0.026	Seine	Juvenile
07-03-2024	Kingsmere	115	0.020	Seine	Juvenile
07-03-2024	Kingsmere	93	0.011	Seine	Juvenile
07-03-2024	Kingsmere	117	0.017	Seine	Juvenile
07-03-2024	Kingsmere	117	0.020	Seine	Juvenile
07-03-2024	Kingsmere	114	0.019	Seine	Juvenile
07-03-2024	Kingsmere	113	0.019	Seine	Juvenile
07-03-2024	Kingsmere	112	0.017	Seine	Juvenile
07-03-2024	Kingsmere	97	0.010	Seine	Juvenile
07-03-2024	Kingsmere	95	0.011	Seine	Juvenile

07-03-2024	Kingsmere	95	0.011	Seine	Juvenile
07-03-2024	Kingsmere	93	0.014	Seine	Juvenile
07-03-2024	Kingsmere	114	0.018	Seine	Juvenile
07-03-2024	Kingsmere	111	0.015	Seine	Juvenile
07-03-2024	Kingsmere	95	0.016	Seine	Juvenile
07-03-2024	Kingsmere	115	0.011	Seine	Juvenile
07-03-2024	Kingsmere	160	0.053	Seine	Juvenile
07-03-2024	Kingsmere	97	0.012	Seine	Juvenile
07-03-2024	Kingsmere	108	0.015	Seine	Juvenile
07-03-2024	Kingsmere	86	0.007	Seine	Juvenile
07-03-2024	Kingsmere	101	0.013	Seine	Juvenile
07-03-2024	Kingsmere	125	0.025	Seine	Juvenile
07-03-2024	Kingsmere	94	0.010	Seine	Juvenile
07-03-2024	Kingsmere	116	0.017	Seine	Juvenile
07-03-2024	Kingsmere	108	0.019	Seine	Juvenile
07-03-2024	Kingsmere	101	0.013	Seine	Juvenile
07-03-2024	Kingsmere	112	0.019	Seine	Juvenile
07-03-2024	Kingsmere	126	0.024	Seine	Juvenile
07-03-2024	Kingsmere	110	0.017	Seine	Juvenile
07-03-2024	Kingsmere	91	0.010	Seine	Juvenile
07-03-2024	Kingsmere	93	0.011	Seine	Juvenile
07-03-2024	Kingsmere	92	0.009	Seine	Juvenile
07-03-2024	Kingsmere	99	0.012	Seine	Juvenile

07-03-2024	Kingsmere	100	0.011	Seine	Juvenile
07-03-2024	Kingsmere	106	0.015	Seine	Juvenile
07-02-2024	Kingsmere	Batch	0.012	Seine	YOY
07-03-2024	Kingsmere	Batch	0.216	Seine	YOY
07-09-2024	Kingsmere	137	0.034	Seine	Juvenile
07-09-2024	Kingsmere	109	0.017	Seine	Juvenile
07-09-2024	Kingsmere	99	0.015	Seine	Juvenile
07-09-2024	Kingsmere	99	0.011	Seine	Juvenile
07-05-2024	Kingsmere	Batch	10.686	Seine	YOY
07-10-2024	Kingsmere	151	0.050	Seine	Juvenile
07-10-2024	Kingsmere	162	0.053	Seine	Juvenile
07-10-2024	Kingsmere	92	0.021	Seine	Juvenile
07-09-2024	Kingsmere	Batch	0.055	Seine	YOY
07-10-2024	Kingsmere	Batch	0.172	Seine	1+
07-12-2024	Kingsmere	216	0.082	Seine	Juvenile
07-12-2024	Kingsmere	157	0.070	Seine	Juvenile
07-12-2024	Kingsmere	122	0.029	Seine	Juvenile
07-12-2024	Kingsmere	159	0.063	Seine	Juvenile
07-12-2024	Kingsmere	141	0.058	Seine	Juvenile
07-12-2024	Kingsmere	132	0.044	Seine	Juvenile
07-12-2024	Kingsmere	96	0.015	Seine	Juvenile
07-12-2024	Kingsmere	112	0.024	Seine	Juvenile
07-12-2024	Kingsmere	163	0.066	Seine	Juvenile



07-12-2024	Kingsmere	140	0.039	Seine	Juvenile
07-12-2024	Kingsmere	137	0.041	Seine	Juvenile
07-12-2024	Kingsmere	132	0.047	Seine	Juvenile
07-12-2024	Kingsmere	109	0.021	Seine	Juvenile
07-12-2024	Kingsmere	150	0.056	Seine	Juvenile
07-12-2024	Kingsmere	123	0.033	Seine	Juvenile
07-12-2024	Kingsmere	129	0.036	Seine	Juvenile
07-12-2024	Kingsmere	156	0.061	Seine	Juvenile
07-12-2024	Kingsmere	130	0.029	Seine	Juvenile
07-12-2024	Kingsmere	147	0.038	Seine	Juvenile
07-12-2024	Kingsmere	86	0.013	Seine	Juvenile
07-12-2024	Kingsmere	93	0.014	Seine	Juvenile
07-12-2024	Kingsmere	90	0.016	Seine	Juvenile
07-12-2024	Kingsmere	107	0.023	Seine	Juvenile
07-12-2024	Kingsmere	122	0.029	Seine	Juvenile
07-19-2024	Kingsmere	117	0.025	Seine	Juvenile
07-12-2024	Kingsmere	Batch	1.203	Seine	1+
07-30-2024	Kingsmere	153	0.052	Seine	Juvenile
07-30-2024	Kingsmere	169	0.072	Seine	Juvenile
07-30-2024	Kingsmere	154	0.046	Seine	Juvenile
07-19-2024	Kingsmere	Batch	0.337	Seine	1+
07-24-2024	Kingsmere	Batch	0.179	Seine	1+
07-25-2024	Kingsmere	Batch	0.035	Seine	1+

07-30-2024	Kingsmere	144	0.037	Seine	Juvenile
07-30-2024	Kingsmere	162	0.062	Seine	Juvenile
07-30-2024	Kingsmere	145	0.040	Seine	Juvenile
07-30-2024	Kingsmere	136	0.028	Seine	Juvenile
07-30-2024	Kingsmere	136	0.032	Seine	Juvenile
07-30-2024	Kingsmere	155	0.049	Seine	Juvenile
07-30-2024	Kingsmere	130	0.033	Seine	Juvenile
07-30-2024	Kingsmere	177	0.077	Seine	Juvenile
07-30-2024	Kingsmere	156	0.051	Seine	Juvenile
07-30-2024	Kingsmere	148	0.043	Seine	Juvenile
07-30-2024	Kingsmere	162	0.055	Seine	Juvenile
07-30-2024	Kingsmere	152	0.049	Seine	Juvenile
07-30-2024	Kingsmere	171	0.067	Seine	Juvenile
07-31-2024	Kingsmere	126	0.026	Seine	Juvenile
07-31-2024	Kingsmere	131	0.029	Seine	Juvenile
07-31-2024	Kingsmere	168	0.070	Seine	Juvenile
07-31-2024	Kingsmere	156	0.058	Seine	Juvenile
07-31-2024	Kingsmere	155	0.058	Seine	Juvenile
07-31-2024	Kingsmere	132	0.030	Seine	Juvenile
07-31-2024	Kingsmere	147	0.046	Seine	Juvenile
07-31-2024	Kingsmere	143	0.036	Seine	Juvenile
07-31-2024	Kingsmere	163	0.067	Seine	Juvenile
07-31-2024	Kingsmere	143	0.036	Seine	Juvenile

08-02-2024	Kingsmere	164	0.064	Seine	Juvenile
08-02-2024	Kingsmere	164	0.069	Seine	Juvenile
08-04-2024	Kingsmere	117	0.020	Seine	Juvenile
07-30-2024	Kingsmere	Batch	0.171	Seine	1+
08-04-2024	Kingsmere	132	0.031	Seine	Juvenile
08-07-2024	Kingsmere	1471	0.078	Seine	Juvenile
07-31-2024	Kingsmere	Batch	4.035	Seine	1+
08-07-2024	Kingsmere	184	0.079	Seine	Juvenile
08-07-2024	Kingsmere	119	0.024	Seine	Juvenile
08-02-2024	Kingsmere	Batch	0.809	Seine	1+
08-07-2024	Kingsmere	145	0.037	Seine	Juvenile
08-24-2024	Kingsmere	167	0.057	Seine	Juvenile
08-04-2024	Kingsmere	Batch	0.461	Seine	1+
06-28-2024	Kingsmere	111	0.018	Seine	Juvenile
06-28-2024	Kingsmere	107	0.016	Seine	Juvenile
06-28-2024	Kingsmere	94	0.010	Seine	Juvenile
08-07-2024	Kingsmere	Batch	0.177	Seine	1+
08-15-2024	Kingsmere	Batch	0.124	Seine	1+
08-20-2024	Kingsmere	Batch	0.153	Seine	1+
08-21-2024	Kingsmere	Batch	0.025	Seine	1+
08-24-2024	Kingsmere	Batch	0.021	Seine	1+

## Appendix C: Lac Mulvihill Raw Data, by Date

Note: Batch data refers to YOY and/or 1+ that were batch-weighted, measured, and later used to back-calculate count data.

Date	Lake	TL (mm)	Mass (kg)	Method	Sex
07-10-2024	Mulvihill	Batch	0.025	Seine	1+
07-22-2024	Mulvihill	Batch	0.109	Seine	YOY
07-23-2024	Mulvihill	Batch	0.088	Seine	1+
07-25-2024	Mulvihill	Batch	0.201	Seine	1+
07-26-2024	Mulvihill	Batch	0.083	Seine	1+
07-22-2024	Mulvihill	144	0.041	Seine	Juvenile
08-05-2024	Mulvihill	Batch	0.188	Seine	1+
07-22-2024	Mulvihill	119	0.022	Seine	Juvenile
08-07-2024	Mulvihill	Batch	0.167	Seine	1+
07-22-2024	Mulvihill	123	0.022	Seine	Juvenile
08-05-2024	Mulvihill	150	0.056	Seine	Juvenile
08-05-2024	Mulvihill	124	0.029	Seine	Juvenile
08-08-2024	Mulvihill	179	0.080	Seine	Juvenile
08-14-2024	Mulvihill	161	0.056	Seine	Juvenile
08-14-2024	Mulvihill	179	0.083	Seine	Juvenile
08-14-2024	Mulvihill	145	0.051	Seine	Juvenile
08-14-2024	Mulvihill	137	0.033	Seine	Juvenile
08-14-2024	Mulvihill	153	0.054	Seine	Juvenile
08-08-2024	Mulvihill	Batch	0.285	Seine	1+

08-14-2024	Mulvihill	Batch	0.323	Seine	1+
08-14-2024	Mulvihill	160	0.061	Seine	Juvenile
08-16-2024	Mulvihill	Batch	0.201	Seine	1+
08-14-2024	Mulvihill	174	0.075	Seine	Juvenile
08-20-2024	Mulvihill	Batch	0.261	Seine	1+
08-14-2024	Mulvihill	166	0.062	Seine	Juvenile
08-14-2024	Mulvihill	172	0.069	Seine	Juvenile
08-16-2024	Mulvihill	110	0.017	Seine	Juvenile
08-21-2024	Mulvihill	Batch	0.083	Seine	1+
08-20-2024	Mulvihill	206	0.123	Seine	Juvenile
08-21-2024	Mulvihill	187	0.075	Seine	Juvenile
08-21-2024	Mulvihill	161	0.052	Seine	Juvenile
08-24-2024	Mulvihill	Batch	0.148	Seine	1+