

Whiskey, Hewitt, and Shell Lakes Pike Suppression Progress Report 2025

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DISCLAIMER

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Cook Inlet Aquaculture Association conducts salmon enhancement and restoration projects in Area H, Cook Inlet, and associated waters. As an integral part of these projects a variety of monitoring and evaluation studies are conducted. The following final report is a synopsis of the studies conducted under an Alaska Sustainable Salmon Fund grant entitled “Mobile Northern Pike Suppression Crew.” Field research was conducted by CIAA at Shell, Whiskey, and Hewitt lakes. The purpose of this report is to provide a vehicle to distribute the information produced by the pike suppression and research work conducted under this project. The information presented in this report has not undergone an extensive review. As reviews are completed, the information may be updated and presented in other reports.

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ACKNOWLEDGEMENTS

Many individuals contributed to the success of the Mobile Northern Pike Suppression Crew Project (Whiskey, Hewitt, and Shell lakes pike suppression). Cook Inlet Aquaculture Association (CIAA) recognizes interns, seasonal fisheries technicians, and regular staff who helped plan and execute this project. Trail Ridge Air provided needed assistance with hauling gear and supplies. Many local residents of Shell, Whiskey, and Hewitt lakes provided a great deal of help and were vital to the project, particularly Christa and Martin Wegscheider who were so gracious in hosting CIAA staff and Calvin Flannigan for allowing CIAA to access Shell Creek via his property. Gratitude is also extended to the staff at the Student Conservation Association and Debbie Maas at the Alaska Sustainable Salmon Fund.

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ABSTRACT

In 2025, Cook Inlet Aquaculture Association started the second year of a three-year northern pike (*Esox Lucius*) suppression project at Shell, Whiskey, and Hewitt lakes by removing pike during the summer season primarily with gillnets. In 2025, a total of 1,891 pike were removed from these lakes while deploying gillnets for 12,708 hours. Catch per unit effort calculated for 2025 showed decreases in the number of pike caught per hour at all lakes when compared to catch per unit effort from a study conducted in 2012. However, catch per unit effort was the highest since 2019 for Shell Lake and the highest since 2020 for Whiskey Lake.

Surveys for the invasive waterweed Elodea were also conducted on Shell, Whiskey, and Hewitt lakes and no elodea was detected.

Adult and smolt salmon enumeration was conducted at Shell Lake in 2025. The target species moving through the smolt weir was sockeye salmon (*Oncorhynchus nerka*). The weir operated from May 29 through June 29. Staff counted 997 sockeye and 3,278 coho (*O. kisutch*) smolt. The remote video weir to enumerate salmon adults was installed and operated from July 12 through September 7. Staff observed 38 sockeye and 248 coho salmon moving through the weir.

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INTRODUCTION AND PURPOSE

Nonnative species are altering aquatic communities worldwide, with opportunistic predators having particularly catastrophic effects (Sepulveda et al. 2013). The introduction of northern pike (*Esox lucius*) to freshwater systems outside their native range has resulted in negative impacts on resident fish populations (Lee 2001, Patankar et al. 2006, Sepulveda et al. 2013). Outside their native range, northern pike have the potential to interfere with ecosystem function and destroy economically important fisheries.

In Alaska, northern pike are native north of the Alaska Range (Morrow 1980) but were illegally introduced to the Matanuska-Susitna Valley in Southcentral Alaska in the 1950s (Rutz 1999). Pike have spread throughout the Matanuska-Susitna Valley, Anchorage, and the Kenai Peninsula (Alaska Department of Fish and Game 2015). The Cook Inlet drainage (Figure 1) encompasses the Susitna River watershed, which comprises 49,210 km² originating in the Alaska Range, and contains a myriad of shallow lakes, sloughs, and clear water tributaries, many of which provide prime northern pike spawning and rearing habitats.

Pike are voracious predators and it is hypothesized their expansion is responsible for the decline of salmonid species in many water bodies in the Susitna basin (Rutz 1999, Patankar et al. 2006, Sepulveda et al. 2013). Once established, northern pike can be devastating to juvenile salmonids and have impacted numerous coho (*Oncorhynchus kisutch*), Chinook (*O. tshawytscha*), and sockeye salmon (*O. nerka*) runs from the Susitna River watershed (Alaska Department of Fish and Game 2015).

The Yentna drainage contains one-half of the sockeye salmon producing lakes that flow into the Susitna River; among the most productive systems in the Yentna are Chelatna, Shell, Hewitt, and Judd lakes. The Susitna River sockeye salmon was designated as a stock of yield concern at the February 2008 Board of Fisheries (BOF) meeting and was attributed to low salmon numbers from predation by invasive northern pike. The BOF subsequently removed the stock of yield concern from the Susitna sockeye population but continued to restrict fishing opportunities stating that there are multiple issues facing the sockeye populations including predation from invasive northern pike (Brehmer 2020).

Although Cook Inlet Aquaculture Association (CIAA) had been monitoring sockeye runs in various Susitna systems since the early 1990s, the invasive pike threat steered CIAA into a new direction. Along with the Alaska Department of Fish and Game (ADF&G), CIAA began to monitor salmon populations at lakes throughout the Susitna River watershed specifically related to invasive pike. Information was lacking about the health of salmon stocks returning to lakes that previously did not have the presence of northern pike. Under a joint CIAA-ADF&G project, several lakes—which included Chelatna, Shell, Hewitt and Whiskey lakes—were monitored for

numbers of salmon returning to spawn (Alaska Sustainable Salmon Fund 2013). Historically, all of these lakes had populations of salmon. Monitoring indicated that eight of these lakes now had northern pike populations, four of which no longer had returning salmon, and three lakes were found to have salmon populations considered to be below historical averages including Shell, Whiskey, and Hewitt lakes near Skwentna. Through this project it was determined that lake depth played a significant factor in pike predation and salmon survival. In shallow lakes (less than 20 meters mean depth), the number of juvenile salmon produced per spawner was significantly lower in lakes with northern pike versus lakes without northern pike. Overall, the mean number of juvenile sockeye salmon produced per spawner was significantly greater in deep lakes versus shallow lakes and the project also found that juvenile salmon are more susceptible to predation by northern pike in shallow lakes (Diana et al. 1977, Glick and Willette 2013).

After realizing the extent of the problem invasive northern pike have caused, CIAA developed a project entitled Northern Pike Investigations (Smukall 2015). It was a three-year project intended to help meet CIAA's ultimate goal for the Susitna River watershed of increasing salmon production by removal of northern pike and rehabilitation of lakes throughout the system. The Northern Pike Investigations Project focused on Chelatna, Whiskey and Hewitt lakes.

Since the conclusion of the Northern Pike Investigations Project, CIAA continued maintenance gillnetting at Whiskey and Hewitt lakes for approximately one week per summer during 2016–2017 catching 251 and 365 northern pike respectively, as funding was sought to continue intensive pike harvests at the lakes. From 2018–2020 the Hewitt and Whiskey Lakes Pike Suppression Project (Alaska Sustainable Salmon Fund 2021) was implemented and designed to build on prior pike suppression efforts. By continuing to remove pike from these lakes while evaluating the fry population in Hewitt Lake, CIAA and ADF&G wanted to determine if measurable increased salmon production could be documented in light of pike suppression efforts. Although the goal of increasing salmon fry rearing in Hewitt Lake to a million was not reached, the Hewitt Lake sockeye fry population did increase by 20% over the course of the 2018–2020 project.

Since 2012 CIAA has funded suppression work and rehabilitation efforts at Shell Lake using a combination of its own funding and various grants. Shell Lake was once a significant contributor to sockeye production in the Susitna River watershed (Wizik 2023). Shell Lake can potentially contribute 10% to the sockeye salmon return to the Susitna River watershed (Tarbox and Kyle 1989). Due to a notable decline in the salmon population (smolt and adult) within Shell Lake CIAA initiated rehabilitation efforts. Starting in 2012, the project included smolt and adult enumeration, salmon stocking, disease screening, invasive northern pike suppression, beaver dam surveys and notching, and an evaluation of what effect the harvesting of northern pike may have on both northern pike and salmon populations.

In 2016 CIAA enlisted the help of researchers at the University of Alaska Fairbanks (UAF) Institute of Arctic Biology and College of Fisheries and Ocean Sciences to model effects that intensive netting may be having on the Shell Lake pike population. This was prompted when CIAA staff noticed a decline in mean length of northern pike harvested at Shell Lake. Observations from other studies within the region have indicated that smaller pike tend to consume more juvenile salmon (Rutz 1999).

Using CIAA pike data obtained from 2013–2016, UAF was able to build a bioenergetics model to estimate the per-capita consumption rates of northern pike ages 1–5 in Shell Lake (Deslauriers 2017). That analysis determined that northern pike of all sizes consumed salmon, but on average salmon made up a smaller fraction of the diets of larger northern pike but larger northern pike consumed more salmon biomass per capita than smaller pike. Total consumption of salmon by all age classes of northern pike decreased substantially from 2013–2016. All five age classes of northern pike consumed less salmon at the population level in 2016 than in 2013. Overall, in comparison to 2013, the northern pike population consumed 67% less salmon in 2014, 74% less in 2015, and 81% less in 2016. Based on this model CIAA continued the intensive harvest of northern pike in Shell Lake from 2020 to 2023 in an attempt to determine if this reduced consumption can translate into positive natural sockeye salmon production in Shell Lake.

Through the collection of broodstock and gametes and back stocking to Shell Lake, CIAA initiated an effort to maintain the genetic lineage of the Shell Lake sockeye population. The goal of this effort was to rebuild the Shell Lake sockeye salmon population to a sustainable level. Gametes were collected in 2012, 2016, and 2017. From 2013–2015, adult returns were insufficient to allow gamete collection. Sockeye salmon escapements to Shell Lake from 2020–2023 were expected to be comprised primarily of hatchery progeny from brood years 2016 and 2017. Because the State of Alaska salmon genetics policy recommends not taking eggs from hatchery-produced salmon, Shell Lake sockeye salmon returning to the lake during 2020–2023 needed to successfully reproduce naturally if this stock is able to survive extirpation.

An Alaska Sustainable Salmon Fund (AKSSF) grant titled Mobile Northern Pike Suppression to continue pike suppression work in Chelatna, Shell, Whiskey and Hewitt lakes from 2021–2023 was secured. From the onset of invasive pike suppression at the project lakes in 2012 to the end of 2023, the relative abundance of northern pike has decreased at Shell, Whiskey, Hewitt, and Chelatna lakes by 99%, 96% 48%, and 76% respectively (Heale 2024). From 2021–2023, pike suppression has further reduced biomass of northern pike in all lakes by decreasing the number of year classes of northern pike. In addition to reducing the number of pike and their inferred consumption on juvenile salmonids, changing the demographics of these pike populations to that of younger/smaller fish reduces the number of northern pike eggs available for spawning each spring. Reducing these populations and transforming the demographic to a population dominated by small one-year-old fish will reduce consumption of juvenile salmonids by pike and may enable

the recovery of important sockeye salmon populations. If netting operations were to cease, it is likely these pike populations would recover within a few years.

Additional funding was received from AKSSF to continue pike suppression work at Shell, Whiskey, and Hewitt lakes from 2024–2026. The following report details findings from the second year, 2025, of this project. Other historical data are provided for reference.

PROJECT AREA

Shell, Whiskey, and Hewitt lakes are located in the Cook Inlet drainage in Southcentral Alaska (Figure 1).



Figure 1: Northern pike suppression project sites in relation to Cook Inlet, Alaska.

Shell Lake

Shell Lake is located at 61°58' N latitude and 151°33' W longitude at the base of Shell Hills in the Susitna River drainage approximately 121 kilometers northwest of Anchorage, Alaska (Figure 2). The lake has a surface elevation of 123 meters. Shell Lake has a surface area of 523 hectares, has maximum depth of 29 m, a mean depth of 11.9 m and 16.6 km of shoreline (Kyle et al. 1994). Shell Lake has seven small tributaries and discharges southeast via Shell Creek, which runs approximately six river miles to the Skwentna River. Shell Lake is part of the Anadromous Waters Catalog, code 247-41-10200-2053-3205-4052-0010 (Giefer and Evers 2025).

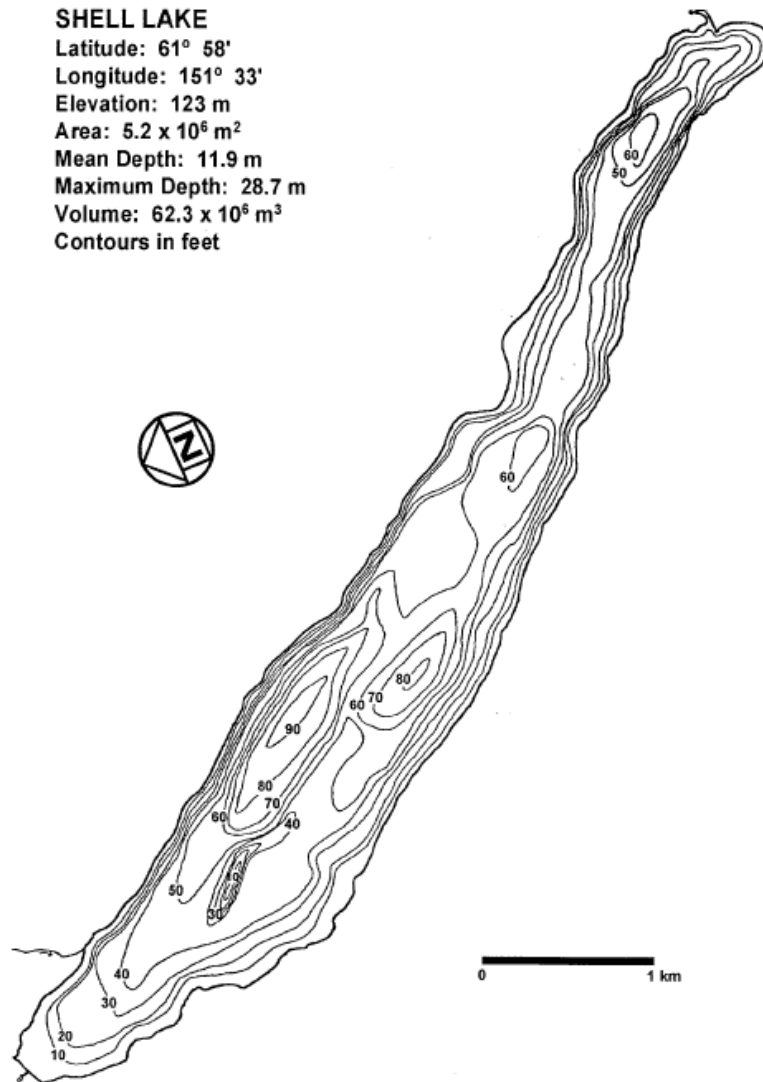


Figure 2: Bathymetric map of Shell Lake

Whiskey Lake

Whiskey Lake is located at 61°59' N latitude and 151°24' W longitude at the base of the Shell Hills in the Susitna River drainage, approximately 118 kilometers northwest of Anchorage, Alaska (Figure 3). The lake has an elevation of 45 meters and a surface area of 110 hectares (Spafard and Edmundson 2000). There is one small unnamed tributary of Whiskey Lake located on the north side of the lake. The lake's discharge forms Whiskey Creek, which flows into Hewitt Creek and the Yentna River. Whiskey Lake is part of the Anadromous Waters Catalog, code 247-41-10200-2053-3213-4052-0010 (Giefer and Evers 2025).

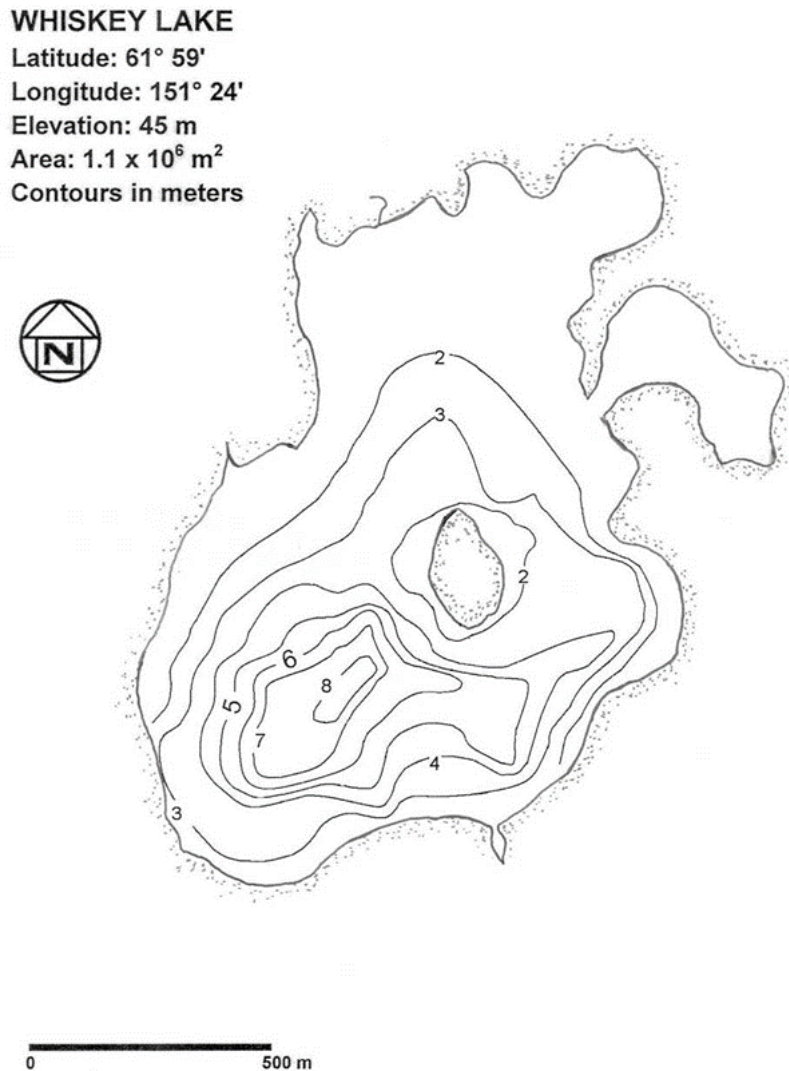


Figure 3: Bathymetric map of Whiskey Lake.

Hewitt Lake

Hewitt Lake (Figure 4) is located approximately 0.5 km to the east of Whiskey Lake. Hewitt Creek is a common outlet for both lakes, and flows 6.4 meandering kilometers to the Yentna River. Hewitt Lake covers 226 hectares, has a maximum depth of 34 m, a mean depth of 13.5 m, a 10.6 km shoreline, and is located at an elevation of 40 m above sea level (Spafard and Edmundson 2000). Hewitt Lake is part of the Anadromous Waters Catalog, code 247-41-10200-2053-3213-4050-0010 (Giefer and Evers 2025).

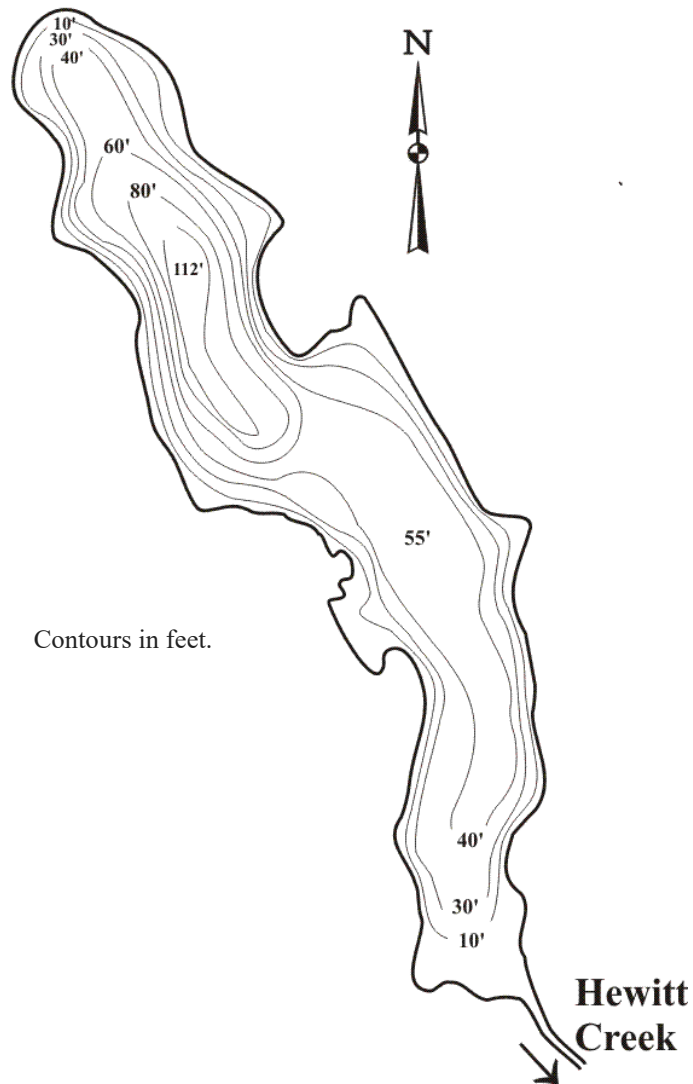


Figure 4: Bathymetric map of Hewitt Lake.

METHODS

Invasive Northern Pike Suppression

Staff from CIAA used one-inch bar mesh gillnets to capture and remove northern pike in Shell, Whiskey, and Hewitt lakes and the Hewitt-Whiskey Creek outlet that connects these two lakes to the Yentna River. Staff removed northern pike at Shell Lake in June, August, and September; and at the Whiskey and Hewitt lakes system from early July through mid-August. Staff also used hook-and-line fishing. Fish caught via hook-and-line were sampled for age, length, weight, and sex but no attempt to calculate catch per unit effort (CPUE) was made for angled fish due to the differences in techniques and skill of anglers.

Each day, staff deployed up to 10 one-inch bar mesh gillnets at 10 different shallow and vegetated sites that typically provide optimal northern pike habitat. Nets were checked at least every 24 hours. Staff recorded the time of each net set and retrieval to the nearest minute. Gillnets were 15.2 m long x 2.4 m deep and constructed of monofilament line with a one-inch bar mesh size. The top line was a floating core line and the bottom line was lead weighted to sink (CIAA 2025a).

Northern pike CPUE was recorded after each net set by dividing the number of northern pike caught by the number of hours the net was in the water. Staff also calculated CPUE figures to factor in the mass of pike by multiplying the CPUE figure by the average weight of pike caught during 2025 to give the biomass of pike caught per effort hour in addition to the number of fish per hour.

Staff recorded any catch of species other than northern pike, and any bycatch still alive was removed and released immediately. Staff removed captured pike from the nets and quickly dispatched any living pike using a small bat. When possible, northern pike were donated to local residents. If no one was available to take the fish, then the fish were cut completely in half and disposed in the middle of the lake in which they were caught.

All northern pike captured during the project that had not been partially eaten by wildlife were measured from the fork of the tail to the tip of the snout, to the nearest mm; and were weighed to the nearest 0.01 kg. Sex was determined for all whole pike by examining the gonads of the fish. The left cleithrum was removed for later age determination at the CIAA Kenai office (Laine et al. 1991). A 20% subsample of collected cleithra was used in the age analysis. Stomach contents were visually inspected and quantified for individual prey items.

Environmental Conditions

The suppression crew recorded environmental data at their respective camp site; one site for Shell Lake and one site on Hewitt Lake, which encompassed time at both Whiskey and Hewitt lakes. Data collected included percent cloud cover (visually estimated) and precipitation measured to the nearest millimeter, both recorded at 5:00 pm each day. Water and air temperatures were recorded during the project using data loggers (Hobo®) that recorded water and air temperature every hour. Recordings were then averaged over a 24-hour period to provide a daily average air and water temperatures. A manual recording of air and water temperature occurred at 5:00 pm each day which serves as a backup to the Hobo data loggers.

Elodea Surveys

The CIAA suppression crew conducted full shoreline surveys for the presence of elodea. These surveys followed a combination of the U.S. Fish and Wildlife Service Aquatic Invasive Species Survey Protocol (2012) and the Survey Design and Methodology for Elodea Detection in Alaska Lakes (Fulkerson 2021). The crew reviewed lake maps with size information, depth and contour information, shoreline length, and adjoining land usage information when available.

Staff conducted full shoreline surveys on Shell, Whiskey, and Hewitt lakes. The crew worked as a team with one person steering the boat and the other doing a visual shoreline survey. At each designated point one crew member threw a vegetation rake to identify all vegetation at the site. When vegetation could not be identified it was collected in a zip-lock bag and labelled with the site number, lake name, and date for later identification with the aid of a field guide; or it would be sent back to the CIAA Kenai office for identification by the biologist. At high risk areas like boat launches, docks, outlets and inlets, more thorough visual surveys were completed and additional rake throws were conducted if visual identification of vegetation was not possible. Information was recorded in a weatherproof notebook and shared with Alaska Exotic Plants Information Clearinghouse (AKEPIC) by November of the survey season.

Smolt Enumeration

The smolt migration from Shell Lake was monitored by placing a smolt trap in Shell Creek. The smolt trap consisted of a modified fyke net with Vexar® netting leads and a double compartment live-box. The leads and fyke net funneled migrating smolt into one of the two live-box compartments where they were enumerated. A total count was made during smolt migrations (CIAA 2025b).

During the 2025 smolt migration staff analyzed age, weight, and length characteristics of emigrating sockeye and coho salmon smolts. Staff collected smolt scale samples in proportion to emigration. This was accomplished by attempting to collect every 100th sockeye and coho salmon smolt that was counted and passed through the smolt trap. The numbering sequence began when the first fish passed through the trap and continued consecutively until the smolt migration was complete. Smolt lengths and weights were recorded for all sampled fish and the mean values of those measurements are presented in this report.

The fish collected for sampling were placed in a plastic container filled with a diluted solution of 99.5% pure Tricaine Methanesulfonate Finquel® MS-222® and water to anesthetize the fish during the sampling event. Sockeye and coho salmon smolts were first measured to the nearest millimeter for fork length and then weighed to the nearest 0.1 gram. Up to 10 scales were removed from the primary growth area and mounted on a glass slide for subsequent age determination for all sampled smolts. All salmon smolts were allowed to recover in a bucket of fresh water and released unharmed after biological data were recorded.

Adult Enumeration

To enumerate adult salmon, staff installed a fixed picket weir fitted with video recording equipment in Shell Creek. The weir was constructed of 1.9 cm galvanized and 7.6 cm aluminum channel. The galvanized pipe was picketed through 1.9 cm holes in the aluminum channel spaced 2.54 cm apart. A gap approximately 2.5 feet wide located in the thalweg of the creek allowed fish to pass the weir via a passage chute without handling stress. Attached to the passage chute was a camera box that was triggered by motion and filmed all passing fish. Footage downloaded from the video weir was to be segregated into motion events allowing the reviewer to count all passing fish while eliminating all non-event footage (CIAA 2025c).

Beaver Dam Monitoring

Beaver dams throughout Shell Creek are monitored via aerial surveys from either helicopter or fixed wing aircraft as funding allows. Aerial surveys will span the 3.8 miles of Shell Creek from Shell Lake to the confluence with the Skwentna River. If beaver dams are found to be blocking the upstream passage of salmon, staff would make a notch approximately 3–5 feet wide in the dam to allow them to pass. In 2025, Shell Creek was monitored for beaver dams by a foot survey and by flying over when transporting the crew and gear to and from camp.

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RESULTS

Invasive Northern Pike Suppression

Gillnetting of northern pike from Shell Lake occurred from May 29–June 29 and August 13–September 4, 2025. Gillnetting of northern pike occurred from Whiskey Lake from July 11–August 10, 2025. Gillnetting of northern pike from Hewitt Lake occurred from July 11–August 10, 2025.

Effort hours were recorded to the nearest minute for all gillnets set on all lakes. During 2025, gillnets fished Whiskey Lake for 3,329.9 hours, Hewitt Lake for 1,855.3 hours, and Shell Lake for 7,522.8 hours.

The total number of pike removed from the lakes via gillnets and hook-and-line fishing in 2025 was 1,891 with 817 captured in Whiskey Lake, 818 removed from Hewitt Lake, and 256 from Shell Lake. Bycatch caught in each lake is reported in Appendix 1.

Catch per unit effort was calculated for all lakes and all efforts undertaken on Hewitt-Whiskey Creek were attributed to Hewitt Lake. CPUE in Whiskey Lake was 0.245; CPUE at Hewitt Lake was 0.305; and the CPUE at Shell Lake was 0.034 pike/hour.

The 2025 CPUE for each lake has decreased since initial netting efforts in 2012 (Figure 5). When compared with the intensive harvest at Whiskey, Hewitt, and Shell lakes in 2012, 2025 CPUE at all lakes has been reduced: 90.8% at Whiskey, 79.4% at Hewitt, and 91.2% at Shell. However, when comparing CPUE data at Shell Lake from 2025 to the previous five years (2020–2024), a substantial increase can be noted (Figure 6). This suggests the population is beginning to recover from near extirpation following the population collapse in 2019 due to a combination of poor spawning conditions and intensive harvest.

Raw CPUE figures calculated for the project lakes were multiplied by the average weights of pike captured to determine the biomass of northern pike caught per hour. Biomass-per-hour calculations from Hewitt Lake was 0.306; Whiskey Lake was 0.07; and Shell Lake was 0.010 kg/hour.

Staff collected data from all harvested pike regarding age, sex, length, and weight. Missing data from some of the pike captured was due to predation by river otters (*Lontra canadensis*). For all lakes, average lengths and weights of captured pike are provided in Table 1.

Stomach contents for all captured northern pike were visually inspected and quantified. Results from that are presented in tables 2–3. Invertebrates and fish species other than pike and salmonids dominated the diets of northern pike in the project lakes.

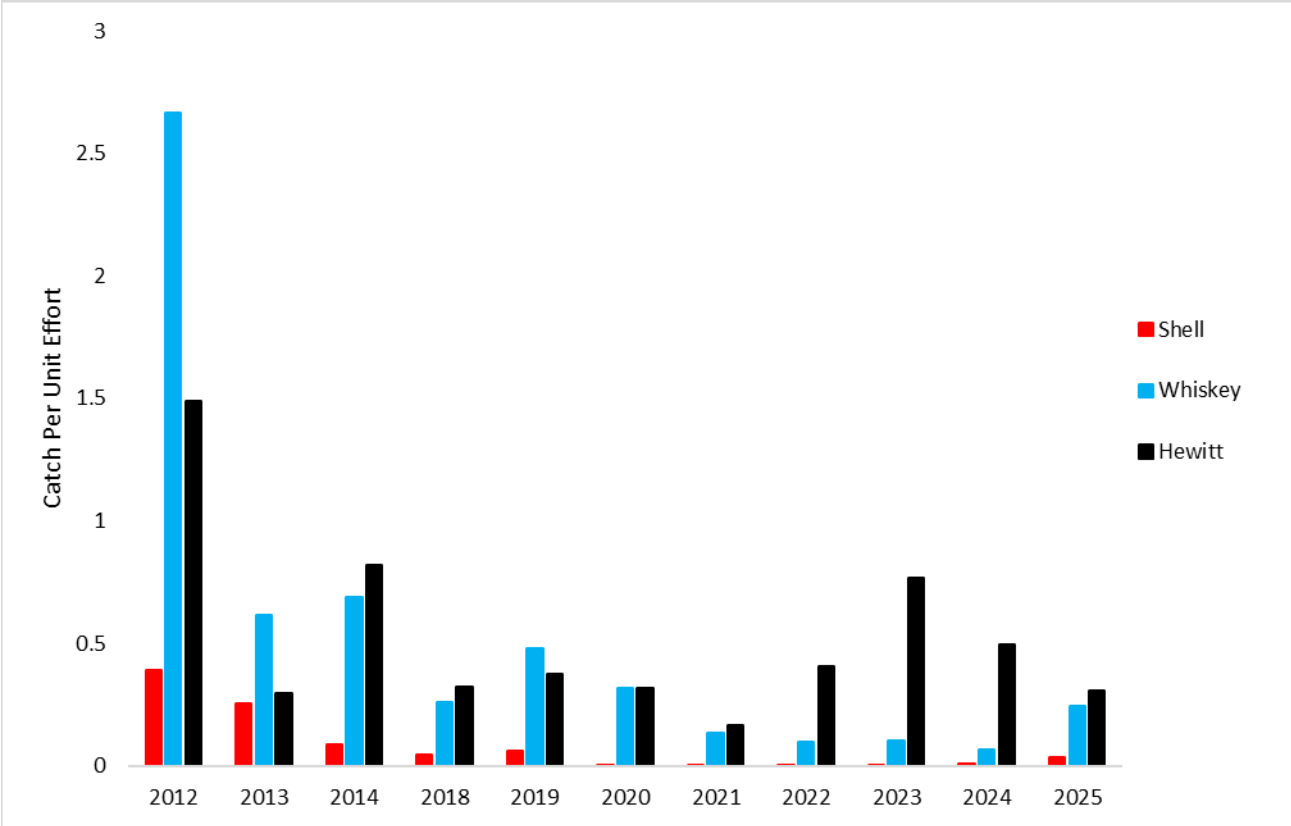


Figure 5: Catch per unit effort for Whiskey, Hewitt, and Shell lakes northern pike suppression 2012–2014, 2018–2025.

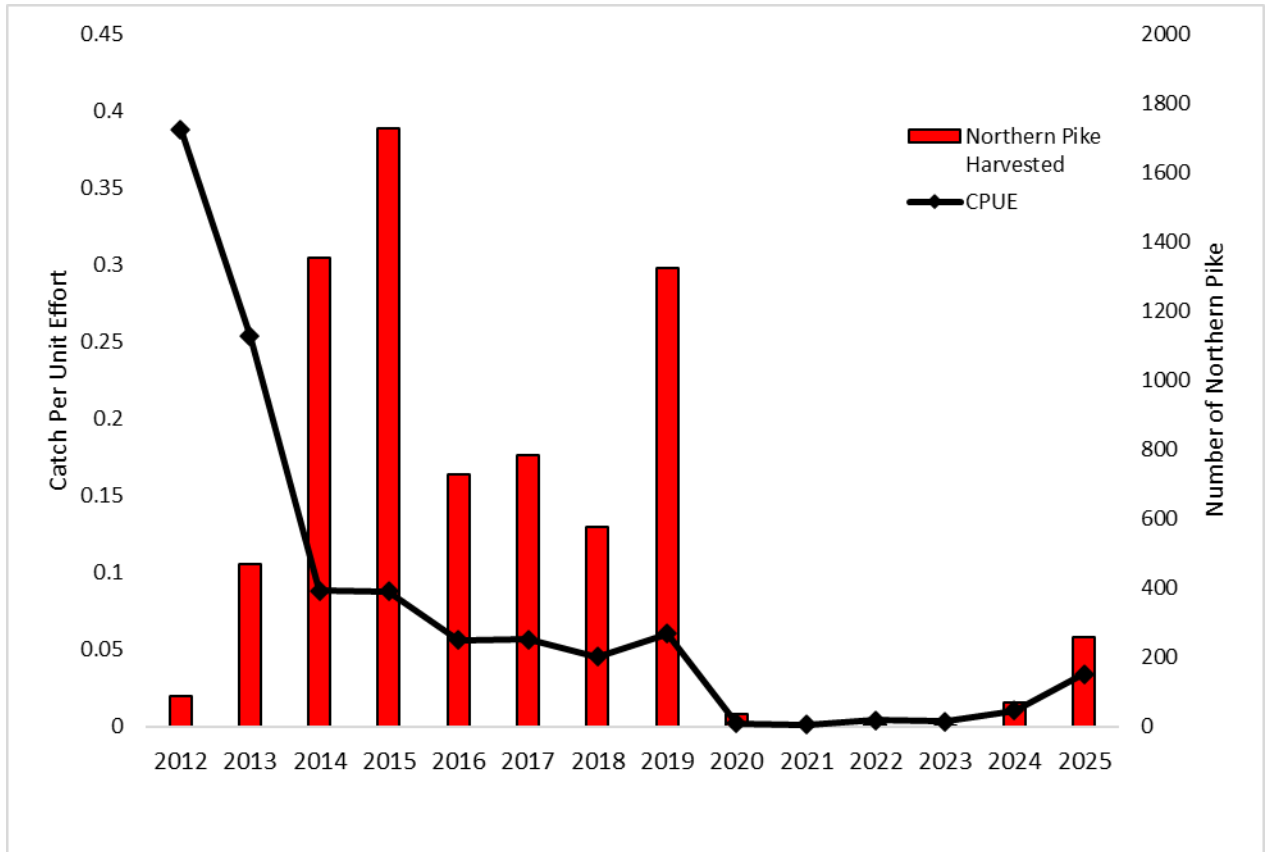


Figure 6: Catch per unit effort and total northern pike harvested via gillnets at Shell Lake 2012–2025.

Table 1: Northern pike characteristics from Whiskey, Hewitt, and Shell lakes, 2025.

Lake	No. of pike	Weight (kg)	Length (mm)	Age	% Female
Shell Lake	256	0.38	350	1.15	47.3%
Whiskey Lake	817	0.38	354	1.18	50.8%
Hewitt Lake	818	0.64	420	2.42	41.9%

Table 2: Number and percentage of examined stomachs for northern pike captured at Shell, Whiskey, and Hewitt Lakes that contained at least one prey item, 2025.

Lake	Number of stomachs analyzed			Percent of stomachs	
	Empty	Non-empty	Total	Empty	Non-empty
Shell	67	147	214	31%	69%
Whiskey	264	460	724	36%	64%
Hewitt	290	483	773	38%	62%

Table 3: Stomach contents of northern pike captured at Shell, Whiskey, and Hewitt Lakes for 2025 by abundance of prey item.

Lake	Pike	Sockeye salmon	Coho salmon	Unidentified salmon	Other fish ^a	Invertebrates	Frogs
Shell	0	2	14	9	286	21	3
Whiskey	2	155	3	31	694	491	0
Hewitt	9	33	0	7	951	951	1

a. Other fish include rainbow trout, burbot, stickleback, sculpin, and suckers.

Environmental Conditions

Environmental data taken at Shell and Hewitt (encompassed both Whiskey and Hewitt lakes as described in the Methods section) lakes included air and water temperature. Water temperatures at Shell Lake ranged from 5.1 to 18.1°C with an average of 12.6°C while air temperatures ranged from 6.8 to 18.2°C with an average of 12.8°C (Appendix 2). At Hewitt Lake, water temperatures ranged from 17.8 to 20.7°C with an average of 19.0°C while air temperatures ranged from 12.8 to 21.1°C with an average of 16.4 °C (Appendix 3).

Elodea Surveys

Surveys for elodea were conducted when time and weather allowed at each lake. There were 146 points on Whiskey; 357 points on Shell; and 244 points on Hewitt. In general, it took the crew two days to survey each lake. No elodea was detected in any of the surveys. Survey data was submitted to AKEPIC in November 2025.

Smolt Enumeration

Staff monitored the Shell Lake salmon smolt migration from May 29 through June 29, 2025, and counted 997 sockeye salmon smolt and 3,278 coho salmon (Appendix 4). Samples for length, weight, and age were collected from 33 coho smolt and 10 sockeye smolt. On average the coho smolt measured 131 mm and weighed 23.5 grams. Staff recorded 29 coho at age-2, 3 coho at age-1 and 1 coho could not be aged. The sockeye smolt on average measured 107 mm and weighed 11.4 grams. Six sockeye were age-1 and 4 sockeye were age-2.

Adult Enumeration

A fixed picket weir was installed in Shell Creek on July 9. The video recording equipment at the weir was operational on July 12 and ran continuously until September 7. A visual estimate of the number of fish passing through the weir was made on September 8 while staff were present. In total 38 adult sockeye and 248 coho were enumerated as they passed into Shell Lake (Appendix 5).

Beaver Dam Monitoring

Beaver dam surveys were conducted on Shell Creek in 2025. Shell Creek was flown with a fixed-wing aircraft opportunistically while transporting crew and gear to and from camp. The crew flying over noted the presence of beaver dams on the creek but did not see any salmon staging behind them. On August 16 and 17, the crew at Shell Lake hiked the entirety of Shell Creek by foot down to its confluence with the Skwentna River. They did not see any active beaver dams, only old dams and none that would present a challenge for migrating salmon. On August 28 and 29, a substantial amount of rainfall occurred (Appendix 2), which coincided with the highest level of fish passage at the weir (Appendix 5). No subsequent surveys were conducted because salmon were making it into Shell Lake as reported by the onsite crew.

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DISCUSSION

From the onset of intensive pike suppression at the project lakes in 2012 to the end of the current project in 2025, the relative abundance of northern pike has decreased at Shell, Whiskey, and Hewitt lakes by 91.2%, 90.8%, and 79.4% respectively. These reductions demonstrate that the sustained pike suppression has been highly effective. However, if netting operations were to cease, it is likely that these pike populations would recover within a few years.

At Shell Lake, the northern pike population appears to be recovering from near extirpation following a combination of poor spawning conditions and intensive harvest in 2019. When comparing the CPUE in 2025 to the average CPUE of the five years following 2019 (2020–2024), there is an increase of 720%. The difference in the efficiency of netters should not be overlooked and likely contributed to the increase in CPUE in 2025. However, the magnitude of increase suggests that the pike recruitment rate exceeded the exploitation rate for the previous year despite intensive harvest efforts. Although pike suppression using gillnets has been effective, this approach requires ongoing effort, and complete eradication remains unlikely given the volume of Shell Lake. It is recommended that CIAA explore other methods of controlling pike while continuing the current suppression strategy.

The northern pike population at Shell Lake remains dominated by age-1 fish. This truncated age structure could leave the population vulnerable environmental factors in a given year, similar to those observed in 2019. CIAA finalized a feasibility study in December 2025 to determine if a flow control could be used to manipulate the waters levels so that manipulating water levels could be used as a suppression tool (HDR 2025). Two flow control options were deemed feasible to produce the desired water levels. Consideration should be given to this method of controlling pike, perhaps first at a smaller uninhabited lake to test the proof of concept. This project could potentially provide a model for other pike infested waters across Southcentral Alaska.

Although the number of sockeye smolt emigrating from Shell Lake was low ($n = 997$), it was the highest number of naturally-produced smolt observed at Shell Lake since 2010. While the increase in smolt in 2025 is not likely to result in a substantial adult return in the immediate future, it is an encouraging sign about the resilience of salmon. The smolt sampled in 2025 originated from brood years 2022 and 2023; the two lowest years of relative abundance of pike in Shell Lake since the onset of the pike suppression project in 2012.

Sockeye salmon originating from these lakes are genetically distinct populations that are pieces of a larger mosaic of genetic diversity making up the Susitna sockeye population. Genetic diversity provides this larger Susitna population with resilience by increasing phenotypic variety and increases the likelihood that a stock will be able to withstand weather anomalies, a disease outbreak, or a variety of other factors detrimental to salmon survival. While working to restore the

positive production of Susitna River sockeye salmon is a noble goal, it will be the act of preserving unique genetic stocks within the larger population of Susitna River sockeye that will ensure that any potential recovery can be sustained long term. The loss of any of these stocks will weaken the recovery and future potential of sockeye salmon in this watershed.

RECOMMENDATIONS

Methods of suppression of northern pike in Shell, Whiskey, and Hewitt lakes should not change in 2026. The CPUE of gillnets should still serve as a measurement of relative pike abundance and age, sex, weight, and length data should still be collected to enable the demographic description of the pike population. Crews should continue to collect stomach contents for analysis to get a better picture of the pike diet as preferred prey species (i.e., salmon) appear to be rebounding in some of these lakes.

For 2026, CIAA staff should not operate the smolt weir on Shell Creek. This will allow the crew to allocate all efforts in the springtime towards northern pike suppression. Pike may be particularly vulnerable to harvest via gillnets immediately after ice-out because they inhabit shallow parts of the lake to spawn during this time. Due to the increase in the number of pike in 2025, it is important to maximize crew efforts on pike reduction. Based on the recent numbers of returning adult salmon, smolt outmigration is forecasted to be low in 2026. Not operating the smolt weir would also minimize handling stress by letting the population migrate unobstructed.

If the adult sockeye population at Shell Lake is adequate another egg take may be warranted to increase the salmon production within the lake. If the adult sockeye population remains too small for an egg take and smolt migration is also small for natural recolonization, CIAA should work with ADF&G to in order to identify a genetically similar stock that could be used for future enhancement of the sockeye population within the lake.

Beaver dam surveys have been conducted annually by CIAA—when funding allows—during the late summer and fall when adult salmon are migrating to their natal lakes to spawn. These surveys are conducted to aid in the salmon migration by identifying barriers that salmon would not be able to bypass without intervention such as notching or heavy rain and increased water flows. Beaver dam surveys should continue to aid with the natural migration of adult salmon into Shell Lake. Shell Creek has had many dams in the past so it is a system in great need of beaver dam monitoring in addition to the other significant efforts and resources that have already been put into rehabilitating the salmon population in the lake.

Alternative methods to keep the northern pike population from rebounding in Shell Lake should also continue to be investigated. Staff should consult with ADF&G and other agencies to explore other methods for fighting against invasive northern pike. Staff should also consider expanding efforts to other lakes in the region as pike continue to be a problem throughout Southcentral Alaska.

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APPENDICES

Appendix 1: Bycatch across all lakes, 2025

		Longnose Sucker <i>Castostomus catostomus</i>		Rainbow Trout <i>Oncorhynchus mykiss</i>		Sockeye Salmon <i>Oncorhynchus nerka</i>		Lake Trout <i>Salvelinus namaycush</i>		Coho Salmon <i>Oncorhynchus kisutch</i>		Burbot <i>Lota lota</i>		Bird <i>Aves species</i>		Whitefish <i>coregonus sp.</i>	
		Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
		Shell Lake	2025	355	244	15	75	1	-	9	11	4	-	-	2	1	-
Whiskey Lake	2025	3	1	1	1	10	2	-	-	-	-	-	-	-	-	-	1
Hewitt Lake	2025	-	-	-	-	9	4	-	-	-	-	-	-	-	-	1	2

Dashes (-) represent zero fish caught.

Appendix 2: Shell Lake Environmental Conditions 2025

Date	Sky	Precip. (mm)	Water Temp. (°C)	Air Temp. (°C)	Date	Sky	Precip. (mm)	Water Temp. (°C)	Air Temp. (°C)
31-May	3	1.0	5.3	8.5	12-Aug	ND	ND	17.8	13.3
1-Jun	5	4.0	5.2	7.6	13-Aug	5	0.0	16.9	12.9
2-Jun	4	6.0	5.2	8.4	14-Aug	4	2.0	16.7	13.6
3-Jun	5	21.0	5.1	7.2	15-Aug	ND	ND	16.3	13.0
4-Jun	5	20.0	5.2	6.8	16-Aug	ND	ND	16.2	13.5
5-Jun	3	10.0	5.7	9.0	17-Aug	ND	ND	16.8	15.2
6-Jun	3	0.0	6.0	10.0	18-Aug	5	1.0	16.9	14.4
7-Jun	5	2.0	5.8	8.0	19-Aug	4	2.0	15.7	13.2
8-Jun	4	ND	7.2	8.5	20-Aug	4	8.0	16.0	13.4
9-Jun	3	12.0	8.3	8.0	21-Aug	5	0.0	15.5	14.6
10-Jun	2	0.0	9.2	10.6	22-Aug	3	0.0	16.1	14.7
11-Jun	3	0.0	9.6	12.4	23-Aug	3	0.0	16.7	12.4
12-Jun	2	0.0	12.9	14.8	24-Aug	ND	ND	16.6	13.8
13-Jun	2	0.0	14.2	15.7	25-Aug	4	1.0	15.5	13.9
14-Jun	2	0.0	9.5	15.4	26-Aug	4	0.0	12.2	13.5
15-Jun	1	0.0	10.2	13.9	27-Aug	5	3.0	12.6	12.9
16-Jun	2	0.0	10.2	13.3	28-Aug	5	82.0	12.2	12.4
17-Jun	4	0.0	11.4	13.5	29-Aug	1	15.0	13.0	12.7
18-Jun	1	0.0	11.7	15.2	30-Aug	4	0.0	13.8	8.6
19-Jun	1	0.0	17.2	18.1	31-Aug	4	8.0	13.6	10.5
20-Jun	1	0.0	15.8	18.2	1-Sep	4	9.0	13.4	12.4
21-Jun	4	0.0	11.7	15.4	2-Sep	4	0.0	13.6	13.9
22-Jun	4	0.0	15.1	15.9	3-Sep	4	2.0	13.8	13.9
23-Jun	4	0.0	11.8	14.3	4-Sep	5	8.0	13.1	14.3
24-Jun	4	0.0	13.5	14.2	5-Sep	3	0.0	13.3	13.4
25-Jun	5	1.0	14.7	13.9	6-Sep	5	3.0	13.4	12.2
26-Jun	3	2.0	12.4	13.5	7-Sep	ND	ND	13.0	11.8
27-Jun	2	0.0	15.6	14.6	8-Sep	ND	ND	13.0	12.2
28-Jun	2	0.0	15.4	17.1	9-Sep	ND	ND	10.9	11.2
29-Jun	2	0.0	18.1	17.1	Total		223.0	Water	Air
ND indicates no data was collected					Avg.		4.5	12.6	12.8
1 = Clear, 2 = Cloud Cover <50%					Min.		0.0	5.1	6.8
3 = Cloud Cover >50%, 4 = Overcast, 5 = Rain					Max.		82.0	18.1	18.2

Appendix 3: Hewitt Lake Environmental Conditions 2025

Date	Sky	Precip. (mm)	Water Temp. (°C)	Air Temp. (°C)
11-Jul	ND	ND	17.9	18.1
12-Jul	ND	ND	20.0	21.1
13-Jul	2	0.0	18.8	17.4
14-Jul	4	0.0	18.4	14.5
15-Jul	ND	ND	17.8	13.9
16-Jul	ND	ND	17.9	15.0
17-Jul	4	0.0	18.3	16.0
18-Jul	3	0.0	18.7	16.3
19-Jul	4	0.0	18.6	15.5
20-Jul	4	0.0	18.3	15.0
21-Jul	5	0.0	18.4	17.1
22-Jul	3	3.0	18.5	17.9
23-Jul	2	0.0	18.7	18.0
24-Jul	3	0.0	18.8	18.4
25-Jul	4	10.0	18.8	13.7
26-Jul	3	0.0	18.3	18.1
27-Jul	3	0.0	19.2	19.2
28-Jul	3	0.0	19.0	17.6
29-Jul	4	0.0	19.3	18.0
30-Jul	3	18.0	19.3	16.3
31-Jul	2	0.0	19.4	19.1
1-Aug	3	0.0	20.3	18.4
2-Aug	4	15.0	19.2	13.6
3-Aug	3	0.0	18.9	15.4
4-Aug	2	0.0	19.8	16.5
5-Aug	1	0.0	20.0	16.9
6-Aug	3	0.0	19.9	15.3
7-Aug	5	1.0	20.7	13.9
8-Aug	4	0.0	19.2	15.4
9-Aug	4	0.0	19.1	15.2
10-Aug	5	13.0	18.4	12.8
11-Aug	ND	ND	20.4	15.6
Total		60.0	Water	Air
Avg.		2.2	19.0	16.4
Min.		0.0	17.8	12.8
Max.		18.0	20.7	21.1

ND indicates no data was collected

1 = Clear, 2 = Cloud Cover <50%

3 = Cloud Cover >50%, 4 = Overcast, 5 = Rain

Appendix 4: Shell Lake 2025 Daily Smolt Migration

Shell Lake 2025 Smolt Migration											
Date	Sockeye			Coho		Rainbow		Dolly Varden		Pink	
	Daily	Mortality	Total	Daily	Total	Daily	Total	Daily	Total	Daily	Total
29-May	0	0	0	0	0	0	0	0	0	0	0
30-May	13	0	13	14	14	0	0	0	0	0	0
31-May	9	0	22	9	23	0	0	0	0	0	0
1-Jun	4	0	26	4	27	0	0	0	0	0	0
2-Jun	6	0	32	2	29	0	0	1	1	0	0
3-Jun	1	0	33	4	33	0	0	0	1	0	0
4-Jun	10	0	43	25	58	0	0	2	3	0	0
5-Jun	34	0	77	17	75	0	0	0	3	0	0
6-Jun	33	0	110	6	81	0	0	0	3	0	0
7-Jun	12	0	122	2	83	0	0	0	3	0	0
8-Jun	34	0	156	196	279	0	0	0	3	0	0
9-Jun	71	0	227	48	327	0	0	0	3	0	0
10-Jun	66	0	293	39	366	0	0	0	3	0	0
11-Jun	76	0	369	44	410	0	0	0	3	0	0
12-Jun	37	0	406	35	445	0	0	1	4	0	0
13-Jun	112	0	518	84	529	0	0	0	4	0	0
14-Jun	85	0	603	672	1,201	2	2	1	5	0	0
15-Jun	42	0	645	281	1,482	3	5	0	5	0	0
16-Jun	19	0	664	260	1,742	0	5	1	6	0	0
17-Jun	58	0	722	161	1,903	0	5	4	10	0	0
18-Jun	35	0	757	222	2,125	0	5	0	10	0	0
19-Jun	15	0	772	31	2,156	0	5	0	10	0	0
20-Jun	10	0	782	147	2,303	2	7	2	12	0	0
21-Jun	45	0	827	357	2,660	1	8	2	14	0	0
22-Jun	5	0	832	9	2,669	0	8	3	17	0	0
23-Jun	13	0	845	59	2,728	0	8	6	23	0	0
24-Jun	37	0	882	148	2,876	0	8	14	37	0	0
25-Jun	86	0	968	326	3,202	0	8	32	69	0	0
26-Jun	11	0	979	20	3,222	0	8	11	80	0	0
27-Jun	17	0	996	42	3,264	0	8	0	80	0	0
28-Jun	1	0	997	8	3,272	0	8	0	80	0	0
29-Jun	0	0	997	6	3,278	0	8	0	80	0	0
Total	997			3,278		8		80		0	

Appendix 5: Shell Lake 2025 Daily Adult Salmon Migration

Date	Sockeye			Coho	Chinook	Rainbow Trout	Dolly Varden
	Daily Escapement	Mortalities	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
12-Jul	0	0	0	0	0	3	1
13-Jul	0	0	0	0	0	5	0
14-Jul	0	0	0	0	0	1	0
15-Jul	0	0	0	0	0	4	0
16-Jul	0	0	0	0	0	3	0
17-Jul	0	0	0	0	0	2	0
18-Jul	0	0	0	0	0	1	0
19-Jul	0	0	0	0	0	1	0
20-Jul	0	0	0	0	0	6	0
21-Jul	0	0	0	0	0	2	0
22-Jul	0	0	0	0	0	4	0
23-Jul	1	0	1	0	0	2	1
24-Jul	0	0	1	0	0	0	0
25-Jul	0	0	1	0	0	1	0
26-Jul	0	0	1	0	0	2	0
27-Jul	0	0	1	0	0	1	0
28-Jul	0	0	1	0	0	0	0
29-Jul	0	0	1	0	0	1	0
30-Jul	0	0	1	0	0	4	0
31-Jul	1	0	2	0	0	4	1
1-Aug	0	0	2	1	0	7	0
2-Aug	0	0	2	0	0	12	0
3-Aug	0	0	2	0	0	2	0
4-Aug	0	0	2	0	0	9	0
5-Aug	0	0	2	0	0	8	0
6-Aug	0	0	2	0	0	6	0
7-Aug	0	0	2	0	0	8	0
8-Aug	0	0	2	0	0	4	0
9-Aug	0	0	2	1	0	3	0
10-Aug	0	0	2	0	0	2	0
11-Aug	0	0	2	0	0	4	0
12-Aug	0	0	2	1	0	3	0
13-Aug	0	0	2	0	0	1	0
14-Aug	0	0	2	0	0	3	0
15-Aug	0	0	2	0	0	2	0
16-Aug	0	0	2	0	0	3	0
17-Aug	0	0	2	0	0	2	0
18-Aug	0	0	2	1	0	3	0
19-Aug	0	0	2	0	0	6	0
20-Aug	0	0	2	0	0	3	0
21-Aug	0	0	2	1	0	2	0
22-Aug	0	0	2	1	0	4	0
23-Aug	0	0	2	1	0	3	0
24-Aug	0	0	2	0	0	6	0
25-Aug	0	0	2	1	0	2	0
26-Aug	0	0	2	0	0	3	0
27-Aug	0	0	2	0	0	2	0
28-Aug	1	0	3	49	0	1	0
29-Aug	22	0	25	96	0	3	0
30-Aug	9	0	34	19	0	6	0
31-Aug	3	0	37	6	0	3	0
1-Sep	1	0	38	1	0	3	0
2-Sep	0	0	38	11	0	1	0
3-Sep	0	0	38	3	0	2	0
4-Sep	0	0	38	11	0	3	0
5-Sep	0	0	38	7	0	1	0
6-Sep	0	0	38	8	0	8	0
7-Sep	0	0	38	9	0	0	0
8-Sep	0	0	38	20	0	0	0
Total	38	0	38	248	0	191	3

Shading represents an estimate of what was seen moving through the weir