TRIP REPORT

State of Alaska

Department of Fish and Game

Field Dates: May 7 - 19, 2026

Location: **Fort Knox Mine – Water Supply Reservoir (WSR) and Wetlands**

Objectives: Arctic grayling annual population assessment in WSR and wetlands complex, Water temperature monitoring in Fish Creek and RO Channel

Participants: Chad Bear, Lauren Yancy, Maria Wessel, Todd Nichols, Olivia Edwards, and Kieren Vasquez

Weather: Sunny, rain, wind, snow, hail, air temperature between -2°C and 10°C

Access: State truck to Fish Creek on Fort Knox Mine

On May 7, Chad Bear and Lauren Yancy deployed fyke nets and initiated the annual Arctic grayling population assessment in the Water Supply Reservoir (WSR) and developed wetlands (Figure 1). Fish Creek remained covered by soft, thin ice, although open water was present at the Pond F outlet culvert. Water temperatures at Pond F measured 2.9°C, influenced by natural groundwater inputs and spring snowmelt sources. The lower RO Channel was covered with aufeis, preventing net deployment at the preferred location. Flowing water was present beneath the ice and became visible just above its confluence with Fish Creek. Despite being capped by aufeis, water temperature measured 4.7°C just before entering Fish Creek. At the Pond AB outlet culverts, RO Channel water temperature measured 5.5°C, reflecting warming associated with RO water processing. The Pond AB outlet culverts were not blocked by beaver dams like those observed during the spring of 2024, allowing water to flow into the RO Channel as designed, instead of overtopping the Pond AB retaining dike and entering into the Fish Creek drainage. On April 28 RO discharge had resumed (Bear, Winter Water Quality Trip Report) and Pond AB was at typical spring water levels (Figure 2).

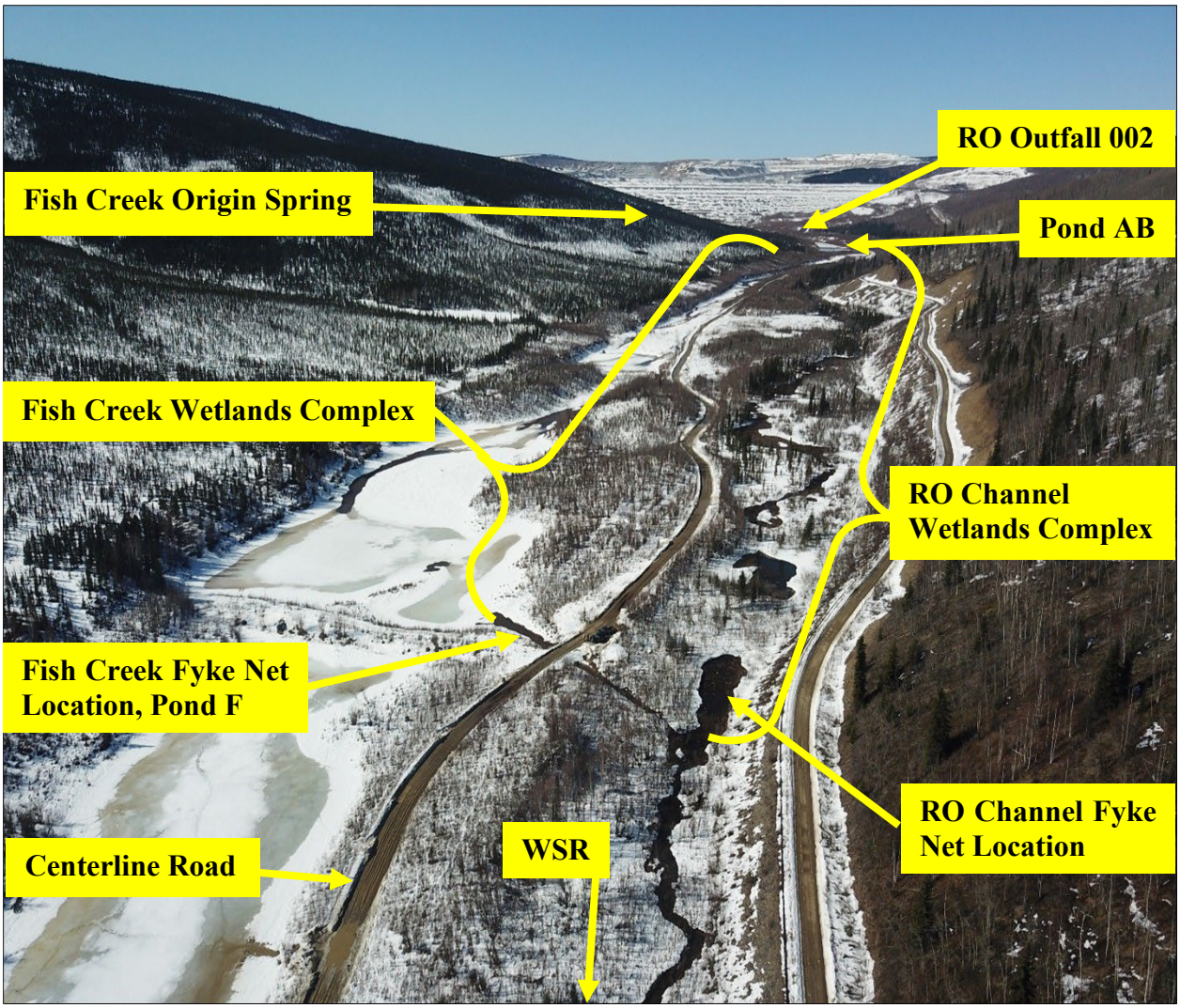

Figure 1.–Fish Creek and RO Channel wetlands features.

Figure 2.–Pond AB water levels 1) when RO was temporarily ceased, April 22, 2026 (left) and 2) May 7 after RO water discharge resumed with typical Pond AB water levels (right).

Arctic grayling have been sampled annually in the Fish Creek wetland complex since 1995. In 2026, sampling methods included fyke nets and visual observations. Fyke nets were deployed in Fish Creek at the Pond F outlet and in the RO Channel just upstream of its confluence with Fish Creek during spring, as Arctic grayling migrate from the WSR into the wetlands complex to spawn (Figure 3). The RO Channel net also served to evaluate Arctic grayling use of wetland habitats created by RO discharge that began in 2015. In the upper RO Channel's Pond AB, a third fyke net has been placed near the outlet each spring since 2022, approximately when that population became seemingly isolated from the WSR by beaver dams in the lower RO Channel (Bear and Ott 2023). Data collected from these sites are used to generate annual abundance estimates and monitor changes in the fish population over time.

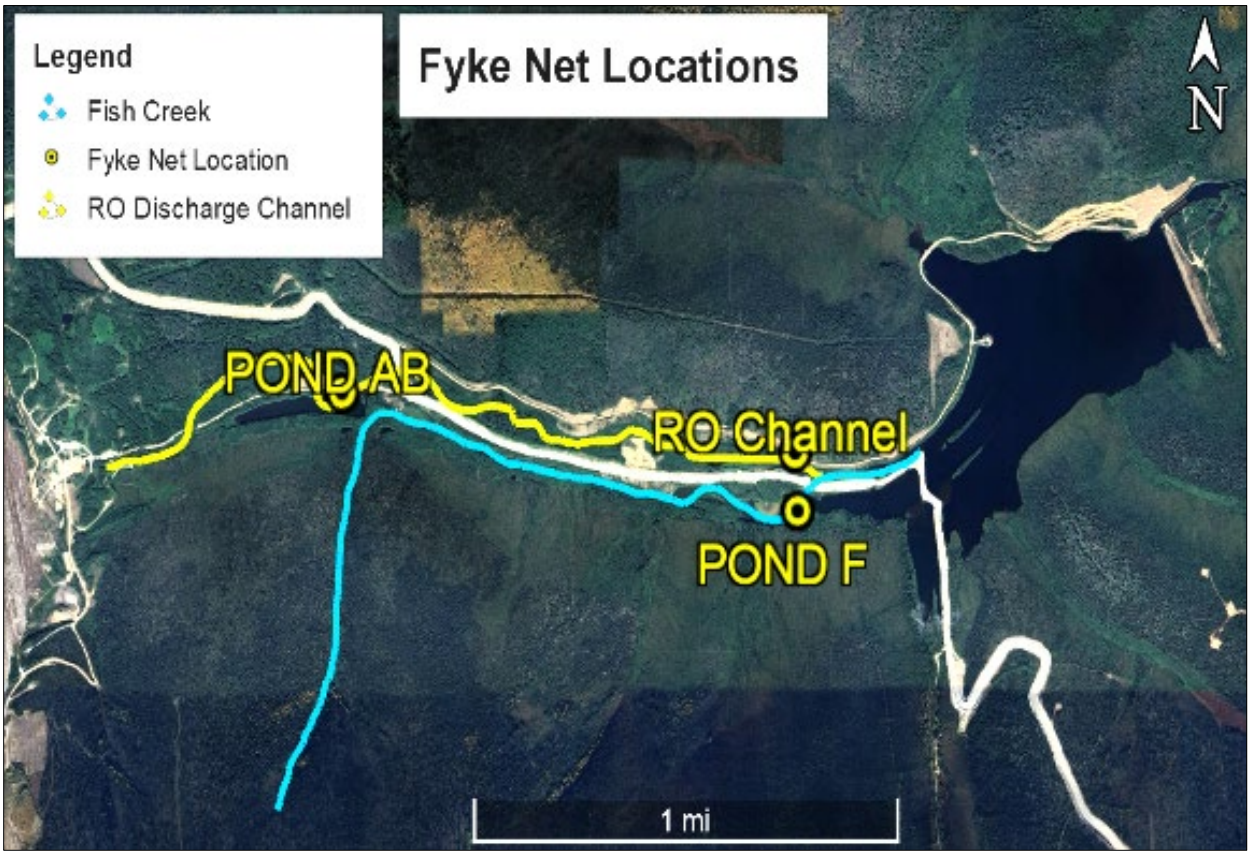

Figure 3.–Fyke net locations in Fish Creek, the RO Channel wetlands complex, and Pond AB 2026.

On May 7, one fyke net was set in Fish Creek at the Pond F outlet and another near the Pond AB outlet (Figures 3 and 4). The lower RO Channel net location initially had substantial aufeis on the valley floor from RO discharge during winter 2025–2026, which precluded placement of the fyke net until May 15, when the sampling area became aufeis free (Figures 3 and 4). All fyke nets were checked daily until removal on May 19.

Figure 4.–Fyke net locations: Fish Creek (left), RO Channel at Pond AB (middle), and Lower RO Channel (right).

Water temperatures were recorded during the Arctic grayling spawning period for inter-annual comparison. Three *Hobo*® brand temperature loggers were deployed on April 22, 2026, in the RO Channel at the Pond AB outlet, in the RO Channel just upstream of the Fish Creek confluence, and in Fish Creek at the Pond F outlet (Figures 3). Water temperature was recorded hourly to capture daily peak high temperatures. The temperature loggers were removed on May 19.

Captured Arctic grayling were measured for fork length (FL) to the nearest millimeter, examined for existing tags, assessed for spawning condition, and then released. Untagged Arctic grayling ≥200 mm were tagged with a uniquely numbered Floy® T-bar internal anchor tag for identification. Juvenile Arctic grayling <200 mm were not tagged, but FL was recorded prior to release. Female Arctic grayling were classified as not ripe, ripe, or spawned based on spawning condition. Incidental burbot captures were inspected for morphological abnormalities, measured for total length (TL) to the nearest millimeter, then released untagged. Both Arctic grayling and burbot were visually inspected for signs of larval *Diplostomulum* of the eye (eye fluke) by examining both eyes for milky white pupils instead of the typical black pupils, and observations were recorded.

The 2025 population abundance estimate for Arctic grayling used spring 2025 as the mark event and spring 2026 as the recapture event. Only fish ≥240 mm were included in the abundance estimate. The abundance of Arctic grayling was calculated using Chapman's modification of the Lincoln-Petersen two-sample mark-recapture model (Chapman 1951) and variance calculated following Seber (1982).

Water Supply Reservoir (WSR)

Water Temperature

The 2026 Fish Creek daily peak water temperature was consistent with previous years without RO water intrusion, such as occurred in 2019 and 2024, when the Pond AB culverts were blocked and RO discharge water was diverted over the retaining dike and into Fish Creek (Bear and Ott 2020). On April 22, 2026, Fish Creek measured 0.4°C, reflecting conditions influenced solely by natural groundwater and spring meltwater. Cooler spring air temperatures during the 2026 sampling period kept water temperatures lower than in 2025 (Figure 5). The latest spring recorded in the dataset occurred in 2013, when Fish Creek remained below the 4°C spawning threshold until late May, after which it warmed rapidly.

The RO Channel exhibits a distinct winter and spring temperature gradient, with warmer water upstream near Outfall 002 and colder water downstream. RO water enters the system at approximately 6.0°C and begins cooling in Pond AB. Lower in the RO Channel, aufeis formation during winter maintains lower water temperatures until late spring. For example, this gradient was evident on May 9, 2026, when the peak daily temperature at the Pond AB outlet was 7.1°C but cooler at 5.0°C just upstream of its confluence with Fish Creek (Figure 3 and 6). RO Channel water temperate measurement from April 22 to 27 reflects fluctuations in discharge as the RO facility began operating after being temporality stopped for maintenance. The temperature difference between water sources complicates spring sampling timing; thus, Fish Creek temperatures remain the preferred indicator for scheduling annual fish sampling. It reflects natural conditions unaffected by discharge variability and is a larger total volume of water compared to typical RO discharge volumes. By May 19, RO water and Fish Creek water temperatures began to equalize as spring progressed and warmer weather dictated thermal conditions (Figure 6).

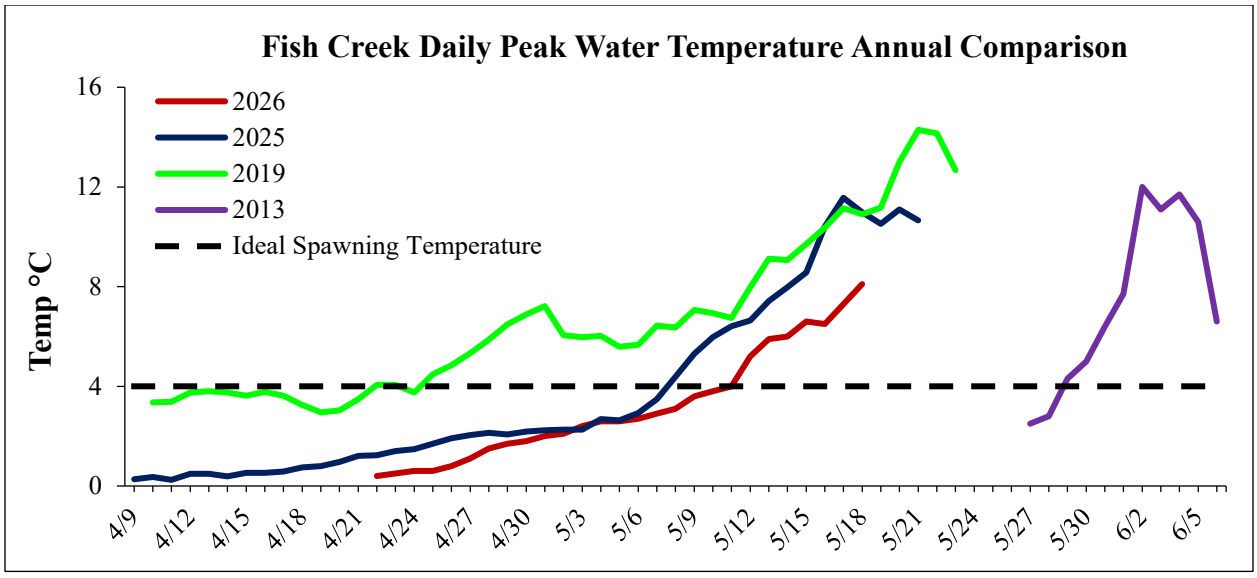

Figure 5.–Daily peak water temperature in Fish Creek at Pond F outlet; select years for reference.

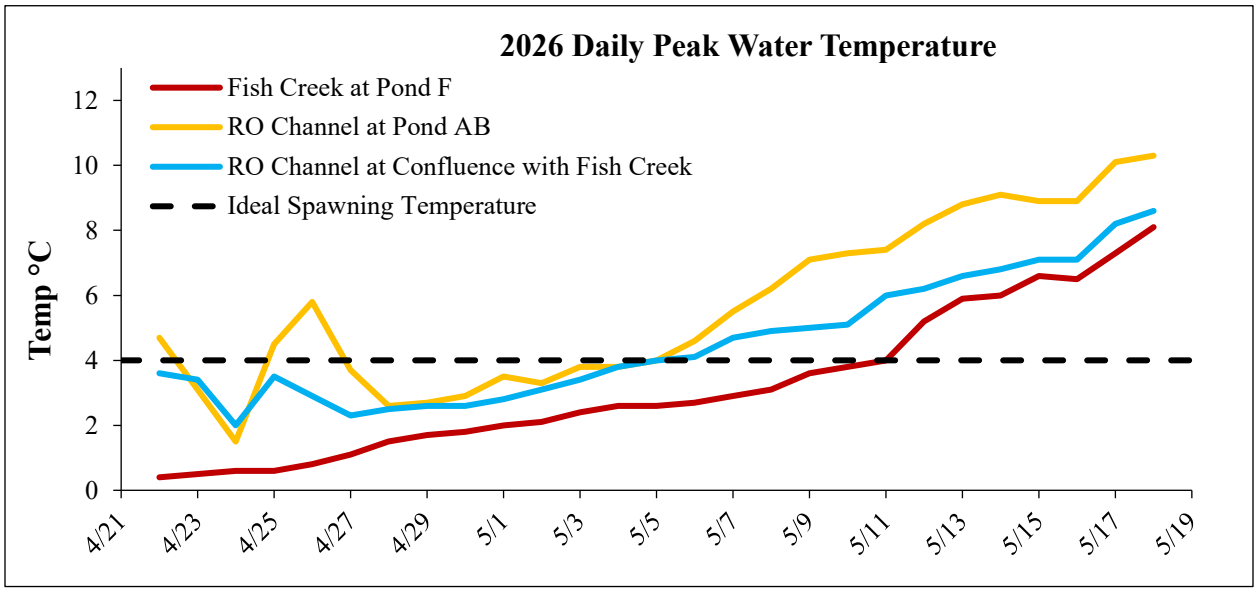

Figure 6.–Daily peak water temperatures in Fish Creek at Pond F outlet, RO Channel at Pond AB outlet and RO Channel upstream of its confluence with Fish Creek, 2026.

Arctic Grayling CPUE

A total of 759 Arctic grayling ≥200 mm were captured in the Fish Creek and RO Channel fyke nets during spring sampling. Arctic grayling catch per unit of effort (CPUE) in Fish Creek varied throughout the sampling period, peaking at 6.8 fish/hour on May 11, as water temperatures increased to the ideal spawning temperature of 4.0°C (Figures 6 and 7). CPUE in the RO Channel reached a peak of 1.8 fish/hour on May 18, but trap efficiency was greatly reduced by holes created by beavers during the sampling period (Figure 6). Fish Creek's CPUE was not affected by fish escaping the net due to holes created by beavers during the 2026 sampling.

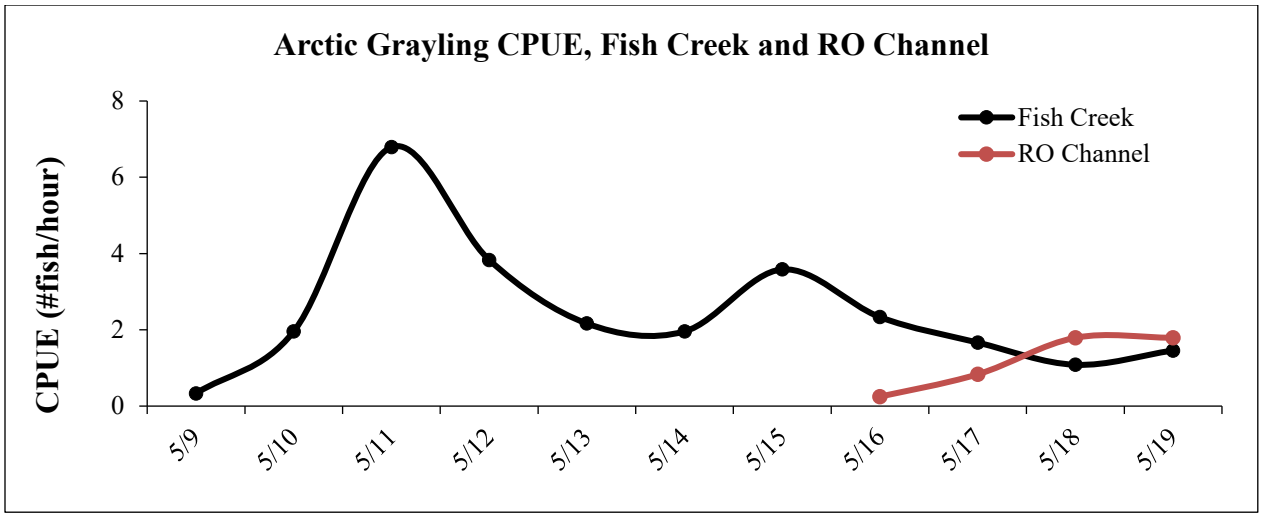

Figure 7.–Arctic grayling catch per unit of effort (CPUE in #fish/hour) in Fish Creek at Pond F and RO Channel fyke nets, 2026.

Female Arctic Grayling Spawning Condition

On May 8, 2026, the first sampling day, 100% of females were classified as not ripe. By May 19, 18% were classified as not ripe, 47% were ripe, and 35% had spawned. (Figure 8). No spawned females were observed during the first eight days of sampling, likely since Fish Creek water temperatures remained below 4°C during this portion of the sampling period (Figure 6). The progression from 100% not ripe to 82% ripe or spawned indicates a temperature-dependent spawning response where the number of fish classified as ripe or spawned increase with water temperature. This initial absence of spawned individuals suggests spawning was delayed until water temperature increased above 4°C. Spawned females have been documented earlier during the sampling period in warmer years where water temperature increased in late April or early May.

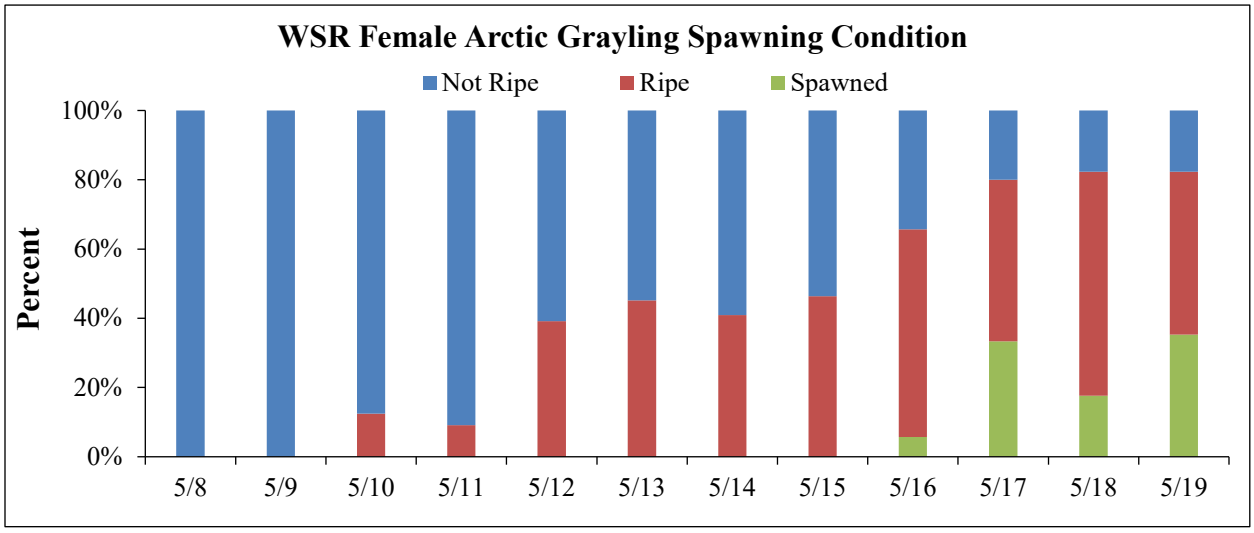

Figure 8.–Spawning condition of female Arctic grayling classified as: not ripe, ripe, or spawned, 2026.

Arctic Grayling Population Abundance

In spring 2026, 615 Arctic grayling ≥240 mm were captured in the Fish Creek and RO Channel fyke nets, of which 98 were recaptures from the 2025 sampling event. The 2026 capture total excludes 144 fish between 200 and 239 mm, as they were likely too small to tag in 2025 based on the average growth rates of juvenile fish, (30–39 mm annually). The 2025 Arctic grayling population estimate was 4,672 fish ≥200 mm (95% CI: 5,454–3,890 fish). Population estimates indicate relatively stable and consistent populations near 4,000 fish in recent years from 2019-2025 (Figure 9). The population remains above the post-mining management goal of 800–1,600 fish ≥200 mm.

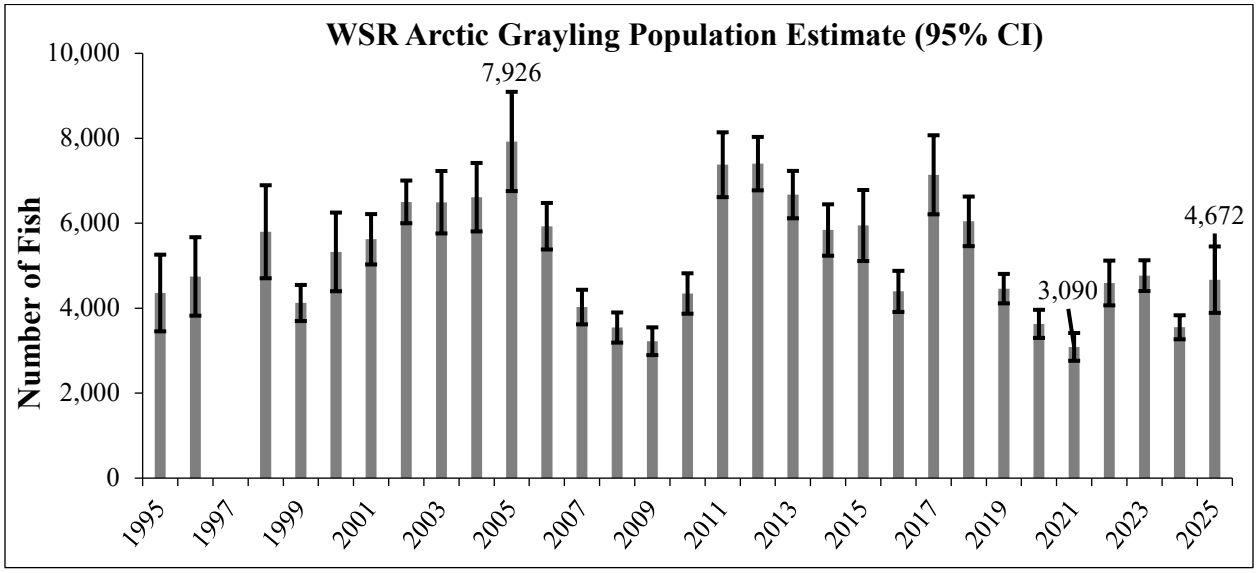

Figure 9.–Annual WSR Arctic grayling population estimates (≥200 mm) with 95% CI, 1995–2025.

Arctic Grayling Recruitment

Recruitment is defined as the total number of untagged Arctic grayling ≥200 mm captured in spring 2026 that were below the tagging threshold (<200 mm) in spring 2025. These age-2 and age-3 individuals typically range from 200–239 mm during spring sampling. Recruitment varies among sampling years, generally following a sinuous pattern. The highest recorded recruitment occurred in 2017 with 406 fish, followed by a decline from 2018–2020 to 41 fish (Figure 10). Recruitment peaked again in 2022 at 370 fish before progressively decreasing from 2023–2025 to 24 fish. In 2025, recruitment increased to 144 Arctic grayling within the 200–239 mm size range, consistent with other years in the dataset.

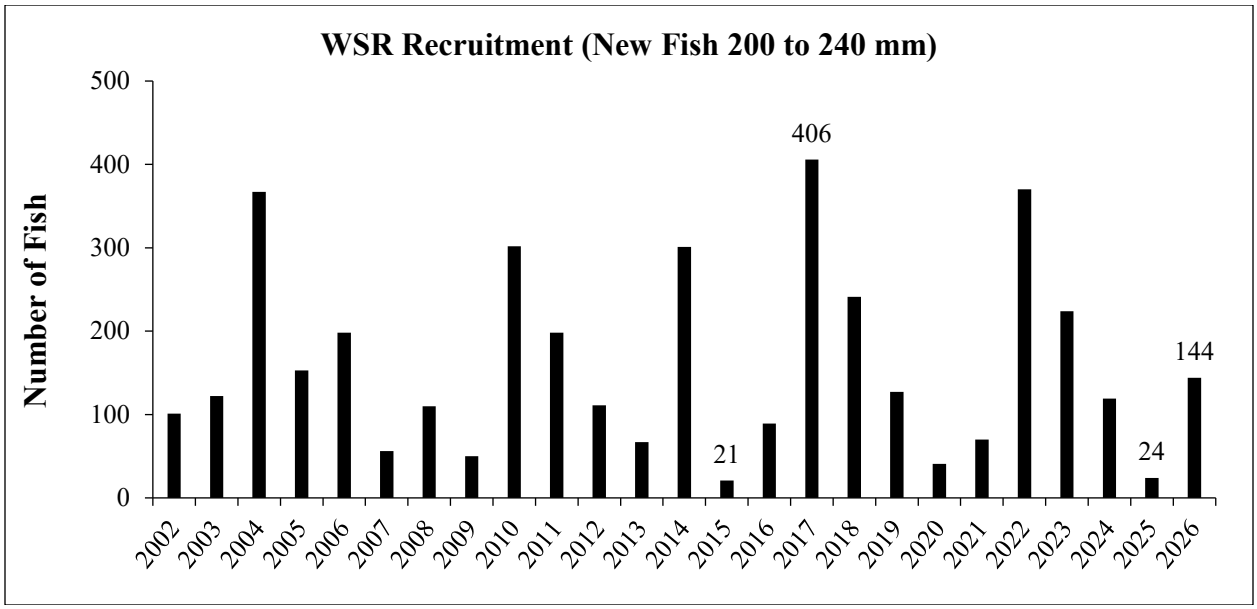

Figure 10.–WSR Arctic grayling recruitment (fish 200–240 mm) 2002–2026.

Arctic Grayling Growth and Length Frequency

Since the construction of the WSR in 1994, the annual average growth of Arctic grayling across size classes has generally increased. Prior to WSR development, growth ranged from 3–17 mm/year among the size classes (Figure 11). In 2026, the average growth for Arctic grayling measuring 220–229 mm at marking was 29 mm (n = 1), while those measuring 280–289 mm exhibited lower average growth of 13 mm (n = 21). This illustrates the decline in annual growth rate as Arctic grayling age and body length increase (Figure 11).

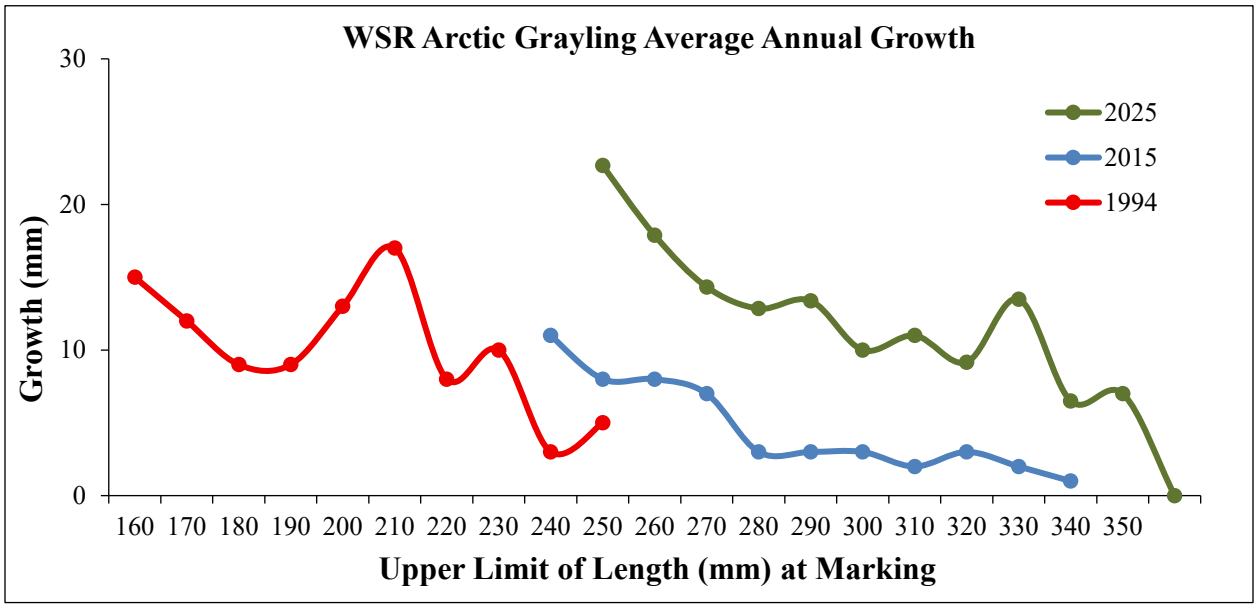

Figure 11.–Average annual growth of Arctic grayling by size group in select years including 1994 baseline (before WSR construction).

The 2026 length frequency distribution of Arctic grayling captured in Fish Creek and the RO Channel fyke nets is presented in Figure 12. Data from 1995, before WSR construction, are included for comparison. The 1995 length frequency distribution reflects the stunted size of individuals in the population due to habitat limitations. The average length in 1995 was 176 mm. The 2026 average length of all 2008 Arctic grayling captured was also 176 mm but consisted of two distinct classes of fish. Juvenile fish <200 mm (n = 1244) averaged 110 mm and made an abundance of small fish within the population. Fish ≥200 mm (n = 764) averaged 268 mm and created a second peak in length frequency larger than the 1995 fish (Figure 12). Sexually immature Arctic grayling, typically <200 mm within the WSR, may not migrate into the Fish Creek wetlands during spawning timing therefore reducing their likelihood of capture in years with persistent low water temperatures like observed in 2025. During the 2026 sampling timing water temperatures were warmer overall and an increased number of juvenile fish were captured compared to 2025 (n = 25).

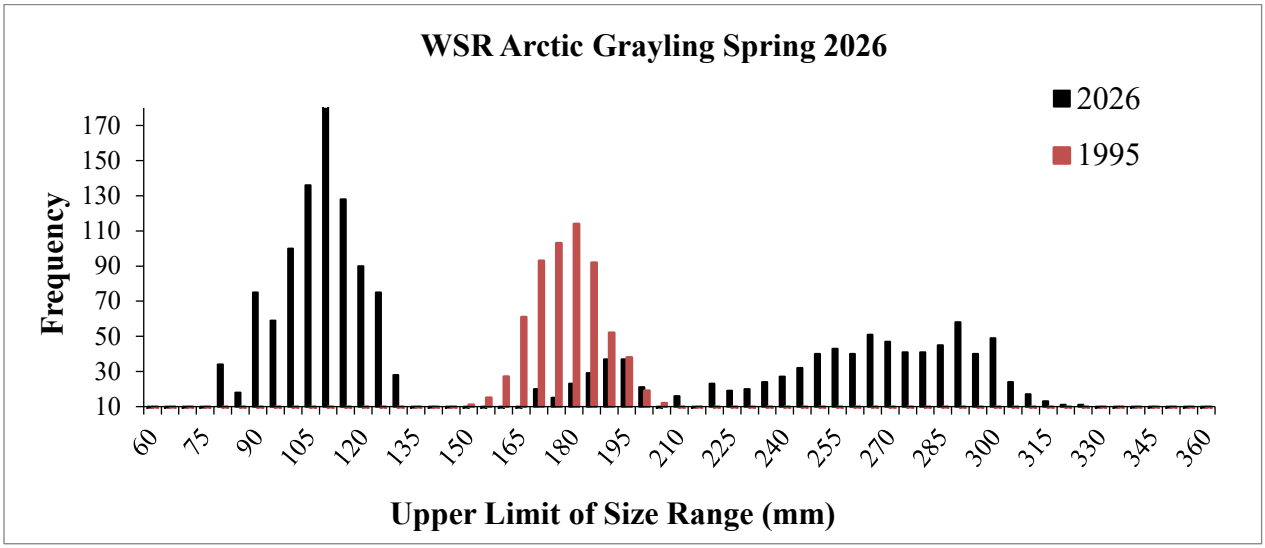

Figure 12.–Length frequency distribution of Arctic grayling captured in Fish Creek, 1995 and 2026.

Pond AB

Pond AB is the uppermost waterbody in the RO Channel wetlands complex, located immediately downstream of the tailings dam and the RO water discharge point (Outfall 002) (Figure 1). Arctic grayling and burbot initially accessed Pond AB during the high RO discharge years (2019–2022). These populations were initially isolated between 2023 and 2025 due to reduced RO discharge rates combined with beaver dam construction, which restricted fish movement within the RO channel. During the spring 2026 sampling eight Arctic grayling that were originally tagged at Pond

F or the lower RO Channel fyke nets were recaptured in Pond AB, showing upstream movement of Arctic grayling into Pond AB. This was the largest upstream movement of fish documented since sampling began. A high-water event, or beaver dam failure, may have allowed fish to pass upstream for a period of time during spring of 2026. However, no downstream movement of fish has been observed, as no Arctic grayling or burbot that were originally tagged in Pond AB have been recaptured in the Pond F or lower RO Channel fyke nets. For the purposes of this report the populations will be discussed separately.

A fyke net was deployed in Pond AB from May 7 to May 19, 2026, capturing 850 Arctic grayling, 349 of which were of taggable size (≥200 mm). Thirty-six Arctic grayling were recaptures from the 2025 sampling event, 28 originally tagged in Pond AB, and 8 tagged in Fish Creek or the lower RO Channel. During the 2023 and 2024 sampling events, two Arctic grayling were recaptured in Pond AB that had been tagged in the lower RO Channel fyke net, suggesting limited upstream fish passage occurs, most likely during high-water events. In 2025, no Arctic grayling were recaptured from the lower RO Channel or Fish Creek sample sites, indicating Pond AB remains generally isolated from the WSR and Fish Creek wetlands populations.

Population Estimate

In 2026, 217 Arctic grayling ≥230 mm were captured in Pond AB, including 28 recaptures from the 2025 Pond AB sampling event. The 2025 population estimate of Arctic grayling ≥200 mm is 1,186 fish (95% CI: 829–1,544), which is higher than the 2024 estimate of 635 (95% CI: 482–789), and lower than the 2023 estimate of 1,243 (95% CI: 866–1,620) (Figure 13).

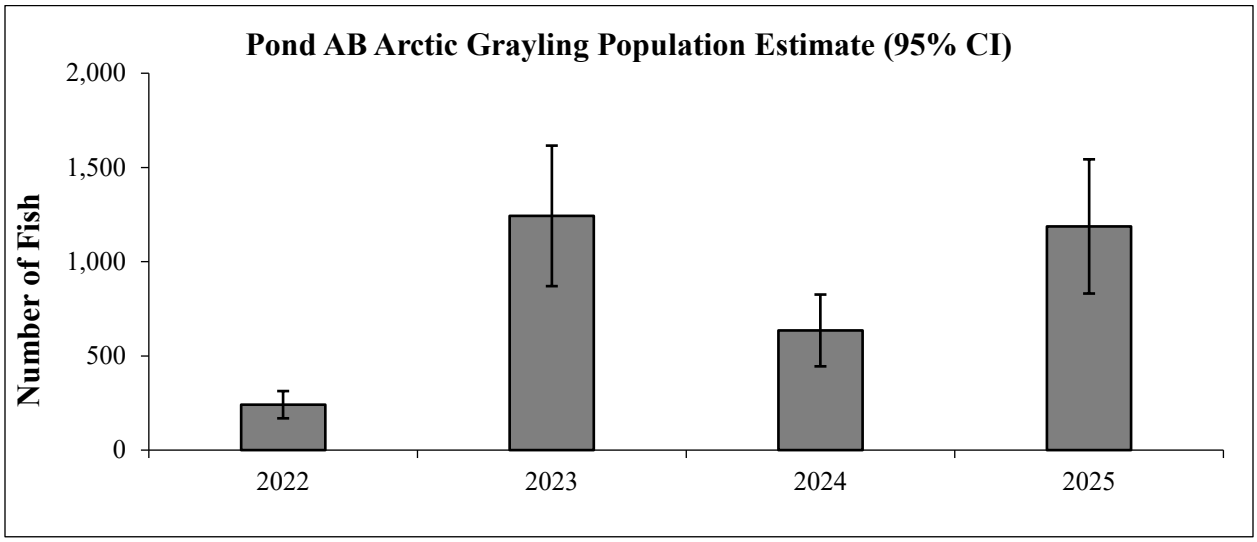

Figure 13.–Annual population estimates of Arctic grayling in Pond AB with 95% CI, 2022–2025.

Length Frequency

Length frequency distributions from 2022–2024 suggests most Arctic grayling in Pond AB belong to a single cohort that entered in 2019. Average length increased from 173 mm (2022) to 237 mm (2023) and further to 261 mm (2024) (Figure 14). In 2024, eight juvenile Arctic grayling (<120 mm) were captured, suggesting successful spawning occurred in Pond AB as the 2019 cohort reached sexual maturity. During 2025 sampling juvenile fish captured increased to 20 individuals.

In 2026, Arctic grayling ranged in length from 70–318 mm, with an average of 174 mm and 264 juveniles (<120 mm) were captured. (Figure 15). The average length declined from 261 mm in 2024 to 189 mm in 2025, and 174 mm in 2026, with 502 of the 849 fish captured below the taggable threshold of 200 mm. These findings support the assumption of ongoing successful spawning within the Pond AB population.

The 2026 length frequency distribution shows increased prevalence of large Arctic grayling compared to 2025 and distinct size classes present in Pond AB (Figure 15). Small fish averaged 110 mm (most abundant), medium size fish averaged 180 mm, while larger fish (235–290 mm) increased compared to 2025 (Figure 15).

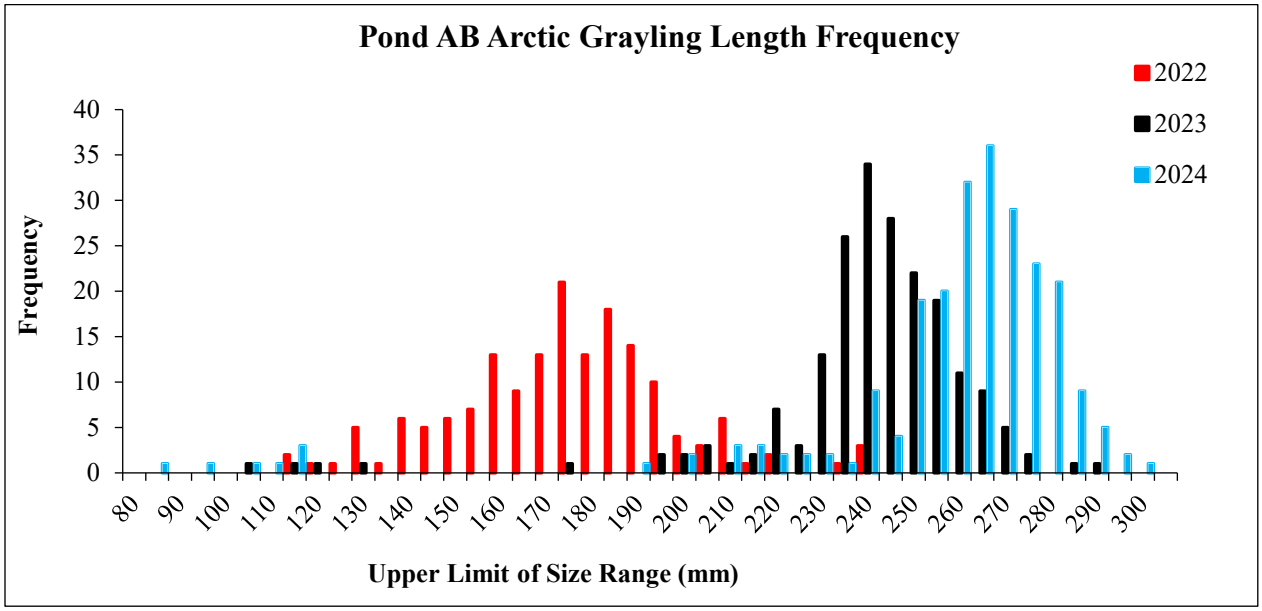

Figure 14.–Length frequency distributions of Arctic grayling captured in Pond AB, 2022–2024.

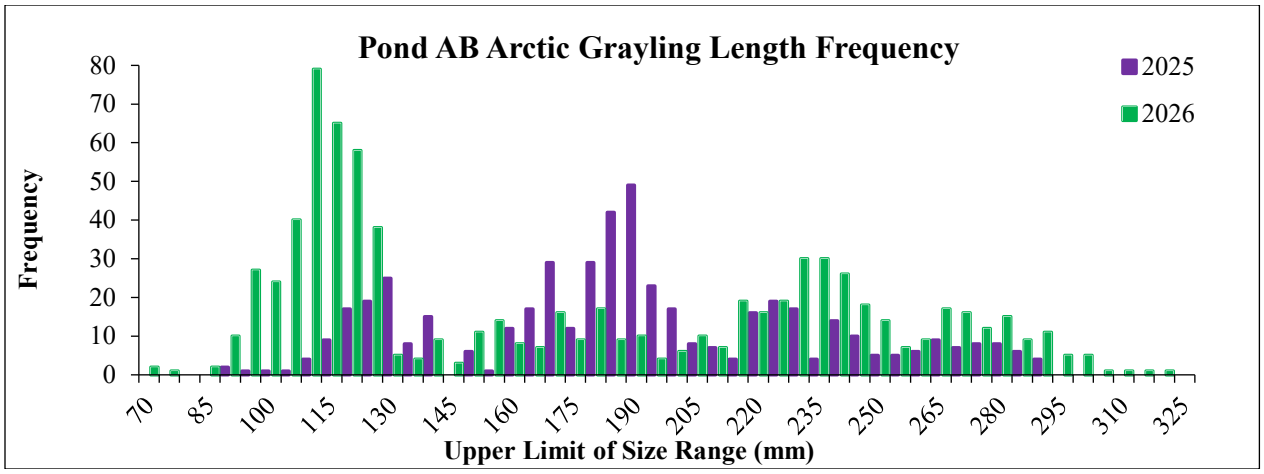

Figure 15.–Length frequency distributions of Arctic grayling captured in Pond AB, 2025–2026.

Growth

In Pond AB small Arctic grayling (200–210 mm) exhibited the highest annual growth, with rates declining as fish age and length increased (Figure 16). Juveniles primarily feed on immature aquatic insects, while adults rely on drifting insects such as black flies, mayflies, stoneflies, and caddisflies. In 2025 and 2026, growth for larger grayling (240–300 mm) was below 10 mm, and overall growth across all size classes was lower than that of Fish Creek Arctic grayling (Figure 16).

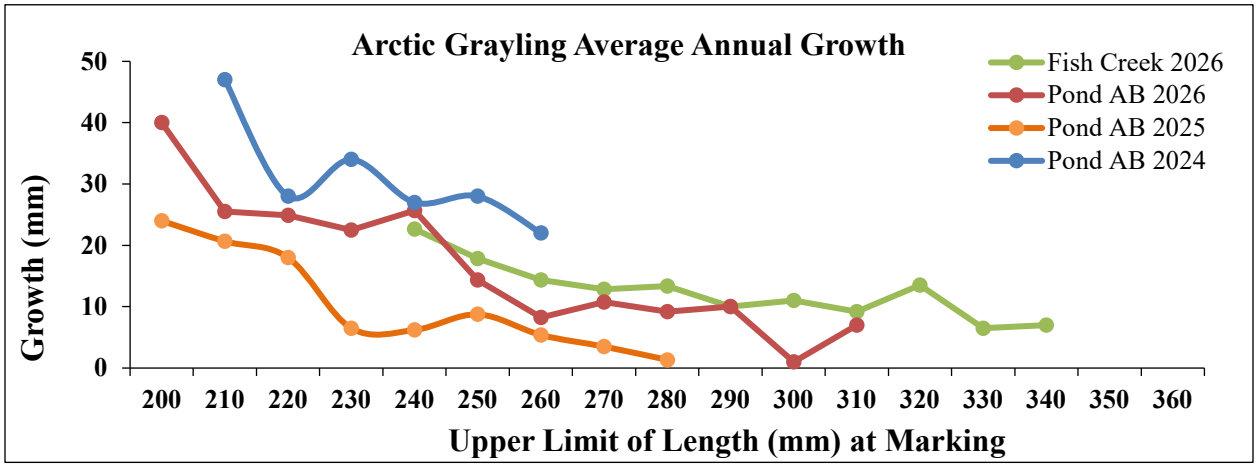

Figure 16.–Average annual growth of Arctic grayling by size group in Pond AB, with Fish Creek growth for comparison.

CPUE

Pond AB CPUE for Arctic grayling ≥200 mm peaked at 2.7 fish/hour on May 10, during the first week of sampling (Figure 17). This was similar timing but lower than Fish Creek's peak CPUE of 6.8 fish/hour on May 11. Most Arctic grayling captured in Fish Creek were ≥200 mm, whereas most Pond AB fish were <200 mm, contributing to its lower CPUE for fish ≥200 mm.

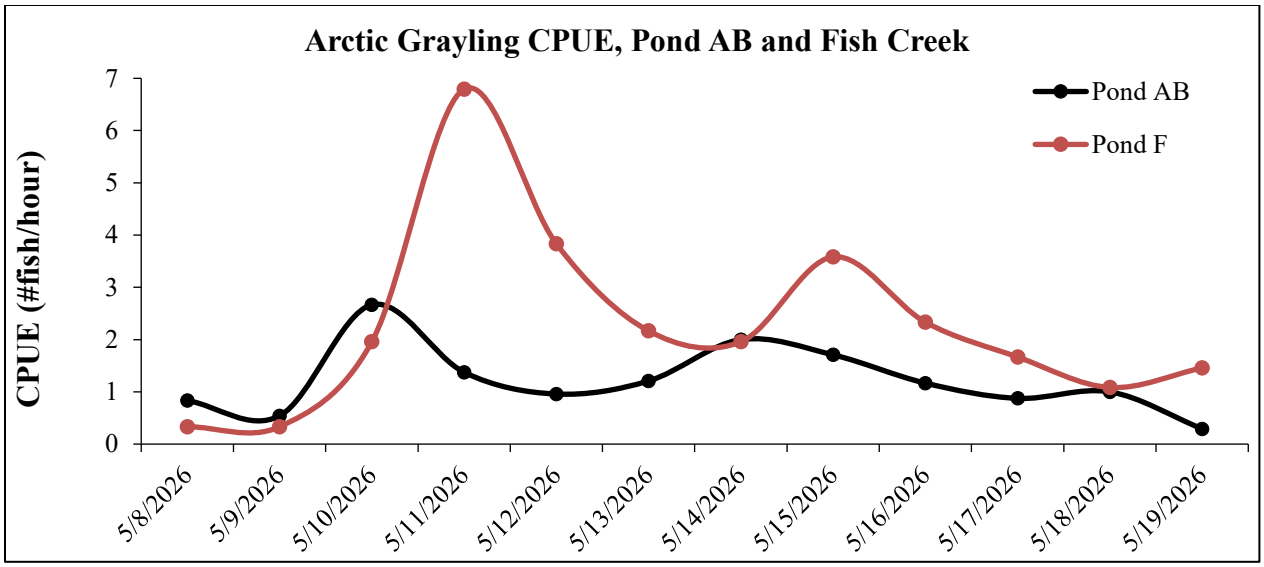

Figure 17.–Catch per unit of effort (CPUE in #fish/hour) for fish ≥200 mm FL captured in the Pond AB and Fish Creek fyke nets, 2026.

Female Arctic Grayling Spawning Condition

No spawned females were observed in Pond AB during the first six days of the sampling period (Figure 18). However, some spawning may have occurred prior to sampling, as water temperature was 5.5°C on May 8, the first day of sampling. Spawning could occur in the RO Channel upstream of Pond AB or downstream below the outlet culverts, where spawned fish could avoid capture. On May 8, 77% of the fish were classified as not ripe. By May 19, 33% of females were classified as not ripe while 66% were ripe or spawned.

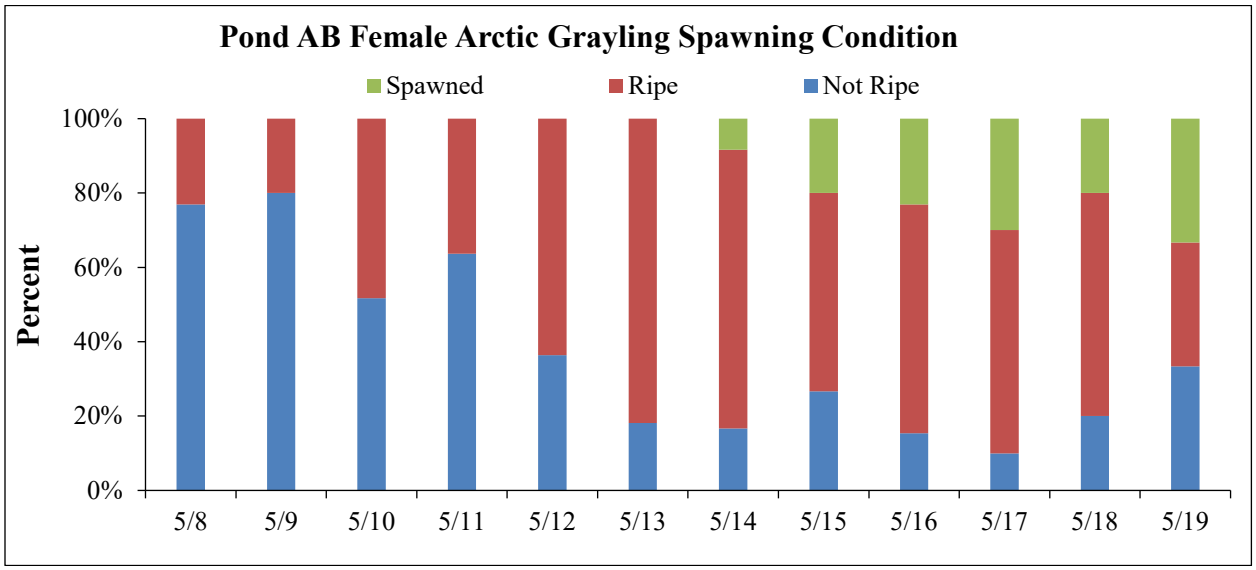

Figure 18.–Spawning condition of female Arctic grayling classified as ripe, not ripe, or spent in Pond AB, 2026.

Other Environmental Observations

Larval *Diplostomulum* of the Eye (Eye Fluke)

During 2024 and 2025 sampling in the Stilling Basin, WSR, and Fish Creek Wetlands, larval *Diplostomulum* of the eye (eye fluke) was detected in the resident burbot population (Bear 2025). In contrast, during the May 2025 sampling, no eye fluke infections were observed among the 775 Arctic grayling captured, indicating the parasite had not become established in WSR or Pond AB Arctic grayling despite high prevalence in WSR burbot. By September 2025, eye fluke prevalence in WSR burbot had increased to 75% of captured individuals. During the same sampling period zero of the 15 burbot captured in Pond AB showed signs of infection. Given this observed parasite increase during the fall 2025 WSR burbot sampling, and the continued presence of the parasite carriers (gulls and snails) observations continued during the spring 2026 Arctic grayling field work to assess whether the parasite was becoming established in WSR or Pond AB Arctic grayling.

During May 2026 sampling, 759 Arctic grayling ≥200 mm were captured in Fish Creek and the RO Channel fyke nets. Each fish was examined for milky pupils indicative of larval eye fluke. Approximately 15% of examined individuals exhibited at least one milky pupil when sunlight was bright and visibility was optimal (Figure 19). Typically, Arctic grayling has uniformly black pupils with yellow to gold irises with no reflective or white structures in the center (Figure 20). Five grayling were collected on May 18, 2026, and submitted to the ADF&G Fish Pathology Laboratory in Anchorage for diagnostic confirmation; results are expected in summer or fall 2026.

Burbot and Arctic grayling occupy the same habitats within the WSR and wetlands complex, and free-swimming eye fluke cercariae can disperse throughout the water column, enabling potential transmission between species. During the same sampling period, 32 burbot were captured in the Fish Creek and RO Channel fyke nets; 10 individuals (31%) showed milky pupils consistent with eye fluke infection (Figure 21). Although this prevalence is lower than the 75% observed in September 2025, the sample size was small and consisted primarily of juvenile fish. Fall 2026 WSR burbot sampling will provide a more representative indication of the population infection rate.

In Pond AB, 349 Arctic grayling larger than 200 mm were captured in May 2026, and none exhibited milky pupils. This is encouraging but may not persist given the documented movement of grayling (eight recaptures) from Fish Creek into Pond AB during 2026 sampling. Three burbot

were also captured in Pond AB, and none showed signs of infection. Based on visual assessments, the largely isolated Arctic grayling and burbot populations in Pond AB appear to remain free of eye fluke at this time. Continued monitoring during each sampling event is recommended.

Figure 19.– Arctic grayling captured in Fish Creek with milky pupils sent for diagnostic analysis, May 2026.

Figure 20.– Arctic grayling captured in Fish Creek with typical all black pupils, May 2026.

Figure 21.– Burbot captured in Fish Creek with eye fluke in both pupils, May 2026.

Glaucous-winged, Glaucous, and Herring gulls are common in Interior Alaska. During May 2026 sampling, 18 gulls were observed flying within the wetlands complex and near the WSR spillway (Figure 22). It is unclear whether these birds are nesting on cliff faces near the spillway or opportunistically feeding on the juvenile fish residing in the WSR and Stilling Basin. These birds are potential hosts for parasites, bacteria, viruses, and fungi that may affect fish populations.

Figure 22.– Gulls observed on the WSR Spillway bridge, May 2026.

Beaver Dam Removal

In May 2025 ADF&G staff breached a large beaver dam at the Pond D outlet, restoring access to spawning habitat within the Fish Creek wetlands complex (Figure 23). Annual breaching or removal of beaver dams at Ponds D, E, and F is necessary to maintain access to the lower wetlands complex (Figure 1). By spring 2026, the Pond D dam had been fully rebuilt and was large and structurally robust (Figure 24). Due to its size and stability, ADF&G staff did not remove the dam as it was beyond our manual labor abilities. Ideally the Pond D dam would be removed during early October, prior to freeze-up, this may allow any fish trapped upriver to move to their primary overwintering habitat in the WSR.

Figure 23.–Pond D outlet in Fish Creek; annual beaver dam removal 2025.

Figure 24.–Beaver dam remaining in Pond D outlet in Fish Creek, May 2026.

Reports Cited:

Bear, 04-03-26; Fort Knox Wetlands Winter Water Quality Sampling Trip Report.

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Chapman, D. G. 1951. Some practices of hypergeometric distribution with applications to zoological censuses. University of California Publications in Statistics. 1:131–160.

Seber, G. A. F. 1982. The estimation of animal abundance. Charles Griffin & Company LTD.

Note: The abundance estimate, and other data presented in this trip report are preliminary. Final estimates will be presented in the ADF&G Technical Report which will summarize all 2026 sampling events in the Fort Knox WSR and associated wetlands.