

TRIP REPORT

**State of Alaska
Department of Fish and Game**

Field Dates: October 1 - 3, 2022
Locations: **Wulik River, Kivalina River and Ikalukrok Creeks**
Objectives: Surveys of overwintering Dolly Varden and Chum Salmon
Participants: Chad Bear (ADF&G) and Fred DeCicco (DeCicco Consulting)
Weather: Sunny, 5 mph wind, 20's and 30's °F
Access: AC135 Helicopter

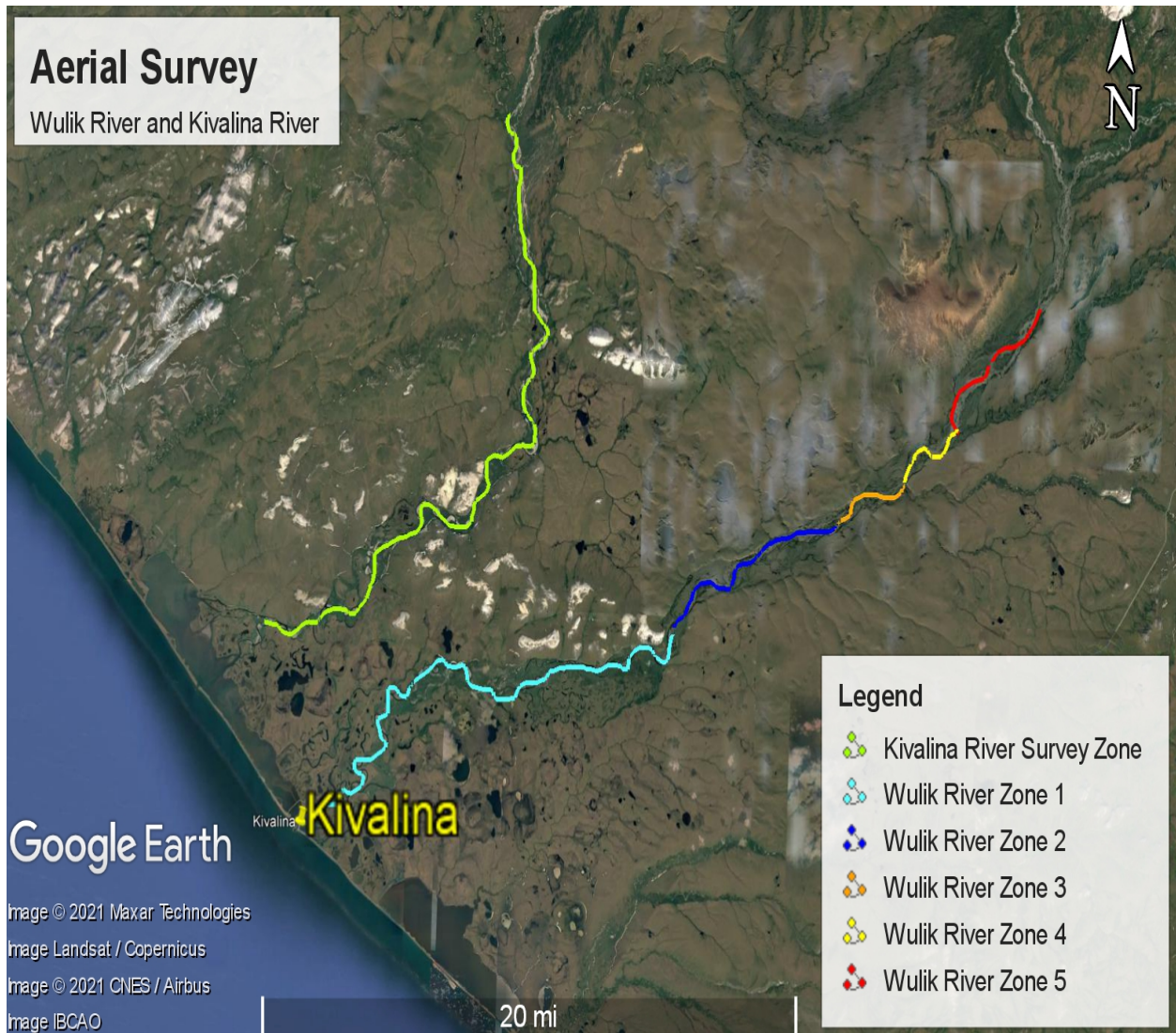


Figure 1. Dolly Varden and chum salmon aerial survey index area locations in the Wulik and Kivalina rivers.

On October 1, Chad Bear and Fred DeCicco traveled to the Red Dog Mine to conduct the annual fall surveys and fish collections. Specific goals to accomplish were: 1) to estimate number of overwintering Dolly Varden in the Wulik River, 2) to estimate the number of overwintering Dolly Varden in the Kivalina River, 3) perform observations of chum salmon in Ikalukrok Creek, 4) collect seven overwintering Dolly Varden for element analysis, and 5) collect Dolly Varden for an otolith microchemistry study.

Wulik River – aerial survey for Dolly Varden & chum salmon

The Wulik River is divided into five zones in relation to the mouth of Ikalukrok Creek (Figure 1). Zone 1 is between the Kivalina village water intake pump and Sivu Hill. This section typically has Dolly Varden mixed in among schools of chum salmon. Zone 2 is from Sivu Hill to Driver's Camp and the river becomes braided in this section. Each braid is flown during the survey. Zone 3 is between Driver's Camp and the mouth of Tutak Creek. Zones 3 and 4 are only about two miles each as the Dolly Varden are typically more concentrated here. Zone 4 is from Tutak Creek to the upriver most mouth of Ikalukrok Creek. Zones 3 and 4 are generally the primary locations for Dolly Varden residing in the Wulik River during late fall. Zone 5 continues upriver from the mouth of Ikalukrok Creek for about three river miles or until Dolly Varden density becomes low. Ikalukrok Creek is surveyed from the mouth upriver to Dudd Creek. Dolly Varden observed in lower Ikalukrok Creek are considered fall spawning fish and are not included in the Wulik River overwintering estimate.

In mid-September 2022 the remnants of Typhoon Merbok impacted Northwest Alaska villages along the Bering Sea coast, and it brought high precipitation to the Red Dog area. The Wulik River peaked at over 14,000 cfs, but by October 2 it had dropped to 1200 cfs, which is higher than the preferred 500 to 700 cfs for the aerial survey, but manageable. Water levels had dropped and were mostly clear in Zones 1 - 3. Turbidity originating from Ikalukrok Creek partially obscured visibility and impacted the estimates of Dolly Varden in the deep-water areas of Zone 4 but was less of an impediment than during the 2019, 2020 and 2021 surveys (Figure 2). Zone 5 is upriver from the mouth of Ikalukrok Creek and was not impacted by the turbidity.

The aerial survey of the Wulik River was conducted by helicopter on October 2. The AC135 helicopter flew between 300 and 500 ft elevation and about 10 mph during the survey. The skies were clear with bright sunlight for most of the survey. The three-day weather window was fortunate timing as the following two weeks were forecast to be wet and snowy before the helicopter departed Red Dog on October 15 for the 2022 season.

Estimates of overwintering Dolly Varden and spawning chum salmon abundance and distribution in the Wulik River are presented in Table 1. Survey counts include live and dead chum salmon.



Figure 2. A portion of Wulik River Zone 4 illustrating the partial obscurity from Ikalukrok Creek turbidity and a school of overwintering Dolly Varden, October 2, 2022.

Table 1. Estimated numbers of Dolly Varden and chum salmon observed during an aerial survey of the Wulik River and Ikalukrok Creek, October 2, 2022.

| Wulik River Survey Area | Index Area | Dolly Varden | Chum Salmon | Other Salmon ^b |
|--------------------------------|-----------------|---------------------|---------------|---------------------------|
| Kivalina to Sivu hill | Zone 1 | 21,045 | 13,713 | 14 |
| Sivu Hill to Driver's Camp | Zone 2 | 16,680 | 175 | 21 |
| Driver's Camp to Tutak Creek | Zone 3 | 17,020 | 0 | 8 |
| Tutak Creek to Ikalukrok Creek | Zone 4 | 15,850 ^a | 0 | 13 |
| Upstream of Ikalukrok Creek | Zone 5 | 3,887 | 390 | 11 |
| Lower Ikalukrok Creek | Lower Ikalukrok | Turbid | Turbid | Turbid |
| Total | | 74,482 | 14,278 | 67 |

^a Minimum estimate due to partial turbidity in the deep-water areas.

^b The “other salmon” category is for bright red spawning salmon (coho, sockeye or Chinook) that could not be definitively identified to species during the aerial survey.

During 2019 and 2020 high turbidity originating from Ikalukrok Creek obscured visibility. In 2019 only Zone 5, upstream of Ikalukrok Creek, had clear water and fish numbers could be estimated. In 2021, air and water temperatures had been cold in late September resulting in reduced discharge from the turbid ground water seeps in Ikalukrok Creek, visibility was improved and fish in all zones could be observed and estimated. The 2022 survey was one week earlier than the October 8, 2021, survey and air and water temperature were not unseasonably cold. Visibility was partially obscured in Zone 4 but acceptable for a minimum aerial survey estimate. Turbidity was diluted in Zones 1 – 3 and water was clear resulting in good survey conditions.

The number of overwintering Dolly Varden estimated during the Wulik River aerial survey varies annually. From 2005 to 2013 the population appeared to be in a general decline. However, since 2014 the estimates of Dolly Varden increased and appear to be relatively stable (Figure 3).

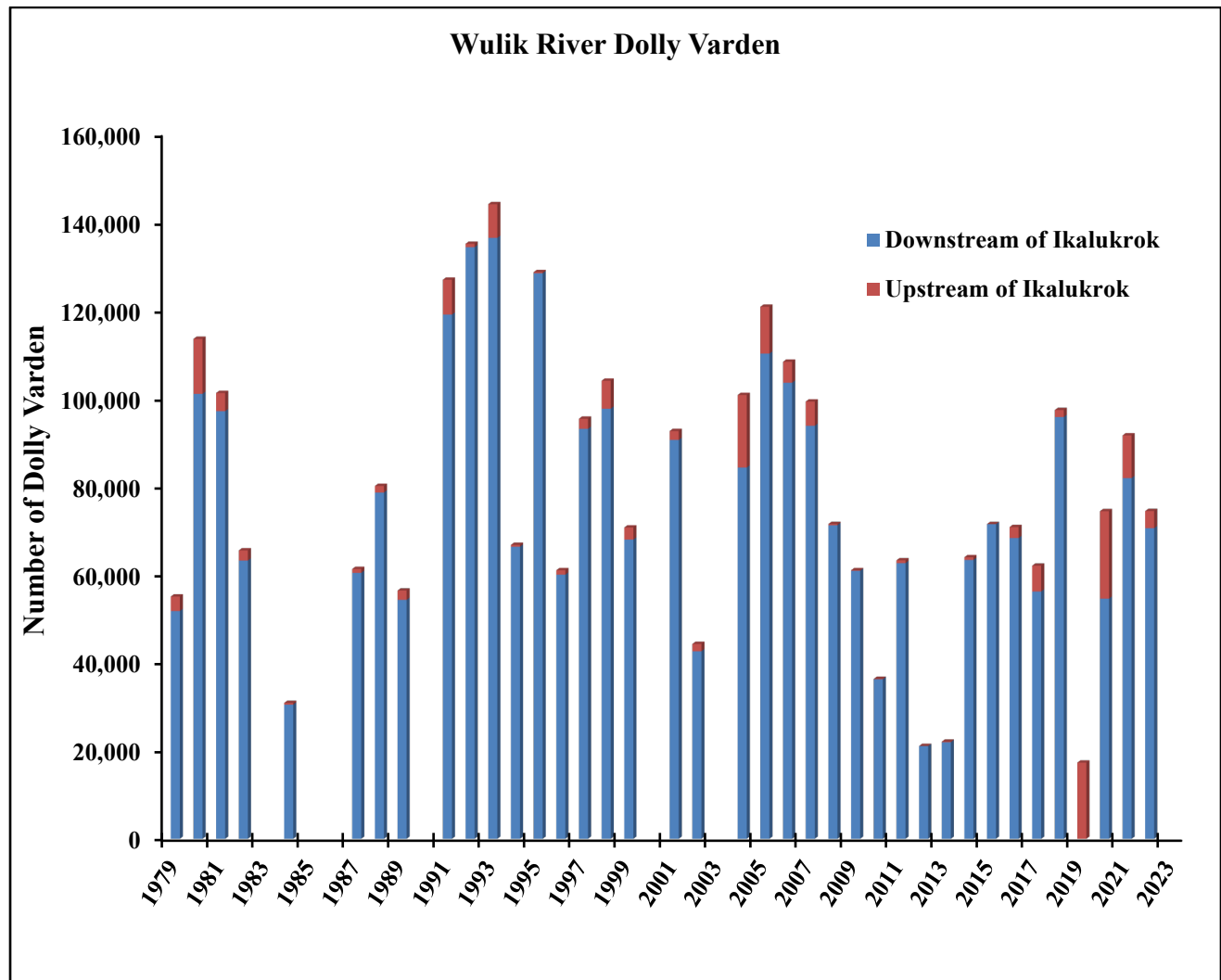


Figure 3. Aerial survey estimates of overwintering Dolly Varden in the Wulik River (Zones 1-5), 1979 – 2022.

In Zone 5, upriver of the confluence of the Wulik River and Ikalukrok Creek, the estimated number of overwintering Dolly Varden has varied. Typically, it has been less than 10% of the total count (Figure 3). Zone 5 estimates range from just a few hundred fish (1984, 2009, 2010) to over ten thousand fish (2004, 2005, 2019, 2020). During the 2018 survey, the Zone 5 estimate was 1,590 fish with 98 percent of overwintering Dolly Varden below Ikalukrok Creek in Zones 1 – 4. During the 2019 survey 17,308 fish were observed in Zone 5 and in 2020 there was 19,860, the highest two years recorded (Figure 4). In 2021 and 2022, 9,700 and 3,887 Dolly Varden were observed respectively upriver of Ikalukrok Creek in Zone 5. These numbers are closer to the typical under 10% observed in most years prior to the increase in the turbid ground water seeps in Ikalukrok Creek (Figures 3 & 4).

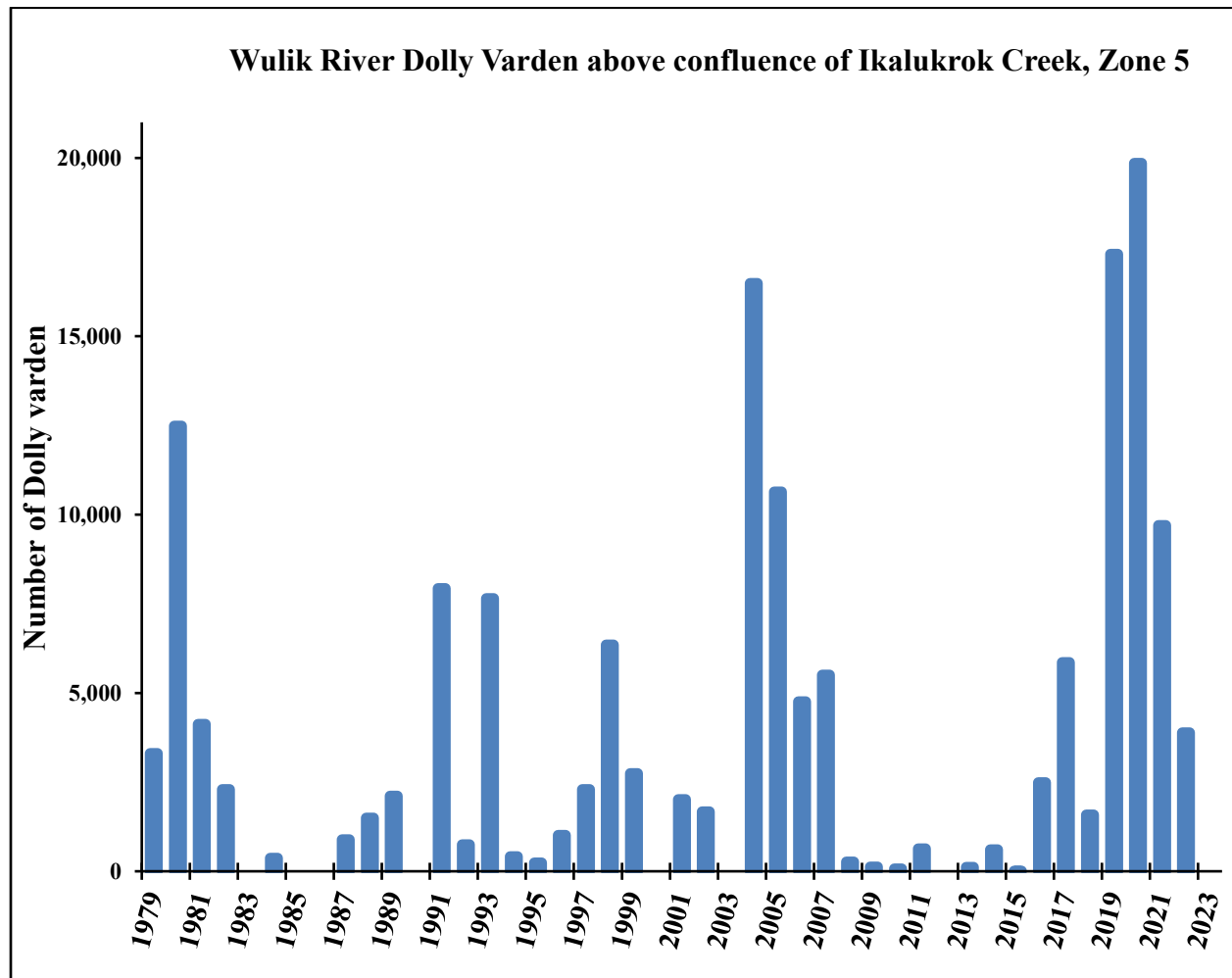


Figure 4. Aerial survey estimates of Dolly Varden in the Wulik River, above Ikalukrok Creek (Zone 5), 1979-2022.

Kivalina River – aerial survey for Dolly Varden & chum salmon

After completion of the Wulik River survey, the Kivalina River was surveyed for overwintering Dolly Varden and spawning chum salmon. The Kivalina River is similar in gradient and flow to the Wulik River, and the proximity would allow for Dolly Varden movement between the two drainages (Figure 1). Both rivers originate from the western end of the Brooks Range and flow into Kivalina Lagoon before entering the Chukchi Sea. The Kivalina River survey began at GPS coordinates 67.807726 N, -164.555923 W, where the river confines into a single channel from its braided delta. All river channels were surveyed until the river branched into two large tributaries at 68.02142 N, - 164.255800 W (Figure 1).

Fred DeCicco (retired ADF&G biologist) surveyed the Kivalina River regularly during his research on Dolly Varden in Northwest Alaska, and his estimates ranged from 45,355 fish in 1981 to 5,474 fish in 1984 (DeCicco 1985). Low and high estimates of Dolly Varden in the Kivalina River tended to correspond to low and high numbers of fish in the Wulik River (DeCicco 1985). During the 2022 survey of the Kivalina River 11,803 Dolly Varden and 1,546 chum salmon were estimated (Table 2). Bright red salmon (44) also were observed in small schools making redds and actively spawning. These were coho, sockeye or Chinook salmon, but species could not be distinguished from the air.

Table 2. Estimated numbers of Dolly Varden, chum salmon and other salmon observed during an aerial survey of the Kivalina River, October 3, 2022.

| Kivalina River Survey | Dolly Varden | Chum Salmon | Other Salmon^a |
|---------------------------------|---------------------|--------------------|---------------------------------|
| Start 67.80772 N, -164,555923 W | 11,803 | 1,546 | 44 |
| End 68.02142 N, -164.255800 W | | | |

^a The “other salmon” category is for bright red spawning salmon (coho, sockeye or Chinook) that could not be definitively identified to species during the aerial survey.

Ikalukrok Creek – aerial survey for spawning chum salmon

After completion of the Wulik and Kivalina Rivers survey areas, we flew Ikalukrok Creek looking for spawning chum salmon. This survey is typically performed in mid to late September but the storm in mid-September postponed the 2022 survey. Ikalukrok Creek has been turbid & difficult to survey since 2019 when 12 tributaries began discharging high-sediment and mineralized water from natural seeps. The river has become turbid and visual counting of salmon has not been possible in the mainstem. Water clarity has not improved and in 2022 we were not able to estimate the total number of spawning chum salmon (Figure 5). We observed 208 live and dead chum salmon in lower Ikalukrok Creek in clear water side channels or washed up on the riverbanks (Figures 5 and 6). Approximately 100 live chums were observed in a small clear side channel actively spawning at GPS coordinates 67.9129 N, -163.4993 W (Figure 6). Despite the increase of

suspended sediment and highly mineralized water in the mainstem of Ikalukrok Creek, chum salmon continue to be observed in clear spawning areas in the lower portion of the river.



Figure 5. Turbid water in Ikalukrok Creek obscuring visual estimates. Chum salmon carcasses observed on riverbanks.



Figure 6. Chum salmon spawning in clear side channel of Ikalukrok Creek, October 3, 2022.

Wulik River – fish tissue collection

Adult Dolly Varden were sampled using hook and line gear in the Wulik River downriver of the mouth of Ikalukrok Creek on October 2. Seven Dolly Varden in overwintering condition were retained for element analysis (Figure 7). These fish were individually bagged and frozen, then transported back to Fairbanks where they were stored at -15°F to be dissected and analyzed for element concentrations. Two hours of hook and line effort were needed to capture these seven Dolly Varden. This is in comparison to June when forty-two hours were necessary to capture the seven samples, because most fish had departed the Wulik River to spend the summer in the ocean.



Figure 7. Dolly Varden in overwintering condition retained for element analysis. Mainstem Wulik River downstream of Ikalukrok Creek.

Wulik River Genetics and Microchemistry Study

The ADF&G Division of Sport Fish and the University of Alaska Fairbanks (UAF) is conducting a genetics and microchemistry study to better understand the distribution and movements of Dolly Varden in Northwest Alaska drainages. Previous research indicates that Dolly Varden in this region display complex movements among rivers for spawning and overwintering, however the frequency and extent of these inter-drainage movements remains unknown. Assessment of seaward migration frequency and overwintering-site fidelity has remained difficult due to the remoteness of the area and the high cost and logistical challenges associated with conventional tracking studies. This study will use the strontium (Sr) concentrations and $^{87}\text{Sr}/^{86}\text{Sr}$ isotope signatures in otoliths collected from Dolly Varden captured in major spawning rivers and subsistence fisheries in the region to evaluate the frequency of seaward and inter-drainage migrations, which may help identify spawning populations and life history strategies that are encountered more frequently in harvests and elucidate the poorly understood interchanges between feeding, overwintering, and spawning areas (Joseph Spencer, ADF&G Sport Fish Fairbanks, personal communication).

To assist in this microchemistry study, eight fall spawning Dolly Varden were captured at the confluence of the East and West Fork Wulik Rivers (67.9999 N, -163.4500 W). There were

actively spawning chum salmon and bright red salmon mixed with fall spawning Dolly Varden (Figures 8 and 9). An additional 12 Dolly Varden were retained from the West Fork Wulik River (68.180451 N, -163.398426 W) below a canyon and series of rapids (Figures 10 and 11). Fred DeCicco documented fall spawning Dolly Varden here during his work as the ADF&G Northwest area biologist. During his work he typically observed 20 to 30 fall spawning Dolly Varden at this location. During the 2021 survey we observed 70 spawning at this location; and in 2022 there were 40 Dolly Varden actively spawning in the river below the falls (see ADF&G Habitat Trip Report 10-08-21). One resident Dolly Varden (155 mm) was captured here but not retained (Figure 12).



Figure 8. Post spawning chum and sockeye salmon carcasses found at the confluence of the East and West Fork Wulik Rivers, October 2, 2022.



Figure 9. Fall spawning Dolly Varden, confluence of the East and West Fork Wulik Rivers.



Figure 10. Fall spawning Dolly Varden male (top) and female (bottom), October 2, 2022.



Figure 11. Fall spawning Dolly Varden, West Fork Wulik River, October 2, 2022.



Figure 12. Resident Dolly Varden, West Fork Wulik River (~155 mm), October 2, 2022.

Water samples from both the Kivalina and Wulik rivers were required as part of the Sport Fish microchemistry study. These were taken from the Wulik River at coordinates 67.8720 N, -163.705 W, and the Kivalina River at 67.8090 N, -164.5740 W on October 3 (Figure 13).



Figure 13. Collecting water samples from the Kivalina River for microchemistry study, October 3, 2022.

Report Cited:

DeCicco, A. L. 1985. Inventory and catalog of sport fish and sport fish waters of western Alaska. Part A. Alaska Dept. Fish and Game. Annual performance report, project F-9-17, Study G-I, Volume 26.