

U.S. Fish and Wildlife Service

APPENDICES FOR THE REPORT:

Migration Patterns of Adult Fluvial Bull Trout in the Methow and Columbia Rivers During 2007

Appendix 1: Descriptions and Maps of the Movements of Bull Trout

Appendix 2: Analysis of Resident Bull Trout in Early Winters Creek



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On the cover: Adult fluvial bull trout in the Lost River. USFWS photo by Mark C. Nelson

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Appendix 1: Descriptions and maps of the movements of bull trout

Appendix 1 contains detailed descriptions and maps of the movements of individual radio-tagged adult fluvial bull trout in the Methow and Columbia rivers during 2007. The movements in 2006 are presented for a few bull trout that exhibited unusual behavior in comparison to 2007. When data were available, movements in the Columbia River are presented. For detailed information of the movements of tagged bull trout at the hydroelectric dams, see the annual reports of the bull trout monitoring programs of Chelan County Public Utility District (Stevenson et al. 2008) and Douglas County Public Utility District (LGL and DCPUD 2008). For information of the movements of bull trout in 2006, see Nelson *et al.* (2007).

The appendix is organized into sections based on the agency that tagged the fish. Maps and descriptions of the movements of twelve bull trout tagged by the U.S. Fish and Wildlife Service (USFWS), seventeen bull trout tagged by Douglas County Public Utility District (DCPUD), and ten bull trout tagged by Chelan County Public Utility District (CCPUD) are presented.

Bull trout tagged by U.S. Fish and Wildlife Service

Code 70 (Figures 1 and 2). Bull trout code 70 was tagged in the Lost River on April 4, 2006; see Nelson et al. (2007) for a description of its 2006 movements. From November 29, 2006 to June 15, 2007 code 70 was located near the town of Methow (rkm 18.8), overwintering at the same general location it held in spring 2006. It began its upstream migration and was detected near Gold Creek during a mobile survey on June 18. It passed the TG fixed station at rkm 64.6 on June 24 and the MC station at rkm 80.6 on June 28, 2007. On June 29 it was detected in the Methow River upstream of the Chewuch River confluence during a mobile survey. Code 70 passed the LW station at rkm 117.5 on July 12 and migrated up the Lost River. It was detected in the Lost River Gorge, downstream of Monument Creek, during an aerial survey on September 5. It moved back downstream and passed the LW station at the Lost/West Fork confluence at 0010 hours on September 30. Prevented by the dry reach from continuing downstream, it moved back upstream past the station 2 hours later. It was next detected at 1328 hours on November 8 during foot tracking at rkm 3 in the Lost River, where it was observed with a 500 mm bull trout and photos were taken (Figure 1). It moved downstream later that day and was detected passing the LW station at 1905 hours. During the next tracking session on November 20, the motionless signal 170 was detected and tracked in the dry reach at rkm 112. The carcass was recovered 25 meters from the bank, where it was buried in a log pile and covered with hardened snow. The head was eaten back to the gills and the dorsal, anal, and pelvic fins were also gone. It is unknown if the bull trout was scavenged or depredated.



Figure 1. Photograph of USFWS bull trout code 70 in the Lost River on November 8, 2007.

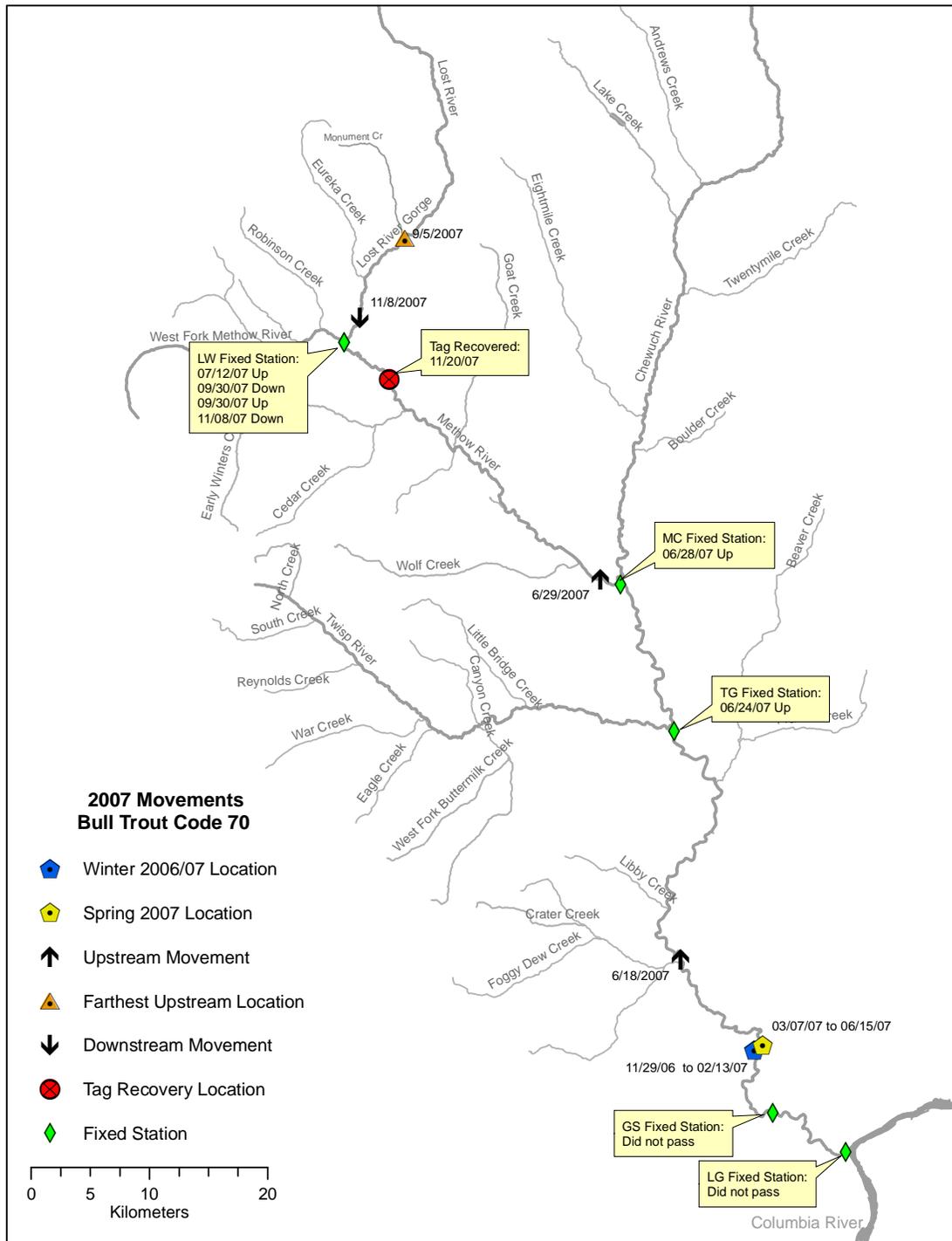


Figure 2. Map of the movements of USFWS bull trout code 70 during 2007.

Code 71 (Figure 3). Bull trout code 71 was tagged in the Lost River on April 4, 2006; see Nelson et al. (2007) for a description of its movements during 2006. Code 71 overwintered near Black Canyon (rkm 11.2) from November 15, 2006 to May 17, 2007. It made one short movement downstream when it was detected at the GS station (rkm 10.6) on January 29 and February 7, 2007. After beginning its upstream migration it was detected at rkm 24 during a mobile survey on May 31. It was recorded passing the TG station (rkm 64.4) on June 17, the MC station (rkm 80.6) on June 20, and the LW station (rkm 117.5) on July 8. It migrated up the Lost River and was detected in the Lost River Gorge downstream of Monument Creek during the aerial survey on September 5. It migrated downstream and passed the LW station on October 4 and was detected upstream of the dry reach at rkm 116.5 during mobile surveys on October 31 and November 8. As the dry reach slowly rewatered, it moved downstream and was located at rkm 112.6 during mobile surveys on November 20 and 21. On November 28, the motionless signal 171 was detected and the tag was recovered within the dry channel. No bones or body parts were found, but coyote tracks were noted in the snow of the recovery area.

Code 73 (Figure 4). Bull trout code 73 was tagged at rkm 77 of the Methow River on April 6, 2006; see Nelson et al. (2007) for a description of its 2006 movements. Code 73 overwintered at its tagging location at rkm 77.2 until June 22, 2007. It moved upstream, passed the MC station and entered the Chewuch River on June 24. It was detected during mobile surveys in the lower river on June 26 to 29. Code 73 migrated past the LC station at the mouth of Lake Creek (rkm 37.5) on July 6. During mobile surveys on July 10 it was detected at rkm 45 and on July 11 to July 18 it was located at rkm 47.5. On August 31 the tag transmitted the motionless code 173 near the Thirty Mile trailhead at rkm 50.7. The tag and jawbone were recovered on the bank and apparently the bull trout was depredated by an unknown predator.

Code 75 (Figure 5). Bull trout code 75 was tagged at rkm 6.6 in Wolf Creek on July 18, 2006; see Nelson et al. (2007) for a description of its 2006 movements. Code 75 overwintered at rkm 88.5 in the Methow River, 3.5 rkm upstream of the Wolf Creek confluence. It entered Wolf Creek and passed the WC station (rkm 1.4) on July 2, 2007. On July 10 it was detected downstream of the log jam at rkm 6.6 and it appeared low stream flow prevented passage of the obstacle. Rain on July 22 substantially increased flow to allow passage and on July 24 code 75 was recaptured during angling upstream of North Fork Wolf Creek. The transmitter antenna was broken and the fistula had healed completely over (Figure 6). The implantation incision was headed, but remnants of suture material were still evident in the needle puncture holes one year after surgery (Figure 7). Code 75 remained in the vicinity of North Fork Wolf Creek during the spawning season before it moved downstream and was detected in Wolf Creek at rkm 8 on November 20. It spent the winter in Wolf Creek but was not detected during aerial surveys on February 15 and April 21, 2008 due to the limited transmission distance of its broken antenna. The tag was recovered at rkm 7.2 on July 16, 2008. Because the tag was found in a small log jam buried under sediment deposited during spring runoff, code 75 apparently died during the winter or early spring.

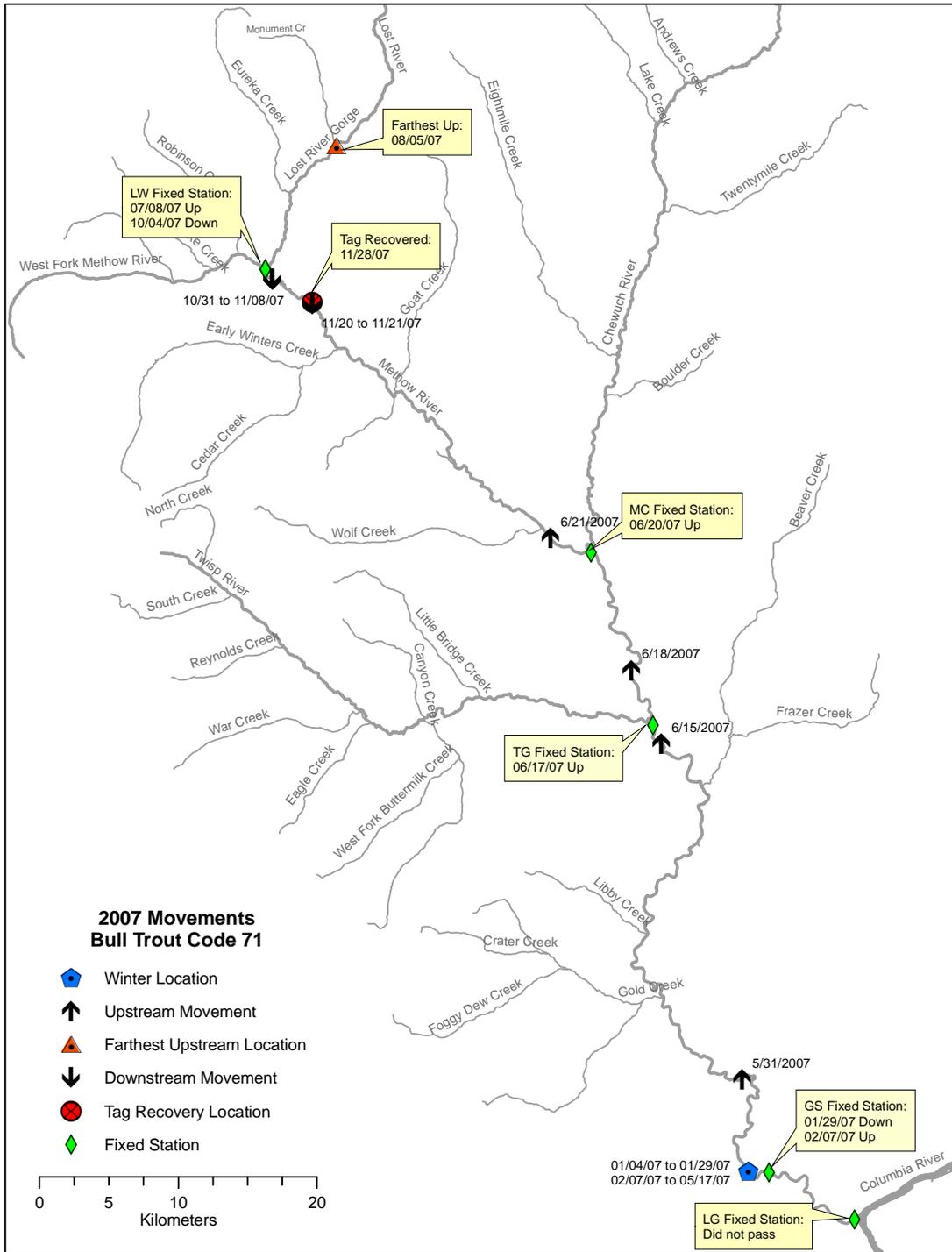


Figure 3. Map of the movements of USFWS bull trout code 71 during 2007.

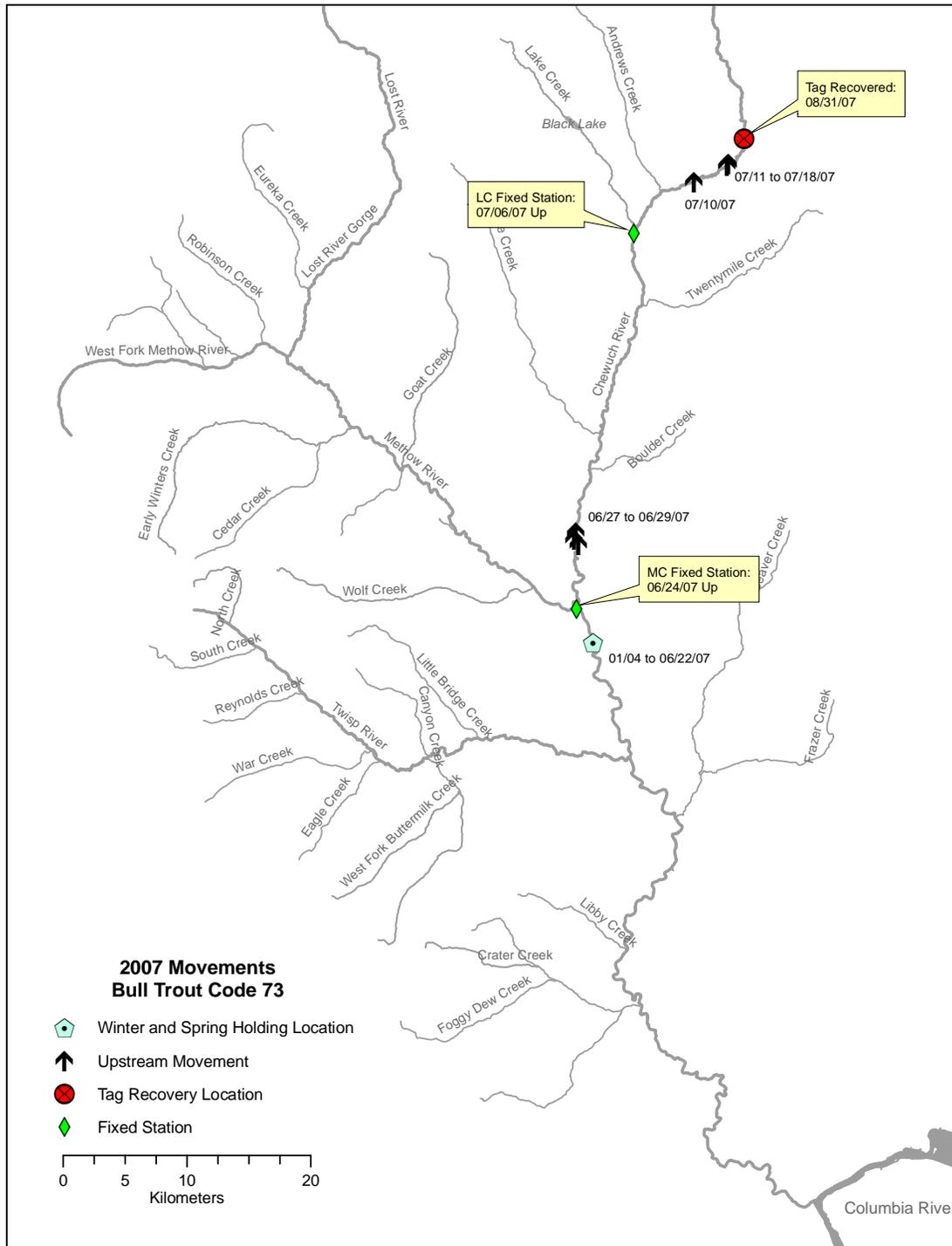


Figure 4. Map of the movements of USFWS bull trout code 73 during 2007.

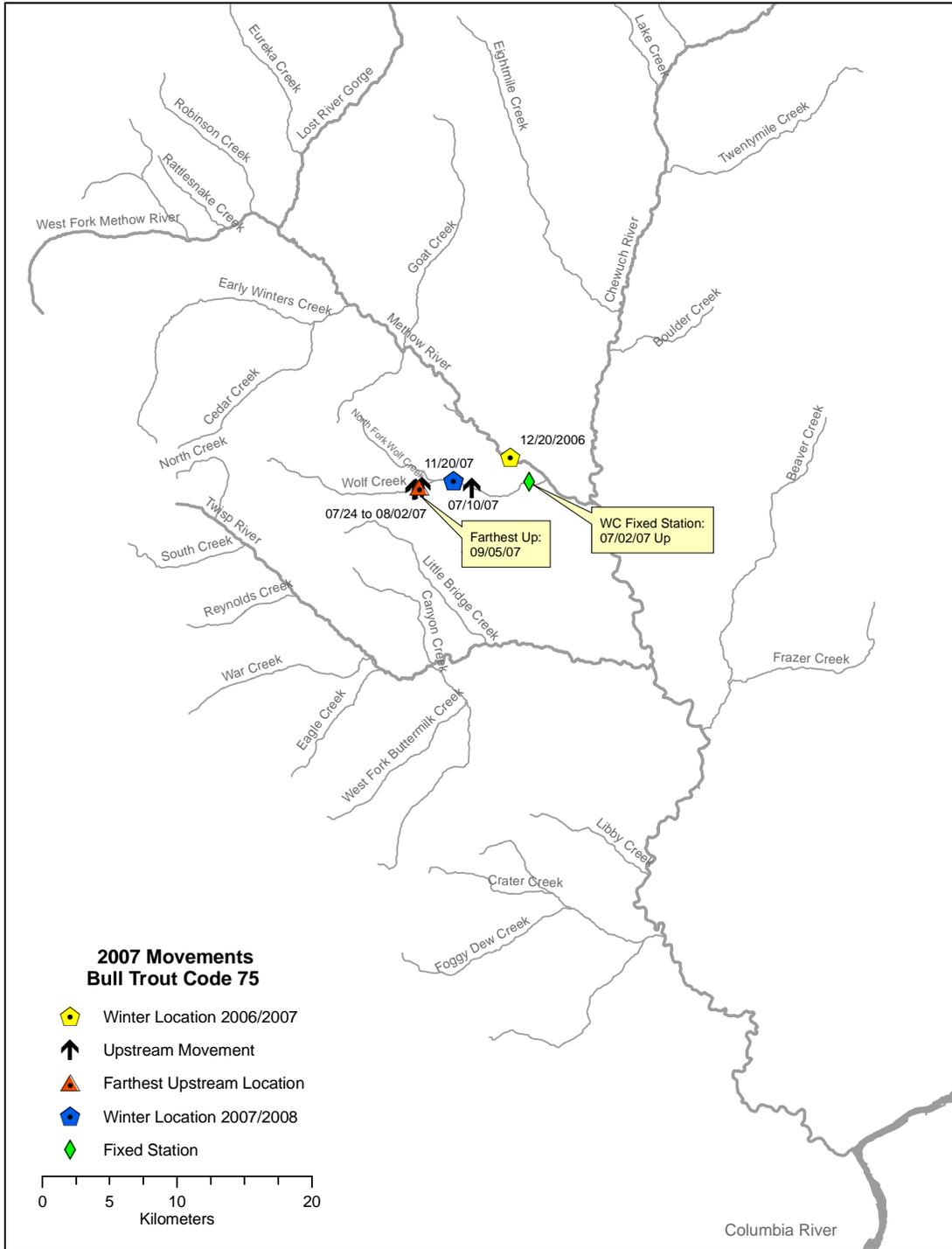


Figure 5. Map of the movements of USFWS bull trout code 75 during 2007.

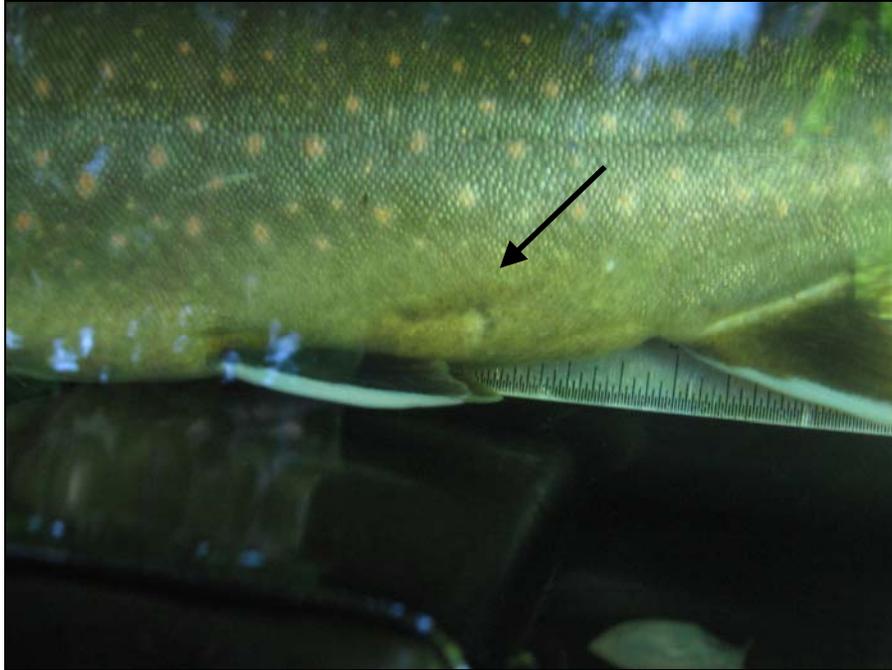


Figure 6. Photograph of healed fistula (arrow- note loss of antenna) of bull trout code 75.

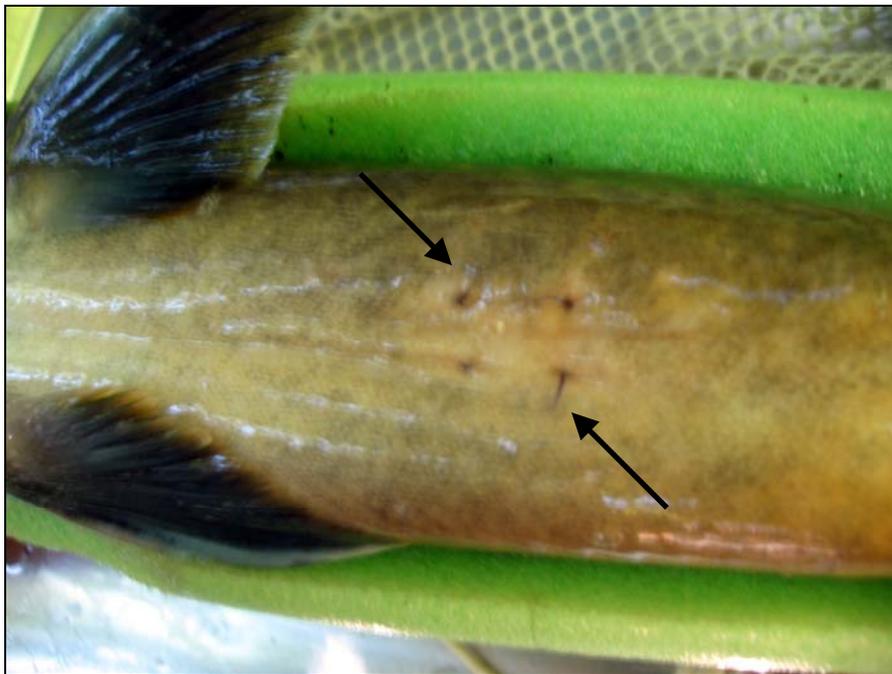


Figure 7. Photograph of bull trout code 75, showing healed surgical incision with remnant of suture material in needle puncture holes (arrows).

Code 78 (Figure 8). Bull trout code 78 was tagged at rkm 6.6 in Wolf Creek on July 25, 2006; see Nelson et al. (2007) for a description of its 2006 movements. Code 78 transmitted the motionless signal 178 from November 29, 2006 until recovered under sediment in a LWD pile on August 29, 2007. No body parts were recovered and whether it died or shed the tag is unknown.

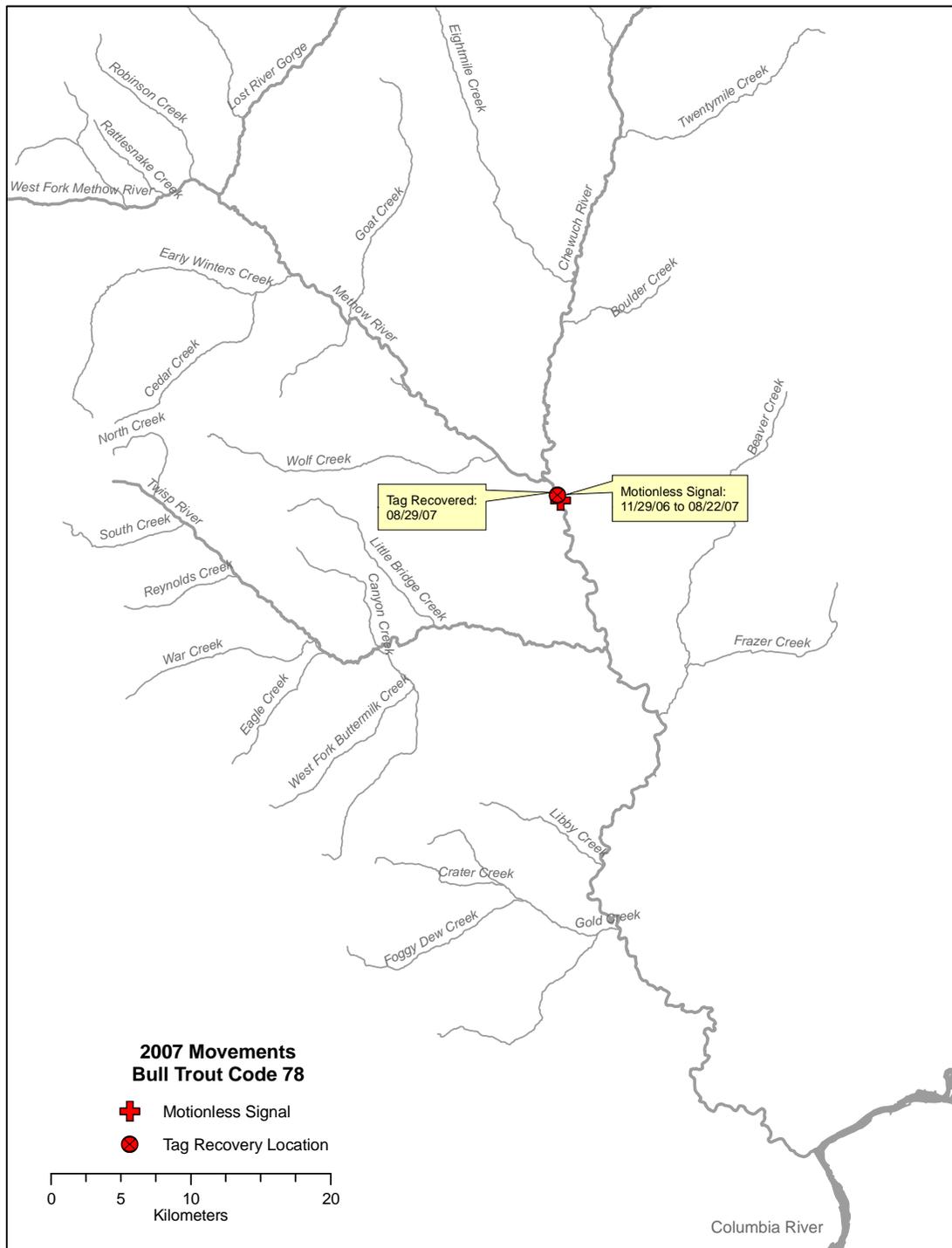


Figure 8. Map of tag recovery location of USFWS bull trout code 78 in 2007.

Code 80 (Figures 9 and 10). Bull trout code 80 was tagged at rkm 4.8 in the West Fork Methow River on July 26, 2006; see Nelson et al. (2007) for a description of its 2006 movements. From November 8, 2006 to July 12, 2007 code 80 was located near the Mazama Bridge at rkm 106 of the Methow River. It moved upstream and passed the LW station at rkm 117.5 on July 18 and entered the West Fork Methow River. On July 19 it was located in the pool at rkm 4.8 where it was tagged in 2006, and was recaptured during angling on July 26. The antenna fistula was enlarged and raw, but the surgical incision was healed (Figure 9). During the aerial survey on September 5 it was detected at rkm 11 in the spawning reach. It moved downstream and was detected on September 28 back in the 2006 tagging pool. On October 24 code 80 was detected near Robinson Creek at rkm 2.6, where it overwintered upstream of the seasonal dry reach (Figure 10).



Figure 9. Photograph of bull trout code 80, showing enlarged and raw antenna fistula and the healed surgical incision (arrow) one year after implantation.

Code 82 (Figure 11). Bull trout code 71 was tagged at rkm 2.1 in the West Fork Methow River on August 2, 2006; see Nelson et al. (2007) for a description of its 2006 movements. On December 20, 2006 it was detected back near rkm 2.1 where it overwintered. Deep snow prevented further mobile or foot tracking until the next aerial survey on April 3, 2007 when the motionless signal 182 was detected at that location. On April 19 the tag and jawbone were recovered on the bank alongside a lateral pool. Circumstances suggest the bull trout was depredated by an otter.

Code 83 (Figure 12). Bull trout code 83 was tagged at the Chewuch Irrigation Diversion at rkm 13 of the Chewuch River on June 20, 2007. It was detected at rkm 13.6, upstream of the diversion, from June 22 to June 26. It moved downstream and was detected at rkm 5 on June 29. It passed the MC station (rkm 0) at the confluence with the Methow River

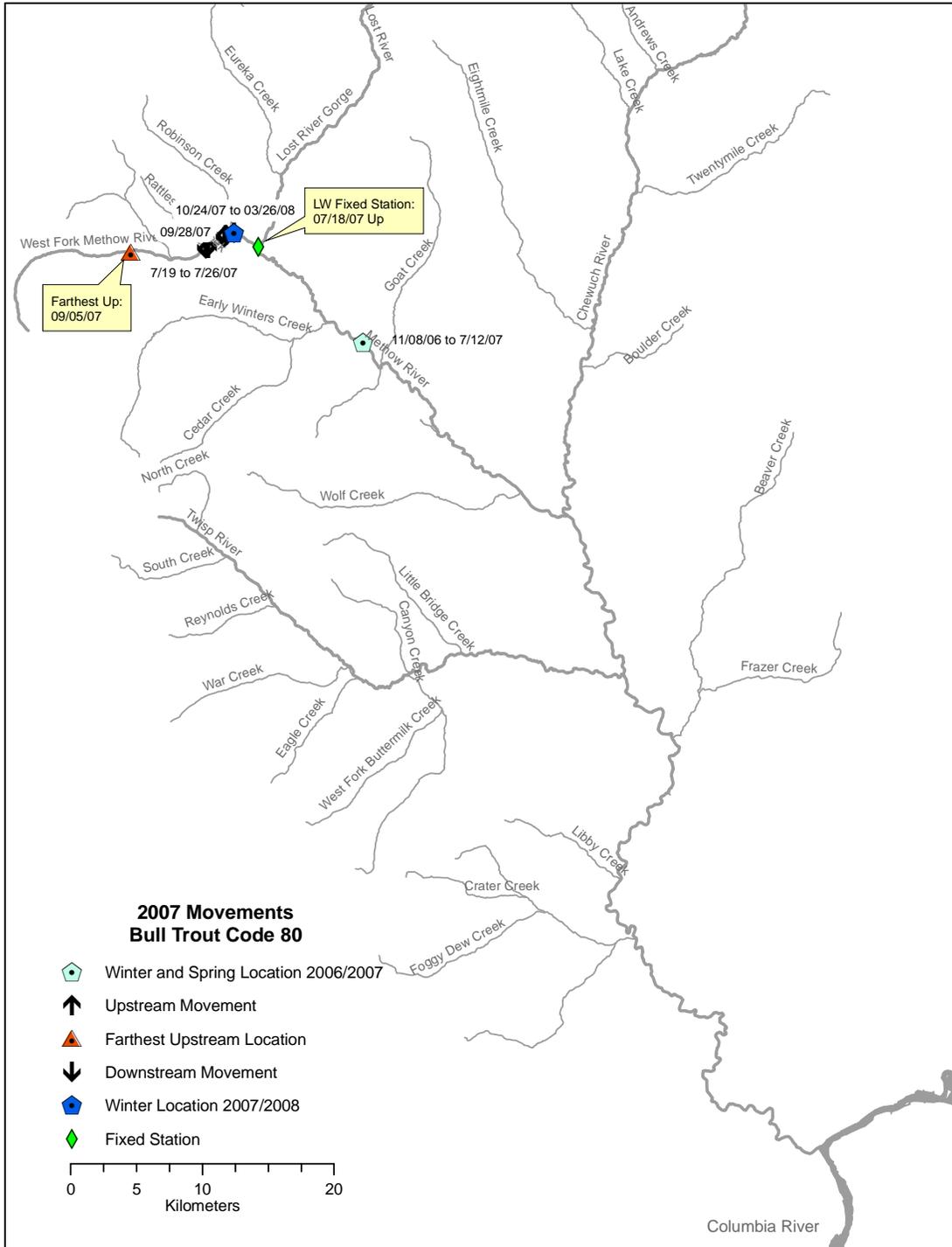


Figure 10. Map of the movements of USFWS bull trout code 80 during 2007.

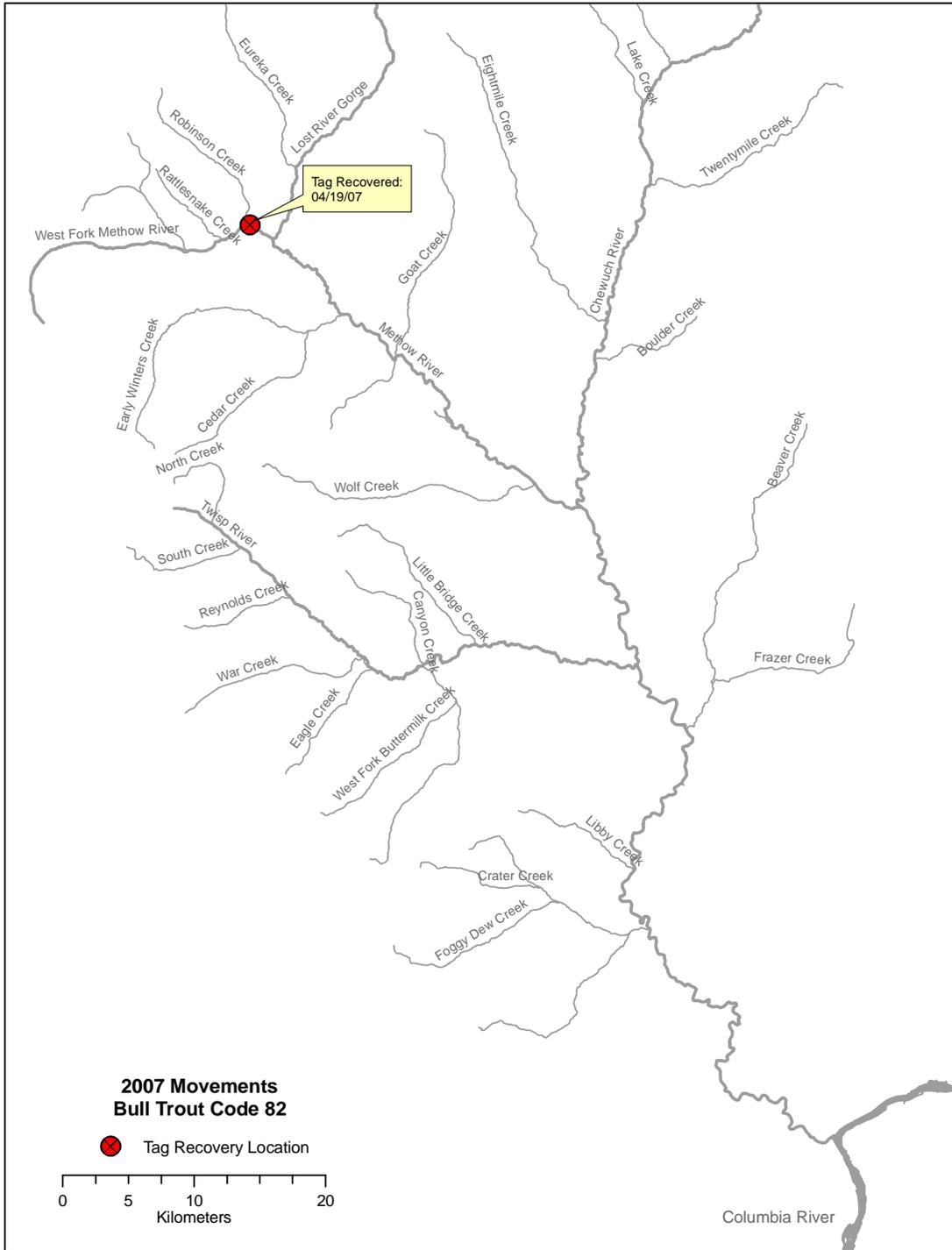


Figure 11. Map of the recovery location of USFWS bull trout code 82 in 2007.

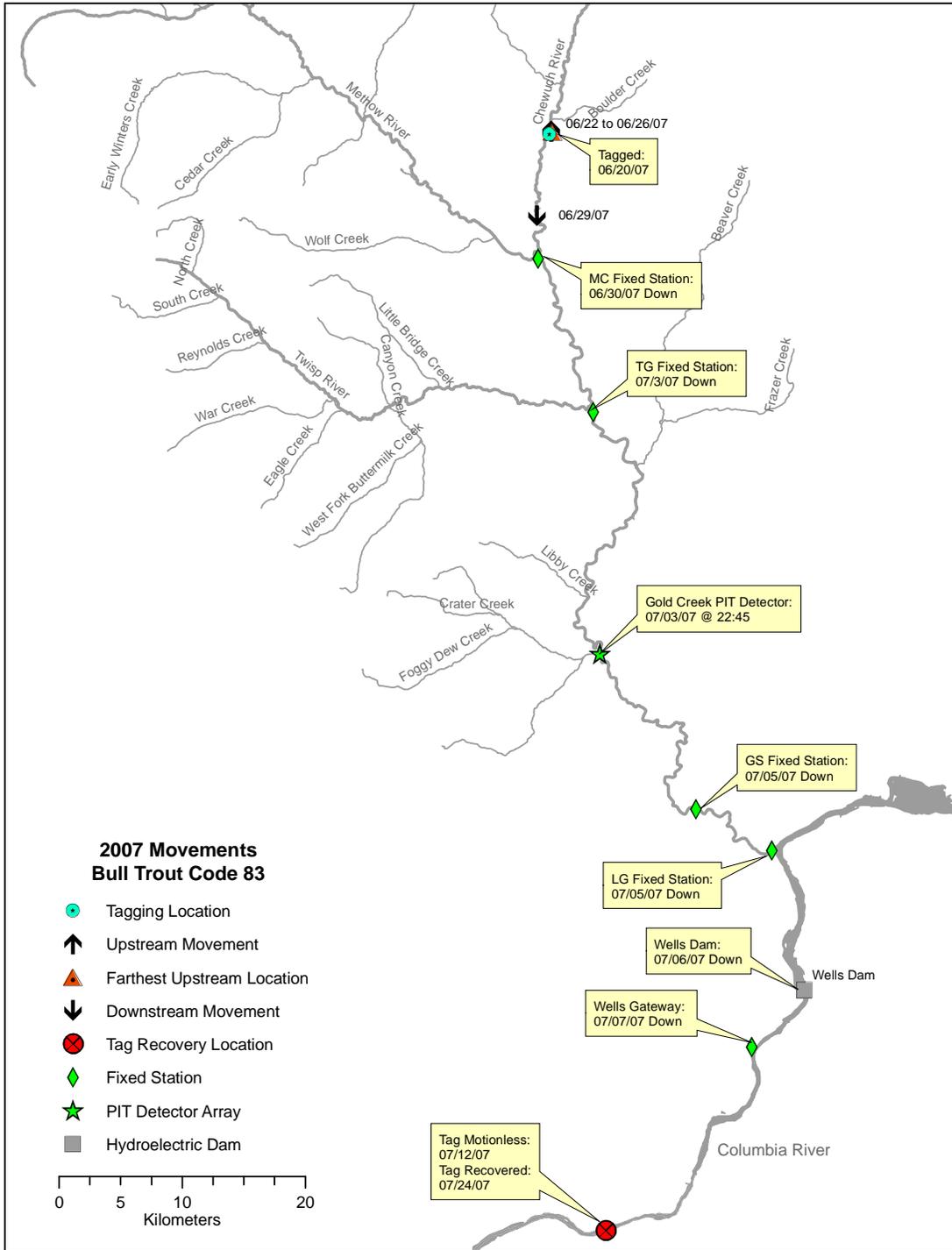


Figure 12. Map of the movements of USFWS bull trout code 83 during 2007.

on June 30, and passed the TG station (rkm 64.4) on July 3 at 02:14 hours. At 22:45 hours it was briefly detected by the USGS PIT interrogation array in Gold Creek (rkm 0.1). It moved back into the Methow River and migrated to the Columbia River on July 5. It was detected at Wells Dam (rkm 830) on July 6 and passed the Wells Gateway station (rkm 823) on July 7. The motionless signal code 183 was detected in the Columbia River at rkm 803 on July 12. On July 24, the BioAnalysts crew used SCUBA to recover the transmitter at a water depth of 9.5 m. The carcass was wedged against a large boulder but disintegrated during collection. The cause of death is unknown.

Code 84 (Figure 13). Bull trout code 84 was tagged at the Chewuch Irrigation Diversion at rkm 13 of the Chewuch River on June 21, 2007. It was detected at the diversion on June 22 and upstream of the diversion on June 26 and 27. It moved upstream and was detected near Eightmile Creek on June 28 and 29. Code 84 was detected at the LC fixed station (rkm 37.5) on July 9 and moved up Lake Creek where it was located on July 10 and July 11. During the aerial survey flown by BioAnalysts on September 5 it was located upstream of Black Lake on the known spawning grounds of upper Lake Creek. On October 30 the tracking crew hiked into Black Lake and located code 84 in the lake. It successfully overwintered in Black Lake as it was detected transmitting a normal signal during an aerial survey flown by BioAnalysts on April 21, 2008.

Code 85 (Figure 14). Bull trout code 85 was tagged at the Chewuch Irrigation Diversion at rkm 13 of the Chewuch River on June 21, 2007. The motionless signal 185 was transmitted on June 26 and the carcass was recovered in the Chewuch River downstream of the tagging site. Circumstantial evidence suggests the effects of tagging in combination with elevated stream temperatures may have contributed to its demise.

Code 86 (Figure 15). Bull trout code 86 was tagged at rkm 4.8 of the West Fork Methow River on July 17, 2007. It moved upstream on July 26. During the aerial survey flown by BioAnalysts on September 5, it was detected upstream of Trout Creek on the known spawning grounds of the West Fork Methow River. After the spawning season, code 86 moved downstream and passed the LW station at the confluence of Lost River on October 25. During a foot survey on October 31 it was located in the Methow River at rkm 116.6, where it was prevented from further downstream movement by the seasonal dry reach. It moved back upstream, passed the LW station on November 1 and entered the Lost River. On November 8 it was located at rkm 1.0, where it overwintered until March 26, 2008 when increased flows re-watered the dry reach and code 86 moved downstream.

Code 87 (Figure 16). Bull trout code 87 was tagged at rkm 10.8 in Wolf Creek on July 24, 2007. On August 2 it was located at rkm 11.3, downstream of a large log jam. During the aerial survey flown by BioAnalysts on September 5, it was detected on the spawning grounds just downstream of North Fork Wolf Creek at rkm 10.7. It moved downstream to rkm 6.8 where it was detected during the foot survey on November 2. Code 87 moved a short distance upstream where it was detected during the last foot survey on November 20. It overwintered in Wolf Creek at this location where it was detected transmitting the normal signal during aerial surveys on February 15, 2008.

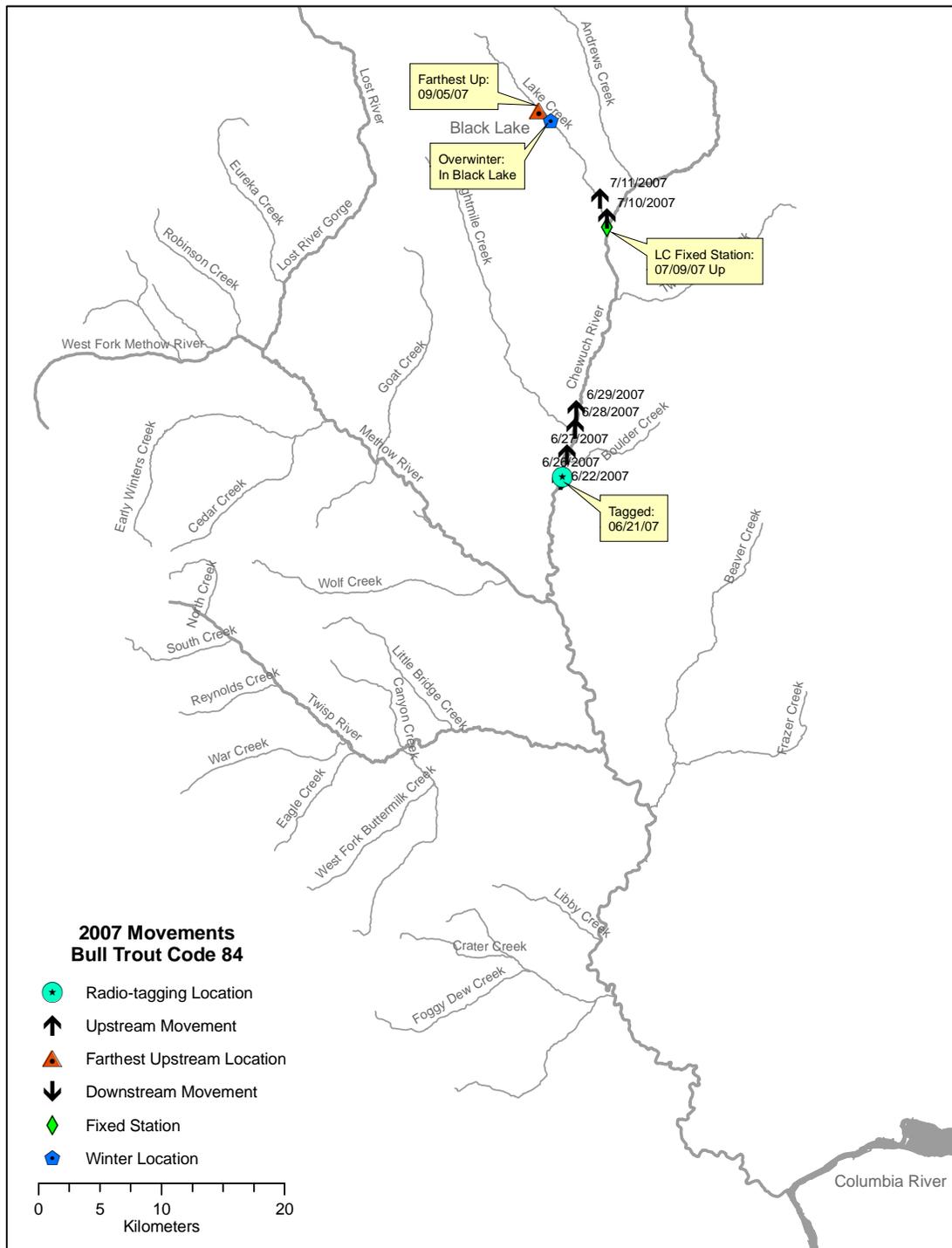


Figure 13. Map of the movements of USFWS bull trout code 84 during 2007.

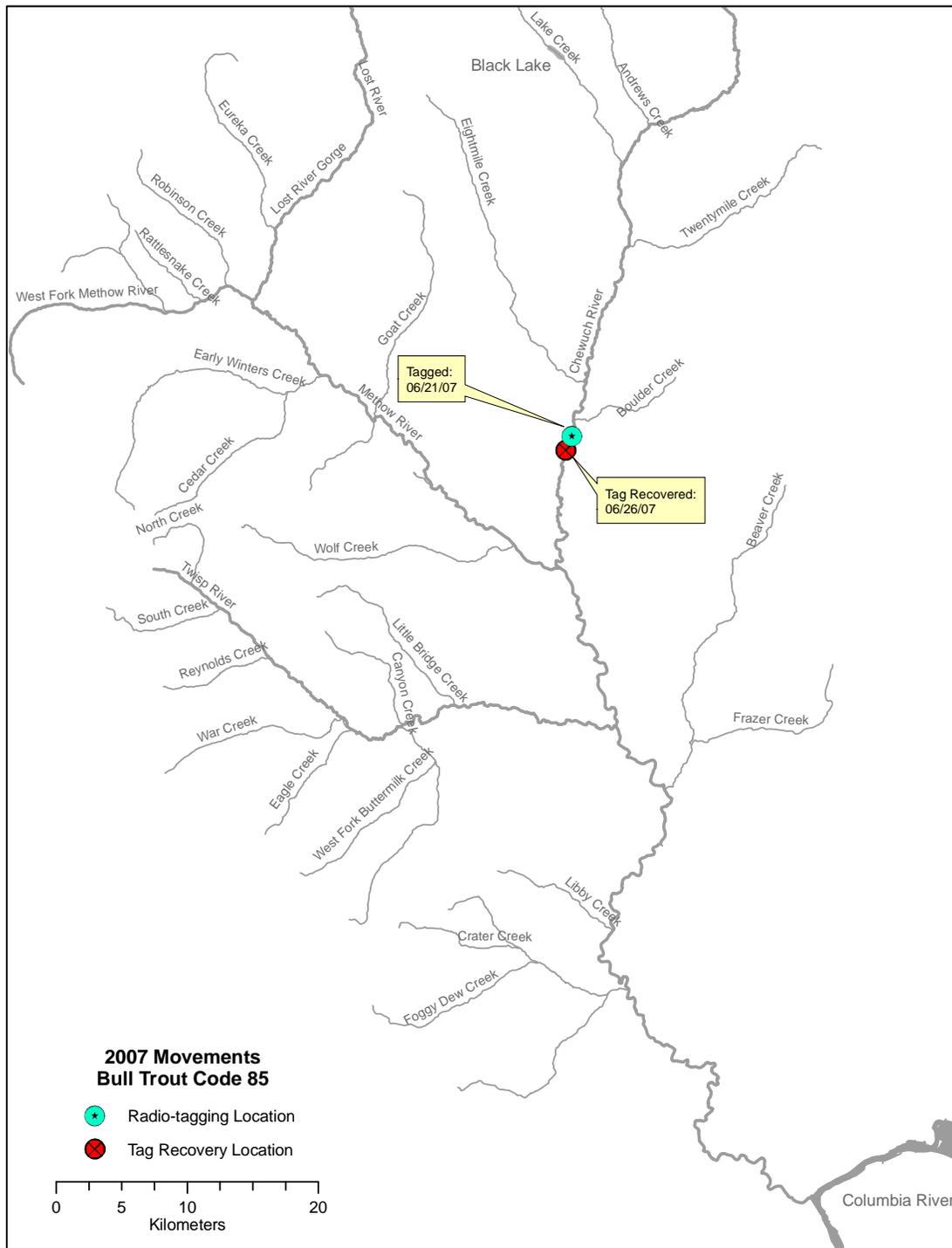


Figure 14. Map of the recovery location of USFWS bull trout code 85 in 2007.

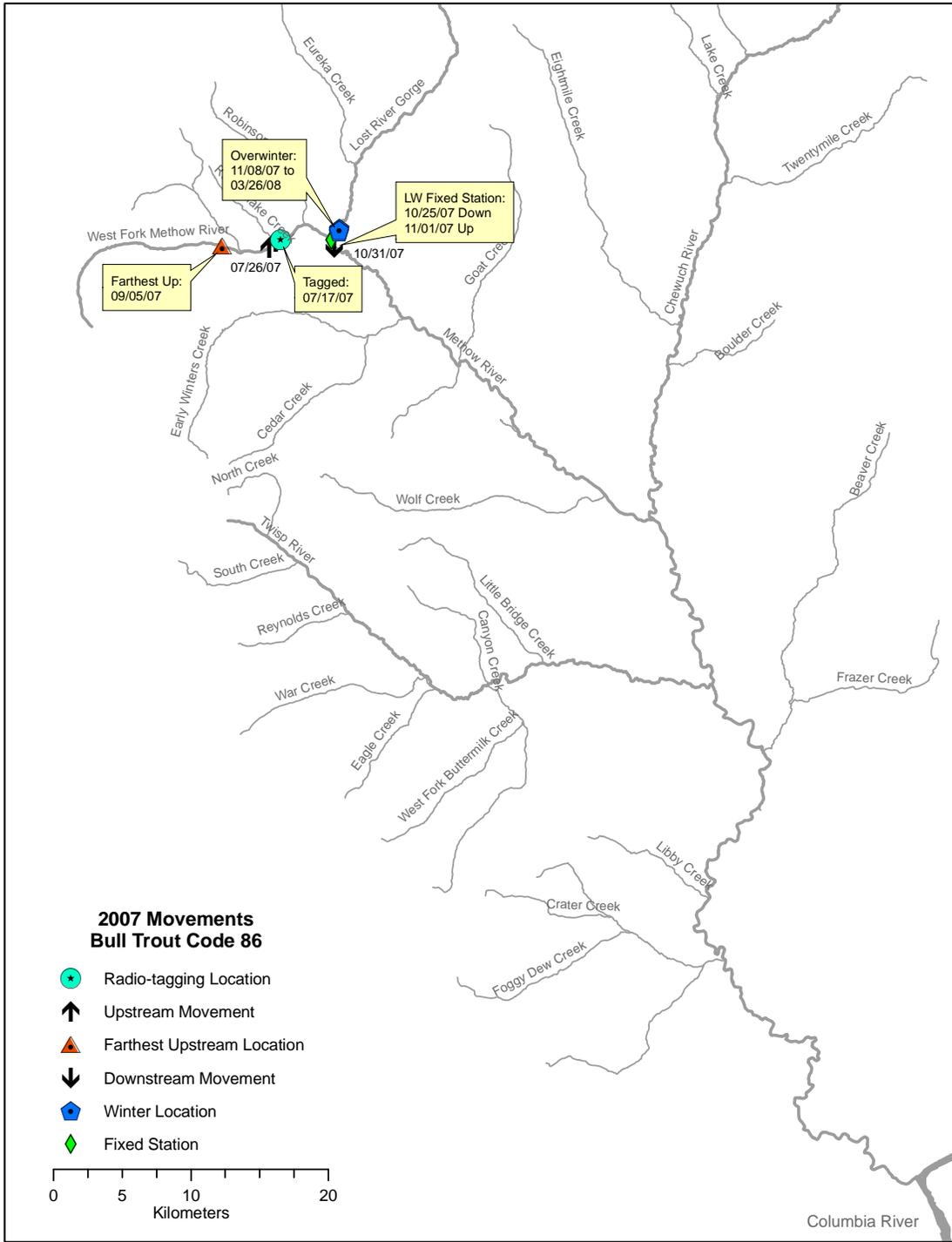


Figure 15. Map of the movements of USFWS bull trout code 86 during 2007.

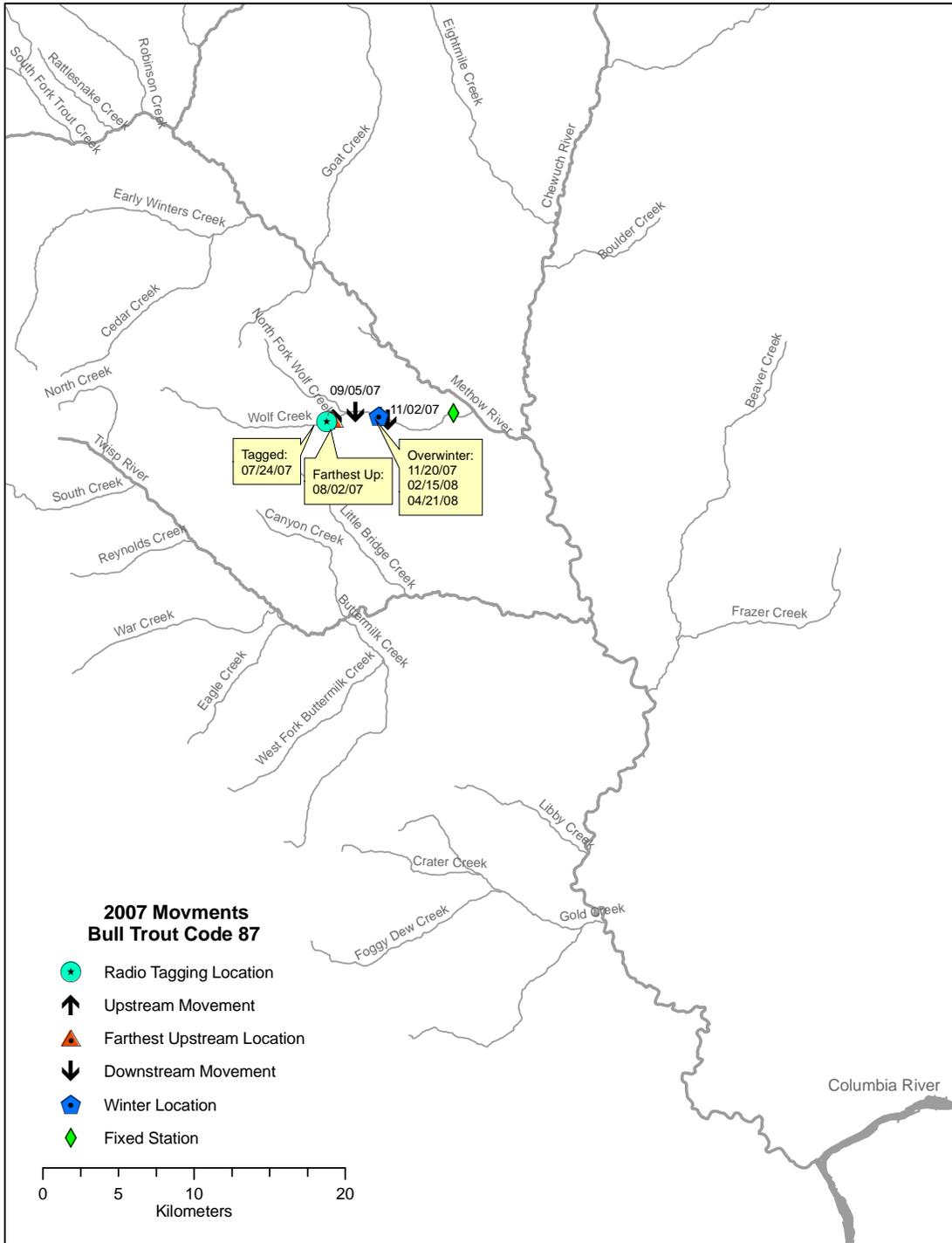


Figure 16. Map of the movements of USFWS bull trout code 87 during 2007.

Bull trout tagged by Douglas County PUD (See LGL and DCPUD 2008)

Code 50 (Figure 17). Bull trout code 50 was tagged by Douglas County PUD at Wells Dam (rkm 830) in 2006. It migrated to the Twisp River where the motionless signal was detected on November 15 upstream of the seasonal dry reach near Poplar Flat but deep snow prevented recovery (Nelson et al. 2007). On July 18, 2007 the motionless tag and part of the jaw bone were recovered 30 m from the stream bed at rkm 41. Circumstances indicate the bull trout was scavenged or depredated.

Code 51 (Figure 18). Bull trout code 51 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 5, 2007. It migrated to the Methow River and passed the LG fixed station (rkm 1.1) on June 7. It moved upstream and passed the GS fixed station (rkm 10.6) on June 13. Code 51 was subsequently detected during several mobile surveys conducted during June 13 to 22 in the Methow River downstream of Twisp. It passed the TG fixed station (rkm 64.4), entered the Twisp River and passed the TR station (rkm 2.1) on June 25. It migrated upstream in the Twisp River and was detected on the spawning grounds upstream of Poplar Flat from July 18 to September 6. It was detected near the mouth of North Creek (rkm 42) during the spawning season on September 17. Code 51 then moved downstream to the dry reach near Poplar Flat. The motionless signal 151 was detected on November 1 and the carcass was recovered along with 8 untagged bull trout in an isolated pool within the dry reach at rkm 38.9.

Code 52 (Figure 19). Bull trout code 52 was tagged by Douglas County PUD at Wells Dam (rkm 830) in 2006 (see Nelson et al. (2007) for the description of its 2006 movements). Code 52 overwintered in the Columbia River but the exact location was not determined. It was not detected at the Wells Gateway telemetry station (rkm 823) or during mobile surveys conducted by DCPUD and CCPUD. It was detected at the Wells Dam tailrace antenna (rkm 830) on April 19, 2007, so presumably it overwintered in the river between the gateway station and the dam. It was intermittently detected downstream and in the tailrace of Wells Dam from April 19 to May 19, including a boat survey on May 2. On May 19 it ascended the ladder and was diverted from the fishway trapping facilities to the Wells Hatchery pond before it was re-released into the Columbia River on May 21 (LGL and DCPUD 2008). Code 52 migrated to the Methow River and staged at the mouth for 24 hours before it passed the LG station (rkm 1.1) on May 26. It moved slowly upstream, passing the GS station (rkm 10.6) on June 9 and the TG station (rkm 64.4) on June 27. It entered the Twisp River on June 28 and was detected during a mobile survey near Eagle Creek on July 11. It was downstream of Reynolds Creek from July 27 to September 6, and began moving back downstream on September 14. It passed the TR station (rkm 2.1) on September 20, entered the Methow River and moved past the TG station (rkm 64.4) later that same day. On September 26 it exited the Methow River before it re-entered on October 3. It remained upstream of the LG station (rkm 1.1) in the lower river and on October 24 transmitted the motionless signal 152. On November 2, the tag was recovered at rkm 2.5 on the shore along with fins and bones. It is unknown whether the bull trout was scavenged or depredated.

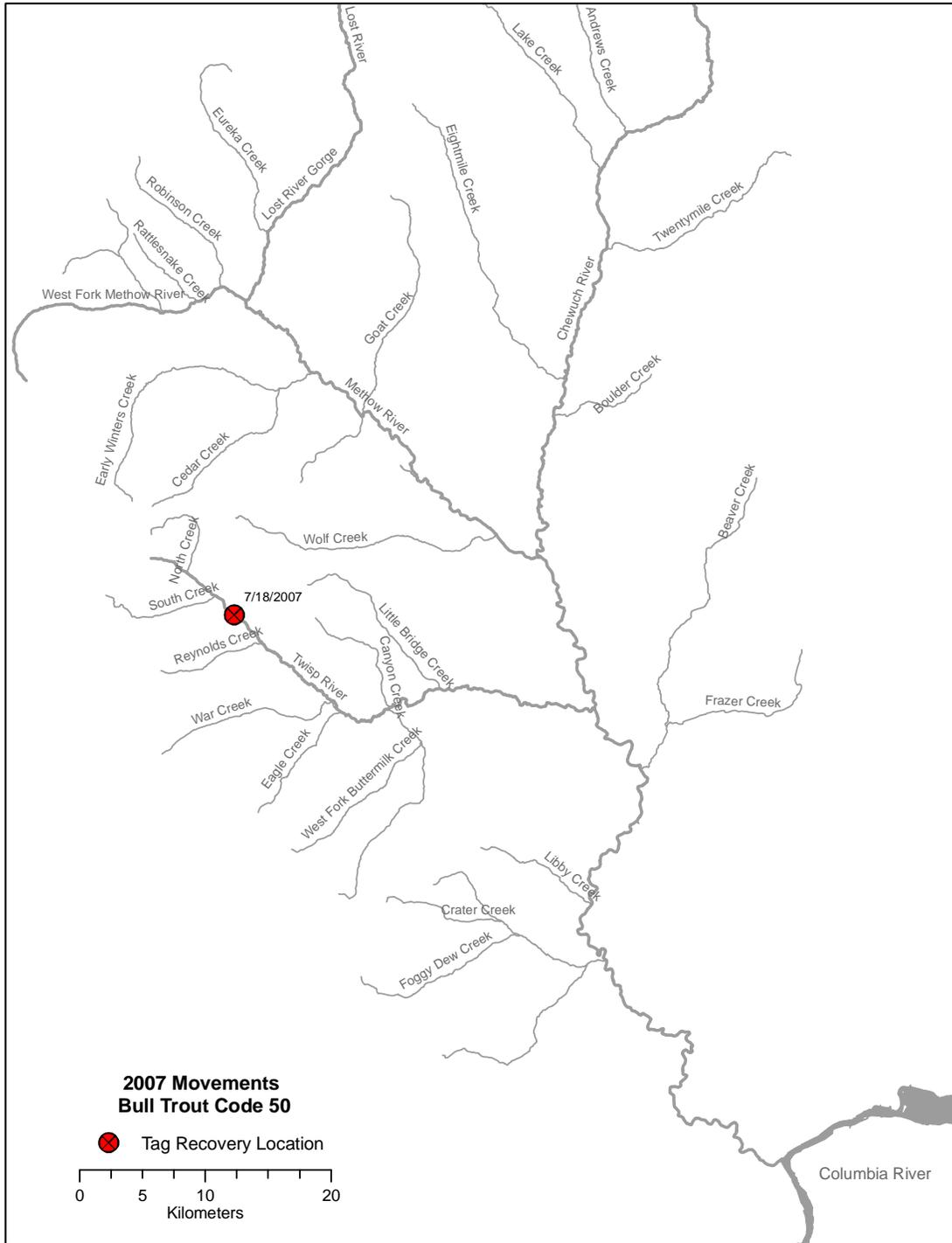


Figure 17. Map of the recovery location of DCPUD bull trout code 50 in 2007.

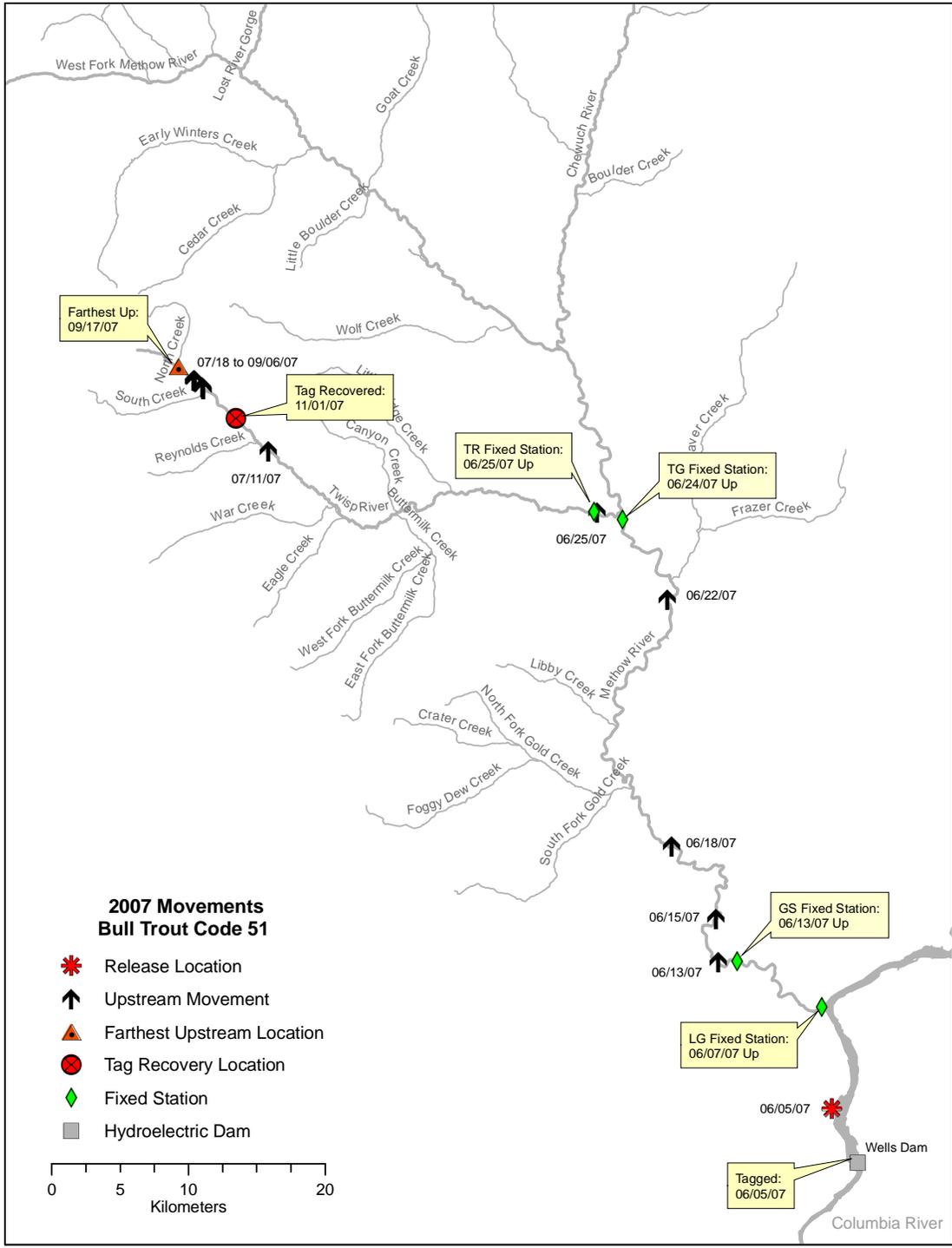


Figure 18. Map of the movements of DCPUD bull trout code 51 during 2007.

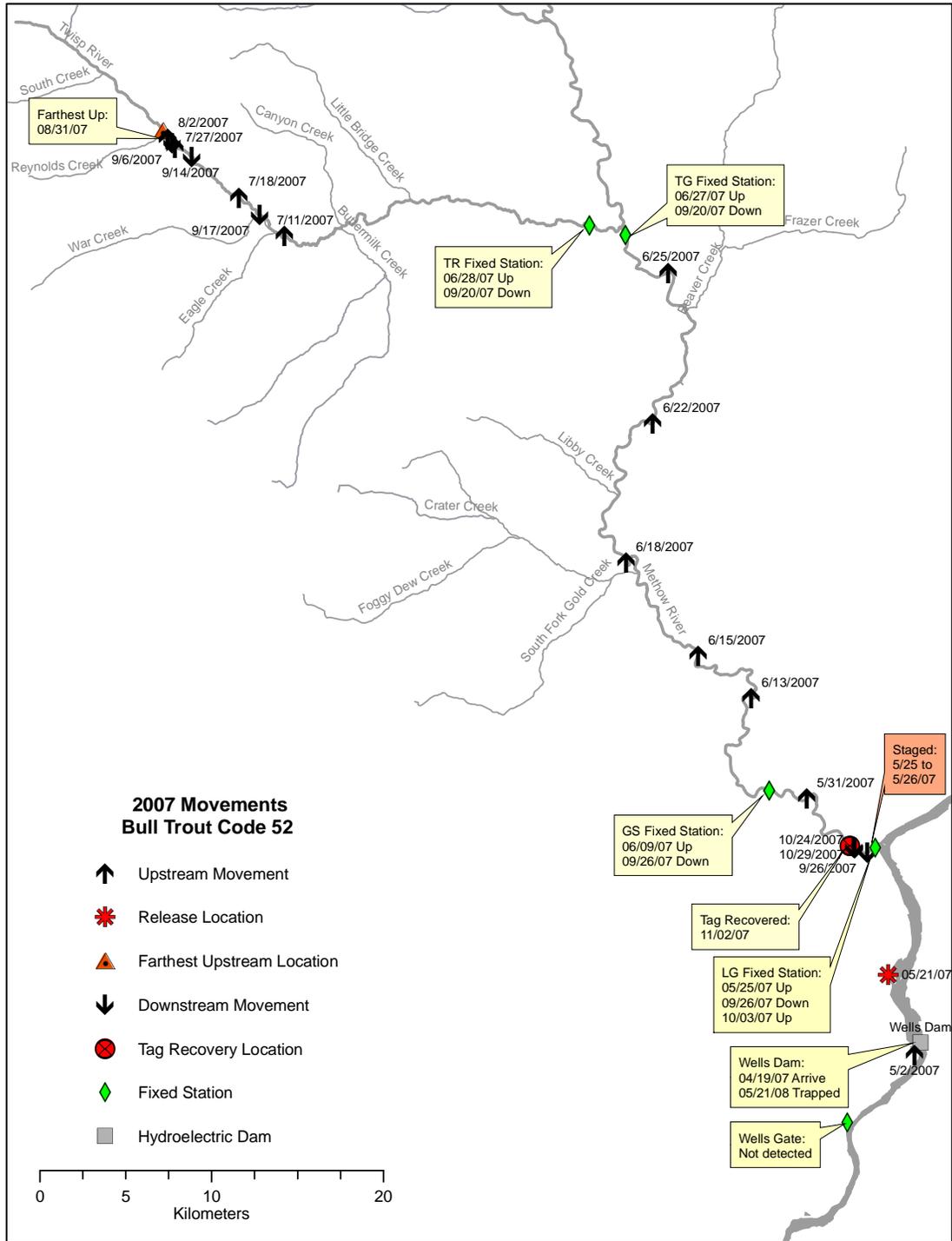


Figure 19. Map of the movements of DCPUD bull trout code 52 during 2007.

Code 53 (Figure 20). Bull trout code 53 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 4, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on June 7 and the GS station (rkm 10.6) on June 11. It moved upstream past the TG station (rkm 64.4) on June 24 and entered the Twisp River. Code 53 was not detected by the TR station (rkm 2.1) as it moved up the Twisp River but was detected near War Creek during a mobile survey on July 11. It was detected near Reynolds Creek on July 18 and upstream of the seasonal dry reach near South Creek from July 27 to October 24. It was able to move through the re-watered dry reach and was detected near Eagle Creek on November 1. It migrated downstream and passed the TR (rkm 2.1) and TG stations (rkm 64.4) on November 11. Code 53 migrated past the GS station (rkm 10.6) on November 16 and entered the Columbia River on November 18. During a truck survey on November 19 it was detected just upstream of Wells Dam. A Douglas PUD boat survey on December 13 detected the motionless signal 153 in the Columbia River 2.7 km upstream of Wells Dam. The tag was not recovered.

Code 54 (Figure 20). Bull trout code 54 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released upstream of the dam at Starr Boat Landing (rkm 834) on May 24, 2006. It moved downstream and passed Wells Dam later that day. It continued downstream and was detected at the Wells Gateway station (rkm 823) on May 30. It moved back upstream past the Wells Gateway on May 31 and was detected at the Wells tailrace array from May 31 to June 8, 2006. Code 54 then moved again downstream past the Wells Gateway on June 8 before moving back upstream past the station on June 9 and returning to the Wells Dam tailrace on June 10, where it was detected until June 30, 2006. It moved downstream past the Wells Gateway on June 30 and continued downstream to the Entiat River (rkm 779). Code 54 entered the Entiat River but was not detected at the ER station (rkm 5.1). It was located near km 16 on July 7, passed the MD station (rkm 16.7) on July 8, and continued to Box Canyon. Code 54 was detected in or just downstream of the canyon at rkm 46.7 from July 21 to September 21, 2006. It then migrated downstream, passed the MD station on September 25, and was detected at the mouth of the Entiat River from October 3 to November 2, 2006. It spent the 2006/2007 winter in the Columbia River at an unknown location in the Rocky Reach reservoir.

In 2007, code 54 moved upstream and migrated to the Twisp River. On May 5, 2007 it was detected in the Columbia River as it moved upstream past the Wells Gateway station at rkm 823. It spent most of the month of May moving between the Wells Gateway and Wells Dam tailrace before it finally passed the dam and entered the Methow River and passed the LG station (rkm 1.1) on May 31. It migrated upstream and passed the GS station (rkm 10.6) on June 8 and the TG station (rkm 64.4) on June 22. It entered the Twisp River and passed the TR station (rkm 2.1) on June 24. During mobile surveys from August 2 to September 14, 2007 it was detected on the spawning grounds downstream of Reynolds Creek and the dry reach. It then began its downstream migration and passed the TR and TG stations on September 19. It slowly migrated downstream in the Methow River and passed the GS station (rkm 10.6) on October 28 and the LG station (rkm 1.1) on November 25, when it entered the Columbia River. The location of code 54 in the Columbia River during the winter of 2007/2008 is unknown.

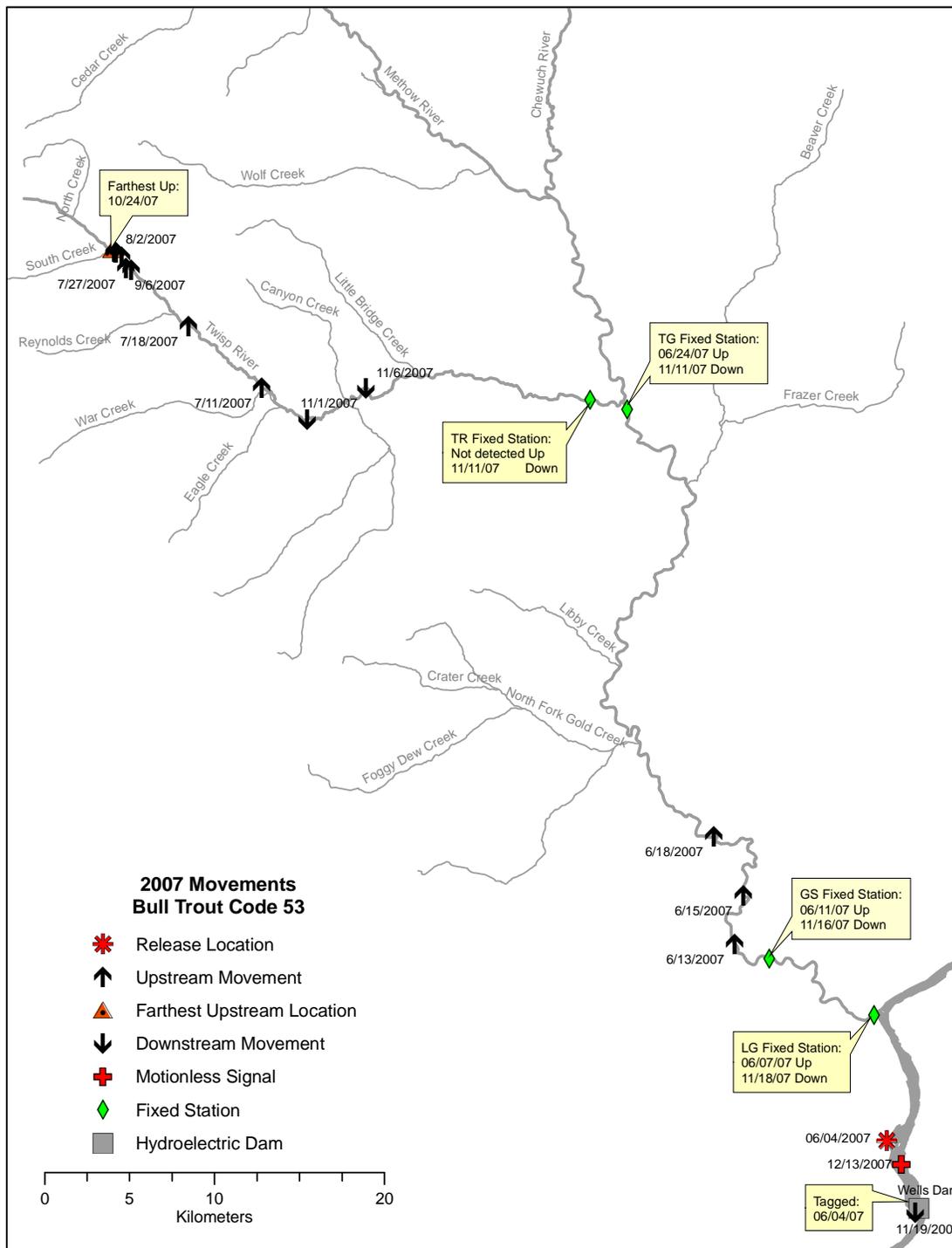


Figure 20. Map of the movements of DCPUD bull trout code 53 during 2007.

Code 55 (Figure 22). Bull trout code 55 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 4, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on June 7 and the GS station (rkm 10.6) on June 13. It was detected during mobile surveys from June 13 to June 25 moving up the Methow River before detection at the TG station (rkm 64.4) on July 4. It entered the Twisp River and passed the TR station (rkm 2.1) on July 4. During mobile surveys it was detected near Little Bridge Creek at rkm 16 on July 11 and near Buttermilk Creek at rkm 20.4 on July 18. The motionless signal code 155 was received on July 18 and the tag was recovered in the stream. No carcass or clues were recovered and the fate of the fish is unknown, but circumstances suggest the tag may have been shed.

Code 56 (Figure 23). Bull trout code 56 was tagged by Douglas County PUD at Wells Dam in 2006; see Nelson et al. (2007) for a description of its movements in 2006. Code 56 overwintered in the Columbia River at rkm 812, where it was detected during mobile surveys from January 4 to April 19, 2007. It moved upstream and was detected passing the Wells Gateway station (rkm 823) on May 21 and at the Wells Dam tailrace (rkm 830) on May 22. Code 56 then began a period of up and downstream movements from the tailrace downstream past the Gateway station to back upstream to the tailrace between May 27 and June 16. It exited the Wells Dam fishway on June 18 and entered the Methow River when it passed the LG station (rkm 1.1) on June 20. Code 56 moved upstream and passed the GS station (rkm 10.6) on June 24. It was detected during mobile surveys on June 25 at rkm 13 and on June 29 at rkm 21.7 of the Methow River. It then moved quickly back downstream, passing the GS station (rkm 10.6) on June 29, the LG station (rkm 1.1) on June 30, Wells Dam (rkm 830) on July 1, and Wells Gateway station (rkm 825) on July 1. During a mobile survey on July 27 the motionless signal code 156 was detected in the Columbia River at rkm 806. Recovery was not attempted and the fate of the fish is unknown.

Code 57 (Figure 24). Bull trout code 57 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 4, 2007. It moved upstream and entered the Methow River and passed the LG station (rkm 1.1) on June 6 and the GS station (rkm 10.6) on June 12. It was detected at various locations in the Methow River downstream of Libby Creek during truck surveys from June 13 to 22. The farthest upstream location was recorded June 22 at rkm 40.7, before code 57 moved back downstream and passed the GS station (rkm 10.6) on June 25 and the LG station on June 26. Code 57 was not detected after exiting the Methow River and its fate is unknown.

Code 58 (Figure 25). Bull trout code 58 was tagged by Douglas County PUD at Wells Dam (rkm 830) in 2006; for details of its movements in 2006 see Nelson et al. (2007). Code 58 was located in the Methow River in a boulder run at rkm 49.9 from December 21, 2006 until November 28, 2007. On August 24 it was observed with 10 mountain whitefish and on November 1 it was observed with 300 suckers; it appeared healthy on both observations. It moved downstream and was detected in the Methow River at rkm 39.4 on December 20, 2007. The motionless signal code 158 was detected at rkm 38.6 on January 9, 2008 but ice cover prevented immediate recovery. No clues were available to indicate the fate of the bull trout when the tag was finally recovered on April 10, 2008.

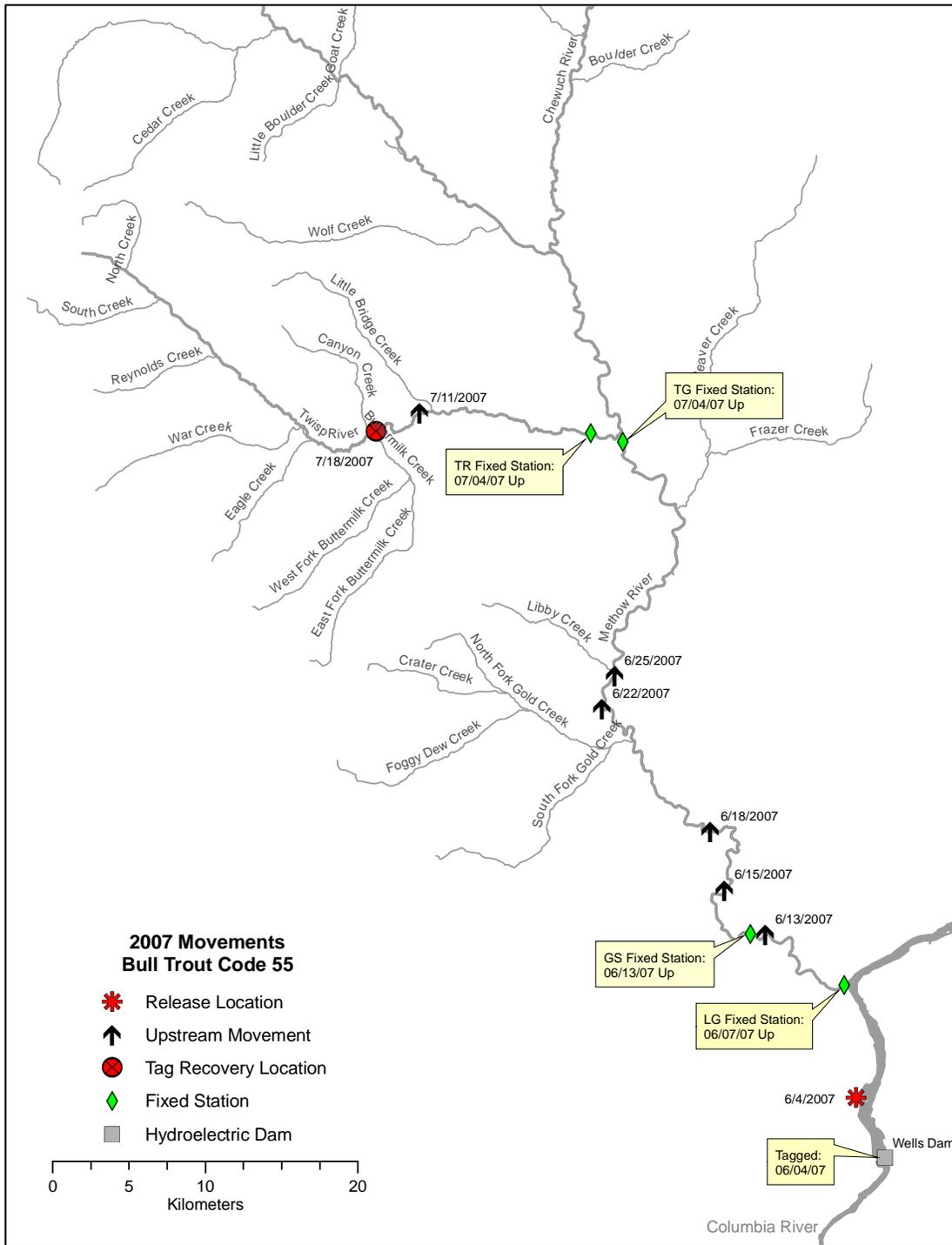


Figure 22. Map of the movements of DCPUD bull trout code 55 during 2007.

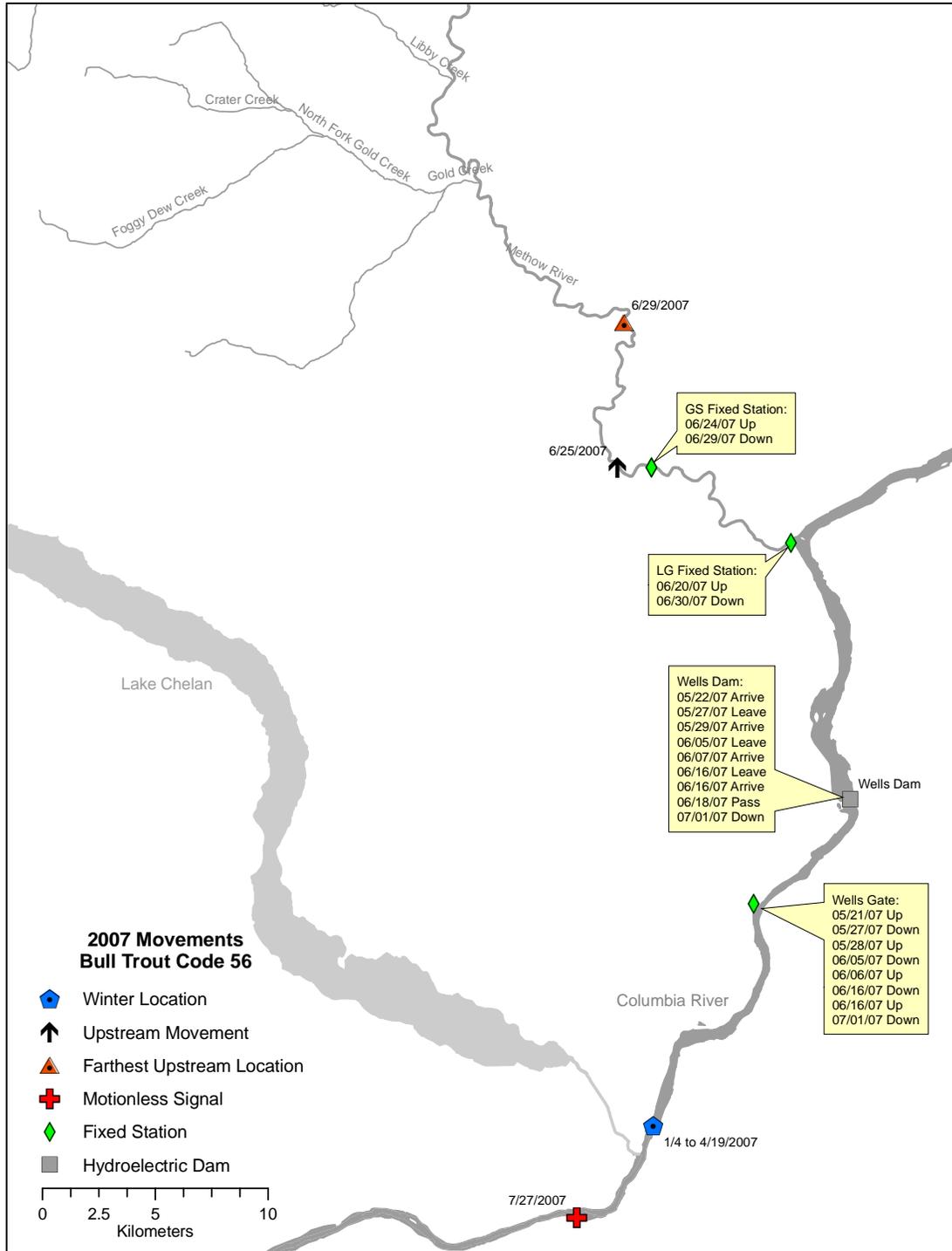


Figure 23. Map of the movements of DCPUD bull trout code 56 during 2007.

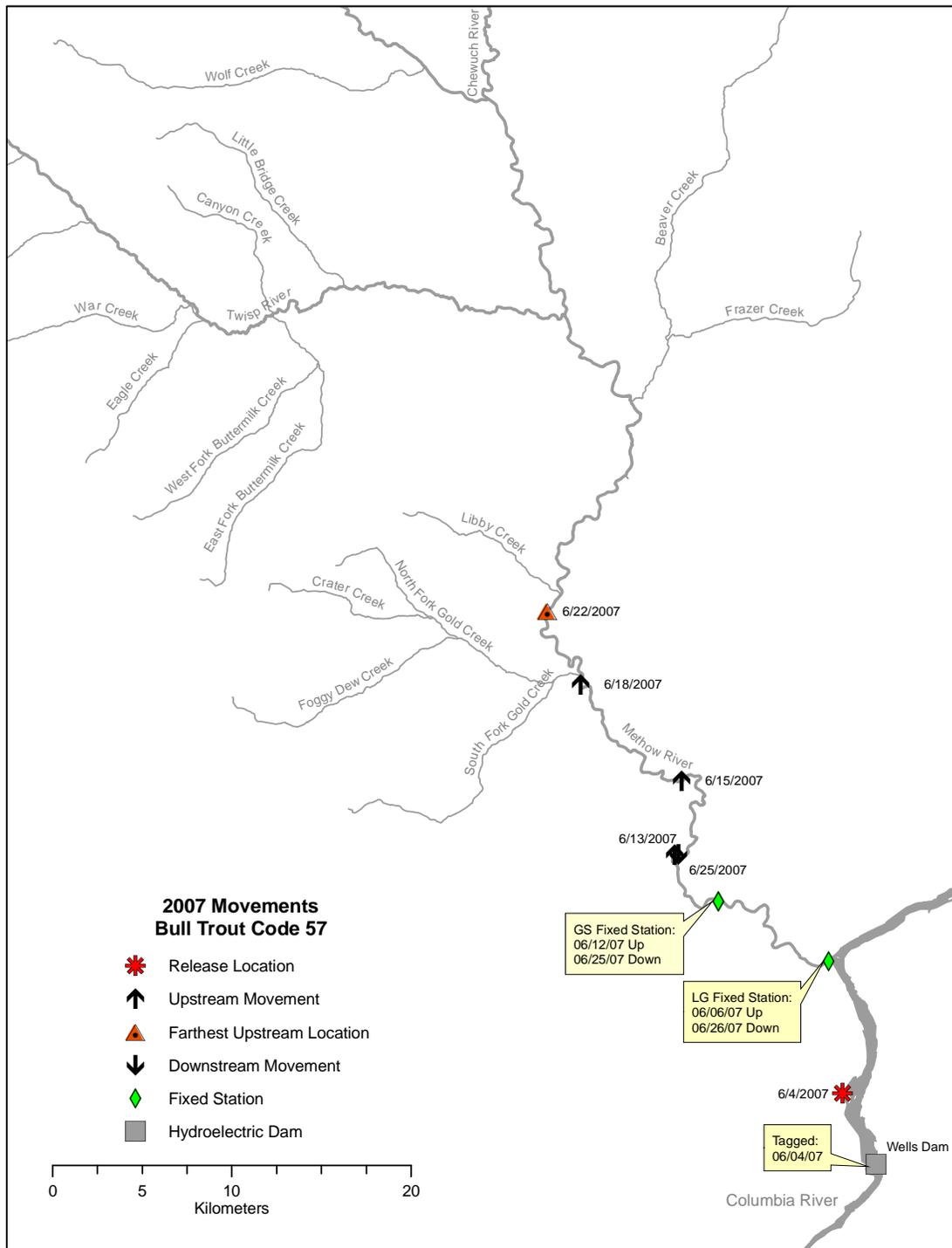


Figure 24. Map of the movements of DCPUD bull trout code 57 during 2007.

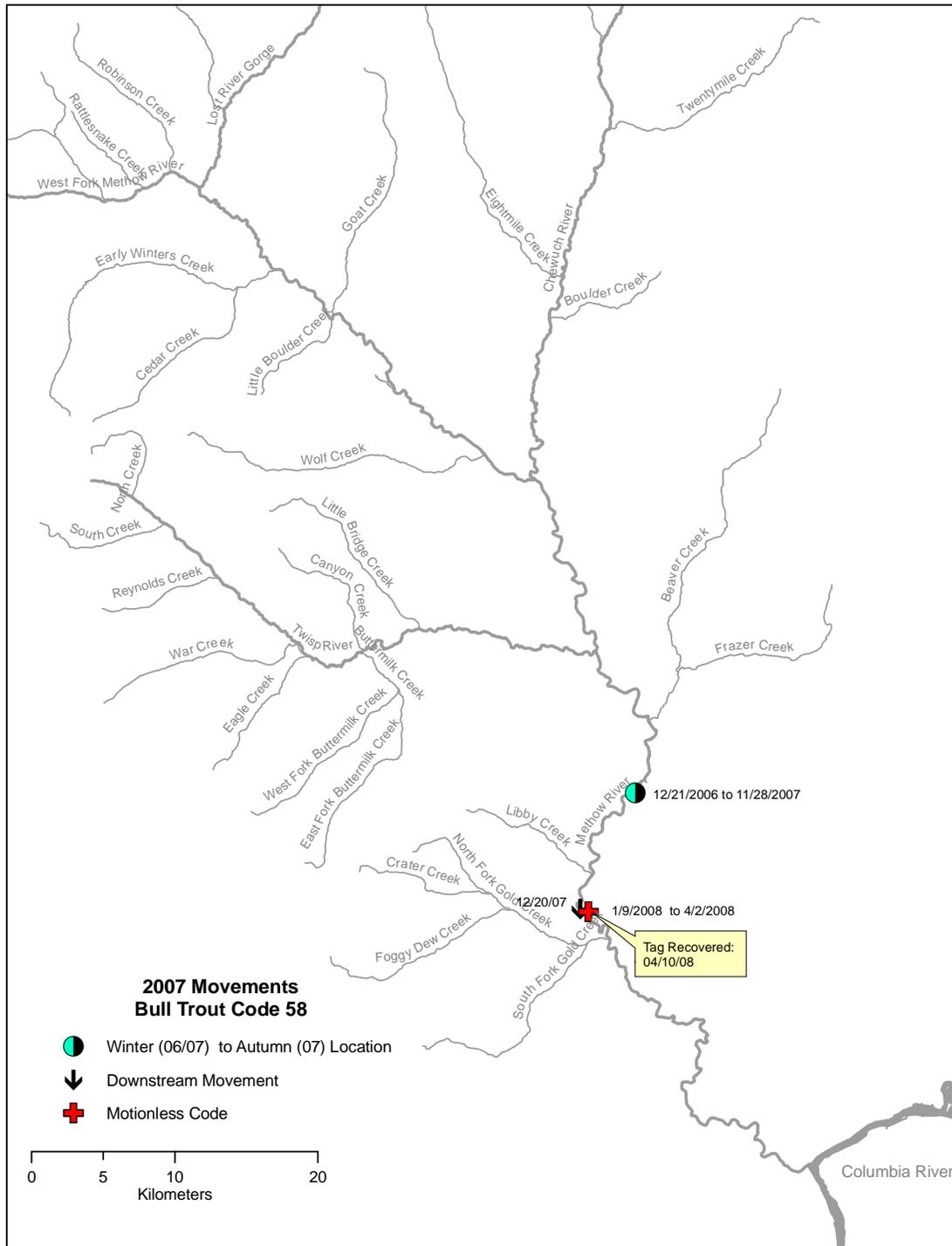


Figure 25. Map of the movements of DCPUD bull trout code 58 during 2007.

Code 59 (Figure 26). Bull trout code 59 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 4, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on June 8 and migrated past the GS station (rkm 10.6) on June 15. It was detected moving up the Methow River during mobile surveys from June 15 to June 25. Code 59 passed the TG station (rkm 64.4) on June 28, entered the Twisp River, and passed the TR station (rkm 2.1) on June 30. It was detected in the Twisp River downstream of Reynolds Creek during a mobile survey on July 11 and downstream of North Creek on July 18. It remained on the known spawning grounds in the vicinity of North Creek until September 26. It moved downstream to the dry reach where it was detected on October 24 during the mobile survey. Discharge increased enough to re-water the dry reach and code 59 migrated downstream and passed the TR station (rkm 2.1) on October 26. It passed the TG station in the Methow River (rkm 64.4) the same day and slowly moved downstream to rkm 51.5, where it was detected from December 20 to January 24, 2008.

Code 61 (Figure 27). Bull trout code 61 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on June 2, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on June 3 and migrated past the GS station (rkm 10.6) on June 9. It was detected moving up the Methow River during mobile surveys from June 15 to June 25. Code 59 passed the TG station (rkm 64.4) on June 25, the MC station (rkm 80.6) on June 28, and the LW station on July 11. It moved up the West Fork Methow River and was detected in the lower reach from July 12 to 19. During foot tracking on July 26, the motionless signal code 161 was detected at rkm 4 and the tag was recovered. The transmitter was on the bottom under a root wad in a small pool, but no body parts were found and the circumstantial evidence suggests the tag was expelled.

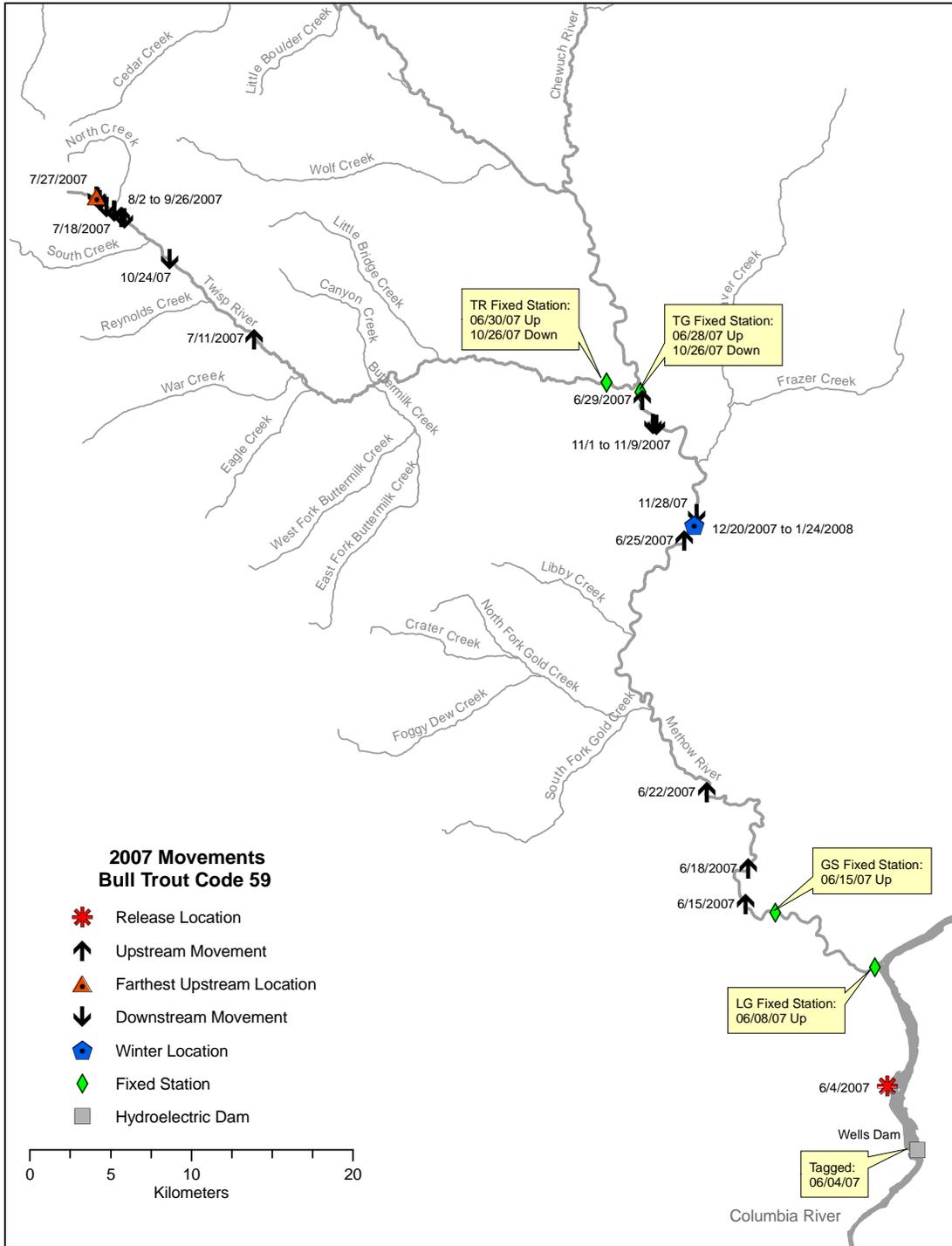


Figure 26. Map of the movements of DCPUD bull trout code 59 during 2007.

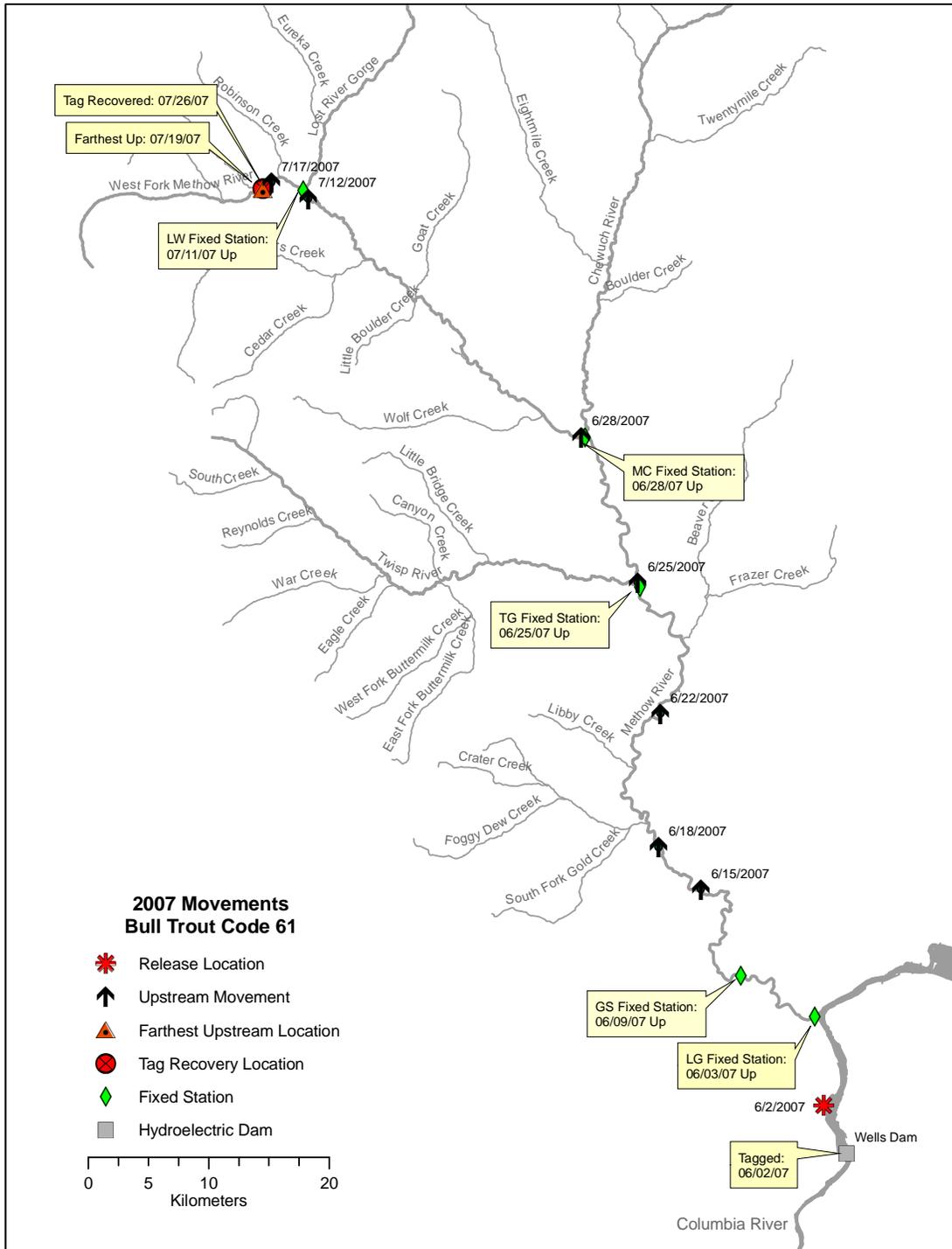


Figure 27. Map of the movements of DCPUD bull trout code 61 during 2007.

Code 62 (Figure 28). Bull trout code 62 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on May 24, 2006. It migrated to the West Fork Methow River in 2006 (see Nelson et al. 2007 for a complete description of its movements in 2006). During mobile surveys from January 4 to April 19, 2007 code 62 was detected at its overwintering location at rkm 814 of the Columbia River. It migrated upstream and was detected at the Wells Gateway station (rkm 823) on May 25 and at Wells Dam tailrace on May 30. It was captured in the fishway trapping facilities and released upstream at Starr Boat Landing (rkm 834) on June 4. It moved back downstream through Wells Dam on June 5 and was detected in the tailrace until it passed upstream through the fishway on June 22 and entered the Methow River on June 23. It passed the GS station (rkm 10.6) on June 24 and the TG station (rkm 80.6) on July 7. During a mobile survey on July 12 it was detected at rkm 74 and on July 16 it was detected downstream at rkm 69. On July 18 it was located at Brandenburg Run (rkm 77). From July 20 to September 28 it was detected in this general vicinity, where it moved in and out of the Barkley Irrigation Ditch. On August 21 it was observed in the ditch near an undercut bank and on August 30 it was detected with a 330 mm bull trout at the ditch intake in Peters Hole (rkm 78). During snorkeling on September 5 it was observed in the ditch under the bank approximately 100 m downstream of the headgate. Water temperature in the ditch was 10 C at 0800 hours on September 7. Photos of code 62 in the ditch were taken on September 14 (Figure 29). During foot tracking on September 26 it was observed with 3 bull trout (210 – 400 mm), 40 adult Chinook salmon, several mountain whitefish and numerous rainbow trout in Peters Hole at the head of the ditch. On October 8, 2007 the WDFW Eastern Washington Water Team conducted a salvage effort to rescue fish stranded in the ditch after draw down and code 62 was captured and released into the Methow River (the bull trout was characterized as “not in good condition- skinny”). Code 62 migrated downstream and passed the TG station (rkm 64.4) on October 17 and the GS station (rkm 10.6) on October 19. It passed the LG station (rkm 1.1) and entered the Columbia River on October 19. During mobile surveys on November 2, 27 and 28 it was detected downstream of Wells Dam. From January 22 to April 2, 2008 it was detected in the Columbia River at rkm 814, the same location it overwintered in 2006/2007.

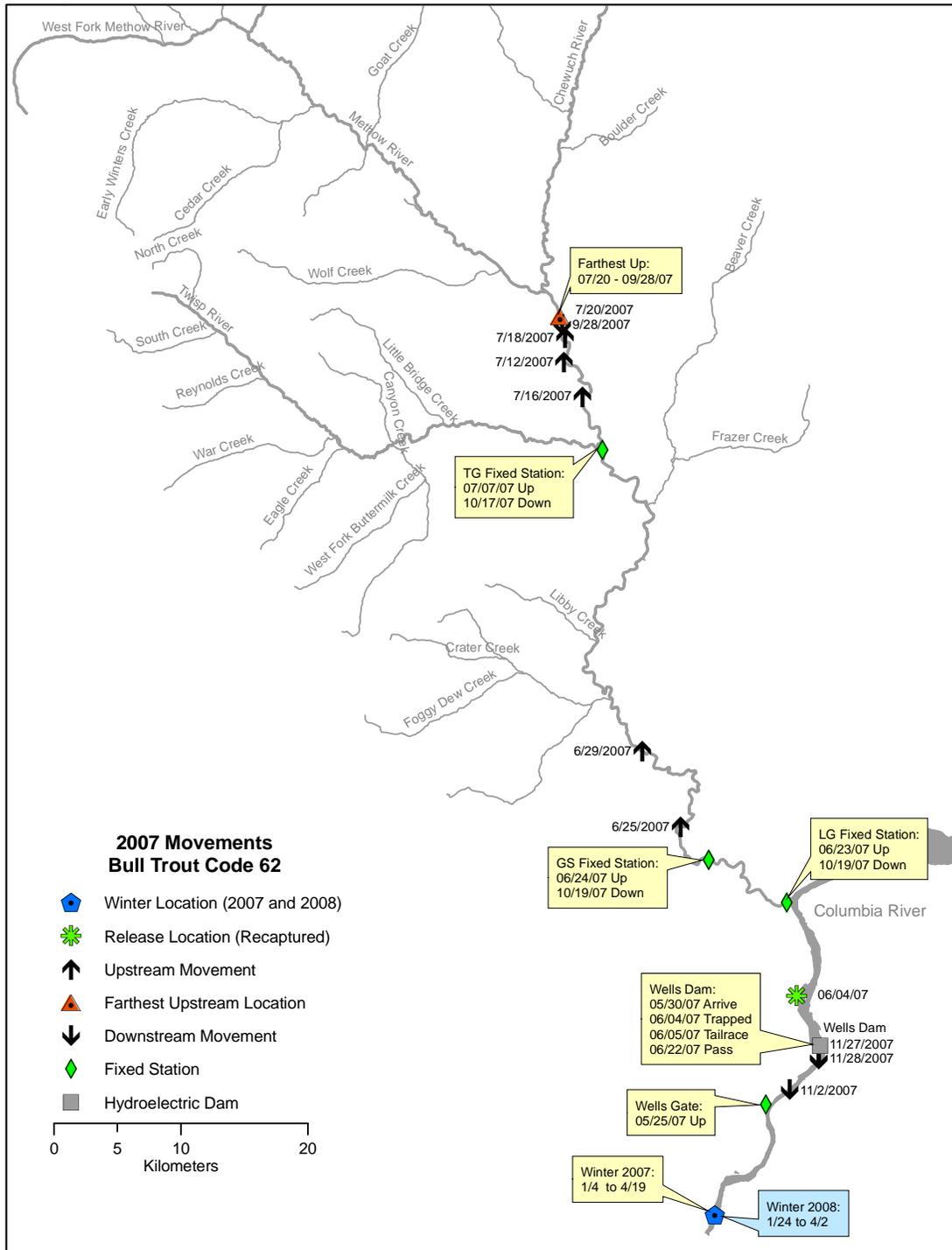


Figure 28. Map of the movements of DCPUD bull trout code 62 during 2007.



Figure 29. Photograph of DCPUD bull trout code 62 in the Barkley Irrigation Ditch.

Code 63 (Figure 30). Bull trout code 63 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on May 29, 2007. It entered the Methow River but was not detected at the LG station (rkm 1.1). During a mobile survey on May 31 it was detected at rkm 2.4. It migrated past the GS station (rkm 10.6) on June 9 and was detected moving up the Methow River during mobile surveys from June 13 to June 18. Code 63 passed the TG station (rkm 64.4) on June 22, entered the Twisp River and was detected at rkm 1.5 during a mobile survey on June 25. It passed the TR station (rkm 2.1) on June 27. During mobile surveys on July 11 and 18 the motionless signal code 163 was detected at rkm 8 and on July 20 the tag was recovered. The transmitter was on the bottom in mid river but no carcass or body parts were found. Circumstances suggest the tag was shed and the fate of the fish is unknown.

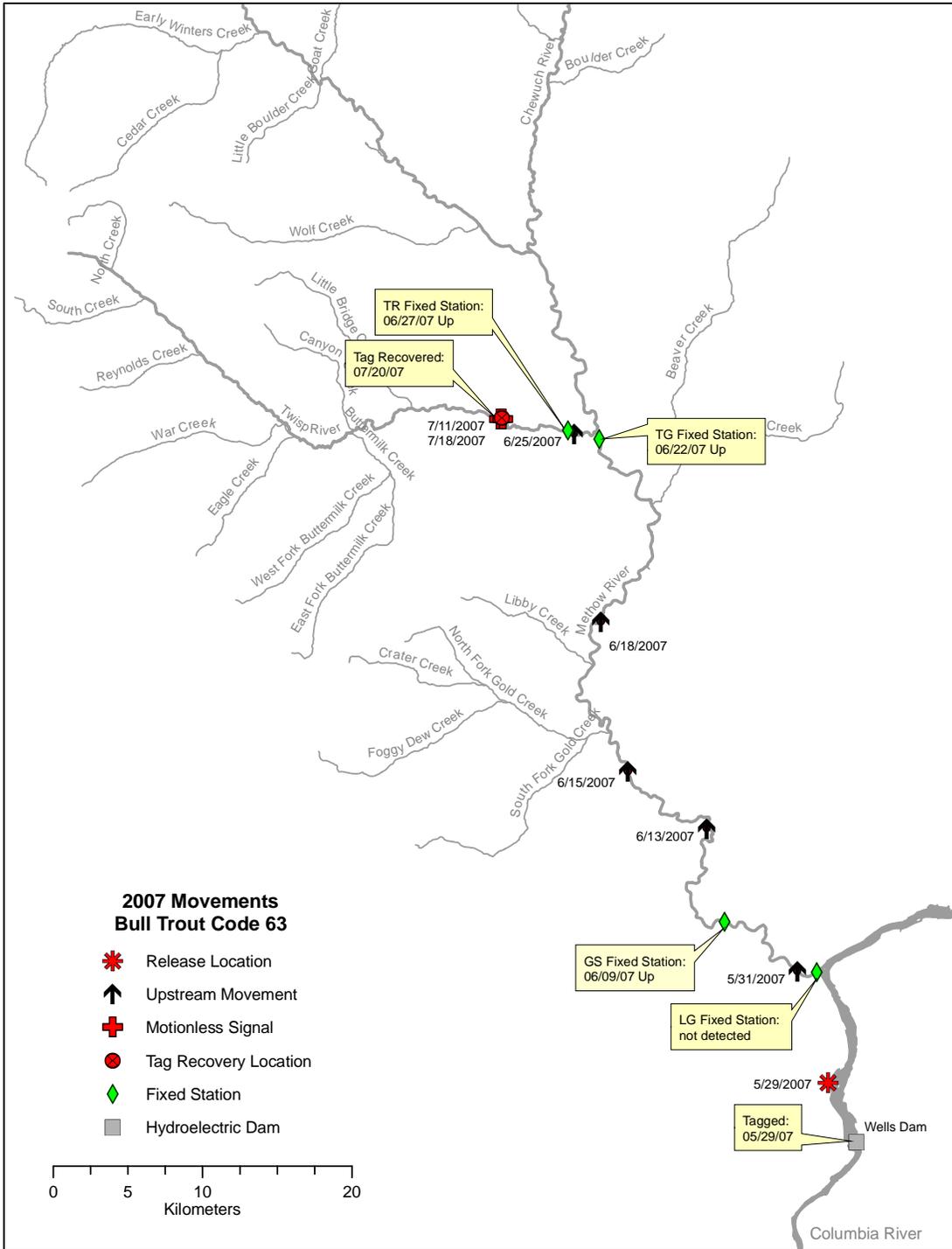


Figure 30. Map of the movements of DCPUD bull trout code 63 during 2007.

Code 65 (Figure 31). Bull trout code 65 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on May 25, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on May 26 and the GS station on May 30. During a mobile survey on May 31 it was detected at rkm 13.2. Code 65 moved back downstream and passed the GS station (rkm 10.6) on June 11 and exited the Methow River on June 12. It moved to the Okanogan River and was detected at the OK station at the mouth (rkm 859) on June 12. It apparently did not move up the Okanogan but instead moved elsewhere in the Columbia River and was detected off the mouth of the Methow River (rkm 843) during a mobile survey on June 15. It re-entered the Methow River and passed the LG station (rkm 1.1) on June 16 and was detected during a mobile survey on June 18 at rkm 2.4. Code 65 apparently milled around near the mouth as it was last detected at the LG station (rkm 1.1) on June 20. It moved upstream in the Methow River and was detected at the GS station (rkm 10.6) on June 20. During mobile surveys on June 22 and 25 it was detected migrating up the Methow River. It passed the TG station (rkm 64.4) on June 26, entered the Twisp River and passed the TR station (rkm 2.1) on June 26. During a mobile survey on July 11 it was detected at rkm 14. On July 18 the motionless signal code 165 was detected and on July 20 the transmitter was recovered. The tag was located in the eddy of a boulder at 0.5 depth in mid channel of a riffle/run area of the river. No body parts were found and circumstances suggest the transmitter was shed. The fate of the fish is unknown.

Code 66 (Figure 32). Bull trout code 66 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released upstream of the dam at Starr Boat Landing (rkm 834) on May 24, 2006. It moved downstream in the Columbia River and passed Wells Dam on May 28. It continued downstream and was detected at the Wells Gateway station (rkm 823) on May 29 and at the mouth of the Entiat River (rkm 779) on June 5, 2006. It moved back upstream in the Columbia River, passed the Wells Gateway (rkm 823) on June 15 and was detected at the Wells tailrace array from June 16 to 19. Code 66 again moved downstream past the Wells Gateway on June 19 and continued downstream back to the Entiat River (rkm 779). It entered the Entiat River but was not detected at the ER station (rkm 5.1). Code 66 passed the MD station (rkm 16.7) on July 4 and was detected at rkm 17.5 during a mobile survey on July 7, 2006. It moved upstream to Box Canyon (rkm 46.7) and was detected in or just downstream of the canyon during truck surveys from July 21 to September 21, 2006. It did not pass Box Canyon as it was not detected at the BC station (rkm 47) or during mobile surveys further upstream. Code 66 then migrated downstream, passed the MD station (rkm 16.7) on October 8, and was detected at the mouth of the Entiat River from October 20 to November 14, 2006. It was detected in the Columbia River at rkm 779 on December 20, 2006.

In 2007, code 66 migrated to the Twisp River. On May 28, 2007 it moved upstream in the Columbia River past the Wells Gateway station (rkm 823). It was detected at the Wells Dam tailrace (rkm 830) on May 29 and passed the dam on May 30, 2007. It traveled to the Okanogan River and passed the OK station at the mouth (rkm 859) on June 10. It moved an unknown distance upstream in the Okanogan River before it was detected moving back downstream past the OK station on June 17. It moved downstream in the Columbia River, entered the Methow River (rkm 843) and passed the LG station (rkm

1.1) on June 17. It migrated upstream and passed the GS station (rkm 10.6) on June 18 and the TG station (rkm 64.4) on June 26. It entered the Twisp River and passed the TR station (rkm 2.1) on June 28. During mobile surveys on July 11 and 18 it was detected migrating up the Twisp River. On July 27 it was detected upstream of Reynolds Creek as it moved upstream past the subsurface flow reach before it was dewatered. Code 66 was detected in the vicinity of South Creek (rkm 39) from August 2 to November 1, 2007. The signal was not detected after November 1 in the Twisp River nor at any of the fixed telemetry stations and its position was unknown until code 66 was detected in the Columbia River (rkm 840) on June 13, 2008.

Code 67 (Figure 33). Bull trout code 67 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on May 20, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on May 23 and the GS station (rkm 10.6) on May 27. During mobile surveys from May 31 to June 15 it was detected moving up the Methow River. Code 67 passed the TG station (rkm 64.4) on June 17, entered the Twisp River and passed the TR station (rkm 2.1) on June 18. During a mobile survey on June 21 it was detected at rkm 8.4. It was located on the spawning grounds in the vicinity of North Creek from July 11 to September 17. It moved downstream to the dry subsurface reach where it was detected from September 26 to November 7. It did not pass the subsurface area when the reach was re-watered, but instead moved upstream to the pool at the mouth of South Creek (rkm 39), where it was detected during the last mobile survey on November 27, before snows rendered the road impassable for the winter. Code 67 did not survive the winter, as the motionless signal code 167 was detected on May 30, 2008. The transmitter was recovered on June 18, 2008 on top of a rock outcropping across the road from the river downstream of South Creek. No bones or body parts were found with the tag, but the circumstances suggest the fish was scavenged or depredated.

Code 69 (Figure 34). Bull trout code 69 was tagged by Douglas County PUD at Wells Dam (rkm 830) and released at Starr Boat Landing (rkm 834) on May 19, 2007. It entered the Methow River and passed the LG station (rkm 1.1) on May 22 and the GS station (rkm 10.6) on May 31. During mobile surveys from May 31 to June 22 it was detected moving up the Methow River. Code 69 passed the TG station (rkm 64.4) on June 25 and the MC station (rkm 80.6) on July 1. It migrated to Early Winters Creek and was detected near the mouth of Cedar Creek on July 12 and 17. During a mobile survey on August 21 it was detected in Cedar Creek upstream of the trailhead parking lot. A foot survey on September 6 found code 69 in a pool downstream of a log jam and rock falls that was judged a probable barrier to further upstream movement. Because the stream temperature was 9.5 C at 1545 hours, Cedar Creek was surveyed from the probable barrier to the mouth for spawning activity. No redds were found, but a 600 mm bull trout was observed 50 m downstream of the code 69 location. Code 69 then moved downstream and was located in the Methow River near Goat Creek during mobile surveys from September 13 to November 21. It was detected passing the MC station (rkm 80.6) on December 9, but it moved back upstream and was detected at the station, where it overwintered in the Methow River from December 20, 2007 to March 26, 2008.

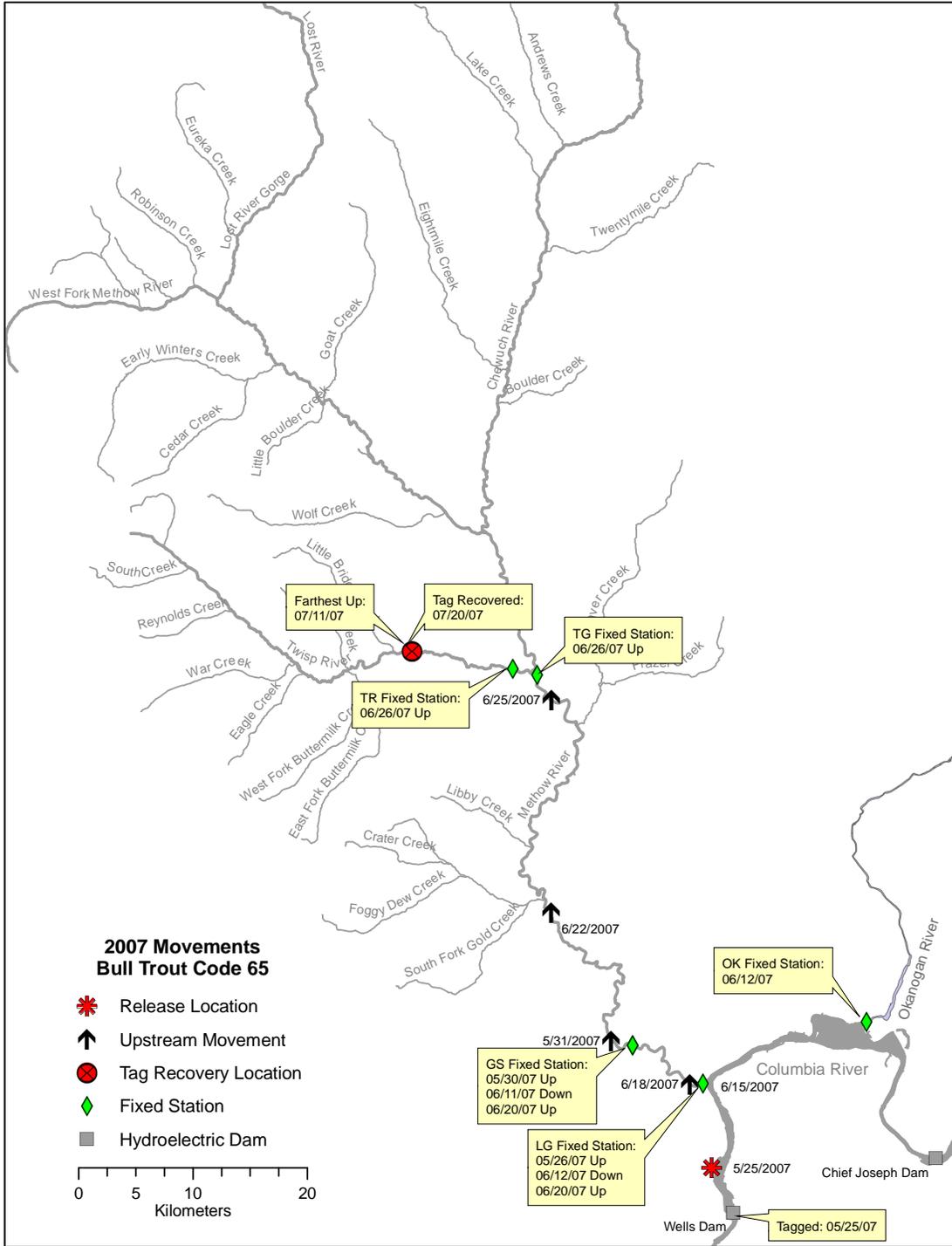


Figure 31. Map of the movements of DCPUD bull trout code 65 during 2007.

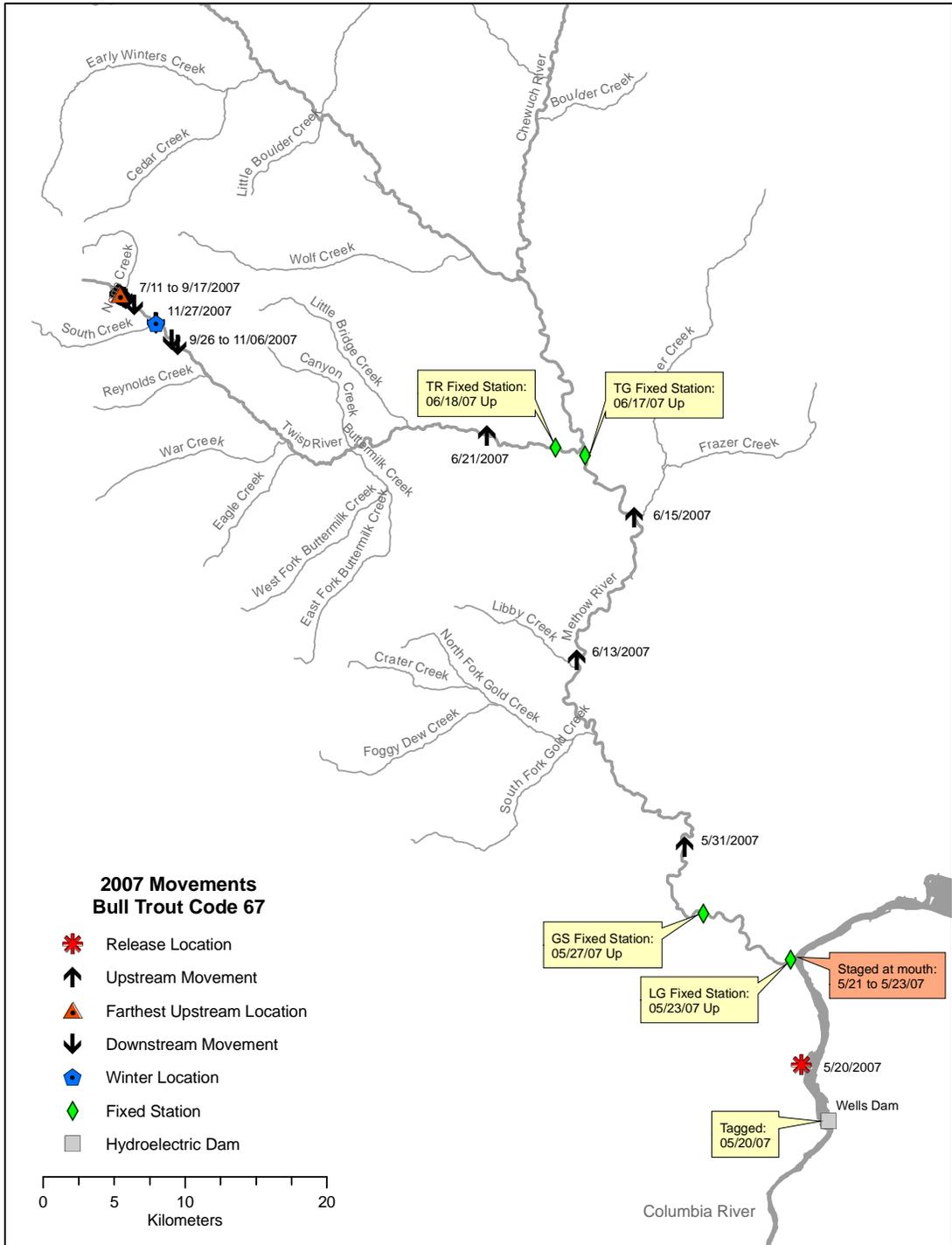


Figure 33. Map of the movements of DCPUD bull trout code 67 during 2007.

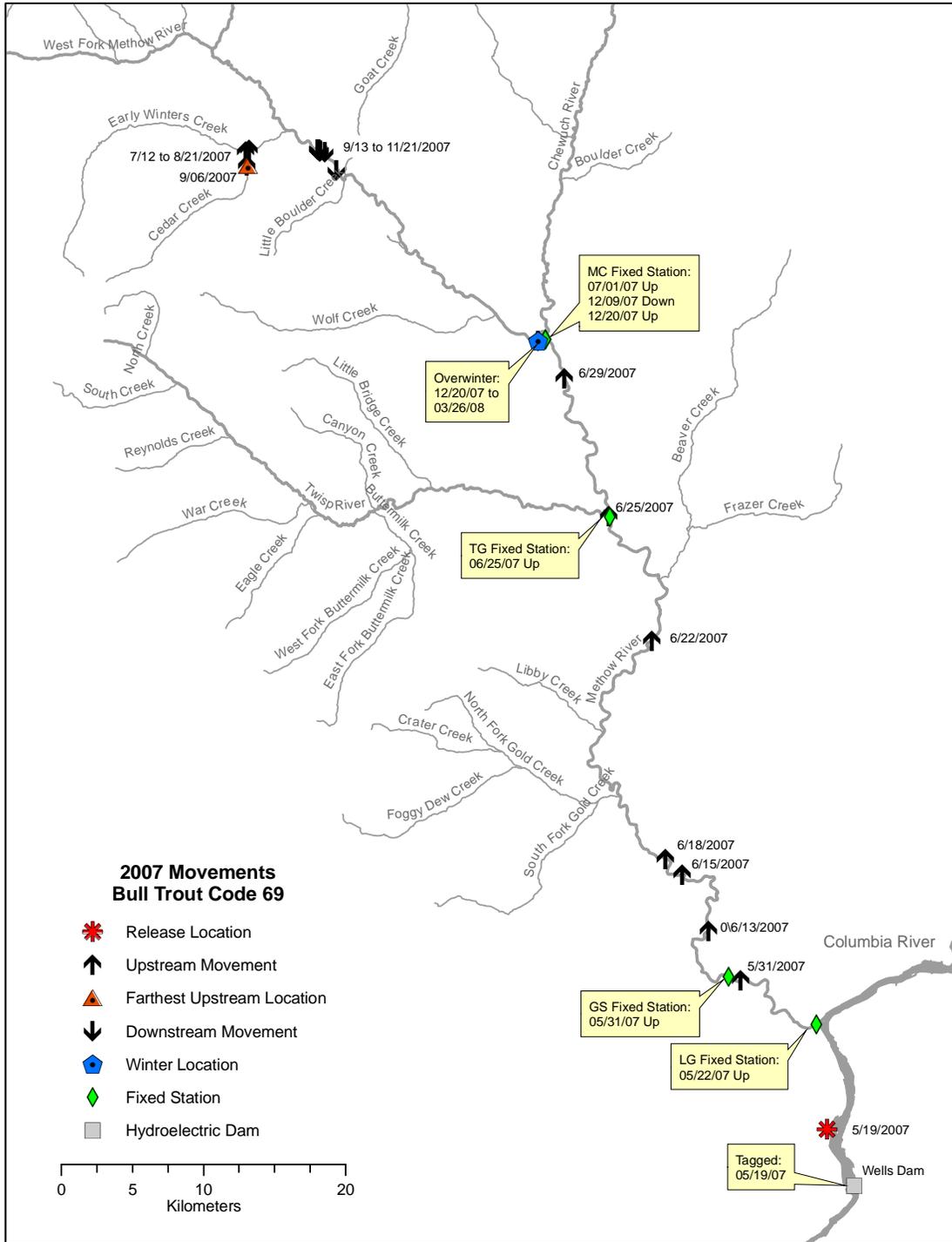


Figure 34. Map of the movements of DCPUD bull trout code 69 during 2007.

Bull trout tagged by Chelan County PUD (see Stevenson *et al.* 2008)

Code 3 (Figure 35). Bull trout code 3 was tagged by Chelan County PUD at Rock Island Dam in the Columbia River (rkm 730) on May 30, 2005. It was detected entering the Methow River and passed the LG station (rkm 1.1) on June 29, 2005 but was not detected again in 2005. Code 3 apparently did not exit the Methow River watershed and was detected in the Twisp River in 2006. After leaving the Twisp River it apparently overwintered in the Methow River at rkm 5, where it was detected during mobile surveys on November 11 and 16, 2006. See Nelson *et al.* 2007 for a complete description of its movements in 2006. Code 3 was detected in the Methow River at rkm 10 during mobile surveys on April 19 and 26, 2007. The fish was near the road, but signal was very weak and indicated the antenna was broken, which may explain the spotty detection history. It moved upstream and passed the GS station (rkm 10.6) on June 7 and the TG station (rkm 64.4) on June 22, entered the Twisp River and passed the TR station (rkm 2.1) on June 24, 2007. It was detected on the spawning grounds downstream of Reynolds Creek and the seasonal dry reach from August 20 to September 17. It moved downstream and was located near Buttermilk Creek (rkm 20.7) during a mobile survey on September 26. It passed the TR station (rkm 2.1), entered the Methow River and passed the TG station (rkm 64.4) on October 1. It was not detected in the Methow River during multiple mobile surveys but was detected at the GS station (rkm 10.6) on November 6. It was detected in the Methow River at rkm 2.7 during a mobile survey on November 30. Code 3 evidently remained in the Methow River near the mouth and was detected on the upstream antenna of the LG station (rkm 1.1) on February 29, 2008.

Code 111 (Figure 36). Bull trout code 111 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 16, 2007. It migrated upstream in the Columbia River, passed the Wells Gateway station (rkm 823) and arrived at Wells Dam tailrace (rkm 830) on May 19. Code 111 passed Wells Dam and entered the Methow River on June 3. It moved upstream and passed the GS station (rkm 10.6) on June 7, the TG station (rkm 64.4) on June 19, and the MC station (rkm 80.6) on June 21. It was detected in the Methow River upstream of Wolf Creek at rkm 87 during a mobile survey on June 27. Code 111 migrated to Early Winters Creek and on July 12 was detected at rkm 13, downstream of the barrier falls at Highway 20. It was never detected upstream of the falls during any mobile surveys but remained in the vicinity of rkm 12 to 13 from July 17 to September 14. It moved downstream and was detected at rkm 8.8 on September 28. On October 24 it was located in the Methow River just downstream of Early Winters Creek at rkm 108. It then quickly migrated downstream and passed the MC station (rkm 80.6) on October 27, the TG station (rkm 64.4) on October 29 and the GS station (rkm 10.6) on November 3. It stopped migration in the Methow River at rkm 6.4, where it remained from November 5, 2007 to March 26, 2008.

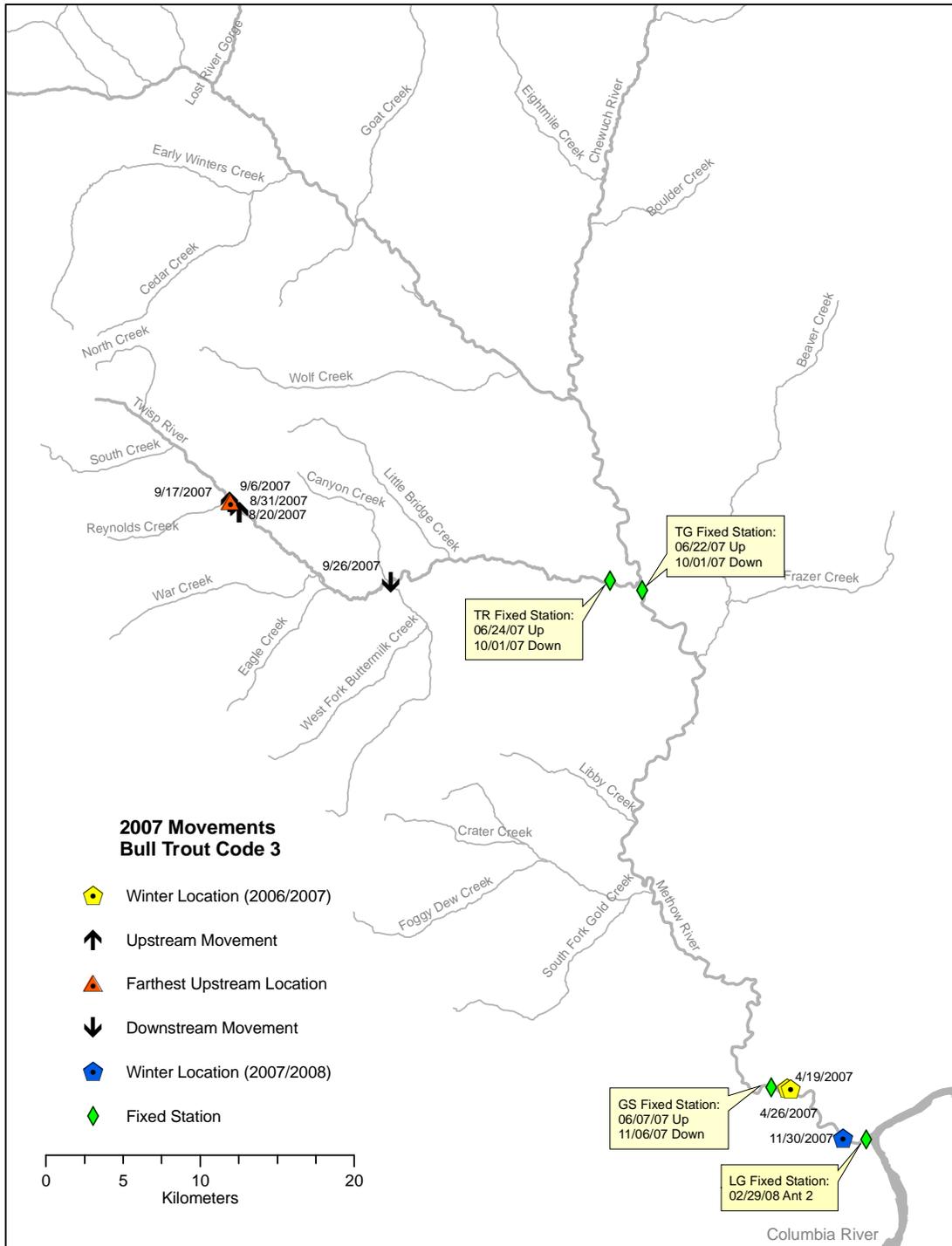


Figure 35. Map of the movements of CCPUD bull trout code 3 during 2007.

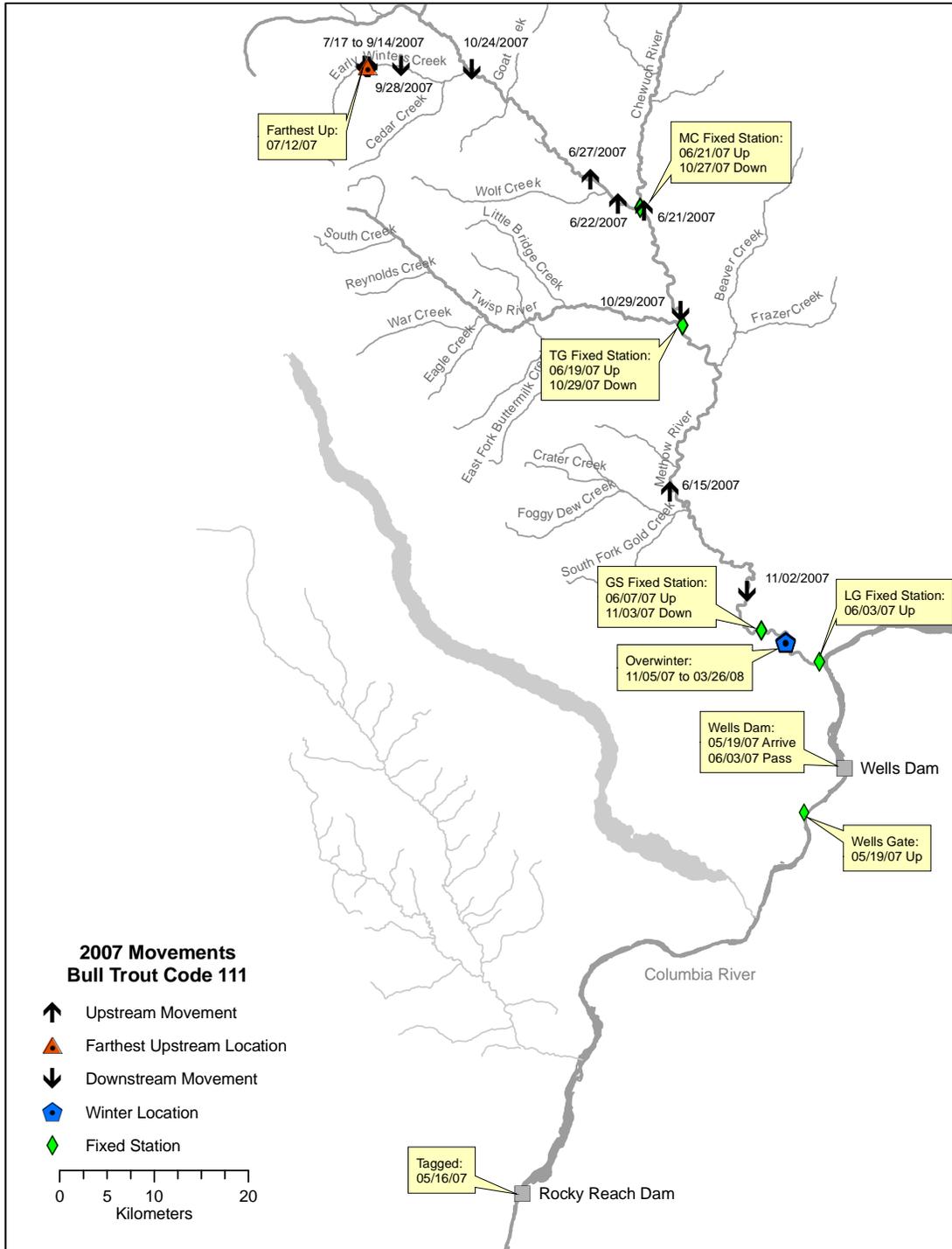


Figure 36. Map of the movements of CCPUD bull trout code 111 during 2007.

Code 115 (Figure 37). Bull trout code 115 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 24, 2007. It migrated upstream in the Columbia River and passed the Wells Gateway Station (rkm 823) and arrived at Wells Dam tailrace (rkm 830) on May 27. It passed Wells Dam, entered the Methow River and passed the LG station (rkm 1.1) on May 31. Code 115 migrated past the GS station (rkm 10.6) on June 8 and passed the TG station (rkm 64.4) on June 17. It entered the Twisp River and passed the TR station (rkm 2.1) on June 19. It migrated to the spawning grounds near Road's End Campground (rkm 43.6) where it was detected during mobile surveys from July 18 to September 26. Its exact position was located during a foot survey on September 17, when it was tracked to a small pool downstream of a cascade at rkm 44.6, upstream of the USFS bull trout spawning grounds index reach. The USFS expanded the index reach to include this area above Road's End Campground to the barrier falls (rkm 45.4) and tallied an additional 22 bull trout redds in 2007. Code 115 moved downstream and was detected at rkm 38.6 near Poplar Flat upstream of the seasonal dry reach. This was the last known location as it was not detected during subsequent mobile surveys or at any fixed stations and the fate of the bull trout is unknown.

Code 116 (Figure 38). Bull trout code 116 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 29, 2007. It migrated upstream in the Columbia River, passed the Wells Gateway station (rkm 823) on June 1, and arrived at the Wells Dam tailrace (rkm 830) on June 2. It passed Wells Dam on June 16 and entered the Methow River undetected at the LG station (rkm 1.1). During a mobile survey on June 18 code 116 was detected in the Methow River at rkm 9. It passed the GS station (rkm 10.6) on June 19 and the TG station (rkm 64.4) on July 5. It entered the Twisp River, passed the TR station (rkm 2.1) on July 6, and was detected moving upstream during mobile surveys on July 11 and 18. Code 116 was detected on the lower spawning grounds near Reynolds Creek (rkm 33.6) from July 27 to September 26. It moved downstream past the TR station (rkm 2.1), exited the Twisp River, and passed the TG station (rkm 64.4) on October 2. It moved downstream in the Methow River until it stopped at rkm 29, where it was detected during mobile surveys from December 20, 2007 to March 26, 2008.

Code 171 (Figures 39). Bull trout code 171 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 25, 2006. It migrated to Early Winters Creek in 2006 before it migrated back to the Columbia River at an unknown location during the winter of 2006/2007 (see Nelson et al. for a description of its movements during 2006). On May 2, 2007 during a mobile survey conducted by BioAnalysts, code 171 was detected in the Columbia River at rkm 800. It migrated upstream, passed the Wells Gateway station (rkm 823) on May 9, and arrived at Wells Dam tailrace (rkm 830) on May 10. It passed Wells Dam on May 15 and was detected in the Columbia River near the Methow River from May 20 to 25. It entered the Methow River and passed the LG station (rkm 1.1) on May 26 and the GS station (rkm 10.6) on May 27. It was detected moving up the Methow River during mobile surveys from May 31 to June 15. Code 171 passed the TG station (rkm 64.4) on June 19 and the MC station on June 24. It migrated to Early Winters Creek and on July 17 was detected at rkm 13, downstream of the barrier falls at Highway 20. It was never detected upstream of the falls during any mobile surveys but remained in the vicinity of rkm 11 to 13 from July 17 to August 21. It moved downstream to rkm 8

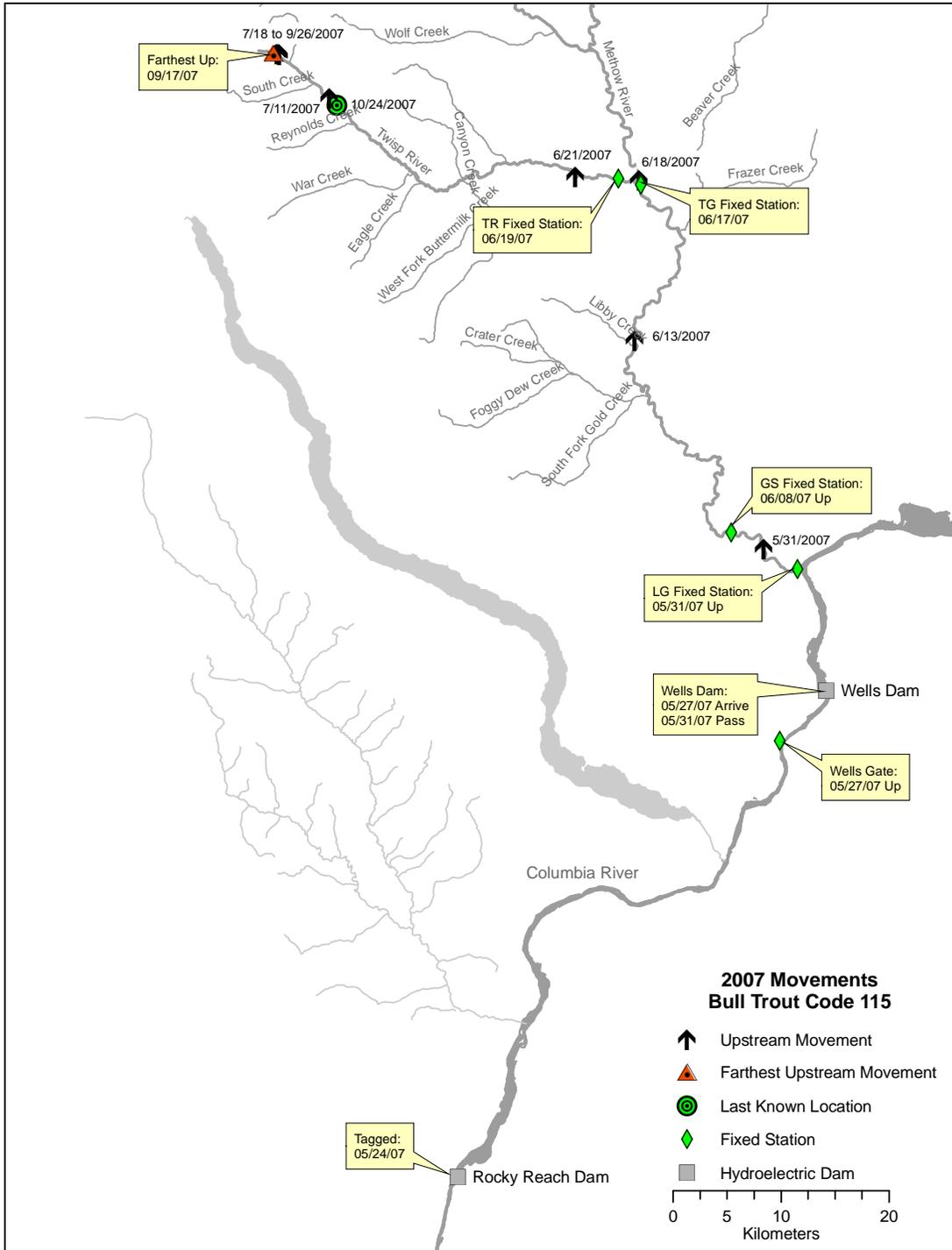


Figure 37. Map of the movements of CCPUD bull trout code 115 in 2007.

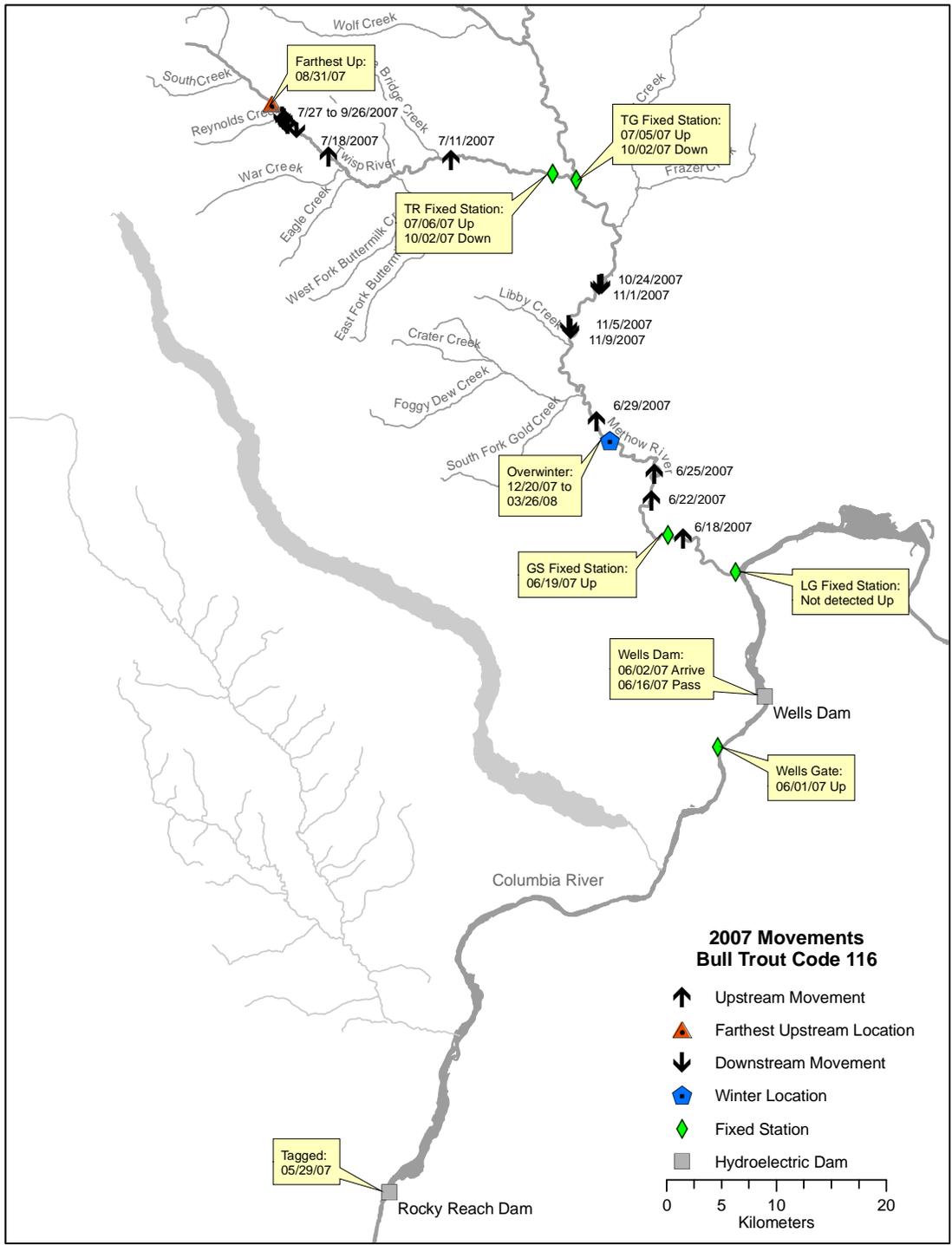


Figure 38. Map of the movements of CCPUD bull trout code 116 during 2007.

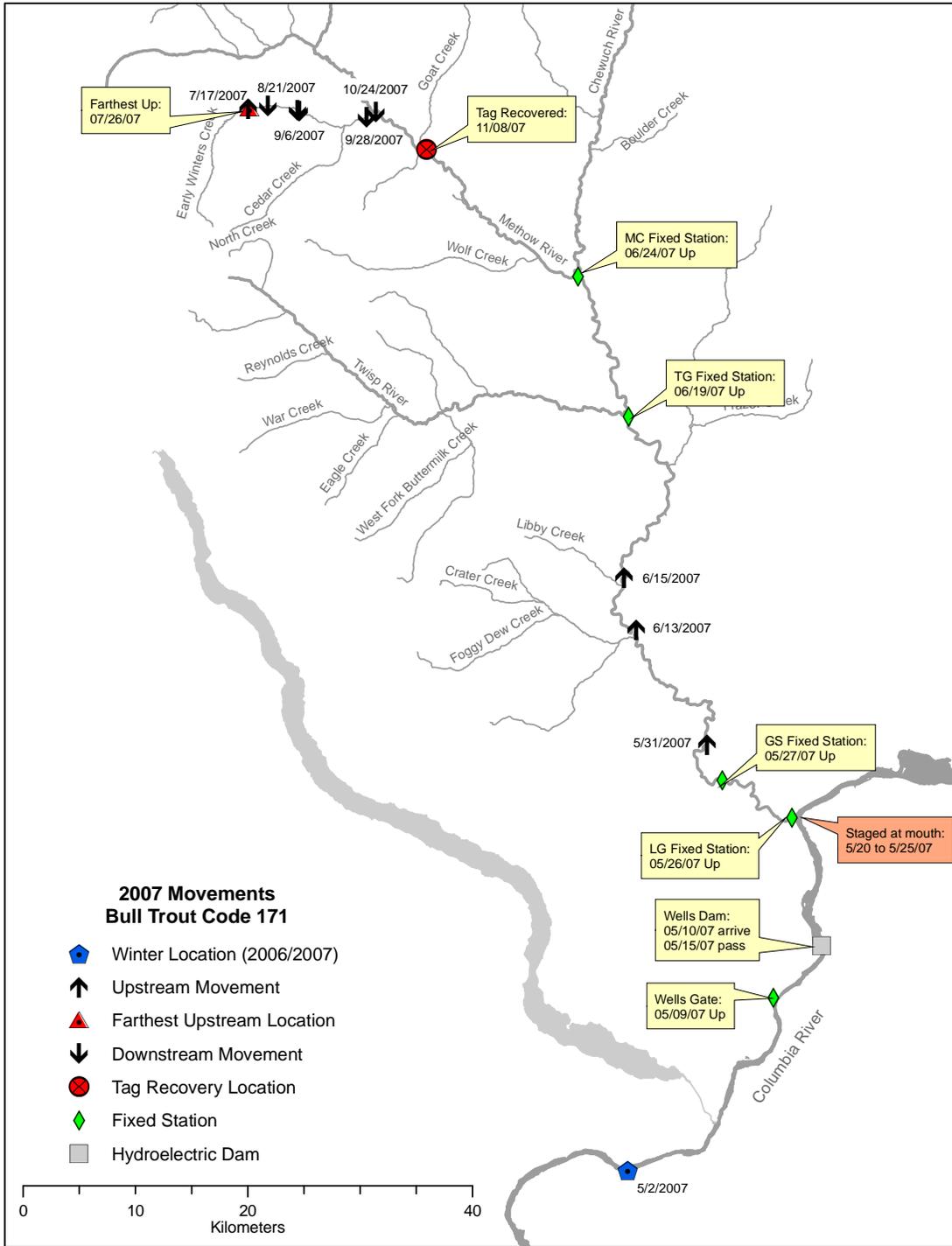


Figure 39. Map of the movements of CCPUD bull trout code 171 during 2007.

where it was detected on September 6 and 14 during the bull trout spawning period. On September 28 code 171 was detected in Early Winters Creek at rkm 1 and on October 24 it was located downstream of Early Winters Creek in the Methow River at rkm 108. On November 8, code 171 was recovered in the Methow River at rkm 101. The carcass was found on the river left bank about 0.25 m from the wetted channel (Figure 40). The body cavity was chewed open on the right side near the vent but it is unknown if the bull trout it was depredated or if it died of natural causes and was scavenged.



Figure 40. Photograph of the carcass of Chelan County PUD bull trout code 171 found on bank of the Methow River at rkm 101 on November 8, 2007.

Code 174 (Figure 41). Bull trout code 174 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 26, 2006. It migrated to the Methow River and was located on the lower spawning grounds of the Twisp River near Reynolds Creek in 2006 (see Nelson et al. (2007) for a complete description of the movements of code 174 during 2006). During the winter of 2006/2007 code 174 was detected upstream of Rocky Reach Dam in the Columbia River (rkm 764 – 766). On May 13, 2007 it was detected by the forebay antennae at Rocky Reach Dam (rkm 762) but it did not move further downstream. It migrated upstream and was detected at the Wells Gateway station (rkm 823) on June 7. It was not detected at the Wells Dam tailrace station (rkm 830) but instead moved back downstream and passed the Wells Gateway and was detected by the EM station at the mouth of the Entiat River (rkm 779) on June 8 to 12. It moved to an unknown location in the Columbia River until it entered the Entiat River and passed the EM station (rkm 0.5) on June 21. It continued upstream in the Entiat River and passed the ER station (rkm 5.1) on June 26. During a mobile survey on July 3 it was located at rkm 8. Code 174 moved upstream past the MD station (rkm 16.7) on July 14, was detected at rkm 21 on July 20 and at rkm 35 on August 1. The farthest upstream detection of code 174 was at rkm 41.8 of the Entiat River during a mobile survey on August 17 (it was not

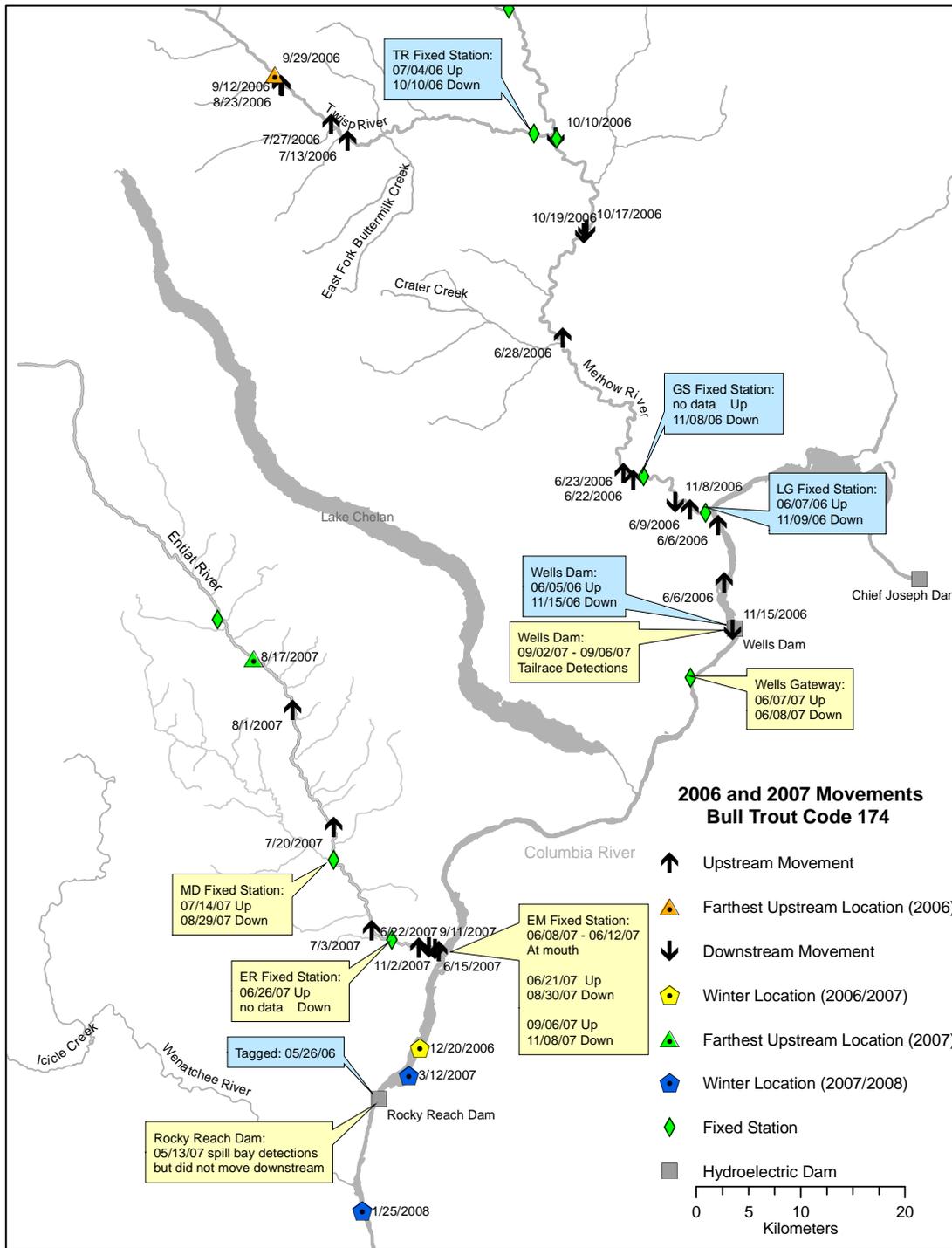


Figure 41. Map of the movements of CCPUD bull trout code 174 in 2006 and 2007.

detected at the DB station (rkm 46.7) below Box Canyon). Prior to the spawning season, code 174 moved downstream and passed the MD station (rkm 16.7) on August 29 and the EM station (rkm 0.5) on August 30. It moved upstream in the Columbia River and was detected in the Wells Dam tailrace from September 2 to 6 before it moved back downstream to the Entiat River. It remained in the lower Entiat River near the mouth from September 6 to November 8, before it passed the EM station (rkm 1) and entered the Columbia River. During a BioAnalysts boat survey on January 25, 2008 code 174 was detected at rkm 751 of the Columbia River, downstream of the Wenatchee River confluence.

Code 177 (Figure 42). Bull trout code 177 was tagged by Chelan County PUD at Rocky Reach Dam (rkm 762) on May 30, 2006. It migrated upstream but was not detected as it passed Wells Dam and entered the Methow River in 2006. It was last detected near the mouth of Gold Creek during a mobile survey on June 23. Because code 177 was not detected during any other mobile surveys in the Methow River or during a truck survey of the Gold Creek watershed on August 22, 2006 it was speculated the transmitter was malfunctioning (Nelson et al. 2007). In 2007, however, code 177 was detected in Foggy Dew Creek during an aerial survey conducted by BioAnalysts on September 5. On September 12 the carcass and tag were recovered in Foggy Dew Creek at rkm 5.9 (Figure 43). Because no signals were detected during the Foggy Dew truck survey in 2006, we suspect that code 177 was at Foggy Dew Falls at that time and beyond the range of our detection capability (when we recovered the carcass and tag one kilometer downstream of the falls, the signal was only faintly detected by the amplified antenna system of the truck parked at the end of the road). Thus it appears code 177 was in Foggy Dew Creek during the fall and winter of 2006, and based on the deteriorated condition of the carcass (Figure 43), died sometime during the summer of 2007. Code 177 is the first fluvial bull trout documented in the Gold Creek watershed and may have spawned there in 2006.

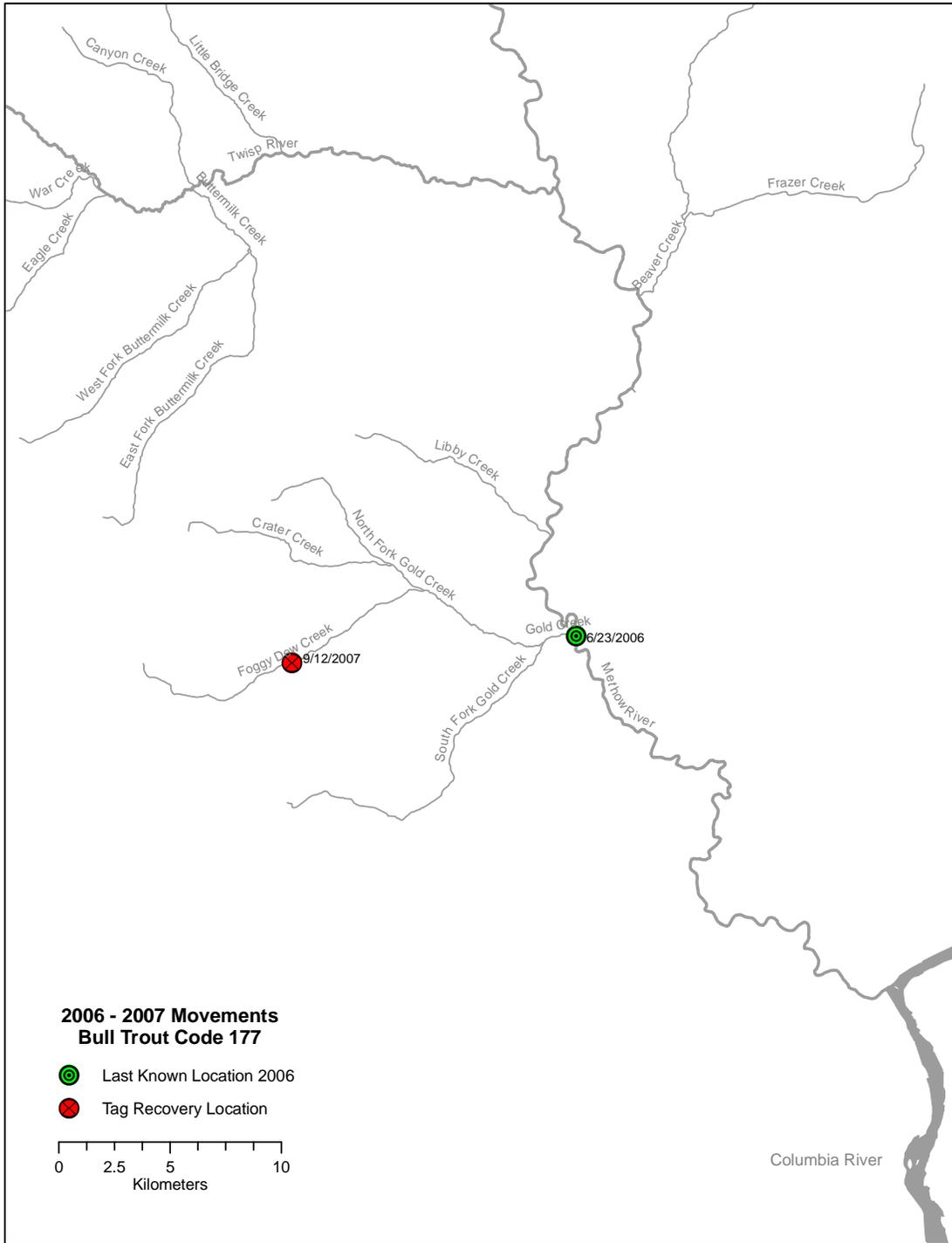


Figure 42. Map of the recovery location of CCPUD bull trout code 177 in 2007.



Figure 43. Photograph of the decomposed carcass (circled) of Chelan County PUD bull trout code 177 in Foggy Dew Creek at rkm 5.9 on September 12, 2007.

Code 184 (Figure 44). Bull trout code 184 was tagged by Chelan County PUD at Rocky Reach Dam on June 5, 2006. It migrated to the Twisp River spawning grounds near North Creek in 2006 (see Nelson et al. 2007). It overwintered in the Columbia River and was detected at rkm 740 during a mobile survey conducted by BioAnalysts on May 3, 2007. Code 184 moved upstream and was detected at the tailrace station of Rocky Reach Dam (rkm 762) on June 4 before it moved back downstream and entered the Wenatchee River (rkm 754). It moved upstream past the WR station (rkm 12.5) on June 18 and was detected at rkm 17 during a mobile survey on June 25. It then moved downstream past the WR station (rkm 12.5) on June 29, re-entered the Columbia River, and was detected at the tailrace station of Rocky Reach Dam (rkm 762) later that same day. Code 184 moved upstream through Rocky Reach Dam on July 2. It passed the Wells Gateway station (rkm 823) and arrived at Wells Dam (rkm 830) on July 4. On July 9, it moved upstream through Wells Dam, entered the Methow River, and was detected at the LG (rkm 1.1) and GS (rkm 10.6) stations. It passed the TG station (rkm 64.4) on July 16, entered the Twisp River and passed the TR station (rkm 2.1) on July 17. It was detected in the Twisp River downstream of Buttermilk Creek (rkm 19) during mobile surveys from July 18 to August 31. It moved downstream and passed the TR station (rkm 2.1) and TG station (rkm 64.4) on September 3. During mobile surveys it was detected in the Methow River between rkm 35 and 17 from September 5 to November 19. It then continued downstream, passed the GS station (rkm 10.6) on November 20 and the LG station (rkm 1.1) on November 21. From November 22 to December 20 it was intermittently detected near the mouth of the Methow River before it entered the Columbia River and wintered at an unknown location.

Code 188 (Figure 45). Bull trout code 188 was tagged by Chelan County PUD at Rocky Reach Dam on June 22, 2006. It migrated to Wolf Creek in 2006 (see Nelson et al. 2007). After leaving Wolf Creek, code 188 overwintered in the Columbia River and was located at rkm 719 near Crescent Bar during a mobile survey conducted by BioAnalysts on December 20, 2006. In the spring it migrated upstream and was detected at Rock Island Dam (rkm 730) on June 7, 2007. It passed Rock Island Dam on June 8 and was detected at Rocky Reach Dam (rkm 762) on June 10. It passed Rocky Reach Dam on June 11 and was detected at Wells Dam (rkm 830) on June 14. Code 188 passed Wells Dam on June 19 and entered the Methow River (rkm 843) on June 20. It migrated upstream past the LG (rkm 21.1) and GS (rkm 10.6) stations on June 20. Code 188 was detected at Gold Creek during a mobile survey on June 29. It passed the TG station (rkm 64.4) on July 3 and the MC station (rkm 80.6) on July 6. It entered Wolf Creek and passed the WC station (rkm 1.4) on July 7. It was not detected during the foot survey in Wolf Creek on July 10 so it was still downstream of the log jam at rkm 6.6. As noted for bull trout code 75, the log jam was not probably not passable for code 188 until July 22, when rain substantially increased stream flow. On July 24 code 188 was detected upstream of North Fork Wolf Creek (rkm 11). It was detected in this spawning area on September 5. During foot surveys on November 7 and 20 it was located at rkm 8. Code 188 wintered at this location and was detected during an aerial survey conducted by BioAnalysts on April 21, 2008. (Because the Chelan County PUD transmitters were not motion sensitive, it is unknown if the bull trout was still alive at that time.) On July 16, 2008 the transmitter was tracked to a log jam at rkm 4.3. The tag was buried in the jam and could not be recovered so the timing and cause of death were not determined.

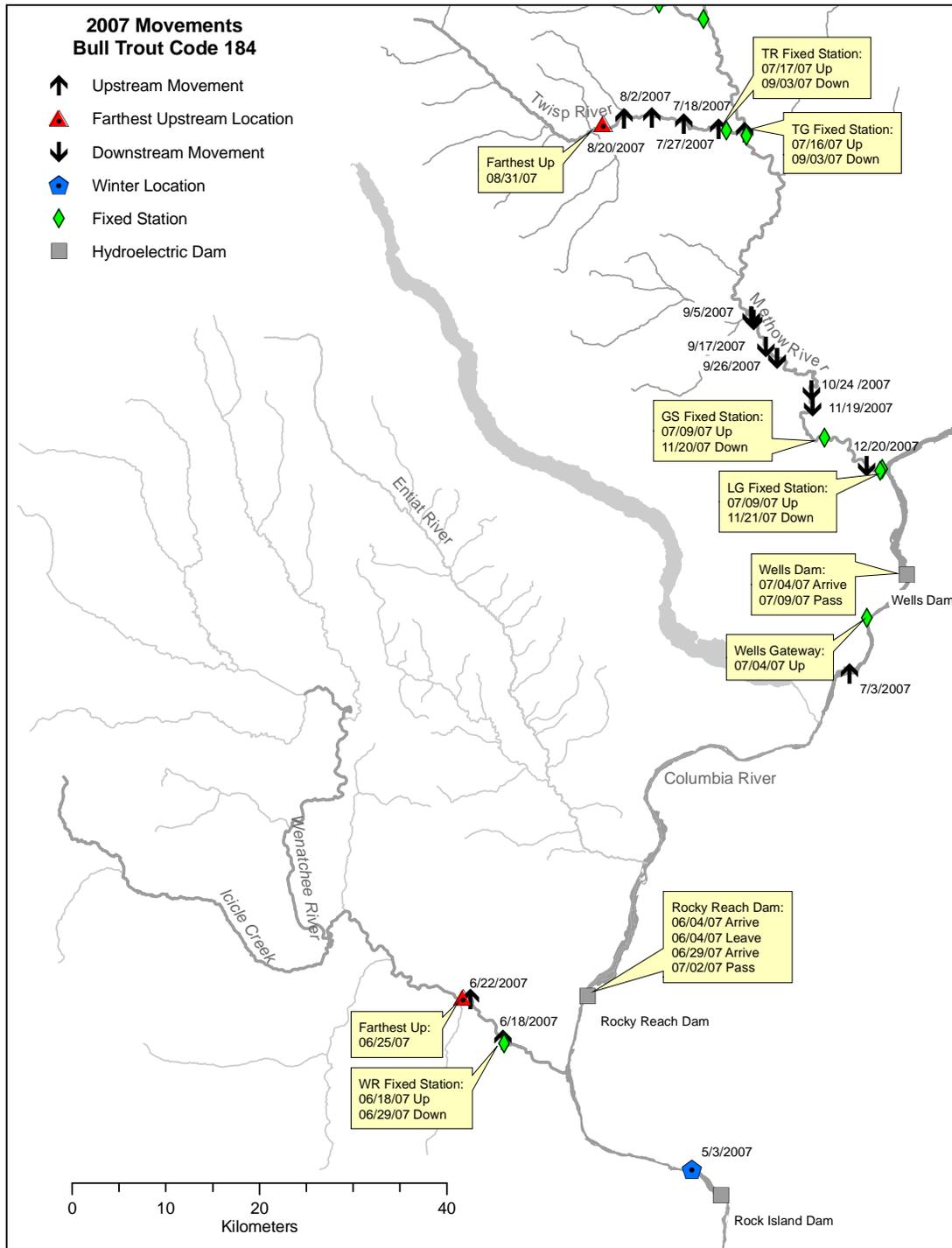


Figure 44. Map of the movements of CCPUD bull trout code 184 during 2007.

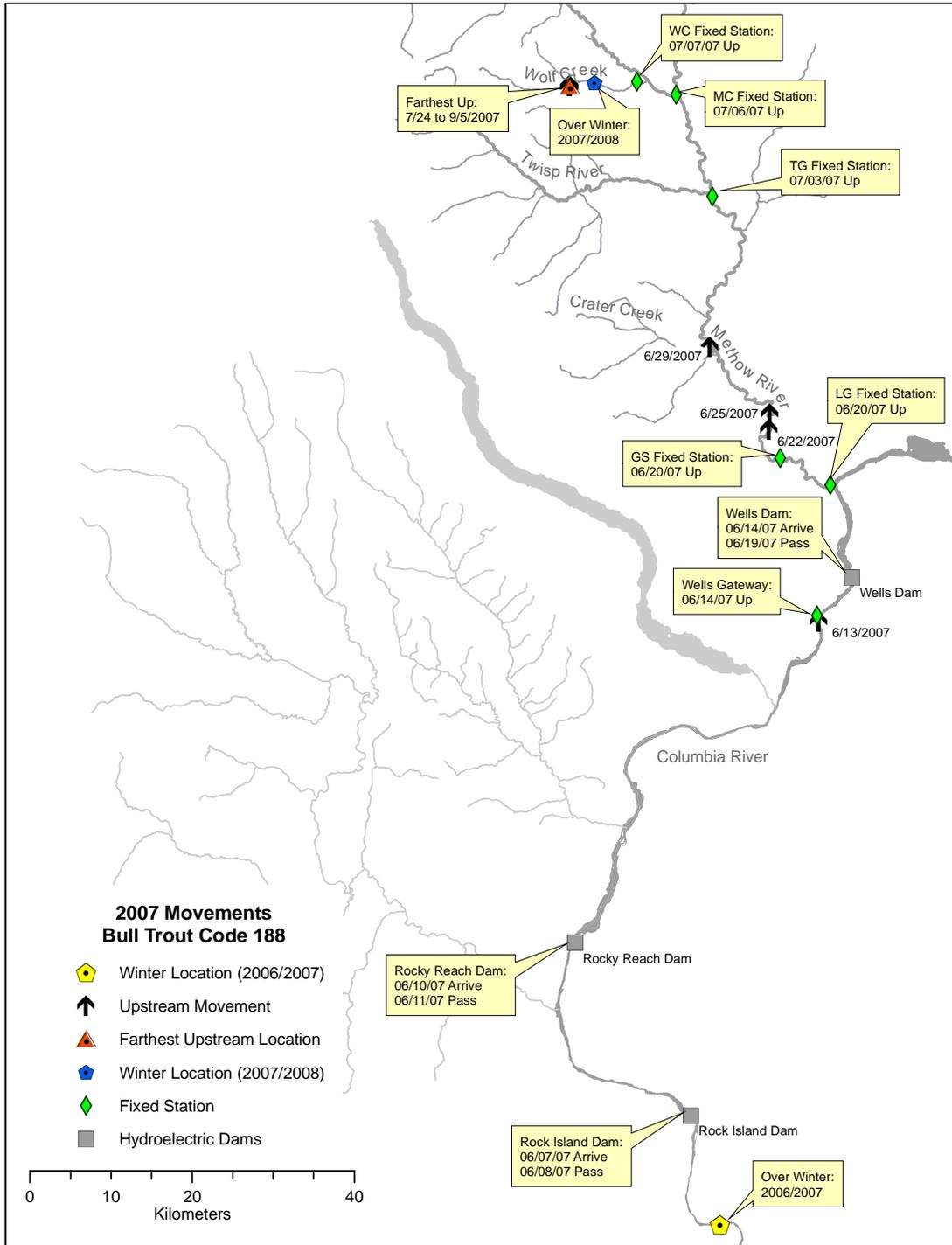


Figure 45. Map of the movements of CCPUD bull trout code 188 during 2007.

Code 190 (Figure 46). Bull trout code 190 was tagged by Chelan PUD at Rocky Reach Dam on June 29, 2006. Code 190 did not migrate out of the Columbia River in 2006, so both its 2006 and 2007 movements are detailed here. After tagging, code 190 moved upstream past the Wells Gateway station (rkm 823) on July 1 and was detected at the Wells Dam tailrace (rkm 830) from July 2 to July 6, 2006. It moved back downstream and was detected at the Wells Gateway station on July 6 before moving back to the Wells Dam tailrace where it was detected from July 9 to July 11. Code 190 was detected in the Wells Dam fishway from July 11 to July 12 before it again moved downstream and was detected at the Wells Gateway station on July 15. It moved back upstream and was detected in the Wells Dam tailrace from July 23 to September 24, including mobile detections on July 26 and September 19, 2006. Code 190 was not detected again during 2006, but on January 24, 2007 it was detected in the Columbia River at rkm 774 during a mobile survey conducted by BioAnalysts.

On March 29, 2007 code 190 was detected moving downstream through Rocky Reach Dam (rkm 762). It was then detected in the Columbia River at rkm 751.5 during a boat survey conducted by BioAnalysts on May 3. It moved upstream to Rocky Reach Dam on June 7 and passed on June 8. It was not detected as it passed the Wells Gateway station but was detected at the Wells Dam tailrace on June 10. Code 190 passed Wells Dam on June 11 and entered the Okanogan River on June 11. It is not known how far upstream it moved in the Okanogan River but was detected exiting the river on June 16. It moved to the Methow River where it was detected at the LG station (rkm 1.1) on June 16 and at the GS station (rkm 10.6) on June 17. Code 190 migrated upstream and was detected during mobile surveys in the Methow River from June 18 to June 29. It passed the TG station (rkm 64.4) on June 30, entered the Twisp River and passed the TR station (rkm 2.1) on July 1. It was detected near Buttermilk Creek on July 11 and near Reynolds Creek on June 18. Code 190 was detected on the upper Twisp River spawning grounds in the vicinity of North Creek (rkm 45.1) from July 27 to September 17. It moved downstream and was detected at rkm 44.9 on September 26. It was next detected at rkm 41, upstream of the dry reach near Poplar Flat Campground, on October 24. On November 1, the transmitter and a few bones were recovered 30 m from the stream bed, in the same area where the bones of code 50 were recovered. Circumstances suggest the bull trout was either depredated or scavenged.

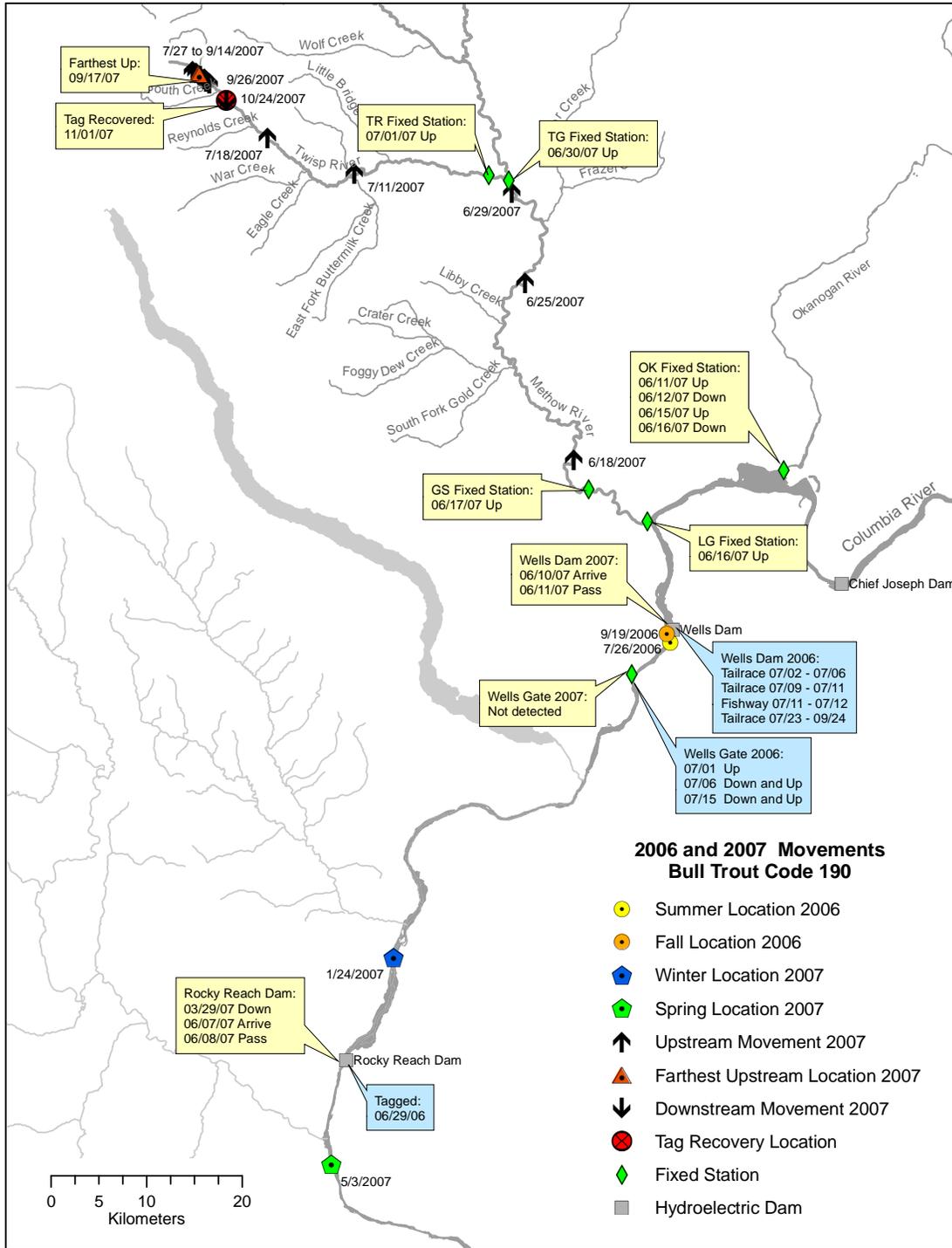


Figure 46. Map of the movements of CCPUD bull trout code 190 in 2006 and 2007.

Appendix 2: Analysis of resident bull trout in Early Winters Creek

Introduction

A six meter high waterfall in Early Winters Creek at the Highway 20 Bridge (rkm 13.1)¹ is considered impassable to anadromous salmonines (Mullan et al. 1992). The behavior and movements of radio-tagged fluvial bull trout indicate that conclusion also applies to migratory riverine fish (Nelson and Johnsen 2012). However, the draft bull trout recovery plan (USFWS 2002 and 2004) cites a personal communication that “migratory-sized bull trout were observed above the waterfall during recent electro-fishing surveys by the U.S. Fish and Wildlife Service.” In order to evaluate this statement, we examined the data from those electro-fishing surveys, which were conducted during the development of bull trout sampling efficiency models (Thurrow *et al.* 2004) and used in a genetic analysis of bull trout populations (Spruell and Maxwell 2002). This appendix contains an analysis of that detailed data on bull trout sizes in Early Winters Creek upstream of the waterfall.²

Methods

The methods used during the surveys for development of the bull trout sampling efficiency models are described by Thurrow *et al.* (2004). Briefly summarized, electro-fishing was used to collect and mark bull trout for enumeration during subsequent snorkeling and electro-fishing surveys. During the pre-survey fish marking, crews used electro-fishing gear to capture, mark, and measure (10 mm size groups) all age 1+ bull trout and other salmonines. One upstream and one downstream pass were completed in each 100 m unit. During the abundance survey, crews snorkeled upstream in the units both in the day (1000 – 1700 hours) and night (2230 – 0430 hours), recorded marks, and estimated size classes (100 mm size groups). After snorkeling was completed, crews again electro-fished the units, recorded marks and the number of bull trout (10 mm size groups) captured during up to 5 passes in each unit. In 2000, fin clips were taken from marked bull trout in Early Winters Creek for use in the genetic analysis (Spruell and Maxwell 2002) and the exact measurements of those bull trout were recorded.

Results

In August 2000, three units in Area A (rkm 13.2 – 14) and three units in Area B (rkm 15 – 15.6) were sampled in Early Winters Creek and in August 2002, three units were sampled in Pine Creek (rkm 15.6) near its mouth (Figure 47). All sites were upstream of the Highway 20 waterfall at rkm 13.1 (Figure 48).

¹ All river kilometer designations are approximate and may differ from those used in other reports or by other agencies.

² Spreadsheets of the data collected during the 2000 and 2002 field seasons were provided by Russ Thurrow and John Guzevich of the USFS Rocky Mountain Research Station. Copies of the 2000 season field datasheets, a list of the size measurements of the bull trout used in the genetic analysis, and maps of the 2000 sampling locations were provided by Jeff Chan of the USFWS Western Washington Fish and Wildlife Office.

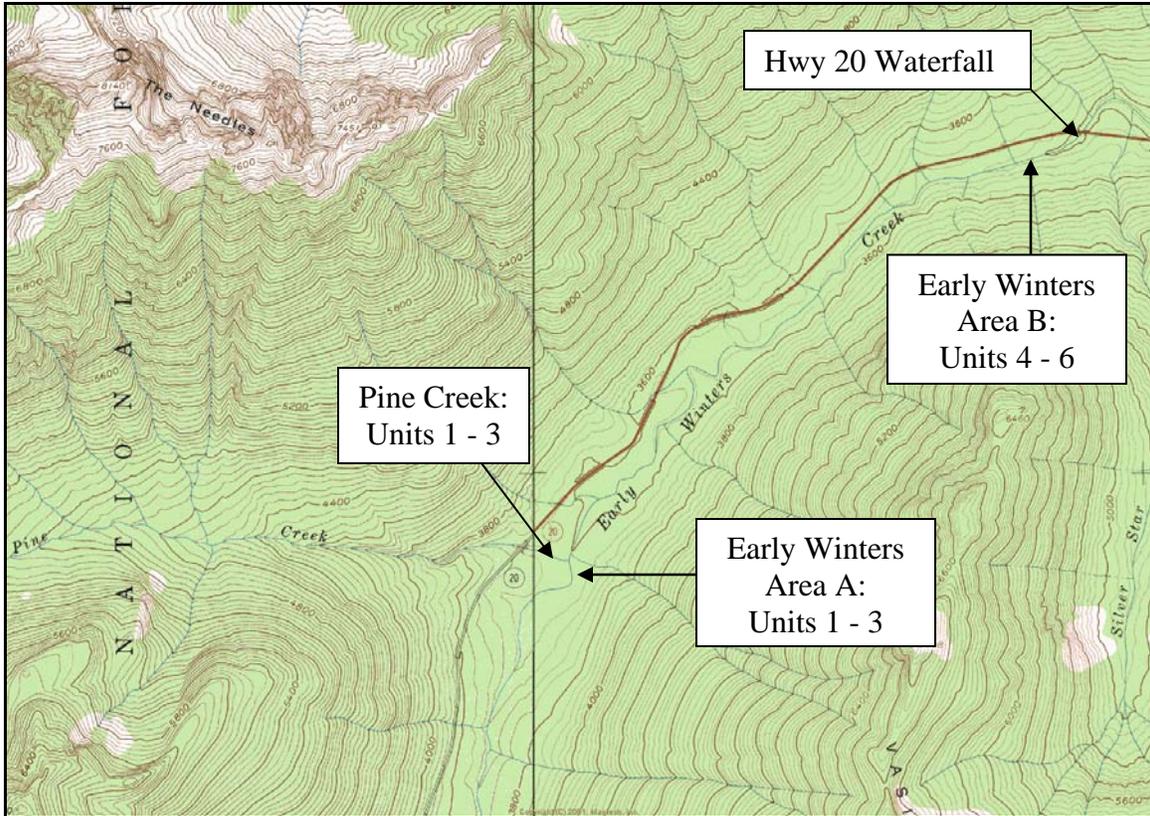


Figure 47. Map of the bull trout sampling locations in Early Winters Creek and Pine Creek during August 2000 and August 2002.



Figure 48. Photograph of the waterfall in Early Winters Creek at the Highway 20 Bridge (rkm 13.1).

In 2000, a total of 105 unmarked bull trout were recorded in the survey units in Early Winters Creek upstream of the Highway 20 waterfall. Of these, 33 were marked and measured while electro-fishing for the pre-survey, 33 unmarked bull trout were captured and measured during the electro-fishing efficiency trials, and 39 unmarked bull trout were recorded during the day and night snorkeling. In all units, bull trout measured during electro-fishing were less than 300 mm in length (Figures 49 and 50). During snorkeling, only 1 bull trout was estimated as greater than 300 mm in length (Figure 50). The exact measurements of the marked fish that were sampled for the genetic analysis ranged from 40 to 271 mm.

In 2002, a total of 108 unmarked bull trout were recorded in the survey units in Pine Creek, upstream of the Highway 20 waterfall. Of these, 59 were marked and measured while electro-fishing for the pre-survey, 36 unmarked bull trout were captured and measured during the electro-fishing efficiency trials, and 13 unmarked bull trout were recorded during the day and night snorkeling. All recorded bull trout were less than 300 mm in length (Figure 51).

Discussion

By the definition used in the draft bull trout recovery plan, resident bull trout are 300 mm or less in length (USFWS 2002). In Washington, however, mature adult resident bull trout are known to range from 200 – 375 mm in size (WDFW 2000). Based on field observations, the USFS Methow Valley Ranger District considered resident bull trout to be 400 mm or less (USFS 2006). The apparent discrepancies in these size definitions results from the omission of a qualifier such as “usually” in the definition used in the draft recovery plan. For example MacPhail and Baxter (1996) state that resident bull trout “rarely exceed 300 mm.” Brown (1994) states “Stream resident seldom reach a size over 30 cm. However, little is known of the life history of these resident bull trout stocks.” Therefore, there is no justification to state that a bull trout is migratory simply because it greater than 300 mm. The largest confirmed resident bull trout in the Methow Core Area is a 324 mm specimen collected in East Fork Buttermilk Creek on October 6, 1989, which otolith annuli indicated was a 10 year old resident (Mullan *et al.* 1992).

All the bull trout measured during electro-fishing in 2000 and 2002 were less than 300 mm, and only one of the bull trout observed during snorkeling in 2000 was estimated in the 300 – 400 mm size class. The estimated length was not given, but Thurow *et al.* (2004) state 350 mm as the upper limit of the size class of bull trout encountered during the study. Given that the snorkel observation was within the size class of the largest known resident bull trout in the Methow Core Area, and combined with the error inherent with underwater visual estimation of fish length, that fish should be considered a resident bull trout. It is thus concluded that all the bull trout observed in Early Winters Creek during 2000 and 2002 were of the resident life history form.

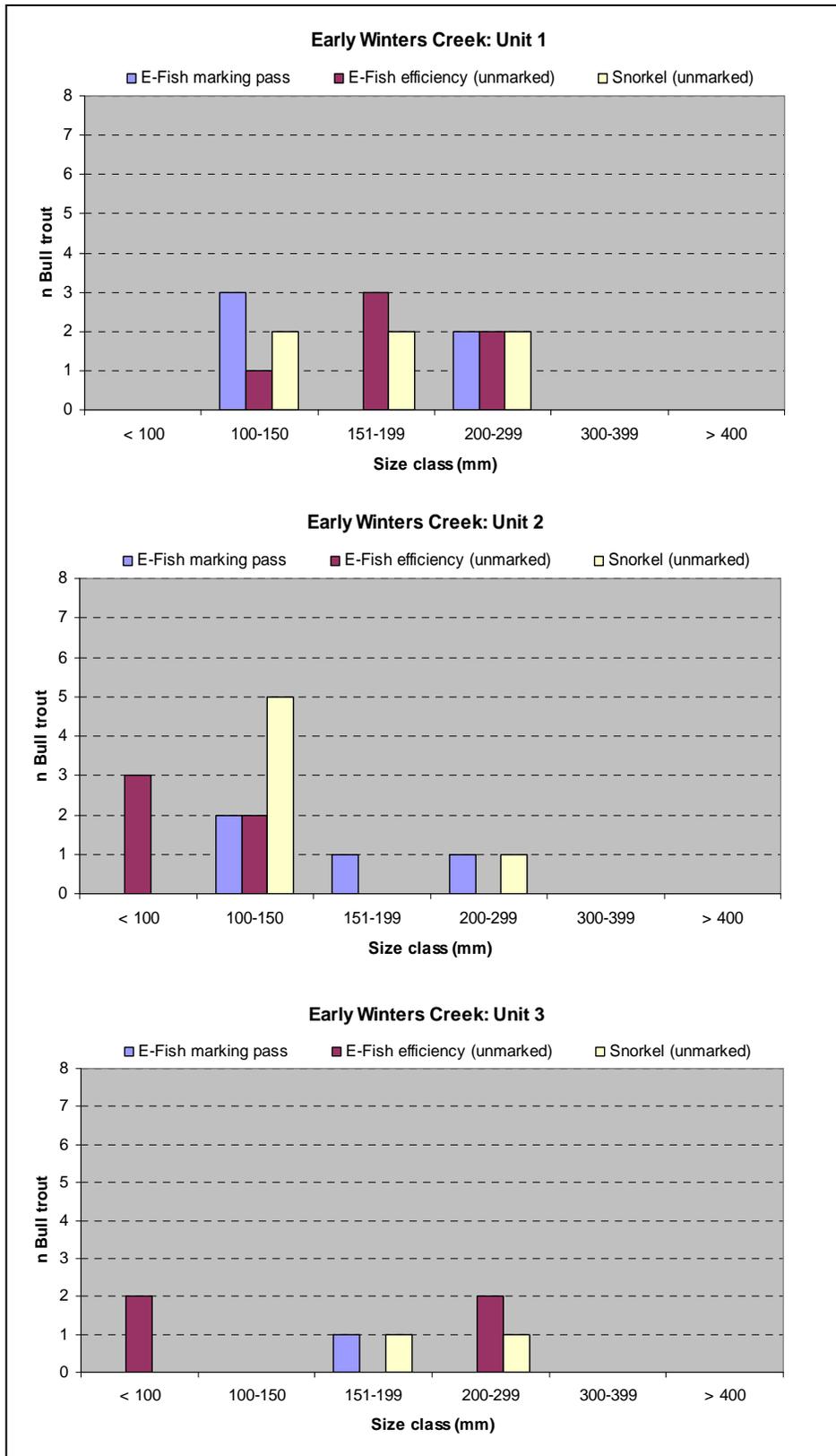


Figure 49. Size classes of bull trout observed at units 1 through 3 in Early Winters Creek during electrofishing and snorkeling in August 2000 (Data provided by R. Thurow and J. Guzevich (USFS) and J. Chan (USFWS)).

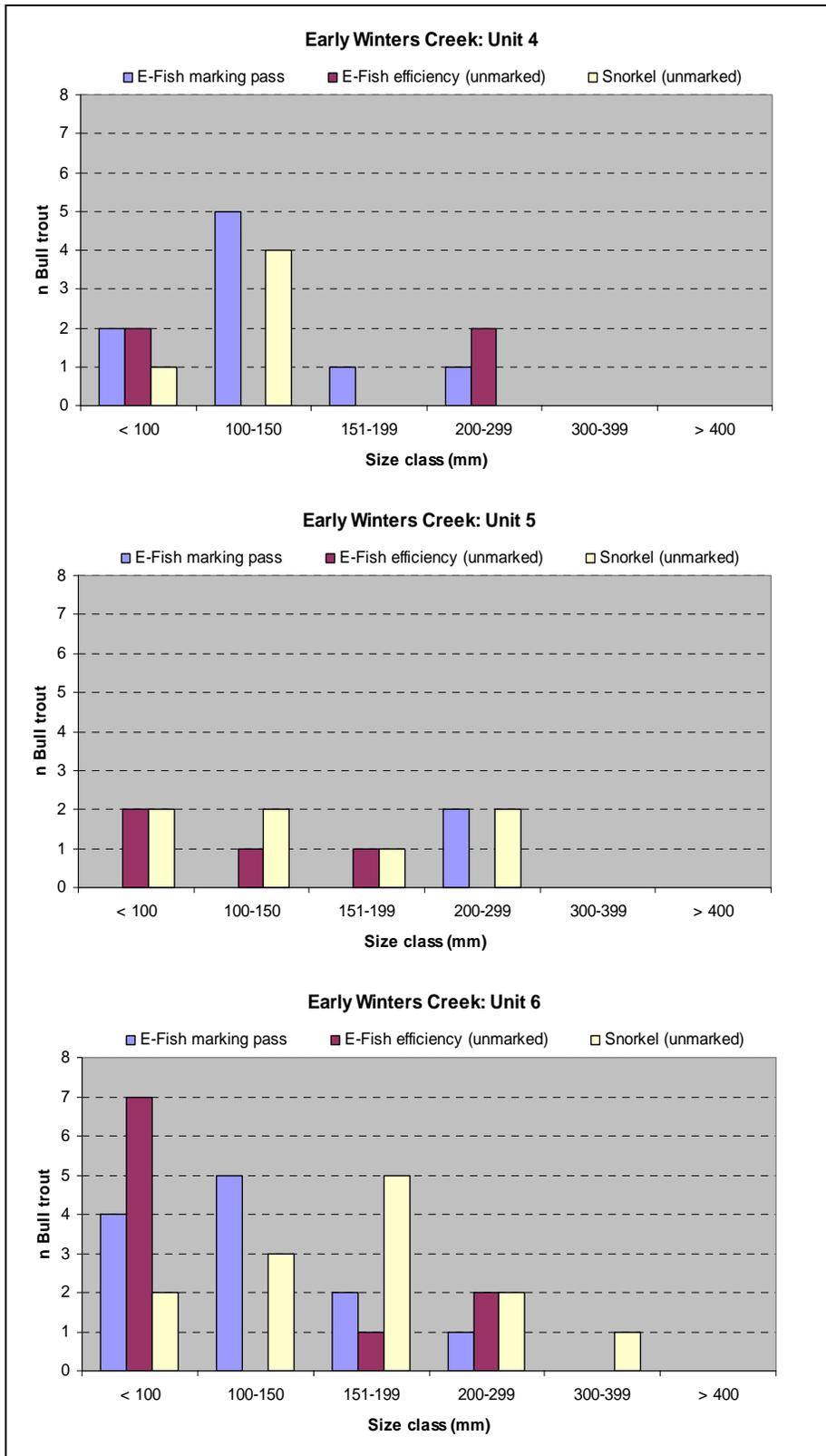


Figure 50. Size classes of bull trout observed at units 4 through 6 in Early Winters Creek during electrofishing and snorkeling during August 2000 (Data provided by R. Thurow and J. Guzevich (USFS) and J. Chan (USFWS)).

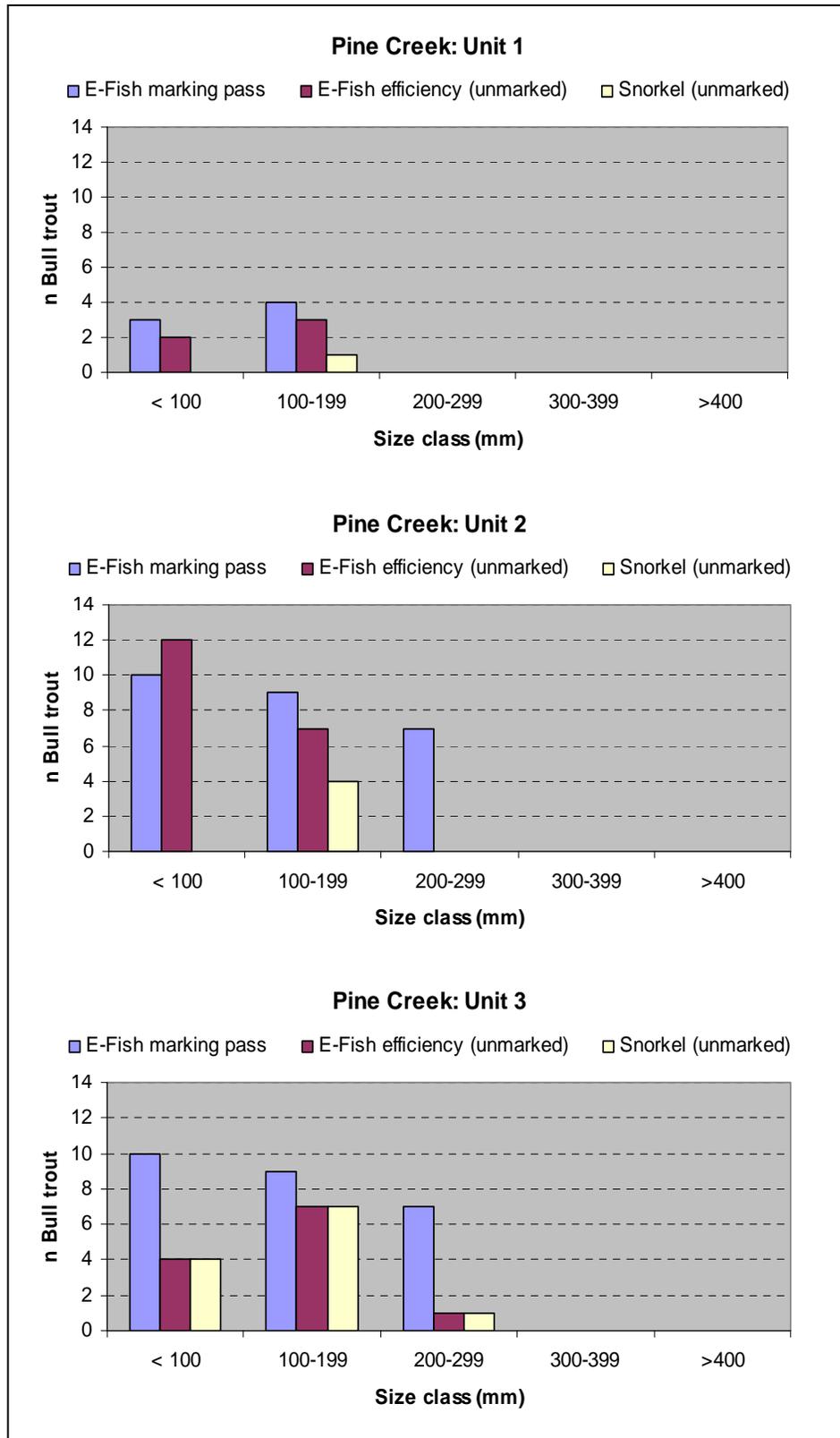


Figure 51. Size classes of bull trout observed in units 1 through 3 in Pine Creek, tributary to Early Winters Creek, during August 2002 (Data provided by R. Thurow and J. Guzevich (USFS) and J. Chan (USFS)).

Bull trout were collected in Early Winters Creek upstream of the Highway 20 waterfall during two previous studies (Mullan *et al.* 1992, Proebstel *et al.* 1998). Only resident-size bull trout were measured in 1989 by Mullan *et al.* (1992). On October 5, 1989, a total of 34 bull trout (42 – 227 mm and 1 – 7 years old) were collected at rkm 14.2 and a total of 32 bull trout (45 – 210 mm and 1 – 12 years) were collected at rkm 19.8. Only resident-size bull trout were measured in 1992 by Proebstel *et al.* (1998), when 6 bull trout (169 – 198 mm) were collected on July 22, 1992 at rkm 20.9.

Mullan *et al.* (1992) also collected bull trout in Early Winters Creek downstream of the Highway 20 waterfall barrier. On September 12, 1986 a total of 12 bull trout were collected at rkm 8.0 and on September 25, 1987 a total of 4 bull trout were collected at rkm 2.4. These fish ranged in size from 50 – 171 mm and the largest bull trout were aged as 4 years. Thus, the age and size of the specimens collected downstream of the waterfall barrier are consistent with juveniles of the migratory life history form of bull trout. Subsequent telemetry, spawning ground surveys, and visual observations of large bull trout (up to 800 mm) have confirmed that migrants are present below the waterfall.

It is concluded that the stream resident type is the only life history form of bull trout currently known upstream of the barrier waterfall in Early Winters Creek. The classification of life history forms of bull trout based solely on a rigid size class is discouraged. Other pertinent ecological information should be considered if life history form must be defined.

Isolated resident populations of bull trout face the highest risk of local extinction due to catastrophic events such as wildfire (Rieman and Clayton 1997). Thus the accurate assignment of life history form has important ramifications for the management and recovery of bull trout. In the case of upper Early Winters Creek, the waterfall is a barrier to migration and natural re-colonization is not possible. Any human activities that impact the Early Winters Creek watershed must be closely monitored and regulated to ensure that risks to the resident population are minimized.

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