

**Kootenai River White Sturgeon *Acipenser transmontanus*:
2009-2025 Investigations in Montana**



by

R. M. Sylvester, J. L. Dunnigan, J. G. Lampton, J. D. Johnson, M. R. Benner, B. C. Stephens, N.
J. Benson, C. J. Dyke, C. R. Naiser, and I. S. Cavanaugh

Montana Fish, Wildlife & Parks
385 Fish Hatchery Road
Libby, Montana 59923

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Executive Summary

Prior to 2009, information regarding Kootenai River White Sturgeon (*Acipenser transmontanus*) in Montana was somewhat limited. Volunteer angler logs collected from the late 1960's to early 1970's provided most of the historical information for the species in Montana. Sampling efforts for sturgeon by Montana Fish, Wildlife & Parks and others from the mid-1970's to 1990's resulted in very few or no sturgeon being captured. By the mid to late-1980's, population monitoring in Idaho indicated that the Kootenai River White Sturgeon population was mainly comprised of older adults and that recruitment to the population was very low. The apparent lack of juvenile recruitment resulted in the development of an experimental conservation aquaculture program lead by the Kootenai Tribe of Idaho several years prior to listing under the Endangered Species Act (ESA) in 1994. Releases of juvenile sturgeon began in 1992. Fertilized eggs and larval sturgeon have also been released in the last 15 years and both juvenile and larval sturgeon have been released in Montana. This report summarizes monitoring efforts in Montana since 2009 including effort, catch, catch per unit effort (CPUE), abundance, apparent survival, condition / growth, movement, reproductive potential and ploidy status.

Since the recent monitoring efforts in Montana began in 2009, 724 sturgeon represented by 324 individuals have been captured. Annual catch ranged from 2-77 sturgeon per year using a combination of setlines and gillnets. CPUE of sturgeon since 2009 appears to be stable or slightly increasing in three reaches of the Kootenai River in Montana. Hatchery origin (HO) sturgeon represented the vast majority ($\geq 98\%$; 712 of 724 captures) of the sturgeon catch to date and of the 324 individuals captured, only 2 were wild adults and 5 were wild juveniles. The age composition of HO sturgeon in Montana has been mostly older juveniles (i.e., ≥ 10 years old), and hatchery origin sturgeon from 22 brood years have been captured. Mark-recapture data collected since 2009 has allowed estimation of abundance, apparent survival, capture probability and the probability of entry in the Montana portion of the Kootenai River. Following the 2025 sampling season, 300 sturgeon were estimated in Montana. Apparent annual survival is high ($\approx 93\%$), and our results are consistent with recent apparent survival estimates within the Kootenai / ay Basin for hatchery origin sturgeon \geq age-3. The average condition (W_r ; 80) of sturgeon captured in Montana is also comparable to condition estimates in portions of Idaho and British Columbia. Growth was generally highest for young sturgeon (≤ 10 years old; > 50 mm/yr) and then decreased to near 25 mm TL/yr for sturgeon ≥ 25 years of age. About 88% of the HO sturgeon with known release records captured in Montana were originally released in Idaho or British Columbia. Of the 47 individual sturgeon sonic tagged in Montana since 2012, about 60% resided solely in Montana post-tagging. Movements by individual sturgeon were variable and included Montana residents which primarily occupied very small areas (i.e., ≤ 10 rkm) of the Kootenai River and others that moved throughout the entirety of the Kootenai / ay River and Kootenay Lake. At this time, there is no evidence of spawning by sturgeon in Montana, but the presence of sexually mature sturgeon is possible. HO sturgeon of suitable age / length have been captured in recent years and a few wild adults have also been in Montana during the presumed spawning window. Monitoring of ploidy levels in Montana in 2024 and 2025 indicated that the incidence of 12N sturgeon in Montana is higher than downstream. Continued monitoring of White Sturgeon in Montana is recommended and data / information collected should be used to adaptively monitor, manage and evaluate recovery efforts for Kootenai River White Sturgeon.

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Introduction

The Kootenai / Kootenay River and Kootenay Lake system in British Columbia (BC; Canada), Idaho (ID; USA) and Montana (MT; USA) contains a unique landlocked population of White Sturgeon (*Acipenser transmontanus*) that has been isolated from anadromous Columbia River and other White Sturgeon populations since the last ice age (Anders et al. 2020; Northcote 1973). This population of White Sturgeon is currently restricted to approximately 300 km of habitat including Kootenay Lake and the Kootenay / Kootenai River upstream to Kootenai Falls in Montana (Anders et al. 2020; Stephenson 2012). This headwater population of White Sturgeon has lower genetic diversity and is more tolerant of colder water temperatures than other populations elsewhere in the western United States and Canada (Paragamian and Kruse 2001). In September 1994, the Kootenai River White Sturgeon was listed as endangered under the Endangered Species Act (ESA) in the United States due to consistent low levels of natural recruitment (Anders et al. 2020; USFWS 1994 and 1999). The species was also listed as endangered in Canada under the Species at Risk Act (SARA) in 2006.

Prior to 2009, little detailed information existed regarding the status of White Sturgeon in Montana. The most extensive information was collected by Applegate (1971), who reported catching 30 White Sturgeon in Montana from 1968-1970. Lengths of the sturgeon captured ranged from 19-72 inches. In the 1970's, Montana Fish, Wildlife & Parks (FWP) staff captured 11 sturgeon between river kilometer (rkm) 305.0 and Kootenai Falls (rkm 310) using overnight gillnet and setline sets (May and Huston 1979). By the late 1970's, less than 10 White Sturgeon were estimated to reside in Montana and harvest was closed in 1979 (Graham 1981; Apperson 1992). From 1980-2008, very little information on White Sturgeon in Montana was collected. During that time, a few observations / angler catches were reported and limited sampling efforts captured few sturgeon (Apperson and Anders 1990; Apperson 1992).

After an experimental conservation aquaculture program was developed in the late 1980's and early 1990's, stocking of juvenile hatchery origin White Sturgeon began in 1992 (KTOI 2023). Most of the juvenile sturgeon stocked into the Kootenai River Basin have been age-1, but free embryos, fertilized eggs and some older juveniles (i.e., 2-4 years) have also been released (Rust and Wakkinen 2009 and 2011; KTOI 2021 and 2023). In September 1994, 10 radio / sonic tagged hatchery origin White Sturgeon from the 1992 brood year were released downstream of Kootenai Falls to assess the efficacy of stocking hatchery origin sturgeon in Montana. By the end of October 1994, 100% of the White Sturgeon had migrated 60-97 km downstream into the Idaho reach of the Kootenai River and all movements were associated with hydropeaking events / elevated discharges in October 1994 (Marcuson et al. 1995). In 2004, 3,529 juvenile sturgeon were stocked in Montana for only the second time. Since 1992, about 25,000 juvenile and 100,000 larval White Sturgeon have been released in Montana (see Appendix 7).

The goals of this study and evaluation are to 1) assess and update the current status of White Sturgeon in the Montana portion of the Kootenai / Kootenay River Basin and 2) supplement ongoing research, monitoring, evaluation and recovery efforts in Idaho and British Columbia. The six primary objectives are to:

1. Assess annual trends in catch, effort and catch per unit effort of White Sturgeon in Montana.
2. Describe the length composition, age composition, and contributions of hatchery and wild White Sturgeon in Montana.
3. Estimate abundance and if possible, apparent survival and other metrics of White Sturgeon in Montana.
4. Assess growth and condition of White Sturgeon captured in Montana.
5. Identify movement patterns of White Sturgeon tagged / captured in Montana.
6. Assess the potential for and or document spawning by White Sturgeon in Montana.
7. Assess ploidy (8N vs. 12N) status of sturgeon captured in Montana

Study Area

Sampling for White Sturgeon in Montana, USA from 2009-2011 occurred from approximately 2 km downstream of Kootenai Falls (rkm 310) downstream to the Montana-Idaho border (rkm 276.1; **Figure 1**). Sampling for sturgeon from 2012-2025 occurred only in three primary areas of the river (i.e., lower, middle and upper sections; **Figure 1**).

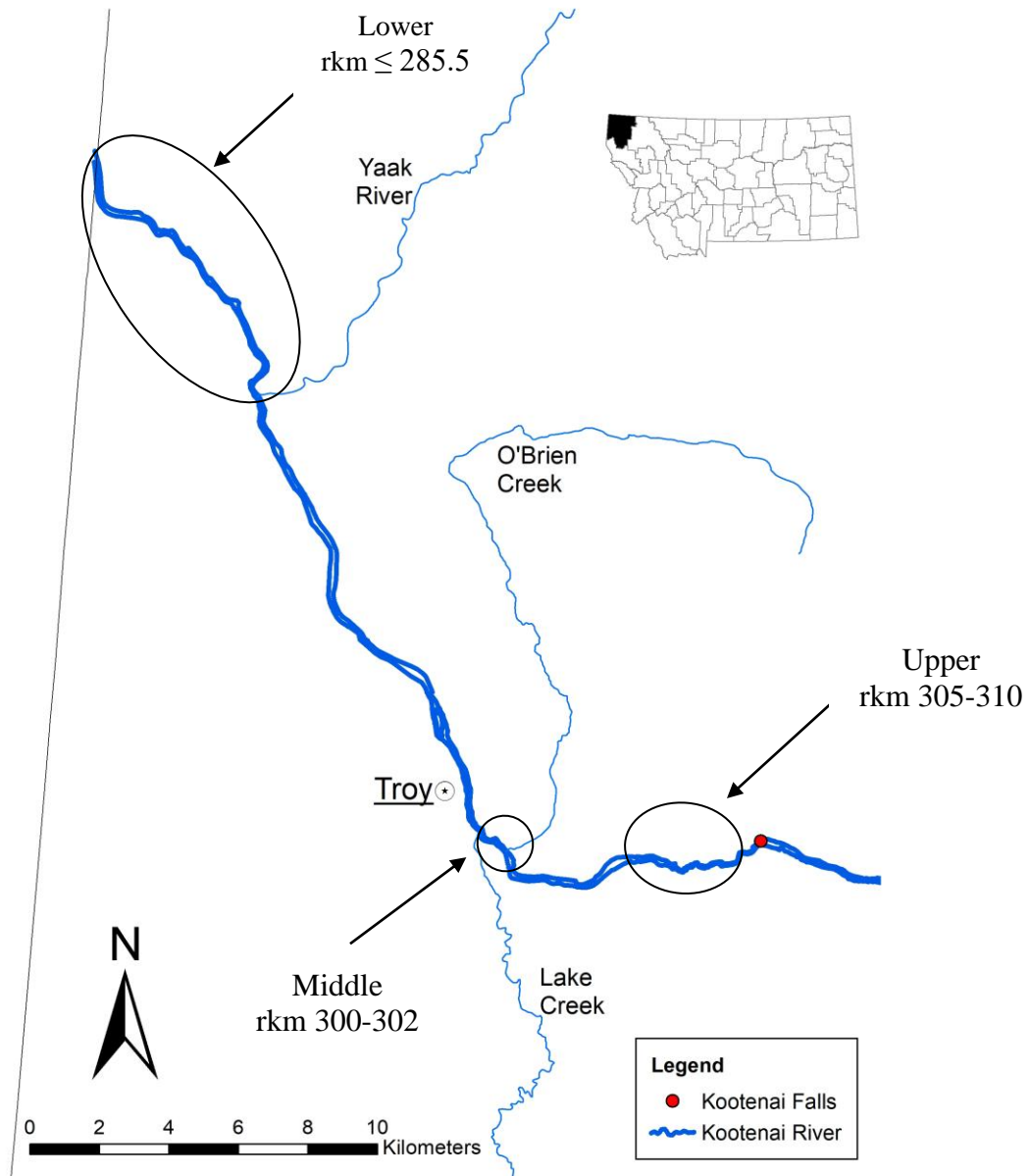


Figure 1. Location of White Sturgeon sampling in the Kootenai River, Montana, USA. Sampling has occurred in the Kootenai River from approximately 2 km downstream of Kootenai Falls to the Montana-Idaho border. Lincoln County, MT is highlighted in black in the inset map.

Methods

Setlines

Beginning in 2009, sturgeon were targeted using baited setlines which consisted of a 45.7 m long, 145 kg-test mainline equipped with 12, 40-50 cm long, 60 kg-test drop-lines. Each drop-line contained a single 2/0-8/0 circle hook. The location of the setline was recorded using a handheld GPS unit (latitude longitude; decimal degrees) as well as the set and pull date and time. From 2009-2011, one of seven sampling reaches was randomly selected without replacement and efforts were made to sample throughout each reach (Stephens et al. 2016 and 2017). Beginning in 2012, setlines were baited almost exclusively with kokanee (*Oncorhynchus nerka*) and setlines were only deployed in three areas of the river: between Kootenai Falls and the Throop Lake tailout (upper; rkms 310-305), from the upper end of the rock island upstream of O'Brien Creek downstream to the Lake Creek confluence (middle; rkms 302-300) and from the Yaak River confluence with the Kootenai River downstream to the MT/ID border (lower; rkms 276.1-285.5). We modified our sampling strategy in 2012 to include only the upper, middle and lower areas because they contained habitats more suitable for sturgeon occupancy. Setlines from 2009-2011 that were not located in the lower, middle, or upper section used since 2012 were designated section "other". Setline effort (hours) for each setline was calculated using the following formula:

$$\text{Effort} = (\text{pull date time} - \text{set date time}) * 24$$

Beginning in 2015, single-hook sets were used periodically in the canyon section (rkm 306.6-310) upstream of Sturgeon Hole (i.e., rkm 306.5). This section of the Kootenai River contains conditions that are not suitable for deployment of a full setline with 12 hooks. Therefore, each sampling event in this section involved deploying 12 separate baited hooks. Each single hook set consisted of a weight, rope, buoy, a single 1-m long, 90-kg test monofilament drop-line and a baited circle hook. Effort for 12 single-hook sets was considered equivalent to one full setline deployed in all other areas of the river. The set date / time and pull date / time for each of the 12 hooks was recorded used to calculate effort as follows:

	Set Date / Time	Pull Date / Time	Effort (hours)
Hook 1	11/4/25 13:00	11/5/25 11:00	22.00
Hook 2	11/4/25 13:20	11/5/25 11:15	21.92
Hook 3	11/4/25 13:40	11/5/25 11:30	21.83
Hook 4	11/4/25 14:00	11/5/25 11:45	21.75
Hook 5	11/4/25 14:20	11/5/25 12:00	21.67
Hook 6	11/4/25 14:40	11/5/25 12:15	21.58
Hook 7	11/4/25 15:00	11/5/25 12:30	21.50
Hook 8	11/4/25 15:20	11/5/25 12:45	21.42
Hook 9	11/4/25 15:40	11/5/25 13:00	21.33
Hook 10	11/4/25 16:00	11/5/25 13:15	21.25
Hook 11	11/4/25 16:20	11/5/25 13:30	21.17
Hook 12	11/4/25 16:30	11/5/25 13:45	21.25
Effort (avg.)			21.56

Gillnets

One-inch bar mesh nylon gillnets were deployed periodically to target smaller sturgeon. Up to four stationary nets were set on each sampling event during the day and nets fished for 1-2 hours depending on the permitted length of net sets by the USFWS. All nets were 2-m deep and either 23-m, 30-m, or 46-m long. Like setlines, the location of the gillnet (latitude / longitude; decimal degrees) and the set time and the pull time were recorded. Effort (hours) for each gillnet deployed was calculated as follows: Effort = (pull date time - set date time) * 24.

Field Data Collection

Captured White Sturgeon captured were measured for fork length (FL; mm) total length (TL; mm), weight (g), inspected for external tags or markings (i.e., floy tag, radio tag, missing scutes, injuries, etc.), and scanned for existing PIT tag(s). If no existing PIT tag(s) were detected, a new PIT tag was inserted into the dorsal musculature and the newly inserted PIT tag code was scanned and recorded prior to release. The total length of all other fish caught was measured or estimated and weights were recorded for some non-target species depending on sampling / data needs. Some species including Rainbow Trout, Westslope Cutthroat Trout, Bull Trout and Burbot were also checked for presence of PIT tag(s). Historical release, capture and recapture information for White Sturgeon in the Kootenai / Kootenay River and Kootenay Lake system was provided by Idaho Department of Fish & Game staff (IDFG; Smith 2025).

Abundance and Survival

Abundance, apparent survival, capture probability, and the probability of entry for White Sturgeon in the Montana portion of the Kootenai River were estimated using an open population framework using capture and recapture data only in Montana. Kootenai River White Sturgeon mark-recapture data were analyzed using the superpopulation (the total number of individuals present during the study; POPAN) parameterization of the Jolly-Seber model (Crosbie & Manly 1985; Jolly 1965; Schwarz and Arnason 1996; Seber 1965), similar to Glassic et al. (2020). Open population data analyses were performed using Program MARK via RMark (White and Burnham 1999, Laake 2013) and R software (R Core Team 2020). Competing constant and time dependent models for survival, capture probability, and probability of entry into the population were compared using AIC_c (Burnham and Anderson 1998; Burnham et al. 1987) and a model selection threshold for delta AIC_c of ≤ 2 was used to determine / select the top model(s).

Growth and Condition

Relative weight (W_r) of captured White Sturgeon ≥ 700 mm TL was calculated using the standard weight equation for White Sturgeon, where W_s = standard weight, $\alpha = 1.952E-6$, $\beta = 3.232$, and L represents the total length in centimeters (cm; Beamesderfer 1993):

$$W_s = \alpha L^\beta$$

The observed weight of an individual sturgeon was divided by the standard weight and multiplied by 100 to obtain W_r . Growth of sturgeon captured in Montana was calculated as the mean total or fork length-at-age (mm) using the assigned brood year, the capture year, and associated fork length and or total length. Annual growth increments were also calculated for age-classes of sturgeon as the change in FL or TL per year between successive capture events in Montana.

Movement

Sonic tags were periodically implanted into Kootenai River White Sturgeon captured in Montana from 2012-2020 and 2025 using methods described in Neufeld and Spence (2004). The implanted sonic tags were model V13-1X and V16-6X tags produced by VEMCO (i.e., now InnovaSea). The 69 and 81 kHz sonic tags were designed to ping at a random interval of approximately 120 seconds, had estimated life spans of approximately 1,200 (V13-1X) and 3,500 (V16-6X) days and contained no water depth / pressure, water temperature or mortality sensors.

Movements of sturgeon captured in Montana were assessed using a combination of data sources including initial release, capture and recapture information (Smith 2025), data from an array of fixed receivers located throughout the Kootenai / ay River and Kootenay Lake (Hardy et al. 2016; Bassett and McGregor 2025), recent capture information in Montana from 2009-2025 and data from mobile tracking efforts in Montana using a VR100 equipped with a mobile hydrophone (MT FWP; data on file). Four fixed receivers were deployed in Montana at approximate river kilometers: 305, 300.5, 282.5, and 278.9.

Movement between habitats / areas within the Kootenai / ay Basin was quantified using only telemetry data (i.e., VR2 receivers) for juvenile sturgeon sonic tagged ($N=47$) in Montana from 2012-2025. Daily / annual movement probability between habitats (i.e., river or lake) and jurisdictional / habitat areas (i.e., Montana river rkm 276-310, Idaho river rkm 170-276, BC river rkm 120-170 and Kootenay Lake rkm < 120) for each sturgeon was calculated as the number of transition events between different areas / habitats out of the total number of days or years each tag(s) was active (i.e., deployment date to estimated expiration date) for each individual sturgeon. The average annual transition probability for each sturgeon was calculated as the number of transition events divided by the number of days tag(s) were active for each sturgeon and then multiplied by 365. We only used telemetry / location data between the sonic tag deployment data and the projected tag expiration date or October 31 of the most recent sampling year (if tag was still active) for each of the 47 sturgeon.

Spawning and Reproductive Potential

Egg mats (McCabe and Beckman 1990) were constructed and deployed from rkm 306.5 downstream to rkm 306.2. Each egg mat consisted of a 2-piece metal frame, mat material and a numbered buoy attached to the frame with floating rope. The location of each deployed egg mat was recorded using a handheld GPS unit along with the deployment / retrieval time, water depth (ft) and water temperature ($^{\circ}\text{F}$ or $^{\circ}\text{C}$). Mats were checked 1-2 times per week and immediately redeployed if no sturgeon eggs were captured. Any sturgeon or other fish eggs collected were

removed from the egg mat and stored in a vial containing a neutral buffered 10% Formalin solution. Egg collection vial(s) were labeled with the collection date, mat number and GPS location.

Ploidy Status

Ploidy status (i.e., 8N vs 12N) of sturgeon captured in Montana was evaluated using field and lab methods similar to Fiske et al. (2019). Blood (0.1-0.3 mL) was drawn from the caudal vein posterior to the anal fin using a 1-2 inch, 23-gage hypodermic needle filled with 0.1 mL of acid citrate dextrose solution (ACD: 0.48 g citric acid, 1.32 g trisodium citrate, 1.47 g dextrose, H₂O to 100 ml). After the blood was drawn, the blood was transferred to a 5 mL sterile FACS tube filled with 0.2-0.3 mL of ACD solution. The combined blood / ACD sample was then gently inverted in the FACS tube. After mixing, the FACS tube was labeled with the date of collection and PIT tag code of the sturgeon and then stored in a cooler with an ice-pack(s). Once we returned to the office, blood samples were stored in a refrigerator for 0-4 days until delivery to the Twin Rivers hatchery facility could occur (Fiske et al. 2019). Blood samples were analyzed on a certified Coulter counter using methods similar to Fiske et al. (2019). Sturgeon with modal nuclei measurements of < 5 microns were deemed to be 8N and sturgeon with modal nuclei measurements \geq 5 microns were identified as 12N (autopolyploids).

Results and Discussion

Catch and CPUE

A total of 1,753 setlines have been deployed in the Kootenai River, Montana since 2009 (**Table 1**). The number of setlines deployed annually ranged from 43-186 (avg. 103 per year; **Table 1**). Since 2009, 45.5% of all setlines deployed in the Kootenai River, Montana were in the upper section (rkm 305-310), 12.7% in the middle section (rkm 300-302), 34.5% in the lower section (rkm \leq 285.5) and 7.3% were deployed in other areas of the river in Montana (**Table 1**). The 1,753 setlines deployed since 2009 fished for 36,399.0 hours (**Table 2**). Overall, the upper section received 45.7% of the time effort and the middle, lower (rkm \leq 285.5) and other sections received 12.7%, 34.8 and 6.8% of the effort respectively (**Table 2**). In 2009, setlines fished for an average of 14 hours due to initial concerns about catch and mortality of Bull Trout *Salvelinus confluentus* (**Table 2**). Once we determined that catch and mortality of Bull Trout on setlines was lower than expected (see **Appendix 1**), the length of setline deployment was increased and has since averaged between 20-22 hours per year from 2010-2025 (**Table 2**).

Annual total catch of sturgeon on setlines has been variable, ranging from 2 in 2009 to 74 in 2016 (**Table 3**). In general, the number of sturgeon captured annually increased from 2012-2025 due to a combination of modified sampling methods (i.e., more targeted sampling in higher quality habitat(s) and increased sturgeon abundance (see later in this report). A disproportionately high percentage of the sturgeon catch on setlines occurred in the upper section. Nearly 75% ($N=519$) of the total sturgeon catch on setlines ($N=713$) has occurred in this reach of river (**Table 3**) despite the reach receiving about 45% of the setline effort. Fewer sturgeon have been captured in the middle ($N=71$, 10.0% of catch), lower ($N=123$; 17.3% of catch) and other reaches in Montana ($N=0$, 0% of catch; **Table 3**). No setlines have been deployed in the other sections of the river since 2011. The percentage of setlines that captured \geq

1 sturgeon has been highest in the upper and middle sections. Since 2009, 36% of setlines deployed in the upper section captured ≥ 1 sturgeon, and the percentage of setlines with at least 1 sturgeon declined in the middle (28%), lower (16%) and other sections of the river (0%; **Table 4**). Overall, 28% of setlines deployed from 2009-2025 and 33% of setlines deployed from 2012-2025 have captured ≥ 1 sturgeon (**Table 4**).

The overall average catch per unit effort (CPUE) of sturgeon since 2009 was 0.41 per setline or 0.02 per setline hour (**Table 5**). Average annual CPUE indices for sturgeon increased significantly after 2011 (**Table 5** and **Figure 2**). Significant differences in the annual average CPUE indices between initial (2009-2011) and later periods (2012-2025) were detected (p-value < 0.05). The highest annual average CPUE indices to date occurred in 2021 (i.e., 0.81 sturgeon per setline and 0.04 sturgeon per setline hour; **Table 5** and **Figures 2 and 3**). After the record high CPUE indices in 2021, CPUE indices decreased in 2022 and 2023. CPUE indices rebounded in 2024 and again in 2025 to slightly above the long-term averages. Since 2009, average annual sturgeon catch per setline has increased significantly in the upper (p-value 0.006), middle (p-value 0.003) and lower sections (p-value < 0.001 ; **Table 5**; **Figure 3**). CPUE of sturgeon in the upper and middle sections have been stable since 2012 (p-values 0.379 and 0.056, respectively) when sampling methods / areas were modified. CPUE in the lower section has continued to increase since 2012 and the linear trend was statistically significant (p-value < 0.05).

We evaluated the effectiveness of using gillnets to capture sturgeon in the Kootenai River, Montana from 2013-2017. Over that 5-year period, 86 gillnets were deployed for 157.8 hours, and 11 sturgeon were captured (**Table 6**). From 2013-2017, the average CPUE of sturgeon in gillnets was 0.13 sturgeon per gillnet and 0.07 sturgeon per gillnet hour. The average of 0.07 sturgeon per net hour in Montana was much lower than some recent gillnet CPUE estimates reported in Idaho and British Columbia (Rust and Wakkinen 2017; 2015 sampling season avg. 3.34 sturgeon per net hour), likely indicating lower abundance of sturgeon in Montana. From 2013-2017, 6% of gillnets deployed captured ≥ 1 sturgeon and the annual percentage of gillnets that captured ≥ 1 sturgeon ranged from 0-17% (**Table 6**). Although we were able to capture some sturgeon in gillnets, the availability of suitable habitat conditions for effective gillnet deployment is limited at most discharges. Based on the preliminary gillnet sampling efforts from 2013-2017, we discontinued the use of gillnets due to spatial and temporal limitations but periodic sampling efforts with nets would result in some sturgeon being captured.

A total of 724 Kootenai River White Sturgeon have been captured in Montana since 2009, including 713 captured on setlines and 11 in gillnets (see **Tables 3 and 6**). To date, no direct mortality events have occurred for juvenile or adult sturgeon in Montana. Most of the sturgeon captured were of hatchery origin (HO; $> 98.3\%$ of all captures; **Tables 8 and 9**) and we were able to assign an age / brood year to most sturgeon based on the presence of an existing PIT tag(s), the associated release record and or the observed scute removal pattern. Since 2009, the average age of hatchery origin White Sturgeon captured in Montana was 17 years and individuals ranged from 5-30 years old at the time of capture (**Table 7**). The average fork length of captured sturgeon was 740 mm (range 221-1,829 mm), the average total length was 852 mm (range 257-1,994 mm) and the average weight (g) was 3,358 g (range 62-46,535 g). Based on the combined length frequency of sturgeon captured in Montana on setlines and gillnets since

2009, sturgeon may not fully recruit to our primary sampling gear (i.e., setlines) until about 70 cm TL (**Figure 4**). Most sturgeon present in Montana are upstream migrants (see later in this report) and stocking of juvenile sturgeon in the Montana reach of the Kootenai River has not occurred since 2016. Since 2009, the 1995 brood year has been captured most frequently ($N=157$; 22%), followed by the 2003 ($N=88$; 12%) and 2000 brood years ($N=71$; 10%; **Tables 8 and 9**). Hatchery origin sturgeon have dominated the total catch of White Sturgeon in Montana since 2009 (98.3%; 712 of 724; **Tables 8 and 9**). The low percentage of the catch represented by wild origin sturgeon in Montana (1.7%; **Tables 7, 8 and 9**) is comparable to the low percentage of wild juvenile sturgeon captured in Idaho and portions of British Columbia (Rust and Wakkinen 2004 and 2011; Hardy et al. 2020; Stephenson et al. 2024b).

Table 1. Annual summary of the number of setlines deployed in the Kootenai River, Montana by sampling area and year from 2009-2025.

Year	# of Setlines Deployed				Total
	Upper (rkm 305-310)	Middle (rkm 300-302)	Lower (rkm \leq 285.5)	Other	
2009	32	19	53	31	135
2010	40	19	54	73	186
2011	31	19	24	24	98
2012	30	7	6	0	43
2013	107	18	24	0	149
2014	49	17	24	0	90
2015	50	12	30	0	92
2016	79	15	42	0	136
2017	41	4	30	0	75
2018	54	7	36	0	97
2019	41	7	30	0	78
2020	38	4	36	0	78
2021	27	12	30	0	69
2022	41	19	42	0	102
2023	50	17	54	0	121
2024	40	14	42	0	96
2025	47	13	48	0	108
Avg. 2009-2025	47	13	36	8	103
Total All Years (%)	797 (45.5%)	223 (12.7%)	605 (34.5%)	128 (7.3%)	1,753 (100%)

Table 2. Summary of setline effort (hours) in the Kootenai River, Montana by sampling area and year from 2009-2025.

Year	Effort (hours)					Avg. Hours per Setline
	Upper (rkm 305-310)	Middle (rkm 300-302)	Lower (rkm ≤ 285.5)	Other	Total	
2009	283.7	249.8	904.9	450.0	1,888.4	14.0
2010	827.9	394.5	1081.4	1,491.1	3,795.0	20.4
2011	646.3	392.7	509.6	521.3	2,069.9	21.1
2012	659.6	153.0	129.5	0	942.1	21.9
2013	2280.7	385.3	519.9	0	3,185.9	21.5
2014	1036.1	360.6	509.5	0	1,906.2	21.2
2015	1046.0	251.2	621.9	0	1,919.0	20.9
2016	1697.7	327.2	906.0	0	2,930.9	21.6
2017	901.0	89.7	641.2	0	1,631.8	21.8
2018	1142.5	157.1	798.5	0	2,098.1	21.6
2019	884.6	159.2	624.2	0	1,668.1	21.4
2020	814.5	85.9	788.5	0	1,689.0	21.7
2021	576.8	267.6	639.3	0	1,483.7	21.5
2022	880.1	404.7	887.5	0	2,172.3	21.3
2023	1,104.4	377.2	1174.7	0	2,656.3	22.0
2024	865.7	301.8	916.4	0	2,083.9	21.7
2025	1002.0	272.9	1003.4	0	2278.4	21.1
Avg. 2009-2025	979.4	272.4	744.5	144.8	2141.1	20.8
Total 2009-2025 (%)	1,6649.6 (45.7%)	4,630.4 (12.7%)	12,656.6 (34.8%)	2,462.4 (6.8%)	36,399.0 (100%)	

Table 3. Annual summary of the number of Kootenai River White Sturgeon captured using baited setlines by sampling area and year in the Kootenai River, Montana from 2009-2025.

Year	# of Sturgeon Captured				Total
	Upper (rkm 305-310)	Middle (rkm 300-302)	Lower (rkm ≤ 285.5)	Other	
2009	0	0	2	0	2
2010	4	0	0	0	4
2011	5	1	1	0	7
2012	28	3	1	0	32
2013	67	3	1	0	71
2014	21	2	5	0	28
2015	24	1	4	0	29
2016	58	4	12	0	74
2017	33	1	7	0	41
2018	44	5	9	0	58
2019	44	5	7	0	56
2020	22	1	10	0	33
2021	34	14	8	0	56
2022	40	7	7	0	54
2023	22	6	15	0	43
2024	30	7	15	0	52
2025	43	11	19	0	73
Avg. 2009-2025	31	4	7	0	42
Total All Years (%)	519 (72.8%)	71 (10.0%)	123 (17.3%)	0 (0%)	713 (100%)

Table 4. Summary of the percent of setlines deployed in the Kootenai River, Montana from 2009-2025 that captured ≥ 1 sturgeon by sampling area and year.

Year	River Section				Total
	Upper (rkm 305-310)	Middle (rkm 300-302)	Lower (rkm \leq 285.5)	Other	
2009	0	0	4	0	1
2010	10	0	0	0	2
2011	13	5	4	0	6
2012	50	43	17	NA	44
2013	37	17	4	NA	29
2014	31	6	17	NA	22
2015	32	8	13	NA	23
2016	42	27	29	NA	36
2017	44	25	23	NA	35
2018	48	57	25	NA	40
2019	46	57	20	NA	37
2020	37	25	19	NA	28
2021	48	67	23	NA	41
2022	56	26	12	NA	32
2023	28	24	17	NA	22
2024	50	36	21	NA	35
2025	49	54	25	NA	39
Avg. 2009-2025	36	28	16	0	28
Avg. 2012-2025	43	34	19	NA	33

Table 5. Annual summary of the average catch per unit effort (CPUE: #/setline and #/setline hour) of Kootenai River White Sturgeon on baited setlines by sampling area and year in the Kootenai River, Montana from 2009-2025.

Year	CPUE (# sturgeon per setline)					CPUE (# sturgeon per setline hour)				
	Upper (rkm 305- 310)	Middle (rkm 300- 302)	Lower (rkm ≤ 285.5)	Other	Total	Upper (rkm 305- 310)	Middle (rkm 300- 302)	Lower (rkm ≤ 285.5)	Other	Total
2009	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.00	0.00	0.00
2010	0.10	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
2011	0.16	0.05	0.04	0.00	0.07	0.01	0.00	0.00	0.00	0.00
2012	0.93	0.43	0.17	NA	0.74	0.04	0.02	0.01	NA	0.03
2013	0.63	0.17	0.04	NA	0.48	0.03	0.01	0.00	NA	0.02
2014	0.43	0.12	0.21	NA	0.31	0.02	0.01	0.01	NA	0.01
2015	0.48	0.08	0.13	NA	0.32	0.02	0.00	0.01	NA	0.01
2016	0.73	0.27	0.29	NA	0.54	0.03	0.01	0.01	NA	0.03
2017	0.80	0.25	0.23	NA	0.55	0.04	0.01	0.01	NA	0.03
2018	0.81	0.71	0.25	NA	0.60	0.04	0.03	0.01	NA	0.03
2019	1.07	0.71	0.23	NA	0.72	0.05	0.03	0.01	NA	0.03
2020	0.58	0.25	0.28	NA	0.42	0.03	0.01	0.01	NA	0.02
2021	1.26	1.17	0.27	NA	0.81	0.06	0.05	0.01	NA	0.04
2022	0.98	0.37	0.17	NA	0.53	0.05	0.02	0.01	NA	0.02
2023	0.44	0.35	0.28	NA	0.36	0.02	0.02	0.01	NA	0.02
2024	0.75	0.50	0.36	NA	0.54	0.03	0.02	0.02	NA	0.03
2025	0.91	0.85	0.40	NA	0.68	0.04	0.04	0.02	NA	0.03
All Years	0.65	0.32	0.20	0.00	0.41	0.03	0.01	0.01	0.00	0.02

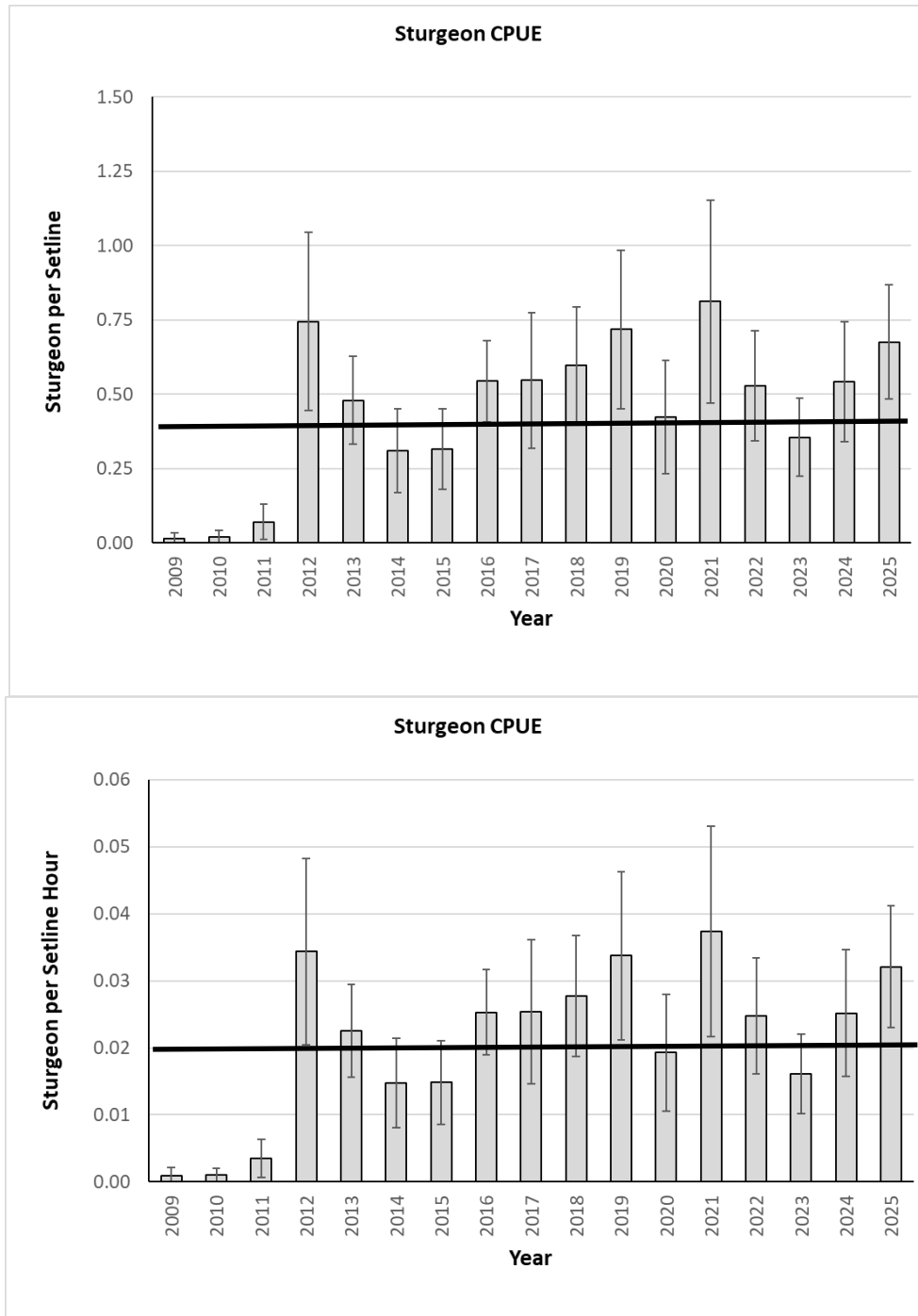


Figure 2. Summary of the average annual catch per unit effort of White Sturgeon (# sturgeon per setline or # per setline hour; \pm 95% CI) in the Kootenai River, Montana from 2009-2025. The thick black line in the upper panel represents the long-term (2009-2025) average number of sturgeon per setline (0.41) and the thick black line in the lower panel represents the long-term average number of sturgeon per setline hour (0.02).

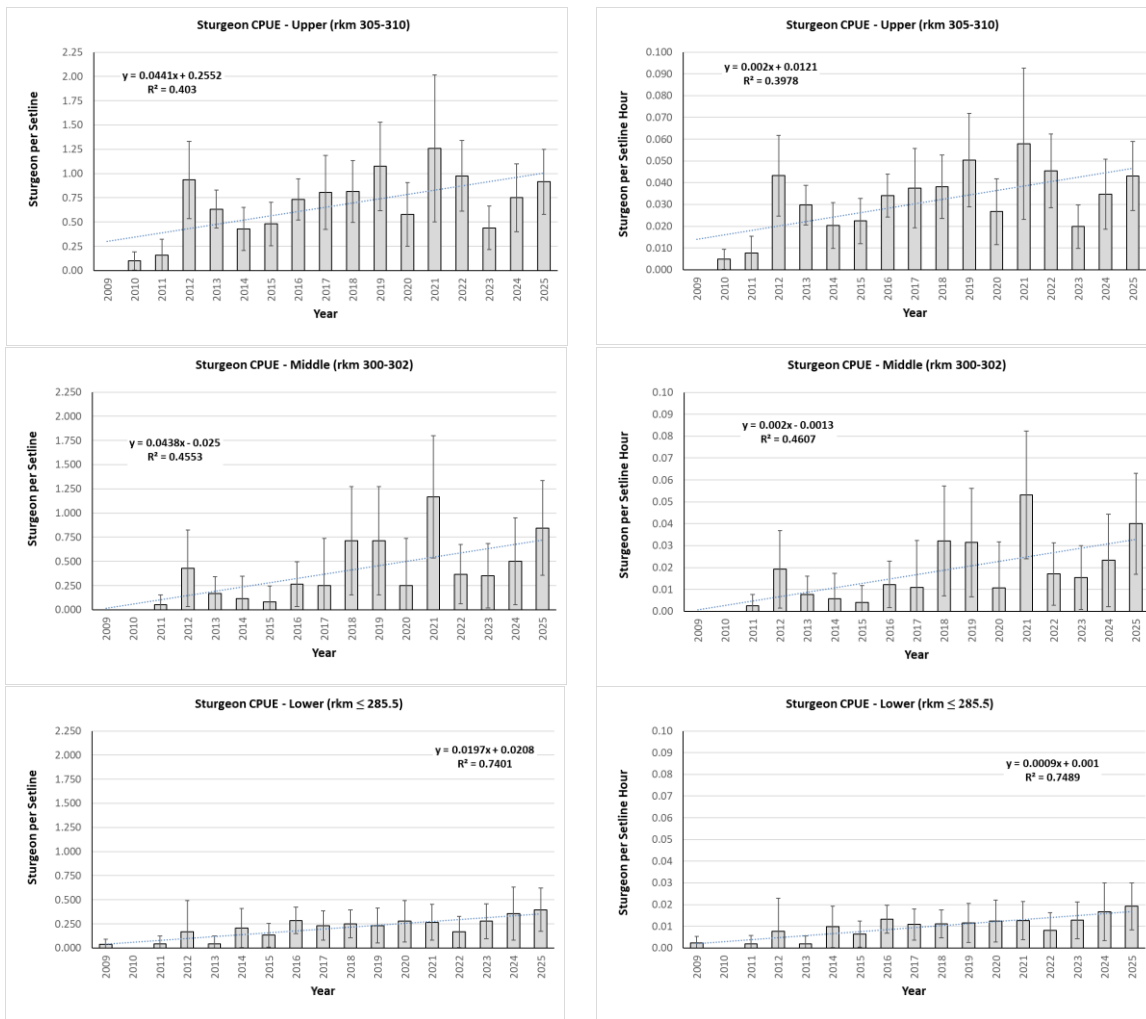


Figure 3. Summary of the average annual catch per unit effort of White Sturgeon (# sturgeon per setline (\pm 95% CI) and # sturgeon per setline hour (\pm 95% CI) by sampling area in the Kootenai River, Montana from 2009-2025. No sturgeon have been captured in other areas of the Kootenai River, Montana.

Table 6. Summary of annual effort, catch, CPUE (#/net and #/ net hour) and percent of gillnets that captured ≥ 1 sturgeon in the Kootenai River, Montana from 2009-2025. No gillnets were deployed from 2009-2012 or from 2018-2025.

Metric	Sampling year							Total
	2009-2012	2013	2014	2015	2016	2017	2018-2025	
# Gillnets	0	30	4	12	28	12	0	86
Hours	NA	56.0	6.4	23.9	52.2	19.3	NA	157.8
# Sturgeon	NA	6	0	3	2	0	NA	11
# sturgeon / net	NA	0.20	0.00	0.25	0.07	0.0	NA	0.13
# sturgeon / net hour	NA	0.11	0.00	0.13	0.04	0.00	NA	0.07
% of Gillnets with ≥ 1 sturgeon	NA	10	0	17	7	0	NA	6

Table 7. Summary statistics for Kootenai River White Sturgeon captured using a combination of gillnets and setlines in Montana from 2009-2025. * no age estimates were made for any wild juvenile or wild adult sturgeon.

Year	Total # of Sturgeon	Average Fork Length (mm; range)	Average Total Length (mm; range)	Average Weight (g; range)	Average Age (years; range)	# of Hatchery Origin (%)	# Wild Origin (%)
2009	2	633 (613-653)	733 (714-751)	1,516 (1,488-1,543)	14 (14)	2 (100%)	0 (0%)
2010	4	904 (833-1,020)	1,023 (963-1,126)	4,832 (4192-5,180)	15 (15)	4 (100%)	0 (0%)
2011	7	836 (660-958)	963 (756-1,090)	4,609 (1960-6,980)	16 (11-21)	7 (100%)	0 (0%)
2012	32	780 (473-1,040)	900 (512-1,170)	3,944 (586-10,020)	15 (5-22)	31 (97%)	1 (3%)
2013	77	688 (418-1,108)	794 (483-1,223)	2,701 (450-11,020)	14 (6-23)	77 (100%)	0 (0%)
2014	28	692 (421-1,122)	798 (488-1,275)	2,730 (516-9,880)	14 (7-19)	28 (100%)	0 (0%)
2015	32	673 (437-1,120)	775 (505-1,275)	2,715 (566-11,960)	15 (8-20)	31 (97%)	1 (3%)
2016	76	726 (221-1,800)	835 (257-1,930)	2,935 (62-11,910)	16 (9-21)	74 (97%)	2 (3%)
2017	41	798 (535-1,185)	916 (615-1,333)	4,589 (1,066-15,000)	17 (9-22)	40 (98%)	1 (2%)
2018	58	718 (493-1,205)	830 (575-1,370)	2,889 (710-15,000)	16 (6-23)	57 (98%)	1 (2%)
2019	56	747 (497-1,232)	862 (572-1,407)	3,255 (742-15,500)	17 (7-24)	56 (100%)	0 (0%)
2020	33	770 (558-1,264)	890 (641-1,461)	3,928 (1,012-17,200)	19 (10-25)	33 (100%)	0 (0%)
2021	56	755 (529-1,340)	870 (615-1,590)	3,666 (902-25,900)	19 (11-26)	56 (100%)	0 (0%)
2022	54	787 (580-1,308)	909 (626-1,486)	4,148 (1236-19,300)	20 (13-27)	53 (98%)	1 (2%)
2023	43	736 (519-1,124)	850 (605-1,289)	3,115 (902-12,168)	19 (11-28)	41 (95%)	2 (5%)
2024	52	763 (528-1,829)	877 (626-1,994)	4,181 (944-46,535)	20 (8-29)	50 (96%)	2 (4%)
2025	73	725 (524-1,092)	837 (588-1,257)	2,856 (822-12,000)	20 (7-30)	72 (99%)	1 (1%)
Total	724	740 (221-1,829)	852 (257-1,994)	3,358 (62-46,535)	17 (5-30)	712 (98.3%)	12 (1.7%)

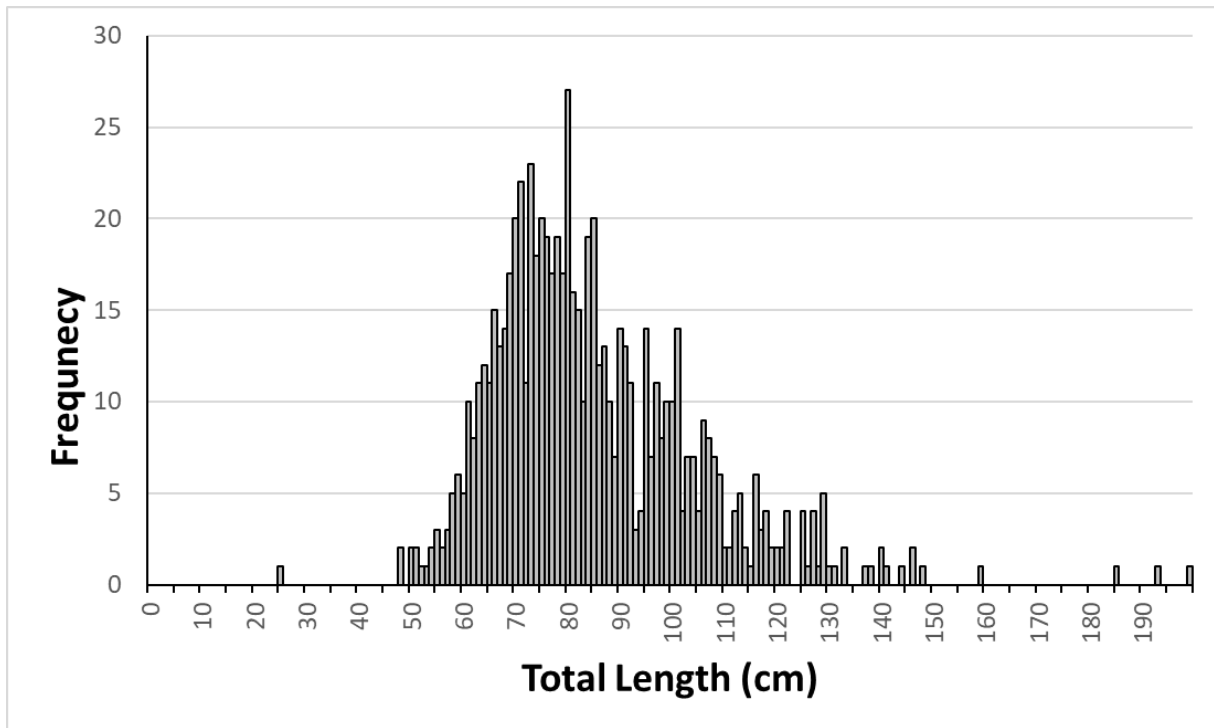


Figure 4. Length frequency (total length; cm) of Kootenai River White Sturgeon captured in Montana from 2009-2025. Length frequency data presented includes all intra- and inter-year recaptures.

Table 8. Brood year frequency of Kootenai River White Sturgeon ($N=724$) captured in the Kootenai River, Montana by sampling year from 2009-2025. Frequencies include intra- and interannual recaptures.

Brood Year	Sampling Year																	Total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
1990			1	1	1													3
1992				1	2													3
1995	2	4	5	15	26	8	8	19	13	7	10	7	9	8	6	3	7	157
1998				6	1	2		2	4	6	2	3	2	4		2	1	35
1999				2	13	4	5	5	2	4	6	2	4	7		4	4	62
2000			1	3	8	3	3	13	3	4	5	3	6	7	3	3	6	71
2001					1			1							1	1	1	5
2002				2	2	1			2		1							8
2003					12	2	4	16	2	10	7	4	2	5	6	11	7	88
2004					1			1	2		1	1	2				2	10
2005					5	2	5	6	3	6	12	3	9	2	4	3	8	68
2006					4	3	2	2	2	3	3	1	5	2	4	2	5	38
2007				1	1	1	1	6	3	8	5	1	5	7	2	5	5	51
2008									1	4		1	1	2	3	1	3	16
2009												1		3	1	2		7
2010												2	4		4	5	3	18
2011																	3	3
2012										1	1				2		4	8
2014										1								1
2015																	4	4
2016																1		1
2018																	2	2
Unknown						2	3	3	3	3	3	4	7	6	5	7	7	53
Wild Adult								1								1		2
Wild Juvenile				1			1	1	1	1				1	2	1	1	10
Total	2	4	7	32	77	28	32	76	41	58	56	33	56	54	43	52	73	724

Table 9. Brood year composition (%) of Kootenai River White Sturgeon ($N=724$) captured in Montana by sampling year from 2009-2025. Composition estimates include intra- and interannual recaptures.

Brood Year	Sampling Year																	Total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
1990	0	0	14	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	100	100	71	47	34	29	25	25	32	12	18	21	16	15	14	6	10	22
1998	0	0	0	19	1	7	0	3	10	10	4	9	4	7	0	4	1	5
1999	0	0	0	6	17	14	16	7	5	7	11	6	7	13	0	8	5	9
2000	0	0	14	9	10	11	9	17	7	7	9	9	11	13	7	6	8	10
2001	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	2	1	1
2002	0	0	0	6	3	4	0	0	5	0	2	0	0	0	0	0	0	1
2003	0	0	0	0	16	7	13	21	5	17	13	12	4	9	14	21	10	12
2004	0	0	0	0	1	0	0	1	5	0	2	3	4	0	0	0	3	1
2005	0	0	0	0	6	7	16	8	7	10	21	9	16	4	9	6	11	9
2006	0	0	0	0	5	11	6	3	5	5	5	3	9	4	9	4	7	5
2007	0	0	0	3	1	4	3	8	7	14	9	3	9	13	5	10	7	7
2008	0	0	0	0	0	0	0	0	2	7	0	3	2	4	7	2	4	2
2009	0	0	0	0	0	0	0	0	0	0	0	3	0	6	2	4	0	1
2010	0	0	0	0	0	0	0	0	0	0	0	6	7	0	9	10	4	2
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
2012	0	0	0	0	0	0	0	0	0	2	2	0	0	0	5	0	5	1
2014	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1
2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Unknown	0	0	0	0	0	7	9	4	7	5	5	12	13	11	12	13	10	7
Wild Adult	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0
Wild Juvenile	0	0	0	3	0	0	3	1	2	2	0	0	0	2	5	2	1	1

Recaptures, Abundance and Survival

Total annual catch of sturgeon in Montana on setlines and gillnets has ranged from 2 to 77 per year from 2009-2025 and the number of unique sturgeon captured annually has ranged from 1 to 65 (**Table 10**). Since 2009, a total of 724 sturgeon represented by 324 individuals have been captured. The majority of the sturgeon captured in Montana since 2009 (93.6%; $N=678$) have ≥ 2 total observations (i.e., release, capture and or recapture), some of which occurred in Montana. The remaining 46 sturgeon (6.4%) captured in Montana had no prior release, capture or recapture information on file (i.e., no PIT tag present or shed PIT tag). The percentage of unique sturgeon recaptured in Montana from previous years increased from 10% in 2012 to $\geq 50\%$ in 10 of 12 (83%) years since 2014 (**Table 10**). Despite the recent high overall percentage of individual sturgeon that have been recaptured in Montana, the percentage of individual sturgeon recaptured within a year is relatively low (avg. 7%; range 0-27%; **Table 10**). Since 2009, 158 of 324 (49%) of the unique traceable White Sturgeon captured in Montana have been recaptured in Montana up to a maximum of 10 times and recaptured sturgeon averaged 2.65 ± 0.31 years (95% CI; range 0.03 – 9.06 years) between successive capture events (**Table 11**).

The capture and recapture data collected from 2009-2025 in Montana allowed sturgeon abundance to be estimated. We previously estimated abundance using both closed (2012-2022) and open (2019-present) population methodologies. However, we were likely violating assumptions of the closed population methodology (see Ross et al. 2015). Since 2019, we have only utilized the open population framework to estimate abundance, apparent survival and other parameters (POPAN; Jolly-Seber; see **Appendices 3** (code) and **4** (capture histories used); Sylvester et al. 2020). Following the 2025 sampling season, we estimated that 300 (95% CI = 252-357) sturgeon were present in Montana (**Table 12 and Figure 5**). Based on annual abundance estimates since 2009, abundance has increased by about 17 sturgeon per year on average but has decreased to about 10 sturgeon per year since 2023 (**Table 12 and Figure 5**).

In addition to annual abundance estimates, additional parameters including apparent annual survival (Φ), probability of capture (p) and probability of entry into the population (p_{ent}) were estimated using a Cormack-Jolly-Seber (CJS) model. The top model included constant apparent annual survival, time dependent capture probability and constant probability of entry into the population based on the mark-recapture data collected only in Montana from 2009-2025 (model weight 0.99998; **Table 13**). Estimated apparent annual survival was 93.0% (95% CI = 90.2-95.1%), annual probability of entry into the population was 0.060 (95% CI = 0.055-0.066%) and annual capture probabilities ranged from 0.080 to 0.466 (**Table 12**). The updated apparent survival estimate (93.0%) of sturgeon in Montana is likely an underestimate of true survival as several individuals left Montana and are known to be alive based on recent telemetry (Bassett and McGregor 2025) and capture data (Smith 2025). The updated parameter estimates following the 2025 season were similar to previous estimates in Montana (Sylvester et al. 2020-2025). The updated apparent annual survival estimates for White Sturgeon in this report are similar to previous estimates of apparent annual survival for juvenile hatchery origin sturgeon in the Kootenai / ay system (Hardy et al. 2020, Ross et al. 2015, Beamesderfer et al. 2013, and Ireland et al. 2002).

Table 10. Annual capture and recapture metrics for White Sturgeon captured and or recaptured in Montana from 2009-2024 using a combination of setlines and gillnets. *One previously untagged or potentially untagged sturgeon was captured and released without the addition of a new PIT tag in 2009, 2016 and 2025.

Year	Total # Sturgeon Captured	# of Unique Sturgeon	# of Individuals Recaptured from Previous Years	% of Individuals Recaptured from Previous Years	# of Individuals Recaptured within Year	% of Individuals Recaptured within Year	# New Sturgeon to MT	% of Individuals that were new to Montana
2009	2	1 *	0	0	0	0	1 *	100
2010	4	4	0	0	0	0	4	100
2011	7	7	0	0	0	0	7	100
2012	32	30	3	10	2	7	27	90
2013	77	56	14	25	15	27	42	75
2014	28	27	13	48	1	4	14	52
2015	32	30	13	43	2	7	17	57
2016	76	65 *	35	54	8	12	30 *	46
2017	41	36	24	67	5	14	12	33
2018	58	54	28	52	4	7	26	48
2019	56	54	32	59	2	4	22	41
2020	33	33	22	67	0	0	11	33
2021	56	52	28	54	4	8	24	46
2022	54	50	31	62	4	8	19	38
2023	43	42	21	50	1	2	21	50
2024	52	46	23	50	6	13	21	46
2025	73	65 *	38	59	5	8	27	42
Total	724	324 *		Avg. 41	Avg. 4	Avg. 7		

Table 11. Capture metrics for uniquely identifiable White Sturgeon ($N= 324$) in Montana from 2009-2025. * three sturgeon were captured without an existing / detected PIT tag(s) and were released without a new PIT tag being inserted. These 3 sturgeon could not be individually tracked at the next possible capture or recapture event and were excluded in these summaries.

# Capture Events in MT	# of Individual Sturgeon	% of Individual Sturgeon	Recaptured (Yes / No)	Number	Percent	Avg. Years Between Recaptures
1	166	51	No	166	51	NA
2	62	19	Yes	158	49	3.32
3	36	11				2.70
4	23	7				2.24
5	11	3				1.91
6	15	5				1.71
7	6	2				1.78
8	2	1				1.27
9	2	1				1.42
10	1	0				1.47
Total	324 *	100				

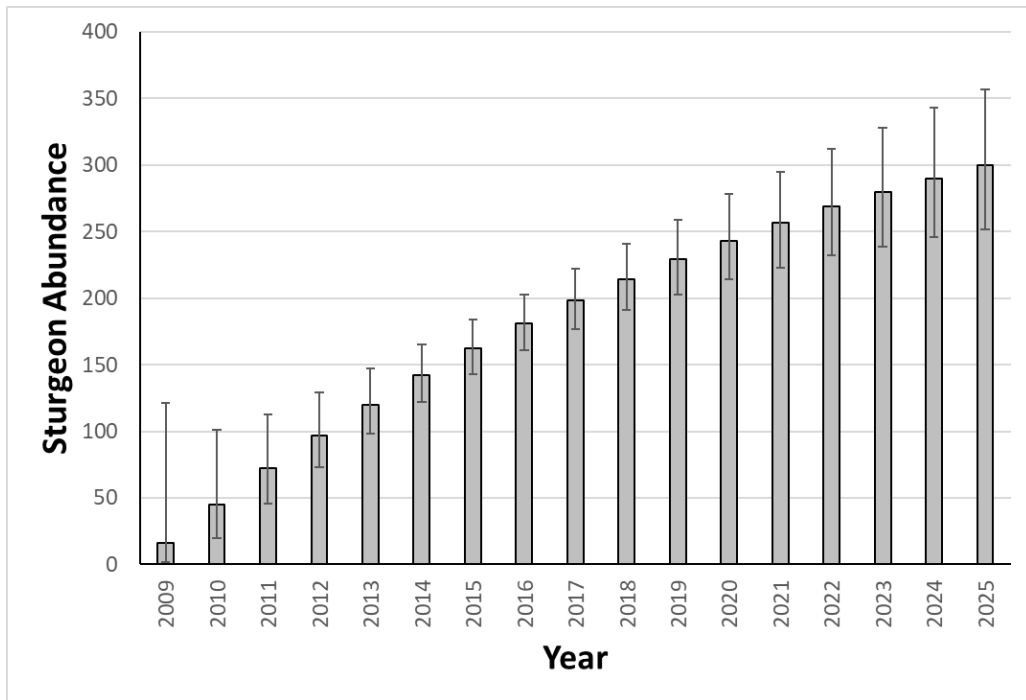


Figure 5. Open population (Jolly-Seber) abundance estimates for Kootenai River White Sturgeon in the Kootenai River, Montana generated from annual mark-recapture data collected only in Montana from 2009-2025.

Table 12. Abundance, apparent annual survival, capture probability and probability of entry estimates for Kootenai River White Sturgeon in the Montana portion of the Kootenai River using mark-recapture data collected from 2009-2025. Only capture and recapture data from Montana were used in the analysis.

Year	Jolly-Seber (Abundance) and CJS (others) Parameter Estimates			
	Abundance Estimate (N; 95% CI)	Apparent Annual Survival (95% CI)	Capture Probability (95% CI)	Probability of Entry (95% CI)
2009	16 (2-121)	93.0 (90.2-95.1)	0.080 (0.016-0.315)	0.060 (0.055-0.066)
2010	45 (20-101)		0.096 (0.041-0.210)	
2011	72 (46-113)		0.307 (0.199-0.441)	
2012	97 (73-129)		0.466 (0.347-0.590)	
2013	120 (98-147)		0.191 (0.130-0.272)	
2014	142 (122-165)		0.187 (0.131-0.261)	
2015	162 (143-184)		0.364 (0.287-0.449)	
2016	181 (161-203)		0.185 (0.134-0.251)	
2017	198 (177-222)		0.257 (0.196-0.328)	
2018	214 (191-241)		0.240 (0.183-0.308)	
2019	229 (203-259)		0.138 (0.097-0.192)	
2020	243 (214-278)		0.205 (0.154-0.267)	
2021	257 (223-295)		0.188 (0.139-0.248)	
2022	269 (232-312)		0.150 (0.109-0.205)	
2023	280 (239-328)		0.188 (0.147-0.236)	
2024	290 (246-343)			
2025	300 (252-357)			

Table 13. Comparison of candidate models for Kootenai River White Sturgeon in the Kootenai River using only mark-recapture data collected in Montana from 2009-2025 to generate a superpopulation and annual abundance estimates. See Appendices 3 and 4 for code and capture histories used in the data analyses.

Model	Number of Parameters	AIC _c	Delta AIC _c	Model Weight	Deviance
Phi(~1)p(~timebin)pent(~1)N(~1)	18	1907.504	0.00000	9.999766e-01	-873.8198
Phi(~time)p(~timebin)pent(~1)N(~1)	33	1928.902	21.39840	2.256246e-05	-884.9720
Phi(~1)p(~timebin)pent(~time)N(~1)	33	1935.490	27.98600	8.373506e-07	-878.3844
Phi(~1)p(~1)pent(~time)N(~1)	19	1949.315	41.81126	8.332771e-10	-834.1305
Phi(~time)p(~timebin)pent(~time)N(~1)	48	1956.357	48.85383	2.463294e-11	-891.6864
Phi(~1)p(~1)pent(~1)N(~1)	4	1963.691	56.18706	6.296886e-13	-788.6141
Phi(~time)p(~1)pent(~time)N(~1)	34	1973.291	65.78781	5.180234e-15	-842.8089
Phi(~time)p(~1)pent(~1)N(~1)	19	1973.975	66.47146	3.680400e-15	-809.4704

Growth and Condition

Most sturgeon captured in Montana had a complete suite of biometric data collected (i.e., TL, FL, weight, scute removal pattern, PIT tag code). Fork length vs. total length and fork length vs. weight (g) indicated strong significant relationships with each other ($R\text{-sq} > 0.96$; **Figure 6**).

Using data from known aged individuals (i.e., known release record with PIT tag present and individuals assigned a brood year using the observed scute removal pattern), length-at-age of White Sturgeon in Montana followed the expected trend of increasing length with age (**Figure 7**). White Sturgeon captured in Montana from 2009-2025 averaged 563, 588, 693, 790 and 903 mm FL or 652, 687, 802, 915, 1,034 mm TL at ages 5, 10, 15, 20 and 25 respectively (**Figure 7**). The mean TL-at-age for sturgeon in Montana more closely aligns with length-at-age data for the 1995-2004 and 2005-2014 time periods from the Kootenai River and Kootenai Lake (see page 42 in Hardy et al. 2020). We approximated sturgeon densities (sturgeon/rkm) in Montana and the remainder of the Kootenai / ay River using abundance estimates of sturgeon in this report (see above) and from Hardy et al. 2020. The higher average length-at-age for sturgeon captured in Montana is likely partially due to lower estimated densities (approx. 8.5 sturgeon/rkm; approx. 300 sturgeon; 35 rkm) compared to the remainder of the Kootenai / ay River (≥ 30 sturgeon/rkm; approx. 10,000-15,000 sturgeon; 150 rkm). Although average length-at-age of sturgeon captured in Montana appears to be more similar to Kootenay Lake and lower density / abundance time periods in the Kootenai / ay River in Idaho and B.C. and Kootenay Lake, B.C., there are some sturgeon captured in Montana that are growing slowly. Sturgeon with 2 or more sequential captures in Montana were used to quantify growth as the change in TL per year in Montana by

age. Younger sturgeon (i.e., ≤ 10 years of age) averaged between 40 and about 80 mm TL/year growth and growth of sturgeon from 25-30 years of age averaged about 20 mm TL/year of growth (**Figure 7**). These growth estimates are similar to estimates on the lower Fraser River, B.C. (Nelson et al. 2018) and the Kootenai River (Ireland et al. 2002). Some age classes had substantial variation due to limited sample sizes and or highly variable growth between individuals.

The average relative weight ($W_r \times 100$) for White Sturgeon captured in Montana since 2009 was 80.5 ± 0.8 (95% CI; $N = 575$; range 59.9-157; **Figure 8**). The mean W_r of sturgeon captured in Montana is similar to that of all sturgeon captured in BC from 2009 to 2015 (Stephenson and Evans 2016) but lower than the mean condition of sturgeon captured in specific habitat types / locations in BC (Stephenson et al. 2020). Several hatchery origin brood years had above average condition estimates and those included 1995, 2000, 2002 and 2010 (**Figure 8**). Wild juvenile and wild adult sturgeon also had above average condition estimates, but sample sizes were extremely limited. Average annual relative weights of sturgeon captured in Montana since 2009 ranged from 73-89 (**Figure 9**). The three sampling years with the highest average W_r values were 2017 (89), 2010 (88), and 2011 (87).

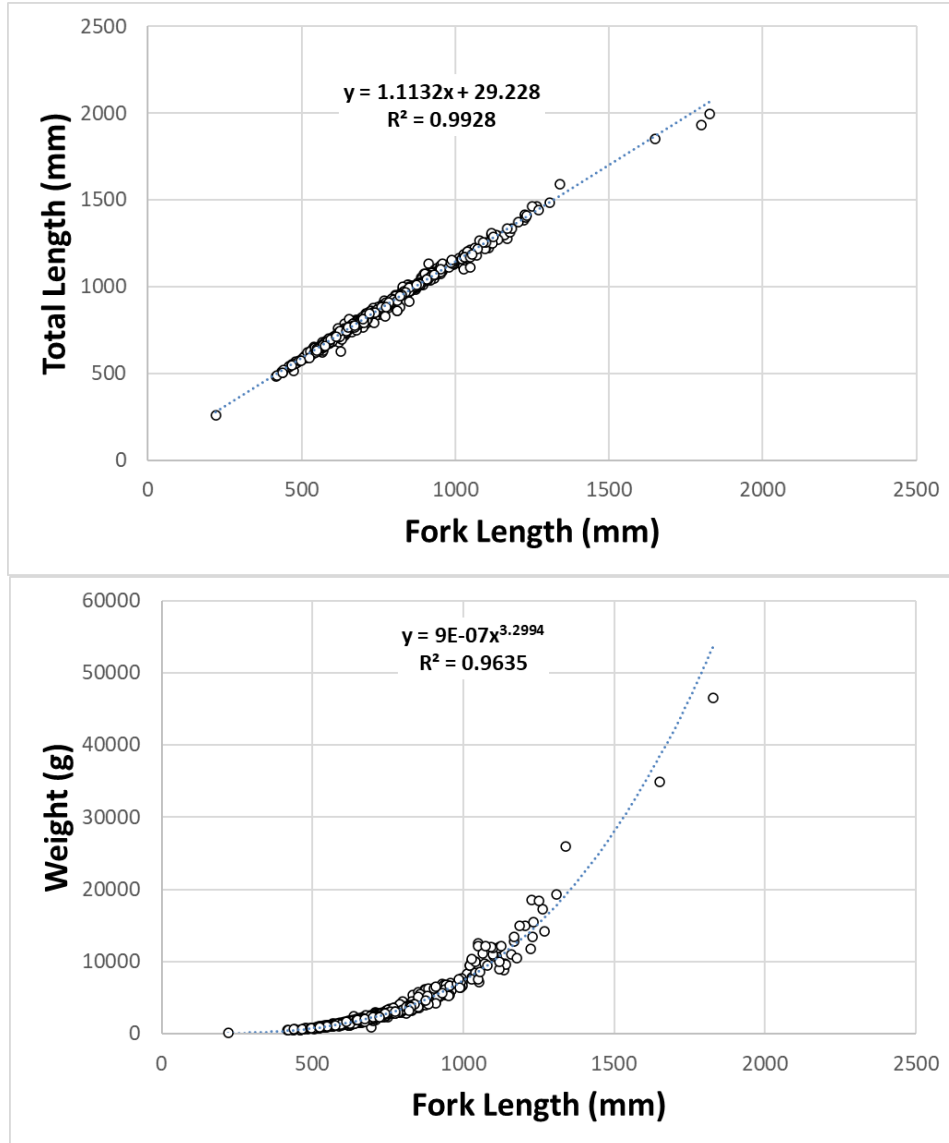


Figure 6. Relationships between fork length (mm), total length (m), and weight (g) of Kootenai River White Sturgeon at the time of capture in Montana from 2009-2025. Three sturgeon including an adult captured in 2016 did not have weights recorded due to a scale malfunction or exceedance of the scale capacity present at the time of capture.

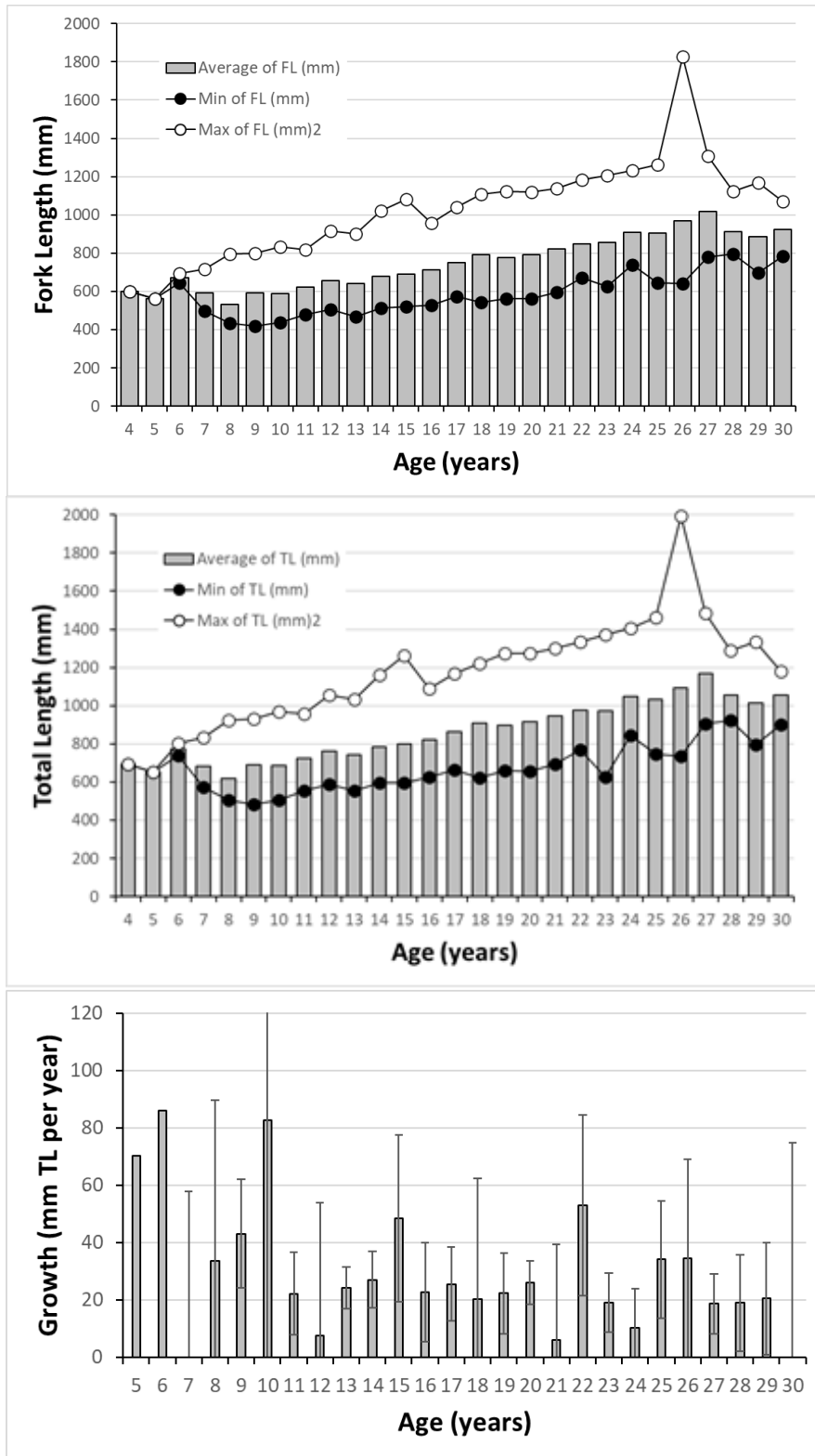


Figure 7. Summary of the average, minimum and maximum fork and total length-at-age (mm; upper and middle panels) and annual growth increments (mm per year TL; lower panel) of hatchery origin Kootenai River White Sturgeon in Montana from 2009-2025.

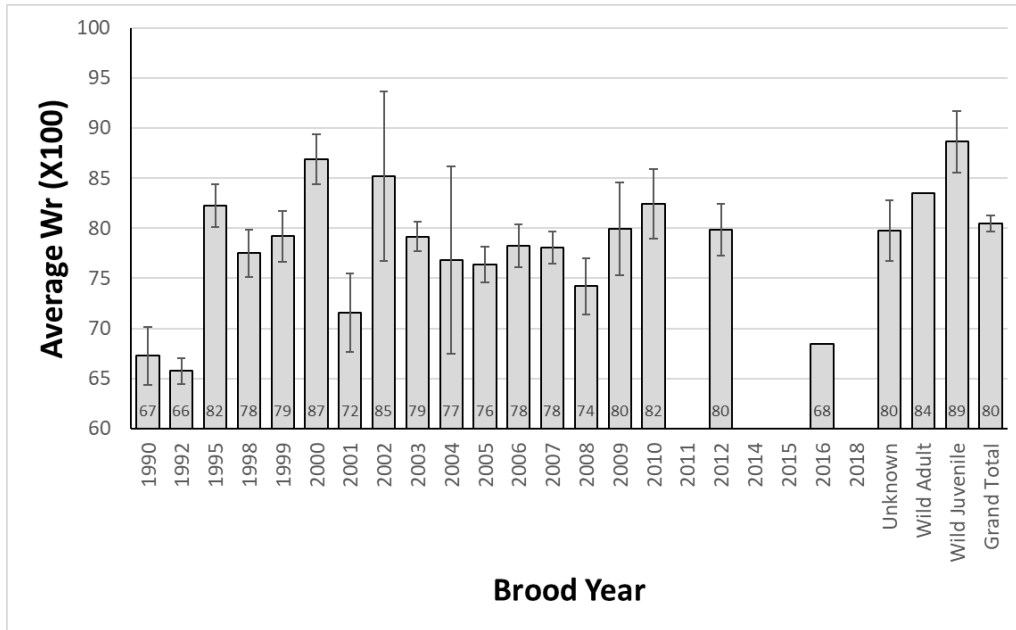


Figure 8. Summary of the average relative weight ($Wr \times 100$; $\pm 95\%$ CI) of hatchery origin sturgeon by brood year (i.e., 1990-2018, unknown) and wild juvenile and adult Kootenai River White Sturgeon captured in Montana from 2009-2025. Relative weight was only calculated for White Sturgeon ≥ 700 mm total length.

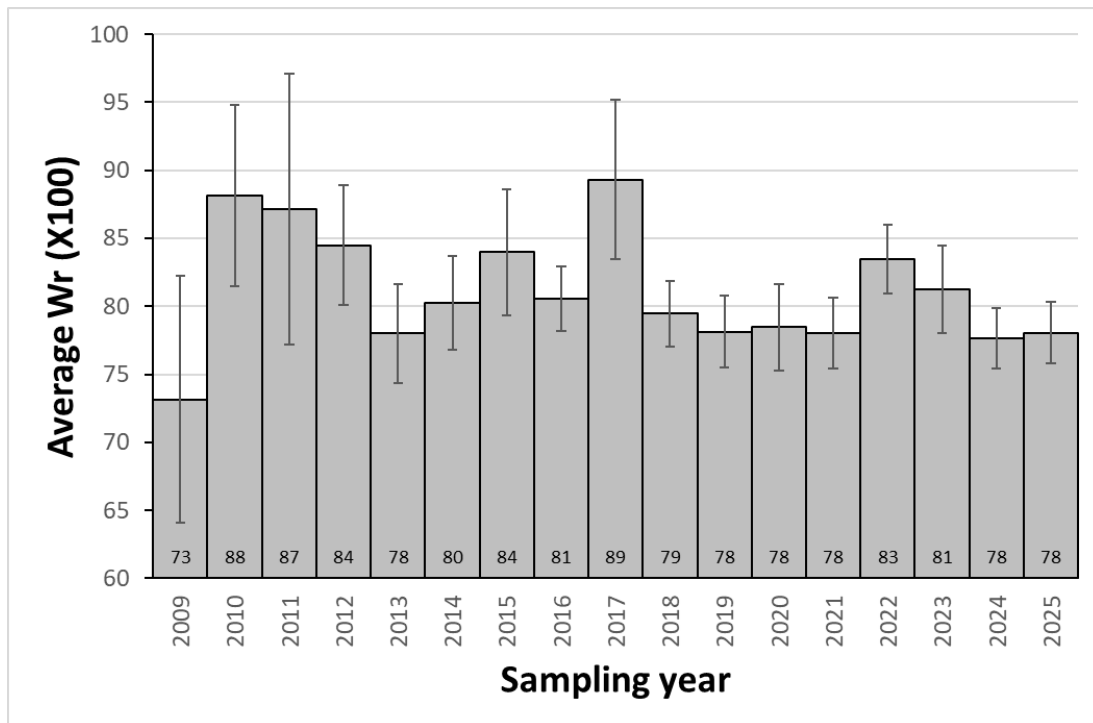


Figure 9. Summary of the average relative weight ($Wr \times 100$; $\pm 95\%$ CI) of Kootenai River White Sturgeon by capture year in Montana from 2009-2025. Relative weight was only calculated for White Sturgeon ≥ 700 mm total length.

Movement

Movement of sturgeon into or residing in Montana had not been evaluated in any significant way until recent sampling and evaluation efforts were re-initiated in 2009. In the late 1970's, Graham (1981) stated that few White Sturgeon migrated upstream into Montana, and it was thought that sturgeon did not reside in Montana for extended periods. In September 1994, ten 2-year-old juvenile sturgeon were released in Montana to assess efficacy of stocking sturgeon in Montana. By late October 1994, all 10 of these sturgeon had migrated 60-97 km downstream of their release locations (Marcuson et al. 1995). In an effort to assess recent movement patterns of sturgeon in Montana, we used a combination of data sources including historical release, capture and recapture data (Smith 2025), capture and recapture data in Montana since 2009 (MT FWP; data on file), mobile tracking data in Montana (MT FWP; data on file) and larger-scale movement data from juvenile and adult sturgeon (Stephenson et al. 2024, Bassett and McGregor 2025).

Since 2009, a total of 724 White Sturgeon have been captured in Montana and 324 unique individuals have been identified. Of the 324 uniquely identifiable sturgeon captured in Montana since 2009, 209 (64.5%) contained an existing PIT tag(s) associated with a release record that included a release location (i.e., rkm, TL, FL, weight, other data). Based on the 209 sturgeon with known release locations, 65.6% ($N=137$) were released in Idaho, 22.0% ($N=46$) were released in B.C. and 12.4% ($N=26$) were released in Montana. Based solely on sturgeon with known release locations, 87.6% ($N=183$) of the sturgeon captured in Montana since 2009 migrated upstream into Montana post-release, while the remaining roughly 12% were originally released in Montana. The number of individual White Sturgeon captured in Montana ($N=324$) as well as the number of individuals that migrated upstream into Montana ($N=183$) both represent a small percentage ($< 0.1\%$) of the approximately 325,000+ juveniles released into the Kootenai / Kootenay River Basin since 1992 (KTOI 2021 and 2023). The total number of individuals currently estimated in Montana ($N=300$ sturgeon) also represents a small percentage ($<3\%$) of the most recent abundance estimate of juvenile hatchery origin sturgeon within the Kootenai / ay Basin (i.e., approximately 10,000-15,000 sturgeon in 2018; see Hardy et al. 2020).

Movements of juvenile White Sturgeon implanted with sonic tags ($N=47$ individuals, 49 sonic tags deployed) in Montana since 2012 were variable and included many longer-term residents and various movement patterns (**Tables 14 and 15; Figure 10**). Of the 47 sturgeon sonic tagged to date, the average range (km) of river / lake habitat used by individual sturgeon was 49.9 km but the amount of river utilized by individuals varied from 0 to 292.5 km (**Table 14**). Resident sturgeon had the lowest average cumulative movement distance (16.9 km) followed by emigrants that had not returned to Montana based on available data through 2025 (99.5 km; **Table 15**). Sturgeon that had emigrated from Montana, returned to Montana and were not known to be in Montana in late 2025 utilized the highest average range of river kilometers (272.1 km), had the highest average cumulative movement (3466.1 km) and had the highest maximum cumulative movement (4,399.5 km; **Table 15**). Of the 47 unique sturgeon implanted with sonic tags, 27 (57.5%) showed no movements from Montana post-tagging based on existing capture / recapture data and detections using mobile and stationary receivers / hydrophones. To date, five sturgeon had emigrated from Montana and had not returned to Montana as of late 2025 (**Table 15 and Figure 10**). Fifteen (31.9%) sturgeon emigrated from Montana post-tagging and

later returned to Montana one or more times and 11 of those 15 sturgeon were last detected / captured in Montana (**Table 15**). Overall, about 80% of the White Sturgeon sonic tagged in Montana appear to have some longer-term or recurring fidelity to the Montana portion of the Kootenai River (**Table 15 and Figure 10**).

We also quantified average annual probability of movement between different habitats (i.e., river vs. lake) and jurisdictional habitat areas (i.e., Montana River, Idaho River, BC River, Kootenay Lake) for the 47 sturgeon sonic tagged in Montana using only sonic tag detection data from 2012-2025. Downstream movement from Montana to the Idaho portion of the Kootenai River had the highest average annual probability of movement (0.133), followed by movement from the BC portion of the river to Kootenay Lake (0.084; **Table 16**). In terms of upstream movement between jurisdictional areas, movement from the Idaho section of the Kootenai River to the Montana portion of the river had the highest average annual probability of movement (0.085) followed by upstream movement from Kootenay Lake to the BC portion of the river (0.071; **Table 16**). Overall, there was a slightly higher average annual probability of downstream movement from the river to lake (0.089; river to Kootenay Lake) than upstream movement from Kootenay Lake to the river (0.074; **Table 16**).

Movement of known adult sturgeon upstream of Bonners Ferry, Idaho was previously noted as occurring infrequently (Rust et al. 2004). Movement of adult sturgeon into Montana still occurs infrequently based on radio / sonic telemetry (Stephenson et al. 2024; Bassett and McGregor 2025; Rust and Wakkinen 2008) and adult capture data in Montana. Five adult sturgeon have been detected at one or more sonic receivers in Montana in the last 20 years (**Figure 11**) and 3 of those 5 sturgeon were likely in Montana for < 1 week. Based on available detection data in Montana, the arrival / departure dates for these 3 sturgeon were Jul 25 / Jul 27, Jun 21 / Jun 24, and Sep 8 / Sep 9 respectively. One of the 5 adults resided in Montana for approximately 2 weeks (i.e., Jun 18 – Jun 30) and the other for about 1.5 months (Jul 16 - Sep 3). Only two wild adult sturgeon have been captured in Montana since 2009, one in July 2016 and the other in June 2024. A confirmed sighting of a likely wild adult sturgeon occurred in September 2015, when an approximately 6 ft long sturgeon was observed by three FWP staff about 200-300 yards downstream of the boat ramp in Troy, MT. In the fall of 2022, FWP staff talked with a member of the public that reported seeing a large sturgeon in the side channel of Scott Island (i.e., near Troy, MT) in May or June 2022. If this sighting was valid, the reported sturgeon did not have an active sonic tag that could be tracked at that time. Abundance / presence of adult White Sturgeon in Montana remains low based on the low number of captures since 2009, the low number of confirmed / reported sightings and few detections of sonic tagged adult sturgeon.

Table 14. Detected movement and residency status of juvenile White Sturgeon sonic tagged ($N=47$) in Montana from 2012-2025.

Sonic Tag	Tagging Location (rkm)	Tag Date (D-M-Y)	Min (rkm)	Max (rkm)	Minimum Cumulative Movement (km)	Last Date (D-M-Y)	Last Location (rkm)	Projected Tag Expiration Date (D-M-Y)	Tag Status	Residency Status
A81-1206-1056	306.5	24-Sep-15	305.0	308.5	24.5	3-May-23	306.8	15-Nov-24	Expired	Resident
A81-1206-1057	306.5	24-Sep-15	209.2	306.8	597.2	19-Sep-24	305	15-Nov-24	Expired	Emigrant with Return
A81-1206-1058	305	10-Jun-15	305.0	307.5	22.8	5-Jun-23	306.5	01-Aug-24	Expired	Resident
A81-1206-1059	306.5	22-Apr-16	305.0	308.5	35.9	31-Oct-23	307.2	14-Jun-25	Expired	Resident
A81-1206-1060	306.4	09-May-19	257.5	306.8	77.6	4-May-25	257.5	30-Jun-28	Active	Emigrant
A81-1206-1061	279.6	14-Jun-16	268.5	305.0	131.6	4-Jun-24	282	06-Aug-25	Expired	Emigrant with Return
A81-1206-1062	306.5	10-Jun-15	306.4	308.5	5.1	5-Jun-23	306.8	01-Aug-24	Expired	Resident
A81-1206-1063	306.5	10-Jun-15	268.5	308.5	84.9	17-Jun-23	305	01-Aug-24	Expired	Emigrant with Return
A81-1206-1064	306.5	10-Jun-15	300.5	307.5	22.1	23-May-25	300.6	04-Jul-18	Expired	Resident
A81-1206-1065	306.5	10-Jun-15	279.2	307.5	63.8	31-Oct-23	306.7	04-Jul-18	Expired	Resident
A81-1206-1194		11-Sep-20						03-Nov-29		
A81-1206-1066	306.5	10-Jun-15	184.9	307.5	259.3	31-Oct-23	307.2	04-Jul-18	Expired	Emigrant with Return
A81-1206-1067	306.5	10-Jun-15	240.0	307.0	290.0	27-Jun-18	306.5	04-Jul-18	Expired	Emigrant with Return
A81-1206-1068	306.5	10-Jun-15	306.5	307.5	6.7	24-Oct-23	307.2	04-Jul-18	Expired	Resident
A81-1206-1069	305	10-Jun-15	268.5	306.5	80.0	29-May-20	306.5	04-Jul-18	Expired	Emigrant with Return
A81-1206-1070	306.5	15-May-15	305.0	306.5	6.8	25-Sep-24	305.7	08-Jun-18	Expired	Resident
A81-1206-1192	306.5	11-Sep-20	306.5	307.1	4.0	23-Oct-25	306.5	03-Nov-29	Active	Resident
A81-1206-1193	305.8	20-Jun-20	300.4	307.3	63.8	19-Jul-25	300.4	15-Aug-29	Active	Resident
A81-1206-1195	306.5	23-Jun-20	305.0	307.2	7.3	18-Oct-24	305	15-Aug-29	Active	Resident
A81-1206-1196	305.8	06-Jun-19	305.0	307.6	32.2	26-Jun-25	305	28-Jul-28	Active	Resident
A81-1206-706	306.5	28-Aug-12	305.0	308.0	23.2	23-Jun-20	306.5	29-Dec-21	Expired	Resident
A81-1206-802	306.5	11-Oct-12	300.4	307.0	13.2	13-Jul-18	306.5	03-Mar-16	Expired	Resident
A81-1206-803	306.5	11-Oct-12	118.0	306.5	230.1	24-Jun-14	118	03-Mar-16	Expired	Emigrant
A81-1206-804	306.5	28-Aug-12	305.0	307.5	7.7	20-Aug-24	307.2	19-Jan-16	Expired	Resident
A81-1206-805	306.5	28-Aug-12	300.4	307.0	16.7	10-Sep-15	305	19-Jan-16	Expired	Resident
A81-1206-806	306.5	11-Oct-12	305.0	307.5	7.0	6-Jun-19	306.5	03-Mar-16	Expired	Resident
A81-1206-807	306.5	07-Jun-13	305.0	308.5	12.9	3-May-23	306.8	07-Oct-22	Expired	Resident

Table 14 continued. Detected movement and residency status of juvenile White Sturgeon sonic tagged ($N=47$) in Montana from 2012-2025.

Sonic Tag	Tagging Location (rkm)	Tag Date (D-M-Y)	Min (rkm)	Max (rkm)	Minimum Cumulative Movement (km)	Last Date (D-M-Y)	Last Location (rkm)	Projected Tag Expiration Date (D-M-Y)	Tag Status	Residency Status
A81-1206-827	306.5	07-Jun-13	264.0	308.5	197.5	20-Jul-22	305	07-Oct-22	Expired	Emigrant with Return
A81-1206-828	305.5	01-Nov-13	243.5	305.5	62.0	14-Dec-13	243.5	23-Mar-17	Expired	Emigrant
A81-1206-829	280.5	09-Aug-13	268.5	305.7	137.6	12-Sep-25	305.7	29-Dec-16	Expired	Emigrant with Return
A81-1206-830	305	24-Jul-13	240.7	305.0	174.2	27-Oct-21	300.6	13-Dec-16	Expired	Emigrant with Return
A81-1206-831	306.5	12-Jun-13	305.0	307.0	5.0	2-Oct-19	306.5	01-Nov-16	Expired	Resident
A81-1206-832 A81-1206-1191	305.8	11-Oct-12 14-Aug-20	253.4	307.0	63.6	16-Jul-25	253.4	03-Mar-16 06-Oct-29	Expired Active	Emigrant
A81-1206-833	306.5	12-Jun-13	250.0	306.5	64.0	29-Jun-15	257.5	01-Nov-16	Expired	Emigrant
A81-1206-834	305	24-Jul-13	305.0	306.5	5.0	6-Dec-16	305	13-Dec-16	Expired	Resident
A81-1206-930	306.5	24-Jul-13	155.5	307.2	329.1	1-Sep-22	305	23-Nov-22	Expired	Emigrant with Return
A81-1206-931	306.5	30-Aug-13	305.0	307.5	16.2	28-Jun-22	306.5	30-Dec-22	Expired	Resident
A81-1206-932	306.5	18-Jun-13	18.0	306.5	3189.7	28-Sep-23	119	18-Oct-22	Expired	Emigrant with Return
A81-1206-933	300.3	25-Oct-13	7.5	300.4	3184.7	24-Oct-24	7.5	24-Feb-23	Expired	Emigrant with Return
A81-1206-934	306.5	18-Jun-13	305.0	308.5	17.7	25-Oct-22	307.2	18-Oct-22	Expired	Resident
A81-1206-935	306.5	14-Aug-13	18.0	308.0	3090.6	14-Dec-22	89.5	14-Dec-22	Expired	Emigrant with Return
A81-1206-936	306.5	07-Jun-13	89.5	306.5	4399.5	18-Jan-23	121	07-Oct-22	Expired	Emigrant with Return
A81-1206-937	306.5	07-Jun-13	306.5	308.5	7.4	15-Mar-20	307.3	07-Oct-22	Expired	Resident
A81-1206-938	301.7	01-Aug-13	301.7	307.5	8.0	31-Oct-23	307.3	21-Dec-16	Expired	Resident
A81-1206-939	305.5	24-Jul-13	268.5	307.5	78.5	27-Jul-16	305	13-Dec-16	Expired	Emigrant with Return
A81-1206-940	306.5	30-May-13	306.4	306.5	0.2	8-Aug-25	306.5	19-Oct-16	Expired	Resident
A81-1206-941	306.5	21-May-13	300.4	307.2	22.1	20-Aug-24	307.2	10-Oct-16	Expired	Resident
A69-9001-42220	306.5	11-Jun-2025	306.4	306.4	0.0	11-Jun-25	306.4	9-Jun-35	Active	Resident

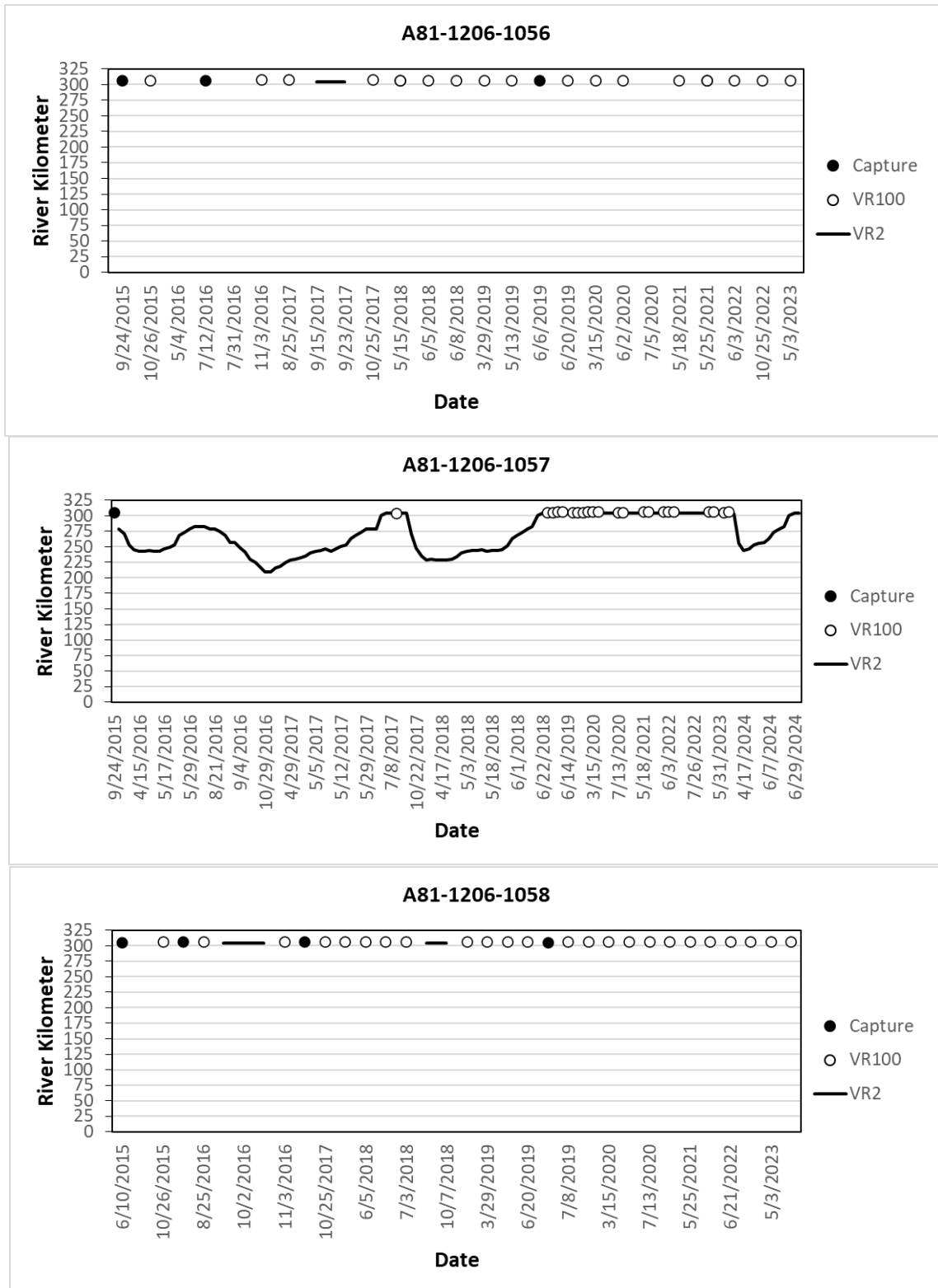


Figure 10. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

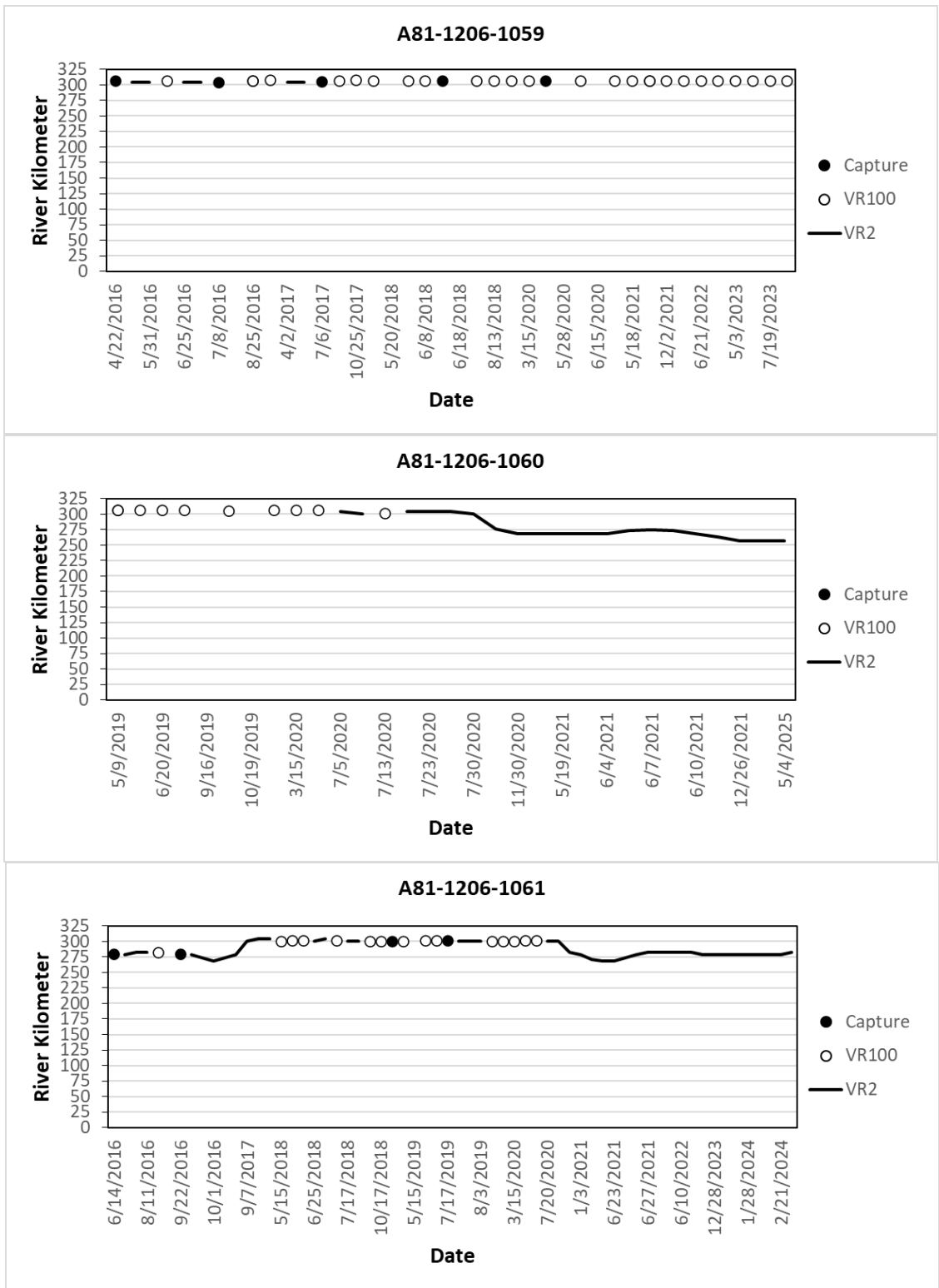


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

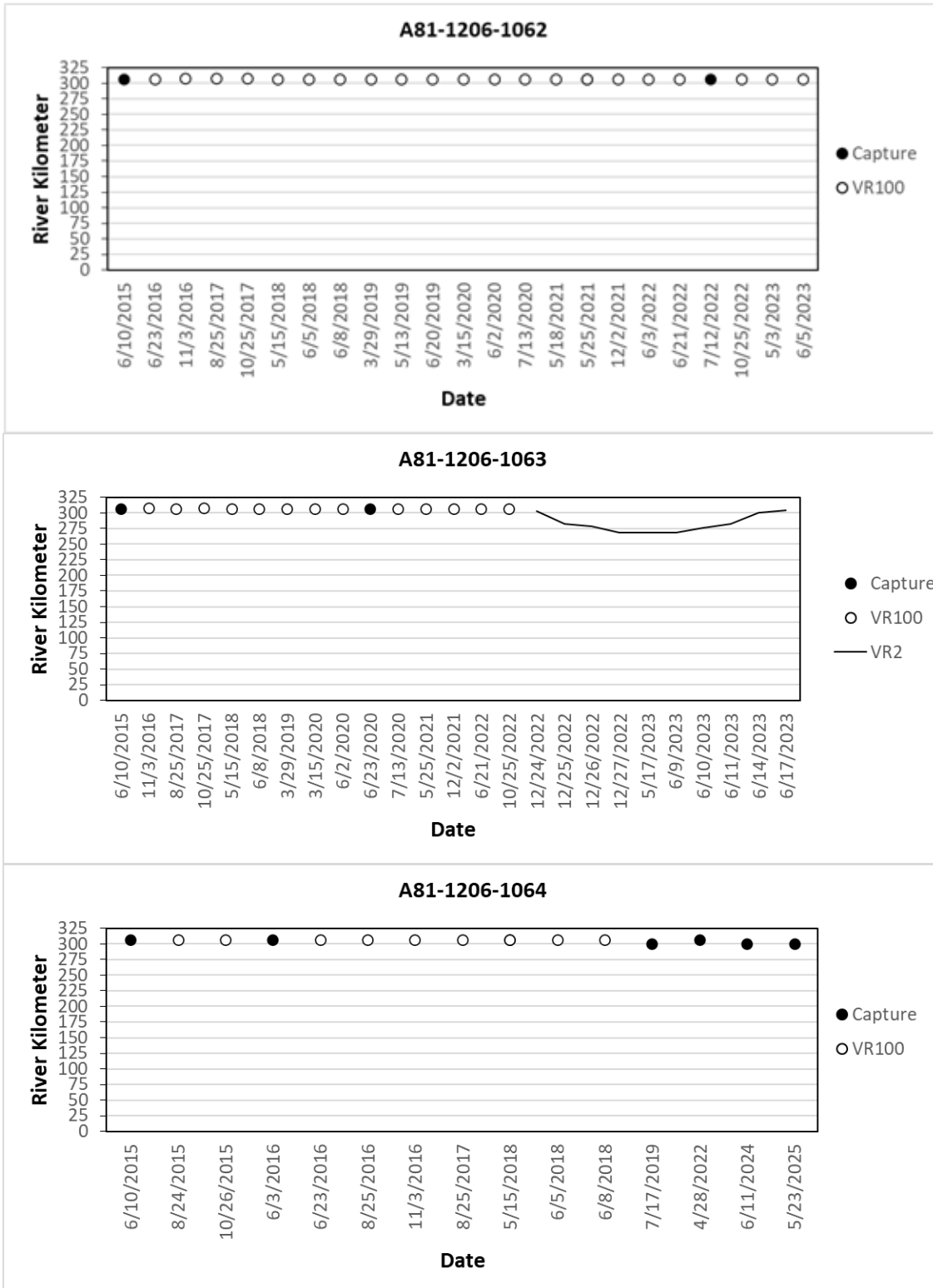


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

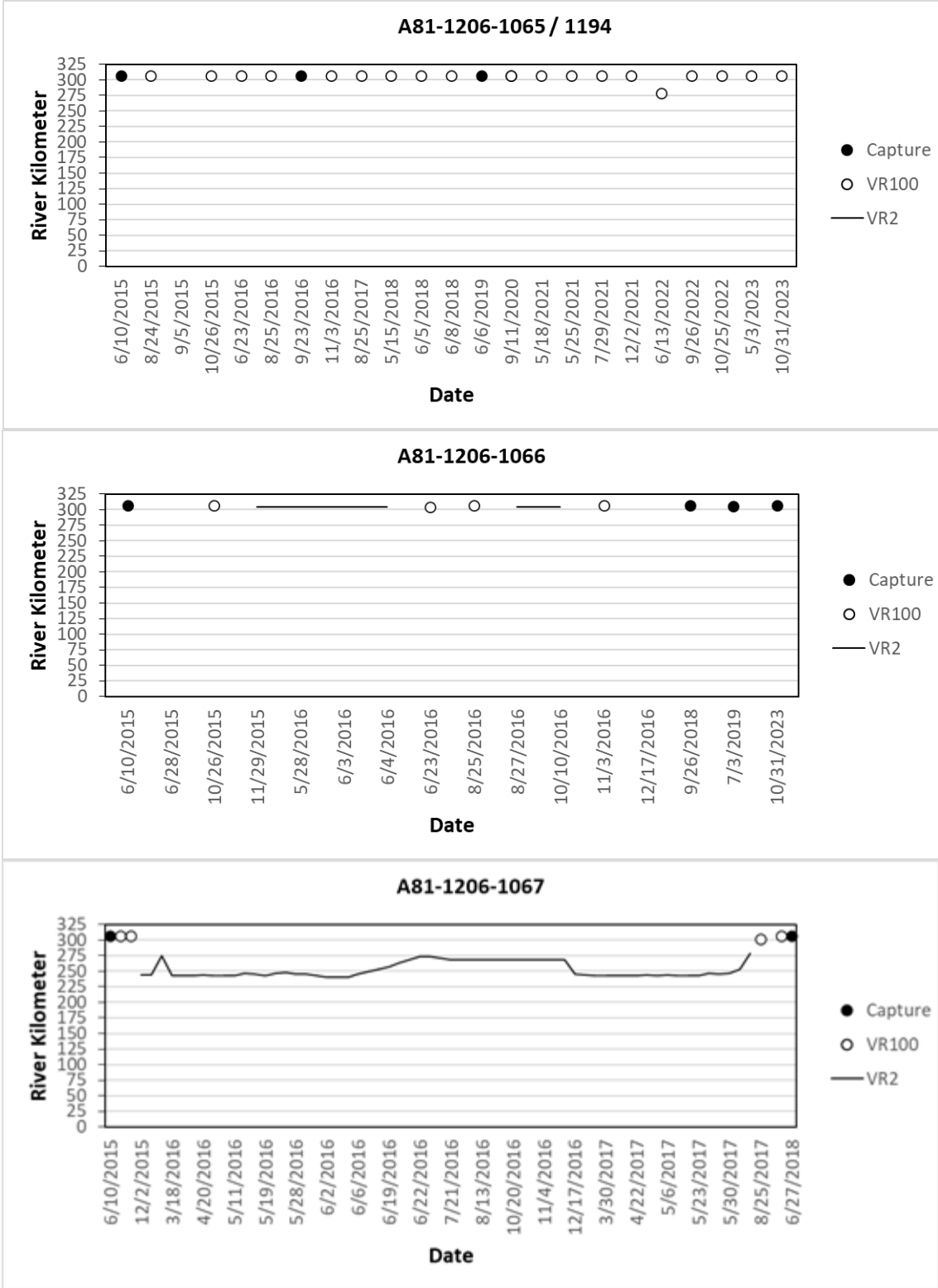


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

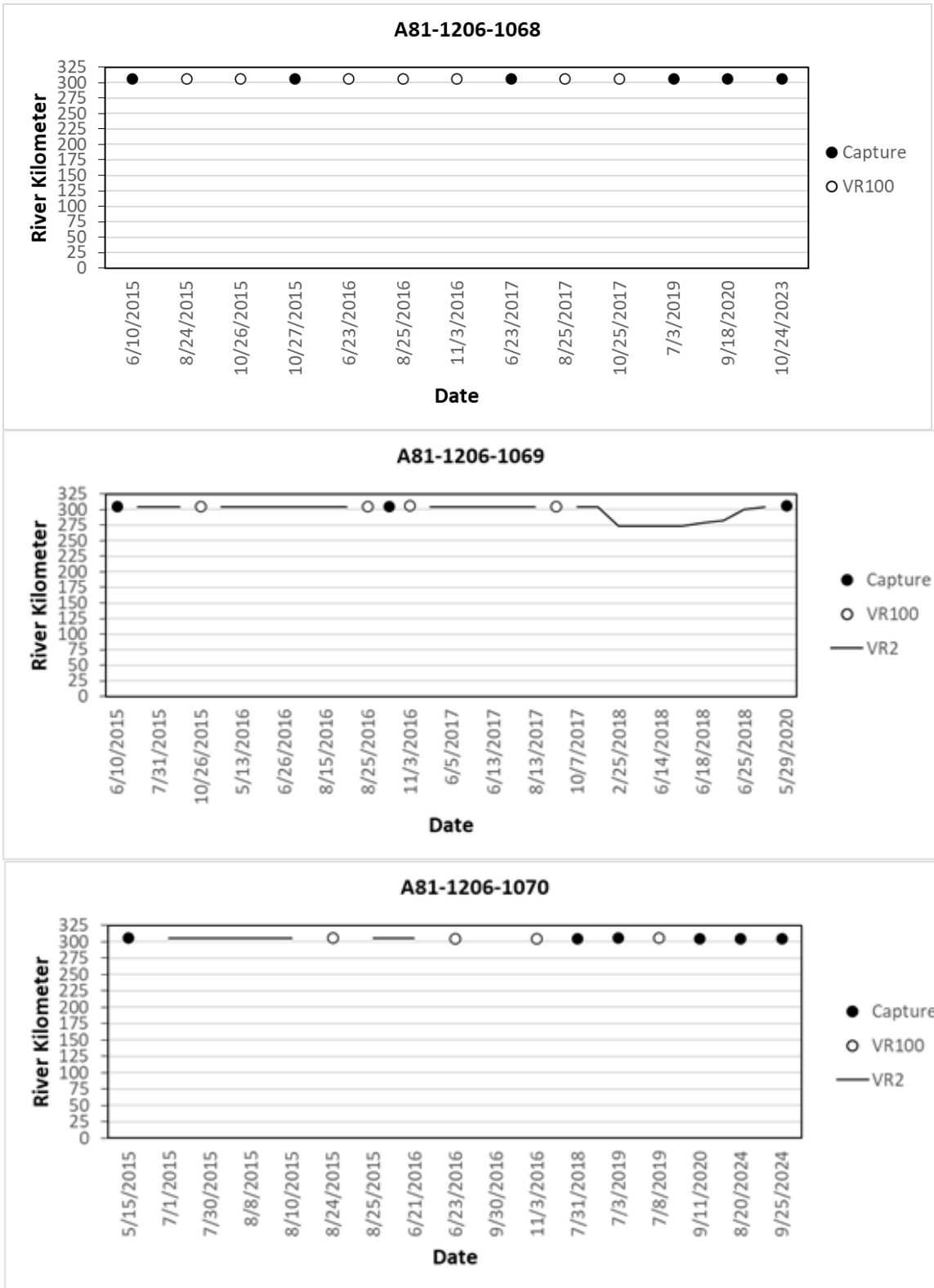


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

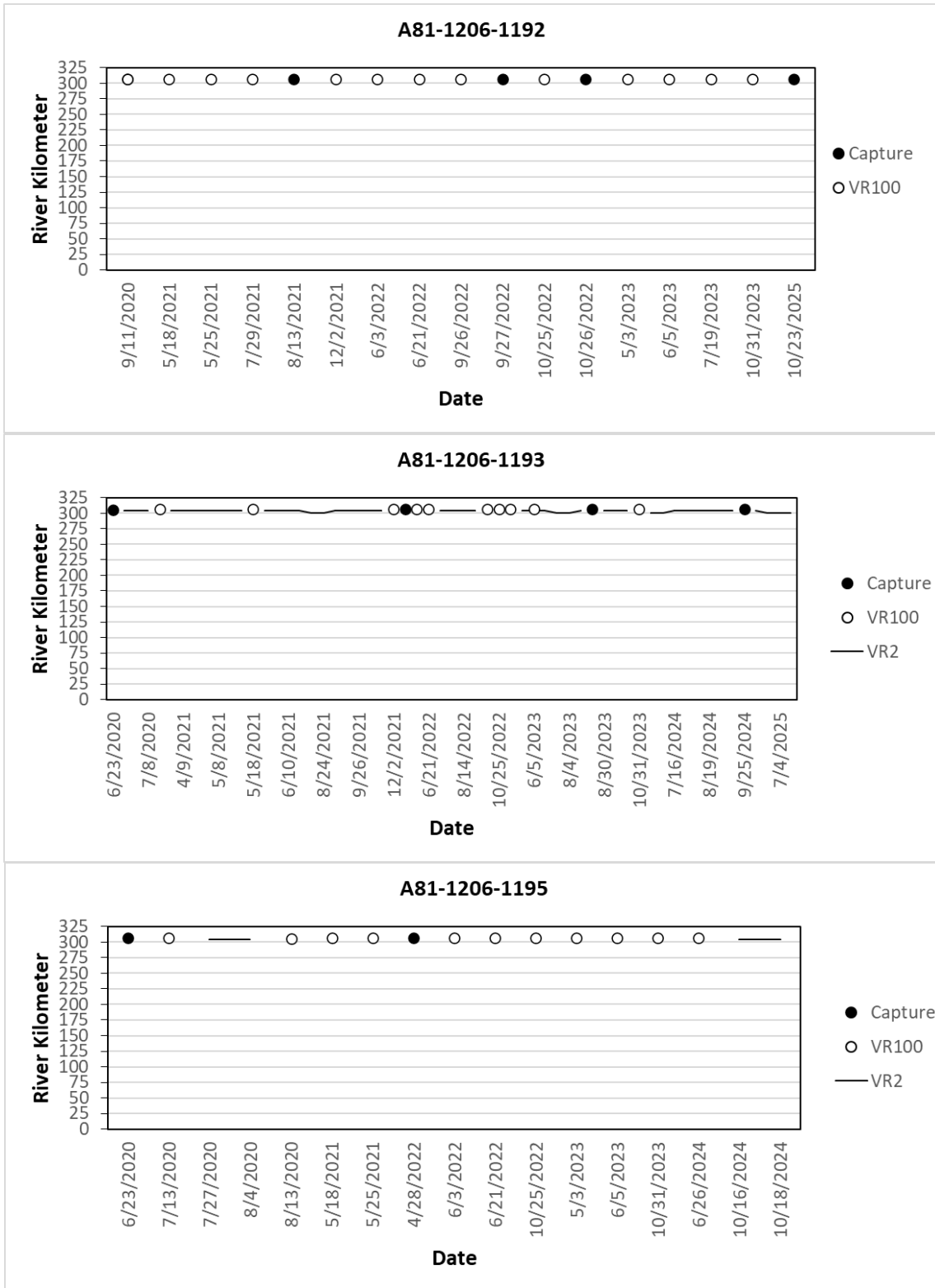


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

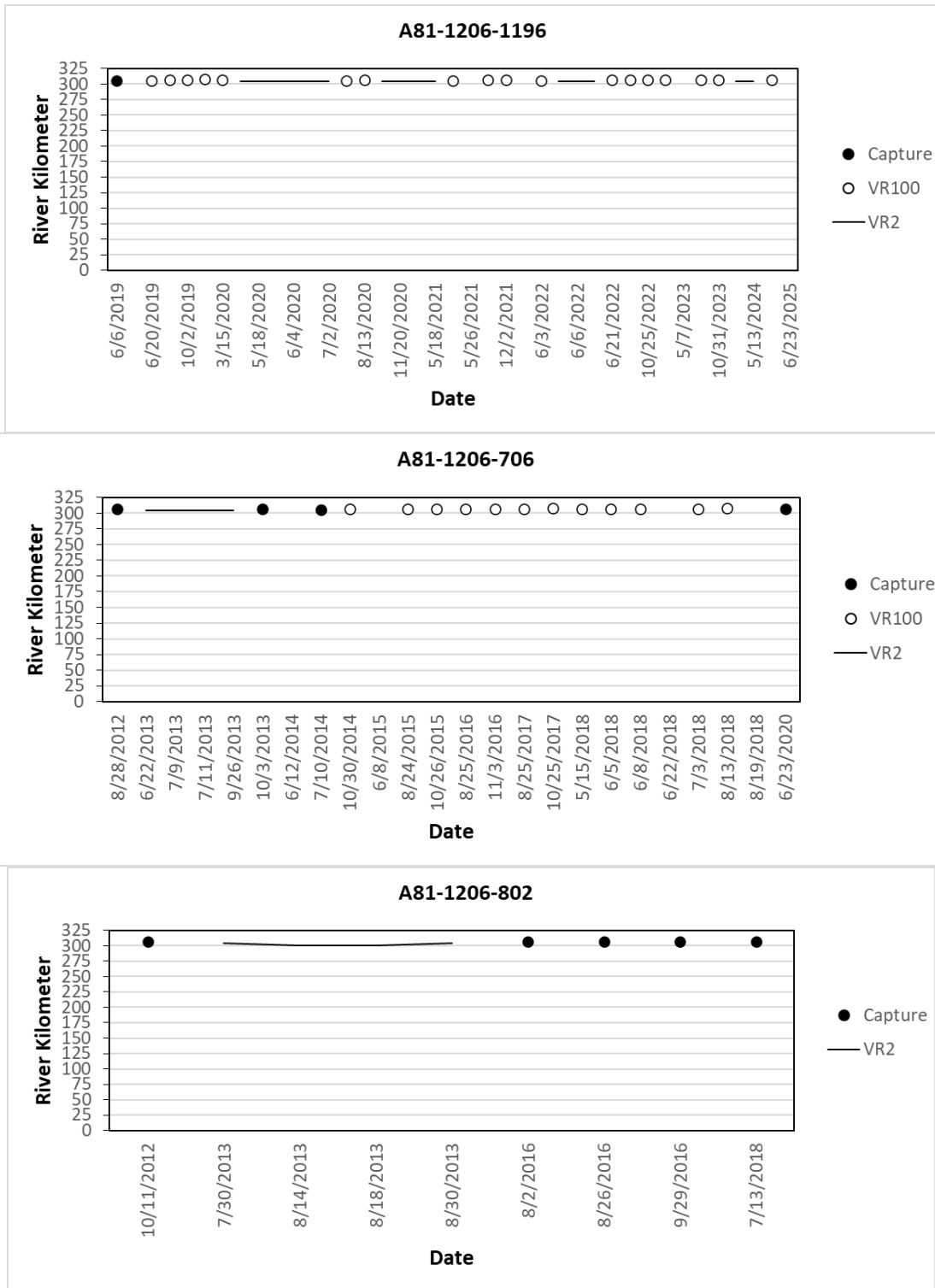


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

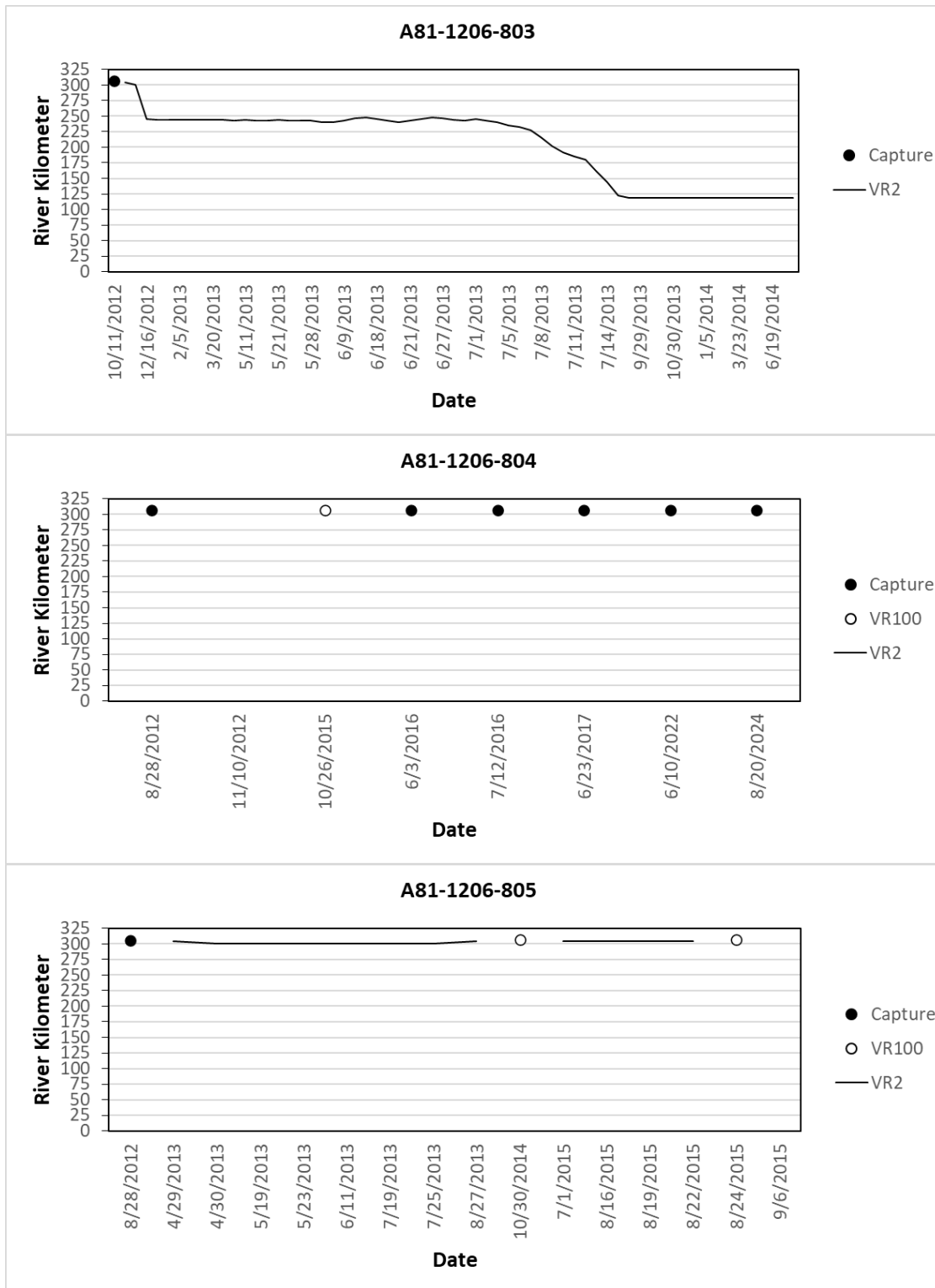


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

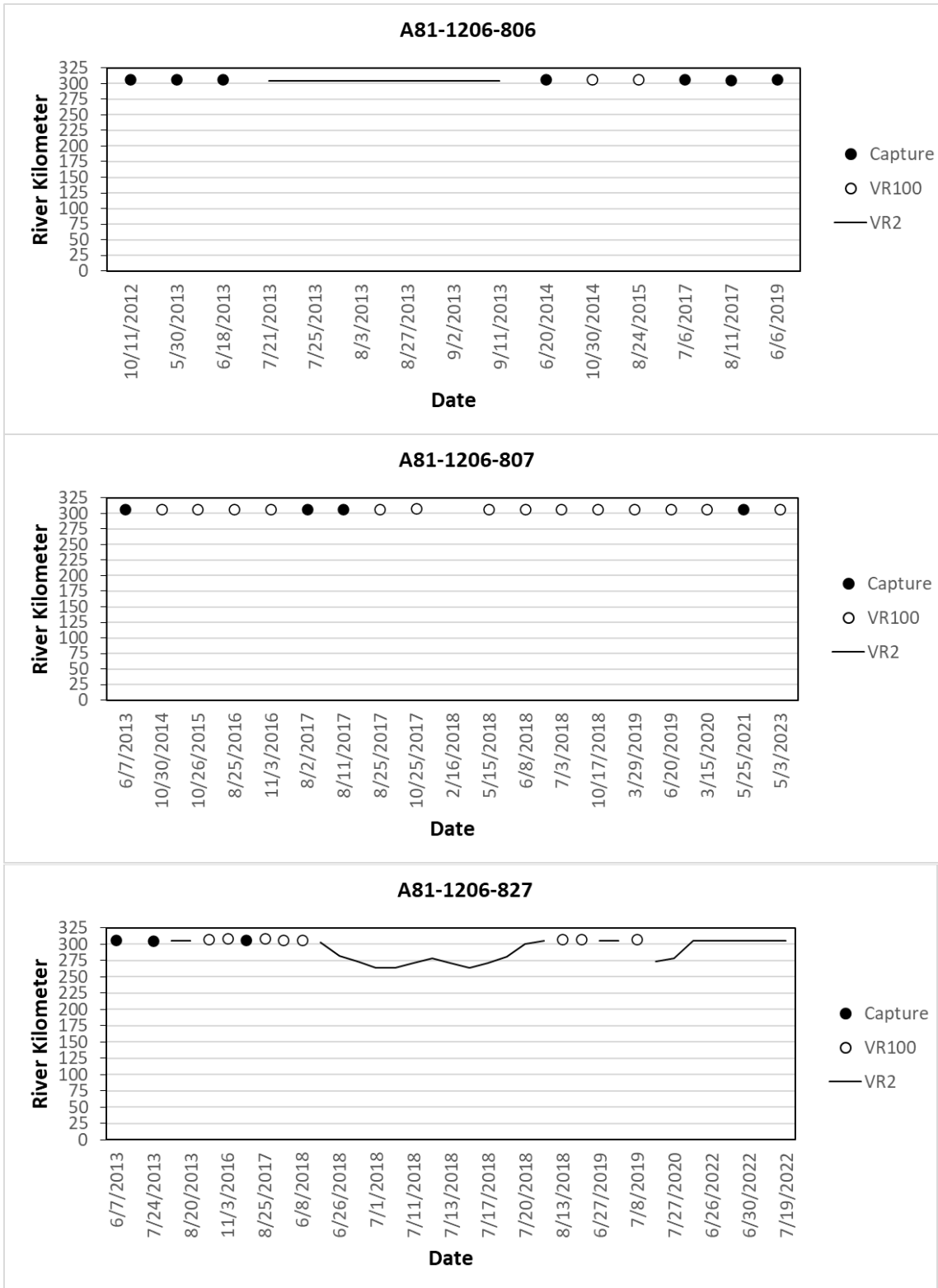


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

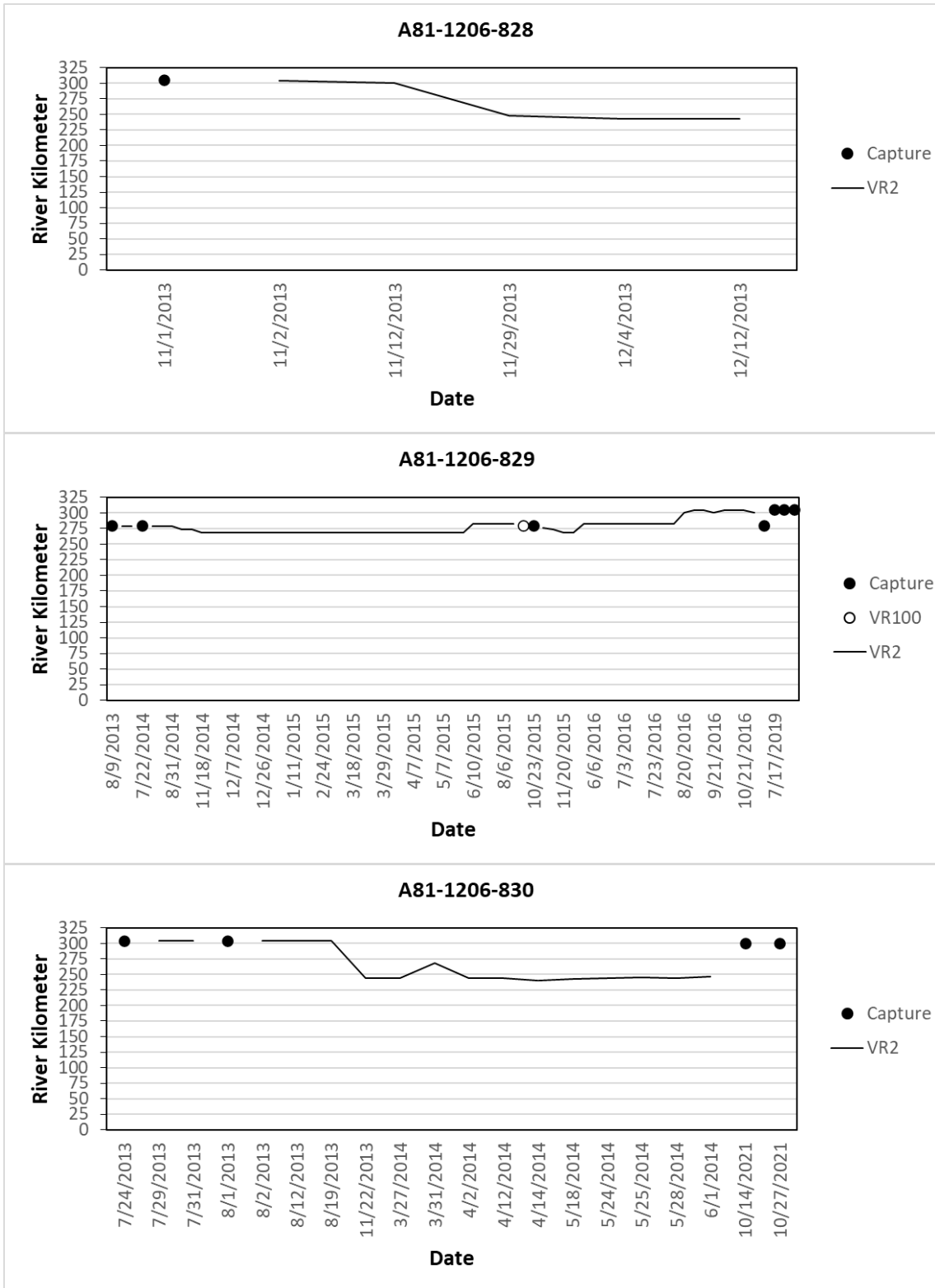


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

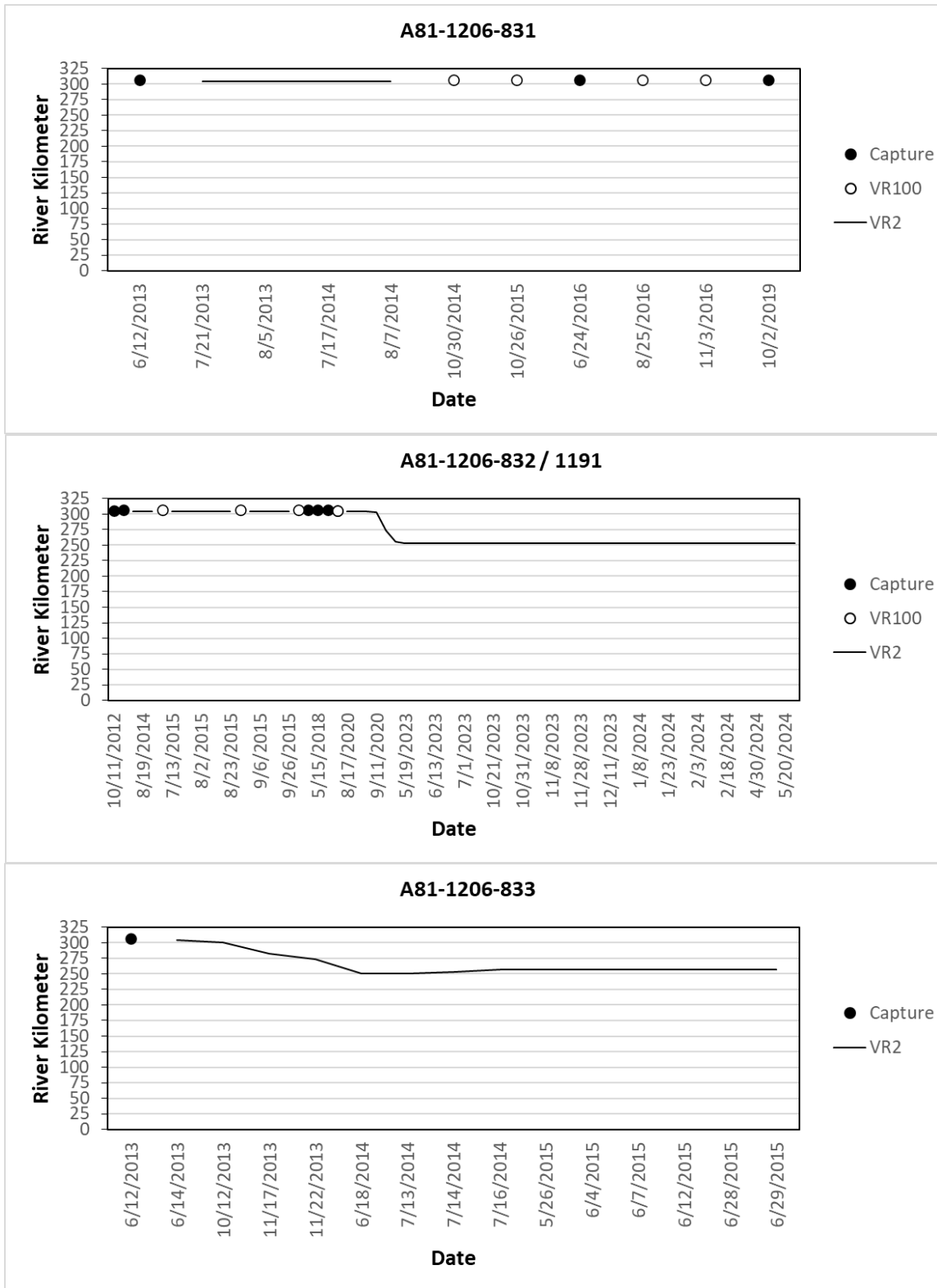


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

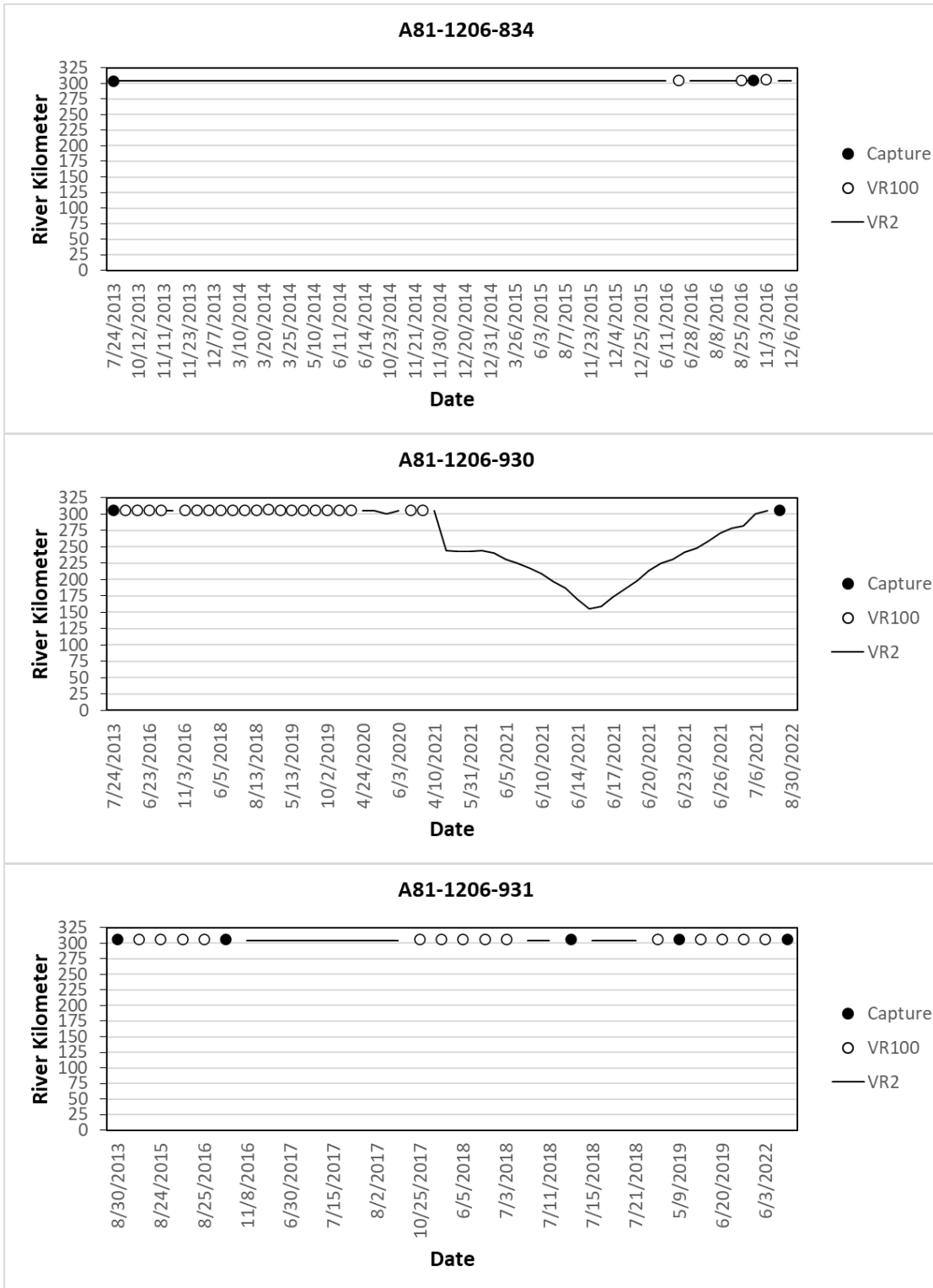


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

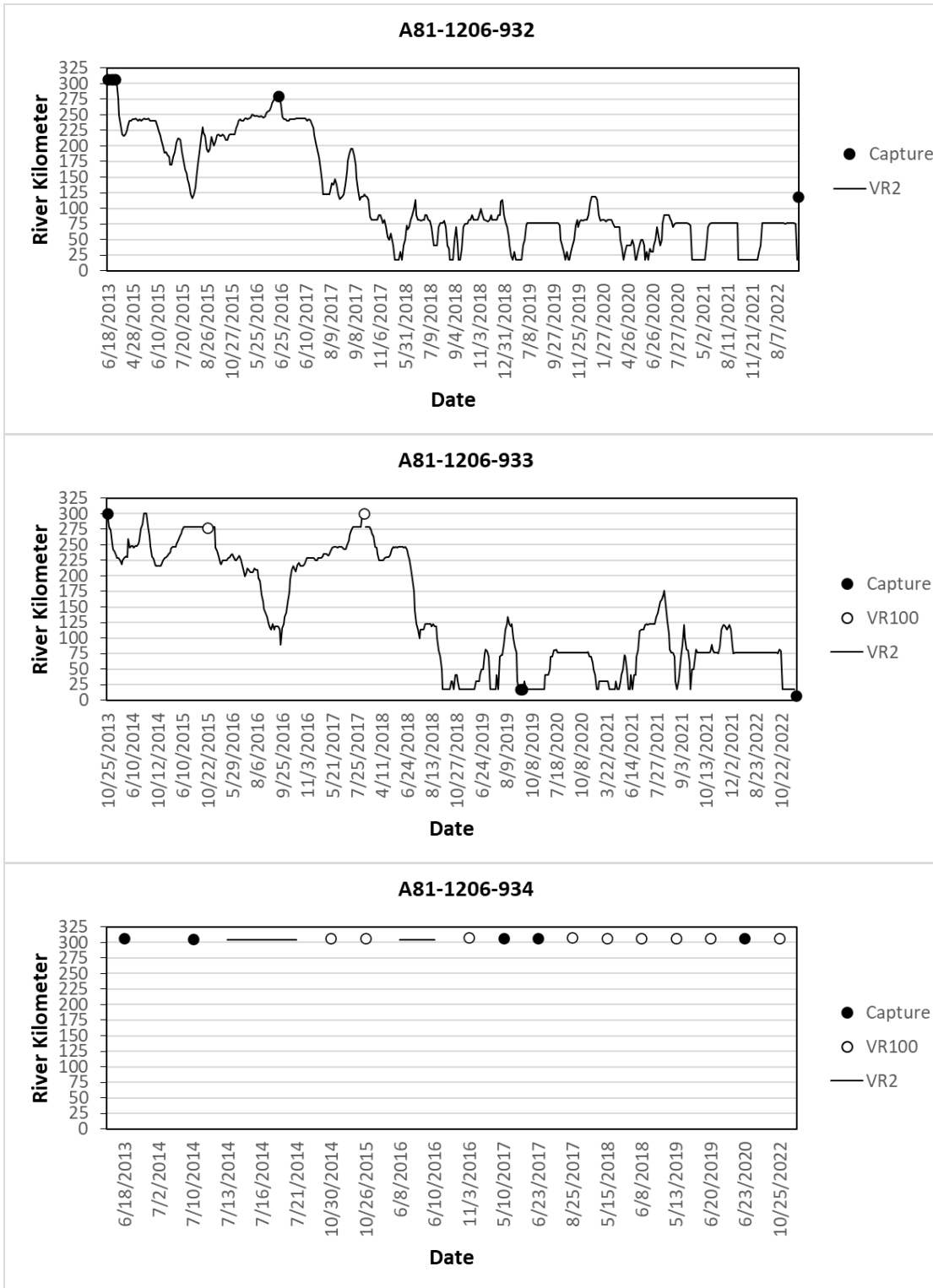


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

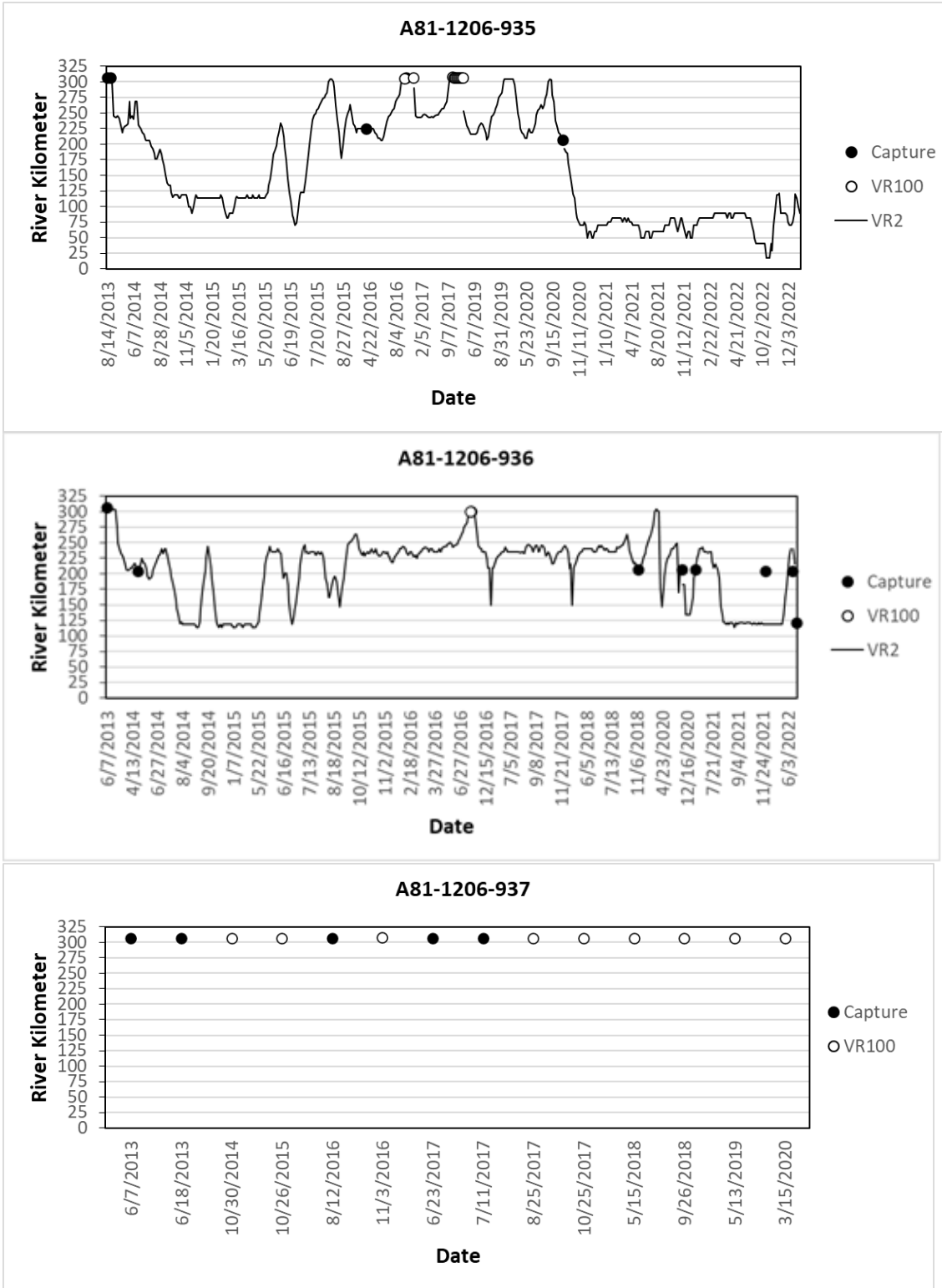


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

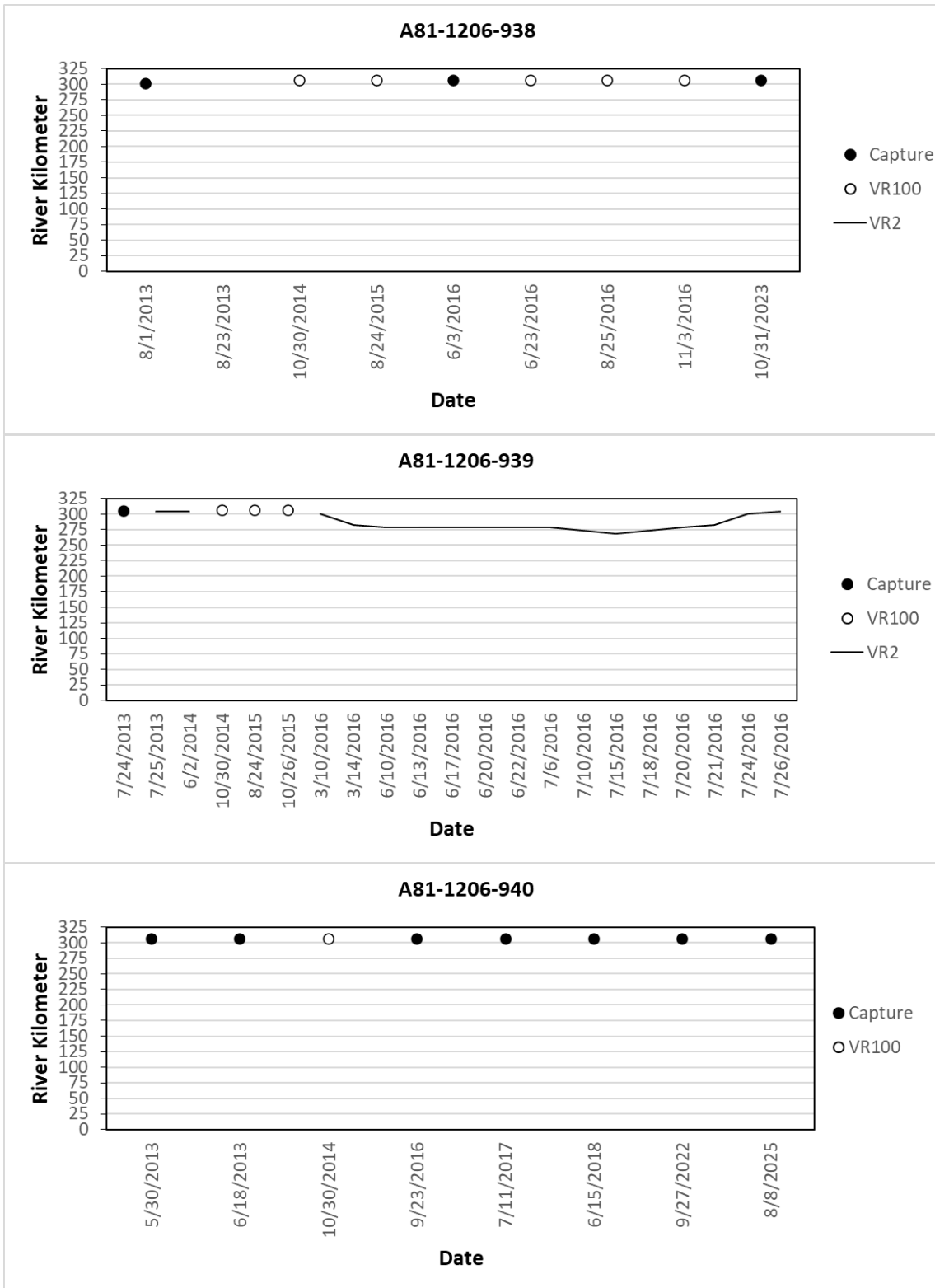


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

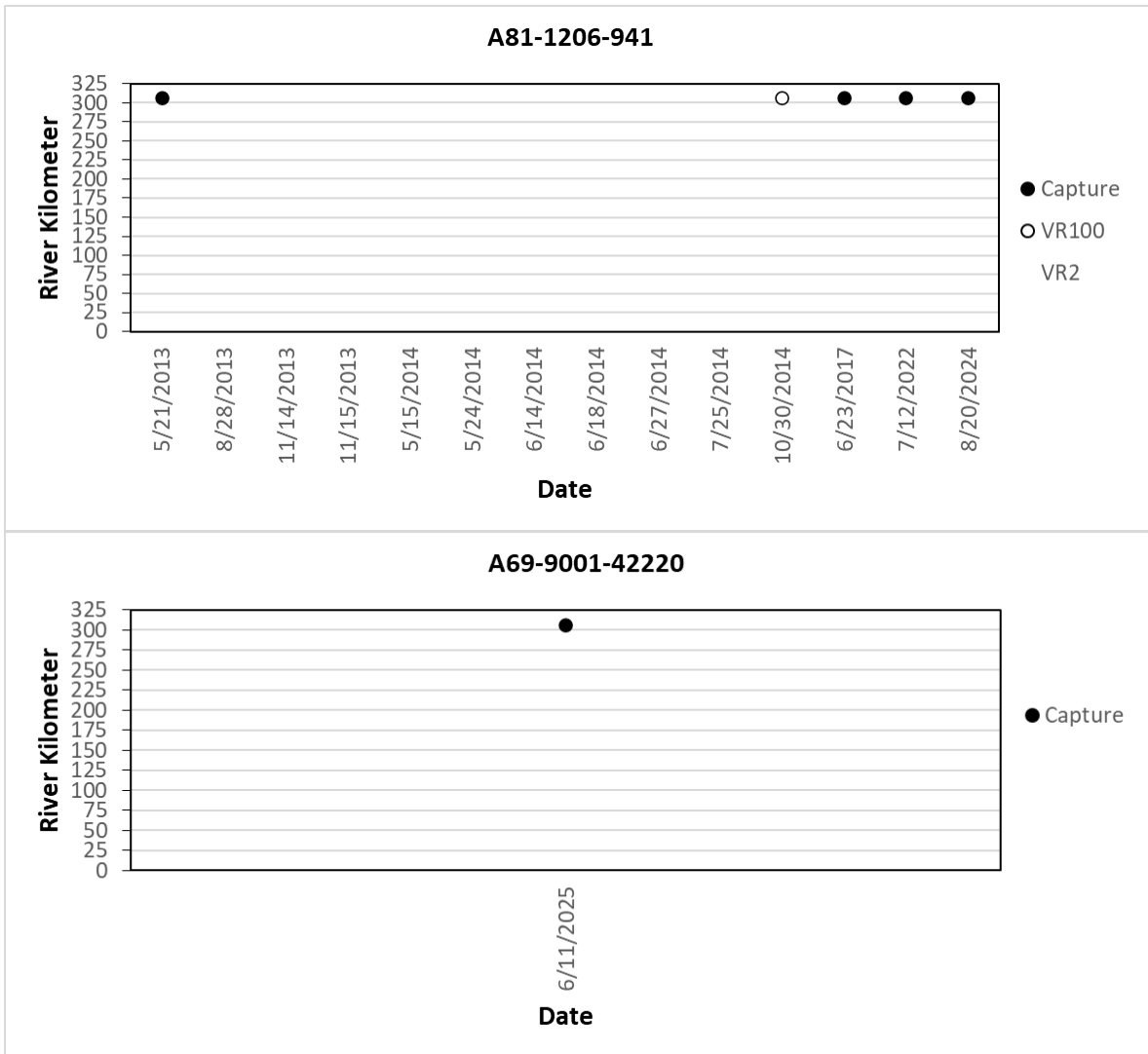


Figure 10 continued. Movement summary of juvenile White Sturgeon tagged in Montana from 2012-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

Table 15. Summary of the residency status and movement of juvenile White Sturgeon ($N=47$) implanted with sonic tags in Montana from 2012-2025. The movement pattern was based on all data collected through the fall of 2025 including capture / recapture data, mobile receiver detections (VR100) and fixed receiver detections (VR2) in the Kootenai / ay River and Kootenay Lake.

Residency Status	<i>N</i>	%	Last Known Location in Montana	Avg. Range (rkm)	Avg. Cumulative Movement (km)	Min. Cumulative Movement (km)	Max. Cumulative Movement (km)	Notes
Montana Resident	27	57.5	Yes ($N=27$; 57.5%)	4.1	16.9	0	63.8	No detected movement from MT
Emigrant with no return to Montana	5	10.6	No ($N=5$; 10.5%)	82.0	99.5	62.0	230.1	Emigrated from MT with no detected returns to MT
Emigrant with ≥ 1 Return to MT	15	31.9	Yes ($N=11$; 23.4%)	67.1	214.5	78.5	597.2	Left MT but returned ≥ 1 time(s) and last known location in MT
			No ($N=4$; 8.5%)	272.1	3466.1	3090.6	4399.5	Left MT but returned ≥ 1 time(s) and last known location not in MT
Total	47	100	47	49.9	365.5			

Table 16. Average annual probability of movement(s) between habitat type and jurisdictional area in the Kootenai / Kootenay River and Kootenay Lake for juvenile sturgeon ($N=47$) sonic tagged in Montana from 2012-2025. Only VR2 receiver data was used from the original date of tagging until the projected tag expiration date or until October 31, 2025 (i.e., if the sturgeon contained an active tag at end of October 2025). Jurisdictional river kilometers used for this analysis were Montana river rkm 310-276.1, Idaho river 276.1-170, BC river rkm 170-120 and Kootenay Lake < rkm 120.

Movement Type	Movement Direction									
	Down					Up				
	Montana River – Idaho River	Idaho River – BC River	Idaho River – Kootenay Lake	BC River – Kootenay Lake	Montana River – Kootenay Lake	Kootenay Lake – BC River	Kootenay Lake – Idaho River	BC River – Idaho River	Idaho River – Montana River	Kootenay Lake – Montana River
Avg. Annual Probability of Movement	0.133	0.054	0.009	0.084	0.071	0.007	0.041	0.085	0.133	0.054
Movement Type	River to Lake (Down)					Lake to River (Up)				
Avg. Annual Probability of Movement	0.089					0.074				

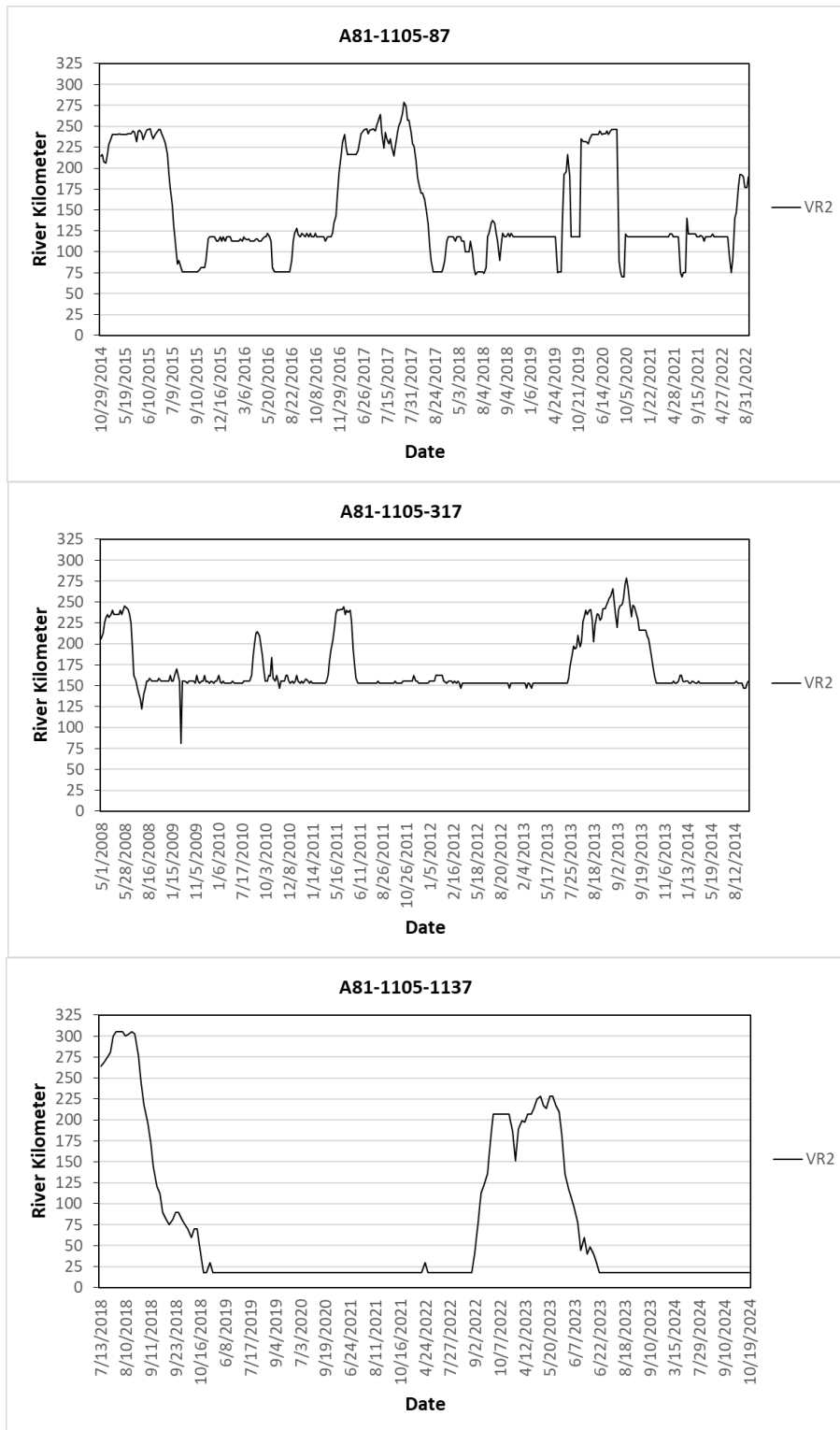


Figure 11. Movement of known sonic tagged adult Kootenai River White Sturgeon detected with stationary (VR2) and or mobile (VR100) sonic receivers in Montana from 2008-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

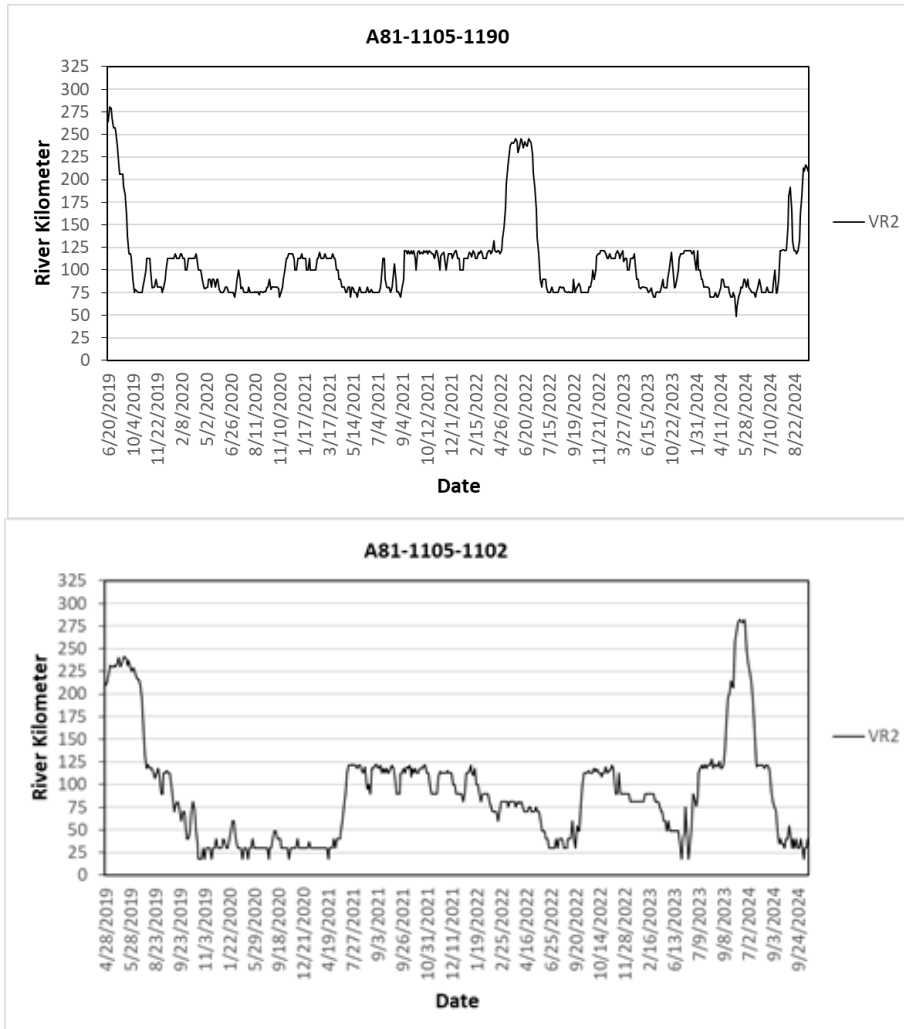


Figure 11 continued. Movement of known sonic tagged adult Kootenai River White Sturgeon detected with stationary (VR2) and or mobile (VR100) sonic receivers in Montana from 2008-2025. River kilometer 276.1 = MT/ID border, 170 = ID/BC border and 120 = Kootenay Lake delta.

Reproductive Status and Spawning Potential

Understanding the reproductive dynamics of populations is important for successful management of fishes (Jakobsen et al. 2016), and reproductive indices (e.g., sex ratio, age and size at puberty or first spawning, reproductive structure, fecundity, and spawning periodicity) are used to describe the reproductive dynamics of populations. Hatchery-origin (HO) White Sturgeon have been released into the Kootenai River through a conservation aquaculture program over the past 30 years. To date, a few male sturgeon have reached the age / sizes where spawning / reproduction is possible (KTOI staff, personal communication). It is unknown if spawning by White Sturgeon historically occurred in Montana due to limited sampling and monitoring efforts prior to 2009 but by all accounts, presence of adult sturgeon in Montana appears to be limited at this time. In an effort to help address this question of spawning potential by sturgeon in Montana, we've used various information sources including the use of egg mats in June and July, handling and examination of White Sturgeon during the potential spawning period (i.e., mid-May / early June to mid-July) and collection of blood samples for hormone analyses.

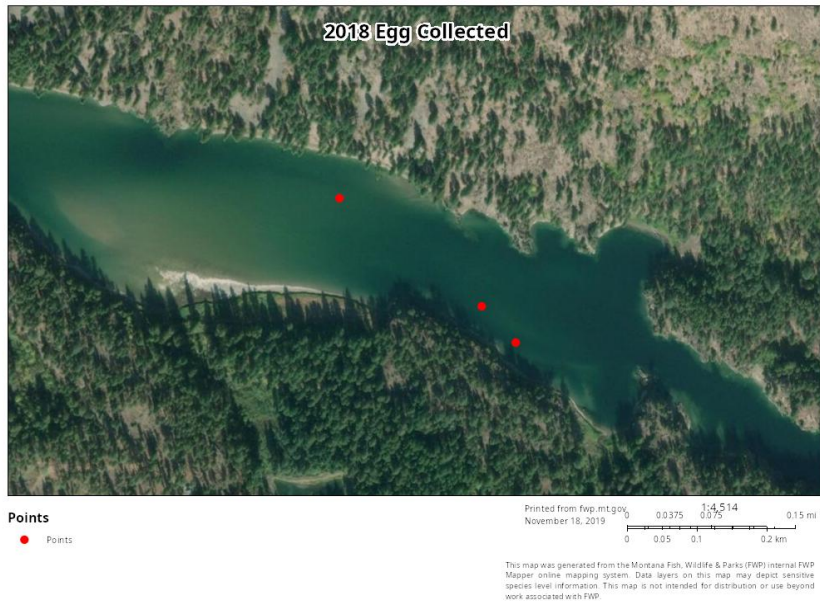
Egg mats have been deployed in Montana in most years since 2018 in an effort to document spawning near / adjacent to the area with the highest apparent abundance of larger sturgeon in Montana (\geq rkm 305.5 and 120 cm TL). In 2018, egg mats were deployed on June 5 and fished until July 6. One mat could not be relocated after the initial deployment and the remaining egg mats fished for 31 days and 6,666.7 hours (**Table 21; Figure 12**). No White Sturgeon eggs were collected in 2018, but three other fish eggs were collected on June 15, 2018 on three separate egg mats (1 per mat; **Figure 12**). The surface water temperatures on June 15, 2018 averaged 47.9°F (8.8°C) and water depths at egg collection sites were 10, 17, and 18 feet (3, 5 and 5.5 m respectively). The eggs collected ranged from 2.3 to 3.4 mm in diameter and were not grey / brown in color or adhesive like sturgeon eggs collected in Idaho (Wes Ewing; personal communication). The eggs collected were suspected to be northern pikeminnow / largescale sucker eggs, but no genetic tests were performed for species determination. In 2019, egg mats were deployed on June 3 and fished until July 11 for a total of 9,132.7 hours (**Table 17**). No Kootenai River White Sturgeon eggs were collected in 2019, but four other fish eggs were collected on four separate egg mats (**Table 17; Figure 13**). Two eggs were collected on June 20 and 2 additional eggs were collected on June 24 in 2019. Water depths at the egg collection sites were 20, 18, 17, and 18 feet (6.1, 5.5, 5.2, and 5.5. m respectively) and surface water temperatures were between 8.9-10°C (48-50°F). Similar to 2018 and 2019, egg mats were deployed in 2020 near rkm 306.5 from June 2 until July 13 and egg mats were fished for a total of 9,108.5 hours (**Table 17**). No White Sturgeon or other fish eggs were collected in 2020 (**Table 17; Figure 14**). The higher discharges during June and July 2020 caused some egg mats to drift downstream up to 1-1.5 km from their original deployment location. As a result, egg mats deployed later in 2020 occurred closer to shore than in 2018, 2019, 2022 and 2023 and no eggs were collected in 2020 (**Figure 14**). No egg mats were deployed in 2021 due to a lack of operable boats during the typical egg mat sampling period (i.e., June to mid-July). Egg mats were deployed again in 2022 for a total of 7,334.1 hours of effort and no White Sturgeon or other eggs were captured (**Figure 15; Table 17**). Water temperatures observed in 2022 ranged from 8.1-10.5°C (46.6-50.9°F). Egg mats were deployed again in 2023 for a total of 6,383.9 hours and a total of 3 non-sturgeon eggs were captured (**Table 17; Figure 15**). The locations in 2023

where eggs were collected were similar to collection sites in 2018 and 2019. Water temperatures in late May and early June 2023 were approximately 2-8°F warmer than water temperatures observed from 2018-2022 and 2024 (**Figure 16**) due to the elevated ambient air temperatures during that period. Egg mats were deployed in 2024 on June 6 and mats were fished until July 9 for a total effort of 6,761.1 mat hours. Discharge of the Kootenai River in 2024 during the time of mat deployment was lower than most previous years (2018-2023) and resulted in the second lowest average water depth of egg mat locations (4.9 m) since 2018 (**Table 17; Figure 17**). Water temperatures recorded at mat locations in 2024 averaged 10.5°C which was about average for the 2018-2024 period (**Table 17; Figure 17**) and no eggs of any kind were collected in 2024. No egg mats were deployed in 2025 after discussions with comanagers at the 2025 APR meeting. We felt that we need to document presence of sexually mature sturgeon in Montana prior to deploying egg mats again. If we can document sexually mature sturgeon residing in Montana, we may be able to better identify an area(s) where spawning may be occurring to better direct future egg mat sampling efforts. Spawning by Kootenai River white sturgeon in Idaho has been documented from mid-May until mid-July. We suspect the primary spawning window for sturgeon in Montana would be June through mid-July when water temperatures are typically 8-12°C (**Figure 18** and **Table 17**) on the descending limb of the hydrograph (Paragamian and Wakkinen 2002; Hardy et al. 2020).

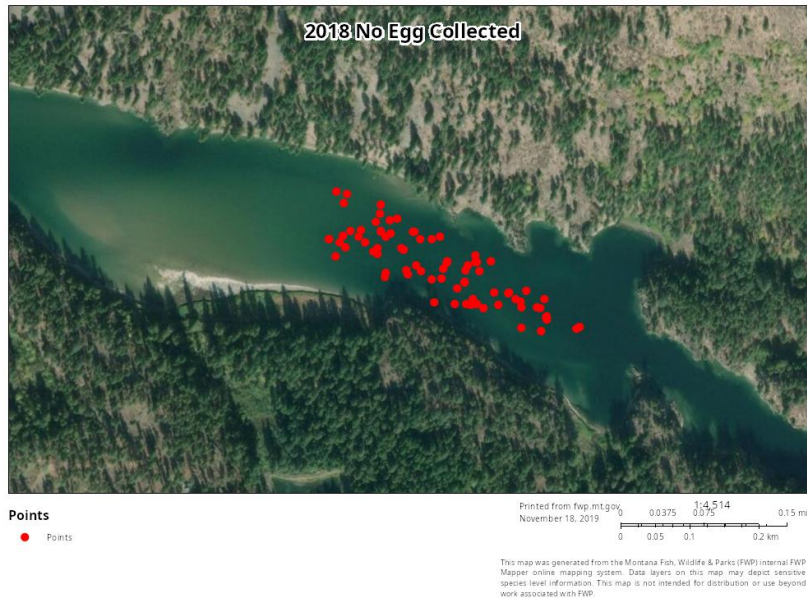
Sturgeon ($N=40$; 5.5%) captured in Montana have exceeded the current total length threshold for juvenile / adult status designation (i.e., ≥ 120 cm = adult) however, none of these sturgeon have expressed sperm or eggs while collecting biometric data before, during or after the presumed spawning period (June to mid-July). Prior to 2024, the largest hatchery origin (HO) juvenile White Sturgeon captured in Montana was 159 cm TL and weighed 25.9 kg in 2021. In early June 2024, a large HO sturgeon was captured, and this sturgeon had a TL of 199.4 cm and weighed 46.535 kg. This large HO sturgeon captured in 2024 was captured approximately 0.5-0.6 km downstream of egg mat sampling locations in Montana (see **Figures 12-17**) and was believed to have been the larger (i.e., 5-6 foot) sturgeon lost at rkm 306.5 on 8/11/2022 due to the presence of an old circle hook which matched the hooks we currently use. While this HO sturgeon may have been sexually mature, we do not know the sex or stage of maturity of this sturgeon. Based on the scute removal pattern identified in the field, it was identified as a 1998 brood year sturgeon. Following the 2023 spawning season, eight HO White Sturgeon had been used in the conservation aquaculture program administered and run by the KTOI. All 8 HO sturgeon used were male and they had total lengths ranging from 151-182 cm, fork lengths from 131-162 cm, and weights from 18-34 kg (Nate Jenson, KTOI, email communication 14-Dec-2023). Sturgeon captured in Montana in 2019 and 2020 had blood samples collected and analyzed for sex hormone concentrations and no post-pubertal sturgeon were identified at that time (Sylvester et al. 2021). It should be noted that no sturgeon sampled in 2019 and 2020 exceeded 120 cm TL which is currently used as a crude length cutoff to identify juvenile or adult sturgeon. The current length designation used to classify juvenile and adult sturgeon is currently being refined using additional data collected in Idaho and British Columbia. However, based on recent length and weight information for the larger hatchery origin and wild sturgeon captured / detected in Montana, it is possible that sexually mature sturgeon could be or have been present in Montana during the presumed spawning window (i.e., June to mid-July).

Table 17. Summary statistics of White Sturgeon egg mat deployments in the Kootenai River, Montana from 2018-2025. No egg mats were deployed in 2021 due to inoperable boats during the presumed spawning period (mid-May to mid-July). No egg mats were deployed in 2025 after comanagers agreed that we need to document sexually mature sturgeon in Montana prior to devoting more time / effort into egg mat sampling. We may not deploy egg mats again in Montana until sexually mature sturgeon are documented during the presumed spawning season..

Year	Date Ranged Sampled	Effort (hours)	# Sturgeon Eggs Collected	# Other Eggs Collected	Avg. Water Depth (range)	Avg. Water Temp (range)
2018	Jun 5 – Jul 6	6,666.7	0	3	5.0 m (3-9.8) 16.5 ft (10-32)	NA
2019	Jun 3 – Jul 11	9,132.7	0	4	5.4 m (3.4-9.8) 17.9 ft (11-32)	NA
2020	Jun 2 – Jul 13	9,108.5	0	0	4.3 m (1.2-13.7) 14.0 ft (4-45)	9.6 °C (7.6-12.1) 49.2 °F (45.6-53.7)
2021	NA	NA	NA	NA	NA	NA
2022	Jun 3 – Jul 11	7,334.1	0	0	5.0 m (1.9-7.6) 16.4 ft (6.3-25)	9.1 °C (8.1-10.5) 48.3 °F (46.6-50.9)
2023	Jun 5 – Jul 6	6,383.9	0	3	6.5 m (3.8-13.8) 21.4 ft (12.4-45.2)	11.2 °C (9.1-13.2) 52.1 °F (48.8-55.8)
2024	Jun 6 – Jul 9	6,761.1	0	0	4.9 m (2.1-6.7) 16.1 ft (7-22)	10.5 °C (9.5-11.9) 50.9 °F (49.1-53.5)
2025	NA	NA	NA	NA	NA	NA

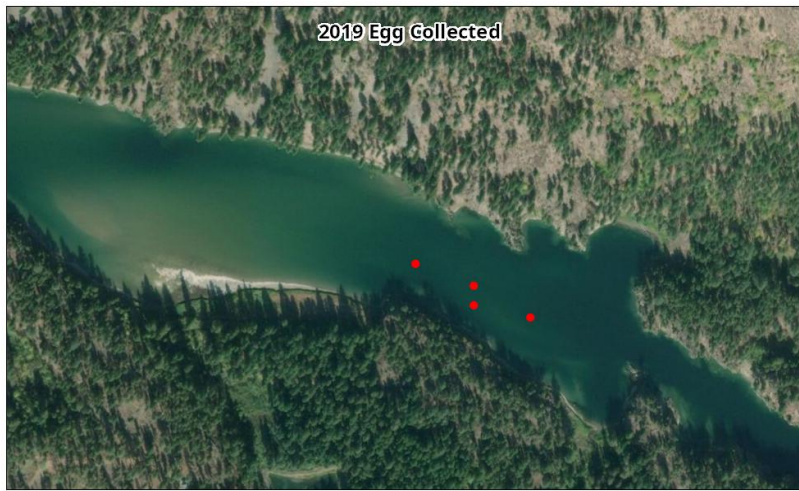


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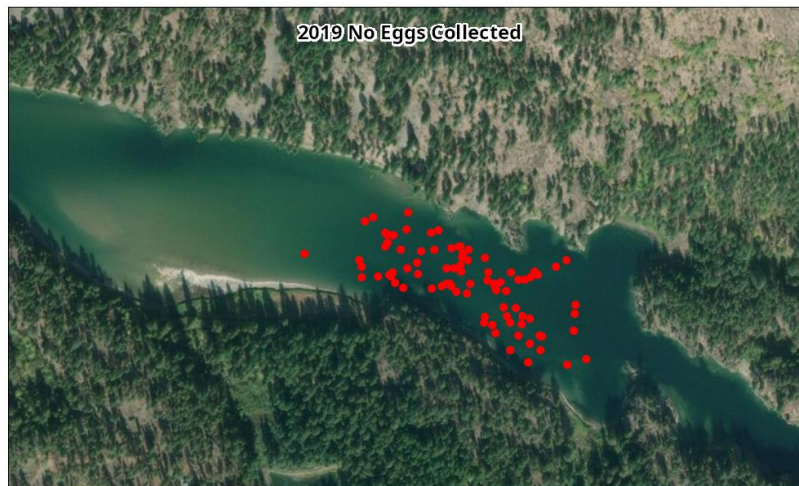
Figure 12. Locations of egg mats deployed in 2018 in the Kootenai River, Montana. No White Sturgeon eggs were collected in 2018.



Printed from fwp.mt.gov
November 18, 2019
1:4,514
0.0375 0.075 0.15 mi
0 0.05 0.1 0.2 km

This map was generated from the Montana Fish, Wildlife & Parks (FWP) internal FWP Mapper online mapping system. Data layers on this map may depict sensitive species level information. This map is not intended for distribution or use beyond work associated with FWP.

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1:4,514
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Figure 13. Locations of egg mats deployed in 2019 in the Kootenai River, Montana. No White Sturgeon eggs were collected in 2019.

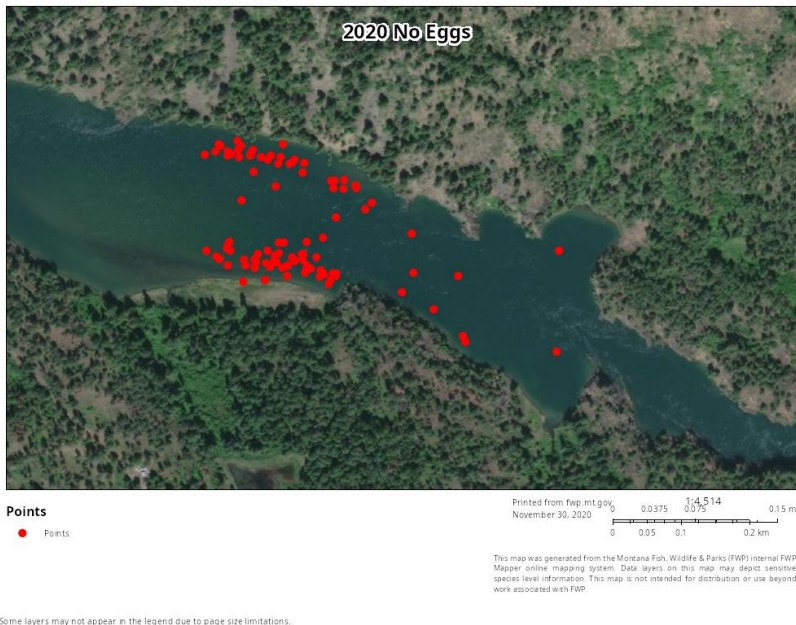


Figure 14. Locations of egg mats deployed in 2020 in the Kootenai River, Montana. No White Sturgeon or other fish eggs were collected in 2020.

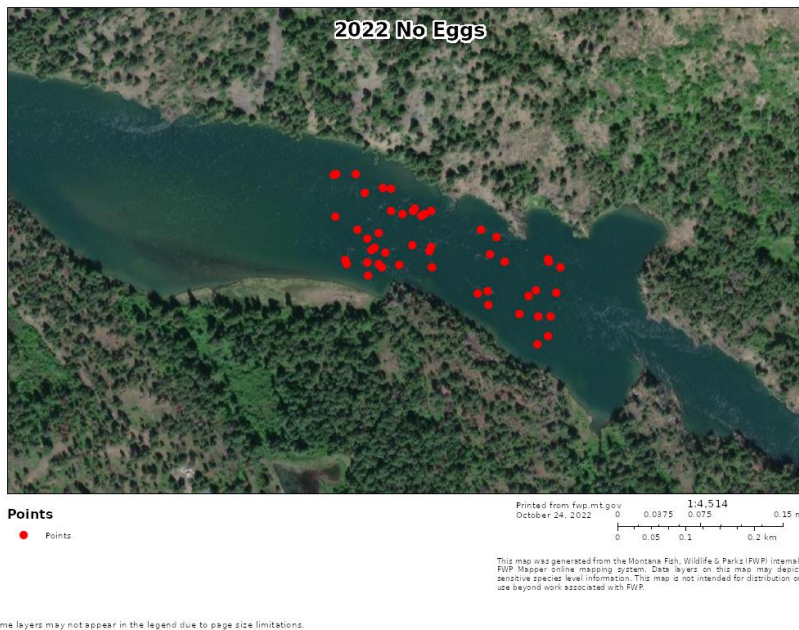
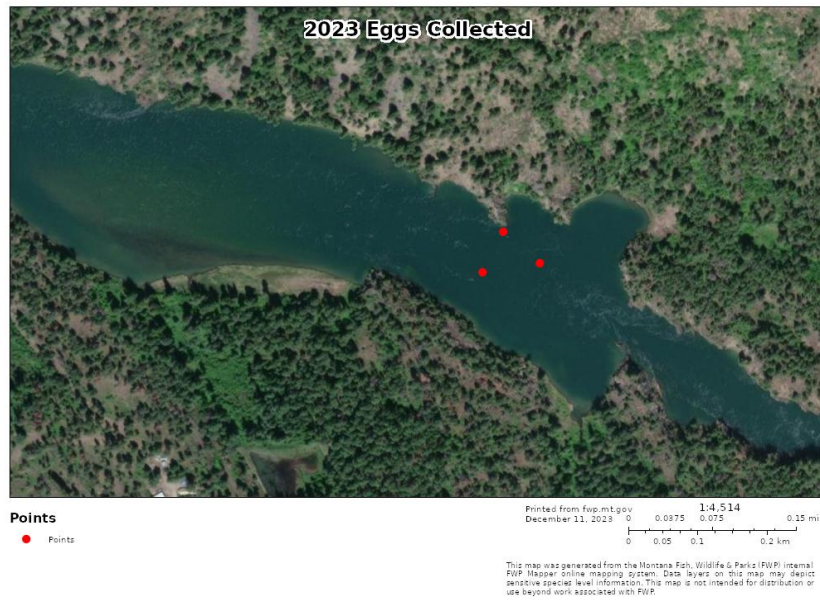
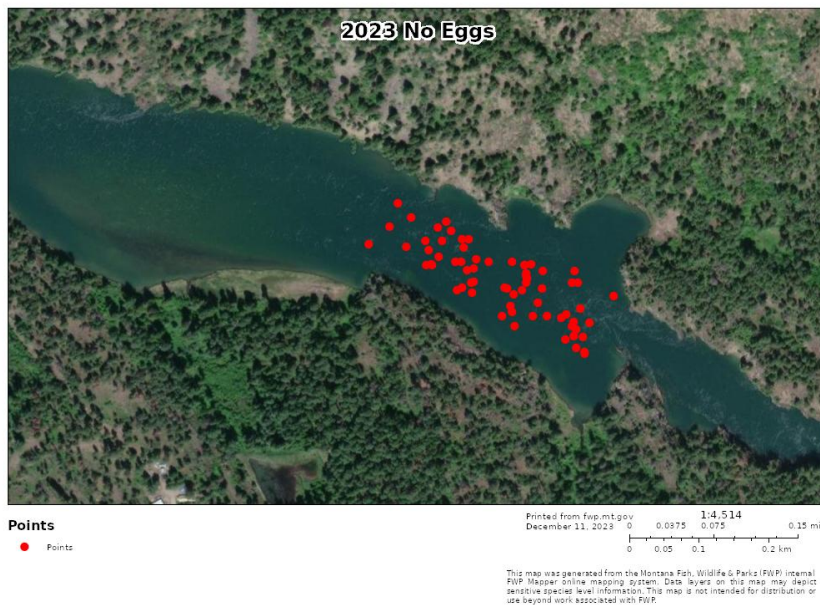


Figure 15. Locations of egg mats deployed in 2022 in the Kootenai River, Montana. No White Sturgeon or other fish eggs were collected in 2022.



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Figure 16. Locations of egg mats deployed in 2023 in the Kootenai River, Montana. No White Sturgeon eggs were collected in 2023.

2024 No Eggs Collected

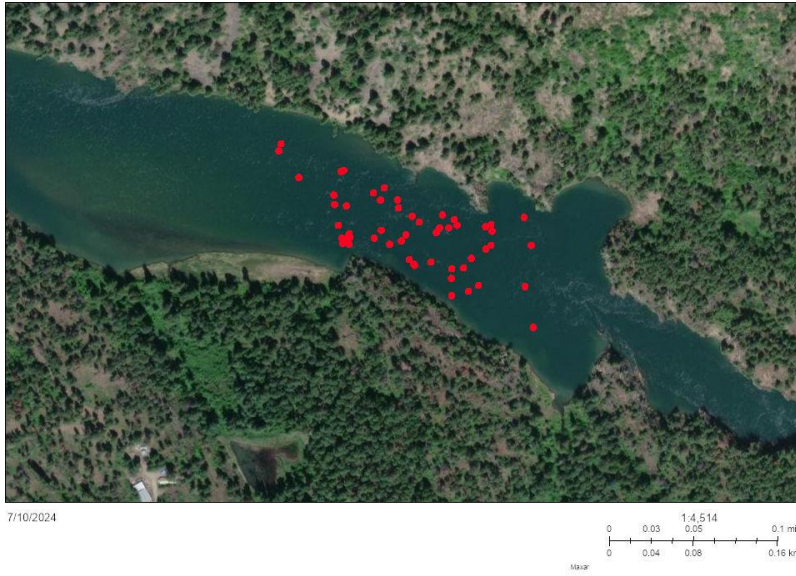


Figure 17. Locations of egg mats deployed in 2024 in the Kootenai River, Montana. No White Sturgeon eggs were collected in 2024.

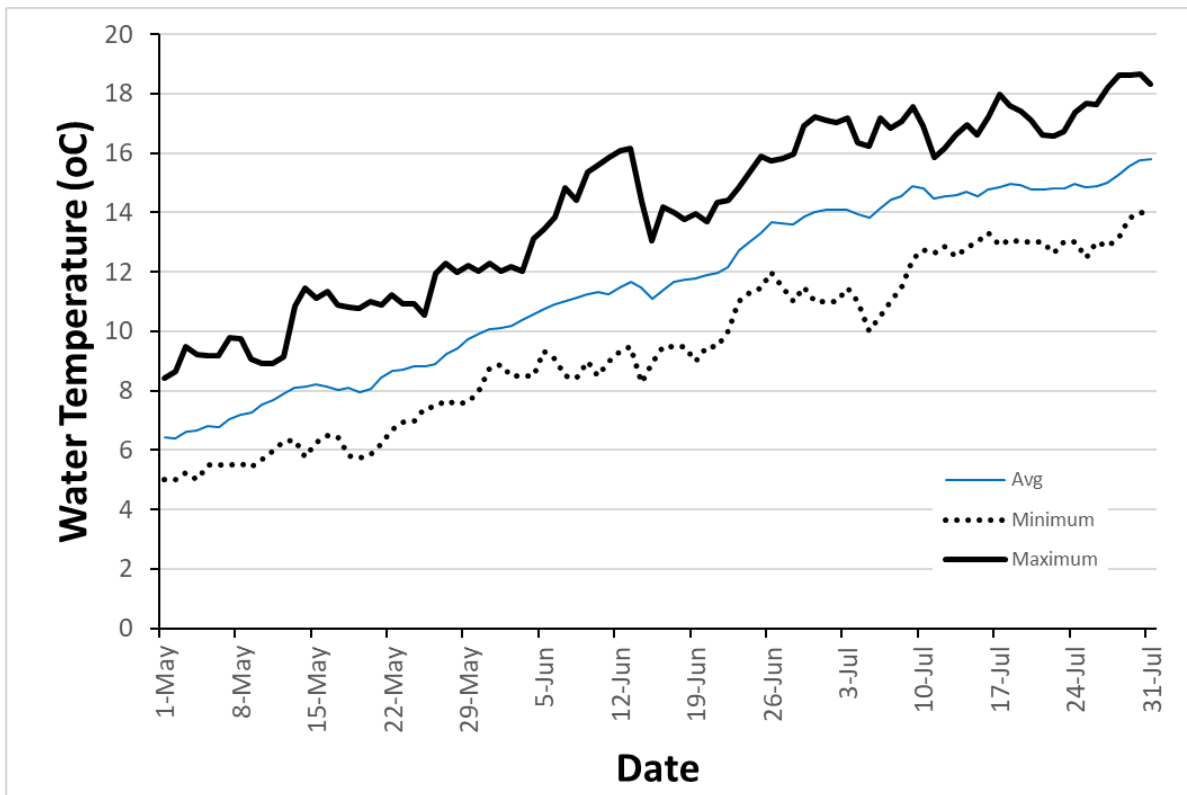


Figure 18. Summary of the average, minimum and maximum daily water temperature (°C) at the Montana-Idaho border (i.e., Leonia; USGS gage station 12305000; May-July only) by date from 2012-2025. The presumed spawning window for Kootenai River White Sturgeon in Montana is approximately June 1 to July 15. Water temperatures (°C) at Leonia would approximate water temperatures upstream in Montana.

Spontaneous Autopolyploidy Assessment

In 2024, 32 blood samples from 31 individual sturgeon captured in Montana were collected for ploidy determination (i.e., 8N vs. 12N). Of the 31 individuals tested, 12.9% ($N=4$) were identified as being spontaneous autopolyploids (i.e., 12N). One individual sturgeon was sampled twice in 2024 and was determined to be 8N on both sampling occasions. The assigned brood years of the four sturgeon identified as being 12N were 2003 ($N=1$, 16.7%), 2010 ($N=1$, 25%), 2016 ($N=1$, 100%), and Unknown ($N=1$, 20%; **Tables 18 and 19**).

In 2025, 66 blood samples were collected from 63 individual sturgeon captured in Montana to determine ploidy status (**Tables 18 and 19**). Of the 63 individuals tested, 3.2% ($N=2$) were identified as spontaneous autopolyploids (i.e., 12N). Four of sixty-six (6.1%) samples collected in 2025 resulted in 12N designations. Three individuals sampled in 2025 had been sampled previously in 2024 and the ploidy status for those sturgeon remained unchanged. Two individuals were sampled multiple times in 2025, with one sturgeon being assigned 12N status on both occasions and the other individuals was sampled 3X. The results of the ploidy

testing for the individual sturgeon that was sampled 3X (WSGID276549, BY2015) in 2025 assigned the fish twice as 8N and once as 12N. As a result, the ploidy status of this individual is uncertain at this time. The assigned brood years of the two 12N sturgeon captured in 2025 were 2005 and 2006 (**Table 22**).

While our sample sizes for ploidy testing in 2024 and 2025 were relatively small ($N=98$ samples from 91 individuals), our in-river ploidy testing indicated that a higher percentage of sturgeon were 12N (6 or 7 of 91 individuals; 6.6-7.7%) compared to in-river sampling conducted by the KTOI and IDFG in 2023. KTOI and IDFG reported 6 out of 413 (1.5%) sturgeon sampled from the lower Kootenai River and Kootenay Lake in 2023 were 12N (Michaels et al. 2023). After additional discussions with comanagers are completed in 2026, we will determine if additional ploidy testing of sturgeon in Montana is warranted.

Table 18. Ploidy status of Kootenai River White Sturgeon samples collected in the Montana portion of the Kootenai River in 2024 and 2025.

Brood Year	Ploidy Status						Total
	8N		8N Total	12N		12N Total	
	2024	2025		2024	2025		
1995	1	6	7				7
1998		1	1				1
1999	3	3	6				6
2000	2	5	7				7
2001	1	1	2				2
2003	5	6	11	1		1	12
2004		2	2				2
2005	2	7	9	1	1	2	11
2006	2	2	4		2	2	6
2007	2	5	7				7
2008		3	3				3
2010	3	3	6	1		1	7
2011		3	3				3
2012		4	4				4
2015		2	2		1	1	3
2016				1		1	1
2018		2	2				2
Unknown	6	5	11				11
Wild Juvenile	1	2	3				3
Total # Samples	28	62	90	4	4	8	98
% of Samples	91.8		91.8	8.2		8.2	100

Table 19. Ploidy status of uniquely identifiable Kootenai River White Sturgeon with blood samples collected in the Montana portion of the Kootenai River in 2024 and 2025. * indicates that 1 or more individuals were sampled more than once between or within a year(s).

Brood Year	Ploidy Status									Total Individuals Sampled
	8N		8N Total	12N		12N Total	Uncertain		Uncertain Total	
	2024	2025		2024	2025		2024	2025		
1995	1	6	7							7
1998		1	1							1
1999	3	3	6							6
2000	2	5	7							7
2001	1	1	2							2
2003	5	6	11	1		1				12
2004		2	2							2
2005	2	7	8 *	1	1	1				10
2006	2	2	4		1 *	1				5
2007	2	5	7							7
2008		3	3							3
2010	3	3	6	1		1				7
2011		3	3							3
2012		4	4							4
2015								1	1 *	1
2016				1		1				1
2018		2	2							2
Unknown	5	5	8 *							8
Wild Juvenile	1	2	3							3
Total # Samples	27	60	84	4	2	6	0	1	1	91
% of Individuals			92.3			6.6			1.1	100

Conclusions and Recommendations

Although historical information on White Sturgeon in Montana is limited, catch, abundance and CPUE of White Sturgeon has likely increased since the 1970's largely due to the conservation aquaculture program and other recovery efforts over the past 30-40 years. Most of the 724 White Sturgeon captured in Montana since 2009 were of hatchery origin (98.3%) and most were ≥ 10 years old at the time of capture(s). Very few wild juvenile and wild adult sturgeon have been captured in Montana since 2009 (1.7% of captures) and the juvenile catch results in Montana are consistent with results downstream in Idaho and British Columbia.

Mark-recapture data collected since 2009 indicates that about 50% of the individual sturgeon captured in Montana have been recaptured in Montana ≥ 1 time. This recapture data allowed abundance of sturgeon in Montana to be estimated using an open population framework (i.e., Jolly-Seber). Following the 2025 sampling season, 300 White Sturgeon were estimated in Montana, an increase of about 10 sturgeon from the 2024 estimate. The estimated number of sturgeon in Montana currently represents a small fraction (i.e., 1-2%) of the most recent hatchery origin sturgeon abundance estimate (about 14,000; see Hardy et al. 2020). System-wide abundance and other population modeling methods are currently being developed, and results are expected in 2026. The apparent annual survival estimate for sturgeon in Montana following the 2025 season was similar to recent estimates in Montana (Sylvester et al. 2020-2025) and our results are consistent with other recent apparent survival estimates for hatchery origin juvenile sturgeon throughout the Kootenai / ay system. Annual capture probabilities varied from approximately 0.080-0.466 and the annual probability of a sturgeon emigrating into Montana was 0.060. Abundance of wild adult sturgeon in Montana continues to be low based on the low number of captures ($N=2$) and infrequent detections / movements ($N=5$) into Montana over the past 10-20 years.

The average relative weight ($W_r = 80$) of White Sturgeon ≥ 700 mm TL in Montana has varied little from year to year due to differences in the age / length composition of sturgeon captured, a prolonged sampling season and individual variation in condition. On average, growth appears to be comparable to growth estimates reported downstream in ID during lower density time periods and in some specific habitat types / areas in BC (Stephens et al. 2019, Stephenson et al. 2020; Hardy et al. 2020).

Based on release and capture data, it appears that a large percentage (87.6%) of the juvenile sturgeon captured in Montana migrated upstream from release locations in Idaho and British Columbia. However, once sturgeon migrate to the Montana portion of the river, a high percentage appear to reside there for extended periods of time (i.e., years) based on capture-recapture data collected from 2009-2025 and from telemetry data collected from 2012-2025. Of the 47 sturgeon sonic tagged in Montana since 2012, 11% ($N=5$) emigrated downstream to Idaho or BC post-tagging and have yet to return to Montana. Approximately 32% ($N=15$) emigrated from Montana but later returned to Montana 1 or more times and 11 of those 15 sturgeon were last captured or detected in Montana. The remaining 58% ($N=27$) of sturgeon appear to be long-term residents of the Montana portion of the Kootenai River based on all available data collected since 2012.

Continued presence of larger wild and hatchery origin White Sturgeon in Montana during the presumed spawning period may lead to spawning upstream of the Montana / Idaho border within the next 5-10 years. Sturgeon > 120 cm TL currently reside in Montana and the largest individuals are reaching total lengths in excess of 150 cm and have weights exceeding 15-20 kg. These sturgeon are of similar length and weight to the eight sexually mature hatchery origin sturgeon (i.e., all male) used in the conservation aquaculture program in recent years. Length-at-maturity of Kootenai River White Sturgeon is currently being reassessed using a combination of endoscopic and field examinations and collection of gonadal tissue in Idaho. Egg mat sampling in Montana from 2018-2024 resulted in no sturgeon eggs being collected and no sturgeon have expressed gametes before, during or after the presumed spawning season (i.e., late May, June, early July). Blood samples collected in 2019 and 2020 confirmed no White Sturgeon in Montana were sexually mature however, 0 of the sturgeon sampled in 2019 and 2020 were \geq 120 cm TL.

Results of ploidy sampling in 2024 and 2025 indicated that 8.2% of samples and 6.6% of individuals sampled in Montana were autopolyploids (12N) and additional sampling is warranted, especially given that the ploidy rate appears to be higher than observed rates downstream. We recommend that blood samples collected in Montana should be delivered to the Twin Rivers Hatchery (H2) within 2 days of collection for ploidy determination to minimize the risks of cell lysing and other possible issues associated with longer holding times. Additional effort and research should be dedicated to exploring potential reason for the observed higher ploidy rate in the Montana portion of the Kootenai River. We also recommend continued monitoring of White Sturgeon in Montana with efforts focusing on trends in CPUE, abundance / survival as well as attempts to document the presence of sexually mature sturgeon from late May into July. We will also continue to work with and share information with comanagers and action agencies to adaptively research, monitor, evaluate and manage the Kootenai / Kootenay River White Sturgeon population and their habitats in Idaho, British Columbia and Montana.

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Appendices

Appendix 1. Summary of all fish captured on setlines during White Sturgeon sampling in the Kootenai River downstream of Kootenai Falls from 2009-2025. Bull trout numbers in parentheses indicate the number of mortalities.

Species	Sampling Year																	Total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Bull Trout	2	1	1	2	15 (2)	3	4	5	6 (1)	6	8	1	3	3	2	3	3	68
Brook x Bull Trout		2	1		1		1	2	1		1					1	1	11
Burbot					1		5		2			2	7	22	25	14	17	95
Brown Trout		1			1		1											3
Largescale Sucker	30	65	11		1					1								108
Mountain Whitefish	1	1																2
Northern Pikeminnow	69	46	21	40	100	58	43	67	31	55	62	41	31	30	55	37	42	828
Peamouth	1	7					2	1		1		2		1	2			17
Rainbow Trout	17	12	2		1	4	3		2			1	2	2	1	4	3	54
Rainbow x Westslope Cutthroat Trout		2	1															3
Salvelinus spp.								1										1
White Sturgeon	2	4	7	32	71	28	29	74	41	58	56	33	56	54	43	52	73	713
Westslope Cutthroat Trout	1	3																4
Grand Total	123	144	44	74	191	93	88	150	83	121	127	80	99	112	128	111	139	1907

Appendix 2. Summary of all fish captured in gillnets during White Sturgeon sampling in the Kootenai River downstream of Kootenai Falls from 2009-2024. No gillnets were deployed from 2009-2012 or from 2018-2025.

Species	Sampling year					Total
	2013	2014	2015	2016	2017	
Bull x Brook Trout					1	1
Kokanee	1					1
Largescale Sucker	1		1	3	11	16
Longnose Sucker					1	1
Mountain Whitefish	4	2	3	19	6	34
Northern Pikeminnow	7		1	10	2	20
Peamouth	14		4	5	1	24
Rainbow Trout	1	1		1	2	5
Smallmouth Bass					1	1
White Sturgeon	6		3	2		11
Total	34	3	12	40	25	114

Appendix 3. R code (R Core Team 2020) used to estimate abundance and other population parameters of Kootenai River White Sturgeon in the Montana portion of the Kootenai River from 2009-2025.

```
#####White sturgeon MARK

#created by HG on 11/14/2019
#last edited by RS on 10/28/2025

#####import data#####
#file.choose()

rm(list=ls())
sturg=read.csv("H:\\Mainstem Amendment Staff/PROJECT/Data/White
Sturgeon/2025/RCode_CH/CH2025_Annual.csv",header=TRUE)

head(sturg)

#####Make CH into concatenated form that R can read#####
#function to read the matrix and create the capture history strings ## 12 bins ##
past.ch<-function(x)
{
  k<-ncol(x)
  n<-nrow(x)
  out<-array(dim=n)
  for (i in 1:n)
  {
    y<-(x[i,]>0)*1

    out[i]<-paste(y[1],y[2],y[3],y[4],
                 y[5],y[6],y[7],y[8],
                 y[9],y[10],y[11],y[12],y[13],y[14],y[15],y[16],y[17],
                 sep="")
  }
  return(out)
}

#Use paste.ch() just created to create an RMARK ch file (will need to tweak function
# and call to match number of time bins - note offset in column indicated to account
# for AnimalID in column 1 of bin.histories)
capt.hist<-data.frame(ch=past.ch(sturg[,2:18]))
capt.hist
dim(capt.hist)
```

```

##324 traceable individuals

#####Run models#####
###Running POPAN model to see whats going on, though may be wrong model.
library(coda)
library(RMark)
library(stringr)

pf.prm = process.data(capt.hist, model = "POPAN")

summary_ch(pf.prm,marray=FALSE)
summary_ch(pf.prm,marray=TRUE)

pf.ddlm = make.design.data(pf.prm)
pf.ddlm = add.design.data(pf.prm, pf.ddlm, parameter = "p", type = "time",
                          bins = c(0,2,3,4,5,6,7,8,9,10,11,12,13,14,15, 17), name = "timebin")

summary_ch((pf.prm))
run.popan <- function()
{
  Phi.dot = list(formula = ~ 1)
  Phi.time = list(formula = ~ time)

  p.dot = list(formula = ~ 1)
  p.time = list(formula = ~ timebin)

  pent.dot = list(formula = ~ 1)
  pent.time = list(formula = ~ time)

  N.dot = list(formula = ~ 1)
  #
  sturg.model.list=create.model.list("POPAN")

  sturg.results.adjTRU=mark.wrapper(sturg.model.list,
                                    data = pf.prm,
                                    ddl = pf.ddlm,
                                    adjust=TRUE)

  # Return model table and list of models
  #
  return(sturg.results.adjTRU)
}

```

```

popan.results.sturgadjTRU = run.popan()
popan.results.sturgadjTRU

topm = popan.results.sturgadjTRU$Phi.dot.p.time.pent.dot.N.dot

topm$results$real

####
####
#####Calculate abundance by year#####
####
####
library(tibble)
library(dplyr)
library(tidyr)

words <- tibble(row.names(topm$results$real))
s.words <- words %>%
  separate(`row.names(topm$results$real)`,
    into = c("parm", "group", "a", "t"),
    sep = " ")
s.words$t <- str_replace(s.words$t, "t", "")

par.est <- topm$results$real
par.est$parm <- s.words$parm
par.est$year <- s.words$t

# get b[i]
b <- par.est %>%
  filter(parm == "pent")
b0 = 1 - sum(b$estimate)

# Examine the b[i] including b[0]
round(c(b0, b$estimate), 4)

N.hat <- par.est %>%
  filter(parm == "N") %>%
  dplyr::select(estimate)

# B[0] is simply the proportion of the superpopulation that was
# present at the start of the study (b[0]*N-hat)
(B0 <- b0 * N.hat)

# Next, calculate the net births by occasion
B.occ <- as.vector(b$estimate) * as.numeric(N.hat)

```

```
round(B.occ, 4)

c(B0, B.occ)

# Sum up all the B[i] including B0
sum(B0, B.occ)
# Compare with N.hat
par.est %>%
  filter(parm == "N")

##Look at the estimated N-hats by occasion
library(ggplot2)
N.hats.topm <- topm$results$derived$`N Population Size`
min(N.hats.topm$estimate)
max(N.hats.topm$estimate)
N.hats.topm$year <- 1:nrow(N.hats.topm)
```

Appendix 4. Annual capture histories of 298 individually identifiable Kootenai River White Sturgeon in the Montana portion of the Kootenai River from 2009-2025. Annual capture histories from 2009-2025 (left to right) are represented by a 0 (not captured) or 1 (captured). Three individuals were excluded from analyses due to being released without the detection of an existing PIT tag and insertion of a new PIT tag.

Capture History	#	Capture History	#	Capture History	#
00000000000000000001	26	00000000010011100	1	00000011000000000	1
0000000000000000010	20	00000000010101110	1	00000011000000010	1
0000000000000000011	1	00000000011000000	1	00000011000100000	1
00000000000000000100	15	00000000011010000	1	00000011101010001	1
00000000000000000101	4	00000000011010101	1	00000100000000000	6
00000000000000000110	2	00000000011100000	1	00000100001001010	1
00000000000000000100	15	00000000010000000	7	00000100010000100	1
000000000000000001010	1	000000000100001100	1	00000100101000001	1
000000000000000001011	2	00000000010010000	1	00000101000000000	1
000000000000000001100	1	000000000100100001	2	00000101000001001	1
000000000000000001000	14	000000000110011001	1	00000101001001000	1
0000000000000000010001	3	000000000100000000	16	00000101001010000	1
0000000000000000010010	2	0000000001000000001	1	00000111000000000	1
0000000000000000010100	3	0000000001000000100	1	00001000000000000	11
0000000000000000011000	2	0000000001000001000	1	00001000000010000	3
0000000000000100000	8	0000000001000010000	1	00001000000010001	1
0000000000000100010	1	0000000001000010101	1	00001000001000000	1
0000000000000110000	1	0000000001000110000	1	00001000001000001	2
0000000000000111111	1	0000000001010000000	1	00001000010000000	1
000000000001000000	13	0000000001010000100	1	00001000010101110	1
000000000001000001	3	0000000001011000000	2	00001000100000000	3
000000000001000010	1	0000000001011000101	1	00001000100000001	1
000000000001001000	1	0000000001100000000	1	00001000110000000	1
000000000001010000	1	0000000001101001000	1	00001000111001000	1
000000000001010101	1	0000000001110010000	1	00001001000000000	2
000000000001100010	1	0000000001000000000	3	00001001000000100	1
000000000001101001	1	00000000010000000010	2	00001001001000000	2
000000000010000000	12	00000000010000010000	1	00001001110001001	1
000000000010000001	1	00000000010000110000	1	00001010000101000	1
000000000010000010	1	00000000010001000000	1	00001010010011010	1
000000000010000011	1	0000000001001000000	1	00001011000000000	2
000000000010000100	1	00000000010011000100	1	00001011001100000	1
000000000010001000	2	00000000010011100010	1	00001100000000000	1
000000000010010000	1	0000000001010000000	1	00001100000001000	1
000000000010011010	1	0000000001010100100	1	00001101000000000	1

Appendix 4 continued. Annual capture histories of 298 individually identifiable Kootenai River White Sturgeon in the Montana portion of the Kootenai River from 2009-2025. Annual capture histories from 2009-2025 (left to right) are represented by a 0 (not captured) or 1 (captured). Three individuals were excluded from analyses due to being released without the detection of an existing PIT tag and insertion of a new PIT tag

Capture History	#
0000110101000000	1
0000111001100100	1
0001000000000000	9
0001000000100000	1
0001000001000000	1
0001000011010100	1
0001000101000000	1
0001000110000101	1
0001000111011100	1
0001001100000000	1
0001001110100000	1
0001010100000010	1
0001010101110000	1
0001100010000101	1
0001100010001000	1
0001100100000000	1
0001100101100100	1
0001101101100101	1
0001110000010000	1
0001110010100000	1
0001110100000000	1
0010000000000000	2
0010010111011000	1
0010100110000000	1
0010101101101000	1
0011100000000000	1
0011100100000000	1
0100000000000000	1
0100011000001100	1
0100101000010000	1
0101110010010000	1
1000000000000000	1

Appendix 5. Summary of abbreviations and acronyms used in this report.

Abbreviation	Description
Avg.	average
BC	British Columbia
BCMFLNRORD	British Columbia Ministry of Forests, Lands & Natural Resource Operations and Rural Development
BPA	Bonneville Power Administration
CI	confidence interval
cm	centimeter(s)
CPUE	catch per unit effort
E2	estradiol
ESA	Endangered Species Act
FL	fork length
ft	feet or foot
FWP	Montana Fish, Wildlife & Parks
g	gram(s)
HO	hatchery origin
hr	hour(s)
ID	Idaho
IDFG	Idaho Department of Fish and Game
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
KTOI	Kootenai Tribe of Idaho
ng	nanogram(s)
m	meter(s)
Max.	maximum
Min.	minimum
ml or mL	milliliter(s)
mm	millimeter(s)
MT	Montana
<i>N</i>	Number or sample size
NA	Not applicable
PIT	passive integrated transponder
rkm	river kilometer(s)
rpm	revolutions per minute
SARA	Species at Risk Act
T	testosterone

Appendix 5 continued. Summary of abbreviations and acronyms used in this report.

Abbreviation / Acronym	Description
T	testosterone
TL	total length
µg	microgram(s)
µL	microliter(s)
USA	United States of America
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
W	weight
Wr	relative weight
Ws	standard weight
yr	year(s)
%	percent
°C	degrees Celsius
°F	degrees Fahrenheit

Appendix 6. Length-frequency (i.e., inch groups) of bycatch by species on setlines and gillnets in the Kootenai River, Montana from 2009-2025.

Fish Species	Sampling Method	Length Group (inches)																				
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25-33
Bull Trout	Setline											2					1	2	1	1	1	32
Bull x Brook Trout	Setline								1			2	1	1	2			1	1		1	
Burbot	Setline										1	4	3	11	11	10	16	11	11	5	5	5
Brown Trout	Setline									1				1								1
Largescale Sucker	Setline							1		1		2	9	25	30	19	6	5	2	2		
Mountain Whitefish	Setline									1			1									
Northern Pikeminnow	Setline				1	6	10	13	42	37	66	71	76	100	88	78	64	53	46	35	8	1
Peamouth	Setline	1		1	2	4	7	1														
Rainbow Trout	Setline					1	1	3	14	9	12	6	4	1			1					
Rainbow x Westslope Cutthroat Trout	Setline									1	1	1										
Westslope Cutthroat Trout	Setline										3	1										
Bull x Brook Trout	Gillnet							1														
Kokanee	Gillnet								1													
Longnose Sucker	Gillnet					1																
Largescale Sucker	Gillnet			1	7	7				1												
Mountain Whitefish	Gillnet					3	14	10														
Northern Pikeminnow	Gillnet					10	6	1	2													
Peamouth	Gillnet			1		14	9															
Rainbow Trout	Gillnet					1	1	1	1		1											
Smallmouth Bass	Gillnet			1																		

Appendix 7. Summary of sturgeon stocking records in Montana. Data courtesy of the Kootenai Tribe of Idaho (Mark Elliston email communication Jan 23, 2026; KTOI 2007) and Montana Fish, Wildlife & Parks stocking records on file.

Release Year	Year Class	Life stage	Number Released	Notes
1994	1992	Juvenile	10	All radio / sonic tagged, released in September and all back in Idaho by late October
2004	2000 2003	Juvenile	10 3519	2000 brood year releases were sonic tagged
2005	2004	Juvenile	1210	
2006	2000 2003 2005	Juvenile	2 2 1517	YC 2005 = 1517 per KTOI 2007 hatchery report
2007	2006	Juvenile	5530	
2008	2007	Juvenile	400	
2009	2008 2009	Juvenile Larvae	2000 100000	25K each @ rkms 303.7, 305.5, 305.7 & 306.4
2010	2009	Juvenile	2405	
2011	2010	Juvenile	1136	
2012	2011	Juvenile	2092	
2014	2013	Juvenile	1500	
2015	2014	Juvenile	1007	
2016	2015	Juvenile	2662	All PIT tagged