# Kootenai River White Sturgeon *Acipenser transmontanus*: 2009-2010 Investigations in Montana

by

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## ***Abbreviations and Acronyms***

| Abbreviation or Acronym Used | Meaning or Description |
|---|---|
| B.C. | British Columbia |
| CI | Confidence interval |
| cm | centimeter |
| CPUE | catch per unit effort |
| CSU | largescale sucker |
| BT | bull trout |
| ESA | Endangered Species Act |
| FL | Fork length |
| ft | Foot or feet |
| g | gram |
| ID | Idaho |
| IDFG | Idaho Department of Fish and Game |
| kg | kilogram |
| km | kilometer |
| KTOI | Kootenai Tribe of Idaho |
| m | meter |
| MFWP | Montana, Fish, Wildlife and Parks |
| mm | millimeter |
| MT | Montana |
| *N* | Sample size |
| NSQ | northern pikeminnow |
| ONC | *Oncorhynchus* spp. |
| PIT | Passive integrated transponder |
| RBT | rainbow trout |
| rkm | river kilometer |
| TL | Total length |
| U.S.A. | United States of America |
| USFWS | United States Fish and Wildlife Service |
| WCT | westslope cutthroat trout |
| WTSTRG | white sturgeon |
| yr | year |
| % | Percent |
| # | number |

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## ***Introduction***

The Kootenai River in British Columbia (B.C.), Canada, and Idaho (ID) and Montana (MT), U.S.A. contains a unique landlocked population of white sturgeon *Acipenser transmontanus* that has been isolated from anadromous Columbia River populations since the last ice age approximately 10,000 years ago (Northcote 1973). This headwater population of white sturgeon varies from other populations of the species by being landlocked, less genetically diverse, and tolerant of colder water temperatures (Paragamian and Kruse 2001). The Kootenai River population is currently restricted to 270 km of river between Kootenay Lake, B.C. and Kootenai Falls, MT, which is approximately 50 km downstream from Libby Dam (MFWP 2009). In September 1994, the Kootenai River white sturgeon population was listed as endangered under the Endangered Species Act (ESA) due to consistent lack of successful juvenile recruitment since the 1960's (Anders et al. 2008; USFWS 1994 and 1999).

Little information exists about this population of white sturgeon particularly in the Montana reach of the Kootenai River. Montana Fish, Wildlife and Parks staff captured eight sturgeon in the spring of 1975 and spring of 1976 between rkm 305 and 309.7. In 1979, five white sturgeon were estimated to reside in the Montana portion of the Kootenai River (Apperson 1992). Applegate (1971) reported catching thirty white sturgeon in the Kootenai River in Montana between June 1968 and July 1970, with lengths of released fish ranging from 19 to 72 inches. Five of the thirty white sturgeon reported were harvested but no length or weight information was reported. Harvest of white sturgeon in Montana was closed in 1979 (Graham 1981). Since 1980, information on the presence/absence or distribution of white sturgeon in Montana has consisted of primarily sparse anecdotal information coming from angler observations and catches. In 2002, an angler illegally harvested a hatchery released 16-inch sturgeon near Troy, MT. In 2007, several anglers and Montana Fish, Wildlife, and Parks (MFWP) game warden, Job Obst, reported observing a four to five foot sturgeon downstream of the swinging bridge near Kootenai Falls. In 2008, MFWP spoke with an angler who had caught, photographed with a cellular phone, and released a three-foot sturgeon downstream of Kootenai Falls.

In addition to this anecdotal information, juvenile white sturgeon have been released into the Kootenai River in Montana since 1994 including juvenile white sturgeon generally from 1-2 years old and free embryos in more recent years (KTOI 2007, Sue Ireland, KTOI, personal communication). Approximately 10,600 individuals were released in Montana between 1994 and 2007. In February 2004, the Kootenai Tribe of Idaho (KTOI) released 10 juvenile sturgeon equipped with radio transmitters in the "Sturgeon Hole" below Kootenai Falls, MT to determine if sturgeon would remain in Montana or if they would move back downstream into Idaho (Rust and Wakkinen 2004). Nine of the 10 sturgeon were located in the Montana reach of the Kootenai River in June 2004 when telemetry activities in this reach ceased. This study aims to elaborate on the currently sparse body of information regarding white sturgeon abundance and distribution in the Montana portion of the Kootenai River within the fish's historic range and has three objectives:

1.) assess the current status and distribution of white sturgeon in Montana.

2.) identify the current size and age structure, length-weight relationship, and growth of individuals and compare this information to information from previous studies in Idaho.

3.) identify contributions of wild and hatchery-reared white sturgeon and determine if natural reproduction and recruitment are taking place in the Kootenai River in Montana.

## ***Methods***

Both juvenile and adult white sturgeon were targeted from June through September 2009 using setlines in the Kootenai River from Kootenai Falls downstream to the Montana-Idaho border (Figure 1). Sampling locations were selected both from recent and historic sampling or sighting locations as well as randomly throughout the Montana reach. Setlines consisted of 45.7 m of 145 kg-test mainline. Each mainline was equipped with 12, 60 kg-test drop-lines approximately 50 cm long spaced 2.4 m apart. Each drop line contained a single circle hook, size 2/0, 3/0, 4/0, 6/0, or 8/0. Individual lines generally consisted of a mix of 2/0 and 3/0 hooks or 4/0, 6/0, and 8/0 hooks. Hooks were baited with either nightcrawlers *Lumbricus terrestris*, live sculpins *Cottus spp.* or longnose dace *Rhinichthys cataractae*, or cut pieces of northern pikeminnow *Ptychocheilus oregonesis*, largescale sucker *Catostomus macrocheilus*, kokanee *Oncorhynchus nerka*, westslope cutthroat trout *Oncorhynchus clarki*, rainbow trout *Oncorhynchus* mykiss, or brook trout *Salvelinus fontinalis*. One end of each setline was anchored to the shore using a piece of rebar pounded into the bank. Twelve hooks were baited and attached to each mainline using a steel spring clip, and the mainline was stretched perpendicular to the current and then set quartering downstream. An eight-kg weight was used to secure the end of each mainline to the river bottom. The set time and pull time as well as a latitude and longitude of each setline were recorded.

Setlines were initially set for approximately two to six hours during daylight hours in 2009 to determine if catch and mortality of non-target species, primarily bull trout *Salvelinus confluentus,* would be significant. Based on initial sampling efforts during the daylight hours, catch and mortality of bull trout was not significant. Most of the subsequent sampling occurred using overnight sets in 2009 and 2010.

All captured white sturgeon were measured for total length (mm), fork length (mm), weight (g), inspected for external tags (i.e., floy, radio), and scanned for PIT tags using readers capable of reading 400kHz, 125kHz, and 134.2kHz PIT tags. Each fish was scanned for PIT tags from head to tail on both the left and right sides and the scute removal pattern on both the left and right side of the fish was recorded. Pictures of each white sturgeon were also taken, including one of the left and right sides of the fish that could be used to verify scute removal patterns. Habitat conditions (i.e., depth and substrate) at the capture location were also recorded or estimated at the capture site of each white sturgeon.

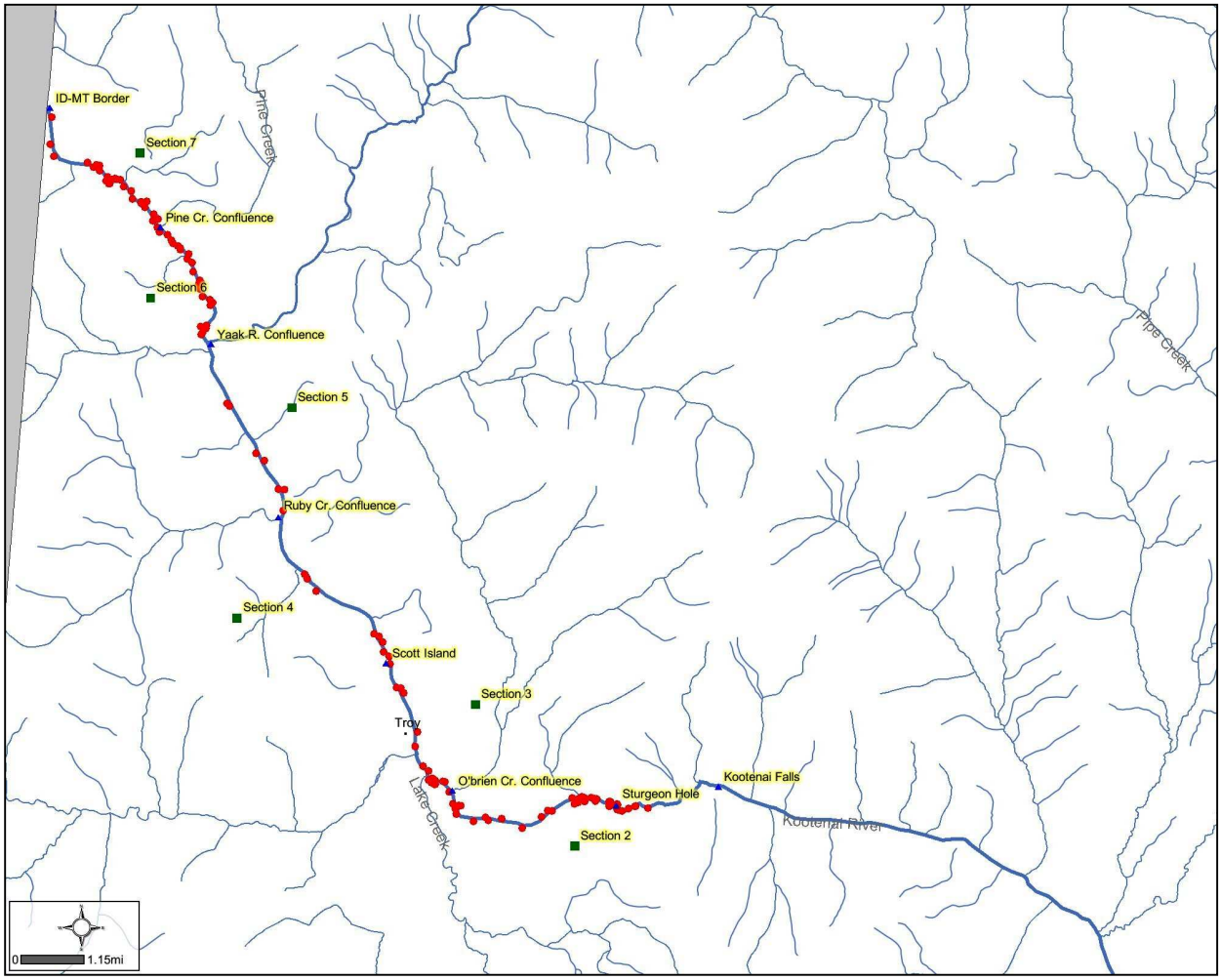


Figure 1. Map of 2009 sampling locations for white sturgeon in the Kootenai River, Montana from Kootenai Falls to the Montana-Idaho border.

In 2010, juvenile and adult white sturgeon were targeted using setlines from May 19 through September 30 downstream of Kootenai Falls using similar methods as used in 2009 (Figure 2). In 2010, this portion of the Kootenai River was partitioned into seven sections for the purposes of randomized sampling. The section numbers, locations, descriptions, and lengths can be found in Table 1. The order of sampling events was randomly determined so that each section was sampled once before any section was sampled an additional time. Section one was eliminated due to potentially dangerous boating conditions in the canyon downstream of Kootenai Falls and problems with setlines being cut on the bedrock formations (Section 1). Therefore, sampling events intended for section one instead occurred in section two.

The setlines, drop-lines, and hooks used in 2010 were identical to those used in 2009. Hook sizes were randomly selected for each line and an individual line was baited with either nightcrawlers or cut pieces of northern pikeminnow, largescale sucker, and peamouth *Mylocheilus caurinus*. From May 19 through August 24, 2010, each sampling event consisted of 12 set lines. From August 30 through September 30, 2010, setlines were placed farther from shore using a weight on each end of the setlines (mid-cannel coverage) instead of anchoring one end to the shore. Due to increased gear demands associated with this technique, only six lines were set during each sampling event.

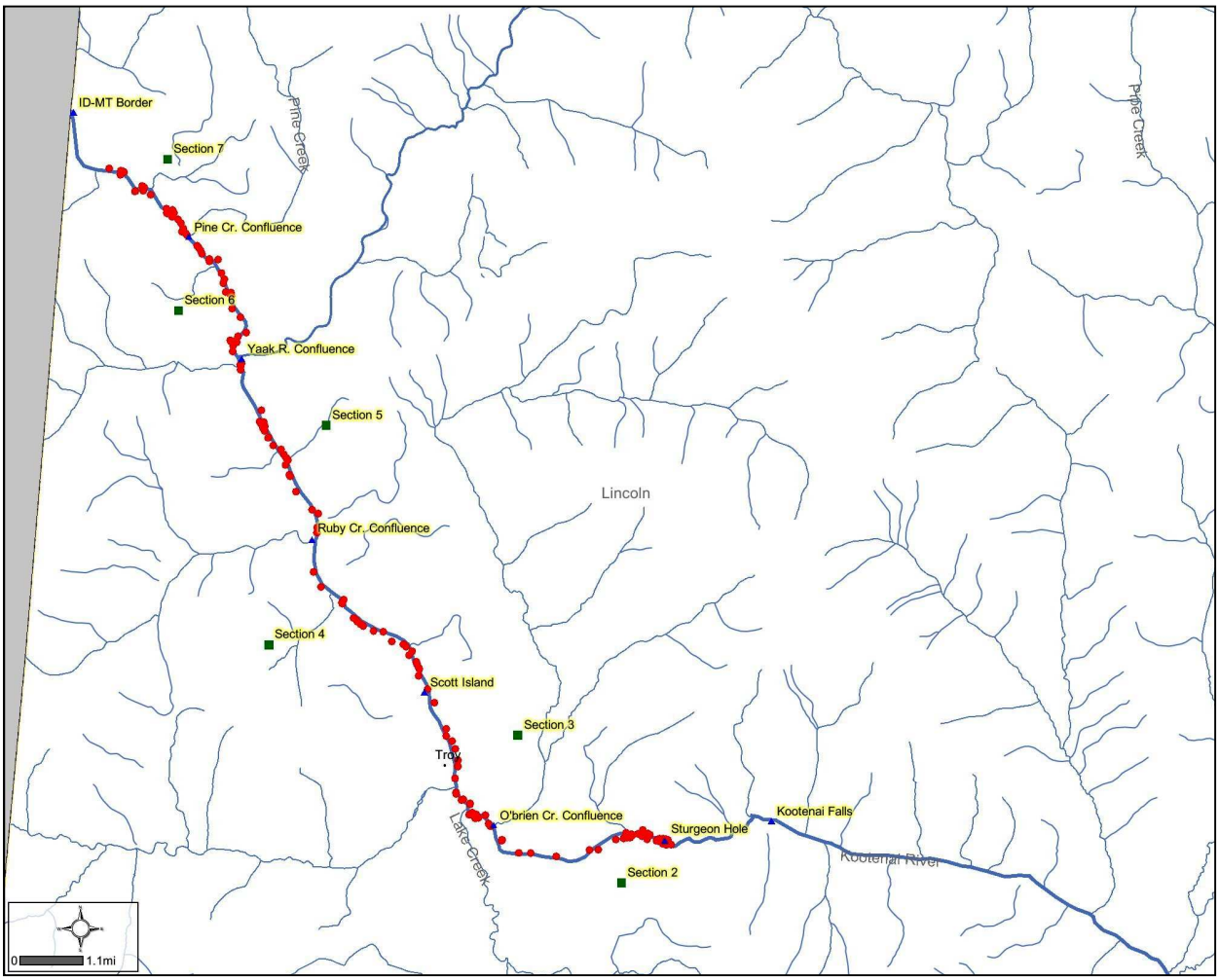


Figure 2. Map of 2010 sampling locations for white sturgeon in the Kootenai River, Montana from Kootenai Falls to the Montana-Idaho border.

Table 1. Sampling section numbers, section boundaries, and section lengths used for randomized sampling of white sturgeon in the Kootenai River, Montana in 2010.

| Section # | Upstream Boundary | Downstream Boundary | Length (km) |
|---|---|---|---|
| 1 | Kootenai Falls<br>48.45448, -115.76143 | Sturgeon Hole<br>48.44732, -115.80097 | 3.2 |
| 2 | Sturgeon Hole<br>48.44732, -115.80097 | O'Brien Creek<br>48.44788, -115.86633 | 5.2 |
| 3 | O'Brien Creek<br>48.44788, -115.86633 | Scott Island<br>48.47960, -115.89657 | 4.9 |
| 4 | Scott Island<br>48.47960, -115.89657 | Ruby Creek<br>48.51567, -115.94365 | 5.1 |
| 5 | Ruby Creek<br>48.51567, -115.94365 | Yaak River<br>48.55951, -115.97585 | 5.8 |
| 6 | Yaak River<br>48.55951, -115.97585 | Pine Creek<br>48.58915, -115.99981 | 4.1 |
| 7 | Pine Creek<br>48.58915, -115.99981 | ID-MT Border<br>48.61819, -116.04762 | 5.5 |

## ***Results and Discussion***

### *Total Catch*

A total of 135 lines were set on 14 different dates between June 4 and September 28, 2009 and fished for 1888 line hours (one line baited with 12 hooks fished for one hour). During this time, 123 fish were caught (0.065 fish/line hour or 0.911 fish/line). Northern pikeminnow (NSQ) was the most common species caught (*N* = 69; 0.037/line hr; 0.511/line), followed by largescale sucker (CSU; *N* = 30; 0.016/line hr; 0.222/line), and *Oncorhynchus* spp. (ONC; *N* = 17 RBT and 1 WCT; 0.010/line hr; 0.133/line; Figure 3). Additionally, two bull trout (BT), two white sturgeon (WTSTRG), one mountain whitefish *Prosopium williamsoni*, and one peamouth were caught.

In 2010, 186 lines were set on 18 different dates between May 19 and September 30, and fished for 3794 lines hours. During this time, 144 fish were caught (0.038 fish/line hour or 0.774 fish/line). Largescale sucker was the most frequent species caught (*N*=65; 0.017/line hr; 0.349/line), followed by northern pikeminnow (*N*=46; 0.012/line hr; 0.247/line), and rainbow trout (RBT), cutthroat trout (WCT), or RBT X WCT hybrids (ONC *N*=17; 0.005/line hr; 0.091/line). Additionally, seven peamouth, four white sturgeon, two brook trout bull trout hybrids (*Salvelinus fontinalis* x *Salvelinus confluentus)*, one bull trout, one brown trout *Salmo trutta*, and one mountain whitefish were captured.

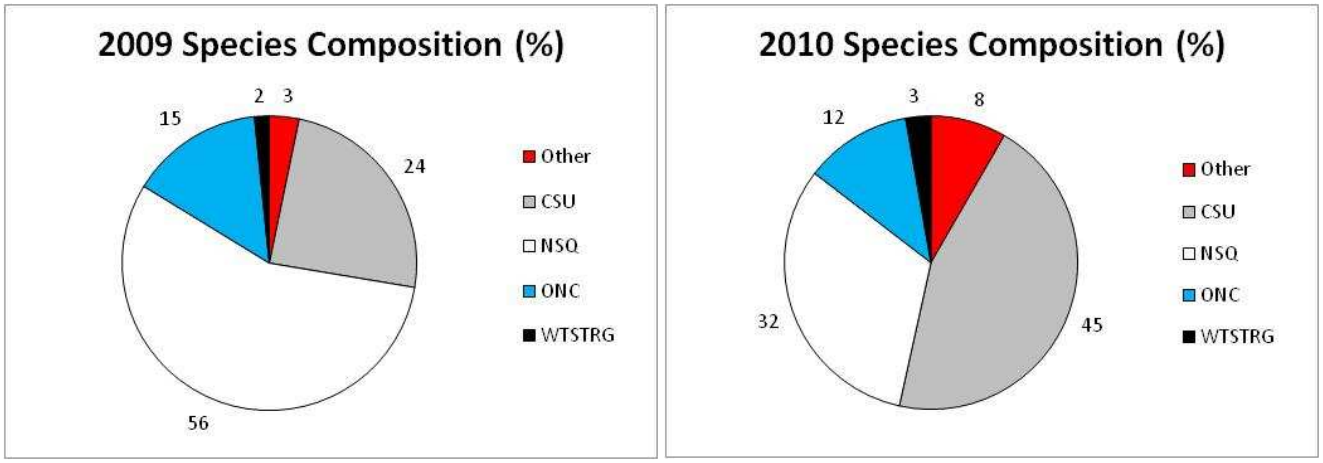


Figure 3. Species composition (percent of total catch) caught during sampling efforts for white sturgeon using baited setlines in the Kootenai River, Montana in 2009 and 2010.

In 2009, northern pikeminnows ranged from 224 to 620mm total length with a mean of 399mm (Figure 4). Largescale sucker total lengths ranged from 300 to 540mm total length and had a mean of 463mm (Figure 5). Of the 18 *Oncorhynchus* spp. caught, 17 were rainbow trout and four of these were dead upon checking the setlines. *Oncorhynchus* spp. ranged from 265 to 450mm total length with a mean of 352mm (Figure 6). Two bull trout, 745 and 790mm total length, were captured and released early in the sampling efforts on June 23 and July 14.

During 2010 sampling, northern pikeminnow total length ranged from 237 to 560mm and had a mean length of 382mm, similar to 2009. Largescale sucker total length was from 335 to 588mm and had a mean of 475mm. *Oncorhynchus* spp. averaged 341mm total length with a range of 246 to 388mm. Of the 17 individuals captured in this group, 12 were rainbow trout, three were westslope cutthroat trout, and 2 appeared to be hybrids. Ten of the 17 *Oncorhychus* spp. were dead upon checking the setlines. One bull trout was caught and released on August 31 (700mm TL, 3294g).

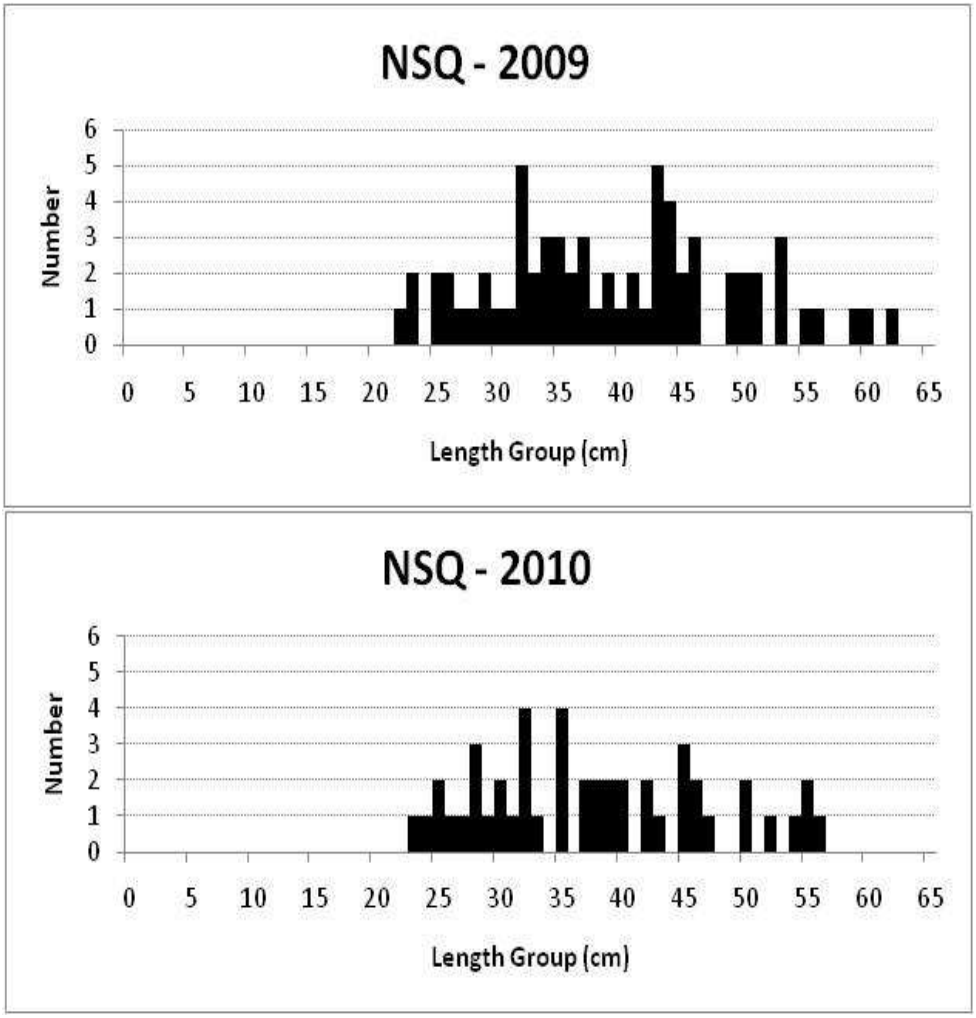


Figure 4. Length frequency distribution of northern pikeminnow caught during setline sampling for white sturgeon in 2009 and 2010 in the Kootenai River, Montana.

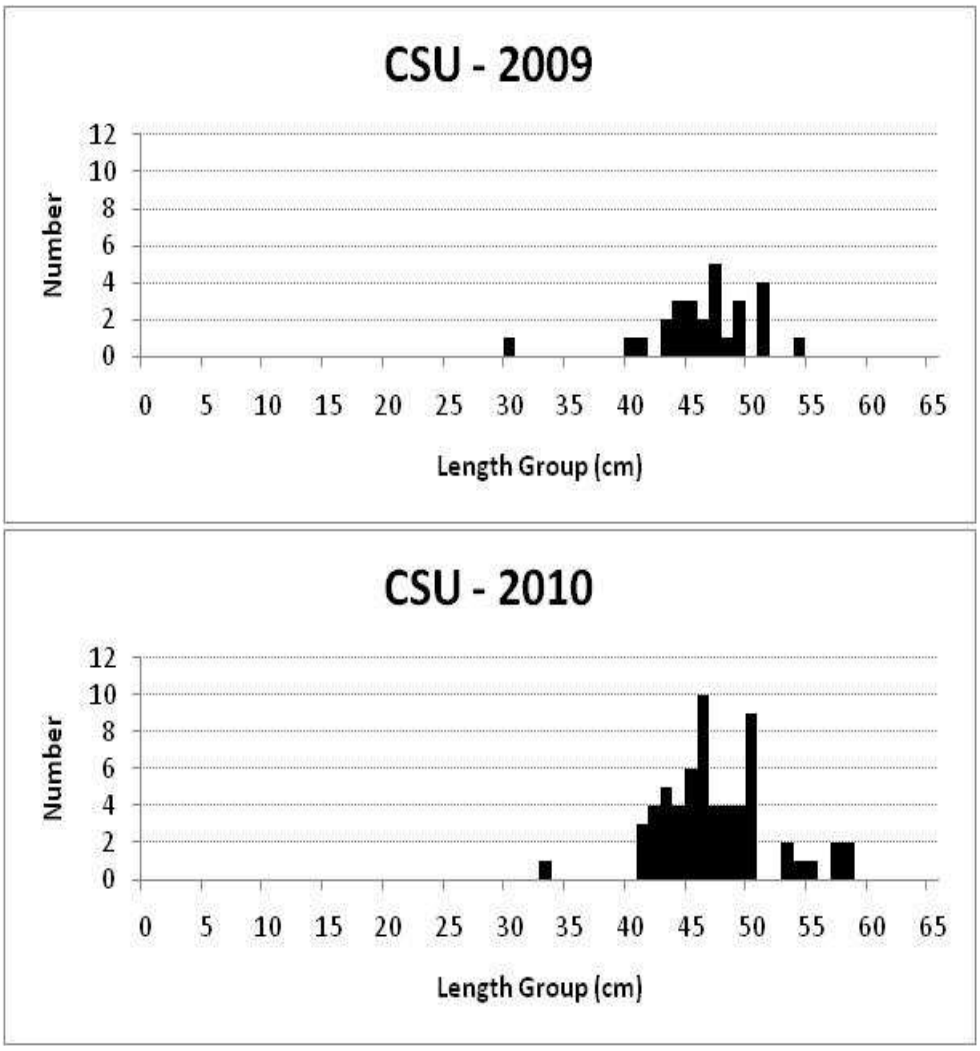


Figure 5. Length frequency distribution of largescale sucker caught during setline sampling for white sturgeon in 2009 and 2010 in the Kootenai River, Montana.

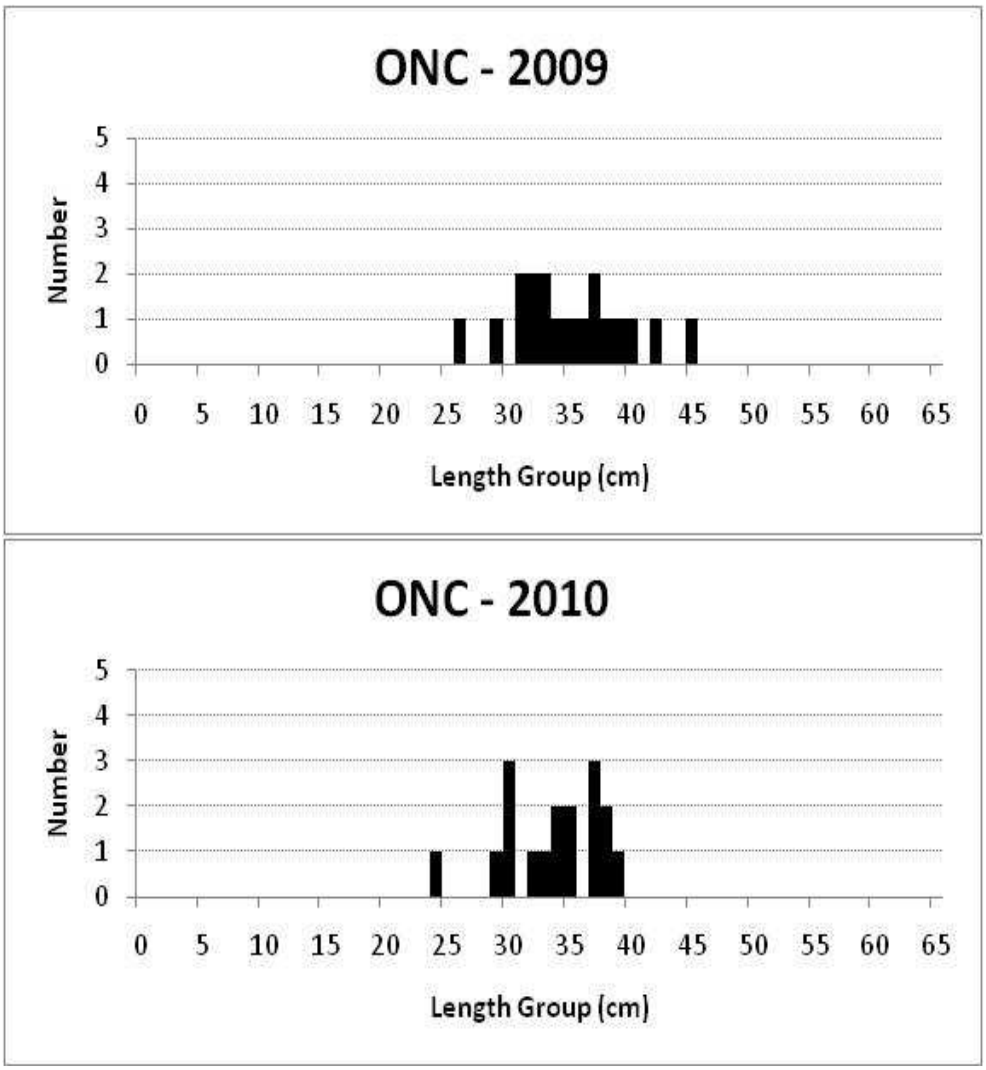


Figure 6. Length frequency distribution of rainbow trout, westslope cutthroat trout, and rainbow X cutthroat trout hybrids caught during setline sampling for white sturgeon in 2009 and 2010 in the Kootenai River, Montana.

Of the three types of bait used in 2009, cut bait was fished for the most time (63.5% of total) at 1199 line/hours on 91 lines and accounted for 44 fish caught (36%; Figure 7) and a catch rate of 0.037 fish/line hr and 0.484 fish/line. Live bait was fished for only 37 hours (2.0% of total) on three lines and accounted for 10 fish (8%) and the highest catch per unit effort (CPUE) of 0.271 fish/line hr and 3.333 fish/line (Figure 8). Nightcrawlers were fished 652 hours (34.5% of total) on 41 lines and accounted for 69 fish (56%; 0.106 fish/line hr; 1.682 fish/line). In 2010, cut bait and nightcrawlers were each used as bait on 93 lines and a total of 1897 lines hours each. During this time, cut bait accounted for 33 fish caught (23% of total) and a catch rate of 0.017 fish/line hr and 0.355 fish/line, while nightcrawlers accounted for 111 fish caught (77% of total) and a catch rate of 0.059 fish/line hr and 1.194 fish/line.

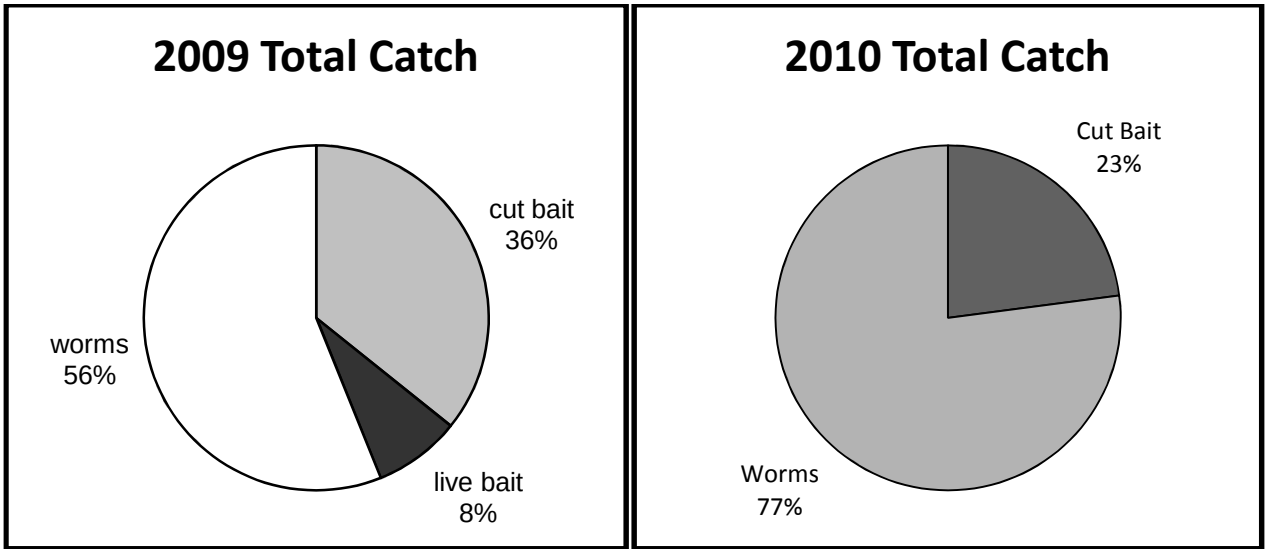


Figure 7. Total catch by bait type during setline sampling for white sturgeon in the Kootenai River, Montana in 2009 and 2010.

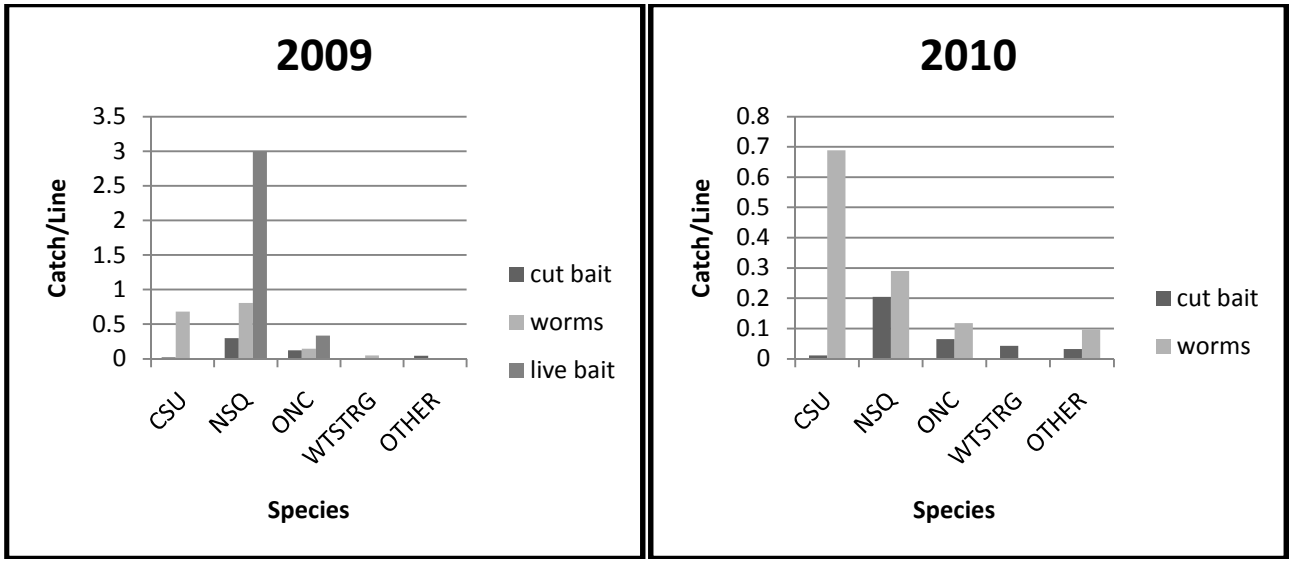


Figure 8. Total catch by species caught and bait used during setlines sampling in the Kootenai River, Montana from June to September 2009 and may though September 2010.

During 2009 sampling, the smallest hooks, 2/0 and 3/0 were baited primarily with worms and accounted for the highest total catch with 33 and 35 fish respectively (29.2% and 31.0%; Figure 9). The largest hooks, 8/0, accounted for the least amount of total fish caught with 9 individuals or 8.0% of the total catch. The 4/0 and 6/0 hooks sizes respectively accounted for 23 and 13 individuals caught, or 20.4 and 11.5 percent of the total catch. Mean total length of all fish caught on each hook size ranged from 399mm to 470mm and generally increased with hook size (Figure 10), but differences in mean length of fish caught among hook sizes were not statistically significant.

In 2010, total catch was highest for 3/0 and 2/0 hooks (37% and 30% of total; Figure 9). The distribution of fish caught per hook size followed similar patterns in 2009 and 2010. Hook sizes 4/0, 6/0, and 8/0 accounted for 21, 9, and 3 percent of the total catch respectively. Mean total length for all fish captured was lowest for smaller hooks, 2/0, 3/0, 4/0 at 387, 421, and 415mm. Fish caught on 6/0 hooks had a significantly higher mean total length of 521mm, and fish caught on 8/0 hooks had the highest mean total length at 756mm (Figure 11). Total catch by hook size (i.e., number of fish) declined linearly with increased hook size in both 2009 (R-square 0.91) and 2010 (R-square 0.84; Figure 12).

The 2009 setline locations were retrospectively assigned to the sample sections used during the 2010 sampling to compare catch in the six sections of the Kootenai River. Total lines set per section in 2009 ranged from eight in sections four and five to 46 in section two (Table 2). Total line hours ranged from 117 in section four to 513 in section seven. Total catch per line was highest in section four (2.13 fish/line) and lowest in section two (0.43 fish/line; Figure 13). During 2010 sampling efforts, total lines per section ranged from 24 in sections four and seven to 48 in section two (Table 2). Total line hours ranged from 466 in section seven to 991 in section two. Total catch per line was highest in section two (1.06 fish/line) and lowest in section three (0.53 fish/line).

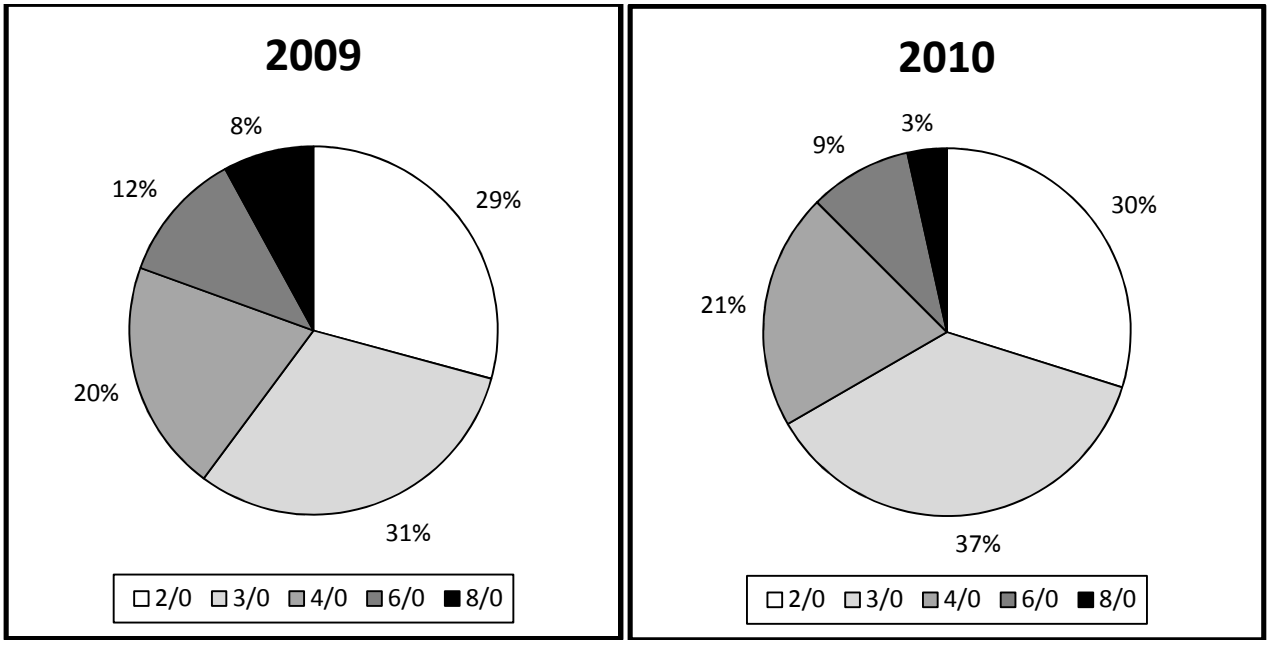


Figure 9. Total catch by hook size (%) during setline sampling for white sturgeon in the Kootenai River, Montana in 2009 and 2010.

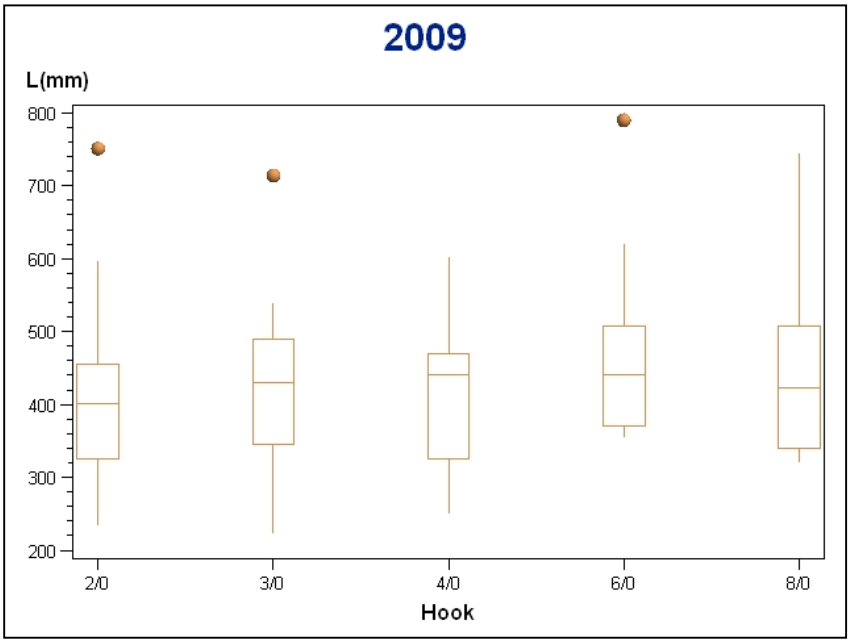


Figure 10. Mean length (mm) of fish caught by hook size during 2009 setline sampling in the Kootenai River, Montana. Dots represent fish with lengths significantly different (outliers) than the mean length by hook size and are represented by white sturgeon or bull trout.

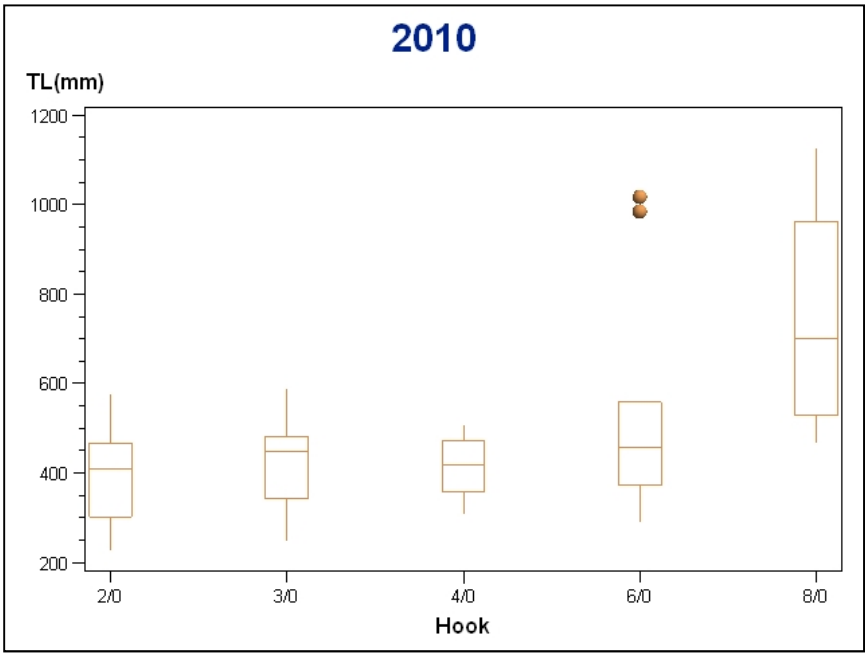


Figure 11. Mean length of fish caught by hook size during 2010 setline sampling in the Kootenai River, Montana. Dots represent fish with lengths significantly different (outliers) than the mean length by hook size and are represented by white sturgeon or bull trout.

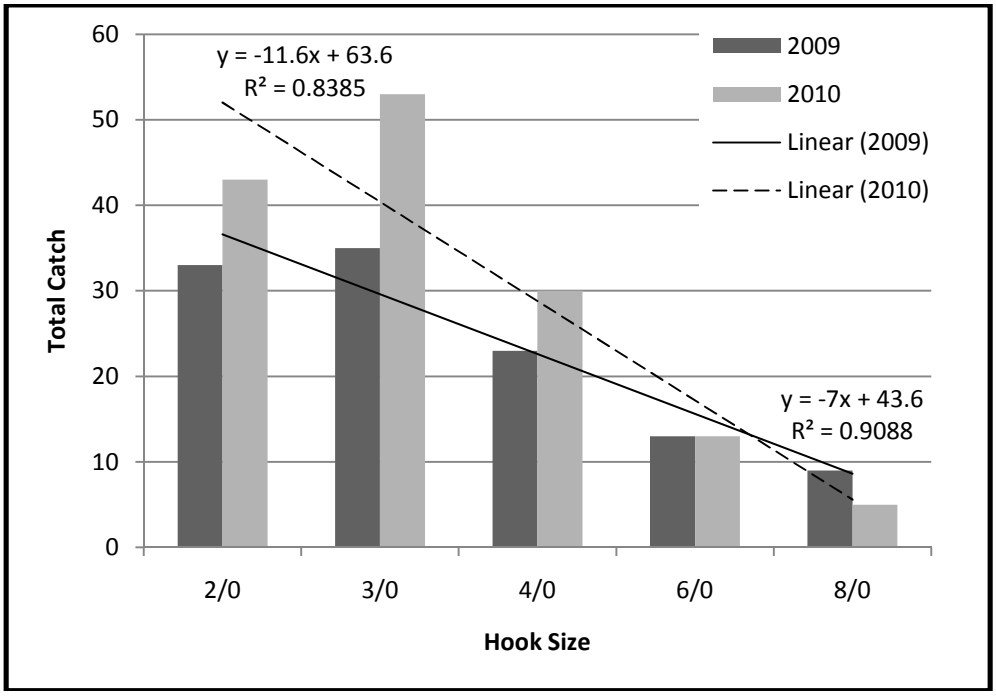


Figure 12. Total catch (number of fish) by hook size during setline sampling in the Kootenai River, Montana during 2009 and 2010.

Table 2. Summary of lines, line hours, total catch (# of fish), and CPUE (catch/line and catch/line hour) by sampling section in 2009 and 2010 sampling.

| **2009** | | | | | |
|---|---|---|---|---|---|
| **Section** | **Lines** | **Line Hours** | **Total Catch (#)** | **Catch/Line** | **Catch/Line hr** |
| 2 | 46 | 453 | 20 | 0.43 | 0.04 |
| 3 | 21 | 296 | 28 | 1.33 | 0.09 |
| 4 | 8 | 117 | 17 | 2.13 | 0.15 |
| 5 | 8 | 134 | 11 | 1.38 | 0.08 |
| 6 | 22 | 375 | 21 | 0.95 | 0.06 |
| 7 | 30 | 513 | 26 | 0.87 | 0.05 |
| Total | 135 | 1888 | 123 | 0.91 | 0.07 |
| | | | | | |
| **2010** | | | | | |
| Section | Lines | Line Hours | Total Catch (#) | Catch/Line | Catch/Line hr |
| 2 | 48 | 991 | 51 | 1.06 | 0.05 |
| 3 | 30 | 628 | 16 | 0.53 | 0.03 |
| 4 | 24 | 488 | 21 | 0.88 | 0.04 |
| 5 | 30 | 605 | 24 | 0.80 | 0.04 |
| 6 | 30 | 616 | 18 | 0.60 | 0.03 |
| 7 | 24 | 466 | 14 | 0.58 | 0.03 |
| Total | 186 | 3794 | 144 | 0.77 | 0.04 |

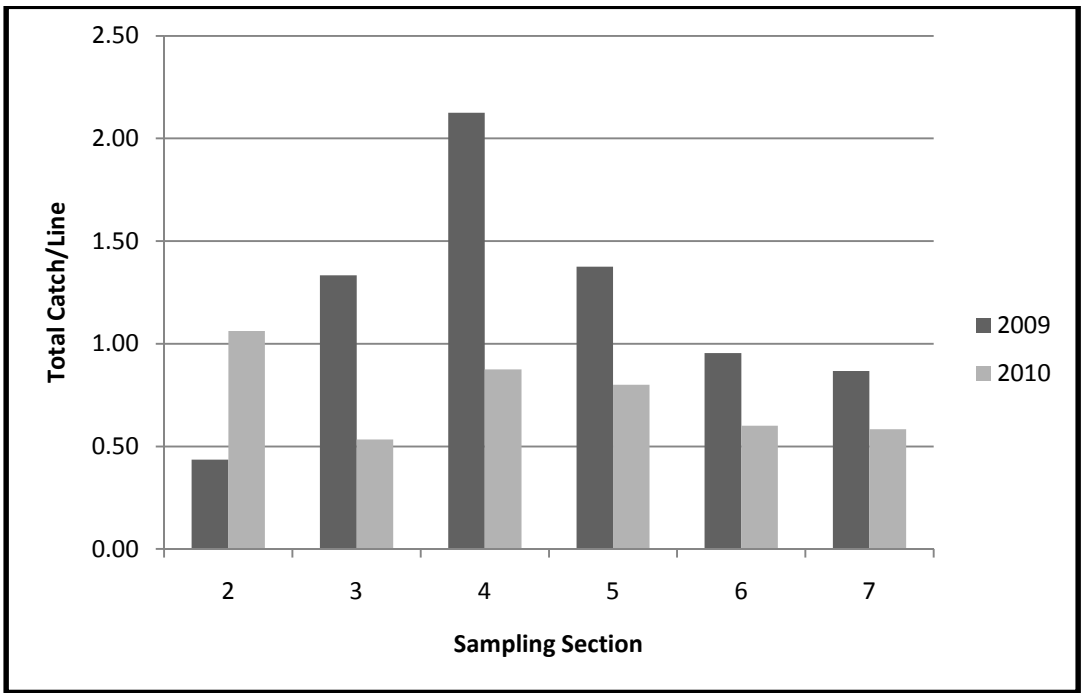


Figure 13. Total catch per line (number of fish) by sampling section during 2009 (retrospectively assigned) and 2010 sampling efforts for white sturgeon in the Kootenai River, Montana.

While it is difficult to assess information collected using two vastly different sampling techniques, the total catch data from this study do not show any unexpected results when compared to MFWP and IDFG's annual electrofishing data conducted downstream of the Yaak River confluence in Montana. In both 2009 and 2010, the three most frequently encountered species collected during this study, northern pikeminnow, largescale sucker, and *Oncorhynchus* spp., have been among the top five most abundantly collected by in the Kootenai River downstream of the Yaak River from 2002 – 2009 (data on file). Our setline gear with large circle hooks biases our collection against capturing other common species that are very small or those with a relatively small mouth gape such as redside shiners *Richardsonius balteatus* and mountain whitefish. Additionally, the individuals of each common species collected using setlines had a mean length much greater than those collected by electrofishing. This was probably a result of the hook size biasing the sampling toward larger fish (Figure 14).

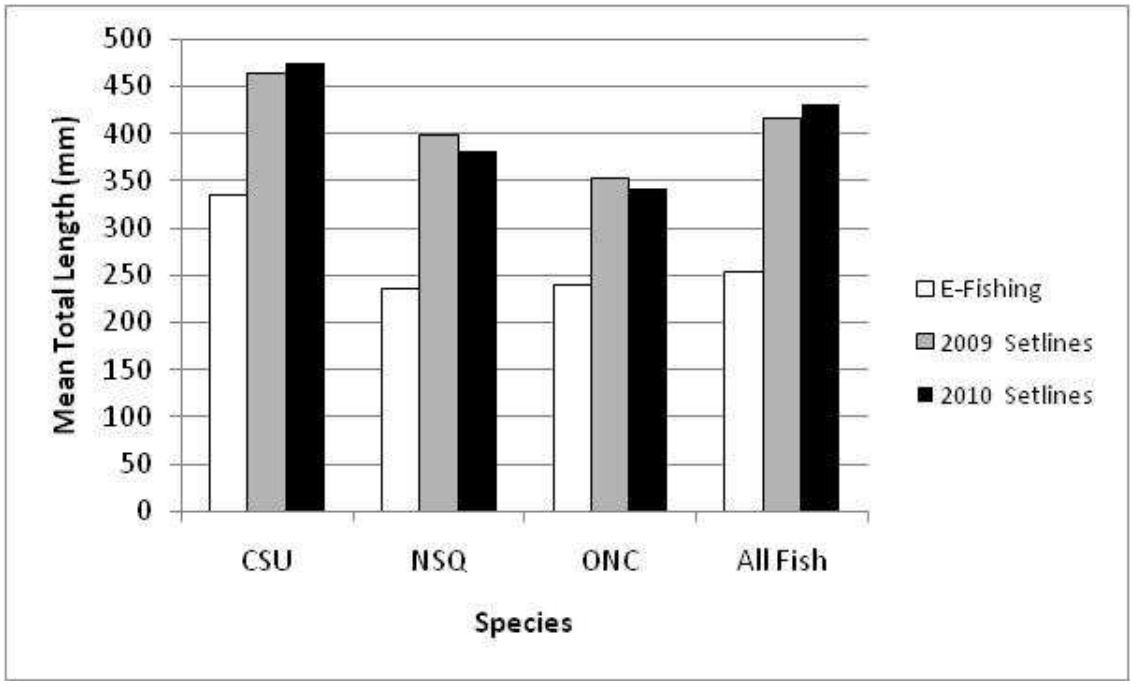


Figure 14. Comparison of mean total length of common fish species captured during 2009-2010 setline sampling for white sturgeon and 2007-2009 IDFG and MFWP electrofishing data downstream of Kootenai Falls in the Kootenai River, Montana.

***White Sturgeon***

Two white sturgeon were captured during the June 4 through September 28, 2009 sampling efforts. The first fish was caught on September 1 at river kilometer (rkm) 278.8 near a rock island toward the south/southeast shore over a sand bottom, approximately 3.25 rkm upstream of the Montana-Idaho border and 6.25 rkm downstream from the mouth of the Yaak River (Figure 15). The fish was caught on a 3/0 circle hook baited with a nightcrawler. Fork length was 613mm; total length was 714mm; weight was 1488g (Figure 16). The sturgeon was missing the tenth scute on the left side and the fifth scute on the right side. Scanning the fish with a PIT tag reader produced the tag code 3D9.1BF27366F7. A fin clip was taken from the pectoral fin for genetic analysis. The fish was released and appeared in good physical condition.

The scute removal pattern and PIT tag code of the first sturgeon captured on September 1, 2009 (left $10^{th}$ and $5^{th}$ right) identified it as being from the 1995 brood year. The PIT tag code identified this individual as fish record #3365, released from the Kootenai Tribe of Idaho hatchery on October 3, 1997 at rkm 245.0 (Wakkinen 2009). At the time of release, the fish had a fork length of 324mm, a total length of 375mm, and no recorded weight. On August 13, 2008 Idaho Fish and Game (IDFG) recaptured this individual at rkm 207.0 (slightly upstream of the Copeland Bridge). The fish measured 610mm fork length, 710mm total length, and 1600g. The sex of this fish was unknown but the age of the fish was known, 14 years in 2009. If the fish is male, it may be approaching sexual maturity based on previous information in the Kootenai River system. Females have been documented to mature as early as age 22 and males at age 16 (Paragamian et al. 1997).

In the nearly 11-year span between the release date and the first recapture event in 2008 by IDFG, the fish increased in fork length by 289mm and in total length by 335mm. The average growth rate during this period was 26 mm/yr FL and 31 mm/yr TL. In the one year between the 2008 and 2009 recapture events, this fish moved over 70 rkm upstream, showed only a 4mm increase in total length, and actually decreased in weight by approximately 100g. The contrasting annual growth rate estimates between the 11-year span and the single year at large period are consistent with variability observed in other Kootenai River white sturgeon studies. In the Idaho stretch of the Kootenai River, Ireland et al. (2002) estimated average annual growth increments for all recaptured hatchery white sturgeon at 64mm/yr, with a range from near zero to over 130mm/yr for fish at large for three years. Ireland et al. (2002) also noted highly variable changes in weight for recaptured hatchery sturgeon. While the weight loss of 100g in one year observed from 2008 to 2009 falls outside the observed range in Idaho of –10 to 268g/yr, Ireland et al. (2002) noted that relative weight decreased between release and recapture for 77% of all recaptured hatchery sturgeon, and some measurement error and variable success of individual fish may have accounted for part of the highly variable range of growth.

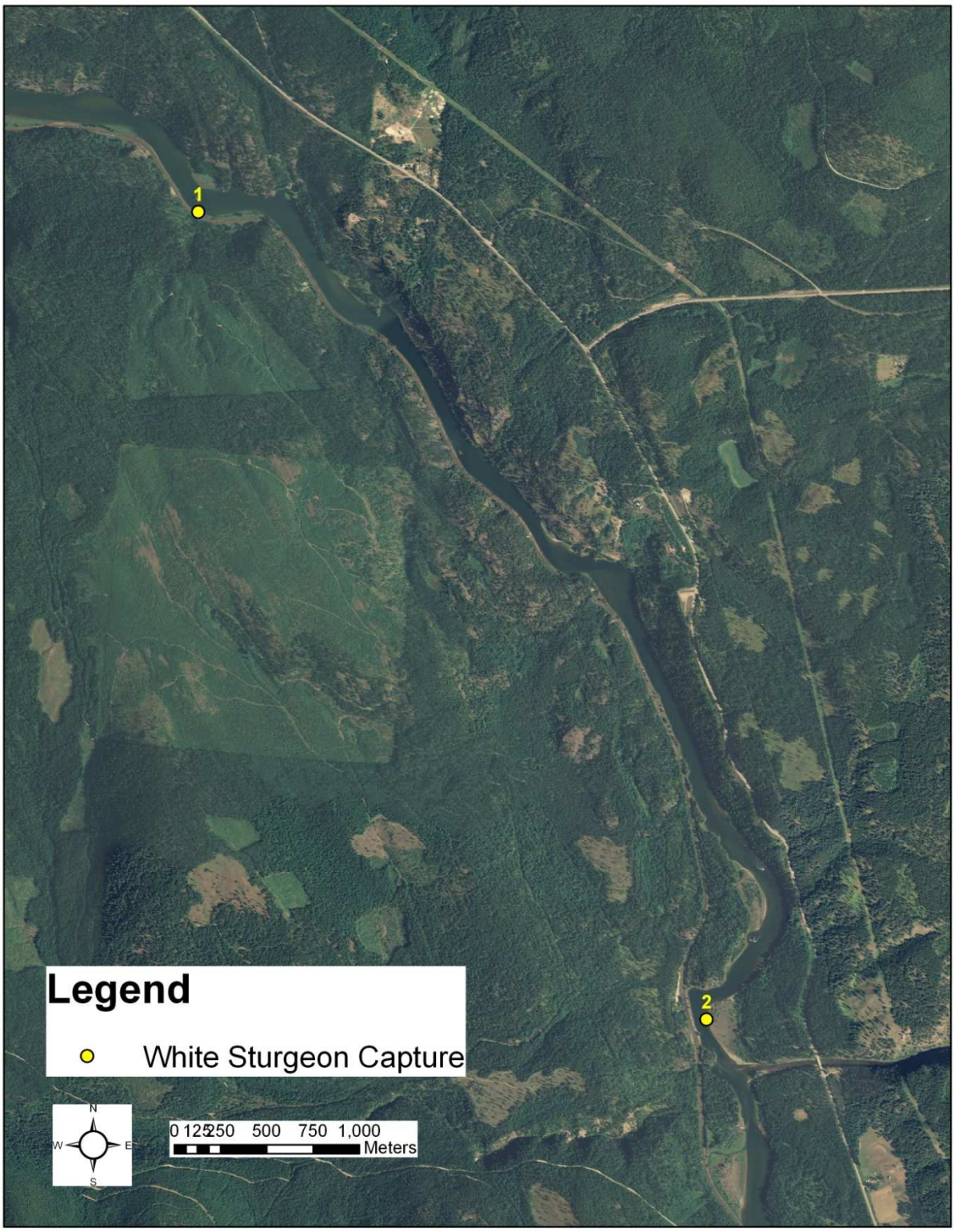


Figure 15. Map of the two sturgeon capture locations between the Yaak River confluence (rkm 285.5; lower right) and near the Montana-Idaho border (rkm 276.1) during setline sampling from June to September 2009 in the Kootenai River, Montana.

Figure 16. White sturgeon (#1) captured on September 1, 2009 in the Kootenai River, Montana.

The second sturgeon (Figures 15 and 17) was caught on September 29 at rkm 284.7 over a gravel and cobble bottom on the inside edge of a sharp bend river right, approximately 0.35 rkm downstream from the mouth of the Yaak River. The sturgeon was caught on a 2/0 circle hook baited with a nightcrawler. Fork length was 653mm; total length was 751mm; weight was 1543g. Based on field identifications, this fish was missing the ninth scute on the left side and the fifth scute on the right side, indicating this was a hatchery reared sturgeon however, no PIT tag was detected. No fin clip was taken for genetic analysis and no new PIT tag was inserted. The fish was released and appeared in good physical condition.

The scute removal pattern of the second sturgeon, captured September 29, 2009 (left 9$^{th}$ and 5$^{th}$ right), indicated that it was from the 1995 brood year. Idaho Department of Fish and Game staff reviewed the pictures for this sturgeon and identified the scute removal pattern was 9 on the left and 1 and 6 on the right side, indicating a 2004 hatchery fish, however, neither year class can be verified without a corresponding PIT tag. Because no PIT tag was detected and no fin clip was taken for genetic analysis, specific growth information unique to this individual was unobtainable. Of 2085 individuals from the 1995 brood year released into the Kootenai River system, 95 percent were released in either spring or fall of 1997 (52 and 43%; KTOI 2007). The remaining five percent were released during the summers of 1998 and 1999. Fish from these groups had mean total lengths at the time of release ranging from 228 to 582 mm and mean weights from 47 to 863 g. Therefore, depending on which release group contained this individual, estimated mean growth per year would range from about 6 to 34 mm/yr FL and 66 to 120 g/yr (Table 3). The growth estimate ranges for length and weight fall within the estimates of other recaptured hatchery white sturgeon observed in Idaho (Ireland et al. 2002). The 2004 year class of Kootenai River white sturgeon was released in May of 2005. White sturgeon from the 2004 year class had a mean FL of 196mm and had a mean weight of 0.06kg (KTOI 2007). Approximately 1.5% (33 of 2038) were released upstream of rkm 275.0 near the Montana-Idaho border (KTOI 2007) but this fish could have possibly migrated upstream. If this fish was from the 2004 year class stocked in 2005, growth estimates (Table 3) were generally higher than those observed by Ireland et al. (2002) but within the ranges observed. A report by the Kootenai Tribe of Idaho (KTOI 2007) stated that there were no PIT tagged or measured 2004 year class releases from the Kootenai Hatchery. Without a unique individual identification code to provide an exact length and

weight at the time of release, as well as a release date or season, the rate of growth for the second fish can only be estimated from the mean sizes of its potential cohorts at time of release.

Figure 17. White sturgeon (#2) captured September 29, 2009 in the Kootenai River, Montana.

Table 3. Growth estimates for the white sturgeon (#2) captured on September 29, 2009 by release cohort. Fork length instead of total length was used for growth estimates because the 2004 year class did not have total lengths reported in Ireland et al. 2002.

| **1995 Brood Year Releases** | | | | **9/29/09 Sturgeon Growth Estimates** | | | | |
|---|---|---|---|---|---|---|---|---|
| Release Time | N | **Mean FL (mm)** | **Mean Weight (g)** | **yrs at large** | **FL (mm)** | **Weight (g)** | **mm/yr** | **g/yr** |
| Spring 1997 | 1075 | 228 | 47 | 12.5 | 653 | 1543 | 34 | 120 |
| Fall 1997 | 889 | 344 | 148 | 12 | 653 | 1543 | 25 | 116 |
| Summer 1998 | 96 | 411 | 288 | 11.25 | 653 | 1543 | 21 | 112 |
| Summer 1999 | 25 | 582 | 863 | 10.25 | 653 | 1543 | 6 | 66 |
| | | | | | | | | |
| **2004 Brood Year Releases** | | | | **9/29/09 Sturgeon Growth Estimates** | | | | |
| Spring 2005 | 2038 | 196 | 60 | 4.5 | 653 | 1543 | 101 | 329 |

Four white sturgeon were captured between May 19 and September 30, 2010. All four fish were captured in section two in the vicinity of Throops Lake (rkm 305.0) and Sturgeon Hole (rkm 306.5; Figure 18). The first sturgeon (Figure 19) was caught on July 14th near Throops Lake at rkm 305.0. The fish was captured in a slow moving tailout less than 3 meters deep over medium sized (1/2" to 2") gravel substrate. The fish was captured using cut bait on a 6/0 hook. This fish had a fork length of 870mm, a total length of 985mm, and a weight of 5123g. It was missing the ninth scute on the left side and the fourth scute on the right side. No existing PIT tag was detected in the fish. Two new PIT tags, codes 3D9.257C6BFFAB and 3D9.257C6BFE02, were inserted into the dorsal muscle tissue. A pelvic fin clip was taken for genetic analysis. The fish was released and appeared in good physical condition.

The scute removal pattern identified in the field and photographs (left 9th, right 4th) of the first sturgeon captured on July 14, 2010 did not match removal patterns recognized by IDFG or the KTOI. However, it is likely that the removal pattern was misidentified or misapplied and most likely the ninth scute on the left and the fifth on the right (Wakkinen 2010) which would identify this fish as being from the 1995 brood year. Because this individual could not be specifically identified from a PIT tag, only estimates of growth can be inferred. Using the same information from the 1995 brood year releases that were used to estimate growth for the sturgeon captured on September 29, 2009, estimated mean annual growth ranged from about 36 to 57 mm/yr TL and 383 to 403 g/yr (Table 4).

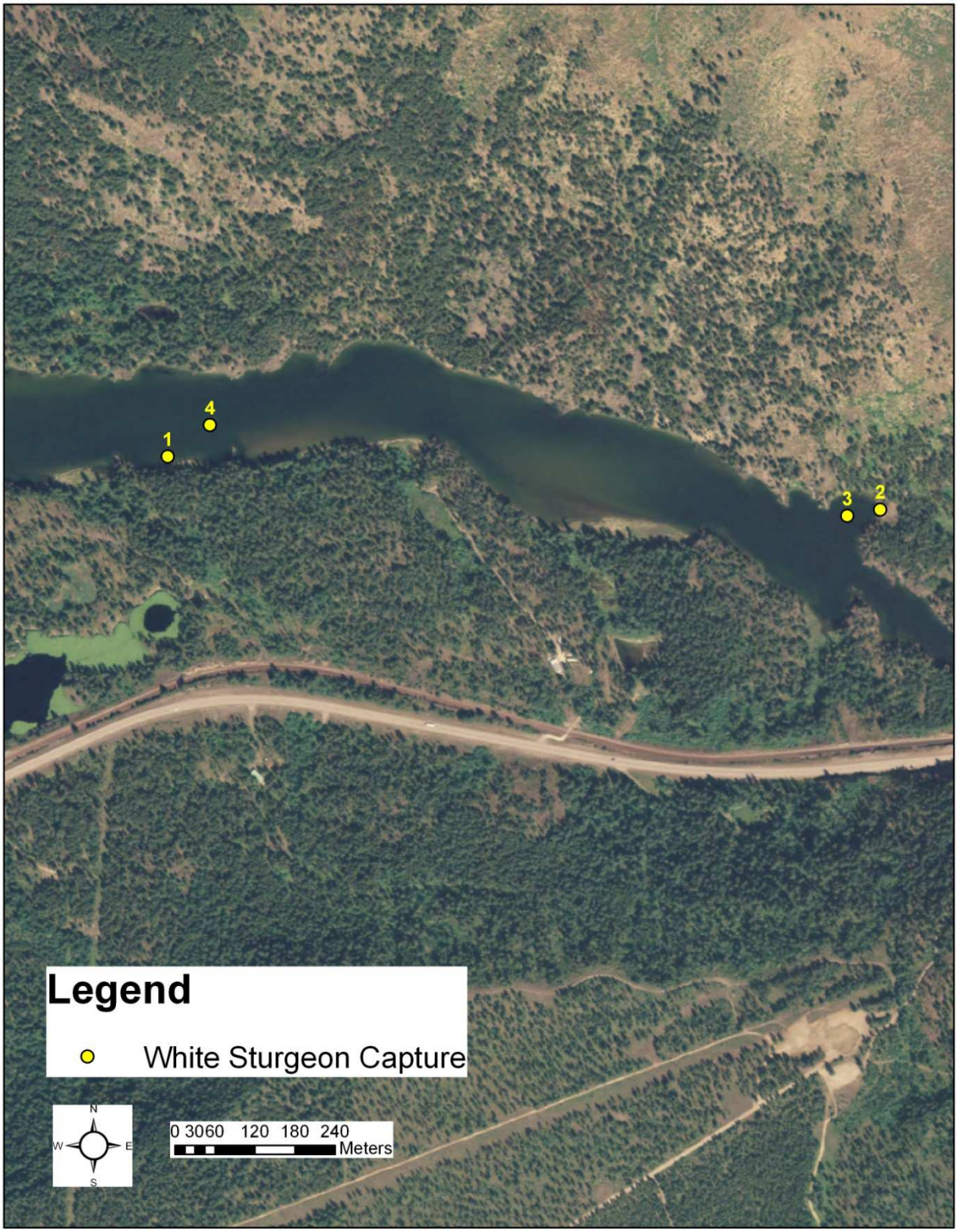


Figure 18. Map of the four white sturgeon capture locations between Throops Lake (rkm 305.0) and Sturgeon Hole (rkm 306.5) during setline sampling from May to September 2010 in the Kootenai River, Montana.

Figure 19. White sturgeon (#1) captured July 14, 2010 in the Kootenai River, Montana.

Table 4. Growth estimates for the white sturgeon (#1) captured on July 14, 2010 by release cohort.

| 1995 Brood Year Releases | | | | 7/14/10 Sturgeon Growth Estimates | | | | |
|---|---|---|---|---|---|---|---|---|
| Release Time | N | Mean TL (mm) | Mean Weight (g) | yrs at large | TL (mm) | Weight (g) | mm/yr | g/yr |
| Spring 1997 | 1075 | 228 | 47 | 13.25 | 985 | 5123 | 57 | 383 |
| Fall 1997 | 889 | 344 | 148 | 12.75 | 985 | 5123 | 50 | 390 |
| Summer 1998 | 96 | 411 | 288 | 12 | 985 | 5123 | 47 | 403 |
| Summer 1999 | 25 | 582 | 863 | 11 | 985 | 5123 | 36 | 387 |

The second sturgeon (Figure 20) was captured on July 23rd in the area known as the Sturgeon Hole, near rkm 306.5, approximately 3.2km downstream from Kootenai Falls. This fish was captured in deep water (> 10m) with no perceivable flow and a presumably sandy bottom, although bedrock exists in the immediate area. The fish was captured using cut bait on an 8/0 hook. This fish was 1020mm FL and 1126mm TL and maximum girth was measured at 425mm. No weight was taken because the fish weighed more than the maximum capacity (6,000g) of our scale and our hanging scale had a dead battery. We estimated the fish weight at 6611g based on the linear relationship ($r^2$=0.98) between total length and weight for the other five white sturgeon captured in Montana during 2009 and 2010 (Figure 20). The sturgeon was missing its ninth scute on the left side and the fifth scute on the right. No existing PIT tag was detected in the fish and two new PIT tags, codes 3D9.257C59455A and 3D9.257C59541A, were inserted into the dorsal muscle. A pelvic fin clip was taken for genetic analysis. The fish was released and allowed to recover in calm shallow water, before descending into deeper water, apparently in good physical condition.

The second sturgeon captured during the 2010 sampling on July 23 was missing the ninth scute on the left and the fifth scute on the right and was identified as a hatchery fish from the 1995 brood year. Again, no PIT tag was detected so the fish could not be identified as a specific individual. Growth estimates for this sturgeon could only be inferred from mean length of hatchery cohorts. Total length likely increased at a mean rate of between 49 and 67 mm/yr (Table 5). Although this fish did not have a recorded weight, it increased at a mean rate of between 495 and 527 g/yr based on the estimated weight and mean weight of release cohorts.

Figure 20. White sturgeon (#2) captured July 23, 2010 in the Kootenai River, Montana.

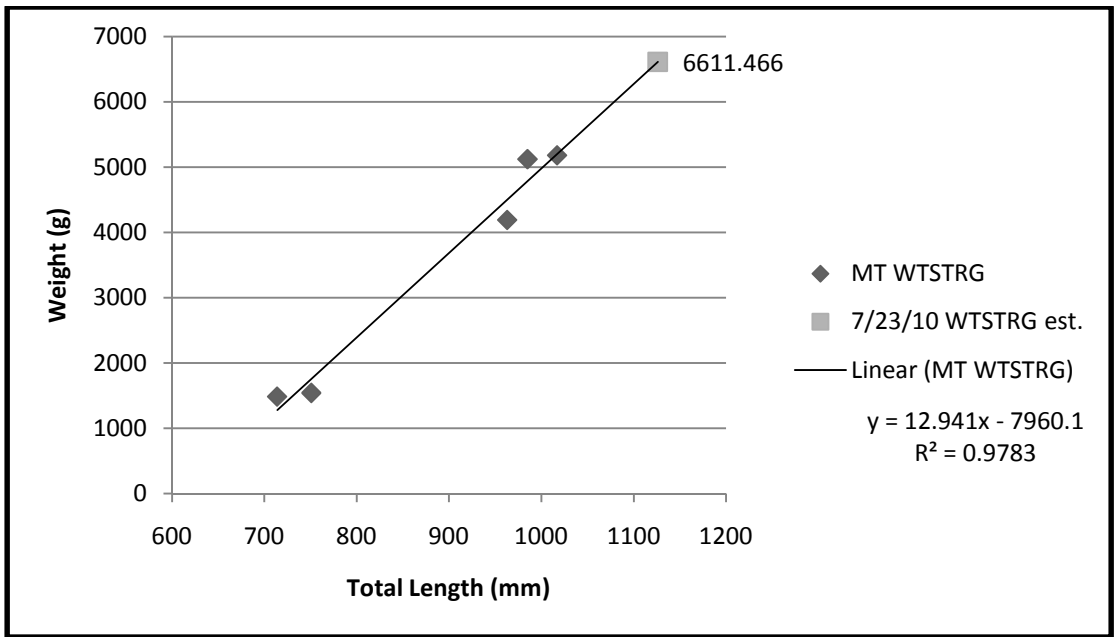


Figure 21. Linear relationship between total length and weight for five white sturgeon captured in Montana during 2009 and 2010 with the estimated weight for one fish for which actual weight was not obtained.

Table 5. Growth estimates for the white sturgeon (#2) captured on July 23, 2010 by release cohort.

| 1995 Brood Year Releases | | | | 7/23/10 Sturgeon Growth Estimates | | | | |
|---|---|---|---|---|---|---|---|---|
| **Release Time** | **N** | **Mean TL (mm)** | **Mean Weight (g)** | **yrs at large** | **TL (mm)** | **Weight (g)** | **mm/yr** | **g/yr** |
| Spring 1997 | 1075 | 228 | 47 | 13.25 | 1126 | 6611 | 67 | 495 |
| Fall 1997 | 889 | 344 | 148 | 12.75 | 1126 | 6611 | 61 | 507 |
| Summer 1998 | 96 | 411 | 288 | 12 | 1126 | 6611 | 59 | 527 |
| Summer 1999 | 25 | 582 | 863 | 11 | 1126 | 6611 | 49 | 523 |

The third sturgeon (Figure 22) was captured on a mid-channel set in the Sturgeon Hole, rkm 306.5, on August 31. Habitat conditions were similar to those from the July 23rd sturgeon capture (>10m and sand or bedrock substrate). Bait used for capture was cut bait and the hook size was 6/0. The sturgeon had a fork length of 891mm, a total length of 1017mm, and a weight of 5180g. It was missing the ninth scute on the left side and the fifth scute on the right. An existing PIT tag was detected in the fish, code 50617E0D72. Additionally, a new PIT tag was inserted, code 3D9.257C6C03A9. A pelvic fin clip was taken for genetic analysis. The fish was released and appeared in good physical condition.

The scute removal pattern and PIT tag code detected in the field both indicated that it was from the 1995 brood year upon review of existing databases. The PIT tag code identified this fish as individual #5059 which was released on April 27, 1997 from the KTOI hatchery at rkm 245.0. At the time of release, the fish measured 200mm FL, 235mm TL, and weighed 37g. This sturgeon was recaptured in 2010 approximately 61.5 km upstream from the release site. This sturgeon was the second documented white sturgeon migrating from Idaho into Montana following release near the KTOI hatchery. In the approximately 13.33 years at large, this fish increased in fork length by an average of 52 mm/yr, increased in total length by an average of 58 mm/yr, and increased in weight by an average of 386 g/yr.

Figure 22. White sturgeon (#3) captured August 31, 2010 in the Kootenai River, Montana.

The fourth and final sturgeon of the 2010 sampling period (Figure 23) was caught on September 17th near Throops Lake near the location of the July 14, 2010 sturgeon capture site. Habitat conditions were similar at this location, a slow moving tailout less than 4 meters deep over gravel substrates. This sturgeon was captured with an 8/0 hook using cut bait. The sturgeon was 833mm FL, 963mm TL, and weighed 4192g. It was missing the ninth scute on the left side and the fifth scute on the right. No existing PIT tag was detected and two new PIT tags were inserted, codes 3D9.257C6C0680 and 3D9.257C6C8C30. A pelvic fin clip was taken for genetic analysis. The fish was released and appeared in good physical condition. This sturgeon was also identified as a hatchery fish from the 1995 brood year. Again, because no PIT tag was detected, the fish could not be identified as a specific individual. Estimated mean growth rates were from 34 to 55 mm/yr TL and from 296 to 319 g/yr weight (Table 6).

Figure 23. White sturgeon (#4) captured September 17, 2010 in the Kootenai River, Montana.

Table 6. Growth estimates for the white sturgeon (#4) captured on September 17, 2010 by release cohort.

| 1995 Brood Year Releases | | | | 9/17/10 Sturgeon Growth Estimates | | | | |
|---|---|---|---|---|---|---|---|---|
| **Release Time** | **N** | **Mean TL (mm)** | **Mean Weight (g)** | **yrs at large** | **TL (mm)** | **Weight (g)** | **mm/yr** | **g/yr** |
| Spring 1997 | 1075 | 228 | 47 | 13.25 | 963 | 4192 | 55 | 307 |
| Fall 1997 | 889 | 344 | 148 | 12.75 | 963 | 4192 | 48 | 311 |
| Summer 1998 | 96 | 411 | 288 | 12 | 963 | 4192 | 46 | 319 |
| Summer 1999 | 25 | 582 | 863 | 11 | 963 | 4192 | 34 | 296 |

The high variability in observed or estimated growth rates between sturgeon captured in 2009 and 2010 makes it difficult to interpret the environmental suitability for successful growth within the Montana portion of the Kootenai River compared to what has been seen in Idaho (Ireland et al. 2002). Sturgeon captured in 2010 had significantly higher estimated mean growth rates than did fish captured in 2009 (Figure 24) however, the unknown year cohort assignment of white sturgeon #2 in 2009 makes data interpretation difficult. If sturgeon #2 captured in 2009 was a 2004 year class fish instead of 1995 year class fish, the growth estimate for the 2009 fish would approximately double to approximately 60mm/yr instead of 30mm/yr (Figure 24). Sturgeon captured in Montana in 2009 and 2010 appeared to grow slower than white sturgeon in Idaho which averaged 64mm per year but sturgeon in Idaho also showed highly variable growth rates (Ireland et al. 2002 and KTOI 2007; Figure 24). Sample sizes of white sturgeon captured in Montana remain small to this point may not reflect the true mean growth rates of fish residing in the Montana portion of the Kootenai River, however the estimates of growth obtained in 2009 and 2010 do provide some baseline information for comparison.

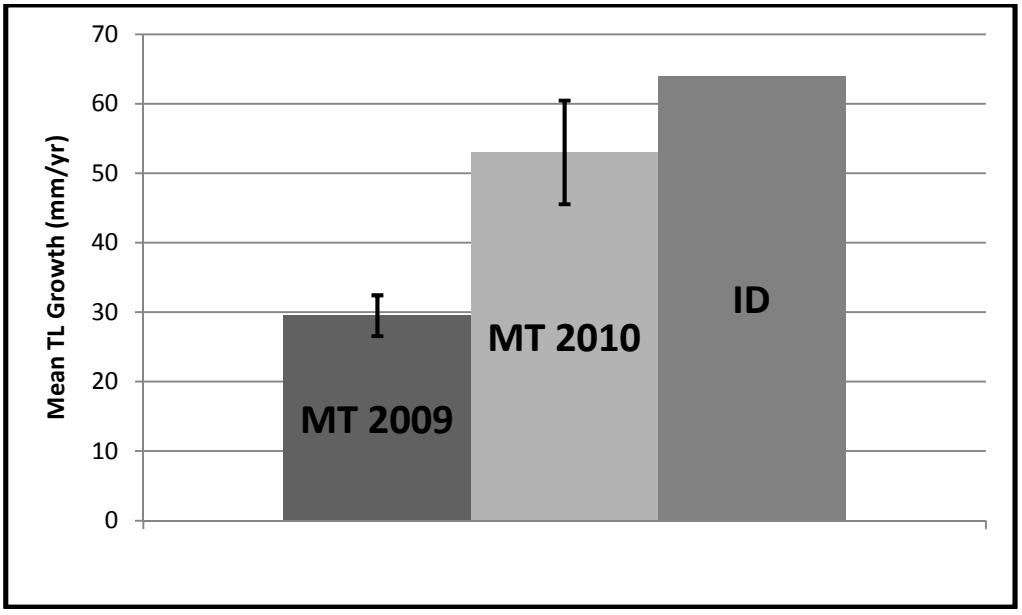


Figure 24. Estimated annual growth rates with 95% CI for white sturgeon captured in Montana in 2009 and 2010 and in Idaho from 1990 – 2007 (KTOI 2007).

During both sampling seasons, several of the smaller hooks (2/0, 3/0, and 4/0) were straightened to some degree between when they were set and when they were pulled. It was apparent that many of these hooks were caught on rocks, logs, or debris and were straightened while trying to free the line. However, it was not obvious that this was the case with all straightened hooks. It may be possible that larger fish were able to free themselves after becoming hooked by creating enough tension to straighten the smaller hooks. While setting the fifth of six lines on September 30, 2010 the sampling crew observed what appeared to be a larger (> 1.25m) white sturgeon breach between the buoys marking line number three. Upon checking the line the next day, one of the smaller hooks had been straightened. Other instances of straightened hooks without obvious cause also occurred in both 2009 and 2010. We may attempt to use stouter smaller hooks in the future.

Our CPUE (fish per line hour) for white sturgeon is roughly an order of magnitude lower than those reported for 2006 sampling by the IDFG. Rust et al. (2007) reported a catch rate of 0.0261 fish per setline hour. The CPUE we observed in 2009 and 2010 were identical at 0.0011 white sturgeon per setline hour. The lower CPUE is likely due to a lower density of white sturgeon in the Montana portion of the Kootenai River. Almost all of the white sturgeon stocked in the Kootenai River have been stocked downstream of Bonners Ferry, although some sturgeon have been stocked upstream. Additional sampling methods (i.e., gillnets) may provide better opportunity for comparison between to Idaho and Montana sections of the Kootenai River. Rust et al. (2007) had a significantly higher catch rate of juvenile sturgeon using gillnets (0.66/hr) than setlines (0.0004/hr). Habitat conditions are much different in the Montana and Idaho portions of the Kootenai River and may limit areas gillnets can be used in Montana.

Most fish from the 1995 brood year appeared to be released near the KTOI hatchery between rkm 240.0 and 245.0. It would seem that most of the individuals captured in 2009 and 2010 had migrated 60 km upstream since their releases dates. This cannot completely be verified since no PIT tags were detected in most of the captured white sturgeon. Some white sturgeon from the 1995 year class were released near the Moyie River (rkm 359.0). Genetic analysis of these individuals captured in 2009 and 2010 may provide additional information on which family group individuals originated from and more specific release location information from IDFG and KTOI records and databases.

Because only six individuals were captured in Montana in 2009 and 2010, little can be said definitively about the status of white sturgeon in the Montana reach of the Kootenai River. All individuals captured were of hatchery origin. We cannot determine if natural reproduction and recruitment are occurring in Montana at this time, although several individuals captured were approaching sexual maturity. Free embryos (3-4 days old) were released in the Kootenai River in Montana in 2008 and 2009 so smaller juvenile white sturgeon appearing to be wild fish might be captured in the future. Genetic analysis of these fish and comparison to the genetics of family groups / parents will need to be performed to verify wild or a hatchery origin. We can say that some white sturgeon are using the Montana portion of the Kootenai River for a portion of their life cycle. With the apparent low population size of white sturgeon in Montana, catch per unit effort as well as the number of fish captured may continue to be low, although additional sampling methods could be considered to better estimate abundance, such as gillnets which have higher catch rates in Idaho (Rust et al. 2007).

One large piece of information gathered from the 2009-2010 sampling is that juvenile / subadult white sturgeon are capable of migrating from downstream of Bonners Ferry, ID into the Montana reach of the Kootenai River. The first white sturgeon captured in 2009 was the first sturgeon documented making such a large upstream (70 km) migration into Montana and one sturgeon captured in 2010 made a similar upstream migration based on PIT tag information. Although sample sizes are small to date, 2 out 6 (33.3%) sturgeon captured in Montana have definitely made upstream migrations into Montana after being released near Bonners Ferry, Idaho and the KTOI Fish Hatchery. Three white sturgeon floy tagged by MFWP staff in the late 1970's were captured in Idaho by anglers and one additional sturgeon was captured within the past couple of years, indicating both upstream and downstream connectivity between Montana and Idaho. No VEMCO radio tagged white sturgeon have been documented migrating upstream into Montana from Idaho based on telemetry data collected by IDFG staff. Ten white sturgeon from the 2000 year class (mean TL 557mm, range 520-610mm) were implanted with radio tags and stocked in Sturgeon Hole (rkm 306.5) in 2004 to assess if fish stocked in Montana would remain in Montana (Dianne Wakkinen, IDFG, personal communication 2009). Many of the white sturgeon remained in the vicinity of release location although small upstream and

downstream movements were made from the release location. None of these fish have been captured during our 2009 and 2010 sampling efforts.

## ***Recommendations***

Based on results from 2009 and 2010, sampling for white sturgeon should continue in the Kootenai River, Montana in 2011. Six white sturgeon were captured in 2009 and 2010. Despite this small number, new critical information on white sturgeon in the Kootenai River was obtained. White sturgeon reared at and stocked from and at the KTOI hatchery are present in the Montana section of the Kootenai River. This indicates that they are capable of surviving in this section of the Kootenai River, however the actual abundance of both hatchery and wild white sturgeon in Montana remains unknown. No definitive information on contributions of hatchery versus wild white sturgeon in Montana can be determined at this time due to the small sample size of white sturgeon collected and the absence of captured wild sturgeon. Increasing the combined sample size of sturgeon in future years will provide more information on the abundance, growth, and contributions of hatchery and wild white sturgeon to the Montana portion of the Kootenai River.

Sampling effort in 2011 may be similar to 2010 and include gear modifications aimed at improving catch rates and reducing by-catch. Stronger hooks should be employed to avoid potential losses from straightened hooks, especially for the 2/0, 3/0, and 4/0 hooks. To increase numbers of sturgeon captured, gillnets may be set in deeper pools and runs with lower water velocities for short periods of time to target smaller individuals that are not susceptible to the setline gear, although larger fish may also be captured. Rust et al. (2007) had much higher CPUE for juvenile white sturgeon using gillnets versus setlines during 2006 sampling efforts but captured more adult white sturgeon using angling and setlines. Our setlines may be slightly biased towards larger juvenile or adult white sturgeon although other fish species near 250mm have been captured. Habitat areas suitable for gillnets in the Montana section of the Kootenai River are limited due to water velocities depending on discharge from Libby Dam but several larger pool areas exist. Stationary gillnets used should be identical to those being used by IDFG to allow for comparison of CPUE data. We may also try drifting shorter gillnets in runs and tailouts where they will not become entangled in debris or boulder piles. Angling may also be used during high flows in May and June from rkm 300.3 to 306.5 to target potentially larger fish in pools that are 15-27m deep (50-90 ft) to avoid sampling issues with setlines and gillnets at elevated discharges.

Sampling in May and June 2010 was largely ineffective due to large amounts of drifting algae covering the setlines, specifically *Didymosphenia geminata*. Large mats of algae were scoured from substrates upstream by elevated discharges from Libby Dam. Setlines were often totally covered by the algae, and many of the hooks did not fish for long periods of time and very few fish were captured during the 2 month period. Once high discharges were reduced in late June 2010, setlines appeared to fish more effectively. Algal conditions are being monitored in the Kootenai River and we may adjust sampling methods accordingly in May and June 2011. Additional passive sampling methods to better evaluate numbers of sturgeon in Montana are being considered and researched including use of underwater cameras with viewfinders, high resolution sonar, and nighttime visual surveys. Sturgeon have been documented to make diel migrations into shallower habitats (Dean 1981) and several of the sturgeon captured in the Kootenai River, Montana have been in water depths less than three meters. Electrofishing was considered but is not commonly used to sample white sturgeon in the Kootenai River and has also been shown to injure a high percentage of white sturgeon (Holliman and Reynolds 2002).

The diet composition of white sturgeon in Montana and Idaho is also unknown. Juvenile sturgeon in other river systems have been reported to feed on chironomids and other insect larvae, while larger sturgeon often switch to a fish-based diets although chironomids, insect larvae, mollusks, clams, crayfish, barnacles, crabs, shrimp, and fish eggs can make up a significant portions of the diet depending on the population and season (Dean 1981; McKechnie and Fenner 1971; Muir et al. 2000). White sturgeon in the Fraser River often follow sockeye salmon spawning runs. We may attempt to modify the sampling duration of our permit to allow sampling through the kokanee spawning run in September and October near Lake Creek and portions of the Kootenai River downstream of Kootenai Falls. Carcasses from dying kokanee may be abundant in deeper pools near Lake Creek, near Sturgeon Hole, and other settling areas. It may be possible to increase our catch of juvenile and adult white sturgeon in the Montana portion of the Kootenai River during these periods of available forage using setlines and gillnets. These locations may also be good locations to dive or perform visual surveys for white sturgeon.

We will continue to share white sturgeon data collected in the Montana portion of the Kootenai River with IDFG and KTOI. All data collected in Montana are included in their shared white sturgeon databases. Continued collaboration will hopefully improve our understanding of the status of white sturgeon in Montana and Idaho and hopefully lead to recovery and delisting of the species.

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## ***Appendices***

Appendix 1. Summary of white sturgeon capture dates, location, length and weight data, scute removal patterns, tag information, physical habitat conditions, and genetic sample information collected in the Kootenai River, Montana during 2009 and 2010 sampling. The abbreviation NA in this appendix indicates the data was not available at the time of this report or was not collected. The weight followed by an asterisk indicates an estimated weight.

| Capture Date | rkm | TL (mm) | FL (mm) | Weight (g) | Scute removal pattern (L /R) | Previous PIT tag detected | New PIT tag Inserted (#1) | New PIT tag Inserted (#2) | Approx. Water Depth (m) | Substrate | Genetic ID # | Family Group |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/1/2009 | 278.8 | 714 | 613 | 1488 | 10/5 | 3D9.1BF27366F7 | NA | NA | 6.5 | sand | BT-09-177 | 33 |
| 9/29/2009 | 284.7 | 751 | 653 | 1543 | 9/5 or 9L 1/6R | NA | NA | NA | 3 | cobble/gravel | NA | NA |
| 7/14/2010 | 305.0 | 985 | 870 | 5123 | 9/4 | NA | 3D9.257C6BFFAB | 3D9.257C6BFE02 | 2.5 | gravel | GEN-2010-213 | NA |
| 7/23/2010 | 306.5 | 1126 | 1020 | 6611* | 9/5 | NA | 3D9.257C59455A | 3D9.257C59541A | >10.0 | sand | GEN-2010-214 | NA |
| 8/31/2010 | 306.5 | 1017 | 891 | 5180 | 9/5 | 50617E0D72 | 3D9.257C6C03A9 | NA | >10.0 | sand/bedrock | GEN-2010-215 | 31 |
| 9/17/2010 | 305.0 | 963 | 833 | 4192 | 9/5 | NA | 3D9.257C6C0680 | 3D9.257C6C8C30 | 3 | gravel | GEN-2010-217 | NA |