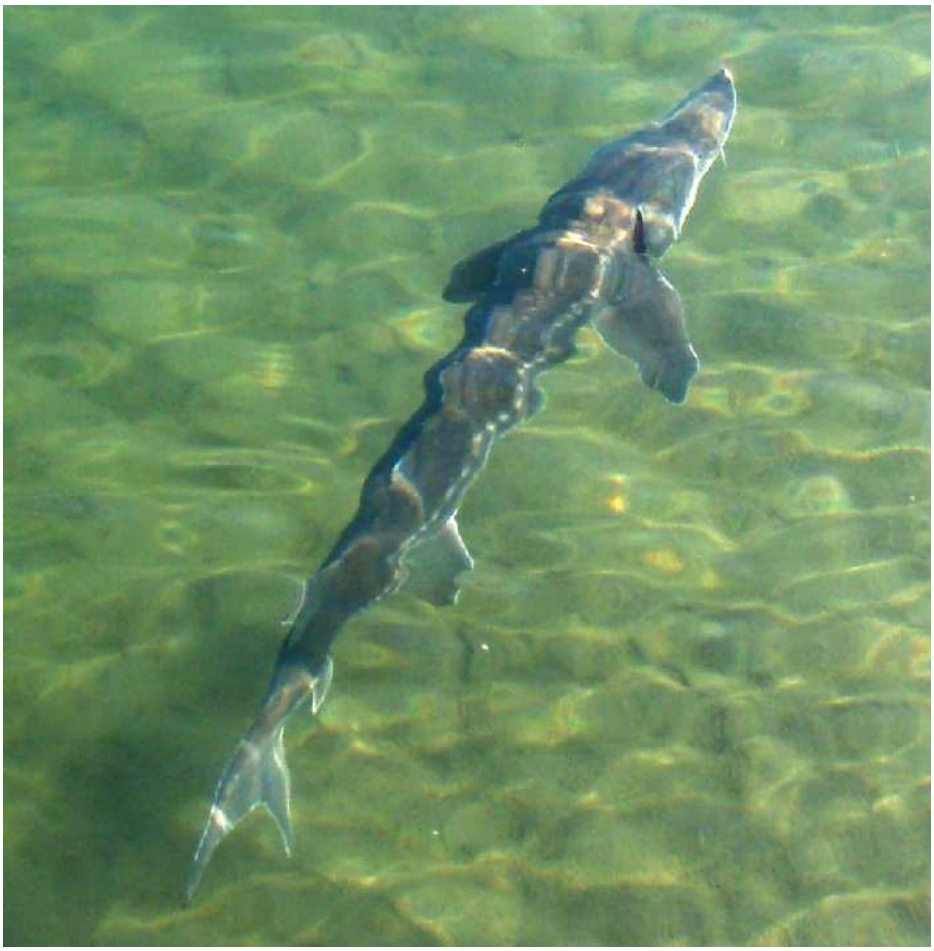
Kootenai River
White Sturgeon *Acipenser transmontanus*:
2009 Investigations in Montana



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Abbreviations and Acronyms

Abbreviation or Acronym	Meaning or Description
B.C.	British Columbia
cm	centimeter
CPUE	catch per unit effort
CSU	largescale sucker
DV	bull trout
ESA	Endangered Species Act
FL	fork length
g	gram
ID	Idaho
IDFG	Idaho Department of Fish and Game
kg	kilogram
KTOI	Kootenai Tribe of Idaho
m	meter
MFWP	Montana, Fish, Wildlife and Parks
mm	millimeter
MT	Montana
MWF	mountain whitefish
NSQ	northern pikeminnow
RBT	rainbow trout
rkm	river kilometer
TL	total length
USA	United States of America
WCT	westslope cutthroat trout
WTSTRG	white sturgeon

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Introduction

The Kootenai River in British Columbia (B.C.), Canada, and Idaho (ID) and Montana (MT), USA 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, BC 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).

Little information exists about this population of white sturgeon particularly in the Montana reach of the Kootenai River. A study in 1979 estimated that five white sturgeon resided in the Montana portion of the river (Apperson 1992). Since 1980, information on the presence/absence or distribution of white sturgeon in Montana has consisted of primarily anecdotal information coming from individual's reported observations. In 2002, an angler illegally harvested a hatchery released 16-inch sturgeon near Troy, MT. In 2007, several anglers and a Montana Fish, Wildlife, and Parks (MFWP) game warden reported observing a four to five foot sturgeon near the swinging bridge below 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. Approximately 10,600 juvenile white sturgeon were released in Montana between 1994 and 2007 (KTOI 2007) and an additional 200,000 free embryos were released in 2008 and 2009. 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 migrate downstream into Idaho (Rust and Wakkinen 2004). Nine of the 10 sturgeon were still residing in the Montana reach of the Kootenai River during 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 reach of the Kootenai River within the fish's historic range and has three objectives:

1.) to 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. Each setline consisted of a 45.7m, 145 kg-test mainline and 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 either a mix of 2/0 and 3/0 hooks or 4/0, 6/0, and 8/0 hooks. Hooks were baited with either nightcrawlers, live sculpins *Cottus sp.* or longnose dace *Rhinichthys cataractae*, or cut pieces of northern pikeminnow *Ptychocheilus oregonensis*, 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 steel spring clips, 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.

Setlines were initially set for approximately two to six hours during daylight hours to determine if catch and mortality of non-target species, primarily bull trout *Salvelinus confluentus*, would be significant. Most of the subsequent sampling occurred using overnight sets of approximately 12 to 18 hours. Generally, initial sets were placed between Kootenai Falls and Troy, MT near historic and recent sturgeon capture, detection, or sighting locations. Later sets were directed at locations between Troy, MT and the MT-ID border. A list of set locations, dates, times, and durations, as well as bait used can be found in Appendix 1.

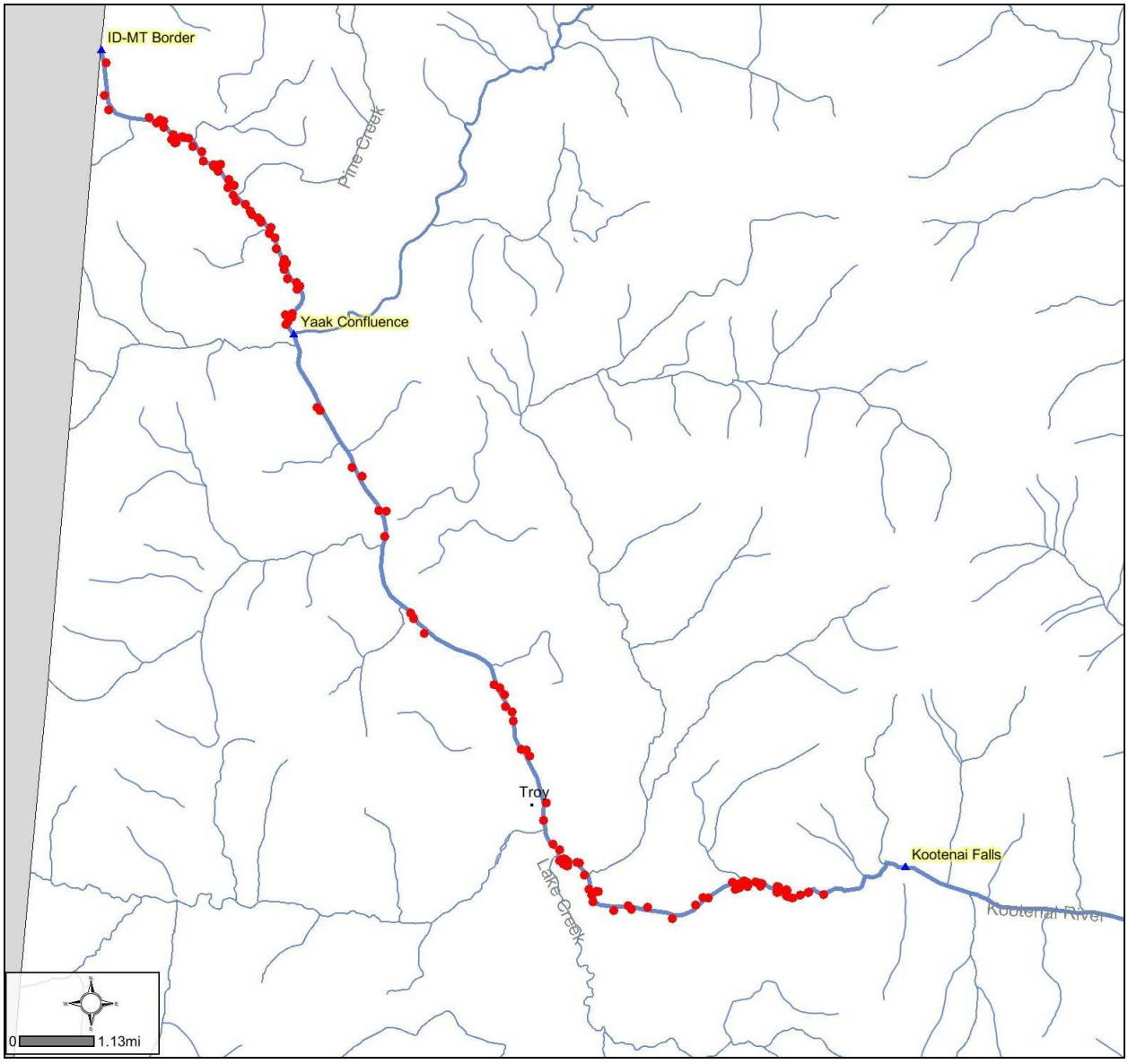

Figure 1. Map of June to September 2009 setline locations in the Kootenai River from below Kootenai Falls to the MT-ID border.

Results

Total Catch

Lines were set on 14 different dates between June 4 and September 28, 2009 and allowed to fish for a total of 1888 line hours (one line baited with 12 hooks fished for one hour). During this time, 123 fish were caught for a total catch rate of 0.065 fish/line hour. Northern pikeminnow (NSQ) was the most common species caught (N = 69; 0.037 fish/line hr), followed by largescale sucker (CSU; N = 30; 0.016 fish/line hr), and rainbow trout (RBT; N = 17; 0.009 fish/line hr; Figure 2). Additionally, two bull trout (DV), two white sturgeon (WTSTRG), one mountain whitefish *Prosopium williamsoni*, one peamouth *Mylocheilus caurinus*, and one westslope cutthroat trout were caught. A list of all fish caught with date, location, and equipment information can be found in Appendix 2.

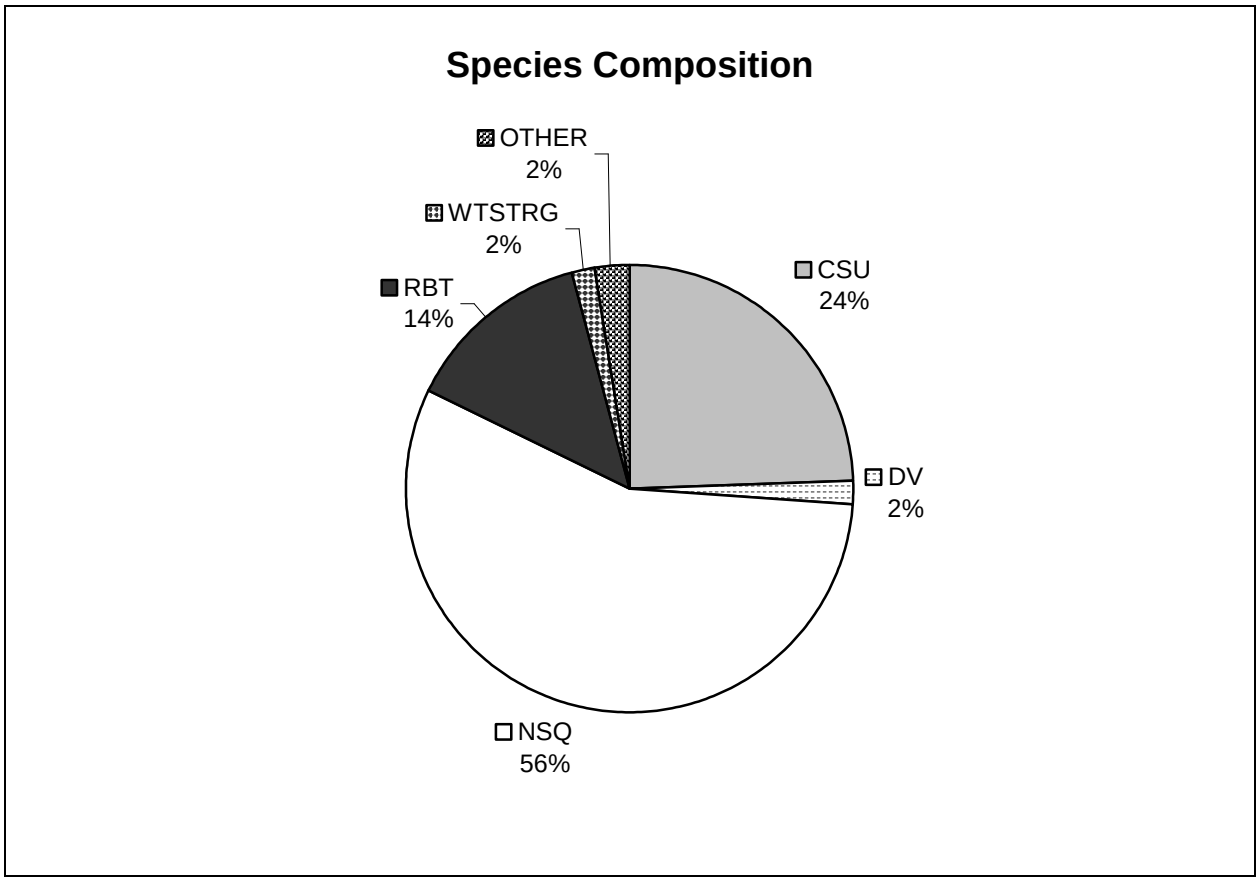

Figure 2. Species composition of fish caught during sampling efforts for white sturgeon using setlines in Montana from June to September 2009.

Northern pikeminnow ranged from 224 to 620mm total length (TL) with a mean of 399mm (Figure 3). Largescale sucker total length ranged from 300 to 540mm and had a mean of 463mm (Figure 4). Of the 17 rainbow trout caught, four were dead upon checking the setlines. Rainbow trout ranged from 265 to 450mm TL with a mean of 352mm (Figure 5). Two bull trout, 745 and 790mm TL, were captured and released early in the sampling efforts on June 23 and July 14.

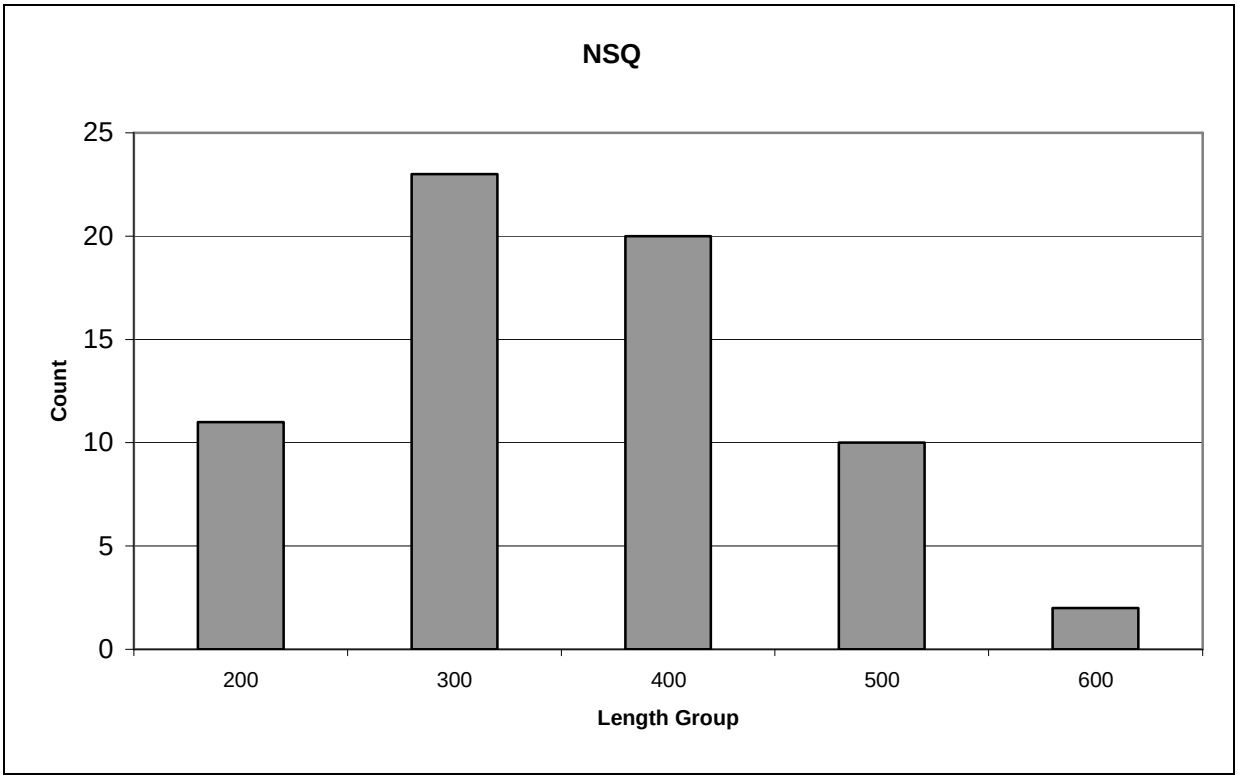

Figure 3. Length frequency distribution of northern pikeminnow caught during setline sampling from June to September 2009 in the Kootenai River, Montana.

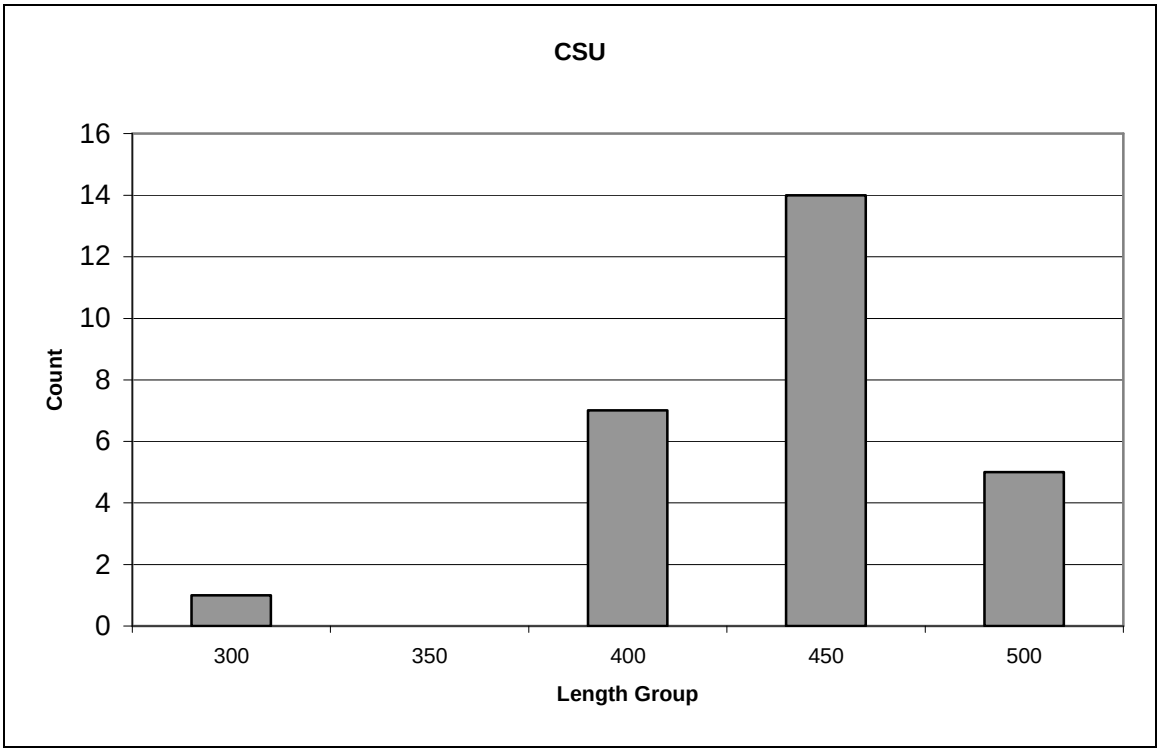

Figure 4. Length frequency distribution of largescale sucker caught during setline sampling from June to September 2009 in the Kootenai River, Montana.

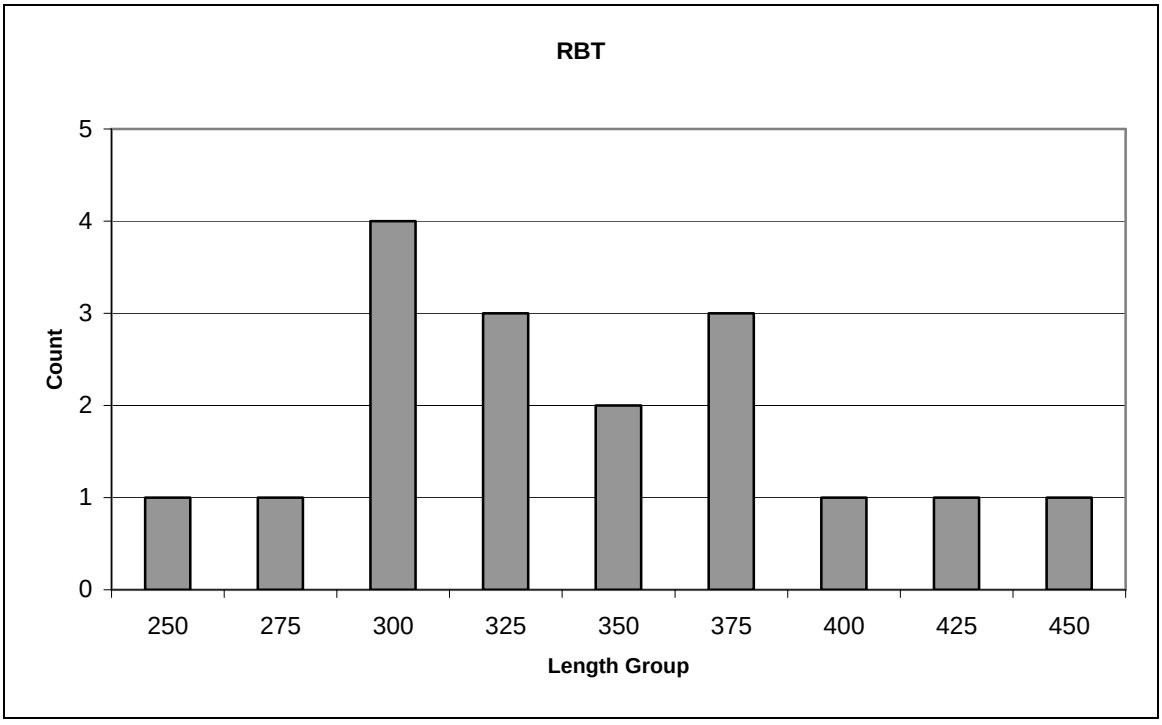

Figure 5. Length frequency distribution of rainbow trout caught during setline sampling from June to September 2009 in the Kootenai River, Montana.

Of the three types of bait used, cut bait was fished for the most time (63.5% of total) at 1199 line/hours and accounted for 44 fish caught (36% of total catch) (Figure 6) and a catch rate of 0.037 fish/line hr (Figure 7). Live bait was fished for only 37 hours (2.0% of total) and accounted for 10 fish (8% of total catch) and the highest catch per unit effort (CPUE) of 0.271 fish/line hr (Figure 8). Nightcrawlers were fished 652 hours (34.5% of total) and accounted for 69 fish (56% of total catch; 0.106 fish/line hr).

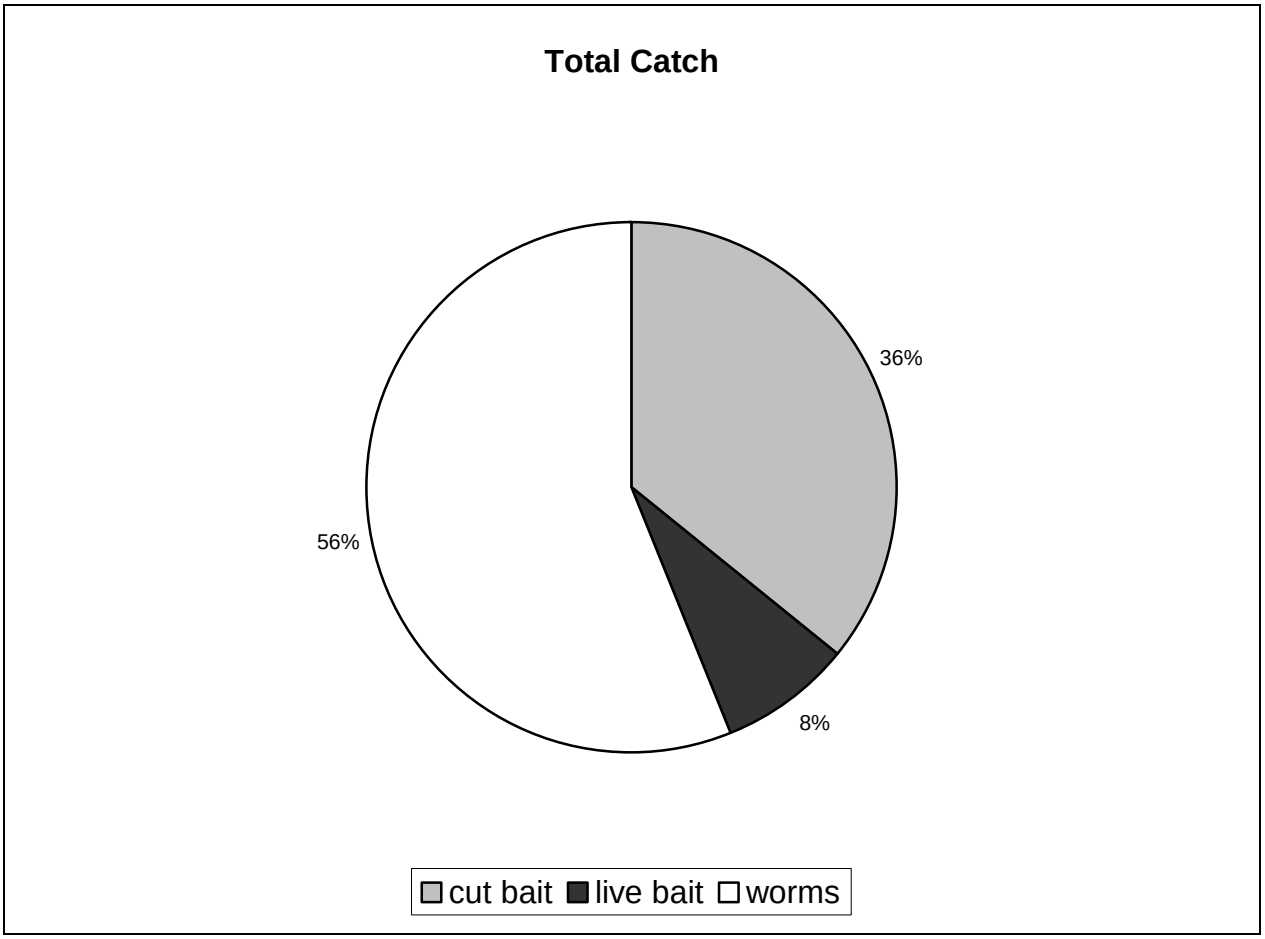

Figure 6. Total catch (%) by bait type during setline sampling for white sturgeon in the Kootenai River, Montana from June to September 2009.

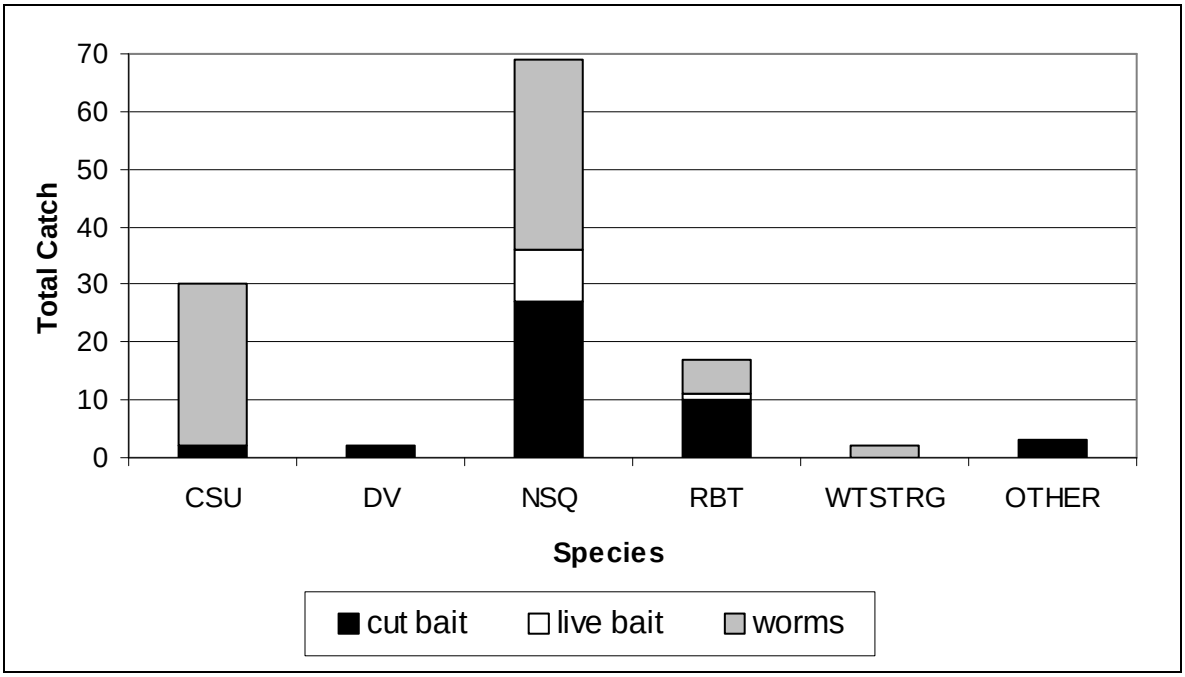

Figure 7. Total catch (number) by species caught and bait used during setline sampling in the Kootenai River, Montana from June to September 2009.

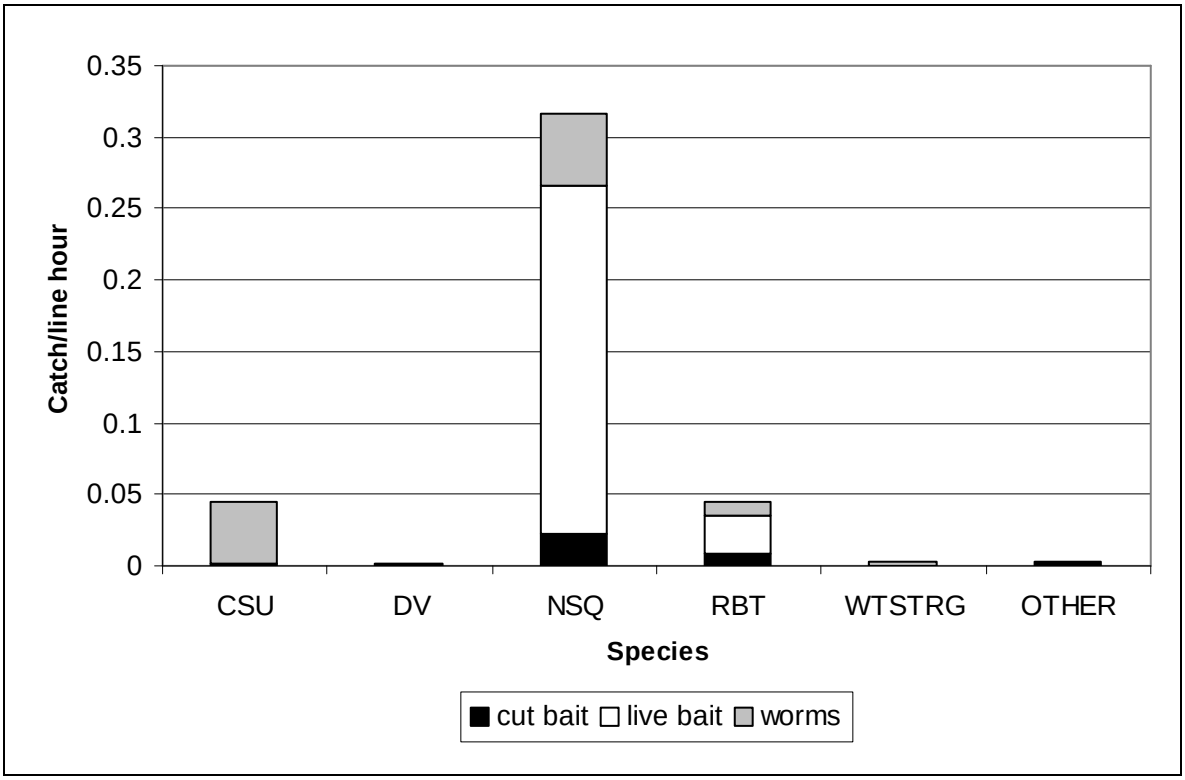

Figure 8. Catch per line hour by species and bait type during setline sampling from June to September 2009 in the Kootenai River, Montana.

The smallest hooks, sizes 2/0 and 3/0, baited primarily with worms, accounted for the most 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 however, differences in mean length of fish caught among hook sizes was not statistically significant (Figure 10).

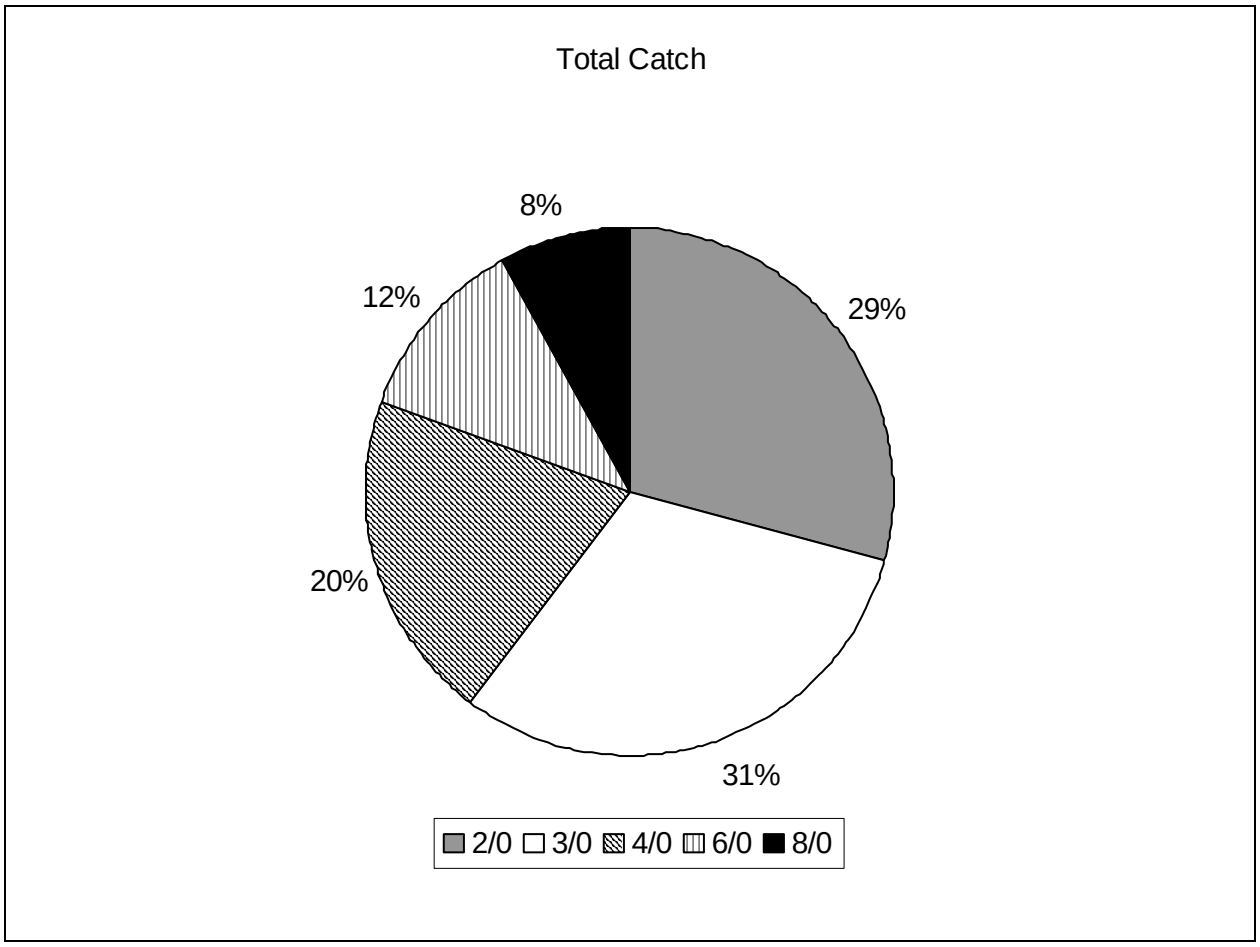

Figure 9. Total catch (%) by hook size during setline sampling in the Kootenai River, Montana from June to September 2009.

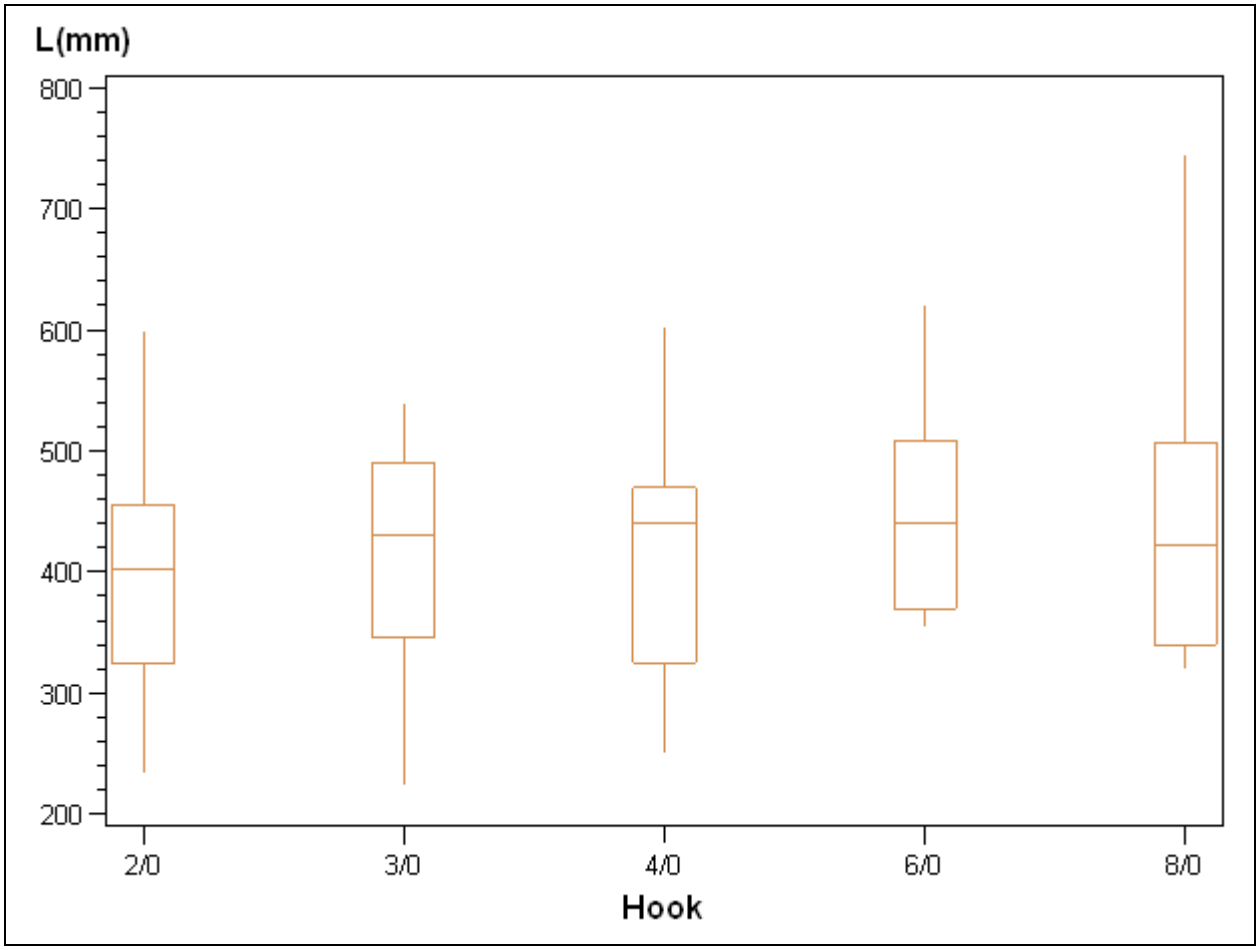

Figure10. Mean length of fish caught by hook size during setline sampling from June to September 2009.

White Sturgeon

Two white sturgeon were captured during the June 4 through September 28, 2009 sampling efforts. The first fish (Figure 11) was caught on August 31 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 MT-ID border and 6.25 rkm downstream from the mouth of the Yaak River (Figure 12). 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. 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, sample identification BT-09-177. The fish was released and appeared in good physical condition.

Figure 11. White sturgeon captured on August 31, 2009 in the Kootenai River, Montana.

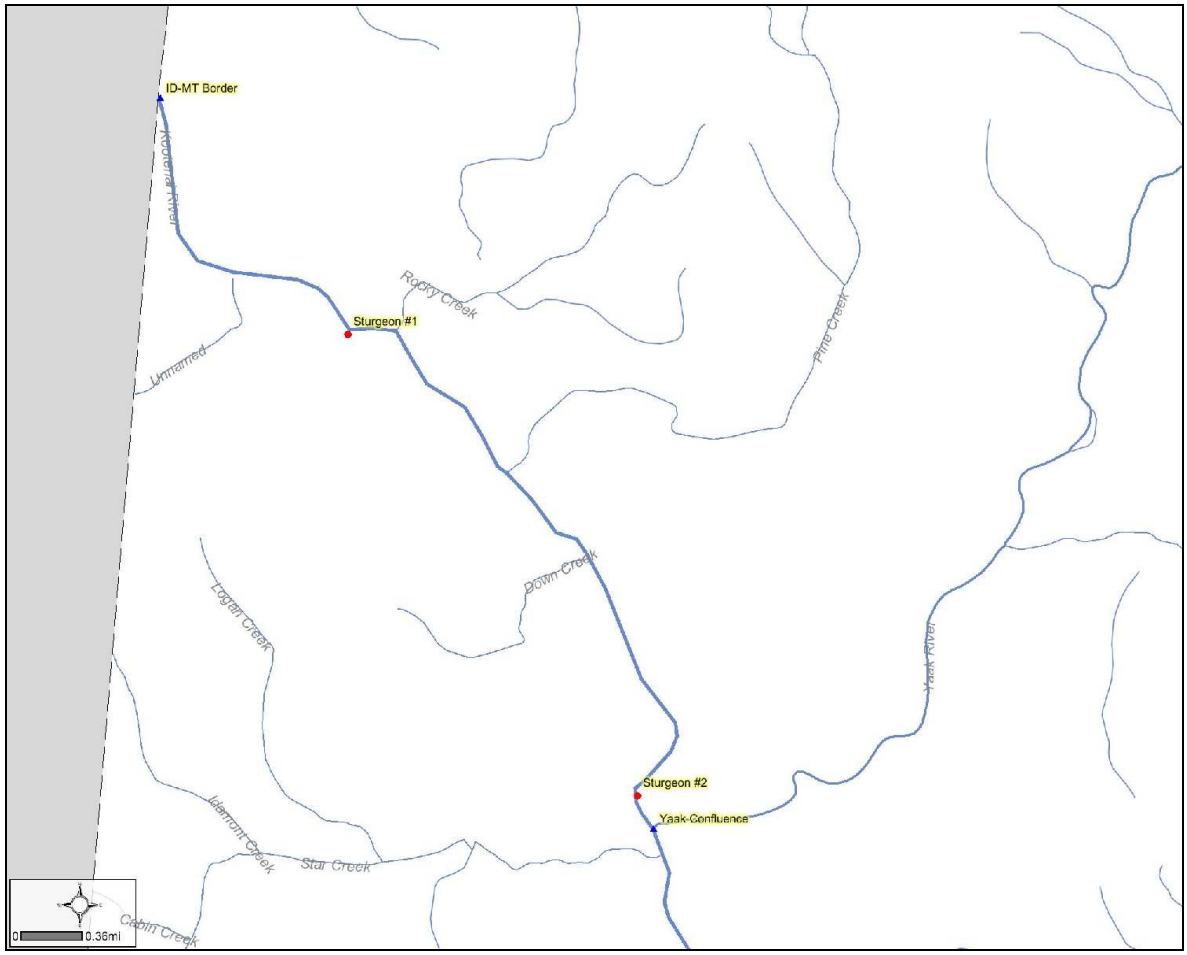

Figure 12. Map of the two sturgeon capture locations between the Yaak River confluence and the MT-ID border during setline sampling from June to September 2009.

The second sturgeon (Figure 13) was caught on September 28 at rkm 284.7 over a gravel and cobble bottom on the inside edge of a sharp river bend, approximately 0.35 rkm downstream from the mouth of the Yaak River (Figure 12). 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. This fish was missing the ninth scute on the left side and the first and sixth scutes 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.

Figure 13. White sturgeon captured September 28, 2009 in the Kootenai River, Montana.

Discussion

Total Catch

While it is difficult to assess information collected using two very different sampling techniques, the 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. The three most frequently encountered species collected during this study, northern pikeminnow, largescale sucker, and rainbow trout, 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 fish 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, likely a result of the hook size biasing our sampling toward larger fish (Figure 14).

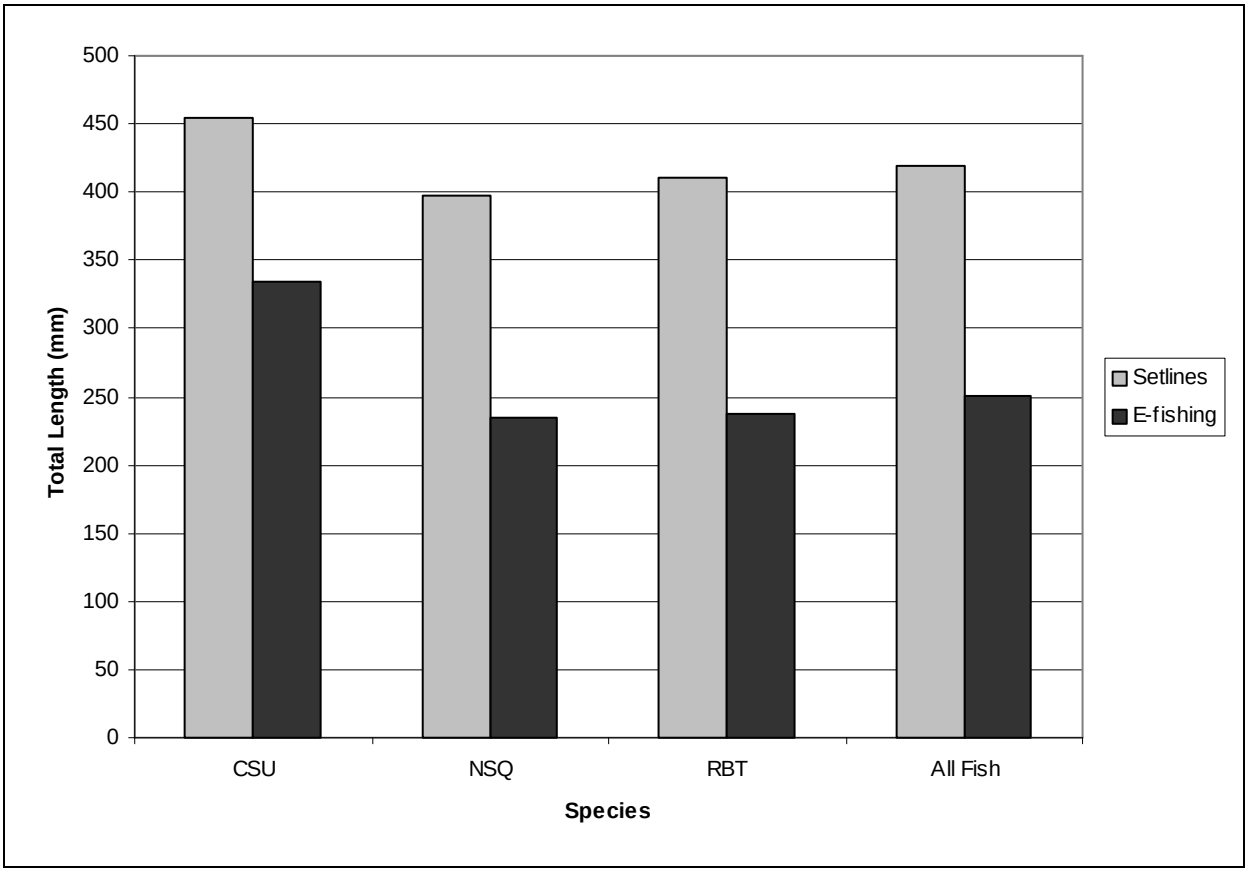

Figure 14. Comparison of mean total length of common fish species during 2009 MFWP setline data and 2007-2009 IDFG and MFWP electrofishing data.

White Sturgeon

The scute removal pattern of the first sturgeon (left 10th and 5th right) identified it as being from the 1995 brood year, released in 1997. 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 near the US-95 bridge at Bonner's Ferry, Idaho (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) and measured 610mm fork length, 710mm total length, and 1600g. The sex of this fish is unknown but the current age is 14 years. If the fish is male, it may be approaching sexual maturity based on previous information in the Kootenai River system as 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, the fish increased in fork length by 289mm and in total length by 335mm. The average growth rate during this period was 26.3mm/yr FL and 30.5mm/yr TL. In the one year between the 2008 and 2009 recapture events, this fish moved over 70 rkm upstream, showed only a 4-mm increase in length, and actually decreased in weight by approximately 100g.

The contrasting annual growth rate estimations 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 in the first sturgeon from 2008 to 2009 falls outside the observed range in Idaho of –10 to 268g/yr, Ireland et al. (2002) noted that relative weight (Wr) decreased between release and recapture for 77% of all recaptured hatchery sturgeon, and some measurement error as well as variable success of individual fish may have accounted for part of the highly variable range of growth. This fish also made a potentially energetically expensive 70-km upstream migration in one year between 2008 and 2009, possibly contributing to the decrease in weight.

The scute removal pattern of the second sturgeon (left 9th and 1st and 6th right) captured September 28, 2009 indicated that it was one of 26 individuals from the 2004 brood year that was released in Montana (upstream of rkm 275.0) on May 11, 2005 (KTOI 2007). Because no PIT tag was detected, specific information unique to this individual was unobtainable. Fish from this group had a mean fork length of 290mm and a mean weight of 190g at the time of release. In four-plus years this fish was at large, its fork length increased approximately 360mm and its weight increased by approximately 1450g.

Without a unique individual identification code to provide an exact length and weight at the time of release, the rate of growth for the second fish can only be estimated from the mean size of its cohort at time of release. In four years at large, this fish had an average annual growth rate around 90mm/yr FL and 315g/yr total weight. The growth estimate for fork length falls within the estimates of other hatchery white sturgeon, but the growth estimate for weight falls outside the ranges of growth observed in Idaho (Ireland et al. 2002). Growth estimates of the second sturgeon should be used with caution as the estimates were calculated from the mean size of the cohort and not the individual fish. Variability in growth between the two sturgeon collected in this study is an acknowledgment of the observed highly variable growth rates of these hatchery released fish.

With only two individuals captured in Montana in 2009, there is little that can be said definitively about the status of white sturgeon in the Montana reach of the Kootenai River. Both individuals were of hatchery origin and therefore we cannot determine that natural reproduction and recruitment are occurring in Montana at this time. However, we can assume that at least some individuals are using this section of the river for at least some portion of their life cycle. While no sturgeon were captured in the upstream portion of the study reach, anecdotal reports indicate that sturgeon are present in that section of the Kootenai River. With the apparent low population size of white sturgeon in Montana, catch per unit effort as well as the number of fish captured will likely be low.

The high variability in observed growth rates of the two sturgeon captured in 2009 does not lend itself to interpreting the environmental suitability for successful growth within the Montana reach of the Kootenai River. However, one significant piece of information gathered from the 2009 sampling was 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 documented making such a large (70 km) upstream migration into Montana. Three white sturgeon floy tagged by MFWP staff in the late 1970's have been captured in Idaho, one within

the past couple of years, indicating downstream connectivity exists between fish in Montana and Idaho. Upstream connectivity also exists with the new information collected during this report period.

Future collaboration with downstream study efforts and continued intensified sampling will hopefully elaborate on the currently sparse understanding of the status of white sturgeon in Montana, as well as the limiting factors concerning potential lack of reproductive success, poor recruitment to the adult population, and potentially slow growth of this unique population.

Recommendations

Based on the initial sampling results in 2009, sampling for white sturgeon should continue in the Kootenai River, Montana in 2010. Two white sturgeon were captured in 2009. Despite this small number, new critical information on white sturgeon movement in the Kootenai River was obtained. White sturgeon reared at and stocked from the Kootenai Tribe of Idaho hatchery are present in the Montana section of the Kootenai River. This indicates that they are capable of surviving in that section of the Kootenai River, however the true abundance of both hatchery and wild white sturgeon remains unknown at this time. No definitive information on objectives 2 and 3 could be determined due to the small sample size of white sturgeon collected in 2009. Increased 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 segment of the Kootenai River white sturgeon population. Sampling effort in 2010 may be intensified to include more setlines in the canyon section of the Kootenai River downstream of Kootenai Falls as well as more total line hours throughout the sample reach.

References Cited

Anders, P. J., S. C. Ireland, B. L. Marotz, and G. C Hoffman. 2008. White sturgeon. Montana AFS. Available http://www.fisheries.org/units/AFSmontana/WhiteSturgeon.html. (November 2009).

Apperson, K. A. 1992. Kootenai River white sturgeon investigations and experimental culture. Annual Progress Report FY1991. Idaho Department of Fish and Game Report to Bonneville Power Administration, Portland, Oregon.

Ireland, S. C., J. T. Siple, R. C. P. Beamesderfer, V. L. Paragamian, and V. D. Wakkinen. 2002. Success of hatchery-reared juvenile white sturgeon (*Acipenser transmontanus*) following release in the Kootenai River, Idaho. Journal of Applied Ichthyology 18: 642-650.

KTOI (Kootenai Tribe of Idaho). 2007. Kootenai River White Sturgeon Conservation Aquaculture Program, 1990-2007 (2nd Edition). Bonners Ferry, Idaho. Report edited by R. Beamesderfer and P. Anders, Cramer Fish Sciences.

MFWP (Montana Fish Wildlife and Parks). 2009. White Sturgeon — Acipenser transmontanus. Montana Field Guide. Retrieved on December 9, 2009, from http://FieldGuide.mt.gov/detail_AFCAA01050.aspx.

Northcote, T. C. 1973. Some impacts of man on Kootenay Lake and its salmonids. Great Lakes Fishery Commission, Technical Report 2, Ann Arbor, Michigan.

Paragamian, V.L., G. Kruse, and V. Wakkinen. 1997. Kootenai River Fisheries white sturgeon spawning and recruitment evaluation. Annual Report 1997. Idaho Department of Fish and Game and Bonneville Power Administration.

Paragamian, V. L. and G. Kruse. 2001. Kootenai River white sturgeon spawning migration behavior and a predictive model. North American Journal of Fisheries Management 21: 10-21.

Rust, P., and V. D. Wakkinen. 2004. Kootenai River white sturgeon spawning and recruitment evaluation. Idaho Department of Fish and Game, Annual Progress Report to the Bonneville Power Administration, Project 88-65, Boise, Idaho.

Wakkinen, V. D. 2009. Idaho Department of Fish and Game. Coeur d'Alene, Idaho. Personal correspondence. September 2009.

Appendices

Appendix 1. Summary of setline date, set time, bait, and location in the Kootenai River 2009.

Line #	Set Date	Set Time	Hours Set	Bait	Latitude	Longitude
1	6/4/2009	10:49	2.00	cut bait	48.44979	-115.81580
2	6/4/2009	11:10	1.92	cut bait	48.44860	-115.81454
3	6/4/2009	11:25	1.83	cut bait	48.44953	-115.81068
4	6/4/2009	11:40	1.83	cut bait	48.44913	-115.80488
5	6/4/2009	11:55	1.83	cut bait	48.44785	-115.80463
6	6/4/2009	12:10	1.83	cut bait	48.44842	-115.80148
7	6/17/2009	8:00	5.67	cut bait	48.44816	-115.81722
8	6/17/2009	8:10	5.67	cut bait	48.44954	-115.81479
9	6/17/2009	8:20	5.67	cut bait	48.44892	-115.81034
10	6/17/2009	8:30	5.58	cut bait	48.44908	-115.80438
11	6/17/2009	8:40	5.50	cut bait	48.44786	-115.80474
12	6/17/2009	8:50	5.50	cut bait	48.44862	-115.80171
13	6/23/2009	19:45	12.75	cut bait	48.44818	-115.81718
14	6/23/2009	19:55	12.75	cut bait	48.44912	-115.81497
15	6/23/2009	20:10	12.67	cut bait	48.44975	-115.81209
16	6/23/2009	20:20	12.67	cut bait	48.44951	-115.80987
17	6/23/2009	20:30	12.75	cut bait	48.44816	-115.80481
18	6/23/2009	20:40	12.92	cut bait	48.44825	-115.80388
19	7/1/2009	19:10	12.83	cut bait	48.44921	-115.81697
20	7/1/2009	19:20	12.92	cut bait	48.44542	-115.82712
21	7/1/2009	19:35	13.00	cut bait	48.44402	-115.86536
22	7/1/2009	19:45	13.00	cut bait	48.44520	-115.86642
23	7/1/2009	20:00	13.00	cut bait	48.44989	-115.87421
24	7/1/2009	20:10	13.08	cut bait	48.45134	-115.87501
25	7/8/2009	19:55	12.25	live bait	48.44488	-115.86397
26	7/8/2009	20:10	12.25	live bait	48.44823	-115.86829
27	7/8/2009	20:20	12.33	cut bait	48.45087	-115.87106
28	7/8/2009	20:30	12.33	cut bait	48.45027	-115.87554
29	7/8/2009	20:40	12.42	live bait	48.45328	-115.87708
30	7/8/2009	20:55	12.33	cut bait	48.45442	-115.87943
31	7/14/2009	7:30	9.17	cut bait	48.44820	-115.78941
32	7/14/2009	7:45	9.00	cut bait	48.44838	-115.79453
33	7/14/2009	7:55	9.00	cut bait	48.44849	-115.79429
34	7/14/2009	8:05	9.00	cut bait	48.44769	-115.79702
35	7/14/2009	8:15	9.00	cut bait	48.44690	-115.79953
36	7/14/2009	8:25	8.92	cut bait	48.44831	-115.80219
37	7/14/2009	17:40	14.58	cut bait	48.44727	-115.80159
38	7/14/2009	17:50	14.58	cut bait	48.44835	-115.80373
39	7/14/2009	18:00	14.67	cut bait	48.44814	-115.80463
40	7/14/2009	18:15	14.67	cut bait	48.44161	-115.85199
41	7/14/2009	18:25	14.67	cut bait	48.44480	-115.86412
42	7/14/2009	18:40	14.58	cut bait	48.26920	-115.52085
43	7/23/2009	16:10	16.00	worms	48.45137	-115.87560
44	7/23/2009	16:20	15.92	cut bait	48.45090	-115.87412
45	7/23/2009	16:30	15.92	cut bait	48.44995	-115.87400
46	7/23/2009	16:45	15.75	cut bait	48.45078	-115.87030
47	7/23/2009	17:00	15.75	cut bait	48.44487	-115.86328
48	7/23/2009	17:10	15.67	worms	48.44255	-115.86477
49	7/23/2009	17:25	15.67	cut bait	48.44233	-115.85315
50	7/23/2009	17:40	15.58	cut bait	48.44030	-115.83833
51	7/23/2009	17:55	15.50	cut bait	48.44543	-115.82882
52	7/23/2009	18:15	15.33	cut bait	48.44927	-115.81958
53	7/23/2009	18:25	15.25	cut bait	48.44777	-115.81850
54	7/23/2009	18:40	15.17	worms	48.44712	-115.80118
55	7/27/2009	16:50	17.00	cut bait	48.47443	-115.89067

Appendix 1 continued. Summary of setline date, set and pull time, bait, and location in the Kootenai River 2009.

Line #	Set Date	Set Time	Hours Set	Bait	Latitude	Longitude
56	7/27/2009	17:00	16.75	worms	48.47448	-115.89236
57	7/27/2009	17:10	16.42	cut bait	48.48051	-115.89574
58	7/27/2009	17:20	16.08	worms	48.48248	-115.89635
59	7/27/2009	17:30	15.75	worms	48.48352	-115.89867
60	7/27/2009	17:40	15.42	cut bait	48.48611	-115.89932
61	7/27/2009	17:50	15.08	cut bait	48.48751	-115.90099
62	7/27/2009	18:00	14.75	worms	48.48808	-115.90301
63	7/27/2009	18:10	14.42	cut bait	48.49802	-115.92725
64	7/27/2009	18:25	14.08	cut bait	48.50106	-115.93116
65	7/27/2009	18:30	13.92	cut bait	48.50222	-115.93231
66	7/27/2009	18:45	13.50	cut bait	48.50591	-155.94108
67	8/11/2009	10:55	6.00	worms	48.45091	-115.87682
68	8/11/2009	11:10	5.92	cut bait	48.44440	-115.86497
69	8/11/2009	11:25	5.83	cut bait	48.44103	-115.85774
70	8/11/2009	11:45	5.75	worms	48.44235	-115.84674
71	8/11/2009	12:00	5.67	cut bait	48.44367	-115.83109
72	8/11/2009	12:15	5.58	worms	48.44808	-115.81760
73	8/11/2009	18:20	15.25	worms	48.45942	-115.88315
74	8/11/2009	18:30	15.33	worms	48.46327	-115.88271
75	8/11/2009	19:15	14.92	cut bait	48.47319	-115.88940
76	8/19/2009	15:20	16.75	worms	48.57140	-115.97750
77	8/19/2009	15:30	16.75	cut bait	48.57068	-115.97833
78	8/19/2009	15:40	16.92	worms	48.57212	-115.97867
79	8/19/2009	15:55	16.67	cut bait	48.57280	-115.98174
80	8/19/2009	16:05	16.67	cut bait	48.57475	-115.98310
81	8/19/2009	16:15	16.58	worms	48.57616	-115.98247
82	8/19/2009	16:25	16.42	cut bait	48.57591	-115.98364
83	8/19/2009	16:35	16.58	cut bait	48.57698	-115.98331
84	8/19/2009	16:50	16.42	worms	48.57910	-115.98625
85	8/19/2009	17:00	16.50	cut bait	48.58147	-115.98695
86	8/19/2009	17:10	16.42	cut bait	48.58233	-115.98898
87	8/19/2009	17:25	16.33	worms	48.58368	-115.98856
88	8/26/2009	15:10	18.08	worms	48.58506	-115.99212
89	8/26/2009	15:20	18.08	cut bait	48.58461	-115.99203
90	8/26/2009	15:30	18.08	worms	48.58553	-115.99314
91	8/26/2009	15:40	18.08	cut bait	48.58614	-115.99520
92	8/26/2009	15:50	18.00	worms	48.58686	-115.99586
93	8/26/2009	16:00	18.00	cut bait	48.58823	-115.99759
94	8/26/2009	16:10	18.00	cut bait	48.58876	-116.00082
95	8/26/2009	16:20	18.00	worms	48.58997	-116.00187
96	8/26/2009	16:30	18.00	cut bait	48.59216	-116.00182
97	8/26/2009	16:40	18.00	worms	48.59156	-116.00383
98	8/26/2009	16:55	17.92	worms	48.59335	-116.00368
99	8/26/2009	17:05	17.83	cut bait	48.59494	-116.00742
100	8/31/2009	16:30	16.58	cut bait	48.59652	-116.00685
101	8/31/2009	16:45	16.50	cut bait	48.59590	-116.00903
102	8/31/2009	16:50	16.50	cut bait	48.59631	-116.00910
103	8/31/2009	17:05	16.42	cut bait	48.59686	-116.01261
104	8/31/2009	17:15	16.42	worms	48.59893	-116.01337
105	8/31/2009	17:25	16.42	worms	48.59990	-116.01648
106	8/31/2009	17:35	16.42	cut bait	48.60161	-116.01804
107	8/31/2009	17:45	16.42	cut bait	48.60170	-116.01953
108	8/31/2009	17:55	16.42	worms	48.60044	-116.02248
109	8/31/2009	18:05	16.58	worms	48.60158	-116.02237
110	8/31/2009	18:10	16.58	worms	48.60353	-116.02652

Appendix 1 continued. Summary of setline date, set and pull time, bait, and location in the Kootenai River 2009.

Line #	Set Date	Set Time	Hours Set	Bait	Latitude	Longitude
111	8/31/2009	18:20	16.58	worms	48.60490	-116.02675
112	9/9/2009	16:55	18.33	cut bait	48.60485	-116.02719
113	9/9/2009	17:05	17.92	worms	48.60503	-116.02795
114	9/9/2009	17:10	17.67	cut bait	48.60435	-116.02905
115	9/9/2009	17:20	17.08	worms	48.60632	-116.04510
116	9/9/2009	17:30	16.75	cut bait	48.60939	-116.04692
117	9/9/2009	17:45	16.25	worms	48.61653	-116.04721
118	9/9/2009	17:55	16.75	cut bait	48.60542	-116.03159
119	9/9/2009	18:05	17.33	worms	48.60210	-116.02320
120	9/9/2009	18:15	17.33	cut bait	48.60102	-116.02366
121	9/9/2009	18:25	17.33	worms	48.60034	-116.02246
122	9/9/2009	18:35	17.33	cut bait	48.60042	-116.02207
123	9/9/2009	18:45	17.33	worms	48.60181	-116.02023
124	9/28/2009	16:20	17.00	cut bait	48.56530	-115.97923
125	9/28/2009	16:30	17.00	cut bait	48.56450	-115.97932
126	9/28/2009	16:40	16.83	cut bait	48.56490	-115.98145
127	9/28/2009	16:50	16.92	worms	48.56339	-115.98048
128	9/28/2009	17:05	17.08	worms	48.56280	-115.98101
129	9/28/2009	17:20	17.08	cut bait	48.54530	-115.96854
130	9/28/2009	17:30	17.00	worms	48.54467	-115.96748
131	9/28/2009	17:45	17.25	worms	48.51842	-115.94286
132	9/28/2009	18:00	16.92	cut bait	48.52396	-115.94303
133	9/28/2009	18:10	16.58	cut bait	48.52396	-115.94547
134	9/28/2009	18:20	16.33	worms	48.53112	-115.95192
135	9/28/2009	18:35	16.00	worms	48.53286	-115.95545

Appendix 2. Summary of fish caught on setlines while sampling for white sturgeon in the Kootenai River in 2009.

Line #	Set Date	Set Time	Hours Fished	Hook	Bait	Species	Length (mm)	Weight (g)
3	6/4/2009	11:25	1.83	4/0	cut bait	NSQ	383	
8	6/17/2009	8:10	5.67	6/0	cut bait	NSQ	519	
9	6/17/2009	8:20	5.67	6/0	cut bait	NSQ	508	
17	6/23/2009	20:30	12.75	6/0	cut bait	DV	790	3755
17	6/23/2009	20:30	12.75	8/0	cut bait	RBT	320	315
24	7/1/2009	20:10	13.08	4/0	cut bait	NSQ	550	
24	7/1/2009	20:10	13.08	6/0	cut bait	NSQ	431	
25	7/8/2009	19:55	12.25	4/0	live bait	NSQ	469	
25	7/8/2009	19:55	12.25	6/0	live bait	NSQ	620	
25	7/8/2009	19:55	12.25		live bait	NSQ	escaped	
26	7/8/2009	20:10	12.25	4/0	live bait	NSQ	320	
26	7/8/2009	20:10	12.25	4/0	live bait	NSQ	365	
26	7/8/2009	20:10	12.25	4/0	live bait	RBT	399	
26	7/8/2009	20:10	12.25	6/0	live bait	NSQ	448	
26	7/8/2009	20:10	12.25	8/0	live bait	NSQ	372	
27	7/8/2009	20:20	12.33	6/0	cut bait	NSQ	355	
29	7/8/2009	20:40	12.42	4/0	live bait	NSQ	446	
29	7/8/2009	20:40	12.42	6/0	live bait	NSQ	369	
30	7/8/2009	20:55	12.33	4/0	cut bait	NSQ	440	
35	7/14/2009	8:15	9.00	8/0	cut bait	NSQ	530	
37	7/14/2009	17:40	14.58	4/0	cut bait	RBT	335	325
38	7/14/2009	17:50	14.58	8/0	cut bait	DV	745	4150
43	7/23/2009	16:10	16.00	2/0	worms	NSQ	270	
47	7/23/2009	17:00	15.75	3/0	cut bait	CSU	415	
47	7/23/2009	17:00	15.75	3/0	cut bait	NSQ	397	
48	7/23/2009	17:10	15.67	2/0	worms	CSU	456	
48	7/23/2009	17:10	15.67	2/0	worms	CSU	470	
48	7/23/2009	17:10	15.67	3/0	worms	CSU	490	
48	7/23/2009	17:10	15.67	3/0	worms	CSU	497	
51	7/23/2009	17:55	15.50	8/0	cut bait	NSQ	507	
52	7/23/2009	18:15	15.33	2/0	cut bait	NSQ	331	
53	7/23/2009	18:25	15.25	3/0	cut bait	NSQ	498	
54	7/23/2009	18:40	15.17	2/0	worms	CSU	300	
54	7/23/2009	18:40	15.17	3/0	worms	NSQ	260	
55	7/27/2009	16:50	17.00	3/0	cut bait	MWF	355	
55	7/27/2009	16:50	17.00	4/0	cut bait	RBT	450	810
55	7/27/2009	16:50	17.00	6/0	cut bait	CSU	475	
55	7/27/2009	16:50	17.00	6/0	cut bait	NSQ	430	
56	7/27/2009	17:00	16.75	2/0	worms	CSU	431	
56	7/27/2009	17:00	16.75	2/0	worms	NSQ	260	
56	7/27/2009	17:00	16.75	3/0	worms	CSU	492	
59	7/27/2009	17:30	15.75	4/0	worms	CSU	443	
59	7/27/2009	17:30	15.75	4/0	worms	CSU	470	
59	7/27/2009	17:30	15.75	4/0	worms	NSQ	281	

Appendix 2 continued. Summary of fish caught on setlines while sampling for white sturgeon in the Kootenai River in 2009.

Line #	Set Date	Set Time	Hours Fished	Hook Size	Bait	Species	Length (mm)	Weight (g)
60	7/27/2009	17:40	15.42	6/0	cut bait	WCT	370	449
60	7/27/2009	17:40	15.42	8/0	cut bait	NSQ	340	
60	7/27/2009	17:40	15.42	8/0	cut bait	NSQ	422	
61	7/27/2009	17:50	15.08	4/0	cut bait	NSQ	325	
61	7/27/2009	17:50	15.08	6/0	cut bait	NSQ	440	
62	7/27/2009	18:00	14.75	2/0	worms	CSU	510	
62	7/27/2009	18:00	14.75	2/0	worms	NSQ	235	
62	7/27/2009	18:00	14.75	3/0	worms	NSQ	346	
62	7/27/2009	18:00	14.75	4/0	worms	CSU	470	
62	7/27/2009	18:00	14.75	4/0	worms	CSU	515	
65	7/27/2009	18:30	13.92	3/0	cut bait	CRC	255	
65	7/27/2009	18:30	13.92	4/0	cut bait	NSQ	438	
66	7/27/2009	18:45	13.50	3/0	cut bait	NSQ	430	
66	7/27/2009	18:45	13.50	4/0	cut bait	NSQ	322	
67	8/11/2009	10:55	6.00	2/0	worms	NSQ	315	
68	8/11/2009	11:10	5.92		cut bait	NSQ	405	
73	8/11/2009	18:20	15.25	4/0	worms	CSU	447	
74	8/11/2009	18:30	15.33	3/0	worms	NSQ	290	
74	8/11/2009	18:30	15.33	3/0	worms	NSQ	398	
74	8/11/2009	18:30	15.33	4/0	worms	NSQ	250	
75	8/11/2009	19:15	14.92	6/0	cut bait	RBT	360	434
76	8/19/2009	15:20	16.75	2/0	worms	NSQ	567	
76	8/19/2009	15:20	16.75	2/0	worms	RBT	425	666
76	8/19/2009	15:20	16.75	3/0	worms	CSU	440	
76	8/19/2009	15:20	16.75		worms	CSU	esc	
78	8/19/2009	15:40	16.92	4/0	worms	NSQ	290	
78	8/19/2009	15:40	16.92	4/0	worms	NSQ	530	
78	8/19/2009	15:40	16.92	4/0	worms	NSQ	603	
81	8/19/2009	16:15	16.58	2/0	worms	RBT	355	370
82	8/19/2009	16:25	16.42	8/0	cut bait	NSQ	490	
84	8/19/2009	16:50	16.42	2/0	worms	NSQ	326	
84	8/19/2009	16:50	16.42	2/0	worms	NSQ	598	
84	8/19/2009	16:50	16.42		worms	NSQ	escaped	
86	8/19/2009	17:10	16.42	3/0	cut bait	NSQ	372	
86	8/19/2009	17:10	16.42	3/0	cut bait	NSQ	375	
88	8/26/2009	15:10	18.08	3/0	worms	NSQ	224	
90	8/26/2009	15:30	18.08	2/0	worms	NSQ	234	
90	8/26/2009	15:30	18.08	2/0	worms	NSQ	417	
92	8/26/2009	15:50	18.00	2/0	worms	NSQ	456	
93	8/26/2009	16:00	18.00	2/0	cut bait	NSQ	418	
95	8/26/2009	16:20	18.00		worms	RBT	380	482
96	8/26/2009	16:30	18.00		cut bait	NSQ	escaped	
97	8/26/2009	16:40	18.00	2/0	worms	NSQ	352	
98	8/26/2009	16:55	17.92	2/0	worms	NSQ	325	

Appendix 2 continued. Summary of fish caught on setlines while sampling for white sturgeon in the Kootenai River in 2009.

Line #	Set Date	Set Time	Hours Fished	Hook	Bait	Species	Length (mm)	Weight (g)
104	8/31/2009	17:15	16.42	3/0	worms	CSU	475	
104	8/31/2009	17:15	16.42	3/0	worms	RBT	265	180
104	8/31/2009	17:15	16.42		worms	RBT	345	367
108	8/31/2009	17:55	16.42	3/0	worms	WTSTRG	714	1488
109	8/31/2009	18:05	16.58	3/0	worms	CSU	404	
109	8/31/2009	18:05	16.58	3/0	worms	NSQ	460	
110	8/31/2009	18:10	16.58	2/0	worms	NSQ	458	
110	8/31/2009	18:10	16.58	2/0	worms	NSQ	463	
110	8/31/2009	18:10	16.58	3/0	worms	NSQ	355	
110	8/31/2009	18:10	16.58	3/0	worms	NSQ	432	
110	8/31/2009	18:10	16.58	3/0	worms	NSQ	510	
116	9/9/2009	17:30	16.75	3/0	cut bait	NSQ	300	
116	9/9/2009	17:30	16.75	3/0	cut bait	RBT	322	281
117	9/9/2009	17:45	16.25	2/0	worms	CSU	453	
117	9/9/2009	17:45	16.25	3/0	worms	CSU	433	
117	9/9/2009	17:45	16.25	3/0	worms	CSU	515	
117	9/9/2009	17:45	16.25		worms	CSU	escaped	
121	9/9/2009	18:25	17.33	2/0	worms	NSQ	256	
122	9/9/2009	18:35	17.33	8/0	cut bait	RBT	332	302
123	9/9/2009	18:45	17.33	2/0	worms	NSQ	334	
123	9/9/2009	18:45	17.33	2/0	worms	NSQ	347	
123	9/9/2009	18:45	17.33	2/0	worms	RBT	290	225
126	9/28/2009	16:40	16.83	2/0	cut bait	RBT	375	530
126	9/28/2009	16:40	16.83	2/0	cut bait	RBT	402	562
127	9/28/2009	16:50	16.92	2/0	worms	NSQ	537	
127	9/28/2009	16:50	16.92	2/0	worms	WTSTRG	751	1543
127	9/28/2009	16:50	16.92	3/0	worms	CSU	513	
127	9/28/2009	16:50	16.92		worms	CSU	escaped	
131	9/28/2009	17:45	17.25	2/0	worms	CSU	451	
131	9/28/2009	17:45	17.25	3/0	worms	CSU	460	
131	9/28/2009	17:45	17.25	3/0	worms	CSU	465	
131	9/28/2009	17:45	17.25	3/0	worms	CSU	482	
131	9/28/2009	17:45	17.25	3/0	worms	CSU	540	
132	9/28/2009	18:00	16.92		cut bait	RBT	315	311
133	9/28/2009	18:10	16.58	3/0	cut bait	RBT	310	268