WHITE STURGEON MITIGATION AND RESTORATION IN THE COLUMBIA AND SNAKE RIVERS UPSTREAM FROM BONNEVILLE DAM

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Edited By:

Michael W. Lovejoy
Philip Simpson
Oregon Department of Fish and Wildlife
Clackamas, Oregon, USA

In Cooperation With:
Columbia River Inter-Tribal Fish Commission
Washington Department of Fish and Wildlife

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EXECUTIVE SUMMARY

We report on our progress from January through December 2021 on determining the status of White Sturgeon populations and effects of mitigation measures on productivity in the Columbia River downstream from McNary Dam to Bonneville Dam. The study is a cooperative effort by the Oregon Department of Fish and Wildlife (ODFW; Report A), Washington Department of Fish and Wildlife (WDFW; Report B), and Columbia River Inter-Tribal Fish Commission (CRITFC; Report C). This report also serves as the study's annual technical report on Bonneville Power Administration funded Research, Monitoring and Evaluation (RM&E) projects.

This is a multi-year study with many objectives requiring more than one year to complete; therefore, findings from a given year may be part of past reports or alternatively, may be part of more significant findings that are yet to be reported. Highlights of the 2021 results are:

Report A

- Overall abundance of White Sturgeon >54 cm Fork Length (FL) decreased 13% from 248,772 to 215,650 in the bonneville Reservoir from 2018 – 2021.

- Abundance of legal-size fish (110 – 137 cm FL) increased from 2018 (n = 8,222) to 2021 (n = 10,063).

- Condition (relative weight) increased for all size classes except for juveniles (< 70 cm FL) from 2018 – 2021. Relative weight across all classes increased from 93.4 to 103.6 throughout the same period.

- Age-0 recruitment was only detected in Bonneville Reservoir (n=8).

Report B

- The number of White Sturgeon retention days in 2021 was 7 in Bonneville Reservoir, 4 in The Dalles Reservoir, and 77 in John Day Reservoir.

- Sturgeon sport harvest estimates were 655 (131% of 500 fish guideline) for Bonneville Reservoir, 235 (124% of 190 fish guideline) for The Dalles Reservoir, and 98 (93% of 105 fish guideline) for John Day Reservoir.

- There were 1,381 angler trips in Bonneville Reservoir, 1,778 in The Dalles Reservoir, and 5,433 in John Day Reservoir.

- Oversize catch in Bonneville Reservoir was 0.2% of the 2021 oversize abundance estimate and 0.4% of total 2021 sturgeon catch (oversize catch is not monitored outside of retention seasons). In The Dalles Reservoir, oversize catch was 1.1% of the 2020 oversize abundance estimate, and 4.4% of total 2021 sturgeon catch. In John Day Reservoir, oversize catch was 0.6% of the 2019 oversize abundance estimate, and 20.4% of total 2021 sturgeon catch.

Report C

- Tagging efforts in Bonneville Reservoir captured in 3,640 White Sturgeon in 260 overnight gillnet sets, a catch per unit effort (CPUE) of 14 sturgeon per set. Captured fish ranged from 24 – 234 cm fork length (FL), with a mean length of 89.0 cm FL.

- There was a increase in catch rate from the 2017-18 sampling period to the 2020-21 sampling period (5.2 fish per set v. 14.0 fish per set).

- The mean fork length of fish caught in 2020-21 was 89.0 cm FL compared to 74.9 cm FL in 2017-18, a 14.1 cm increase.

- The proportion of legal sturgeon increased from 7.4% (2017-18) to 29.3% (2020-21) as well as the proportion of over-sized sturgeon from 0.4% (2017-18) to 7.0% (2020-21). Proportions of sublegal sturgeon sampled decreased from 91.9% (2017-18) to 70.0% (2020-21).

WHITE STURGEON MITIGATION AND RESTORATION IN THE COLUMBIA AND SNAKE RIVERS UPSTREAM FROM BONNEVILLE DAM

ANNUAL PROGRESS REPORT

JANUARY – DECEMBER 2021

Report A

Evaluate the success of developing and implementing a management plan for enhancing production of White Sturgeon in reservoirs between Bonneville and McNary Dams

This report includes: 1) An update of abundance, life history parameters, and population dynamics of White Sturgeon in The Bonneville Reservoir.

2) A summary of annual recruitment of age-0 White Sturgeon in three Columbia River reservoirs.

Prepared By:

Michael Lovejoy
Shelley K Tattam
Colin G. Chapman

Oregon Department of Fish and Wildlife
17330 SE Evelyn St.
Clackamas, Oregon, USA

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ABSTRACT

This report summarizes data collected from 1 January 2021 through 31 December 2021 and provides: 1) an update of abundance, life history parameters, and population dynamics for White Sturgeon *Acipenser transmontanus* in Bonneville Reservoir and 2) an evaluation of annual recruitment of age-0 White Sturgeon in three lower impounded Columbia River reservoirs.

Sampling to estimate the abundance of White Sturgeon in Bonneville Reservoir was a cooperative effort among staff from the Oregon Department of Fish and Wildlife (ODFW), the Columbia River Inter-Tribal Fish Commission (CRITFC), Yakima Nation (YN), and the Washington Department of Fish and Wildlife (WDFW). The estimated abundance of White Sturgeon ≥ 54 cm FL in Bonneville Reservoir in 2021 was 215,650 (95% CI: 180,388-268,048), a 13% decrease from the 2018 estimate. Although the abundance estimate of legal sized fish (96-137 cm FL) increased since 2018, the greatest decrease in abundance estimates was observed in sub legal size class (54 – 70 cm FL). The overall mean relative weight of White Sturgeon in Bonneville Reservoir increased to 103.3, which is the second highest level on record. Condition has increased for all size classes since the previous stock assessment conducted in 2018. Information from recaptured individuals has indicated that somatic growth has increased on average by 10% across all size classes.

We assessed recruitment of age-0 White Sturgeon in Bonneville, The Dalles, and John Day Reservoirs during October 2021. Recruitment was only detected in Bonneville Resevoir, although Ep and CPUE has decreased from prior years. This is the first year since 2016 in which there was no observed recruitment in The Dalles Reservoir. Over the past 25 years (1997 – 2021) there has been measurable recruitment only 9 times in the John Day Resevoir, the most recent occurring in 2019. The lack of measurable recruitment in both The Dalles and John Day Resevoirs may be attributed to flow conditions that were below the levels considered desirable for spawning. The John Day Resevoir continues to be an area of concern with prolonged periods of no Age-0 recruitment. With this being evident, even during years with desirable flows, it must be considered that other environmental and ecological factors may influence spawner response in this reservoir.

Adaptive management actions include increasing harvest guidelines in Bonneville Reservoir from 1,000 to 1,350 for the 2022 – 2024 period and integrating most recent growth rate data (2018 – 2021) into population abundance models. Implementation of the most recent data available will prevent overestimatation of future legal-size abundance, over-exploitation, and reduced escapement to the broodstock population. Also, further study of the hydraulic conditions and habitat below McNary Dam may help identify factors that limit White Sturgeon growth, condition and recruitment in years with adequate flow.

INTRODUCTION

White Sturgeon *Acipenser transmontanus* is the largest species of North American sturgeon and is found from southern California to the Gulf of Alaska (Scott and Crossman 1973). White Sturgeon inhabit approximately 1,600 kilometers of the main stem Columbia River from the estuary to Idaho and Canada. Overharvest during the late 1800s resulted in substantial population declines, meriting the first protections placed on sturgeon harvest within the Columbia and Snake River systems. In 1899, Oregon and Washington state agreed to extended seasonal closures as well as a minimum size limit for harvested fish (Craig and Hacker 1940). By the 1950s, White Sturgeon abundance had increased enough to support limited commercial and recreational fisheries. Declining harvest opportunities for anadromous salmon *Oncorhynchus spp.* at this time led to increased angler participation in the White Sturgeon fishery. Harvest of White Sturgeon doubled in the 1970s and again in the 1980s (Tracy 1993). In 1986, ODFW and other state, tribal and federal agencies began long-term monitoring of sturgeon populations in the impounded lower Columbia River reservoirs (ILCRR), from Bonneville Dam to the mouth of the Snake River. This monitoring work was intended to develop a better understanding of White Sturgeon population dynamics and aid in developing appropriate management and mitigation actions to maintain and enhance White Sturgeon populations.

Project goals have evolved over time as new information becomes available. The current focus of this project is to implement and evaluate measures (i.e., harvest closures, catch quotas, size limits, and sanctuaries) to protect and enhance White Sturgeon populations, and to mitigate for effects of the Federal Columbia River Power System (FCRPS) on production of White Sturgeon in the ILCRR.

To assess the productivity of White Sturgeon populations, abundance and recruitment are measured throughout the ILCRR. Stock assessments have been conducted on a three-year rotation (one reservoir per year) since 2001 to evaluate White Sturgeon abundance and population dynamics. These data are critical for assessing management and mitigation approaches. Recruitment of age-0 White Sturgeon is monitored in each reservoir annually to evaluate the relative success of spawning. This information has helped identify recruitment trends over time within individual reservoirs.

This report summarizes work performed from 1 January 2021 through 31 December 2021 for the Bonneville Power Administration Project 1986-050-00. During this period, staff from the Oregon Department of Fish and Wildlife (ODFW), the Columbia River Inter-Tribal Fish Commission (CRITFC), Yakima Nation (YN), and the Washington Department of Fish and Wildlife (WDFW) collaborated on two large scale efforts to assess White Sturgeon populations in the impounded reaches of the lower Columbia River upstream from Bonneville Dam:

1) From 24 May through 19 August 2021 we sampled for White Sturgeon in Bonneville Reservoir to update information on abundance, growth, survival, and condition.

2) During October 2021 we sampled for age-0 White Sturgeon in Bonneville, The Dalles, and John Day reservoirs to assess the relative annual spawning success in these reservoirs.

METHODS

Stock Assessment

Sampling for White Sturgeon in Bonneville Reservoir was divided into three periods. Sampling during the winter marking period (period 1) took place from 7 December 2020 through 21 January 2021. During this time, Tribal commercial fishers, contracted by CRITFC staff, used gill nets distributed throughout the reservoir to capture White Sturgeon (see Report C for details regarding Tribal gill net methodology). Sampling during the summer recapture periods took place from 24 May through 24 June 2021 (period 2), and from 26 July though 19 August 2021 (period 3) and involved staff from Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Columbia River Inter-Tribal Fish Commission, and Yakima Nation. Bonneville Reservoir was divided into eight sections (Figure A-1) with each section approximately 9 km in length (boat restricted zones were not sampled). Sampling effort was distributed equally throughout the reservoir, with all sections being sampled during each period. During periods 2 and 3, setlines were used to capture White Sturgeon (see Elliot and Beamesderfer 1990) as documented in Method ID 784 available at monitoringresources.org. Setlines were deployed on Mondays, then checked and reset on Tuesdays and Wednesdays. All gear was checked and removed from the water on Thursdays.

Biological data collected from captured White Sturgeon included fork length, weight, disposition (i.e., alive, dead, sacrificed), and the presence of pectoral fin and/or scute removal scars (Method ID 2781). If a White Sturgeon has a PIT tag applied, the second movable lateral scute from the left side of the fish was removed. This external mark helps aid in identifying previously tagged fish in future stock assessments. This process was applied to all captured White Sturgeon, regardless of the presence of other external marks and tags, unless the second lateral scute was removed prior. In addition, during sampling activities that take place on Tuesdays, Wednesdays, and Thursdays, a small tissue sample is taken from all fish under 50 cm FL and over 136 cm FL for genetic analysis.

The relationship between length (L) and weight (W) was described by the exponential function, $W = a*L^b$ (Method ID 5554). The condition of White Sturgeon in Bonneville Reservoir was assessed using relative weight (W_r) (Method ID 4038). The standard weight equation for White Sturgeon, $W_s = 2.735\ E\text{-}6*L^{3.232}$, was obtained from Beamsderfer (1993). Annual growth increments (AGI) for White Sturgeon in Bonneville Reservoir were obtained from recaptures of PIT tagged fish (Method ID 2782).

Overall abundance (N) of White Sturgeon in Bonneville Reservoir in 2021 was estimated using a Schnabel population estimator (Schnabel 1938; Chapman 1952, 1954) (Method ID 780). However, the total number of marked fish at the start of a given period was adjusted to account for removals of PIT-tagged fish via sport and commercial fisheries.

The Schnabel estimator was first used to estimate the abundance of sturgeon in the 70 – 109 cm FL size class. The length-frequency distribution of the 2021 setline catch was then used to apportion the Schnabel estimates by 1 cm increments. The abundance estimate was then expanded to estimate abundance of the remaining two size groups (< 70 cm FL and ≥ 110 cm FL) based on the relative frequency of the 2021 setline catch after adjusting for gear selectivity. In 2019 a new setline selectivity curve was derived using empirical data from the last 19 years of mark-recapture sampling in the ILCRR. Confidence intervals for expanded abundance estimates were calculated using the delta method (Dorfman 1938).

Age-0 Indexing

During October 2021, staff from ODFW, WDFW, and YN conducted sampling in Bonneville, The Dalles, and John Day reservoirs to evaluate annual recruitment of age-0 White Sturgeon (Figure A-2) (Method ID 376). Sampling took place in John Day Reservoir from 4 – 8 October, in the Dalles Reservoir from 11 – 14 October, and in Bonneville Reservoir from 18 – 21 October.

Sinking gill nets were used to capture age-0 White Sturgeon (Method ID 787). A single gill net was deployed at predetermined, standard sites within each reservoir. Sampling methodology and locations were consistent with past years.

Biological data from White Sturgeon captured during age-0 indexing were collected as detailed above in the Stock Assessment section (Method ID 2781). Ages of captured White Sturgeon were estimated following procedures outlined in Beamsderfer et al. (1989) (Method ID 2782).

To assess annual recruitment, both the proportion of positive efforts (E_p; proportion of all sets that captured at least one sturgeon; Method ID 3783) and the catch-per-unit-effort (CPUE; number of White Sturgeon caught per set; Method ID 5257) were calculated.

RESULTS

Stock Assessment

Effort and Catch

During period 1, Tribal commercial fishers set 260 gill nets in Bonneville Reservoir and caught a total of 3,639 White Sturgeon, of which 2977 (82%) were PIT-tagged. During periods 2 and 3, staff from ODFW, WDFW, and YN set 443 setlines in Bonneville Reservoir and caught a total of 4,469 White Sturgeon (Table A-1), of which 3,852 (86%) received a PIT-tag. Overall, a total of 8,112 White Sturgeon were captured during all sampling periods with 6,829 (84%) receiving a PIT-tag.

White Sturgeon were captured in all reservoir sections within Boneville Reservoir (Figure A-1). For periods 2 and 3, there was an average catch of 648 White Sturgeon per section. For all sections and weeks combined (periods 2 and 3), CPUE was 11.1 White Sturgeon per setline (Table A-1). CPUE was lowest in both the forebay and tailrace sections (sections 1 and 8) compared to the rest of the reservoir (Table A-1).

Size Structure, Growth and Condition

White Sturgeon captured in Bonneville Reservoir using setlines ranged in length from 43 - 276 cm FL, with a median length of 77 cm FL. The length distribution of the setline catch was: 38.9% ≤ 70 cm FL, 50.8% 71 – 95 cm FL, 7.2% 96 – 109 cm FL, 3.5% 110 − 137 cm FL, 0.2% 138 – 166 cm FL, and 0.4% greater than 167 cm FL. Three White Sturgeon were released without obtaining fork length measurements.

Weights of White Sturgeon in Bonneville Reservoir ranged from 0.5 – 105 kg, with a median weight of 5.3 kg. The relationship between fork length (L) and weight (W) was described by the exponential function (Figure A-4):

$$W = 3.00E-6 * L^{3.17}$$

Relative weights of White Sturgeon ranged from 43.4 – 229.7, with a median relative weight of 103.3 (Figure A-4).

Abundance

The estimated abundance of White Sturgeon (≥ 54 cm FL) in Bonneville Reservoir during 2021 was 215,650 (95% CI: 180,388 – 268,048); Table A-3). The estimated abundance of legally harvestable White Sturgeon (96 - 137 cm FL) was 10,063 (95% CI: 8,277-12,834; Table A-3). Additional size-specific abundance estimates of White Sturgeon in Bonneville Reservoir from 1999 – 2021 are provided in Figure A-8. Abundance estimates of White Sturgeon in each of the impounded lower Columbia River reservoirs and the Hanford reach of McNary Reservoir from 1987 – 2021 are presented in Table A-7.

Age-0 Indexing

During age-0 indexing, in all reservoirs combined, 58 White Sturgeon were captured in 115 net sets for an average CPUE of 1.98 fish per set (Table A-5). Of the 58 White Sturgeon captured, 8 were age-0, the other 50 White Sturgeon were Age-1 or older. Age-0 White Sturgeon were only captured in Bonneville Reservoir (Table A-5). Captured White Sturgeon ranged in length from 22.3 – 96, all age-0 White Sturgeon were ≤ 30.0 cm FL with a mean FL = 26.4 cm (range: 22.3 – 29.5) (Figure A-7). We applied a total 46 (79% of the total catch) PIT-tags to White Sturgeon captured from Bonneville, The Dalles, and John Day Reservoirs in 2021. No sturgeon < 40.0 cm FL received a PIT-tag. Incidental catch of other fish species during age-0 sampling is presented in Table A-8.

John Day Reservoir

A total of 1 White Sturgeon was captured in 40 net-sets in 2021. The single White Sturgeon captured, was not classified as age-0. White Sturgeon of any size were captured in 2.5% of the sets. The CPUE was 0.03 for all White Sturgeon and 0.0 for age-0 White Sturgeon (Table A-5).

The Dalles Reservoir

A total of 7 White Sturgeon were captured in 40 net-sets in 2021. Of the 7 White Sturgeon captured, 0 were classified as age-0. White Sturgeon (of any size) were captured in 17.5% of the sets. CPUE was 0.19 for all White Sturgeon and 0.0 for age-0 White Sturgeon (Table A-5).

Bonneville Reservoir

A total of 50 White Sturgeon were captured in 39 net-sets in 2021. Of the 50 White Sturgeon captured, 8 were classified as age-0. White Sturgeon (of any size) were captured in 59% of the sets, while age-0 White Sturgeon were captured in 18% of the sets. The CPUE was 1.28 for all White Sturgeon and 0.21 for age-0 White Sturgeon (Table A-5).

DISCUSSION

Stock Assessment

The 2021 estimated abundance of White Sturgeon in Bonneville Reservoir was 215,650. This is a 13% decrease from the previously estimated abundance in 2018 (n = 248,772). Despite this decrease, the 2021 estimate marks the fourth highest estimate since the study begain in 1999 (Table A-3). Increases were observed in five of the seven size class structures in which all sturgeon are distributed. The greatest increase occurred within fish that measure inside the legal size slot for sturgeon retention (96 – 137 cm FL) with a 22% increase from the 2018 stock assessment. It is also noteworthy the fish within this size class accounted for 10% of the total setline catch. During the previous two stock assessments in Bonneville Reservoir (2015 and 2018), legal-size fish accounted for 3% and 7% of the setline catch, respectively. The continual increase of fish into the legal size class can be attributed to the large recruitment classes of the late 1990s. Figure A-8 visibly demonstrates the movement of fish through size classes over time, while annual recruitment is demonstrated on Figure A-9. These figures show the large recruitment class from the late 1990s growing into the legal slot, and years of poor to adequate recruitment leading to lower abundance of all smaller size classes. The estimated abundance of adult White Sturgeon (≥ 167 cm FL) increased by 17% (n = 4,070) from 2018 levels (Table A-3). However, due to relatively low encounter rates for adult White Sturgeon, coupled with the expansion technique used to generate the abundance estimate, this estimate is extremely sensitive to small changes in catch. Therefore, it may be more appropriate to consider trends in abundance indices for these fish, rather than the point estimate of abundance. Monitoring this trend is becoming increasingly important to ensure an adequate number of broodstock are available to produce measurable age-0 recruitment when conditions become favorable.

The largest decrease in population estimate occurred in the sub-adult size class (138 – 166 cm FL)—a difference of 191 fish (37.0% decrease) from the 2018 estimate (Table A-3). This was the lowest estimated abundance within this size class since 2009. This decrease is likely due to fish growth and movement into the adult size class. The other decrease in population abundance across size classes occurred in the juvenile group, 54 – 70 cm FL. With a current estimate of 125,758, this is a decrease of nearly 36,000 juveniles (13.3%) from the 2018 stock assessment estimates (Table A-3). While these shifts can be attributed to movement into larger size classes and intermittent periods of poor recruitment, this population is susceptible to the same population estimate sensitivities as adult fish due to gear selectivity.

Estimation of population abundance is an important measurement tool to monitor the overall sustainability of a population, but other factors must be considered when looking at the complete health of a population. Indicators of body condition, such as relative weight, as well as annual growth, provide an indirect means of evaluating ecological relations and the effects of management strategies, especially when making size-specific comparisons within or among populations. This is especially relevant in closed systems such as reservoirs where natural mobility and food availability may be truncated. The mean annual growth rate of White Sturgeon in Bonneville Reservoir over the last three stock assessments, 2015 – 2021, has decreased compared to the mean annual growth rate over the entirety of the study, 1988 – 2021 (Figure A-6). The overall condition of White Sturgeon in Bonneville Reservoir is measured using a relative weight index. An index valaue of 100 represents a physical condition considered slightly better than the average condition of all White Sturgeon populations along the Pacific coast of North America. For most size classes of White Sturgeon from Bonneville Reservoir, mean relative weights determined from the 2021 stock assessment where the highest observed since 1994 (Table A-5).

Information from recaptured individuals has indicated that somatic growth has increased in recent stock assessments. While mean growth rates over long term periods are informative, growth rates of juvenile and sub-adult white sturgeon from Zone 6 reservoirs can very substantially over time. Reliability on growth rates for estimating future legal size abundance can lead to an over estimation of fish populations within the larger class sizes. If growth rate is to be used as a factor to estimate population abundance across size classes, only recent data should be used within the matrix growth model to forecast White Sturgeon forward in time. Doing so will prevent overestimation of abundance and limit exploitation of legal size populations when considering harvest guidelines and future recruitment needs, ensuring adequate numbers of adult size broodstock.

Age-0 Indexing

During 2021, recruitment of age-0 White Sturgeon was detected in Bonneville Reservoir but not The Dalles or John Day Reservoirs. This is only the third time since 2004 that The Dalles Reservoir has produced no detectable recruitment and only the fifth time since recruitment measurements began in 1997 (Table A-6). Since 2012, we have only captured one (2019) age-0 White Sturgeon in the John Day Reservoir. John Day Reservoir also went through a six-year period where no recruitment was detected from 2000 – 2005 (Table A-6). Although age-0 White Sturgeon were captured in Bonneville Reservoir, both E_p and CPUE were low. A principle factor related to successful spawning years is adequate dam discharge into the reservoirs during the spring. It has been determined that successful spawning occurs when flows are at a minimum of 250 kcfs. This relationship can be seen in Figure A-9. The 2021 spring discharge levels averaged 200 kcfs, providing further evidence that a positive correlation between discharge and spawning success exists. When considering the steady decline in overall E_P and CPUE in all reservoirs, other environmental factors should also be considered. White Sturgeon are sensitive to changes in the environment, most notably water temperature. During the late spring of 2021, the likely period of peak spawning, Oregon suffered through several periods of above average temperatures. The increased periods of warming likely negatively affected spawning success in congruence with the low discharge levels.

Adaptive Management & Lessons Learned

The Stock Assessments conducted in Bonneville Reservoir in 2021 indicated that the overall abundance of White Sturgeon (≥ 54 cm FL) has decreased since the previous stock assessment in 2018, despite an overall increase in all size classes except within sub-adult and juveniles size classes. There was 17% increase in the adult size class which will benefit future development of broodstock and subsequent recruitment. The increase in legal size fish (96-137 cm FL) and sub-legal (96-109) fish is promising for future fisheries efforts within the reservoir. Harvest guidelines for Bonneville Reservoir were correspondingly increased from 1,000 to 1,350 for 2022 through 2024. The 12% harvest rate will be distributed evenly between sport fishing and treaty commercial. An area of concern is the decrease of nearly 36,000 (-22%) fish within the juvenile size class. This decrease will likey be reflected in future stock assessments as fish grow and recruit into larger size classes. The potential for less fish to be available within the sub-legal and legal size classes warrants a cautious approach towards future guidelines.

In the impounded lower Columbia River, water velocity, which is heavily influenced by dam discharge, appears to be a major component of White Sturgeon spawning success (Chapman and Counihan, 2018,

Parsley 1993; Parsley et al., 1993; Parsley and Beckman, 1994). Data from age-0 indexing, combined with dam discharge data, suggest that higher discharge rates (which create the physical conditions required for successful spawning) generally result in higher levels of age-0 recruitment (Figure A-9). When the average daily discharge rate at McNary Dam during May - July (the primary spawning period of White Sturgeon in the lower Columbia River) reaches or exceeds 250 kcfs, there has generally been a detectible level of recruitment in all reservoirs. Although, even with adequate flow and strong numbers of adult (i.e., broodstock) individuals, recent recruitment in John Day Reservoir remains extremely poor. This suggests other factors may be influencing age-0 recruitment in John Day Reservoir and could have similar influences the The Dalles and Bonneville Reservoirs as well resulting in further low recruitment years in the future.

Further study of the hydraulic conditions and habitat throughout the impounded lower Columbia River below McNary Dam may help identify factors that limit White Sturgeon recruitment in years with adequate flow. To this end, ODFW will potentially continue an acoustic telemetry study of adult White Sturgeon below McNary Dam and throughout John Day Reservoir that was initiated in 2018. The purpose of this study is to track adult movements within the reservoir throughout the year and monitor their movements in and out of the tailrace, especially in late spring when spawning typically occurs.

Results obtained through this contract will continue to be shared through a variety of inter-agency and stakeholder meetings including annual meetings of the Sturgeon Management Task Force Technical and Policy Committees, US. v. Oregon coordination meetings, meetings with commercial and recreational advisor groups and a wide variety of other *ad hoc* meetings as needed.

ACKNOWLEDGMENTS

We would like to thank the following people who helped collect the data used in this report. ODFW: Kevin Rybacki, Michael Lovejoy, Gabriella Brill, Morgan Johnston, Colin Chapman, Phil Simpson and Matt Wissler; WDFW: Brad Cady, Kevin Fox, Laura Llyod, Bryan Moser, Shaffryn Shade and Mathew Sturza; Yakama Nation: Steven Begay, Maria Jim, Philip Watlamet and Megan Begay; CRITFC: Teddy Walsey. We would also like to thank Blaine Parker for his help coordinating our cooperative sampling program with CRITFC and the individual treaty tribes.

FIGURES

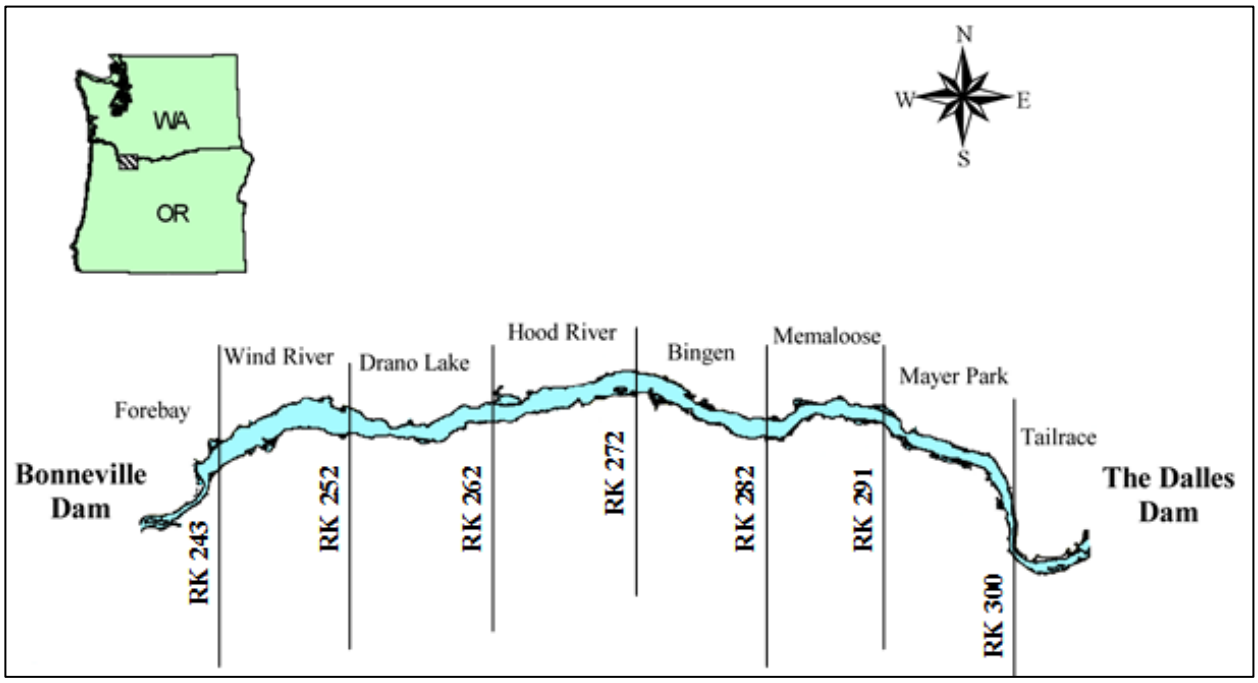

Figure A-1. Bonneville Reservoir. Stock assessment sampling sections for 2021 are indicated by lines. Boat-restricted zones were not sampled.

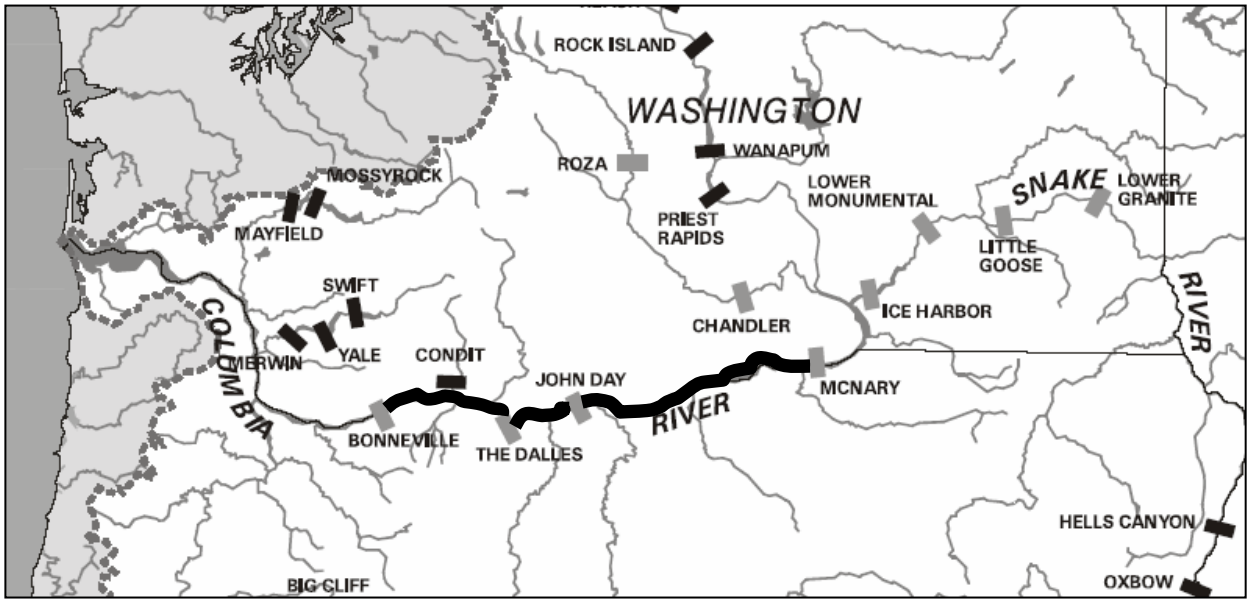

Figure A-2. Map of the mid and lower Columbia River basins, with highlighted river sections indicating the reservoirs in which age-0 sampling took place during 2021. Black blocks denote dams that are associated with Public Utility Districts (PUDs) or private companies. Grey blocks are associated with dams that are operated by Federal agencies.

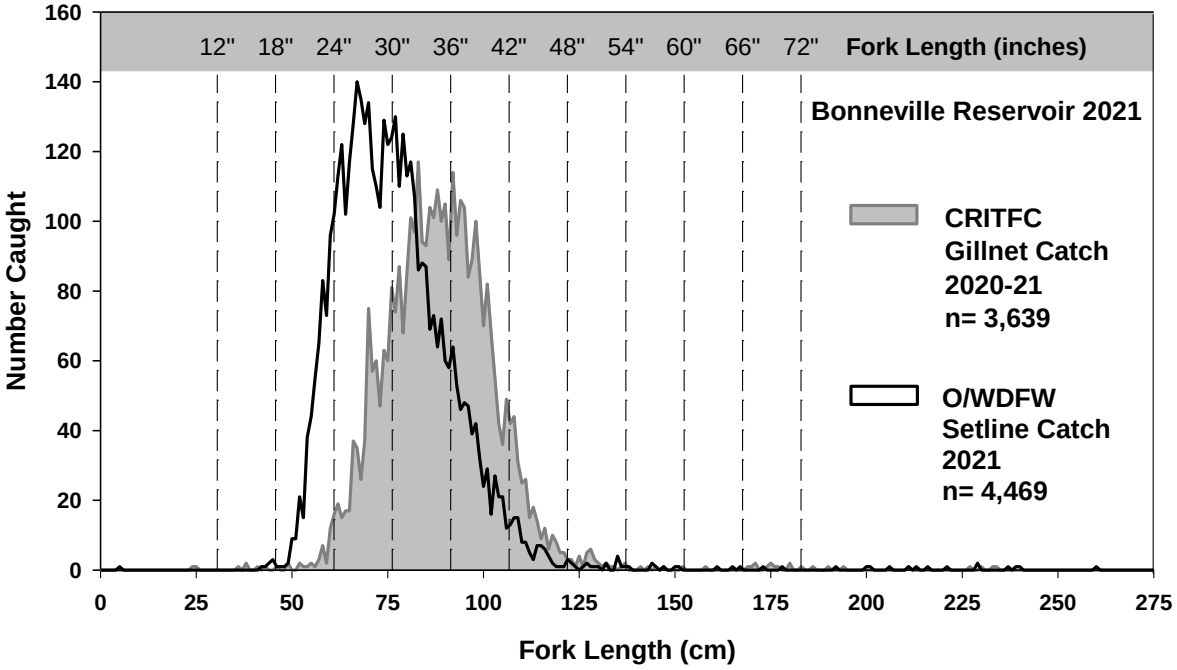

Figure A-3. Length frequency of White Sturgeon captured by setlines and gillnets during the 2021 stock assessment in Bonneville Reservoir.

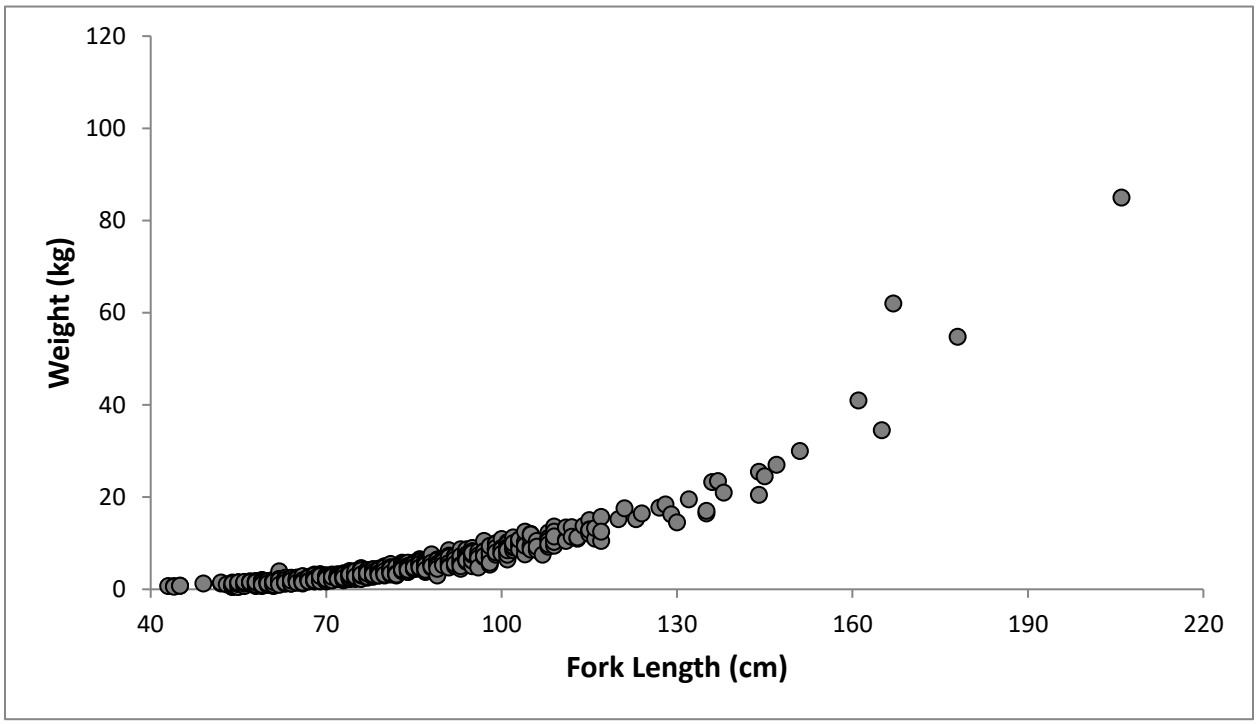

Figure A-4. Length-weight relationship of White Sturgeon captured with setlines during stock assessment sampling in Bonneville Reservoir, 24 May through 19 August 2021 (periods 2-3).

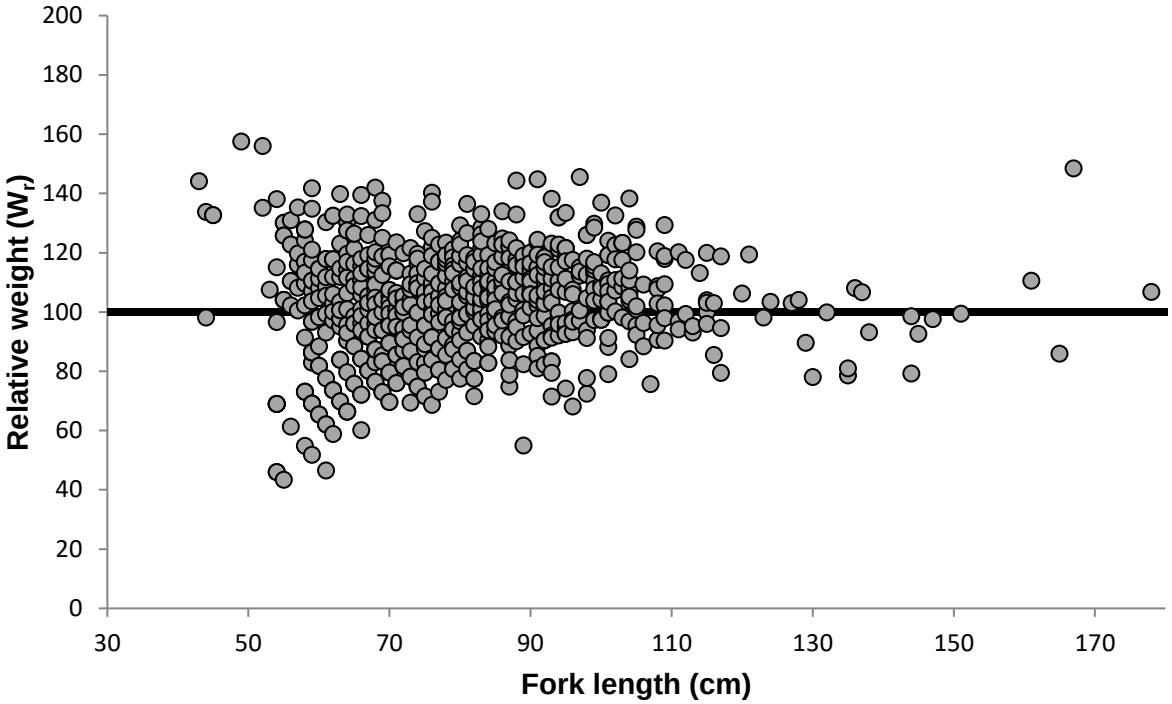

Figure A-5. Relative weights of White Sturgeon captured with setlines during stock assessment sampling in Bonneville Reservoir, 24 May through 19 August 2021 (periods 2-3). Horizontal line marks relative weight of 100, the value that represents normal condition based on the standard weight equation.

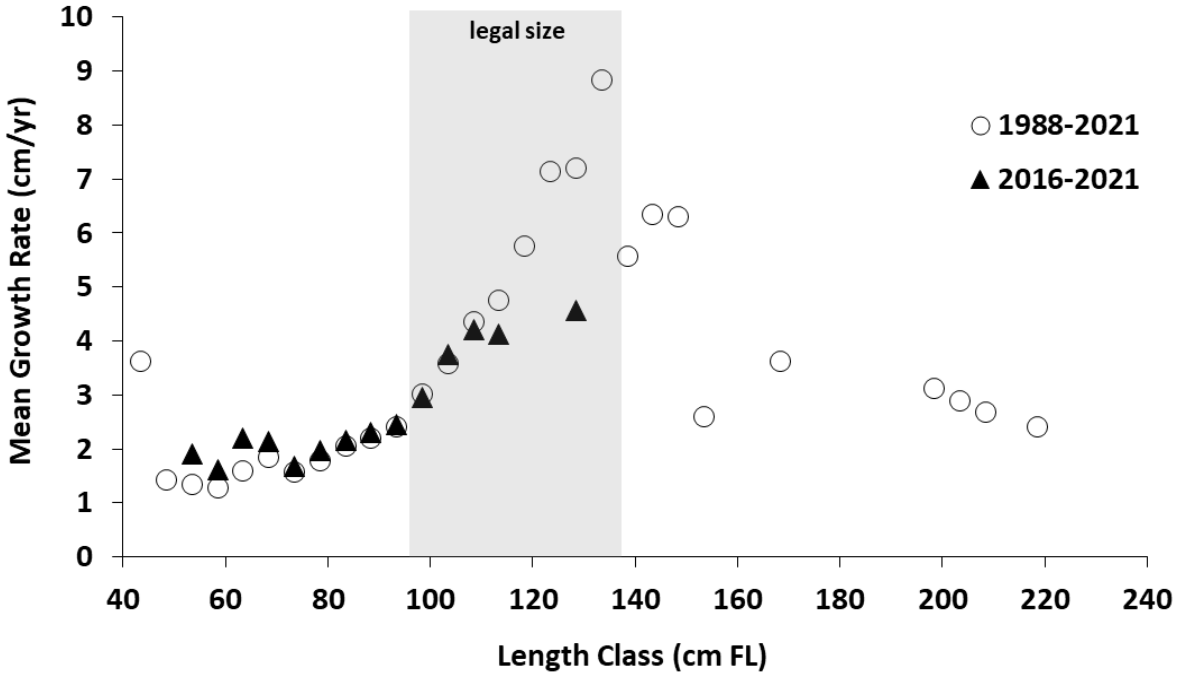

Figure A-6. Mean annual growth rates of White Sturgeon captured from Bonneville Reservoir, 1988 - 2021 and 2013 – 2021.

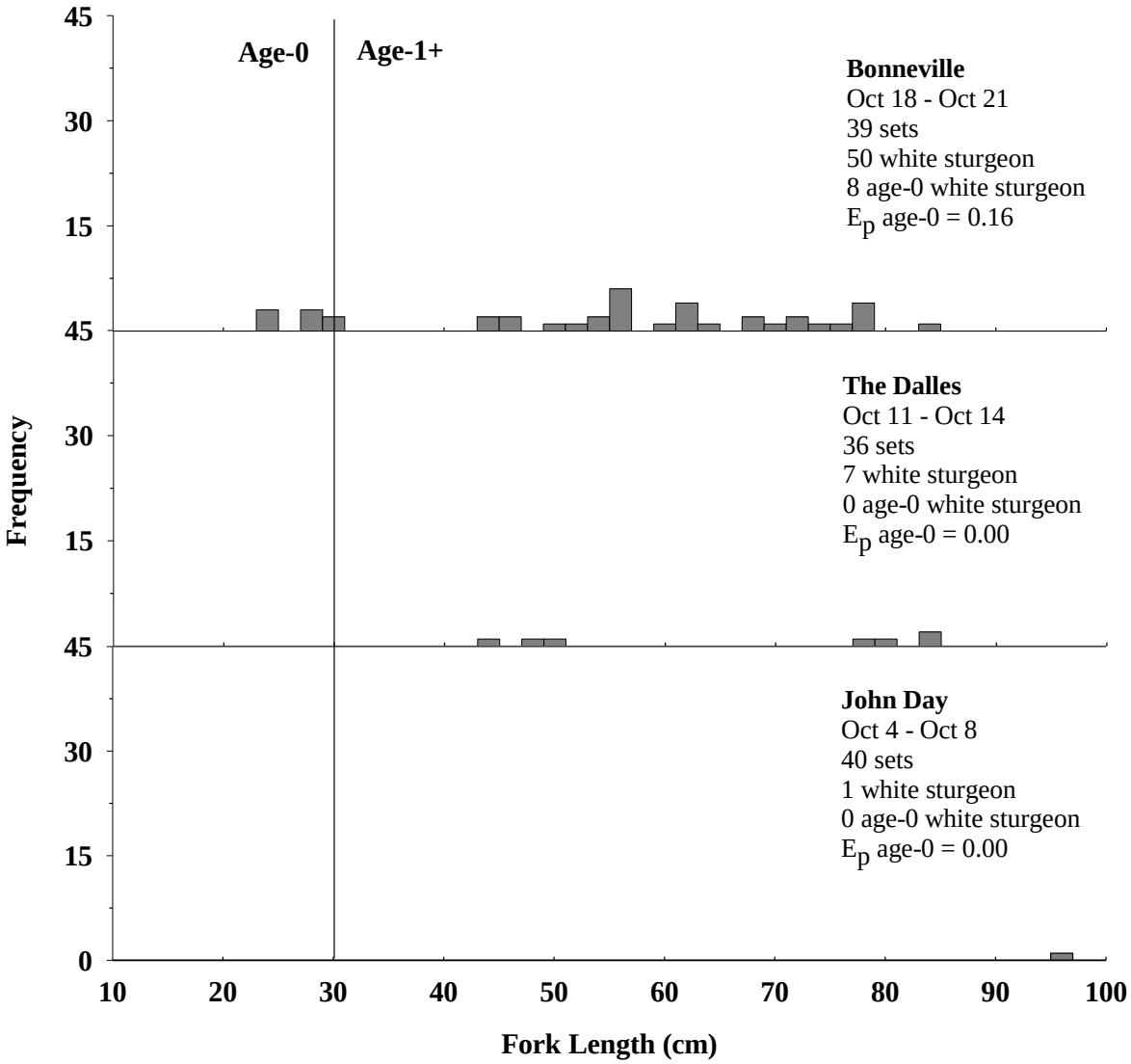

Figure A-7. Length-frequency distribution of White Sturgeon captured from Bonneville, The Dalles, and John Day reservoirs during 2021 age-0 recruitment indexing. Fish ≤ 30 cm FL are considered age-0.

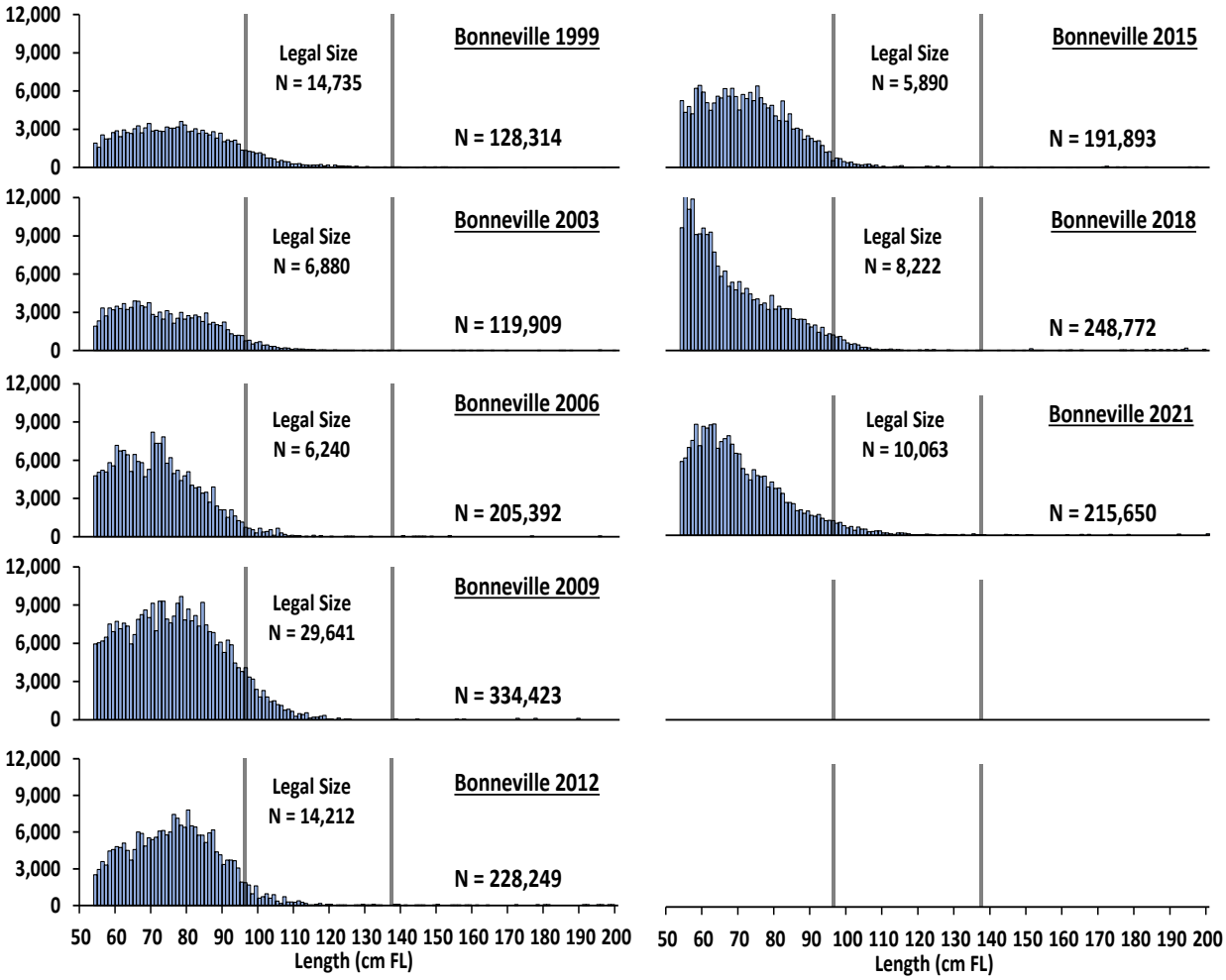

Figure A-8. Estimated abundance of White Sturgeon by 1cm fork length intervals in Bonneville Reservoir, 1999-2021.

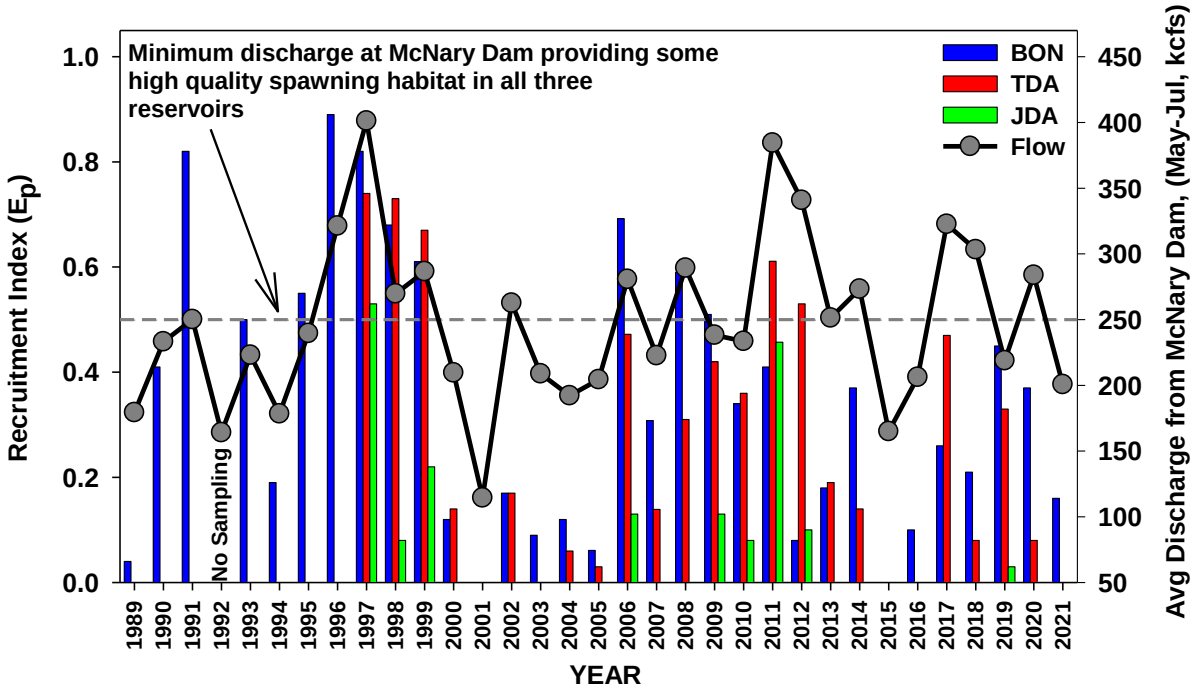

Figure A-9**.** Relative recruitment of age-0 White Sturgeon in Bonneville, The Dalles, and John Day reservoirs, 1989-2021 and average daily flow at McNary Dam (May-July). In 2006 age-0 indexing in Bonneville Reservoir switched from USGS trawl surveys to ODFW/WDFW/CRITFC gillnet surveys.

TABLES

Table A-1. Sampling effort (number of setlines), catch (WST), and catch-per-unit-effort (CPUE) for White Sturgeon in Bonneville Reservoir by week and sampling section in periods 2 and 3.

Week			Sampling Section								Weekly Totals
			1	2	3	4	5	6	7	8	
Period 2	24	Effort							29	27	56
		WST							222	177	399
		CPUE							7.7	6.6	7.1
	25	Effort	30	29							59
		WST	201	412							613
		CPUE	6.7	14.2							10.4
	26	Effort			28	29					57
		WST			274	404					678
		CPUE			9.8	13.9					11.9
	27	Effort					30	30			60
		WST					315	291			606
		CPUE					10.5	9.7			10.1
Period 3	28	Effort							31	24	55
		WST							441	267	708
		CPUE							14.2	11.1	12.9
	29	Effort	30	30							60
		WST	260	436							696
		CPUE	8.7	14.5							11.6
	30	Effort			30	30					60
		WST			406	417					823
		CPUE			13.5	13.9					13.7
	31	Effort					30	28			58
		WST					356	303			659
		CPUE					11.9	10.8			11.4
Section Totals		Effort	60	59	58	59	60	58	60	51	**465**
		WST	461	848	680	821	671	594	663	444	**5182**
		CPUE	7.7	14.4	11.7	13.9	11.2	10.2	11.1	8.7	**11.1**

Table A-2. Schnabel estimate of White Sturgeon abundance (70 – 109 cm FL) in Bonneville Reservoir, 2021.

Period (t)	Catch[1] (C)	Marks[2] (M)	Recaps[1] (R)	Harvest Mortalities Not Tagged	Harvest Mortalities Tagged	Marks at Large (Mt)	Mt*C	Modified Schnabel Estimate SUM(M*C)/(R+1)	percent CI	Poisson Variable
BON 2021 estimated abundance of < 110 cm FL stg from PIT-tags										
1	3,377	3,361		0	0	0				
2	1,979	1,977	26	0	0	3,361	6,651,419	246,349		
3	2,389	2,388	59	0	0	5,338	12,752,482	212,541		
4	0	0	0	0	0	7,726	0	0		
Sum	7,745	7,726	85				19,403,901	**225,627**		
					95% Conf. Intervals		lower	182,890	-0.19	105.1
							upper	278,217	0.23	68.7

[1] Excludes within-period recaptures.
[2] Includes first captures of fish tagged prior to 2021.

Table A-3. Abundance estimates by size-class from stock assessments in Bonneville Reservoir 1999-2021

Year	54-70 cm FL (21-27" FL)	71-95 cm FL (28-37" FL)	96-109 cm FL (38-42" FL)	110-137 cm FL (43-54" FL)	96-137 cm FL[1] (38-54" FL)	138-166 cm FL (55-65" FL)	167+ cm FL (66+" FL)	All (54+" FL)
1999	45,501	67,166	11,507	3,228	14,735	620	292	128,314
2003	55,015	57,117	5,860	1,020	6,880	151	746	119,909
2006	100,081	98,472	5,648	592	6,240	355	243	205,392
2009	123,420	180,021	26,322	3,319	29,641	277	1,064	334,423
2012	76,489	134,570	11,757	2,455	14,212	1,004	1,974	228,249
2015	90,965	93,995	4,845	1,045	5,890	433	610	191,893
2018[2,3]	161,594	74,962	7,344	878	8,222	521	3,473	225,861
2021	125,758	75,428	8,290	1,773	10,063	330	4,070	215,650
(95%CI)[2]					(8,277-12,834)			(180,388-268,048)

[1] 96 – 137 cm FL represents the size range of legally harvestable fish (sport and commercial) in Bonneville Reservoir
[2] Methodology used to correct for setline size selectivity was updated in 2018
[3] Numbers for 2018 were updated
[4] 95% confidence intervals (CI's) estimated using the Delta Method

Table A-4. Effort and catch of White Sturgeon in Columbia River reservoirs during age-0 sampling, October 2021.

Parameter	Reservoir BON	TDA	JDA
Gill Net Sets	39	36	40
Total Hours Fishing	942	834	881
White Sturgeon Catch (all sizes)	50	7	1
White Sturgeon Catch (Age-0)	8	0	0
White Sturgeon / Set (CPUE)	1.28	0.19	0.03
Age-0 White Sturgeon /Set (CPUE)	0.21	0	0
Prop. of positive sets (all sizes)	0.59	0.19	0.03
Prop. of positive sets (Age-0)	0.21	0	0

Table A-5. Mean relative weights of White Sturgeon in Bonneville Reservoir, 1994 – 2021. Shaded values indicate estimates with small sample size (n < 5).

	Mean Relative Weight					
Year	<70 cm FL (<31 in TL)	70-95 cm FL (31-42 in TL)	96-137 cm FL (42-60 in TL)	138-159 cm FL (60-70 in TL)	160 + cm FL (70+ in TL)	All
1994	109.2	106.7	107.4	102.9	95.8	106.6
1999	--	96.8	102.0	101.4	92.9	97.3
2003	93.6	91.5	90.9	95.3	100.8	91.8
2006	100.1	94.1	96.0	98.2	90.7	95.4
2009	95.0	100.2	97.5	108.2	90.3	99.3
2012	100.8	91.5	87.9	88.7	94.1	92.9
2015	96.9	93.3	92.0	109.9	96.5	94.6
2018	100.1	92.3	90.5	92.2	97.0	93.4
2021	101.7	103.7	105.7	93.4	102.5	103.3

Table A-6. Annual recruitment index for age-0 White Sturgeon in Columbia and Snake River reservoirs 1989 – 2021. Data for 2021 are preliminary; final results pending aging.

Year	LCR	Will. R.	BON[1]	TDA	JDA	MCN	IHA	LGO
1989			0.04					
1990			0.41					
1991			0.82					
1992								
1993			0.50					
1994			0.19					
1995			0.55					
1996			0.89					
1997			0.82	0.74	0.53		**0.00**	
1998			0.68	0.73	0.08		--	0.32
1999			0.61	0.67	0.22	0.08	0.03	0.08
2000			0.12	0.14	**0.00**	**0.00**	**0.00**	**0.00**
2001			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
2002			0.17	0.17	**0.00**	0.06	**0.00**	**0.00**
2003			0.09	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
2004	0.44		0.12	0.06	**0.00**	**0.00**	**0.00**	**0.00**
2005	0.49		0.06	0.03	**0.00**	0.03	**0.00**	**0.00**
2006	0.52		0.69	0.47	0.13	0.06		
2007[2]	--		0.31	0.14	**0.00**	0.06		
2008	0.45		0.59	0.31	**0.00**	0.06		
2009	0.78		0.51	0.42	0.13	0.06		
2010	0.18	0.24	0.34	0.36	0.08	**0.00**		
2011	0.34	0.06	0.41	0.61	0.46	0.26		
2012	0.35	0.22	0.08	0.53	0.10			
2013[3]	0.12	--	0.18	0.19	**0.00**			
2014	0.31	0.38	0.37	0.14	**0.00**			
2015	0.05	0.26	**0.00**	**0.00**	**0.00**			
2016	0.14	0.50	0.10	**0.00**	**0.00**			
2017	0.58	0.46	0.26	0.47	**0.00**			
2018	0.27	0.83	0.21	0.08	**0.00**			
2019	0.21	0.67	0.45	0.33	0.03			
2020[4]	--	--	0.37	0.08	**0.00**			
2021	0.02	0.17	0.16	**0.00**	**0.00**			

[1] Index values for BON from 1989-2005 are based on standardized trawl sampling conducted by the USGS. Index values for BON since 2006 are based on standardized gill-net sampling.

[2] No sampling in the LCR in 2007.

[3] Incomplete sampling in the lower Columbia River and no sampling in the Willamette River in 2013.

[4] No sampling in either the lower Columbia River or the Willamette River in 2020

Table A-7. Abundance estimates for impounded lower Columbia River reservoirs and the Hanford Reach of McNary Reservoir, 1987 – 2021.

	30-72 inch total length	Number of fish by total length interval (inches)						Number/	Pounds/
Year	N (95% CI)	24-36	36-48	48-60	60-72	72+	Sum	Acre[a]	Acre[c]
Bonneville Reservoir									
1989	35,400 (27,500-45,400)	32,900	16,700	1,000	200	600	51,400	2.5	27
1994	35,200 (24,800-66,000)	31,300	18,300	1,300	200	900	52,000	2.5	--
1999	85,400 [b]	82,400	41,800	3,200	600	400	128,400	6.2	59
2003	74,000 [b]	84,500	33,000	1,100	120	780	119,500	5.7	46
2006	113,300 [b]	159,000	45,200	590	350	240	205,400	9.9	67
2009	235,713 [b]	223,955	106,086	3,112	3,749	1,064	334,424	16.1	149
2012	165,567 [b]	147,895	74,921	2,455	1,004	1,974	228,249	11	36
2015	116,629 [b]	147,439	42,365	1,045	433	610	191,893	9.2	61
2018				878	521	3,473	225,861	10.9	80
2021				1,773	330	4,070	215,861	10.4	
The Dalles Reservoir									
1987	23,600 (15,700-33,600)	7,800	11,000	6,100	1,800	1,000	27,700	2.5	73
1988	9,000 (7,300-11,000)	4,200	4,300	1,500	500	800	11,300	1	32
1994	9,700 (7,500-14,000)	5,800	5,700	800	<50	300	12,600	1.1	--
2002	33,000 (26,200-42,000)	82,900	13,500	5,900	1,200	800	104,300	9.4	87
2005	45,700 (37,000-56,300)	90,600	10,200	1,100	500	400	102,800	9.3	69
2008	123,410 [b]	55,600	74,800	1,650	200	950	133,200	12	132
2011	91,001 [b]	42,097	54,866	2,730	269	1,044	101,006	9.1	132
2014	68,526 [b]	48,800	34,939	1,854	280	1,022	86,895	7.8	76
2017	64,296 [b]	42,853	34,481	3,664	379	1,503	82,880	7.5	89
John Day Reservoir									
1990	3,900 (2,300-6,100)	16,600	1,700	400	100	500	19,300	0.4	3
1996	27,100 (23,800-30,800)	5,800	19,700	4,050	350	700	30,600	0.6	11
2001	19,600 b	14,900	12,800	1,100	300	900	30,000	0.6	9
2004	30,000 b	30,200	11,500	1,100	170	470	43,500	0.8	9
2007	39,020 b	17,834	21,793	1,587	529	841	42,584	0.8	10
2010	37,635 b	4,472	29,110	3,900	718	2,449	40,649	0.8	14
2013	27,377 b	5,351	13,478	9,344	1,501	1,315	30,989	0.6	12
2016	23,076 b	11,817	6,826	5,177	3,332	2,123	29,275	0.6	9
2019	24,688b	10,333	10,264	2,992	5,672	2,846	33,627	0.6	8.6
Hanford Reach and McNary Reservoir									
1995	5,234 (3,782-9,086)	900	2,700	3,400		1,250	8,250	0.2	8
2011	7,881	1,129	3,517	2,516	1,001	1,078	9,241	0.2	6

[a] Hanford Reach and McNary Reservoir = 45,500 acres; Bonneville Reservoir = 20,800 acres; The Dalles Reservoir = 11,100 acres; John Day Reservoir = 51,900 acres.

[b] Confidence intervals for these estimates are not provided because they are derived from expansion, not directly calculated from mark-recapture data.

[c] Total poundage is estimated by multiplying the within-year total abundance by the within-year median weight of sturgeon caught with setlines.

Table A-8. Catch of non-target species during sampling for age-0 sturgeon in Bonneville, The Dalles, and John Day reservoirs, October 2021. Disposition: 1= alive and released, 2= sacrificed, 3= dead or dying at capture.

Species	Bonneville			The Dalles			John Day			Combined		
	1	3	Total	1	3	Total	1	3	Total	1	3	Total
American Shad *Alosa sapidissima*		5	5					6	6		11	11
Bridgelip Sucker *Catostomus columbianus*	1		1							1		1
Bullhead Catfish *(Ameiurus spp.)*							1		1	1		1
Channel Catfish *Ictalurus punctatus*				1		1	20		20	21		21
Chiselmouth Chub *Acrocheilus alutaceus*	1		1							1		1
Coho Salmon *Oncorhynchus kisutch*				1		1				1		1
Largescale Sucker *Catostomus macrocheilus*				1	3	4				1	3	4
Northern Pikeminnow *Ptychocheilus oregonensis*	43	62	105	14	38	52	1	3	4	58	103	161
Peamouth Chub *Mylocheilus caurinus*	34	62	96	1	2	3				19	84	103
Pumkinseed *Lepomis gibbosus*		1	1								1	1
Sculpin *(Cottus spp.)*	1		1				1		1	2		2
Smallmouth Bass *Micropterus dolomieu*		4	4	9	2	11	12	5	17	21	11	32
Walleye *Sander vitreus*	1	11	12	5	31	36	7	52	59	13	94	107
Yellow Perch *Perca flavescens*	1	4	5	6	7	49	16	122	138	23	133	155

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WHITE STURGEON MITIGATION AND RESTORATION IN THE COLUMBIA AND SNAKE RIVERS UPSTREAM FROM BONNEVILLE DAM

ANNUAL PROGRESS REPORT
JANUARY – DECEMBER 2021

Report B

Evaluate the success of developing and implementing a management plan to enhance production of white sturgeon in reservoirs between Bonneville and Priest Rapids dams

This report includes: Progress on implementing the fisheries management component of the white sturgeon management plan for the Columbia River between Bonneville and Priest Rapids dams including results of surveying 2021 sport and commercial white sturgeon fisheries.

Prepared by:

Matthew T. Sturza
Laura Heironimus

Washington Department of Fish and Wildlife
Southwest Region
5525 South 11th Street
Ridgefield, Washington 98642

January 12, 2021

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ABSTRACT

Staff from Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and the Columbia Inter-Tribal Fish Commission monitored sturgeon fisheries between Bonneville Dam and McNary Dam (Zone 6) during 2021. Non-Treaty recreational effort and harvest per unit effort (HPUE) were both very high in Bonneville Pool and The Dalles Pool. Effort and HPUE were more in line with recent averages in the John Day Pool. Recreational harvest was 655 (131 % of guideline) fish in Bonneville, 235 (124% of guideline) in The Dalles, and 98 (93% of guideline) in John Day. Treaty commercial harvest was 1,537 (307% of guideline) in Bonneville, 523 (93% of guideline) in The Dalles, and 166 (79% of guideline) in John Day. Recreational anglers continue to encounter a low percentage of the oversize population in each pool. Mild weather and light winds led to advantageous conditions for anglers during the Bonneville and The Dalles recreational seasons. John Day Pool angling conditions and harvest were good at the beginning of the season, but became poor by the end of January, before rebounding during mid-March. To help reduce the chance of exceeding The Dalles Pool non-treaty guideline, WDFW and ODFW altered the season structure to a staggered 3 days per week approach, allowing for time to close the fishery in between retention days.

INTRODUCTION

This annual report describes progress made by the Washington Department of Fish and Wildlife (WDFW) toward completing tasks outlined in the Statement of Work for Bonneville Power Administration Project 1986-050-00, White Sturgeon Mitigation and Restoration in the Columbia River Upstream from Bonneville Dam. The reporting period is from January 1 through December 31, 2021.

Washington Department of Fish and Wildlife (WDFW), in cooperation with Oregon Department of Fish and Wildlife (ODFW), conducted a survey of the 2021 sturgeon sport fishery on the Columbia River from Bonneville Dam upstream to McNary Dam (Columbia River commercial management unit Zone 6) to estimate white sturgeon *Acipenser transmontanus* harvest. In cooperation with Columbia Inter-Tribal Fish Commission (CRITFC) we monitored the treaty Indian commercial fisheries in Zone 6.

METHODS

Compliance with the Sturgeon Management Task Force (SMTF) annual harvest guidelines was addressed through in-season management actions. The 2020 sport fishery survey was conducted in Bonneville and The Dalles reservoirs, and that portion of the John Day Reservoir between Crow Butte Park at river kilometer (rkm) 423 (Figure B-1) and McNary Dam at rkm 470, where fishing was concentrated. Methods were similar to those used annually since 1995 (James et al. 1996), and follow accepted procedures documented in Method ID 3784 on monitoringmethods.org (also described in James et.al. 1996).

Angling effort (angler hours) was estimated by counting anglers within representative index areas and expanding those counts to the entire reservoir using an established relationship derived from the 1987 to 1991 aerial counts of anglers within and outside of established index areas (Hale and James, 1993). Thirty-nine indices of angler effort (17 in Bonneville Reservoir, 10 in The Dalles Reservoir, and 12 in John Day Reservoir) were established at popular fishing locations and vantage points in each reservoir

and have remained essentially the same since 1995. One Oregon bank index area (rkm 262) was reassigned upriver and shared by two adjacent locations (rkm 270 and rkm 271) in 2000 to account for a shift in Oregon bank angler effort (James et al., 2001). Another Oregon bank index area (rkm 439) was dropped in 2013 due to closure by the landowner. One Washington bank index area (rkm 270) was dropped in 2005 due to lack of angler use. Subsequently, access to that site has been restricted by the landowner (Burlington Northern Railroad). Harvest estimates were derived for each angling method (bank/boat), reservoir subsection, and weekend/weekday type to account for differential catch and sampling rates. Harvest and angling effort estimates were derived for each week.

After an inquiry by the Sturgeon Management Task Force (SMTF) about recreational sturgeon effort and catch following the closure of retention in Zone 6, WDFW and ODFW initiated a limited monitoring program designed to qualify the proportion of anglers targeting sturgeon and how successful they were in catching sturgeon. The effort began in Bonneville Pool and The Dalles Pool in February and occurred on a limited basis (1-2 days per week) until April 11, 2021. In John Day, staff continued to work 5 days per week after the March 18, 2021 retention closure until April 15, 2021.

RESULTS

Retention season lengths in the lower two pools were the shortest on record; 7 days in Bonneville Pool and 4 days in The Dalles pool. There were 1,381 angler trips in Bonneville and 1,778 in The Dalles, all increases relative to 2020 (Figure B-2). This was also the highest average number of trips per day in either pool that's been recorded, 197 trips per day in Bonneville and 444 trips per day in The Dalles. Sturgeon sport harvest estimates were 655 (131% of 500 fish guideline) for Bonneville and 235 (124% of 190 fish guideline) for The Dalles (Figure B-2 and Table B-1). Harvest per unit effort (HPUE), defined as the number of legal size sturgeon harvested per angler trip, was nearly three times as high in Bonneville (0.47 vs 0.16) and nearly twice as high in The Dalles (0.13 vs 0.07) compared to 2020.

At 77 days the retention season length in John Day Pool was similar to the average season length of 72 days since the recreational guideline was reduced to 105 fish. The number of estimated angler trips was down from 6,541 in 2020 to 5,433 in 2021. An estimated 98 fish were harvested (93% of 105 fish guideline). The HPUE during 2021 was only slightly higher than in 2020 (0.18 vs 0.16).

Oversize catch in Bonneville Reservoir was 0.2% of the 2021 oversize abundance estimate (Figure B-4), and 0.4% of total 2021 sturgeon catch. In The Dalles Reservoir, oversize catch was 1.1% of the 2020 oversize abundance estimate, and 4.2% of total 2021 sturgeon catch. In John Day Reservoir, oversize catch was 0.6% of the 2019 oversize abundance estimate, and 20.4% of total 2021 sturgeon catch.

Treaty commercial sturgeon harvests were 1,537 (307% of 500 fish guideline) for Bonneville Reservoir, 523 (93% of 560 fish guideline) for the Dalles Reservoir, and 166 (79% of 210 fish guideline) for John Day Reservoir (Figure B-2 and Table B-1). An estimated 168 sturgeon were harvested for ceremonial and subsistence use in Bonneville Reservoir, 36 sturgeon harvested in The Dalles Reservoir, and 29 sturgeon harvested in John Day Reservoir (Table B-1).

After retention closed staff conducted 5 days of recreational fishery monitoring in Bonneville Pool and 5 days in The Dalles Pool. A total of 55 angler interviews were conducted. Of those, only 4 were targeting

sturgeon. The majority anglers were targeting warmwater species, especially bass or walleye. The sturgeon anglers reported catching and releasing 2 sublegal, 3 legal size, and 3 oversize sturgeon. Staff monitoring the John Day Pool conducted 260 interviews between March 19 – April 15, 11 of these were targeting sturgeon, all others were targeting bass and walleye. A total of 3 sublegal, 2 legal size, and 8 oversize sturgeon were caught and released during this period.

DISCUSSION/CONCLUSION

The combination of higher effort and HPUE in Bonneville Pool and The Dalles Pool led to the dramatic reduction in season lengths. Several factors likely led to this combination. Weather during the first week of January 2021 was mild, with warmer daytime temperature and light wind. This potentially encouraged more anglers to come out, especially anglers with smaller boats that typically may not be suited for winter conditions in the Columbia River Gorge. It also may have allowed anglers to stay on the water longer, increasing their chance of catching legal sized fish. The unseasonable warm weather also led to higher than normal water temperatures. It is possible warmer water led to more active and aggressive sturgeon, leading to very HPUE values. Finally, the abundance of legal size fish has been increasing in Bonneville since 2015 and in The Dalles since 2014, possibly originating from strong recruitment during the mid-2000s There are likely just more fish for anglers to encounter than in historical seasons where harvest was lower.

Fishing in the John Day Pool started off strong, but by late January cold weather and high winds combined to make recreational fishing extremely difficult. During February, only 3 legal sturgeon were estimated to be harvested. By early March, conditions started to improve. A stretch of warmer weather during the middle of the month led to an increase in flow of the Umatilla River. Reports by staff monitoring the fishery and anglers indicate that when this occurs, sturgeon tend to congregate on the Oregon side of the Pool between Umatilla and Irrigon. This phenomenon appeared to occur again in 2021, leading to high catches during the week preceding the March 18, 2021 closure to retention.

Oversize catch in Bonneville pool continues to remain low, both as a proportion of overall catch and as the estimated proportion of the oversize population abundance. This trend has continued, even as oversize abundance has increased, likely because sublegal and legal size abundance have outpaced the increase in oversize fish. Oversize catches are more common The Dalles Pool, but are typically less than 5% of total catch and have remained steady in recent years. Similar to Bonneville, oversize abundance has increased over the previous decade, but so have sublegal and legal size fish abundances. In the John Day Pool, oversize catches are far more common than the other two pools. The proportion of total catch during 2021 was higher than it’s ever been. However, the percentage of oversize sturgeon abundance that was caught was still low, indicating the relative abundance of oversize fish compared to Bonneville and The Dalles. Overall, the proportion of the oversize population handled in recreational fisheries continues to be limited.

ADAPTIVE MANAGEMENT AND LESSONS LEARNED

During 2021, the recreational guideline was exceeded for the third time in four years. It was also the second time in three years that the season was less than one week long. Mild weather has contributed to better conditions for anglers and high catch rates. Forecasting when conditions are going to be ideal can be challenging and unpredictable, making closing the fishery for retention difficult to accomplish before the catch guideline is surpassed. In order to address these issues the states implanted an emergency rule for the 2022 retention season in The Dalles Pool by going to a staggered 3 days per week approach. This has the potential to both extend the season further into the year and to allow time in between retention days to close the fishery should that be necessitated without exceeding the guideline.

FIGURES

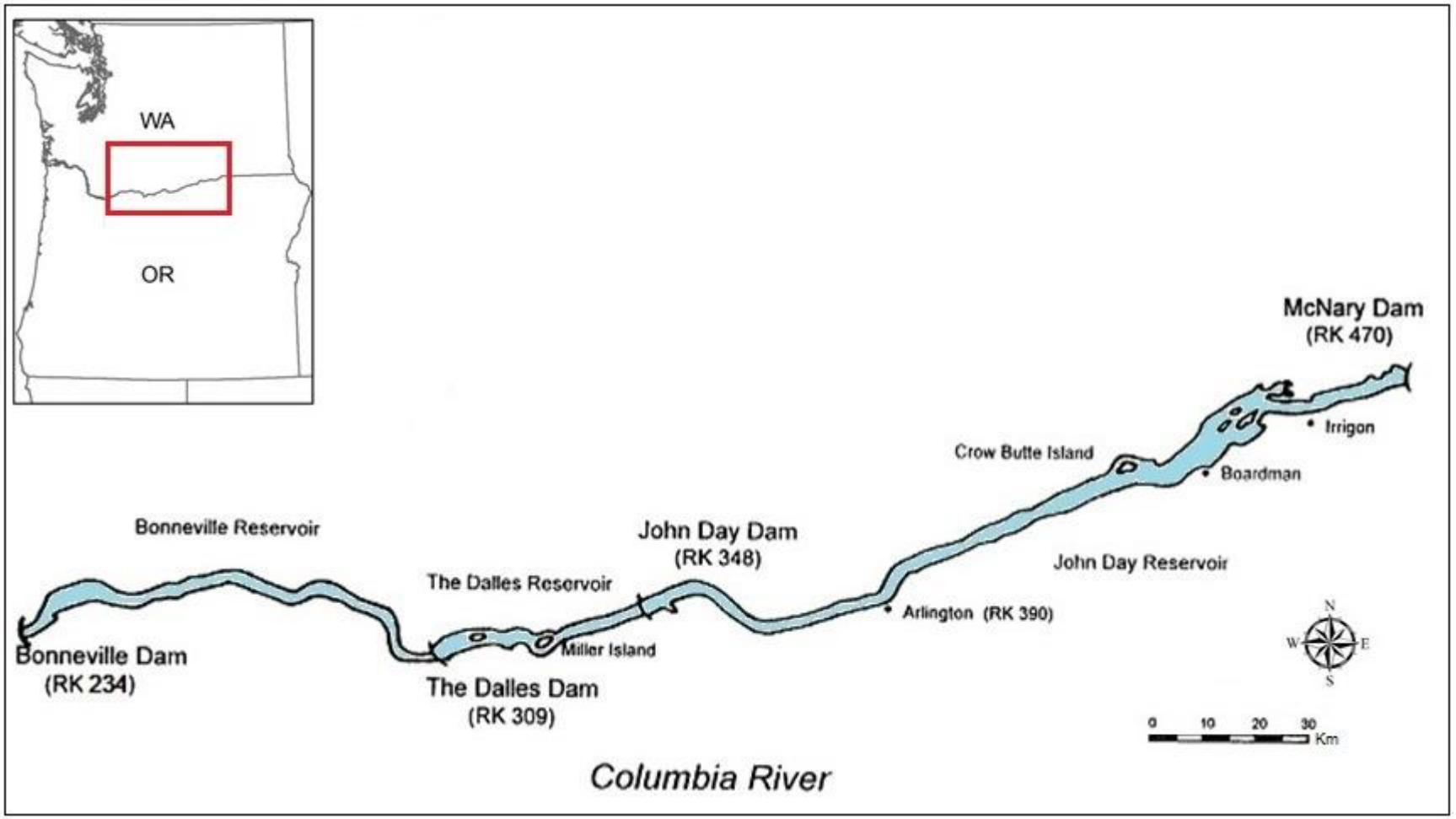

Figure B-1. The recreational fishery survey on the Columbia River occurs throughout Bonneville and The Dalles Reservoirs, and from Crow Butte Island upstream to McNary Dam on John Day Reservoir. Commercial fisheries occur throughout all three reservoirs.

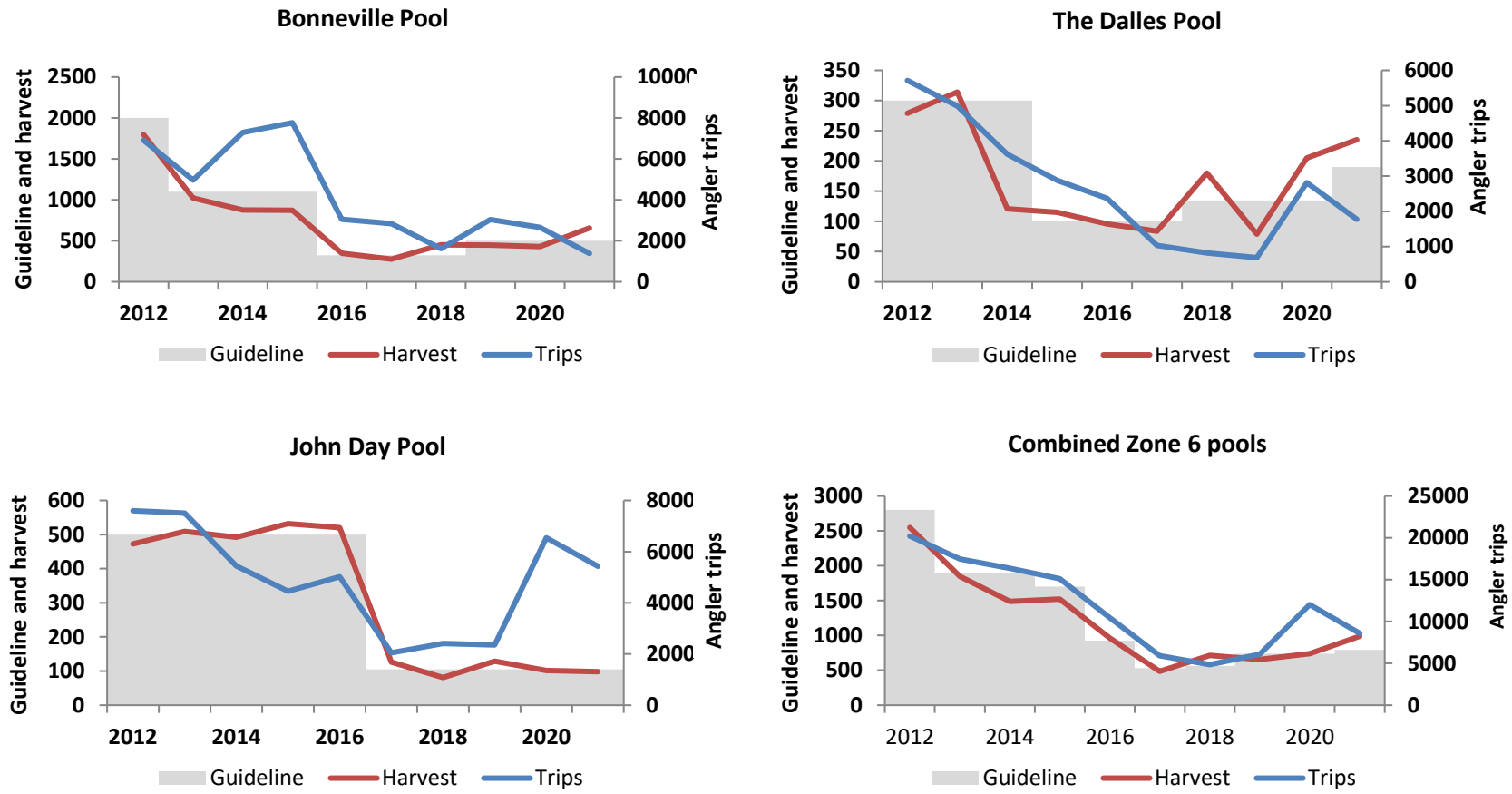

Figure B-2. Sport effort in terms of total angler trips (blue line) and harvest (red line) compared to harvest guidelines (gray bars) in Zone 6 reservoirs on the Columbia River, 2012–2021.

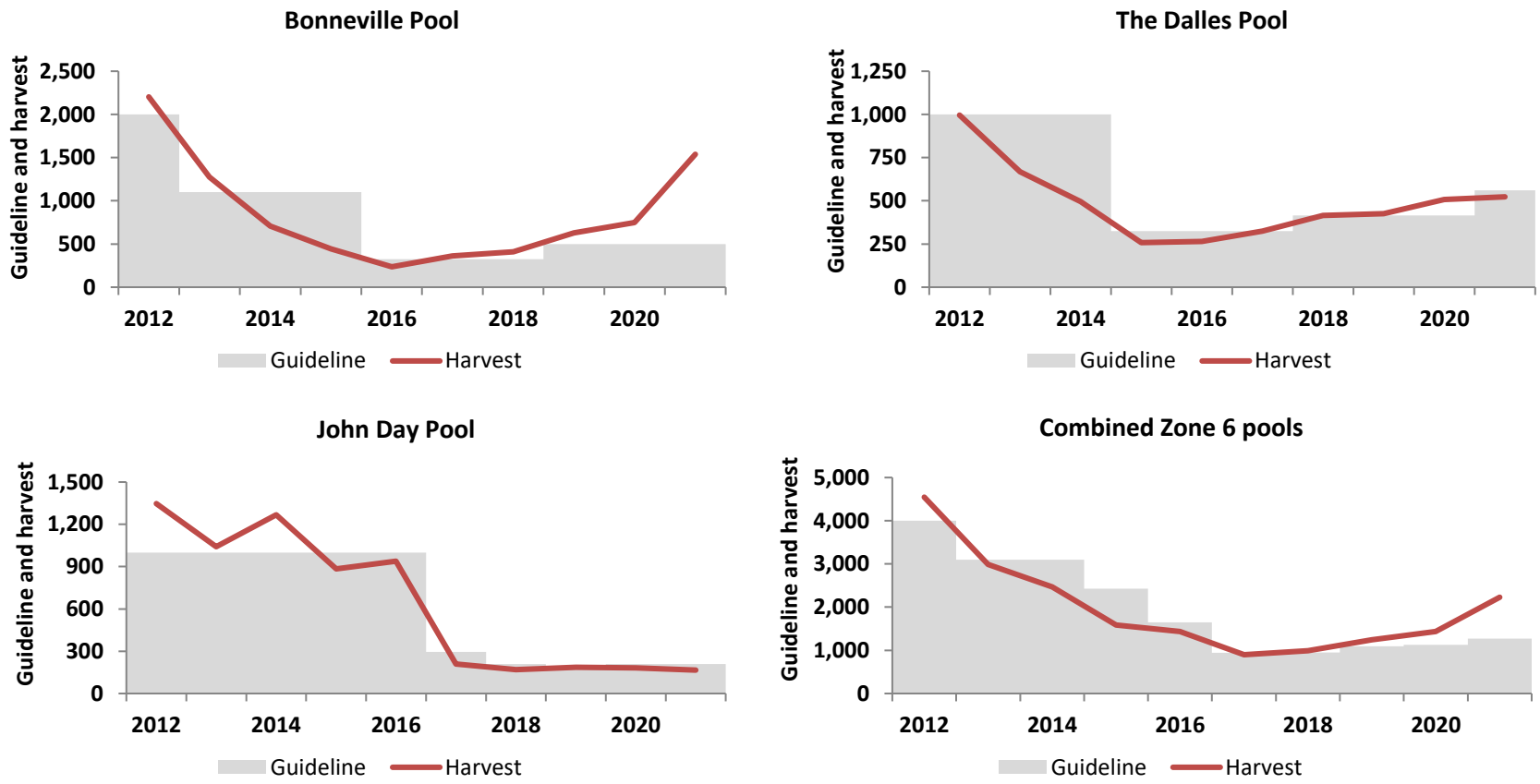

Figure B-3 Commercial harvest (red line) compared to harvest guidelines (gray bars) in Zone 6 reservoirs on the Columbia River, 2012–2021.

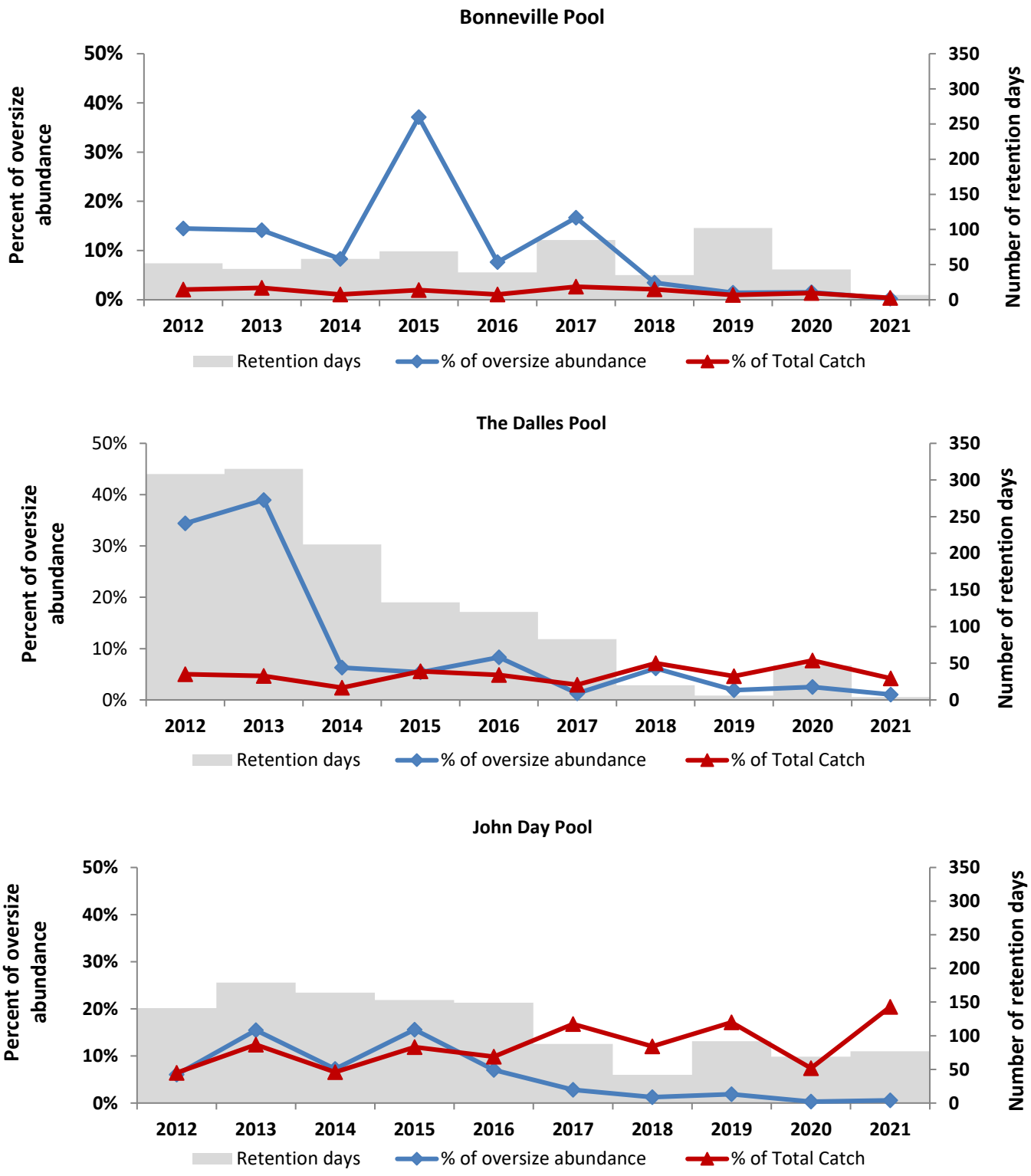

Figure B-4. The reported handling rates of over legal-size sturgeon during retention fishing periods is plotted as a percentage of estimated oversize abundance (blue line) and as a percentage of total sturgeon catch (red line). Gray bars represent the total number of retention fishing days in Zone 6 reservoirs, 2012–2021. Spawning sanctuaries were implemented in The Dalles and John Day reservoirs in 2006, in Bonneville Reservoir in 2014, and updated in all three areas in 2019.

TABLES

Table B-1. Zone 6 White Sturgeon Harvest Guidelines and Harvest Estimates, 2011–2021.

Area/Fishery	2011-2012			2013-2014			2015		2016		2017		2018		2019		2020		2021	
	Guide-line	2011 Catch	2012 Catch	Guide-line	2013 Catch	2014 Catch	Guide-line	Catch	Guide-line	Catch[1]	Guide-line	Catch	Guide-line	Catch	Guide-line	Catch	Guide-line	Catch	Guide-line	Catch
Bonneville Pool																				
Sport	2,000	2,334	1,796	1,100	1,022	877	1,100	874	325	349	325	276	325	452	500	448	500	431	500	655
Treaty Commercial	2,000	2,089	2,203	1,100	1,277	706	1,100	445	325	236	325	368	325	406	500	630	500	748	500	1,537
Total	**4,000**	**4,423**	**3,999**	**2,200**	**2,299**	**1,583**	**2,200**	**1,319**	**650**	**585**	**650**	**644**	**650**	**858**	**1,000**	**1,078**	**1,000**	**1,179**	**1,000**	**2,192**
Treaty Subsistence		429	238		194	97		68		45		63		43		90		249		168
Abundance estimate			14,212				5,890						8,222							
The Dalles Pool																				
Sport	300	220	279	300	314	121	100	115	100	96	100	84	135	180	135	79	135	205	190	235
Treaty Commercial	1,000	604	996	1,000	676	496	325	258	325	264	325	326	415	415	415	426	415	508	560	523
Total	**1,300**	**824**	**1,275**	**1,300**	**990**	**617**	**425**	**373**	**425**	**360**	**425**	**410**	**550**	**595**	**550**	**505**	**550**	**713**	**750**	**758**
Treaty Subsistence		60	81		72	74		33		33		26		33		34		34		36
Abundance estimate	2,730					1,854					3,664						5,650			
John Day Pool																				
Sport	500	533	473	500	509	492	500	532	500	520	105	126	105	81	105	129	105	102	105	98
Treaty Commercial	1,000	1,208	1,347	1,000	1,050	1,267	1,000	884	1,000	881	295	209	210	166	175	187	210	182	210	166
Total	**1,500**	**1,741**	**1,820**	**1,500**	**1,559**	**1,759**	**1,500**	**1,416**	**1,500**	**1,401**	**400**	**335**	**315**	**247**	**280**	**316**	**315**	**284**	**315**	**264**
Treaty Subsistence		163	128		100	99		107		66		14		13		16		12		29
Abundance estimate				9,620					5,177						6,443					
Zone 6 Total																				
Sport	2,800	3,087	2,548	1,900	1,845	1,490	1,700	1,521	925	965	530	486	565	713	740	656	740	738	795	988
Treaty Commercial	4,000	3,901	4,546	3,100	3,003	2,469	2,425	1,587	1,650	1,381	945	903	950	987	1,090	1,243	1,125	1,438	1,270	2,226
Total	**6,800**	**6,988**	**7,094**	**5,000**	**4,848**	**3,959**	**4,125**	**3,108**	**2,575**	**2,346**	**1,475**	**1,389**	**1,515**	**1,700**	**1,830**	**1,899**	**1,865**	**2,176**	**2,065**	**3,214**
Treaty Subsistence		652	447		366	270		208		144		103		89		140		295		233
Sport retention periods:																				
Bonneville Pool		1/1-2/18 6/30-7/2 7/7-7/8	1/1-2/17 6/15-16 6/22-23		1/1-2/10 6/14-15 6/21	1/1-19; 2/1-17 2/24-3/9 6/13-14 6/20-21 7/11-12, 18-19		1/1-3/1 6/19-21, 26-28		1/1-2/7 6/18		1/1-3/24 6/10, 23		1/1-2/3 6/15		1/1-4/12		1/1-2/13		1/1-1/7
The Dalles Pool		1/1-7/29	1/1-11/3		1/1-11/11	1/1-7/31		1/1-5/13		1/1-4/29		1/1-3/24		1/1-19 6/15		1/1-6		1/1-2/17		1/1-1/4
John Day Pool		1/1-4/9	1/1-5/20		1/1-6/28	1/1-6/13		1/1-6/2		1/1-5/28		1/1-3/29		1/1-2/11		1/1-4/2		1/1-3/9		1/1-3/18
Commercial open periods [1]																				
Bonneville Pool		1/1-1/31S 2/2-3/21G 6/27-6/30 G 8/1-13 S 10/10-26 S	1/1-1/31S 2/1-3/6 G		1/1-1/31S 2/2-3/6 G	1/1-1/31S 2/2-3/15 G		1/1-1/31S 2/23-3/21G		1/1-1/31S 3/14-3/21G 8/1-8/13 S 11/14-11/26 S		1/1-1/31S 3/6-17 G		1/1-1/31S 3/5-14 8/6-25 10/17-31		1/1-1/31S 3/1-3/23 G		1/1-1/31S 2/27-3/7 G		1/1-1/31S 3/1-3/5 G
The Dalles Pool		1/1-1/31S 2/2-3/21G 6/27-6/30 G 8/1-13 S 10/10-31S 11/2-12/3 S	1/1-1/31S 2/1-3/21G 7/30-8/11S		1/1-1/31S 2/2-3/21G 5/24-6/15 G	1/1-1/31S 2/2-3/3 G 3/12-22 G 11/25-12/31S		1/1-1/31S 2/2-2/24 G		1/1-1/31S 2/1-3/12 G 11/7-11/12 S		1/1-1/31S 2/1-3/4 G		1/1-1/31S 2/1-16 2/22-3/3 3/15-19		1/1-1/31S 2/1-2/19 G		1/1-1/31S 2/1-2/8 G		1/1-1/31S 2/1-2/6 G
John Day Pool		1/1-1/31S 2/2-3/21G 6/27-6/30 G 8/1-13 S 10/10-31S	1/1-1/31S 2/1-3/1G		1/1-1/31S 2/1-2/27 G	1/1-1/31S 2/1-2/26 G		1/1-1/31S 2/2-2/24 G		1/1-1/31S 2/1-3/12 G 11/7-11/12 S		1/1-1/31S 2/1-3/4 G 8/1-12 S 12/11-30 S		1/1-1/31S 2/1-3/3 3/15-24 6/6-15 7/27-8/4		1/1-1/31S 2/1-2/27 G 7/26-8/8 S		1/1-1/31S 2/1-2/8 G 2/12-2/17 G 2/20-2/24 G		1/1-1/31S 2/1-2/6 G 2/12-2/15 G 2/24-2/26 G
Size limits (in.) BP Sport BP Commercial TD & JD Sport TD & JD Comm.																				

[1] *S = setline; G = gillnet.*

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WHITE STURGEON MITIGATION AND RESTORATION IN THE COLUMBIA AND SNAKE RIVERS UPSTREAM FROM BONNEVILLE DAM

ANNUAL PROGRESS REPORT

JANUARY – DECEMBER 2021

Report C

Evaluate the success of developing and implementing a management plan to enhance production of White Sturgeon in reservoirs between Bonneville and McNary dams.

This report includes: Results regarding capture and marking efforts in Bonneville Reservoir for White Sturgeon population-abundance estimates for 2021.

Prepared by:

Blaine L. Parker

Columbia River Inter-Tribal Fish Commission
700 NE Multnomah Ave, Suite 1200
Portland, Oregon 97232

March 10, 2022

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ABSTRACT

Tribal fishers and Yakama Nation fisheries technicians completed Bonneville Reservoir tagging effort in January 2021. Our sampling is a first step in a two-step coordinated process to document White Sturgeon populations in management Zone 6 (i.e., Bonneville, The Dalles, and John Day Reservoirs). These reservoirs have been monitored cooperatively by tribal and state fishery managers since the 1990's (Parker 2015). The winter sampling effort, using highly experienced tribal commercial sturgeon fishers using commercial gear; has been an integral part of the co-management effort to document population changes in the White Sturgeon population structure for Bonneville and the other Zone 6 reservoirs (i.e., The Dalles and John Day Reservoirs) in a cooperative co-management effort with Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife since 1990's.

INTRODUCTION

This annual report documents the efforts of the Columbia River Inter-Tribal Fish Commission (CRITFC) and its subcontractors; the Yakama Nation (YN) and contracted tribal fishers. Jointly, we worked on tasks outlined in the Statement of Work for Bonneville Power Administration Project 1986-050-00, White Sturgeon Mitigation and Restoration in the Columbia and Snake Rivers Upstream from Bonneville Dam. Our winter tagging work was initiated in Bonneville Reservoir on December 7, 2020 and was completed on January 21, 2021 (Figure 1). It is common for the winter tagging effort to straddle two separate reporting periods; due to the number of weeks necessary to capture and mark the numbers of fish specified in our deliverable.

In addition to winter tagging in Bonneville Reservoir; YN technicians monitored tribal commercial fisheries, specifically the winter setline (January) and gillnet seasons (February and March). Monitoring of tribal fisheries was a cooperative effort with Washington Department of Fish and Wildlife (WDFW), with the results reported in WDFW's companion annual report. From May-August of 2021, YN technicians worked cooperatively with WDFW and Oregon Department of Fish and Wildlife (ODFW) stock assessment staff to conduct the summer phase of the population assessment in Bonneville Reservoir. In October 2021, YN fishery technicians again worked alongside ODFW and WDFW staff to conduct annual young of year White Sturgeon surveys in John Day, The Dalles and Bonneville Reservoirs. In December of 2021, White Sturgeon tagging efforts were initiated in John Day Reservoir; results will be reported in the 2022 report.

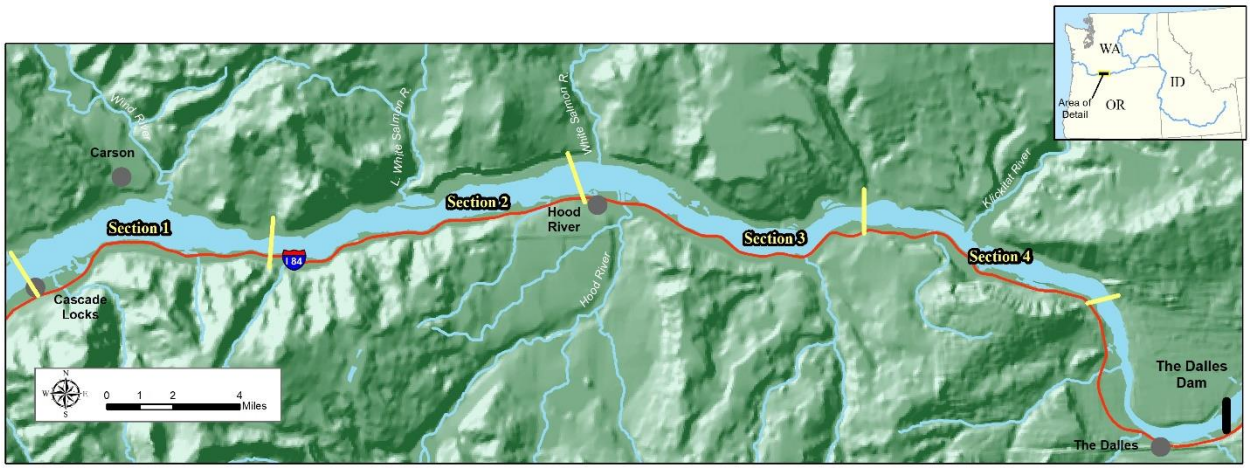

Figure C-1. Map of Bonneville Reservoir Columbia River with sampled reaches delineated by yellow bars for December 2020 and January 2021 survey period.

METHODS

Tagging procedures used are described in (Parker 2015). In addition, the capture and tagging procedures are described in [Method ID. 775 (monitoringmethods.org).]

RESULTS

Sampling efforts within Bonneville Reservoir during the winter of 2020-21 captured in 3,640 sturgeon in 260 overnight gillnet sets, a catch per unit effort (CPUE) of 14.0 sturgeons per set (Table C-1). Fish ranged in length from 24 cm FL to 234 cm FL, with a mean fork length of 89.0 cm FL (Table C-2). The proportion of sublegal (<96 cm FL) sturgeon was 70%, the proportion of legal sized (96-137 cm FL) sturgeon 29.3% and the proportion of oversize (> 137 cm FL) sturgeon was 0.7 % of the catch or 26 fish (Table C-2). We applied PIT tags to 2,977 sturgeon for an 82.0% overall tagging rate. The incidental catch total of 99 fish, comprising 7 species, dominated by common carp and Coho salmon (Table C-3).

Sampling Period	Sturgeon Catch	No. of Sets	Fish per Set (CPUE)
2008-09	3,739	75	49.9
2011-12	4,599	141	32.6
2014-15	3,290	648	5.1
2017-18	2,909	559	5.2
2020-21	3,640	260	14

Table C-1. Catch, number of sets, and catch per set of white sturgeon with gillnets in Bonneville Reservoir for sampling periods in 2008-09, 2011-12, 2014-15, 2017-18, and 2020-21.

Sample Period	Sub-Legal (<109 cm FL)	Legal (109-137 cm FL)	Over Legal (>137 cm FL)	Mean Fork Length (cm)
2008-09	92.1%	7.8%	0.0%	78.2
2011-12	88.3%	113.0%	0.4%	82.0
2014-15	92.0%	7.3%	0.7%	76.4
2017-18	91.9%	7.4%	0.4%	74.9
2020-21	70.0%	29.3%	7.0%	89.0

Table C-2. Proportions of sub-legal fish (<109 cm FL), legal fish (109–137 cm FL), and over legal fish (>137 cm FL) and mean fork length (cm) of White Sturgeon captured with gillnets in the 2008-09, 2011-12, 2014-15, 2017-18, and 2020-21 sampling periods in Bonneville Reservoir.

Species	Released Alive	Released Dead	Total
Chinook Salmon[1] *Oncorhynchus tshawytscha*	1	4	5
Coho Salmon[1] *Oncorhynchus kisutch*	8	14	22
Steelhead *Oncorhynchus mykiss*	0	1	1
Common Carp *Cyprinus carpio*	53	14	67
Northern Pikeminnow *Ptychocheilus oregonensis*		2	2
Suckers *Catastomus sp.*			1
Smallmouth Bass *Micropterus dolomieu*		1	1

Table C-3. Incidentally caught species from the 2020-21 gillnet sampling effort in Bonneville Reservoir.
[1] Chinook and Coho salmon incidentally captured were primarily post-spawn fish from the Klickitat River, Washington.

DISCUSSION/CONCLUSIONS

Bonneville Reservoir sampling in 2020-21 took place over seven weeks, nearly identical to the weeks fished in the 2017-18 tagging effort. However, in 2020-21 sampling was conducted by 2 fishers instead of 3 fishers that sampled for us in 2017-18. Ironically, there was an increase in the catch in 2020-21 of over 600 fish from the total in 2017-18 (Table C-1). In addition to the increased catch, the CPUE in 2020-21 was 14.0 sturgeon compared to 5.2 CPUE in the 2017-18. This CPUE was the third highest value in since the record rate of 49.9 sturgeon per set in 2008-09 (Table C-1). The number applied and the proportion of PIT tags applied nearly doubled; 2,977 (82%) in 2020-21 versus 1,245 (43%) in 2017-18, potentially an artifact of the increased catch. The mean fork length of sturgeon sampled in 2020-2021 (89.0 cm FL) increased 14.1 cm, from the mean fork length (74.9 cm FL) of sturgeon sampled in 2017-2018. This increase in substantially greater than the fork length increases in the previous sampling periods back to 2008-09 (Table C-2).

The substantial increase in the proportion of legal fish and the mean fork length may be due in part to possible gear selectivity that inadvertently selected for larger fish, or the growth rates of larger fish increased the overall numbers of these fish in the population (Figure C-2). The disparity between the two gears is more divergent than in previous years when the length frequency distribution graphs were almost identical between gear types (Figure C-2). It is unlikely that our sampling strategy or gear type could have created this disparity given that we have consistently used 20.3 cm stretched mesh for several years. However, these significant changes may also reflect back-to-back years of poor recruitment documented in 2015 and 2016, having reduced the numbers of recruits and increasing the availability of resources, thereby increasing growth rates in the older juvenile fish (2022 SMTF Technical Report).

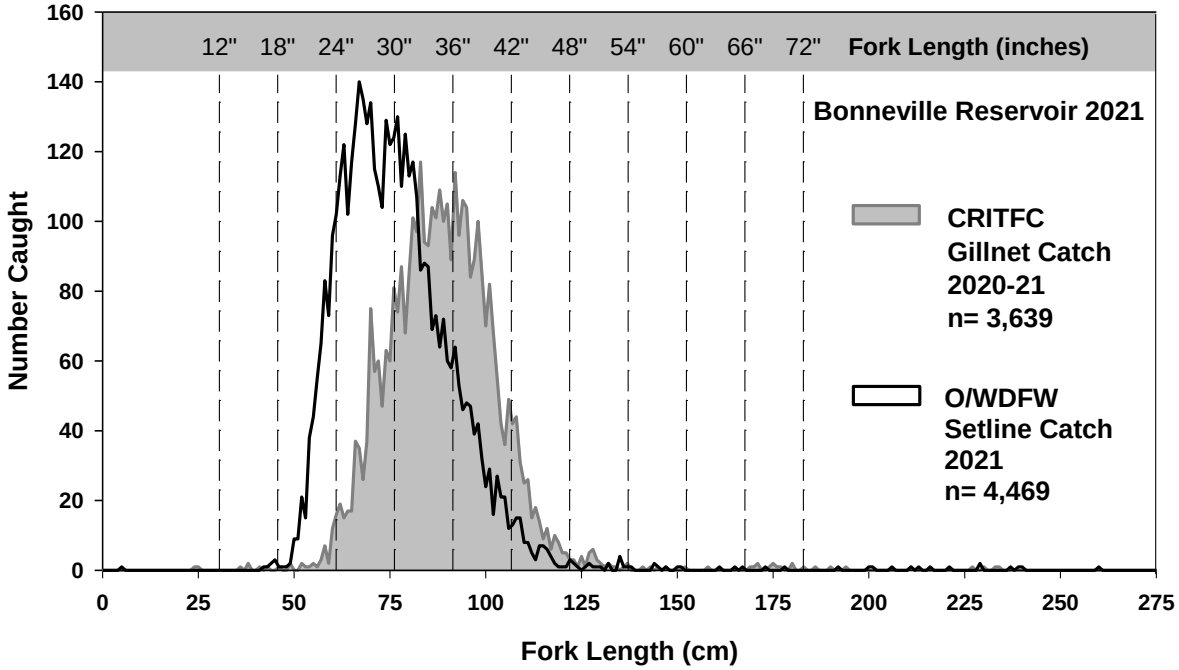

Figure C-2. Length frequency differences between White Sturgeon captured during winter tagging using gillnets and summer 2021 stock assessment using setlines in Bonneville Reservoir (From 2022 SMTF Technical Report).

ADAPTIVE MANAGEMENT and LESSONS LEARNED

The Bonneville Reservoir White Sturgeon population appears to be on an upswing based on the increased numbers of legal and oversized sturgeon since bottoming out in the mid 2000's (Table C-2). Correspondingly, catches of White Sturgeon have slowly increased concurrent with the population shifts in the sublegal and legal proportions of the population since 2008-09.
At the January 2021 Sturgeon Management Task Force (SMTF) meeting, tribal and state policy representatives will have the opportunity to discuss and possibly minor increases in commercial and sport fishery guidelines for this reservoir, affirming the availability of additional legal fish.

ACKNOWLEDGEMENTS

Our sincere appreciation to Yakama Nation fishery technician CRITFC technician Teddy Walsey and to tribal fishers Alfred M^{c}Conville and Chris Sergeant and their crew members for their dedication that made our tagging efforts a success. We thank Maria Jim for her data entry and proofing work during field season and Megan Begay for her efforts on daily operations and coordination. To Ruth Hannevig of ODFW for her patience and assistance with data entry and proofing of our catch data. We also thank Denise Kelsey and Joe Nowinski for their skill and expertise in the redesign of our field manual, data sheets, and data entry materials and their assistance in training the technicians.

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