

Channel Catfish Management on the San Juan River

2020 and 2021

Prepared by

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Fish Biologist Daniel Kaus with a large Channel Catfish collected from the San Juan River, Utah.

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Executive Summary

In 2020 and 2021, New Mexico FWCO continued non-native fish management in the San Juan River Basin. Our removal reaches were between Four Corner's Bridge, Colorado (River Mile 116.3) to Sand Island, Utah (RM 76.8). We were tasked with calculating exploitation rates, each year, in wintertime months in this river segment. We chose wintertime months because we predicted that lower flows and higher water clarity would increase both catch rates and exploitation rates compared to past nonnative removal.

In 2020, we removed a total of 4,225 Channel Catfish and we did not remove any other non-native fishes. In 2021, we removed 4,782 Channel Catfish for a total of 9,007 Channel Catfish removals of all sizes. In 2021, we also removed 19 Common Carp and 2 Black Bullhead Catfish and 1 Largemouth Bass. Our effort was greater in 2021, with 175.8 hours of electrofishing compared to 161.9 hours in 2020.

Exploitation rates varied by year and by size class. In 2020 we removed 23.0% of tagged Channel Catfish and in 2021 we removed 17.8%. In both years exploitation rates were greatest for the largest Channel Catfish; Channel Catfish > 500 mm total length had the greatest percent of tagged fish removed.

Sampling conditions were more variable in 2021 than in 2020. In 2020 water clarity, measured by Secchi Disk depth did not vary substantially during or between removal trips, but in 2021 water clarity was below our preferred level during two sampling trips. Low water clarity (high turbidity) corresponded with low catch rates in one of the two sampling trips.

Channel Catfish appeared to have areas of high density consistent in both 2020 and 2021. The areas of highest concentration were near the town of Montezuma Creek, Utah.

Our sampling trips were focused on tagging and removing non-native fishes from the San Juan River. We did have a few incidental collections of Colorado Pikeminnow and Razorback Sucker. These collections were infrequent and were to check for PIT tags in very large Colorado Pikeminnow or small Razorback Sucker.

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Introduction

The establishment of Channel Catfish (*Ictalurus punctatus*) and Common Carp (*Cyprinus carpio*) in the San Juan River has been identified as a detriment to the recovery of Colorado Pikeminnow (*Ptychocheilus lucius*) and Razorback Sucker (*Xyrauchen texanus*) (USFWS 2002a, b). Reducing the impacts of nonnative fishes has specifically been identified as a management element in the San Juan River Basin Recovery Implementation Program's Long Range Plan (SJRBRIP 2015). However, the level of threat that Channel Catfish pose on endangered fishes remains unknown. Channel Catfish are thought to pose a threat to native fishes in multiple forms such as: predation, competition for resources, and as a choking hazard to the piscivorous Colorado Pikeminnow. In an effort to quantify the threat nonnative fish pose to recovery, a two-year study assessing the predatory effect of Channel Catfish on endangered fishes was initiated in 2018.

In 2019, the New Mexico Fish and Wildlife Conservation Office (New Mexico FWCO) and Utah Division of Wildlife Resources (Utah DWR) completed field work, as identified in Kansas State University's (KSU) SOW 18-26 *Incidence and consumption of endangered fishes by Channel Catfish (Ictalurus punctatus) in the San Juan River*, to quantify the predatory effects Channel Catfish have on the two endangered fishes in the San Juan River. Additionally, the objectives of the two-year field effort were to determine more precise abundance estimates, detection probabilities, and annual survival rates for Channel Catfish through mark-recapture. Finally, we were tasked with estimating age-1 Colorado Pikeminnow abundance using calcein marked hatchery fish. Data from both the stomach content analysis (i.e., percent predation) and abundance/survival estimates (number of predatory fish), when used in concert, would aid the SJRBRIP in the development of a future nonnative fish management program commensurate with the level of threat.

We (New Mexico FWCO and Utah DWR) were able to calculate a single population estimate in 2018. The estimated adult Channel Catfish population (fish ≥ 300 mm total length) between Shiprock Bridge, New Mexico (River Mile (RM) 147.9) to Mexican Hat, Utah (RM 52) was 56,224 individuals (Duran et al 2020). The estimated adult Channel Catfish population (fish ≥ 300 mm total length) within our sample reach (Four Corner's Bridge, Colorado (RM 116.3) to Sand Island, Utah (RM 76.8) was 22,149 individuals. A population estimate was not calculated in 2019 because recaptures of tagged fish were low. We also found that the objective of estimating age-1 Colorado Pikeminnow abundance was not possible; marking fish with calcein failed when the mark could not be seen in the field.

The results of the KSU Channel Catfish diet study (Hedden et al. 2020) have been used, since publication, to provide evidence to continue field efforts to suppress Channel Catfish. In the two years of the study, KSU evaluated the stomach contents of 4,649 adult Channel Catfish and found that 7.7% contained identifiable fish (Hedden et al. 2020). Channel Catfish

consumption of all fish increased with Channel Catfish size, water temperature, and turbidity. Of the fish identified in Channel Catfish stomachs, 54% were native fish. Only two Colorado Pikeminnow were found in Channel Catfish stomachs, and subsequent analysis (SJRIP Program Office personal communication) of the results of the study determined that even with the low occurrence of Colorado Pikeminnow found in Channel Catfish stomachs, there was potential that a large adult Channel Catfish population could still have a detrimental effect on juvenile Colorado Pikeminnow survival. The analysis estimated that an average of 795 Colorado Pikeminnow individuals could be consumed each year and estimated that removing 25% of the Channel Catfish population annually would potentially result in an estimated additional 158 (range 0 – 461) Colorado Pikeminnow surviving through lowered consumption rates by Channel Catfish. This analysis has provided the impetus to continue non-native removal, during more targeted and advantageous sampling conditions, and in a shorter reach of river.

Study Area

We conducted removal trips from Four Corners Bridge (River Mile 119) to Sand Island, Utah (River Mile 76.5) using raft-mounted ETS electrofishing systems. We used two rafts on adjacent shorelines and sampled 12-15 river miles per day. We began each removal year with a single tagging trip followed by either three removal trips (2020) or four removal trips (2021) during the winter months when water temperatures were cool and water clarity was typically high. We attempted to complete all tagging and removal trips under predetermined sampling conditions that maximized sampling efficiency. These conditions, we predicted would increase adult Channel Catfish catch rates. Specifically, we would complete all trips when river flows are less than 1,000 ft³/sec and water clarity was high (>250mm Secchi disk). Raft-mounted electrofishing in the San Juan River is negatively impacted by elevated turbidity when flows increase after regional rainfall cause flash floods in intermittent tributaries. Channel Catfish catch rates were lower in past removal efforts when increased turbidity resulted in decreased visibility for the field crews. Based on the experience during past seasonal non-native removal projects, we predicted that Channel Catfish catch rates during winter months would be greater as flows would be low and water clarity should be high and more predictable.

In 2020, we did all removal trips between January and March, and in 2021 we did all removal trips between February and April, the COVID-19 Navajo Nation travel restrictions prevented beginning trips earlier in the winter season in 2021.

Tagging Protocol

We tagged all Channel Catfish ≥ 300 mm total length (TL) captured during the first marking trip with an individual numerical T-bar anchor tag inserted in the left dorsal area. Fish were usually collected over an approximately three river mile section and released back into the

river at the end of that section. We recorded tag data and total length (mm) for every tagged fish. A subset of fish was weighed to the nearest gram. Channel Catfish <300 mm TL were not tagged but still removed following New Mexico FWCO non-native removal protocols. Tagging of Channel Catfish allowed us to generate exploitation rates during the sampling period.

We removed all Channel Catfish captured on removal trips after the marking pass. We measured and recorded total length of all fish to the nearest millimeter and weighed a subset of fish to the nearest gram. If Channel Catfish were tagged, we recorded the tag number before removal from the river. Though the objective of this project is to remove all adult Channel Catfish ≥ 300 mm TL from the San Juan River, all juvenile Channel Catfish or any other non-native fishes collected were also removed from the river.

We calculated exploitation rates of Channel Catfish for each year and each removal trip. Exploitation rate is the percent of tagged Channel Catfish reencountered and removed from the San Juan River. Exploitation rates will continue to increase with each successive removal pass, so we added an additional removal trip in 2021. By adding one more removal pass we hoped to increase exploitation rates and remove additional large adult Channel Catfish from the San Juan River. In 2021, we continued the removal protocol from 2020; we conducted a tagging pass prior to the removal passes. This allowed us to calculate exploitation rates and provide data that will be useful for population estimates.

Rare Fishes Captures

We limited rare fish collections, because of demographic monitoring of Colorado Pikeminnow and Razorback Sucker already taking place in the fall on the San Juan River. If rare fishes were encountered the electrofishing crew was instructed to cease shocking (i.e., take their foot off the control pedals) and allow the fish to swim off before restarting electrofishing. During 2020 and 2021 non-native removal we did collect a small number of Razorback Sucker less than 300 mm SL to check for PIT tags and Colorado Pikeminnow for the same reason.

Results 2020 and 2021

In 2020, New Mexico FWCO continued Channel Catfish suppression, focusing on removing larger Channel Catfish from the San Juan River during winter months between Four Corners Bridge and Sand Island, Utah when flows and water turbidity were low. We were able to maximize removal efficiency under our preselected conditions in 2020.

In 2020, we completed three removal trips after an initial tagging trip, and cumulative exploitation rates were greater than 20% in the 42-mile river reach. We tagged 920 adult Channel Catfish and removed 4,246 adult Channel Catfish in three subsequent removal trips (Table 1). Our catch rate (Channel Catfish/hour of electrofishing) was highest during the second removal trip (Table 1). Most Channel Catfish we removed were greater than 400 mm TL. Exploitation

rates were calculated by size class (Table 2) and ranged from 16.6% for fish 300 to 399 mm TL to 31.0% for fish >500 mm TL. The exploitation rate for all Channel Catfish combined was 23.0%. Total Channel Catfish removed was greatest from river mile 97 to 93 in 2020, this short river section is near the town of Montezuma Creek (Figure 1).

We were able to complete all removal trips close to the criteria established in our protocol; river flows were less than 1000 ft³/sec and visibility was high, i.e., river clarity was close to or greater than 25.0 cm measured with a Secchi Disk (Table 3). We canceled and rescheduled one removal trip because turbidity increased during the trip.

Table 1. Effort, total fish tagged and total fish removed by trip in the San Juan River 2020.

Trip	Effort (hours)	Channel Catfish	Fish/hour
Tagging	33.92	920	27.7
Removal 1	42.93	955	22.3
Removal 2	43.39	1,748	40.4
Removal 3	41.65	1,523	36.8
Total	161.9	5,146	32.0

Table 2. Total Channel Catfish tagged and removed by size class and trip form the San Juan River in 2020.

Size class	Total tagged	Trip 2	Trip 3	Trip 4	Total	Percent
300-399	465	19	35	23	78	16.6
400-499	397	30	53	34	117	29.5
500+	58	6	4	8	18	31.0
Total	920	55	92	65	212	23.0

recaps/trip

Table 3. Secchi Disk depth in centimeters and mean daily discharge (ft³/sec) range at the Four Corner's USGS Gauge during tagging and removal trips San Juan River in 2020 and 2021.

Trip	2020			2021		
	Date	Depth	(ft ³ /sec)	Date	Depth	(ft ³ /sec)
Tagging	22-24 Jan	50.0 cm	738-844	23-25 Feb	7.0 cm	552-564
Removal 1	4-6 Feb	27.0 cm	744-769	9-11 Mar	38.0 cm	567-569
Removal 2	11-13 Feb	21.5 cm	673-760	16-18 Mar	38.0 cm	594-610
Removal 3	10-12 Mar	34.5 cm	679-699	23-25 Mar	31.0 cm	547-579
Removal 4	-	-	-	30-31 Mar	5.5 cm	482-514

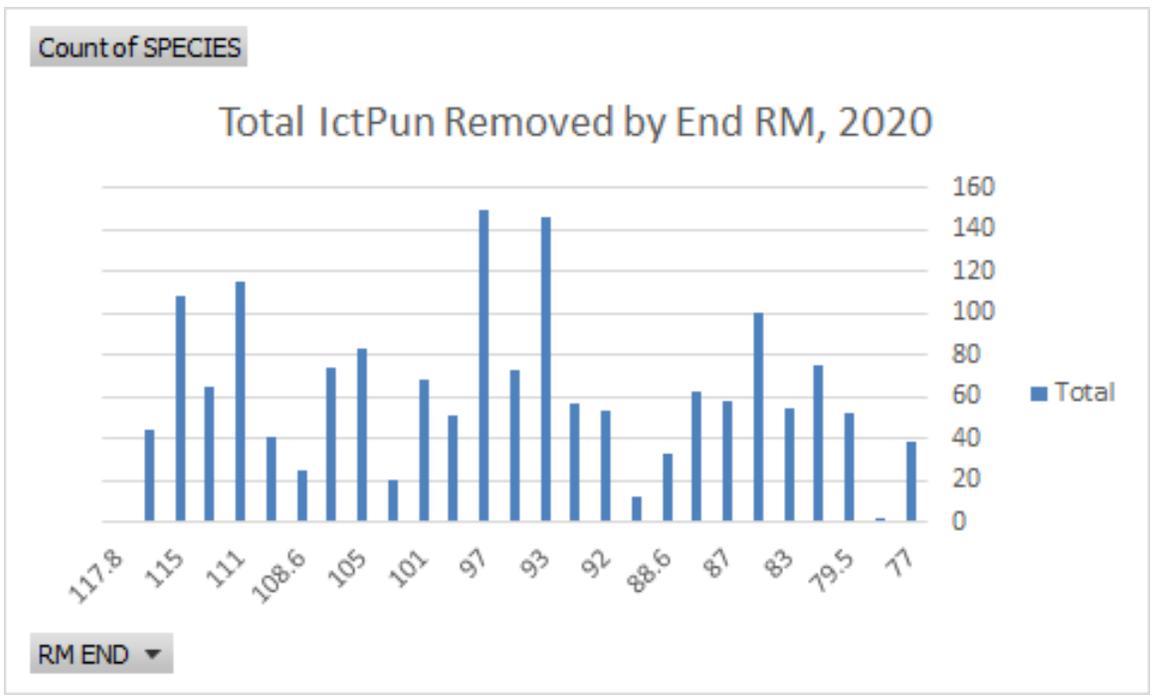


Figure 1. Total number of Channel Catfish collected by end river mile in the San Juan River 2020.

In 2021, we conducted four removal trips after the initial tagging trip. Total exploitation rates were less than 20%, and environmental conditions between trips were more variable than in 2020 (Table 1 and 4). We completed all fish tagging and removal trips from February to April 2021. On our initial tagging trip, we tagged 1,038 Channel Catfish and removed an additional 337 Channel Catfish less than 300 mm TL (Table 5). We removed a total of 3,209 Channel Catfish in 2021. Our catch rate (34.3 fish/hour) was highest during the first removal trip (Table 4), and lowest during our last removal trip (9.7 fish/hour). Most Channel Catfish we removed were greater than 400 mm TL. Exploitation rates were calculated by size class (Table 5) and ranged from 13.3% for fish 300 to 399 mm TL to 20.7% for fish >500 mm TL. Exploitation rates for all Channel Catfish combined was 17.8%. Total Channel Catfish removed was greatest from river mile 93 to 91 in 2021, this short river section is near the town of Montezuma Creek (Figure 2).

Table 4. Effort, total fish tagged and total fish removed by trip San Juan River 2021.

Trip	Effort (hours)	Channel Catfish	Fish/hour
Tagging	30.12	1,038	34.5
Removal 1	38.03	1,305	34.3
Removal 2	41.28	705	17.1
Removal 3	41.09	1,223	29.7
Removal 4	25.34	246	9.7
Total	175.86	4,517	25.7

Table 5. Total Channel Catfish tagged and recaptured by size class by trip San Juan River 2021

Size class	Total tagged	Trip 2	Trip 3	Trip 4	Trip 5	Total	Percent
300-399	392	28	5	19	1	53	13.3
400-499	525	46	17	33	12	108	20.6
500+	121	13	3	4	5	25	20.7
Total	1,038	87	25	56	18	186	17.9

recaps/trip

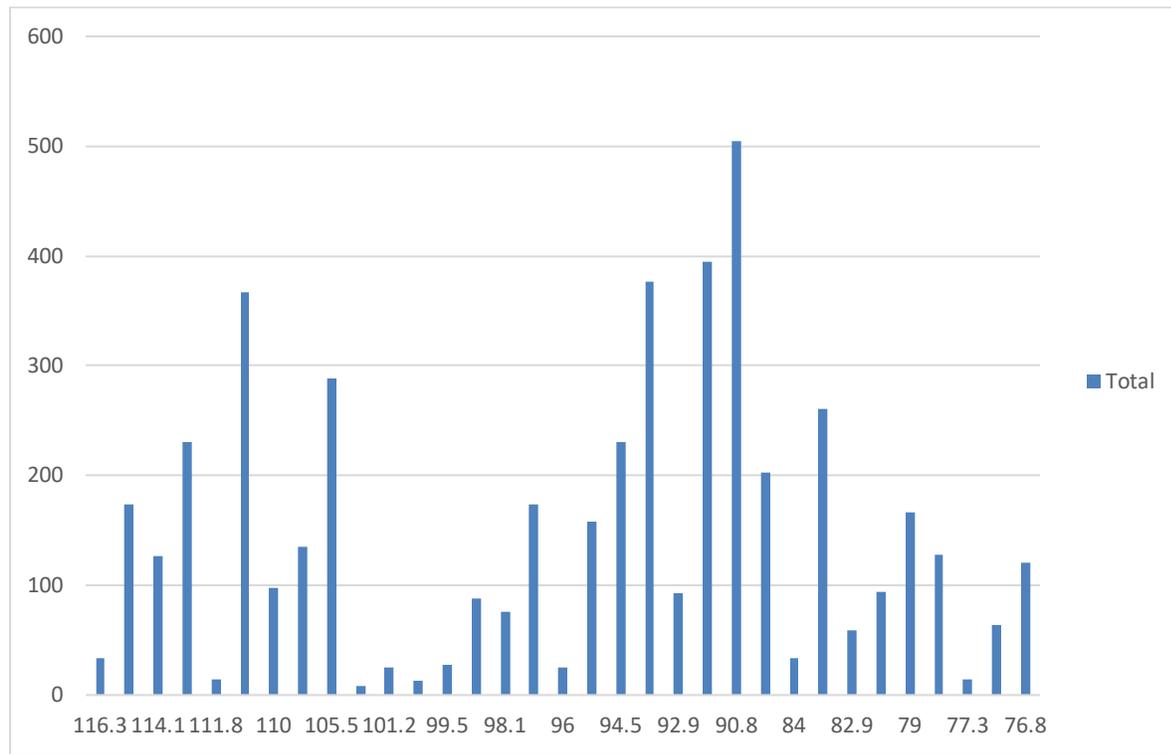


Figure 2. Total number of Channel Catfish collected by end river mile in the San Juan River in 2021

Discussion

Our results from 2020 and 2021 winter sampling supported our prediction that targeting Channel Catfish in this section and time of the year could be successful and result in high exploitation rates. Movement of Channel Catfish in the San Juan drives exploitation rates down (Duran et al 2018), and because Channel Catfish move when water temperatures are warm, we conducted our removal trips in winter months when water temperatures were cool. By focusing trips when water temperature was cool and when water clarity was high, we had hoped to increase our efficacy and exploitation rates.

Exploitation rates for the Channel Catfish greater than 400 mm TL was over 20% in each year. In the diet study by Kansas State University large Channel Catfish consumed substantially more fish than small individuals. For example, a 300 mm TL Channel Catfish, averaged across all water turbidity levels, had a 12% (range 3-28%) chance of having a fish prey present in its stomach, compared to a 600 mm fish with a 50% (21-80%) chance (Hedden et al. 2020). Thus, we concentrated on removing large Channel Catfish from our study area.

We were not able to conduct all sampling trips in 2021 under our preselected environmental conditions of low flows and high water clarity. During the initial tagging trip and the final removal trip water clarity was low but catch rates between these trips was notably different. The 2021 initial tagging trip had the highest catch rates of the two-year study ($n = 1,038$ tagged fish plus another 326 fish <300 mm TL for a total of 1364 fish collected) and the final removal trip had the lowest catch rate. Water clarity was similar during both trips (Table 3). The high catch rates during low water clarity in our initial tagging trip was unexpected. When we encountered similar low water clarity conditions in our final removal trip we continued the trip, partly based on our experience during the tagging trip. In the final removal trip, we only sampled for two days and ended sampling at RM 92.9 due to increasing turbidity and resulting low catch rates.

During the tagging trip in 2021 we encountered a large number of Channel Catfish as crews approached the town of Montezuma Creek, UT. Between RM's 95.8 and 93.8 crews captured 376 Channel Catfish with 69 of them too small to tag. The resulting 307 fish that were tagged between those two river miles accounted for 29.6% of all tagged fish from the entire tagging effort. This is equivalent to a catch rate of 202.2 fish/hour for all fish captured. To contrast this to the immediate upstream and downstream sampling sections, RM's 99.5-95.8 and 90.8-87, the catch rates were 45.0 fish/hour and 46.5 fish/hour, respectively. We encountered this aggregation during every subsequent removal effort. Even during the increased turbidity during Removal Trip 4 between the RM's 98.1 and 92.9 there were 145 Channel Catfish removed representing 59.1% of all fish removed on that trip. It is unclear what may have caused this aggregation, but the fact that there were so many fish, in such a short distance, could be useful if

there is a wish to target areas with high concentration of Channel Catfish for removal in the future.

We began our 2021 Channel Catfish removal trips late in the winter season compared to 2020 because of access to the San Juan River on Navajo Nation during the COVID 19 pandemic. Because of the late start (February) we had very little time to reschedule removal trips prior to April when Razorback Sucker spawning season begins. We did not want to disrupt Razorback Sucker spawning with multi-pass electrofishing trips for Channel Catfish removal. Thus, we chose to continue with removal trips when water clarity was low to complete field work.

We were encouraged by the exploitation rates in 2020 and in 2021 even with variable water clarity conditions between years. The total number of Channel Catfish removed was lower than in past removal efforts because our effort was lower, and our study area targeted fewer river miles. For example, in 2014, 20,033 individual Channel Catfish were removed in 797 hours of electrofishing, and Channel Catfish removal happened over 106 river miles. We removed a total of 7,435 Channel Catfish in the first two years of the three-year effort. Our objective with this project was to establish exploitation rates for Channel Catfish during low flow and high water clarity periods. The objective was not to have a river wide impact on the Channel Catfish population. If a greater number of Channel Catfish are to be removed for a targeted management priority, then effort will need to increase.

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