



**UPPER AND LOWER BOX CREEK RESERVOIRS
2021 TREND NET SURVEY**

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BACKGROUND: Upper and Lower Box Creek Reservoirs are two small impoundments located on Monroe Mountain west of Greenwich, Utah, in northern Piute County. Both are found within the Fishlake National Forest. The upper reservoir (UBC) covers 62 acres, has a maximum depth of 18 feet, and is fed by Box Creek and the North Fork of Box Creek (Figure 1). The lower reservoir (LBC) covers 21 acres, has a maximum depth of 23 feet and is fed by the spillover from UBC through Box Creek. Water from both reservoirs is completely dedicated to irrigation, though UBC has experienced greater fluctuations in water level in recent years. Extreme drought in 2020 led to the nearly complete draining of UBC, while LBC was also drawn fairly low.

Stocked rainbow (RBT) and brook (BRK) trout made up the sport fisheries in the Box Creek reservoirs for several decades. Redside shiners were illegally introduced and have often maintained dense populations. Water fluctuation and competition with shiners provided challenges to trout survival and growth, resulting in generally marginal fisheries sustained by catchable-sized RBT and inconsistently available BRK. Evaluation of the fisheries was limited to angler reports until 2013, when regular monitoring was initiated with trend net surveys. Three surveys have been conducted since then and the current regional sampling strategy has prescribed netting surveys at the Box Creek reservoirs every five years. Following observation of a single large splake (apparently mistakenly stocked with a load of BRK) in UBC during the 2013 survey, managers recognized the potential benefit of stocking predators that could utilize redside shiners as forage. Half of the BRK quotas were converted to tiger trout because they are generally more easily caught by anglers than splake. The BRK quotas were eventually canceled after the 2016 survey found that tiger trout were performing well in LBC. Netting results were less favorable in UBC, though this may have been due to insufficient sampling effort. Requested quotas of RBT and tiger trout were adjusted to better reflect the relative size of the reservoirs, while a quota of splake was eventually added to UBC (Tables 1 and 2). In addition, excess Bonneville cutthroat trout (BCT) produced by the Manning Meadow brood were stocked in UBC in an attempt to add more potential production to the fishery. While the UBC fishery has continued to struggle, anglers have begun targeting large tiger trout in LBC and have caught fish up to eight pounds in size.

METHODS: One experimental gill net was set in each of the Box Creek reservoirs on May 10, 2021, and allowed to fish overnight. A diving net was set in LBC, while a floating net was set in UBC. A diving net was also planned for UBC, but was not set due to the extremely low water level. Nets measured 6 ft x 80 ft, with eight panels of randomly-arranged mesh size (1.5", 2.25", 1", 0.75", 2.5", 1.25", 2"). Nets were set in locations that were deemed suitable for catching fish at the time of the survey (Fig. 1). Fish caught were removed from nets on the morning of May 11 and were measured to the nearest mm (total length) and weighed to the nearest gram. Trout body condition was measured by the calculation of Fulton's K_{TL} (generated from total length [TL]):

$$K_{TL} = (Weight/Length^3) \times 100,000$$

Results of the 2021 survey were compared with those from historic trend net surveys.

RESULTS:

Lower Box Creek Reservoir – Twelve tiger trout, ten RBT, and one brown trout were collected in LBC on May 11, 2021 (Table 3). The catch rate of 23 trout per net-night was higher than that observed during the last survey in 2016 (Table 4), primarily due to an increase in RBT catch (Fig. 2). Tiger trout spanned at least four size classes (Fig. 3, 4) and averaged 352 mm (13.9 in) in total length (TL), 576 g (1.3 lbs) in weight, with a mean condition (K_{TL}) of 1.11. All values were higher than those observed in 2016. Tiger trout ranged in size up to 514 mm (20.2 in) and 1,450 g (3.2 lbs) (Title Page). All RBT sampled were stocked at catchable size (261 mm, 10.3 in)

in May 2020 and averaged 327 mm (12.9 in), 391 g (0.9 lbs), with a mean condition of 1.11. All values were higher than those observed in previous years. Condition was noticeably improved over previous surveys (Fig. 4). The single, large brown trout collected measured 673 mm (26.5 in) and weighed 3,280 g (7.2 lbs) (Title Page). The fish was successfully released. Although brown trout are known to occur in Box Creek below the reservoir, none have been reported being caught in LBC before. The fish obviously grew to such large size by feeding on redbase shiners. In addition to the trout, 21 redbase shiners were caught in the net. This was the first survey that successfully sampled shiners at LBC. All redbase shiners caught were large adults (132-145 mm). Even though shiner and trout catches were similar, trout made up more than 95% of the sampled biomass, thanks to contributions by large trout.

Upper Box Creek Reservoir – Only one RBT and one BCT were collected in UBC on May 11, 2021 (Table 5). The catch rate of 2 trout per net-night was the lowest observed in the limited monitoring at UBC (Table 6, Fig. 5). The RBT measured 180 mm, indicative of a wild fish entering the reservoir from a tributary. The BCT measured 237 mm (9.3 in) and had a distinct sloped head, often indicative of whirling disease infection (Fig. 6). No other fish were sampled.

DISCUSSION: Utah has experienced almost continual significant drought for most of the past decade. While the UBC fishery has clearly been negatively impacted by water level fluctuation, results of the 2021 trend net survey indicate that LBC has fared much better. Multiple age classes of tiger trout were observed in LBC, while the presence of large trout – caught by both nets and anglers – also demonstrated that at least a minimum pool has sustained some overwinter survival for several years. RBT also showed improved condition over previous years, despite drought conditions experienced in late 2020. The drawing down of UBC in 2020 may have contributed to the abundance of RBT and tiger trout observed in LBC, though it should also be noted that no BCT or splake were observed in the lower reservoir. The higher catch of RBT may have also resulted from the stocking of diploid fish in 2020. Triploid RBT have often shown reduced or less consistent overwinter survival in waters where low water level and reduced oxygen are common. Although RBT quotas in both reservoirs were converted from triploid to diploid in recent years, triploid RBT have still been stocked at times in LBC. A note should be added to both quotas to ensure that they are filled with diploid RBT.

The addition of tiger trout has created a valuable new fishery in LBC that has gained significant interest from local anglers. Tiger trout have also proved to be a more efficient use of fingerling stocking resources over the previously stocked brook trout. While tiger trout may not be able to significantly control redbase shiners, predation pressure may be able to mitigate the effects of shiner competition. Stocking requests for LBC were reduced in recent years to better match the reservoir's smaller size in relation to UBC. These quotas should continue for this reason, as well as due to the potential for fish spillover from UBC when it is drawn down and due to the longer life span often exhibited by tiger trout. The discovery of a brown trout in LBC was not expected, but could be reasonably explained by a previously unknown population of wild brown trout in Box Creek above the reservoir. Electrofishing should be conducted in the tributary to confirm whether such a population exists.

Water level fluctuation appears to have impacted trout stocked in UBC in recent years. The reservoir was drawn to a particularly low pool in fall 2020 and the poor snowpack of 2021 only worsened the drought. Reduced numbers of RBT (600) and tiger trout (500) were stocked in 2021, while splake and BCT were not stocked at all. In addition, the trout harvest limit was later increased to allow anglers to utilize fish before they were lost, although it appears that the reservoir received little fishing pressure anyway. Attempts to improve the fishery should

continue through stocking predators (tiger trout, splake) and BCT, until these additions can be fully evaluated. At least one brown trout performed well in LBC, so they may also be considered for stocking in UBC. Catchable-sized tiger trout may also be considered as a better stocking choice than fingerlings, if frequent water fluctuation continues in the future.

RECOMMENDATIONS:

1. As recommended in the Southern Region Sampling Strategy, conduct trend nets surveys every five years at the Box Creek reservoirs, unless specific need for another survey arises. Set two or three nets (at least one floating net) in Upper Box Creek Reservoir, using a small boat.
2. Stock only diploid rainbow trout in the Box Creek reservoirs in order to optimize overwinter survival of fish that escape summer harvest.
3. Maintain current stocking quotas of rainbow, tiger, and splake trout in the Box Creek reservoirs. Stock Bonneville cutthroat trout in Upper Box Creek Reservoir when conditions are favorable.
4. Adjust stocking quotas in Upper Box Creek Reservoir as dictated by netting surveys. An intermediate survey may be added in 2023 or 2024 to better evaluate recent stocking adjustments. Consider alternative quotas (brown trout, catchable tiger trout) if current quotas do not improve angling opportunities.

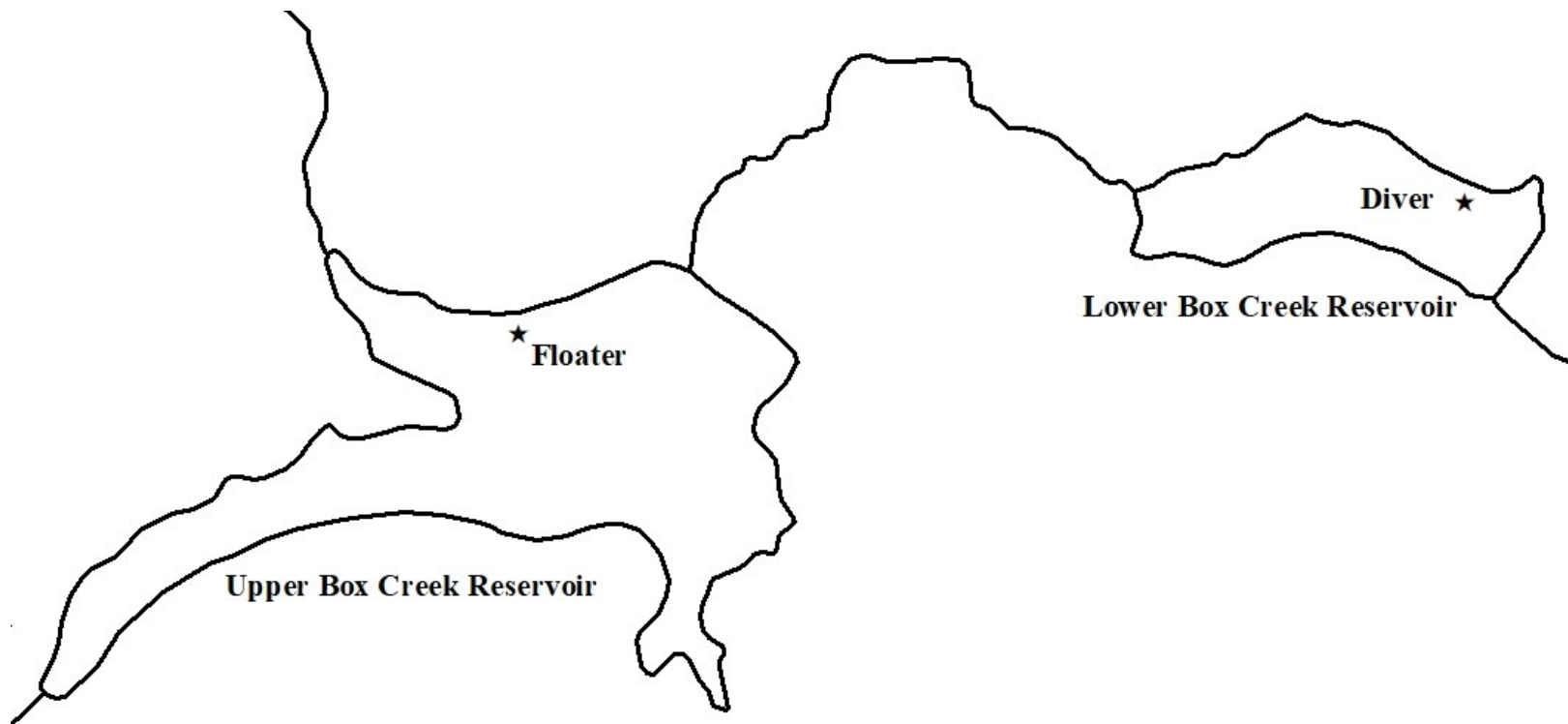


Figure 1. Upper and Lower Box Creek Reservoirs, with locations of gill nets set in the 2021 trend net survey.

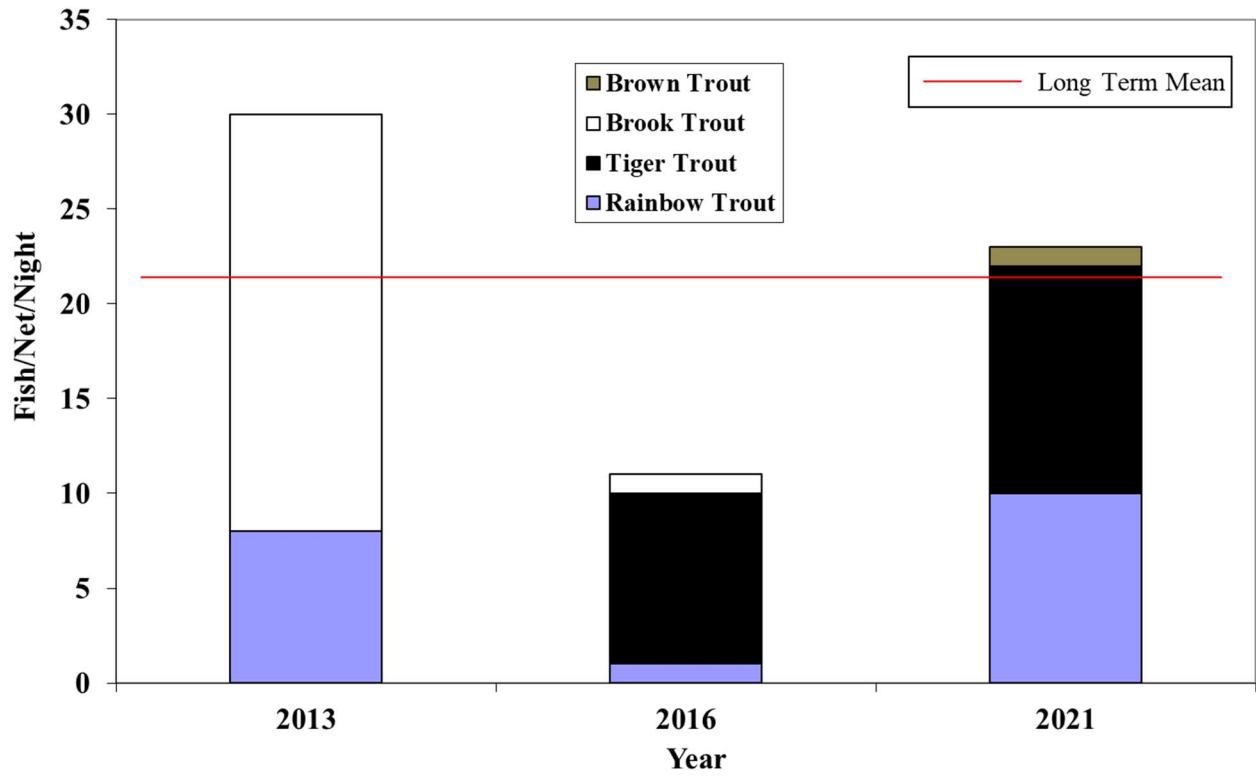


Figure 2. Trout catch rate during trend net surveys at Lower Box Creek Reservoir, 2013-2021.

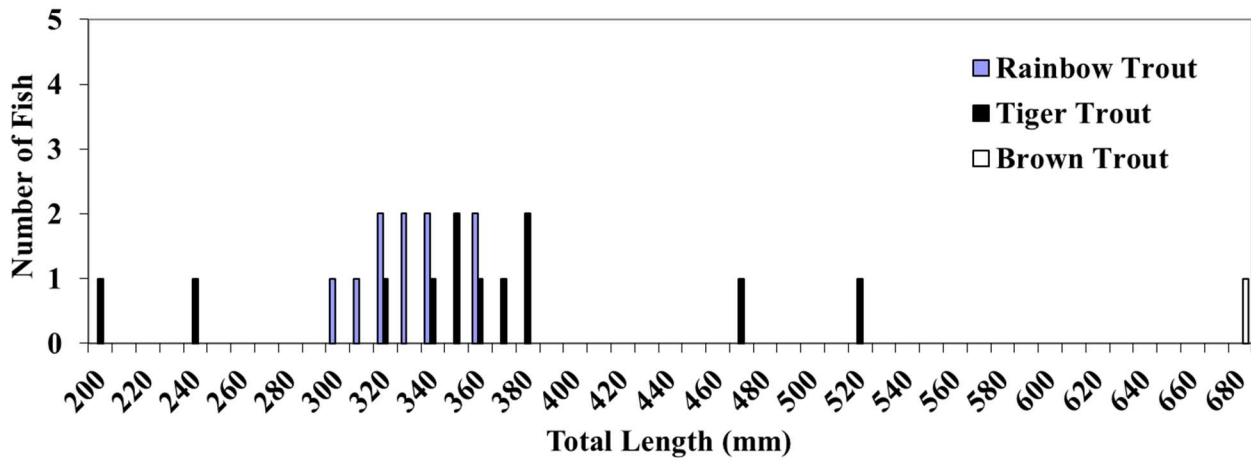


Figure 3. Length distribution of trout collected at Lower Box Creek Reservoir on May 11, 2021.



Figure 4. Tiger (left) and rainbow (right) trout collected at Lower Box Creek Reservoir on May 11, 2021.

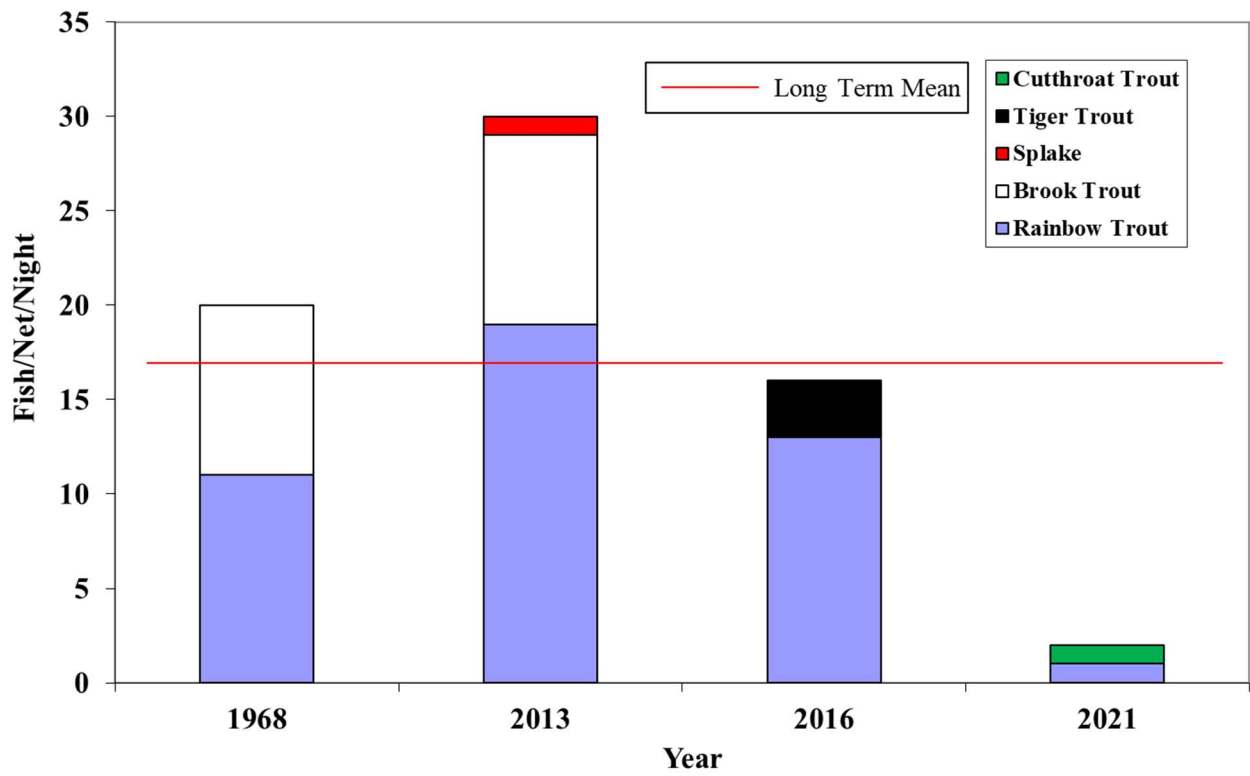


Figure 5. Trout catch rate during trend net surveys at Upper Box Creek Reservoir, 1968-2021.



Figure 6. Bonneville cutthroat trout collected at Upper Box Creek Reservoir on May 11, 2021.

Table 1. Record of trout stocking in Lower Box Creek Reservoir for the five years prior to the 2021 trend net survey.

<u>Year</u>	<u>Rainbow Trout</u>		<u>Tiger Trout</u>		<u>Brook Trout</u>	
	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>
2016	1,995	9.2	810	3.9	801	2.1
2017	2,000	9.5	1,003	3.6		
2018	1,493	10.0	750	2.9		
2019	2,492	9.6	751	3.0		
2020	1,045	10.3	754	3.0		
<i>2021 Quota</i>	<i>1,000</i>	<i>10.0</i>	<i>750</i>	<i>3.0</i>	<i>---</i>	<i>---</i>

Table 2. Record of trout stocking in Upper Box Creek Reservoir for the five years prior to the 2021 trend net survey.

<u>Year</u>	<u>Rainbow Trout</u>		<u>Tiger Trout</u>		<u>Splake Trout</u>		<u>Cutthroat Trout</u>		<u>Brook Trout</u>	
	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>
2016	1,995	9.2	810	3.9					801	1.2
2017	2,000	9.5	1,003	3.6	507	3.1	10,020	2.1		
2018	2,489	10.0	1,102	2.1	565	3.2	6,624	2.2		
			1,251	2.9						
2019	2,020	9.8	1,751	3.0			5,114	1.8		
2020	3,001	10.1	1,252	3.0	506	3.1				
<i>2021 Quota</i>	<i>2,500</i>	<i>10.0</i>	<i>1,250</i>	<i>3.0</i>	<i>500</i>	<i>3.0</i>	<i>---</i>	<i>---</i>	<i>---</i>	<i>---</i>

Table 3. Summary of the results from the 2021 trend net survey at Lower Box Creek Reservoir.

Water:	Lower Box Creek Reservoir		Catalog #:	VI 401A												
Date Set:	5/10/2021		Weather:													
Date Pulled:	5/11/2021		Water Temp:													
# Nets:	1 AFS Diver		Collectors:	M. Hadley, M. Roundy, A. Silva, J. Swensen												
Summary for Sport Fish																
Species	N	Total Weight (kg)	fish per net/night	Total Length (mm)			Weight (g)			Condition (Ktl)			% total catch	% total biomass	% trout catch	% trout biomass
				Mean	SE	Range	Mean	SE	Range	Mean	SE	Range				
Rainbow Trout	10	3.91	10.00	327	5.78	295-354	391	27.7	308-562	1.11	0.02	0.87-1.34	22.73	26.52	43.48	27.72
Tiger Trout	12	6.91	12.00	352	24.7	191-514	576	111	55-1450	1.11	0.04	0.79-1.29	27.27	46.89	52.17	49.02
Brown Trout	1	3.28	1.00	---	---	673	---	---	3280	---	---	1.08	2.27	22.24	4.35	23.26
Trout	23	14.10	23.00	355	19.5	191-673	613	136	55-3280	1.11	0.03	0.79-1.34	52.27	95.65	---	---
Summary for Non-Sport Fish																
Species	N	Total Weight (kg)	fish per net/night	% total catch	% total biomass	Total Length (mm)										
						Range										
Redside Shiner	21	0.64	21.00	47.73	4.35	132-145										

Table 4. Trend net survey results at Lower Box Creek Reservoir, 2013-2021.

Date	Net Sets		Total Trout	Trout per net-night	Rainbow trout all ages			Brook Trout all ages			Tiger Trout all ages			Total Nongame per net-night	Comments
	Flo	Div			Mean TL (mm)	Mean W (g)	Mean Ktl	Mean TL (mm)	Mean W (g)	Mean Ktl	Mean TL (mm)	Mean W (g)	Mean Ktl		
	14-May-13	0			1	30	30	283	197	0.84	294	239	0.93		
17-May-16	0	1	11	11							293	288	0.99	0	Redside shiner present; 1 RBT, 1 BRK
11-May-21	0	1	23	23	327	391	1.11				352	576	1.11	21	1 brown trout
	Long-term mean			21	308	306	0.99	293	237	0.93	327	453	1.06	7	

Table 5. Summary of the results from the 2021 trend net survey at Upper Box Creek Reservoir.

Water:	Upper Box Creek Reservoir			Catalog #:	VI 401B												
Date Set:	5/10/2021		Time:		Weather:												
Date Pulled:	5/11/2021		Time:		Water Temp:												
# Nets:	1 AFS Diver			Collectors:	M. Hadley, M. Roundy, A. Silva, J. Swensen												
Summary for Sport Fish																	
Species	N	Total Weight (kg)	fish per net/night	Total Length (mm)			Weight (g)			Condition (Ktl)			% total catch	% total trout	% total biomass	% trout biomass	
				Mean	SE	Range	Mean	SE	Range	Mean	SE	Range					
Rainbow Trout	1	0.04	1.00	---	---	180	---	---	43	---	---	0.74	50.00	50.00	28.10	28.10	
Cutthroat Trout	1	0.11	1.00	---	---	237	---	---	110	---	---	0.83	50.00	50.00	71.90	71.90	
Trout	2	0.15	2.00	209	28.5	180-237	77	33.5	43-110	0.78	0.04	0.74-0.82	100.00	---	100.00	---	
Summary for Non-Sport Fish																	
Species	N	Total Weight (kg)	fish per net/night	% total catch	% total biomass	Total Length (mm)											
						Range											
None																	
Comments:	Reservoir very low, mostly drained in 2020.																

Table 6. Trend net survey results at Upper Box Creek Reservoir, 1968-2021.

Date	Net Sets		Total Trout	Trout per net-night	Rainbow trout all ages			Brook Trout all ages			Tiger Trout all ages			Total Nongame per net-night	Comments
	Flo	Div			Mean TL (mm)	Mean W (g)	Mean Ktl	Mean TL (mm)	Mean W (g)	Mean Ktl	Mean TL (mm)	Mean W (g)	Mean Ktl		
2-Jul-68	1	1	39	20											
14-May-13	0	1	30	30	302	257	0.93	277	199	0.90				8	1 splake
17-May-16	0	1	16	16	279	201	0.89				261	152	0.85	1	
11-May-21	1	0	2	2										0	Mostly drained 2020
	Long-term mean			17	289	228	0.91	277	199	0.90	261	152	0.85	3	