FISHERY MANAGEMENT INVESTIGATIONS

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Jim Fredericks, Director

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ABSTRACT

Established in 1950, Anderson Ranch Reservoir (ARR) is an 1,865-ha impoundment on the South Fork Boise River in Elmore County, Idaho. Angling opportunities exist for a variety of game fish in the reservoir. However, Idaho Department of Fish and Game (IDFG) manages the reservoir primarily as a kokanee fishery. An angler index creel survey was performed over 16 days from June 19th – July 18th, 2017, at Curlew Creek boat ramp. Four hundred twenty-eight kokanee anglers were interviewed, which fished for a total of 2,263.5 hours. Catch per unit effort (CPUE) of angled kokanee was 0.8 fish/h with a mean TL of 336 mm (± 1.6; mean TL ± 90% CI). Kokanee gill netting was conducted at ARR July 25th, 26th, and 27th. Gill nets captured 412 kokanee *Oncorhynchus nerka*, two Bull Trout *Salvelinus confluentus*, five Chinook Salmon *Oncorhynchus tshawytscha*, four Largescale Sucker *Catostomus macrocheilus*, five Northern Pikeminnow *Ptychocheilus oregonensis*, seven Rainbow Trout *Oncorhynchus mykiss*, and only one Smallmouth Bass *Micropterus dolomieu*. Catch per unit effort for kokanee increased from 23 fish/net-night in 2016 to 68.7 fish/net-night in 2017. In both 2017 surveys (i.e., index creel and gill netting), proportional size distribution (PSD) and PSD-Preferred (PSD-P) were exceptionally high (PSD > 99 and PSD-P > 94), which anglers appeared to be pleased with.

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INTRODUCTION

Constructed in 1950, ARR is an 1,865-ha impoundment on the South Fork Boise River in Elmore County, Idaho and is used for irrigation water storage, power generation, and flood control. The reservoir also provides recreational opportunities (e.g., boating, water sports, and angling) with six boat ramps including Deer, Pine, Fall, Castle, Curlew, and Elk creek ramps. Boat ramps are managed by the Bureau of Reclamation and the Boise National Forest. Angling opportunities in ARR are managed by the Idaho Department of Fish and Game (IDFG) and exist for a variety of game fish including, Bull Trout *Salvelinus confluentus*, Chinook Salmon *Oncorhynchus tshawytscha*, kokanee *Oncorhynchus nerka*, Rainbow Trout *Oncorhynchus mykiss*, Smallmouth Bass *Micropterus dolomieu*, and Yellow Perch *Perca flavescens*. However, IDFG manages the fishery primarily for kokanee.

The kokanee fishery is managed with a daily bag limit of 25 fish and a possession limit of 75 (i.e., 3X the daily bag limit). The Department's kokanee management objective for ARR is to provide a kokanee fishery resulting in a catch rate of 1.0 fish/h with a mean TL between 305 – 366 mm. As such, monitoring the kokanee population (e.g., gill net surveys) and angler participation (e.g., creel surveys) are integral to determining if management objectives are being met. Thus, summer gill netting was implemented to evaluate kokanee relative abundance and to determine age-class availability for the next year's fishery as well as provide insight into spawner size, fecundity, and relative abundance of the next year's spawning age class, and to determine the need for hatchery supplementation. The kokanee population is primarily maintained through natural recruitment as kokanee are known to spawn in several tributaries including the upper South Fork Boise River, Lime Creek, and Fall Creek. However, population abundance fluctuates from year-to-year due to factors such as inconsistent recruitment, entrainment, predation, or other natural events. Because of these fluctuations, staff have implemented varying management strategies such as stocking, following years when low abundance is observed. Additionally, creel surveys were performed. The goals of the surveys were to: 1) evaluate angler harvest and catch rates for kokanee and 2) describe basic size distribution and relative abundance.

METHODS

Angler effort and catch rates were described using a creel survey. Angler creel surveys were performed from June 19th to July 18th, 2017 at Curlew Creek boat ramp on ARR (Figure 1). Surveys were conducted during this time frame based on previous creel data that suggested June – July was the peak period of kokanee angling effort. Additionally, Curlew Creek boat ramp was selected for surveys as it is the most-often used access site on ARR (Megargle et al. 2016). Data was collected by surveying anglers as they exited the water. The data was then used to index fisheries metrics. Kokanee were the primary focus of the evaluation and data on other fish species encountered during the creel survey was not recorded.

During each survey, creel clerks were stationed at a Curlew Creek boat ramp to intercept anglers as they exited the fishery. Sixteen total dates, including 15 weekdays and one weekend day were selected during the survey period. Surveys were conducted from ~ 09:00 to 16:00. Data collection focused on completed fishing trips. Each interview or contact was assigned a unique interview number for that day, based on the numerical order by which anglers were encountered. Number of rods used, time spent angling, and the number of kokanee that were harvested or released was also recorded. Fishing method (e.g., shore, trolling boat, still boat, float tube), gear type (e.g., flies, lures, bait), and biological data such as total length (mm), weight (g), sex of harvested fish, number of eggs per female, and otoliths were collected with angler permission. Mean party size and mean trip length were estimated along with catch per unit effort (CPUE; fish/h) of angled kokanee.

Gill netting was conducted on ARR July 25th, 26th, and 27th, 2017. A total of six neutrally buoyant nets were set on the thermocline overnight at unknown locations on the reservoir and retrieved the following day. Four nets were set on July 25th, one net was set on the 26th, and one net was set on the 27th. Each gill net measured 48.8 m in length and 6.0 m in depth. Gill nets contained 16 panels, each measuring ~ 3.0 m in length. Nets consisted of eight different mesh sizes (12.7-, 19.0-, 25.4-, 38.1-, 50.8, 63.5-, 76.-2, 101.6-mm; stretch measure) with two panels of each mesh size randomly positioned throughout the net. Sampled fish were identified to species, measured for total length (mm), and weighed (g).

A length-frequency histogram was developed to depict the relationship between kokanee sampled with gillnets and kokanee sampled from angler harvest. Fish were assigned to 10-mm length bins based on their total length.

Proportional size distribution (PSD) was used to describe the length structure of kokanee observed in surveys (Gablehouse 1984; Neumann et al. 2012):

$$\mathrm{PSD} = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}}$$

PSD-Preferred (PSD-P, 350 mm TL) and PSD-Memorable (PSD-M, 430 mm TL) were also estimated.

Body condition of kokanee was estimated using relative weight (W_r):

$$Wr = \left(\frac{\mathrm{W}}{\mathrm{Ws}}\right) \times 100,$$

where W is the weight of the fish and W_s is the length specific standard weight of the fish (Wege and Anderson 1978; Neumann et al. 2012). Relative weight was also reported by standard length category (e.g., stock – quality, quality – preferred).

RESULTS

Four hundred twenty-eight kokanee anglers fished for 2,263.5 hours based on interviews. Mean party size (± 90% CI) was 1.6 anglers (± 0.1), and mean trip length was 5.4 h (± 0.2). Catch per unit effort of angled kokanee was 0.8 fish/h with a mean total length (TL ± CI) of 336 mm (± 1.6; *n* = 795; Figure 2), with a mean weight (g ± CI) of 401 g (± 5.9; *n* = 616). Kokanee PSD from the creel survey was 100, PSD-P was 94, and PSD-M was 2 (Gablehouse 1984: Neuman et al. 2012) (Figure 3). Mean W_r of kokanee was 101 (Figure 4).

Gill nets captured 412 kokanee, 2 Bull Trout, 5 Chinook Salmon, 4 Largescale Sucker, 5 Northern Pikeminnow, 7 Rainbow Trout, and 1 Smallmouth Bass. Kokanee CPUE was 68.7 fish/net-night and Chinook Salmon CPUE was 0.86 fish/net-night. Total length of kokanee varied from 85 to 460 mm with a mean total length of 347 mm (± 1.7; Figure 2). Kokanee PSD captured in gill nets was 99, PSD-P was 97, and PSD-M was 1 (Figure 3). Average W_r of all gill netted kokanee was 97 (Figure 4).

DISCUSSION

Kokanee management objectives were partially met in 2017 in terms of kokanee size, but not in catch rates. Mean TL of kokanee met the established objective of 305 mm to 356 mm in both the index creel (335 ± 1 mm) and the gill net (347 ± 2 mm) surveys. In both surveys, PSD and PSD-P were exceptionally high (PSD ≥ 99 and PSD-P ≥ 94). The combination of high PSD and W_r values suggest that fish likely grew quickly and had a large forage base (Wright and Craft 2012). However, the kokanee population in Anderson Ranch Reservoir experiences fluctuations as a result of inconsistent recruitment, entrainment, predation, and other natural events (e.g. Elk Creek Fire in the South Fork Boise River basin in August 2013). Thus, the lack of smaller kokanee (i.e., < Stock length and Stock – Quality length) in the creel and gill net survey is worrisome and suggests that 2015- and 2016-year classes may have had poor recruitment. As a result, we may see mean TL and body condition remain high for the next few years, but could observe a decline in catch rates. We may need to consider stocking hatchery kokanee as an option to offset highly unpredictable natural recruitment.

While the mean angler catch rate objective of 1 fish/h was not met, catch rates were near the objective at 0.8 fish/h and increased from 2016 (0.5 fish/h; Megargle et al. 2016). Given the current population metrics, achieving established management objectives for ARR kokanee may not be realistic on an annual basis. Thus, the current management objectives should be re-evaluated and potentially altered to reflect a more realistic management objective for the fishery.

MANAGEMENT RECOMMENDATIONS

1. Consider annually stocking kokanee in ARR as a means to mitigate for varying recruitment.

2. Continue annual horizontal gill net monitoring of ARR with a primary focus on kokanee.

3. Evaluate the current kokanee management objectives to determine the feasibility of achieving these objectives in relation to the current fishery.

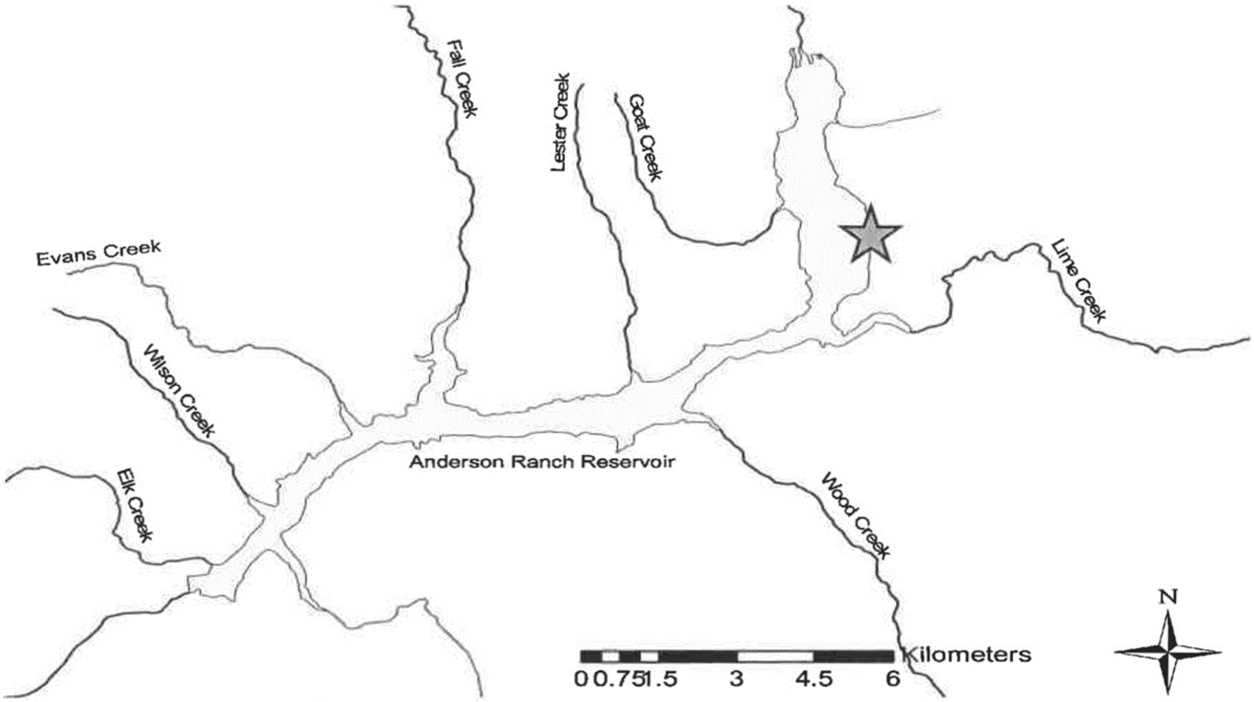

Figure 1. Anderson Ranch Reservoir in Elmore County, Idaho. The star marks the location of the Curlew Creek boat ramp where index creel surveys were performed from June 19 to July 18, 2017.

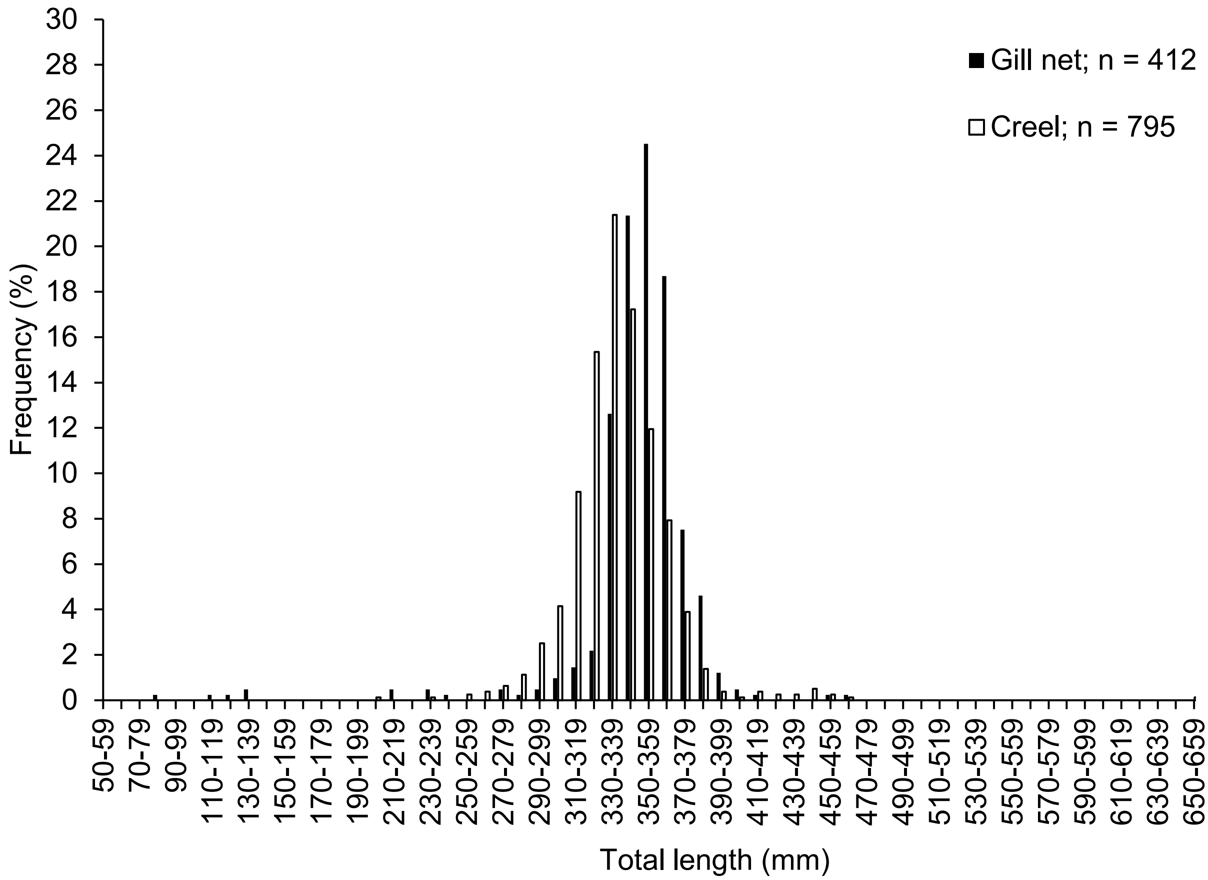

Figure 2. Length-frequency histogram of kokanee sampled in 2017 from both creel and gill net surveys in Anderson Reservoir.

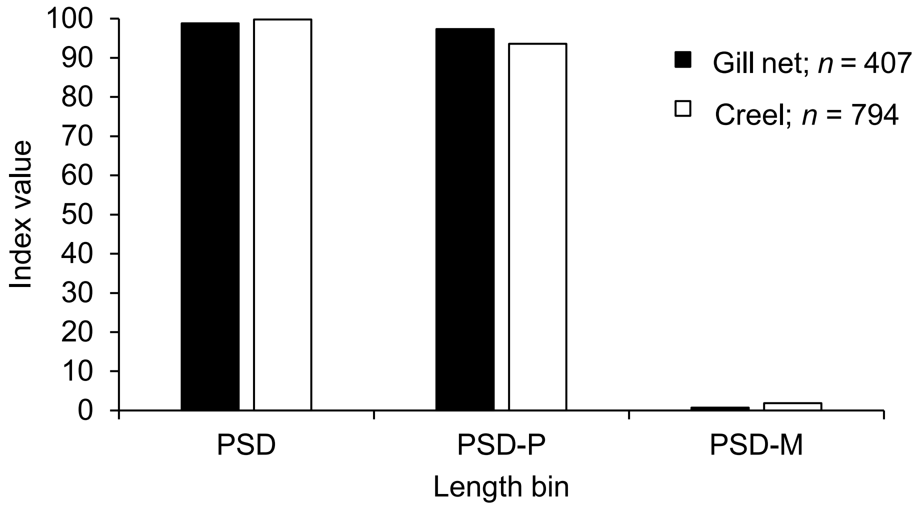

Figure 3. Proportional-size distribution index values of kokanee sampled in 2017 from creel and gill net surveys in ARR. Additionally, preferred (PSD-P, ≥ 300 mm) and memorable (PSD-M, ≥ 400 mm) values are provided.

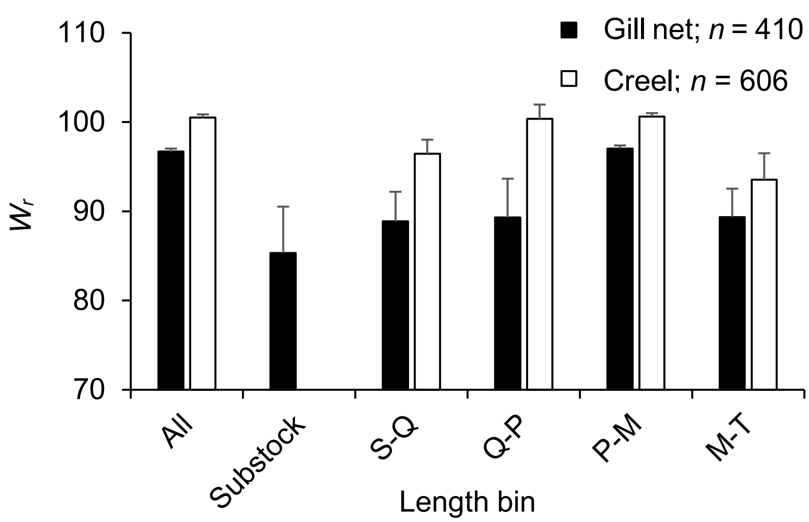

Figure 4. Relative weight index values of kokanee sampled in 2017 from creel and gill net surveys in ARR. Index values are provided for all fish, substock (≤ 120 mm), stock – quality (S-Q; 120 – 249 mm), quality – preferred (Q – P; 250 – 299), preferred – memorable (P-M; 300 – 399), memorable – trophy (M-T; 400 – 500). Error bars represent one SE.

DOG CREEK RESERVOIR

ABSTRACT

Dog Creek Reservoir is a 21.8-ha impoundment located approximately 10 km northwest of Gooding, Idaho and provides diverse fishing opportunities. Dog Creek Reservoir experiences little drawdown once irrigation season begins resulting in minimal fluctuation in surface elevation except during drought years. Historically, Dog Creek Reservoir has been stocked with a variety of fish including Rainbow Trout *Oncorhynchus mykiss*, Channel Catfish *Ictalurus punctatus*, and tiger muskellunge *Esox masquinongy X E. lucius* at variable lengths and stocking densities. In June of 2017, Idaho Department of Fish and Game (IDFG) fisheries staff performed a lowland lake survey on Dog Creek Reservoir to assess the fisheries community. Of the gamefish sampled, Largemouth Bass *Micropterus salmoides* had the highest PSD (89) and a PSD-P of 44, while Yellow Perch *Perca flavescens* only had a PSD of 3. Fish in the reservoir generally exhibited good body condition. Relative weights were near or exceeded the standard (i.e., 100) for five of the six gamefish species. Bluegill *Lepomis macrochirus* had the highest W_r (114), while Yellow Perch had the lowest (82). In summary, Dog Creek Reservoir provides unique opportunities for anglers to target a variety of fish.

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INTRODUCTION

Dog Creek Reservoir provides diverse fishing opportunities within the Magic Valley Region. Dog Creek Reservoir is a 21.8-ha impoundment located approximately 10 km northwest of Gooding, Idaho. The reservoir is formed by an earthen dam and possesses an outflow controlled with a headgate and manually installed dam boards. Dog Creek Reservoir experiences minimal drawdowns during the irrigation season resulting in negligible fluctuations in surface elevations. As a result, Dog Creek Reservoir presents a chance to create and maintain consistent fishing opportunities.

From 1967 – 1993 Dog Creek Reservoir was stocked on an annual basis with Rainbow Trout *Oncorhynchus mykiss* and sporadically with other trout species (e.g., Cutthroat Trout *Oncorhynchus clarkii*, Brown Trout *Salmo trutta*). In 1991, juvenile tiger muskellunge (tiger muskie) Esox *masquinongy* × *Esox lucius* and Channel Catfish *Ictalurus punctatus* fingerlings were introduced to the reservoir. Regular stocking of Rainbow Trout, Channel Catfish, and tiger muskie continued through 2011. Since 2011, (when the reservoir was last surveyed) stocking of catchable-sized Rainbow Trout, juvenile tiger muskie, and periodic adult Channel Catfish transplants have occurred. In 2017, a lowland lake survey was performed to evaluate the fisheries in the reservoir. The objectives of this survey were to: 1) determine current species composition in the reservoir, 2) determine relative abundance and population size structure of various gamefish species present in the reservoir, and 3) inform future fish stocking decisions.

METHODS

Idaho Department of Fish and Game (IDFG) established standardized methods to sample lowland lakes in 2012 (Lamansky and Meyer 2012). This protocol was used partially to design the survey in Dog Creek Reservoir during 2017. Sampling occurred during the second full week in June and sample locations on the reservoir were selected at random based on protocol guidelines. Three methods were used to sample fish which included electrofishing, gill nets, and trap nets. Sampled fish were identified to species and measured for total length (TL; mm) and weight (g).

Three sites were electrofished as part of the survey. Unfortunately, the starting and ending waypoints of the three sites were not recorded, nor was the amount of total effort (i.e., time with power on). However, for the purpose of this report, calculations assumed that all three electrofishing surveys were ~900 s in length based on previous surveys completed within the Magic Valley Region since 2010. Electrofishing settings were also assumed based on prior reports. A Midwest Lake Electrofishing Systems [MLES], Polo, Missouri; Infinity Control Box; Smith-Root, Vancouver, Washington; AUA-6 Anode Array set at 24% duty cycle and approximately 2,200 – 2,800 watts of pulsed DC power was used. Current was generated by a 7,000-watt Honda generator.

Trap nets (1.8 m long x 0.91 m high; 13-mm bar mesh; 22.86-m lead) were set at four random locations on the reservoir (Figure 5, Table 1). Nets were set perpendicular to the shoreline and allowed to soak overnight. Nets were set on June 7th, 2017, and retrieved the following day on June 8th. Calculations for catch per unit effort (CPUE) were made based on one net-night/net set.

Four sinking gill nets and four floating were set at various locations on the reservoir (Figure 5, Table 1), but were not paired. Gill nets were eight panel monofilament nets 1.8 m deep, 61.0 m long, with 7.6 m panels measuring 25-, 38-, 51-, 64-, 76-, 102-, 127-, and 152-mm stretched mesh. Nets were set on June 5th and retrieved on June 6th. Calculations for CPUE were made based on one net-night/net set.

Electrofishing mean CPUE was calculated by summing the species-specific CPUE for each of the three sites and then divided by the total number of sites (three). Catch per unit effort was then reported as the number of fish sampled per hour of electrofishing. For trap nets, mean CPUE was calculated by summing the catch of all four nets and dividing by the total number of net-nights (i.e., four). For gill nets, mean CPUE was calculated by summing the catch of all eight nets and dividing by the total number of net-nights (i.e., eight).

Proportional size distribution was used to describe the length structure of various fish species observed in surveys (Gablehouse 1984; Neumann et al. 2012).

$$\text{PSD} = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}}$$

PSD-preferred (PSD-P, 380 mm TL) was also estimated for Largemouth Bass *Micropterus salmoides*. Body condition of various fish species was estimated using relative weight (W_r):

$$Wr = \left(\frac{\text{W}}{\text{Ws}}\right) \times 100,$$

where W is the weight of the fish and W_S is the length specific standard weight of the fish (Wege and Anderson 1978; Neumann et al. 2012). Finally, a length-frequency histogram was used to illustrate these relationships for Largemouth Bass (n = 77) and Bluegill *Lepomis macrochirus* (n = 114). Fish were assigned to 10 mm length bins based on their TL.

RESULTS

A total of 276 fish and 8 different species were sampled during electrofishing surveys. Bluegill had the highest CPUE (± SE) of 123 fish/h (± 55), while Channel Catfish had the lowest (8 fish/h, ± 2; Figure 6). Largemouth Bass and Yellow Perch *Perca flavescens* CPUE was 91 fish/h (± 23) and 53 fish/h (± 9), respectively. Both were high when compared to other sampled fish such as Common Carp *Cyprinus carpio* (23 fish/h, ± 10), Green Sunfish *Lepomis cyanellus* (31 fish/h, ± 10), and hatchery Rainbow Trout (17 fish/h, ± 7). Tiger muskie were not encountered during the electrofishing portion of the survey. The total mean electrofishing CPUE for all fish combined was 364 fish/h (± 79).

A total of 187 fish and 7 different species were sampled during the trap netting portion of the survey. Yellow Perch had the highest mean CPUE (36.3 fish/net-night), while Pumpkinseed *Lepomis gibbosus* and Green Sunfish *Lepomis cyanellis* had the lowest mean CPUE (0.3 fish/net-night; Figure 7). Tiger muskie were encountered, but at low mean CPUE (0.5 fish/net-night).

A total of 482 fish and 9 different species were sampled using gill nets. Similar to trap nets, Yellow Perch had the highest mean CPUE (19.5 fish/net-night) followed by hatchery Rainbow Trout (18.9 f/net-night) and Largescale Sucker *Catostomus macrocheilus*, (10.1 fish/net-night; Figure 8). Only one bullhead *Ameiurus spp*. was captured. Tiger muskie (1.0 fish/net-night), Largemouth Bass (1.1 fish/net-night), Channel Catfish (1.9 fish/net-night), and Common Carp (1.3 fish/net-night) all had low mean CPUE.

Largemouth Bass TL ranged from 130 to 519 mm with a mean TL (± 90% CI) of 202 mm (± 18 mm). Bluegill TL ranged from 80 to 199 mm with a mean TL of 122 mm (± 3 mm) (Figure

11). Eighty-eight percent of the Bluegill sampled were between 100 and 149 mm. Of the Largemouth Bass sampled, 76% were between 130 and 199 mm. The remaining 26% were all greater than 200 mm (i.e., stock length).

Proportional size distribution varied widely among fish sampled. Largemouth Bass had the highest PSD (89) and a PSD-P of 44 followed by Channel Catfish (26; Figure 9). Bluegill and Yellow Perch had relatively low PSDs at 11 and 3, respectively. Common Carp, a non-game fish, had the highest PSD (96).

Relative weight was near or exceeded the standard (i.e., 100) for five of the six gamefish species (Figure 10). Bluegill had the highest W_r (114), while Yellow Perch had the lowest (82). Channel Catfish had the second highest W_r of the gamefish (110). Largemouth Bass also had a high W_r of 98. Common Carp had a W_r of 90.

DISCUSSION

Dog Creek Reservoir has a variety of fish species available for anglers to target. There are opportunities for anglers to target cold and warm water fish species such as Rainbow Trout and Channel Catfish. The present diversity is a result of previous stocking, fish translocations, natural recruitment, and potential entrainment from the Snake River at Milner Reservoir through the canal system.

The stocking of Rainbow Trout on an annual basis provides a put-and-take fishery. Channel Catfish translocations from the Snake River also provide angling opportunity. We currently have little more than anecdotal information to support the idea that few anglers take advantage of the Channel Catfish opportunity that exists within the reservoir. It may be important to tag some of the Channel Catfish within the reservoir to determine angler use and exploitation. This would help us determine whether the effort that we put forth to conduct translocations is actually making fishing better. Conversely, the stocking of tiger muskie does not appear to be successful and an investigation as to why may be warranted. Tiger muskie were initially introduced in 1991 and since then 6,109 have been stocked in the reservoir. During the 2017 survey we have only encountered nine Tiger Muskie, with the largest being 370 mm indicating that survival is poor.

In terms of natural recruitment contributions, Yellow Perch are abundant in the reservoir and provide plenty of recreational opportunity for anglers but lack good size structure indicated by their low PSD (3) and *Wr* (82). Largemouth Bass and Bluegill are also abundant, but less so than Yellow Perch. However, when evaluating PSD and *Wr* of fish in Dog Creek, data indicate that there is a high-quality Largemouth Bass fishery available to the public. This is due to multiple factors such as: high PSD (89) and PSD-P (44) of Largemouth Bass, and low Bluegill PSD (11). Additionally, high W_r of Bluegill (114; SE ± 2) and Largemouth Bass (98; SE ± 1) further support this argument. Although Bluegill PSD is a little lower than optimal (i.e., 15 – 20; Schramm Jr. and Willis 2012), other fish (e.g., other sunfish species, suckers, perch) likely act as an alternate food source for Largemouth Bass and supplement their diet. However, it remains unclear as to why there was a lack of 200 to 300 mm Largemouth Bass in the survey.

In summary, Dog Creek Reservoir provides unique opportunities for anglers to target a variety of fish. Furthermore, Dog Creek Reservoir has the potential to provide a sustainable quality Largemouth Bass fishery under current population dynamic trends and management regulations. Continued monitoring of the fishery will be important to provide managers with the information needed to make management recommendations necessary to maintain and/or potentially improve the fisheries in the reservoir.

MANAGEMENT RECOMMENDATIONS

1. Tag Rainbow Trout, Channel Catfish and Largemouth Bass to develop estimates of angler use and exploitation.

2. Continue stocking hatchery Rainbow Trout annually to maintain the put-and-take fishery component.

3. Conduct a similar lowland lake survey in 5 to 7 years to continue monitoring document potential changes in population dynamics of fishes present in the reservoir.

4. Evaluate tiger muskie releases to determine whether we should continue to stock them in the reservoir. Identify levels of survival needed to recruit fish large enough to contribute to the fishery.

Table 1. Location name, gear type, date sampled, effort, and waypoints of sites sampled on Dog Creek Reservoir.

Location Name	Gear Type	Date Sampled	Effort	Latitude	Longitude
FGN1	Floating gill net	6/6/2017	1 net night	43.02590	-114.74170
FGN2	Floating gill net	6/6/2017	1 net night	43.02613	-114.74417
FGN3	Floating gill net	6/6/2017	1 net night	43.02765	-114.74383
FGN4	Floating gill net	6/6/2017	1 net night	43.02530	-114.74243
SGN1	Sinking gill net	6/6/2017	1 net night	43.03138	-114.74467
SGN2	Sinking gill net	6/6/2017	1 net night	43.02797	-114.74502
SGN3	Sinking gill net	6/6/2017	1 net night	43.02593	-114.74403
SGN4	Sinking gill net	6/6/2017	1 net night	43.02632	-114.74233
TN1	Trap net	6/6/2017	1 net night	43.03103	-114.74639
TN2	Trap net	6/6/2017	1 net night	43.02738	-114.74546
TN3	Trap net	6/6/2017	1 net night	43.02878	-114.74361
TN4	Trap net	6/6/2017	1 net night	43.02709	-114.74144

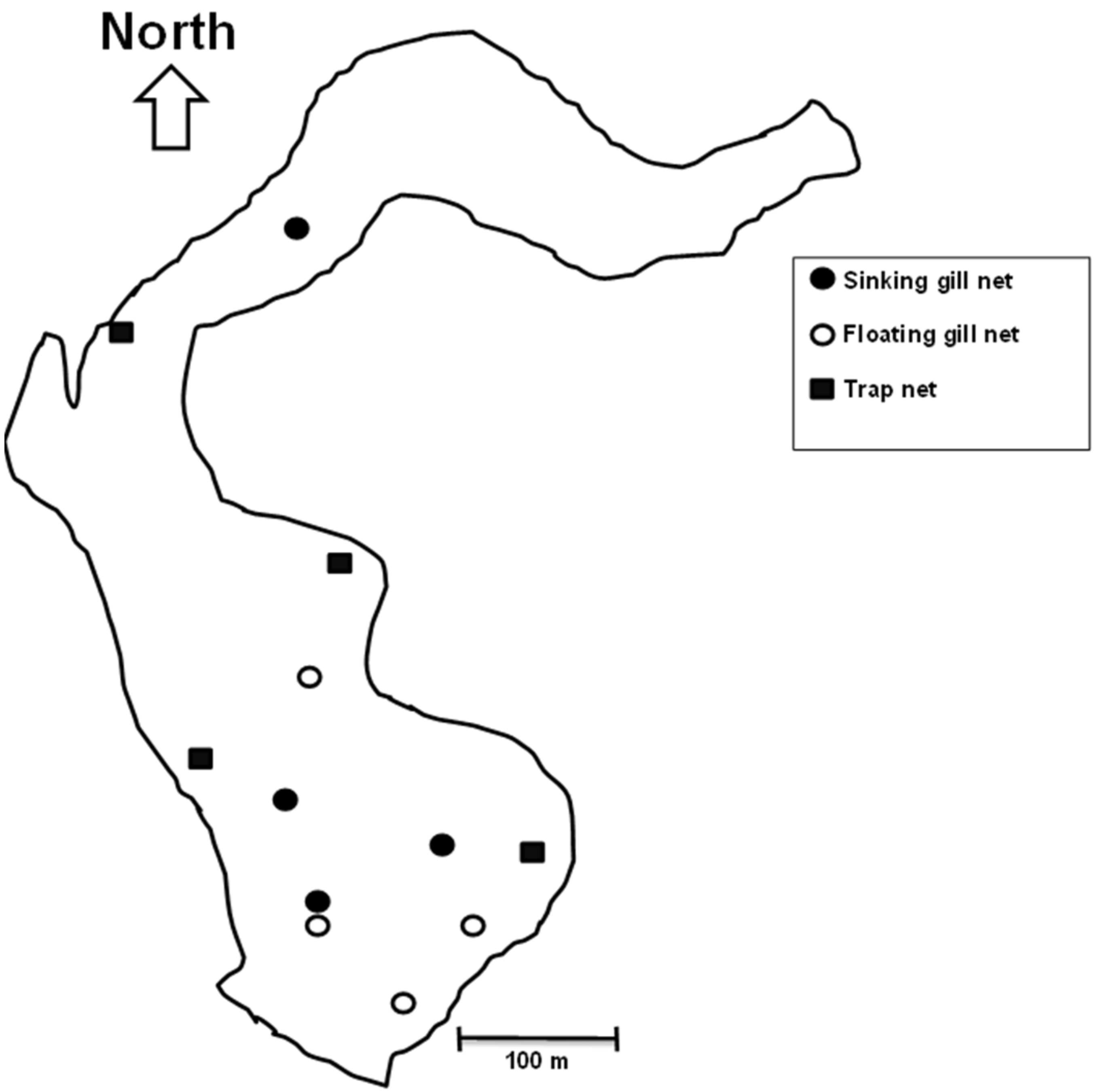

Figure 5. Map of sampling locations on Dog Creek Reservoir sampled on June 6, 2017.

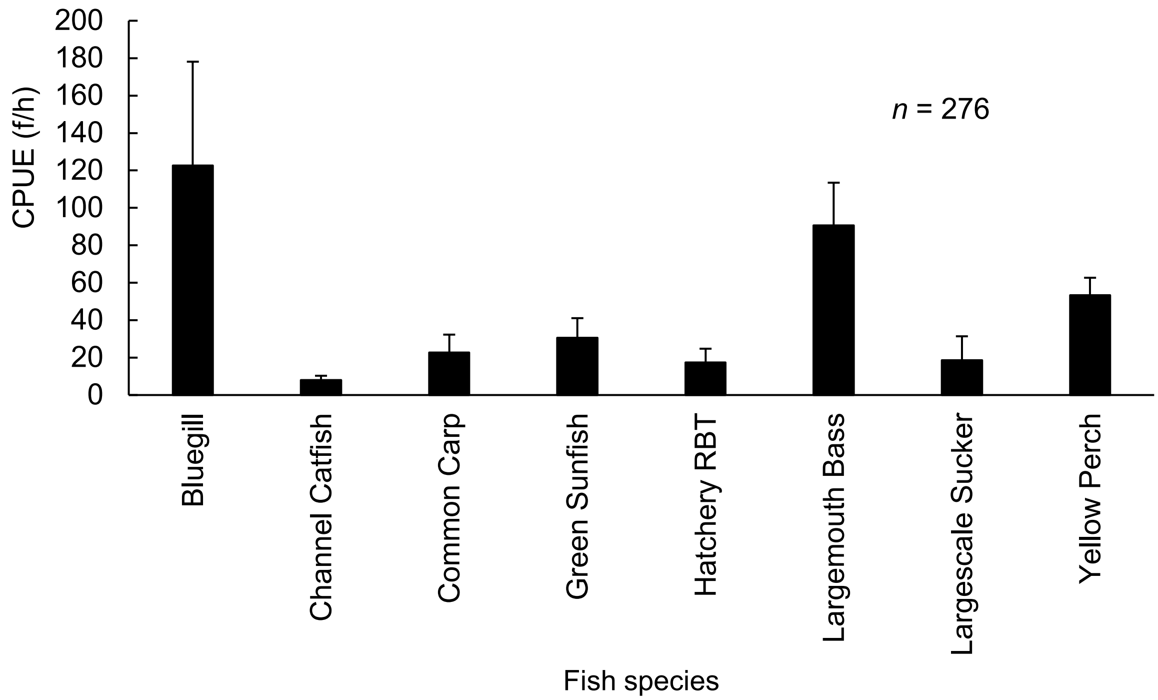

Figure 6. Electrofishing mean CPUE of fish sampled within Dog Creek Reservoir in 2017. Error bars represent one SE.

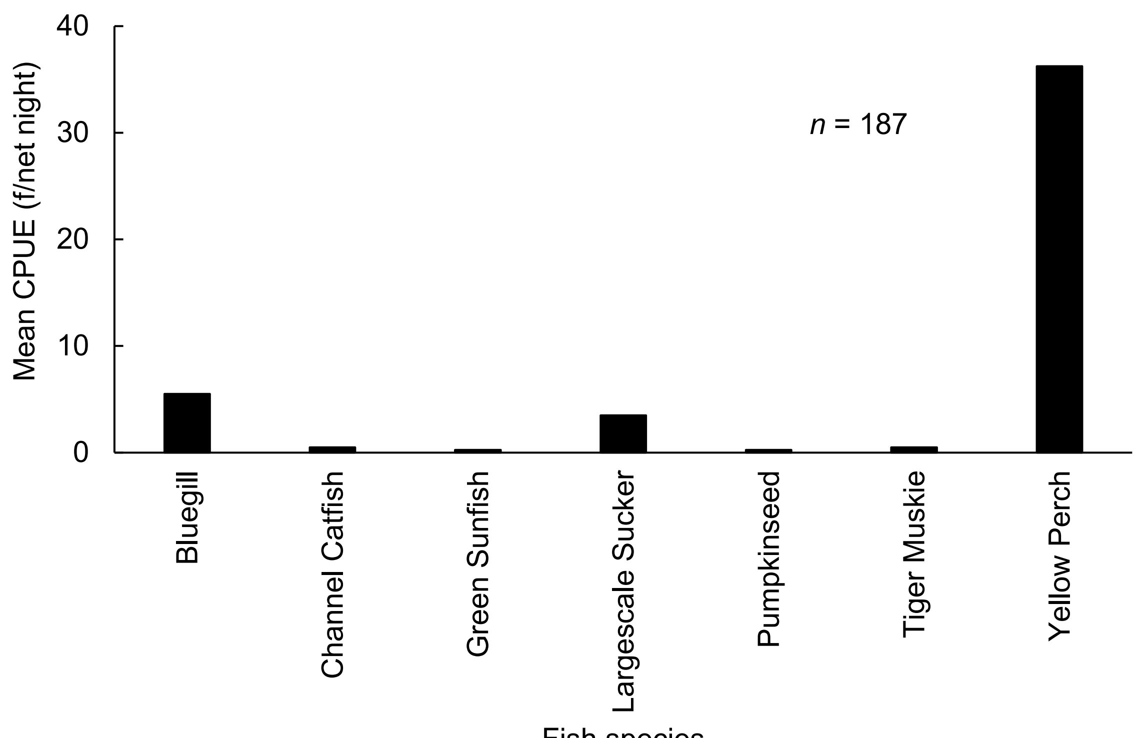

Figure 7. Trap net mean CPUE of fish sampled within Dog Creek Reservoir in 2017.

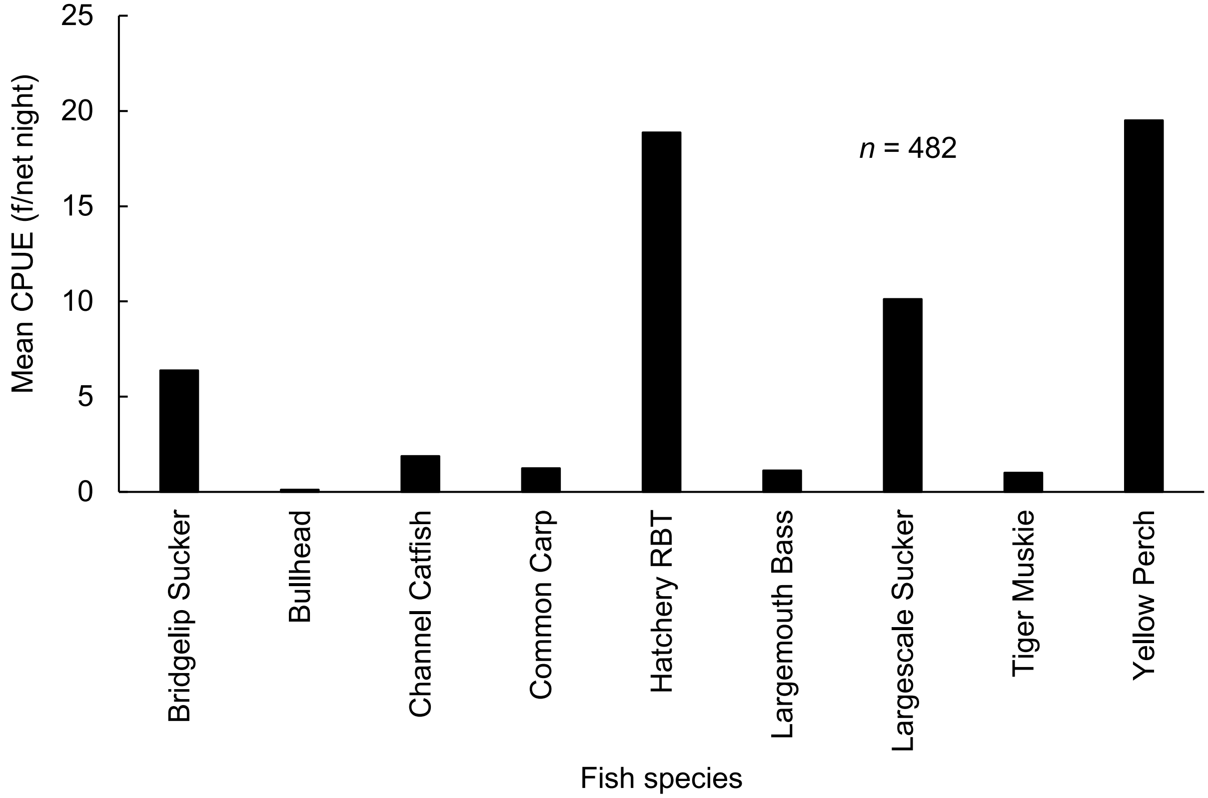

Figure 8. Gill net mean CPUE of fish sampled within Dog Creek Reservoir in 2017.

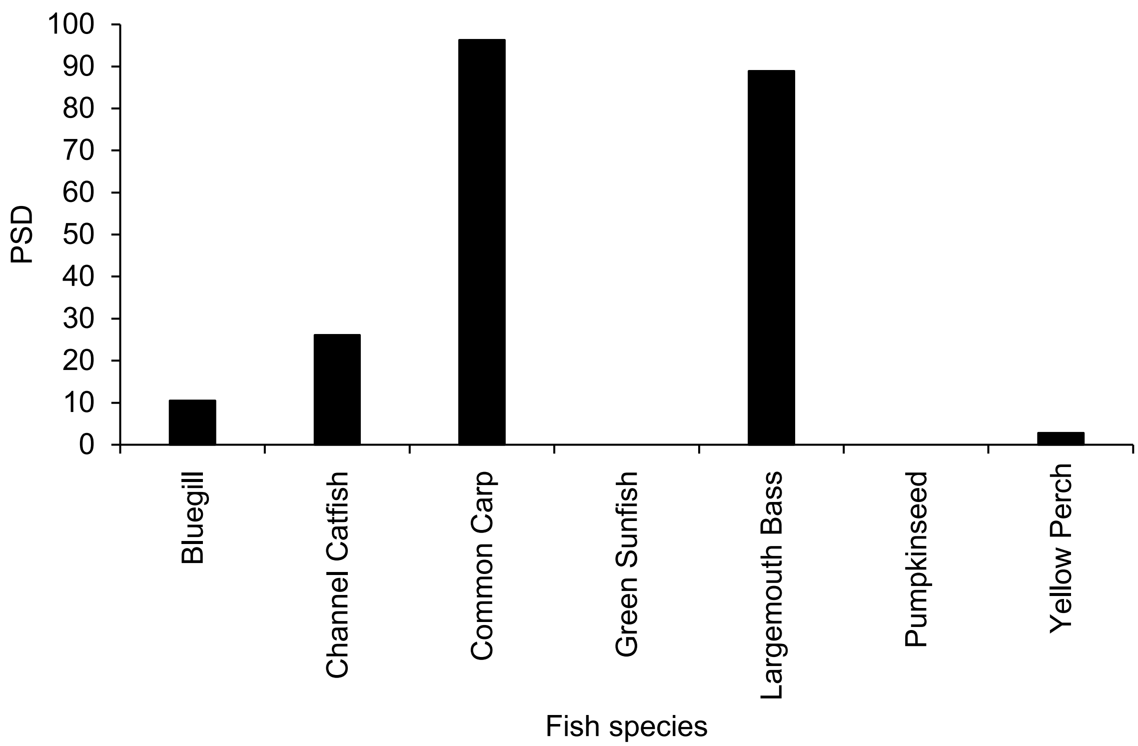

Figure 9. Proportional size distribution of fish sampled within Dog Creek Reservoir in 2017.

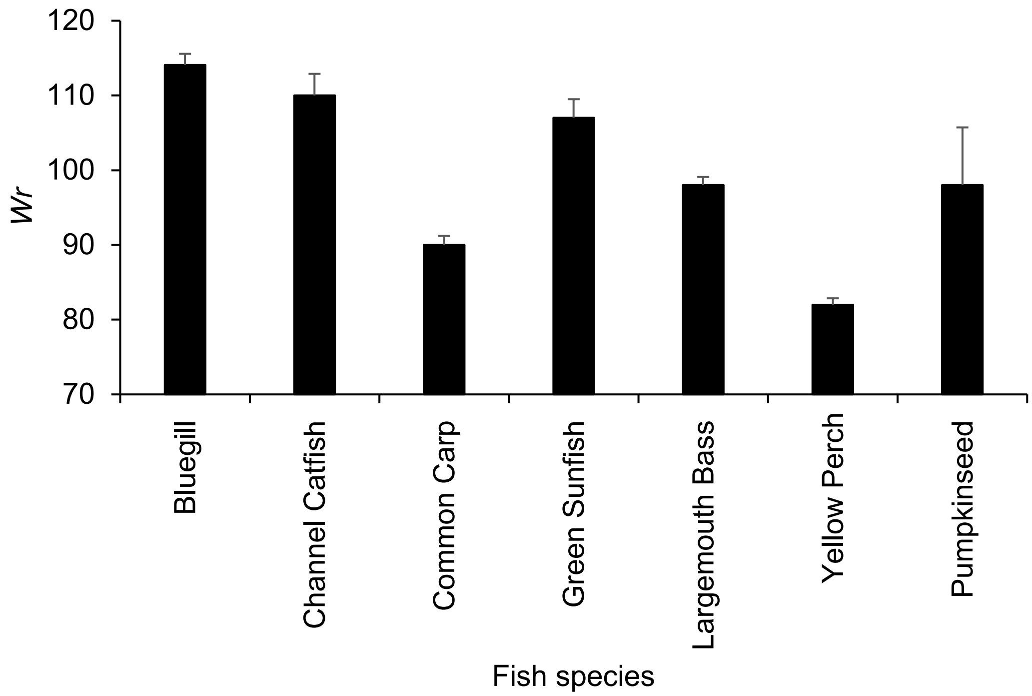

Figure 10. Relative weight of fish sampled within Dog Creek Reservoir during 2017. Error bars represent one SE.

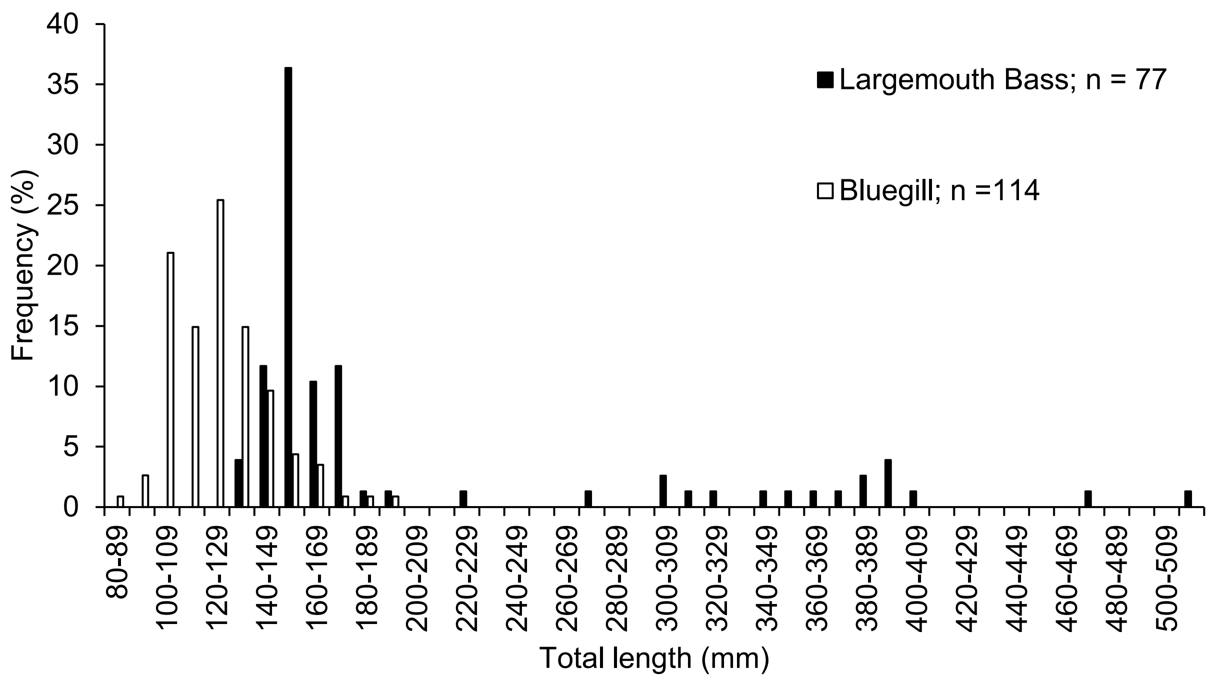

Figure 11. Length-frequency distribution of Bluegill and Largemouth Bass sampled on Dog Creek Reservoir.

LAKE WALCOTT CREEL AND EXPLOITATION

ABSTRACT

In the fall of 2016, the Bureau of Reclamation switched the flood water release mechanism at Minidoka Dam from top spill dam boards to radial gates. To evaluate exploitation and potential entrainment of hatchery Rainbow Trout *Oncorhynchus mykiss* in the Snake River below Minidoka Dam, the Idaho Department of Fish and Game (IDFG) released T-bar anchor tagged trout as part of the *Tag, You're it!* program in Lake Walcott in November 2016 (before radial gate operations) and November 2017 (after radial gates operations). In 2016 and 2017, exploitation of released hatchery Rainbow Trout was estimated at 11.9 (± 6.2) and 11.7 % (± 4.8) respectively. Additionally, tag returns from anglers provided insight into entrainment of hatchery Rainbow Trout in the Snake River downstream of Minidoka Dam. In addition, creel surveys were conducted at the Walcott State Park boat ramp and at an IDFG fishing access site located just downstream of Minidoka dam on the Snake River from April to November 2017. Anglers at Lake Walcott and the spillway fished for an estimated 33,414 h and caught an estimated 3,891 fish. Based on our findings, entrainment of hatchery Rainbow Trout occured from the reservoir to the Snake River downstream of Minidoka Dam. Anglers reported catching Rainbow Trout, that were tagged and released in the reservoir, being caught below the dam. Additional investigation into level of entrainment of Rainbow Trout in the Snake River from Lake Walcott is warranted.

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INTRODUCTION

Lake Walcott is a 3,338-ha impoundment formed by Minidoka Dam on the Snake River near Burley, Idaho. In the fall of 2016, the Bureau of Reclamation switched the flood water release mechanism at Minidoka Dam from top spill dam boards to radial gates. With the change from top spill to radial gates an investigation was done to determine if hatchery Rainbow Trout *Oncorhynchus mykiss* released in the reservoir were being entrained to the Snake River below Minidoka Dam. Historically, Lake Walcott has demonstrated an ability to produce preferred (500 mm) length Rainbow Trout. A 2006 creel survey found the mean TL of harvested Rainbow Trout was 506 mm (Ryan et al 2006). However, catch rates for Rainbow Trout during the same creel survey were low varying from 0.03 to 0.17 fish/h. A lowland lake survey that took place in June of the same year reported that Rainbow Trout made up only one percent of the total catch supporting the observed low angling catch rates. Rainbow Trout captured during the lowland lake had a mean TL of 269 and a PSD of 11 contrasting what was observed in the creel survey.

There is concern that the change in dam infrastructure may result in entrainment of hatchery Rainbow Trout downstream of the dam, which in turn may negatively impact trout fishing opportunities in the reservoir. Thus, to evaluate potential entrainment, the Idaho Department of Fish and Game (IDFG) released T-bar anchor tagged trout in Lake Walcott in November 2016 (before radial gate operations), and again in November 2017 (after radial gates operations). Additionally, to evaluate shifts in angling because of the changes at the dam, a creel survey was conducted in 2017 from April – November. The objectives of this study were to: 1) evaluate potential entrainment of hatchery Rainbow Trout in the Snake River downstream of the Minidoka Dam spillway, and 2) evaluate exploitation of hatchery Rainbow Trout.

METHODS

Prior to hatchery Rainbow Trout being stocked in Lake Walcott, a subset of fish were tagged with 70-mm fluorescent orange T-bar anchor tags as part of IDFG's *Tag, You're it!* program (Dell 1968; Guy et al. 1996; Meyer and Schill 2014). Fish were collected for tagging by crowding them in raceways at hatcheries and capturing them with dip nets to ensure a representative sample. Fish were sedated, measured for TL (mm), and tagged through the pterygiophores just beneath the dorsal fin. Within 24 h of tagging, tagged fish were loaded by dip net onto stocking trucks with the normal lot of untagged fish and transported to Lake Walcott. All hatchery trout were stocked at the Walcott State Park boat ramp in both 2016 and 2017.

A total of 292 hatchery Rainbow Trout were tagged and released in Lake Walcott in 2016. The next year (2017), 349 were tagged and released. Angler harvest data (exploitation) was calculated for these tagged fish in 2016 and in 2017 based on the T-bar anchor tags that were reported by anglers. Additionally, information from tag returns regarding the location where anglers caught fish (e.g., Lake Walcott, Snake River downstream of Minidoka Dam) provided insight into entrainment of fish from Lake Walcott into the Snake River. For a detailed description of the angler tag reporting system used, see Meyer and Schill (2014). In short, anglers could report tags using the IDFG "Tag-You're-It" phone system or website (set up specifically for this program), as well as at regional IDFG offices or by mail. To facilitate angler reporting of tagged hatchery 'catchable-sized' Rainbow Trout, T-bar anchor tags were labeled with "IDFG" and a tag reporting phone number on one side, with a unique tag number on the opposite side. Returns of tagged fish were monitored for ~1.5 years for fish tagged in 2016 and ~1 year for fish tagged in 2017.

We collected angler creel data using check stations, using methods similar to a portion of the access-access survey design described by Pollock et al. (1994). Surveys were conducted April – November 2017 for ~ 10 days/month. Survey days were randomly selected for each month. Data was collected on all fish species encountered and all angling effort. Creel stations were set up at two locations, Walcott State Park and the sportsman's access site below Minidoka Dam. Creel clerks were stationed at a single access site for each randomly selected creel day. Clerks intercepted anglers as they exited the fishery to gather trip data. Two time periods were used including an early time period (0800 - 1400 hours) and a late time period (1400 - 2000 hours). Each angler interview was assigned a unique interview number for that day and was based on the numerical order by which anglers were contacted. Number of anglers in a party, time fishing, and the number of each species harvested or released were recorded. Fishing method, gear type, total length (mm), weight (g) of harvested fish, total hours, and total catch were recorded.

RESULTS

Exploitation of hatchery Rainbow Trout tagged and released on Lake Walcott in 2016 was estimated at 11.9% (± 6.2%; exploitation ± 90% CI; Figure 12). This estimate included fish captured in Lake Walcott, as well as entrained fish that were captured in the Snake River downstream of Minidoka Dam. Exploitation of hatchery Rainbow Trout tagged and released in Lake Walcott in 2017 was estimated at 11.7% (± 4.8%; Figure 12). A noticeable portion of the total hatchery Rainbow Trout released in Lake Walcott were caught downstream of the dam in the Snake River at the spillway. Of the 12 reported tags from the 2016 tagging event, 50% (i.e., 6 of 12) were reported as captured downstream of Lake Walcott in the Snake River (Table 3). Similarly, of the 349 fish tagged in 2017, 57% (i.e., 12 of 21) were reported as captured downstream of Lake Walcott in the Snake River.

In 2017, anglers at Lake Walcott and the spillway fished for an estimated 33,414 h from April to November (Table 2). Anglers on Lake Walcott fished, for all species, an estimated 26,595 h and caught an estimated 6,819 Rainbow Trout. Mean TL of captured trout, within the reservoir, sampled during creel surveys was 401 mm (± 6 mm; mean TL ± 90% CI). Anglers at the spillway fished, for all species, an estimated 2,387 h and caught an estimated 1,504 Rainbow Trout. Mean TL of captured trout, below the spillway, sampled during creel surveys was 459 mm (± 12 mm).

DISCUSSION

Rainbow Trout stocked in Lake Walcott are released with the intent and hope that they will grow to sizes preferred by anglers (e.g., preferred to memorable) and will subsequently be caught and harvested within the reservoir. Quality to preferred length trout are being caught as the mean TL of harvested trout was 401 mm and 459 mm in Lake Walcott and downstream of the reservoir in the Snake River, respectively. This also indicated that a small proportion of stocked fish survival or carry over for at least one year. However, mean TL of Rainbow Trout in Walcott has decreased from the 2006 creel findings when the mean TL was 506 mm.

Harvest of hatchery Rainbow Trout in the reservoir and just downstream in the Snake River appear to be low (11.7% and 11.9% in 2016 and 2017, respectively). First, it is possible that fewer anglers are currently targeting Rainbow Trout within the reservoir than in past surveys because it is primarily a trophy Smallmouth Bass fishery. Second, it is also possible that White Pelican predation within the reservoir has reduced survival of hatchery Rainbow Trout, post release, even after moving stocking to the fall when pelicans leave for the winter. Pelican predation estimates have been previously conducted and it was suggested that Pelican can consume up to 34% of the released fish (Meyer et al. 2016). We did not correct our exploitation estimates for pelican predation, which would have decreased the number of tags available to anglers for reporting and caused us to underestimate exploitation of these release groups.

Angler reports of tagged trout indicated that a portion of hatchery trout are captured in the reservoir where they are released. However, fish are also being entrained downstream of Minidoka Dam in the Snake River. A minimum of 50% of the returned tags came from downstream of Minidoka Dam in the Snake River. The apparently high rate of trout entrainment is concerning, as they are primarily intended to produce a quality trout fishery in Walcott Reservoir, and a significant proportion are lost to reservoir through entrainment. One solution to reduce the potential for entrainment would be to change the stocking location from Walcott State Park to further up-reservoir options such as Gifford Springs or Smith Springs. Regardless, further investigation into entrainment from Lake Walcott to the Snake River is warranted.

MANAGEMENT RECOMMENDATIONS

1. Continue stocking hatchery Rainbow Trout in Lake Walcott but consider stocking at alternate locations such as Smith Springs or Gifford Springs to reduce entrainment in the Snake River downstream of Minidoka Dam.

2. Develop an estimate of entrainment from the reservoir to below the dam after identifying a suitable stocking location upstream from the park.

3. Investigate hatchery Rainbow Trout survival from fall releases after moving the stocking location further upstream and away from the White Pelican colony.

Table 2. Angler creel data for hatchery Rainbow Trout from Lake Walcott and Minidoka Dam Spillway (Snake River) Fisheries in 2017.

	Lake Walcott	Snake River	Total
Mean total length (mm)	404	459	430
Estimated hours fished	26,595	6,819	33,414
Estimated total catch (fish)	2,387	1,504	3,891

Table 3. *Tag, You're it!* data from Lake Walcott and the Minidoka Dam Spillway (Snake River) Fisheries in 2017.

Year	Release location	Number released	Recaptured in Lake Walcott	Recaptured in Snake River
2016	Lake Walcott	292	6	6
2017	Lake Walcott	349	9	12
Total	Lake Walcott	641	15	18

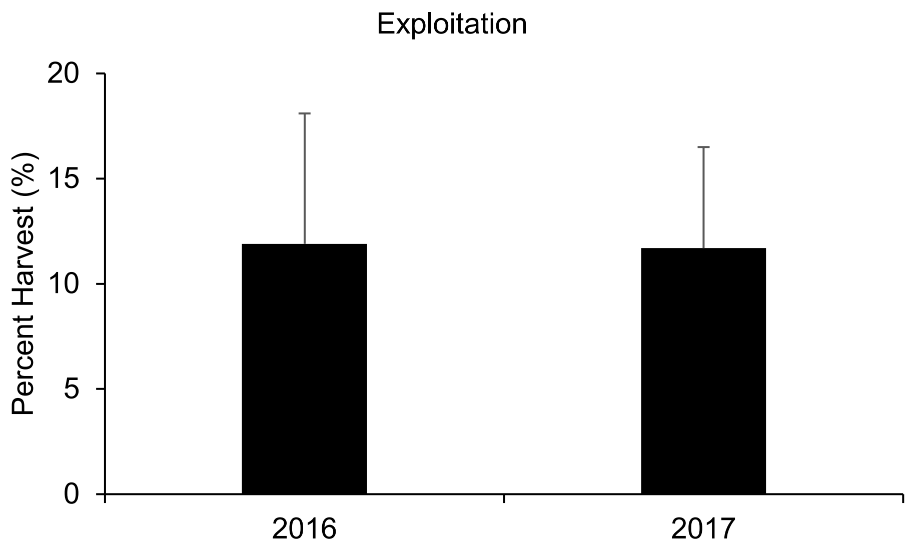

Figure 12. Exploitation rates of tagged Rainbow Trout released in Lake Walcott in 2016 and 2017. Exploitation estimates include fish captured in Lake Walcott and downstream of the reservoir at the Minidoka spillway (Snake River).

HAGERMAN WILDLIFE MANAGEMENT AREA LAKES AND PONDS

ABSTRACT

The Hagerman Wildlife Management Area (HWMA) was established in 1940 and provides habitat for waterfowl, wildlife, and fish populations. It also offers recreational fishing opportunities for Rainbow Trout *Oncorhynchus mykiss*, Largemouth Bass *Micropterus salmoides*, and Bluegill *Lepomis macrochirus*. Despite its diversity of angling opportunities, little work has been done to evaluate Largemouth Bass or Bluegill since 1995. The objective of the study was to estimate relative abundance and describe population size structure of Largemouth Bass and Bluegill found within the various surveyed ponds at HWMA. Between 2016 and 2017, five waterbodies on the HWMA were sampled via electrofishing to evaluate abundance and size structure of Largemouth Bass and Bluegill. Catch per unit effort (CPUE) and proportional size distribution were used to describe the populations. CPUE (± SE) for Largemouth Bass sampled in Oster Lake # 4 was 47.6 fish/h (± 18.2). Bluegill CPUE was also 47.6 fish/h (± 25.9) in Oster Lake # 4. Oster Lake # 3 had the lowest CPUE of 0 fish/h for both Largemouth Bass and Bluegill as neither species were sampled.

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INTRODUCTION

Hagerman Wildlife Management Area (HWMA) is located approximately 5 km south of the town of Hagerman, ID. The HWMA was established in 1940 and is 357 ha in size. Its primary purpose is to provide winter habitat for waterfowl, but it also provides habitat for wildlife and fish populations as well as recreational opportunities for the public. Recreational fishing opportunities focus primarily on hatchery Rainbow Trout *Oncorhynchus mykiss*, Largemouth Bass *Micropterus salmoides*, and Bluegill *Lepomis macrochirus.* While Largemouth Bass and Bluegill are present on HWMA, little work has been done to evaluate relative abundance and size structure of these two fishes since 1995 (Partridge and Warren 1995). Five waterbodies on the HWMA were sampled to gain insight into the fish communities within these ponds, estimate relative abundance, and describe basic population size structure of Largemouth Bass and Bluegill.

METHODS

Electrofishing surveys were completed on five waterbodies on HWMA; Anderson Lake #4, Riley Creek Pond, Oster Lake #2, Oster Lake #3, and Oster Lake #4 (Figure 13). The dates of the surveys, number of electrofishing sites/waterbody and the amount of time spent electrofishing varied by waterbody (Table 3). However, the exact electrofishing transects within each waterbody are unknown. Electrofishing surveys were either 600 or 1,200 s in length. Electrofishing settings were assumed based on prior reports. A MLES Infinity unit set at 24% duty cycle and approximately 2,200 – 2,800 watts of pulsed DC power was used. Current was generated by a 4000-watt Honda generator. Surveys took place during the daytime, which is not typical. Warmwater species electrofishing surveys typically occur at night due to higher CPUE (Bennett and Brown 1969; Paragaman 1989; Malvuestuto and Sonski 1990; Sanders 1992).

Catch per unit effort (CPUE) was estimated for these surveys. Electrofishing CPUE was calculated by summing the catch (by species) for all sites on a waterbody and dividing by the total number of sites. Catch per unit effort was then reported as the number of fish sampled per hour of electrofishing.

Proportional size distribution (PSD) was used to describe the length structure of Largemouth Bass and Bluegill observed in surveys (Gablehouse 1984; Neumann et al. 2012):

$$\text{PSD} = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}}.$$

Stock length and quality length of Largemouth Bass are 200 and 300 mm TL, respectively. Whereas stock length of Bluegill is 80 mm TL and quality length is 150 mm TL.

RESULTS

Catch per unit effort of both Largemouth Bass and Bluegill varied by waterbody (Table 4). Oster Lake # 4 had the highest CPUE of all waterbodies for both species (Figure 14). Largemouth CPUE (± SE) on Oster Lake # 4 was 47.6 fish/h (± 18.2). Bluegill CPUE was also 47.6 fish/h (± 25.9). Oster Lake # 3 had the lowest CPUE of 0 fish/h for both Largemouth Bass and Bluegill as neither species was observed there. Riley Pond also exhibited low CPUE (< 6.2 fish/h) for both species.

Similar to CPUE, PSD also varied by waterbody and was calculated for one of the five sampled waterbodies for Largemouth Bass and two of the five waterbodies for Bluegill.

Proportional size distribution was not calculated for Riley Creek Pond as no Largemouth Bass nor Bluegill of stock size or greater were sampled. Additionally, neither Largemouth Bass nor Bluegill were sampled in Oster Lake # 3. Furthermore, very few Largemouth Bass of stock-length or greater were sampled in Oster Lake # 2 (*n* = 3) and Oster Lake # 4 (*n* = 2), so PSD values were not reported. Anderson Lake # 4 (n = 13) had a Largemouth Bass PSD of 85 (Figure 15). For Bluegill, only two PSD values were calculated. Oster Lake # 4 (*n* = 21) had the lowest PSD of zero as no Bluegill greater than quality-length were sampled. Oster Lake # 2 (*n* = 16) had a PSD of six.

DISCUSSION

Results from these surveys indicate variability in relative abundance and size structure among the surveyed waterbodies which provides for different angling experiences for these species. However, caution should be used prior to making management decisions based on the findings from these surveys as sample sizes to calculate PSD were small and sampling occurred during the day. Daytime sampling is not directly comparable to past survey data and therefore nighttime surveys in these waterbodies should be conducted to provide meaningful comparisons to past survey results.

The last thorough population dynamics study on the various waterbodies at HWMA was performed by IDFG personnel in 1995 (Warren 1995). In 2011, angler surveys indicated that the waterbodies within the HWMA received substantially lower angling effort (predominately for hatchery Rainbow Trout) when compared to a prior survey in 1984 (Grunder et at. 1986; Stanton, et al. 2011). A future investigation should be performed to sample each waterbody to establish baseline population dynamic metrics, and to evaluate potential management strategies that can improve angling opportunities.

MANAGEMENT RECOMMENDATIONS

1. Perform standardized lowland lake survey methods on each of the HWMA waterbodies to develop estimates more precise estimates of relative abundance and size structure.

Table 4. Hagerman Wildlife Management Area waterbodies, survey date, number of sites electrofished per waterbody, and the approximate time spent electrofishing per site during these surveys.

Waterbody	Survey Date	Number of sites	Effort/site (s)	Total Fish Sampled		CPUE	
				Largemouth Bass	Bluegill	Largemouth Bass	Bluegill
Anderson 4	4/19/2017	3	1,200	18	2	18	2
Riley Pond	4/19/2017	3	1,200	5	6	5	6
Oster 2	5/25/2017	3	600	13	17	26	34
Oster 3	5/25/2017	2	600	0	0	0	0
Oster 4	5/25/2017	3	600	24	24	48	48

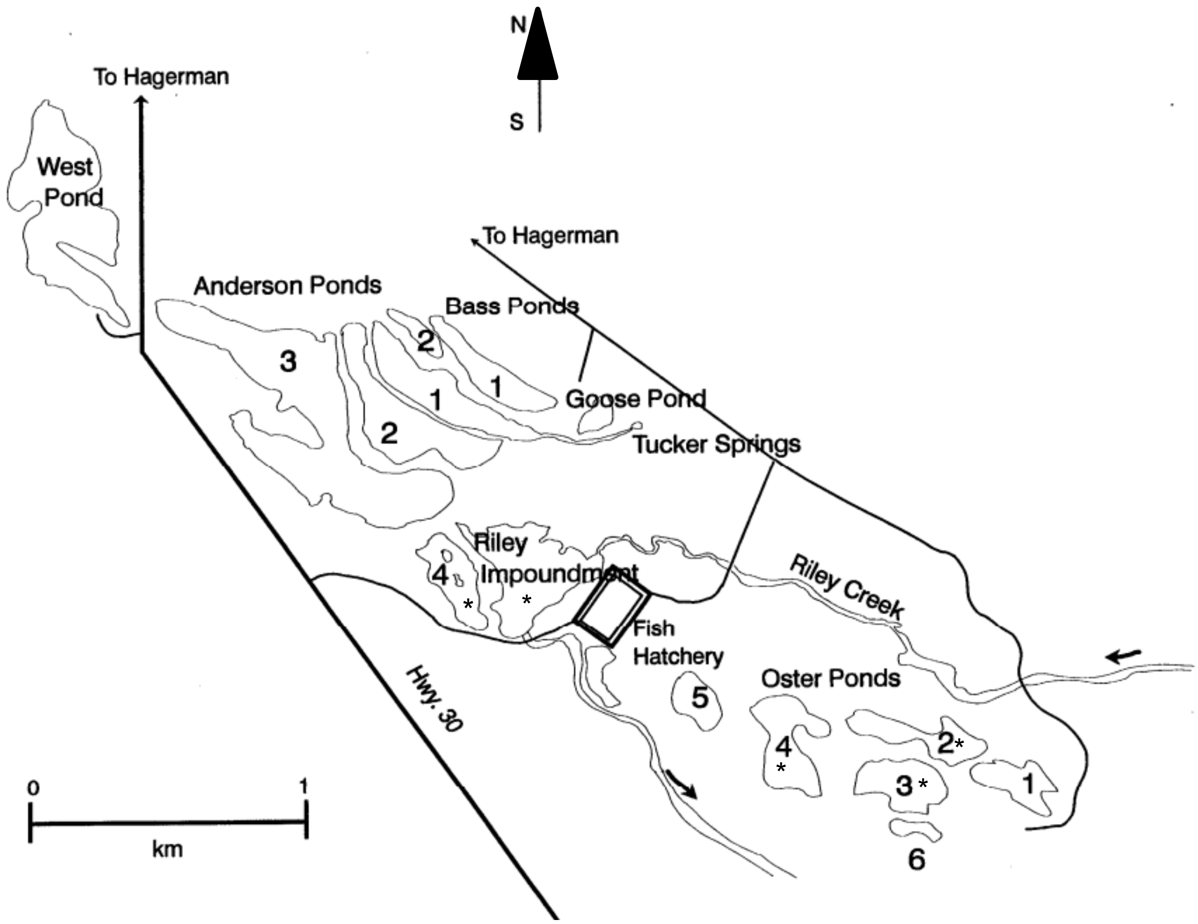

Figure 13. Location of waterbodies within the Hagerman WMA. Surveyed waterbodies are identified with an asterisk near the name.

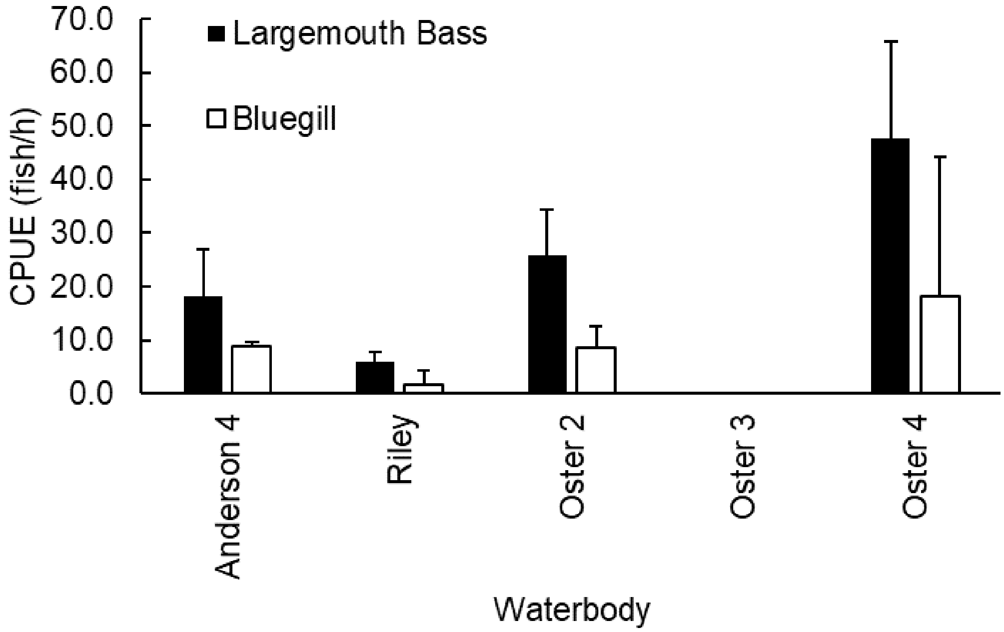

Figure 14. Catch per unit effort of Largemouth Bass and Bluegill on the various waterbodies at Hagerman Wildlife Management Area. Error bars represent one SE.

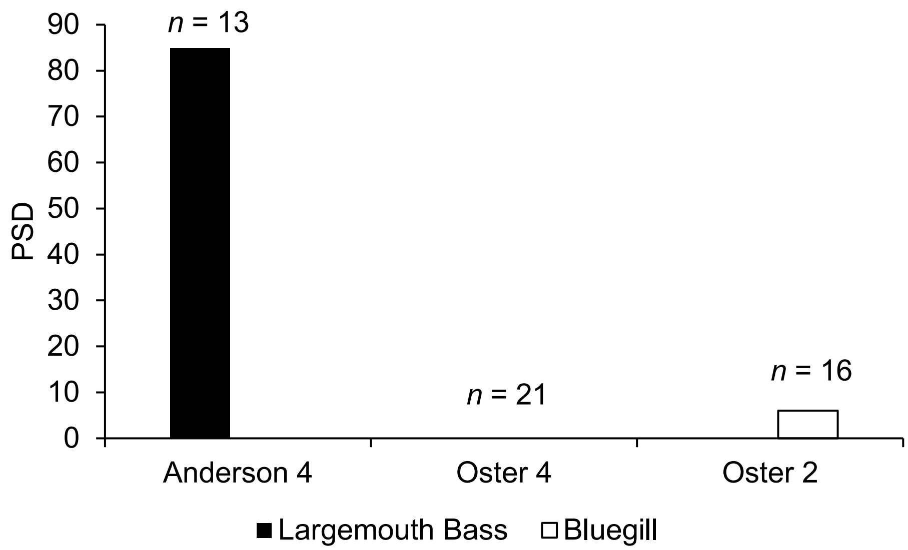

Figure 15. Proportional size distribution of Largemouth Bass and Bluegill at the various ponds on Hagerman Wildlife Management Area. No quality length fish were sampled on Riley Pond. Additionally, no Largemouth Bass or Bluegill were sampled on Oster Lake # 3.

RIVERS AND STREAMS INVESTIGATIONS

HEART ROCK RANCH

ABSTRACT

Heart Rock Ranch is a privately owned ranch located approximately 20 km west of the town of Picabo, ID near the intersection of State Highway 75 and US-20. Two electrofishing surveys were conducted on ranch property ten years apart, one in 2007 and the other survey in 2017. In between the surveys, major man-made changes to the habitat occurred. The property was changed from a pasture landscape with low-flowing streams to more of a wetland area with numerous small ponds on the property. During both surveys, all encountered fish were sampled. Changes in species composition and abundance occurred between the 2007 and 2017 surveys. Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss* were documented in two locations during the 2017 survey where they were not observed in the 2007 survey. Brown Trout and Rainbow Trout appear to be displacing Brook Trout *Salvelinus fontinalis*, which were present in higher abundance during the 2007 survey, with the exception of Crystal Creek where increases in all three species were observed.

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INTRODUCTION

Heart Rock Ranch is located approximately 20 km west of the town of Picabo, ID near the intersection of State Highway 75 and US-20. The ranch (formerly Diamond Dragon and Spring Creek Ranches) was purchased in 2010 by Harry and Shirley Hagley and the name was changed to Heart Rock Ranch. Two surveys were conducted on ranch property ten years apart. One survey took place in 2007 and the other survey took place in 2017. In between the surveys, major man-made changes to the habitat occurred. The property was changed from a pasture landscape with low-flowing streams to more of a wetland area with numerous small ponds on the property and streams with increased flows. Habitat alterations occurred to improve angling on the property. Prior to the habitat changes, the streams were shallow, wide, and laden with sediments. The habitat project narrowed and deepened the streams. The ponds were created to act as catchment areas for sediment. The objective of the 2017 survey was to document and describe any shifts in Brook Trout *Salvelinus fontinalis*, Brown Trout *Salmo trutta*, and Rainbow Trout *Oncorhynchus mykiss* population trends between the two time periods as the streams on the property are connected to the Big Wood River and have the potential to impact the lower river trout fishery.

METHODS

Backpack electrofishing surveys took place on Black Slough, Crystal Creek, and Willow Creek. The 2007 and 2017 sites were not the same but were similar in location (Table 5; Figure 17). No information exists on the settings used or the number of shockers. However, Snyder (2003) suggests that units be set up to 60 hz and 12% duty cycle and it is assumed that these or similar settings were likely used. During the surveys all encountered fish were identified to species and measured to total length (TL; mm). Relative abundance was estimated by dividing the total catch (by species) for each individual site by 100 linear m and then reported as density (i.e., fish/100 m).

RESULTS

Changes in species composition and abundance occurred between the 2007 surveys and the 2017 surveys. In the 2007 survey, only Brook Trout were sampled in Black Slough and Crystal Creek (Figure 16). In 2017, Brook Trout, Brown Trout, and Rainbow Trout were all sampled in both locations. In 2017, the density of Brook Trout in Black Slough was 1.5 fish/100 m, which represented a 50% decrease from 2007, while the density of Brook Trout in Crystal Creek increased from 1.4 fish/100 m in 2007 to 10.4 fish/100 m in 2017. Additionally, in 2017, the density of Brown Trout in Black Slough was 18.6 fish/100 m, while in Crystal Creek the Brown Trout density was estimated at 69.3 fish/100 m (Figure 16). In 2017, the density of Rainbow Trout in Black Slough was 2.2 fish/100 m, while in Crystal Creek the Rainbow Trout density was estimated at 37.4 fish/100 m (Figure 16). In Willow Creek, densities of Brown Trout and Rainbow Trout increased between 2007 and 2017, whereas, Brook Trout densities decreased (Figure 16).

DISCUSSION

There were changes observed between the 2007 and 2017 surveys. Generally speaking, Brown Trout and Rainbow Trout may be displacing Brook Trout within Black Slough and Willow Creek. Crystal Creek saw an increase of all three species. Brown Trout, Rainbow Trout, and Brook Trout are all present in the Big Wood River, which directly connects to Black Slough, Crystal Creek, and Willow Creek, so it's possible that these species migrate freely into and out of these waterbodies from the Big Wood River. It is also possible that fish are simply occupying different sections of the waterbodies than they did in 2007 as major man-made habitat changes occurred that likely altered species composition within the system. Considering the observed shifts in species composition and relative abundance, continued monitoring may be warranted in the future. Developing a better understanding of how these off-channel habitats provide connectivity between the lower Big Wood River and the Big Wood River near the Glendale diversion may be important for understanding how species such as Brown Trout have pioneered into the upper Big Wood River. Additional surveys on the lower Big Wood River should be conducted to determine if species composition and relative abundance are changing there as well.

MANAGEMENT RECOMMENDATIONS

1. Conduct additional surveys on the lower Big Wood River and potentially Heart Rock Ranch in 2027 to evaluate and monitor potential shifts in salmonid relative abundance.

Table 5. Year, tributary, GPS coordinates, and transect length (m) for backpack electrofishing surveys conducted on Heart Rock Ranch in 2007 and 2017.

Year	Tributary	Longitude	Latitude	Length (m)
2007	Black Slough	43.34553	-114.29726	102
2007	Crystal Creek	43.34268	-114.29112	146
2007	Willow Creek	43.32412	-114.32078	146
2017	Black Slough	43.34148	-114.30341	102
2017	Crystal Creek	43.34164	-114.29346	125
2017	Willow Creek	NA	NA	135

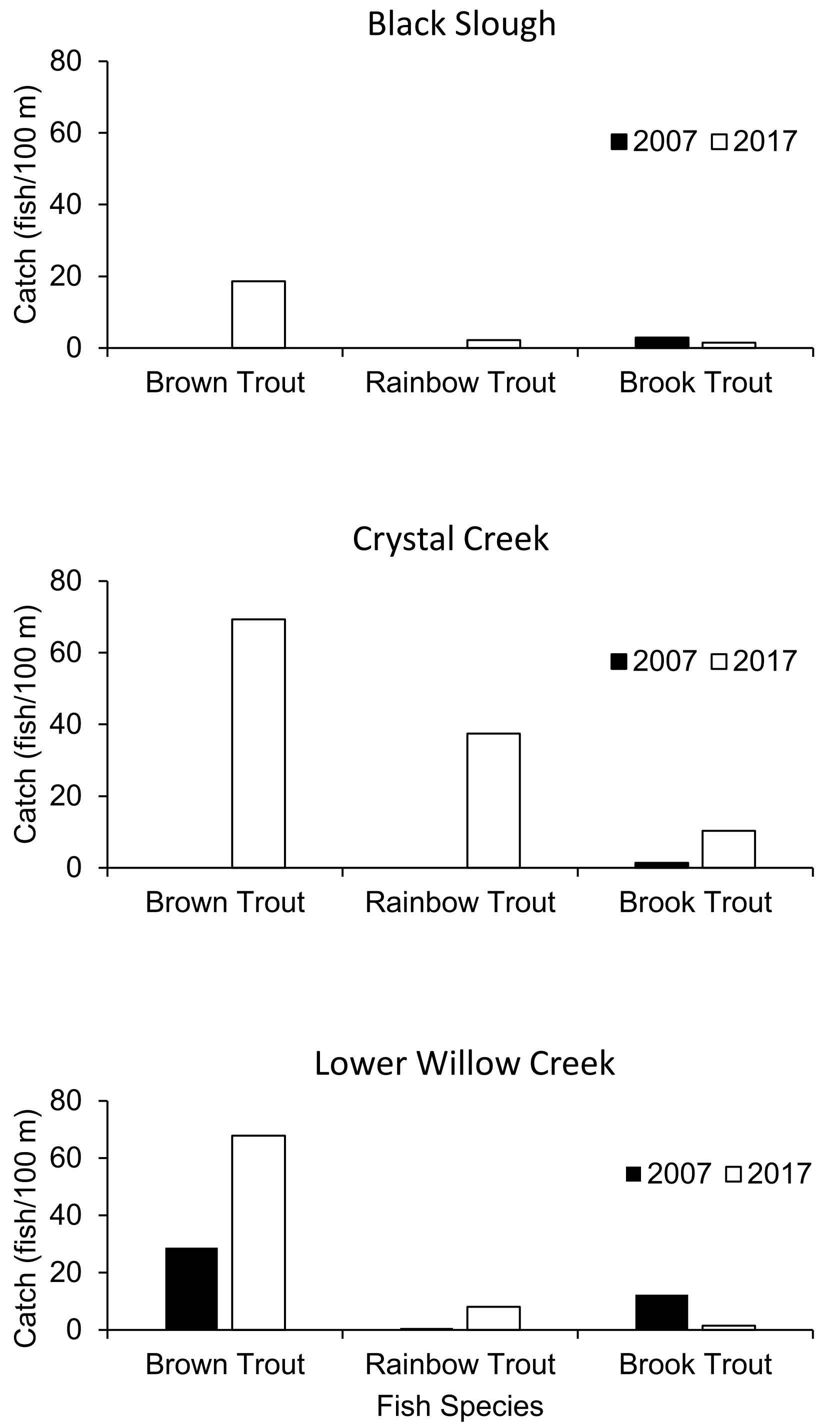

Figure 16. Total catch (density of fish/100 m) of Brown Trout, Rainbow Trout, and Brook Trout in Black Slough, Crystal Creek, and Lower Willow Creek on the Heart Rock Ranch surveyed in both 2007 and 2017.

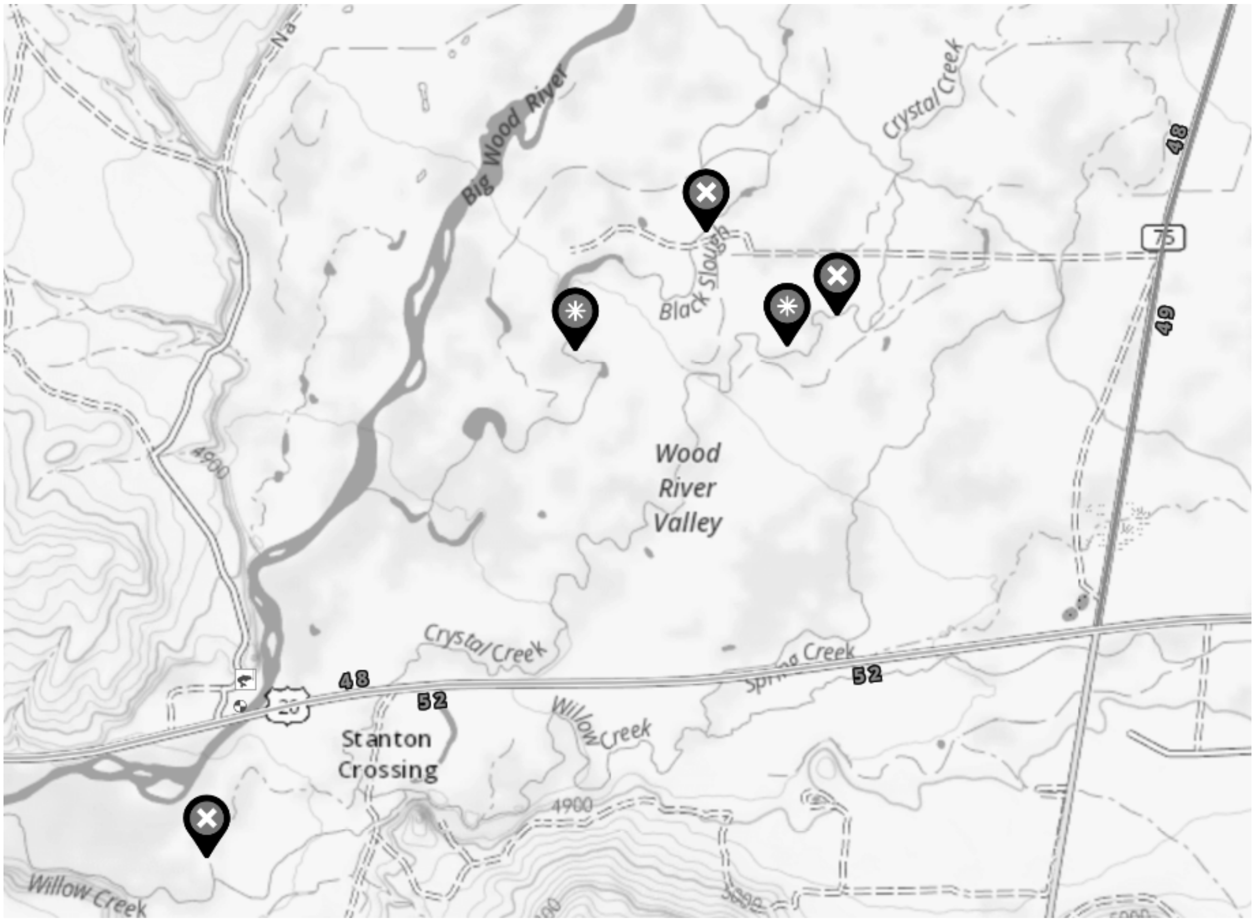

Figure 17. Map of fisheries surveys on Heart Rock Ranch. Points with an X denote 2007 surveys. Points with an asterisk denote 2017 surveys. One 2017 survey on Willow Creek contained the incorrect waypoints and was not included in this figure.

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