Speckled Dace (*Rhinichthys osculus*) Abundance in Critical Habitat on the West Kettle River

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Speckled Dace (*Rhinichthys osculus*) Abundance in Critical Habitat on the West Kettle River

by

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Speckled Dace (*Rhinichthys osculus*) are listed under the *Species at Risk Act* (SARA) as endangered. Their critical habitat was protected in 2018. These freshwater fish, of the family Leuciscidae, are only found in the Kettle Valley of British Columbia, Canada. From October 19th to the 22nd 2015, nocturnal pole seining surveys were conducted to enumerate Speckled Dace within designated critical habitat on the West Kettle River; one of three rivers containing Speckled Dace. The estimated population abundance of Speckled Dace within the survey area was 8,978 (6,143–11,814), and within the 2.4km of critical habitat is estimated to be 15,048 (ranging from 10,296–19,800). Few adults were found in the survey (estimated 1,014) raising concerns that critical habitat may not be suitable to support all life stages. It has been estimated that in order to support long term persistence, 3,000 mature fish/km are required in critical habitat, this survey estimated 708 adults/km.

RÉSUMÉ

MacConnachie, S., Wade, J., and Flostrand, L. 2023. Speckled Dace *(Rhinichthys osculus*) abundance in critical habitat on the West Kettle River. Can. Manuscr. Rep. Fish. Aquat. Sci. 3265: v + 14 p.

Le naseux moucheté (*Rhinichthys osculus)* est inscrit comme espèce en voie de disparition au *Loi sur les espèces en péril*. Leur habitat essentiel a été protégé en 2018. Ces poissons d'eau douce, de la famille des Cyprinidés, se trouvent au Canada uniquement dans la vallée de Kettle en Colombie-Britannique. Du 19 au 22 octobre 2015, des relevés nocturnes à la senne à la perche ont été effectués pour dénombrer le naseux moucheté dans l'habitat essentiel désigné de la rivière West Kettle; une des trois rivières contenant du naseux moucheté. L'abondance estimée de la population de naseux mouchetés dans la zone du relevé était de 8,978 (6,143–11,814) ; dans les 2,4 km d'habitat essentiel, il y en a 15,048 (allant de 10,296–19,800). Peu d'adultes ont été trouvés dans le relevé (estimé à 1,014 poissons), ce qui soulève des inquiétudes quant au fait que l'habitat essentiel pourrait ne pas convenir à tous les stades de vie. Il a été estimé que pour soutenir la persistance à long terme, 3,000 poissons matures/km sont nécessaires dans l'habitat essentiel, cette étude a estimé 708 adultes/km.

INTRODUCTION

Dace are minnows belonging to the Family Leuciscidae, Order Cypriniformes, which also includes chub, shiner, and minnow. Members of the genus *Rhinichthys*, occur in Canada from Nova Scotia to British Columbia (BC). Speckled Dace (*Rhinichthys osculus*) is small in length (51–94 mm fork length), with a prominent snout and a sub-terminal mouth (McPhail 2003), and is restricted to the Kettle Valley in BC.

In 2016 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) re-assessed Speckled Dace as endangered because of its small distribution range, perceived sensitivity to threats, including climate change and habitat loss (COSEWIC 2016). This species was previously listed as endangered under the *Species at Risk Act* (SARA) in 2009. Field studies conducted by Batty (2010) and Andrusak & Andrusak (2011) have confirmed that the range of Speckled Dace is specifically the West Kettle, Kettle and Granby rivers.

When a species is listed as threatened, endangered, or extirpated, a recovery strategy must be developed that includes the identification of critical habitat. Brown et al. (2012) provided science advice to support the identification of critical habitat for Speckled Dace within the West Kettle, Kettle and Granby rivers, subsequently leading to its protection in 2018. The science advice was based on a population level of 7,000 adult fish, being the minimum population required for long-term persistence of the species (Reed et al. 2003) and using Batty's (2010) estimate of three fish per linear metre of river, 2.4 km of river with the features necessary for Speckled Dace survival was identified as critical habitat. To be conservative, this value was applied to each of the three rivers in which Speckled Dace are found (Figure 1). A further recommendation was to conduct surveys in proposed critical habitat to estimate population abundance (Brown et al. 2012).

This report summarizes the results of a field survey conducted in October 2015 within critical habitat on the West Kettle River. The goal of the survey was to determine the density of Speckled Dace and to estimate total abundance within the survey area.

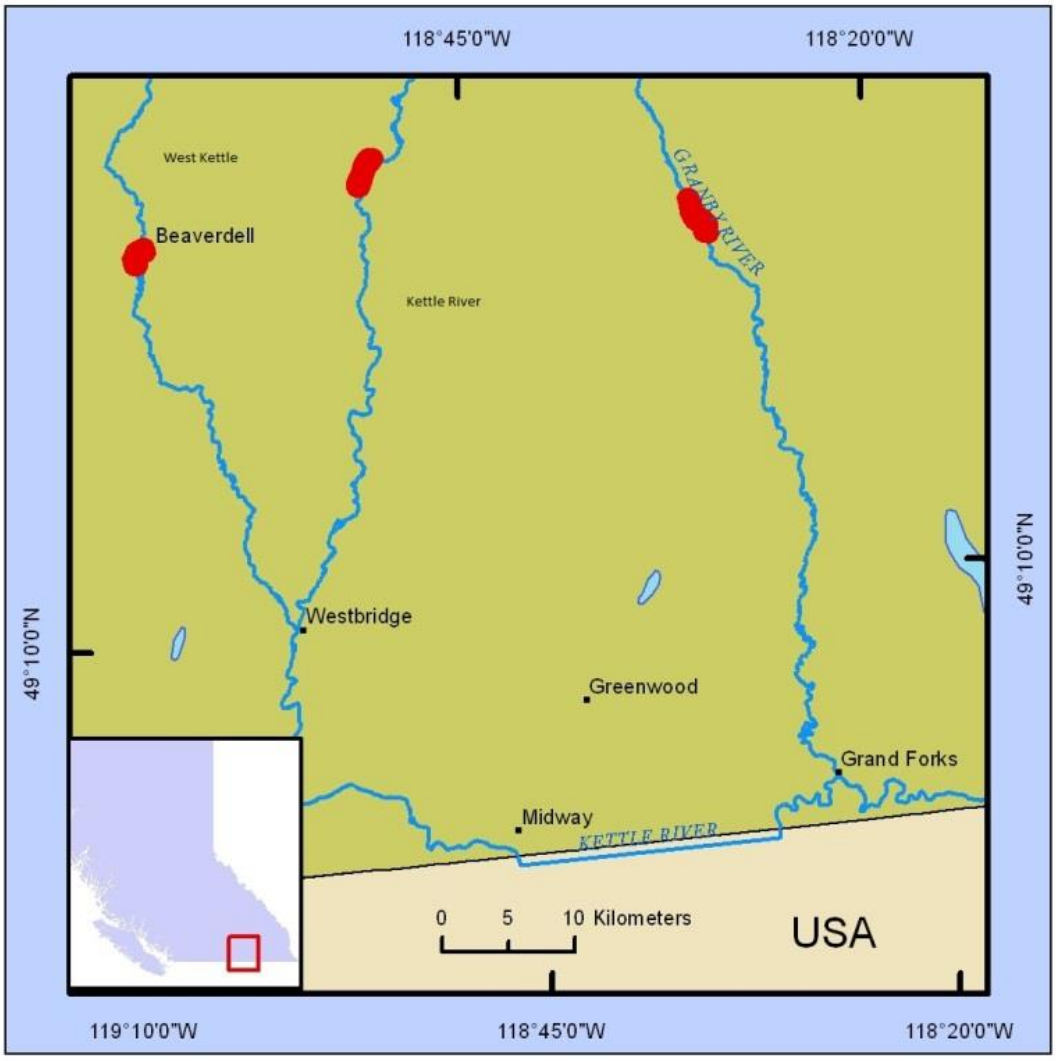

Figure 1. Locations of Speckled Dace critical habitat (red polygons) on the West Kettle, Kettle and Granby rivers, British Columbia. The 2015 survey was conducted in critical habitat on the West Kettle River.

METHODS

SURVEY DESIGN AND LOCATION

Following methods outlined in Lockwood and Schneider (2000), a two-pass depletion pole seine survey was conducted within delineated critical habitat on the West Kettle River near Beaverdell, BC, between October 19th and October 22nd, 2015 (Figure 2). Surveys were conducted at night as the species is nocturnal and more active at night. Over the course of the four nights, fifteen strata were surveyed, approximately 100 m apart for a total survey length of 1,432 m. The initial strata was selected based on the accessibility from the adjacent highway.

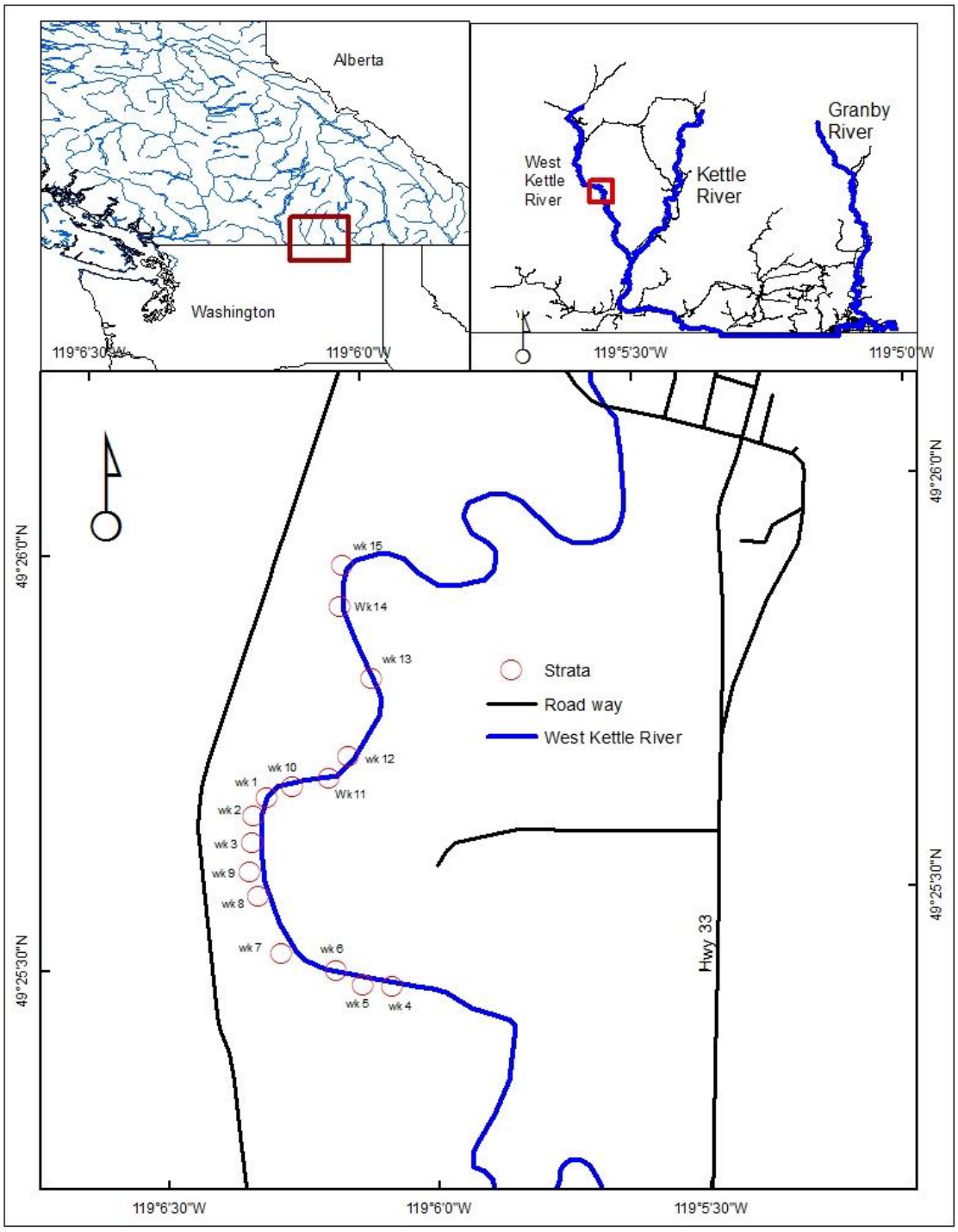

Figure 2. Survey location and strata (wk) of the Speckled Dace density survey conducted in October 2015.

STRATA SAMPLING

At each stratum, barrier nets were installed, upstream and down, in order to ensure no fish could enter or exit. Two barrier nets were used, each measuring 15 m long and 0.5 m tall (0.5 cm mesh size) with a cork line and lead line. Total area was calculated for each stratum; strata locations were determined using a Trimble Juno T41/5 rugged handheld computer with internal GPS running the proprietary TerraSync GPS software. Dominant substrate in each stratum was noted as well as stream flow characteristics, such as presence of glides or riffles.

Time was recorded for each pass. A "pass" is considered the sampling of the entire strata. A pole seine, 1.5 m high and 2.8 m wide (0.5 cm mesh) was used by two people to capture fish. A similar amount of time was spent on all strata thereby standardizing effort.

A "sweep" is defined as one sweep of the net from downstream to upstream within the strata. Depending on the configuration of the strata, up to 5 sweeps would be required to sample the entire area, or complete a "pass". At the end of each sweep, fish were removed from the pole seine with a small aquarium dipnet and placed in a bucket of water. All fish were examined after the pass was complete.

Fish were anesthetized using TMS (tricaine methanosulfate) (0.025 mg/L), identification was confirmed, and fork length (mm) measured on a subsample of fish. Fish were allowed to recover in a bucket of fresh river water before being released downstream of the stratum. Other fish species were identified and enumerated but not measured.

A second pass of the survey strata was undertaken and the previous steps were followed. Care was taken to ensure that survey effort (time and number of sweeps) were consistent between the two passes.

Catch statistics and survey population estimates were calculated based on methods for two-pass surveys described in Seber and Le Cren (1967). To estimate the abundance of Speckled Dace within the surveyed area, the first step was to determine the estimated abundance of Speckled Dace in each stratum (equation below).

$$N = C1^2/(C1 - C2) \quad (1)$$

Variance of N= $C1^2C2^2(C1 + C2)/(C1 - C2)^4$ (2)

Standard error (SE) of N =$\sqrt{Variance\ of\ N}$ (3)

P= $\frac{C1-C2}{C1}$ (4)

where,

C1 = number of fish removed in first sample

C2 = number of fish removed in second sample

N = Population estimate

P = Probability of capture

In order for the two-pass depletion method to be effective the following requirements must be met (Seber and Le Cren 1967):

1. That P is large enough to have a significant effect upon N.
2. That P is constant, or, in other words, that the fishing effort is the same for the two passes and the fish remaining after the first fishing are as vulnerable to capture as were those that were caught in the first fishing.
3. That there is no recruitment, mortality, immigration or emigration between the two passes, and
4. That the first catch is removed from the population or, if returned alive, the individuals are marked so that they can be ignored in counting the second catch.

The second step of estimating abundance was to extrapolate the mean stratum estimate (the mean across strata from the two-pass method) over the length of the sampled area (1,432 m).

RESULTS

STRATA SAMPLING

A total of 15 strata were sampled with areas ranging from 56.95 m^2 to 109.65 m^2 (Table 1). Substrate varied considerably from large boulder, to imbedded cobble, to sand mixed with gravel and a few cobbles (Table 1). Flow rates were not measured but strata were generally located either in glides, just downstream of riffles, or in small back eddies with low flow. The dataset is too small to determine statistically if there is any relationship between catch (Table 2) and substrate type (Table 1). Higher catches (e.g. stratum 3,7,12,13,15) did tend to be associated with sand substrates but this may be an artifact of methods used or even time of year.

Table 1. Spatial description of strata for Speckled Dace survey (Kettle River, October 2015).

Stratum	Length (m)	Width (m)	Area (m^2)	Latitude	Longitude	Substrate and flow comments
1	13.0	8.0	104.0	49.42823	-119.10322	Embedded cobble
2	9.0	11.0	99.0	49.42805	-119.10459	Embedded cobble
3	10.0	8.0	80.0	49.42718	-119.10473	Pool with sand and cobble at edges.
4	9.5	10.5	99.75	49.42402	-119.10087	Gravel with occasional boulder in centre of channel.

5	8.5	9.5	80.75	49.4241	-119.10177	Gravel with occasional boulder in centre of channel.
6	9.0	7.5	67.5	49.42444	-119.10256	Gravel with occasional boulder in centre of channel.
7	7.4	9.6	71.04	49.42491	-119.10414	Sand and gravel in back eddy. Low flow and algal growth.
8	8.7	11.8	102.66	49.42609	-119.10472	Gravel with occasional boulder in centre of channel.
9	8.3	9.7	80.51	49.4266	-119.10490	Embedded cobble.
10	8.0	8.3	66.4	49.42823	-119.10332	Large boulders with gravel.
11	13.1	8.3	108.73	49.42832	-119.10218	Embedded cobble with surface gravel.
12	9.0	8.0	72.0	49.42871	-119.10151	Sand and gravel in back eddy. Low flow and algal growth.
13	10.0	10.0	100.0	49.43042	-119.10058	Cobble and sand. Slow moving water.
14	12.9	8.5	109.65	49.43176	-119.10132	Embedded cobble with a few large boulders.
15	8.5	6.7	56.95	49.43257	-119.10112	Sand and gravel in back eddy. Low flow and algal growth.

The West Kettle River is regulated and therefore experiences extreme fluctuations between high summer-spring flows and very low fall-winter discharge (Figure 3). During the survey (19th and 22nd of October, 2015), the primary water level ranged from 0.653 to 0.567m, and provisional discharge 0.79-0.86 m^3/sec as measured by the Water Survey of Canada at the Westbridge station Figure 4.

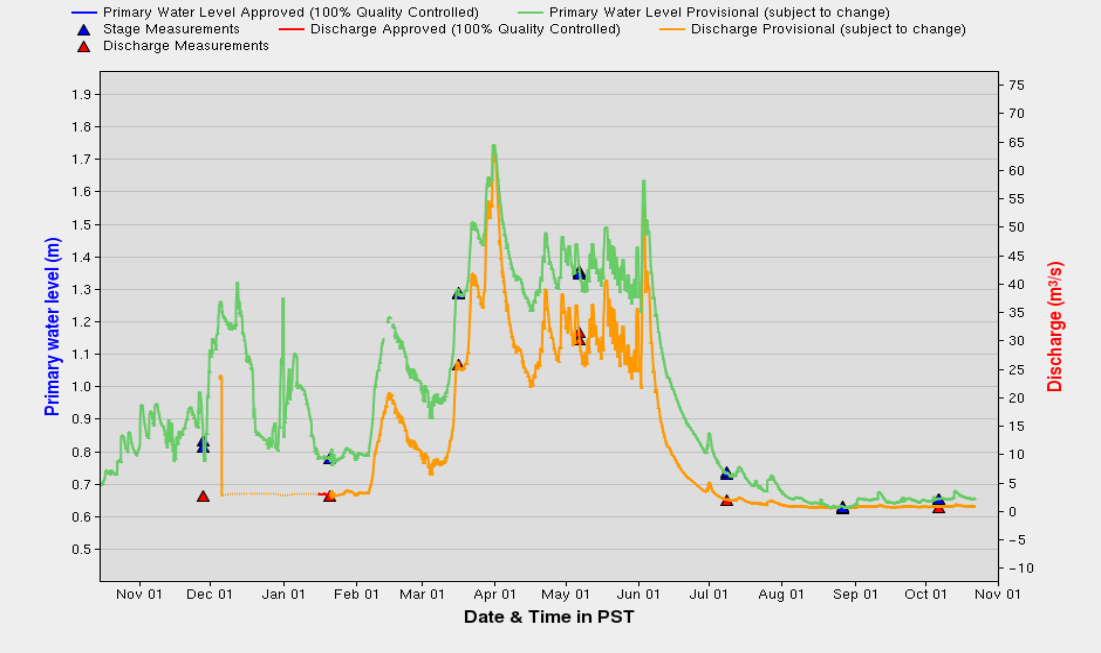

Figure 3. Annual water level (m) and discharge (m^3/s) at Westbridge on the West Kettle River (Water Survey of Canada).

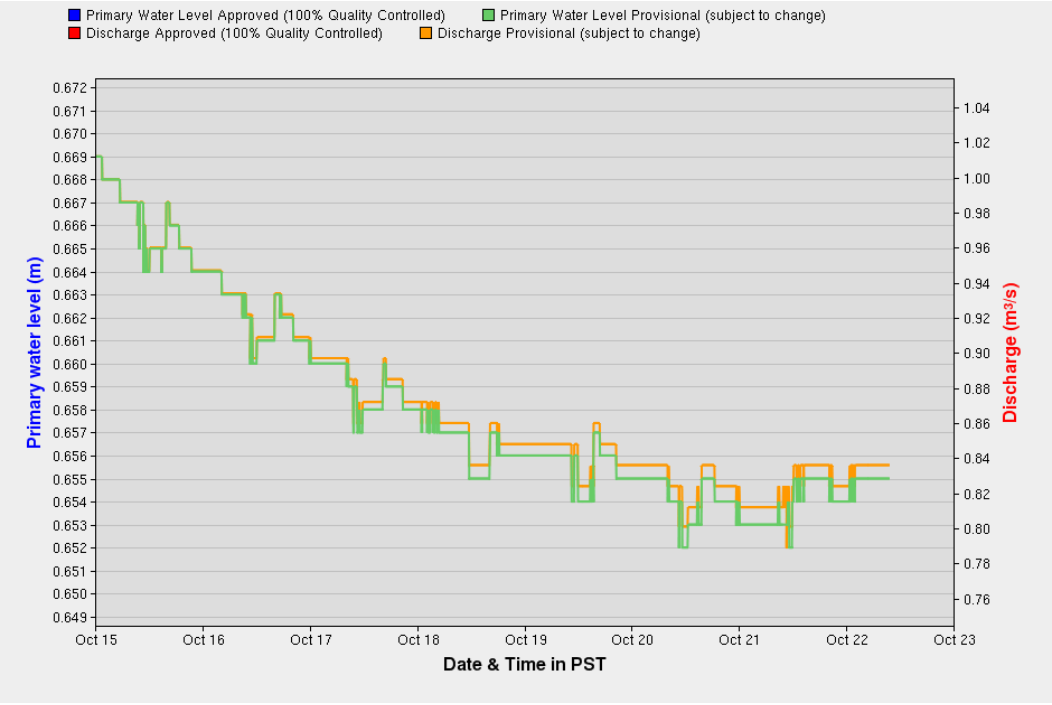

Figure 4. Daily water level (m) and discharge (m^3/s) at Westbridge (station number 08NN003) on the West Kettle River during the course of the survey (Water Survey of Canada).

CATCH STATISTICS AND POPULATION ESTIMATES

In all strata, the number of Speckled Dace caught in the first pass was greater than the number in the second pass (Table 2). Total catch of Speckled Dace caught in each pass varied within each stratum (e.g., range of 1–116) (Table 2). The estimated probability of capture ranged from 3% (stratum 7) to 100% (stratum 10) (Table 2). The difference between pass counts for some strata was small, resulting in large standard error in abundance estimates (i.e. strata 1, 2, 8 and 14).

Table 2. Catch of Speckled Dace and estimate of abundance using two-pass method (Kettle River, October 2015).

Stratum	Catch			Probability of Capture (%)	Abundance estimate	SE	Lower 95%	Upper 95%
	Pass 1	Pass 2	Total					
1	7	6	13	17	49	151	0	352
2	14	13	27	8	196	946	0	2087
3	21	12	33	8	49	18	13	85
4	3	2	5	50	9	13	0	36
5	8	4	12	25	16	7	2	30
6	26	11	37	9	45	8	30	61
7	84	30	116	3	131	9	112	149
8	4	3	7	33	16	32	0	79
9	32	12	44	8	51	6	38	64
10	2	1	3	100	4	3	0	11
11	1	0	1	--	1	0	1	1
12	68	25	93	4	108	9	90	125
13	25	9	34	11	39	5	29	49
14	4	3	7	33	16	32	0	79
15	59	23	82	4	97	9	78	116

Abundance estimates by stratum ranged between 1–196 Speckled Dace (Table 2). The strata with highest abundance estimates (strata 2, 7, 12 and 15) also had relatively low probabilities of capture. Strata 7, 12 and 15 had the highest pass counts from with relatively low flow, such as back eddies. The cumulative population estimate was 827 Speckled Dace (SE = 959, n = 15); however when stratum 2, which had a very large SE, was removed from the analysis, the estimate was 631 (SE = 161, n = 14, Table 2).

The average density per linear metre was 6.27 (SE = 1.98); extrapolating over the length of the surveyed area (1.432 km), the mean population estimate was 8,978 (ranging from 6,143–11,814). Assuming similar habitat characteristics, the mean population estimate for the entire 2.4 km length of critical habitat in the West Kettle River, was 15,048 (ranging from 10,296 to 19,800).

LENGTH AND CATCH COMPOSITION

Although Speckled Dace was the target species, Slimy Sculpin (*Cottus cognatus*), Chiselmouth (*Acrocheilus alutaceus*), juvenile trout (*Salmo* sp.), Signal Crayfish (*Pacifastacus leniusculus*) and an unidentified frog were also captured.

Mean fork length of Speckled Dace was 30.83 mm with a standard deviation 7.67 mm (range 18–81 mm, n = 453) (Figure 5 and Figure 6). Based on adult/juvenile size differentiation as identified by Batty (2010) and Penden and Hughes (1981, 1984), it was estimated that 1,014 adults were captured in the survey (1.432 km length), an average of approximately 708 adults/km.

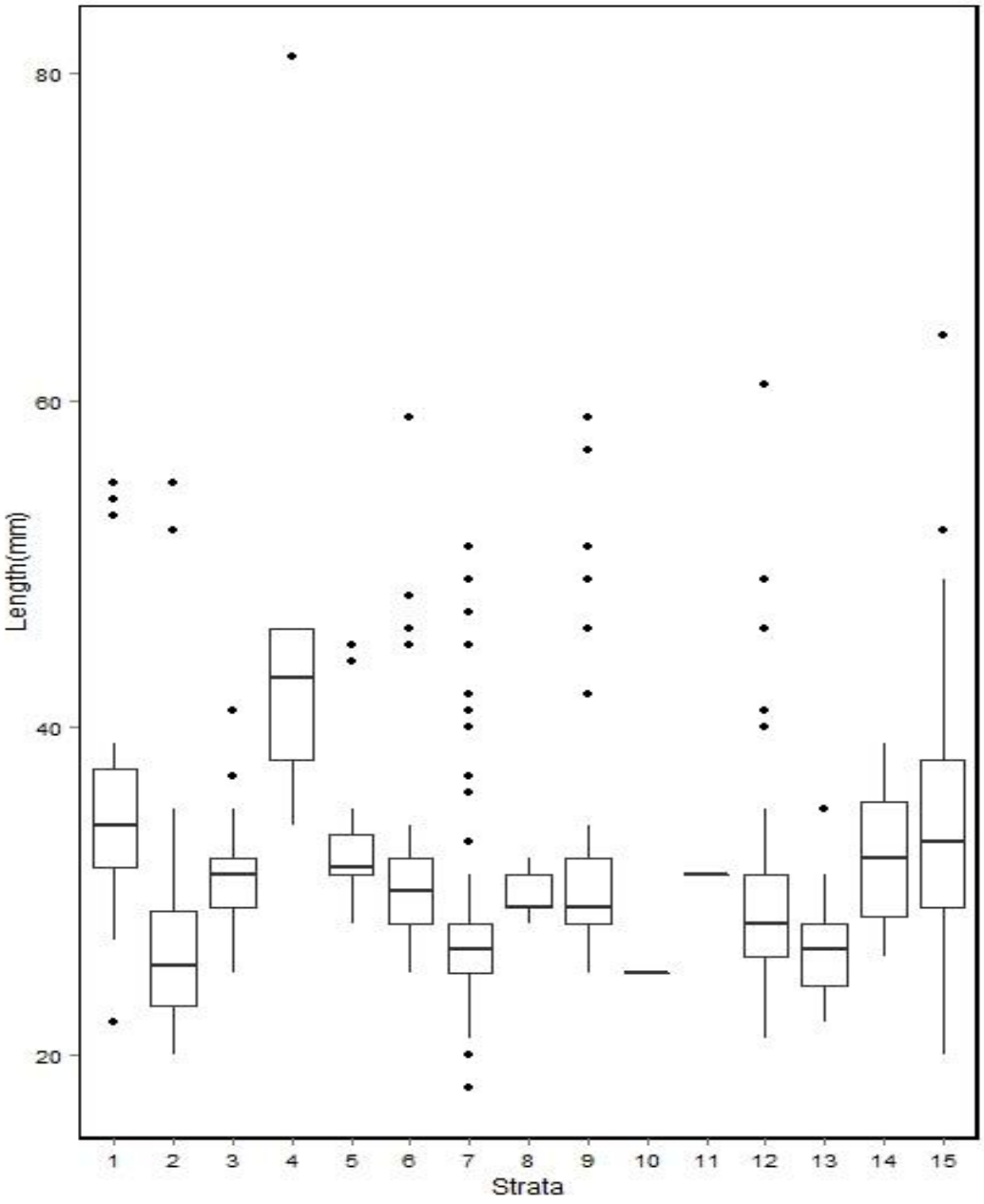

Figure 5. Boxplots of Speckled Dace fork lengths for each stratum. The middle line of the box represents the median length, the whiskers extend from the hinge to highest and lowest values that are 1.5* the inter-quartile range between the first and third quarterlies. Data beyond the whiskers are considered outliers and plotted as points.

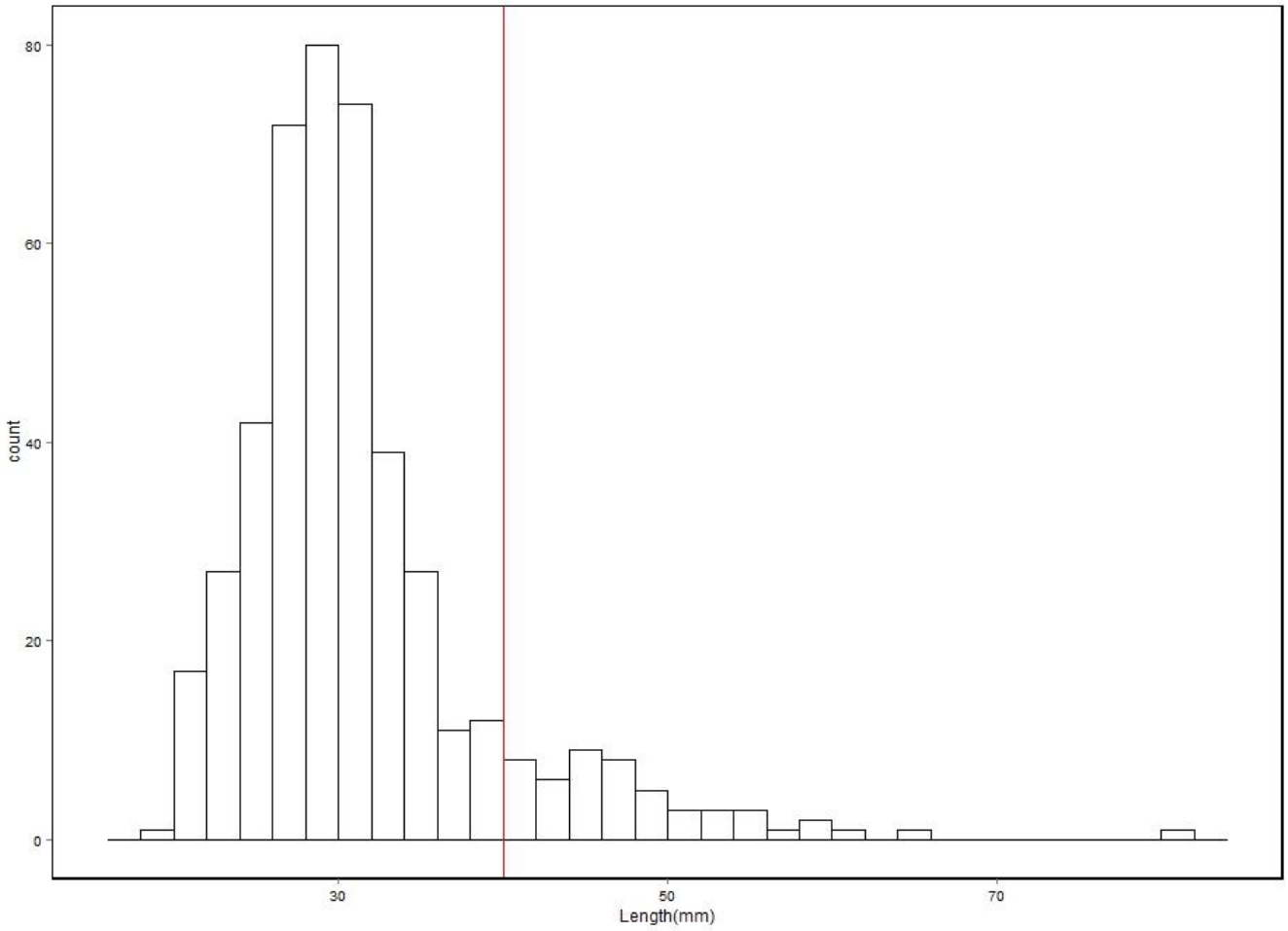

Figure 6. Speckled Dace fork length frequency distribution. Vertical red line indicates putative division between adults and juvenile fish based on descriptions in Batty (2010) and, Peden and Hughes (1981,1984).

DISCUSSION

The West Kettle River is characterized by having extreme fluctuations between high summer-spring flows and very low fall-winter discharge. The River has also been heavily impacted by habitat disturbance arising from human activities such as logging practices, mining, agricultural and water withdrawal (Brown et al. 2012). Cumulatively, these activities have modified the river habitat, by promoting changes in substrate, reducing pool and riparian habitat, and reducing large wood debris to allow for habitat complexity (Summit Environmental Consultants 2012). Variability in habitat substrate and water flow dynamics, and their relationships to different life stages and densities of Speckled Dace ecology have been described (Peden and Hughes 1981, 1984; McPhail 2007; Batty 2010; and Andrusak and Andrusak 2011). Generally, these studies report

that younger, smaller fish tend to be found in reaches with low current near the margins of the river, whereas larger adults tend to be in the middle of the channel where the water depth and current are greater.

A variety of different habitat types were sampled during the course of the survey. Most types were reaches that were characterized by heavily embedded cobble substrate with larger boulders in the centre of the channel. Andrusak and Andrusak (2011), Batty (2010), DFO (2013) and McPhail (2007) all indicate that larger older fish prefer the deeper portions of the river, whereas the smaller, juvenile fish prefer the periphery of the river in slower moving waters. Over the course of the survey only one pool type stratum was surveyed. This was in part due to stratum selection but also low water flow. We found few adults in our survey area and in general, higher total catch was found in areas with low flow and sandy substrate.

Speckled Dace are believed to spawn from mid-June to mid-July. Fry emerge in early August at about 9 mm in length, and by late October, fry are 20–30 mm fork length (FL) (McPhail 2007). Batty (2010) identified the point of 50% maturity as a fork length (FL) of 55.8 mm. Peden and Hughes (1981,1984) found that spawning begins when fish are 40–50 mm FL. They also suggest that Speckled Dace smaller than 40 mm in length are no more than 1.5 years old. Based on the data reported in Figure 6, the population sampled had a Poisson distribution and greater than 88.7% of the fish were less than 40 mm, suggesting that they were 0+ or 1+ age fish and unlikely to spawn until the spring of 2016 or 2017. The length distribution of the sampled fish was consistent across all strata with the exception of stratum 4 where one large (81 mm FL) fish was caught.

Over the 1.4 km survey area, only one area with large woody debris was observed that caused the development of a significant pool and complex habitat. The pool that was sampled, was just downstream of a riffle in a meander. The uniformity of the habitat and the consistency in the embeddedness of the substrate did not appear to provide significant habitat diversification for the different age classes. This is likely reflected in the low number of adults estimated (~1,100 or 708 adults/km).

Although there are many sources of uncertainty associated with the population estimate including the challenges of fishing at night, inexperience of the samplers, and uniformity of the habitat sampled, it is reasonable to conclude that more work needs to be done to determine the suitability of critical habitat for this species, both in terms of length (or area) and habitat functions and features. If we presume that a population target of 7,000 adults is needed to achieve long term persistence results from this study would indicate that the delineated critical habitat on the Kettle River is not sufficient to support this target.

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