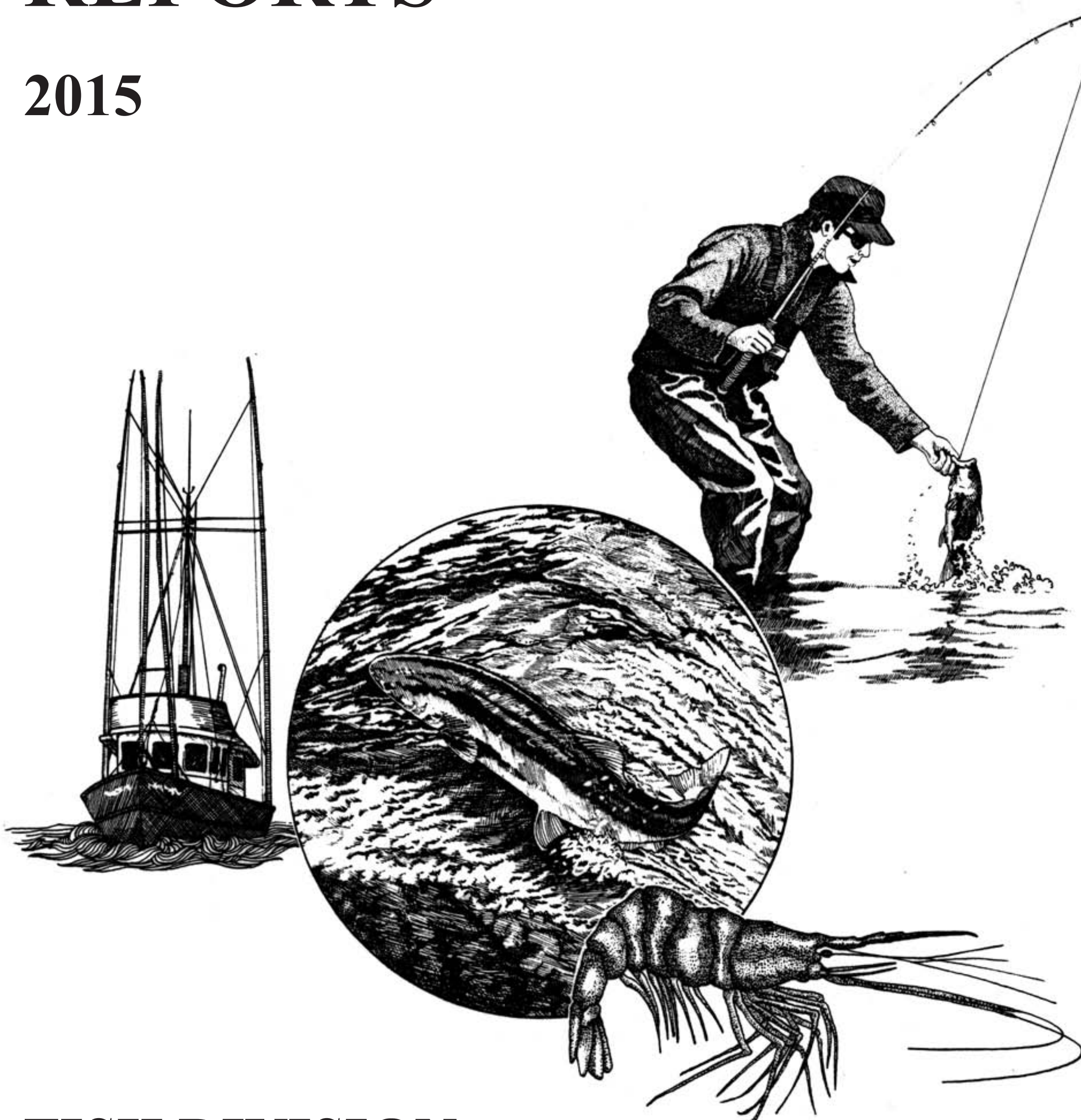
PROGRESS REPORTS

2015



FISH DIVISION

Oregon Department of Fish and Wildlife

2015 Millicoma Dace Investigations (Tioga Creek and Williams River)

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: **Distribution and Abundance of Millicoma Dace in the Williams River and Tioga Creek, South Fork Coos River Basin, Oregon**

CONTRACT: L14AC00083 (10/1/2014 - 9/30/2019)

Photograph of Millicoma dace (credit- D. Markle) and its habitat.

Paul D. Scheerer[1], Jim Peterson[2], and **Shaun Clements[1]**

[1]Oregon Department of Fish and Wildlife, 28655 Highway 34, Corvallis, Oregon 97333

[2]USGS Oregon Cooperative Fish and Wildlife Research Unit, 104 Nash Hall, Oregon State University, Corvallis, OR 97331

This project was financed with funds administered by the US Bureau of Land Management.

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Abstract— The Millicoma dace (*Rhinichthys cataractae)* is a form of longnose dace endemic to the Coos River drainage in southwestern Oregon. Sparse species records in the Oregon State University Ichthyology Collection and infrequent recent encounters prompted a 2014 survey to assess the current status and distribution of these fish. In 2015, we extended these surveys further upstream in the Tioga Creek drainage and into the Williams River. We surveyed locations using backpack electrofishing to document presence/absence and to estimate dace capture probabilities and abundance. We used an N-mixture model to estimate abundance and capture probability for Millicoma dace at each sampling location. We evaluated the effects of habitat covariates on both capture probability and abundance at each sample site. We found Millicoma dace were widespread and relatively abundant in the Williams River and in lower Tioga Creek. We only found Millicoma dace associated with native fishes; we did not collect any nonnative fish during our surveys. We collected Millicoma dace from swift water habitats, which were relatively uncommon in the basin, and found them typically associated with cobble or boulder substrates. We estimated a mean capture probability for Millicoma dace of 34% (range 6–81%). Abundance estimates obtained in 2015 ranged from 0 to 66 dace per sampling location with expanded tributary estimates of 3,257 and 12,286 fish in Tioga Creek and the Williams River, respectively.

INTRODUCTION

The longnose dace *Rhinichthys cataractae* is widespread in North America and in Oregon. The Millicoma dace is a form of longnose dace endemic to the Coos River drainage in southwestern Oregon and is a strategy species under the Oregon Conservation Strategy. Bisson and Reimers (1997) first described the unique characters of Millicoma dace and nearby Umpqua dace *R. evermanni* and found large morphological differences between these coastal longnose dace and those inhabiting Columbia River tributaries, likely resulting from prolonged geographical isolation. McPhail and Taylor (2009) conducted a phylogeographical maximum likelihood analysis that indicated that, together the Umpqua and Millicoma dace form a distinctive Oregon coastal clade within the *R. cataractae* species group (originated from a common *R. cataractae* like ancestor) and the Millicoma dace likely evolved from the Umpqua dace (sister taxa). They noted substantial genetic divergence of Millicoma dace from Umpqua dace and argued that the Millicoma dace warrants specific taxonomic status (distinct species).

In 2014, we described the widespread distribution and high relative abundance of Millicoma dace at historical locations in the Coos basin (Scheerer et al. 2014). In 2015, we expanded these surveys to upper Tioga Creek and the Williams River, in the South Coos subbasin. The objectives of the current study were to: 1) survey locations in upper Tioga Creek and the Williams River for Millicoma dace using backpack electrofishing to document presence/absence, and 2) estimate dace capture probabilities and abundance.

METHODS

We sampled seven locations in upper Tioga Creek and ten locations in the Williams River from 28 September to 8 October, 2015 (Figure 1). At each location, we used single-pass backpack electrofishing to sample a section (length) of stream that was approximately six times the wetted width and included riffle habitat. We flagged the upstream and downstream boundaries. We placed the Millicoma dace that we captured in a five gallon bucket until the entire site was sampled. After sampling was completed, we measured the Millicoma dace to the nearest 1 mm. If Millicoma dace were collected at a location, we repeated the sampling on one more occasion, 1–3 d later. If no dace were collected at a site, we repeated the sampling on two more occasions. We recorded the other fish species collected and counted all Coho salmon *Oncorhynchus kisutch*, to satisfy National Oceanic and Atmospheric Administration 4(d) permit reporting requirements.

We collected habitat information at each location that we visited. We used a graduated measuring tape or laser range finder to measure stream width and site length. We determined the stream length for each sampling location by multiplying the average wetted stream width by six, thus scaling the sampling area to the size of the stream channel. At three transects at each site, we determined the site depth using a graduated measuring staff and calculated the average of five equally spaced measurements across the channel and recorded the dominant substrate type based on the following categories: fines- <0.063 mm, sand- 0.063-2 mm, gravel- 3-64 mm, cobble- 65-256 mm, boulder- >256 mm, or bedrock. We calculated average site depth and dominant substrate for each site from these measurements. We estimated the cover provided by large wood and/or large boulders, expressed as a percentage of surface area of the site. We recorded the water temperature using a hand held thermometer. We recorded the Universal Transverse Mercator (UTM) coordinates for the start and end points at each site using a handheld Global Positioning System (GPS) and photographed each sampling location.

We used an N-mixture or binomial-mixture model, which uses data from spatially replicated populations (i.e., sampling sites) with temporally replicated counts of independent individuals (i.e., multiple sampling occasions) within a period of closure (i.e., assuming no immigration, emigration, or mortality) to estimate abundance and capture probability for Millicoma dace at each sampling location (Royle 2004; Kéry and Schaub 2012). The binomial mixture model is appealing, since it allows us to estimate abundance, corrected for imperfect capture, using simple counts without individual identification. The capture of dace present at a site was modeled assuming a binomial distribution, whereas the variation in abundance among sites was assumed to follow a negative binomial distribution.

The N-mixture model also allowed us to evaluate evidence for the effect of covariates on both capture probability and abundance at a sample site. We included the following habitat covariates as potential predictors for the capture probability submodel: stream width, substrate type, stream temperature, percent cover, average depth, and mean stream cross-sectional area. We also evaluated the following habitat covariates as predictors for the abundance submodel: stream temperature, percent cover, average depth, sample unit length, and sample unit area. We evaluated the effect of these variables by systematically fitting alternative

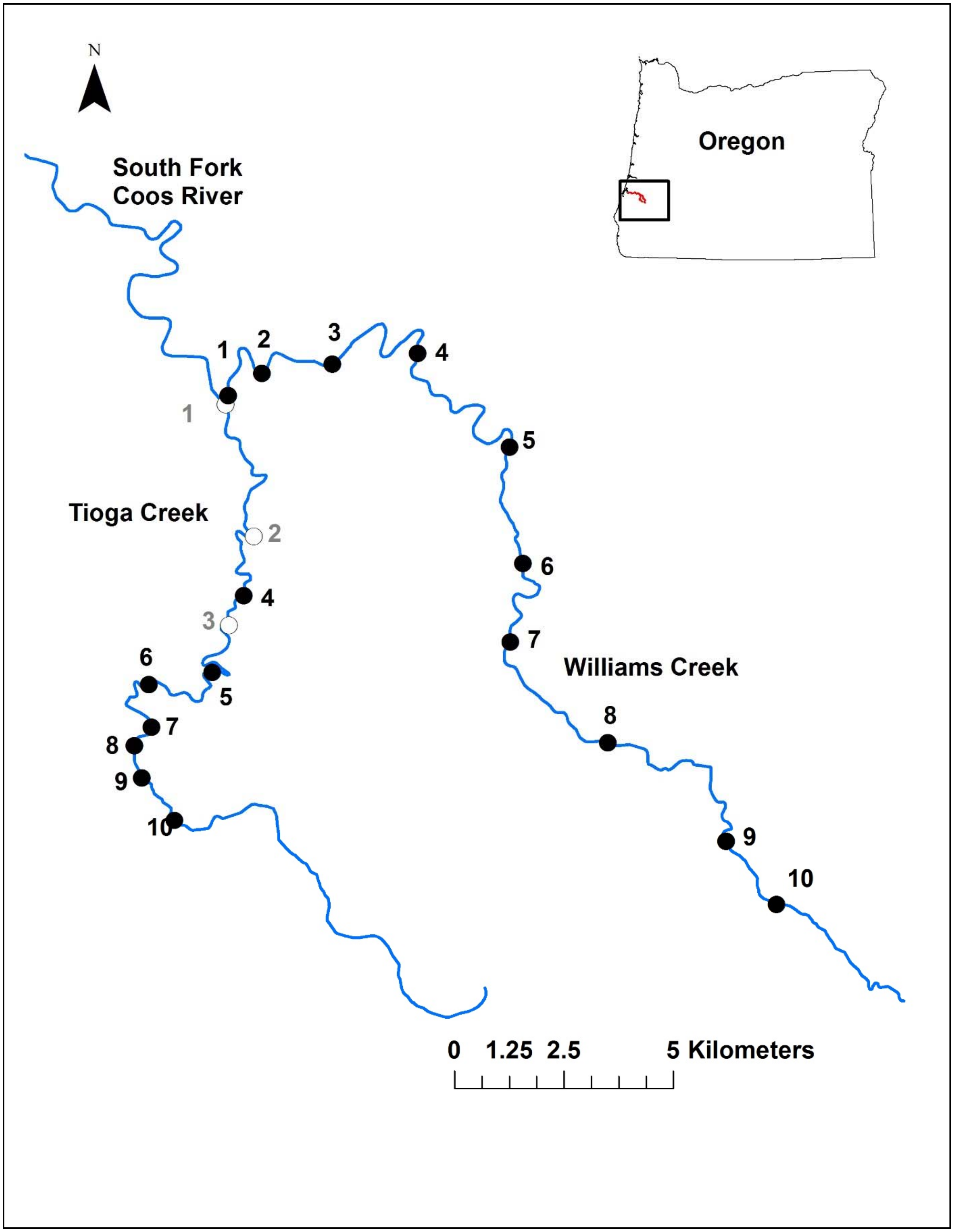

Figure 1. Sampling locations for Millicoma dace (dark circles) in the South Coos River drainage, September 2015. Site numbers refer to those listed in Table 1. Tioga Creek sites 1-3 (open circles), sampled in 2014 (Scheerer et al. 2014), are also shown.

submodels with and without the predictors and selected the best model using Akaike's Information Criteria with a small sample bias adjustment (AICc; Burnham and Anderson 2002). During the model selection procedure, the same covariate (e.g., average depth) was not included simultaneously in both submodels to avoid model convergence and parameter identifiability problems. We calculated 95% confidence limits for abundance estimates using the asymptotic variance for lambda, which represents the density of occurrences within a time interval, as described by Royle (2004). All models were fit using R package UNMARKED (Fiske and Chandler 2011). Goodness-of-fit of the best supported models was evaluated using a bootstrap goodness-of-fit test as implemented in R package AICcmodavg (Mazerolle 2014).

RESULTS

We sampled 17 locations in the South Coos River drainage and collected Millicoma dace from ten of these locations (Figure 2). We collected dace from nine of these ten locations on both the first and second sampling occasions and the numbers of individuals caught were remarkably consistent across repeat sampling visits at these locations (Table 1). We did not capture Millicoma dace above ~RKm 11 (Milepost ~6.1) on Tioga Creek (Tioga sites 6-10). There is a bedrock falls with a fish ladder immediately upstream of Tioga Creek site 7 that may limit upstream distribution in this tributary (however none were captured at site 7). We captured Millicoma dace in the Williams River upstream as far as ~21 RKm (Milepost ~35.5).

We collected Millicoma dace from swift water habitats, which were relatively uncommon in the basin, and found them typically associated with cobble or boulder substrates. When the Coos basin was previously logged (1880's-1950's), the timber was transported downstream using water stored behind splash dams. When the spillway of these dams was opened to release a large flood of water stored in the upstream reservoir, the stream bed was severely scoured, resulting in low habitat complexity and a stream substrate that was dominated by bedrock. This logging practice resulted in an environmental legacy which has been slow to reverse. The majority of the stream channels in the study area had low channel gradient and were dominated by pools and glides.

We collected eight non-target fish species during our sampling, including speckled dace *Rhinichthys osculus*, coastrange sculpin *Cottus aleuticus*, riffle sculpin *C. gulosus*, rainbow trout *Oncorhynchus mykiss,* cutthroat trout *O. clarkii*, Coho salmon *O. kisutch*, redside shiner *Richardsonius balteatus*, and Pacific lamprey ammocoetes *Lampetra* sp. (Table 2). We also captured native Pacific Giant salamanders (*Dicamptodontidae*) at most of the fishless sites on Tioga Creek and native signal crayfish (*Pacifasticus leniusculus*) at most of the sites on the Williams River.

The best approximating N-mixture model included an intercept only for estimating capture probability and abundance was modeled as a function of sample site area and temperature, plus dispersion (i.e., additional variation not described by the Poisson distribution). Estimated capture probabilities averaged 34%. The bootstrap goodness-of-fit test indicated that the model met the statistical distributional assumptions of the N-mixture model with the chi square test p-value of 1.0.

Millicoma dace were most common in the Williams River and were only detected at two sites in Tioga Creek (Table 2). The site abundance estimates ranged from 0 to 66 dace per sampling location. Abundance was positively related to sample site area and water temperature. Parameter estimates for the model are shown in Table 3. We expanded the site estimates by the total area of swift water habitat (riffles and rapids) in each tributary and the resulting expanded estimates were 3,257 and 12,286 fish in Tioga Creek and the Williams River, respectively (APPENDIX A).

Table 1. Fish catch and habitat details for 2014 Millicoma dace sampling locations. Fish codes: MD-Millicoma dace, SPD- speckled dace, CRS- coastrange sculpin, RT- rainbow trout, RS- riffle sculpin, CT- cutthroat trout, CO- Coho salmon, RSS- redside shiner, LAM- lamprey ammocoete. Note, only one electrofishing pass (presence/absence) was conducted at Williams Creek site 10.

Date	Location	Water temperature (C)	Pass	Shock time (min)	Length (m)	Width (m)	Dominant substrate	Average depth	Cover (%)	**MD**	SD	CRS	RT	RS	CT	CO	RSS	LAM
9/28/15	Tioga Creek 4	12.0	1	26	39.3	5.8	cobble	0.13	10	**4**	x	x	x					
9/29/15	Tioga Creek 4	10.0	2	31	39.3	5.8	cobble	0.13	10	**2**	x	x	x					
9/28/15	Tioga Creek 5	11.5	1	30	43.6	5.0	gravel	0.07	10	**1**	x	x	x			0		
9/29/15	Tioga Creek 5	11.0	2	27	43.6	5.0	gravel	0.07	10	**0**	x		x			1		x
9/28/15	Tioga Creek 6	11.5	1	35	42.7	5.4	gravel	0.17	10	**0**	x	x	x			0		x
9/29/15	Tioga Creek 6	11.0	2	35	42.7	5.4	gravel	0.17	10	**0**	x	x				1		x
9/29/15	Tioga Creek 6	11.5	3	33	42.7	5.4	gravel	0.17	10	**0**	x	x				0		
9/29/15	Tioga Creek 7	12.0	1	25	34.0	5.2	gravel	0.08	5	**0**	x		x			3		
9/30/15	Tioga Creek 7	11.0	2	21	34.0	5.2	gravel	0.08	5	**0**	x		x			7		
9/30/15	Tioga Creek 7	11.0	3	22	34.0	5.2	gravel	0.08	5	**0**	x		x			5		
9/29/15	Tioga Creek 8	13.0	1	18	44.0	6.4	bedrock	0.10	10	**0**			x		x	1		
9/30/15	Tioga Creek 8	12.0	2	18	44.0	6.4	bedrock	0.10	10	**0**			x		x	0		
9/30/15	Tioga Creek 8	12.0	3	16	44.0	6.4	bedrock	0.10	10	**0**			x		x	0		
9/29/15	Tioga Creek 9	14.0	1	14	40.0	6.9	boulder	0.12	50	**0**	x	x	x			1		
9/30/15	Tioga Creek 9	14.0	2	16	40.0	6.9	boulder	0.12	50	**0**	x	x	x			1		
9/30/15	Tioga Creek 9	14.5	3	15	40.0	6.9	boulder	0.12	50	**0**	x	x	x			0		
9/29/15	Tioga Creek 10	12.0	1	18	38.8	5.4	cobble	0.10	25	**0**			x		x	3		
9/30/15	Tioga Creek 10	12.0	2	17	38.8	5.4	cobble	0.10	25	**0**			x		x	2		
9/30/15	Tioga Creek 10	12.0	3	15	38.8	5.4	cobble	0.10	25	**0**			x		x	1		
10/1/15	Williams River 1	13.0	1	52	54.0	8.9	cobble	0.08	5	**23**	x	x	x			0	x	
10/5/15	Williams River 1	13.0	2	62	54.0	8.9	cobble	0.08	5	**17**	x	x	x			0	x	x
10/1/15	Williams River 2	13.0	1	50	38.6	7.5	boulder	0.14	10	**23**	x	x				0	x	x
10/5/15	Williams River 2	12.5	2	45	38.6	7.5	boulder	0.14	10	**12**	x	x				0	x	
10/1/15	Williams River 3	13.0	1	64	55.0	7.9	bedrock	0.10	5	**26**	x	x	x			0	x	
10/5/15	Williams River 3	13.0	2	67	55.0	7.9	bedrock	0.10	5	**19**	x	x	x			0	x	
10/5/15	Williams River 4	12.5	1	45	64.0	10.2	cobble	0.09	5	**7**	x	x	x	x		0		
10/6/15	Williams River 4	11.0	2	42	64.0	10.2	cobble	0.09	5	**9**	x	x	x			0		
10/6/15	Williams River 5	12.0	1	60	72.0	19.0	cobble	0.12	10	**15**	x	x	x			0		
10/7/15	Williams River 5	12.5	2	66	72.0	19.0	cobble	0.12	10	**12**	x	x	x			0		
10/6/15	Williams River 6	12.5	1	60	57.0	7.7	gravel	0.07	5	**13**	x	x	x			1		x
10/7/15	Williams River 6	13.0	2	62	57.0	7.7	gravel	0.07	5	**13**	x	x	x			0		
10/6/15	Williams River 7	13.0	1	50	48.0	6.3	cobble	0.10	10	**15**	x	x	x		x	1		
10/7/15	Williams River 7	13.0	2	61	48.0	6.3	cobble	0.10	10	**18**	x	x	x			2		
10/7/15	Williams River 8	12.0	1	57	54.0	7.8	boulder	0.07	50	**9**	x	x	x			2		
10/8/15	Williams River 8	11.5	2	72	54.0	7.8	boulder	0.07	50	**11**	x	x	x			1		
10/7/15	Williams River 9	12.0	1	24	44.5	7.3	gravel	0.10	10	**0**	x	x	x			3		
10/8/15	Williams River 9	12.0	2	28	44.5	7.3	gravel	0.10	10	**0**	x	x	x			2		
10/8/15	Williams River 9	12.0	3	24	44.5	7.3	gravel	0.10	10	**0**	x	x	x			2		
10/8/15	Williams River 10 (p/a only)	11.0	1	22	55.0	4.4	cobble	0.18	10	**0**		x	x			2		

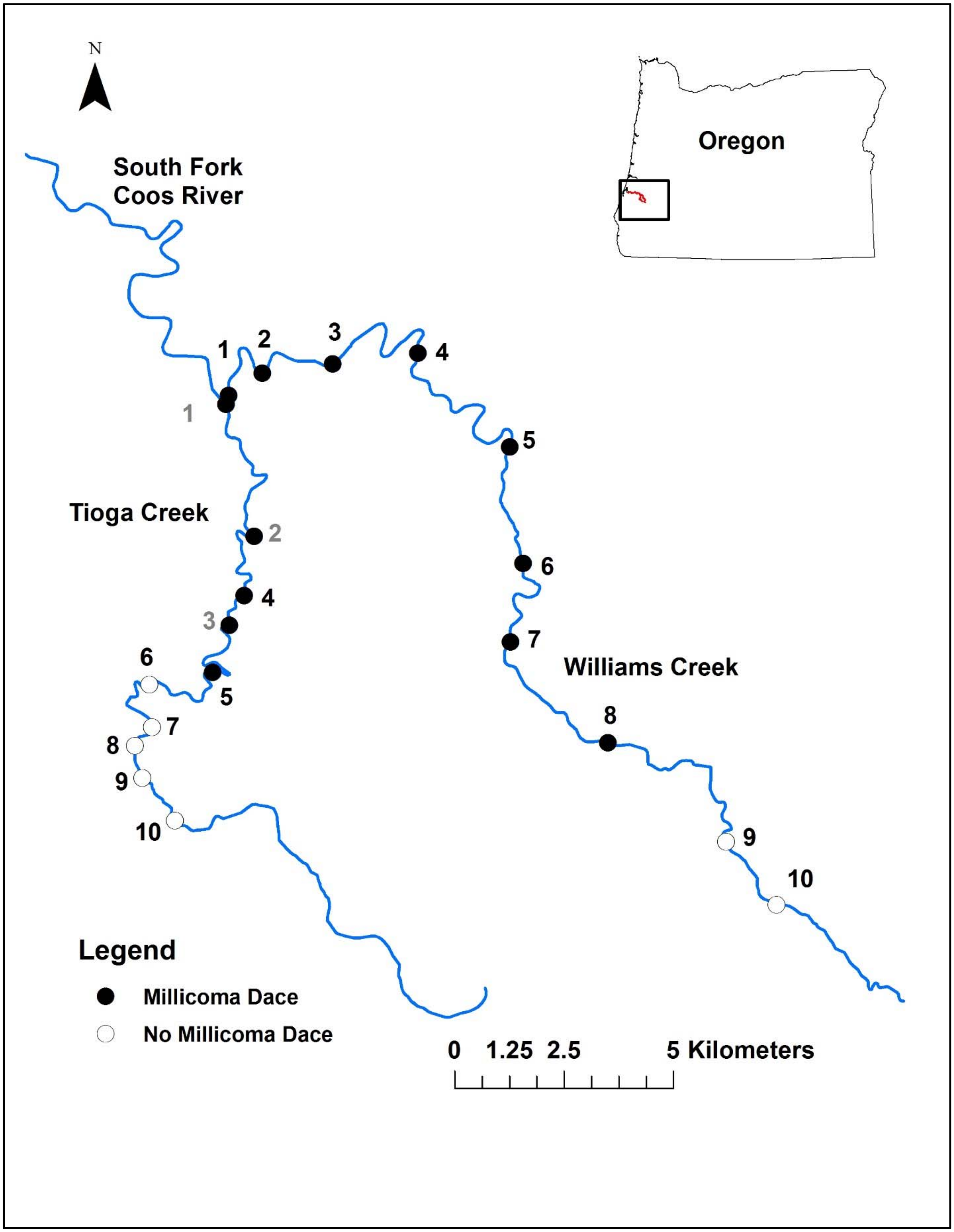

Figure 2. Sites where Millicoma dace were detected (dark circles) and not detected (open circles) in 2015. Also included are results for Tioga Creek sites 1-3 from 2014.

Table 2. Estimated 2015 Millicoma dace abundance and 95% confidence limits from the best fitting N-mixture model. Note, also included are abundance estimates from Tioga Creek sites 1-3 (*italicized*) from 2014 sampling (Scheerer et al. 2014).

Site	Estimate	Lower 95% CI	Upper 95% CI
Tioga Creek 1	*304*	*214*	*409*
Tioga Creek 2	*54*	*21*	*102*
Tioga Creek 3	*97*	*50*	*160*
Tioga Creek 4	**8**	4	14
Tioga Creek 5	**2**	1	5
Tioga Creek 6	**0**	0	1
Tioga Creek 7	**0**	0	1
Tioga Creek 8	**0**	0	1
Tioga Creek 9	**0**	0	1
Tioga Creek 10	**0**	0	1
Williams River 1	**58**	45	74
Williams River 2	**52**	39	66
Williams River 3	**66**	51	82
Williams River 4	**23**	15	33
Williams River 5	**40**	29	53
Williams River 6	**38**	27	50
Williams River 7	**48**	36	62
Williams River 8	**28**	19	39
Williams River 9	**0**	0	1
Williams River 10 (p/a only)	**1**	0	4

Table 3. N-Mixture model parameter estimates and standard errors.

Parameter	Estimate	Standard Error	Lower 95% CI	Upper 95% CI
Abundance submodel (log scale)				
Intercept	-11.7009	6.6060	-24.6486	1.2468
Site area	0.0028	0.0015	-0.0002	0.0058
Water temperature	1.0882	0.5443	0.0215	2.1550
Dispersion	-0.9630	0.4460	-1.8372	-0.0888
Capture probability (logit-scale)				
Intercept	-0.6500	1.0700	-2.7472	1.4472
Estimated capture probability	0.34299		0.06024	0.80957

The spatial data presented in this report is also available from ODFW's Natural Resources Information Management Program in Salem, Oregon https://nrimp.dfw.state.or.us/nrimp/default.aspx?p=259.

DISCUSSION

We found Millicoma dace were widespread and relatively abundant in the Williams River and lower Tioga Creek and described the approximate upper limits of their distribution in these tributary streams. All of the sites sampled were outside the previously known historical distribution. We only found Millicoma dace associated with native fishes; we did not collect any nonnative fish during our surveys. Consistent with 2014 surveys, we noted in 2015 that Millicoma dace appear to have very specific habitat requirements (based on our field observations), preferring swift water habitats, which were relatively rare in the Coos drainage where we sampled. We only collected Millicoma dace from riffles and rapids, primarily associated with (hiding under) cobble or boulder substrates. Because of the history of splash dam logging in the basin, complex stream habitats with coarse substrates are currently uncommon in the basin. Many of the riffles and rapids in the drainage are dominated by bedrock and we typically captured Millicoma dace from these habitats only in areas where cobble or boulders were present.

We used an N-mixture model to estimate dace abundance at the sampling locations. This type of model has most commonly been used with bird counts (Kéry 2008; Kéry and Royle 2010). The appeal of these models is the ability to estimate abundance and capture probability from count data. These models assume: 1) each sample site is closed between visits, i.e., no immigration, emigration, birth or death; 2) capture probability is constant for all individuals present during a visit to a sample site; 3) the capture of individuals at a sample site is independent of others at that site; 4) the distribution animals among sample sites is adequately described by the chosen parametric distribution, i.e., negative binomial; and 5) there are no false positives such as double counts or species misidentification. We believe that we met these assumptions. We conducted our surveys over a very short time period, thus meeting the assumption of closure. We collected and measured all dace at a site at a single time point, thus eliminating the possibility of double counting individuals during a sampling visit. The goodness-of-fit test indicated that we met the distributional assumptions.

In summary, during our 2014-2015 surveys, we found that Millicoma dace were widespread and relatively abundant in the Coos River basin (APPENDIX B) (Scheerer et al. 2014; this study). Despite being widespread, they apparently have very specific habitat requirements (swift water habitats with coarse substrate) and are thus patchily distributed due to the relative rarity of these habitats in the basin. We suggest periodic surveys (every 5-10 years) to assess the future status and trends of this species. These surveys would benefit by incorporating available habitat surveys and targeting sites within stream segments that have higher amounts of riffle habitat. If restoration projects are implemented in the basin, we suggest addition of large wood and/or coarse substrates to increase the amount of physical structure in swift water habitats to benefit this and other native fish species.

ACKNOWLEDGEMENTS

We thank S. Messerle, J. Feola, J. Jackson, G. Vonderohe, M. Gray, M. Mims, and J. Heinrich for field assistance and B. Bangs for GIS assistance. We thank BLM for funding this study.

LITERATURE CITED

Bisson, P. A., and P. E. Reimers. 1977. Geographic variation among Pacific Northwest populations of longnose dace, *Rhinichthys cataractae*. Copeia 1977:518-522.

Burnham, K.P. and D.R. Anderson. 2002. Model selection and multimodel inference: a practical-theoretic approach, second edition. Springer-Verlag, New York, 353 p.

Fiske, I. and R. Chandler. 2011. Unmarked: An R Package for Fitting Hierarchical Models of Wildlife Occurrence and Abundance. Journal of Statistical Software, 43(10), 1-23. URL http://www.jstatsoft.org/v43/i10/.

Kéry, M. 2008. Estimating abundance from bird counts: binomial mixture models uncover complex covariate relationships. Auk 125:336-345.

Kéry, M., and J. A. Royle. 2010. Hierarchical modeling and estimation of abundance and population trends in metapopulation designs. Journal of Animal Ecology 79:453-461.

Kéry, M., and M. Schaub. 2012. Bayesian population analysis using WinBUGS- a hierarchical perspective. Elsevier Press, Burlington, VT. 560 p.

Mazerolle, M.J. 2014. AICcmodavg: Model selection and multimodel inference based on (Q)AIC(c). R package version 2.00. http://CRAN.R-project.org/package=AICcmodavg.

McPhail, J. D., and E. B. Taylor. 2009. Phylogeography of the longnose dace (*Rhinichthys cataractae*) species group in northwestern North America – the origin and evolution of the Umpqua and Millicoma dace. Canadian Journal of Zoology 87:491-497.

Royle, J. A. 2004. N-Mixture models for estimating population size from spatially replicated counts. Biometrics 60:108-115.

Scheerer, P. D., J. T. Peterson, and S. Clements. 2014. Distribution and abundance of Millicoma dace in the Coos Basin, Oregon. Oregon Department of Fish and Wildlife, Annual Progress Report, Corvallis. 10 p.

APPENDIX A. Millicoma dace site abundance estimates expanded for occupied portions of Tioga Creek and the Williams River. Tioga Creek estimates include sites from both 2014 and 2015.

Drainage	Sum of site abundance estimates	Total area surveyed (m^2)	Total area of riffles and rapids (m^2)	Multiplier	Expanded abundance estimate
Tioga Creek	465	1461.8	20,973	7.0	3,257
Williams River	354	390.0	171,967	34.7	12,286

APPENDIX B. Presence (P) and absence (A) of Millicoma dace at locations sampled in 2014-2015 in the Coos River drainage.

Year	Site name	Subbasin	Millicoma dace
2014	EF Millicoma River 1	Millicoma River	P
2014	EF Millicoma River 2	Millicoma River	P
2014	EF Millicoma River 3	Millicoma River	P
2014	EF Millicoma River 4	Millicoma River	A
2014	EF Millicoma River 5	Millicoma River	P
2014	WF Millicoma River 1	Millicoma River	P
2014	WF Millicoma River 2	Millicoma River	P
2014	WF Millicoma River 3	Millicoma River	P
2014	WF Millicoma River 4	Millicoma River	P
2014	WF Millicoma River 5	Millicoma River	P
2014	WF Millicoma River 6	Millicoma River	P
2014	Cox Creek	SF Coos River	A
2014	Fall Creek	SF Coos River	P
2014	SF Coos River 1	SF Coos River	P
2014	SF Coos River 2	SF Coos River	P
2014	Tioga Creek 1	SF Coos River	P
2014	Tioga Creek 2	SF Coos River	P
2014	Tioga Creek 3	SF Coos River	P
2015	Tioga Creek 4	SF Coos River	P
2015	Tioga Creek 5	SF Coos River	P
2015	Tioga Creek 6	SF Coos River	A
2015	Tioga Creek 7	SF Coos River	A
2015	Tioga Creek 8	SF Coos River	A
2015	Tioga Creek 9	SF Coos River	A
2015	Tioga Creek 10	SF Coos River	A
2015	Williams River 1	SF Coos River	P
2015	Williams River 2	SF Coos River	P
2015	Williams River 3	SF Coos River	P
2015	Williams River 4	SF Coos River	P
2015	Williams River 5	SF Coos River	P
2015	Williams River 6	SF Coos River	P
2015	Williams River 7	SF Coos River	P
2015	Williams River 8	SF Coos River	P
2015	Williams River 9	SF Coos River	A
2015	Williams River 10	SF Coos River	A

4034 Fairview Industrial Drive SE

Salem, Oregon 97302