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Monitoring of juvenile Chum Salmon and other fishes in Bear Creek and Clatskanie River, Oregon

Annual Report for 2020

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Monitoring of juvenile Chum Salmon and other fishes in Bear Creek and Clatskanie River, Oregon

Annual Report for 2020

Oregon Department of Fish and Wildlife

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INTRODUCTION

ODFW developed a Chum Salmon *Oncorhynchus keta* recovery strategy (ODFW 2010) with the objectives of (1) identifying and addressing limiting factors, (2) re-establishing self-sustaining, naturally reproducing Chum Salmon populations, and (3) monitoring the effectiveness of our strategy. Since 2012, one aspect of this effort has been to collect baseline data on juvenile Chum Salmon production in Oregon tributaries to the LCR, against which ODFW can evaluate the effectiveness of recovery efforts. Monitoring efforts are presently focused on quantifying juvenile production in discrete locations within the Clatskanie River and Big Creek populations where small populations of Chum Salmon spawn. Juvenile salmonid monitoring in the four coastal stratum populations from 2012–2019 was covered thoroughly in a previous report (Wiley and Homel 2020). This report covers juvenile salmonid monitoring at currently operated sites in the Bear Creek and Clatskanie River watersheds, including updated results from the 2020 trapping season.

GENERAL METHODOLOGY

To monitor the distribution and abundance of Chum Salmon fry and other fish species production, rotary screw traps were installed in tributary streams to the LCR in the Big Creek (Bear Creek) and Clatskanie River (Clatskanie River) populations (Figure 1 and Table A.1). Traps generally began fishing in late February at both sites and fished continuously (24 hours/day and 7 days/week) through late May or early June except during conditions associated with rising river levels, high debris loads, or other circumstances (e.g., see discussion on Peamouth *Mylocheilus caurinus* migration in Bear Creek "Non-Salmonid" section) where operation of the trap could endanger personnel or result in fish losses. Traps were typically checked and cleared of fish and debris once a day, with visits more frequent during storm events and high debris loads. Odometers, rain gauges, temperature loggers, and staff gauges were installed at each trap site so that trap rotations (i.e., the actual amount of sampling in a 24 hour period by a screw trap) and environmental conditions could be correlated to daily abundance in future analyses.

During each trap check, all fish were transferred from the trap live box and placed into 5-gallon holding buckets. Fish were held in buckets of stream water until they were anesthetized with MS-222 (tricaine methanesulfonate, concentration = 60 mg/l) buffered with baking soda (sodium bicarbonate, concentration = 125 mg/l). Once anesthetized, fish were enumerated by species and age or size group, all salmonids were examined for fin marks, and fork length (FL) and weight (g) were recorded for a trap-specific number of salmonids per day. Genetic samples were also collected from Chum Salmon fry, with previous results discussed in Small et al. (2014) and Homel et al. (2019).

Each species was categorized by size class and stage, depending on the life history of the species. All Chum Salmon and un-clipped Chinook Salmon *Oncorhynchus tshawytscha* were fry (age 0). Coho Salmon *Oncorhynchus kisutch* were identified as fry (age 0) or smolts (age 1+). Trout

species were identified by size classes that roughly approximate age classes, with fry (< 60 mm) not differentiated by species. The largest size class of Steelhead *Oncorhynchus mykiss* (≥ 120 mm) was considered smolts as the majority of fish in this size class showed signs of smoltification. Steelhead were also identified into two smaller size classes (90−119 mm and 60−89 mm) and considered pre-smolts, although a small percentage of fish in the 90−119 mm size class may have been in the early stages of smoltification. Coastal Cutthroat Trout *Oncorhynchus clarkii clarkii* were identified into five size classes (≥ 250 mm, 160−249 mm, 120−159 mm, 90−119 mm, and 60−89 mm), with a portion of the largest size class including adults and kelts that had recently spawned. Although not considered to be juveniles, this portion of the catch is shown in this report for inclusiveness. The other four juvenile Cutthroat Trout size classes are considered to be migrants, recognizing the complex life history diversity of the species.

Trap efficiency was evaluated for each species and size class by marking up to 100 individuals of each species and size class per day, depending on the characteristics of the trap site and vulnerability of a species size class to recapture. Marks were produced using a razor blade by removing a diagonal slice of the upper or lower caudal fin. Marked fish were then released in a location at least 100 m upstream from the trap site where fish could acclimate sufficiently before migrating downstream in a natural manner. Prior to 2015, marked fish were placed in time-release boxes that were set to release fish at twilight. In all other years, fish were manually released within 2 hours of marking to minimize overcrowding stress that sometimes occurred in the release boxes. All other fish not needed to evaluate trap efficiency were released safely downstream. Marking and recapture methods were adjusted iteratively throughout the year to maximize recapture rates without exceeding numbers allowed in our sampling take permit.

Hatchery salmonids were enumerated in the trap catch, but in most years estimates of total migrants were not made. Hatchery salmonids were measured and weighed, and in most cases interrogated for a coded-wire tag (CWT) with a metallic wand. Fish positively detected for a CWT were euthanized and later sent in to the Oregon Department of Fish and Wildlife (ODFW) CWT laboratory in Clackamas, OR. Hatchery Coho Salmon smolts were marked at the Bear Creek screw trap site in 2019 and 2020 (except fish detected positive for a CWT), as sufficient hatchery strays were captured in those years for population estimation.

Non-salmonids were also enumerated in the trap catch, but no population estimates were made of total migrants. We used the Lamprey terminology described in Clemens (2019) to distinguish larva (non-eyed, immature, filter-feeding) from juveniles (eyed, transformed, ready to feed). In this report, we do not distinguish larva to species in areas where both Pacific Lamprey *Entosphenus tridentatus* and Western Brook Lamprey *Lampetra richardsoni* occur. Most non-salmonids were released downstream after proces0sing, except for some non-native species (e.g.,

Common Goldfish *Carassius auratus*, Golden Shiner *Notemigonus crysoleucas*, Goby spp. *Gobiidae* etc….) that were euthanized as voucher specimens or for positive identification.

Weekly stratified (Stratified) and non-stratified (Pooled) Petersen population estimates were made (Package BTSPAS version 2012.0219 in program R; Bonner and Schwarz 2012) for each species and size class when at least 10 recaptures were obtained for the trapping season. The Stratified Petersen estimator produced weekly population estimates using weekly catch, marks, and subsequent recaptures. The weekly estimates were then summed to produce a total season estimate with standard error. The Pooled Petersen estimator produced a total season estimate with standard error using catch, marks, and recaptures for the entire season with no weekly stratification. We calculated a 95% confidence interval (Standard Error * 1.96) for each estimate. Finally, we compared dispersion between estimators by dividing each standard error by the population estimate (CV). We report either the Stratified or Pooled Petersen estimate using the following criteria:

Estimator Selection

1. If Stratified CV = 0−20% , always use Stratified Estimator
2. If Stratified CV is > 20% and < 30% and Pooled CV is < 5% lower than Stratified CV, use Stratified Estimator
    a. If Stratified CV is > 20% and < 30% and Pooled CV is > 5% lower than Stratified CV, use Pooled Estimator
3. If Stratified CV ≥ 30% and Pooled CV is > Stratified CV, use Stratified Estimator
    a. If Stratified CV ≥ 30% and Pooled CV is < Stratified CV, use Pooled Estimator

RESULTS

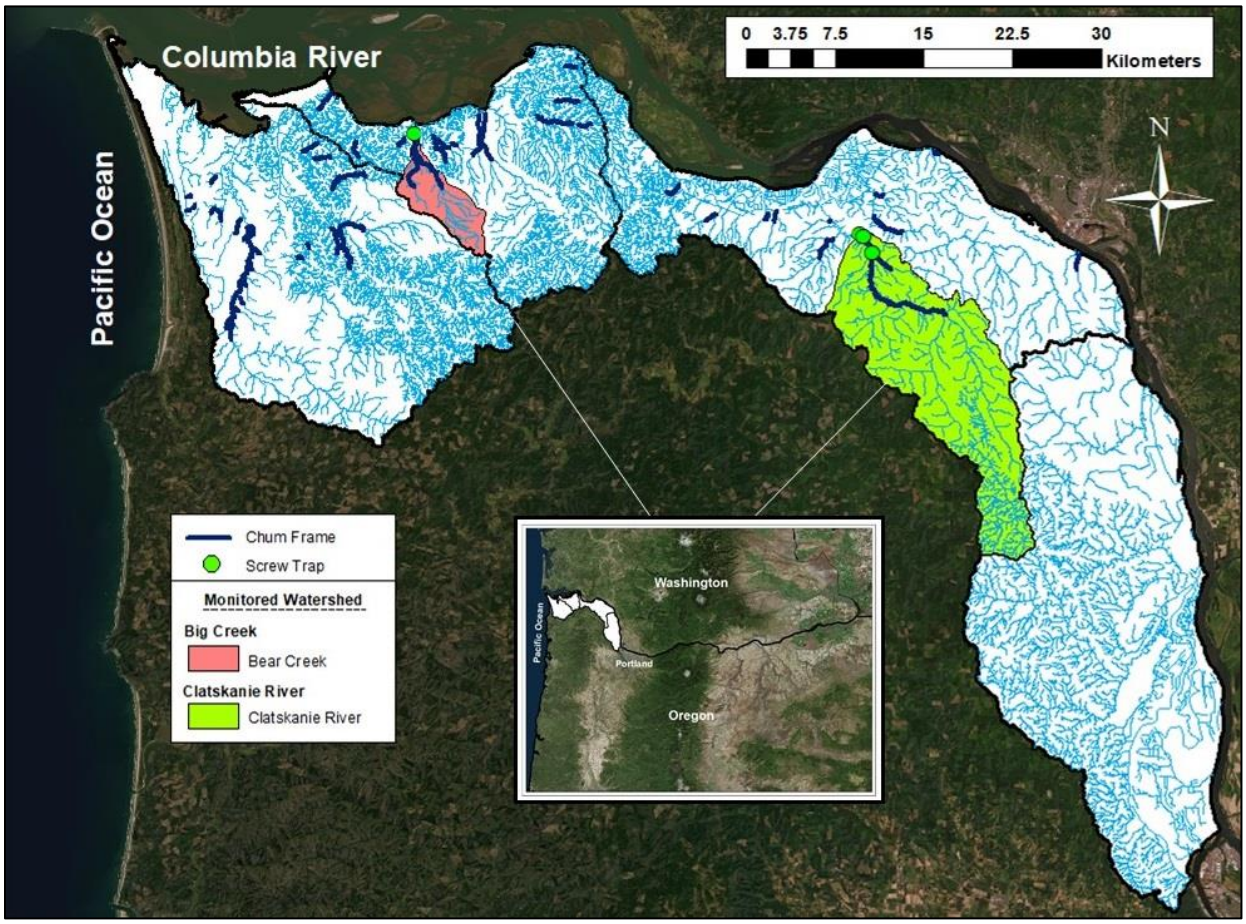

Figure 1. Location of the Bear Creek and Clatskanie River watersheds currently monitored for juvenile salmonids *Oncorhynchus* spp. in the Lower Columbia River Basin.

Bear Creek (Big Creek Basin)

Description

Bear Creek is located 0.4 km west of the town of Svensen, OR and flows north into Svensen Slough and the Columbia River (Figures 1 and 2). No hatchery releases occur in Bear Creek, but spawning of wild and hatchery Coho Salmon, Steelhead, and to a lesser extent Chinook Salmon are known to occur in the basin. Historically, Bear Creek may have supported up to 200 adult Chum Salmon spawners (based on habitat area-spawner density expansions from data in Parkhurst et al. 1950 and Fulton 1970). However, few Chum Salmon have been observed on spawning surveys in recent years other than during a large return to the Lower Columbia River in fall, 2016 and from outplanting efforts from Big Creek Hatchery in 2005 and 2006. The lower portion of Bear Creek is primarily rural residential and there is a water storage facility in the watershed that provides water for the town of Astoria, OR. Water withdrawals during summer can result in significant

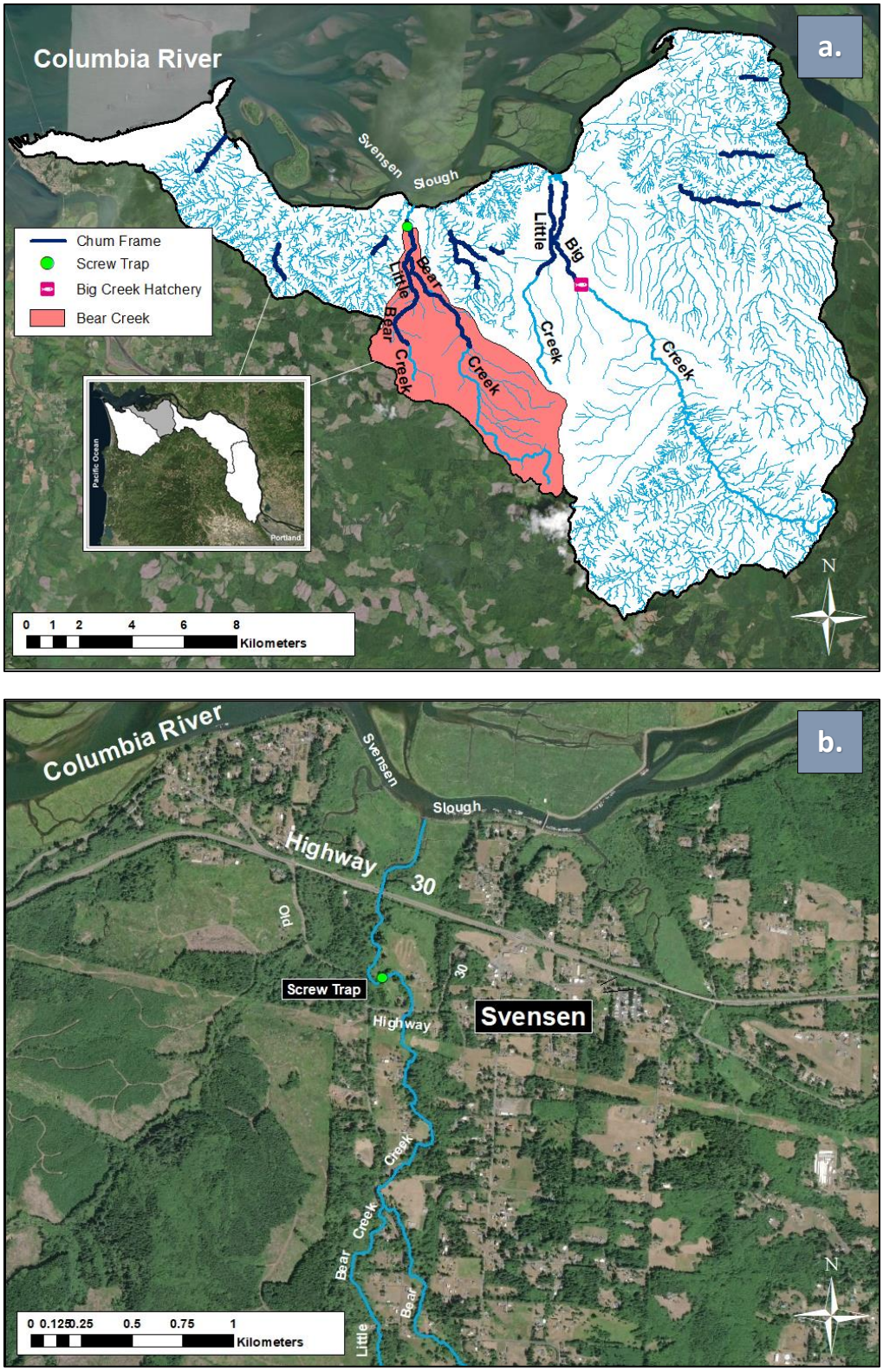

Figure 2. Location of the Bear Creek screw trap in the (a) Big Creek population, and (b) town of Svensen, Oregon downstream of Old Highway 30.

temperature and dewatering issues (Bischoff et al. 2000). Land use in the upper Bear Creek watershed is a mixture of industrial and non-industrial forest land. Bear Creek has approximately 3.2 km of low gradient habitat suitable for Chum Salmon (Bischoff et al. 2000).

Monitoring

Chum Salmon

In 2020, a rotary screw trap was installed near head of tide, approximately 0.3 rkm downstream of Old Highway 30 and 1.1 rkm upstream of Svensen Slough (Table A.1, Figures 2a and 2b). The trap was operated from February 28th through May 24th (Table A.1). Only two Chum fry were captured in 2020 (Figure 3 and Table A.2), one on March 27th and the other on April 8th. Both Chum fry were small (36 mm and 40 mm, $\bar{x}$ = 38 mm; Table A.2, Figure A.15) and weighed 0.4 g (Table A.2 and Figure A.16).

Other Salmonids

In 2020, large numbers of Peamouth were captured at the Bear Creek screw trap in May in association with low late season stream flows. This was similar to the high catch observed in 2018 and 2019 and required staff to conduct overnight trap checks to mitigate mortality risks (see Bear Creek Non-Salmonid section and Wiley and Homel 2020). Although this effort was useful in providing a means to continue monitoring during peak salmonid migration in May, safety concerns regarding the overnight schedule, low late season stream flows, and other project priorities required staff to terminate trapping prior to our target date in early June (i.e., May 24th). We used capture data from our Clatskanie screw trap to complete our Bear Creek population estimates. This was done by applying the same percentage of the total estimate observed for each species/size class at the Clatskanie screw trap from May 25th through June 6th (i.e., non-trapping period at Bear Creek) to our Bear Creek population estimates for 2020.

No Chinook fry (Figure 3, Table A.3) and relatively few Coho fry (142 fry; Figure 3, Table A.4) were captured in 2020. The low catch of Coho fry resulted in few recaptures and precluded population estimation. Coho fry were captured from February 29th through May 24th, with fork length and weight ranging between 30 and 95 mm ($\bar{x}$ = 48.3 ± 2.9 mm; Table A.5, Figure A.19) and 0.2 and 9.9 g ($\bar{x}$ = 1.8 ± 0.4 g; Table A.5, Figure A.20).

An estimated 2,292 ± 290 Coho smolts outmigrated from Bear Creek in 2020 (Figure 4 and Table A.4), with peak catch occurring during the week of May 11th through May 17th (Range = February 29th-May 24th; Table A.5). Coho smolt fork length and weight ranged between 83 and 142 mm ($\bar{x}$ = 118.5 ± 1.3 mm; Table A.5, Figure A.21) and 6.3 and 31.7 g ($\bar{x}$ = 18.2 ± 0.6 g; Table A.5, Figure A.22).

An estimated 1,799 ± 425 Steelhead smolts outmigrated from Bear Creek in 2020 (Figure 4 and Table A.6), with peak catch occurring during the week of May 11th through May 17th (Range =

February 29th-May 24th; Table A.7). Steelhead smolt fork length and weight ranged between 125 and 215 mm ($\bar{x}$ = 162.8 ± 2.5 mm; Table A.7, Figure A.23) and 18.7 and 93.3 g ($\bar{x}$ = 43.0 ± 2.1 g; Table A.7, Figure A.24).

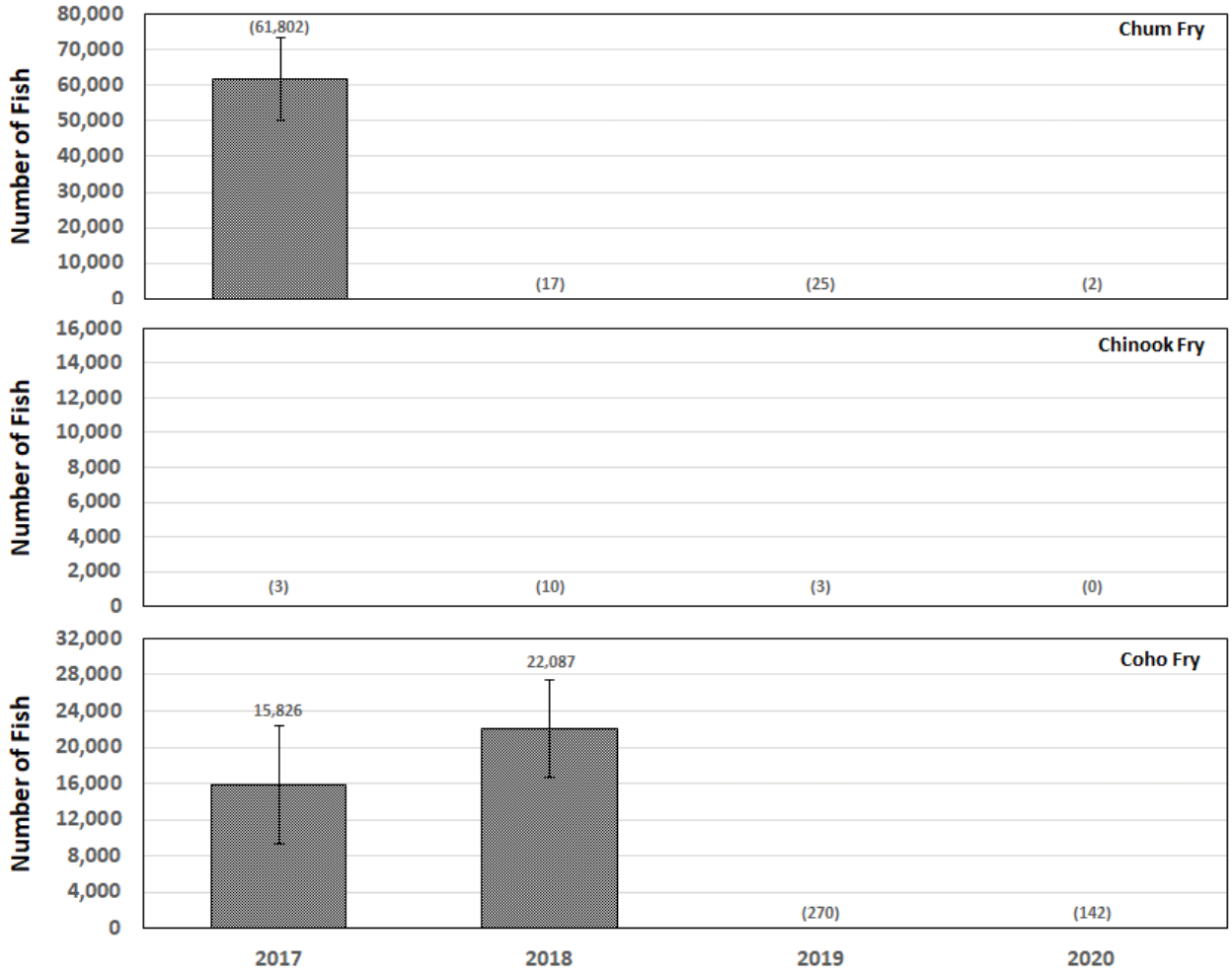

Figure 3. Population estimates of Chum *Oncorhynchus keta*, Chinook *O. tshawytscha*, and Coho *O. kisutch* fry outmigrants in Bear Creek from monitoring using a rotary screw trap, 2017−2020 outmigration years. Extrapolated catch is shown in parentheses for years with insufficient recaptures precluding population estimation.

Cutthroat Trout catch was dominated by the 160−249 mm size range, with an estimated 568 ± 169 fish outmigrating from Bear Creek in 2020 (Figure 4 and Table A.8). Catch of Cutthroat Trout in the 160−249 mm size class occurred from February 28th through May 24th, with fork length and weight ranging between 160 and 245 mm ($\bar{x}$ = 189.1 ± 3.3 mm; Table A.9, Figure A.25) and 34.3 and 121.9 g ($\bar{x}$ = 62.7 ± 3.4 g; Table A.9, Figure A.26). Significantly less fish were estimated as outmigrants in the 120−159 mm size range in 2020 (92 ± 31 fish; Figure 4, Table A.8), with peak catch occurring during the week of April 20th through April 26th (Range = March 3rd-May 24th; Table A.10). Fork length and weight of fish in this size class ranged between 122 and 158 mm

($\bar{x}$ = 144.9 ± 3.3 mm; Table A.10, Figure A.27) and 16.7 and 39.4 g ($\bar{x}$ = 29.4 ± 1.9 g; Table A.10, Figure A.28). Few Cutthroat Trout in the 60−89 mm, 90−119 mm, and ≥ 250 mm size ranges were captured (1, 10, and 7 fish, respectively), with information on length, weight, and migration timing found in the appendices.

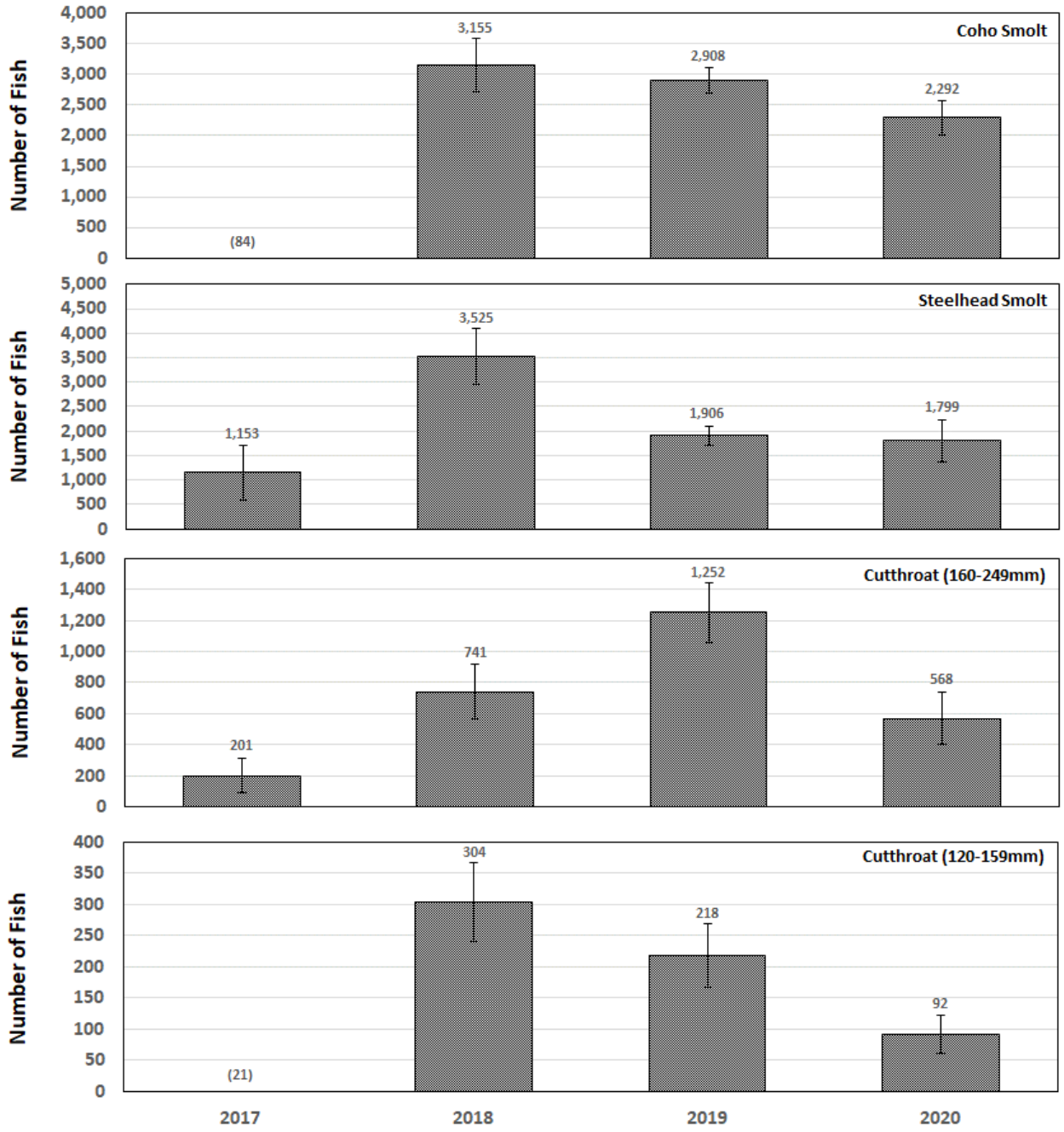

Figure 4. Population estimates of Coho *Oncorhynchus kisutch* smolt, Steelhead *O. mykiss* smolt, and Cutthroat *O. clarkii clarkii* outmigrants in Bear Creek from monitoring using a rotary screw trap, 2017−2020 outmigration years. Extrapolated catch is shown in parentheses for years with insufficient recaptures precluding population estimation.

Hatchery Salmonids

Although no hatchery releases occur in Bear Creek, a significant number of hatchery salmonid juveniles were again captured at the screw trap site in 2020. (Table A.11). A total of 34 hatchery Coho smolts were captured between March 23rd and May 8th (Table A.11), with CWTs detected in two of these fish (Table A.12). The first hatchery Coho smolt with a CWT was captured on May 4th and originated from a CEDC (Clatsop Economic Development Council) net pen hatchery release in Youngs Bay on April 23rd (11 days earlier; Table A.12). The other hatchery Coho smolt was captured on May 7th and originated from a net pen release at Tongue Point on April 28th (9 days earlier; Table A.12). Fork length and weight of the CWT fish in order of capture date were 123 and 135 mm and 20.9 and 24.5 g, respectively (Table A.12). Fork length and weight of all hatchery Coho smolts captured at the Bear Creek screw trap in 2020 ranged between 113 and 146 mm ($\bar{x}$ = 132 ± 3 mm; Table A.11) and 14.1 and 31.1 g ($\bar{x}$ = 23.3 ± 1.3 g; Table A.11). In 2020, sufficient catch and recaptures of hatchery Coho smolts yielded a population estimate of 86 ± 33 smolts, with peak catch occurring during the week of April 20th through April 26th.

A total of 9 hatchery Chinook were captured at the Bear Creek screw trap between March 7th and April 24th (Table A.11), with CWTs detected in three of these fish (Table A.12). The first two fish with CWTs were hatchery spring Chinook captured on March 7th and March 30th and originated from net pen releases in Youngs Bay and Blind Slough (3 and 6 days earlier, respectively; Table A.12). The other fish with a CWT was a hatchery spring Chinook that was captured on April 24th and originated from a Cowlitz Salmon Hatchery (~152 rkm upstream of the Bear Creek screw trap) release from the Cowlitz River, WA between March 16th and March 20th (approximately 37 days earlier; Table A.12). Fork length and weight of the three CWT fish in order of capture date were 150, 140, and 151 mm and 34.9, 32.0, and 43.7 g, respectively (Table A.12). Fork Length and weight of all hatchery Chinook captured at the Bear Creek screw trap in 2020 ranged between 130 and 153 mm ($\bar{x}$ = 144 ± 6 mm; Table A.11) and 25.9 and 43.7 g ($\bar{x}$ = 35.7 ± 3.8 mm; Table A.11).

A total of 8 hatchery steelhead were captured at the Bear Creek screw trap between April 9th and May 5th (Table A.11), with none of these fish detected with a CWT or other unique mark to determine origin. Fork length and weight of all hatchery Steelhead captured at the Bear Creek screw trap in 2020 ranged between 193 and 242 mm ($\bar{x}$ = 209 ± 14 mm; Table A.11) and 70.5 and 129.5 g ($\bar{x}$ = 87.0 ± 17.1 g; Table A.11).

Non-Salmonids

Non-salmonid catch in 2020 (in decreasing abundance) consisted of Peamouth, Lamprey Larva, Western Brook Lamprey Adult, Cottid *Cottus* spp., and to a much lesser extent Largescale Sucker *Catostomus macrocheilus*, Pacific Lamprey Adult, Three-Spined Stickleback *Gasterosteus aculeatus*, and Eulachon *Thaleichthys pacificus*. Lamprey Larva and Cottid catches occurred

consistently throughout the season, whereas Largescale Sucker catch occurred mostly between mid-April and mid-May. Eulachon were a rare surprise catch, with both individuals captured on consecutive days in early April. However, Peamouth were by far the most dominant non-salmonid catch despite a narrow capture period between May 8th and the end of the trapping season on May 24th (25,878 fish; Table A.13). Similar to observations from prior years (Tables A.14), Peamouth captures coincided with low spring flows in May when tight paneling was necessary to provide suitable water flows for trap operation, thereby increasing trap efficiency of all species. As a result, to mitigate for mortality risks associated with exceeding trap capacity, we once again employed overnight checks as described for prior years in Wiley and Homel 2020. These checks are the only reliable means to avoid overcrowding mortalities and prevented at least six mortality events that would have occurred on nights when the trap was fishing in 2020 (Figure A.29). Unfortunately, the trap could only be fished for portions of each week and through May 24th in 2020 to balance out safety concerns with the overnight schedule and other project priorities. To learn more about the Peamouth migration in Bear Creek and our monitoring efforts in the watershed, see the following film (https://www.youtube.com/watch?v=Sj9POTGzjuI).

Clatskanie River (Clatskanie River Basin)

Description

The Clatskanie River flows through the town of Clatskanie, OR, before entering Beaver Slough and Westport Slough and then the Columbia River (Figures 1 and 5). Historically, the Clatskanie River may have supported spawning by up to 3,000 Chum Salmon based on expanded estimates of abundance (Parkhurst et al. 1950, Fulton 1970) and potential habitat availability. However, no Chum Salmon adults have been observed in this system for nearly 30 years. Currently, Coho Salmon, Steelhead, Coastal Cutthroat Trout, and to a lesser extent Chinook Salmon are now observed with no hatchery releases occurring in the basin. Land use in the Clatskanie River is urban (in Clatskanie), rural residential, agriculture, and industrial timber. High quality spawning habitat currently exists in some areas of the watershed, and numerous additional restoration opportunities to improve lower quality spawning habitat throughout the Clatskanie River system are also possible (Alfonse et al. 2017). Specific restoration needs include adding more large woody debris to the system, bank stabilization, restoration and reconnection of side channel complexes, and reducing excess fine sediment.

Monitoring

Chum Salmon

In 2020, a rotary screw trap was installed near head of tide, approximately 2.8 rkm upstream of the town of Clatskanie and Hwy 30 and in the same location monitored from 2017 through 2019 (Table A.1, Figure 5b). During high flows, trapping at this location was challenging due to the wide river channel and low trap efficiencies were observed during these times.

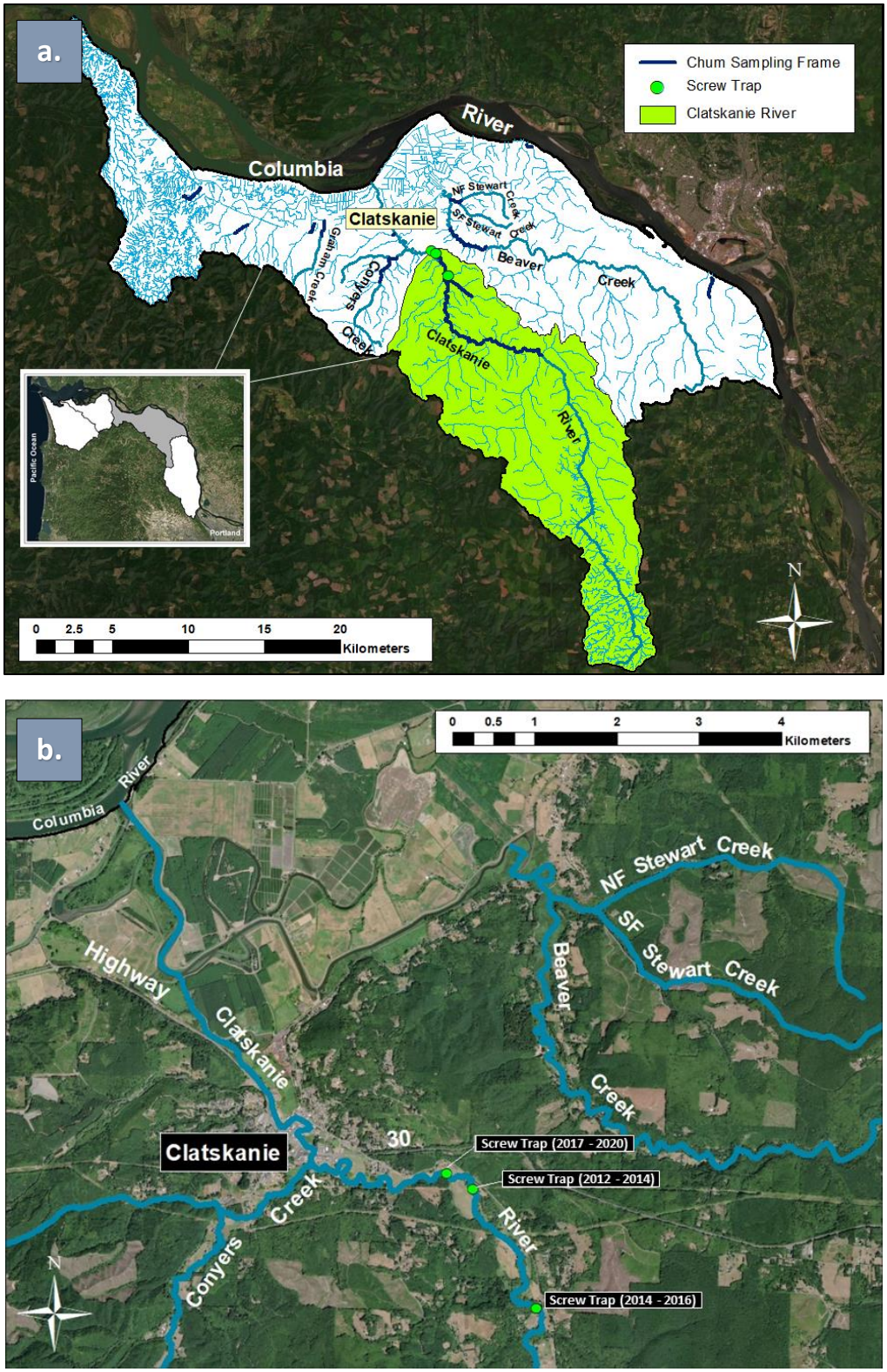

Figure 5. Location of the Clatskanie River screw traps in the (a) Clatskanie River population, and (b) town of Clatskanie, Oregon near Highway 30.

However, this current trap location is near head of tide and immediately downstream of high quality spawning habitat, providing the best opportunity to detect the presence of Chum Salmon in the Clatskanie River basin. Additionally, the location of the trap in a pool immediately downstream of an extensive gravel bar allows the trap to be paneled effectively as water level recedes throughout the trapping season, thereby providing sufficient catch and trap efficiency for normal spring water levels. No Chum Salmon were observed in the Clatskanie River screw trap in 2020.

Other Salmonids

Chinook and Coho fry were captured in the Clatskanie River in 2020, with catch and recaptures sufficient to make population estimates for both species. A modest number of Chinook fry outmigrated from Clatskanie River in 2020 (2,718 ± 372 fry; Figure 6, Table A.3), with peak catch occurring during the week of March 16th through March 22nd (Range = February 28th-June 6th; Table A.3). Chinook fry fork length and weight ranged between 32 and 99 mm ($\bar{x}$ = 50.1 ± 1.6 mm; Table A.3, Figure A.17) and 0.3 and 9.5 g ($\bar{x}$ = 1.6 ± 0.2 g; Table A.3, Figure A.18). The number of Coho fry outmigrants in 2020 was higher than observed for Chinook fry (8,674 ± 2,227; Figure 6, Table A.4), with catch occurring ranging from February 28th through June 6th. Coho fry fork length and weight ranged between 30 and 101 mm ($\bar{x}$ = 45.8 ± 1.8 mm; Table A.5, Figure A.19) and 0.3 and 11.8 g ($\bar{x}$ = 1.4 ± 0.2 g; Table A.5; Figure A.20).

An estimated 23,107 ± 3,865 Coho smolts outmigrated from Clatskanie River in 2020 (Figure 7, Table A.4), with peak catch occurring during the week of May 4th through May 10th (Range = February 28th-June 6th; Table A.5). Coho smolt fork length and weight ranged between 81 and 167 mm ($\bar{x}$ = 122.7 ± 1.3 mm; Table A.5, Figure A.21) and 5.1 and 48.9 g ($\bar{x}$ = 20.1 ± 0.6 g; Table A.5, Figure A.22). The number of Steelhead smolt outmigrants in 2020 was higher than observed for Coho smolts (29,477 ± 6,378; Figure 7 and Table A.6), with peak catch occurring during the week of April 27th through May 3rd (Range = March 3rd-June 6th; Table A.7). Steelhead smolt fork length and weight ranged between 122 and 232 mm ($\bar{x}$ = 171.1 ± 2.3 mm; Table A.7, Figure A.23) and 18.0 and 124.6 g ($\bar{x}$ = 51.4 ± 2.2 g; Table A.7, Figure A.24).

Cutthroat Trout catch was dominated by the 160−249 mm size range, with an estimated 7,718 ± 2,140 fish outmigrating from Clatskanie River in 2020 (Figure 6 and Table A.8). Catch of Cutthroat Trout in the 160−249 mm size class occurred from February 28th through June 6th, with fork length and weight ranging between 160 and 245 mm ($\bar{x}$ = 200.5 ± 2.7 mm; Table A.9, Figure A.25) and 35.1 and 141.2 g ($\bar{x}$ = 75.5 ± 3.1 g; Table A.9, Figure A.26). Relatively few Cutthroat Trout in the 60−89 mm, 90−119 mm, 120−159 mm, and ≥ 250 mm size ranges were captured (0, 9, 61, and 28 fish, respectively) and no population estimates could be made for these size classes. Additional information on length, weight, and migration timing can found in the appendices.

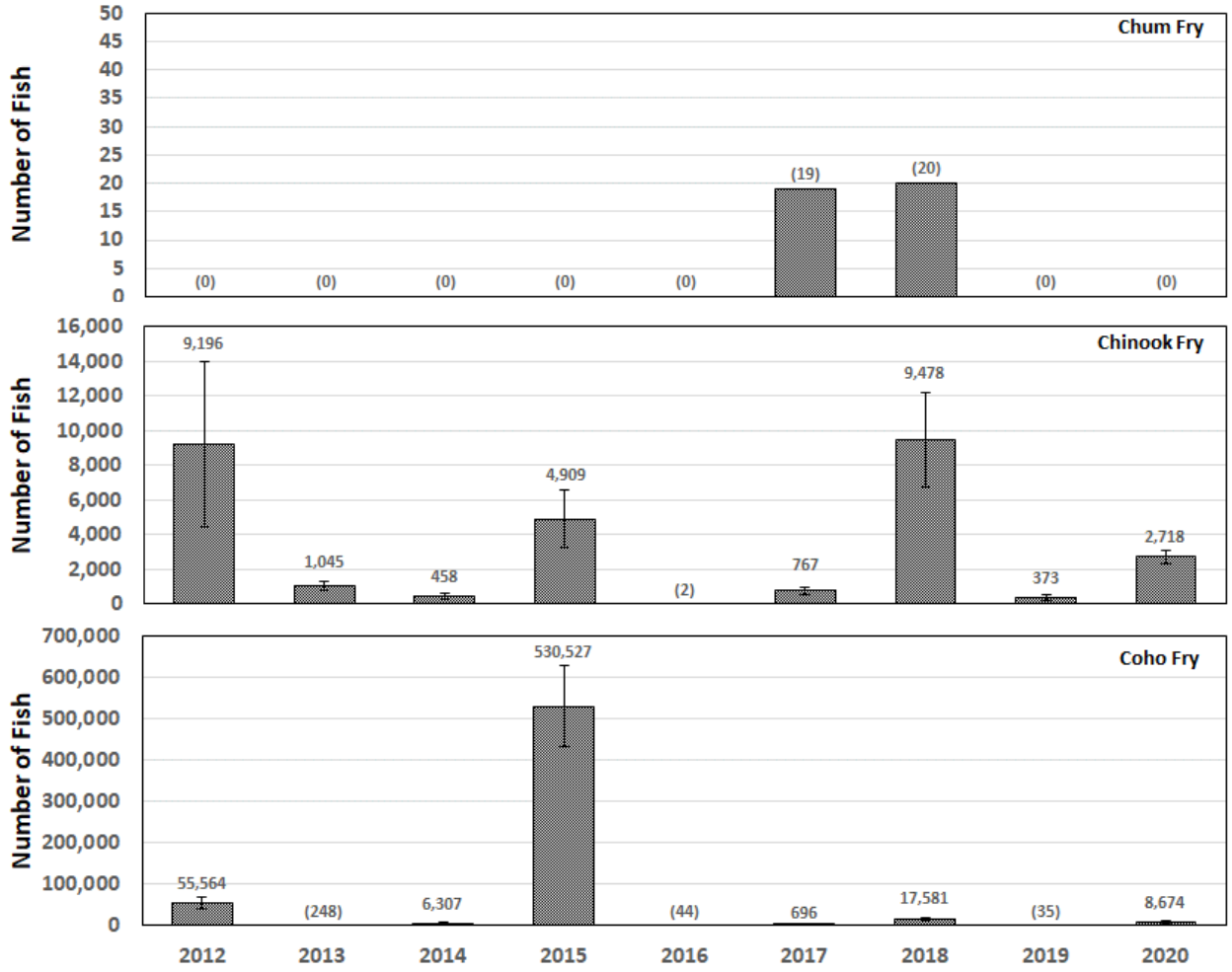

Figure 6. Population estimates of Chum *Oncorhynchus keta*, Chinook *O. tshawytscha*, and Coho *O. kisutch* fry outmigrants in Clatskanie River from monitoring using a rotary screw trap, 2012−2020 outmigration years. Extrapolated catch is shown in parentheses for years with insufficient recaptures precluding population estimation.

Hatchery Salmonids

Few hatchery salmonids have been captured during our juvenile monitoring in the Clatskanie River basin. However, hatchery catch more than doubled for all species (i.e., Coho smolts, Chinook, and Steelhead smolts) in 2020 (Table A.11). In 2020, four hatchery Coho smolts were captured between April 24th and May 15th in the Clatskanie River screw trap, with none of these fish detected with a CWT to determine origin. Fork length and weight of all hatchery Coho smolts captured at the Clatskanie River screw trap in 2020 ranged between 122 and 141 mm ($\bar{x}$ = 133 ± 15 mm; Table A.11) and 18.5 and 29.3 g ($\bar{x}$ = 24.9 ± 7.4 g; Table A.11).

Eight hatchery Chinook were captured at the Clatskanie River screw trap between March 6th and June 2nd (Table A.11), with CWTs detected in two of these fish (Table A.12). The first fish with a CWT was a hatchery spring Chinook captured on March 13th and originated from a Lewis

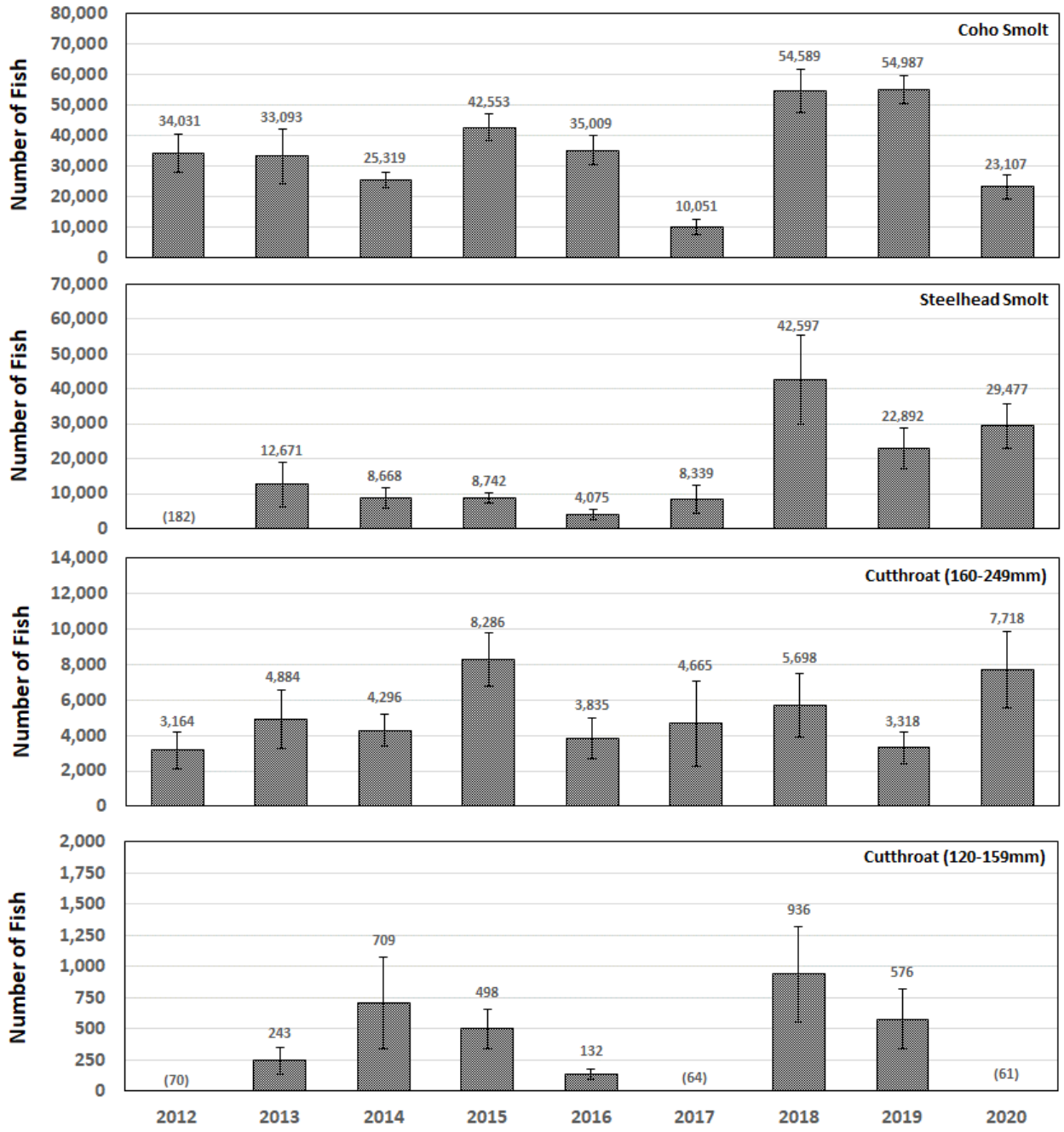

Figure 7. Population estimates of Coho *Oncorhynchus kisutch* smolt, Steelhead *O. mykiss* smolt, and Cutthroat *O. clarkii clarkii* outmigrants in Clatskanie River from monitoring using a rotary screw trap, 2012−2020 outmigration years. Extrapolated catch is shown in parentheses for years with insufficient recaptures precluding population estimation.

River Hatchery (~97 rkm upstream of the Bear Creek screw trap) release from the NF Lewis River, WA between February 11th and February 28th (approximately 22 days earlier; Table A.12). The other fish with a CWT was a hatchery spring Chinook that was captured on March 24th and originated from a Dexter Ponds (satellite rearing facility to Willamette Hatchery, OR) release in the

Coast Fork Willamette River on February 1st (52 days earlier; Table A.12). Fork length and weight of the two CWT fish in order of capture date were 149 and 146 mm and 37.4 and 34.0 g, respectively (Table A.12). Fork Length and weight of all hatchery Chinook captured at the Clatskanie River screw trap in 2020 ranged between 124 and 149 mm ($\bar{x}$ = 139 ± 8 mm; Table A.11) and 19.6 and 37.4 g ($\bar{x}$ = 28.5 ± 6.1 g; Table A.11). One small hatchery Steelhead smolt was captured in 2020 (141 mm and 24.7 g, May 16th; Table A.11). No CWT tag or unique mark was detected to identify the source of this hatchery stray.

Non-Salmonids

Similar to past years, a large diversity of non-salmonid species were captured in 2020, with both native and non-native species captured at the screw trap (Table A.13). Non-salmonid catch (in decreasing abundance) consisted of Cottid, Three-Spined Stickleback, Western Brook Lamprey Adult, Lamprey Larva, Peamouth, and Pacific Lamprey Adult, and to a lesser extent Largescale Sucker, Northern Pikeminnow *Ptychocheilus oregonensis*, Redside Shiner *Richardsonius balteatus*, Banded Killifish *Fundulus diaphanus*, Pacific Lamprey juvenile, Longnose Dace *Rhinichthys cataractae*, and Smallmouth Bass (*Micropterus dolomieu*) (Table A.13).

Both adult and larval Pacific and Western Brook Lamprey were frequently encountered in the Clatskanie River, with spawning activity commonly observed both upstream and downstream of the current trapping location near head of tide. Counts of Pacific Lamprey and Western Brook Lamprey adults in 2020 were significantly higher than observed in any other monitoring year on the Clatskanie River (Table A.13). More specifically, the number of Pacific Lamprey adults captured in 2020 (283 adults) was nearly double the previous highest catch year (2014, 158 adults). Western Brook Lamprey adult catch in 2020 (601 adults) was also significantly higher than in any previous year (2019, 460 adults; Table A.13). Another interesting finding in 2020 was the capture of a possible "dwarf" Pacific Lamprey adult. This fish was captured on June 1st and measured 217 mm, significantly smaller than the size range of all other Pacific Lamprey adults that were measured at the Clatskanie River screw trap from 2018 through 2020 (Range = 339−560 mm). Another interesting capture in 2020 was of a juvenile Smallmouth Bass, the first observation of this species in the Clatskanie River for the Chum Salmon Reintroduction project. Additionally, from 2018 through 2020 some large Northern Pikeminnow were captured in the screw trap at the end of the trapping season. Some of these fish measured > 500 mm and were observed with partially digested Coho smolts and Cutthroat in their mouths.

DISCUSSION

Chum Salmon

Chum fry production was observed in Bear Creek in all years indicating this system is likely to be important in Chum recovery efforts. However, significant fry production was only observed in 2017. This was after an estimated 41,620 adult Chum Salmon returned to the LCR in 2016 (i.e.,

the largest return in over 50 years; estimate from Todd Hillson, WDFW; accessed on cax.streamnet.org on Sep 17, 2020). Spawning ground surveys conducted in several reaches of Bear and Little Bear Creeks in 2016 by the Chum Salmon Reintroduction and Oregon Adult Salmonid Inventory and Sampling (OASIS) projects showed a significant number of Chum spawners throughout the watershed. Peak Chum counts in Bear (17.54−59.42 fish/mile) and Little Bear (26.74 fish/mile) Creeks in 2016 were the highest observed since both projects began conducting surveys in the watershed (Homel and Wiley 2021).

From 2018 through 2020, few Chum fry were captured at the Bear Creek screw trap which is not surprising considering few adult Chum were observed in Oregon tributaries to the LCR from 2017 through 2019. Chum fry production was observed in the Clatskanie River in 2017 and 2018, but catch was low and no estimate of total outmigrants could be made in either year. No Chum Salmon adults have been observed in the Clatskanie River on spawning surveys in recent years, but suitable spawning habitat exists in the river. Considering habitat availability, spawner observations, fry production, and outplanting efforts throughout the Clatskanie River population, this population remains a high priority for monitoring and recovery efforts.

Chum fry migration occurred as early as February 25th and as late as May 8th in Bear Creek, with peak catch in 2017 occurring from March 20th through March 26th. In Clatskanie River, Chum fry were captured between March 30th and May 2nd. Between the two sites, nearly all Chum fry (99.8%) were captured during the months of March and April. However, 71% of Bear Creek Chum fry were captured in March, whereas 86% of Clatskanie River Chum fry were captured in April. Chum fry outmigrated at a comparable size and weight from Bear Creek and Clatskanie River ($\bar{x}$ =39.7 mm and 0.45 g and $\bar{x}$ = 40.9 mm and 0.40 g, respectively), with fry captured as small as 32 mm and as large as 50 mm.

Peak catch and size of Chum fry reported here are fairly consistent with that described for Grays River and Crazy Johnson Creek, WA (Hillson et al. 2017) and an Oregon coastal population (Little NF Wilson River, OR; D. J. Wiley, unpublished data). The percentage of Chum fry catch occurring in March was high in both Grays River ($\bar{x}$ = 75%, Range = 69−84%; 2008−2016 outmigration years) and Crazy Johnson Creek ($\bar{x}$ = 65%, Range = 37−79%; 2011−2016 outmigration years). This was consistent with most Chum fry catch occurring in March at Bear Creek but differed from the April dominated catch in Clatskanie River. The mean annual size of Chum fry from both Grays River and Crazy Johnson Creek that were measured for size selectivity analyses (39−40 mm; Hillson et al. 2017) was consistent with the mean Chum fry size observed at Bear Creek and Clatskanie River.

Monitoring data from screw trap operation in the Little NF Wilson River, OR from 1998 through 2013 showed peak Chum fry catch mostly occurred during the first two weeks in April (11 monitoring years; 68%) and to a lesser extent in late March (5 monitoring years; 32%). This was generally later than observed at Grays River, Crazy Johnson Creek, and Bear Creek and more

similar to catch at Clatskanie River. However, in several years a few Chum fry were captured as late as early June in the Little NF Wilson River, significantly later than the last observation date for Bear Creek or Clatskanie River (May 8th and May 2nd, respectively). Mean annual size of Chum fry outmigrants in the Little NF Wilson River ($\bar{x}$ = 41.1 mm; Range 37.6 to 46.2 mm) was similar to Chum fry size reported from Grays River, Crazy Johnson Creek, and the two Chum Reintroduction Project sampling sites.

Other Salmonids

Chinook were largely absent in Bear Creek, with none captured in 2020 and less than 10 individuals captured at the screw trap from 2017−2019. Abundance was higher in Clatskanie River, but given the size of the Clatskanie River watershed Chinook production should be considered modest as less than 10,000 fry outmigrants were estimated in all monitoring years. Chinook production in the Clatskanie River was also inconsistent from year to year. In 2016, only two Chinook were captured for the entire season and in three other years (2014, 2017, and 2019) less than 1,000 fry outmigrants were estimated. Naturally produced Chinook outmigrated at a significantly smaller size than the size of hatchery Chinook captured at the site. Additionally, no naturally produced Chinook were observed as residuals or to be precocial, unlike that observed for some hatchery Chinook.

Coho were the most abundant of all salmonids captured and production varied between the two sites. In the Clatskanie River in 2015 following a strong adult Coho return to the LCR the previous fall, over 500,000 Coho fry were estimated to have outmigrated past the screw trap site. Relatively few fry were estimated or caught in most other years in the Clatskanie River, suggesting the large outmigration in 2015 likely resulted from high spawner abundance in 2014. In years when few Coho fry were captured in the Clatskanie River it is likely that available habitat in the basin was underutilized. Therefore, most fry likely chose to remain in upstream reaches for another year as opposed to outmigrating past the screw trap near head of tide. Significant Coho smolt production was observed in the Clatskanie River, with outmigrant estimates remaining fairly consistent and typically ranging from 25,000 to 55,000 smolts except for 2017, when low trap efficiency likely underestimated the number of outmigrants.

In Bear Creek, Coho fry estimates could only be made in 2017 and 2018 when approximately 20,000 fry migrated past the screw trap site and Coho smolt estimates generally ranged between 2,000 and 3,000 smolts. Additionally, spawning surveys in the Bear Creek watershed show most adult Coho on the spawning grounds are hatchery fish (i.e., adipose fin-clipped) unlike the Clatskanie River watershed that is dominated by wild production. Given several thousand smolts (unclipped) are outmigrating from Bear Creek annually but few adults observed on spawning surveys (live fish and carcasses) are unclipped, most production in the system is likely occurring from spawning by hatchery adult strays and not adults produced by outmigrating smolts

from Bear Creek. This is in contrast to Clatskanie River where nearly all production is occurring from adult spawners produced by outmigrating smolts.

Coho smolt size was generally larger in Bear Creek ($\bar{x}$ = 117 mm and 16.9 g) than in Clatskanie River ($\bar{x}$ = 112.9 mm and 15.5 g). In six years, Coho smolts were shorter and weighed less in Clatskanie River than the smallest mean size and weight observed in any year at Bear Creek. Clatskanie River Coho smolts were only larger than Bear Creek smolts in 2017 (length only) and 2020, the two lowest Coho smolt outmigrant years in Clatskanie River when habitat capacity was likely under seeded. Coho smolt size at Bear Creek and Clatskanie River was significantly smaller than smolts observed outmigrating from some Oregon streams monitored by the Life Cycle Monitoring (LCM) project from 1997 through 2014 (Suring et al. 2015). For instance, Coho smolts captured in Mill Creek, Yaquina River ($\bar{x}$ = 130.7 mm, Range 117.4−146.4 mm), where smolts partially rear in a reservoir environment, and NF Scappoose Creek, Lower Columbia River ($\bar{x}$ = 132.0 mm, Range 120.6−142.3 mm) were larger than Bear Creek and Clatskanie River smolts in nearly all monitoring years. However, Bear Creek and Clatskanie River smolts were generally larger than smolts at several LCM sites ($\bar{x}$ = 97.6 mm, Range = 79.2−120.3 mm, Mill Creek, Siletz River, Cascade Creek, Alsea River, and Winchester Creek, South Slough, Coos Bay; Suring et al. 2015) and more comparable to LCM smolts in the NF Nehalem River, Nehalem River, EF Trask River, Trask River, and WF Smith River, Smith River ($\bar{x}$ = 108.4 mm, Range = 98.9−118.4 mm; Suring et al. 2015).

Steelhead and Cutthroat Trout were present in every year at both sites, although generally few individuals less than 120 mm were captured as most fish this size and smaller were likely non-migratory. Clatskanie River Steelhead smolt estimates were consistently large, although the estimate in 2018 (42,597 smolts) was likely an overestimate due to poor trap efficiency in that year. Monitoring data for all other years demonstrate that the Clatskanie River Basin is capable of producing 4,000 to 30,000 smolts annually. Annual Steelhead smolt estimates for Bear Creek were significantly smaller, with some of this production likely from spawning by hatchery fish as several adults were captured at the screw trap in recent years. In 2019, the first year we began to document fin mark status for adult Steelhead captures at Bear Creek, six hatchery adult Steelhead were captured out of a total catch of 22 adult Steelhead (27% hatchery origin). In 2020, few adult Steelhead were captured at the trap, with only one hatchery adult Steelhead captured from a total catch of five fish (20% hatchery origin). Steelhead smolt size was comparable between the two sites, although smolts were generally larger at Clatskanie River ($\bar{x}$ = 166.9 mm and 45.9 g) than fish observed at Bear Creek (162.2 mm and 42.3 g). Smolts at both sites were typically smaller than reported for LCM sites on the north Oregon Coast (i.e., NF Nehalem and EF Trask Rivers, $\bar{x}$ = 172.8 mm) but larger than southern sites (i.e., Mill Creek, Siletz River, Cascade Creek, and WF Smith River, $\bar{x}$ = 149.9 mm; Suring et al. 2015).

Cutthroat Trout were commonly captured at Bear Creek and Clatskanie River, with 160−249 mm Cutthroat always more abundant than 120−159 mm Cutthroat at both sites. Cutthroat Trout were most abundant in Clatskanie River, with estimates for 160−249 mm Cutthroat ranging from about 3,000−8,000 migrants. Estimates for Bear Creek were generally less than 1,000 migrants except in 2019. At least a few sea-run Cutthroat Trout (i.e., ≥ 250 mm) were observed at both sites (Range = 2−45 fish), with fish as large as 435 mm and weighing 641 g captured. Visual inspection of these fish showed some were underweight and in poor condition, likely indicating a post-spawn migration downstream into the estuary. Other fish were observed to be relatively bright and in good condition and assumed to be migrating upstream to spawn.

Hatchery Salmonids

Hatchery fish were captured at both sites in most years, with hatchery captures more frequent at Bear Creek than at Clatskanie River. The 2017 hatchery Coho smolt catch in Bear Creek (1 fish) should be considered an underestimate, as trap efficiency was poor throughout the season. In all other years catch was significantly higher. This includes the 2018 trapping season, when a surprising number of hatchery Coho smolts was initially captured and staff decided to mark fish for population estimation beginning in 2019. A population estimate of 524 hatchery Coho smolts from a catch of 221 smolts at the screw trap in 2019 shows the extent of hatchery straying in some years. The number of hatchery Coho smolts straying into Bear Creek declined significantly in 2020 (86 fish), demonstrating how variable stray rates can be from year to year. This was also evident at Clatskanie River in 2020, when four hatchery Coho smolts were captured at the screw trap. This compares to two hatchery Coho smolts captured in the preceding eight monitoring years.

Most hatchery Coho smolts were captured at both sites in April and May, although at Bear Creek in 2019 hatchery Coho smolts were captured throughout the entire trapping season from late February through May. Hatchery Coho smolt recoveries in Bear Creek were most often sourced to Tongue Point net pen releases approximately 8 rkm downstream in the Columbia River and occasionally to Big Creek Hatchery releases approximately 7 rkm upstream. However, larger migrations were observed, as at least one hatchery Coho smolt captured in 2020 at the Bear Creek screw trap can be sourced to a Youngs Bay net pen release. This required the fish to enter the Columbia River and then swim upstream approximately 25 rkm before entering Svensen Slough and then Bear Creek.

Hatchery Chinook were observed frequently at both monitoring sites, with strays captured in all years at Bear Creek and all but three years at Clatskanie River (2012, 2014, and 2016). However, relatively few fish were captured in any given year (1−9 fish). Bear Creek captures have been fairly consistent from year to year. Clatskanie River captures have been less consistent, with one or two hatchery Chinook strays caught in some years and then no strays captured in other

years. In 2020, surprisingly eight hatchery Chinook strays were captured at Clatskanie River, exceeding the total catch in all previous monitoring years.

Two hatchery spring Chinook with CWTs were captured in Bear Creek in 2019. Interestingly, these fish were released in late February from net pens located in Youngs Bay (~25 rkm downstream) and then captured at the Bear Creek screw trap in early to late March (5 and 22 days later). In 2020, an additional three hatchery spring Chinook with CWTs were captured in Bear Creek and two with CWTs in Clatskanie River. Two of the fish captured at Bear Creek were sourced to net pen releases in Youngs Bay and Blind Slough. The third fish originated at Cowlitz Salmon Hatchery in Washington, approximately 150 rkm upstream of the Bear Creek trap site. The two CWT hatchery spring Chinook captured at Clatskanie River also originated a significant distance upstream from the trap site, as one fish was released from Lewis River Hatchery (~97 rkm upstream) and the other fish from Dexter Ponds (~415 rkm upstream). The size and weight of hatchery Chinook captured at both monitoring sites was significantly larger than naturally produced Chinook, with several fish observed to be precocial males that released milt during handling.

Hatchery steelhead were observed at Bear Creek from 2018−2020 and Clatskanie River in 2020, with catches occurring from mid-April through mid-May at both sites. No hatchery Steelhead were detected with a CWT or unique mark, so the origin of these fish could not be positively determined. However, hatchery Steelhead were captured at the Bear Creek screw trap within two to three weeks of direct releases of hatchery Steelhead into Big Creek (none with CWTs) from Big Creek Hatchery, so it is likely this is the source of at least some of these hatchery strays. The origin of the Clatskanie River hatchery Steelhead is unknown, and it is difficult to ascertain a possible origin as numerous hatcheries exist upstream in the LCR and its tributaries. The mean annual size and weight of hatchery steelhead at Bear Creek was substantially larger than naturally produced steelhead in this watershed. The size of the hatchery Steelhead captured in Clatskanie River was surprisingly small (141 mm and 24.7 g), smaller than the mean size of naturally produced Steelhead smolts in Clatskanie River over the monitoring period.

As previously described, hatchery fish were consistently captured at the two monitoring sites in low to moderate numbers in most years despite no juvenile hatchery salmonid releases occurring in either watershed. CWT release information shows strays made significant migrations, both upstream and downstream in the Columbia River, before entering each system. In Bear Creek, strays had to swim an additional 2 rkm upstream from the confluence with the Columbia River to migrate past the screw trap and have a chance to be captured. In Clatskanie River, strays had to swim nearly 9 rkm upstream of the confluence with the Columbia River to migrate past the screw trap site. These significant movements demonstrate that hatchery straying was not limited to the areas around the mouths of each site, where smolt occupancy might be expected as natural downstream migration occurs in the mainstem Columbia River and off-channel habitats.

Additionally, the consistent catch of hatchery fish at the screw trap sites, and especially at Bear Creek, shows at least some hatchery fish released in the Columbia River Basin explore tributaries both upstream and downstream of their release sites during their outmigration to the ocean.

Given all hatchery strays were captured at the screw traps presumably on a "return" downstream migration, one can reasonably assume most of these fish eventually migrated back to the Columbia River to resume outmigration to the estuary and ocean. However, monitoring data from both sites reported here and from two other screw trap sites previously operated by this project (i.e., Conyers Creek, Clatskanie River Population and Milton Creek, Scappoose Creek Population; Wiley and Homel 2020) also show that at least some hatchery fish (e.g., observed precocial Chinook males) may not migrate to the ocean and instead may mature in freshwater habitats. Although the number of precocial hatchery Chinook observed on this project was low and this life history strategy is also observed in wild populations (Larsen et al. 2004), hatchery fish that fail to migrate to the ocean can introduce domesticated or nonnative traits into wild salmon populations (Larsen et al. 2010). Additional research is needed to describe exploratory behavior of hatchery fish in the Columbia River Basin, the proportion of hatchery fish that are straying into other tributaries, and the amount of time spent (presumably feeding) in those tributaries.

When hatchery fish stray into tributaries or rear in slough and estuary habitats for a prolonged time frame, they may prey upon or compete with other salmonid species in these habitats, some of which are listed under the Endangered Species Act. For example, Coho smolts are known to prey upon Chum fry (Hunter 1959; Parker 1971; Hargreaves and LeBrasseur 1986; Fresh and Schroder 1987; Magnhagen 1988; Roegner et al. 2010) and it appears that predation is size-selective (Parker 1971; Good 1983; Hargreaves and LeBrasseur 1986). Hatchery Coho smolts that are larger than their wild counterparts may consume larger prey, potentially exposing a greater size range of Chum fry to predation (discussed in Homel and Roegner 2020). In the Columbia River and estuary, Coho predation on Chum fry has been documented (Roegner et al. 2010) and Steelhead smolts have been observed preying upon Chum fry released from Big Creek Hatchery (R. Dietrichs and R. McDorman, ODFW, personal communication). Larger yearling Chinook prey upon juvenile Chum at nearshore sites in the ocean (Duffy et al. 2010), and smaller subyearling Chinook exhibit significant diet overlap with juvenile Chum while in the estuary (Weitkamp, LCEP Science Work Group Presentation, 2017), which could indicate competition for food resources. In the Columbia River, hatchery yearling Chinook are larger than their wild counterparts (Weitkamp et al. 2015), are released earlier in the year than when wild Chinook yearlings would normally migrate (Weitkamp et al. 2012), and may potentially prey upon Chum fry.

Non-Salmonids

At least thirteen native fish species (not including salmonids) were captured over the monitoring period at Bear Creek (2017−2020) and Clatskanie River (2012−2020). Native species

included Pacific and Western Brook Lamprey, Chiselmouth *Acrocheilus alutaceus*, Cottids, Eulachon, Largescale Sucker, Longnose Dace, Mountain Whitefish *Prosopium williamsoni*, Peamouth, Northern Pikeminnow, Redside Shiner, Speckled Dace *Rhinichthys osculus*, and Three-Spined Stickleback. Peamouth were by far the most abundant native species encountered, as approximately 60,000 individuals were captured between the two sites. However, catch was significantly higher in Bear Creek (~55,000 fish) than in Clatskanie River (~5,000 fish). Western Brook and Pacific Lamprey, Cottids, and Largescale Sucker were also commonly captured, with catches of all four species occurring at both sites in every year. Pacific Lamprey adults were more commonly caught in the Clatskanie River than at Bear Creek, with adults frequently observed spawning upstream and downstream of the trap site in late spring. Pacific Lamprey adult catch at both sites in 2020 includes at least one capture of a presumed "dwarf" adult as noted by the small size (217−259 mm) and discussed with ODFW's Statewide Lamprey Coordinator (B. Clemens, personal communication, June, 2020). Western Brook Lamprey adults were abundant at both sites, and in Clatskanie River some observations were made of Pacific and Western Brook Lamprey adults spawning within the same redd. Lamprey Larva were also frequently encountered at both sites, but are not differentiated to species in this report.

Three-Spined Stickleback were caught in abundance in the Clatskanie River from 2017 through 2020 when the screw trap was moved close to head of tide, but were infrequently captured in most other years at this site and in Bear Creek. Redside Shiner and Northern Pikeminnow were caught consistently at Clatskanie River, but were not observed in any year at Bear Creek. Northern Pikeminnow captures at Clatskanie River include some very large specimens collected in late May to early June that were found to have predated on Coho smolts and Cutthroat. Juvenile Northern Pikeminnow were also encountered in the catch at Clatskanie River. Dace were infrequently captured at both sites, with only one observation made at Bear Creek (Speckled Dace, 2018) and up to six individuals in a given year at Clatskanie River. Prior to 2017, dace were not differentiated to species at Clatskanie River. However, species identifications since 2017 show presence of both Longnose and Speckled Dace in the watershed. Other native species captured over the monitoring period include one Chiselmouth (Clatskanie River, 2017), one Mountain Whitefish (Clatskanie River, 2018), and two Eulachon (Bear Creek, 2020).

Seven non-native fish species were captured over the monitoring period at Bear Creek and Clatskanie River. However, catch was low for all species in most years except Banded Killifish in Clatskanie River in 2018 and 2019 (110 and 23 fish, respectively) when the trap was located near head of tide. Sunfish (i.e., Bluegill and Pumpkinseed) were captured at both sites, with most catches occurring at Bear Creek in 2017 and 2018 (15 fish) after high water events likely flushed fish from an upstream pond into the creek. Only one bluegill was captured in Clatskanie River, a large specimen caught in mid-May in 2018. All other non-native fish captures occurred at Clatskanie River, including one Golden Shiner captured in 2013, several Common Goldfish and Goby spp. captured from 2017 through 2019, and one juvenile Smallmouth Bass captured in 2020.

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APPENDICES

Table A.1. Coordinates and trapping period for juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

<table>
<tr><th rowspan="2">Basin</th><th rowspan="2">Site</th><th colspan="9">Site Coordinates & Trapping Period</th></tr>
<tr><th>2012</th><th>2013</th><th>2014</th><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th></tr>
<tr><td rowspan="2">Big Cr</td><td rowspan="2">Bear Cr</td><td colspan="5" rowspan="2"></td><td>2/25–6/5</td><td>2/21–5/23</td><td>2/25–5/26</td><td>2/28–5/24</td></tr>
<tr><td colspan="4">Lat: 46.16462
Lon: -123.668</td></tr>
<tr><td rowspan="2">Clatskanie R</td><td rowspan="2">Clatskanie R</td><td>2/22–6/21</td><td>2/19–6/16</td><td>3/1–6/15</td><td>2/25–6/18</td><td>2/17–6/14</td><td>3/2–6/14</td><td>2/21–6/11</td><td>2/27–6/9</td><td>2/28–6/6</td></tr>
<tr><td colspan="3">Lat: 46.09869
Lon: -123.174</td><td colspan="2">Lat: 46.08590
Lon: -123.164</td><td colspan="4">Lat: 46.10026
Lon: -123.178</td></tr>
</table>

Table A.2. Summary of annual catch (Catch), population estimate (Est.) with 95% confidence interval (CI), percentage trap efficiency (Eff.), population estimate method (PopEst Method), catch range and peak catch dates, and average length and weight with 95% confidence interval of Chum Salmon *Oncorhynchus keta* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers in parentheses indicate extrapolated catch due to insufficient recaptures for population estimation.

Trap Year	Chum Fry													
	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch		Length			Weight		
							Range	Peak[b]	Fork	±	CI	Grams	±	CI
Bear Cr														
2017	3,787	61,802	±	11,650	6%	Stratified	2/27–5/8	3/23	39.8	±	0.3	0.46	±	0.01
2018	(17)				0%		2/25–4/5		41.7	±	0.7	0.43	±	0.06
2019	(25)				0%		3/25–4/22		38.4	±	0.7	0.36	±	0.02
2020	(2)				0%		3/27–4/8		38.0	±	25.4	0.40		
Clatskanie R.														
2012	(0)													
2013	(0)													
2014	(0)													
2015	(0)													
2016	(0)													
2017	(19)				0%		4/4–5/2		40.1	±	1.4	0.39	±	0.06
2018	(20)				6%		3/30–4/16		41.8	±	0.4	0.40	±	0.02
2019	(0)													
2020	(0)													

[a] Weighted efficiency is shown for size classes with Petersen Stratified population estimates and overall efficiency for size classes with Petersen Pooled estimates or extrapolated catch.

[b] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.3. Summary of annual catch (Catch), population estimate (Est.) with 95% confidence interval (CI), percentage trap efficiency (Eff.), population estimate method (PopEst Method), catch range and peak catch dates, and average length and weight with 95% confidence interval of Chinook Salmon *Oncorhynchus tshawytscha* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers in parentheses indicate extrapolated catch due to insufficient recaptures for population estimation.

Trap Year	Chinook Fry													
	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch		Length			Weight		
							Range	Peak[b]	Fork	±	CI	Grams	±	CI
Bear Cr														
2017	(3)				0%		4/1–6/5		50.0	±	139.8	1.75	±	17.15
2018	(10)				10%		2/26–4/27		40.4	±	7.5	0.61	±	0.65
2019	(3)				0%		5/24–5/25		77.0	±	279.5	4.90	±	43.20
2020	(0)													
Clatskanie R.														
2012	288	9,196	±	4,749	5%	Pooled	2/22–6/20		42.6	±	1.3	1.27	±	0.27
2013	249	1,045	±	259	24%	Pooled	2/20–6/16		55.7	±	2.4	2.28	±	0.30
2014	130	458	±	159	22%	Stratified	3/3–6/15	5/1	56.1	±	2.4	2.32	±	0.31
2015	422	4,909	±	1,680	7%	Stratified	2/25–5/28	3/12	38.8	±	0.8	0.52	±	0.09
2016	(2)				0%		4/25–6/7		80.5	±	108.0	6.05	±	23.51
2017	205	767	±	192	23%	Stratified	3/31–6/14	6/15	65.1	±	2.5	3.67	±	0.42
2018	1,084	9,478	±	2,760	10%	Stratified	2/21–6/11	3/15	49.3	±	1.2	1.27	±	0.12
2019	83	373	±	165	15%	Stratified	2/27–6/8	3/7	52.2	±	2.9	1.49	±	0.31
2020	923	2,718	±	372	33%	Stratified	2/28–6/6	3/19	50.1	±	1.6	1.57	±	0.19

[a] Weighted efficiency is shown for size classes with Petersen Stratified population estimates and overall efficiency for size classes with Petersen Pooled estimates or extrapolated catch.

[b] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.4. Summary of annual catch (Catch), population estimate (Est.) with 95% confidence intervals (CI), percentage trap efficiency (Eff.), and population estimate method (PopEst Method) of Coho Salmon *Oncorhynchus kisutch* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers in parentheses indicate extrapolated catch due to insufficient recaptures for population estimation.

Trap Year	Coho Smolts						Coho Fry					
	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch	Est.	±	CI	Eff.[a]	PopEst Method
Bear Cr												
2017	(84)				12%		840	15,826	±	6,515	4%	Stratified
2018	639	3,155	±	431	24%	Stratified	1,501	22,087	±	5,415	6%	Stratified
2019	1,380	2,908	±	202	58%	Stratified	(270)				3%	
2020	770	2,292	±	290	41%	Stratified	(142)				7%	
Clatskanie R.												
2012	3,369	34,031	±	6,194	9%	Stratified	2,266	55,564	±	14,414	4%	Stratified
2013	2,979	33,093	±	8,838	8%	Stratified	(248)				1%	
2014	5,976	25,319	±	2,560	24%	Stratified	296	6,307	±	3,387	5%	Pooled
2015	11,149	42,553	±	4,412	26%	Stratified	31,045	530,527	±	97,706	6%	Stratified
2016	4,270	35,009	±	4,806	12%	Stratified	(44)				6%	
2017	771	10,051	±	2,564	8%	Pooled	84	696	±	419	5%	Stratified
2018	10,199	54,589	±	7,146	19%	Stratified	1,409	17,581	±	3,787	8%	Pooled
2019	11,431	54,987	±	4,557	21%	Stratified	(35)				0%	
2020	2,834	23,107	±	3,865	12%	Stratified	747	8,674	±	2,227	9%	Pooled

[a] Weighted efficiency is shown for size classes with Petersen Stratified population estimates and overall efficiency for size classes with Petersen Pooled estimates or extrapolated catch.

Table A.5. Summary of catch range and peak catch dates, and average length and weight with 95% confidence interval of Coho Salmon *Oncorhynchus kisutch* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

Trap Year	Coho Smolts								Coho Fry							
	Catch		Length			Weight			Catch		Length			Weight		
	Range	Peak[a]	Fork	±	CI	Grams	±	CI	Range	Peak[a]	Fork	±	CI	Grams	±	CI
Bear Cr																
2017	3/12–6/4		120.2	±	5.0	19.88	±	2.07	2/25–6/5	3/2	42.8	±	2.1	1.28	±	0.29
2018	2/22–5/22	5/10	117.4	±	1.7	16.32	±	0.70	2/21–5/22	2/22	44.5	±	2.1	1.12	±	0.24
2019	2/25–5/24	5/9	114.7	±	1.4	15.73	±	0.58	2/25–5/25		47.7	±	1.9	1.27	±	0.20
2020	2/29–5/24	5/14	118.5	±	1.3	18.22	±	0.57	2/29–5/24		48.3	±	2.9	1.77	±	0.37
Clatskanie R.																
2012	2/22–6/21	5/10	112.8	±	0.5	15.27	±	0.21	2/28–6/20	4/26	39.1	±	0.3	0.60	±	0.05
2013	2/22–6/16	5/2	107.5	±	1.6	13.81	±	0.59	2/21–6/15		42.7	±	2.2	0.99	±	0.26
2014	3/1–6/15	5/1	110.8	±	1.4	14.80	±	0.50	3/12–6/15		44.6	±	1.6	1.18	±	0.19
2015	2/25–6/18	5/7	111.2	±	1.4	15.27	±	0.52	2/25–6/18	3/26	51.5	±	2.1	2.29	±	0.31
2016	2/22–6/14	5/12	118.5	±	1.4	18.10	±	0.61	2/22–6/12		41.7	±	4.2	1.02	±	0.63
2017	3/25–6/14		122.7	±	1.4	19.29	±	0.61	3/2–6/14	3/2	51.6	±	4.8	2.80	±	0.87
2018	2/21–6/11	5/3	108.4	±	1.2	13.30	±	0.41	2/21–6/11		49.0	±	1.8	1.58	±	0.24
2019	3/1–6/9	5/9	109.0	±	1.2	13.42	±	0.44	3/25–6/6		47.1	±	5.1	1.34	±	0.71
2020	2/28–6/6	5/7	122.7	±	1.3	20.11	±	0.58	2/28–6/6		45.8	±	1.8	1.35	±	0.21

[a] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.6. Summary of annual catch (Catch), population estimate (Est.) with 95% confidence intervals (CI), percentage trap efficiency (Eff.), and population estimate method (PopEst Method) of Steelhead *Oncorhynchus mykiss* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers in parentheses indicate extrapolated catch due to insufficient recaptures for population estimation.

	Steelhead													
	≥ 120						**90–119**						**60–89**	
Trap Year	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch	Eff.[a]
Bear Cr														
2017	131	1,153	±	555	8%	Stratified	(9)				0%		(1)	
2018	665	3,525	±	582	21%	Stratified	88	473	±	216	16%	Stratified[b]	(10)	40%
2019	765	1,906	±	196	43%	Stratified	53	192	±	74	21%	Stratified[b]	(1)	100%
2020	349	1,799	±	425	22%	Stratified	(30)				9%		(2)	50%
Clatskanie R.														
2012	(182)				4%		(8)				0%		(3)	0%
2013	452	12,671	±	6,309	2%	Stratified	(17)				6%		(0)	
2014	654	8,668	±	2,975	8%	Stratified	(25)				21%		(2)	0%
2015	1,594	8,742	±	1,394	18%	Stratified	(30)				7%		(1)	0%
2016	340	4,075	±	1,441	6%	Stratified	(3)				67%		(51)	5%
2017	370	8,339	±	4,120	3%	Stratified	(4)				25%		(0)	
2018	2,006	42,597	±	12,624	4%	Stratified	(77)				7%		(6)	17%
2019	1,697	22,892	±	5,807	7%	Stratified	(27)				15%		(0)	
2020	1,669	29,477	±	6,378	5%	Stratified	(16)				7%		(0)	

[a] Weighted efficiency is shown for size classes with Petersen Stratified population estimates and overall efficiency for size classes with Petersen Pooled estimates or extrapolated catch.

[b] Estimate was not extrapolated for weeks after trap was removed as no 90−119 mm Steelhead estimate was available from the Clatskanie River screw trap for extrapolation.

Table A.7. Summary of catch range and peak catch dates, and average length and weight with 95% confidence interval of Steelhead *Oncorhynchus mykiss* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

Trap Year	Steelhead (≥ 120)								Steelhead (90–119)							
	Catch		Length			Weight			Catch		Length			Weight		
	Range	Peak[a]	Fork	±	CI	Grams	±	CI	Range	Peak[a]	Fork	±	CI	Grams	±	CI
Bear Cr																
2017	3/8–6/3	5/4	160.8	±	3.5	41.11	±	2.60	3/1–5/30		104.2	±	5.1	13.92	±	3.25
2018	3/6–5/22	5/3	166.1	±	3.4	44.74	±	2.83	3/7–5/22	5/17	106.6	±	1.9	12.34	±	0.67
2019	2/25–5/25	5/2	159.5	±	2.8	40.35	±	2.17	3/31–5/25	5/16	106.5	±	2.1	12.72	±	0.77
2020	2/29–5/24	5/14	162.8	±	2.5	42.95	±	2.08	3/15–5/19		104.7	±	3.5	12.26	±	1.29
Clatskanie R.																
2012	3/24–6/14		167.3	±	1.9	45.99	±	1.72	4/9–5/30		100.8	±	7.0	13.43	±	6.03
2013	3/19–6/12	5/9	168.0	±	2.6	46.54	±	2.10	3/14–6/15		109.4	±	5.1	14.59	±	2.15
2014	3/21–6/9	5/1	166.6	±	2.6	43.85	±	1.91	3/5–6/9		108.0	±	3.6	14.20	±	1.45
2015	2/28–6/12	4/30	171.1	±	2.7	49.05	±	2.28	3/6–6/11		110.4	±	2.4	14.85	±	0.89
2016	3/21–6/14	5/5	169.4	±	2.8	50.23	±	2.55	4/9–5/25		103.2	±	15.1	12.14	±	4.47
2017	3/31–6/14	5/11	159.0	±	2.6	38.48	±	1.97	4/23–5/17		104.0	±	12.9	12.68	±	6.87
2018	3/10–6/11	5/3	162.8	±	2.4	41.85	±	1.83	3/11–6/11		105.4	±	1.8	12.52	±	0.68
2019	3/3–6/6	4/25	164.9	±	2.4	43.50	±	1.93	2/28–5/26		105.7	±	2.9	12.21	±	1.19
2020	3/3–6/6	4/30	171.1	±	2.3	51.40	±	2.18	3/13–5/15		105.7	±	4.2	17.85	±	10.53

[a] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.8. Summary of annual catch (Catch), population estimate (Est.) with 95% confidence intervals (CI), percentage trap efficiency (Eff.), and population estimate method (PopEst Method) of Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers in parentheses indicate extrapolated catch due to insufficient recaptures for population estimation.

	Cutthroat														
	≥ 250	**160–249**						**120–159**						**90–119**	**60–89**
Trap Year	Catch	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch	Est.	±	CI	Eff.[a]	PopEst Method	Catch	Catch
Bear Cr															
2017	(2)	47	201	±	108	16%	Stratified	(21)				22%		(6)	(0)
2018	(13)	167	741	±	174	24%	Stratified	86	304	±	63	34%	Stratified	(8)	(0)
2019	(45)	322	1,252	±	192	33%	Stratified	71	218	±	51	32%	Stratified	(4)	(0)
2020	(7)	140	568	±	169	32%	Pooled[b]	38	92	±	31	37%	Stratified[b]	(10)	(1)
Clatskanie R.															
2012	(1)	338	3,164	±	1,029	8%	Stratified	(70)				13%		(11)	(0)
2013	(12)	444	4,884	±	1,644	7%	Stratified	56	243	±	110	12%	Stratified	(4)	(0)
2014	(15)	585	4,296	±	917	14%	Pooled	110	709	±	368	8%	Stratified	(15)	(1)
2015	(38)	1,416	8,286	±	1,501	16%	Stratified	131	498	±	157	20%	Stratified	(11)	(0)
2016	(13)	396	3,835	±	1,162	10%	Pooled	42	132	±	41	19%	Stratified	(2)	(6)
2017	(6)	282	4,665	±	2,399	4%	Stratified	(64)				8%		(28)	(4)
2018	(35)	661	5,698	±	1,823	10%	Stratified	134	936	±	384	8%	Stratified	(22)	(2)
2019	(42)	463	3,318	±	894	12%	Stratified	115	576	±	241	15%	Stratified	(30)	(3)
2020	(28)	612	7,718	±	2,140	8%	Pooled	(61)				9%		(9)	(0)

[a] Weighted efficiency is shown for size classes with Petersen Stratified population estimates and overall efficiency for size classes with Petersen Pooled estimates or extrapolated catch.

[b] Estimate was not extrapolated for weeks after trap was removed as weekly Cutthroat data were not available from the Clatskanie River screw trap for extrapolation.

Table A.9. Summary of catch range and peak catch dates, and average length and weight with 95% confidence interval of ≥ 250 mm and 160–249 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

Trap Year	Cutthroat (≥ 250)								Cutthroat (160–249)							
	Catch		Length			Weight			Catch		Length			Weight		
	Range	Peak[a]	Fork	±	CI	Grams	±	CI	Range	Peak[a]	Fork	±	CI	Grams	±	CI
Bear Cr																
2017	3/22–4/27		267.0	±	216.0	129.50			3/15–6/5	5/25	184.8	±	4.9	56.70	±	5.13
2018	3/13–5/14		330.3	±	41.3	336.48	±	126.84	2/24–5/22	5/10	192.0	±	3.8	62.19	±	3.98
2019	2/26–5/8		332.6	±	11.8	318.26	±	36.61	2/25–5/25	5/2	184.2	±	2.4	54.86	±	2.41
2020	3/10–4/24		285.1	±	30.0	215.63	±	69.09	2/28–5/24		189.1	±	3.3	62.70	±	3.38
Clatskanie R.																
2012	3/7		257.0			135.00			3/3–6/13	5/24	181.7	±	1.7	53.48	±	1.68
2013	3/3–5/17		317.7	±	25.1	286.09	±	66.45	3/15–6/15	5/9	189.6	±	2.9	61.95	±	3.08
2014	3/23–6/5		278.5	±	21.7	195.68	±	41.66	3/1–6/11		187.6	±	3.0	59.61	±	3.18
2015	2/26–5/20		287.6	±	12.1	218.49	±	27.55	3/7–6/13	4/30	193.1	±	2.8	66.44	±	3.21
2016	4/5–6/14		293.4	±	29.3	210.47	±	52.72	3/28–6/14		192.8	±	2.6	65.06	±	2.84
2017	3/25–6/12		274.3	±	40.8	170.33	±	11.41	3/2–6/14	5/18	189.0	±	3.1	61.36	±	3.27
2018	2/21–6/10		303.7	±	14.3	235.26	±	29.85	2/25–6/11	5/3	187.7	±	2.7	58.61	±	2.67
2019	3/5–6/1		327.5	±	15.4	287.63	±	34.55	3/4–6/9	5/30	187.8	±	2.8	58.47	±	2.95
2020	3/10–6/1		288.4	±	15.5	219.52	±	35.12	2/28–6/6		200.5	±	2.7	75.52	±	3.13

[a] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.10. Summary of catch range and peak catch dates, and average length and weight with 95% confidence interval of 120–159 mm and 90–119 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

Trap Year	Cutthroat (120–159)								Cutthroat (90–119)							
	Catch		Length			Weight			Catch		Length			Weight		
	Range	Peak[a]	Fork	±	CI	Grams	±	CI	Range	Peak[a]	Fork	±	CI	Grams	±	CI
Bear Cr																
2017	4/18–6/3		142.6	±	5.4	28.05	±	2.56	4/13–6/1		108.4	±	10.8	14.34	±	4.11
2018	3/8–5/22	5/10	147.3	±	2.1	28.05	±	1.04	3/11–5/12		108.0	±	12.8	15.42	±	9.20
2019	3/2–5/24	5/2	145.2	±	2.4	27.89	±	1.19	3/12–4/18		106.5	±	7.8	10.93	±	1.43
2020	3/3–5/24	4/23	144.9	±	3.3	29.37	±	1.86	3/6–5/13		110.4	±	4.2	12.96	±	1.21
Clatskanie R.																
2012	2/24–6/16		148.0	±	2.4	29.92	±	1.23	3/5–6/7		110.0	±	7.4	18.13	±	9.06
2013	2/25–6/14	5/23	146.6	±	3.0	28.14	±	1.45	2/26–5/23		106.4	±	5.3	13.73	±	5.52
2014	3/5–6/10	5/15	147.1	±	2.1	28.40	±	1.03	3/14–6/13		106.3	±	4.6	11.97	±	1.49
2015	2/28–6/14	5/21	148.8	±	1.6	30.20	±	0.89	4/18–5/29		113.7	±	3.4	14.18	±	1.26
2016	2/18–6/13	5/12	146.0	±	3.1	29.73	±	2.02	3/27–4/10		114.0	±	63.5	13.65	±	13.34
2017	3/3–6/2		145.4	±	2.8	28.97	±	1.72	3/5–5/29		109.2	±	2.7	13.62	±	2.14
2018	2/28–6/11	3/29	146.0	±	1.9	27.77	±	0.94	3/6–6/11		110.2	±	3.2	13.74	±	1.90
2019	3/8–6/9	5/9	140.2	±	2.2	24.65	±	1.07	3/4–5/17		108.8	±	3.0	12.05	±	0.95
2020	2/28–6/6		143.9	±	2.9	28.87	±	1.61	3/1–5/18		106.1	±	8.3	11.38	±	2.46

[a] Peak migration timing is the date at the middle of the sampling week when outmigrant estimation was highest in a given year.

Table A.11. Summary of catch and capture date range, and average length and weight of hatchery salmonids captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020.

Trap Year	Coho Smolts				Chinook				Steelhead Smolts			
	Catch		Length	Weight	Catch		Length	Weight	Catch		Length	Weight
	#	Range	Fork ± CI	Grams ± CI	#	Range	Fork ± CI	Grams ± CI	#	Range	Fork ± CI	Grams ± CI
Bear Cr												
2017	1	3/8	143	33.8	8	2/26–3/27	134 ± 15	27.1 ± 9.4	0			
2018	49	4/24–5/15	132 ± 2	22.1 ± 1.2	1	5/6	157	40.2	6	4/24–5/8	194 ± 25	64.8 ± 20.7
2019	221[a]	2/25–5/22	133 ± 1	22.9 ± 0.6	3	3/5–3/22	132 ± 13	23.8 ± 6.6	38	4/16–5/10	196 ± 5	66.9 ± 4.9
2020	34[b]	3/23–5/8	132 ± 3	23.3 ± 1.3	9	3/7–4/24	144 ± 6	35.7 ± 3.8	8	4/9–5/5	209 ± 14	87.0 ± 17.1
Clatskanie R.												
2012	0				0				0			
2013	1	5/1	126	21.2	2	2/25–3/17	149 ± 38	36.1 ± 69.9	0			
2014	0				0				0			
2015	0				1	3/2	139	27.5	0			
2016	0				0				0			
2017	0				1	3/7	140	24.3	0			
2018	1	5/5	118	16.7	1	5/21	88	6.3	0			
2019	0				1	4/1	147	35.2	0			
2020	4	4/24–5/15	133 ± 15	24.9 ± 7.5	8	3/6–6/2	139 ± 8	28.5 ± 6.1	1	5/16	141	24.7

[a] A Stratified Petersen population estimate was made in this year (524 ± 84).

[b] A Stratified Petersen population estimate was made in this year (86 ± 33).

Table A.12. Capture date, length (mm), and weight (g) of hatchery salmonids captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020 with coded-wire tags (CWTs). Origin information including tag code, stock, origin, release location, brood year, and release date(s) is shown for each capture. The number of days between hatchery release date and capture at a sampling site (Days to Recap) for hatchery releases with multiple dates was calculated using the average of the two release dates.

Trap Year	Capture Information			Origin Information							
	Date	Length	Weight	Tag Code	Stock	Origin	Release Location	Brood Year	Release Dates 1st	Release Dates 2nd	Days To Recap
Bear Cr - Coho											
2018	4/30/18	140	25.4	091158	Tanner Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2016	4/12/18	4/27/18	10
2018	5/7/18	134	22.2	091158	Tanner Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2016	4/12/18	4/27/18	18
2019	4/20/19	126	20.5	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		-4
2019	4/26/19	133	21.7	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		2
2019	4/27/19	140	25.8	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		3
2019	5/2/19	141	25.1	090909	Big Cr (OR)	Big Cr Hatch	Big Cr (OR)	2017	4/18/19	4/19/19	14
2019	5/3/19	133	22.0	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		9
2019	5/4/19	132	21.9	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		10
2019	5/5/19	150	32.0	090909	Big Cr (OR)	Big Cr Hatch	Big Cr (OR)	2017	4/18/19	4/19/19	16
2019	5/5/19	129	20.8	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		11
2019	5/6/19	127	19.4	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		12
2019	5/9/19	119	17.3	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		15
2019	5/9/19	136	23.9	090909	Big Cr (OR)	Big Cr Hatch	Big Cr (OR)	2017	4/18/19	4/19/19	20
2019	5/9/19	129	22.6	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		15
2019	5/13/19	143	30.0	091201	Big Cr (OR)	CEDC Net Pens	Tongue Pt. (OR)	2017	4/24/19		19
2020	5/4/20	123	20.9	091315	Tanner Cr (OR)	CEDC Net Pens	Youngs R/Bay (OR)	2018	4/23/20		11
2020	5/7/20	135	24.5	091313	Tanner Cr (OR)	Bonneville Hatch	Tongue Pt. (OR)	2018	4/28/20		9
Bear Cr - Chinook											
2019	3/5/19	138	26.9	091203	S Santiam R (OR)	CEDC Net Pens	Youngs R/Bay (OR)	2017	2/28/19		5
2019	3/22/19	129	22.2	091203	S Santiam R (OR)	CEDC Net Pens	Youngs R/Bay (OR)	2017	2/28/19		22
2020	3/7/20	150	34.9	091319	M Willamette R (OR)	Willamette Hatch	Youngs R/Bay (OR)	2018	3/4/20		3
2020	3/30/20	140	32.0	091320	M Willamette R (OR)	Willamette Hatch	Blind Slough (OR)	2018	3/24/20		6

Trap Year	Capture Information			Origin Information							
	Date	Length	Weight	Tag Code	Stock	Origin	Release Location	Brood Year	Release Dates 1st	Release Dates 2nd	Days To Recap
Bear Cr – Chinook (Continued)											
2020	4/24/20	151	43.7	637507	Unknown	Cowlitz Salmon Hatch	Cowlitz R (WA)	2018	3/16/20	3/20/20	37
Clatskanie R - Chinook											
2020	3/13/20	149	37.4	637481	Unknown	Lewis R Hatch	NF Lewis R (WA)	2018	2/11/20	2/28/20	22
2020	3/24/20	146	34.0	091388	M Willamette R (OR)	Dexter Ponds Hatch	Coast Fk Willamette R	2018	2/1/20		52

Table A.13. Number of non-salmonid fish species captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Numbers represent actual catch and are not adjusted for trap efficiency or non-fishing days. Larval lamprey are immature, filter-feeding individuals without eyes and juvenile lamprey are transformed individuals with eyes that are ready to feed as described by Clemens (2019).

Trap Year	Lamprey				Banded Killifish	Bluegill	Chiselmouth	Common Goldfish	Cottid spp.	Dace spp.	Eulachon	Goby spp.	Golden Shiner	Largescale Sucker	Mountain Whitefish	Northern Pikeminnow	Peamouth	Pumpkinseed	Redside Shiner	Smallmouth Bass	Sucker spp.	Three-Spine Stickleback
	Pacific Adult	Western Brook Adult	Larva	Juvenile																		
Bear Cr																						
2017	1	121	293		6	2			162								1197				12	
2018	8	116	407	4		12			426	1				181			3686	1				
2019	16	471	391	5	2				370					368			24850					4
2020	19	283	392						254		2			84			25878					2
Clatskanie R.																						
2012	22	147	236						264	4						2	19				3	66
2013	145	327	84	1					329				1			15	69				10	123
2014	158	122	418	4					325								413				28	1
2015	116	61	391		1				477	6						60	969				57	2
2016	142	130	69						315	2						1	1948				5	3
2017	35	259	246		9		1	1	160							91	15		14		7	997
2018	112	403	493	25	110	1			652	2		1		55	1	40	391		94			569
2019	106	460	490	4	23			3	860	4		2		43		15	715		65			907
2020	283	601	406	3	9				1150	2				74		28	326		25	1		1092

Table A.14. Estimated number of Peamouth *Mylocheilus caurinus* visually observed on spawning surveys downstream (Highway 30 to screw trap) and upstream (screw trap to old Highway 30) of the Bear Creek screw trap site by date during the 2018 trapping season.

	Number of Peamouth Observed	
	Highway 30 to Screw Trap	**Screw Trap to Old Highway 30**
Survey Date	**Downstream**	**Upstream**
5/24	17,000	6,125
5/25	15,000	225
5/26	10,000	0
5/27	8,000	0
5/28	15,000	25,000
5/29	25,000	4,500
5/30	***Not surveyed***	
5/31	30,000	2,000
6/1	***Not surveyed***	
6/2	50,000	500
6/3	70,000	11,000
6/4	***Not surveyed***	
6/5	70,000	0
6/6	45,000	700
6/7	37,000	500
6/8	20,000	0
6/9	***Not surveyed***	
6/10	***Not surveyed***	
6/11	3,000	75
Average	**29,643**	**3,616**

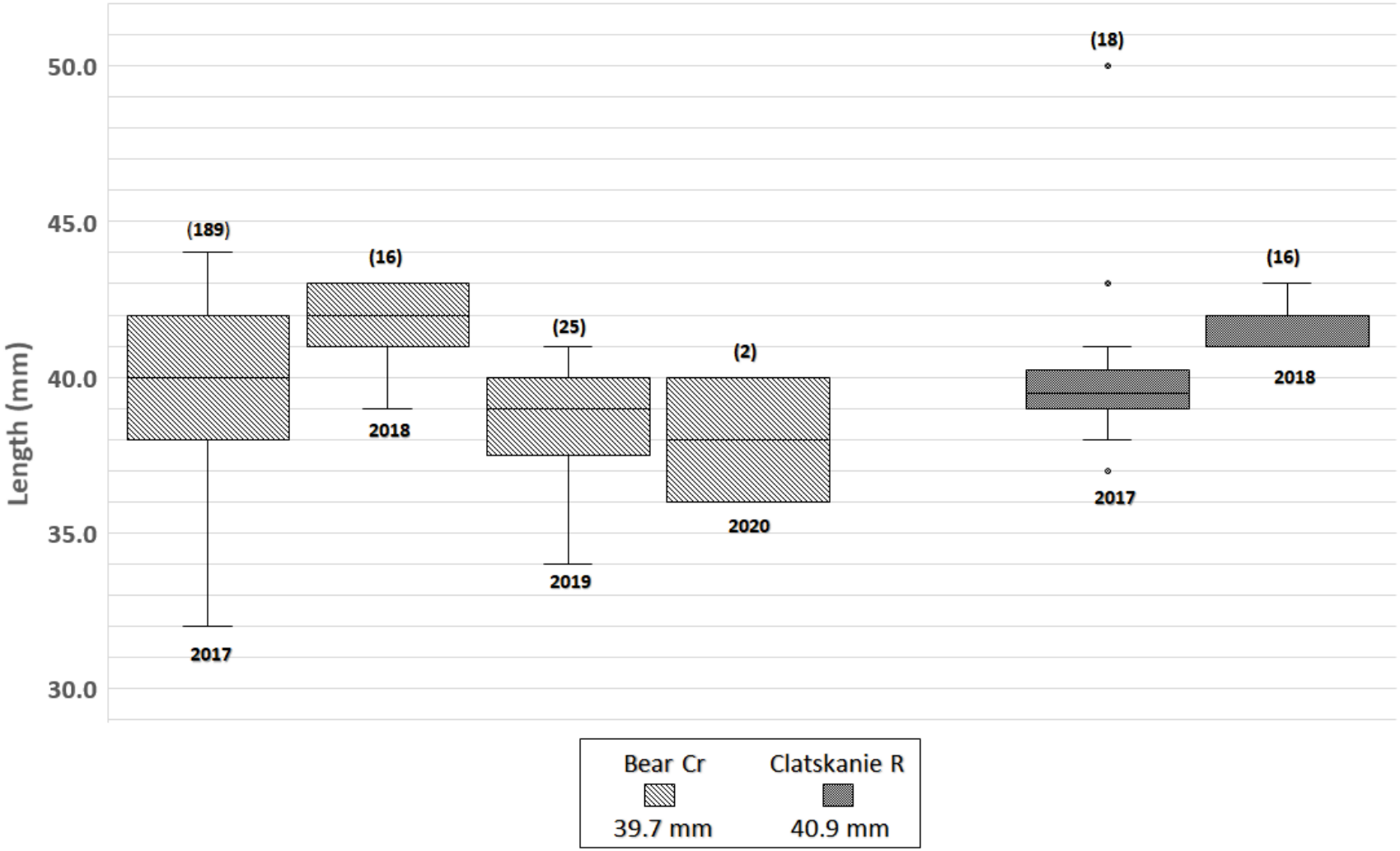

Figure A.15. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of Chum *Oncorhynchus keta* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean Chum fry length for all years sampled at each site is shown in the legend. Total number of fry measured for all years sampled at each site is shown in parentheses.

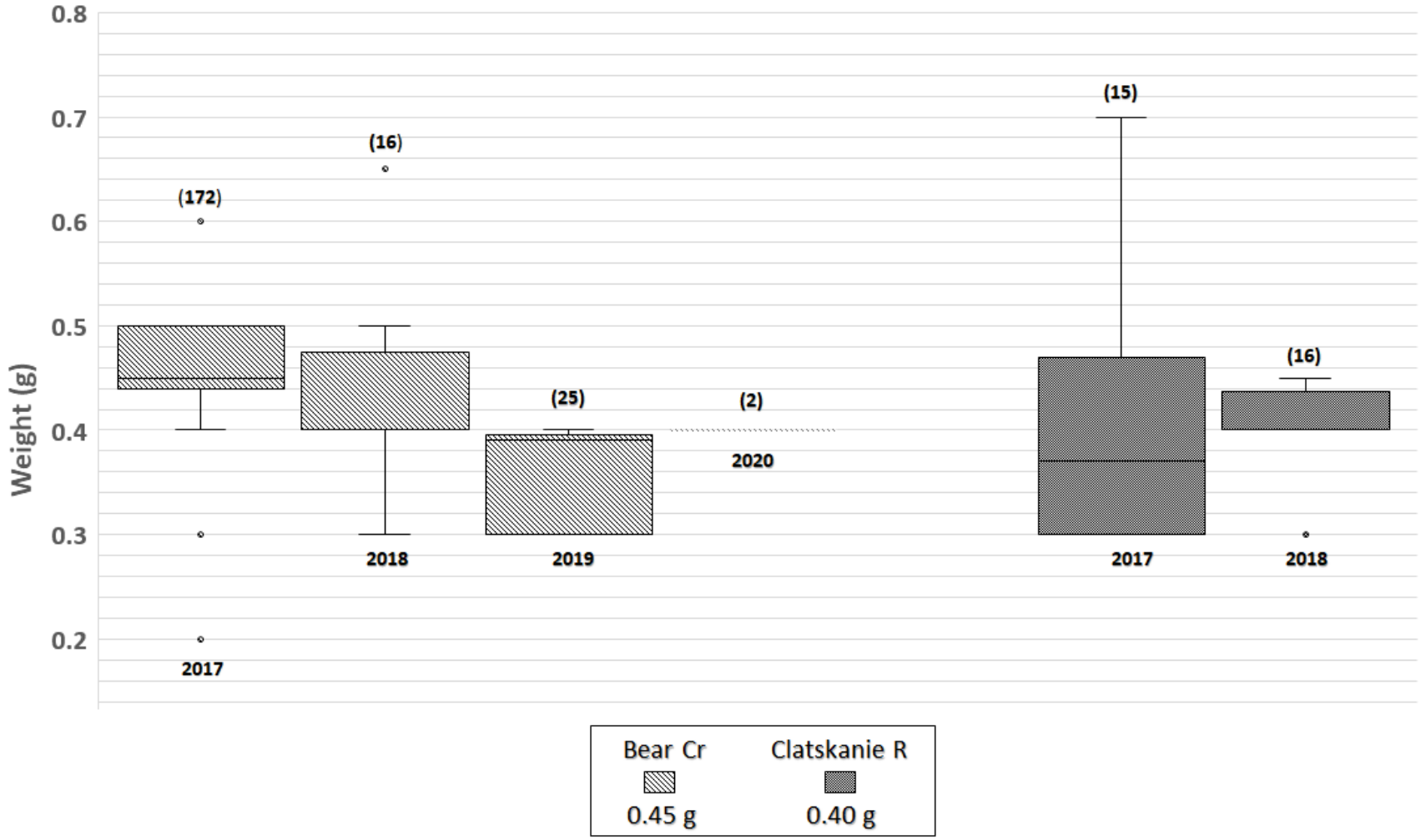

Figure A.16. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of Chum *Oncorhynchus keta* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean Chum fry weight for all years sampled at each site is shown in the legend. The total number of fry weighed for all years sampled at each site is shown in parentheses.

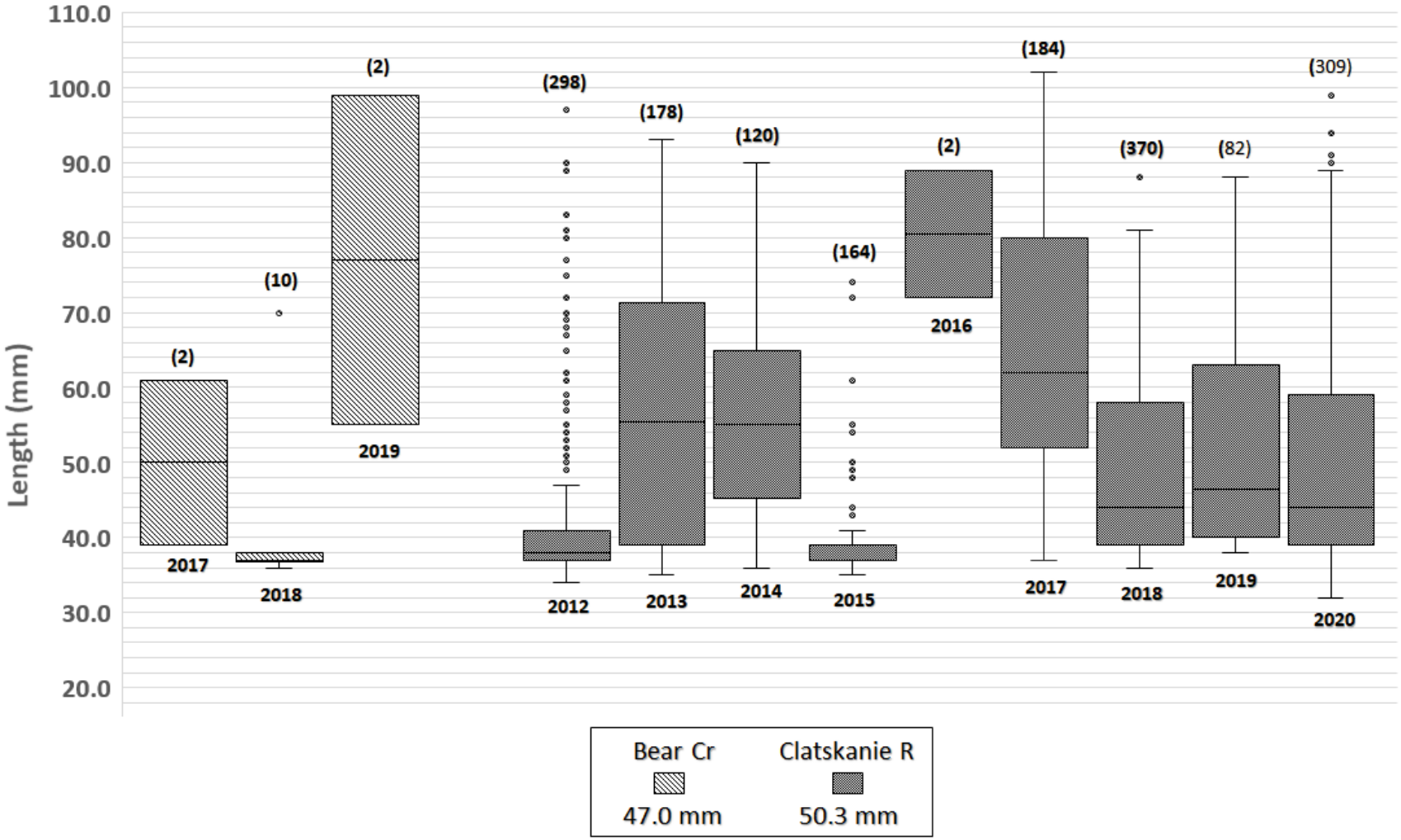

Figure A.17. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of Chinook *Oncorhynchus tshawytscha* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean Chinook fry length for all years sampled at each site is shown in the legend. Total number of fry measured for all years sampled at each site is shown in parentheses.

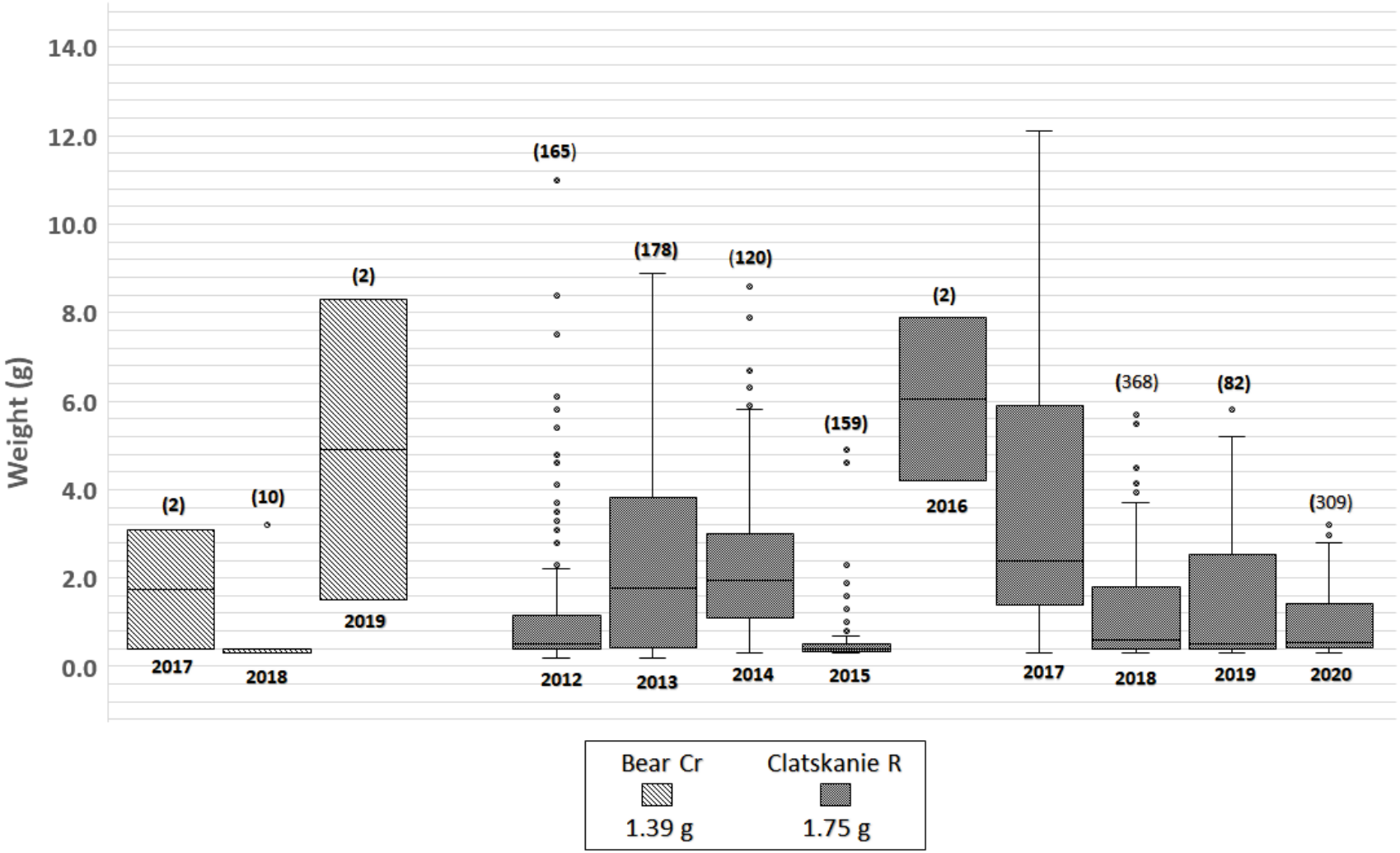

Figure A.18. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75% Percentile (box top), and Maximum (top whisker) weight (g) of Chinook *Oncorhynchus tshawytscha* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean Chinook fry weight for all years sampled at each site is shown in the legend. The total number of fry weighed for all years sampled at each site is shown in parentheses.

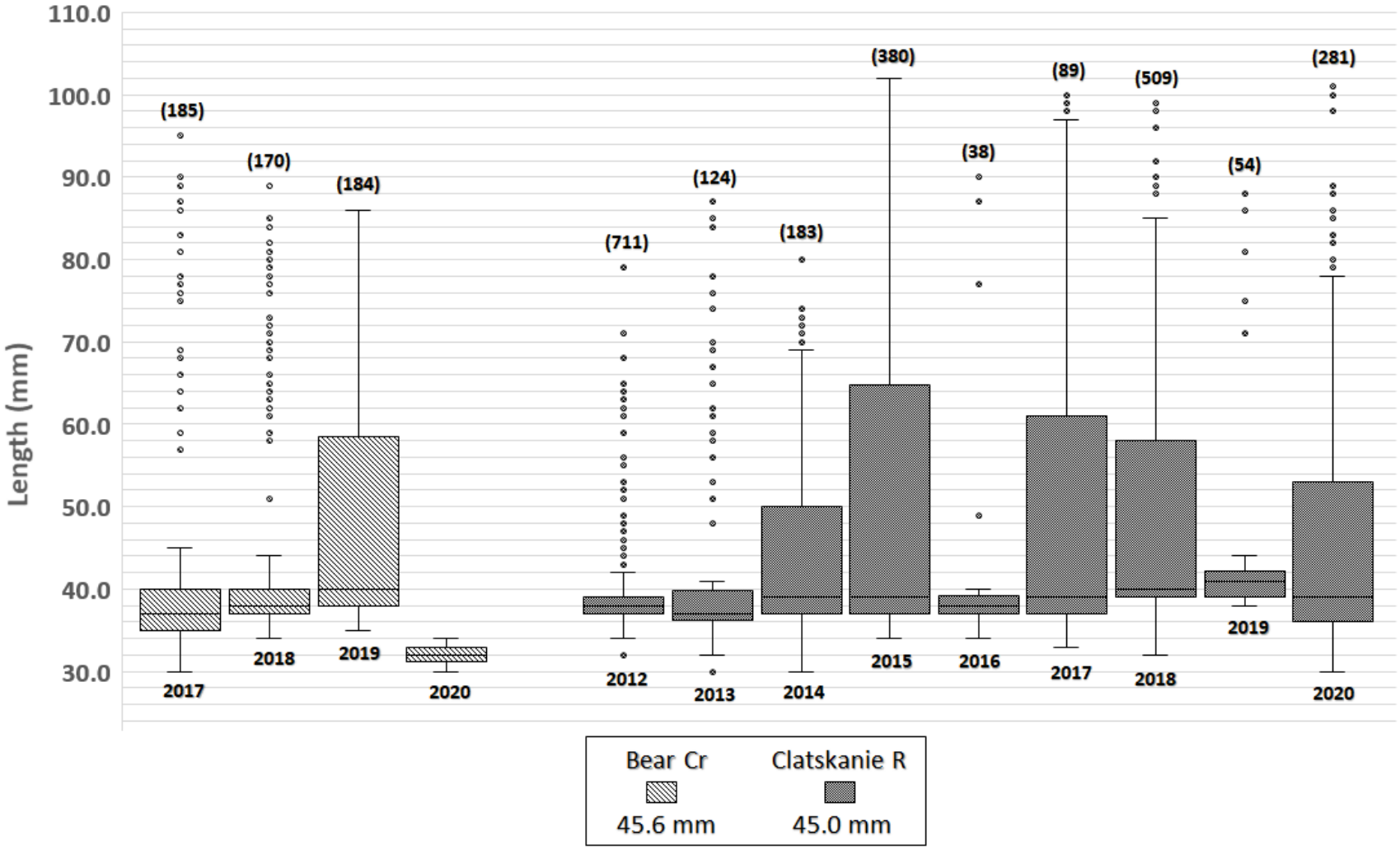

Figure A.19. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of Coho *Oncorhynchus kisutch* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean Coho fry length for all years sampled at each site is shown in the legend. The total number of fry measured for all years sampled at each site is shown in parentheses.

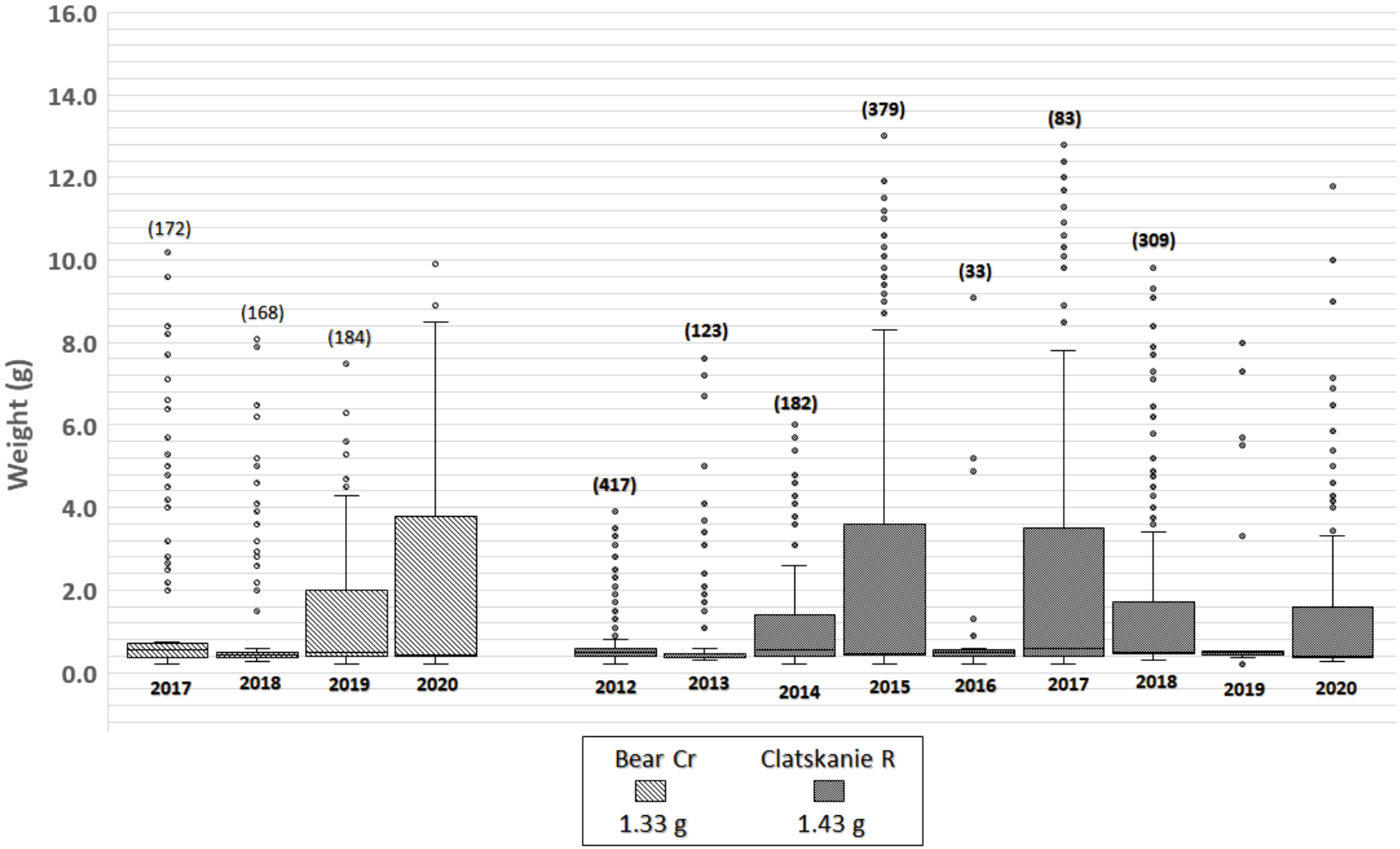

Figure A.20. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of Coho *Oncorhynchus kisutch* fry captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean Coho fry weight for all years sampled at each site is shown in the legend. The total number of fry weighed for all years sampled at each site is shown in parentheses.

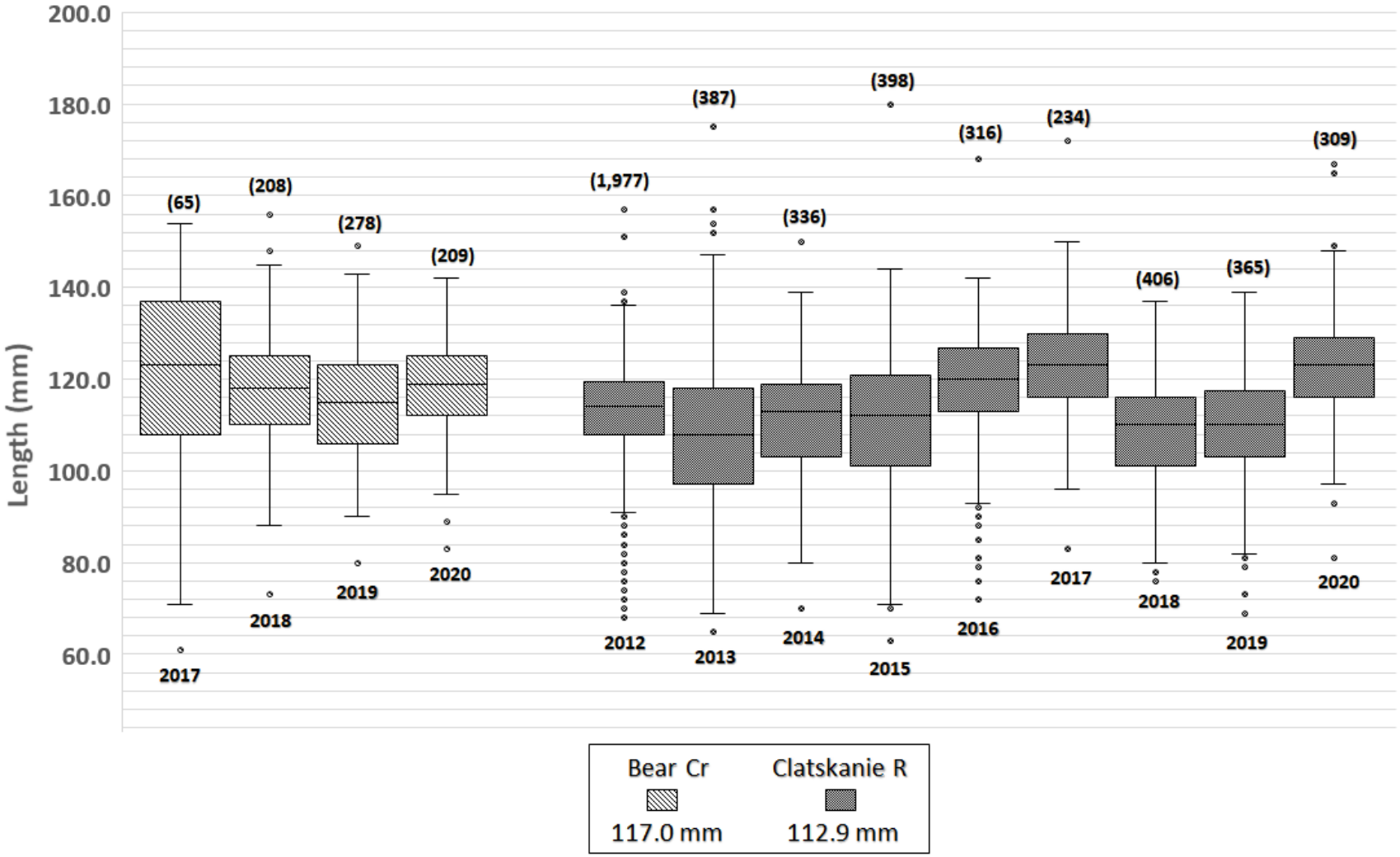

Figure A.21. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of Coho *Oncorhynchus kisutch* smolts captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean Coho smolt length for all years sampled at each site is shown in the legend. The total number of smolts measured for all years sampled at each site is shown in parentheses.

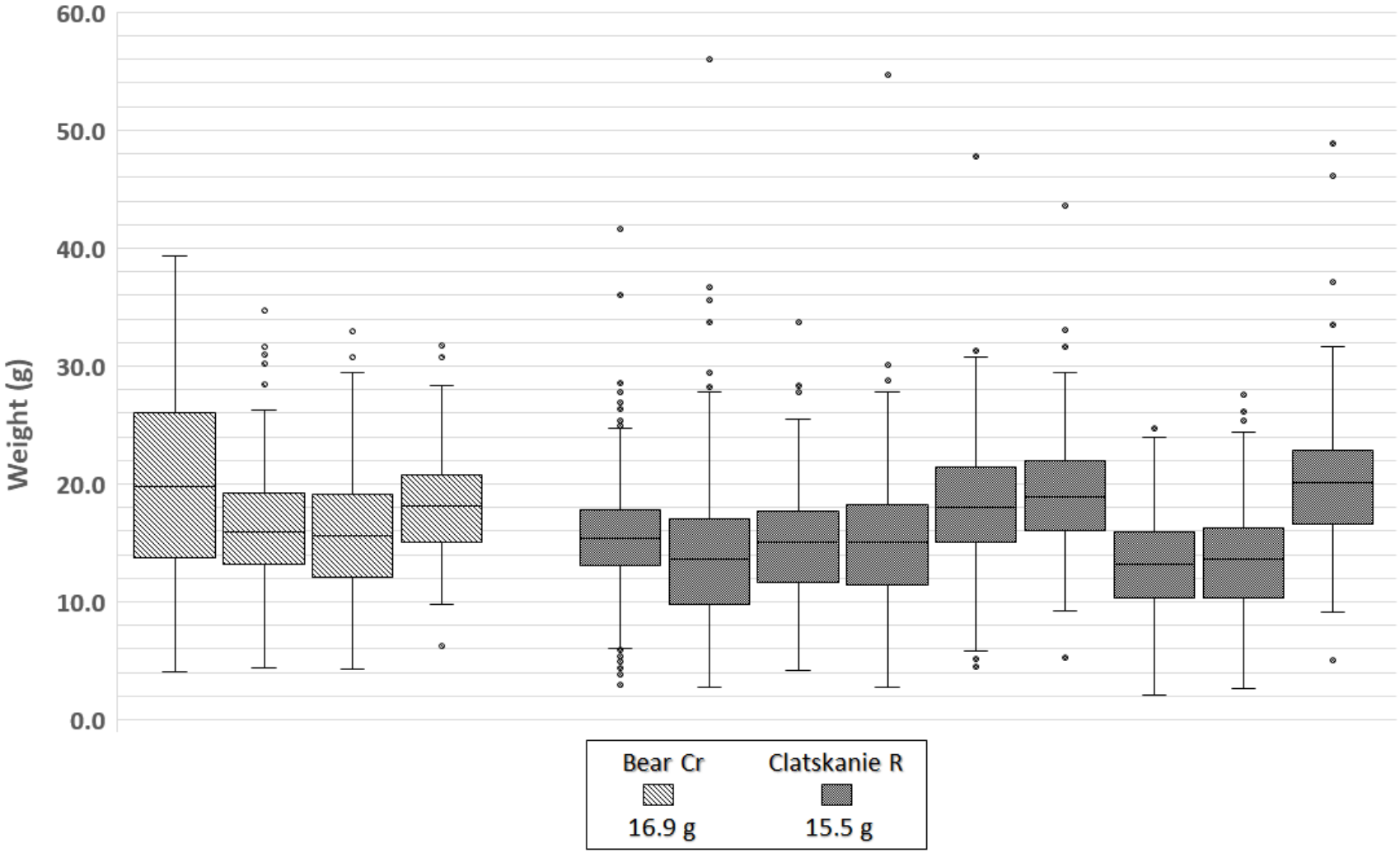

Figure A.22. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of Coho *Oncorhynchus kisutch* smolts captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean Coho smolt weight for all years sampled at each site is shown in the legend. The total number of smolts weighed for all years sampled at each site is shown in parentheses.

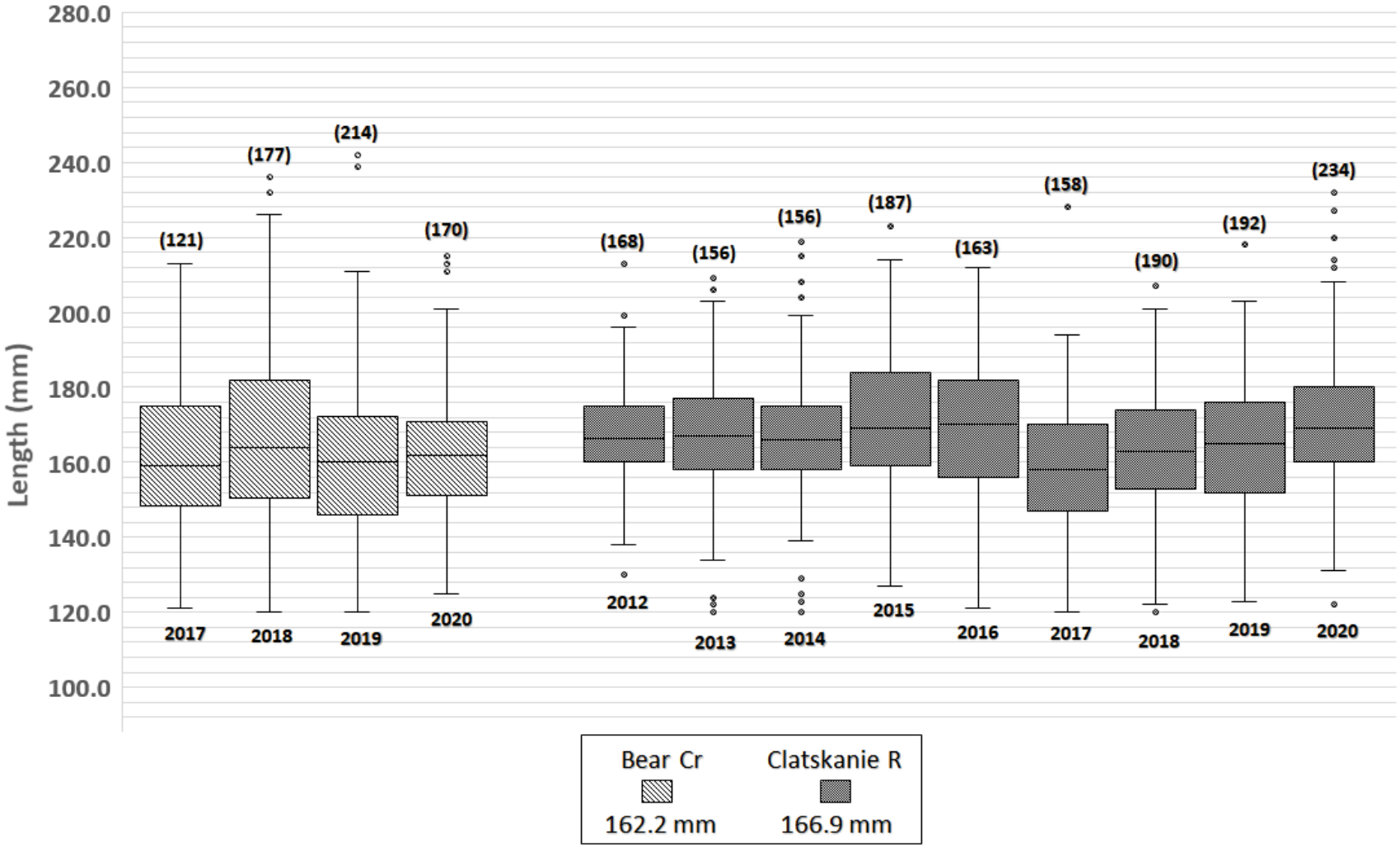

Figure A.23. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of Steelhead *Oncorhynchus mykiss* smolts captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean Steelhead smolt length for all years sampled at each site is shown in the legend. The total number of smolts measured for all years sampled at each site is shown in parentheses.

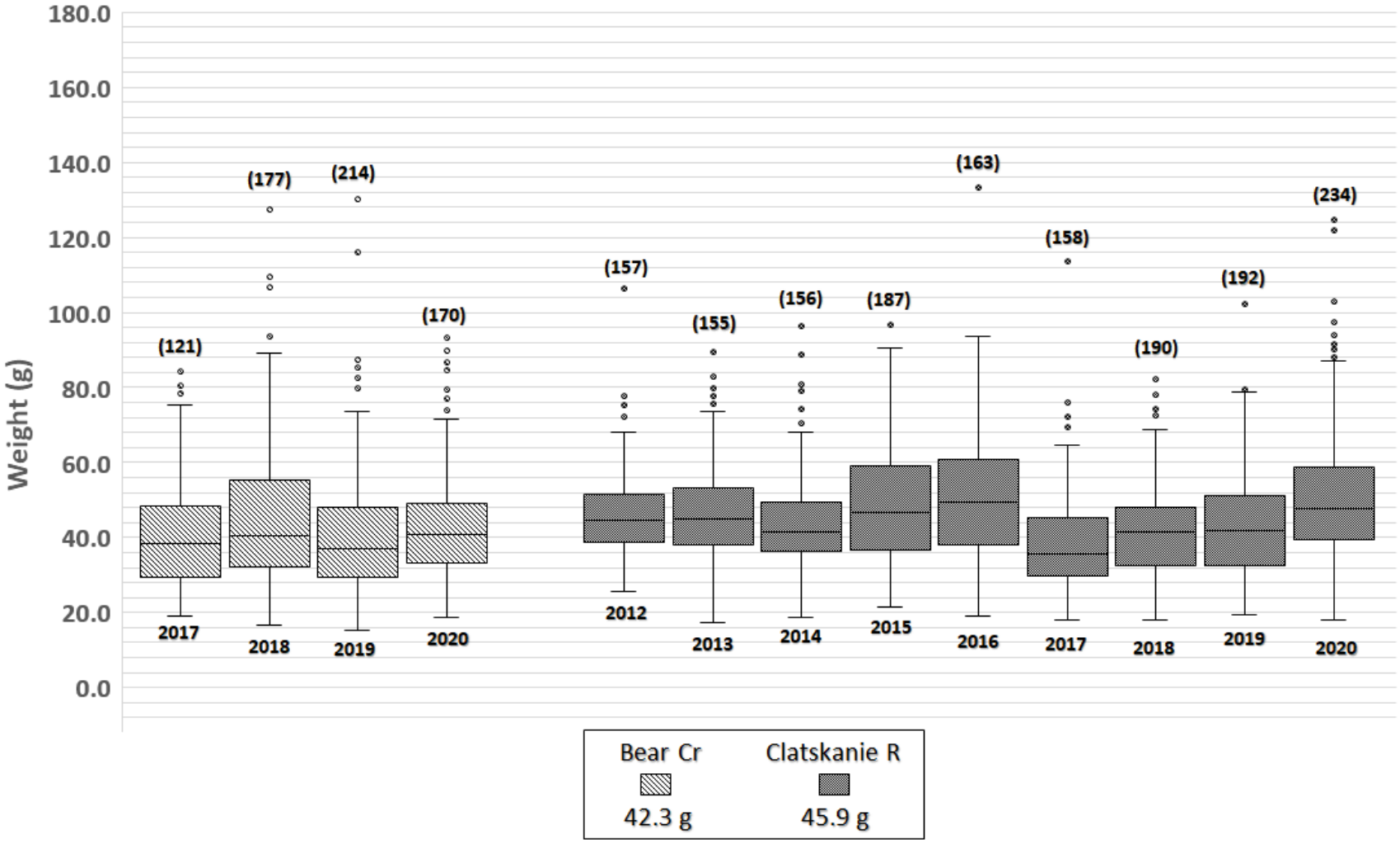

Figure A.24. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of Steelhead *Oncorhynchus mykiss* smolts captured juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean Steelhead smolt weight for all years sampled at each site is shown in the legend. The total number of smolts weighed for all years sampled at each site is shown in parentheses.

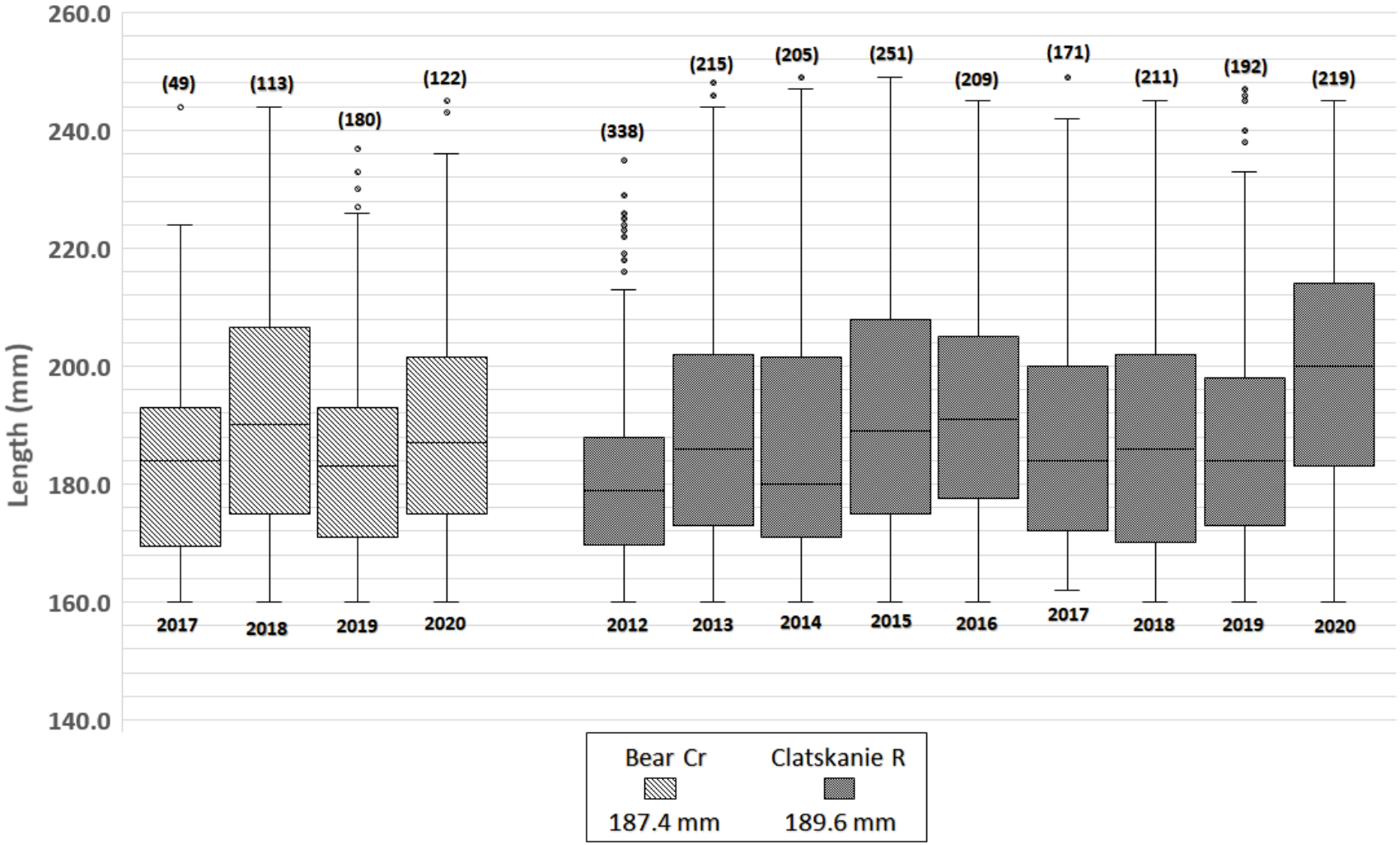

Figure A.25. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of 160–249 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean 160–249 mm Cutthroat Trout length for all years sampled at each site is shown in the legend. The total number of trout measured for all years sampled at each site is shown in parentheses.

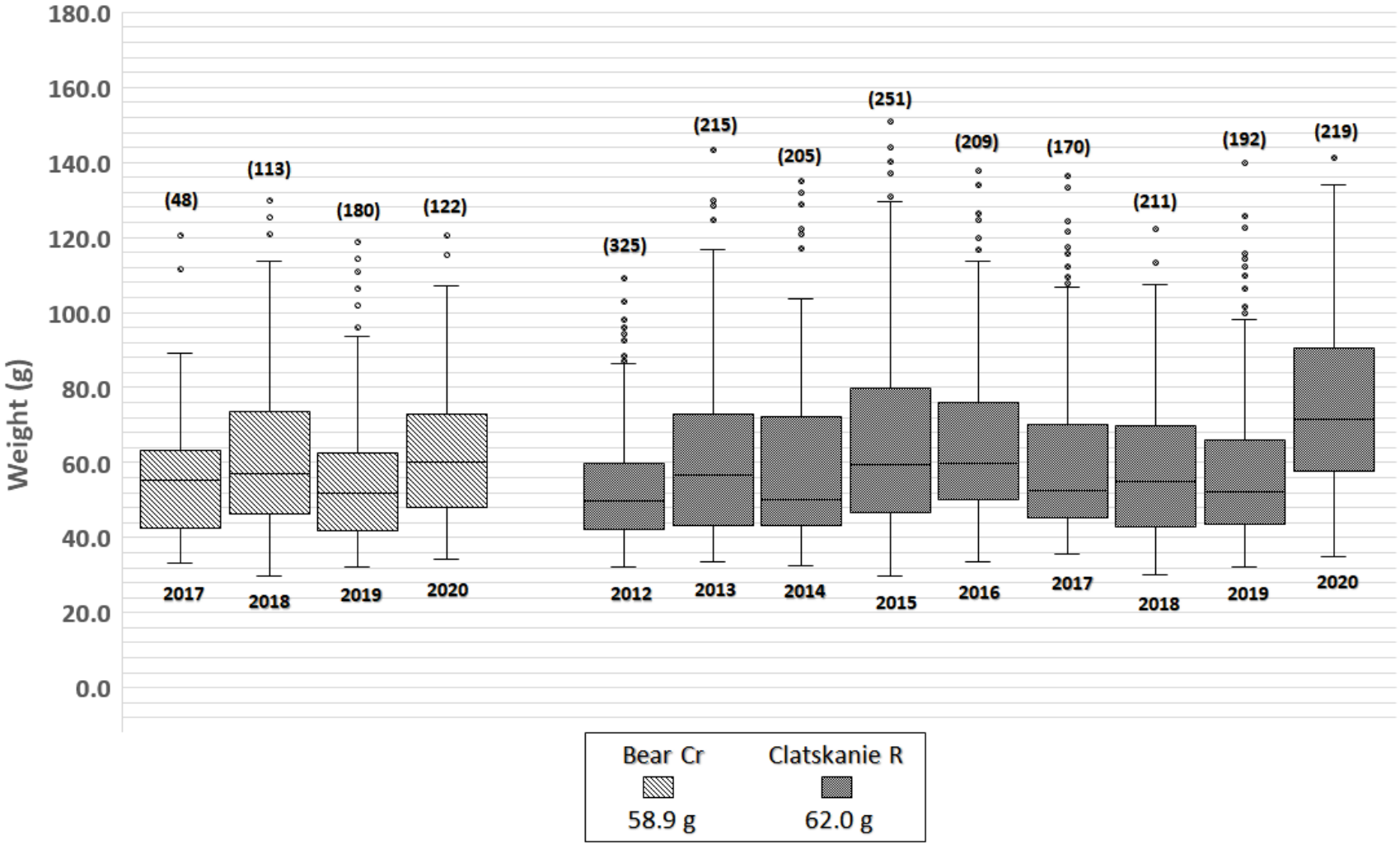

Figure A.26. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of 160–249 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean 160–249 mm Cutthroat Trout weight for all years sampled at each site is shown in the legend. The total number of trout weighed for all years sampled at each site is shown in parentheses.

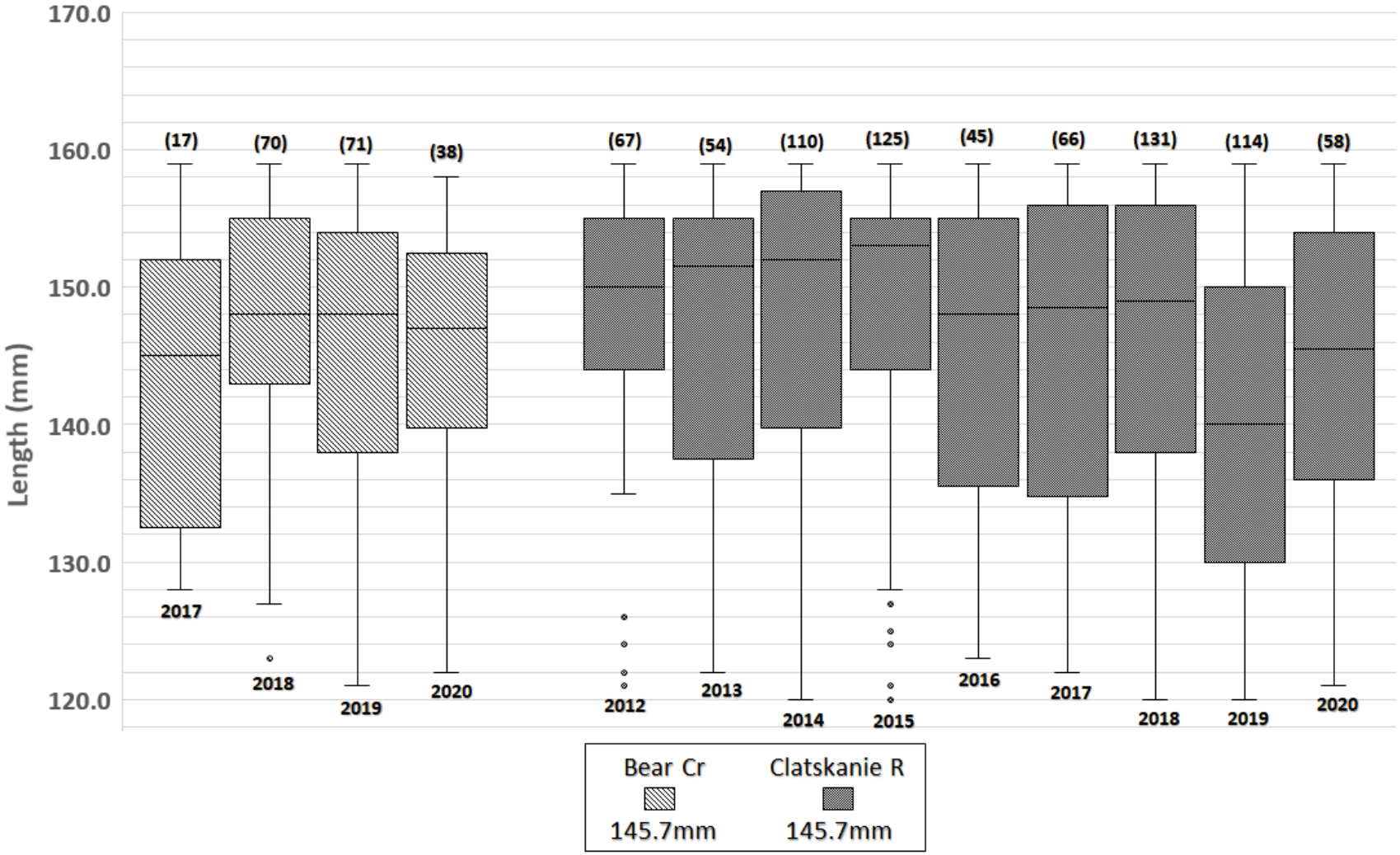

Figure A.27. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) length (mm) of 120–159 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps operated in Bear Creek and Clatskanie River from 2012–2020. Dots represent lengths > 1.5 times interquartile range (i.e., outliers). Mean 120–159 mm Cutthroat Trout length for all years sampled at each site is shown in the legend. The total number of trout measured for all years sampled at each site is shown in parentheses.

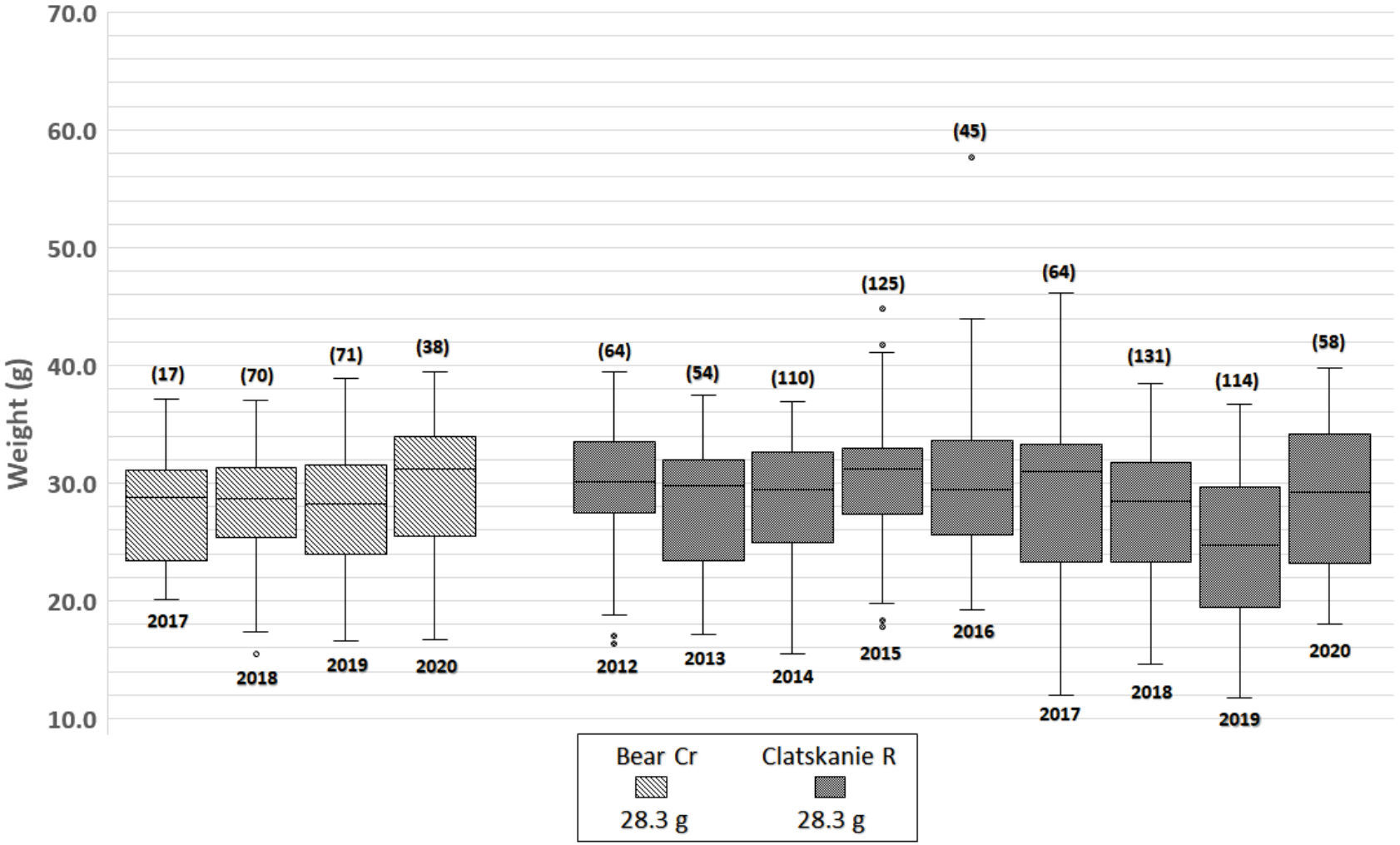

Figure A.28. Minimum (bottom whisker), 25th Percentile (box bottom), Median (middle bar), 75th Percentile (box top), and Maximum (top whisker) weight (g) of 120–159 mm Cutthroat Trout *Oncorhynchus clarkii clarkii* captured at juvenile traps in Bear Creek and Clatskanie River operated from 2012–2020. Dots represent weights > 1.5 times interquartile range (i.e., outliers). Mean 120–159 mm Cutthroat Trout weight for all years sampled at each site is shown in the legend. The total number of trout weighed for all years sampled at each site is shown in parentheses.

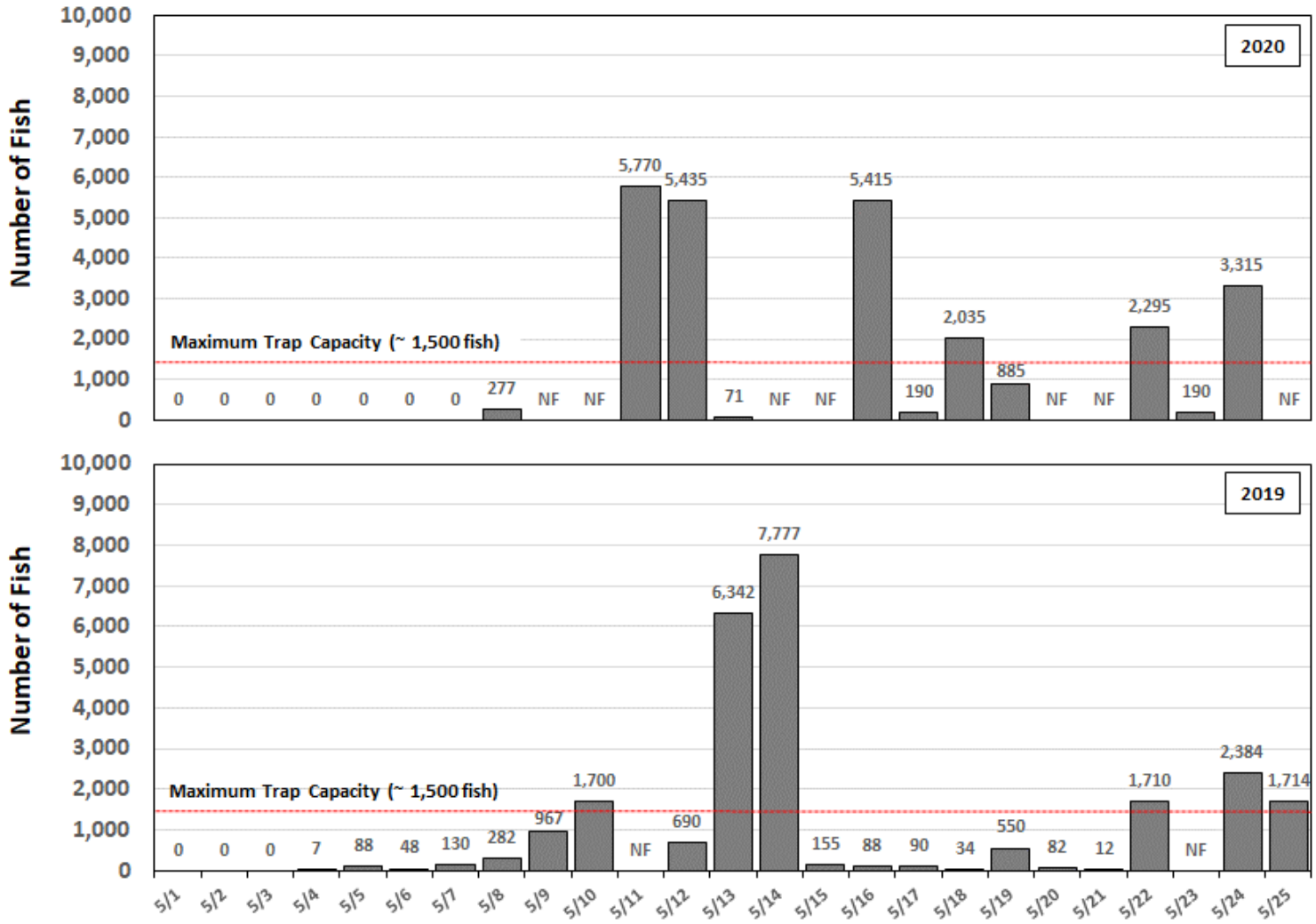

Figure A.29. Peamouth *Mylocheilus caurinus* catch by date for the 2019 and 2020 trapping seasons. The red horizontal line shows the approximate maximum capacity of the trap before overcrowding mortalities will occur if overnight checks are not employed. Dates with "NF" indicates trap was not fishing and no catch is available.