

# **SOUTH DAKOTA STATEWIDE FISHERIES SURVEY**

**2102-F21-R-45**

**Survey Location: Box Elder Creek**

**Survey Dates: June 15 – 22, 2012**

**County(ies): Pennington, Meade and Lawrence**

## **Introduction**

The Box Elder Creek watershed lies between the Elk Creek and Rapid Creek watersheds. The headwaters of Box Elder Creek's Forks lie west of Custer Crossing off of Highway 385. The creek flows east through the north-west end of Rapid City and drains into the Cheyenne River south of Wasta, SD. This watershed is in a pine/spruce forest and managed by the United States Forest Service (USFS). As with the rest of the Black Hills, many USFS roads cut through the watershed with a few houses and ranches present. Boxelder Creek and its tributaries are managed under standard regulations with a daily limit of five trout (in any combination) with one allowed 14 inches or longer. Two lakes in the watershed are stocked with trout; Roubaix Lake on Middle Box Elder Creek and Reausaw Lake on Hay Creek.

## **Survey Methods**

Four reaches in Box Elder Creek were surveyed during June 2012. Three sites were chosen based on locations where sampling had occurred in the past (Figure 1). These were sites BOX 1 (below Steamboat Rock Picnic Area), BOX 7 at the Boxelder Forks Campground, and BOX 4, two km west of Hwy 385 on Benchmark Road. One more site was chosen that was thought to be a good representation of the creek in that area. Efforts were made to satisfy the assumptions: 1) the population is static, 2) capture probability remains constant across sampling periods, and 3) all fish in the population are equally vulnerable to capture (Van Den Avyle and Hayward 1999; Hayes et al. 2007). Block nets at the upstream and downstream boundaries were used to prevent fish from emigrating or immigrating within the sample site. Three passes were made with one or two backpack electrofishing units depending on width of stream, and captured fish were removed and held in holding cages between passes until processing. For all sites, captured fish were anesthetized with carbon dioxide (made by mixing glacial acetic acid and baking soda in water), measured to the nearest millimeter (mm), weighed to the nearest gram (g), held in recovery cages, and returned to the stream. Data was entered into Coldstream database. The Coldstream database was used to calculate parameters such as population estimates of fish per 100 meters and estimated numbers of fish per acre. Calculations are based on depletion of fish numbers in each pass, and the catchability of fish within each site.

In addition to fish data; pH, temperature, and specific conductance were measured and recorded. Stream widths were measured every ten meters and averaged to obtain an estimate of total area sampled.



Figure 1: Map of Boxelder Creek Watershed with 2012 survey sites depicted.

## Results and Discussion

The Black Hills received less than average amounts of spring and summer moisture during 2012 (NOAA 2013). This was after four consecutive years with above average moisture. Box Elder Creek's mean monthly flow at the USGS gauging station near the town of Nemo, SD is  $1.6 \text{ m}^3/\text{s}$  (58 cfs) for June (1970-2012); whereas, the June mean monthly flow in 2012 was  $0.17 \text{ m}^3/\text{s}$  (5.9 cfs). These changing conditions have likely had an effect on the Boxelder Creek fishery.

Eight species of fish were captured in Box Elder Creek during 2012 sampling (Table 1). The most abundant species in the watershed was longnose dace (*Rhinichthys cataractae*). From a game fish perspective, the creek appears to switch from a brown trout (*Salmo trutta*) fishery to a brook trout (*Salvelinus fontinalis*) fishery with upstream progression. Other species found were mountain sucker (*Catostomus platyrhynchus*), creek chub (*Semotilus atromaculatus*), stonecat (*Noturus flavus*), and black bullhead (*Ameiurus melas*). Trout species are the only ones discussed further in this report.

**Table 1.** Population estimate (number/100 m) of fish surveyed in Boxelder Creek during the 2012 survey. Sites are listed in upstream progression.

| Site            | BOX 1 | BOX 8 | BOX 7 | BOX 4 |
|-----------------|-------|-------|-------|-------|
| Brook trout     | 19    | 11    | 62    | 262   |
| Brown trout     | 51    | 49    | 65    | 0     |
| Longnose dace   | 815   | 245   | 795   | 131   |
| White sucker    | 5     | 143   | 1     | 0     |
| Mountain sucker | 16    | 40    | 78    | 5     |
| Creek chub      | 1     | 2     | 0     | 0     |
| Stone cat       | 95    | 50    | 0     | 0     |
| Black bullhead  | 0     | 1     | 0     | 0     |

*Brook trout* – Population estimates for brook trout generally increased with upstream progression in Box Elder Creek during the 2012 survey with 262 estimated at Site 4 (Table 2). This site met the criteria for a Class 1 brook trout fishery (>150 fish/acre  $\geq$ 200 mm). Site 7 met the criteria for a brook trout Class 2 fishery (25-150 fish/acre  $\geq$ 200mm).

Sites 1 and 4 were surveyed previously in 1993. During that survey, fish greater than 200 mm were more abundant in Site 1 with 40 estimated and less abundant in site 4 with 70 estimated. Estimates of brook trout greater than 200 mm were lower in 1993 with two and nine estimated in Sites 1 and 4, respectively.

**Table 2.** Population (number/100 m) and density (number/acre) estimates of brook trout by length (mm) in Boxelder Creek during the 2012 survey. Sites are listed in upstream progression.

| Site  | <200 mm/100 m | $\geq$ 200 mm/100 m | $\geq$ 200 mm/acre |
|-------|---------------|---------------------|--------------------|
| BOX 1 | 16            | 5                   | 24                 |
| BOX 8 | 8             | 3                   | 12                 |
| BOX 7 | 57            | 5                   | 31                 |
| BOX 4 | 244           | 16                  | 192                |

*Brown trout* – Population estimates for brown trout were greater in the lower sites during the 2012 Boxelder Creek survey with none surveyed in the uppermost site (Table 3). Sites 1 and 8 met the criteria for a Class 2 brown trout fishery (25-150 fish/acre  $\geq$ 200 mm). When Site 1 was sampled in 1993 there were fewer brown trout surveyed with only eight fish greater than 200 mm.

**Table 3.** Population (number/100 m) and density (number/acre) estimates of brown trout by length (mm) in Boxelder Creek during the 2012 survey. Segments are listed in upstream progression.

| Site  | <200 mm/100 m | ≥200 mm/100 m | ≥200 mm/acre |
|-------|---------------|---------------|--------------|
| BOX 1 | 35            | 16            | 76           |
| BOX 8 | 28            | 20            | 79           |
| BOX 7 | 63            | 1             | 6            |
| BOX 4 | 0             | 0             | 0            |

*Other species-* Six species other than trout were surveyed in Boxelder Creek in 2012 (Table 1). Longnose dace, a native species, were the most abundant fish and were found at all sites. White suckers were found at Sites 1, 8, and 7. They are also a native fish found in many Black Hills streams. Mountain suckers are another native fish and have been designated a species of greatest conservation need in South Dakota with their population shown to be in decline in the Black Hills. (See Schultz and Bertrand 2012 for further information). They were found in all sites sampled with the greatest abundance at Site 7. Stonecat, another native species, were found at the two lower sites in Boxelder Creek in 2012. This is one of the few places where they have been sampled in the Black Hills. Creek chubs and black bullhead were also detected with just a few sampled.

#### Literature Cited

- Hayes, D. B., J. R. Bence, T. J. Kwak, and B. E. Thompson. 2007. Abundance, biomass, and production. Pages 327-374 in C. S. Guy and M. L. Brown, editors. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.
- NOAA UNR Webmaster . (Feb 10th 2013). Local Climate Information. Reviewed Feb. 12, 2013, from NOAA's National Weather Service Weather Forecast Office, Rapid City, SD. <<http://www.nws.noaa.gov/climate/index.php?wfo=unr>>
- Schultz, L. D., and K. N. Bertrand. 2012. Long term trends and outlook for mountain sucker in the Black Hills of South Dakota. American Midland Naturalist 167: 96–110. 19-NRM
- USGS Real-Time Water Data for South Dakota. January 08, 2013. US. Department of the Interior, U.S. Geological Survey. Reviewed Feb. 12, 2013. <<http://waterdata.usgs.gov/sd/nwis/rt>>.
- Van Den Avyle, M. J. and R. S. Hayward. 1999. Dynamics of exploited fish populations. Pages 127-166 in C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Appendix A. Population and Biomass Estimates for Rapid Creek in the 2012 survey.

Table 1. Population and Biomass Estimates for Boxelder Creek.

|  |  |                           |                              |
|--|--|---------------------------|------------------------------|
| Site Number: 1   | Survey Completed by: South Dakota Game, Fish and Parks | Date Sampled: 20 JUN 2012 | Conductivity (umhos): 320    |
| Site Description: 1- Steamboat Rock Camp (1984 site 9) |  | Site Length (m): 100      | pH: 8.4                      |
| Legal Description: S1,R5E,T2N                          |  | Mean Width (m): 8.5       | Water Temperature (°C): 18.2 |
| Stream Classification: BKT3 BNT2                       |  | Number of Passes: 3       | Air Temperature (°C): ****   |

| Species         | Size Class | Total Number Captured | Est. # in site | Lower 95% CI | Upper 95% CI | # per hectare | Kg per hectare | # per Km | # per acre | lb. per acre | # per mile | Mean Length (mm) | Mean Weight (grams) | Mean Fulton K-factor |
|-----------------|------------|-----------------------|----------------|--------------|--------------|---------------|----------------|----------|------------|--------------|------------|------------------|---------------------|----------------------|
| Brook Trout     | <200 mm    | 13                    | 16             | 13           | 26           | 187           | 7.04           | 160      | 76         | 6.28         | 257        | 153.8            | 37.5                | 1.00                 |
| Brook Trout     | ≥200 mm    | 5                     | 5              | 5            | 5            | 59            | 6.17           | 50       | 24         | 5.51         | 80         | 211.6            | 105.4               | 1.11                 |
| Brook Trout     | ALL        | 18                    | 19             | 18           | 23           | 223           | 12.55          | 190      | 90         | 11.21        | 306        | 169.9            | 56.4                | 1.03                 |
| Brown Trout     | <200 mm    | 34                    | 35             | 34           | 39           | 410           | 23.94          | 350      | 166        | 21.38        | 563        | 98.3             | 58.4                | 1.13                 |
| Brown Trout     | ≥200 mm    | 16                    | 16             | 16           | 16           | 187           | 31.38          | 160      | 76         | 28.02        | 257        | 253.9            | 167.4               | 1.01                 |
| Brown Trout     | ALL        | 50                    | 51             | 50           | 54           | 597           | 74.98          | 510      | 242        | 66.95        | 821        | 152.4            | 125.5               | 1.06                 |
| Creek Chub      | ALL        | 1                     | 1              | 1            | 2            | 12            | 0.36           | 10       | 5          | 0.32         | 16         | 112.0            | 31.0                | 2.21                 |
| Mountain Sucker | ALL        | 16                    | 16             | 16           | 17           | 187           | 5.96           | 160      | 76         | 5.32         | 257        | 138.9            | 31.8                | 1.08                 |
| Stone Cat       | ALL        | 19                    | 95             | 19           | 744          | 1,113         | 30.93          | 950      | 451        | 27.61        | 1,529      | 139.4            | 27.8                | 1.01                 |
| White Sucker    | ALL        | 5                     | 5              | 5            | 7            | 59            | 1.22           | 50       | 24         | 1.09         | 80         | 116.2            | 20.8                | 1.04                 |
| Longnose Dace   | ALL        | 167                   | 815            | 167          | 2,585        | 9,547         | ***            | 8,150    | 3,867      | ***          | 13,113     | ***              | ***                 | ***                  |

|  |  |                           |                              |
|--|--|---------------------------|------------------------------|
| Site Number: 4   | Survey Completed by: South Dakota Game, Fish and Parks | Date Sampled: 15 JUN 2012 | Conductivity (umhos): 225    |
| Site Description: 4- 1 mile above Benchmark/Nemo Road Junction |  | Site Length (m): 100      | pH: 8.5                      |
| Legal Description: S11,R4E,T3N                                 |  | Mean Width (m): 3.4       | Water Temperature (°C): 19.9 |
| Stream Classification: BKT1                                    |  | Number of Passes: 3       | Air Temperature (°C): ****   |

| Species         | Size Class | Total Number Captured | Est. # in site | Lower 95% CI | Upper 95% CI | # per hectare | Kg per hectare | # per Km | # per acre | lb. per acre | # per mile | Mean Length (mm) | Mean Weight (grams) | Mean Fulton K-factor |
|-----------------|------------|-----------------------|----------------|--------------|--------------|---------------|----------------|----------|------------|--------------|------------|------------------|---------------------|----------------------|
| Brook Trout     | <200 mm    | 211                   | 244            | 219          | 269          | 7,235         | 206.09         | 2,440    | 2,930      | 184.01       | 3,926      | 130.1            | 28.5                | 1.12                 |
| Brook Trout     | ≥200 mm    | 13                    | 16             | 13           | 26           | 474           | 46.75          | 160      | 192        | 41.74        | 257        | 210.5            | 98.5                | 1.05                 |
| Brook Trout     | ALL        | 224                   | 262            | 235          | 289          | 7,768         | 263.65         | 2,620    | 3,146      | 235.41       | 4,216      | 134.8            | 33.9                | 1.12                 |
| Mountain Sucker | ALL        | 5                     | 6              | 5            | 13           | 178           | 8.93           | 60       | 72         | 7.97         | 97         | 167.8            | 50.2                | 1.07                 |
| Longnose Dace   | ALL        | 130                   | 154            | 131          | 177          | 4,566         | ***            | 1,540    | 1,849      | ***          | 2,478      | ***              | ***                 | ***                  |

Population and Biomass Estimates for Boxelder Creek. (Continued)

Site Number: 7      Survey Completed by: South Dakota Game, Fish and Parks  
 Site Description: 7 -(1980s site 5) just below conf w/ S. Boxelder Crk  
 Legal Description: S00,R00E,T  
 Stream Classification: BKT2 BNT3

Date Sampled: 20 JUN 2012      Conductivity (µmhos): 262  
 Site Length (m): 100      pH: 8.6  
 Mean Width (m): 6.6      Water Temperature (°C): 18.6  
 Number of Passes: 3      Air Temperature (°C): \*\*\*\*

| Species         | Size Class | Total Number Captured | Est. # in site | Lower 95% CI | Upper 95% CI | # per hectare | Kg per hectare | # per Km | # per acre | lb. per acre | # per mile | Mean Length (mm) | Mean Weight (grams) | Mean Fulton K-factor |
|-----------------|------------|-----------------------|----------------|--------------|--------------|---------------|----------------|----------|------------|--------------|------------|------------------|---------------------|----------------------|
| Brook Trout     | <200 mm    | 57                    | 57             | 57           | 58           | 859           | 28.86          | 570      | 348        | 25.76        | 917        | 142.7            | 33.6                | 1.09                 |
| Brook Trout     | ≥200 mm    | 5                     | 5              | 5            | 5            | 75            | 7.81           | 50       | 31         | 6.97         | 80         | 209.8            | 103.6               | 1.12                 |
| Brook Trout     | ALL        | 62                    | 62             | 62           | 63           | 934           | 36.66          | 620      | 378        | 32.73        | 998        | 148.1            | 39.2                | 1.09                 |
| Brown Trout     | <200 mm    | 51                    | 63             | 51           | 81           | 949           | 46.41          | 630      | 384        | 41.44        | 1,014      | 79.3             | 48.9                | 1.09                 |
| Brown Trout     | ≥200 mm    | 1                     | 1              | 1            | 2            | 15            | 2.56           | 10       | 6          | 2.29         | 16         | 250.0            | 170.0               | 1.09                 |
| Brown Trout     | ALL        | 52                    | 65             | 52           | 85           | 979           | 59.75          | 650      | 397        | 53.35        | 1,046      | 82.6             | 61.0                | 1.09                 |
| Mountain Sucker | ALL        | 49                    | 78             | 49           | 130          | 1,175         | 51.79          | 780      | 476        | 46.24        | 1,255      | 152.9            | 44.1                | 1.10                 |
| White Sucker    | ALL        | 1                     | 1              | 1            | 5            | 15            | 0.80           | 10       | 6          | 0.71         | 16         | 160.0            | 53.0                | 1.29                 |
| Longnose Dace   | ALL        | 585                   | 795            | 700          | 890          | 11,979        | ***            | 7,950    | 4,852      | ***          | 12,792     | ***              | ***                 | ***                  |

Site Number: 8      Survey Completed by: South Dakota Game, Fish and Parks  
 Site Description: 8 Above Steamboat Picknic  
 Legal Description: S00,R00E,T  
 Stream Classification: BKT3 BNT2

Date Sampled: 22 JUN 2012      Conductivity (µmhos): 306  
 Site Length (m): 100      pH: 8.3  
 Mean Width (m): 10.2      Water Temperature (°C): \*\*\*\*  
 Number of Passes: 3      Air Temperature (°C): \*\*\*\*

| Species         | Size Class | Total Number Captured | Est. # in site | Lower 95% CI | Upper 95% CI | # per hectare | Kg per hectare | # per Km | # per acre | lb. per acre | # per mile | Mean Length (mm) | Mean Weight (grams) | Mean Fulton K-factor |
|-----------------|------------|-----------------------|----------------|--------------|--------------|---------------|----------------|----------|------------|--------------|------------|------------------|---------------------|----------------------|
| Black Bullhead  | ALL        | 1                     | 1              | 1            | 2            | 10            | 0.30           | 10       | 4          | 0.27         | 16         | 187.0            | 31.0                | 0.47                 |
| Brook Trout     | <200 mm    | 8                     | 8              | 8            | 9            | 79            | 3.13           | 80       | 32         | 2.79         | 129        | 138.6            | 39.8                | 0.98                 |
| Brook Trout     | ≥200 mm    | 3                     | 3              | 3            | 3            | 29            | 3.15           | 30       | 12         | 2.81         | 48         | 215.0            | 107.0               | 1.07                 |
| Brook Trout     | ALL        | 11                    | 11             | 11           | 12           | 108           | 6.72           | 110      | 44         | 6.00         | 177        | 159.5            | 62.2                | 1.01                 |
| Brown Trout     | <200 mm    | 25                    | 26             | 25           | 30           | 255           | 16.88          | 260      | 103        | 15.07        | 418        | 87.4             | 66.2                | 1.26                 |
| Brown Trout     | ≥200 mm    | 20                    | 21             | 20           | 25           | 206           | 51.05          | 210      | 83         | 45.58        | 338        | 277.4            | 247.7               | 0.99                 |
| Brown Trout     | ALL        | 45                    | 49             | 45           | 56           | 481           | 97.29          | 490      | 195        | 86.86        | 788        | 173.8            | 202.3               | 1.06                 |
| Creek Chub      | ALL        | 2                     | 2              | 2            | 3            | 20            | 0.37           | 20       | 8          | 0.33         | 32         | 130.5            | 19.0                | 0.85                 |
| Mountain Sucker | ALL        | 9                     | 40             | 9            | 380          | 393           | 9.59           | 400      | 159        | 8.56         | 644        | 140.4            | 24.4                | 0.94                 |
| Stone Cat       | ALL        | 10                    | 50             | 10           | 542          | 491           | 15.95          | 500      | 199        | 14.24        | 805        | 150.4            | 32.5                | 0.93                 |
| White Sucker    | ALL        | 125                   | 143            | 125          | 161          | 1,403         | 198.27         | 1,430    | 568        | 177.03       | 2,301      | 178.5            | 141.3               | 1.14                 |
| Longnose Dace   | ALL        | 49                    | 245            | 49           | 1,279        | 2,404         | ***            | 2,450    | 974        | ***          | 3,942      | ***              | ***                 | ***                  |