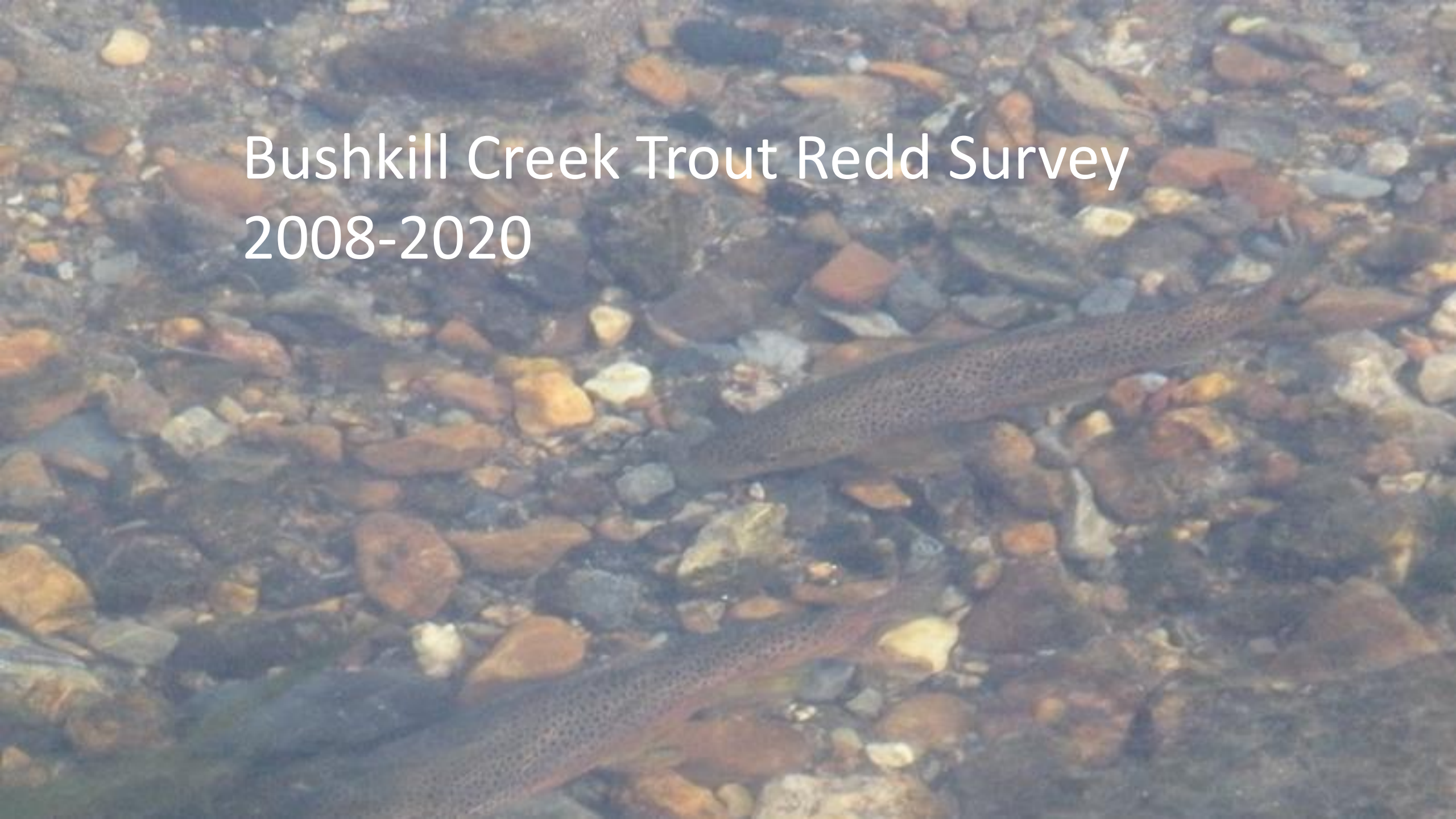
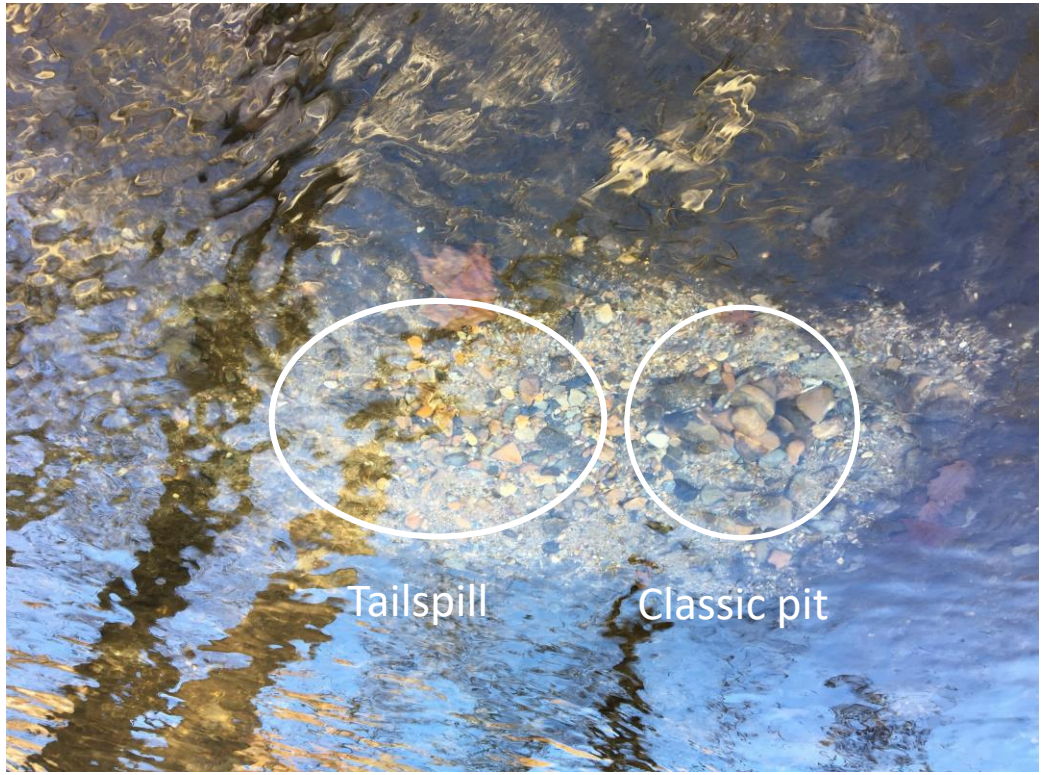


Bushkill Creek Trout Redd Survey 2008-2020

Identifying Redds

Redd construction includes the excavation of an initial pit, laying and fertilizing the eggs within the pit, and covering the eggs by the female with loose gravels. This process creates a “classic pit and tailspill”, which constitutes a fully formed redd or a Complete Redd (aka “true” redds) (Dunham and Rieman, 2001).



Timing

Table 4-1. Recommended timing for redd surveys

Species	Freestone streams North of I-80	Freestone streams South of I-80	Limestone streams North of I-80	Limestone streams South of I-80
Brook trout	Oct. 15 to Nov. 10	Oct. 15 to Nov. 15	Oct. 15 to Nov. 10	Oct. 20 to Nov. 15
Mixed brook and brown	Nov. 5 to Dec 1	Nov. 10 to Dec 5	Nov. 10 to Dec 1	Nov. 10 to Dec 10
Brown trout	Nov 10 to Dec 10	Nov 15 to Dec 15	Nov 15 to Dec 20	Nov 20 to Dec 31
Rainbow trout				

Redd surveys must be conducted after a significant amount (80-90%) of spawning has occurred.

Selection of redd sites by late spawners frequently is over top of existing redds.

Delay allows earlier redds to be colonized by periphyton, which causes them to blend into the surrounding stream bottom.

Pre-Survey Observations (5 control sites are checked periodically prior to actual survey to monitor progression of the spawning season to ensure majority of spawning has occurred prior to the count)

2020 Pre-Survey Observations

- November 10th. A trout was observed on a redd above Penn's Grant bridge. Redds were observed at Edgewood Avenue. No activity was observed at Pearl Street, Stocker Mill or Newlin's Mill.

- November 21st. Significant spawning had taken place at three of the control sites. Edgewood Avenue, Penn's Grant bridge and Newlin's Mill. Based on these observations and meteorological forecast, November 22nd was chosen for actual survey to be completed.

Where? Bushkill Creek, 3 Sections

Section 1: Extends approximately 0.9 miles from the bridge at Newlin's Mill Rd. (upper limit) to the bridge at Stocker Mill Rd. (lower limit).

Section 2: Extends approximately 0.5 miles from the bridge at Edgewood Ave. (upper limit) to the bridge at GJ Mills (lower limit).

Section 3: Extends approximately 0.75 miles from the bridge at Bushkill St. in Tatamy (upper limit) to the bridge at Newlin's Mill Rd. (lower limit).

When? November 22nd, 2020

No trout were present on any redds during the survey. Timing for the actual count in 2020 was optimal with excellent water clarity and lower flows between 97 and 142 cubic feet/second.

The PFBC protocol for conducting trout redd surveys was followed.

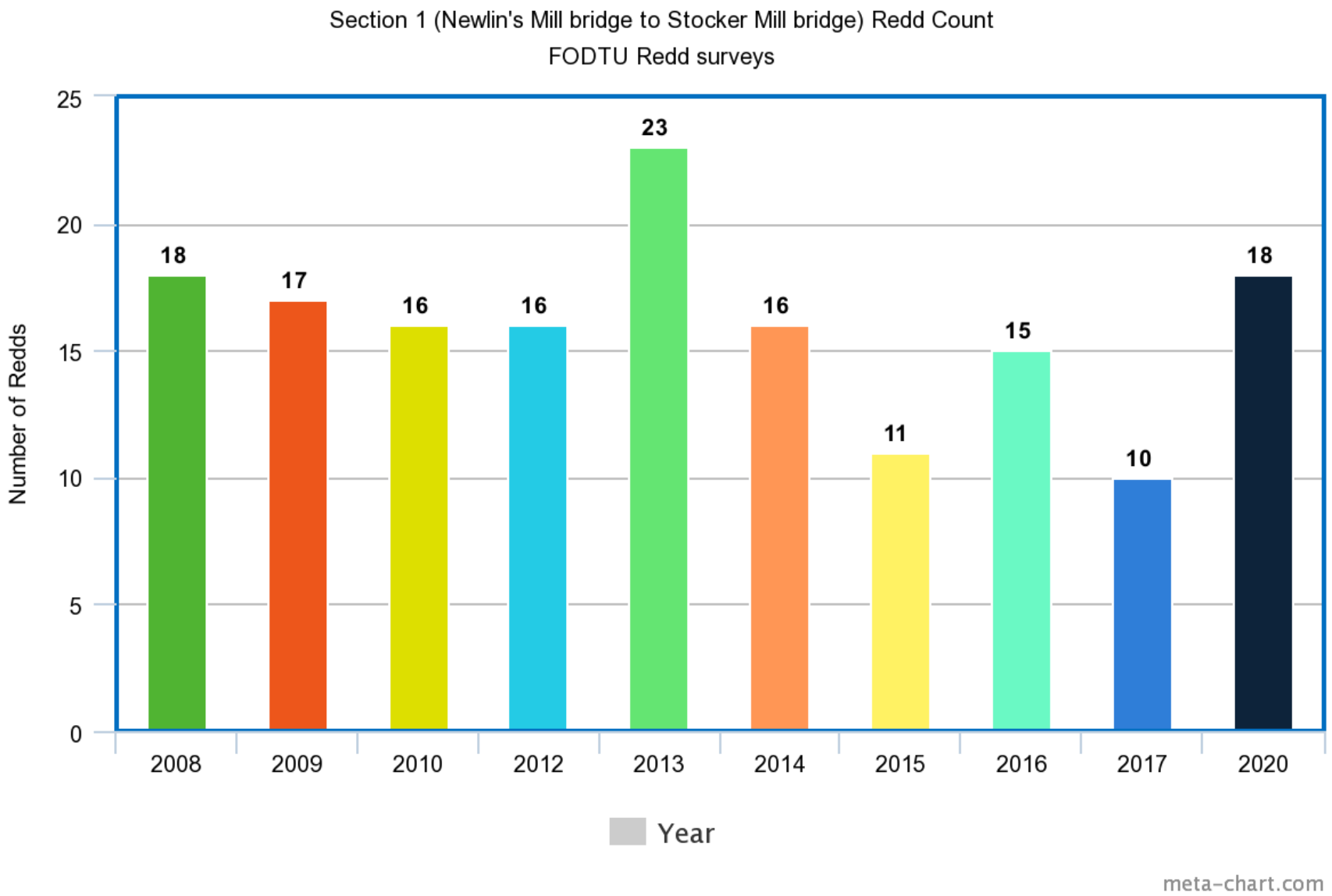
2020 Results:

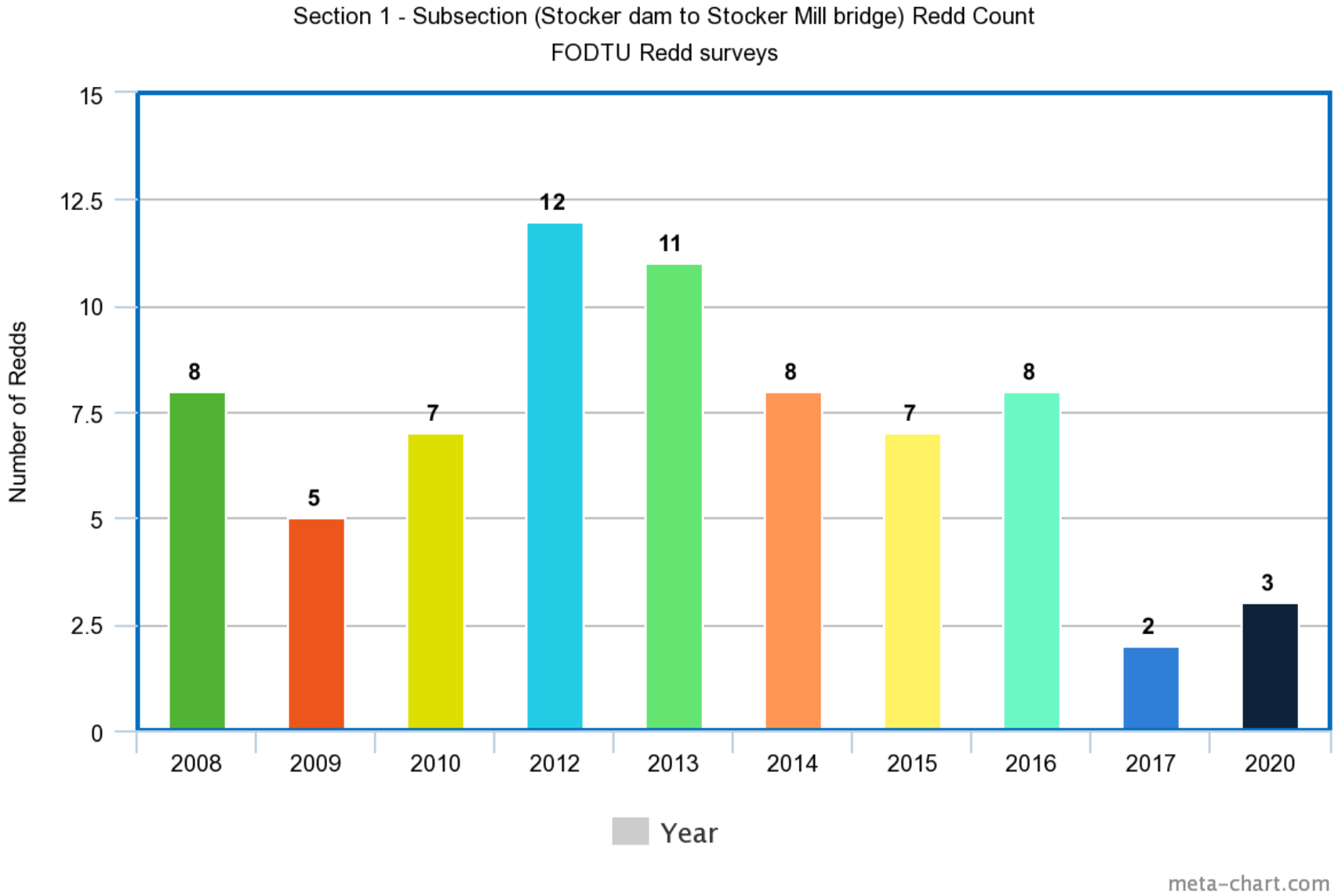
Section 1: 18 redds

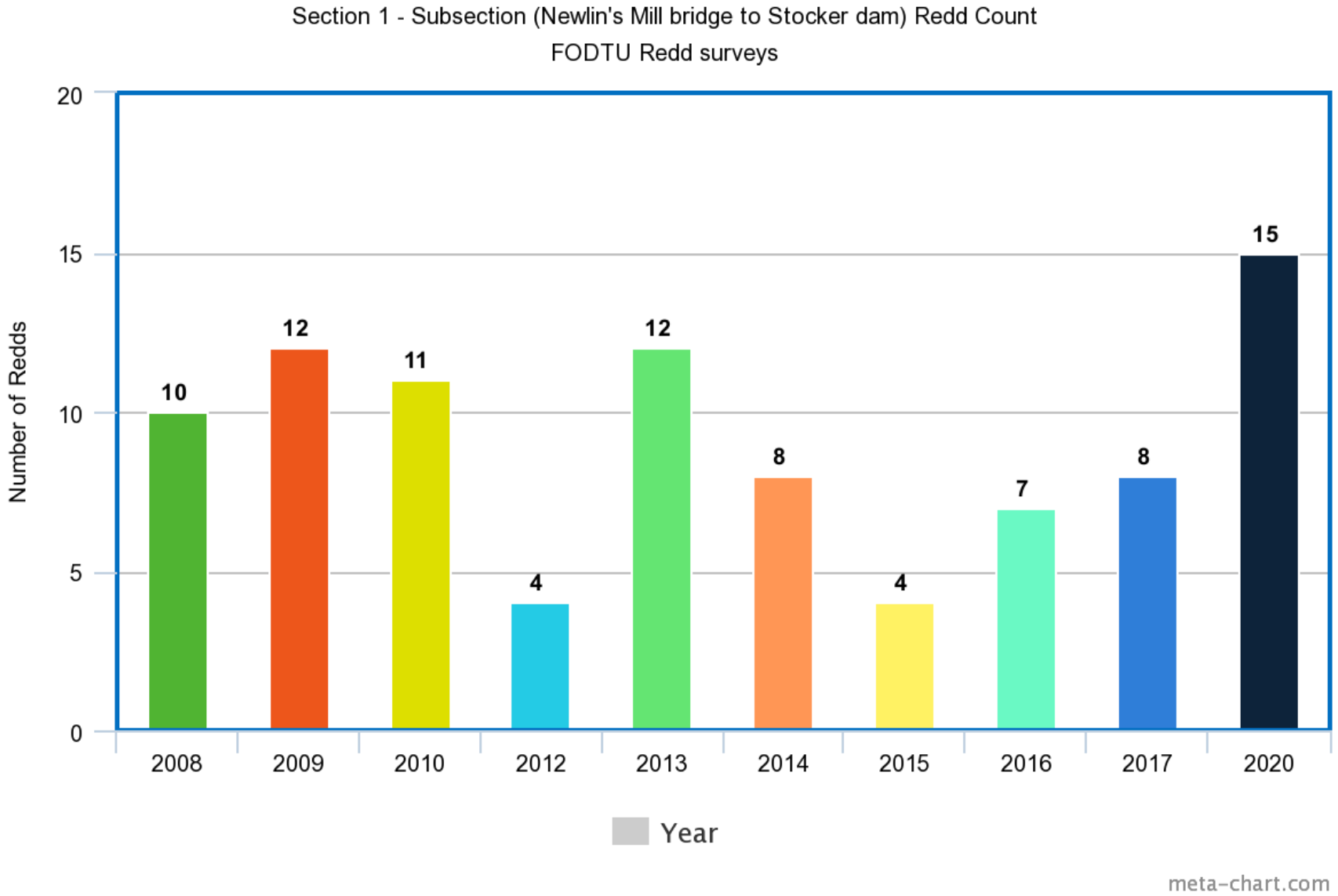
Section 2: 29 redds

Section 3: 12 redds

The actual number of redds is generally estimated at +/- 20 % of the field count.


Section 1 (Newlin's Mill bridge to Stocker Mill bridge) Redd Count
FODTU Redd surveys
Number of Redds
25
20
15
10
5
0
18
17
16
16
23
16
11
15
10
18
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com


Section 1 - Subsection (Stocker dam to Stocker Mill bridge) Redd Count
FODTU Redd surveys
Number of Redds
15
12.5
10
7.5
5
2.5
0
8
5
7
12
11
8
7
8
2
3
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com


Section 1 - Subsection (Newlin's Mill bridge to Stocker dam) Redd Count
FODTU Redd surveys
Number of Redds
20
15
10
5
0
10
12
11
4
12
8
4
7
8
15
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com

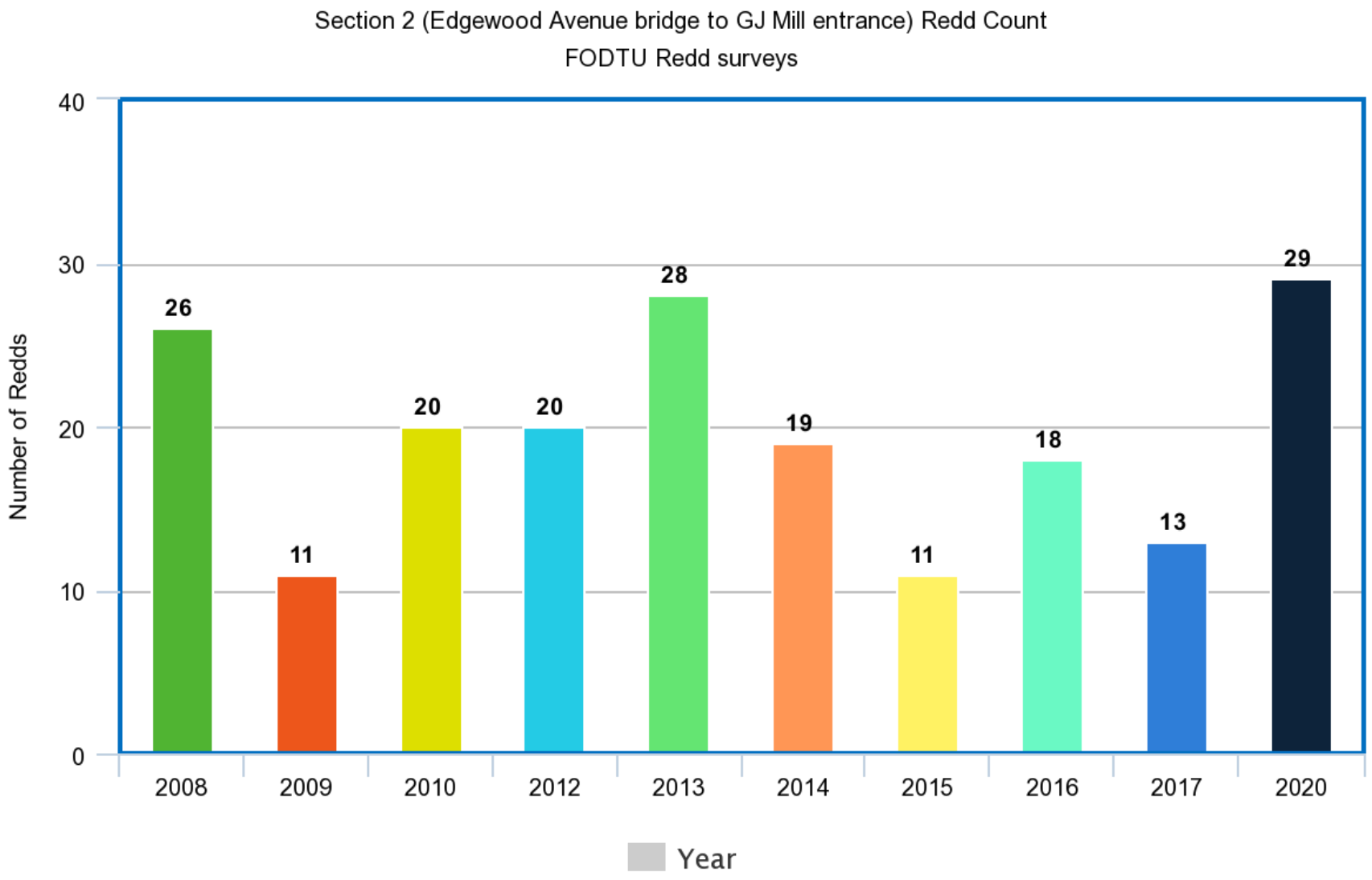
Section 1 Conclusions

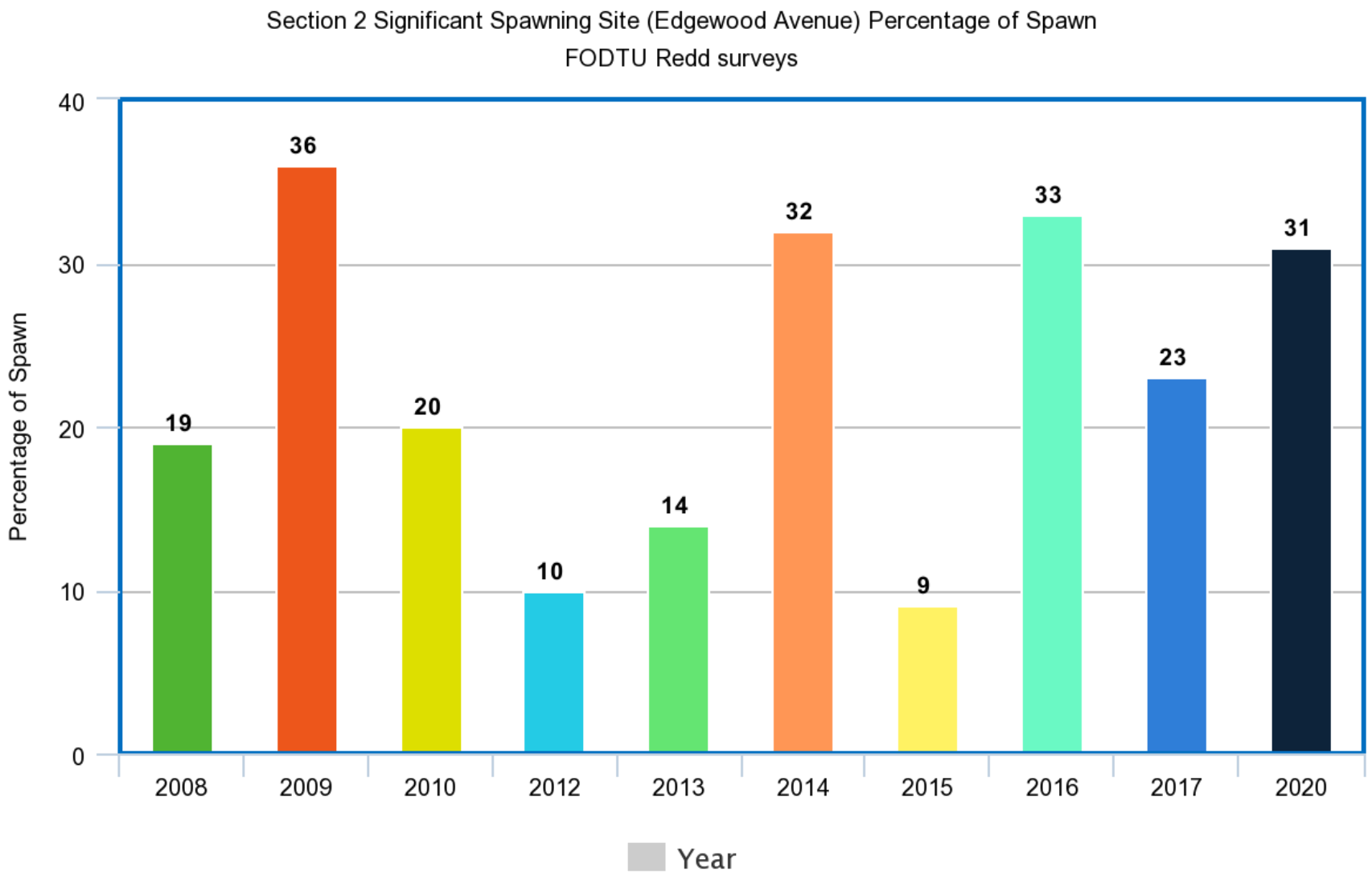
Results indicate a downward trend in number of redds between Stocker dam and Stocker Mill bridge from 2012 (peak) through 2020. Like 2017, there was a nominal number of redds from the gas line to Zucksville Road (a past significant spawning site) and no redds observed at Stocker Mill bridge. Is this indicative of a downward trend in redd production in this subsection or just a cyclical variation? Are the trout finding more suitable spawning habitat elsewhere?

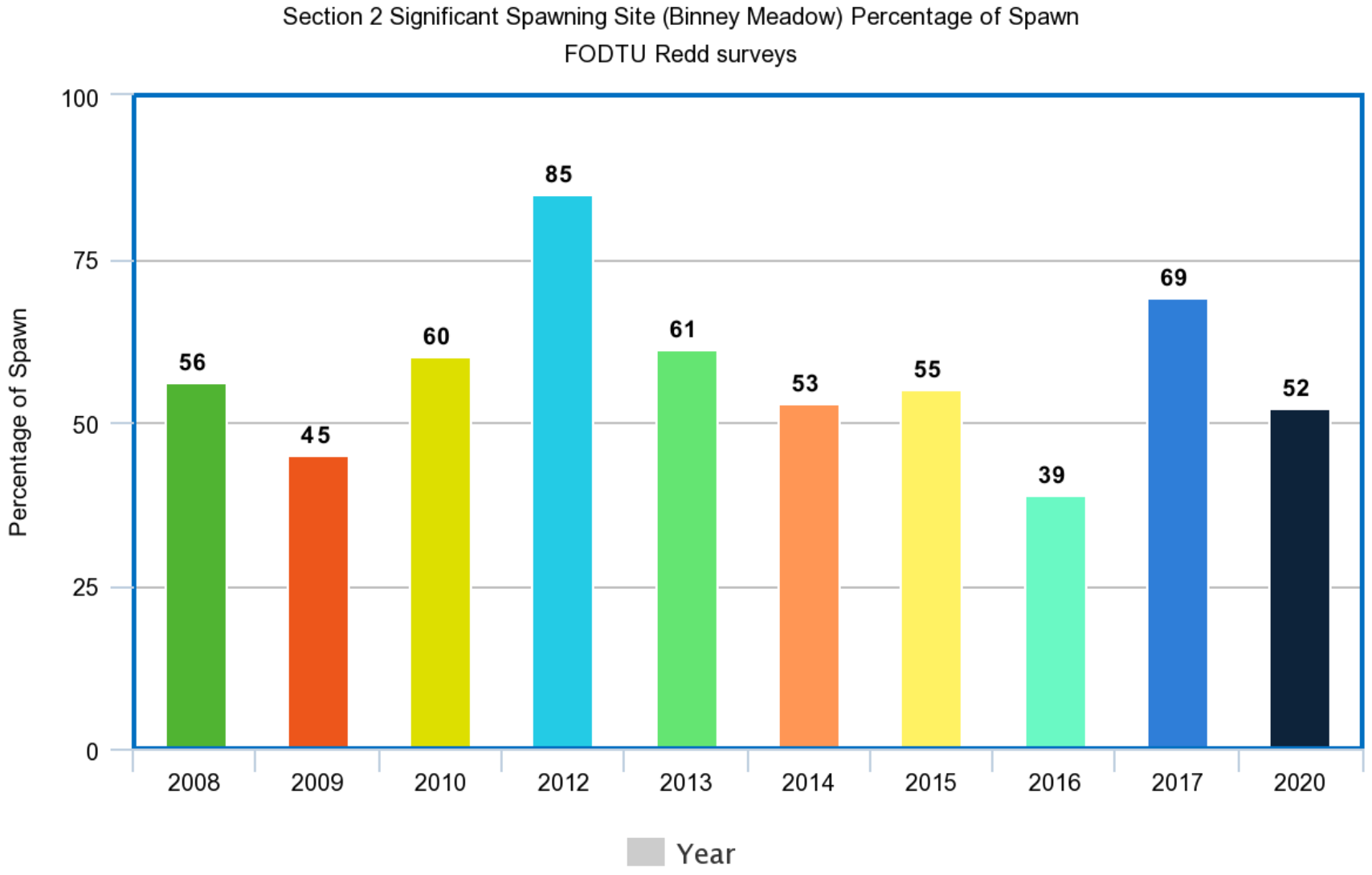
Results indicate an upward trend in number of redds from Newlin's Mill bridge to Stocker Mill bridge from 2012 onward.

The area above and directly below Penn's Grant Bridge (upstream from the Schoeneck Creek) was utilized again this year and is a dependable annual spawning site with 40% of the redds for Section 1 in 2017 and 28% in 2020.

Overall, the number of redds in section 1 have remained constant over time with a median of 16 redds.


Section 2 (Edgewood Avenue bridge to GJ Mill entrance) Redd Count
FODTU Redd surveys
Number of Redds
40
30
20
10
0
26
11
20
20
28
19
11
18
13
29
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com


Section 2 Significant Spawning Site (Edgewood Avenue) Percentage of Spawn
FODTU Redd surveys
Percentage of Spawn
40
30
20
10
0
19
36
20
10
14
32
9
33
23
31
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com


Section 2 Significant Spawning Site (Binney Meadow) Percentage of Spawn
FODTU Redd surveys
Percentage of Spawn
100
75
50
25
0
56
45
60
85
61
53
55
39
69
52
2008
2009
2010
2012
2013
2014
2015
2016
2017
2020
Year
meta-chart.com

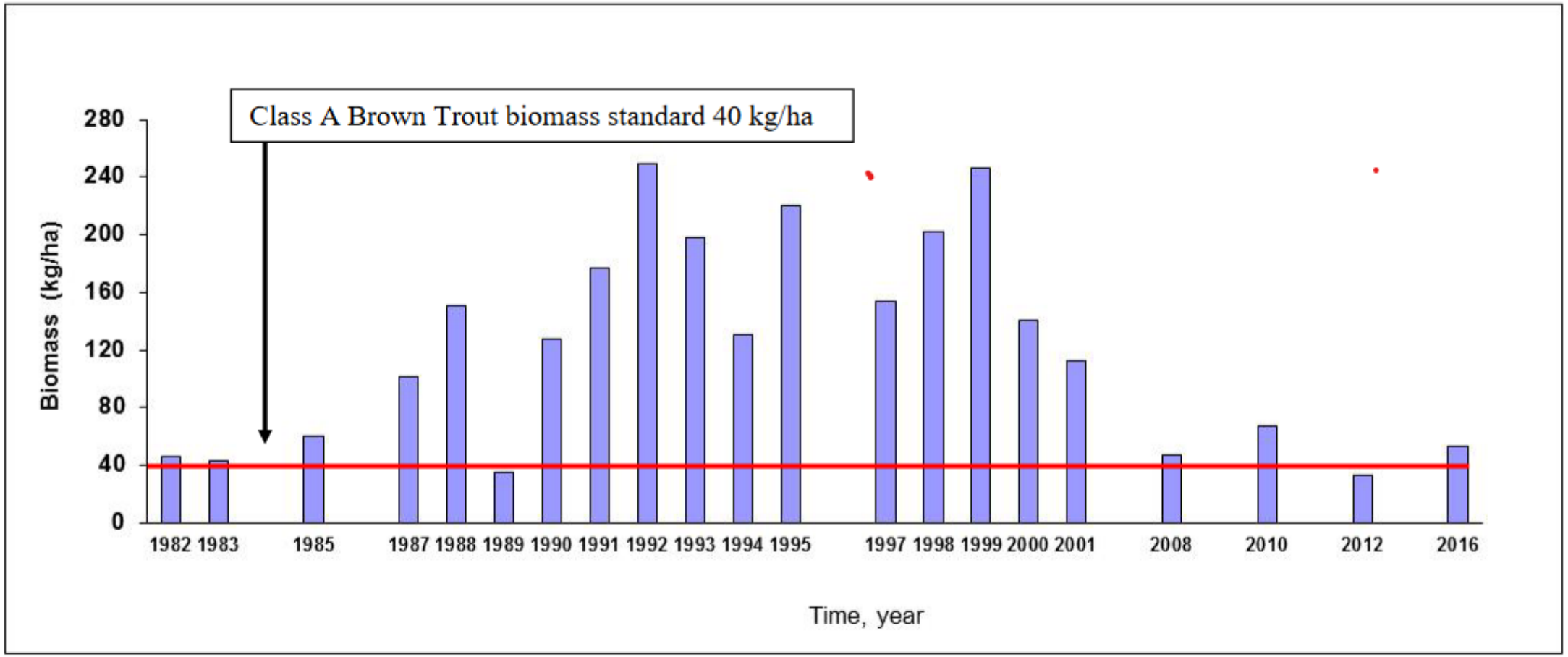


Figure 1. Time series of Brown Trout biomass estimates for Section 06 of Bushkill Creek from 1982 through 2016. Population assessments were not performed in 1984, 1986, 1996, from 2002 through 2007, 2009, 2011, and 2013 through 2015, which are noted on the X-axis as being unlisted or blank spaces between years listed.

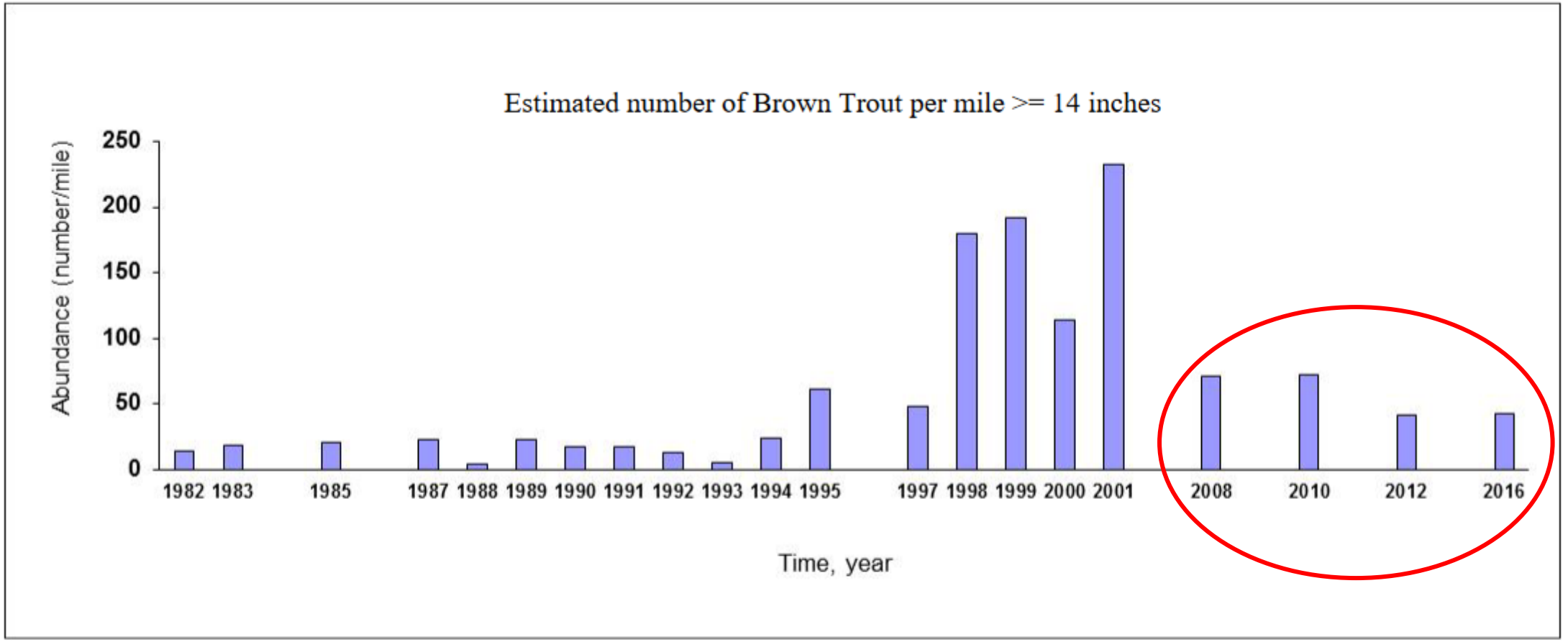
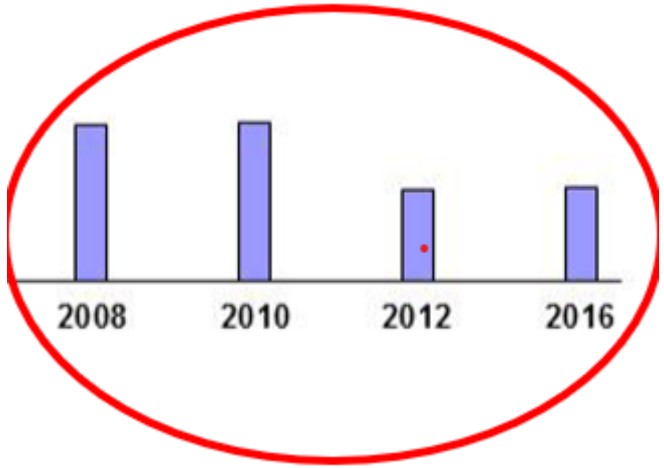
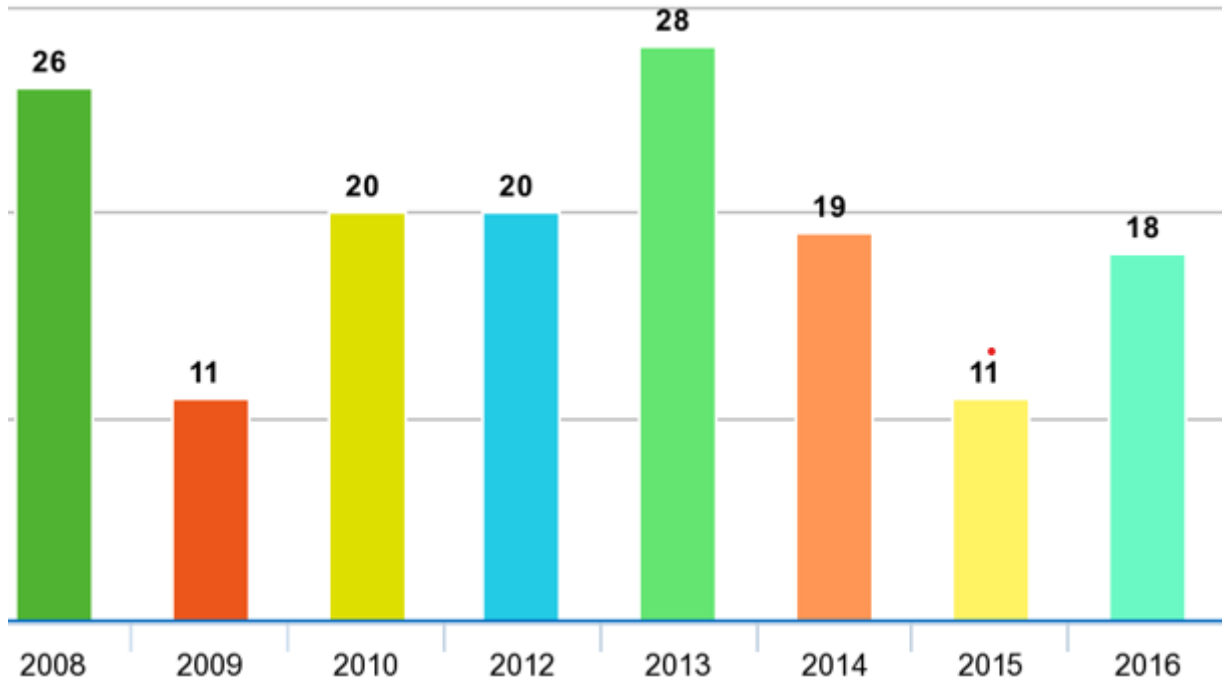


Figure 3. Comparison of the estimated number of Brown Trout per mile greater than 14 inches in total length for Section 06 of Bushkill Creek from 1982 through 2016. Population assessments were not performed in 1984, 1986, 1996, from 2002 through 2007, 2009, 2011, and 2013 through 2015, which are noted on the X-axis





2008 & 2010 combined = 46 redds

2012 & 2016 combined = 38 redds

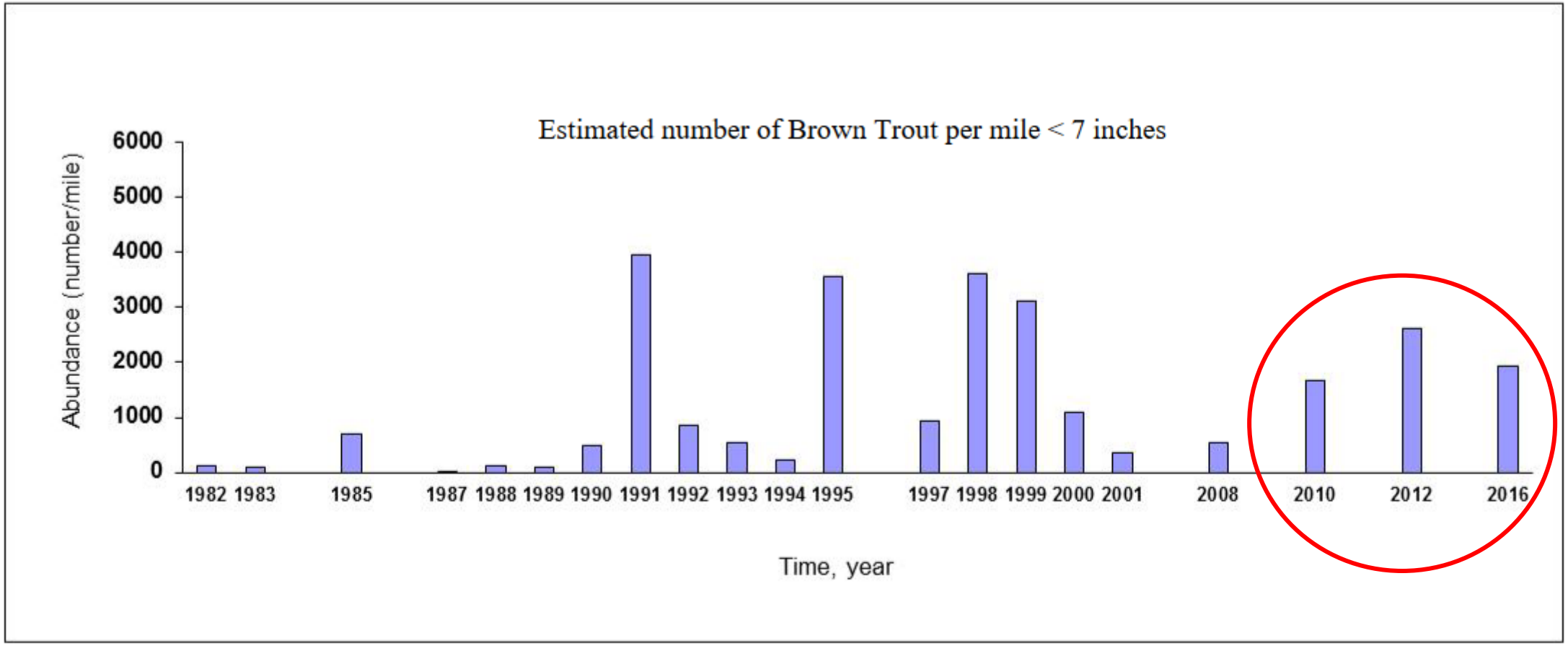
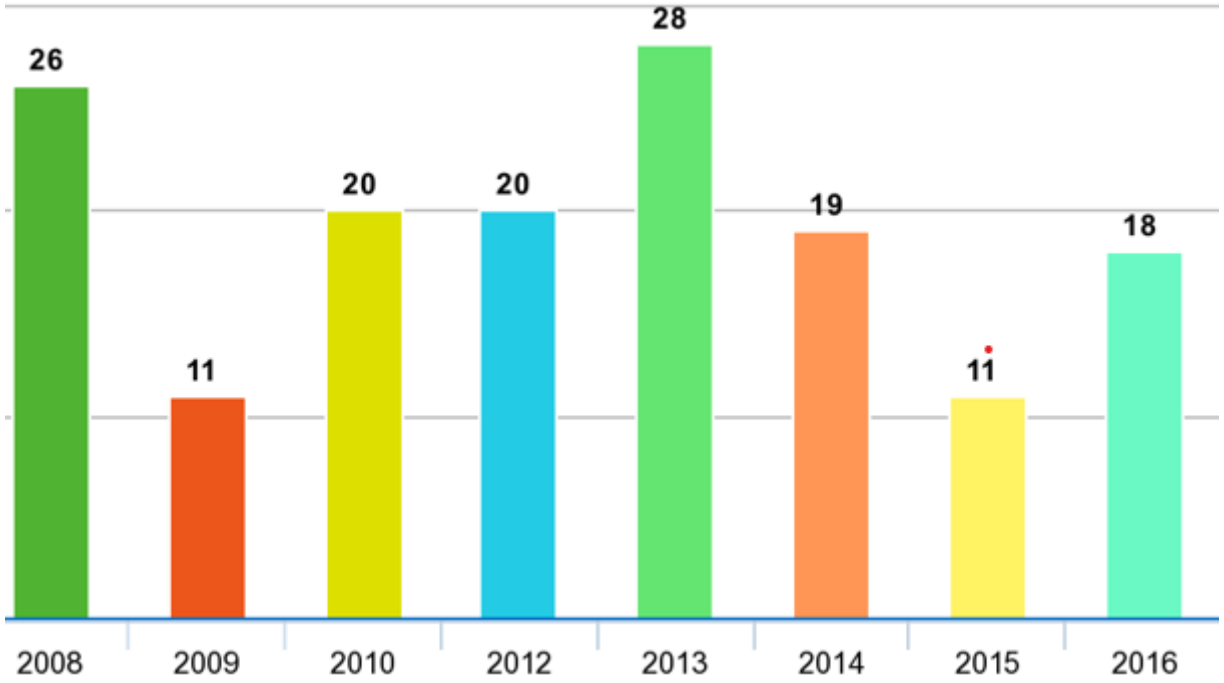


Figure 4. Comparison of the estimated number of Brown Trout per mile < 7 inches in total length for Section 06 of Bushkill Creek from 1982 through 2016. Population assessments were not performed in 1984, 1986, 1996, from 2002 through 2007, 2009, 2011, and 2013 through 2015, which are noted on the X-axis as being



2008 & 2009 combined = 37 redds

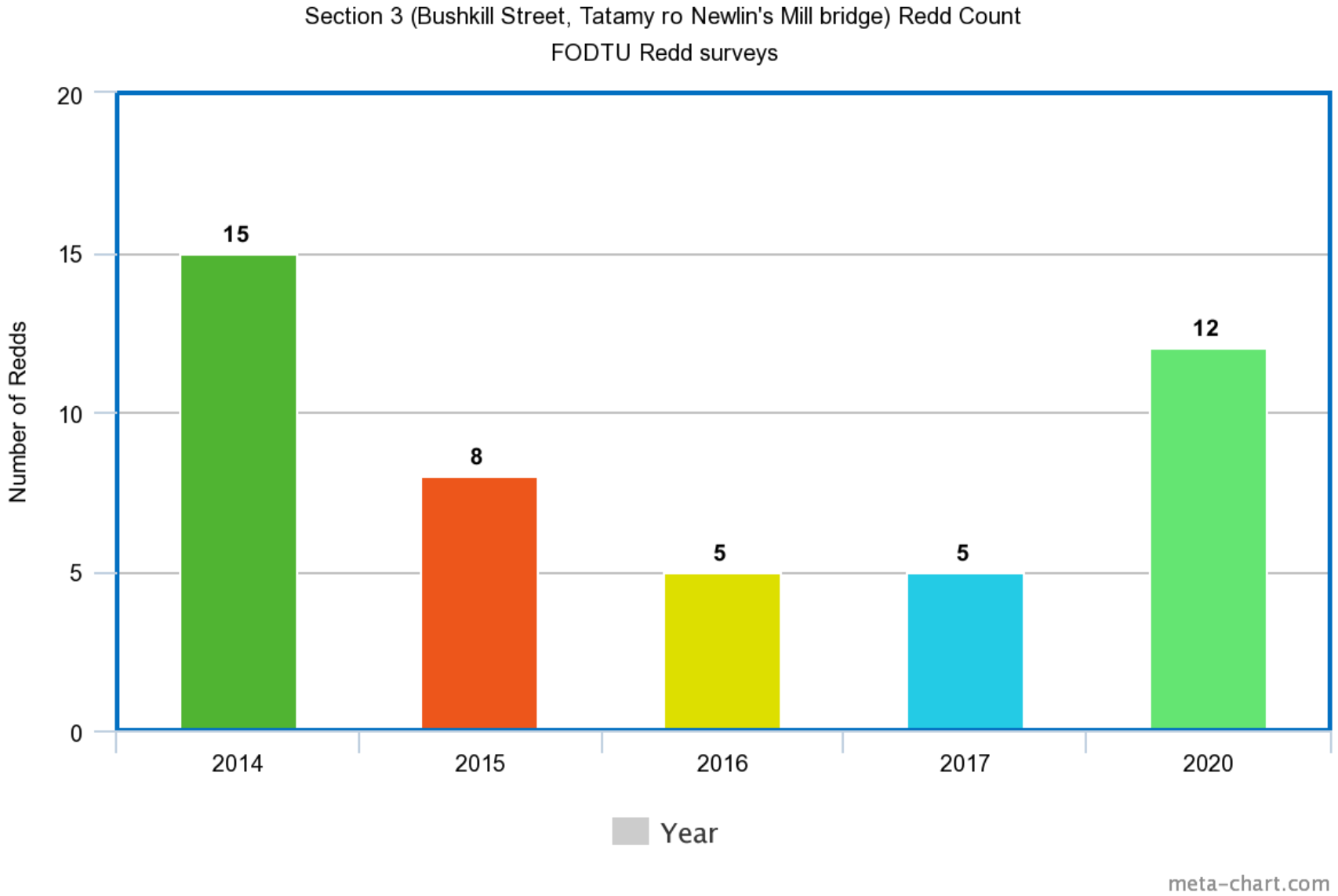
2014 & 2015 combined = 30 redds

*** Not enough data to draw any correlation***

Section 2 Conclusions

Of the three sections, section 2 seems more cyclical but also is the most prolific (median of 19.5 redds) with two significant spawning sites, Edgewood Avenue pool and Binney Meadow pool.

As a percentage of redd production (mean) Edgewood Avenue produces 23% of redds in this section with Binney Meadow a whopping 58%.


Section 3 (Bushkill Street, Tatamy ro Newlin's Mill bridge) Redd Count
FODTU Redd surveys
Number of Redds
20
15
10
5
0
15
8
5
5
12
2014
2015
2016
2017
2020
Year
meta-chart.com

Section 3 Conclusions

The redd count in 2020 was the second highest of the five surveys completed for this section. Compared to the other two sections, however, the redds appear smaller in section 3, indicating less suitable habitat. I did observe entrenched fine sediment in the substrate.

Section 3 has the most potential to be impacted by low flows. Low flow conditions, like on November 25th, 2017 due to a Buzzi Unicem extended pump shutdown, expose the trout to increased predation from herons and other fish eaters and jeopardizes the fertilized eggs which need oxygenated water flowing over them.

Recommendations

Habitat:

- Identify sources and causes of siltation from industrial, urban, and agricultural practices and develop remediation and restoration measures.

- Identify solutions to the dewatering of the Bushkill Creek.

- Implement habitat restoration plan in section 3 and track resulting redd production in future years.

Recommendations

Education:

- Educate the public about the importance of naturally reproducing wild trout and their role in a functioning ecosystem.

- Educate anglers to not disturb redds and to be careful wading during and after spawning season (mid-fall to late winter). Redds become increasingly difficult to identify as they blend in with the surrounding stream bottom due to colonization of periphyton.

- Implement educational signage at significant spawning sites.

- Continue annual trout redd surveys for these control sections, adding additional sections if possible, to identify additional significant spawning sites. Identify correlations between spawning activity (number of redds) and recruitment of juveniles (electro-fishing).