



Department of  
Environmental  
Conservation



# 2018 PROGRESS REPORT: CREEL SURVEY

**Delaware Tailwaters Fisheries Investigation Plan: A  
Joint Project of the New York State Department of  
Environmental Conservation and the Pennsylvania  
Fish and Boat Commission 2018-2020**

March 15, 2019

Delaware Tailwaters Fisheries Investigation Plan, 2018 - 2020  
Delaware Tailwaters Creel Survey Plan, 2018 - 2019  
2018 Progress Report Creel Survey  
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## Introduction

The New York City (NYC) reservoir tailwaters in the upper Delaware River Basin (Delaware Tailwaters) are an increasingly popular destination water for wild trout fishing. The New York State Department of Environmental Conservation (NYSDEC) and Pennsylvania Fish and Boat Commission (PFBC) have agreed supporting a Joint Fisheries Investigation Plan<sup>1</sup> (Plan). This Plan identifies information most urgently needed to inform a new fisheries management plan and a set of strategies to collaboratively obtain that information over the next three years, 2018 – 2020. A creel survey during the 2018 season was conducted to characterize the fishery-dependent aspect of the Delaware Tailwaters trout population<sup>2</sup>. Findings within this progress report are considered provisional and subject to modification pending additional analysis, scrutiny and review over the duration of the Plan lifespan.

## Methods

A roving-roving creel survey design was employed to collect angler catch and effort in the Delaware Tailwaters (Pollack *et al.* 1994). Three creel clerks canvassed the West Branch (Cannonsville Dam downriver to confluence with East Branch; 18 miles), East Branch (Pepacton Dam outlet to confluence with West Branch; 32 miles) and Delaware River (confluence East and West Branches downriver to Callicoon, NY; 27 miles); one creel clerk per river. Creel clerks collected angler use (i.e., from discrete vantage points) and angler catch, effort, and demographics (i.e., interview questionnaire) on each day of the census. Anglers interviewed before they were done fishing received a “catch card” to allow them to document the remainder of their trip. Survey period was defined from 1 April 2018 through 14 October 2018, (197 total days), corresponding to the opening and closing of trout season within New York State. Days included in the census, were all weekend (N = 57) and holidays (N = 4) and two randomly selected weekdays (N = 58), representing 60.4 % of the total days within the survey period. Either a morning or afternoon work shift was randomly (50 % probability for either) selected for each census day, with either work shift representing an 8-hour day creel clerks were on the water. Morning shifts started one hour prior to sunrise. Afternoon shifts ended one hour after sunset. Data presented in this progress report focuses solely on angler catch, effort and demographics gathered via the angler interviews conducted by the creel clerks. To improve the quality of estimates, information from catch cards was combined with the corresponding interviews to convert incomplete trips to completed trips wherever possible. Without these catch card data the vast majority of the interviews would not have been completed trips. Expansion of angler catch and effort based on estimated angler use will be presented in a future progress report.

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<sup>1</sup> <http://www.dec.ny.gov/outdoor/112782.html>

<sup>2</sup> [http://www.dec.ny.gov/docs/fish\\_marine\\_pdf/dfipcreel.pdf](http://www.dec.ny.gov/docs/fish_marine_pdf/dfipcreel.pdf)

## Results

### Angler Trips

An angler trip was defined as the duration an angler fished in a single day, inclusive if they fished multiple rivers of the Delaware Tailwaters. A total of 4,166 records were collected with the majority (67 %) originating from anglers fishing the West Branch (Table 1). A few interviews (N = 22) pertained only to angler opinion demographics and are not usable for assessing angler catch and effort. Most (77 %) anglers indicated fishing a single river during their trip. Some anglers who fished multiple rivers (36 %), were able to accurately separate their catch and effort by river when queried at the time of the interview. This permitted the division of their multiple river trip into its individual river components. Thus, a total of 3,536 single river trips, 292 double river trips, and 1 triple river trip summing to 3,851 total trips were captured by the creel clerks over the course of the entire survey period.

### Angler behavior

Commonality among angler behaviors can be gleaned from information gathered during the angler interviews (Table 2). A total of 1,936 trips (50 %) were considered completed. While the roving-roving creel design is based on incomplete trip information, the concern of overwhelming reliance on incomplete trips was not realized. Fly terminal tackle predominated (N = 2,947; 77 %), with anglers preferentially targeting strictly trout (3,649; 95 %) within Delaware Tailwaters. Nearly two-thirds (N = 2,278; 59 %) were wade fishing mode trips. Five hundred forty-five trips (14 %) of the 3,851 total trips documented were professionally guided. Guide services, however, were nearly ubiquitously (N = 528; 97 %) boat fishing mode trips (Table 3). Only 17 (3 %) of the 545 total guided trips were guided wade fishing trips (Table 3).

During plan development, concern arose for potentially differing angler catch and effort relative to observed angler behavior. For example, bass anglers might have an entirely different angling behavior than trout anglers. However, trips not exclusively targeting trout were so rare (N = 202; 5 %) that further investigation of angling behavior differences relative to targeted species is unnecessary. Non-trout targeted trips should be removed from future calculations of angler catch and effort for characterizing Delaware Tailwaters trout fishery. Variation in angler behaviors may be strongly influenced by fishing mode. Wade anglers can more easily move throughout the Delaware Tailwaters than boat anglers; whereas boat anglers can access reaches of river, which may be inaccessible to wade anglers. Future investigation of angler behavior separated by fishing mode is likely warranted; given the observed disparity among the frequency of fishing mode trips. Given the rarity of guided wading anglers, any future investigations towards angler behaviors regarding guide services could be limited to boat fishing mode only.

### Angler Catch

Incomplete records preclude the use of all 3,851 unique trips for the determination of angler catch and effort. The original data dataset was reduced to a total of 2,500 usable trips for the Delaware Tailwaters in its entirety (Table 4). Further reductions of usable angler trips occur at the river-specific (Del. R.: N = 323; East Br.: N = 377; West Br.: N = 1,673) and reach-specific (Stilesville: N = 454; No Kill: N = 308; Hale Eddy: N = 140; Border Water: N = 629) resolutions. Overall, a total of 11,522 angler hours were expended (Table 5), with most occurring in the West Branch (7,973 hrs.; 69 %). Estimation of total trip hours and mean trip duration are biased towards under-representation of angler effort, given 50 %

of the trips are incomplete. Collectively, anglers caught 2,645 Brown Trout, releasing 2,578 (97.5 %) fish and harvesting 67 (2.5 %) fish of their total catch. Similarly, of the 709 Rainbow Trout total caught, 700 (99 %) fish were released and nine (1 %) fish were harvested. The nominal harvest of trout suggests it is a relatively minor component of the Delaware Tailwaters fishery, in 2018. Mean angler catch rates for the Delaware Tailwaters overall were 0.25 trout/hr. for Brown Trout and 0.06 trout/hr. for Rainbow Trout.

#### Timing of angler effort and harvest

Timing of angler effort within the day can be inferred from angler interviews. Frequency of angler trip start times (Table 6), coupled with their associated trip duration (i.e., hours fished per trip), suggested peak angler effort occurring 1400 hours (i.e., 2 pm; Figure 1). While many anglers were fishing during the early morning (0400 – 0600 hours; N = 346; 3 %) and evening (1900 – 2200 hours; N = 626; 5 %) hours, the majority (79 %) of the angler effort occurred during mid-day (0900 – 1700) hours. In several instances, some anglers (N = 85) indicated exceptionally long trips ( $\geq 13$  hours), who tended to start their trips in the early morning hours. Potentially, work shifts for future creel census, may need to consider principal focus on 0900 – 1700 hours, with less sampling effort in the early morning/evening hours. Estimation of the daily hour angler effort, however, is likely biased towards earlier in the day (i.e., time-of-interview). Approximately half of the trips (N = 1,915; 50 %; Table 2) were considered incomplete, signifying anglers from those incomplete trips continued fishing after completing the interview process. Thus, angling effort is likely higher in the afternoon and/or evening hours than represented.

The 2018 survey design was based, in part, on fishery participants *a priori* concern of anglers specifically fishing during early morning hours, who were perceived as tending towards harvest of trout. As such, the morning work shift was designed to quantify this component of the fishery. Results are summarized in table 7, where harvest of trout would be implied to occur between the time-of-day the trip started to the time-of-day the interview occurred. A total of 229 (9.3 %) Brown Trout were caught prior to 0800 hours in the morning, during which approximately one-third (N = 26; 37 %) of the total harvest (N = 70) of Brown Trout occurred. Similarly, three (30 %) of the 10 Rainbow Trout harvested were taken prior to 0800 hours. A significant component of the trout harvest occurs during the early morning hours, but the total trout harvest remains exceptionally low.

#### Size of trout caught and harvested

The Delaware Tailwater fishery reputation is a commonly acknowledged availability of athletic trophy-sized trout. Catch data from angler interviews indicated all sizes of trout were caught (Table 8). The 14 – 16-inch and 16 – 20-inch size-classes of Brown Trout were the most common size-classes reported caught; whereas, no apparent pattern was evident of anglers predominantly catching a particular size-class of Rainbow Trout (Figure 2). Harvest of either trout species, however, tended to target the 16 – 20-inch size class (Brown Trout: 25 %; Rainbow Trout: 40 %), with 14 – 16-inch sized Brown Trout also preferentially (23 %) being harvested. Several (N=130; 5 %)  $\geq 20$ -inch Brown Trout were reported being caught, of which seven (5 %) were harvested, suggesting anglers are not preferentially harvesting exceptionally large-sized trout. The harvest of trophy-sized Brown Trout is suggestive, if an angler does harvest a trout, they generally take the 16 – 20-inch size trout, rather than the largest trout. Rainbow Trout, within the Delaware Tailwaters, typically do not attain  $\geq 20$ -inch sizes. Thus, harvest of the 16 – 20-inch size-class, suggests, anglers are preferentially harvesting the largest

sized Rainbow Trout. Any harvest of trout, during any angler trip, was a rare occurrence during the 2018 season.

Estimation of total angler catch, harvest, and effort rely on applying angler catch and effort from the angler interviews to the observed angler use as estimated by the creel clerk vantage point counts. Depending on the scale of resolution, such as, entire Delaware Tailwater, river-specific, or reach-specific, the total number of usable angler trips will vary (Table 4). Additionally, paucity of usable trips through the survey period may not be adequately representative of angler behavior and/or use (Table 9). Based on frequency of interviews gathered across the survey period, the months of May, June and July represent peak angler use. After July, frequency of interviews become scarce ( $N < 10$ ) or unavailable ( $N = 0$ ). Previous expansions of angler creel data considered splitting the survey period into three separate components McBride (2003), which delineated the peak season (i.e., 1 April – 4 July) based on the date of hatchery trout stocking into the East Branch. Relative to the 2018 datasets, using two temporal components, 1 April – 4 July and 5 July 15 October, will likely suffice. Expansion at the entire tailwaters scale may be considered as relatively more conclusive (i.e., inclusive of the greatest number of interviews), than at finer river or reach-specific expansions. Yet, future work will attempt eight initial expansions: entire tailwater, one each at the river-specific resolution, and one each for the four reach-specific resolution of the West Branch only, to enable direct comparisons to reach-specific historic findings (McBride, 2003). Expansions may also need to be separated by fishing mode dependent on any strongly disparate findings of angler behaviors among wade vs. boat angler behaviors.

### Angler Demographics

Tabularization of angler demographics yielded interesting findings (Table 10). Most anglers encountered were male ( $N = 3,697$ ; 96 %), which is typical of fishing participants throughout the states of New York and Pennsylvania. Angler origin, as indicated by solicited zipcodes, indicated a total of 1,276 unique zipcodes ( $N = 213$  were unrecorded). Considering those zipcodes that intersect the Delaware Tailwaters and their neighboring zipcodes as “local” to the Delaware Tailwaters ( $N = 37$ ), most anglers ( $N = 3,326$ ; 86 %) were not local. Thus, the Delaware Tailwaters is principally a destination fishery, drawing anglers outside of the immediate vicinity of the Delaware Tailwaters. If the individual trip was indicated as being guided (i.e., paid guide outfitter services), guide origin, via their solicited zipcodes, were also collected. Nearly half ( $N = 248$ ; 45 %) of the total guided trips ( $N = 545$ ) were guided by “local” guide services. Further scrutiny is warranted for characterizing regional population centers from which angler and guide services originate.

### Angler Opinions

During the interview process, angler opinion responses were solicited via a series of four questions (Table 11). These questions were focused on determining angler satisfaction with the Delaware Tailwater fishery. Responses were limited to only those anglers who were not previously asked for their opinions ( $N = 2,414$ ) or were unsure if previously asked ( $N = 16$ ). Overall, majority of angler responses indicated either being very satisfied ( $N = 1,040$ ; 43 %) or satisfied ( $N = 814$ ; 34 %) with their fishing experiences over the last three years. Some were neutral ( $N = 235$ ; 10 %), dissatisfied ( $N = 57$ ; 2%), or very dissatisfied ( $N = 12$ ; 0.5 %). No single component, catching many trout regardless of size ( $N = 652$ ; 27 %), catching large trout ( $N = 889$ ; 37 %), catching at least one  $\geq 20$ -inch sized trout (634; 26 %), was overwhelming singularly evident for generating angler satisfaction when asked to pick their top choice; although, a slightly more propensity was given towards importance of catching large trout. Anglers clearly indicated harvest was not of any importance ( $N = 75$ ; 3 %) for a satisfactory fishing trip.

## River flow influences on angler participation

River conditions can strongly influence angler behaviors. High flows/river stage may tend to favor boat angling over wade angling and *vice versa* during low flows. Reservoir releases supporting the Delaware Tailwater fisheries are regulated, as per the 1954 U.S. Supreme Court Decree<sup>3</sup> and subsequent agreements among the Parties-to-the-Decree. Most recently, a newly adopted 10-year Flexible Flow Management Plan (FFMP)<sup>4</sup> is the current management mechanism. Managed seasonal reservoir releases generally keep bank-to-bank river stage with summertime highest target flow of 525 cubic-feet-per-second (cfs), under normal operations (i.e., L2). Yet, these reservoirs can have un-managed spill during periods of high rainfall. During 2018, springtime high flows successively declined through July, when reservoir release were increasingly restricted (< 525 cfs), until August, when un-managed spill from excessive within-basin rainfall accumulations created springtime like flows (> 1,000 cfs; Figure 3). Plotting monthly percent frequencies of angler fishing modes (i.e., boat and wade), over monthly mean river flows is suggestive wade angling fishing mode did indeed increase during periods of low flow and declined during the later season under the higher rain-induced flows. The opposite appears to be evident for anglers fishing from boats. This pattern of observed angler behavior further lends credence to evaluation of angler behaviors separately by fishing mode.

### **Observations**

- Census of angler use via kayaking the tailwaters was considered exceptionally successful. Census agents were easily able to visually assess angler use; however, the trade-off was a need for a large census crew (N > 5 paddlers) in addition to the original three creel clerks.
  - A kayak census crew of six people and four vehicles (N = 2 NYSDEC vehicles, N = 2 PFBC vehicles) was optimal. Given multiple agency involvement, having drivers for their respective state vehicle most efficiently allowed staging drop-off/pick-up of paddlers.
  - A kayak census crew of four (4) to five (5) people is inadequate to fully cover all East Branch and Delaware River main stem reaches, forcing the combining of census reaches (Delaware River, only) or outright exclusion from the day's census (East Branch, only). On the Delaware River, the short census reaches were combined into longer lengths. Exclusion of East Branch census reaches via kayaking targeted downriver reaches (i.e., Fishs Eddy & Peas Eddy), which were censused via vehicle, as best as possible. Substitute vehicle counts for excluded kayak census reaches, however, are inferior and likely need to be discounted when evaluating comparisons to the paired creel clerk vehicle counts.
  - Kayak crews of less than four paddlers will force cancellation of that day's angler use kayak census.
  - Under typical discharge conditions, paddlers were able to cover one river mile per 15-minute interval and achieve a 7-minute per mile rate under high discharge conditions. Overall, each count took approximately three (3) hours to complete, inclusive of travel to/from the staging area to the assigned river reaches and paddling.

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<sup>3</sup> 1954 New Jersey v. New York. U.S. Supreme Court Decree. Summarized by the Delaware River Basin Commission. <https://www.state.nj.us/drbc/programs/flow/decree.html>

<sup>4</sup> Office of the Delaware River Master. 2017. Agreement for a Flexible Flow Management Program. U.S. Geological Survey. <https://webapps.usgs.gov/odrm/ffmp/FFMP2017.pdf>; <https://webapps.usgs.gov/odrm/ffmp/index.html>

- The use of a designated meeting location (either Fireman's Launch or SR 30 NYSDEC Access) aided in logistical organization of paddlers and ensuring all paddlers safely completed their assigned river reach.
- Exceptionally high flows were encountered during the 2018 census. Experienced gained has determined cancelation of kayak counts should occur when discharge becomes excessive. Resultant standing waves in areas of riffles/rapids are capable of swamping slack-water kayaks.
  - West Branch: USGS Hale Eddy gage exceed 2,200 cfs.
  - East Branch: USGS Harvard gage exceed 1,400 cfs.
  - Delaware R.: Automatic cancelation if either the WB or EB is canceled.
- Use of hand-held GPS unit(s) with waypoint navigation will eliminate guess-work of count start/stop points. Yet, once paddlers gained experience with each census reach, this concern was reduced, especially aided by flagged points of interest.
- Incomplete records, while unavoidable in certain instances, tended to exclude a considerable number of potentially usable interviews.
  - Quality control procedures will allow reclamation of some incomplete interviews; however, a robust electronic inputting form (e.g., Access) will greatly aid in consistency of entry and insurance of all fields collected. An electronic data entry form will also allow for some capacity of instantaneous error checking to avoid common mistakes.

Table 1. Frequency of gathered angler interviews reduced into potentially available individual angler trips, 2018 Delaware Tailwaters creel census.													
Water	Interviews	Opinion only	Potentially Available	Fish Mult. Water		Accurately Split Trip		Potential Angler Trips Available					
				Yes	No	Yes	No	Single River	Double River	Triple River	Unknown	Total	
Del. R.	715	2	713	411	302	136	275	438				12	450
East Br.	655	6	649	104	545	48	56	593	20			6	619
West Br.	2796	14	2782	434	2348	157	277	2505	272	1		4	2782
Total	4166	22	4144	949	3195	341	608	3536	292	1		22	3851
Percent				22.9%	77.1%	35.9%	64.1%	91.8%	7.6%	<0.1%		0.6%	



Table 2. Summary tabularization of individual angler trips relative to various angler behaviors, 2018 Delaware Tailwaters creel census.

	Delaware R.		East Branch		West Branch		Total	
	N	%	N	%	N	%	N	%
<b>Completed Trips</b>								
Yes	306	68.00%	307	49.60%	1323	47.56%	1936	50.27%
No	144	32.00%	312	50.40%	1459	52.44%	1915	49.73%
Total	450		619		2782		3851	
<b>Fishing Mode</b>								
Boat	229	50.89%	145	23.42%	1189	42.74%	1563	40.59%
Wade	221	49.11%	470	75.93%	1587	57.05%	2278	59.15%
Unknown	0	0.00%	4	0.65%	6	0.22%	10	0.26%
Total	450		619		2782		3851	
<b>Guided Trip</b>								
Yes	83	18.44%	73	11.79%	389	13.98%	545	14.15%
No	353	78.44%	540	87.24%	2336	83.97%	3229	83.85%
Unknown	14	3.11%	6	0.97%	57	2.05%	77	2.00%
Total	450		619		2782		3851	
<b>Terminal Tackle</b>								
Fly	327	72.67%	420	67.85%	2200	79.08%	2947	76.53%
ALO <sup>1</sup>	79	17.56%	111	17.93%	342	12.29%	532	13.81%
Bait	16	3.56%	23	3.72%	104	3.74%	143	3.71%
Combo <sup>2</sup>	26	5.78%	58	9.37%	82	2.95%	166	4.31%
Unknown	2	0.44%	7	1.13%	54	1.94%	63	1.64%
Total	450		619		2782		3851	
<b>Targeted Species</b>								
Trout <sup>3</sup>	396	88.00%	586	94.67%	2667	95.87%	3649	94.75%
Combo <sup>4</sup>	31	6.89%	13	2.10%	46	1.65%	90	2.34%
Non-Trout <sup>5</sup>	21	4.67%	12	1.94%	9	0.32%	42	1.09%
Unknown	2	0.44%	8	1.29%	60	2.16%	70	1.82%
Total	450		619		2782		3851	

1 – Artificial Lure Only, other than a wet/dry fly

2 – Interchanged among multiple types of terminal tackle during the trip

3 – Inclusive of Brown Trout, Rainbow Trout and Brook Trout

4 – Inclusive of multiple targeted trout and warmwater species (i.e., basses, Am. Shad)

5 – Inclusive of warm-water species only (i.e., basses, Am. Shad)

Table 3. Frequency of guided trips by fishing mode, 2018 Delaware Tailwaters creel census.								
Guided	Del. R.		East Br.		West Br.		Total	
	N	%	N	%	N	%	N	%
<b>Boat</b>								
Yes	83	36.24%	66	45.52%	379	31.88%	528	33.78%
No	143	62.45%	79	54.48%	760	63.92%	982	62.83%
Unknown	3	1.31%	0	0.00%	50	4.21%	53	3.39%
Total	229		145		1189		1563	
<b>Wade</b>								
Yes	0	0.00%	7	1.49%	10	0.63%	17	0.75%
No	210	95.02%	458	97.45%	1571	98.99%	2239	98.29%
Unknown	11	4.98%	5	1.06%	6	0.38%	22	0.97%
Total	221		470		1587		2278	
<b>Unknown</b>								
Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%
No	0	0.00%	3	75.00%	5	83.33%	8	80.00%
Unknown	0	0.00%	1	25.00%	1	16.67%	2	20.00%
Total	0		4		6		10	
<b>Overall</b>								
Yes	83	18.44%	73	11.79%	389	13.98%	545	14.15%
No	353	78.44%	540	87.24%	2336	83.97%	3229	83.85%
Unknown	14	3.11%	6	0.97%	57	2.05%	77	2.00%
Total	450		619		2782		3851	

Table 4. Unique individual angler trips available for calculation of angler catch and effort. Trips are removed from further consideration at finer resolutions due to incomplete, conflicting or short trip duration, 2018 Delaware Tailwaters creel census.

Water	Original Total	Missing Start Time	Missing End or Interview Time	End or Interview Time Prior to Start Time	Unknown Reach Fished	Total Fishing Duration < 0.5 hours	Total No. Trips Removed	Total No. Trips Retained
<b>Overall<sup>1</sup></b>								
Total	3851	480	35	442	NA	394	1351	2500
Percent		12.46%	0.91%	11.48%	NA	10.23%	35.08%	64.92%
<b>River-specific<sup>2</sup></b>								
Del. R.	438	7	3	43	4	58	115	323
East Br.	593	12	11	41	18	134	216	377
West Br.	2505	432	16	232	6	144	830	1675
Total	3536	451	30	316	28	336	1161	2375
Percent		12.75%	0.85%	8.94%	0.79%	9.50%	32.83%	67.17%
<b>Reach-specific, West Branch only<sup>3</sup></b>								
Stilesville	454	40	6	42	0	52	140	314
No Kill	308	50	1	34	0	9	94	214
Hale Eddy	140	11	2	12	0	18	43	97
Border	629	89	3	85	0	50	227	402
Within – WB <sup>4</sup>	893	169	2	59	648	15	893	0
Unknown	81	73	2	0	4	2	81	0
Total	2505	432	16	323	652	146	1569	1027
Percent		17.25%	0.64%	12.89%	26.03%	5.83%	62.63%	41.00%

- 1 – Considers the Delaware Tailwaters as a whole. Includes all trips regardless of fishing multiple waters, or unknown reaches fished. Cause for removal of trips relies solely on incomplete fishing times or short trip durations.
- 2 – Considers each river separately. Cause for removal of individual angler trips relies on incomplete catch and/or effort data, but also if the angler fished multiple rivers, and cannot accurately split their catch and effort at the time of the interview.
- 3 – McBride (2003), considered each reach of the West Branch separately for expansion of angler catch and effort to total angler use. Cause for removal of individual angler trips relies on incomplete catch and/or effort, or those trips not identified as having fidelity to one of the four specific reaches within the West Branch. In other words, only those trips when anglers did not move among reaches within the West Branch.
- 4 – Anglers fishing solely with the West Branch, but moved among the four reaches of the West Branch, such that, trip catch and effort cannot be accurately split among the reaches.

Table 5. Angler catch and effort gathered from the angler interviews, 2018 Delaware Tailwaters creel census.

Water	Total		Mean Trip Duration (hours) <sup>1</sup>	Brown Trout						Rainbow Trout					
				Total (N) <sup>2</sup>			Mean Catch Rates (fish/hr.)			Total (N) <sup>2</sup>			Mean Catch Rates (fish/hr.)		
	Anglers	Hours <sup>1</sup>		Rel.	Har.	Catch	Rel.	Har.	Total	Rel.	Har.	Catch	Rel.	Har.	Total
<b>Delaware River</b>															
Junction P. River Rd.	108	378.47	3.50	33	0	33	0.096	0.000	0.096	30	0	30	0.057	0.000	0.057
Buckingham	1	1.92	1.92	1	0	1	0.522	0.000	0.522	0	0	0	0.000	0.000	0.000
Lordville	29	77.43	2.67	15	0	15	0.228	0.000	0.228	12	0	12	0.140	0.000	0.140
Long Eddy	6	9.58	1.60	1	0	1	0.133	0.000	0.133	0	0	0	0.000	0.000	0.000
Hankins	10	44.42	4.44	7	0	7	0.100	0.000	0.100	18	0	18	0.481	0.000	0.481
Callicoon	2	5.33	2.67	0	0	0	0.000	0.000	0.000	0	0	0	0.000	0.000	0.000
Within-DR <sup>3</sup>	13	37.78	2.91	3	0	3	0.097	0.000	0.097	4	3	7	0.191	0.060	0.251
Total	154	854.08	5.55	105	1	106	0.134	0.001	0.134	47	0	47	0.051	0.000	0.051
Total	323	1409.02	4.36	165	1	166	0.127	0.000	0.128	111	3	114	0.079	0.002	0.081
<b>East Branch</b>															
Downsville	62	177.95	2.87	13	13	26	0.085	0.119	0.203	1	0	1	0.004	0.000	0.004
Corbett	25	63.83	2.55	37	7	44	0.599	0.082	0.681	1	0	1	0.027	0.000	0.027
Shinhopple	77	255.38	3.32	42	5	47	0.151	0.025	0.176	2	0	2	0.006	0.000	0.006
Harvard	18	64.03	3.56	5	0	5	0.085	0.000	0.085	4	0	4	0.046	0.000	0.046
Fish Eddy <sup>4</sup>															
Peas Eddy <sup>4</sup>															
Within-EB <sup>5</sup>	194	864.45	4.46	178	5	183	0.178	0.004	0.182	44	3	47	0.037	0.007	0.044
Total	377	1428.15	3.79	275	30	305	0.180	0.032	0.212	52	3	55	0.025	0.003	0.028

Table 5. Continued.

Water	Total		Mean Trip Duration (hours) <sup>1</sup>	Brown Trout						Rainbow Trout					
	Anglers	Hours <sup>1</sup>		Total (N) <sup>2</sup>			Mean Catch Rates (fish/hr.)			Total (N) <sup>2</sup>			Mean Catch Rates (fish/hr.)		
				Rel.	Har.	Catch	Rel.	Har.	Total	Rel.	Har.	Catch	Rel.	Har.	Total
<b>West Branch</b>															
Stilesville	314	910.98	2.90	312	14	326	0.400	0.017	0.417	59	2	61	0.059	0.002	0.061
Hale Eddy	215	867.78	4.04	304	1	305	0.370	0.002	0.372	29	0	29	0.047	0.000	0.047
No Kill	97	349.33	3.60	134	7	141	0.477	0.021	0.498	39	0	39	0.110	0.000	0.110
Border Wat.	402	1572.58	3.91	354	1	355	0.179	0.000	0.180	225	0	225	0.135	0.000	0.135
Within-WB <sup>6</sup>	648	4272.25	6.59	866	12	878	0.239	0.004	0.243	116	1	117	0.028	0.000	0.028
Total	1675	7958.43	4.75	1965	35	2000	0.285	0.006	0.292	468	3	471	0.067	0.001	0.067
<b>Non-river specific data<sup>7</sup></b>															
Among	103	639.45	6.21	158	1	159	0.287	0.005	0.292	56	0	56	0.100	0.000	0.100
Unknown	22	74.55	3.39	10	0	10	0.275	0.000	0.275	13	0	13	0.196	0.000	0.196
Overall	2500	11521.60	4.61	2548	67	2645	0.249	0.009	0.258	700	9	709	0.064	0.001	0.065

1 – Are estimations based on both complete and incomplete trips, which results in an under-representation of angler effort.  
 2 – Totals represent fish caught used for calculation of angler effort. A few fish caught were excluded (Table 6), due to incomplete records and short trip durations when calculating angler effort.  
 3 – Trips that fished multiple reaches only within the Delaware River.  
 4 – No interviews collected from anglers fishing these reaches.  
 5 – Trips that fished multiple reaches only within the East Branch.  
 6 – Trips that fished multiple reaches only within the West Branch.  
 7 – Anglers indicating fishing multiple rivers or unable to identify reaches fished.

Table 6. Angler fishing pressure based on individual trip start time and duration of the trip gathered from the angler interviews, 2018 Delaware Tailwaters creel census.

Hour of the day <sup>1</sup>		0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100 <sup>5</sup>	2200 <sup>5</sup>
Trip Duration (Total hours fished) <sup>2</sup>	1	2	18	25	43	29	29	49	63	41	50	50	37	27	25	26	8	5		
	2	0	15	27	29	30	49	49	28	22	34	20	33	19	24	24	9	1		
	3	3	16	19	12	24	17	8	25	28	39	22	19	22	5	18	0	0		
	4	0	17	4	21	27	26	35	28	23	37	61	23	8	12	4	0	0		
	5	0	7	5	11	14	18	25	21	36	35	24	11	24	1	0	0	0		
	6	0	5	13	10	5	9	41	27	68	28	25	7	1	0	0	0	0		
	7	0	4	6	4	9	14	28	35	19	16	12	0	0	0	0	0	0		
	8	0	1	12	6	11	14	38	42	56	20	3	0	0	0	0	0	0		
	9	0	2	12	8	8	17	24	35	14	0	0	0	0	0	0	0	0		
	10	1	3	7	6	7	12	23	14	0	0	0	0	0	0	0	0	0		
	11	0	1	1	4	4	11	10	0	0	0	0	0	0	0	0	0	0		
	12	1	3	2	4	8	10	0	0	0	0	0	0	0	0	0	0	0		
	13	0	1	0	5	9	0	1	0	0	0	0	0	0	0	0	0	0		
	14	1	3	2	9	1	0	0	0	0	0	0	0	0	0	0	0	0		
	15	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	16	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	17	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total <sup>3</sup>		11	99	137	172	186	226	331	318	307	259	217	130	101	67	72	17	6		
Total Freq <sup>4</sup>		11	108	227	356	456	588	837	1002	1125	1250	1293	1219	1097	922	662	423	187	14	2
Percent		0.09%	0.92%	1.93%	3.02%	3.87%	4.99%	7.11%	8.51%	9.56%	10.62%	10.98%	10.36%	9.32%	7.83%	5.62%	3.59%	1.59%	0.06%	0.02%

1 – Top of the hour (military), within a day  
 2 – A trip duration of 1 hour indicated the angler trip was initiated sometime in that hour of the day. For example, 25 anglers started fishing during 0600 hours.  
 3 – Total number of trips with valid trip starting times and trip durations, representing a subset of the original potentially available total number of trips (N = 3,851).  
 4 – Total number of angler trips occurring at the top of each day hour. For example, the 19 anglers who started fishing at 0600 hours and fished for 3 hours, contribute to the total frequency of anglers for 0600 hours through 0800 hours (i.e., 0600, 0700, 0800 hours).  
 5 – No angler trips were encountered starting at these times of a day. Any angler fishing during these hours, are from trips initiated earlier within the Day.

Table 7. Frequency of angler catch by hour of completed angler interviews, 2018 Delaware Tailwaters creel census.

Hour	Brown Trout						Rainbow Trout					
	Released		Harvest		Total		Released		Harvest		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
0500	46	1.93%	8	11.43%	54	2.20%	8	1.29%	1	10.00%	9	1.43%
0600	71	2.97%	13	18.57%	84	3.42%	7	1.13%	2	20.00%	9	1.43%
0700	86	3.60%	5	7.14%	91	3.70%	12	1.94%	0	0.00%	12	1.91%
0800	168	7.04%	6	8.57%	174	7.08%	54	8.74%	0	0.00%	54	8.60%
0900	135	5.65%	6	8.57%	141	5.74%	29	4.69%	0	0.00%	29	4.62%
1000	165	6.91%	10	14.29%	175	7.12%	45	7.28%	4	40.00%	49	7.80%
1100	219	9.17%	1	1.43%	220	8.95%	47	7.61%	0	0.00%	47	7.48%
1200	106	4.44%	2	2.86%	108	4.39%	33	5.34%	0	0.00%	33	5.25%
1300	72	3.02%	2	2.86%	74	3.01%	28	4.53%	0	0.00%	28	4.46%
1400	122	5.11%	3	4.29%	125	5.09%	46	7.44%	0	0.00%	46	7.32%
1500	244	10.22%	0	0.00%	244	9.93%	75	12.14%	0	0.00%	75	11.94%
1600	191	8.00%	2	2.86%	193	7.85%	54	8.74%	0	0.00%	54	8.60%
1700	169	7.08%	2	2.86%	171	6.96%	25	4.05%	0	0.00%	25	3.98%
1800	232	9.72%	8	11.43%	240	9.76%	53	8.58%	0	0.00%	53	8.44%
1900	190	7.96%	2	2.86%	192	7.81%	51	8.25%	3	30.00%	54	8.60%
2000	98	4.10%	0	0.00%	98	3.99%	26	4.21%	0	0.00%	26	4.14%
2100	73	3.06%	0	0.00%	73	2.97%	23	3.72%	0	0.00%	23	3.66%
2200	1	0.04%	0	0.00%	1	0.04%	0	0.00%	0	0.00%	0	0.00%
2300	0	0.00%	0	0.00%	0	0.00%	2	0.32%	0	0.00%	2	0.32%
Total <sup>1</sup>	2388		70		2458		618		10		628	

1 – Totals represent all fish released and harvested of all trips, which will be different from those totals of fish caught used for calculation of angler effort (Table 4), due to incomplete records and short trip durations.

Table 8. Length frequencies of trout caught that were reported during the interview process, 2018 Delaware Tailwaters creel census.

Length Size-class (inches)	Released		Harvested		Total	
	N	%	N	%	N	%
Brown Trout						
0 - 9	323	11.83%	1	1.49%	324	11.58%
9 - 12	441	16.15%	0	0.00%	441	15.76%
12 - 14	501	18.34%	8	11.94%	509	18.19%
14 - 16	636	23.29%	24	35.82%	660	23.59%
16 - 20	707	25.89%	27	40.30%	734	26.23%
≥ 20	123	4.50%	7	10.45%	130	4.65%
Total	2731		67		2798	
Rainbow Trout						
0 - 9	151	19.69%	0	0.00%	151	13.73%
9 - 12	168	21.90%	0	0.00%	168	15.27%
12 - 14	111	14.47%	0	0.00%	111	10.09%
14 - 16	173	22.56%	3	30.00%	176	16.00%
16 - 20	153	19.95%	7	70.00%	160	14.55%
≥20	11	1.43%	0	0.00%	11	1.00%
Total	767		10		777	



Table 9. Frequency of angler trips by reach fished, month and day type, 2018 Delaware Tailwaters creel census.

Water	April		May		June		July		August		September		October		Total
	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	
<b>Delaware River</b>															
Junction P.	6	9	7	10	18	15	6	10	6	3	1	13	0	4	108
River Rd.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Buckingham	0	2	6	2	4	9	0	2	0	0	0	3	0	1	29
Lordville	3	3	0	0	0	0	0	0	0	0	0	0	0	0	6
Long Eddy	0	2	0	0	3	5	0	0	0	0	0	0	0	0	10
Hankins	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
Callicoon	0	0	4	1	4	4	0	0	0	0	0	0	0	0	13
Within-DR	6	31	28	39	11	20	1	3	3	1	2	5	2	2	154
Sub-Total	15	47	45	52	41	55	7	15	9	4	3	21	2	7	323
<b>East Branch</b>															
Downsville	1	12	2	4	3	9	3	10	3	4	1	6	0	4	62
Corbett	4	3	0	5	5	1	3	0	0	0	0	3	0	1	25
Shinhopple	9	15	7	14	10	6	0	0	1	1	1	8	0	5	77
Harvard	0	3	2	0	1	3	0	7	1	0	0	1	0	0	18
Fish Eddy <sup>3</sup>															
Peas Eddy <sup>3</sup>															
Within-EB	18	56	30	37	12	4	0	6	1	6	0	15	0	9	194
Sub-Total	32	89	41	60	31	23	6	23	6	11	2	33	0	19	376

Table 9. Continued.

Water	April		May		June		July		August		September		October		Total
	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	WkDay <sup>1</sup>	WkEnd <sup>2</sup>	
<b>West Branch</b>															
Stilesville	21	31	18	28	28	35	31	31	24	22	8	26	5	6	314
No Kill	3	8	24	11	29	20	36	48	5	7	4	19	0	1	215
Hale Eddy	5	5	1	10	20	14	9	31	1	0	0	1	0	0	97
Border Wat.	8	34	61	22	50	65	25	85	10	2	4	24	4	8	402
Within-WB	25	65	73	58	39	55	25	93	40	21	32	67	12	43	648
Sub-Total	62	143	177	129	166	189	126	288	80	52	48	137	21	58	1676
Among	2	6	11	13	29	19	4	6	0	3	6	2	0	2	103
Unknown	0	0	0	6	5	3	1	4	0	0	1	0	0	2	22
Grand Total	111	285	274	260	272	289	144	336	95	70	60	193	23	88	2500
Monthly Total	396		534		561		480		165		253		111		
1 – All trips occurring during Monday – Friday, except holidays. 2 – All trips occurring during Saturday – Sunday, inclusive of holidays (Memorial Day, July 4 <sup>th</sup> , Labor Day, and Columbus Day). 3 – No interviews collected from anglers fishing these reaches.															

Table 10. Angler demographics, 2018 Delaware Tailwaters creel census.

	Del. R.		East Br.		West Br.		Total	
	N	%	N	%	N	%	N	%
Local	57	12.67%	71	11.47%	185	6.65%	313	8.13%
Non-local	373	82.89%	509	82.23%	2443	87.81%	3325	86.34%
Unknown	20	4.44%	39	6.30%	154	5.54%	213	5.53%
Total	450		619		2782		3851	
<b>Guide Origin</b>								
Local	51	61.45%	28	38.36%	169	43.44%	248	45.50%
Non-local	30	36.14%	31	42.47%	187	48.07%	248	45.50%
Unknown	2	2.41%	14	19.18%	33	8.48%	49	8.99%
Total	83		73		389		545	
<b>Angler Gender</b>								
Female	13	2.89%	26	4.20%	109	3.92%	148	3.84%
Male	435	96.67%	592	95.64%	2670	95.97%	3697	96.00%
Unrecorded	2	0.44%	1	0.16%	3	0.11%	6	0.16%
Total	450		619		2782		3851	

Table 11. Solicited angler responses to four opinion questions at the time of interview by the creel clerk, 2018 Delaware Tailwaters creel census.

<b>Question 1 - Have you previously been interviewed for your opinion?</b>								
Response	N	%						
No	2414	0.623289						
Yes	1411	0.364317						
Unsure	16	0.004131						
Unknown	32	0.008262						
Total	3873							
<b>Question 2 - How satisfied were you with your overall fishing experience(s) in the Delaware Tailwaters in the last three years?</b>								
Response	N	%						
Very satisfied	1040	42.80%						
Satisfied	814	33.50%						
Neutral	235	9.67%						
Dissatisfied	57	2.35%						
Very dissatisfied	12	0.49%						
No response	164	6.75%						
Unknown	1	0.04%						
Unasked	107	4.40%						
Total	2430							
<b>Question 3 - How Important are the below descriptions to you for a satisfactory experience?</b>								
Response	Catch many trout regardless of size		Commonly catch large trout		Catch at least one 20-inch sized or larger trout		Harvest – To catch trout to eat	
	N	%	N	%	N	%	N	%
Extremely important	98	4.03%	284	11.69%	340	13.99%	38	1.56%
Very important	327	13.46%	832	34.24%	623	25.64%	67	2.76%
Somewhat important	879	36.17%	785	32.30%	704	28.97%	159	6.54%
Not important	1019	41.93%	417	17.16%	646	26.58%	2051	84.40%
No Response	12	0.49%	12	0.49%	18	0.74%	14	0.58%
Unknown	7	0.29%	7	0.29%	8	0.33%	12	0.49%
Unasked	88	3.62%	93	3.83%	91	3.74%	89	3.66%
Total	2430		2430		2430		2430	
<b>Question 4 - Of the four characteristics listed in question 3, which is the most important?</b>								
Response	N	%						
Catch many trout regardless of size	652	26.83%						
Commonly catch large trout	889	36.58%						
Catch at least one 20-inch sized or larger trout	634	26.09%						
Harvest – To catch trout to eat	75	3.09%						
Unknown	180	7.41%						
Total	2430							

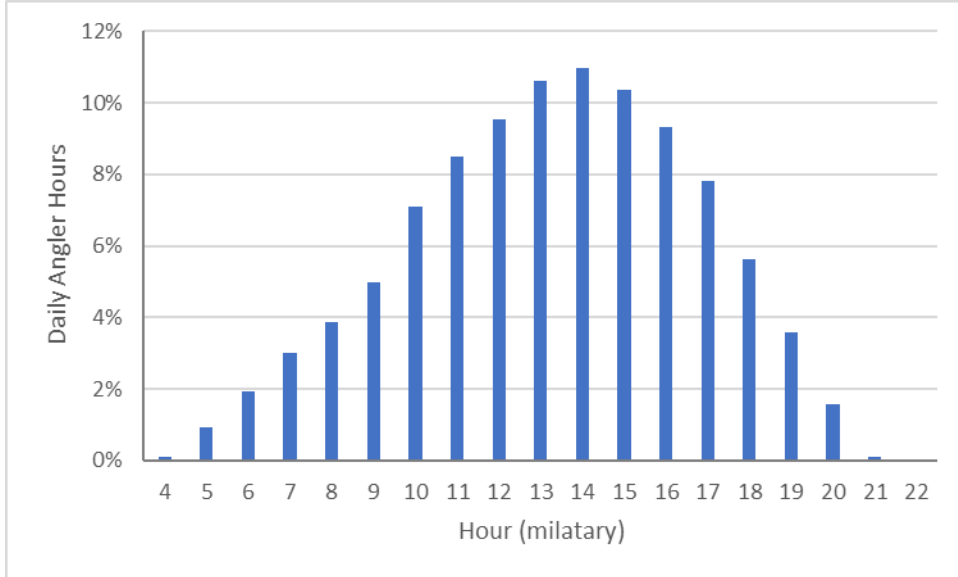


Figure 1. Estimated daily angler effort (anglers actively fishing) per hour of the day, 2018 Delaware Tailwaters creel census.

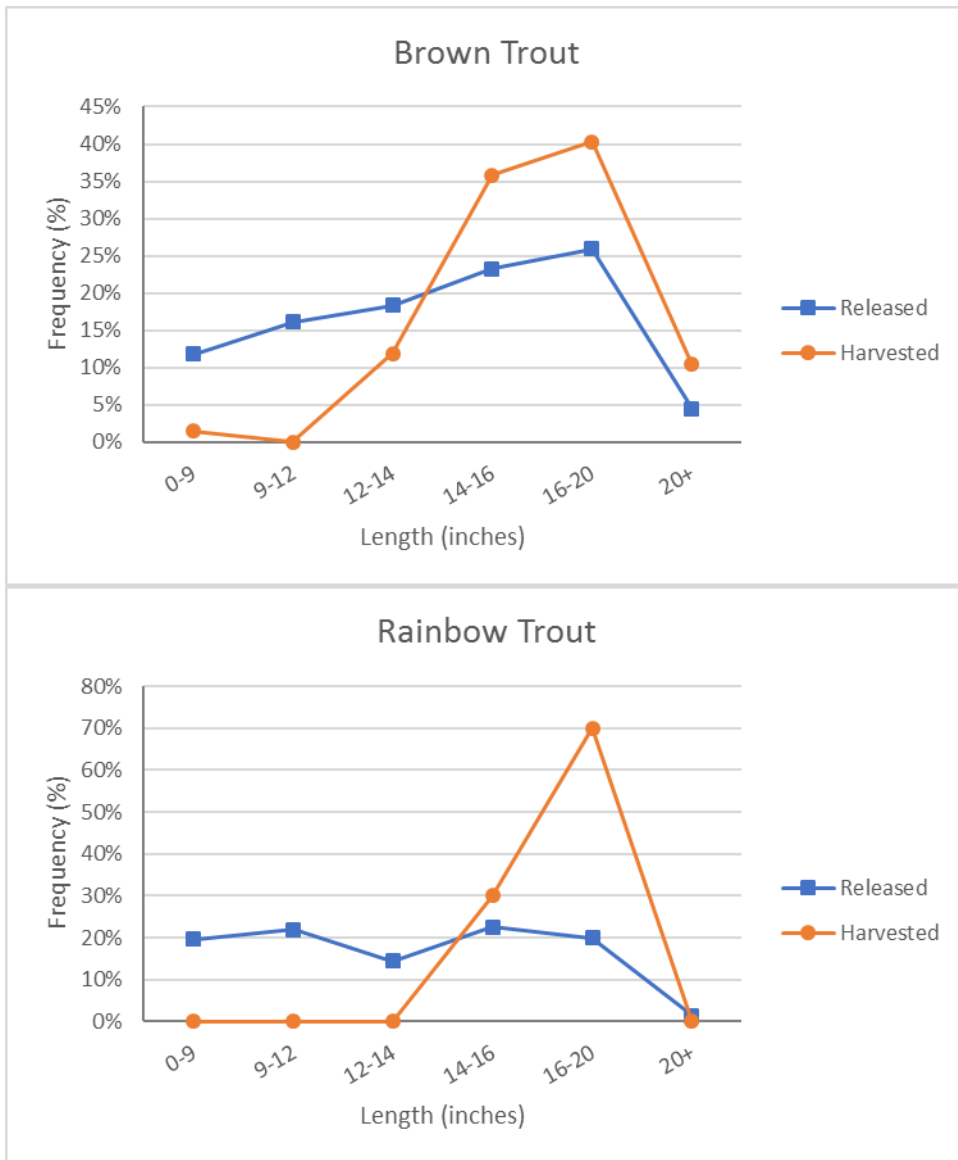


Figure 2. Length frequency of released and harvested trout reported during the angler interviews, 2018 Delaware Tailwaters creel census.

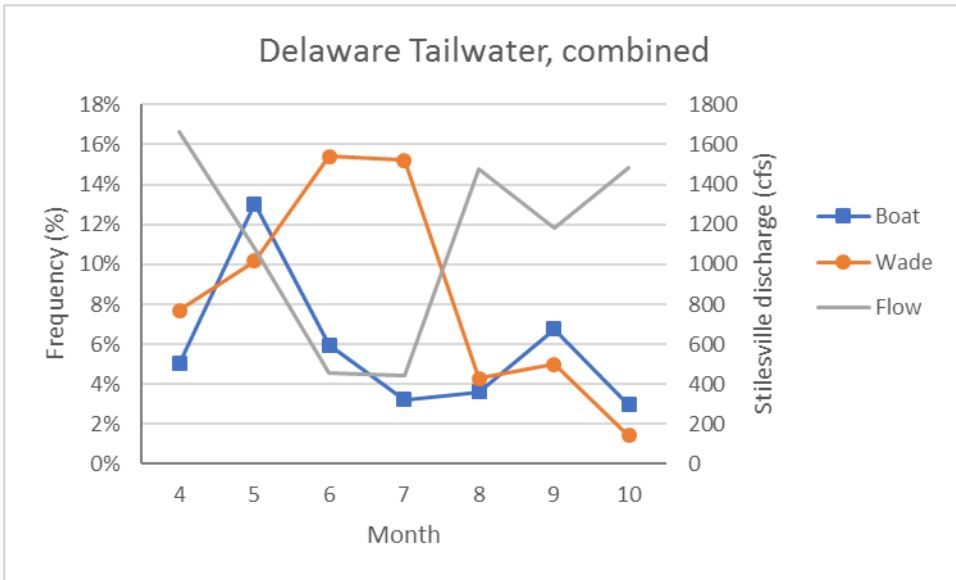


Figure 3. Monthly percent frequencies of boat and wade angler fishing modes relative to monthly mean flow rates as measured at the USGS Stilesville gage, 2018.