

A Summary of the Initial Screening for the Presence of Brook Trout Gill Lice (*Salmincola edwardsii*) in Connecticut

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A recent literature review showed that the Brook Trout gill lice, *Salmincola edwardsii*, has been increasingly found within the native range of the Brook Trout (*Salvelinus fontinalis*); recently documented for the first time in North Carolina (Ruiz et al. 2017) and Pennsylvania (Crale 2017). Gill lice have also been documented from privately operated hatcheries in Pennsylvania. The Fisheries Division has issued liberation permits for private clubs and individuals who have imported and liberated Brook Trout from PA hatcheries. Although the parasite is endemic to the northern hemisphere and has a Holarctic distribution (Kabata 1969), its occurrence may be on the rise due to a warming climate (White et al. 2020) and the increased frequency of



drought (Mitro 2016 and Mitro & Griffin 2017). Little is known about the effects of this parasite and its existence in Connecticut (to date none have been observed), but in Wisconsin it has been linked to decreased density of wild Brook Trout (Mitro 2016). Therefore, the Connecticut DEEP Fisheries Division hopes to gain insight on the parasite's presence and possible effects in Connecticut water. This will be done by sampling

wild Brook Trout from a variety of locations where they are found in varying densities across several categories related to stocking including; control streams, non-control streams, and private hatchery (PA) stocked streams (Appendix 1).

Final Sample Site Selection

Esri ArcGIS was used to plot the aforementioned waterbodies by category type (Figure 1), and sampling focus regions were determined by targeting areas that provided the best opportunity to encounter wild Brook Trout that may have come in contact with *S. edwardsii* through private stockings from Pennsylvania hatcheries. Waterbodies that fell into the other categories were chosen for sampling because of their close proximity to privately stocked waterbodies. Forty (40) waterbodies were selected for sampling in the target areas (Appendix 2, red boxes in Figure 1) during the summer of 2020.

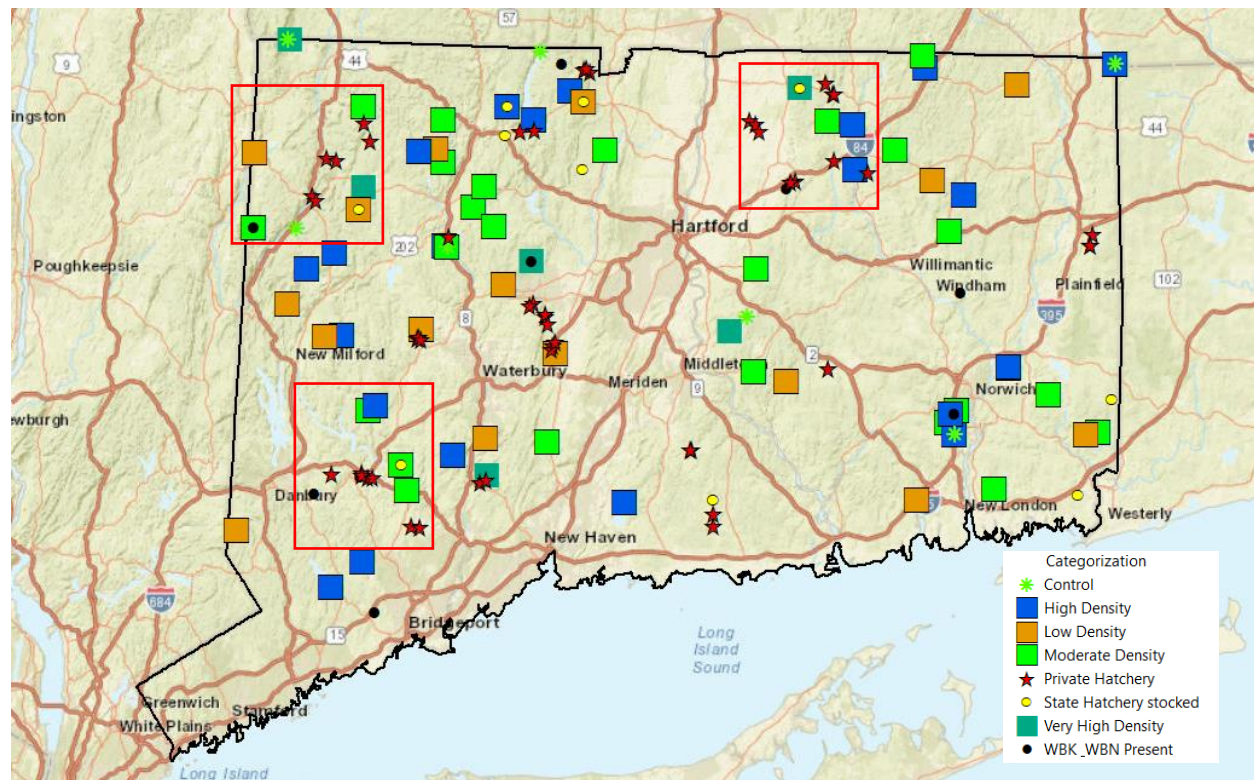


Figure 1. All possible locations for gill lice sampling. The red boxes indicate where sampling was focused during summer 2020 based on previous stockings in Connecticut from private hatcheries located in Pennsylvania.

Sampling Protocol

Sampling took place between August 1st and September 17th, 2020, as female gill lice are largest and most readily observed by the naked eye from mid- to late summer/early fall. Smith-root backpack shockers were utilized and stream sections where Brook Trout tend to congregate (pools) were targeted for sampling. Up to 50 fish (multiple year classes) were targeted for inspection from each designated sampling area, and all Brook Trout were enumerated, measured (TL mm), investigated for the presence of *S. edwardsii*, and gill condition was assessed on a scale of 0 to 2 (0 = no gill deformation, 1 = moderate gill deformation, 2 = severe gill deformation). Fin condition was also assessed using the same scale as gill condition because lice are also known to infest the base of fins, which can lead to erosion (0 = no fin erosion, 1 = moderate fin erosion, 2 = severe fin erosion). All fish were returned to the water after being processed. If present, gill lice location(s) and number were recorded for each individual fish. Gill lice were preserved if collected in the field to ensure proper identification.

Sampling crew size was limited to 2-4 to follow the most current approved COVID-19 sampling guidance for backpack electrofishing. All crew members were required to wear masks, gloves, and maintain a safe distance (6 ft.) when possible. Crew members were assigned sampling

equipment each day that was only handled by that member. All equipment was disinfected each day prior to and after each use with a bleach solution.

To expedite sampling, sample length and stream width was not measured. But, start and end point descriptions were recorded, so that future efforts can be replicated. In general, large streams (> 5 meter estimated width) were sampled for close to 1,000 seconds backpack on time (18 min.), and smaller streams (< 5 meter estimated width) for close to 500 seconds backpack on time (9 min.) when possible.

Outcomes

Thirty (30) of the targeted 40 waterbodies were sampled (Table 1) in 2020 to determine if *Salmincola edwardsii* was present in Connecticut's wild Brook Trout populations. The remaining ten sites were not sampled due to limited time, poor access, or because they were posted "No Trespassing". All sites sampled except for six (6) had wild Brook Trout present. Those sites without Brook Trout (stocked or wild) present were Pond Brook, Pootatuck River, Curtis Pond Brook, Conant Brook, Nelson Brook, and Crystal Lake Brook (Table 1). All other sites had between one (1) and 57 individual wild Brook Trout present (Table 1). One (1) stocked Brook Trout was observed at Macedonia Brook.

Table 1. The 30 waterbodies sampled during summer 2020 with the category, number of Brook Trout observed, sample effort, and density.

Station Name	Station ID	Categorization	Number of Brook Trout Sampled	Sampling effort (minutes)	Num BK/min
Aborn Brook	16469	Moderate Density	1	4.6	0.2
Barrows Brook	15594	Private Hatchery	40	9.3	4.3
Broad Brook	20454	Private Hatchery	20	18.3	1.1
Conant Brook	16584	Private Hatchery	0	7.9	0
Creamery Brook	17574	Private Hatchery	25	16.9	1.5
Crystal Lake Brook	20456	Private Hatchery	0	7.6	0
Curtis Pond Brook	20446	Private Hatchery	0	9.3	0
Deep Brook	15839	Private Hatchery & WBK/WBN Present	15	18.1	0.8
Diamond Ledge Road	17360	Private Hatchery	52	8.3	6.2
East Branch Shepaug River	16630	Very High Density	57	9.1	6.3
Green Brook	20447	High Density	41	7.3	5.6
Guinea Brook	15507	Private Hatchery	5	17.7	0.3
Gulf Stream	17945	Very High Density & State Stocked	18	9.0	2.0
Heffers Brook	20451	Private Hatchery	40	8.2	4.9
Kent Falls Brook	18019	Control	35	18.3	1.9
Kent Falls Brook	17639	Control	5	15.9	0.3
Kettletown Brook	15577	Moderate Density & State Stocked	31	13.6	2.3
Limekiln Brook	14849	WBK & WBN Present	22	16.8	1.3
Macedonia Brook	16821	Moderate Density & WBK/WBN Present	11	15.0	0.7
Means Brook	20453	Private Hatchery	3	15.7	0.2
Mill Brook	15969	Private Hatchery	22	18.3	1.2
Mohawk Pond Outflow	16857	Low Density & State Stocked	14	5.7	2.5
Nelson Brook	20452	Private Hatchery	0	2.3	0
Pond Brook	16425	Private Hatchery	0	16.4	0
Pootatuck River	16095	Private Hatchery	0	10.8	0
Tankerhoosen River	18780	Private Hatchery & WBK/WBN Present	1	16.5	0.1
Transylvania Brook, Tributary To	20231	Moderate Density	2	8.3	0.2
Transylvania Brook, Tributary To	17133	High Density	36	8.4	4.3
Unnamed trib to southeast of Hall's Pond	20448	Private Hatchery	28	9.2	3.1
Webetuck Creek	19663	Low Density	9	18.3	0.5

No Brook Trout Gill Lice were documented on any of the 533 Brook Trout (stocked or wild) found in the samples; all life stages (young-of-year through adult) of wild brooks were inspected. But, slight gill erosion was observed on a single wild Brook Trout in each of Broad Brook and the unnamed tributary to Hall's Pond. Wild Brook Trout from both systems would have had the ability to have come in contact with a stocked Brook Trout from Pennsylvania. Additionally, slight caudal fin wear was observed on a single wild brook from each of Weebatuck Creek, East Branch Shepaug River, and Diamond Ledge Brook.

Other findings included the presence of a single young-of-year wild Rainbow Trout in Curtis Pond Brook that likely resulted from a spawning event from a private stocking of spring-spawning adult Rainbow Trout into the Pootatuck River. This phenomenon has been observed during previous sampling efforts in the Pootatuck before, and resultant offspring likely do not survive to the adult stage to reproduce. Additionally, two (2) wild Tiger Trout were observed in Kettletown Brook. Also of note were strong populations of wild Brown Trout in the Broad Brook and Kent Falls Brook (Dugan Road) samples.

Looking Forward

During this initial screening, had Fisheries Division staff encountered any Gill Lice, information regarding its occurrence would have been disseminated through various sources. As well, the Division would have looked to determine how widespread the organism was. And, appropriate

management actions would have been developed to limit its spread (if possible) and mitigate any possible negative effects on wild Brook Trout.

Moving forward, screening for gill lice, and other external parasites on all stocked and wild Brook Trout collected during fish community samples will become standard protocol when encountered during the mid-summer to early fall period. We may also request that the angling public report its presence if observed during a fishing trip, especially since literature suggests that the louse is often found at the base of the fins and is easily detected. A survey using ArcGIS Survey123 is being developed for circulation for members of the public to use when/if gill lice are observed (or not observed); pending its approval. Finally, as a preventative measure, the Division should consider restricting importations of Brook Trout from other states, as stockings from private hatcheries have been determined to be a source of Brook Trout Gill Lice infestations in wild brook populations elsewhere.

Citations

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Appendices

Appendix 1: A list of candidate waterbodies considered for gill lice evaluation on wild Brook Trout. Final selections are in Appendix 2.

Categories of Stocking Practice		
Category	Rationale	Candidate Locations
Control Streams	No stocking of hatchery Brook Trout has occurred within the last 15 years (records show that Stony Brook was stocked with Rainbow Trout through 2014, Kent Falls Brook is currently stocked with Brook Trout below impassable falls, and Spruce Brook flows into the Naugatuck River, which receives stockings of Brook Trout).	Valley Brook, Sages Ravine (site A), Mott Hill Brook, Spruce Brook, Kent Falls Brook (above the falls), Rocky Brook, Stony Brook (Montville, at rest area).
Stocked with fish from CT state hatcheries	Stocking of hatchery Brook Trout raised by the state has occurred within the last five years - stocking has ceased since 2017 at most waterbodies where wild Brook Trout populations exist. Sampling will take place in areas that have been directly stocked with hatchery trout and within tributaries in close proximity to stocked stream sections.	Green Falls River, Morgan Brook, Gulf Brook, Chatfield Hollow Brook, Stratton Brook, West Branch Salmon Brook, Beaver Brook (Barkhamsted, in state forest), Kettletown Brook, Mohawk Brook Outflow, Anguilla Brook.
Private Hatchery (PA) Stocked Streams	Developed through a review of liberation permits in close proximity to sites known to have or predicted to have wild Brook Trout using EBTJV patches.	Tennant Brook, Snake Meadow Brook, and Wood Brook in Plainfield; Ellis Brook, Patten Brook in Stafford; Conant Brook and Unnamed tributary to southeast of Hall's Pond, Barrows Brook, Tankerhoosen River, and Rickenback Brook in Vernon; Gillette

		<p>Brook in Colchester; possible unnamed streams of Lyon's Pond in Durham; Chatfield Hollow Brook (repeat) in Killingworth; Broad Brook, Creamery Brook, Bradleys Brook, and Muddy Brook in East Windsor and Ellington; Nelson Brook and Means Brook in Shelton; Bladens River and Hopp Brook in Seymour; Pond Brook, Pootatuck River, Tom Brook, Sandy Hook Brook, and Curtis Pond Brook in Newtown; Roaring Brook and Dayton Brook in Southington; Cussgutter Brook, Mix Brook, and Grannis Brook in Wolcott; South Mountain Brook in Bristol; Unnamed tributaries of the Nonewaug River in Bethlehem; Pickett Brook and unnamed tributaries of Hudson Pond possibly; Storehouse Brook in Barkhamsted; East Branch Salmon Brook and unnamed Tributaries in Granby; Guinea Brook and upstream unnamed tributaries, and Bonney Brook in Sharon; Mill Brook in Cornwall; Brown's Brook and Ocain Brook in Canaan.</p>
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The continuum of wild Brook Trout abundance based on a recent resample of sites sampled nearly 30 years ago.

Density	Range of fish present	Candidate Locations
<u>Very high Density</u>	> 570 fish/km	Buck Brook, Hopp Brook, Sages Ravine (Site B), and East Branch Shepaug River.
<u>High Density</u>	180.1 – 570 fish/km	Bonemill Brook, Tributary to Brown's Brook, Crooked Brook, Goodwin Brook, Green Brook, Hall Meadow Brook, Hawleys Brook, Jefferson Hill Brook, Kettle Brook, Kirby Brook, Tributary to Lake Waramuag Brook, Lisbon Brook, Tributary to Lisbon Brook, Moosehorn Brook, Rocky Brook (repeat), Stony Brook (upstream of rest area), Tatetuck Brook, Towantic Brook, Tributary to Transylvania Brook, and Tributary to West Aspetuck River)
<u>Moderate Density</u>	30.1 – 180 fish/km	Aborn Brook, Buttonball Brook, Curtis Brook, East Branch Naugatuck River, East

		Branch Leadmine Brook, Ford Brook, Great Brook, May Brook, Miller Brook, Muddy Gutter Brook, Owens Brook, Pendleton Hill Brook, Roaring Brook, Tributary to Rock Brook, Rugg Brook, Spruce Brook (repeat), Tarringford Brook, and Wangum Lake Brook.
<u>Low Density</u>	<i>0.1 – 30 fish/km</i>	Beacon Hill Brook, Bebbington Hill Brook, Bigelow Brook, Denman Brook, Eightmile River (Southington), Fox Brook, Gravelly Brook, Halfway River, Tributary to Nonewaug River, Oil Mill Brook, Poland River, Titicus River, Tributary to Walker Brook, Webetuck River, and Wyassup Brook)
Streams with co-existing wild Brown Trout		
	<i>Wisconsin documented the effects of gill lice on wild Brook Trout increased when brooks are found co-existing with wild Brown Trout (Mitro 2016).</i>	Belden Brook, Trading Cove Brook, Limekiln Brook, Deep Brook, Freeman’s Hill Brook, Tankerhoosen River, Merrick Brook, Mill River (Fairfield), and Macedonia River.

Appendix 2. Waterbodies targeted for sampling (40) during summer of 2020. Those with a ranking of one (1) are highest priority and were targeted first. Those in bold (30) were streams where sampling occurred.

Station Name	Station ID	Proximity Landmark	Lat	Long	Municipality	Categorization	Region	Rank
Wangum Lake Brook	17172	US Cannan Mountain Rd	41.9528	-73.2792	Canaan	Moderate Density	Northwest	1
Brown's Brook	16139	Route 63	41.9268	-73.2802	Canaan	Private Hatchery	Northwest	2
Heffers Brook	20451	Upstream Route 128	41.872	-73.3346	Cornwall	Private Hatchery	Northwest	1
Ocairn Brook	19159	Route 63	41.9007	-73.268	Canaan	Private Hatchery	Northwest	1
Guinea Brook	15507	Above River Road	41.8144	-73.3769	Sharon	Private Hatchery	Northwest	1
Mill Brook	15969	Upstream Dibble Hill Road	41.8751	-73.352	Cornwall	Private Hatchery	Northwest	1
Bonney Brook	16525	US Route 7	41.8141	-73.3739	Sharon	Private Hatchery	Northwest	1
East Branch Shepaug River	16630	10 M US Allyn Rd	41.8342	-73.2876	Goshen	Very High Density	Northwest	1
Mohawk Pond Outflow	16857	State Forest Road	41.8017	-73.2886	Goshen	Low Density & State Stocked	Northwest	2
Macedonia Brook	16821	US of wooden bridge at Upper Hickory campsite	41.7753	-73.4947	Kent	Moderate Density & WBK/WBN Present	Northwest	2
Kent Falls Brook	17639	Downstream Dugan Road	41.7726	-73.4132	Kent	Control	Northwest	1
Kent Falls Brook	18019	Downstream Carter Road	41.7637	-73.4074	Kent	Control	Northwest	2
Webetuck Creek	19663	Upstream Sharon Station Rd.	41.8848	-73.4937	Sharon	Low Density	Northwest	2
Limekiln Brook	14849	Upstream Rockwell Road	41.3838	-73.3761	Bethel	WBK & WBN Present	Southwest	1
Pond Brook	16425	DS intersection of Pond Brook Rd and Obtuse Rd	41.4432	-73.3545	Newtown	Private Hatchery	Southwest	1
Tom Brook	16037	Commerce Road	41.4146	-73.2837	Newtown	Private Hatchery	Southwest	3
Deep BrooK	15839	Old Farms Road	41.4098	-73.285	Newtown	Private Hatchery & WBK/WBN Present	Southwest	2
Pootatuck River	16095	Upstream Confluence with Deep Brook	41.4124	-73.2817	Newtown	Private Hatchery	Southwest	2
Curtis Pond Brook	20446	Toddy Hill Road	41.4073	-73.2635	Newtown	Private Hatchery	Southwest	1
Kettletown Brook	15577	At Mouth of Lake Zoar	41.427	-73.206	Southbury	Moderate Density & State Stocked	Southwest	1
Halfway River	16718	Rte 34 pulloff 0.25 miles US Great Quarter Rd	41.3886	-73.1936	Monroe	Moderate Density	Southwest	2
Nelson Brook	20452	Barn Hill Road	41.3352	-73.1853	Monroe	Private Hatchery	Southwest	1
Means Brook	20453	Upstream Saw Mill City Road	41.3195	-73.1619	Shelton	Private Hatchery	Southwest	1
Towantic Brook	17122	100 M Down Hill Past end of Harpin Rd	41.4408	-73.1044	Oxford	High Density	Southwest	1
Transylvania Brook, Tributary To	20231	Parallel to Flag Swamp Rd	41.5142	-73.2765	Roxbury	Moderate Density	Southwest	2
Transylvania Brook, Tributary To	17133	Parallel to Rte 67 US town line	41.5069	-73.27	Southbury	High Density	Southwest	2
Broad Brook	20454	Adjacent to Rt. 140 below confluence with Creamery Bk.	41.9248	-72.5125	East Windsor	Private Hatchery	Northcentral	1
Creamery Brook	17574	Rt. 140	41.9256	-72.5084	East Windsor	Private Hatchery	Northcentral	1
Bradleys Brook	TBD	Hike in off of Abbott Road	41.9146	-72.5016	East Windsor	Private Hatchery	Northcentral	1
Tankerhoosen River	17099	US of bolton road Immediately US of Belden Pond	41.8314	-72.4472	Vernon	WBK/WBN Present & Private Hatchery	Northcentral	1
Tankerhoosen River	18780	Reservoir Road	41.8406	-72.4396	Vernon	Private Hatchery & WBK/WBN Present	Northcentral	1
Barrows Brook	15594	Hike in from Fish & Game Road	41.8414	-72.4299	Vernon	Private Hatchery	Northcentral	1
Gulf Stream	17945	Upstrem Gulf Rd first crossing	41.9792	-72.4201	Somers	Very High Density & State Stocked	Northcentral	1
Aborn Brook	16469	5 M US of andSy Beach Road/Rt. 140	41.9308	-72.3675	Ellington	Moderate Density	Northcentral	1
Patten Brook	17402	Tetrault Road	41.9861	-72.372	Stafford	Private Hatchery	Northcentral	1
Crystal Lake Brook	20456	Rt. 190	41.9897	-72.3638	Stafford	Private Hatchery	Northcentral	1
Diamond Ledge Road	17360	Rt. 190	41.9712	-72.3567	Stafford	Private Hatchery	Northcentral	1
Conant Brook	16584	Sharps Mill Road/Luchon Road	41.8716	-72.2916	Willington	Private Hatchery	Northcentral	1
Unnamed trib to southeast of Hall's Pond	20448	Navratil Road	41.8547	-72.288	Willington	Private Hatchery	Northcentral	1
Green Brook	20447	US of south river rd	41.86	-72.3114	Tolland	High Density	Northcentral	1
Bonemill Brook	14141	Upstream 100 m Sweetheart Lake	41.9249	-72.3162	Tolland	High Density	Northcentral	1