Coldwater Fish Habitat: What We Know

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The Goal

Goal 1: Maintain healthy fish populations and their habitat +

Ensure freshwater fish populations remain healthy and are sustainably managed into the future.

Some actions to help reach this goal include:

- Conserve native fish species, particularly those exhibiting population decline, including state listed freshwater fish, as well as fish of greatest conservation need
- Use cost-effective modern scientific approaches to monitor, assess, and respond to changes in key sport fish, forage fish, and species of greatest conservation need
- Limit the spread and distribution of all aquatic invasive species, including fish pathogens, through surveillance, permitting, interagency coordination, research, remediation, and public outreach
- Implement actions identified in Maine's state Wildlife Action Plan to conserve Species of Greatest Conservation Need
- Provide timely consultation recommendations to regulatory agencies (MDEP, LUPC, FERC, ACF, etc.) to limit potential impacts to fish and aquatic communities from proposed actions
- Provide technical support and collaborate with private landowners to develop research and implement appropriate solutions to address management and conservation challenges
- Coordinate and collaborate with state, federal, tribal, and non-governmental organization partners to manage state fishery interests
- Promote and direct conservation actions, including conservation of riparian habitat, habitat restoration, and habitat connectivity targeting the state's highest priority wild native fisheries
- Manage for sustainable harvest of sport fish
- Manage harvest and recreational use of live fish as bait to support the popular practice of fishing with live fish as bait, where such practices do not threaten native coldwater fish populations
- Manage stocking and management programs considerate of potential negative interactions to native and wild fish through adherence to stocking guidelines, post stocking monitoring, research, interagency coordination, and consideration of hatchery fish sterilization techniques

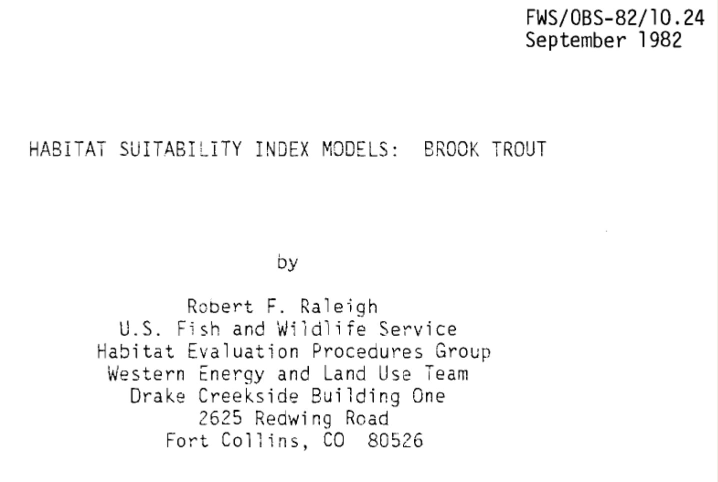
https://www.maine.gov/ifw/fish-wildlife/fisheries/strategic-management-plans.html

Coldwater Fish Habitat

What is 'good' BKT habitat?

….what is needed for sustainable wild population management?

- **Microhabitat diversity**
- **Cool water or the ability to access it when needed**
- **Ample <u>cover elements</u>**
- **Ample food resources**
- **Few strong competitors (non-natives/invasives)**
- *****Open river networks and habitat diversity, especially access to <u>pools!</u>*****



FWS/OBS-82/10.24
September 1982

HABITAT SUITABILITY INDEX MODELS: BROOK TROUT

by

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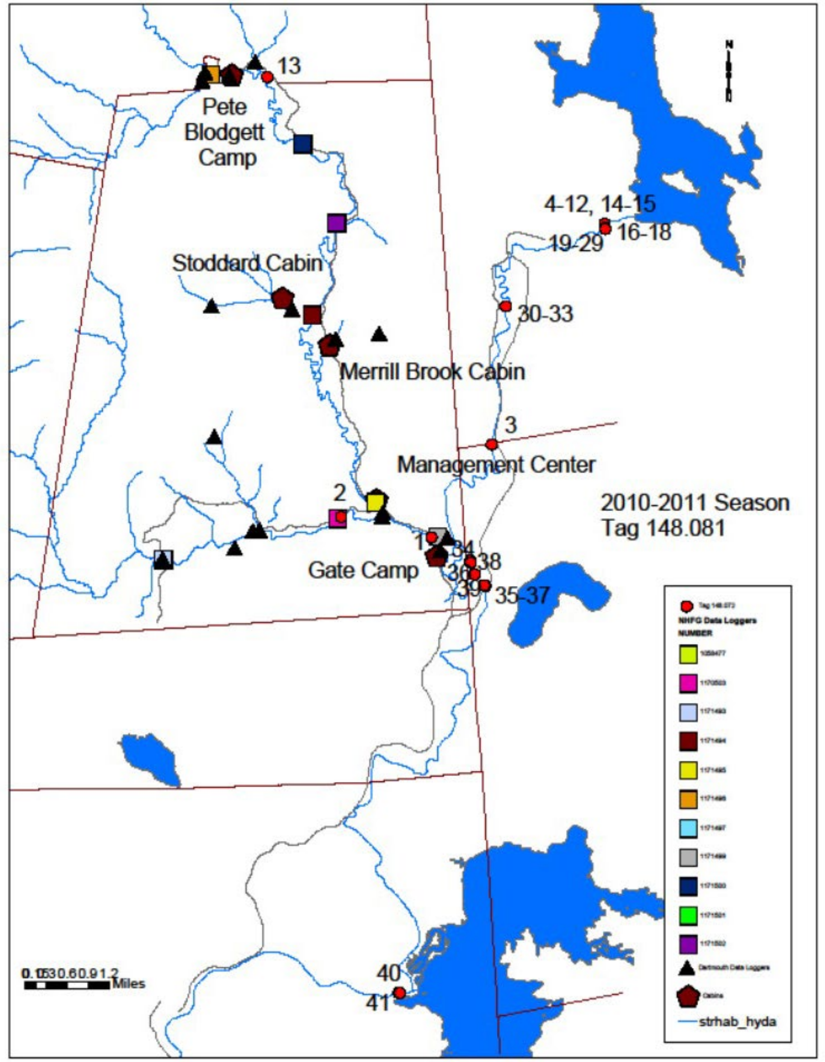
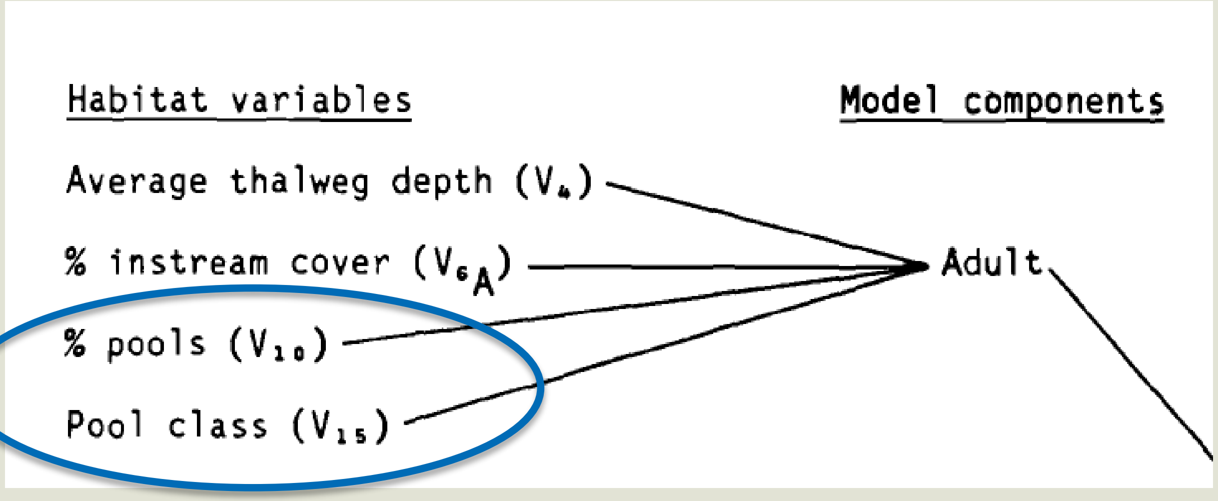


Why pools?



Raleigh 1982 HSI model – Brook Trout adults (riverine form)

- Important conditions: depth, degree of cover elements, and amount and type of POOLS!
- Larger/older fish need bigger spaces

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ARTICLE

Factors Limiting Brook Trout Biomass in Northeastern Vermont Streams

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TABLE 2. The generalized additive models for Brook Trout biomass ranked by AIC_c, along with the R^2, log likelihood (logLik), and number of parameters (k). Included in k are the parameters in the GAM and the smoothing parameters used in the splines.

Model	AIC_c	R^2	logLik	k
dur20 + woodtot + maxriff	27.19	0.766	0.97	9.8

DISCUSSION

The top-ranked model suggested that water temperature, wood density, and maximum riffle depth were all related to Brook Trout biomass in headwater streams of northeastern Vermont.

How we do it

Lots and lots of factors are measured or visually assessed!

STREAM ASSESSMENT:
Protocols for MDIFW stream data collection efforts

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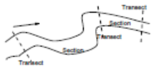
Stream Survey Project for Inland Waters
Revised May 2007
Stream Survey Guidelines Committee:

- *Merry Gallagher*, Research Biologist
- *Philip Wick*, Research Specialist
- *James Pellerin*, Region A
- *Robert Van Riper*, Region B
- *Greg Burr*, Region C
- *Forrest Bonney*, Region D
- *Jeff Bagley*, Region E
- *Nels Kramer*, Region F
- *Frank Frost*, Region G

Section 3.2 Meso-scale Stream Habitat Survey

STREAM SURVEY LEVEL 2
Meso-scale Stream Habitat Survey
Field Form Coding Instructions

The file format assumes that habitat measurements have been taken both at transverse transects and within sections. Transect and section numbering is downstream since surveys are normally conducted by starting at an upstream point and moving downstream. Each section takes the number of the upstream transect. Transects should be spaced accordingly:

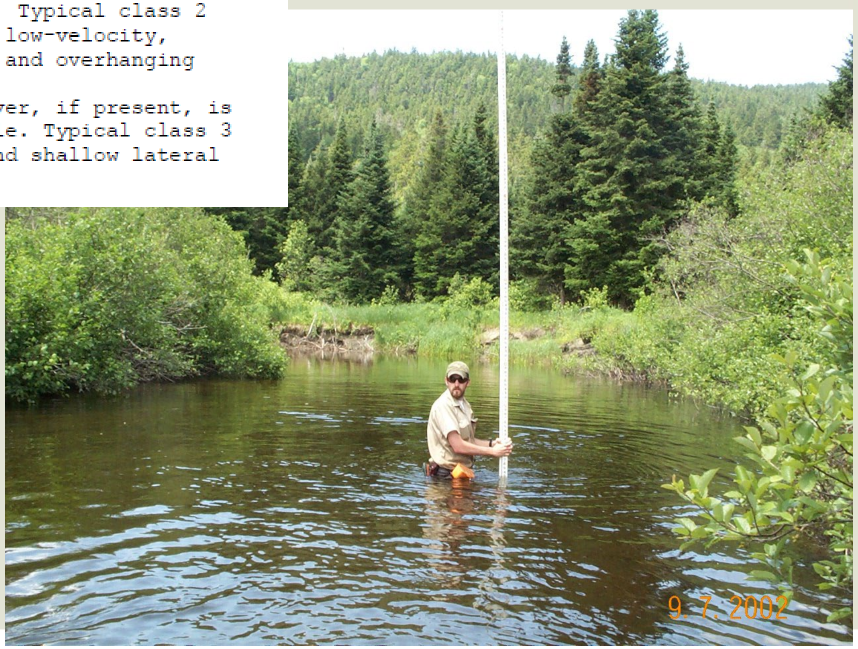


- At the onset of survey activities by each crew per day
- At sites of noticeable habitat breaks or changes
- Appropriately spaced within sections so that each section includes at least two transects (transect spacing does not need to be uniform within sections)

Therefore, care should be taken in measuring distances between transects.

<u>Class</u>: Pool class is a rating of the ability of a pool to hold adult salmonids based on surface area, depth, and cover.

1 = (Large, deep, good cover) More than 30 % of the bottom area is obscured by depth, surface turbulence, or structure (instream or overhanging cover); or max pool depth is ≥1.5 m (5 ft) in streams ≤5m (16 ft) wide or ≥ 2m (6.5 ft) in streams >5 m (16 ft) wide. Typical class 1 pools are the "angling gems" or "swimming holes", usually extending the entire width of the stream and over 3 feet deep.
2 = (Intermediate size, depth, or cover) From 5 to 30 % of the bottom area is obscured by depth, surface turbulence, or structure (instream or overhanging cover). Typical class 2 pools are large eddies behind boulders and low-velocity, moderate deep areas beneath undercut banks and overhanging vegetation.
3 = (Small and/or Shallow, poor cover) Cover, if present, is limited and the entire bottom is discernible. Typical class 3 pools are small eddies behind structures and shallow lateral pools.



How do Maine’s rivers and streams fare?

FISHERY INTERIM SUMMARY REPORT SERIES NO. 09-

WESTERN MAINE RIVER MORPHOLOGY

By

Forrest R. Bonney

Maine Department of Inland Fisheries and Wildlife

Fisheries and Hatcheries Division

Augusta, Maine

April 2009

Table 1. Dimensions and drainage areas of rivers and streams surveyed.

Name	Town	Length (mi.)	Av. width (ft.)	Area (acres)	Drainage area (mi²)	Stream order at mouth
Allagash Stream	T8R15 WELS	14.9	41.6	62	.	3
Bemis Stream	Township D	6.3	36.2	28	11.6	3
Cold Stream	West Forks, etc.	18.0	63.9	139	46.8	4
Cupsuptic River	Upper Cupsuptic	19.3	42.9	120	62.5	4
Dead River, S. Br.	Dallas Plt. to Eustis	23.5	61.6	1,839	144.0	4
Long Pond Stream	Sandy River Plt.	1.8	34.5	8	13.3	3
Magalloway River	Parmachenee, etc.	14.8	89.1	160	112.0	4
South Bog Stream	Rangeley Plt.	6.3	31.7	24	17.9	3
Sunday River	Newry etc.	13.3	81.9	132	51.4	4

Table 2. Streams for which Level II classifications and/or water quality parameters were determined for electrofishing reaches only.

Name	Town	Length (mi.)	Drainage area (mi.²)	Stream order at survey site
Alder Brook	Perkins Plt.	6.2	.	1
Bachelor Brook	Weld	3.0	.	1
Cascade Stream	Sandy River Plt.	5.0	7.84	3
Fillibrown Brook	New Sharon	6.2	8.91	2
Four Ponds Brook	Township D	.	.	2
Heald Stream	Moscow	4.0	.	2
Martin Brook	Rangeley Plt.	2.5	.	2
Mink Brook	Moscow	4.4	.	2
Moose Brook	Lynchtown	1.5	.	3
Mountain Pond Str.	Rangeley Plt.	2.3	.	1

What about pools?

Instream condition

Low number of pools

Large distances between them

Table 12. Pool frequency by stream type and order. Distances in feet.

Rosgen class	Order	Number of pools	Stream length	Distance between pools	Bankfull widths between pools observed	Bankfull widths between pools expected[1]
A1	3	3	1,037	346	10	.
A4	1	18	7,800	437	22	.
B2	4	2	1,962	981	14	4-5
B3	2	9	7,080	787	36	4-5
B3	3	3	2,800	933	19	4-5
B3a	2	2	2,000	1,000	36	4-5
B4	4	5	8,820	1,764	15	4-5
B4a	1	4	3,000	750	40	4-5
B4a	3	43	7,820	182	5	4-5
C2	3	5	1,800	360	8	5-7
C3	2	47	31,881	678	21	5-7
C3	3	21	7,075	337	12	5-7
C4	1	73	7,880	108	9	5-7
D4	2	4	2,880	720	31	.
D4	3	14	2,420	173	5	.
F4	3	29	54,752	1,888	26	.

From: F. Bonney (2009) Western Maine River Morphology (IFW report)

Low overall percentage of pool habitat

Table 10. Habitat characteristics by reach. Measurements in ft and ft².

Stream class	Stream order	Mean length	Mean width	Mean depth	Cover (%) shade	Cover (%) shrub	Area stream	Area pool	% pool
A1a+	4	1,440	63.3	2.1	41	10	63,167	664	1.1
A1	3	2,619	31.0	0.9	29	67	273,055	16,918	9.3
A2	3	4,500	44.2	1.1	47	41	199,050	38,520	19.4
A4	1	7,800	20.2	0.5	66	23	157,560	8,370	5.3
B2	3	2,275	60.5	0.9	42	31	126,290	11,340	9.0
B2	4	1,962	68.6	1.7	36	31	133,703	6,093	4.6
B2a	2	5,846	30.9	0.8	42	35	74,775	31,755	42.5
B3	2	7,080	21.6	0.5	65	17	152,928	20,855	13.6
B3	3	6,627	49.2	1.0	37	28	323,612	1,729	0.5
B3	4	3,909	62.3	1.6	9	16	243,531	149	0.1
B3a	2	2,000	28.0	0.5	49	6	56,000	1,680	3.0
B3c	4	11,200	68.2	1.1	9	36	725,210	89,890	12.4
B4	1	7,880	20.9	0.7	73	30	141,140	24,400	17.3
B4	3	8,283	42.3	1.0	30	22	852,015	63	0.01
B4	4	8,820	118.2	1.5	2	12	1,042,524	19.1	0.2
B4a	2	6,100	18.8	0.4	18	19	114,680	71	0.1
B4a	3	7,820	44.3	0.6	55	14	340,094	0	0
B4c	3	10,050	27.8	1.2	.	.	279,390	21,235	7.6
B4c	4	3,850	75.7	1.5	56	10	357,105	440	0.1
C2	3	1,800	47.4	1.2	40	82	85,320	22.1	0.03
C3	2	32,280	33.1	0.7	37	71	1,068,468	124.6	0.01
C3	3	13,091	32.6	0.9	25	71	432,302	40,716	9.4
C3	4	14,907	80.0	1.7	3	47	1,060,916	342,921	32.3
C4	3	3,278	27.7	0.6	38	19	278,037	160,000	57.5
C4	4	9,523	56.1	1.4	28	12	534,240	1,219	0.2
C5	3	5,150	40.7	0.7	36	60	266,110	91,275	34.3

Cold Stream

Table 11. Pool frequency, Cold Stream.

Reach	Rosgen class	Number of pools	Stream length	Distance between pools	Bankfull widths between pools observed	Bankfull widths between pools expected
1	F3	11	15,230	1,385	20	
2	B2	.	350	.	.	4-5
3	A1a+	2	440	220	4	
4	Bc2	.	4,589	.	.	4-5
5	Bc4	5	7,200	1,440	15	4-5
6	A1a+	3	1,500	500	8	
7	Bc4	2	500	250	4	4-5
8	C4	9	9,523	1,058	19	5-7
9	B4	1	3,909	3,909	63	4-5
10	A1a+	2	1,000	500	8	
11	B3	14	46,454	3,318	68	4-5

Take home: we need more pools that are closer together and offer a diversity of depths and cover types.

Table 12. Pool characteristics by Reach, Rosgen stream type and by pool class, Cold Stream.

Reach	Stream type	Pool class	No. pools	Area (ft^2)	Max. depth
1	F3	1	3	10,475	5.6
		2	5	18,183	4.4
		3	3	2,616	4.2
3	A1a+	3	2	7,200	.
5	Bc4	2	2	2,500	5.2
		3	3	4,000	3.9
6	A1a+	1	2	8,575	7.9
		3	1	1,500	4.2
7	Bc4	3	2	2,300	3.9
8	C4	2	2	10,200	.
		3	7	1,986	3.3
9	B4	2	1	1,488	5
10	A1a+	2	1	1,575	6.2
		3	1	1,050	3.1
11	B3	1	1	3,290	6.2
		2	11	6,124	25.8?
		3	2	1,755	4.3
	All	**1**	**6**	**22,340**	**7.9**
		2	**22**	**40,070**	**6.2**
		3	**21**	**22,407**	**4.3**
		All	**49**	**84,817**	

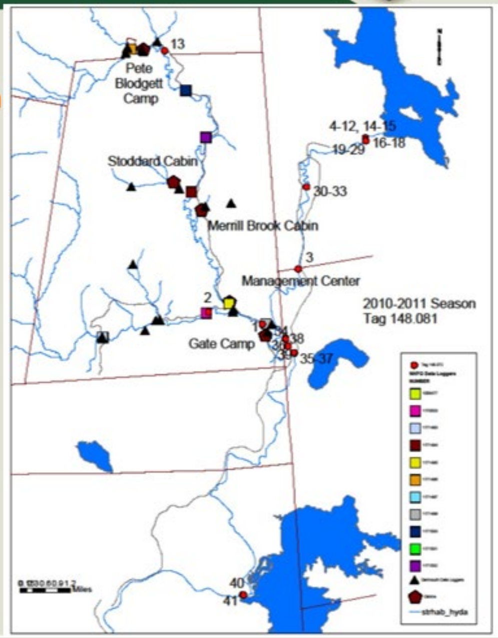
What next?

- From earlier:

What is 'good' BKT habitat?

….what is needed for sustainable wild population management?

- Microhabitat diversity
- Cool water or the ability to access it when needed
- Ample cover elements
- Ample food resources
- Few strong competitors (non-natives/invasives)
- *****Open river networks and habitat diversity, especially access to pools!*****



- Improve connectivity – *we are making progress!*
- Keep it cold and get cold water as far downstream as possible
- Improve instream conditions
  - Increase cover quantity and availability
  - Improve depth profiles
    - Channel constriction
  - Increase habitat diversity
    - POOLS! Whatever it takes!
    - Wood addition
    - Return rocks/boulders to channels**

If you build it, they will come

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MANAGEMENT BRIEF

Response of Brook Trout Biomass to Strategic Wood Additions in the East Branch Nulhegan River Watershed, Vermont

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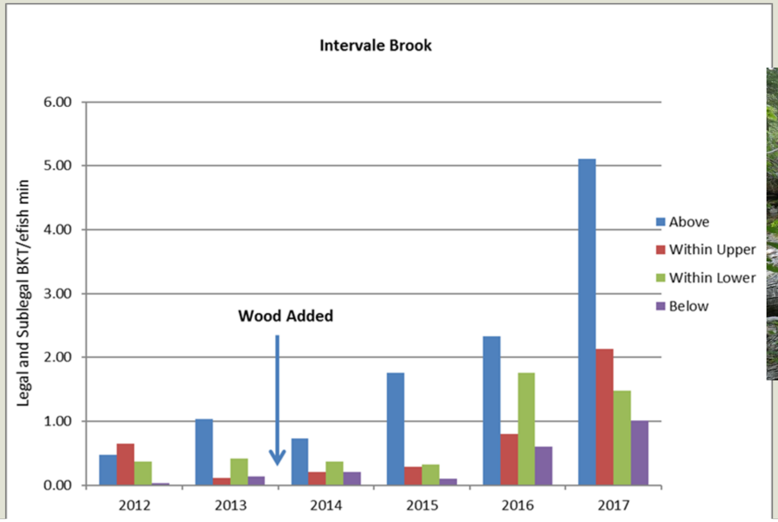

A high gradient, channelized 'large' stream. Multiple 'treatments' were conducted over 2 years.

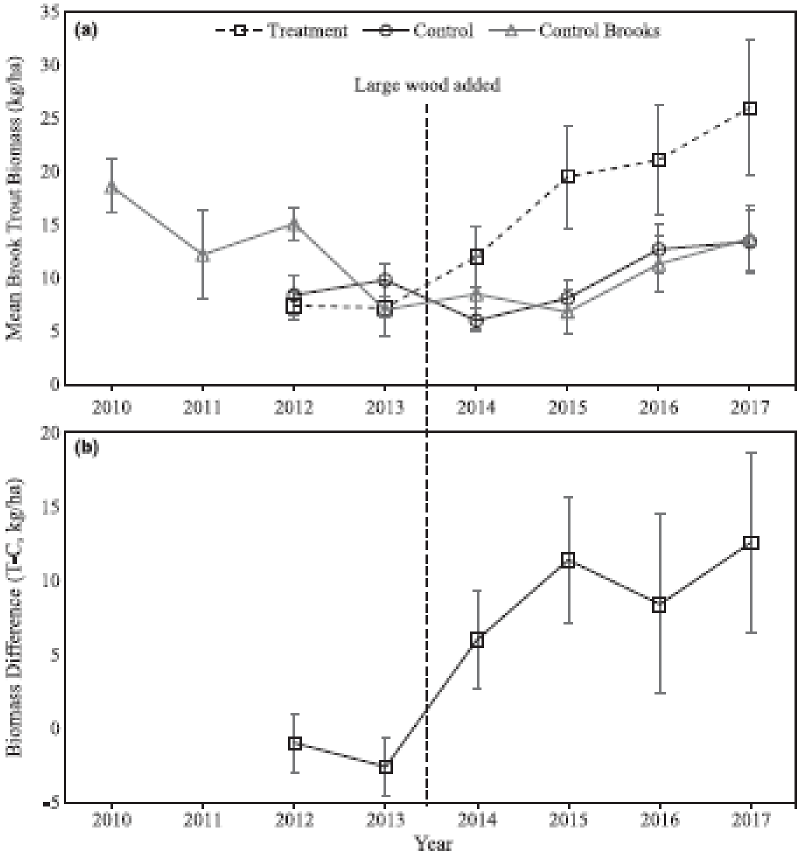

FIGURE 2. (a) Mean Brook Trout biomass through time at the nine treatment sites, nine control sites, and three sites that are in the same watershed but are isolated by distance and/or impassable culverts (control brooks), and (b) the mean difference in Brook Trout biomass (treatment minus control) for each of the nine control–treatment pairs through time. Large woody material was added to the treatment sites following the 2013 sampling (dashed vertical line). Error bars display ± 1 standard error.

Too much of this More please!*