

## **Upper East Twin River Trout Survey-2009**

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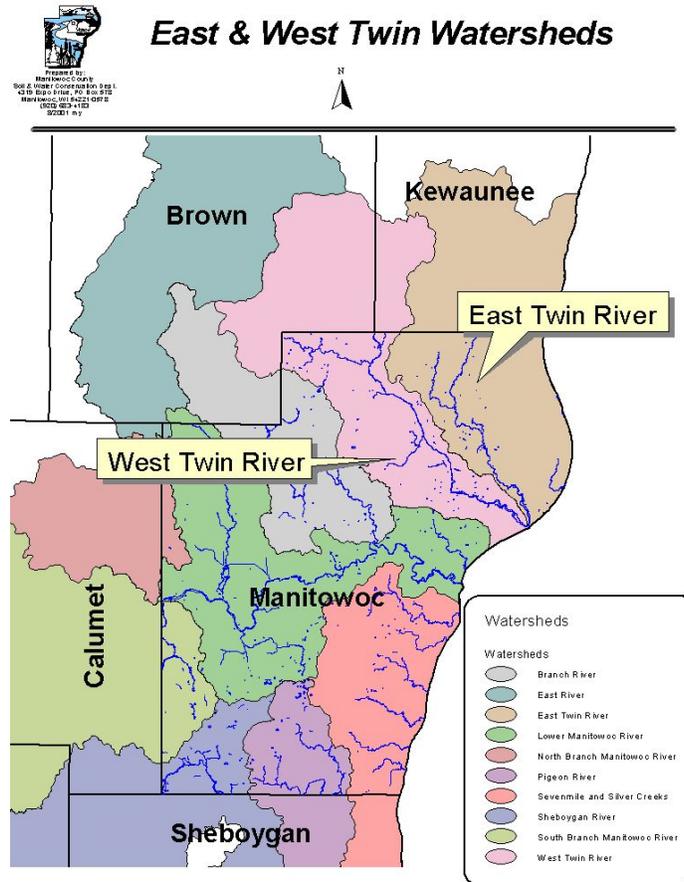
Streams in the East Twin Watershed flow southeastward through southern Kewaunee County and northern Manitowoc County before joining the East Twin River and flowing to the City of Two Rivers where it enters Lake Michigan. Upper sections of the watershed are conducive for trout and have been classified as trout waters by the DNR. Trout populations in these upper watershed streams are a mixture of native trout (brook trout), stocked trout (brown trout) or recently colonizing trout (rainbow trout).

The purpose of the study described in this report was to determine the status of trout in the headwaters of the East Twin River, Krok Creek and Tisch Mills Creek by using the Index of Biotic Integrity (IBI) and catch per effort data for trout (CPE). By quantifying the type and number of fish species, we can judge the current condition of the fish population in that stream, compare the results to previous stream surveys and compare that stream to other streams across the state. Streams and survey segments were randomly selected using protocols developed for Tier 1 monitoring of Wisconsin trout waters. Actual survey locations were selected based on professional judgment, past survey locations and management need. In addition to collecting fish we measured other variables including air and water temperature, dissolved oxygen, percent oxygen saturation, flow and habitat was qualitatively rated.

This survey found that fish populations in the upper East Twin River Watershed have generally remained stable since the 2001 survey. Results from an individual stream survey location indicate: that brook trout populations in Tisch Mills Creek and in the East Twin River above HWY 29 have remained stable between the two surveys, that brook trout numbers in the East Twin River below Highway 29 have declined since 2001 and that although Krok Creek supports coldwater fish species, trout were not captured during either survey. Further we found that water quality within the watershed is generally good as indicated by dissolved oxygen levels greater than 5 PPM and cool water temperatures. Also that streams within this system are well buffered and feature a variety of large-scale and small-scale habitats for aquatic organisms. However, habitat in some stream sections appeared to be limited which likely negatively impacted fish populations in those river sections.

# INTRODUCTION

Streams in the East Twin Watershed flow southeastward through southern Kewaunee County and northern Manitowoc County before joining the East Twin River and flowing to the City of Two Rivers where it enters Lake Michigan (Figure 1). The 40,854 hectare watershed is split nearly evenly between Kewaunee and Manitowoc Counties with 17,332 hectares (42.5%) in Kewaunee County and 23,522 hectares (57.5%) in Manitowoc County (WCD 1966 and 1968).



**Figure 1. The East Twin River Watershed is located in southern Kewaunee and northeastern Manitowoc Counties.**

Streams within the watershed range from being intermittent to perennial cold water streams. Biological use classifications of these streams also vary widely with multiple classifications found on some streams. Of the 159.1 stream kilometers in the basin, 72.6 kilometers have had their biological use classified (WDNR 1995). In this watershed 13.4 kilometers of stream are classified as trout waters, 28.8 kilometers are classed as warmwater sport fisheries, 14.5 kilometers as warmwater forage fisheries, 10.6 kilometers as limited forage fisheries and 5.3 kilometers of limited aquatic life. Unclassified streams have the default classification of warmwater sport fisheries.

## **East Twin River**

The East Twin River is a large, low gradient stream that flows 36.9 through mostly agricultural land on its way to Lake Michigan. Upper sections in Kewaunee County are slightly stained and classified as either Class 1 or Class 2 trout waters (WDNR 1995). Stream corridors are well buffered by forests and numerous groundwater seeps are present. Stream bottom sediments range from all sand to all silt with bedrock and gravel present in some streams (WCD 1966). Although fish surveys have been conducted infrequently on the East Twin River, they have found a wide variety of gamefish which range from trout in upper reaches, to smallmouth bass and northern pike in middle reaches to Lake Michigan species in the area near Lake Michigan (Fago 1985, Hogler 2000).

## **Tisch Mills Creek**

Tisch Mills Creek is an 8.6 kilometer long creek that is a tributary to the East Twin River. The headwaters of the creek are in Kewaunee County where it drains a large amount of wetland. Upper sections of Tisch Mills Creek are classified a warmwater forage fishery because of low flow and poor habitat (WCC 1968). The lower 1.6 kilometers of Tisch Mills Creek are classified as Class II brown trout waters because of improved flow, habitat and cooler water temperatures. Electroshocking surveys in the 1960's (Hogler and Cahow 2002) found that stocked trout clipped from previous seasons had survived well and showed good growth rates. Bank and pool cover, and food abundance were considered good.

## **Krok Creek**

Kroc Creek is a small, shallow 4.3 kilometer long tributary to the East Twin River. Flow is sluggish and the water is stained (Hacker 1957). Hacker (1957) found that stream bottom material consisted of 80% silt, and that the remainder was sand and gravel. Creek chub and pearl dace were the most commonly captured fish with white sucker, brook stickleback and sea lamprey occasionally captured. Trout have been occasionally captured in the lower sections of Krok Creek by anglers.

## **Study Rationale**

The purpose of the study described in this report was to determine the status of trout in the headwaters of the East Twin River, Krok Creek and Tisch Mills Creek by using the Index of Biotic Integrity (IBI) (Lyons 1992) and catch per effort (CPE) data. By quantifying the type and number of fish species, we can judge the current condition of the fish population in the stream, then compare results to previous stream surveys and compare that stream to other streams across the state.

## METHODS

Streams and survey segments were randomly selected using protocols developed for Tier 1 monitoring of Wisconsin trout waters. Actual survey locations were selected based on professional judgment, past survey locations and management need. Each site was 150 meters in length although because of brushy conditions, the site on Krok Creek was 100 meters length and to match the 2001 survey, 300 meters of stream was surveyed on Tisch Mills Creek. Fish were collected in a single upstream pass using either a standard backpack electroshocking unit in small streams or a stream shocker in larger streams. All fish were netted, identified, counted and gamefish length was measured to the nearest millimeter.

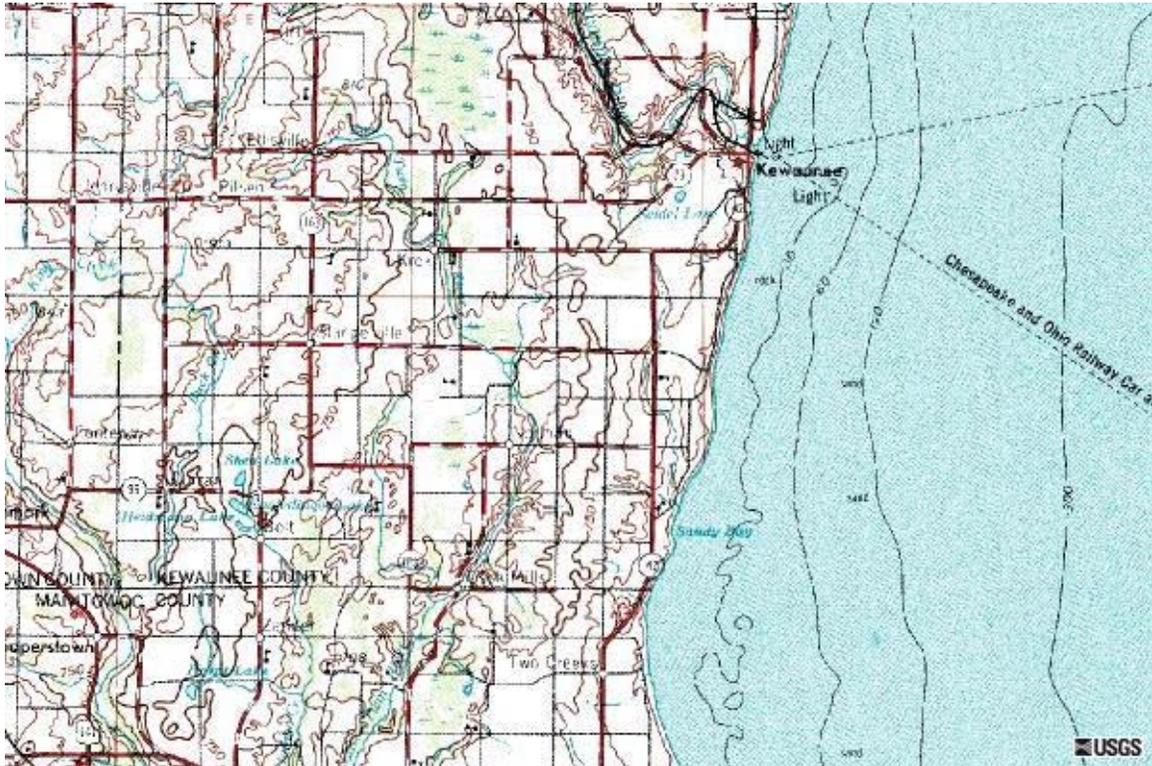
Other variables that were measured while on site included air and water temperature, dissolved oxygen, percent oxygen saturation, flow and habitat was qualitatively rated (Simonson et al 1994). Qualitative scores can range from 0 to 100 with scores less than 25 indicating poor habitat, 25 to 49 fair habitat, 50 to 74 good habitat and scores above 74 indicating excellent habitat. Within the scoring matrix, items that are rated include buffer width, bank erosion, pool depth, stream width to depth ratio, riffle to riffle distances, fine sediment coverage and cover for fish. Streams that score high on the rating index have diverse habitats, deep pools and no erosion. Streams that score low include those that have limited buffers, shallow water, erosion, sediment deposition and little fish habitat.

Gradient and sinuosity were determined by using GIS and map measuring tools to determine the value of these variables.

The Index of Biotic Integrity (IBI) based on the fish community at each sampling location was calculated using excel spreadsheets for cold water communities. IBI scores can range from 0 (poor) to 100 (excellent). Fish communities that receive poor IBI scores have few coldwater species and many species tolerant to warmwater or disturbed habitat while streams with high scores have many coldwater species of fish, and species intolerant to habitat disturbances. All sampling was conducted in July 2009.

## RESULTS

The three survey sites that were selected on the East Twin River were upstream of Townline Road, at Krok Road and upstream of County Highway J (Figure 2). The Townline Road site was located in the Class 1 section of the East Twin River and other two sites were located in the Class 2 section of the river. The Townline and HWY J sites were also sampled during the 2001 survey (Hogler and Cahow 2002). The site on Krok Creek was upstream of Highway 29 and the site on Tisch Mills Creek was upstream of County Highway BB. Both of these sites were also sampled in 2001.



**Figure 2. Trout sampling locations on the East Twin River, Tisch Mills Creek and Krok Creek surveyed in 2009. Site 1 is upstream of Townline Road, site 2 is at Krok Road, site 3 is upstream of HWY J, site 4 is Krok Creek upstream of Highway 29 and site 5 is on Tisch Mills Creek upstream of County Highway BB.**

## **East Twin River**

### Townline Road

The site at Townline Road was located upstream of the road and ran for 150 meters. At this location the East Twin River is a 3<sup>rd</sup> order stream with a gradient of 1.15 meters per kilometer and a sinuosity of 1.45:1. The surveyed section of river ran through mainly a shrub-woodland landscape (Figure 3).

This site was surveyed on July 1 during the morning hours. At the time of survey the air temperature was 16° C, the water temperature was 12.4° C, and the stream dissolved oxygen (DO) was 75.1% saturated at 8.03 mg/l.

The water level in the stream was judged to be normal for the time of year and was clear. Flow was measured at 0.03 cubic meters per second (CMS).



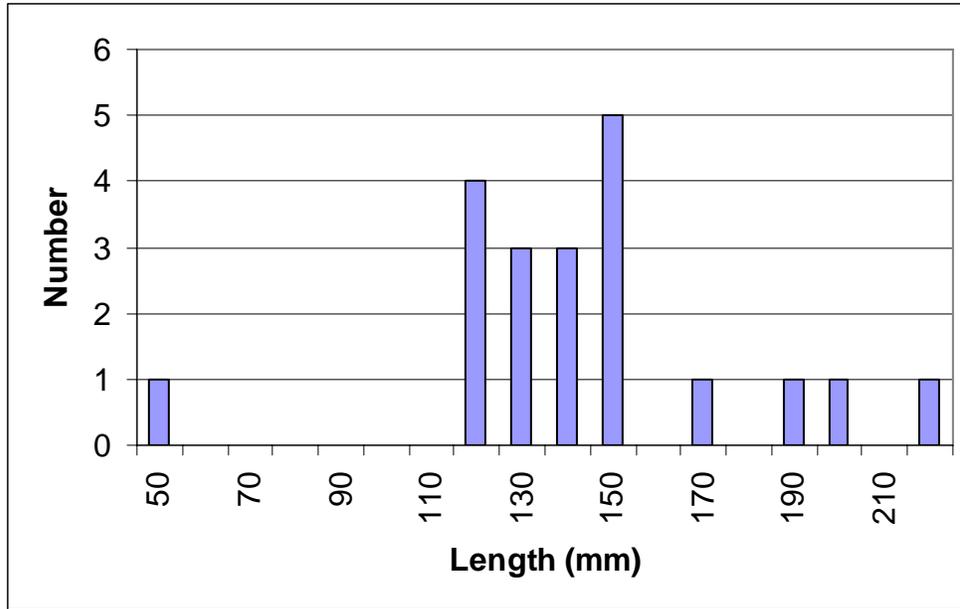
**Figure 3. Fisheries staff member using a backpack shocker upstream of Townline Road on the East Twin River. At this location the stream is well buffered and runs through a shrub-woodland complex.**

A backpack shocker was utilized to survey the 150 meter station above Townline Road. During the 41 minutes of shocking we captured 163 individual fish representing eight species (Table 1). This catch resulted in an IBI score of 50 which is indicative of a fair to good coldwater fish community.

**Table 1. The species mix and abundance of fish captured during electroshocking upstream of Townline Road on the East Twin River.**

<b>Species</b>	<b>Number</b>
<b>Mottled Sculpin</b>	<b>78</b>
<b>Central Mudminnow</b>	<b>42</b>
<b>Brook Trout</b>	<b>20</b>
<b>Pearl Dace</b>	<b>13</b>
<b>American Brook Lamprey</b>	<b>7</b>
<b>Blacknose dace</b>	<b>1</b>
<b>White Sucker</b>	<b>1</b>
<b>Creek Chub</b>	<b>1</b>
<b>TOTAL</b>	<b>163</b>

Mottled sculpin dominated the catch followed by central mudminnow and brook trout. The twenty brook trout ranged in length from 55 mm to 220 mm in length with an average length of 147 mm. Nine of twenty (45%) captured brook trout were greater than 150 mm, three of twenty (15%) were greater than the 178 mm size limit and two of twenty (10%) were greater than 200 mm in length. It appears from length frequency analysis that at least two age classes of brook trout were present in our sample (Figure 4). Brook trout CPE was 13.4 per 100 meters shocked.



**Figure 4. Brook trout length frequency of fish captured and measured during electroshocking at Townline Road.**

Following shocking, staff evaluated stream habitat using the qualitative habitat scoring sheet. At this location the river had high rankings for buffer width and for limited bank erosion. It scored low in depth and because of the presence of extensive fine sediment coverage throughout the site. Overall the stream at this location scored 53 points indicating good qualitative habitat.

#### Krok Road

The site at Krok Road was located between Church Road and Townline Road where the river crosses into the ditch line of the road (starting location N44.42909, W-87.63942). At this location the East Twin River is a 3<sup>rd</sup> order stream with a gradient of 1.13 meters per kilometer and a sinuosity of 1.85:1. The river at this location runs through a grassland-shrub complex (Figure 5).



**Figure 5. This photo looks upstream at the East Twin River near Krok Road.**

The survey at this location was conducted on July 2 during morning hours. At the time of the survey the air temperature was 17° C, the water temperature was 13.6° C and the DO in the stream was 90.4% saturated at 9.4 mg/l.

Water level was judged to be normal for this time of year and the water was clear. Flow was measured at 0.05 CMS.

A backpack shocker was utilized to survey the 150 meter station at Krok Road. During the 50 minutes of shocking we captured 178 individual fish representing eight species (Table 2). This catch resulted in an IBI score of 20 which is indicative of a poor coldwater fish community.

**Table 2. The species mix and abundance of fish captured during electroshocking near Krok Road on the East Twin River.**

<b>Species</b>	<b>Number</b>
<b>Central Mudminnow</b>	<b>78</b>
<b>Pearl Dace</b>	<b>42</b>
<b>Creek Chub</b>	<b>20</b>
<b>White Sucker</b>	<b>13</b>
<b>Mottled Sculpin</b>	<b>7</b>
<b>Common Shiner</b>	<b>1</b>
<b>Blacknose Dace</b>	<b>1</b>
<b>Redside Dace</b>	<b>1</b>
<b>TOTAL</b>	<b>178</b>

Central mudminnow dominated our catch followed by pearl dace and creek chub (Table 2). One reddsidedace, species of special concern was captured but no trout were seen or captured at this location.

Following shocking, staff evaluated stream habitat using the qualitative habitat scoring sheet. At this location the river had high rankings for limited bank erosion and low rankings for shallow depth and extensive fine sediment coverage. Overall the stream at this location scored 47 points indicating fair qualitative habitat.

### County Highway J

The East Twin River at this location is a 3<sup>rd</sup> order stream that has a gradient of 0.53 meters per kilometer and a sinuosity of 1.87:1. The lower portion of the site appears to have been channelized to allow for easier passage under HWY J. This site is characterized as following through a woodland complex that contains a mixture of tree species (Figure 6).



**Figure 6. Looking upstream at the East Twin River at HWY J as it flows through woodland complex.**

We surveyed this location on July 6 during the morning hours. At this time the air temperature was 20° C, the water temperature was 15.6° C and the DO of the stream was 89.5% saturated at 8.93 mg/l.

Flow was measured at this location at 0.10 CMS. Water level was judged to be near normal or slightly below (0.1m) for this time of year and was clear.

We used a stream shocker with 2 probes at this location to capture fish. In 35 minutes of shocking we captured 361 individual fish representing 15 species (Table 3).

**Table 3. The species mix and abundance of fish captured during electroshocking upstream of HWY J on the East Twin River.**

<b>Species</b>	<b>Number</b>
Creek Chub	111
Common Shiner	68
Hornyhead Chub	34
White Sucker	31
Southern Redbelly Dace	28
Mottled Sculpin	27
Central Mudminnow	25
Pearl Dace	15
Blacknose Dace	7
American Brook Lamprey	4
Johnny Darter	3
Redside Dace	3
Brook Stickleback	3
Rainbow Trout	1
Longnose Dace	1
<b>Total</b>	<b>361</b>

Creek Chub and common shiner dominated the catch with substantially fewer individuals of other species captured (Table 3). One 150 mm long rainbow trout and one redbelly dace was captured at this location. Rainbow trout CPE was 0.67 per 100 meters shocked. The species mix at this location resulted in an IBI score of 20 indicating a poor coldwater fish community at this location.

Following shocking, staff evaluated stream habitat using the qualitative habitat scoring sheet. At this location the river had high rankings for buffers, limited erosion and fish cover and lower rankings for depth and extensive fine sediment coverage and limited habitat diversity. Overall the stream at this location scored 53 points indicating good qualitative habitat.

## **Krok Creek**

### Highway 29

Krok Creek upstream of HWY 29 is a second order stream that has a gradient of 0.92 meters per kilometer and a sinuosity of 1.18:1. The stream flows through a thick cover of tag alder and has a perched culvert about 80 meters upstream of HWY 29 (Figure 7).

The survey in Krok Creek was conducted on July 1 during the early afternoon. At the time of the survey the air temperature was 21° C, the water temperature was 13.2° C and the DO in the stream was 96.6% saturated at 10.17 mg/l.

Water level was judged to be normal for this time of year and the water was clear. Flow was measured at 0.03 CMS.



**Figure 7. Looking upstream on Krok Creek at the dense tag alder cover that was common throughout the survey site.**

We used a backpack shocker to sample the 100 meter station on Krok Creek. During the 25 minute shocking assessment we captured 43 individual fish representing 4 species (Table 4).

**Table 4. The species mix and abundance of fish captured during electroshocking upstream of HWY 29 on Krok Creek.**

<b>Species</b>	<b>Number</b>
Pearl Dace	36
Creek Chub	4
Mottled Sculpin	2
White Sucker	1
<b>Total</b>	<b>43</b>

Pearl dace dominated the catch with substantially fewer fish of other species captured. The species mix at this location resulted in an IBI score of 40 indicating a fair coldwater fish community at this location.

Following shocking, staff evaluated stream habitat using the qualitative habitat scoring sheet. At this location the river had high rankings for buffers width and low rankings for depth, extensive fine sediment coverage and limited habitat diversity. Overall the stream at this location scored 28 points indicating fair qualitative habitat.

## **Tisch Mills Creek**

### County Highway BB

Upstream of Highway BB Tisch Mills Creek is a 1<sup>st</sup> order stream with a gradient of 1.2 meters per kilometer and a sinuosity of 1.5:1. Tisch Mills Creek at this location runs through mostly woodland with some grassland and shrub cover present (Figure 8).



**Figure 8. Looking upstream at Tisch Mills Creek from the County Highway BB bridge.**

The survey at this location was conducted on July 7 during the morning. At the time of the survey the air temperature was 22° C, the water temperature was 14.7° C and the DO in the stream was 9.98 mg/l.

Water level was judged to be normal for this time of year and the water was clear. Flow was measured at 0.04 CMS.

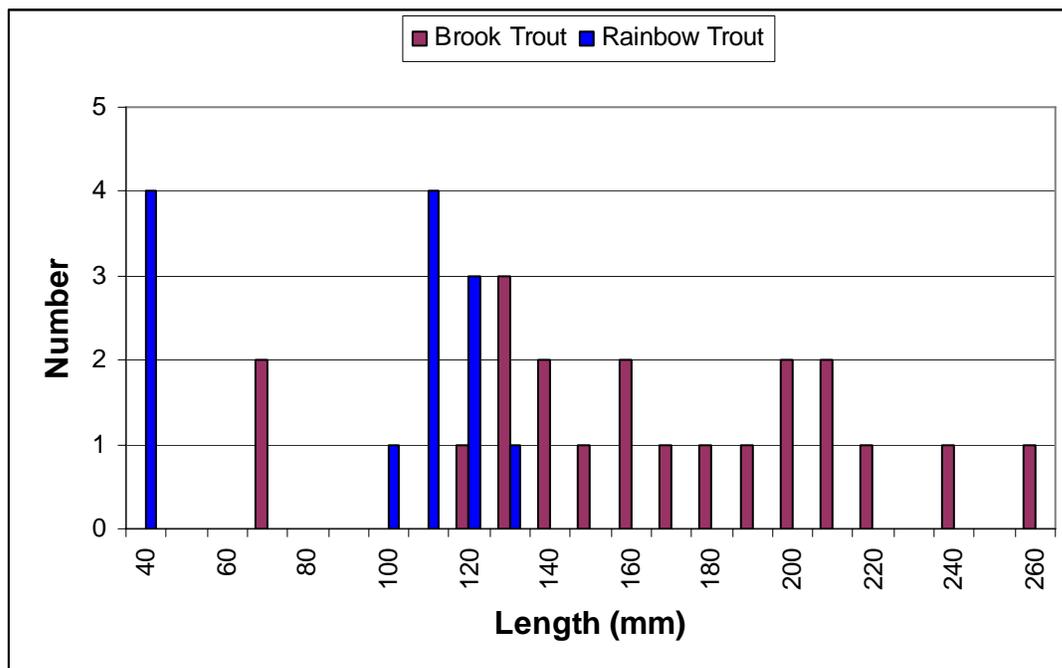
We electroshocked the 300 meter long survey site on Tisch Mills Creek in 41 minutes. A total of 149 fish representing 9 species were captured (Table 4). Blacknose dace and mottled sculpin were the species most commonly captured with other species caught less frequently. The species mix at this location resulted in an IBI score of 50 indicating a fair to good coldwater fish community at this location.

During shocking we captured 21 brook trout and 13 rainbow trout. The brook trout ranged in length from 74 mm to 260 mm and had an average length of 169 mm. Thirteen of twenty-one (61.9%) captured brook trout were greater than 150 mm in length, 9 of 21 (42.9%) were greater than 178 mm size minimum and 7 of 21 (33.0%) were greater than 200 mm in length. The rainbow trout ranged in

length from 41 mm to 135 mm and had an average length of 95 mm. All captured rainbow trout were less than 150 mm in length. Based on the distribution of length, it appears that we captured at least three classes of brook trout including young of year and 2 year classes of rainbow trout including young of year (Figure 9). Brook trout CPE at this location was 6.93 per 100 meters shocked and the rainbow trout CPE was 4.29 per 100 meters shocked.

**Table 4. The species mix and abundance of fish captured during electroshocking upstream of HWY BB on Tisch Mills Creek.**

Species	Number
Blacknose Dace	35
Mottled Sculpin	33
Creek Chub	28
Brook Trout	21
Rainbow Trout	13
Pearl Dace	7
White Sucker	4
Central Mudminnow	4
American Brook Lamprey	4
<b>Total</b>	<b>149</b>



**Figure 9. The length distribution of brook and rainbow trout captured by backpack shocking on Tisch Mills Creek.**

Evaluation of stream habitat using the qualitative habitat scoring sheet was completed following the shocking assessment. At this location the river had high rankings for buffers, limited erosion and fish cover and lower rankings for depth

and extensive fine sediment coverage and limited habitat diversity. Overall the stream at this location scored 77 points indicating excellent qualitative habitat.

## **DISCUSSION**

Following Wisconsin sampling protocols we surveyed three sites on the East Twin River and one site on Krok Creek and one site on Tisch Mills Creek, to assess trout populations in the upper East Twin Watershed. The work in 2009 was similar to work that was done in 2001 (Hogler and Cahow 2002). In addition to electrofishing to assess the fish population at each site, we measured DO, flow and qualitatively assessed habitat.

### **Temperature and Dissolved Oxygen**

At each of the 5 sites, measured dissolved oxygen levels and water temperatures were adequate to support trout populations. The results from 2009 were very similar to those in 2001 when all but Krok Creek had temperatures less than 22 C. It is likely that a cool 2009 (2001 was very warm) is responsible for the cooler stream temperatures noted in 2009 than we measured in 2001 (Hogler and Cahow 2002).

### **Flow**

Similar to temperature and DO, measured flow in 2009 was very similar to what was measured in 2001 and was sufficient not to limit the communities found in each stream. This is not surprising since these streams owe a high percentage of their flow to groundwater inputs rather than from surface flow which results in more consistent stream flows than in systems that are exclusively surface water drained.

### **Habitat**

Habitat in 2009 was assessed qualitatively at each of the survey sites. Scores from the ratings ranged from a low of 28 on Krok Creek to a high of 77 on Tisch Mills Creek. All streams scored well for having wide buffers and limited bank erosion. If a stream had a low score it was likely because of shallow water, monotonous habitat and widespread fine sediment coverage. In 2001, habitat was directly measured (width, length of features, etc) and sediment makeup was visual estimated at 4 locations along 12 transects so comparisons between 2001 and 2009 are more subjective than objective.

Despite the lack of direct comparisons, Tisch Mills Creek appears to have the "best" trout habitat based on both surveys with very little change observed between the two surveys. Habitat was diverse consisting of a mix of runs, riffles and pools, fish cover types and there was little fine sediment in the surveyed section of river.

The East Twin River above Townline Road was surveyed in 2001 and 2009 and habitat was assessed during both survey years. Habitat in this section of the East Twin River appears to be good with some limited changes noted between the survey years. In 2001 fine sediments were found near areas of bank erosion while in 2009, fine sediment coverage was more extensive. Fine sediment did not appear to be local in nature and likely came from upstream river sections although we did note in 2001 and 2009 several areas of erosion near the upstream end of the survey site.

Habitat at HWY J also appeared to be good although more sediment was noted in 2009 than in 2001. Lower sections of this location appear to have been straightened when the culvert under HWY J was last replaced. Stream straightening homogenizes habitat reducing the diverse habitat needed by fish.

Habitat in the survey site near Krok Road was rated fair. This section of river had very monotonous habitat with few bends, no riffles, shallow water and extensive fine sediment coverage. This site was not surveyed in 2001 so we can not determine if a change has occurred since 2001.

Although Krok Creek had a fair habitat ranking for habitat in both 2001 and 2009 we considered the habitat poor and not conducive for trout. Surveys in both years noted overgrown tag alder, shallow water, sand dominated sediments and a perched culvert all of which contribute to our belief trout populations would be limited in this river section. However, since water temperatures are cool, a coldwater community consisting of forage species could exist in Krok Creek above Highway 29 in the habitat that currently exists. It is possible with habitat work a small brook trout population could become established at this location.

## **Fish Populations**

Fish populations appear to be relatively stable in the upper East Twin River Watershed since the 2001 survey despite a large fish kill in 2006 that killed fish from Highway 29 downstream to at least Krok Road and likely beyond. This is based on IBI scores that have remained stable between survey years with the exception of the IBI score and rating at Highway J that dropped from fair to poor (Table 5).

**Table 5. IBI rankings and scores for upper East Twin River Watershed streams from surveys conducted in 2001 and 2009.**

<b>Location</b>	<b>2001</b>	<b>2009</b>
<b>Townline Road</b>	<b>50- Fair/Good</b>	<b>50- Fair/Good</b>
<b>Near Krok Road</b>	<b>--</b>	<b>20- Poor</b>
<b>Highway J</b>	<b>40- Fair</b>	<b>20- Poor</b>
<b>Krok Creek at HWY 29</b>	<b>40- Fair</b>	<b>40- Fair</b>
<b>Tisch Mills Creek at HWY BB</b>	<b>55- Good</b>	<b>50- Fair/Good</b>

Tisch Mills Creek continues to be a high quality brook trout stream for this area of Wisconsin. Multiple year classes of brook trout were captured in both 2001 and 2009 and had similar distributions of length. We captured fewer brook trout in 2009 than in 2001 mainly due to fewer young of year fish in our 2009 sample. Poor overwinter/spring conditions may have limited the success of this year class. In addition to naturally reproducing brook trout we captured rainbow trout in 2009 that appear to be reproducing naturally. These fish were not captured in 2001. Other members of the fish community including native lamprey, several species of dace and sculpin were captured both years indicating a stable coldwater fish community in Tisch Mills Creek (Table 5).

We surveyed the East Twin River at Townline Road during both survey years. In 2009 we captured over twice the number of fish at this location than we did in 2001. Despite the change in fish abundance, species makeup was similar in each year. This location was upstream of the fish kill in 2006 and therefore we expected to capture similar species over time. The largest increases in fish numbers were for central mudminnow, mottled sculpin and brook trout. In both survey years, we captured only one young of year brook trout at this site indicating that this may not be an area of spawning but rather an over summering location for age 1 and older brook trout. It appears this site has a stable coldwater fish community.

The survey station near Krok Road was only surveyed in 2009. The fish population was rated poor. Most of the fish we captured with the exception of mottled sculpin and redbreast dace are considered to be tolerant species that are generally found in streams with low DO, disturbed habitat or moderate amounts of organic pollution. The lack of trout is surprising because following the fish kill in 2006, this section of stream was walked by Conservation Wardens who found at least 24 dead brook trout. The lack of brook trout in this section of river could be caused by slow movement by brook trout back into the river section following the kill, alteration of stream habitat caused by the fish kill or from other watershed processes or from ongoing contributions of warm water, chlorides and other substances from an unnamed tributary that has likely degraded the East Twin River below Highway 29.

At Highway J, we noted a decline in the coldwater fish community based on IBI scores. While the general species make up of the fish community was similar in 2001 and 2009, the number of generalist and tolerant species such as common shiner increased in abundance. We did not capture brook trout at this location either survey year, but in 2001 we captured two stocked brown trout and in 2009 we caught one rainbow trout. Since this location is near the downstream boundary of the classified trout waters one would expect water temperatures to fluctuate more than upstream locations so it is not known if the decline in the IBI scores are due to the 2006 fish kill or from several warm summers with limited rainfall that may have increased water temperatures.

Krok Creek based on surveys in 2001 and 2009 continues to be a coldwater stream with a marginal fish community because of the lack of habitat and shallow water (low flow) (Table 5). Fewer individual fish and species were captured in 2009 as compared to 2001. Some minor improvements in the fish community are likely to occur if stream banks were brushed and the perched culvert was removed from the stream.

## **CONCLUSIONS**

- Brook trout populations in Tisch Mills Creek and in the East Twin River above HWY 29 have remained stable between surveys conducted in 2001 and 2009. Trout numbers in the East Twin River below Highway 29 have declined since 2001. Survival of stocked brown trout appears to be low since we did not capture any of the recently stocked brown trout near the stocking location at Highway J.
- Water quality within the watershed is generally good as indicated by dissolved oxygen levels greater than 5 PPM and cool temperatures.
- Streams within this system are well buffered and feature a variety of large-scale and small-scale habitats for aquatic organisms. However it does appear that in some sections of Krok Creek and the East Twin River habitat appears to limit the fish community.

## **RECOMMENDATIONS**

- Actively utilize streambank protection programs (CRP, CREP) to maximize stream bank protection. Encourage land owners to protect wetlands and springs in the watershed to maintain stream flow patterns and cold water temperatures.
- Continue to monitor these stream locations in the future to determine the status of fish populations and identify trends in the brook trout population in the upper East Twin River Watershed.
- Determine the feasibility of stream improvements on Krok Creek to improve brook trout populations. Work with Kewaunee County and adjacent landowners to remove the perched culvert on Krok Creek.
- Discontinue brown trout stocking in the upper East Twin River Watershed. The stocking history of brown trout in the East Twin River and Krok Creek is not clear because of widespread confusion over the name of the designated trout water. Records indicate that the East Twin River locally known as the West Branch of Krok or even just as Krok Creek was

identified as the trout water in 1953 (Hacker 1953). However just to the east of the trout water is Krok Creek which is a tributary to the East Twin River and also a coldwater stream. Stocking records indicate that brown trout were stocked into “Krok” Creek and the East Twin River since 1972 on a nearly annual basis. Certainly some fish were stocked in to the East Twin River below the confluence with Krok Creek but the location of other stockings could have been in either the East Twin River or Krok Creek because site specific stocking locations were not recorded on stocking receipts.

Based on our survey results from 2001 and 2009 in which we captured many brook trout and few brown trout in the East Twin River, it appears that brown trout stocking has had very limited success in producing a fishable population of trout. Although there has been some anecdotal evidence of anglers catching brown trout, evidence from our surveys indicate poor survival of the stocked fish. Since the brook trout population is doing well it is recommended that brown trout stocking in the East Twin River be discontinued.

Krok Creek appears to be a coldwater stream although we did not capture any trout during the 2001 or 2009 survey. Analysis of stream habitat in 2001 and a qualitative habitat assessment in 2009 indicated that trout habitat is limited in Krok Creek because of low flow and sandy sediments. It is recommended because of the current lack of trout habitat and because we did not capture any trout in either the 2001 or 2009 surveys that trout not be stocked in Krok Creek.

The brown trout stocking history of Tisch Mills Creek is much clearer. Brown trout were stocked into Tisch Mills Creek from 1972 through 2003 when they were discontinued following the 2001 survey when an abundant brook trout population was noted. It is recommended to continue to manage Tisch Mills Creek as a brook trout stream and not to stock brown trout into the stream.

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