

**Black River: Analysis of brook trout population data in relation to angling regulations:  
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This is a preliminary analysis of the effects of different angling regulations on the size structure of brook trout populations in the Black River. Trout population data used in the analyses extends back to 1986. The general statewide minimum size limit for harvest of brook trout from inland stream in the Lower Peninsula of Michigan was 8 inches from 1979 to the present time. The general statewide daily creel limit for brook trout was 10 fish from 1979 through 1999 (There were lower creel limits for larger individual fish during part of this period but these have no practical significance, particularly for short-lived brook trout). In 2000, Type 2 regulations were applied to the Black River from Tin Shanty Bridge downstream to Tower Dam. The minimum size limit (MSL) for brook trout is 10 inches under Type 2 regulations; bait fishing is permitted; the daily creel limit is 5 trout with no more than 3 over 15 inches long; and the possession season extends from the last Saturday in April through September 30. Type 1 regulations were applied to the remainder of the Black River system in 2000. The daily creel limit was 5 trout under Type 1 regulations as compared to 10 trout under the previous "general statewide" regulations. In 2008, an artificial lures or flies regulation was applied to a 4.4-mile reach of the Black River extending from Tin Shanty Bridge downstream to Town Corner Lake Stairs (Figure 1). The MSL for brook trout remained at 10 inches; the daily creel limit was reduced to 2 fish, and catch-and-release angling for brook trout was allowed when the normal April-September possession season was closed.

An evaluation of the effects of these regulation changes was made by comparing the density and size structure of brook trout populations from reaches of the Black River system managed under different regulations during the period from 1986-2010. In some reaches, the MSL did not change during this 24-year period while in other reaches different MSL's and gear restrictive regulations were applied.

**Preliminary findings:**

For this initial analysis I used analysis of variance (ANOVA) to compare mean density (numbers/mile) before and after 2000 at each of the six population index stations. I set the rejection criterion  $\alpha$  at 0.05 for all comparisons.

Numbers of brook trout 10 inches or larger before and after 2000 were similar at all population index stations regardless of what regulations were in effect (See top panel of Figure 2). This indicates that natural mortality rates were more important than angling mortality rates in shaping population size structure. During the past 24 years very few brook trout in the Black River survived to age 3; an age at which most would grow larger than 10 inches. Almost all of the brook trout  $\geq 10$  inches long depicted in the top panel of figure 2 are fast growing 2-year-old fish.

Numbers of brook trout 8 inches or larger were similar at 5 of the 6 index stations before and after 2000 (See bottom panel of Figure 2). The only exception was observed at the Tin Shanty Bridge Station where the station location changed after 2000. Prior to 2000 the index station extended both upstream and downstream of the bridge. Sampling conducted after 2000 was conducted only downstream of the bridge because this was the area where regulations were changed. Thus, I can not separate possible effects of regulations from differences in habitat quality upstream and downstream of the bridge. At the springs station located further downstream only one usable estimate of brook trout density collected prior to 2000 was available and hence statistical comparisons between effects of 8 inch and 10 inch MSL's were not possible.

Further downstream, point estimates for mean density of larger brook trout at both Sid's Drive and Main River Bridge were virtually identical before and after 2000, again indicating that the regulation changes in 2000 exerted little influence on brook trout population size structure (Figure 2).

Densities of larger brook trout in the East Branch Black River railroad grade station have been stable over the past two decades (Figure 3). By contrast, on the mainstem Black River at McKinnon's Bend abundance of larger brook trout was more variable over time (Figure 4). The lack of significant differences in brook trout density before and after 2000 at these two reference (control) stations where minimum size limits did not change suggests that habitat conditions here have been relatively stable over the past 20 years.

The best data available for assessing the effects of artificial lures regulations were collected at the springs index station. Population estimates were not conducted at Tin Shanty Bridge between 2000 and 2007 when Type 2 regulations were in effect (Figure 5). However, at the springs station, five consecutive population estimates were conducted from 2006 to 2010 and hence data for comparing brook trout density under Type 2 regulations and artificial lures regulations were available at this site (Figure 6). No significant differences in abundance of larger brook trout were found between the period when bait was permitted and the period when artificial lures were required in this stream reach.

Type 2 regulations were clearly ineffective at increasing abundance of larger brook trout at either the Sid's Drive or Main River Bridge stations (See figures 7 and 8). Mean abundance of brook trout larger than 8 inches long at Sid's Drive was remarkably stable over the past 24 years, averaging around 90 fish per mile before and after 2000 (See figure 7 and bottom panel of figure 2). The point estimate for mean abundance of brook trout larger than 10 inches was lower after 2000, but not significantly different than before 2000 (Figure 7). At Main River Bridge density of larger brook trout was more variable than at Sid's Drive over time, but again there were no significant differences in density before and after 2000.

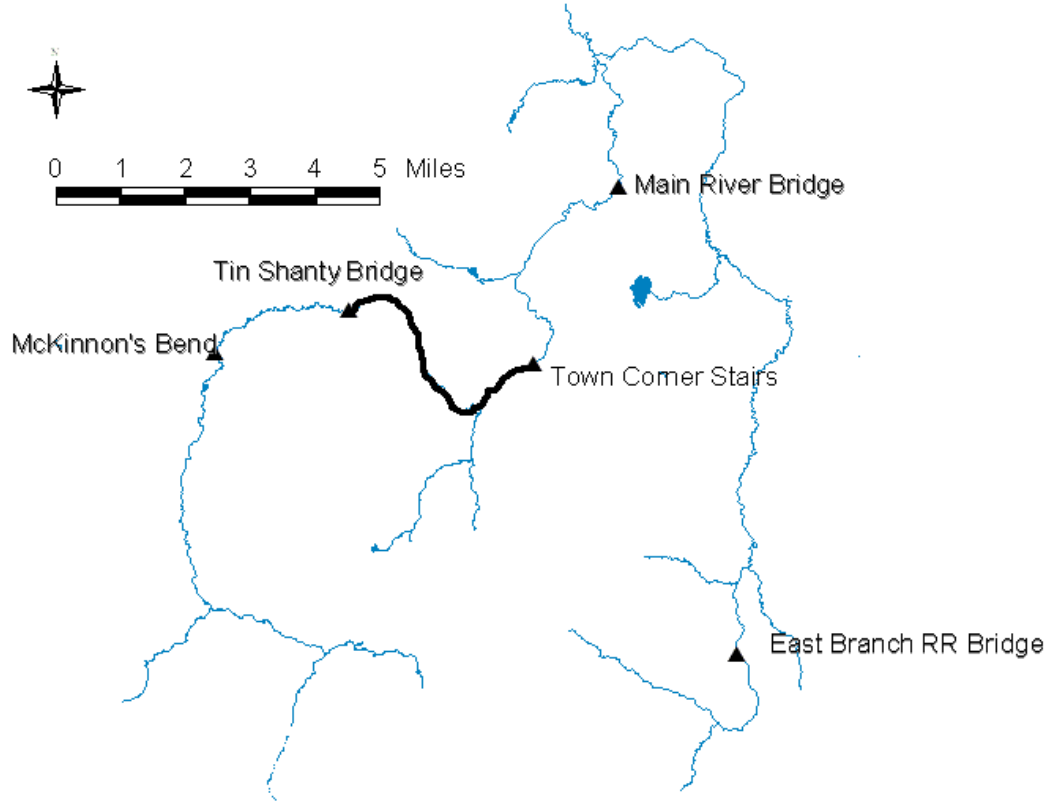


Figure 1.—Black River study area. General statewide or Type 1 regulations were in effect on the mainstem upstream of Tin Shanty Bridge Road and on all of the East Branch Black River. Type 2 regulations were in effect on the mainstem downstream of Tin Shanty Bridge from 2000-2007. In 2008-2010 an artificial lures or flies regulation was in effect for the reach between Tin Shanty Bridge and Town Corner Stairs (heavy black line). Type 2 regulations remained in effect on the mainstem downstream of Town Corner Stairs to Tower Dam.

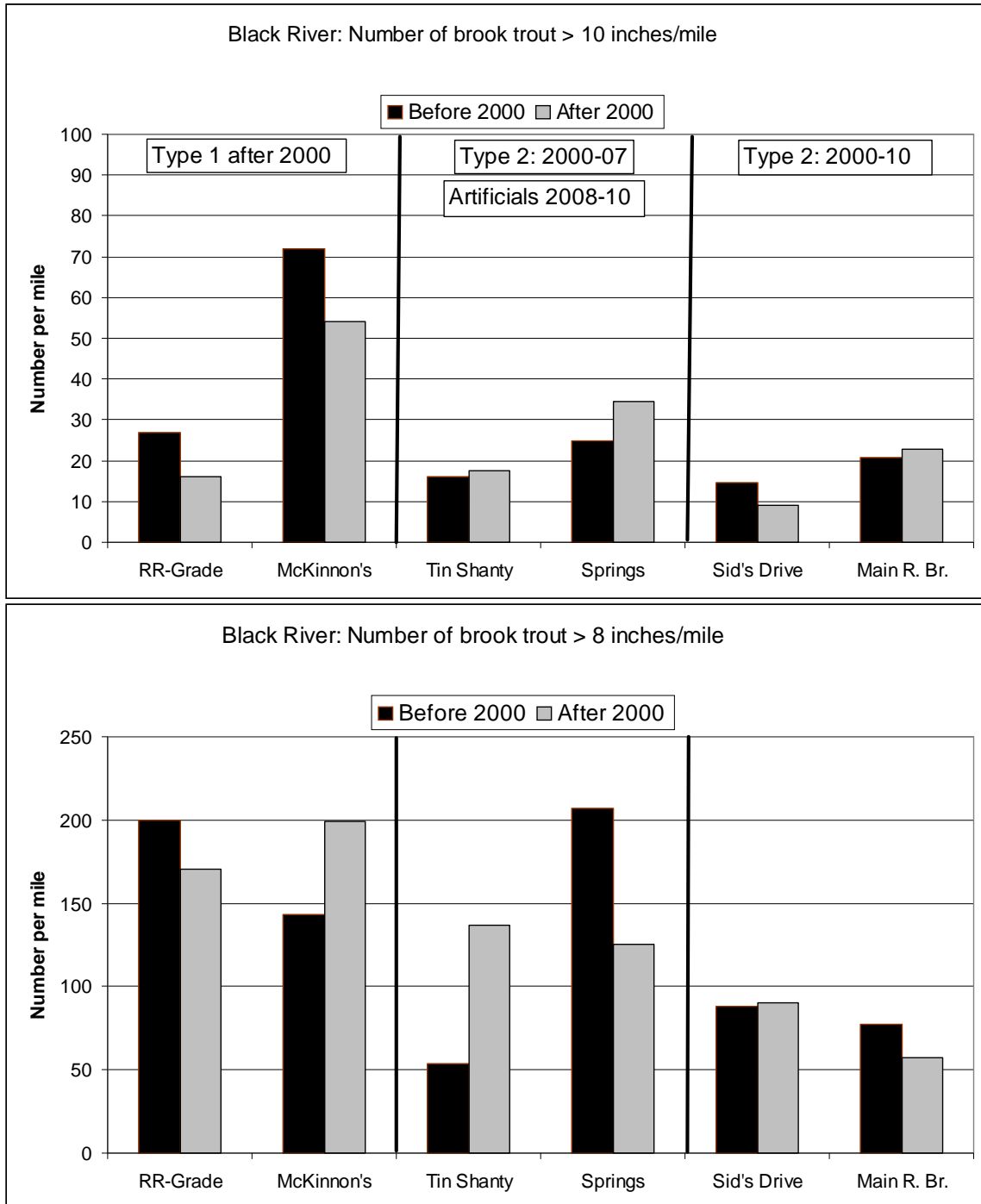


Figure 2.—August numbers of brook trout per mile at Black River population index stations before and after 2000. Note that before 2000 the Tin Shanty Bridge station was approximately twice as large and extended upstream and downstream from the bridge. Population data collected after 2000 was from a 1,000 foot station extending downstream from the bridge (where the new regulations were in effect).

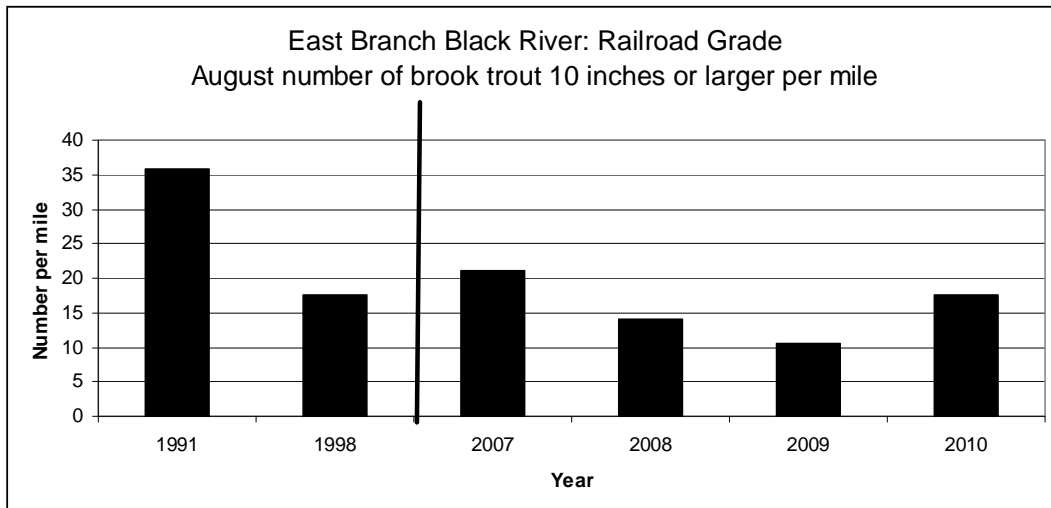
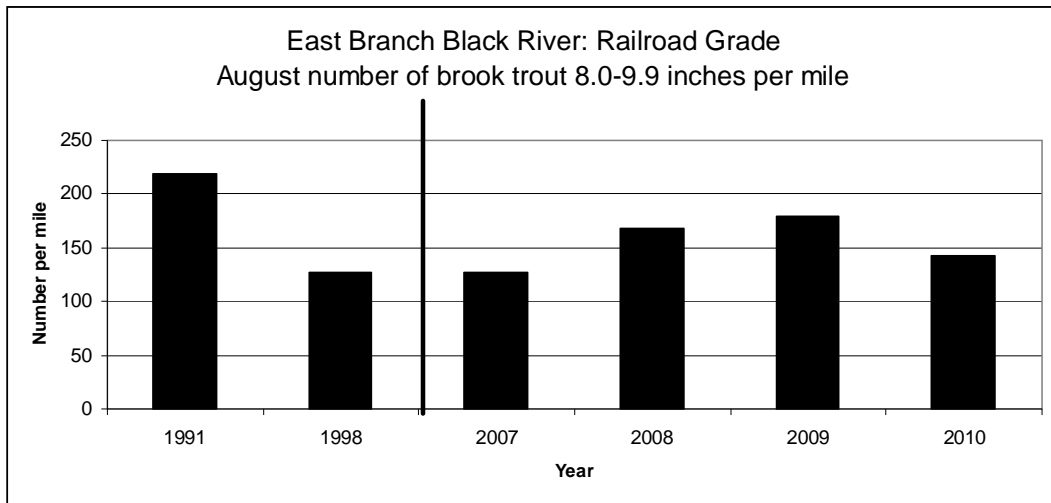
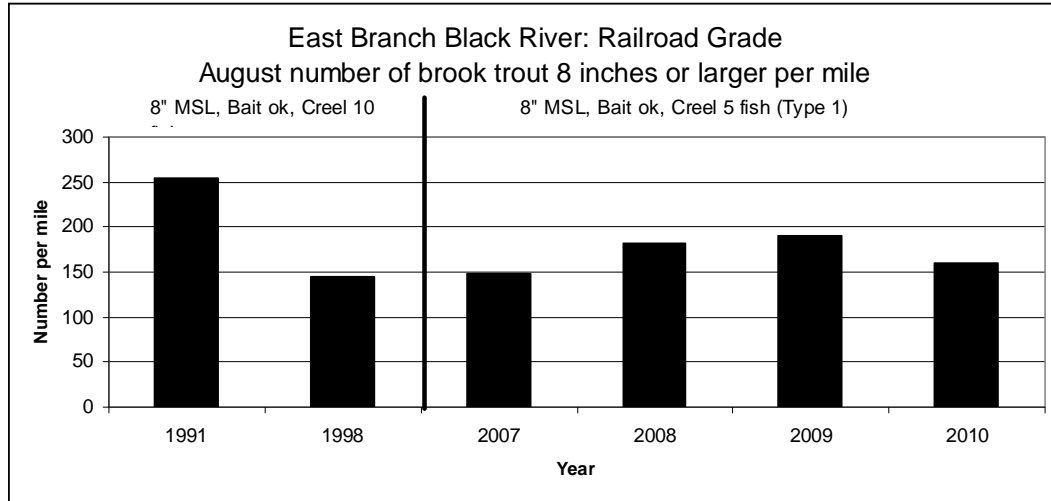


Figure 3.—Populations of brook trout per mile by size in the East Branch Black River at the Railroad Grade index station. The boundaries of this 1,500-foot station were the same for all surveys shown.

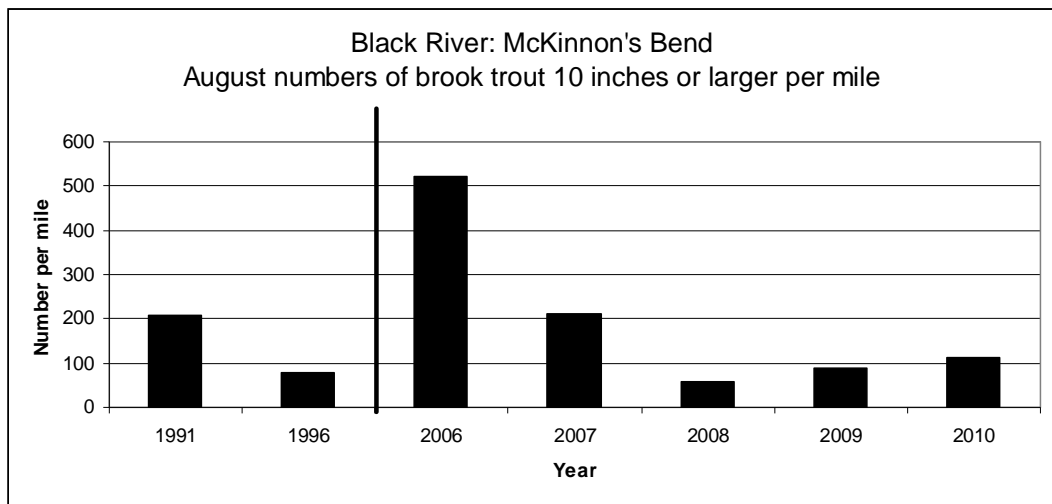
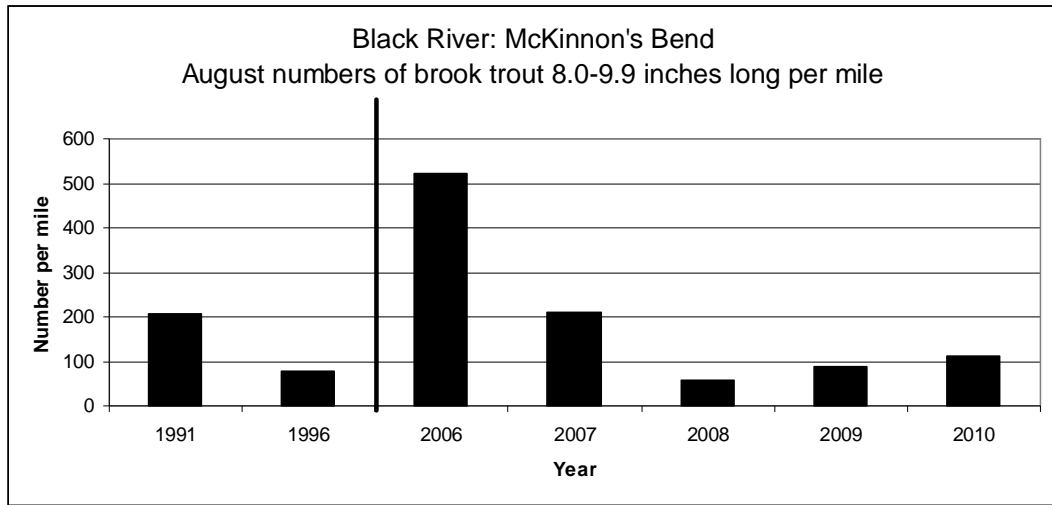
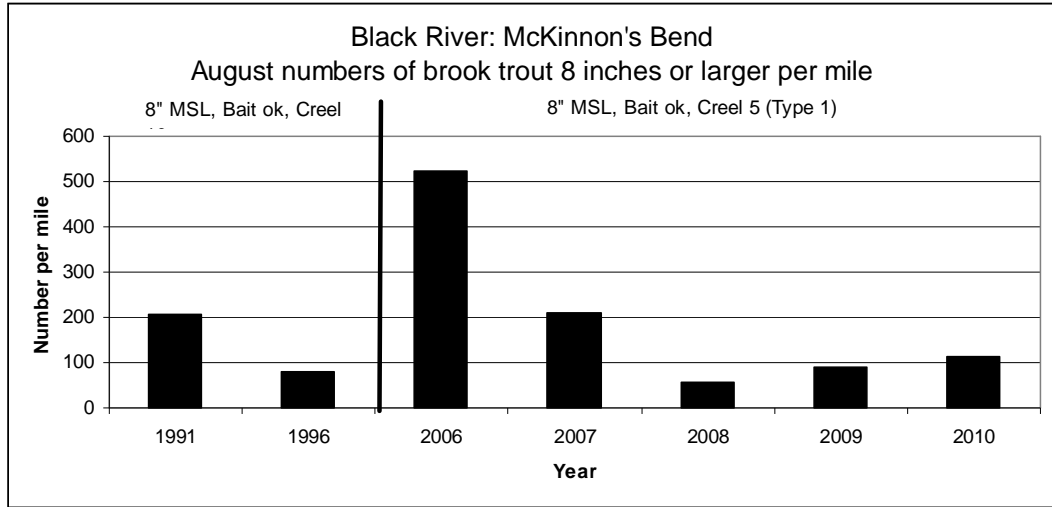


Figure 4.—Populations of brook trout per mile by size in the Black River at the McKinnon's Bend index station. The boundaries of this 1,000-foot station were the same for all surveys shown.

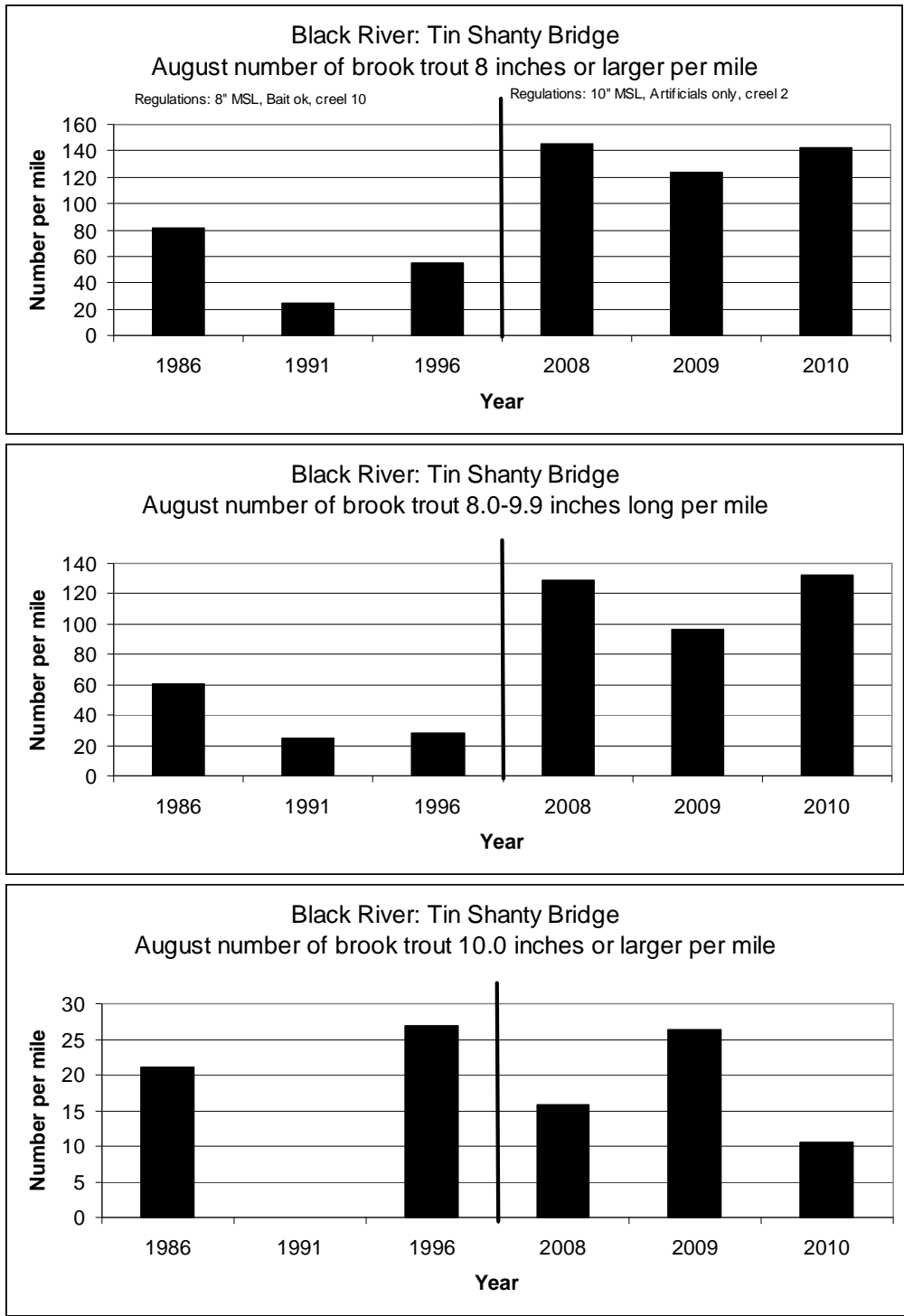


Figure 5.—Populations of brook trout per mile by size in the Black River at Tin Shanty Bridge. The boundaries of this station varied over time. From 2008 to 2010 the station extended 1,000 feet downstream of the bridge. In 1986 the station was 2,000 feet long, extending 1,000 feet in both directions from the bridge. In 1991 and 1996 the station started 1,000 feet downstream from the bridge and extended 1,350 feet upstream from the bridge

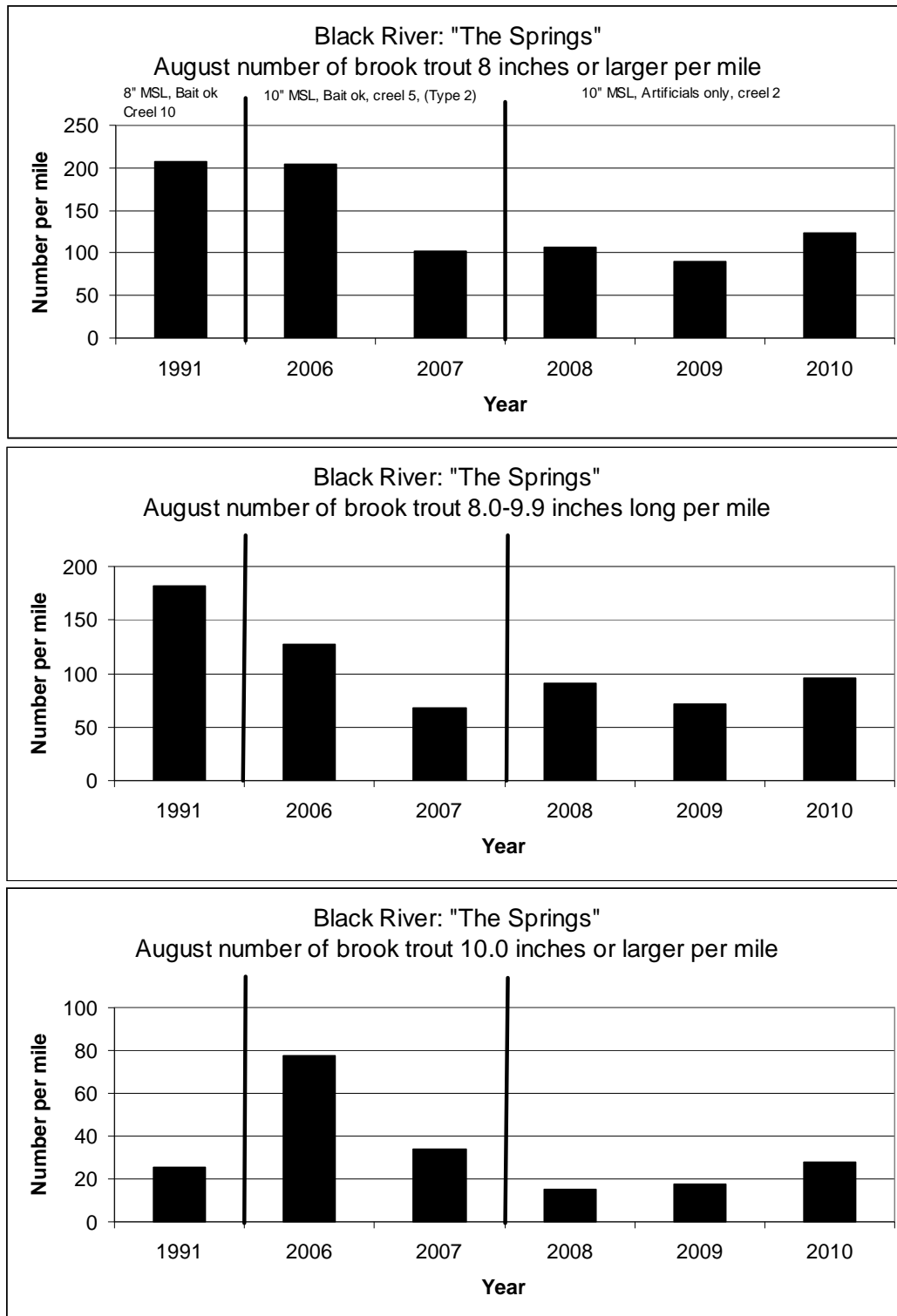


Figure 6.—Populations of brook trout per mile by size in the Black River at “The Springs” index station. The boundaries of this 2,400-foot station were the same for all surveys shown.



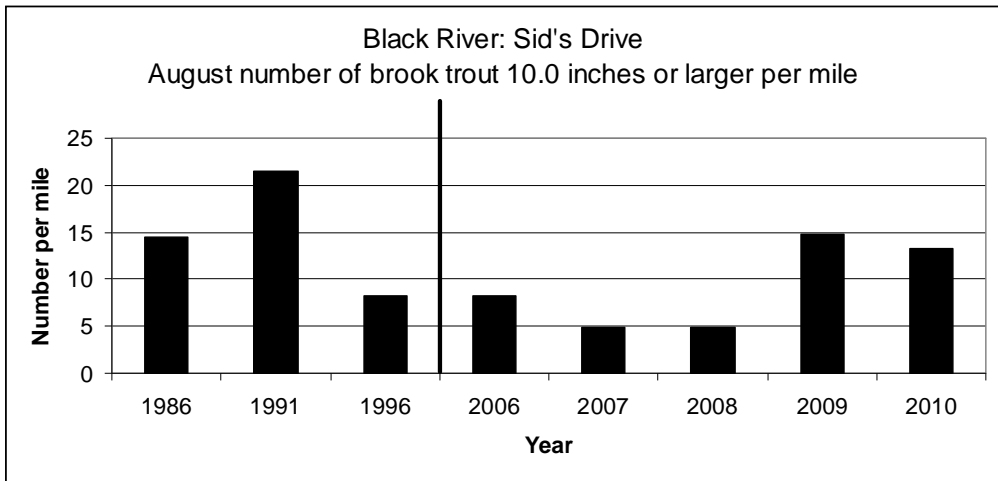
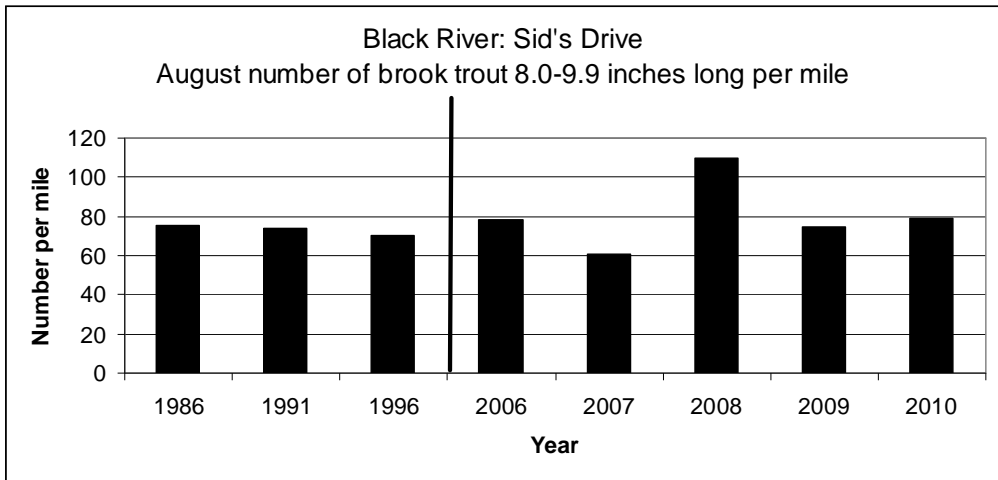
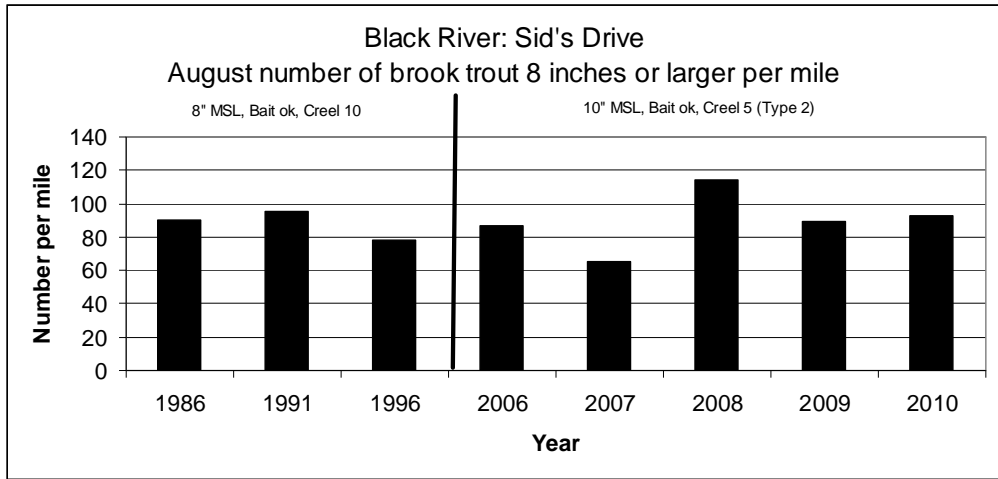


Figure 7.—Populations of brook trout per mile by size in the Black River at the Sid's Drive index station. The boundaries of this 3,200-foot station were the same for all surveys shown.

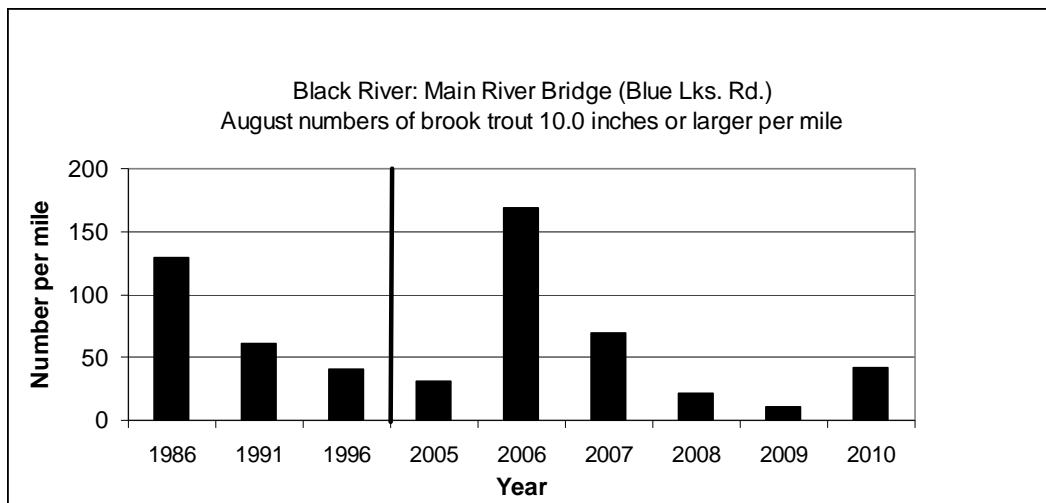
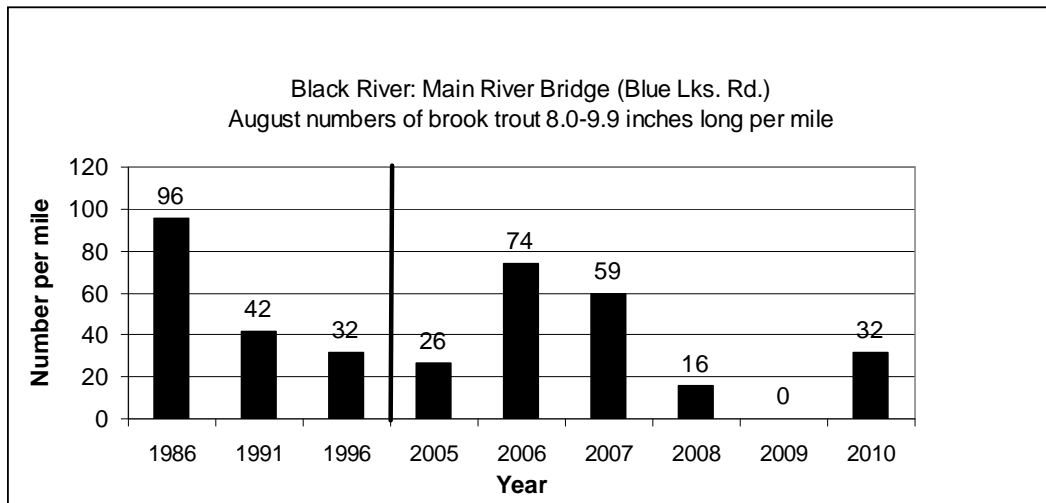
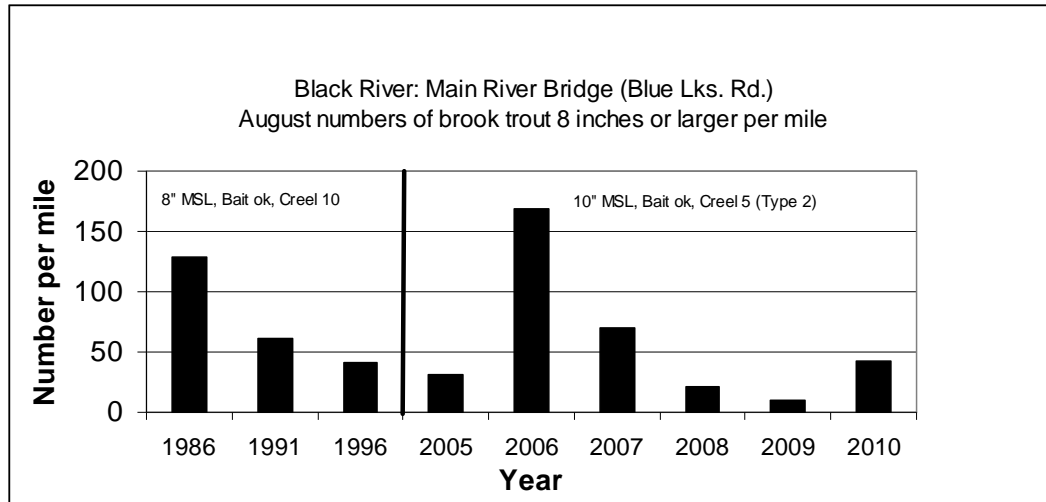


Figure 8 .-Populations of brook trout per mile by size in the Black River at Main River Bridge (Blue Lakes Road) index station. This station was 3,000 feet long from 1986-1996 and was 1,000 feet long from 2005 to 2010.