

Cool (or Warm-transitional) Large River

A Brief Ecological Description of this Michigan River Type

Cool Large River segments are defined (by the Michigan Department of Natural Resources, Fisheries Division) as typically having drainage areas greater than 300 mi² and cool July mean water temperatures between 67.5°F and 69.8°F. These systems occur in two situations: 1) downriver of **Cold-transitional Small Rivers** where upriver warming of the river's water mass cannot be offset by modest groundwater deliveries to the channel; thus they warm slightly; or 2) downriver of **Cool Small Rivers** where some combination of modest groundwater deliveries to the channel and cool northern air temperatures maintain cool water temperatures even as the river grows in volume. **Cool Large Rivers** occur in landscapes of fine and medium textured geologies and gentle topographic relief, where groundwater deliveries to stream channels are moderate. **Cool Large Rivers** are commonly found in the transitional regions between colder and warmer stream regions and are widespread across the Upper Peninsula where summer air temperatures remain cool.

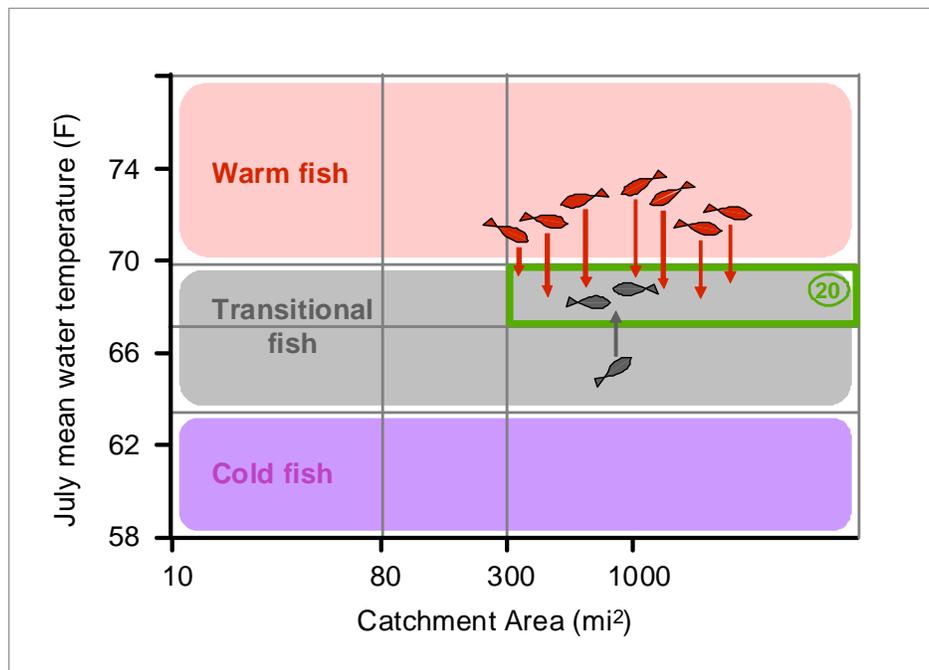
*Figure 1. Geographic distribution of **Cool Large River** segments in Michigan.*



Fish Species of Cool Large Rivers

The typical summer fish assemblage of a Michigan **Cool Large River** includes 22-27 fish species: many adapted to transitional temperatures (chubs, daces, suckers, bullheads, and burbot). Due to large water volume, July diurnal temperature fluctuations are modest, allowing a number of warm-adapted fishes to also be supported (chubs, shiners, minnows, suckers, redhorses, bullheads, pikes, sunfishes, darters, and walleyes).

Figure 2. Michigan's **Cool Large Rivers** type highlighted (green box) on the environmental gradients of river segment catchment area and July mean water temperature. The typical number of characteristic fish species for this river type is shown circled in green. And the proportional makeup of the expected fish assemblage for this river type is shown by the number of colored fish icons representing each of three thermal preference zones.



Photos of some fish species characteristic of Michigan's **Cool Large Rivers**. Warm fishes are **red font**; thermally transitional fishes are **gray font**.



Fish species characteristic of Michigan's **Cool Large Rivers**. This is a generalized, potential species list for an "average" river site; samples from any specific site are expected to be a variable subset of this list. Fish species are listed in descending order of their preferred mean July temperature, based on Michigan river surveys (Zorn et al. In press). Warm fishes are **red font**; thermally transitional fishes are gray font.

Common carp
Smallmouth bass
Black redhorse
Northern hog sucker
Shorthead redhorse
Walleye
Rock bass
Rosyface shiner
Sand shiner
Greenside darter
Logperch
Northern pike
Bluntnose minnow
Common shiner
Rainbow darter
Blackside darter
Burbot
White sucker
Longnose dace
Creek chub

Literature on Michigan River and Stream Fish Assemblages and their Relationship to Summer Water Temperatures

- Bailey, R. M., and G. R. Smith. 2002. Names of Michigan fishes. Michigan Department of Natural Resources, Fisheries Division, Ann Arbor.
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- Lyons, J., T. G. Zorn, J. Stewart, P. W. Seelbach, K. E. Wehrly, and L. Wang. In Press. Defining, characterizing, and quantifying coolwater streams and their fish assemblages in Michigan and Wisconsin, USA. *North American Journal of Fisheries Management*.
- Wehrly, K. E., M. J. Wiley, and P. W. Seelbach. 2003. Classifying regional variation in thermal regime based on stream fish community patterns. *Transactions of the American Fisheries Society* 132:18–38.
- Zorn, T. G., P. W. Seelbach, and M. J. Wiley. 2002. Distributions of stream fishes and their relationship to stream size and hydrology in Michigan's Lower Peninsula. *Transactions of the American Fisheries Society* 131:70–85.
- Zorn, T. G., P. W. Seelbach, and M. J. Wiley. In press. Relationships between habitat and fish density in Michigan streams. Michigan Department of Natural Resources, Fisheries Research Report, Ann Arbor.
- Zorn, T. G., P. W. Seelbach, E. S. Rutherford, T. C. Wills, S. Cheng, and M. J. Wiley. 2008. A regional-scale habitat suitability model to assess the effects of flow reduction on fish assemblages in Michigan streams. Michigan Department of Natural Resources, Fisheries Research Report 2089, Ann Arbor.
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