MDC response to DNR request for impoundment fish community, chlorophyll, and Secchi depth information for Missouri lake nutrient criteria.
26 June 2012

Primary fish species, representative water quality conditions, and proposed criteria for chlorophyll (Chla) and Secchi depth for physiographic sections of Missouri.

	Primary fish species			
Physiographic section	Small impoundments (<1,000 acres)	Large reservoirs (≥1,000 acres)	Water quality conditions[a] Mean (range)	Proposed criteria[b]
Glacial Plains	Largemouth bass, bluegill, white crappie, black crappie, redear sunfish, green sunfish, gizzard shad, common carp (invasive), channel catfish (stocked)	Largemouth bass, bluegill, white crappie, black crappie, gizzard shad, common carp (invasive), channel catfish, flathead catfish, blue catfish, freshwater drum, white bass, bigmouth buffalo, smallmouth buffalo, river carpsucker, longnose gar, shortnose gar	Chla: 21.6 µg/L (2.5-114.3 µg/L) Secchi depth: 0.9 m (0.4-2.6 m)	Chla: 30 µg/L Secchi depth: 0.6 m
Ozark Border	Largemouth bass, bluegill, white crappie, black crappie, redear sunfish, green sunfish, gizzard shad, common carp (invasive), channel catfish (stocked)	N/A	Chla: 13.6 µg/L (1.5-35.7 µg/L) Secchi depth: 1.4 m (0.7-4.0 m)	Chla: 22 µg/L Secchi depth: 0.7 m
Ozark Highlands	Largemouth bass, bluegill, white crappie, black crappie, redear sunfish, green sunfish, gizzard shad, common carp (invasive), channel catfish (stocked)	Largemouth bass, smallmouth bass, spotted bass, bluegill, walleye, longear sunfish, rock bass, white crappie, black crappie, walleye, gizzard shad, threadfin shad, common carp (invasive), channel catfish, flathead catfish, blue catfish, freshwater drum, white bass, bigmouth buffalo, smallmouth buffalo, river carpsucker, river redhorse, black redhorse, logperch, brook silversides, paddlefish, longnose gar, shortnose gar	Chla: 7.3 µg/L (1.1-25.3 µg/L) Secchi depth: 2.0 m (0.8-4.3 m)	Chla: 15 µg/L Secchi depth: 0.9 m

[a]Data from Jones et al. (2008).

[b]Justification for these criteria are listed below.

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Justification and Rationale:

1) Globally, fish biomass and production increase with increasing total phosphorus (TP) and chlorophyll (Chla) concentrations (Downing and Plante 1993).
2) Sport fish biomass probably does not peak at less than 100 µg/L of TP (about 39 µg/L Chla) and reductions in nutrient inputs have led to declines in sport fisheries (Ney 1996).
3) In Missouri, sport fish harvest was positively related to Chla concentrations up to 70 µg/L (Jones and Hoyer 1982).
4) A recent study of small Missouri impoundments revealed no harmful influences of high nutrient/algal concentrations on sport fish populations until Chla exceeded 40-60 µg/L (Michaletz et al. 2012) and growth, size structure, and condition of sport fishes usually improved with increasing Chla (Michaletz 2009; Michaletz et al. 2012).
5) EPA's 14 ecoregions differ in soils, vegetation, climate, and other factors. EPA's nutrient criteria guidance documents are based on the view that lakes and reservoirs within each ecoregion will have similar water quality. Missouri's Ozark Highlands and Plains fall within Ecoregion XI and Ecoregion IX, respectively.
6) Based on the above information, a maximum Chla value of 30 µg/L and a minimum value for Secchi depth of 0.6 m are conservative values for nutrient criteria in the Glacial Plains ecoregion of Missouri. Impoundments with these values support substantial sport fisheries in these fertile landscapes. These levels should protect aquatic life and prevent undesirable species such as common carp and other benthivorous fishes from dominating the fish community (Egertson and Downing 2004). Similar criteria accepted by EPA in states within EPA Ecoregion IX instill further confidence in this value. South Carolina and Virginia, both in EPA Ecoregion IX, have chlorophyll criteria (40 µg/L and 25-60 µg/L, respectively) that are similar to this value (EPA web site). For the Ozark Highlands, a Chla value of 15 µg/L and a Secchi depth of 0.9 m would be appropriate given that these waters are situated in less fertile landscapes and the large reservoirs contain species characteristic of clear Ozark streams that are likely more sensitive to high nutrient concentrations. The proposed criteria are similar to those proposed for Alabama reservoirs that contain similar nutrient concentrations and fish communities (Maceina et al. 1996). The proposed chlorophyll value is similar to criteria accepted by EPA in states within EPA Ecoregion XI. Virginia and West Virginia, both in EPA Ecoregion XI, have chlorophyll criteria (10-35 µg/L and 20 µg/L, respectively) that are similar to this value (EPA web site). The Ozark Border section represents a transition zone between the Glacial Plains and the Ozark Highlands and contains impoundments with nutrient levels intermediate to those in the Glacial Plains and Ozark Highlands. Consequently, Chla and Secchi depth values for the Ozark Border are proposed to be intermediate to the other two sections.

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