Distribution Date: 12/6/13
Purpose: Deep Creek Lake Watershed Characterization
Resource: Lake Fisheries

This information has been compiled by MDNR subject matter experts using the best available information and Departmental monitoring data for the purpose of describing the condition of Deep Creek Lake watershed natural resources and environmental features. Recommendations have been provided for the Steering Committee and Subcommittees to review and consider in the development of the Deep Creek Lake Watershed Management Plan.

Deep Creek Lake Fishery

Historical Trends

Deep Creek Lake supports at least nineteen fish species indicative of coldwater, coolwater, and warmwater fish community based on the 2012 fish population survey. Fish species composition in DCL was largely unchanged from that observed during the last ten-year study period (2001 – 2010) when eighteen fish species were collected. Largemouth Bass, Smallmouth Bass, and Walleye are the most popular sport fish, attracting anglers from throughout the mid-Atlantic Region. Annual stocking of adult Brown Trout and Rainbow Trout provide trout fishing opportunities throughout the year. The Yellow Perch and Bluegills are known for their large sized attained in DCL. Warmwater gamefish and panfish, except Walleye and Yellow Perch, are managed under Maryland's statewide regulations as described in the *Maryland Guide to Fishing 2013* (www.dnr.maryland.gov). Walleye and Yellow Perch are managed in DCL by special regulations. Walleye regulations include a closed season from 1 March through 15 April, a five fish daily creel limit, and a 15 inch minimum size limit the remainder of the year. Yellow Perch regulations include a ten fish creel limit, no closed season, and no minimum size restriction. Trout fishing is managed under Put and Take regulations as described in the *Maryland Guide to Fishing 2013*.

The list of common names, scientific names, and observed abundance of the nineteen fish species collected in DCL is contained in Table 1. These species representing seven Families are indicative of a warmwater/ coolwater/coldwater fishery. The panfish species Bluegills, Pumpkinseeds, Rock bass, and Yellow Perch are regarded as common to abundant. Smallmouth Bass, Largemouth Bass, and Walleye are the most abundant gamefish species. Golden Shiners are the most abundant forage fish. Only Brown Trout

and Rainbow Trout are stocked on an annual basis, and the remaining fish species are self- sustaining.

Table 1. Common and scientific names and observed abundance of fish species in Deep Creek Lake.

Common Name	**Scientific Name**	**Observed Abundance**
Common Carp	*Cyprinus carpio*	Common
Golden Shiner	*Notemigonus crysoleucas*	Abundant
White sucker	*Catostomus commersoni*	Common
Yellow Bullhead	*Ameiurus natalis*	Common
Brown Bullhead	*Ameiurus nebulosus*	Common
Northern Pike	*Esox lucius*	Scarce
Redfin Pickerel	*Esox americanus*	Scarce
Chain Pickerel	*Esox niger*	Abundant
Rainbow Trout	*Oncorhynchus mykiss*	Scarce
Brown Trout	*Salmo trutta*	Scarce
Rock Bass	*Ambloplites rupestris*	Common
Pumpkinseed	*Lepomis gibbosus*	Common
Bluegill	*Lepomis macrochirus*	Abundant
Smallmouth Bass	*Micropterus dolomieu*	Abundant
Largemouth Bass	*Micropterus salmoides*	Common
Black Crappie	*Pomoxis nigromaculatus*	Scarce
Johnny Darter	*Etheostoma nigrum*	Scarce
Yellow Perch	*Perca flavescens*	Abundant
Walleye	*Sander vitreus*	Abundant
Total species = 19		

Current Conditions

Walleye

Deep Creek Lake supports a popular Walleye fishery. Regulation modifications first implemented in 1993 (increased the minimum size limit from 14 inches to 15 inches) and 1995 (established a closed season from March 1 through April 15) have resulted in improved age and size structures, characterized by an abundance of stock and quality-size fish. Fall electrofishing samples show Walleye had the highest abundance of any gamefish species during 2012. Natural reproduction in 2012 was very low, although 2011 had the highest reproductive level since 2004. The electrofishing and tournament capture samples both indicate that the majority of legal-size Walleye are between 15 inches and 17 inches, with opportunities to catch trophy-size fish greater than 20 inches. Results from the 2013 surveys are pending; however cursory results indicate that the Walleye population density is still regarded as abundant.

Yellow Perch
The Yellow Perch population in DCL is well balanced with stock (≥ 5 inches), quality (≥ 8 inches), preferred (≥ 10 inches), and memorable (≥ 12 inches) sized fish represented in the population. Reproductive success in 2012, described by the seining net index was considered excellent, similar to the indices from 2006 - 2011. A ten perch daily creel limit was implemented for DCL effective 1 January 2010. The regulation change, which was based on electrofishing sampling and creel census data from angler interviews, should maintain and enhance the Yellow Perch populations in DCL. The 2012 length frequency distribution shows a population characterized by a diverse size structure; from young of year size to memorable size (> 12 inches). The 2013 study results are pending; however cursory observations indicate that the Yellow Perch population continues to be outstanding.

Smallmouth Bass
Smallmouth Bass are one of the most sought after gamefish species in DCL. Smallmouth Bass continue to maintain sustainable harvest levels and adequate survival to older year-classes as evidenced by the diverse age and size structure in the electrofishing and tournament angler capture samples. Both proportional stock density and relative stock density values indicate a balance population. Reproduction was considered "good' in 2012. Survey results are pending for 2013.

Largemouth Bass
Largemouth Bass were less abundant in the 2012 electrofishing sample than previous years. Tournament data show a slight decrease in Largemouth Bass catch ratios compared to the years 1996 – 2000 when the Smallmouth Bass to Largemouth Bass catch ratio was 1.8 to 1 compared to the 2012 catch ratio of 2.0 to 1. In July 2010, the Maryland Department of the Environment determined that abnormal high water temperatures aided the bacterium *Aeromonas hydrophila* and a protozoan gill parasite to cause a large fish kill in DCL. Most DCL fish species were affected, and an estimated 10,000 fish died. The reduced abundance of Largemouth Bass in 2012 may indicate that the 2010 fish kill had an adverse effect on the population size. Reproduction was considered "good" in 2012; however a corrective stocking of 10,000 Largemouth Bass fingerlings were stocked to enhance the population during spring 2012. Cursory results for 2013 show that Largemouth Bass showed an increase in abundance from 2012.

Northern Pike
Northern Pike are becoming more common in electrofishing samples, and this increase in abundance is the result of the increased minimum size restriction (24 inches to 30 inches, enacted in 2001). The increase in the minimum size allows the Northern Pike to reach sexual maturity before reaching harvestable size, thereby increase reproductive potential. Trophy size fish exceeding 40 inches are routinely captured in DCL.

Chain Pickerel
Chain Pickerel are very abundant; however angler interest in this species is relatively low in DCL. The proportional stock density and relative stock density values are indicative of a balanced population. Length frequency distribution of Chain pickerel collected in 2012 shows a diverse age and size structure.

Trout species
Brown Trout, Rainbow Trout, and Golden Trout are stocked annually in DCL. Adequate coldwater and oxygen in the hypolimnion during summer allows for year-round survival, creating angling opportunities in all seasons. A combined total of 4,805 Brown Trout, Rainbow Trout, and Golden Trout were stocked in DCL in 2012. However, trout are not routinely collected during electrofishing sampling efforts primarily due to their pelagic, deeper water habitat preferences.

Panfish species
Bluegill, Pumpkinseeds, and Rock Bass are common to abundant in DCL and the populations are characterized by having adequate quality-size fish to provide angler interest. Bluegill population data for 2012 indicated a population comprised of an abundance of quality and preferred size fish. Bluegill length frequency distribution further shows a diverse size and age structure from juveniles to memorable size (10 inches or greater) fish in the population.

Minnow species
Golden Shiners are the most abundant forage fish species in DCL. Common Carp are common and reach very large sizes (exceeding 20 pounds) in DCL, and there is increased angler interest in this species.

Threats

Deep Creek Lake Fishkill

On 19 July 2010 MD DNR received the first report of a fishkill in the Beckman's Area of DCL of about 30 – 40 fish. Maryland Department of Environment (MDE) Fish Kill Investigators responded, and reported no unusual water quality conditions. On 21 July 2010, Beckman's area residents called MD DNR Fisheries and indicated more than 50 fish were dead in that area of the lake. MD DNR Fisheries personnel responded with a shoreline survey and counted 186 dead fish in a mile of shoreline in the Beckman's area. McHenry Cove and Rt. 219 Bridge areas were also surveyed and no fish kills were observed. Fish species included Yellow Perch, Walleye, Smallmouth Bass, Largemouth Bass, Northern Pike, Chain Pickerel, Bluegills, Rock Bass, Brown Bullheads, Golden Shiners, and crayfish. These fish species are considered cool water (prefer 65 - 70°F) and warmwater fish species (prefer 70 - 85°F). MDE and DCL Management Office were notified and plans were made to continue additional investigations. On 22 July 2010, DCL Management Office and MD DNR Fisheries investigated the extent of the fishkill

and found dead fish scattered throughout the southern portion of the lake on the east shoreline, with the another concentration of dead fish in Green Glade Cove. Dead fish also observed in Meadow Mountain Cove north of Glendale Bridge. We observed about 500 dead fish on that date. On 23 July 2010, MDE and DNR used gill nets in Beckman's and Green Glade Area to collect live fish within the 10 to 30 foot water column. Ten Yellow Perch, one Walleye, and one Smallmouth Bass were collected. Bacteriological, histological and parasitological samples were obtained from each fish. The MDE Fish Kill Unit biologists determined that two pathogens affected the fish - one was the bacterium *Aeromonas hydrophila* and the other was a protozoan gill parasite. *Aeromonas hydrophila* is described as a "saprophytic" meaning it becomes pathogenic when fishes are physiologically unbalanced, nutritionally deficient or there are other abnormalities which allow opportunistic organisms to invade. This bacterium is common in most aquatic systems in Maryland and fish of all species serve as "reservoirs" for this bacterium. The temperature in Deep Creek Lake during July had been the highest ever recorded over several decades of temperature monitoring, and may have been a contributing factor for the outbreak. We estimated as many as 10,000 fish died during the summer of 2010, and based on 420 fish counted by species – we arrived at the percentage of affected fish by species: Yellow Perch (62.2 %), Walleye (13.8 %), Smallmouth Bass (13.1%), Brown Bullhead (4.0 %), Bluegill (3.1 %), Largemouth Bass (1.4 %), Chain Pickerel (1.0 %), Northern Pike (0.5 %), Rock Bass (0.5 %), Black Crappie (0.2 %), and Golden Shiner (0.2 %). By September 2010, the fishkill subsided, and anglers reported fishing success had improved.

Youghiogheny River Trout Fishery

Historical Trends and Current Conditions

The portion of the Youghiogheny River from the Deep Creek Hydro Station (DCHS) tailrace downstream approximately 4 miles to the Sang Run bridge was designated a Catch and Release Trout Fishing Area (C&R TFA) in 1993. Regulations limit terminal tackle to artificial lures and flies. Fishing is permitted year-round. Prior to 1993, this portion of the river was managed under Maryland's Designated Trout Stream regulations, which specified a two-fish daily creel limit with no minimum size, bait, or tackle restrictions. The fishery in the C&R TFA is maintained through put-and-grow stockings of fingerling Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss.* We strive to maintain a trout population density of 1,000 trout per mile as measured during fall sampling efforts. The current list of fish species and their observed abundance is in the Youghiogheny River Catch and Return Trout Fishing Area is contained in Table 2.

The current operating license for the DCHS requires temperature control (maintenance of < 25° C in the Youghiogheny River measured at Sang Run during June, July, and August), minimum flow maintenance (40 cfs in the Youghiogheny River measured at the DCHS tailrace outflow), and dissolved oxygen augmentation to meet State standards ($\geq$ 6 ppm average, 5 ppm minimum in the DCHS discharge) for downstream coldwater fisheries enhancement. These combined measures were implemented beginning in 1995

as part of an operating license renewal agreement with the Maryland Department of the Environment, Water Resource Administration -Deep Creek Lake Project - Water Appropriation Permit No. GA92S009(01) and re-issued in 2007 with Water Appropriation Permit No. GA1992S009(07).

Trout standing crops, adult trout densities, and numbers of quality size trout in the Youghiogheny River C&R TFA have increased since catch and release regulations as well as minimum flow, dissolved oxygen augmentation, and coldwater temperature enhancement releases implemented at the DCHS beginning in 1995. Maintenance of water temperature and flow volume within a range which Brown and Rainbow Trout can tolerate has increased available habitat in the Youghiogheny River C&R TFA during critical mid-summer periods, increasing survival and supporting a larger population as well as a high quality fishery. We strive to produce an adult trout population of 1,000 trout per mile throughout the Youghiogheny River C&R TFA to maintain a high-quality trout fishery. The 2005 estimated trout population decreased significantly from previous post-temperature enhancement years. River temperatures during the summer of 2005 reached the critical thermal maxima or the temperature at which trout loses their ability to escape lethal conditions. The Maryland Department of the Environment issued a Notice of Violation of State Water Appropriation Permit to the operators of the DCHS. The notice charged the operators that Condition 16 of the permit was violated on six dates during June-August 2005. The DCHS operators acknowledged the non-compliance occurrences, and reported they were caused by protocol problems and operator error. Recovery took a number of years, but by 2009 and 2010, the trout density and standing crops have met the DNR management objective. The number of quality-size trout in the Youghiogheny River C&R TFA in the post-enhancement period was comparable to the very high quality trout population of Maryland's Savage River Trophy Trout Fishing Area.

Threats

During 2011 and 2012, the trout population densities and standing crops were reduced to levels observed prior to the temperature enhancement plan mainly due to the number and duration of temperature exceedances. The loss of trout densities in 2011 and 2012 was the greatest reduction (6.2 and 6.4-fold decrease respectively from 2010) since the temperature enhancement plan was instituted in 1995. In addition, changes made in the Brookfield Water Appropriation permit instituted by MDE's Water Supply Program in June 2011 will further have a detrimental effect on the Youghiogheny River coldwater trout resource. The changes to Condition 17 along with operational changes resulting from the new verified estimate of wicket flow threaten the coldwater habitat and high quality trout fishery which exist in the Youghiogheny River downstream of the discharge. The USGS verified wicket flow at 17 cfs. It is likely that the historical estimate of 9 cfs was in error due to the use of less rigorous techniques. Previous modeling, management actions and permit conditions were all developed under the assumption of 9 cfs of cold water flowing to the river at all times, however, it more likely has been closer to the 17 cfs now observed. Operational changes resulting from adopting this new estimate will

reduce the amount of cold water discharged to the river during critical low flow, high temperature periods. These changes alone will have negative implications for the coldwater resource downstream. The additional changes to the permit will elevate the risk to a high probability that environmental harm will occur throughout the downstream river reaches. Flow bypass volumes will be reduced in hot and drought conditions to maintain the 40 cfs in the river, thereby significantly decreasing by more than 50% available coldwater habitat previously (16 years) available under the water appropriations permit. The cold water reduction will have significant impacts on river temperatures below the tailrace and reduced the coldwater water refugia which have been present for trout in the river since operations started at the dam.

In addition to the adjustments for the new wicket flow estimate, MDE has directed Brookfield to close one penstock during non-discharge periods. This will further reduce coldwater discharge to the river and compound the impacts to downstream habitat and the fishery. This change will cut the minimum supply of coldwater which the river has historically received on a continual basis by half (8.5 cfs). The percentage of coldwater in the river at minimum flow will be reduced from 35% historically to 21%. This loss of cold water will have significant impacts on maximum and average temperatures below the tailrace and will severely reduce the coldwater water refugia for trout which has been present since operations started at the dam.

This operational change may also compromise the effectiveness of the TER protocols since they were developed with the 17 cfs wicket flow in place. Shreiner and Dew-Baxter (2011) reported that river temperatures at Sang Run exceeded 25°C on 18 days and maximum temperature reached 28°C for a three-hour duration during July 2011. Additionally, augmentation for minimum flow will now not occur until the river has dropped 8.5 cfs lower than in previous years, also having negative impacts to the coldwater resource.

Finally, the provision to suspend the 40 cfs minimum flow when lake elevation drops more than one foot below the lower rule band would very likely severely impact trout populations. This would occur after the use of shallow areas of the lake had already been compromised and would provide no immediate relief for lake users since is likely to occur during a low inflow scenario. Lake levels would recover quickly once precipitation returned to normal. However coldwater resources and the trout fishery would take 4 to 5 years to recover and a valuable public resource has been put at risk. Loss of this fishery is not just a degradation of Maryland's natural resources but it would result in a loss of local revenues in response to poor fishing and would impact the local economy and resource supported businesses.

Table 2. List of common and scientific names and relative abundance of fish species collected in the Youghiogheny River Catch and Release Trout Fishing Area, 2012.

Common Name	**Scientific Name**	**Observed Abundance**
River Chub	*Nocomis micropogon*	Abundant
Longnose Dace	*Rhinichthys cataractae*	Common
White Sucker	*Catostomus commersoni*	Scarce
Northern Hog Sucker	*Hypentelium nigricans*	Abundant
Margined Madtom	*Noturus insignis*	Scarce
Brook Trout	*Salvelinus fontinalis*	Scarce
Rainbow Trout	*Oncorhynchus mykiss*	Common
Brown Trout	*Salmo trutta*	Common
Mottled Sculpin	*Cottus bairdi*	Common
Bluegill	*Lepomis macrochirus*	Scarce
Rock Bass	*Ambloplites rupestris*	Common
Smallmouth Bass	*Micropterus dolomieu*	Common
Total species = 12		