Monocacy River
Final Report 2001 - 2005

Introduction

The Monocacy River is the largest Maryland tributary to the Potomac River with a watershed that encompasses nearly 251,230 hectares. Originating near the Pennsylvania line by the junction of Marsh and Rock Creeks, the Monocacy flows south 93 km to its mouth near Dickerson. Varying in width from 12 m (40') to 114 m (375'), the Monocacy flows gently with an average gradient of 3 percent (DeRose, 1966). Mean water quality data suggests that the Monocacy is slightly basic (pH 7.7), moderately hard (139 mg/l CaCO3) with fair buffering capacity (104 mg/l CaCO3), and minimally conductive (299 microhmos/cm). During runoff events turbidity becomes very high.

Electrofishing surveys were conducted throughout the Monocacy in 2004 and 2005 and just within the Black Bass Catch-and-Release Area in 2001. The purpose of the surveys was to assess the smallmouth bass population with the following objectives:

- Determine smallmouth bass yearclass strength, abundance, size structure, condition, and growth rates

- Collect smallmouth bass for analysis of endocrine disruption in cooperation with a USFWS study

- Maintain a current fish species list

Methods

Seining - Young-of-year (YOY) fish species were collected using a 9.1 m x 1.2 m, 3.2 mm mesh haul seine. Three locations (general, pool, riffle) within a station were sampled to compensate for variable habitats. The geometric mean number per seine haul was used to quantify YOY smallmouth bass abundance. One was added to each haul to compensate for zero values.

Electrofishing – Both commercially built electrofishing boat and barge equipment manufactured by Smith-Root Inc. was used to collect fish species because of depth/habitat and access variations among sites. Three anode probes were used while barge electrofishing to cover the width of the river and reduce the potential of fish escaping the electrical field. Timed runs were conducted to obtain relative abundance data. Electrofishing was accomplished using pulsed (60pps) DC current; voltage was adjusted for maximum shocking efficiency; shocking time was automatically recorded. Collected fish were held in flow-through float boxes or the boats livewell until the data were collected, then released. A total of 40 smallmouth bass were sacrificed for analysis

of endocrine disruption through a USFWS study. Both scales and otiliths were removed from these fish for age examination.

Lengths and weights of collected fish were used to obtain relative weight (Wr), a method of determining fish condition as described by Wege and Anderson, 1978. Evaluation of smallmouth bass size structure was made using the concept of Proportional Stock Density (PSD) as proposed by Gablehouse (1984). Catch-per-Unit-Effort ($CPUE_{Hr}$) was used as a measure of relative abundance expressed as the number of fish collected per hour of actual electrofishing time.

Results and Discussion

Reproduction of smallmouth bass in 2005 was very good in the upper reaches, poor in the lower river, and good overall based on yoy electrofishing CPUEs (Table 1). Downstream of Frederick, reproduction is usually low. The geometric mean yoy smallmouth per seine haul in 2005 was the third highest since 1997 (Table 2) and slightly higher than the long-term geometric mean (1.8). No seining data were collected during 2003 because of high flows and turbidity, but recruitment was expected to be very low because of high flows. Virginia Department of Game and Inland Fisheries biologists found evidence to suggest that both high and low flows during and immediately after the spawning season are linked to a reduction in recruitment success (Rizzo, et al, 2005).

Catch rates for stock-size and greater smallmouth bass were very low in 2004 (Table 3). The drought that began in 2001 and continued through 2002 greatly reduced carrying capacity for adult fish and poor recruitment in 2003 slowed recovery. According to USGS data for the Jug Bridge gauging station, mean monthly flow for July and August, 2002 was 68 and 62 cfs, respectively. The mean flow for those months, 1929 – 2004, was 452 and 403, respectively. The electrofishing catch rate for stock smallmouth bass increased substantially in 2005 and is expected to further increase as the strong 2005 yearclass reaches stock size.

Unlike abundance, smallmouth bass size structure has not changed appreciably during the last grant period (Table 3). Whereas the 2004 and 2005 length frequency distributions (Figure 1) show a clear increase in abundance, the Kolmogorov-Smirnov test at the 95% CL suggests no difference in the proportion of stock and quality length bass ($D = .2083$, $P = .081$). Smallmouth bass PSD has consistently fallen just below the 30 – 60 range suggested by Anderson and Weithman (1978) for a balanced population. However, this difference was not significant at the 95% CL.

Smallmouth bass Wr has been quite variable during the last grant period ranging from 83 to 93 (Table 3). These differences were significant at the 95% CL.

Scales were removed from 71 smallmouth bass in 2004 for age and growth analysis. Length at age data indicates that the average smallmouth bass in the Monocacy River will

reach the 300 mm minimum length limit during its fifth year of life, typical of riverine populations in Maryland. Scales and otoliths were removed from 40 smallmouth bass in 2005 to compare the accuracy and precision of the two aging techniques. The results will be reported in a future report.

The most important forage species found in the Monocacy River in terms of percent occurrence and relative abundance are spottail shiner, spotfin shiner, and bluntnose minnows. Intermediate river chubs and golden redhorse suckers are common and no doubt also contribute to the prey base. Forage fish populations are extremely plentiful in the lower Monocacy and should be providing a more-than-adequate forage base for smallmouth bass. A list of fish species collected from the Monocacy River to date by seining and electrofishing is shown in Table 2.

Management Recommendations

- Continue annual seining surveys to determine smallmouth bass yearclass strength and monitor abundance of forage species.

- Conduct late summer or early fall (water temperature > 15°C) electrofishing surveys of the upper and lower river to assess the effectiveness of the catch-and-return regulations by examining the adult smallmouth bass size structure (PSD, RSD35), relative abundance (CPUE), and physical condition (Wr). Conduct electrofishing surveys at least every three years.

- Stock fingerling largemouth bass where suitable habitat exists to increase angling opportunities for this species.

Table 1. Geometric mean at the young-of-year smallmouth bass per seine haul collected from the Monocacy River, 1997 – 2007 (95% CI). Running geometric mean 1997 – 2005 = 1.8. MD DNR.

	2007	**2005**	**2004**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**
# hauls	12	27	23	20	24	24	18	34	29
# smb	150	68	39	37	67	39	81	58	50
GeoMean	8.4	1.9	1.4	1.5	2.2	1.4	3.3	1.4	1.5
smb/haul	± 2.0	± 1.3	± 1.3	± 1.3	± 1.3	± 1.2	± 1.5	± 1.2	± 1.2

Table 2. Young-of-year (yoy) smallmouth bass electrofishing catch per unit of effort (CPUEs) from the Monocacy River, 2005. MD DNR.

Site	**LeGore**	**Devilbiss**	**Mon. Blvd.**	**Pine Cliff**	**Park Mills**	**Total**
# yoy	11	15	6	0	0	32
# hours	.43	.82	.53	.52	.47	2.77
$CPUE_{Hr}$	26	18	11	0	0	12

Table 2. Fish species collected to date by location from the Monocacy River.

Common	Scientific	Sample Site						
		S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**
American Eel	*Anguilla rostrata*	x	x	x				x
Tiger Muskie	*Esox masquinongy x Esox lucius*							x
Stoneroller	*Campostoma anomalum*	x	x		x	x	x	x
Carp	*Cyprinus carpio*	x	x	x	x	x	x	x
Silverjaw Minnow	*Ericymba buccata*	x		x			x	
River Chub	Nocomus micropogon	x	x	x	x	x	x	x
Golden shiner	*Notemigonus crysoleucus*		x			x		
Comely shiner	*Notropis amoenus*			x				x
Common shiner	*Notropis cornutus*	x	x	x	x	x	x	
Spottail Shiner	*Notropis hudsonius*	x	x	x	x	x	x	x
Swallowtail Shiner	*Notropis procne*	x	x	x	x	x	x	x
Rosyface Shiner	*Notropis rubellus*	x	x	x	x			x
Spotfin Shiner	*Notropis spilopterus*	x	x	x	x	x	x	x
Bluntnose Minnow	*Pimephales notatus*	x	x	x	x	x	x	x
Longnose Dace	*Rhinichthys cataractae*	x	x		x			x
Creek chub	*Semotilus atromaculatus*				x	x	x	x
Fallfish	*Semotilis corporalis*		x	x	x		x	x
White Sucker	*Catostomus commersoni*	x	x	x	x	x	x	x

S1 - Rt 77

S2 - Rt 550

S3 - Devilbiss Br

S4 - Pinecliff Park / Rt 355

S5 - Rt 80

S6 - Criss Ford Rd

S7 - Park Mills Rd / Rt 28

Table 2. Fish species collected from the Monocacy River - continued.

Common	Scientific	S1	S2	S3	S4	S5	S6	S7
Northern Hog Sucker	*Hypentelium nigricans*	x	x	x	x	x	x	x
Golden Redhorse	*Moxostoma erythrurum*	x	x	x	x	x	x	x
Shorthead Redhorse	*Moxostoma macrolepidotum*				x	x		
Yellow Bullhead	*Ictalurus natalis*	x	x	x			x	
Brown Bullhead	*Ictalurus nebulosus*							x
Channel Catfish	*Ictalurus punctatus*	x	x	x	x		x	x
Margined Madtom	*Notorus insignus*	x		x			x	
Rock Bass	*Ambloplites rupestris*	x	x	x	x	x	x	x
Redbreast Sunfish	*Lepomis auritus*	x	x	x	x	x	x	x
Green Sunfish	*Lepomis cyanellus*		x				x	
Pumpkinseed	*Lepomis gibbosus*		x			x	x	
Bluegill	*Lepomis macrochirus*	x	x	x		x	x	
Longear Sunfish	*Lepomis megalotis*	x	x	x	x	x		
Smallmouth Bass	*Micropterus dolomieui*	x	x	x	x	x	x	x
Largemouth Bass	*Micropterus salmoides*		x		x	x	x	x
Black Crappie	*Pomoxis nigromaculatus*						x	
Greenside Darter	*Etheostoma blennioides*	x	x	x	x	x	x	x
Tessellated Darter	*Etheostoma olmstedi*	x	x	x	x	x	x	x
Walleye	*Sander vitreus*						x	x

S1 - Rt 77

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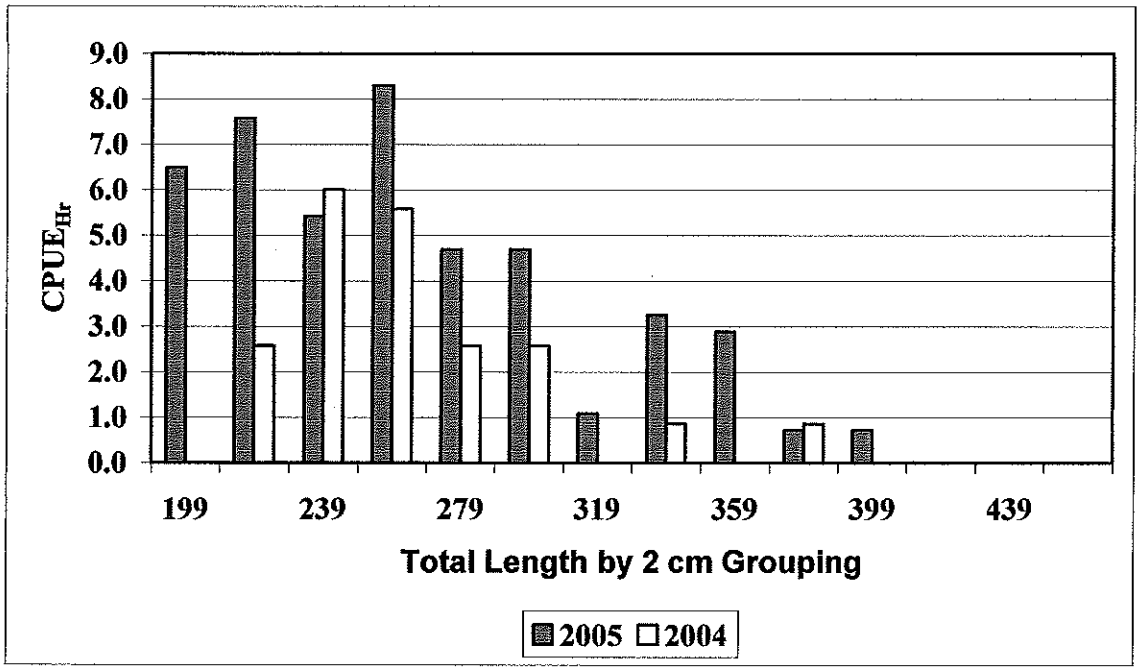

Figure 1. Length frequency of stock-size and greater Monocacy River smallmouth bass collected by electrofishing during 2004 and 2005. MD DNR. 2005 N = 127, 2004 N = 43.