Potomac River Smallmouth Bass Supplemental Stocking Plan

Justification:

Yearclass strength of Potomac River smallmouth bass has been monitored annually since 1975 by a summer seining survey. Annual yearclass strength is measured as the mean number of young of year (YOY) smallmouth bass collected per seine haul referenced as the Recruitment Index. Smallmouth bass Recruitment Index scores are highly variable, predominantly influenced by spring river conditions such as flow magnitude/variability and turbidity. Smallmouth bass recruitment scores are negatively associated with high average monthly river discharge in May ($r = -0.347$, $P = 0.027$) and June ($r = -0.362$, $P = 0.021$)(Figure 1). Flow alteration curves showing median monthly river discharge (cfs) values from the USGS Point of Rocks gage station prior to 2008 (1900-2007) and after (2008-2017) shows significantly higher May discharge in recent years (Figure 2), the month that most of the spawning takes place.

Potomac River smallmouth bass average Recruitment Index scores after 2007 have been lower than the average of scores 1975 – 2007 (Table 1 and Figure 3). Over the last decade there has been an unprecedented lack of dominant yearclasses (Figure 4). Further, seven of those years were below the long term median; five years were considered "poor". Declines in the proportion of smallmouth bass between 7 and 11 inches in electrofishing surveys in the middle and lower river sections illustrates the declining recruitment and lower survival of age 0 and age 1 bass in these river sections (Figures 5 and 6). Consecutive years of poor recruitment reduces adult fish stocks, alters size distributions, reduces the number of large bass available for anglers and ultimately fishing quality declines. The Freshwater Fisheries Program is responsible for managing Maryland's freshwater resources to provide high quality, diverse, and accessible fisheries for Maryland residents and visitors.

Objectives:

The goals of this five year pilot stocking initiative are to supplement natural reproduction to improve smallmouth bass yearclass strength and to reduce annual recruitment variability with the following objectives:

- Supplement average yearclasses to produce dominant yearclasses that reflect recruitment patterns observed prior to 2007 (ie 4 – 5 years).
- Supplement poor yearclasses to produce average yearclasses and maintain the proportion of smallmouth bass 7 - 11 inches $\geq$ 40 percent.
- Maintain a mean electrofishing catch rate $\geq$ 28 quality-size bass (11 inches) per hour ($\geq$ 25^{th} percentile of 2008 – 2017 mean catch rate for entire river)
- Improve angler catch and satisfaction with the Potomac River smallmouth bass fishery.

Consequences of taking no action:
The electrofishing catch of quality size and greater (≥ 11 inches) smallmouth bass remains at desirable levels. However, consistent and consecutive average or below average smallmouth bass recruitment will ultimately result in lower angler catch rates and fewer bass reaching larger sizes. Angler satisfaction is likely to decline and expectations will have to be reduced until environmental conditions result in improved recruitment and survival of age 0 and age 1 bass. A recent angler preference survey revealed that the nontidal Potomac River smallmouth bass fishery is Maryland's most popular freshwater fishing destination and generates an economic impact estimated to reach $23,000,000 (Knocke, 2016).

Alternative actions:
Smallmouth bass abundance can be increased by improving recruitment (the number of juvenile fish entering the adult population) and/or reducing mortality of angled fish. Average annual mortality of catchable smallmouth bass (≥ age 2) is around 39 percent, of which 25 percent can be attributed to natural causes. The rate of voluntary release of legal size bass by anglers is very high, so much of the fishing mortality is the result of catch and release fishing. Population modeling based on smallmouth bass mortality and growth revealed much greater increases in the abundance of bass ≥ 14 inches under existing regulations and higher recruitment than Catch and Release regulations under lower recruitment. However, recreational and tournament anglers should still minimize angling mortality by following good fish handling practices and stewardship

Stocking Locations:
River reaches to be stocked will be prioritized based on recent recruitment patterns, electrofishing catch rates for stock to quality size smallmouth bass, and angler input. The preliminary potential stocking locations are shown in Figure 4 and span 56 river miles from Dam 5 downstream to Point of Rocks.

Stocking Rate:
The mean smallmouth bass recruitment index for the entire mainstem Potomac for the period 1975 through 2007 was 1.8 smallmouth bass per seine haul. Each haul of the 30 foot seine covers approximately 50 feet of shoreline. The priority stocking reaches cover 56 river miles. Accounting for both shorelines, this would require ~ 21,000 fingerlings to equate to an average yearclass if the fish are stocked during July or later.

General Protocol:

- Maintain genetic integrity by utilizing smallmouth brood collected from the Potomac River within the targeted stocking area
- Organize angling event/tournament to efficiently collect the number of brood smallmouth bass specified by the hatchery (12 - 15 pairs) to reach production goal.
    - Brood collected by angling event held between March 15 and April 15.
    - Use biosecurity protocols specified by the Aquatic Animal Health Program Manager to disinfect boat livewells prior to fish collection
    - Secure exemption for participants to possess bass during the closed season through Tournament Permit
    - Conduct angler outreach regarding the project and provide updates on progress through department social media and link on Freshwater Fisheries Program web page
- Bass transported to hatchery via department hauling trucks and hatchery staff
- Updates on hatchery progress documented through web page and social media
- Brood bass returned to river at collection site via department hauling trucks
- Fry marked with OTC (oxytetracycline)
- Fingerlings marked with coded wire tags to identify hatchery fish during electrofishing surveys (if available).
- Fingerlings stocked in chosen river reaches with documentation
- Monitor percent contribution of hatchery fish through examination of otoliths for OTC mark and/or coded wire tags on age 1 bass.
- Continue stocking effort for five consecutive years and evaluate.
- Encourage angler participation in the Potomac River Smallmouth Bass Volunteer Angler Survey and monitor catch rates.

Considerations/Limitations:

There are a number of factors that could affect the success of this pilot project. Potomac River smallmouth brood have had difficulty adapting to the hatchery pond environment in the past and may not produce the desired number of fingerlings. Potential stocking locations will be prioritized to determine the most appropriate sites to stock for a given level of production.

The age structure of the Potomac River smallmouth bass population, estimated by applying a length-age key to the electrofishing catch, suggests that annual mortality of 2 year old and older bass has been declining (Figure 8). A general increase in voluntary release of legal sized bass (12 inches) by anglers is believed to be the primary driver of improved survival. However, other currently unidentified mortality factors are reducing the survival of juvenile bass between Age 0 and Age 2 in the middle and lower river segments (Figure 6). This mortality could also reduce the overall contribution of the stocked fingerlings and the effectiveness of the stocking program.

Table 1. Potomac River smallmouth bass Recruitment Index and river discharge at the USGS Point of Rocks gauging station by time period.

Time Period	Lower	Middle	Upper	Total	POR Mean May Discharge (cfs)
1975 – 2007 Mean	1.7	2.4	1.8	1.8	12649
1975 – 2007 Median	0.88	2.0	1.1	1.21	8970
2008 – 2017 Mean	0.82	0.52	0.71	0.67	17765
2008 – 2017 Median	0.31	0.41	0.72	0.52	14000
% change (mean)	< 52	< 78	< 61	< 63	> 40

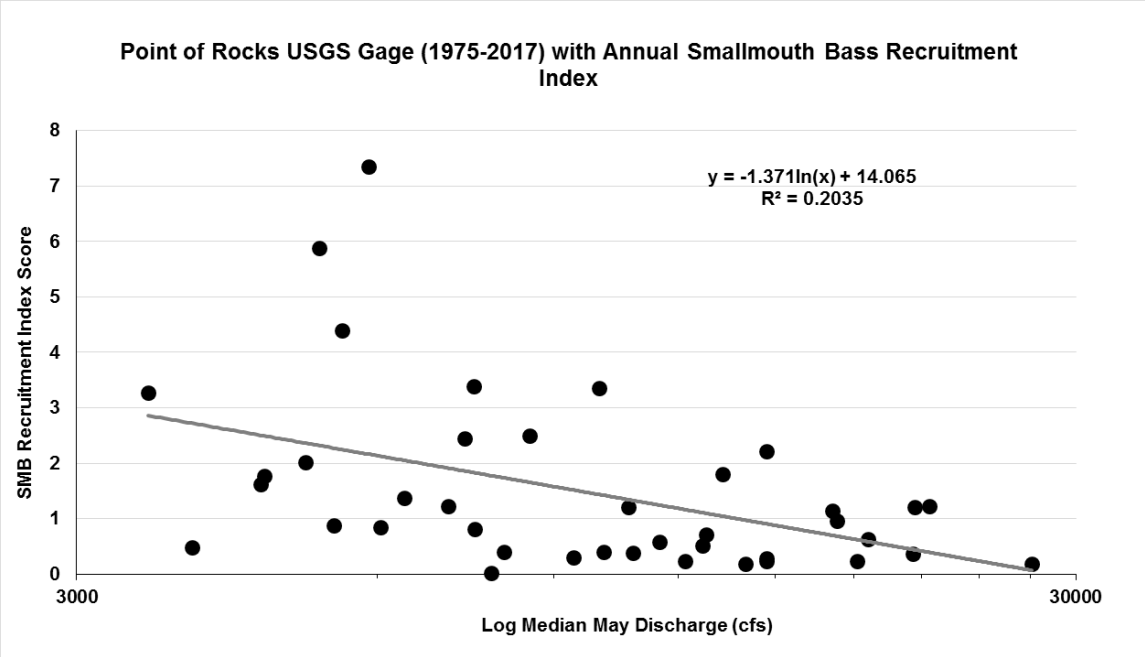

Figure 1. Relationship of smallmouth bass recruitment index score and median May Potomac River discharge measured at the Point of Rocks gauge 1975 – 2017.

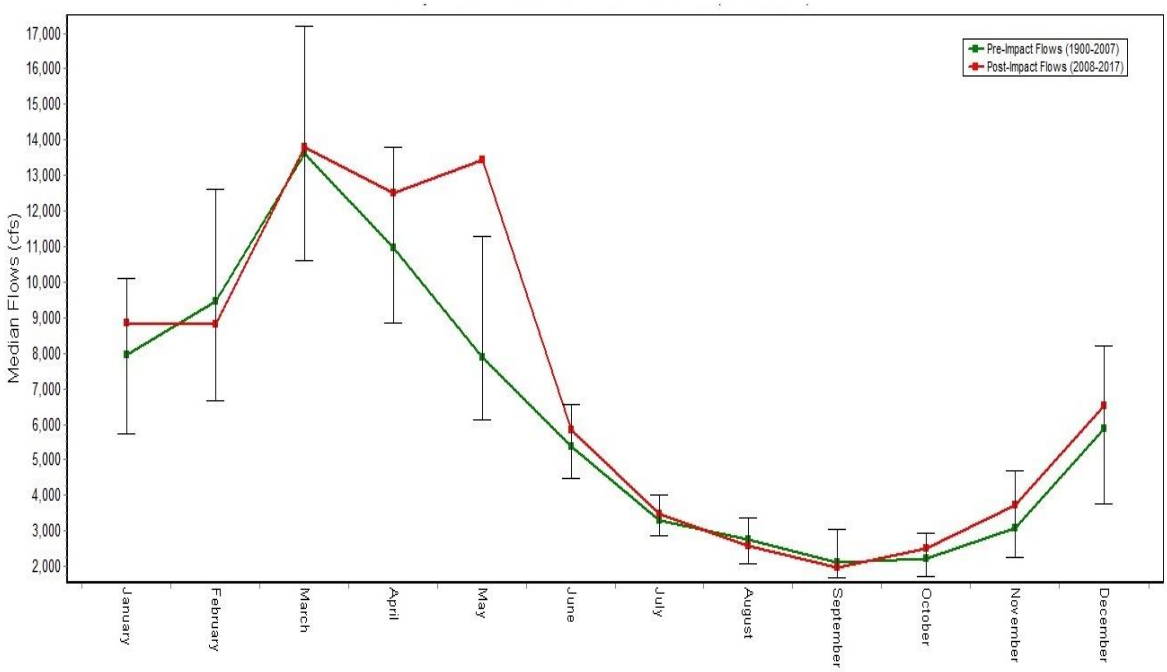

Figure 2. Flow alteration curve showing median monthly discharge (cfs) values from USGS Point of Rocks gage station for pre-impacted (1900-2007) and impacted (2008-2017) periods.

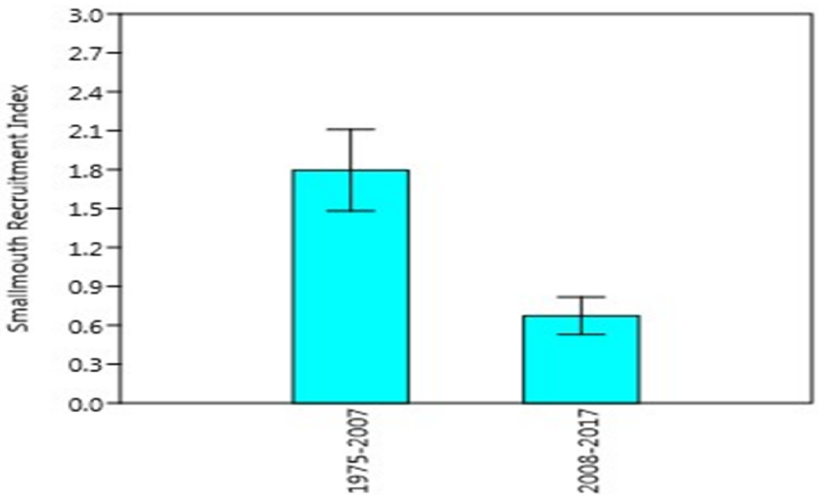

Figure 3. Mean Potomac River smallmouth bass Recruitment Index scores by time period and 95% CI.

Figure 4. Mean annual smallmouth bass recruitment score (YOY/seine haul) for the upper Potomac River (1975-2017).

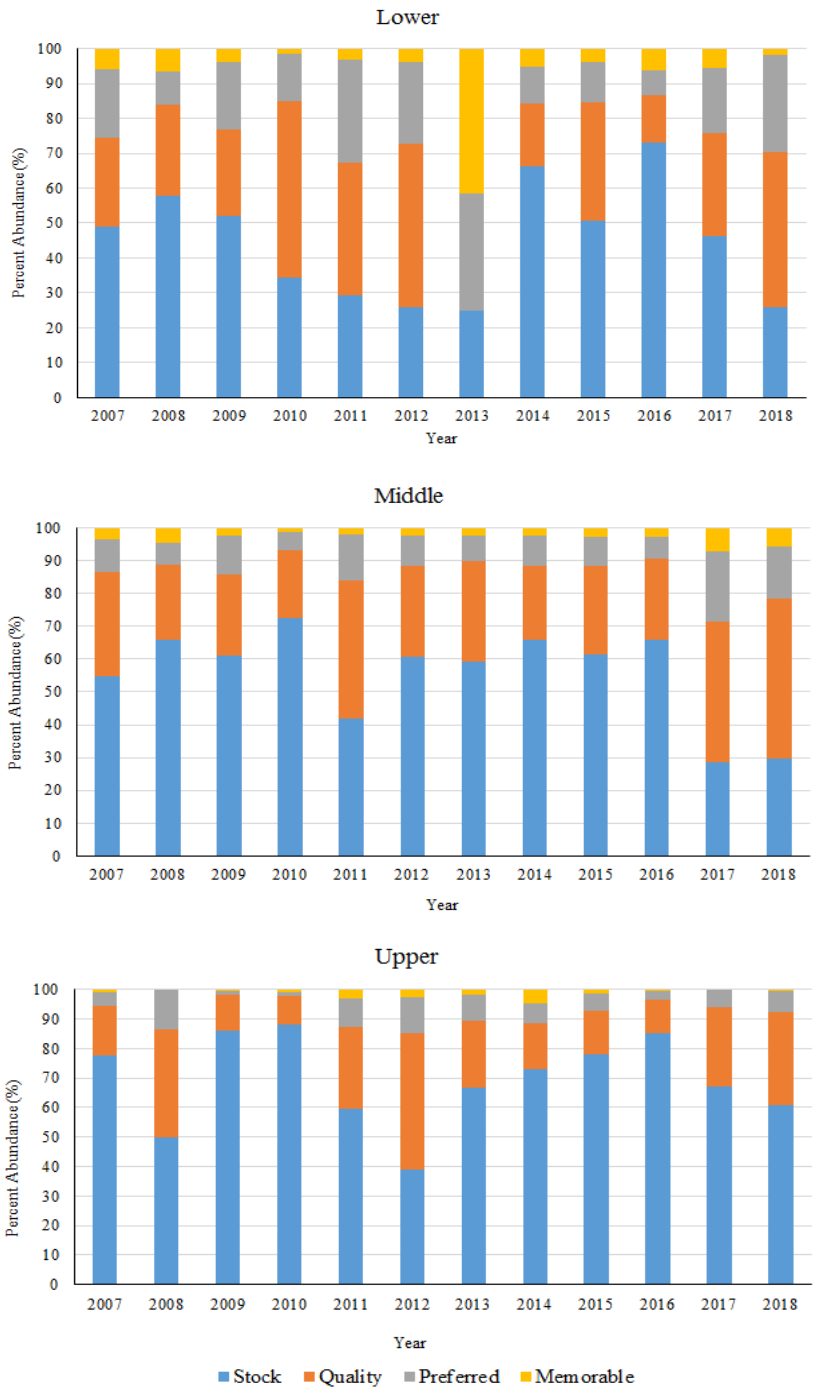

Figure 5. Percent abundance of stock (7 - 11”), quality (11 - 14”), preferred (14 - 17”), and memorable (17 - 20”) sized smallmouth bass from three sections of the upper Potomac River (2007-2018).

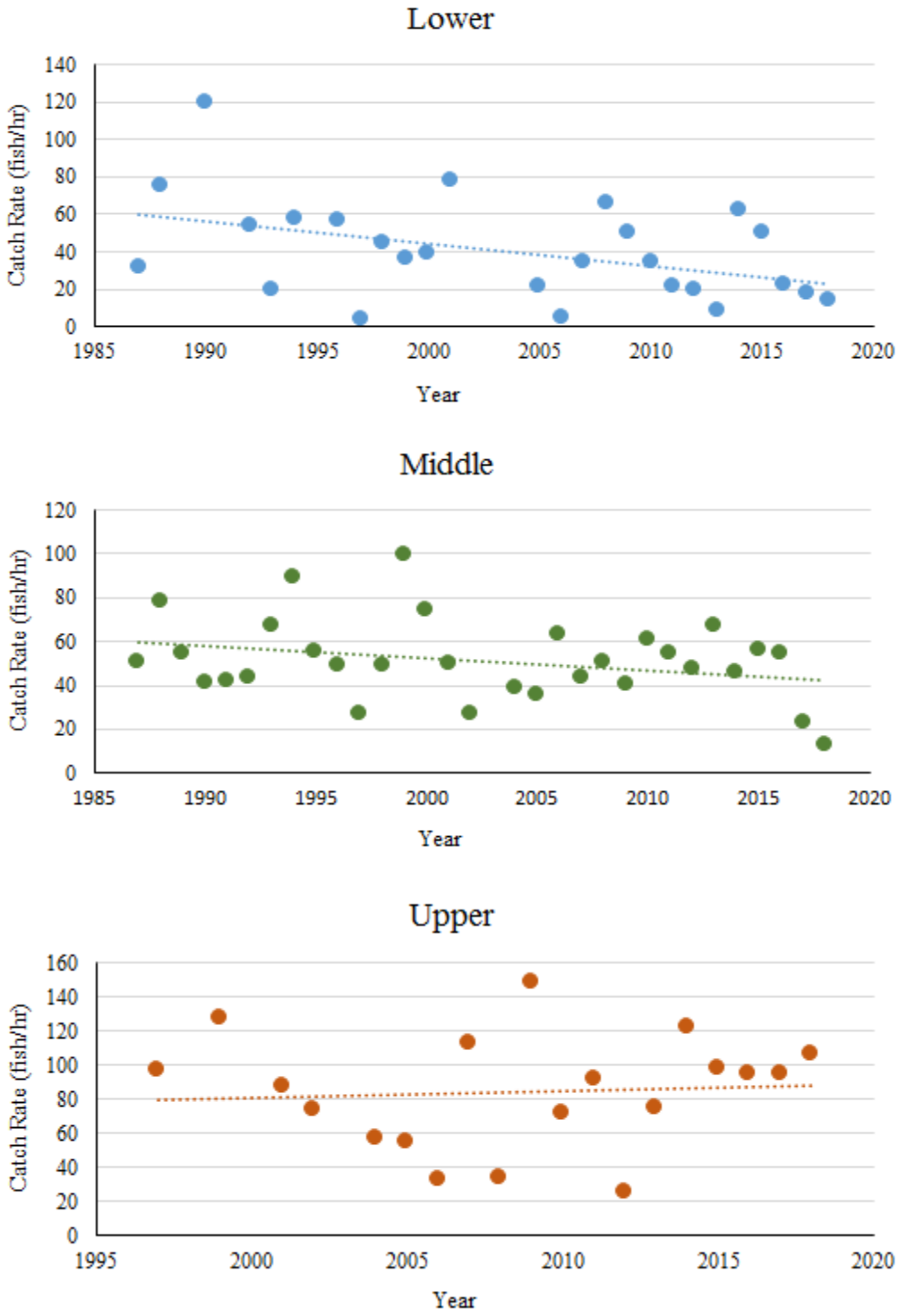

Figure 6. Catch rates (fish/hr) for stock to quality size increment of smallmouth bass 180 - 279 mm (7 - 11”) for three sections of the upper Potomac river (1988-2018).

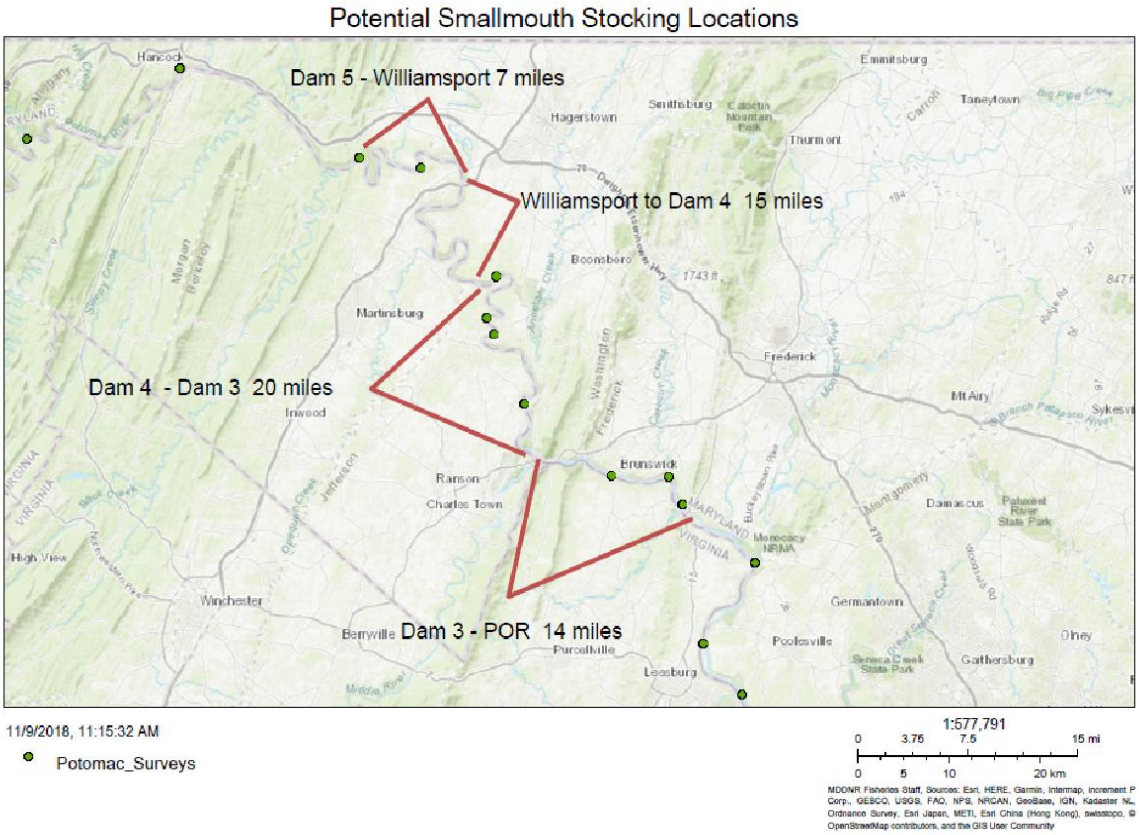

Figure 7. Potential smallmouth bass supplemental stocking locations and mileage. Total mileage 56.

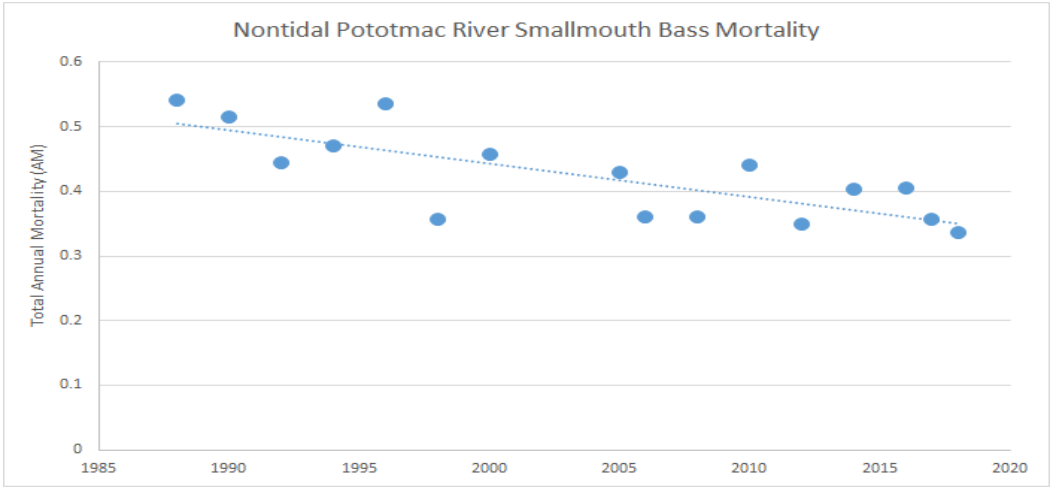

Figure 8. Total annual percent mortality (AM) of Potomac River smallmouth bass ≥ Age 2 determined from catch curves of electrofishing catch, by year.

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