

# **Delaware River**

## **Wayne, Pike, Monroe, Northampton, and Bucks Counties**

### **Adult and Juvenile Smallmouth Bass Assessments 2005-2020**

Fisheries biologists from Area 5 and Area 6 of the Pennsylvania Fish and Boat Commission routinely assess the status of the Delaware River Smallmouth Bass population. Area 5 staff sample Smallmouth Bass at sites in: (1) the upper Delaware River (Damascus to Matamoras at Neversink River, New Jersey), (2) and middle Delaware River (Matamoras to Easton at Lehigh River); whereas Area 6 staff sample sites in the lower Delaware River (Easton to Morrisville at Trenton Falls). Two distinct Smallmouth Bass surveys are conducted annually. During summer (i.e. July), shoreline backpack electrofishing surveys targeting young-of-the-year (YOY) Smallmouth Bass are conducted to assess reproductive success and disease prevalence. In the fall (i.e., Sep. – Oct.), nighttime boat electrofishing surveys are conducted to evaluate abundance, age and growth, and size structure of Smallmouth Bass. Although Smallmouth Bass have been sampled in the Delaware River since the early 1990's, regular river-wide collections were initiated in 2005. The long-term Smallmouth Bass data is presented by river section (lower, middle, upper, combined) because habitat differences exist across these sections and for ease of interpretation by anglers that fish in a particular area of the river.



Area 5 Fisheries Manager Daryl Pierce measuring a 300m transect for a YOY survey. This habitat is preferred by YOY smallmouth bass.

## **YOY Trends**

Young-of-the-year Smallmouth Bass utilize the littoral (near shore) zone of the river for nursery habitat immediately following their dispersal from nests. Preferred habitat is characterized by shallow, flowing water (1-6 inches water depth) with crevasses and nooks created by bottom substrates (i.e., cobble, rock, boulder, etc.) which offers refuge from predators. Smallmouth Bass YOY collected from these habitats during summer backpack electrofishing surveys range in size from 20 to 100 mm total length (approximately 1-4 inches).

The long-term catch of YOY Smallmouth Bass from the Delaware River follows a longitudinal pattern, where the highest median catch rate (2.7 fish/50m; Figure 1) was observed in the lower river, followed by the middle river (2.2 fish/50m), and the upper river (1.6 fish/50m). In recent years (2016 – 2019), YOY catch rates have been below long-term medians, suggestive of below average YOY production. However, catch rates of YOY Smallmouth Bass during this year's survey were above the long-term median catch rate across all sites (Figure 1). We remain hopeful that this above average year class exhibits high over winter survival and recruits to the fishable adult population in the coming years.

The Delaware River Smallmouth Bass population is maintained entirely through natural reproduction. Successful reproduction and eventual recruitment can be affected by various abiotic (non-living) and biotic (living) factors. River flow is probably the most important abiotic variable affecting Smallmouth Bass recruitment in rivers. Increased flow can alter water temperatures, which affects the timing or ability (through not being cued to spawn or abandonment of a nest) of adult Smallmouth Bass to successfully spawn or may not provide optimal temperatures for egg development. Extreme high flows can remove eggs from the nest or cover them with sediment, which suffocates the eggs and prevents hatching. Additionally, newly hatched fry do not possess the strong swimming abilities needed to withstand long durations of high flow. All of these factors can affect the early life of Smallmouth Bass and potentially result in poor YOY production.

Evidence of flow induced factors affecting Smallmouth Bass YOY production were previously observed in our [2011 Delaware River YOY Survey report](#) and have continued since. For instance, the 2007 and 2008 year classes were two of the largest year classes on record and recruited extremely well to the adult population, whereas conditions in 2009 and 2019 produced weak year classes. In 2007 and 2008, river flows were low (< 10,000 cfs) and stable (no large peaks) in June, suggesting that stable conditions during the early life of Smallmouth Bass is critical for production of larger year classes (Figure 2A and 2B). In contrast, 2009 and 2019 were years with high, variable flows throughout the spawn and early life history period that resulted in two of the lowest catch rates over the time series (Figure 2C and 2D).



Area 7 Fisheries Manager Bryan Chikotas (previously an Area 5 and 6 fisheries biologist) holding two robust Delaware River Smallmouth Bass

## **Adult Trends**

Nighttime boat electrofishing surveys for Smallmouth Bass target shoreline habitats such as large boulders, shale outcroppings, woody debris, and vegetation beds. All Smallmouth Bass are netted during these surveys and have ranged from 50 – 520 mm total length (approximately 2 - 20.5 inches).

The long-term total catch rates (fish of all sizes combined) of Smallmouth Bass follows a pattern opposite of that observed for YOY Smallmouth Bass, where catch rates are lowest in the lower river and increase as you move upriver. The long-term median catch rate of all fish combined for the lower river is 26.5 fish/hr (Figure 3), followed by the middle river (83.5 fish/hr), and upper river (108.2 fish/hr). Catch rates of legal-sized (> 12") Smallmouth Bass were lowest in the lower river (2.7 fish/hr; Figure 4), but the highest catch rates were observed in the middle river section (8.3 fish/hr). The catch rate of 12" Smallmouth Bass in the upper river section (5.5 fish/hr) fell between those observed in the lower and middle river sections. Catch rates of fish >15" followed the same trend where catch rates were lowest in the lower river section (0.8 fish/hr; Figure 5), highest in the middle river (2.0 fish/hr), and intermediate in the upper river (0.65 fish/hr).

In general, the catch rate of Smallmouth Bass in 2020 decreased in comparison to those observed during 2019 surveys and is well-below the long-term median across sites and size classes of fish. There are a few potential explanations for the observed decline in catch rates between years. Firstly, Tropical Storm Isaias affected the Delaware River Basin in August 2020 resulting in near flood stage river levels in the mainstem Delaware and exceeded flood stage levels in many tributaries to the river. These extreme flows may have re-distributed fish

throughout the river and into areas that were not sampled in 2020. Secondly, and probably more important, sampling efficiency in fall 2020 was greatly affected by extremely low water levels. Water levels at historic sampling locations were well below normal (1-2 feet lower) at the time of the surveys. During low flow conditions fish move into the deepest water available. Because shoreline areas are targeted during these surveys, it is possible we encountered fewer fish because they were predominately in deeper, channel environments, un-accessible by our electrofishing gear.

Despite the lower than normal catch rates in 2020, the Smallmouth Bass catch rates in the Delaware River have remained at or above the long-term median for legal-sized fish in three of the last four years sampled (Figure 4; excluding 2018 because no surveys were conducted due to high flows). Further, the catch rates of YOY in 2020 were above the long-term median. Typically, one or two consecutive years of above median catch rates of YOY tends to translate into high catch rates of fish >12" three to five years into the future. For example, the strong 2007/2008 year classes contributed to legal-sized fish (> 12") in 2011-2014. The observations of higher than median catch rates of adult Smallmouth Bass in recent surveys and potential for the 2020 year class to contribute to the adult population, suggests that fishing for Smallmouth Bass should remain stable in the upcoming years.

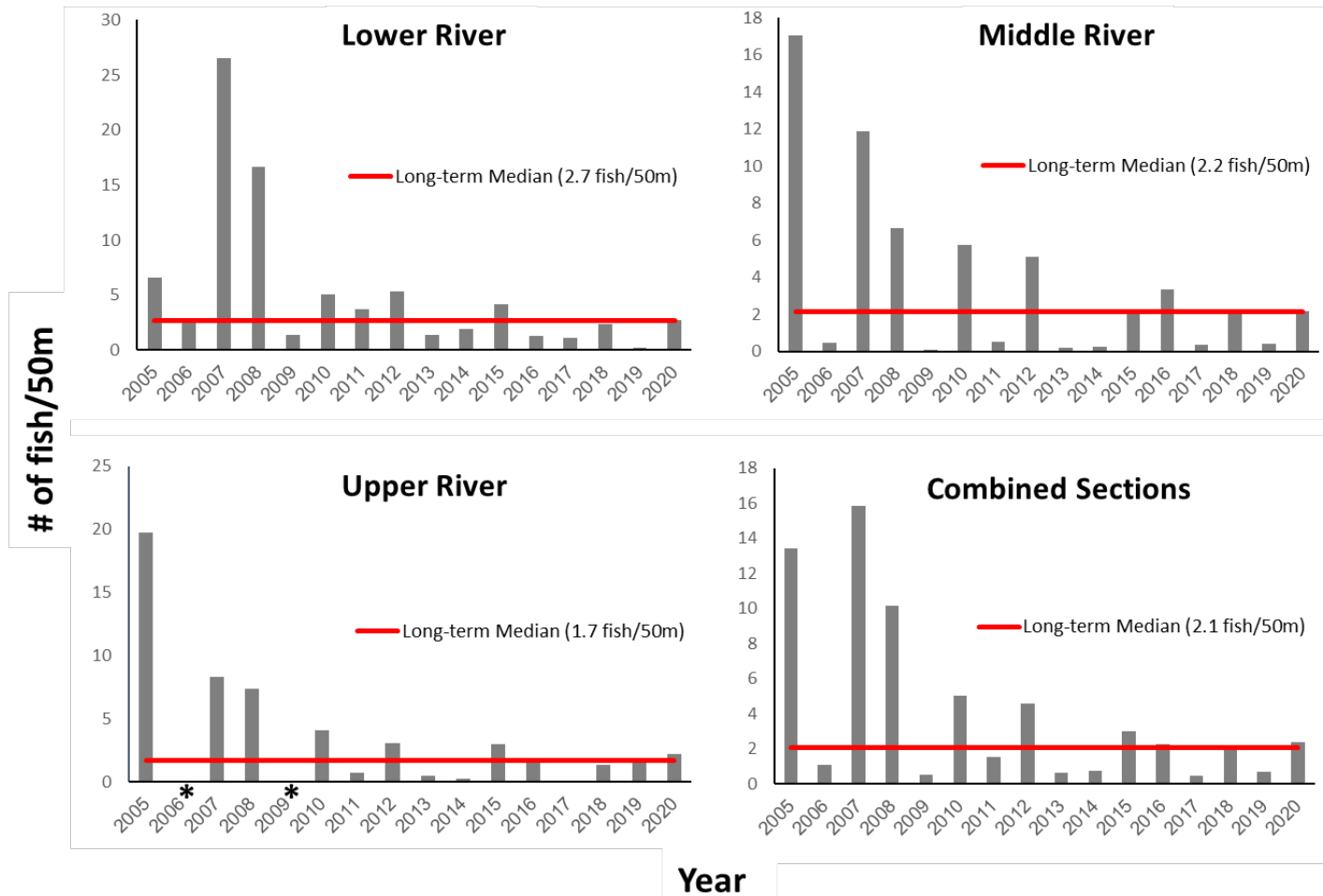
However, anglers targeting Smallmouth Bass in the Delaware River should still be catching fish from the 2015 and 2016 year classes as they now begin to reach their maximum size. Our data suggests the best locations to target Smallmouth Bass is the section of Delaware River between the Lehigh River and Matamoras. There are numerous boat/kayak [launches](#) to access this area of river, including those at Sandts Eddy, Smithfield Beach, Bushkill, and Dingmans Ferry. Additionally, there are numerous parks along the river in this section that provide anglers with wet-wading access. Anglers are reminded that during the [cold-weather period \(November 1 – April 30\)](#), use of PFDs is mandatory at all times for those canoeing, kayaking, and boating (boats less than 16 feet in length). Smallmouth Bass anglers should also follow creel and size limits, and seasons found in the [2021 Summary Book](#).

**Tyler Grabowski, Area 6 Fisheries Biologist**

**Mike Porta, Area 6 Fisheries Manager**

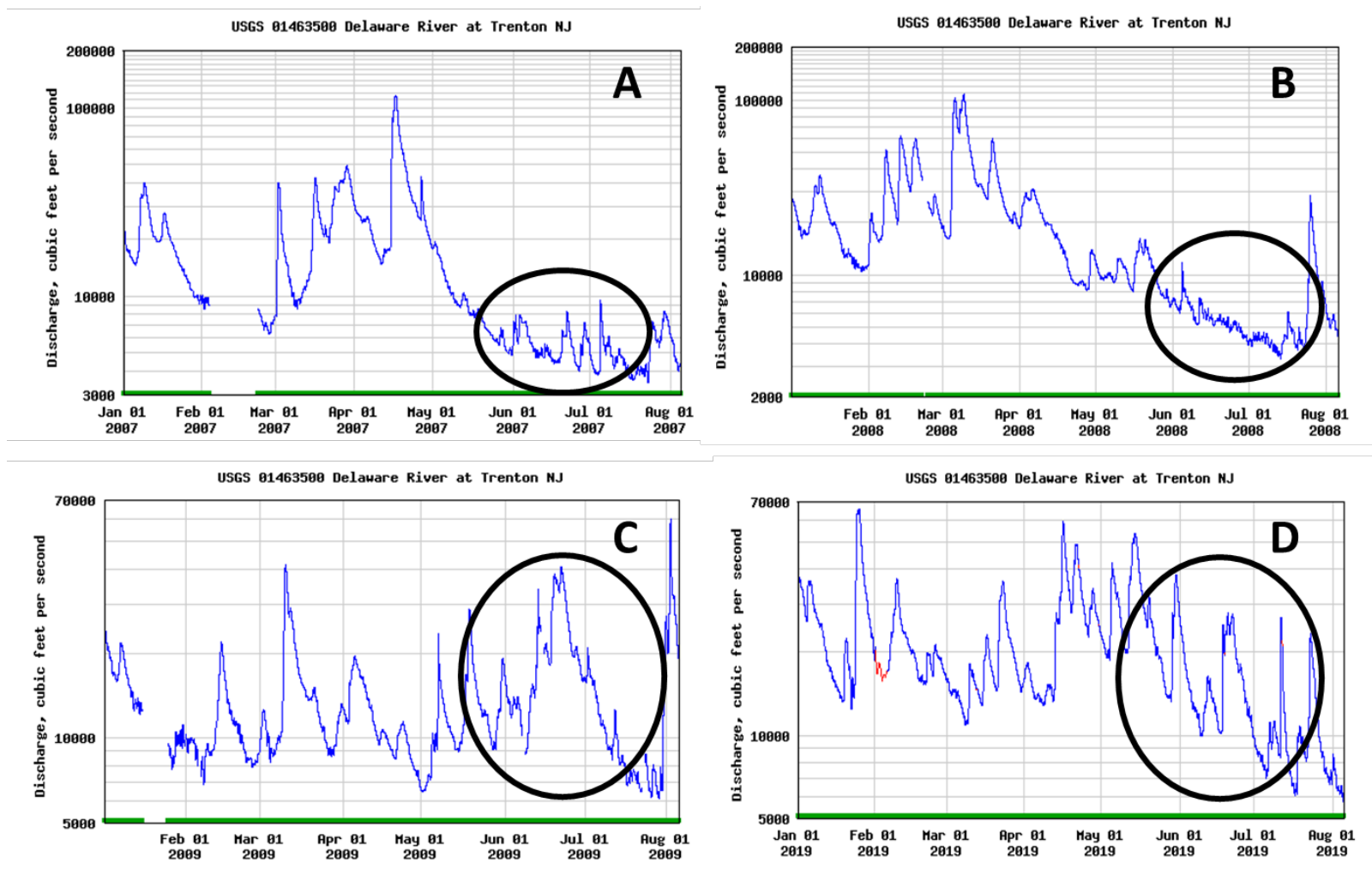
**Daryl Pierce, Area 5 Fisheries Manager**

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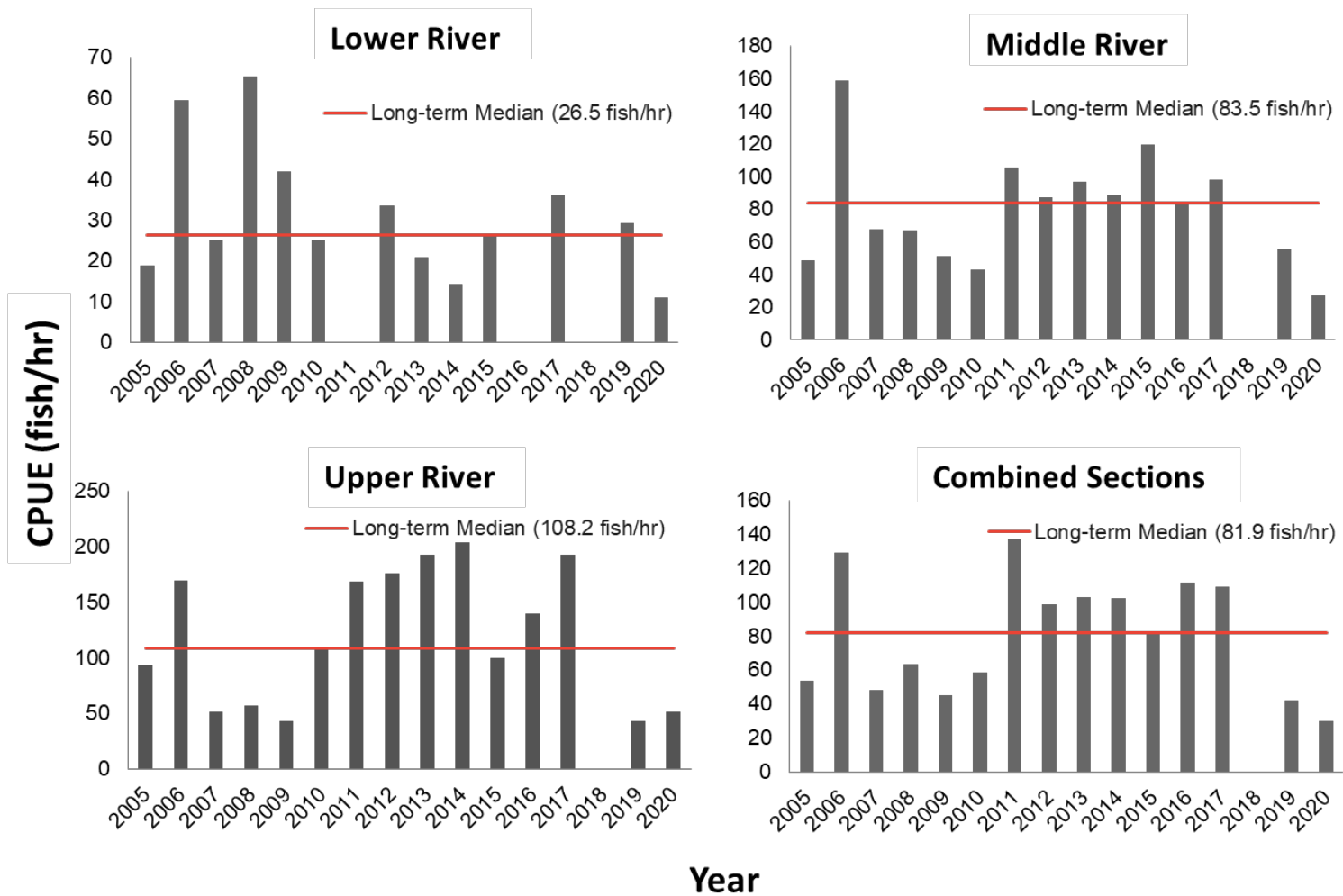


**Figure 1.** Catch rate (number per 50 meters of shoreline) of YOY Smallmouth Bass captured during shoreline, backpack electrofishing surveys from 2005 to present in the lower (Yardley, Pt. Pleasant, Kintnersville, and Raubsville), middle (Sandts Eddy, I-80, Bushkill, Dingman’s Ferry, Matamoras), and upper (Lackawaxen, 10 Mile Run, Narrowsburg, and Damascus.) Delaware River, and for all river sections combined. Blank values represent years where surveys were not conducted. Years with an asterisk (\*) represent surveys when no fish were captured. Scale on the vertical axis of the graphs are different for visual purposes.

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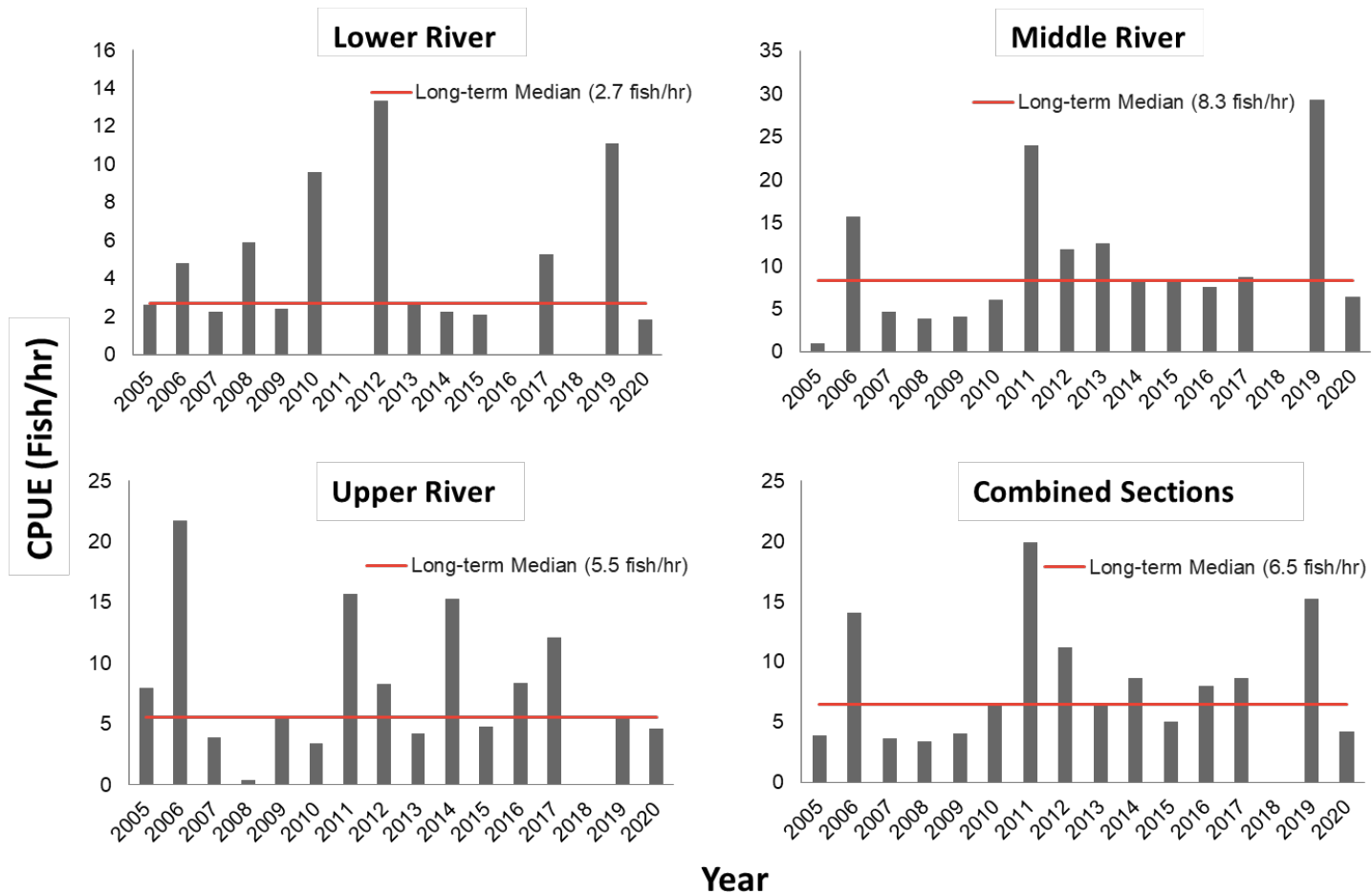


**Figure 2:** Hydrographs from the USGS stream gage at Trenton, NJ showing river conditions that led to higher year class production A) 2007 and B) 2008 and those conditions that lead to lower year class production in C) 2009 and D) 2019. The circled areas show differences in flow patterns that affected the early-life stages of Smallmouth Bass.



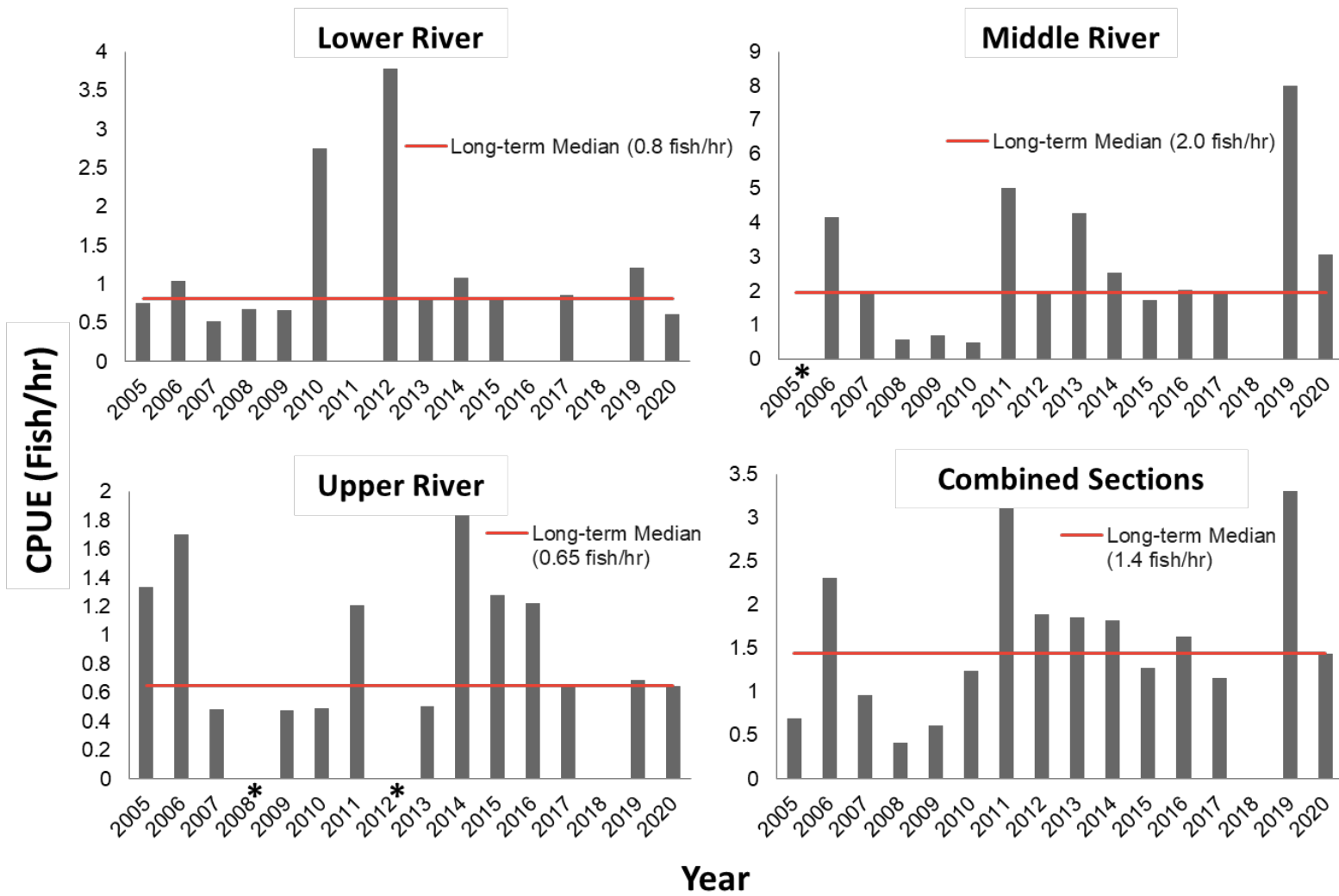
**Figure 3.** Catch per unit effort (CPUE, by hour) of all Smallmouth Bass captured during nighttime electrofishing surveys conducted from 2005 – 2020 in the lower (Yardley, Pt. Pleasant, Upper Black Eddy), middle (Sandts Eddy, I-80, Dingman’s Ferry), and upper (Lackawaxen and Damascus) Delaware River, and for all river section combined. Blank values represent years when surveys were not conducted. Years with an asterisk (\*) represent surveys when no fish were captured. Scale on the vertical axis of the graphs are different for visual purposes.

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**Figure 4.** Catch per unit effort (CPUE, by hour) of Smallmouth Bass > 12” captured during nighttime electrofishing surveys conducted from 2005 – 2020 in the lower (Yardley, Pt. Pleasant, Upper Black Eddy), middle (Sandt’s Eddy, I-80, and Dingmans Ferry), and upper (Lackawaxen and Damascus) Delaware River, and for all river section combined. Blank values represent years when surveys were not conducted. Scale on the vertical axis of the graphs are different for visual purposes.





**Figure 5.** Catch per unit effort (CPUE, by hour) of Smallmouth Bass > 15” captured during nighttime electrofishing surveys conducted from 2005 – 2020 in the lower (Yardley, Pt. Pleasant, Upper Black Eddy), middle (Sandt’s Eddy, I-80, and Dingmans Ferry), and upper (Lackawaxen and Damascus) Delaware River, and for all river section combined. Blank values represent years when surveys were not conducted. Years with an asterisk (\*) represent surveys when no fish were captured. Scale on the vertical axis of the graphs are different for visual purposes.