U.S. Fish & Wildlife Service

Tumors in Brown Bullhead Catfish in the Anacostia and Potomac Rivers:

1996 through 2016

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Fig. 1a. Brown bullhead with skin tumor diagnosed as squamous cell carcinoma.

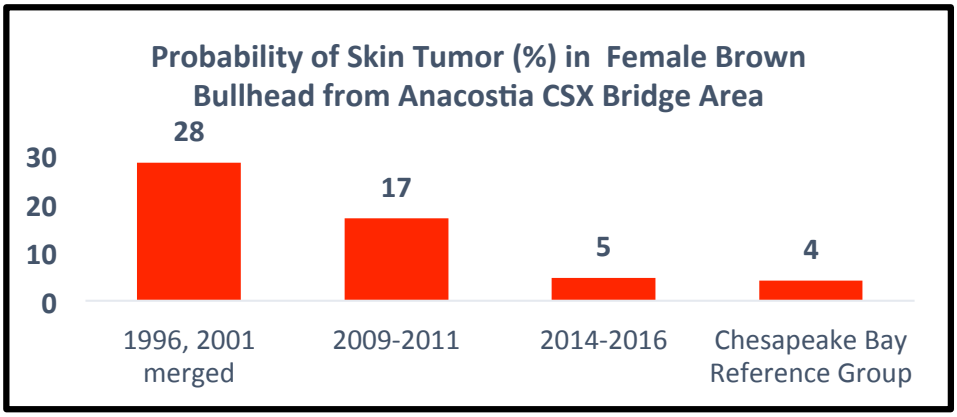

Fig. 1b. Decrease in skin tumor probabilities for 280 mm brown bullhead

Background

The brown bullhead catfish *(Ameiurus nebulosus)* lives in tidal and non-tidal rivers, lakes, and ponds. These bottom feeders eat worms, crustaceans, insect larvae, clams, snails, and fish.

Bullheads and other fish species develop liver tumors after exposure to cancer-causing chemicals known as polynuclear aromatic hydrocarbons (PAHs), some of which also cause cancer in people. PAHs are found in pavements, tars, coal, oil and gasoline. These chemicals, which enter rivers from roads, storm sewers, waste sites, and air, build up in sediments. Fish are also exposed to chemicals, such as polychlorinated biphenyls (PCBs) and DDT, which promote the development and spread of liver tumors initiated by PAHs. The causes of skin tumors in bullheads are uncertain.

The Anacostia River, a Chesapeake Bay Program Region of Concern, flows through Maryland and Washington, D.C. to the Potomac River. Since 1992, the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (CBFO) has studied skin (Fig. 1a) and liver (Fig. 2a) tumors in bullheads from the Potomac, Anacostia, and other Chesapeake Bay tributaries (Fig. 3). In 1996 and 2001, CBFO determined that the liver tumor rate in Anacostia bullheads equaled the highest reported for this species in North America.

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Fig. 2a. Liver with white lesion diagnosed as a cholangiocarcinoma (bile duct tumor)

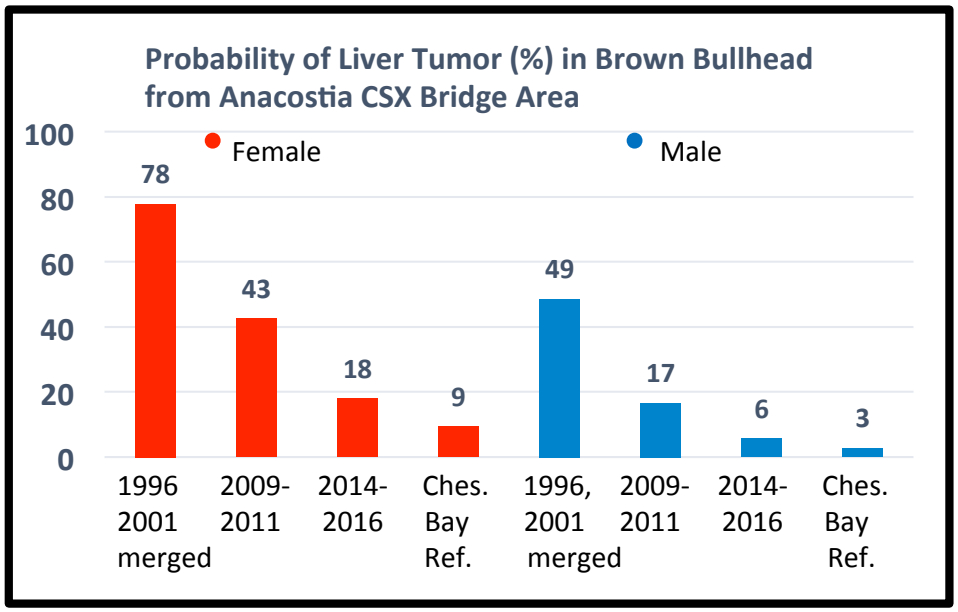

Fig. 2b. Decrease in liver tumor probabilities for 280 mm brown bullhead

Key Findings

Skin tumors (Anacostia): percentage in 2014-2016 surveys decreased significantly to less one-fifth compared with the 1996, 2001 period.

Liver tumors (Anacostia): percentage in 2014-2016 surveys decreased significantly to less than one quarter (females) and less than one eighth (males) compared with the 1996, 2001 period.

Comparisons near Washington DC: bullheads from both Anacostia locations and Piscataway Creek had similar percentages of liver and skin tumors. Those from Dyke Marsh were lower in liver tumors but similar in skin tumors.

Comparisons with reference areas: liver tumor percentages in the Anacostia CSX and Piscataway Creek 2014-2016 collections were significantly higher than the Chesapeake Bay Reference Group (CBRG), 473 bullheads collected from mostly rural areas between 1992 and 2016. The Anacostia Bladensburg and Dyke Marsh collections were not elevated. The percentage of skin tumors in bullheads from all four locations was similar to that for the CBRG.

Reasons for decreased liver tumors: it is unclear whether bullhead exposure to PAHs declined. Previously we showed that the amount of liver DNA with attached PAH molecules decreased in 2009 vs. 2000 and 2001. PAH concentrations in sediment from the Anacostia locations, however, were similar in 2000 and 2015. Fish fillet analyses showed that exposure to tumor promoters (PCBs and DDT) decreased substantially since 2001.

The New Study

In 2014, 2015, and 2016, the District Department of Energy & Environment (DOEE) funded new surveys. In the Anacostia, CBFO again sampled bullheads near the CSX Railroad Bridge, and at a new location near the Bladensburg Marina. We also collected fish from Piscataway Creek and Dyke Marsh (2016) (Fig. 3). To compare collections, we used logistic regression to account for differences due to sex and length (more tumors in females and in bigger fish).

Using the Anacostia CSX as a yardstick, female bullheads had a decreasing probability of developing skin tumors—28 percent (1996, 2001 merged) dropping to 17 percent (2009-2011) and then to 5 percent (2014-2016) (Figure 1b). There was a similar trend in males.

The probability of liver tumors declined from 78 percent in 1996, 2001 to 42 percent in 2009-2011 to 18 percent in 2014-2016 for female fish. In male fish, the probability of liver tumors declined from 49 percent to 17 percent to 6 percent for those same time periods (Fig. 2b).

Followup

We are conducting molecular and genetic analyses with scientists from the U.S. Geological Survey National Fish Health Research Laboratory and American University to gain insights on chemical classes involved, and whether viruses may be linked with skin tumors. We recommend conducting tumor surveys every 5 years, along with measuring exposure to PAHs, PCBs, and DDT. Such studies will help agencies monitor the progress of cleanup actions.

For More Information:

Pinkney, Alfred E., John C. Harshbarger, Michael A. Rutter, and Peter C. Sakaris. 2018. Tumor prevalence in brown bullhead *(Ameiurus nebulosus)* in the tidal Potomac River watershed: 2014-2016. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD. CBFO-C18-01.

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Funding was provided by the District of Columbia Department of Energy & Environment.
The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

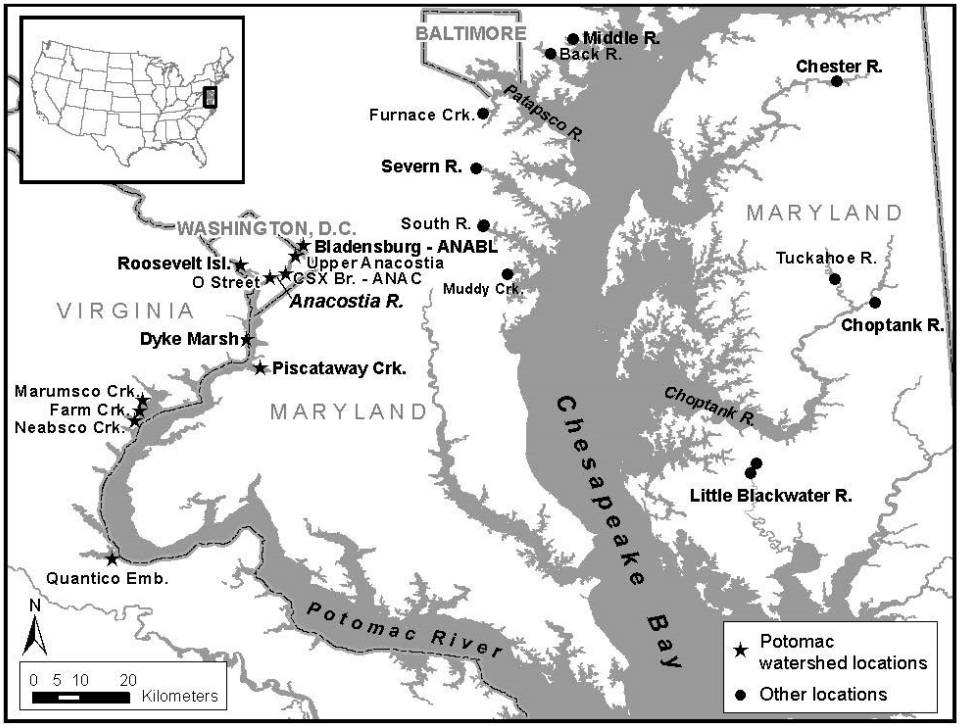

Fig. 3. Brown bullhead collection locations in the Chesapeake Bay watershed