NONPOINT SOURCE SUCCESS STORY

Arizona

Erosion Control and Natural Degradation of Pesticides Leads to a Decline in Pollutants in the Middle Gila River

Waterbodies Improved

Historical pesticide use in the Middle Gila River watershed contaminated aquatic life, making it unsafe for consumption. Based on these conditions, 12 segments within the Middle Gila River watershed were added to Arizona's 2002 Clean Water Act (CWA) section 303(d) list for pesticide impairments (i.e., dichlorodiphenyltrichloroethane [DDT], chlordane and toxaphene). The natural degradation of the chemical constituents within the ecosystem, combined with landowner implementation of best management practices (BMPs), decreased pesticide levels in the watershed over time. Based on this improvement, Arizona removed 12 segments within the Middle Gila River watershed from its impaired waters list in 2014.

Problem

The Middle Gila watershed is in central Arizona around Phoenix. It contains a total of 1,786 miles (mi) of major streams and canals (Figure 1). The Gila River is the longest river in the watershed at 263 mi. Major tributaries to the Gila River in the study area include the Salt River, the Agua Fria River, and the Hassayampa River, all of which are intermittent in flow.

Widespread pesticide applications in western Maricopa County, such as DDT and its metabolites (DDTr) (1945 to 1969), toxaphene (1960s to 1982) and chlordane (1970s to 1988), caused biological impairment in the Middle Gila watershed. Agricultural runoff, sedimentation/erosion into waterways, and possible instances of inadvertent direct application over waterbodies allowed legacy pesticides to enter the food chain and rise through trophic levels over time.

Multiple reaches of the Gila, Salt, and Hassayampa rivers were listed on Arizona's CWA section 303(d) list of impaired waters in 2002 by the U.S. Environmental Protection Agency (EPA) for excessive levels of DDTr, chlordane and toxaphene in fish tissue. The listed segments included:

- Hassayampa River (AZ15070103-001B, 2.3 mi)
- Salt River (AZ15060106B, 14.1 mi)
- Painted Rock Borrow Pit Lake (AZ15070201-1010, 190 acres)

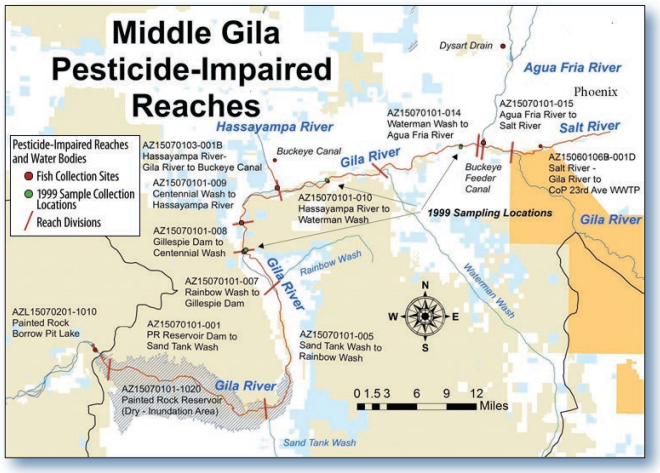

Figure 1. Many of central Arizona's Middle Gila River watershed segments were impaired for pesticides.

- Painted Rock Reservoir (AZ15070101-1020, size varies)
- Eight Gila River segments (AZ15070101-001, 18.7 mi; AZ15070101-005, 16.9 mi; AZ15070101-007, 5.1 mi; AZ15070101-008, 5.3 mi; AZ15070101-009, 7 mi; AZ15070101-010, 13.9 mi; AZ15070101-014, 11.9 mi; AZ15070101-015, 3.7 mi).

No official state standards for these impairments exist. Fish tissue levels in periodic studies were compared to EPA-recommended thresholds for subsistence and recreational fishing for all three pesticides. Exceedance of thresholds led to posting of fish consumption

advisories in 1991. Advisories were used as the basis of the CWA section 303(d) listings by EPA in 2002.

Project Highlights

Due to the extent of the affected area exhibiting pesticide contamination of aquatic life, the previous banning of the use of these pesticides, and the relatively recent efforts in assessment, major activities have consisted of conducting periodic surveys of aquatic life contamination while waiting for the pesticides to break down and be eliminated from the food chain. The area has been surveyed several times over the last 35 years by various agencies and individuals, including in 1980 by Clark and Krynitsky, in 1984–1985 by the U.S. Fish and Wildlife Service (USFWS), in 1994 by USFWS and the Arizona Department of Environmental Quality (ADEQ), in 1999 by ADEQ, and in 2012 by ADEQ and USFWS. Contamination levels consistently declined from survey to survey, following a half-life decay pattern that allowed for rough projections of the dates the problem would take care of itself. Fish consumption advisories were first posted in 1991 and finally removed in 2015 (in the first Arizona action consisting of lifting consumption advisories). Because pesticide contamination of water and sediment had long since passed by the time ADEQ began investigating the problem, not much additional action could be taken.

Area farmers were already aware of the economic benefits of soil conservation activities, and many have implemented soil retention BMPs in recent decades. Although not necessarily implemented to protect water quality at the time, these measures likely prevented further liberation of sequestered pesticides in the soils of the area. In a related matter, the Arizona State Parks system, which served as the former administrator of the Painted Rock Borrow Pit Lake, was forced to close down the park in 1989 due to rising pesticide levels. The Borrow Pit Lake lease was relinquished and returned to the Army Corps of Engineers (Corps), Los Angeles district office, in the early to mid-1990s. It is not known what the Corps' plans are with regard to the lake now, but they have been advised that lake is no longer under a fish consumption advisory.

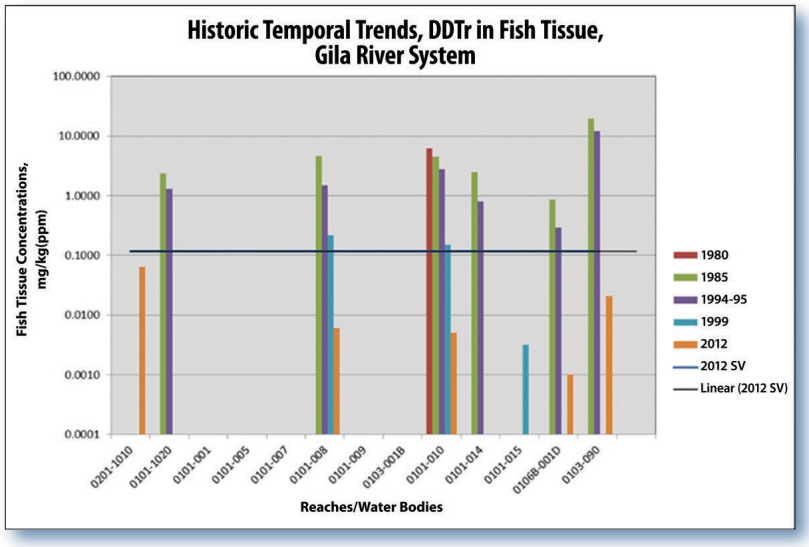

Figure 2. Decreasing levels of DDT and its metabolites (DDTr) levels in fish tissue over time. Black bar represents screening value of 0.117. This value is calculated as a function of a designated fish consumption rate, carcinogenic risk level and body weight.

Results

Sampling by ADEQ and the USFWS in 2011 and 2012 indicated that DDT, toxaphene and chlordane levels have substantially decreased over time. Toxaphene was not detected in any 2012 samples (54 total fish collected). Chlordane was detected in just about half the USFWS samples from Painted Rock Borrow Pit Lake (6 of 13), but was not detected in the samples collected by ADEQ. DDT derivatives were detected in about half (23 of 54) of samples collected by both ADEQ and the USFWS. The geometric mean concentrations of these data met screening values (Figure 2). On the basis of these data, Arizona has removed 12 segments from its 2014 impaired waters list for DDT, toxaphene and chlordane impairment. ADEQ lifted the fish consumption advisories after consulting with the Arizona Department of Health Services.

Partners and Funding

The restoration of the Middle Gila Watershed was supported by the USFWS–Arizona Ecological Services Field Office and the Arizona Game and Fish Department. The USFWS–Arizona Ecological Services Field Office supported sampling efforts. The Arizona Game and Fish Department was the consulted agency for the lifting of the fish consumption advisory.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-16-001EE
November 2016

For additional information contact:

Doug McCarty
Arizona Department of Environmental Quality
602-771-4521 • dm4@azdeq.gov
Sam Rector
Arizona Department of Environmental Quality
602-771-4536 • smr@azdeq.gov