# Recent Records of the Endangered Western Banded Killifish, *Fundulus diaphanus menona*, in the Portage River Basin, Ohio[1]

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ABSTRACT. **Within the past decade, the western banded killifish, *Fundulus diaphanus menona*, has been collected on several occasions in the Portage River basin, from which it was previously considered extirpated. In 1994 while conducting fish community assessments using electrofishing, a total of 13 *F. d. menona* were collected at three localities within the Portage River basin. Additional recent collections of *F. d. menona* have been made by Ohio Department of Natural Resources personnel. The recent records have been plotted along with historic records in order to update the status and distribution of *F. d. menona* in Ohio. The well-being of Ohio *F. d. menona* populations may depend upon several factors. Habitat disturbance has been and continues to be detrimental to *F. d. menona* and other fish species in the Portage River basin. The recent invasion or population increase of blackstripe topminnow, *Fundulus notatus*, may affect the *F. d. menona* population through competition or hybridization. Intergradation between *F. d. menona* and the eastern banded killifish, *F. d. diaphanus*, may occur if the latter continues its westward range expansion in the Lake Erie basin.**

**OHIO J. SCI. 95 (4): 294–297, 1995**

## INTRODUCTION

The western banded killifish, *Fundulus diaphanus menona*, historically had a limited Ohio distribution, and its range in Ohio has declined during the 1900s (Trautman 1981). Because of this decline, *F. d. menona* was listed as endangered in Ohio in 1974 (D. Ross, Ohio Department of Natural Resources [ODNR] pers. comm.). *F. d. menona* is also imperiled in other parts of its range and is endangered in Pennsylvania and South Dakota (Houston 1990). The largest Ohio population of *F. d. menona* remains in Miller Blue Hole, Sandusky County (Trautman 1981, D. Ross, ODNR pers. comm.).

Past records have been confined to northcentral/northwest Ohio and the Portage Lakes (Trautman 1981). *Fundulus diaphanus menona* was formerly known to inhabit the Portage River basin, but was supposedly extirpated between the 1920s and the 1950s (Trautman 1981). Hoke et al. (1979) collected 37 species in the lower Portage River during a fish survey in 1975; however, *F. d. menona* was not captured. Populations were discovered in Crystal Lake, Summit County, in 1980 (20 Nov.; 15 killifish) and 1987 (22 Oct.; 1 killifish) (D. Rice, ODNR pers. comm.), and in Bull Creek (6 Aug. 1985; 12 killifish) and Middle Branch (14 Aug. 1985; 5 killifish), both of the latter in the Portage River basin (J. Gallant, ODNR pers. comm.). Additionally, Ohio Environmental Protection Agency (OEPA) personnel collected *F. d. menona* from three localities within the Portage River basin in 1994. The ODNR and OEPA collections represent some new locality records and also, some of the few known occurrences of this species from the Portage River basin in several decades. Data regarding recent collections are provided as well as a discussion of current research, conservation efforts, and factors that may influence Ohio populations of *F. d. menona*. We have updated the Ohio distribution of both the Ohio native *F. d. menona* and non-native *F. d. diaphanus* utilizing the maps in Trautman (1981) with both distributions on a single map.

## MATERIALS AND METHODS

Specimens were collected by electrofishing with a pulsed-DC, gasoline-powered generator (wading and boat methods) according to standardized procedures (Ohio EPA 1989). Sampling distance was 200 m for Bull Creek (7/14/94, downstream of Greensburg Pike Road, Portage Twp., Wood County, OH, Lat./Long. 41°18'45"/83°35'12"; R. Miltner, D. Davis, K. Cappuzzi, and W. Poly), 150 m for Needles Creek (7/19/94, upstream of Cygnet Road, Henry Twp., Wood County, OH, Lat./Long. 41°13'24"/ 83°45'04"; RM, KC, and WP), and ≈ 20 m (demonstration site) for the Portage River (9/7/94, at I-80/I-90 Turnpike bridge, Harris Twp., Ottawa County, OH, Lat./Long. 41°28'05"/83°18'29"; RM, KC, and T. Schmidt). Specimens were either preserved in formalin, 95% ethyl alcohol (ETOH), kept alive, or released. Live specimens were taken to the Columbus Zoological Gardens (CZG), specimens preserved in ETOH were given to D. Sears at Ohio State University (OSU), and formalin-preserved specimens were deposited in the fish collection of the OSU Museum of Biological Diversity. Of the five fishes from Bull Creek, two were released alive, two small individuals were preserved in formalin, and one larger individual was kept alive and transported to CZG for study. Of the seven fishes from Needles Creek, four were preserved in ETOH, one was preserved in formalin, and two were kept alive and subsequently transported to CZG. One fish captured in the Portage River was released. Specimens preserved in ETOH were used in population mtDNA analyses of this subspecies being carried out by D. Sears and Dr. P. Fuerst, OSU (funded by ODNR Division of Wildlife). All three live fishes initially taken to CZG were later included in the mtDNA analysis (D. Sears, OSU pers. comm.).

[1]Manuscript received 20 February 1995 and in revised form 6 September 1995 (#95-05).

## RESULTS AND DISCUSSION

A total of 13 *F. d. menona* were collected in the Portage River basin by OEPA personnel during fish community assessments. Five *F. d. menona* were captured in Bull Creek, seven were captured in Needles Creek, and one was captured in the lower Portage River. Records exist for Bull Creek and the lower Portage River; however, the Needles Creek locality represents a new stream record within the Portage River basin (Fig. 1).

Standard lengths of all specimens from Needles Creek were as follows: 25 mm, 26 mm, 27 mm, 28 mm, 47 mm, 48 mm and 51 mm. Bull Creek specimens were of similar size with two small (≈ 25 mm) and one large (≈ 45-50 mm) specimen; the size of the two released individuals was not noted. The Portage River individual was also an adult (≈ 50 mm). Species composition in Bull Creek and Needles Creek was very similar although abundance differed dramatically for some species (Bull Creek:Needles Creek): *Campostoma anomalum* (0:97), *Carassius auratus* (32:3), *Cyprinella spiloptera* (9:22), *Cyprinus carpio* (59:25), *Luxilus cornutus* (2:21), *Lythrurus umbratilis* (59:53), *Notropis buccatus* (44:205), *Notropis stramineus* (2:92), *Phenacobius mirabilis* (12:33), *Pimephales notatus* (0:353), *Pimephales promelas* (133:55), *Semotilus atromaculatus* (21:73), *Carpiodes cyprinus* (12:31), *Catostomus commersoni* (16:52), *Ameiurus natalis* (28:0), *Fundulus diaphanus menona* (5:7), *Fundulus notatus* (33:27), *Lepomis cyanellus* (43:8), *Etheostoma nigrum* (82:132), *Percina maculata* (1:0). Ten other species not captured by OEPA were recorded from the Portage River head-

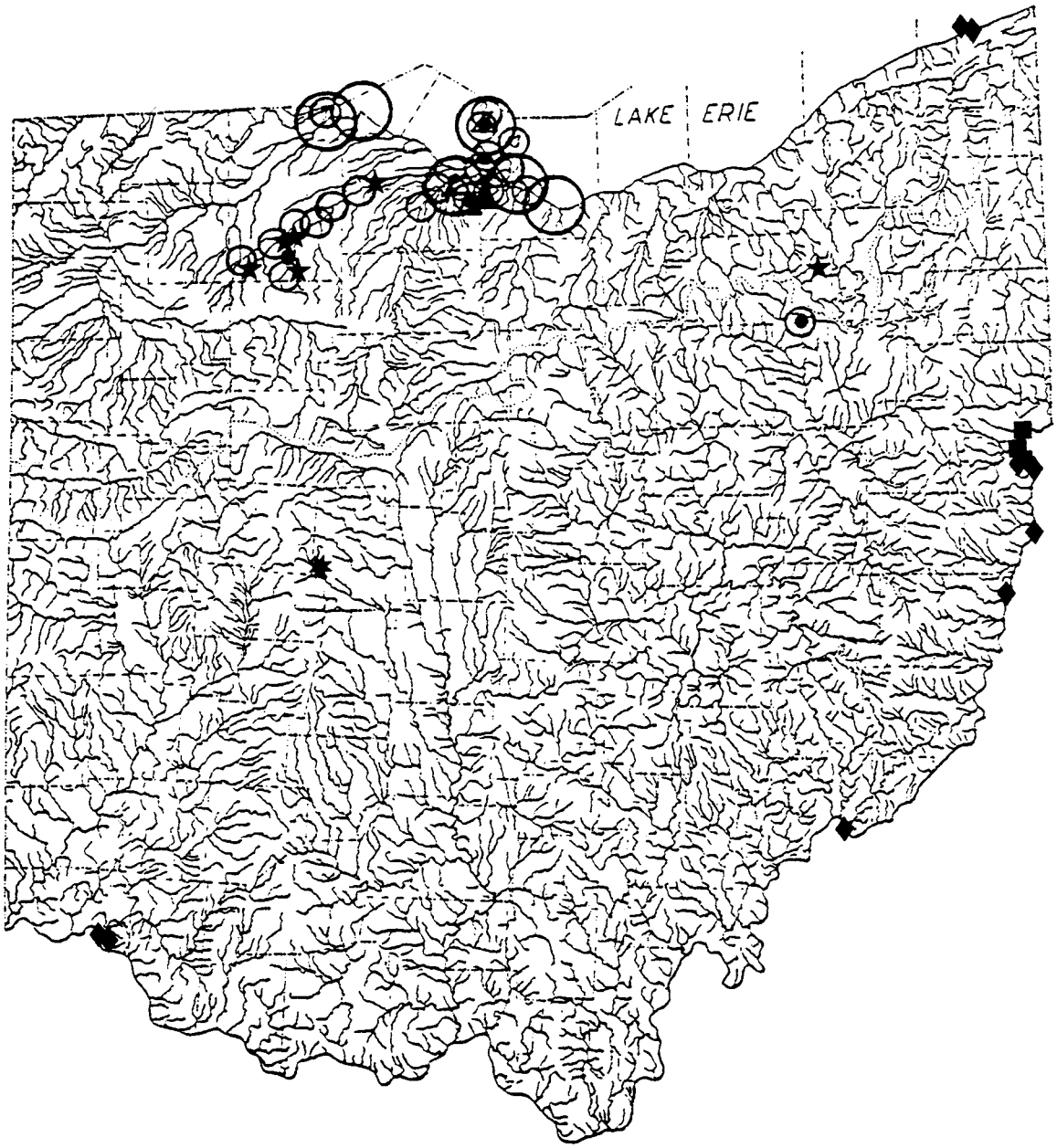


FIGURE 1. Updated distribution of *Fundulus diaphanus menona* and *Fundulus diaphanus diaphanus* in Ohio. Symbols (*F. d. menona*): O before 1900, O 1920-1930, • 1931-1954, Δ 1955-1980, ★1981-1994 (including the 20 Nov. 1980 ODNR collection); (*F. d. diaphanus*): ■ after 1943, ♦ 1955-1980, ✷ 1981-1994 (1981-1994 records from ODNR, unpubl. data and OEPA, unpubl. data). Map adapted from *The Fishes of Ohio*, Milton B. Trautman, copyright 1981 by Ohio State University Press. Used with permission.

waters by Trautman (1981). The degraded condition of the streams most likely accounts for the absence of a species such as the rosyface shiner, *Notropis rubellus*, which is sensitive to siltation and turbidity.

Trautman (1981) reported the largest populations of *F. d. menona* in low-gradient streams with clear water, abundant aquatic vegetation, and substrates of sand, marl, or organic debris. Both Bull Creek and Needles Creek are degraded by agricultural practices, and conditions in the two streams do not closely match the conditions necessary for large populations of this subspecies (*sensu* Trautman 1981). Habitat in both streams is impacted by channelization, removal of riparian canopy, siltation, and agricultural runoff. However, Needles Creek differs from Bull Creek in that the substrate is composed of more sand and less silt and algal growth. Perhaps the populations present today have adapted in some degree to the degraded conditions of streams within the Portage River basin. Nevertheless, the Bull Creek and Needles Creek populations may be in danger of extirpation given the degraded habitats and the periodic disturbance from channelization and removal of riparian vegetation.

Trautman (1981) discussed the movement of *F. notatus* into the range of *F. d. menona* while the latter was in decline and hypothesized that reduction of *F. d. menona* populations may have permitted the invasion of *F. notatus*. Trautman (*op. cit.*) did not collect *F. notatus* in the Portage River basin, but it has apparently either colonized the basin recently or greatly expanded a formerly small population since it was taken in abundance with *F. d. menona* in the headwaters and was also common at several downstream sites (OEPA unpubl., W. Poly pers. obs. 23 May 1995). Hoke et al. (1979) also did not collect *F. notatus* from the lower Portage River in 1975; therefore, the "invasion" of *F. notatus* may have been very recent. Becker (1983) noted that *F. notatus* had expanded its range in Wisconsin within the past 50 years.

Food habits of *F. notatus* and *F. d. menona* populations outside of Ohio have been studied by several investigators. Both species feed on a wide variety of organisms. The diet of *F. notatus* often consisted largely of terrestrial insects indicating that the species feeds primarily, but not entirely, at the surface (Thomerson and Woolridge 1970, Atmar and Stewart 1972, McAllister 1987). *Fundulus d. menona* has a varied diet that, unlike *F. notatus*, consists of few terrestrial insects, but rather a variety of aquatic insect larvae such as chironomids and tricopterans as well as ostracods (Pearse 1922, Keast and Webb 1966). Juvenile stages of both species feed on microcrustaceans; therefore, competition may be more likely between juveniles than adults (Keast and Webb 1966, Atmar and Stewart 1972, Becker 1983). The wide array of foods consumed by *F. d. menona*, particularly subsurface and benthic organisms, would seem to indicate the adaptability of this species to changes in available forage (Keast and Webb 1966). Diet may differ intraspecifically between lotic and lentic habitats simply because of differences in available forage (Turner 1921). The amount of dietary overlap and hence, competition, between *F. d. menona* and *F. notatus* will depend upon the availability (i.e., quantity and type) of foods within the Portage River and its tributaries. The cited food studies for both species may apply generally, but perhaps not specifically, to their diets in Bull and Needles creeks.

The abundance of *Fundulus notatus* may negatively affect *F. d. menona* not only through competition, but also because of the potential hybridization between the two species. Hybrids between *F. notatus* and *F. diaphanus* have not been recorded; however, *F. diaphanus* has hybridized naturally with *F. heteroclitus* (Hubbs et al. 1943, Fritz and Garside 1974). Fritz and Garside (1974) found a hybridization frequency of 8.6% (170 of 1,973 fishes) between *F. d. diaphanus* and *F. heteroclitus* in Porters Lake, Nova Scotia, and several year classes of $F_1$ hybrids were represented. *Fundulus notatus* has hybridized with *F. olivaceus* in several states (Thomerson 1967, Howell and Black 1981). One may hypothesize that cytogenetic differences between *F. d. menona* and *F. notatus* may be a barrier to the production of viable $F_1$ hybrids since *F. d. menona* has a diploid chromosome number of 48, while *F. notatus* has a diploid number of 40 (except in the Tombigbee River, AL, 2n = 44) (Chen 1971, Howell and Black 1981). However, *F. notatus* and *F. olivaceus* (2n = 48) produce viable hybrids and $F_1/F_2$ hybrids or backcrosses with diploid chromosome numbers ranging from 41 to 47 (Howell and Black 1981). Therefore, cytogenetic differences may not be a barrier to hybridization and introgression between *F. notatus* and *F. d. menona*. Both *F. notatus* and *F. d. menona* have very similar, but not identical, breeding habits (Richardson 1939, Carranza and Winn 1954). Hybridization is thought to be more likely in a situation where one species is abundant (*F. notatus*) and another species is rare or uncommon (*F. d. menona*) (Hubbs 1955). Concern has also been expressed about the invading eastern banded killifish, *F. d. diaphanus*, which has been extending its range westward in both the Ohio and Lake Erie drainages (Trautman 1981, Eaton and Frame 1965, OEPA unpubl.). If this subspecies contacts the *F. d. menona* populations, intergradation will very likely result. The two subspecies intergrade in the upper St. Lawrence River (Scott and Crossman 1973, Lee et al. 1980). OEPA (unpubl. data) recently collected *F. d. diaphanus* in the headwaters of Big Darby Creek (Ohio River drainage, Fig. 1). There do not appear to be any records concerning further westward extension of the *F. d. diaphanus* range in Lake Erie.

Populations of *F. d. menona* in the Portage River basin are surviving at the present time. Size distributions of specimens from both streams suggest that at least two year classes are present and that they continue to reproduce in degraded habitats (Becker 1983, Trautman 1981). Recent collections of this endangered subspecies from the Portage River basin indicate that although the populations are severely reduced, there are still remnants. An alternative hypothesis is that the subspecies has reinvaded the drainage; however, this is less likely.

Genetic studies on *F. d. menona* from Ohio populations and populations in other states have revealed little genetic variation (D. Sears and P. Fuerst, OSU pers. comm.). Since *F. d. menona* are rather homogenous,

**Erratum:** Page 296, Column 2, Line 12 should read "...found a hybridization frequency of 7.9% (170 of 2,143..."

genetically speaking, throughout their range, supplemental stockings would not seriously compromise the genetic integrity of Ohio populations. A 10-year recovery plan is also currently underway (D. Ross, ODNR pers. comm.). As part of the 10-year recovery plan, ODNR and CZG are currently studying *F. d. menona* ecology in order to insure its survival in Ohio, and ODNR surveys continue in the Portage River basin to determine the population size and distribution of *F. d. menona* (J. Gallant, ODNR pers. comm.).

ACKNOWLEDGEMENTS. We thank OEPA for technical assistance and other support. J. Gallant, D. Rice, and D. Ross kindly informed us of recent ODNR collections of western banded killifish. D. Sears and P. Fuerst provided information concerning their genetic research. Several anonymous reviewers made helpful comments on the manuscript.

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