INTRODUCTION

Mosquitofish [Gambusia affinis (Baird and Girard) and G. holbrooki Girard] have been used as a biological control agent for mosquitoes for more than 100 years and, when used under appropriate conditions, remain one of the best candidates for biological control programs against mosquitoes. Mosquitofish are prolific, hardy, omnivores that are capable of rapidly producing large populations following introduction into most aquatic habitats. During the 20th century, Gambusia was introduced to more than 60 countries on nearly every continent and the 2 mosquitofish species remain the preferred larvivorous fishes (85–90% of studies) for biological control programs focused on mosquitoes (Gerberich and Laird 1985).

The literature on mosquitofish is vast and numerous studies on native fishes as replacements for the mosquitofish in biological control programs have been carried out since Meisch’s (1985) and Bay’s (1985) reviews of larvivorous fishes previously used in mosquito control programs. Recent bibliographies (Haas and Pal 1984, Gerberich and Laird 1985, Ahmed et al. 1988, Legner 1995), as well as a recent publication focusing on mosquitofish culture and use in mosquito control programs (Swanson et al. 1996), illustrate the great interest and integral role that larvivorous fish fulfill in modern mosquito control programs. Ahmed et al. (1988) compiled a bibliography of 204 references related to indigenous fishes for mosquito control and 96 references for fishes for aquatic weed control. Gerberich and Laird’s (1985) review of the literature on larvivorous fishes found that more than 253 fish species have been considered for the biocntrol of mosquitoes.

The great interest in Gambusia as a control agent for mosquitoes is tempered by the concerns of ichthyologists and ecologists for the potential negative aspects of mosquitofish on non-target organisms and natural ecosystems (Arthington and Lloyd 1989, Meffe and Snelson 1989, Rupp 1996, Gratz et al. 1996). Regardless whether a particular fish species is used in biological control programs or stocked for recreational fisheries, adding non-native fish to ecosystems can have dramatic consequences on the fauna of some aquatic habitats (Goodman 1991, Adams et al. 2003), especially in habitats lacking fish (Wellborn et al. 1996, Hamer et al. 2002). A greater awareness of the ecological consequences of biomanipulation is needed (Rupp 1996) including both the direct effects of predation on non-target taxa and indirect trophic effects such as facilitation of other non-native organisms (Stachowicz 2001, Adams et al. 2003).

This chapter provides an overview and highlights some of the important advances in our knowledge of mosquitofish and other larvivorous fishes since Meisch’s (1985) and Bay’s (1985) reviews, respectively. The reader is referred to Swanson et al. (1996) for thorough discussion of mosquitofish biology, culture systems and use of Gambusia spp. as a biological control agent for mosquitoes, and to Gerberich and Laird (1985), Ahmed et al. (1988), Legner (1995) and Hurst (2004) for bibliographies of larvivorous fishes used for mosquito control.

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BIOLOGY

The 2 mosquitofish subspecies recognized in 1985 have been elevated to species. Based on the original distributions (Rosen and Bailey 1963) and morphological (Rivas 1963), chromosomal (Black and Howell 1979), and biochemical differences, Wooten et al. (1988) distinguished the western mosquitofish, Gambusia affinis (Baird and Girard), from the eastern mosquitofish, G. holbrooki Girard. Both species are native to the southeastern United States (Rauthenberger 1989). In North America, the original range (circa 1900 before widespread stocking for mosquito control) of G. affinis extended from southern Illinois and Indiana to Alabama, Texas, and northern Veracruz, Mexico. Gambusia holbrooki was found from New Jersey to Florida and southern Alabama. During the last 100 years, both species have been utilized worldwide for mosquito control and currently occur on every continent except Antarctica and have been introduced throughout much of the IndoPacific region (Swanson et al. 1996).

Mosquitofish are sexually dimorphic (Fig. 1). Mature males [<35 mm or 1.4 in. total length (TL)] are smaller than mature females (<60 mm