# THE NATURE OF THERMAL TOLERANCE IN THE WESTERN MOSQUITOFISH, *GAMBUSIA AFFINIS*, EXPOSED TO HEATED EFFLUENTS

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*Gambusia affinis* (Baird and Girard), the Western Mosquito fish, a live-bearing species native to the southern United States, is one of the most widespread, introduced species in the world and has a wide thermal tolerance range, surviving 8 ºC to 40 ºC. High heat tolerance allows this species to inhabit thermal effluents of power stations where temperatures approach and often exceed its upper thermal limit. Thus, artifically induced natural selection may act on these populations, allowing only thermally tolerant individuals to survive during summer months. Potential influences on thermal tolerance in *G. affinis* are examined here, including thermal history, dispersal, and the possibility of natural selection on a population of mosquitofish inhabiting the thermal effluent of a power station in Texas. Natural selection is a syllogism with three main components necessary and sufficient for operation: variation among individuals in some phenotypic trait, heritability of that trait, and fitness differences associated with the trait. Thermal tolerance estimates for heated-effluent mosquitofish were 0.6-1.0 ºC higher than the main-reservoir population after both were acclimated to constant temperature. Second-generation offspring retained ancestral thermal tolerance levels and heritability was estimated to be 69.7% by regression of mid-parent with mean offspring thermal tolerance. Fitness differences were suggested by measuring mortality over time while holding thermally sensitive and thermally tolerant mosquitofish in enclosures within the heated effluent during mid-summer. Although reproduction was also monitored, no reproduction occurred. Yet, approximately half of the heated-effluent mosquitofish survived when all main-reservoir mosquitofish perished. Evidence was provided that mosquitofish avoid midsummer temperatures by dispersing into cooler waters within stands of emergent vegetation along the

margins of the heated effluent rather than downstream toward the main reservoir. Additionally, thermal history, within the lifetimes of individuals, was found to influence adult thermal tolerance. Exposure temperature change during development was associated with a corresponding change in adult thermal tolerance: mosquitofish exposed to increasing temperatures during development tended to have higher thermal tolerance, while those exposed to decreasing temperatures had lower thermal tolerance. Thus, although environmental factors influence thermal tolerance, all three components required of natural selection were present in this population, strongly suggesting local adaptation of a thermally tolerant race.