Title

Laboratory Evaluation of Modified Traveling Screens for Protecting Fish at Cooling Water Intakes

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Abstract

Section 316(b) of the Clean Water Act requires thermal power generating facilities to minimize adverse environmental impact resulting from the operation of cooling water intake structures (CWIS). Adverse environmental impact can occur when aquatic organisms are impinged on traveling water screens. Modified traveling screens were developed to improve the post-impingement survival of organisms. These screens have been used at a few power plants and are now being considered at additional facilities to reduce the mortality of juvenile and adult fish.

Existing biological efficacy data show that post-impingement survival is highly variable by species. The majority of previous installations are at estuarine facilities. As such, there is a lack of biological efficacy data with many of the freshwater species commonly impinged at CWIS. In addition, most of the existing modified screen installations were installed prior to 1990. Since that time, improvements in screen designs have increased survival. For these reasons, the existing biological efficacy of the new screen designs was limited and largely unknown for many freshwater species.

The mortality, injury, and scale loss rates of 10 species of freshwater fish impinged and recovered with a modified traveling screen were evaluated in the laboratory. Species tested included: golden shiner (Notemigonus crysoleucas); fathead minnow (Pimephales promelas); white sucker (Catostomus commersoni); bigmouth buffalo (Ictiobus cyprinellus); channel catfish (Ictalurus punctatus); hybrid striped bass (Morone chrysops × M. saxatilis); bluegill (Lepomis macrochirus); largemouth bass (Micropterus salmoides); yellow perch (Perca flavescens); and freshwater drum (Aplodinotus grunniens).

Fish were impinged at 0.3, 0.6, or 0.9 m•s-1 velocity. Mortality, injury, and scale loss rates were generally low. Mortality rates did not exceed 5% for any species and velocity tested, indicating that this technology has potential to substantially reduce impingement mortality at CWIS. Despite a general trend toward increasing mortality at higher velocities, velocity was only a significant factor in the mortality of bluegill ($P=0.0005$).

Injury and scale loss rates were low for most species tested, although they were more variable than observed rates of mortality. There was a trend toward lower mortality, injury, and scale loss in larger fish. In all cases where fish length was a significant factor ($P<0.05$), the pattern of decreasing mortality, injury, and scale loss as fish increased in length was constantly observed.

Additional tests were undertaken with channel catfish, fathead minnow, and golden shiner to assess the effect of duration of impingement on mortality, injury, and scale loss. Longer durations of impingement appeared to result in higher mortality, injury, and scale loss, especially at

durations of impingement greater than 6 minutes. However, longer durations of impingement could be avoided at most cooling water intake structures by continuously rotating screens.

First Advisor

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