

## **ENV Report 23 - *Hull shear mortality of eggs and larval fish* by Steve Maynard**

### **ABSTRACT**

The Upper Mississippi River-Illinois Waterway System (UMR-IWWS) Navigation Feasibility Study evaluates the justification of providing additional lockage capacity at sites on the UMR-IWWS while maintaining the social and environmental qualities of the river system. The system navigation feasibility study is accomplished by executing the Initial Project Management Plan (IPMP). The IPMP outlines Engineering, Economic, Environmental, and Public Involvement Plans.

The Environmental Plan identifies the significant environmental resources on the UMR-IWWS and probable impacts in terms of threatened and endangered species; water quality; recreational resources; fisheries; mussels and other macroinvertebrates; waterfowl; aquatic and terrestrial macrophytes; and historic properties. It considers system-wide impacts of navigation capacity increases, while also assessing in preliminary fashion potential construction effects of improvement projects.

One element of the Environmental Plan addresses the impacts of navigation on larval and adult fish. One element of the fish study addressed in another part of the UMR-IWWS study is the mortality of early life stages of fish passing near the hull of the vessel where they could be exposed to shear stress that could lead to mortality. The various elements of the hull shear mortality study are the waterway zone passing adjacent to the hull, the distribution of larval fish in the hull passage zone, the quantity of water passing through the zone having lethal values of shear stress, and the mortality of larval fish subjected to shear stress.

The object of this study is to evaluate the experiments by Morgan et al. (1976) who used concentric cylinders to determine the mortality of larval fish subjected to shear stress. Results of this study show that mortality tests are representative of shear along the hull of a vessel, and the shear stress computed in that publication is validated by recent measurements. The computed shear along the hull of UMR-IWWS tows is below the levels required to produce mortality of 50 percent of the fish eggs and larval tested. For typical vessel speed (2.9 m/sec) and a representative shear (87 dynes/sq. cm) that is exceeded/not exceeded in 50 percent of the zone beneath the tow, the average mortality for the four species/life stages is 9 percent. These results do not provide information about the sensitivity of most species of fish in the UMR-IWWS. Some of these species may be more sensitive to shear than the striped bass and white bass that were tested.