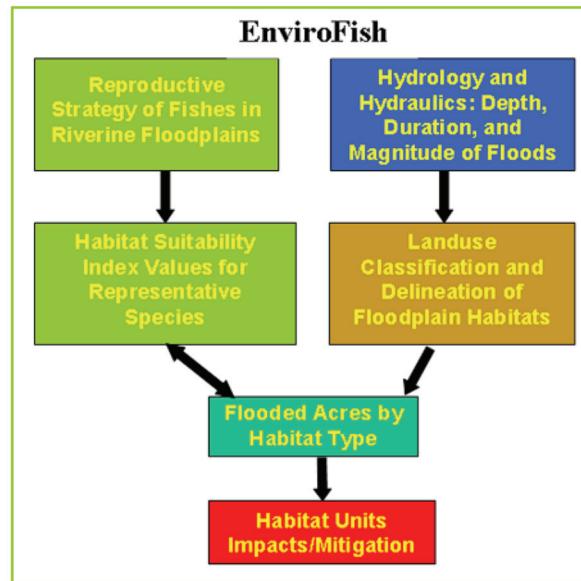




System-Wide Water
SWWRP
Resources Program

EnviroFish

Description: The timing, duration, and magnitude of flooding influence ecosystem functions of riverine floodplains, including reproductive success of fishes and other organisms. Flood-control projects alter the natural flooding regime resulting in environmental impacts that must be quantified. EnviroFish was developed to quantify impacts of flood control on fish habitat in large alluvial rivers of the United States. Once impacts are determined, specific floodplain restoration or mitigation techniques can be planned and benefits can be calculated. Overall, EnviroFish provides a tool to determine the appropriate amount of mitigation to offset adverse environmental impacts of large-scale flood-control projects on fish habitat. Other aquatic organisms, such as invertebrates and amphibians, can also be used in the evaluation. The conceptual basis of EnviroFish requires integration of hydroperiod, land use, and empirically-based knowledge of aquatic organism's use of inundated floodplains. The model has been applied to flood-control projects in the lower Mississippi River Valley and continues to be refined and updated.



Applications: The current configuration of EnviroFish is a series of interrelated, but independent modules that are mathematically linked to calculate changes in functional floodplain habitat of fishes at different stage elevations. EnviroFish is compatible with the institutionally-accepted Habitat Evaluation Procedure (HEP). The concept of HEP is to calculate a unitless index value, known as Habitat Units, as the product of area (e.g., acres of floodplain habitat) and quality (i.e., Habitat Suitability Index). EnviroFish incorporates three categories of data to derive a final value to determine impacts and mitigation.

EnviroFish has been used on multiple flood-control projects. The hydraulic component was originally developed by the USACE Vicksburg District. Working with ERDC, it was applied to the Yazoo Delta projects in Mississippi during the late 1990's. The model was used to determine mitigation requirements, which in this case, was reforesting thousands of acres of cleared, agricultural lands in the 2-year floodplain. EnviroFish has also been applied to Mississippi River flood-control projects. The impacts of closing the New Madrid Floodway to backwater flooding was addressed. Several types of mitigation techniques were identified to offset adverse impacts including reforestation, construction of borrow pits, and restoring or managing water levels in backwater lakes. EnviroFish provided a unifying method to determine impacts of a project on fish habitat, and using the same variables, identify numerical requirements of mitigation (e.g., number of acres to reforest) to fully compensate for impacts.



US Army Corps
of Engineers®

Engineer Research
and Development Center

[more . . .](#)

EnviroFish

Benefits: Fish assemblages are often the primary resource impacted from flood-control projects. Other methods of impact calculation, such as Hydrogeomorphic (HGM) or simply mitigating each acre lost (or use ratios) without regard to quality or function, do not directly address fish habitat. EnviroFish can be used in conjunction with HGM models or other watershed-level assessment techniques to specifically evaluate the magnitude of environmental impacts to fish and other aquatic organisms, identify sensitive species that are most susceptible to altered hydroperiod, and quantify benefits of mitigation. Over 100 species of fish are represented in the current framework of EnviroFish, so this technique has applicability to a broad range of warmwater fish assemblages. There is no geographic limit to its applicability. Small or large watersheds can be modeled. The biological criteria (i.e., Habitat Suitability Index values) can be modified to account for site-specific factors that influence habitat preference of different fish species. Hydraulic engineers are familiar with the hydraulic modeling process used by EnviroFish, which allows rapid transfer of capability to the field. Most importantly, EnviroFish provides a unique capability to document benefits of mitigation based on sound scientific principles of fish and fluvial ecology, and is fully compatible with incremental cost analysis to justify expenditures.

Future Capabilities: The biological concepts of EnviroFish can be applied to numerous types of flood-control and restoration projects in riverine floodplains. Potential future capabilities include linking EnviroFish to other assessment methodologies, such as HGM or the Ecosystem Functions Model (EFM) developed by IMR-HEC. More sophisticated hydraulic models can also be incorporated into the EnviroFish concept to better delineate surface topography (e.g., LIDAR) and hydraulic connections in floodplains, including Gridded Surface Subsurface Hydrologic Analysis (GSSHA). Advancements in our understanding on distribution and habitat preferences of spawning and rearing fish across a variable landscape will improve the predictive capability of EnviroFish and lead to better methods of watershed analysis.

Point of Contact: Jack Killgore, Environmental Laboratory, U.S. Army Engineer Research and Development Center, CEERD-EE-A, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, (601) 634-3397, Jack.Killgore@usace.army.mil.