



Assessment of Recharge Areas for Groundwater-Dominant Streams Inhabited by the Threatened Okaloosa Darter

Project # SAP-OD-19

Background:

The Okaloosa darter (*Etheostoma okaloosae*) is a small fish that inhabits only six shallow creek systems that flow almost entirely within Eglin Air Force Base (AFB) in the panhandle of northwest Florida. Listed as Endangered by the U.S. Fish and Wildlife Service (USFWS) in 1973, improvements in erosion control and habitat restoration led to the Okaloosa darter being downlisted from Endangered to Threatened in 2011.



Okaloosa Darter (*Etheostoma okaloosae*) at Eglin AFB, Florida. The darter is resting on sand from the sand and gravel aquifer. Photo by Bill Tate, USFWS.

Objective:

This project was designed to acquire new data and information about the recharge areas that supply groundwater to the darter creeks at Eglin AFB. Delineation of the extent of recharge would be crucial in continuing the long-term management of Okaloosa darters. Moreover, such data are imperative if future population increases, or industrial growth, is supported by new groundwater withdrawals from the shallow sand and gravel aquifer that feeds the darter creeks.

Summary of Approach:

Groundwater samples were collected from below 11 headwater and 11 downgradient sites across six creek basins in February and December 2020. The samples were analyzed in the field for temperature, specific conductance, pH, and dissolved oxygen, and in the laboratory for concentrations of sulfur hexafluoride (SF₆), dissolved gases (methane, carbon dioxide, nitrogen, oxygen, and argon), and the stable isotopes of hydrogen and oxygen of water. The SF₆-concentrations were used to determine the groundwater “age”, or residence time since recharge, for each sample. These ages were then combined with representative values of hydraulic conductivity for the sand and gravel aquifer so recharge distance from the sampling sites could be calculated.

Benefit:

The results of this study are currently being used to improve management for the species and will ultimately be an essential component in the USFWS decision to remove the species from the Endangered Species List. While delisting a species is a massive achievement for the Department of Defense, particularly at the installation level, the findings of this study are broadly applicable across a large number of coastal installations and bases sited in areas of predominately well-drained, sandy soils. All bases are subject to Clean Water Act compliance and information on groundwater transport is essential to managing, mitigating, and offsetting impacts to surface waters that might compromise the military mission. Contaminant leaching from testing, training, or other mission activities as well as stormwater and wastewater controls are potential sources of groundwater impacts and are common to all military installations. As such, mapping recharge areas and predicting groundwater residence time and movement allow managers to predict not only where an action or impact might affect surface waters but also when. Mission flexibility is achieved by providing managers, planners, and regulators information essential to effective planning, protection, and restoration of critical natural resources on base.

Accomplishments:

This project identified recharge areas in the sand and gravel aquifer that supply groundwater to the creeks in Eglin AFB that harbor the Okaloosa darter. Creeks with older groundwater had longer groundwater-flow pathways and these factors would provide the darters with more protection from upland contamination events. In contrast, creeks with younger groundwater had shorter groundwater-flow pathways and would provide the darters with less protection against these threats. This new information can be used by natural resource managers as additional evidence to support the USFWS Recovery Plan and proposed delisting of the Okaloosa darter from the Endangered Species List.

Contact Information:

James E. Landmeyer
Research Hydrologist
U.S. Geological Survey
4446 Pet Lane, Suite 108, Fort Belvoir, IL 61704
(803) 727-9047
(813) 498-5002
jlandmey@usgs.gov

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