

Science Notes

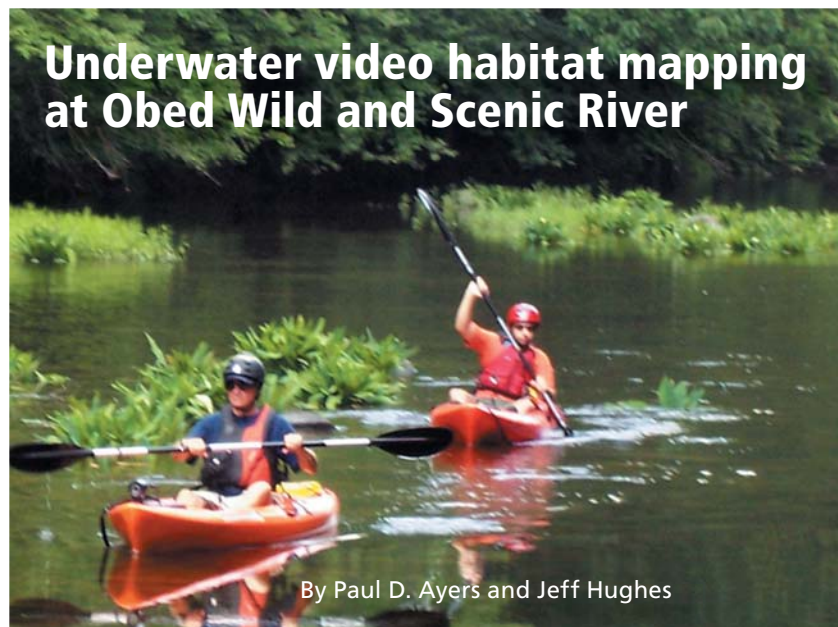


Figure 1. Researcher Ayers and a graduate student map Clear Creek, Obed Wild and Scenic River, using the underwater video mapping system.

RESOURCE MANAGERS AT OBED WILD AND

Scenic River are striving to understand the effects of growing human population on the park's watershed. As in much of the country, human population is increasing on the Cumberland Plateau of Tennessee, where the wild and scenic river is located. Managers are concerned that development associated with population growth may significantly alter the flow regime and water quality of portions of the Obed River, Daddy's Creek, and Clear Creek in the park. They have begun to study the potential impacts of development on park hydrology and water-related resources. Recently they initiated research to determine the location and amount of riverine habitat available for aquatic species in the park.

Paul D. Ayers, professor at University of Tennessee, Department of Biosystems Engineering and Soil Science, is leading the project and has surveyed the entire 45 miles (72 km) of Obed River, Clear Creek, and Daddy's Creek within the park (fig. 1). He is assembling the complete river system map in a Geographic Information System (GIS) format for use by the National Park Service (NPS) for general river management, determining areas of impact from development, and identifying resource values and habitat of endangered species. The federally listed endangered and threatened species under the scope of this research include three fishes (the spotfin chub [*Erimonax monachus*], blackside dace [*Phoxinus cumberlandensis*], and dusktail darter

[*Etheostoma percnurum*]) and six mussels (the Cumberland elktoe [*Alasmidonta atropurpurea*], purple bean [*Villosa perpurpurea*], Cumberland bean [*Villosa trabalis*], Cumberlandian combshell [*Epioblasma brevidens*], tan riffleshell [*Epioblasma florentina walker*], and littlewing pearlymussel [*Pegias fibula*]).

Ayers developed the underwater video mapping system (UVMS) to examine submerged ecosystems and record their locations. The system incorporates three Ocean Systems, Inc., DropShot underwater video cameras; a Garmin 18 differentially corrected Global Positioning System (GPS) receiver; a Red Hen Systems, Inc., video mapping system (VMS) 200, which integrates GPS locations with video; three Sony digital video recorders; a pair of underwater laser pointers (20 mW, 635 nm); and a depth sonar transducer (fig. 2). Two DropShot underwater cameras are flush-mounted to the bottom and side of the kayak hull; the third camera is mounted to the bow to acquire above-water video (figs. 3 and 4). The GPS receiver is a 12-channel, high-performance unit that uses a system of satellites and ground-based stations to provide better location accuracy than satellites alone. The video recorders save the geo-referenced video locations from the VMS 200. The laser pointers, also flush-mounted to the kayak, produce two dots on the substrate to provide a scale to determine substrate size (see fig. 2). Sonar measures river depth.

Ayers has previously conducted UVMS research that used underwater technology on a canoe and outboard motor boat at Biscayne National Park (Florida), Cherokee National Forest (Tennessee), and in Molokai (Hawaii). The customized kayak UVMS apparatus used at Obed Wild and Scenic River, however, was more compact and, overall, the kayak protected sensitive equipment from harsh environmental conditions very effectively (see fig. 3). The kayak-based system proved its durability and navigational precision in shallow, narrow channels and swift water (see fig. 1).

Researchers analyzed video footage for substrate, river characteristics, river depth, and embeddedness of the substrate in developing maps of optimal habitat for the threatened and endangered fish and mussel species (fig. 5).

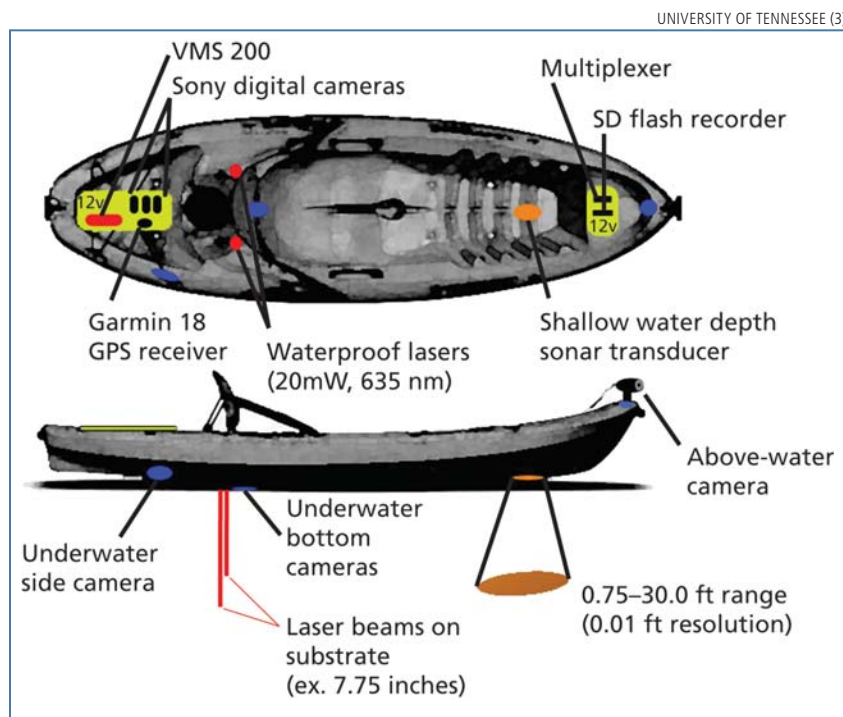


Figure 2. Schematic of the kayak-based underwater video mapping system.

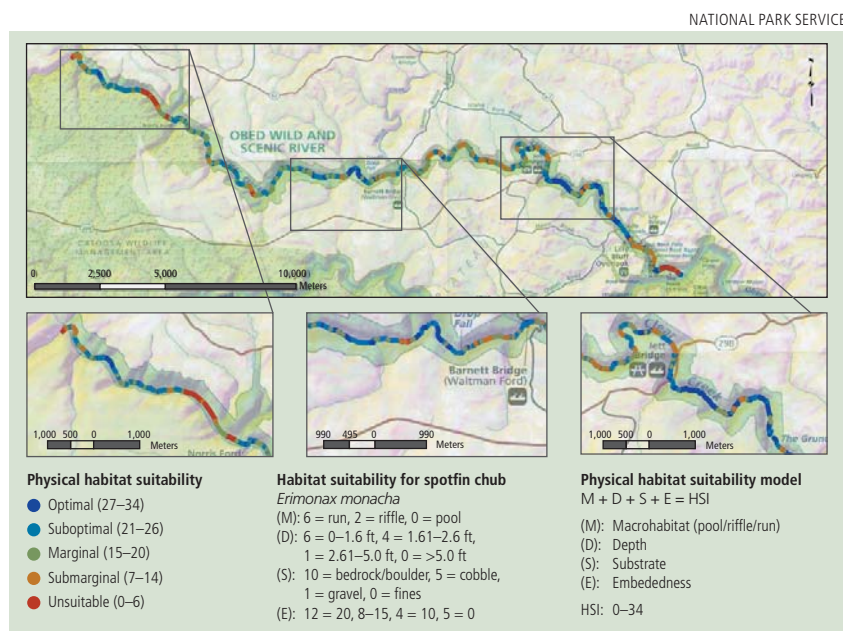


Figure 5. One of the maps produced from the research was this one of Clear Creek that shows the habitat suitability transitions for spotfin chub within Obed Wild and Scenic River.



Figure 3 (left). Underwater camera and laser pointers are embedded into the bottom of the kayak where they are well protected.

Figure 4 (above). The above-water camera in front of the kayak captures images of river characteristics.

Habitat mapping has become an effective tool contributing to aquatic conservation and management. Compared to traditional river surveying methodologies, the underwater video mapping system invites management awareness of habitat that is usually out of sight. It provides for management recommendations on a large scale but with zoom-in capabilities to assess microhabitat.

Acknowledgments

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