



96-19 Description of Fish Mobility and Habitat Use in a Large Regulated Fast Flowing River (the Rhône River, France) Using Fine Scale Acoustic Tracking

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Understanding fine scale behavioral responses of fish to changes in abiotic characteristics of streams (in term of flow and water temperature) is an interesting innovative issue to improve river management of highly disturbed large rivers. Acoustic telemetry system have become an essential technology for such studies involving continuous (per second) and accurate tracking of fish movements.

In the Rhône River (France), important hydrology and thermal contrasts are mainly explicated by the succession of dams and nuclear power plant from the Leman Lake (Switzerland). In this context, it is likely that fish are compelled to adapt their behaviour and their habitat selection in this changing environment. In order to test this hypothesis, a fixed acoustic telemetry survey was performed in the Rhône River during summer 2009 in front of the Bugey nuclear power plant which released warmed water within the river. A study site of 1.8 km long and 140 m wide was monitored using 32 hydrophones developed by HTI<sup>®</sup> (Hydroacoustic Technology Inc.). Sixty two fish mainly belonging to three species barbel (*Barbus barbus*), chub (*Leuciscus cephalus*) and wels catfish (*Silurus glanis*) were marked with acoustic tags (307 KHz; pulse rate ~ 3 sec.) and followed continuously during 89 days. Fish positions were coupled with a 2D hydraulic model to obtain main physical characteristics encountered by fish such as flow velocity, water depth, water temperature and substrate. The accuracy of the telemetry system was checked and a positional error less than 4 m was found in the channel (detection efficiency of 50 %) and less than 8 meters along the banks (detection efficiency of 20 %).

Behavioral responses of fish were investigated through the individual mobility and activity during selected phases of flow (increase, decrease and stability) and water temperature changes (imposed by both warm water plumes and

the rapid transition of deep cold waters from the Lemna Lake discharged within the river). Mobility and activity of fish were particularly studied to determine the amount of movement associated with a change of abiotic conditions. The separate effects of each environmental factors on behavioral responses of fish were studied and interactions between factors were analyzed to highlight potential synergistic or antagonistic effects.

Finally, movement rules (i.e. individual movement decisions in a particular surrounding environment) were analyzed to determine the role of perception of the environment by fish (i.e. how the fish feel the changes in physical habitat) in the use of space.