BRIEFING PAPER

Behaviour and passage success of upriver-migrating lake sturgeon *Acipenser fulvescens* in a vertical slot fishway on the Richelieu River, Quebec, Canada

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This first in a series of studies carried out on the Richelieu River, Quebec, examines how the construction of dams has affected spawning migrations of sturgeon. Dams create barriers to migration thus contributing to the imperilment of sturgeon and, although devices have been installed to facilitate upstream passage of fish at barriers, such devices have generally been unsuccessful and are not designed for sturgeon. The researchers examined fine-scale movements of adult lake sturgeon *(Acipenser fulvescens*) during passage through a vertical slot fishway located on the Richelieu River in order to determine passage success, passage duration and inter-individual differences in fishway use. Sturgeon demonstrated an ability to pass through the fishway quickly; however, the scientists discovered that the duration of successful passage events was variable, as was passage behaviour. Passage durations through two turning basins, designed to create a more compact fishway design and provide low velocity resting locations, were disproportionately longer compared with other basins; however, the activity of individuals within these basins and other locations remains unknown and represents an important knowledge gap. Collectively, data from this study contribute to understanding how the use of fishways can facilitate the upstream passage of sturgeon at dams.

It is evident that the construction of dams on large rivers (primarily for hydropower and flood control) has resulted in fragmentation of riverine habitats. This disconnection has caused a loss of key migratory pathways for several species of fish, which is often reflected by a decline in populations. Fishways commonly prevent or delay passage for numerous species. In many cases, the causes of failure remain unknown. In the case of sturgeon, unsuccessful fishway passage remains a particular concern, as it can limit population recovery for several species. Barriers that block the passage of migratory pathways are considered to be a key threat to all sturgeon species and have been implicated in their global imperilment.

Restoring the connectivity of riverine systems that have been fragmented by dams and providing access to essential habitats at all life history stages is critical to rebuild sturgeon populations and prevent extinction. Although fishways are regarded as a means of mitigating the installation of barriers, studies have documented that their efficiency can be highly variable. Such knowledge is useful in identifying potential means of improving sturgeon passage in existing and future fishways. If sturgeon populations in rivers with migration barriers are to recover, provisions for effective fish passage are thus vital.

BRIEFING PAPER

Biology of lake sturgeon (*Acipenser fulvescens*) spawning below a dam on the Richelieu River, Quebec: behaviour, egg deposition, and endocrinology

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This study follows on from and adds to the findings of *Behaviour and passage success of upriver-migrating lake sturgeon Acipenser fulvescens in a vertical slot fishway on the Richelieu River, Quebec, Canada*. The researchers set out to characterize the reproductive biology of lake sturgeon downstream of the St. Ours dam on the Richelieu River. As determined in the earlier study, river fragmentation has resulted in the loss of critical spawning habitat, which limits the recovery of many populations already decimated through overharvest. Knowledge of the reproductive biology of wild populations of sturgeon is vital to ensure the perpetuation of this species. The severe population decline of lake sturgeon has been attributed to dam construction, as such barriers limit access to upstream spawning and nursery areas and isolate populations, although lake sturgeon will spawn below dams where suitable habitat exists. Where suitable spawning grounds are not naturally available, creating artificial spawning grounds or expanding ones may aid recovery of the species.

Specifically, the researchers were interested in determining the location of the spawning ground and quantifying key habitats, the timing of spawning, and the abundance, composition, and residency of spawners. The study site is downstream from a dam equipped with a fishway, which is known to pass lake sturgeon to access upstream spawning habitat. The site location enabled a further goal, i.e. to determine if lake sturgeon are able to find and use suitable spawning sites downstream of the dam or if fishway attraction and passage efficiency limit spawning success.

The researchers applied a multiple lines of evidence approach to confirm that lake sturgeon spawned in late May and early June downstream of the St. Ours dam, and at water temperatures consistent with previous studies of this species that promotes optimal survival of eggs and larvae. The researchers confirmed the location of a lake sturgeon spawning ground directly below a dam, which is not surprising, as such impassable obstacles frequently provide a habitat that is conducive to spawning and egg survival (due to coarse substrate and/or high water velocities). Although the barrier is fitted with a fishway used by lake sturgeon, no observations were made of passage past the dam or through the fishway by any of the radio-tagged fish.

This study and others demonstrate that lake sturgeon will spawn below water control structures if suitable habitat exists. Dam construction often results in the loss of large spawning areas by blocking upstream fish passage and altering spawning ground characteristics in the lower and upper reaches of these new barriers. Preventing additional fragmentation of this 350 km stretch of fluvial habitat is an important protective measure to prevent permanent disruption of the life cycle of the lake sturgeon population. The study also highlights the challenges of studying passage without also knowing about the presence of spawning sites downstream.