

Heppell, M. and C. Théberge, 2003. *Aménagement hydroélectrique Sainte-Marguerite-3. Fraie de l'éperlan arc-en-ciel dans l'estuaire de la rivière Sainte-Marguerite – Suivi environnemental 2002.* (Sainte-Marguerite-3 hydroelectric development. Rainbow smelt spawning in the Sainte-Marguerite River estuary. Environmental follow-up 2002.) Groupe conseil GENIVAR inc., for Direction de projet Sainte-Marguerite-3, Hydro-Québec, Montréal (Qc), 51 pages and appendices.

Context and objectives. In April 1994, Hydro-Québec began the Sainte-Marguerite-3 hydroelectric development project, which was to be built a hundred kilometres north of Sept-Îles. The project was completed with impoundment of the reservoir in 2001. This project was subject to compliance with condition 4 of the federal approval, which required a study of the physical and chemical properties of water bodies and their influence on biological productivity in the estuary. It was also subject to compliance with condition 28 of the provincial order requiring monitoring of the fish communities in the Sainte-Marguerite River estuary. When monitoring began in 1998, rainbow smelt (*Osmerus mordax*) was identified as a species of interest for verifying compliance with these conditions. 2002 was the fifth year of monitoring for rainbow smelt spawning in the Sainte-Marguerite River estuary.

Summary. Rainbow smelt spawning was monitored from June 4 to July 20, 2002, in the upper Sainte-Marguerite River estuary downstream of SM-1 powerhouse. During this time, the water temperature remained between 5.0°C and 15.3°C. Unlike previous years of monitoring, the spawning areas remained flooded all the time: the average daily flows were 75 to 270 m³/s, with depths of about 2.1 to 2.6 m and a low water level of 1.5 m, which occurred on June 7. The highest elevation on spawning grounds ZF2 and ZF3 was established at 1.3 m in previous years. Flow conditions in 2002 were much the same as before impoundment of Sainte-Marguerite-3 reservoir.

Experimental fishing in the study area on June 15 and 20 resulted in a catch of 100 smelt. The highest fishing success was recorded on June 15, immediately downstream of the rock sill. The rainbow smelt caught belonged to three main age classes: two years old (40%), three years old (43%) and four years old (16%). More males (61) were caught than females (39), for a sex ratio of 1.6. Specimen size in 2002 was similar to that for individuals caught in 2000, but smaller than for individuals caught in previous years.

Eggs were collected to determine the limits and assess the area of egg deposition zones ZF2, ZF7 and ZF8. The first rainbow smelt eggs were discovered on June 13 in spawning area ZF7. Egg density, measured with collectors, peaked on June 28 at 80 eggs/m² in ZF2 and on July 5 at 613 eggs/m² in ZF7. No significant egg density was recorded in ZF8. The first hatchings were noted on July 11 and continued to about 97% on July 18. High mortality rates of 93 to 100% were observed in spawning area ZF7 beginning on June 28. The experimental use of steel collectors, 30 cm x 30 cm, showed their efficiency as a

substrate for egg adherence. However, under heavy runoff conditions as observed in 2002, their overall design should be reconsidered to improve yield.

The total number of eggs laid in the upper Sainte-Marguerite River estuary in 2002 was estimated at around 4,300,000. The last eggs were laid shortly before July 5, so the spawning period lasted about 28 days.

The conclusions about the impacts of the first five years of impoundment of SM-3 reservoir on rainbow smelt spawning in the upper Sainte-Marguerite River estuary were based on analysis of data collected since 1998. Once again, it was shown that this species adapts its spawning to the physical conditions in the environment. Between 1998 and 2001, with a lower flow, smelt found optimum spawning conditions upstream of the rock sill. In 2002, when flow was higher, the species preferred to use area ZF7, located at the rock sill. This site, however, is subject to high current velocities, and egg detachment was substantial. The real effect of this observation on annual recruitment cannot be evaluated without further monitoring.