

**PI Name/Short Description:** Golden shiner (*Notemigonus crysoleucas*) – suitable feeding habitat surface area (Lake St. Louis to Trois-Rivières) [E20]

**Technical Workgroup:** Environment TWG

**Researched by:** Mingelbier M. and J.Morin

**Modeled by:** Morin J., S. Martin and O.Champoux.  
Modeled using full 2D system and reduced to a simplified relationship to discharge.



**Performance Indicator Metric:** Hectares of habitat suitable for golden shiner feeding and living, relative to a particular water discharge measured at the Sorel gage.

**Ecological Importance/Niche:** Fish are a major component of the aquatic ecosystem, influenced at various degrees by the water discharge. The golden shiner, which is omnivorous, plays an important ecological role in the St. Lawrence River as a forage fish for the main sport fish such as large mouth bass and muskellunge. It is also used as bait by fishermen.

**Temporal validity:** Valid between August 1st and October 31st and computed from the QM33 to QM 42

**Spatial validity:** Valid between Lake St. Louis and Lake St. Pierre (not Lachine Rapids and Laprairie Basin)

**Hydrology Link:** The golden shiner lives in shallow waters, which are sensitive to water level variations. Water discharge regulation may have adverse effects on habitat supply.

**Algorithm:** The algorithm is based on the mean value of discharge estimation at Sorel from QM33 to QM42. A fish habitat model was combined with a 2D physical model to compute the probability of presence and the surface of the feeding ground for six discharge scenarios. The habitat model was based on field measurements. Three hydrological attributes were used to model the feeding habitat of golden shiner:

1. Current velocity
2. Percent of Clay
3. Simulated vegetation density

**Calibration Data:** No data available

**Validation data:** Leave one out method with the 512 samples, cross validation between three sections of the St. Lawrence River, and historical data (when available) were used to validate the fish habitat model.

**Documentation and references:**

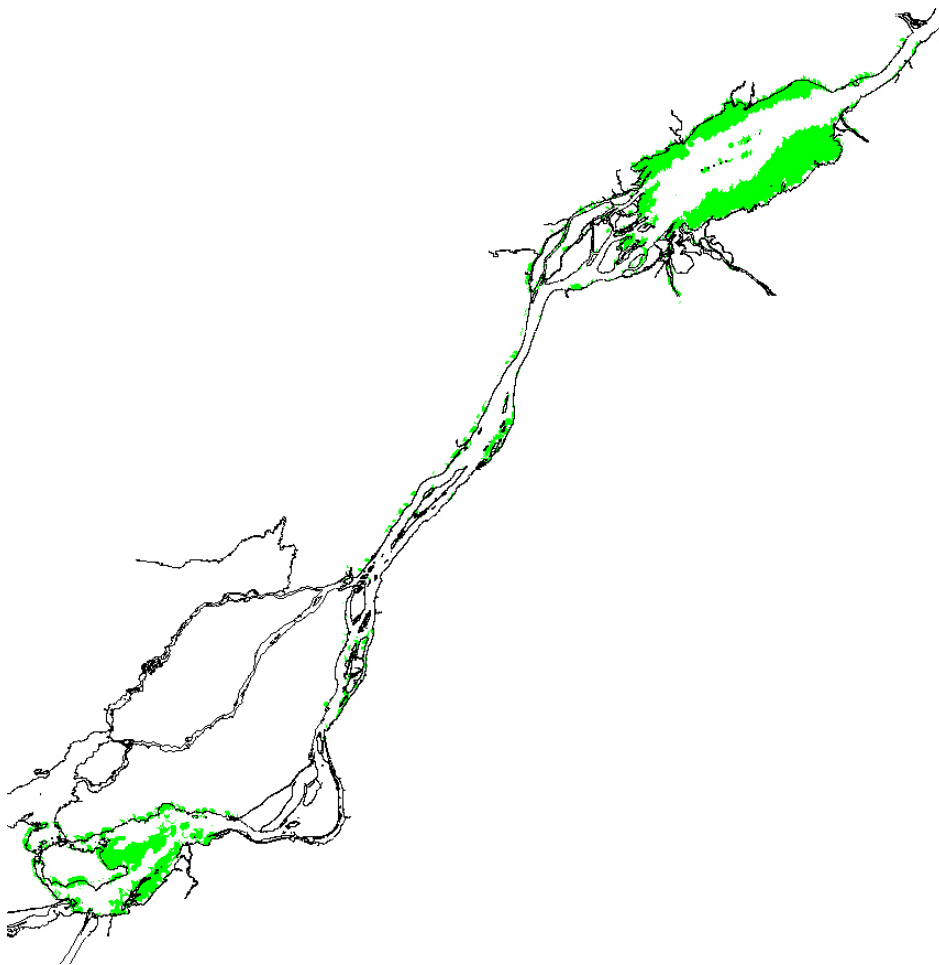
Mingelbier M., P. Brodeur and J. Morin 2004. Preliminary recommendations concerning fish and their habitat in the St. Lawrence River to assess and evaluate the current criteria used for regulating the Lake Ontario - St. Lawrence system. Société de la faune et des parcs du Québec, Direction de la recherche sur la faune. 124 p.

Mingelbier M. and J. Morin (2004). Modelling the occurrence of fish species in a large river using 2D numerical habitat, the St. Lawrence River, Canada. Vth International Symposium on Ecohydraulics, September 2004, Madrid, Spain.

Mingelbier M. and J. Morin (in press). Modélisation numérique 2 D de l'habitat des poissons du Saint Laurent fluvial pour évaluer l'impact des changements climatiques et de la régularisation. Naturaliste Canadien.

Mingelbier M., P. Brodeur and J. Morin (in prep. due by March 2005). First recommendations concerning fish and their habitat in the St. Lawrence River to improve current criteria used for regulating the Lake Ontario - St. Lawrence River system. Société de la faune et des parcs du Québec, Direction de la recherche sur la faune.

**Risk and Uncertainty Assessment:** We are confident that the present habitat model, which is based on data collected in the field (512 sites of gillnets and seines; 142 presences and 370 absences), accurately predicts the habitat suitable for golden shiner between August and October. The performance corresponded to  $R^2 = 0.26$  and the goodness of fit (concordance between predicted and observed) was 77%. The present model was especially designed to evaluate the sensitivity of fish habitat to water discharge variations. It does not take into account any other confounding factors such as overfishing, anthropogenic habitat losses, agriculture impacts, toxics, etc.



**Figure 1. Map of the suitable habitat (feeding and living) for the Golden shiner (*Notemigonus crysoleucas*) for an average discharge (9500 m<sup>3</sup>/s or 335,489 ft<sup>3</sup>/s at Sorel)**

## Transfers from 2D explicit models to 1D simplified SMV curves:

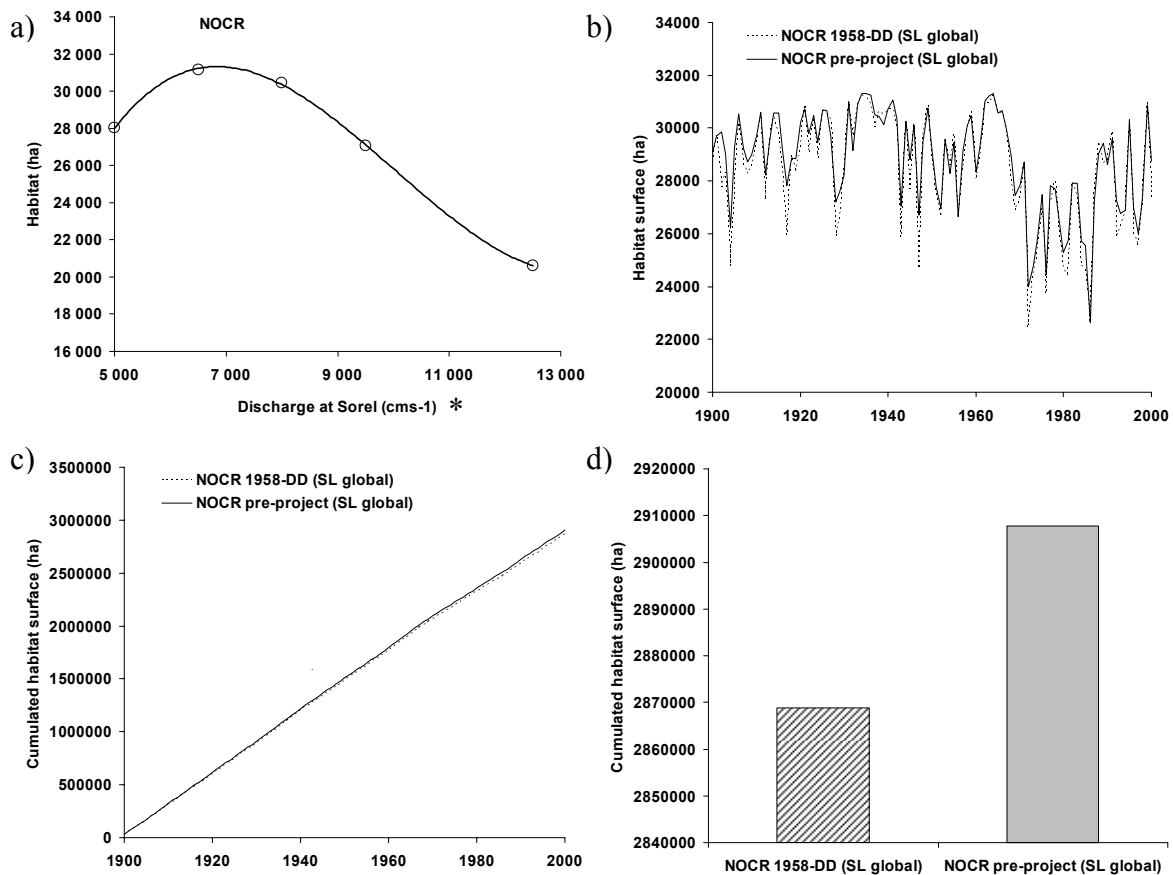


Figure 2. (a) Global relationship between “Surface area of suitable summer habitat” for NOCR and the discharge in Sorel; (b) suitable average summer habitat (ha) for the period 1900-2000, calculated with the 1958-DD and Pre-project Plans; (c) cumulated suitable habitat (ha) over time for the period 1900-2000; (d) difference in suitable habitat between the two scenarios 1958-DD and Pre-Project after 100 years.

Table 1. Best fit curves for the Golden shiner, for the five regions in the St. Lawrence River; QS= discharge at Sorel

Regions	Best fit for: Golden shiner ( <i>Notemigonus crysoleucas</i> = NOCR)
Lake St. Louis (LSL)	$0,000000034650*QS^3 - 0,000882669386*QS^2 + 6,309187523211*QS - 3930,594638713770$
Montreal-Sorel	$-0,000000001212*QS^3 + 0,000002061839*QS^2 + 0,273961784965*QS - 1,381076170031$
Sorel archipelago	$-0,000000005177*QS^3 + 0,000099356534*QS^2 - 0,423343675751*QS + 1474,272275798660$
Lake St. Pierre	$0,000000057108*QS^3 - 0,001775099068*QS^2 + 16,774782070481*QS - 31127,376622406600$
LSL_3-Rivières	$0,000000086598*QS^3 - 0,002601389418*QS^2 + 23,431383597885*QS - 34953,469234567000$

\* 5000 cms = 176,578 cfs  
 7000 cms = 247,209 cfs  
 9000 cms = 317,840 cfs  
 11000 cms = 388,472 cfs  
 13000 cms = 459,103 cfs