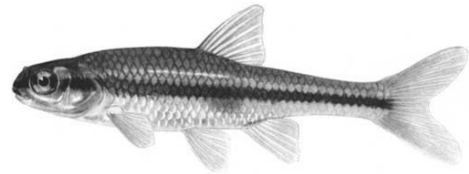


**PI Name/Short Description:** Bridle Shiner (*Notropis bifrenatus*) – reproductive habitat surface area (Lake St. Louis to Trois-Rivières) [E32]

**Technical Workgroup:** Environment TWG

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**Performance Indicator Metric:** Spawning and egg development of the Bridle Shiner, a small (6 cm maximum) feeder fish (fish eaten by larger fish). Units are hectares of river at a particular flow level with the characteristics preferred by the Bridle Shiner. Flows are those predicted at the Sorel gage.

The PI gives an annual value of the available safe potential surface area of spawning and egg development habitat (measured at the Sorel gage). The aggregated 100 year plan scenarios are expressed by the percent of time that the PI exceeds the first quartile value for plan 1958DD for the comparable water supply series (e.g. Historic, S1, S2 S3, etc). This metric will be used for plan evaluation by calculating a ratio of metrics between two plans.

**Ecological Importance/Niche:** The Bridle Shiner is designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species is listed in schedule 1 of the Species At Risk Act. Under this Act, a management plan, including appropriate measures for the conservation of the species, is required for this species. Wherever it occurs in sufficient numbers, the Bridle Shiner is presumably an important forage fish for a variety of important game fish. This indicator computes the available safe potential surface area of spawning and egg development habitat for different water discharge conditions.

**Temporal validity:** We measure the potential spawning habitat availability for all of June and the two first quarter month (QM) of July while we measure the risk to dry up eggs and larvae from the first QM of June until the third one of July.

**Spatial validity:** The PI is valid for the Lower St. Lawrence River between Lake St. Louis and Lake St. Pierre (except Laprairie Basin). The Lake St. Pierre sub region is used to evaluate plans since the larger and healthiest bridle shiner population is found there.

**Hydrology Link:** The Bridle Shiner prefers to spawn in 60 cm to 120 cm (23.62 inches to 47.24 inches) of water in moderate to dense submerged vegetation. The presence of 15 cm to 45 cm (5.91 inches to 17.72 inches) of free water above the vegetation is important to reproduction activities of this species. Water levels fluctuations have two known linkages to this fish reproduction:

- 1) Flood and minimum flow amplitude, recurrence and duration are good indicators of the submerged vegetation composition and density.
- 2) Water level decreases can dry up eggs and larvae.

**Algorithm:** This PI is influenced by hydraulic attributes responsible for spawning habitat availability and eggs/larvae survival. More specifically, the PI was developed using 2D modeling based on the combination of hydrodynamic, substrate and submerged plants density models. Three hydraulic variables were considered: *mean water depth*, *mean current velocity* and *water level decrease*.

The PI is made from the potential spawning and eggs development habitat model, from which the mortality model removes all portions where water levels fluctuations create “unsafe” conditions to the eggs/larvae development. The two models built to create the PI are presence / absence type models that are based on the parameters and values coming from literature review (more info in Giguère and al. (2005)).

#### Potential spawning and eggs development habitat model (QM 21 to 26)

Habitat is considered as suitable if all the following features are present: substrate polygon contains > 10% of clay or silt or sand; current velocity > 0 m/s & < 0.15 m/s (<5.91 inches/second); water depth > 0.45 m & < 1.20 m (>1.48 ft & <3.94 ft); submerged vegetation density > 1.5

#### Mortality model (QM 21 to 27)

From the resulting potential habitat, the mortality model removes all the nodes where the water level drops > 0.15 m during at least one of the considered QM.

**Calibration Data:** No data available

**Validation Data:** In the study area, there is no known recorded observation of Bridle Shiner within the reproduction period. However, The ministère des Ressources naturelles, de la Faune et des Parcs (MRNFP) has several recorded observations for the summer period. Considering that this poor swimmer fish possibly use similar habitat during reproduction and summer time, the models has been run for a summer discharge similar to those recorded during the survey periods. 42 of 49 occurrences (79,7 %) matches the characteristics selected in this modeling effort.

#### **Documentation and References:**

Giguère, S, J. Morin, P. Laporte and Mingelbier, M. (2005) Évaluation des impacts des fluctuations hydrologiques sur les espèces en péril. Tronçon fluvial du Saint-Laurent (Cornwall – Pointe-du-Lac). Rapport final déposé à CMI (2002 - 2005). Environnement Canada, Région du Québec, Service canadien de la faune.

#### **Risk and Uncertainty Assessment:**

This PI is based on the following assumptions:

- Spawning habitat supply and egg/larvae survival are significant factors influencing the size and integrity of Bridle Shiner populations.

- Predicted fish response to hydrologic conditions based upon literature review is valid.
- Wetland habitat models are providing an accurate, relative estimate of submerged plants density.
- Quarter month hydrologic data is representative of real hydrologic conditions.
- Predicted fish response to hydrologic conditions based on statistical modeling is valid.
- Transformation from a 2D to 1D hydrologic model is correct.

**Confidence rating:** This PI has been built from a moderate amount of literature information that was available from outside the region of interest. The potential habitat model has been validated with several independent field data that matches the characteristics selected. A “precaution” principle has also been used in order to obtain a “conservative” type PI. Thus we are confident that the PI allows for an accurate relative comparison among alternate water level and flow regimes within the Lower St. Lawrence.

Although hydrologic variables are strongly associated with habitat and Bridle Shiner occurrence, there is also a significant amount of variation not explained by hydrology. In order to assess 100 year water level scenarios, the predictive models necessarily ignore, or hold constant other important population variables (e.g. productivity, age and sexes distribution) and environmental variables (e.g. predation, food availability, pollution, exotic species) that can also impact reproductive success, and have an influence on regional Bridle Shiner populations. For these reasons the PI values should only be considered as relative measures between plans.

**Significance of the species:** The Bridle Shiner is designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species is listed in the Schedule 1 of the *Species at risk Act*; the species and its critical habitat are legally protected under this Act. Critical habitat protection will be applied when it is identified within the Recovery Strategy or Action Plan. Wherever it occurs in sufficient numbers, the Bridle Shiner is presumably an important forage fish for a variety of important game fish.

**Sensitivity to water levels management:** The scientific literature document the close association between Bridle Shiner occurrence, during spawning period, and specific hydrological condition. Bridle Shiner PI is retained as a Key PI because it clearly shows an important vulnerability and sensitivity to alternations in water levels and flows, and is listed as a Species at risk. As such it should be used to evaluate potential environmental responses to alternative water regulation plans.