

Tay River Macroinvertebrate Survey - 2009

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**report to the Ontario Freshwater Mussel
Recovery Team, February 2010.**

A survey of a small Eastern Ontario
river with a sparse Unionid fauna,
undertaken in the first year after Zebra
Mussels were first observed there.

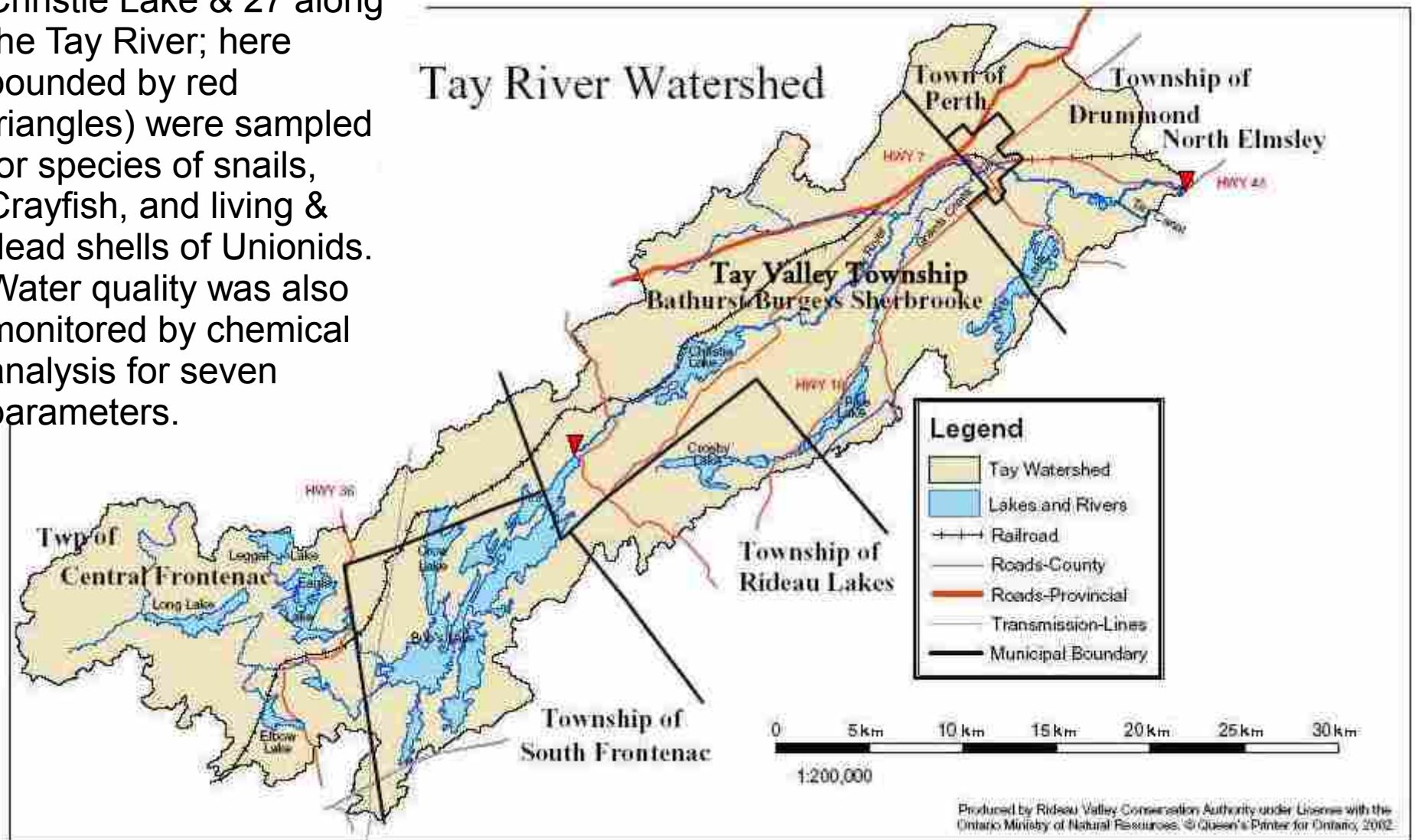


The Tay River and Christie Lake are part of the Tay River Watershed, in eastern Ontario within the counties of Lanark, Leeds, and Frontenac. It is the largest subwatershed of the Rideau, and is bounded by the Mississippi watershed to the north, the Black Creek watershed to the east, direct tributaries of the Rideau to the south, and Bay of Quinte drainages to the west.

The Tay flows in a northeasterly direction for 40 km (in a watershed which has an overall extent of 95 km) from the outlet from Bob's Lake at the Bolingbroke Dam (controlled by Parks Canada as a water source for the Rideau Canal) through to Port Elmsley, where it empties into the Lower Rideau Lake of the Rideau Canal. The upper part of the Tay flows through the Canadian Shield of the Frontenac Axis over igneous/metamorphic bedrock covered with a thin overburden.

The lower Tay (below the outlet from Christie Lake) flows through the Smiths Falls Limestone Plain and is impacted by agriculture and more population. Below Perth, the river spreads out into the extensive Tay Marshes and the historic Tay Canal, eventually flowing into Lower Rideau Lake at Port Elmsley.

From 23 June-14 August 2009, 40 sites (13 in Christie Lake & 27 along the Tay River; here bounded by red triangles) were sampled for species of snails, Crayfish, and living & dead shells of Unionids. Water quality was also monitored by chemical analysis for seven parameters.





Our methodology was derived from Schueler *et al.*'s "*How to do a Bridge*" (2007): "focusing on the large creatures that can be identified to species in the field... a protocol for hunting, rather than for random sampling... taking reference collections to constrain the uncertainty of field identifications, and archiving data to make long-term revisits meaningful."

Water chemistry was assessed with a Hydrolab Model 4 Surveyor, with alkalinity determined by titration using a kit. Water temperature, pH, total dissolved solids, conductivity, total alkalinity, dissolved oxygen, and % saturation of dissolved oxygen were measured.


Because we depended on day-to-day volunteers for most of the sampling, and because Unionids are sparse at most stations, we didn't attempt any quantitative protocols, but just measured & counted all the Unionids that were picked up, with a separate search for predator (=Muskrat) shell piles.

Of the 27 stations along the Tay River, public bridges accounted for 9 (33%); private bridge points, 2 (7%); while private & public land access points each accounted for 8, 29.5%.

Zebra Mussels (*Dreissena polymorpha*) had not been found in the Tay before 2008, but in 2009 SCUBA divers found Zebra Mussels on the shoals of Christie Lake of a size that suggests they were at least four years old. Zebra Mussels were found at seven sites in the Tay River in the course of the survey, though in as-yet low numbers.

Water chemistry data collected in the survey found levels of calcium in the reaches upstream of Perth which are in the range in which *Dreissena* reproduction isn't certain (22-26 mg/L), while below Perth the levels are within the range that suggests successful reproduction (24-31 mg/L). These are similar to calcium levels in the [Rideau River](#) at sites where *Dreissena* became abundant only a decade after it was first noticed (Martel, *et al.*, 2006, Schueler & Martel 2009).



A close-up photograph of numerous Unionid mussel shells. The shells are dark brown to black, with some showing signs of damage or decay, such as holes and irregular patterns on their surfaces. The shells are piled together, creating a dense, textured background. A white text box is overlaid on the center of the image.

Elliptio complanta was the most abundant Unionid, making up an even 90% of the individuals tallied.



Alasmidonta marginata -- Elktoe

While this species is fairly common in southwestern Ontario, in Eastern Ontario it is common only in the Mississippi River below Almonte; only two shells had previously been found in the Tay, and only one in the entire Rideau River.

In our survey we found 13 alive and 17 shells. They were found living in 4 locations and shells were present in another 3 locations, all characterized by more or less flat bedrock bottom. The largest population (half of all living individuals found) was on the limestone flats above the OMYA water intake, where the bare bedrock made up most of the bed of the river.





Lasmigona compressa / Canada: Ontario:
Lanark County: T03, TayR abvDeacon's
Bridge, off CoRd36 / 44.77685N 76.49873W /
12 Aug 2009 / Frederick W. Schueler, Aleta
Karstad Schueler, Orion Clark, Lucy Welch,
Drew Lampman field#: 2009/193/h (shell)

***Lasmigona
compressa* –
Brook
*Lasmigona***

This is a brook and
headwaters species
that is rarely abundant
in eastern Ontario.

**Despite the superficially brook-like character of much of the riverbed,
We found only one shell & one alive, in the River above & below
Christie Lake.**



Lasmigona costata **– Fluted Shell**

This is a big heavy species, often found on bare bedrock substrate. We found it sparingly all along the River. Seven of the 23 found were alive, but never more than one living individual at any station.

In some other drainages in eastern Ontario shells may show scarcely any of the posterior corrugations that give the species its name, but Tay shells were boldly fluted, though they may be extensively eroded.



***Pyganodon cf
grandis* –
Common Floater**

A thin-shelled species characteristic of lakes and brown-water habitats.

It was found in 6 stations in Christie Lake, and at 10 all along the River. About a third of those found by searches were alive (11 of 31), and an equal number (12) in Muskrat shell piles. Most of the shells had the beaks too eroded for the beak sculpture to be assessed.



Strophitus undulatus / Canada: Ontario:
Lanark County: Bathurst: TayR, 0.1km ENE
CoRd6, Schoolhouse Bridge / 44.82430N
76.38780W / 11 Aug 2009 / Frederick W.
Schueler field#: 2009/191/le

***Strophitus undulatus* – Squaw-Foot or Creeper**

This species is rarely abundant in Eastern Ontario, and then only in clayey bottoms which are not found in the Tay.

Only 4 were found, two of them alive, in the 2009 survey, though an equal number had been found along the river previously.

***Ligumia
recta* –
Black
Sand-Shell**

Ligumia recta
grows to a
greater length
than any other
local Unionid,
but it is rarely
abundant, and
is often
represented at
sites only by
long-dead
shells.



Ligumia recta / Canada, Ontario, Lanark
County: T02, TayR at Davern Lane, 1.8km NE
Belingbroke / 44.77086N 76.50334W / 12
Aug 2009 / Frederick W. Schueler, Aleta
Karstad Schueler, Orion Clark, Lucy Welch,
Drew Lampman field#: 2009/194/h

The 2009 survey conformed to this pattern: only 13 shells were found, and 2 alive, at 7 sites along the river.

Lampsilis radiata siliquoidea – Fatmucket

In 2009 this 'subspecies' was found sparsely in Christie Lake and below the lake in the Tay (1 alive, 2 shells, 3 in Muskrat piles). In 2001, a sample from the river in Perth had included 21 shells of this morphology.



L. r. s. with attached *Dreissena* from Christie Lake, Long Island Shoal

Lampsilis radiata siliquoidea / Canada:
Ontario: Lanark County: Perth: island
inTayR@LastDuelPark / 44.89852N
76.23621W / 13 Aug 2009 / Frederick W.
Schueler field#: 2009/198/me

The two subspecies or species, *Lampsilis (r.) radiata* (eastern) and *L. (r.) siliquoidea* (western), meet or hybridize in eastern Ontario. Clarke (1981) maps eastern Ontario within the range of *Lampsilis r. radiata*. Schueler (1996) concluded that populations in the lakes and big rivers were closer to *L. r. radiata*, while populations in smaller rivers & creeks were large & heavy and may well be hybrids. Those in the Mississippi above Almonte, and in some lakes, are typical northern-Ontario *L. r. siliquoidea*, as were a few shells picked up along the Tay, and one photographed in Christie Lake. In eastern Ontario *Lampsilis radiata* usually comes right behind *Elliptio complanata* in abundance, but in the Tay that position is held by the Tay *Lampsilis*, of uncertain taxonomic status.

The bulk of the *Lampsilis* from the Tay are a light-shelled small-toothed form, which superficially resemble the Atlantic-drainage Tidewater Mucket *Leptodea* (or *Lampsilis* or *Ligumia*) *ochracea*. These are similar to *Lampsilis* in the Mississippi River below Almonte, and will require study to determine their taxonomic status.

“Calling Dr Martel... Calling Dr Zanata... these populations are in an indeterminate state...”



Lampsilis / Canada: Ontario: Lanark County:
Perth: T22, TayR at RiversideDr/Canalbank
Rd access point / 44.89797N 76.23108W /
13 Aug 2009 / Chris Stone field#:
FWS2009/198/ob

Tay *Lampsilis*, found at 21 stations along the River, about a quarter alive. This amounted to 160 individuals, the second most abundant species, 5.3% as many as the 2995 of the most-abundant *Elliptio complanata*.



Pyganodon grandis / Canada: Ontario:
Lanark County: T02, TayR at DavernLane,
2009/194/lb (shell)

Despite moderate levels of calcium, and above-neutral pH in August 2009 (mean=7.84, 6.36-9.08, st. dev.=0.64) many Tay Unionids have most of their periostracum eroded away. This may be due to slow growth and long lifespans, or it may be due to lack of soft substrates for burrowing.

In some sites, residual sawdust and barkchips from former lumber mills may provide less protection from erosion than mineral substrates would.

Only *Elliptio complanata* (206), *Pyganodon grandis* (17) and *Lampsilis r. siliquoidea* (1) were found in Christie Lake, some of the living ones with adherent *Dreissena*

Unionids taken by SCUBA, from Christie Lake, Long Island Shoal



16/05/2005

Christie Lake ~ Middle
Friends of the Tay Watershed



Mesotrophic Christie Lake has a surface area of 646 hectares with a long irregular, heavily cotted, steep shoreline of 27.4 km. The Tay River enters the lake at its west end, and flows out to the northeast.

The number of Unionid species at sites where they occurred was lower in the Lake (11 stations, mean= 1.55) than in the River (30 stations, mean= 3.47) overall mean= 2.95 $t = +3.9$, $p=0.001$ for t and Mann-Witney U.

In 1995 a paucity of Unionids was noticed at the mouth of the Tay at the Rideau River (and at the mouths of other Rideau tributaries, Schueler 1996a). In our present sample of 30 river sites, the correlation between longitude and total *Elliptio* was only $r = 0.1103$ ($p=0.56$). The correlation between the number of *Elliptio* found and the number of other species of Unionids was only $r=0.0019$. The one significant relationship was between the number of Unionid species and longitude, which increased upstream ($r = -0.4345$, $p=0.01$).

Comparing the River above Perth (20 stations, mean= 3.80) vs the river in and below Perth (10 stations, mean = 2.80) $t = +1.7$, p (one-tail) = 0.0501, (2-tail) = 0.100; Mann Whitney U = 65.5, $p_1 = 0.067$, $p_2 = 0.134$. The one-tailed test may be appropriate given previous speculations that pollution or the "mouth at the Rideau" effect might reduce the number of species downstream. However, given the nonrandom selection of sites, and the disparate effort expended at some stations, it's best to say that the data suggest such a decline, but that it's not established.

we conclude that:

- **The Tay supports a fauna of 9 Unionid species, with 3 of these in Christie Lake.**
- ***Elliptio complanata* makes up at least 90% of the fauna**
- **The second most abundant species is a *Lampsilis* superficially similar to *L. ochracea*.**
- ***Alasmidonta marginata* is modestly common in places; its only known population in the Rideau drainage.**
- **eroded periostracum & low numbers of most species suggest that conditions are marginal for many species.**
- **Zebra Mussels are present throughout the system; calcium levels above Perth are within the range where Zebra Mussels may or may not become dominant over the coming decade.**



What's next:

- **Continued monitoring of Zebra Mussels**
- **Surveys of tributaries such as Grant's Creek, of other lakes, and of Scotts Snye**
- **Canoe surveys through wetlands & isolated reaches of the River**
- **Resolution of the taxonomic status of the *Lampsilis***
- **Begin quantitative monitoring at selected stations.**
- **Be ready to salvage shells of Unionids that will be killed if Zebra Mussels become abundant.**





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Aleta Karstad isn't in any of the photos, because she took almost all of them.

