Research & Science Note 1

Linking Aquatic Macroinvertebrates to Water Quality and Fish Habitat in the Milk River Watershed

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Background

Decline in the biodiversity of freshwater aquatic organisms is now a globally-recognized concern. Such declines are best documented for relatively large and visible species (e.g. amphibians, unionid mussels), but they are also commonly reported for smaller, less well-known fauna.

For those cases where species declines are best documented, evidence is equally strong for dramatic, sometimes catastrophic, changes to the functioning of aquatic ecosystems. Losses of aquatic biodiversity and the associated impacts on ecosystem functioning have strong impacts on how aquatic ecosystems are managed.

Losses of aquatic biodiversity and the associated impacts on ecosystem functioning have strong impacts in the context of fisheries management.

Benthic invertebrate communities reflect their environment and are indicators for water quality and overall river health (e.g., oxygen conditions).

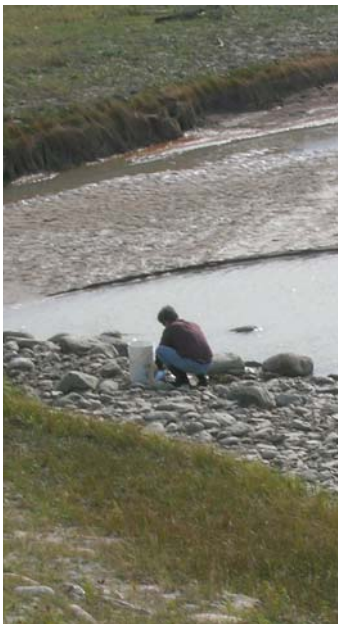
Benthic invertebrates play a critical role in the flow of energy through riverine ecosystems. They typically function as key primary and secondary consumers and they are often favoured prey of keystone (and other) species of fishes.
Declines in benthic invertebrate biodiversity are well documented. In a recent review of the literature, Haxton and Findlay (2007) showed that macroinvertebrate abundance and species richness was typically lower in dewatered reaches of rivers. Further, altered flows were associated with reduced abundance of specialist invertebrates, but not generalists. These results have clear implications to the management of riverine resources, especially for those species of fish that include macroinvertebrates as primary sources of food.

This project seeks to understand long-term changes in macroinvertebrate communities within 5 selected reaches of the Milk River, in southern Alberta. These sites were first sampled by Beth Cornish in 1986 (Cornish, 1988; Benthic invertebrate communities in the Milk River, Alberta and potential effects of a proposed impoundment)). The sampling design developed by Cornish (1988), which involved extensive replication and randomization, together with accurate species level identifications, provide a unique opportunity to evaluate changes over a period that includes both the highest (1995) and lowest (2004) river flows on record. The data collected in this study will be linked to land use, water quality and fish habitat.

This project is being undertaken in partnership with the Milk River Watershed Council Canada, University of Lethbridge, Sustainable Resource Development and Fisheries and Oceans Canada. This partnership creates a strong link for information sharing and exchange.

This study will provide critical information that will support the Milk River Watershed Management Plan.

We thank the Stewardship in Action Program (Fisheries and Oceans Canada) for assisting with the funding of this important project.



Study Area

The Milk River is a tributary of the Missouri River. Both the North Milk River, a major tributary of the Milk River and the Main stem Milk River originate in Northwestern Montana and flow easterly across southern Alberta. The North fork of the Milk River receives a boost in flow from a diversion of the St.Mary's River located in Montana. The confluence of the North Milk River and the Main stem Milk River is located approximately 20 km west of the Town of Milk River and is the beginning of the 240 km stretch of the Milk River that was sampled for macro invertebrate community composition. The first of the sampling sites is located on the North fork of the Milk River just above the confluence and a second site is located on the Main stem or South fork of the Milk River also above the confluence. From the confluence, the Milk River then extends approximately another 230 km east where it eventually crosses back into Montana on the eastern border. Twenty kilometers from the confluence is the Town of Milk River and south of the town site is location of Site #3. Site #4 is located upstream of Writing-On-Stone Provincial Park at the Hwy 500 Bridge approximately 145km from the eastern border crossing and Site #5 is approximately 100 km from the eastern border crossing and is located at the Hwy 880 Bridge.

Diptera Larvae (Stone fly Larvae)

Plecoptera Larvae (Stone fly Larvae)

Oligochaetae

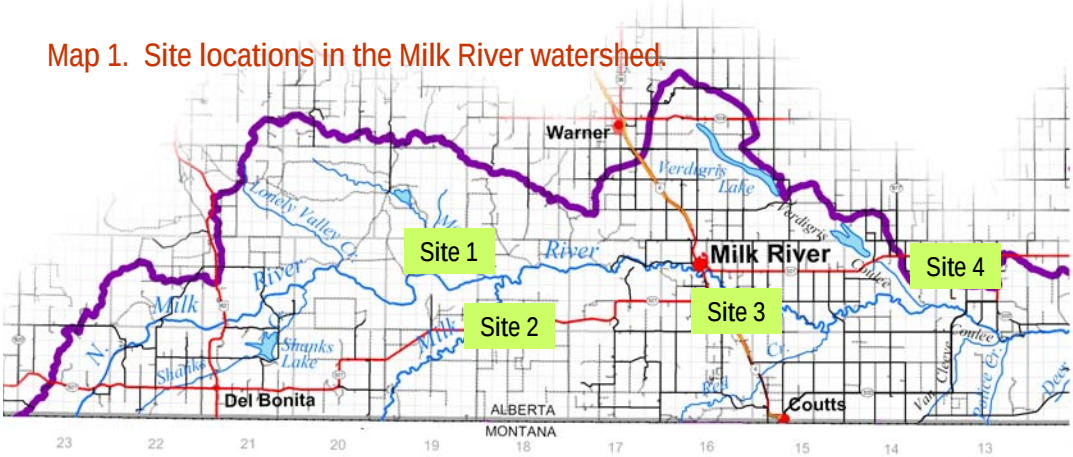
Photo: Jillian Barnes

Methods

The purpose of this project was to replicate the sampling protocol described by Cornish (1986) as closely as possible. We therefore conducted the fall 2008 sampling within a one week time period of the 1986 study (September 30 to October 7) which allows for an excellent temporal comparison to be made. Five replicate and randomly placed samples were collected at each of the 5 sites at a depth of 30-50cm along a 20m stretch of the river that contained riffle areas and where there was a moderate flow. A 0.1 m^2 invertebrate sampling cylinder was placed at the indicated depth and large stones were washed and removed from the designated area. The substrate within the cylinder was then stirred and agitated numerous times sometimes taking up to 10 minutes to capture all the material via a catching net. Material was transferred to vials and preserved in 70% ethanol.

In the laboratory, entire samples were thoroughly examined under a dissecting microscope, counts were made and taxa have been separated to Order. Samples are currently in the process of being further keyed to family, genus and species where possible.

Map 1. Site locations in the Milk River watershed.



Interim Results

Figure 1. shows that total invertebrate abundance has decreased since 1986 at all five sites.

Table 1 (back page) summarizes results found by Cornish (1986) combined with the community composition of benthic invertebrates to the level of Order found by in the 2008 sampling period. Although further identification of species is required before conclusions cand be drawn regarding community composition, species abundance and species diversity on a spatial and temporal scale, a few observations can be made.

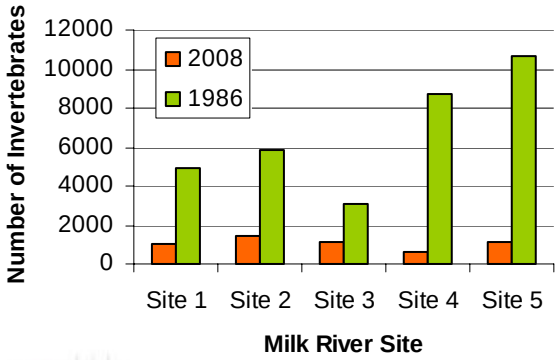
Site #3 Below the Town of Milk River. Photo: Jillian Barnes

Site #5 located at the Hwy 880. Photo: Jillian Barnes

General Observations

- Diptera (flies) was the most abundant species at all sites in 1986 and 2008.
- Several species were observed in 1986 that were not observed in 2008. These included many species of the Crustacean Family (Cladocera (water flea), Copepoda, and Malcostraca (only at Site 2 in 2008), Hymenoptera (bees) (Site 5), Pisces and Turbellaria.
- Several species were observed in 2008 that were not observed in 1986. These included Rhynchobdellida (leeches) and Hemiptera (true bugs, only at Sites 1, 2 and 5).
- Acari (water mites) was observed at all sites except Site 4.

Further analysis will be required to determine trends and link this information to water quality, fish and fish habitat.



Acari (Water Mites)

Odanata Larvae

Table 1. Summary of macroinvertebrates collected in 1986 and 2008.

PHYLUM	CLASS	ORDER	Site 1		Site 2		Site 3		Site 4		Site 5	
			2008	1986	2008	1986	2008	1986	2008	1986	2008	1986
ANNELIDA	OLIGOCHAETA											
		HAPLOTAXIDA	158	500	87	260	175	788	31	324	6	206
	HIRUDINEA											
		RHYNCHOBDELLIDA	0	0	1	0	0	0	0	0	0	0
ARTHRO-PODA	ARACHNOIDA											
		ACARI	31	712	66	19	117	126	0	0	45	1267
	CRUSTACEA											
		CLADOCERA	0	2	0	302	0	3	0	1370	0	4
		COPEPODA	0	45	4	239	0	4	0	4816	0	30
		MALCOSTRACA	0	0	6	53	0	0	0	0	0	0
		OSTRACODA	4	6	26	21	2	5	0	20	2	3
	IINSECTA											
		COLEOPTERA	4	12	0	0	0	0	2	1	2	4
		COLLEMBOLA	0	0	0	0	0	0	0	0	6	1
		DIPTERA	373	2574	938	4567	559	1947	253	1613	991	7006
		EPHEMEROPTERA	149	84	240	168	138	60	98	83	36	545
		HEMIPTERA	2	0	11	0	0	0	0	0	4	0
		HYMENOPTERA	0	0	0	0	0	0	0	0	0	19
		ODONATA	6	3	0	1	2	0	0	1	17	12
		PLECOPTERA	163	115	0	2	53	30	56	70	0	192
		TRICHOPTERA	87	504	9	7	108	63	97	142	28	1330
MOLLUSCA			4	52	20	2	4	0	0	0	6	0
NEMATODA			52	344	19	155	6	62	8	34	6	74
PISCES			0	0	0	0	0	0	0	4	0	0
PLATY-HELMINTHES												
	TURBELLARIA		0	2	0	0	0	13	0	17	0	0

Next Steps

Statistical analysis of abundance and diversity of invertebrates species collected will be conducted when further keying is complete and comparative statistics with 1986 data will also be provided to better assess the long-term changes in the community structure of the Milk River benthic macroinvertebrate community in Southern Alberta. These comparative statistics will help determine if macro invertebrate populations remain stable over long periods of time or if there is a response to changes in water flow that may further affect how fisheries management is conducted and how riverine systems with similar characteristics to the Milk River are managed to maintain healthy ecosystems.

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