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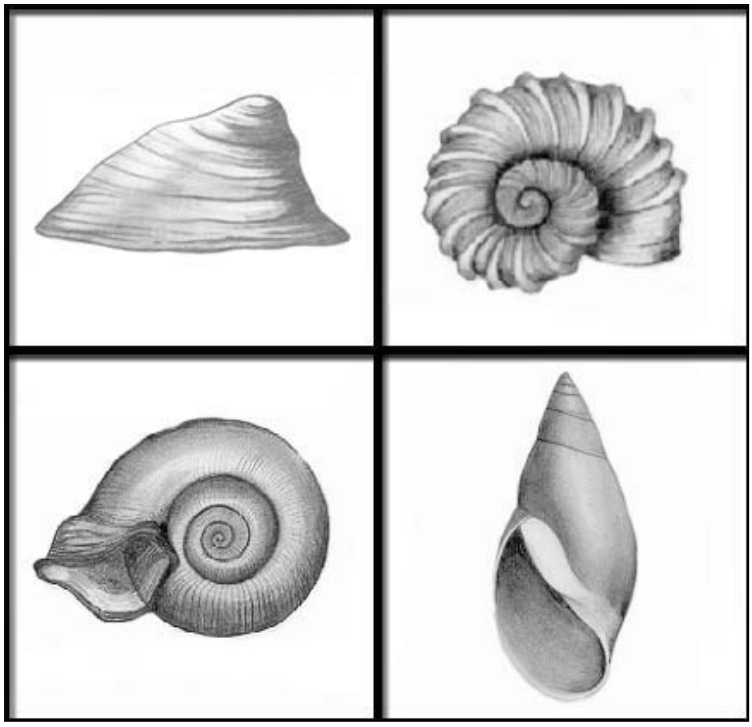
RESOURCE DATA AND SPECIES AT RISK SECTION

Survey of Aquatic Gastropods in the Central Parkland Subregion of Alberta



Alberta Species at Risk Report No. 92

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Survey of Aquatic Gastropods in the Central Parkland Subregion of Alberta

David R. C. Prescott and Medea M. Curteanu

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EXECUTIVE SUMMARY

Despite their importance in wetland systems, few studies have focused on aquatic molluscs in Alberta. Our current understanding for many species is too limited to accurately determine their range, habitat requirements and biological status. Twenty-four (30%) of 80 recognized species or subspecies of aquatic gastropods and bivalves are currently listed as being of "Undetermined" status in the province because of poor information (Clifford 2001, Lepitzki 2001). Of those that can be classified, almost half are deemed to be either "Sensitive", "May be at Risk" or "At Risk". Most authorities urge that current information be enhanced through extensive inventory efforts. In 2001, we conducted a detailed inventory of aquatic mollusks in the Central Parkland Subregion of central Alberta (representing approximately 8% of the province). Our ultimate goal was to clarify the biological risk of many species that are currently classified as being of "Undetermined" status in the province. This report deals only with the aquatic gastropods; analysis of bivalves will be reported at a future date.

To ensure representative sampling over a wide area, we collected samples from (when available) one creek, one river, one pond and one lake within each of the 1:50,000 map sheets that encompass the Subregion. Samples were collected primarily with hand nets and Eckman dredges. We recorded pH and conductivity with handheld meters at each site. Samples were later sorted and identified based on morphological characteristics, following nomenclature of Lepitkzi (2001) and Turgeon et al. (1998).

Sampling was conducted at a total of 197 sites (43 creeks, 67 lakes, 32 rivers and 55 ponds) between 14 July and 5 September 2001. Waterbodies ranged in pH from 6.0 to 10.7, and in conductivity from 0.24 to 119.1 mS. Seventeen sites (8.7%), generally alkali lakes and ponds, contained no aquatic gastropods. Of the 180 sites that supported aquatic gastropods, a total of 31,904 identifiable specimens of 32 species or subspecies were found. *Valvata tricarinata* was the most abundant species, in terms of both total numbers of specimens collected (9448) and mean number of individuals/sample (304.8). The most widely distributed species (live or dead specimens) was *Gyraulus deflectus* (54.8% of sites). The most widely distributed species based on the occurrence of live specimens was *Physella gyrina* (25.4% of sites). Twenty-one species (65.6% of total) were found at less than 10 sites in the Central Parkland Subregion.

Species showed wide tolerances to water conditions. Taxa found alive at the highest values of pH (10.7) included *Promenetus e. exacuous*, *Planorbella subcrenata*, *Lymnaea stagnalis appressa*, *Physa skinneri* and *Gyraulus circumstriatus*. *Physella gyrina* was found to live over the greatest range of pH (6.0-10.2). Live specimens of all 32 species or subspecies were found at values of conductivity <1.0 mS, but only six species were found alive in relatively alkali wetlands with conductivities >6.0 mS. *Valvata tricarinata* was found to live at conductivities as high as 42.65 mS.

We identified one species, *Planorbella campanulata*, which has not previously been recorded in Alberta. The species was found at a single site approximately 10 km southwest of Edmonton. A single shell of *Ferrissia fragilis* (apparently the second record

for Alberta) was retrieved from a site 15 km north of Edmonton. A notable range extension was observed for *Planorbella pilsbryi infracarinatum*, which was found at three sites in the Battle River system in the western half of the region. The species was previously known in Alberta only from Lac La Biche.

Based on information collected in this inventory, the current status of four species may require revision: *Valvata tricarinata* (currently listed as "Sensitive") was found to be widespread, abundant and tolerant of a broad range of water conditions; *Aplexa elongata* (currently "Secure") was sparsely distributed and of low abundance; *Gyraulus crista* (currently "Sensitive") was common and widespread; and *Menetus opercularis* (currently "May be at Risk") had a broad distribution and was locally abundant. Substantial new information was provided that will help clarify the status of many other species in the province. However, resolution of outstanding taxonomic issues and completion of inventories in other areas of Alberta will be necessary to accomplish this task.

1.0 INTRODUCTION

One group of organisms that has been largely overlooked in Alberta is the aquatic molluscs (bivalves and gastropods). These animals are widely distributed and relatively common in a variety of lentic and lotic wetland types in the province. Molluscs are therefore important components of the aquatic systems and are important food for many aquatic, semi-aquatic and terrestrial organisms (Todd 1979, Pennak 1989, Brown 2001). They are also intermediate hosts of a variety of fish and waterfowl parasites (Brown 2001). In addition, many gastropods are filter feeders, and can concentrate toxic substances. This, along with their sensitivity to hydrological regimes (oxygen, nutrients, temperatures, etc.), make them excellent bio-indicators of environmental health in landscapes influenced by activities such as pulp mills, irrigation and hydroelectric dams, deforestation, and agriculture (Hart and Fuller 1974, Clarke 1981, Clifford 1991).

Despite their importance in wetland systems, few studies have focused on aquatic molluscs in Alberta. The most significant work to date has been the efforts of Clarke (1973), who spent parts of three field seasons between 1959 and 1969 collecting specimens in Alberta. The collections were made at 78 sites in the province, with a total of 6720 specimens being gathered. As a result of his work, we now know that there are approximately 28 species of bivalves and 50 species of aquatic gastropods in the province (the taxonomy of many closely related species is under debate). Many of these species are only known from a very few sites, which likely reflects both their patchy distributions and incomplete sampling effort. In any case, our current understanding for most species is too limited to accurately determine their range, habitat requirements and biological status. The uncertain status of many species was highlighted in a recent review of these taxa conducted for Alberta Sustainable Resource Development (Clifford 2001, Lepitzki 2001). They concluded that 24 (30%) of 80 species of aquatic gastropods and bivalves were of "Undetermined" status because of poor information. Of those that could be classified, a relatively high proportion (46.4%) were deemed to be either "Sensitive", "May be at Risk" or "At Risk" in the province. The single "At Risk" species, the Banff Springs Snail (*Physella johnsoni*), is also considered to be "Endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2000). These syntheses and most other references that have assessed the status of aquatic molluscs (e.g. Clarke 1973, 1981), stress that current information on most species is weak, and must be enhanced through extensive and detailed inventory efforts.

Our main objective was to conduct a large-scale inventory of bivalves and aquatic gastropods in a wide variety of waterbodies in the Aspen Parkland of central Alberta. The work will be only the second effort to characterize aquatic mollusc populations over a large geographical area of Alberta, and will build on previous work by Clarke in the early 1960s. Our ultimate goal is to clarify the biological risk of many species that are currently classified as being of "Undetermined" status in the province. This will allow wetland managers to apply particular attention to species that are at high risk of extirpation in Alberta, that have unique or narrow habitat requirements, or that are highly sensitive to human activities. This report deals only with the aquatic gastropods. Analysis of bivalves collected during this study will be reported at a future date.

2.0 METHODS

The Central Parkland Subregion, one of three subregions comprising the Aspen Parkland Natural Region in Alberta (see Achuff 1994 for description of Natural Regions and Subregions), is a transitional zone between the Grassland and Boreal Forest Natural Regions. The Central Parkland Subregion encompasses approximately 53,400 km^2 (about 8% of Alberta), and is characterized by an interspersion of grasslands and trembling aspen (*Populus tremuloides*) groves, and a wide variety of permanent and ephemeral wetland types. The subregion supports the highest human population in Alberta. As a consequence, both upland and wetland habitats have been radically altered by human activities over the past 100 years (Alberta Environmental Protection 1997).

During the summer of 2001, we sampled aquatic molluscs across the entire Central Parkland Subregion. To ensure representative sampling from a variety of areas and wetland types, we attempted to sample one lake (generally a named, permanent wetland), one river (generally a named watercourse >20 m in width at the point of sampling), one creek (often unnamed watercourse <10 m in width), and one pond (usually an unnamed waterbody <30 ha in size) within each of the approximately 70, 1:50,000 map sheets that cover the subregion. We also attempted to sample one alkali wetland in each mapsheet in the eastern half of the subregion. Sample sites were chosen primarily for their accessibility by road, and presence of suitable launch sites for boats, when necessary.

A variety of sampling techniques were used at each site, depending on wetland size, water depth, substrate type, and complexity of emergent vegetation and other habitats (for general discussion of sampling techniques see Clarke 1981 or Dillon in press). These techniques included: 1) use of an Eckman dredge in deeper waters (>1.5 m) or off bridges, 2) sweeping with hand-nets off lake and river bottoms, and 3) sweeping with hand-nets through emergent vegetation, and (4) hand-picking of larger shells along shorelines. Small boats were used to access larger or deeper wetlands, whereas smaller or shallow areas were sampled using chest or hip-waders. Sampling continued until it was deemed a representative sample of molluscs had been collected (generally <30 minutes). At each site, we recorded pH and conductivity (mS) using handheld meters, and recorded the location with handheld GPS units. Notes were recorded on the particular sampling techniques used at each site. Preliminary cleaning of samples was done on site to remove large debris so that samples could be stored in 500 or 1000 ml jars containing 70% ethanol. All sampling equipment was rinsed before proceeding to the next site, in order to prevent cross-contamination of samples. Upon return to the laboratory, samples were cleaned and placed in smaller sample vials. In some cases, samples contained a large number (>500) of specimens. These samples (approximately 25% of collection sites) were usually split into smaller subsamples (generally 50%) for final cleaning and analysis. In all cleaned samples, bivalves were removed and stored separately in ethanol for future analysis.

Like many large and poorly studied taxa, the classification of aquatic gastropods is the source of considerable debate (Burch 1989). Because our work was primarily an attempt to clarify the status of species evaluated by Lepitzki (2001), we adopted the nomenclature

therein. His nomenclature closely follows that of Turgeon et al. (1998), which is the most widely used reference for common and scientific names of molluscs in North America. However, Lepitzki (2001) refers to several subspecies that are not recognized by Turgeon et al. (1998). These subspecies are also recognized in the current study. A list of names used by Lepitzki (2001) and this study, are compared with those of Turgeon et al. (1998) and Clarke (1981) in Table 1.

To aid in identification, a dichotomous key (available from the authors) was developed, based primarily on morphological descriptions of Clarke (1981). Other guides, such as Burch (1989) were also consulted, as were specimens of known identity obtained from various museums and universities (see Acknowledgements). We also developed a reference collection of the taxa we encountered. Reference specimens, along with all collected samples, are archived in the Provincial Museum of Alberta for future reference. A representative specimen of each taxon in the reference collection was photographed (see Appendix 1) through a Leica MZ16 dissecting microscope, using a Canon S40 digital camera, fibre optic lighting, and Remote Capture software for Macintosh.

Specimens were identified to the species (and occasionally subspecies) level based on morphological characteristics. Examination was facilitated with a dissecting microscope. Calipers were used to measure shells when required for identification. The number of individuals of each species or recognized subspecies in each sample was tallied. Juveniles were included in counts when positive identification was possible. We also noted whether at least one shell of each species or subspecies contained fleshy tissue, indicating that live specimens were present in the local population. If samples had previously been split into smaller units for counting (see above), an appropriate correction factor was used to determine the total number of individuals of each taxon present. We subsequently classified the species as being "rare" (1 individual), "uncommon" (2-10 individuals), "common" (11-100 individuals), or "abundant" (>100 individuals) in each sample.

Data for each species were compiled into a one-page summary that included a photograph, a map showing sites where the species was found, a summary of abundance, distribution and habitat characteristics where the species was collected, and a textual synthesis of information relative to the species' status in the region (see Appendix 1).

3.0 RESULTS

Sampling was conducted at a total of 197 sites in the Central Parkland Subregion (Figure 1, Appendix 2) between 14 July and 5 September 2001. A small number (13) of sites were outside of the recognized boundaries of the subregion. Ten of these were in the Boreal Forest Natural Region (Dry Mixedwood Subregion), whereas three were in the Grassland Natural Region (Northern Fescue Subregion). All but one of these sites was within 10 km of the Central Parkland Subregion. The exception was Wabamum Lake, which was approximately 30 km west of the Subregion boundary. All 13 sites were situated in "parkland-like" habitats, and are included in the study as being representative

Table 1. Comparison of species/subspecies nomenclature used in this report (following Lepitzki 2001) versus that used in Turgeon et al. (1998) and Clarke (1981). Current risk status is from Lepitzki (2001).

This Study/Lepitzki 2001	Turgeon et al. 1998	Clarke 1981	Current Status
Valvata lewisi lewisi	*Valvata lewisi*	*Valvata sincera sincera*	Sensitive
Valvata sincera sincera	*Valvata sincera*	*Valvata sincera helicoidea*	Sensitive
Valvata tricarinata	*Valvata tricarinata*	*Valvata tricarinata*	Sensitive
Fossaria dalli	*Fossaria dalli*	*Bakerilymnaea dalli*	Sensitive
Fossaria galbana	*Fossaria galbana*	*Fossaria decampi*	Sensitive
Fossaria modicella	*Fossaria modicella*	*Fossaria modicella*	Secure
Lymnaea stagnalis appressa	*Lymnaea stagnalis*	*Lymnaea stagnalis jugularis*	Secure
Stagnicola caperata	*Stagnicola caperatus*	*Stagnicola caperata*	Secure
Stagnicola catascopium catascopium	*Stagnicola catascopium*	*Stagnicola catascopium catascopium*	Undetermined
Stagnicola elodes	*Stagnicola elodes*	*Stagnicola elodes*	Secure
Stagnicola exilis	*Stagnicola exilis*	*Stagnicola reflexa*	Undetermined
Aplexa elongata	*Aplexa elongata*	*Aplexa hypnorum*	Secure
Physa skinneri	*Physa skinneri*	*Physa jennessi skinneri*	Undetermined
Physella gyrina	*Physella gyrina*	*Physa gyrina gyrina*	Secure
Gyraulus circumstriatus	*Gyraulus circumstriatus*	*Gyraulus circumstriatus*	Secure
Gyraulus crista	*Gyraulus crista*	*Armiger crista*	Sensitive
Gyraulus deflectus	*Gyraulus deflectus*	*Gyraulus deflectus*	Secure
Gyraulus parvus	*Gyraulus parvus*	*Gyraulus parvus*	Secure
Helisoma anceps anceps	*Helisoma anceps*	*Helisoma anceps anceps*	Sensitive
Menetus opercularis	*Menetus opercularis*	*Menetus cooperi*	May be at Risk
Planorbella binneyi	*Planorbella binneyi*	*Helisoma trivolvis binneyi*	Undetermined
Planorbella pilsbryi infracarinatum	*Planorbella pilsbryi*	*Helisoma pilsbryi infracarinatum*	Undetermined
Planorbella subcrenata	*Planorbella trivolvis* (in part)	*Helisoma trivolvis subcrenatum*	Secure
Planorbella campanulata[a]	*Planorbella campanulata*	*Helisoma campanulatum campanulatum*	Not Assessed
Planorbula armigera	*Planorbella armigera*	*Planorbula armigera*	Sensitive
Planorbula campestris	*Planorbella campestris*	*Planorbula campestris*	Sensitive
Promenetus exacuous exacuous	*Promenetus exacuous* (in part)	*Promenetus exacuous exacuous*	Secure
Promenetus exacuous megas	*Promenetus exacuous* (in part)	*Promenetus exacuous megas*	Sensitive
Promenetus umbilicatellus	*Promenetus umbilicatellus*	*Promenetus umbilicatellus*	Sensitive
Ferrissia fragilis	*Ferrissia fragilis*	*Ferrissia fragilis*	Undetermined
Ferrissia rivularis	*Ferrissia rivularis*	*Ferrissia rivularis*	Undetermined
Ferrissia parallelus	*Ferrissia parallela*	*Ferrissia parallela*	Undetermined

[a] not listed by Lepitzki (2001), so name from Turgeon et al. (1998) used.

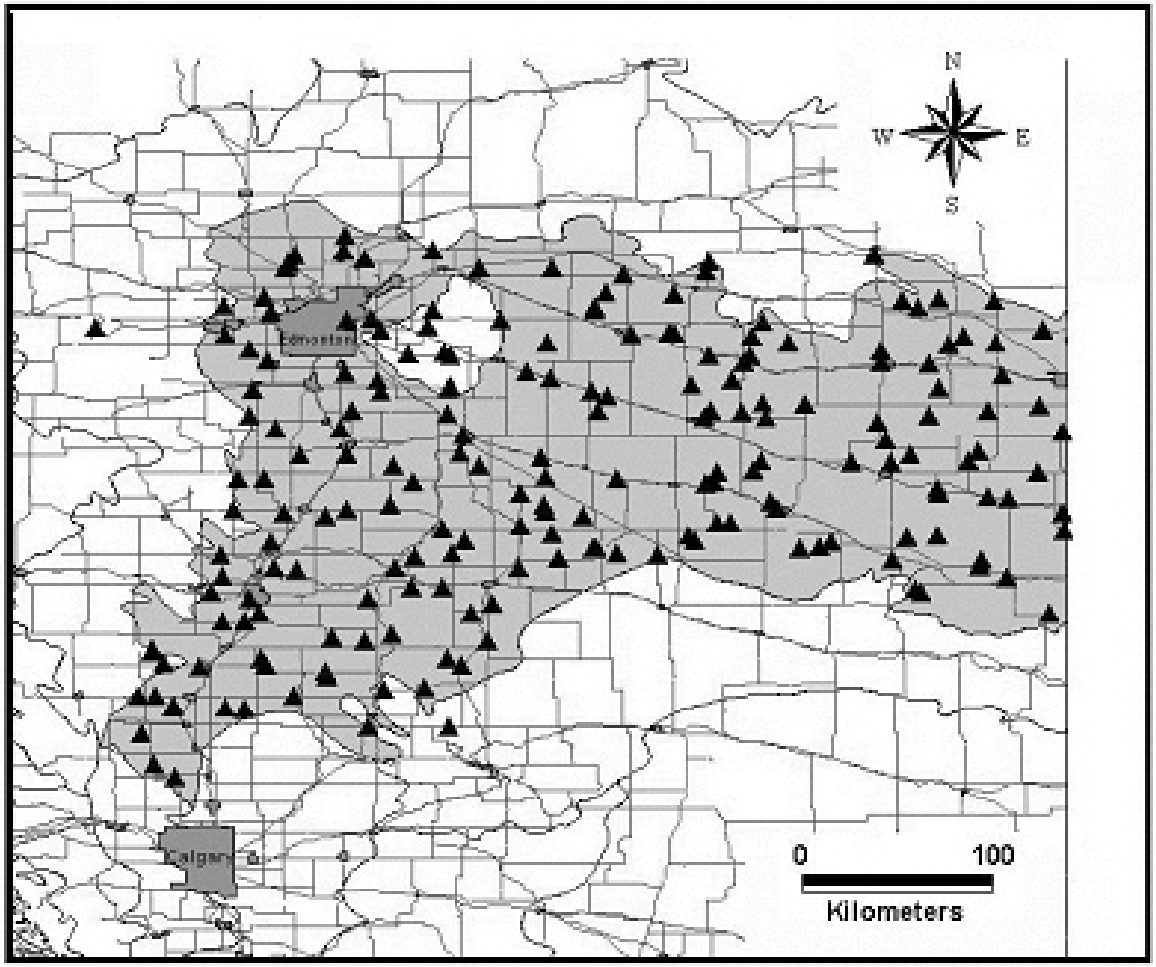

Figure 1. Location of 197 sites sampled during aquatic mollusc inventories in the Central Parkland Subregion of Alberta in 2001.

of the area. Sites included 43 creeks (21.8% of total), 67 lakes (34.0%), 32 rivers (16.3%) and 55 ponds (27.9%). These waterbodies ranged in pH from 6.0 to 10.7 (mean=8.8 $\pm$ 0.1 [SE]), and in conductivity from 0.24 to 119.1 mS (mean = 3.66 $\pm$ 0.77).

Seventeen sites (8.7%) contained no aquatic gastropods. Fourteen of these sites were alkali lakes or ponds, which tended to have higher pH (9.32 vs. 8.73; T=1.65, df=194, $p<0.01$) and higher conductivity (20.17 vs. 2.20 mS; T=7.1, df=194, $p<0.0001$) than sites where specimens were present. Terrestrial species (total of 378 individuals, usually empty shells) were found at 64 sites, including one of the sites where no aquatic species were found. *Succinea sp*. was the most commonly encountered terrestrial species (194 individuals at 43 sites).

Of the 180 sites that supported aquatic gastropods, a total of 31,904 identifiable specimens of 32 species or subspecies were found (Table 2). *Valvata tricarinata* was the most abundant species, in terms of both total numbers of specimens collected (9448) and

mean number of individuals/sample (304.8), although it ranked only 11th in terms of number of sites occupied. The most widely distributed species (live or dead specimens) was *Gyraulus deflectus*, which was found at 54.8% of sites, although the percentage of sites occupied by live specimens ranked 6th (14.7%). The most widely distributed species determined by the presence of live specimens was *Physella gyrina* (25.4% of sites). Twenty-one species (65.6% of total) were found at less than 10 sites in the Central Parkland Subregion (Table 2).

Individual species showed great differences in the mean and range of water pH and conductivity where live specimens were found (Table 3). However, caution must be expressed in inferring that these ranges represent "tolerances", as the number of sites where live specimens occurred was undoubtedly underrepresented, the ranges of water conditions in the region may be smaller than some species could tolerate (especially for pH, where only one site had pH<7.0), and because sample sizes for many species were small. Species found alive at the highest pH values recorded in the study site (10.7) were *Promenetus e. exacuous*, *Planorbella subcrenata*, *Lymnaea stagnalis appressa*, *Physa skinneri* and *Gyraulus circumstriatus*. The species found living over the greatest range of pH was *Physella gyrina* (6.0-10.2). Other species found over a wide pH range (>3.5 units) include *Gyraulus deflectus* (6.0-9.9), *Stagnicola elodes* (6.0-9.8), *Planorbella subcrenata* and *Lymnaea stagnalis appressa* (both 7.0-10.7). Live specimens of all 32 species or subspecies were found at values of conductivity <1.0 mS, but only six species were found alive in relatively alkali wetlands with conductivities >6.0 mS. Most notable was *Valvata tricarinata*, which was found to live at conductivities as high as 42.65 mS. Other species found in these alkali wetlands were *Stagnicola elodes* (maximum conductivity 16.11 mS), *Physa skinneri* (8.78 mS), *Planorbella subcrenata* (8.65 mS), *Menetus opercularis* and *Gyraulus deflectus* (both 6.50 mS).

The inventory of the Central Parkland Subregion yielded several notable records. We identified one species, *Planorbella campanulata*, which has not previously been recorded in Alberta. The species was found at a single site (17 specimens, including live individuals) in an unnamed pond approximately 10 km southwest of Edmonton. *P. campanulata* is known to be common across eastern North America as far west as central Saskatchewan, and may also occur in the lower Fraser River of British Columbia (Clarke 1981; referred to as *Helisoma campanulatum campanulatum*). A single empty shell of *Ferrissia fragilis* was retrieved from an unnamed pond approximately 15 km north of Edmonton. Clarke (1981) describes this species as being "common" in still-water habitats in southwestern British Columbia and in southern Ontario and Quebec, and as being "widely distributed" in the United States. This record is apparently the second for Alberta, with the only previous record occurring in the Mariana Lakes in northeastern Alberta (Lepitzki 2001). A notable range extension was observed for *Planorbella pilsbryi infracarinatum*, which was found at three sites in the Battle River system in the western half of the region. The species was previously known in Alberta only from Lac La Biche (Clarke 1973, Lepitzki 2001).

Table 2. Summary of abundance and occurrence data for species (and identifiable subspecies) of aquatic gastropods in the Central Parkland Subregion of Alberta in 2001. Total number of specimens, and mean #/sample are for all specimens retrieved (live or dead), whereas the percentage of sites where found are separated for all specimens, and for sites where only live specimens were found. Numbers in parentheses are ranks.

Species/Subspecies	Total # individuals	% sites found (all individuals)	% sites found (at least one live individual)	Mean #/sample (all)
Valvata lewisi lewisi	25 (20)	2.0 (22)	2.0 (13)	6.3 (20)
Valvata sincera sincera	461 (13)	6.1 (15)	1.5 (15)	38.4 (3)
Valvata tricarinata	9448 (1)	15.7 (11)	8.6 (8)	304.8 (1)
Fossaria dalli	73 (16)	9.6 (12)	1.5 (15)	3.8 (24)
Fossaria galbana	199 (14)	3.6 (17)	2.5 (12)	28.4 (6)
Fossaria modicella	9 (26)	1.0 (26)	0.0 (28)	4.5 (22)
Lymnaea stagnalis appressa	1109 (11)	35.5 (6)	22.3 (2)	15.8 (14)
Stagnicola caperata	127 (15)	7.1 (14)	1.5 (15)	9.1 (18)
Stagnicola catascopium catascopium	16 (23)	0.5 (29)	0.5 (21)	16.0 (13)
Stagnicola elodes	1914 (5)	45.2 (4)	20.8 (5)	21.5 (11)
Stagnicola exilis	23 (21)	2.5 (18)	0.5 (21)	4.6 (21)
Aplexa elongata	33 (18)	5.6 (16)	0.5 (21)	3.0 (25)
Physa skinneri	1400 (6)	47.2 (2)	22.3 (2)	15.1 (15)
Physella gyrina	2152 (4)	37.6 (5)	25.4 (1)	29.1 (5)
Gyraulus circumstriatus	1160 (10)	23.4 (9)	11.2 (7)	25.2 (9)
Gyraulus crista	1303 (7)	30.0 (8)	7.6 (9)	22.1 (10)
Gyraulus deflectus	3598 (3)	54.8 (1)	14.7 (6)	33.3 (4)
Gyraulus parvus	5693 (2)	34.0 (7)	2.0 (13)	85.0 (2)
Helisoma anceps anceps	66 (17)	2.5 (18)	1.0 (18)	13.2 (17)
Menetus opercularis	484 (12)	9.1 (13)	3.6 (11)	26.9 (8)
Planorbella binneyi	5 (28)	1.0 (26)	0.0 (28)	2.5 (28)
Planorbella pilsbryi infracarinatum	12 (25)	1.5 (24)	0.5 (21)	4.0 (23)
Planorbella subcrenata	1247 (9)	47.2 (2)	22.3 (2)	13.4 (16)
Planorbella campanulata	17 (22)	0.5 (29)	0.5 (21)	17.0 (12)
Planorbula armigera	3 (30)	1.0 (26)	0.0 (28)	1.5 (30)
Planorbula campestris	8 (27)	2.5(18)	0.5 (21)	1.6 (29)
Promenetus exacuous exacuous	1269 (8)	22.8 (10)	6.6 (10)	28.2 (7)
Promenetus exacuous megas	29 (19)	2.0 (22)	1.0 (18)	7.3 (19)
Promenetus umbilicatellus	4 (29)	1.5 (24)	1.0 (18)	1.3 (31)
Ferrissia fragilis	1 (32)	0.5 (29)	0.0 (28)	1.0 (32)
Ferrissia rivularis	13 (24)	2.5 (18)	0.5 (21)	2.6 (27)
Ferrissia parallelus	3 (30)	0.5 (29)	0.0 (28)	3.0 (25)

Table 3. Species arranged in ascending order of mean pH (A) and conductivity (B). Means were only calculated for sites where live specimens were found (sample size in parentheses beside species name). Five species are omitted (*Fossaria modicella*, *Planorbella binneyi, Planorbula armigera, Ferrissia fragilis* and *Ferrissia parallelus)* as no live specimens were found at any sites.

A. pH

Species/Subspecies	Mean pH (range)
Promenetus umbilicatellus (2)	7.6 (7.4-7.8)
Planorbula campestris (1)	7.7
Promenetus exacuous megas (2)	7.7 (7.5-7.8)
Aplexa elongata (1)	7.8
Fossaria galbana (5)	8.1 (6.0-9.3)
Valvata lewisi lewisi (4)	8.1 (7.7-8.6)
Planorbella campanulata (1)	8.1
Promenetus e. exacuous (13)	8.5 (7.5-10.7)
Stagnicola elodes (41)	8.5 (6.0-9.8)
Gyraulus deflectus (29)	8.6 (6.0-9.9)
Planorbella subcrenata (44)	8.6 (7.0-10.7)
Gyraulus crista (15)	8.7 (7.7-9.5)
Physella gyrina (50)	8.7 (6.0-10.2)
Valvata sincera sincera (3)	8.7 (8.1-9.1)
Lymnaea stagnalis appressa (44)	8.8 (7.0-10.7)
Fossaria dalli (3)	8.8 (7.8-9.5)
Menetus opercularis (7)	8.8 (7.8-9.5)
Physa skinneri (44)	8.9 (7.4-10.7)
Gyraulus parvus (4)	8.9 (7.7-9.5)
Helisoma anceps anceps (2)	8.9 (8.6-9.2)
Stagnicola caperata (3)	8.9 (8.0-9.5)
Stagnicola c. catascopium (1)	9.0
Gyraulus circumstriatus (22)	9.1 (7.8-10.7)
Valvata tricarinata (17)	9.1 (8.1-10.0)
Stagnicola exilis (1)	9.2
Ferrissia rivularis (1)	9.3
Planorbella pilsbryi infracarinatum (1)	9.9

B. Conductivity (mS)

Species/Subspecies	Mean conductivity (range)
Ferrissia rivularis (1)	0.30
Helisoma anceps anceps (2)	0.33 (0.24-0.41)
Stagnicola c. catascopium (1)	0.34
Valvata sincera sincera (3)	0.41 (0.35-0.45)
Planorbella campanulata (1)	0.43
Valvata lewisi lewisi (4)	0.44 (0.31-0.57)
Stagnicola exilis (1)	0.46
Gyraulus parvus (4)	0.48 (0.24-0.77)
Physella gyrina (50)	0.62 (0.24-2.50)
Fossaria dalli (3)	0.64 (0.50-0.82)
Planorbella pilsbryi infracarinatum (1)	0.64
Planorbula campestris (1)	0.66
Aplexa elongata (1)	0.82
Promenetus e. exacuous (13)	0.93 (0.47-1.45)
Fossaria galbana (5)	1.01 (0.30-3.65)
Lymnaea stagnalis appressa (44)	1.04 (0.29-3.65)
Promenetus exacuous megas (5)	1.06 (0.82-1.30)
Stagnicola caperata (3)	1.18 (0.59-1.68)
Promenetus umbilicatellus (2)	1.22 (0.82-1.62)
Gyraulus circumstriatus (22)	1.28 (0.29-4.29)
Planorbella subcrenata (44)	1.33 (0.31-8.65)
Gyraulus crista (15)	1.34 (0.45-3.01)
Menetus opercularis (7)	1.55 (0.45-6.50)
Gyraulus deflectus (29)	1.58 (0.24-6.50)
Stagnicola elodes (41)	1.93 (0.30-16.11)
Physa skinneri (44)	2.05 (0.33-8.78)
Valvata tricarinata (17)	3.15 (0.29-42.65)

Summary accounts for each of the 32 species or subspecies found during the survey are found in Appendix 1. Information on each of the 197 collection sites, including numbers of each species/subspecies collected, is provided in Appendix 2.

4.0 DISCUSSION

The majority of species listed by Lepitzki (2001) as occurring in central Alberta were found during this study. Several species that were not detected include four species of *Fossaria* (*F. bulimoides, F. parva*, *F. rustica* and *F. obrussa*) that are of uncertain taxonomy, and may not represent valid species (Burch 1989, Lepitzki 2001). The ranges of two additional species, *Stagnicola traski* and *Physa jennessi* are largely outside of the Central Parkland, although their presence in our study area cannot be ruled out. *Physa megalochlamys*, a recently defined species in western North America (Taylor 1988), is very similar to *P. skinneri*, and no attempt was made to separate the two species in this study (all were considered to be *P. skinneri*). However, *P. megalochlamys* is believed to occur in southern Saskatchewan and Alberta, and possibly throughout British Columbia (Taylor 1988, Lee 2000, Lepitzki 2001). It is therefore probable that some of our specimens of *P. skinneri* may actually be of *P. megalochlamys*. One specimen of *Probythinella emarginata* was found in a sample that was collected before organized sampling for this study began. Location data was not recorded (it was likely from the eastern part of the region), and the specimen was eventually lost. The species is therefore present, but apparently very rare in central Alberta. *P. emarginata* has been reported from several sites in Alberta (Lepitzki 2001).

Our primary intent in this inventory was to better define the distribution and population size of aquatic gastropods in central Alberta, and thereby help clarify the risk status of species in the province. For many species, such clarification is difficult to achieve, because the taxonomy and identification are unclear (e.g. *Fossaria* spp., *Stagnicola* spp., *Planorbella* spp.), because the generalized sampling technique we used underestimated occurrence and abundance (e.g. *Ferrissia* spp.), or because the distribution and abundance in central Alberta may not be reflective of the rest of the province. Nevertheless, the Central Parkland Subregion supports the vast majority of species found in the province as a whole, so the status of species in this region has significant bearing on the provincial status for many taxa. Given this, the following species may be candidates for a revision of status in the future (see Appendix 1 for more detailed discussion of individual species and Lepitzki 2001 for derivation of current status ranks):

(1) *Valvata tricarinata*: Currently listed as “Sensitive”, but found in this study to be widespread, often abundant, and with wide tolerance to water conditions

(2) *Aplexa elongata*: Currently listed as “Secure”, but found to be sparsely distributed and of low abundance

(3) *Gyraulus crista*: Currently listed as “Sensitive”, but found to be common and widespread

(4) *Menetus opercularis*: Currently listed as “May be at Risk”, but found to have a broad distribution and to be locally abundant.

(5) *Planorbella campanulata*, a new species for the province that was found during this inventory, will need to be considered for assignment of an appropriate status.

Our inventory is probably the most intensive conducted to date in the province, but covered only a single Natural Subregion, which encompasses a small proportion (8%) of the provincial land base. It is clear that much more study of aquatic gastropods is necessary in Alberta, and we hope that our work will prompt similar efforts in other parts of the province. Such surveys will be necessary to clarify the status of a number of species, and if repeated, will provide data required for detecting temporal and spatial changes in distribution resulting from human activities. Given the poor information for many aquatic gastropods, any future studies will contribute greatly to our knowledge of the ecology, status, and ultimately the conservation of this valuable aquatic resource.

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Appendix 1. Summary accounts for 32 species and subspecies of aquatic gastropods found during the 2001 inventory in Alberta's Central Parkland Subregion. See text for complete description of nomenclature, status, and sampling methodology. Refer to Clarke (1981) and Burch (1989) for definitions and descriptions of morphological terms.

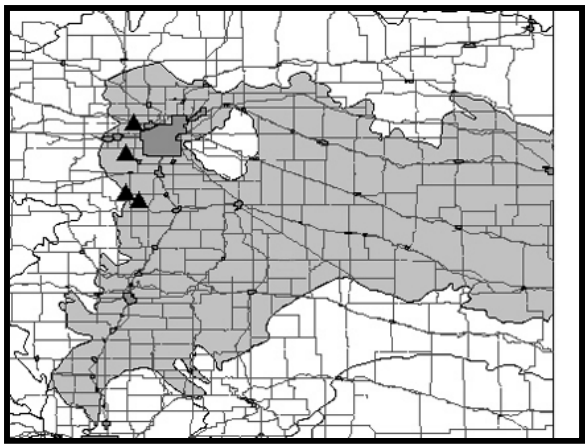
Notes to "Characteristics" section of Appendix 1:

(1) Wetland use is presented as raw percentages, along with percent difference in use relative to availability (in parentheses). Difference in use is based on creeks, lakes, rivers and ponds representing 21.8%, 34.0%, 16.3%, and 27.9% of sites sampled, respectively (see text).
(2) Mean #/sample is based on all individuals (alive or dead), for sites where species or subspecies was found.
(3) Abundance classes are: "Rare" (1 individual), "Uncommon" (2-10 individuals), "Common" (11-100 individuals), and "Abundant" (>100 individuals), and include both live and dead specimens in a sample.

Valvata lewisi lewisi

Fringed valvata

Current Status: Sensitive



Valvata lewisi lewisi is similar to *V. sincera sincera* in having a small depressed shell, dextral coiling and moderately elevated spire (Clarke 1981; where *V. l. lewisi* is referred to as *Valvata sincera sincera, and V. s. sincera* is referred to as *V. lewisi helicoidea* [see Burch 1989]). As well, the operculum, which is characteristic of live specimens of this genus, is round, horny and multispiral (Clarke 1981). *V. l. lewisi* can be differentiated by the lower spire and the presence of conspicuous surface lamellae or fine blade-like ridges present in fresh specimens (Clarke 1981).

V. l. lewisi has a broad distribution across North America, from Newfoundland to British Columbia and north to the Yukon Territory. The range extends south in the United States to Maine and Minnesota (Clarke 1981). The subspecies is believed to intergrade with *V. s. sincera* where their ranges overlap (Clarke 1981). *V. l. lewisi* is most commonly found in lakes, often at considerable depths, as well as on mud among submerged vegetation (Clarke 1981). In British Columbia, the subspecies is common throughout the province and is listed as "secure" (Lee 2000). In Alberta, *V. l. lewisi* has been found at a variety of locations in all natural regions except the Canadian Shield (Lepitzki 2001). It appears to be absent from west-central parts of the province (Clarke 1981, Lepitzki 2001).

Surveys in the Central Parkland Subregion found *V. l. lewisi* to have a localized distribution. The subspecies was collected from 4 (2.0%) sites, all in the northwestern corner of the Subregion to the west and southwest of Edmonton. At the locations where it was found, the subspecies was most often observed to be "rare" (1 individual), with a maximum of 20 individuals being retrieved from a site. Living specimens were found at all sites. These sites spanned a relatively narrow range of pH (7.7 to 8.6) and conductivity (0.31 to 0.57 mS).

Valvata lewisi lewisi has a limited distribution in the Central Parkland Subregion, and, where it occurs, is uncommon and lives in a fairly narrow range of water conditions.

Characteristics

Present at 4 (2.0%) of 197 sites
Alive at 4 (2.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	25.0%	+53.4%
Lake	25.0%	-26.5%
Creek	0.0%	-100.0%
Pond	50.0%	+79.2%

Abundance:
Mean #/sample: 6.3 (range: 1-20)

Rare: 50.0% Common: 25.0%
Uncommon: 25.0% Abundant: 0.0%

Water Chemistry:

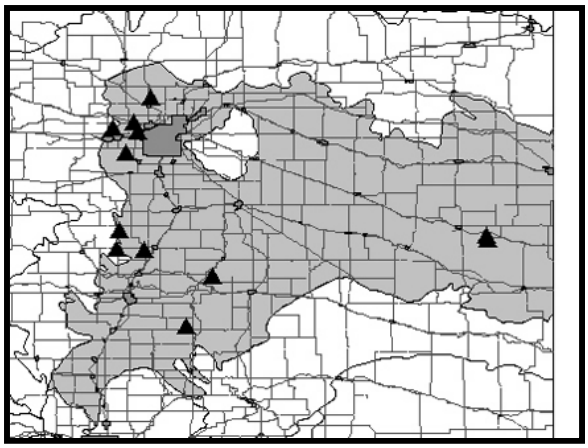
All Sites
Mean pH: 8.1 (range: 7.7-8.6)
Mean conductivity: 0.44 mS (range: 0.31-0.57)

Sites With Live Specimens
Mean pH: 8.1 (range: 7.7-8.6)
Mean conductivity: 0.44 mS (range: 0.31-0.57)

Valvata sincera sincera

Mossy valvata

Current Status: Sensitive



Valvata sincera sincera is identified by its small depressed shell, dextral coiling and moderately elevated spire (Clarke 1981; referred to as *Valvata sincera helicoidea*). The operculum, present in live specimens, is round, horny, and multispiral. In comparison to *V. lewisi lewisi*, adult shells of *V. s. sincera* are larger, lack surface lamellae and have finer, more crowded collabral lines (Clarke 1981). There has been some confusion regarding the identification and nomenclature of *V. s. sincera* and *V. l. lewisi* in the literature (Burch 1989, Lee 2000, Lepitzki 2001).

V. s. sincera is described as an arctic and subarctic species, occurring from Alaska to Labrador and south to James Bay. A more southerly, disjunct population is reported to cover a broad area of west-central Alberta (Clarke 1981). *V. s. sincera* lives among aquatic vegetation in a variety of habitats such as lakes, ponds, slow-moving streams and rivers, and muskeg pools (Clarke 1981). In British Columbia, the species, when identified according to Burch (1989), is common throughout the province and is listed as "secure" (Lee 2000). In Alberta, the species has been found at several locations in all natural regions except the Grasslands (Lepitzki 2001).

Surveys in the Central Parkland Subregion suggest a broad, although sparse, distribution. *V. s. sincera* was collected from 12 (6.1%) sites sampled, mostly in the western parts of the region. It occurred in a variety of habitats, but was most typically found in rivers and lakes. At the locations where it was found, the species was most often observed to be "uncommon" or "common" (2-100 individuals). However, the species was occasionally found to be "abundant" with a maximum of 169 individuals being retrieved from a site. Living specimens were found over a moderate pH range of 8.1 to 9.1, and over a relatively narrow range of conductivities (0.35 to 0.45 mS).

Valvata sincera sincera has a limited distribution, is rarely abundant, and occurs over a fairly narrow range of water conditions in Alberta's Central Parkland Subregion.

Characteristics

Present at 12 (6.1%) of 197 sites
Alive at 3 (1.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	25.0%	+53.4%
Lake	41.7%	+22.6%
Creek	8.3%	-61.9%
Pond	25.0%	-10.4%

Abundance:
Mean #/sample: 38.4 (range: 1-169)

Rare: 16.7% Common: 50.0%
Uncommon: 25.0% Abundant: 8.3%

Water Chemistry:

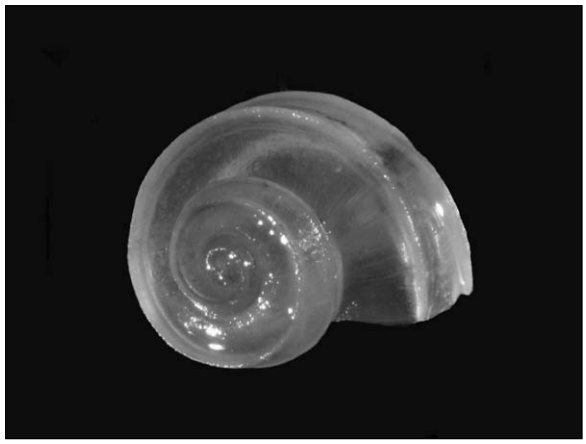
All Sites
Mean pH: 8.5 (range: 7.9-9.1)
Mean conductivity: 0.54 mS (range: 0.29-0.98)

Sites With Live Specimens
Mean pH: 8.7 (range: 8.1-9.1)
Mean conductivity: 0.41 mS (range: 0.35-0.45)

Valvata tricarinata

Threeridge valvata

Current Status: Sensitive

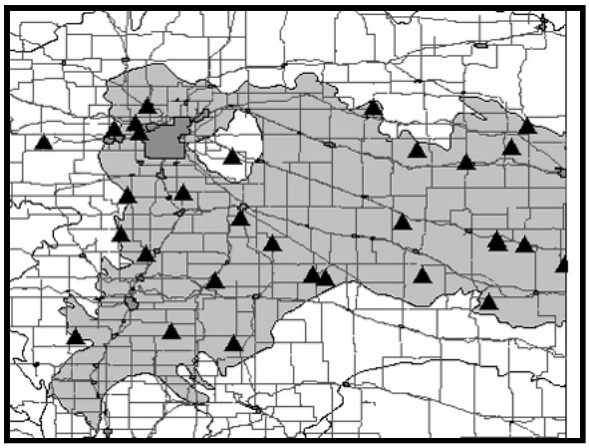


Valvata tricarinata is easily identified by the unique presence of three prominent carinae, or spiral ridges, around a flattened body whorl (Clarke 1981). Adult shells are small, solid and depressed, generally reaching a height of 5 mm. The operculum, which is present in live specimens, is round, horny, and multispiral (Clarke 1981). The shell is generally green and translucent, although brownish individuals may also be encountered.

V. tricarinata has a broad distribution across North America. The range extends from New Brunswick to eastern British Columbia and the Northwest Territories up to the tree line, and south to Virginia, Iowa and Nebraska (Clarke 1981). The species lives in vegetated, perennial waterbodies such as lakes, rivers, streams and muskeg pools, and occasionally in ponds (Clarke 1981). In British Columbia, the species has been found at only one location and is listed as being of "historical occurrence" (Lee 2000). In Alberta, *V. tricarinata* has been previously found in all natural regions, but is apparently absent from the southwestern corner of the province (Lepitzki 2001).

Surveys in the Central Parkland Subregion indicate that this species is of widespread distribution, and can reach high abundances. *V. tricarinata* was found at 31 (15.7%) sites, with a strong bias towards occurring in larger rivers and lakes. At locations where it was found, *V. tricarinata* was most often described as being "common" or "abundant" (>10 individuals). In addition, the species had the highest average abundance (304.8 specimens/sample) and the greatest total number of specimens observed (9448) of all the species identified in this study (Table 2). Living specimens were found over a pH range of 8.1 to 10.0, and at conductivities of 0.29 to 42.65 mS. The species was far more tolerant of alkali conditions (i.e., high conductivity) than any other species in central Alberta (Table 3).

Valvata tricarinata has a widespread distribution, is often abundant, and has a wide tolerance to water conditions in Alberta's Central Parkland Subregion. The current status of "Sensitive" (Lepitzki 2001) may require revision to a lower risk category.



Characteristics

Present at 31 (15.7%) of 197 sites
Alive at 17 (8.6%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	35.5%	+117.8%
Lake	51.6%	+51.8%
Creek	3.2%	-85.3%
Pond	9.7%	-65.2%

Abundance:

Mean #/sample: 304.8 (range: 1-5856)

Rare: 9.7% Common: 32.3%
Uncommon: 19.4% Abundant: 38.7%

Water Chemistry:

All Sites

Mean pH: 9.0 (range: 7.8-10.0)
Mean conductivity: 2.20 mS (range: 0.29-42.65)

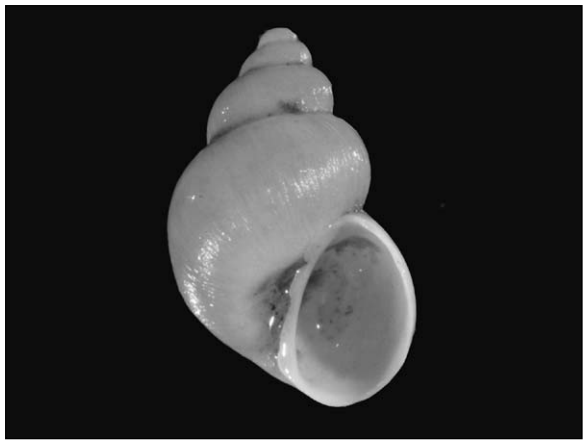
Sites With Live Specimens

Mean pH: 9.1 (range: 8.1-10.0)
Mean conductivity: 3.15 mS (range: 0.29-42.65)

Fossaria dalli

Dusky fossaria

Current Status: Sensitive

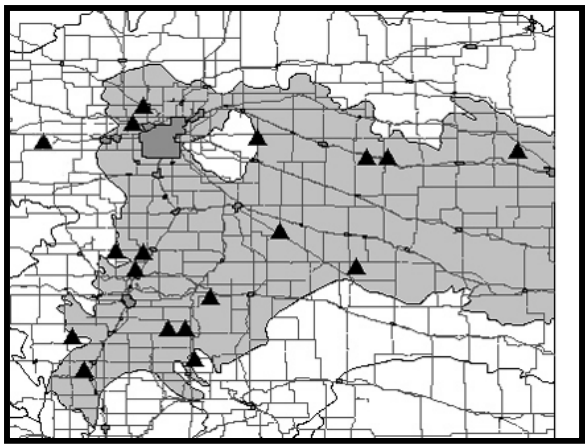


Fossaria dalli is the smallest species of lymnaeid snail in Alberta. The unique characteristic of this species is the large number of whorls in relation to its small size (<6 mm long) (Clarke 1981; referred to as *Bakerilymnaea dalli*). The species can also be identified by its round aperture, continuous lip, strongly shouldered whorls, deep sutures, and thread-like collabral lines on the shell surface.

F. dalli has a limited distribution in Canada. Clarke (1981) reported that the species has been found in southern Ontario, and from southern Manitoba to eastern British Columbia. Lee (2000), however, reports that the species has not been found in British Columbia. In the United States, *F. dalli* ranges from Ohio to Arizona (Clarke 1981). The species lives among vegetation in a variety of aquatic habitats (Clarke 1981). Studies done in southern Manitoba in the 1970s reported *F. dalli* as being rare, but further research conducted in 1998 failed to find this species in the same areas (Pip 2000). In Alberta, *F. dalli* has been reported from several sites in the Rocky Mountains, Foothills, Parkland and Grasslands Natural Regions, and is likely more common than current records indicate (Lepitzki 2001).

F. dalli has a wide distribution in the Central Parkland Subregion. The species was collected from 19 (9.6%) sites sampled, with the majority of these sites being found in the central and western parts of the region. The species was found in all habitat types, but was most common in rivers and creeks. At the locations where it was found, the species was usually observed to be “rare” or “uncommon” (1-10 individuals). Living specimens were found over a pH range of 7.8 to 9.5, and conductivities of 0.50 to 0.82 mS.

Fossaria dalli is widely distributed in the Central Parkland Subregion, which is likely near the northern edge of the species’ range. The species occurs over a moderate range of water conditions, but is not very common at sites where it is found.



Characteristics

Present at 19 (9.6%) of 197 sites
Alive at 3 (1.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	21.1%	+29.4%
Lake	26.3%	-22.6%
Creek	31.6%	+45.0%
Pond	21.1%	-24.4%

***Abundance*:**
Mean #/sample: 3.8 (range: 1-23)

Rare: 47.4% Common: 5.3%
Uncommon: 47.4% Abundant: 0.0%

Water Chemistry:

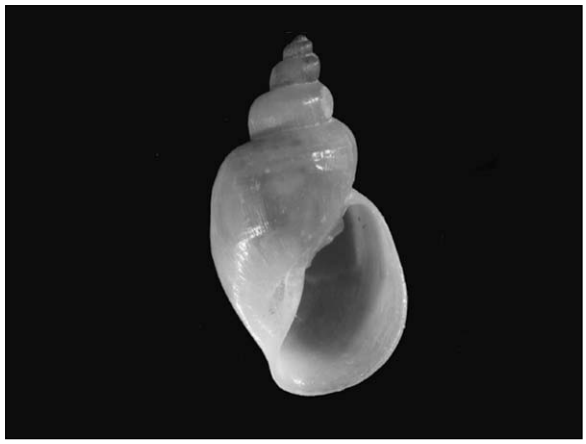
All Sites
Mean pH: 8.4 (range: 6.0-9.5)
Mean conductivity: 1.19 mS (range: 0.24-6.53)

Sites With Live Specimens
Mean pH: 8.8 (range: 7.8-9.5)
Mean conductivity: 0.64 mS (range: 0.50-0.82)

Fossaria galbana

Boreal fossaria

Current Status: Sensitive

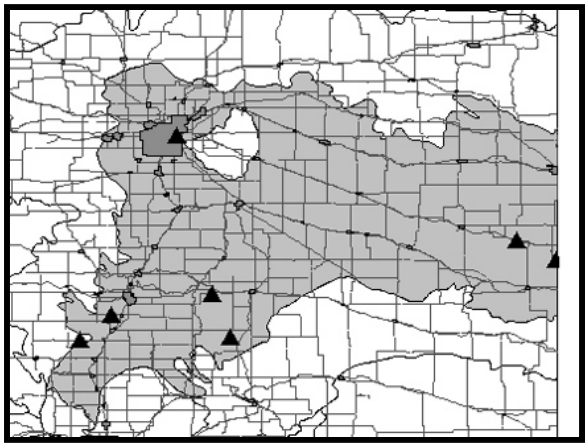


Fossaria galbana is recognized by its small shell size (height <11 mm), dextral coiling and smooth columella. Adults of this species can be distinguished from the other fossarid species by the strongly shouldered whorls, laterally flattened body whorl, reflected inner lip, and distinct aperture shape (narrowly arched above and broadly rounded below) (Clarke 1981; referred to as *Fossaria decampi*). The shell is commonly thickened and whitish. Burch (1989) recommends that further biological, morphological and conchological research is required for accurate identification of *Fossaria* species.

F. galbana has a broad distribution across North America, ranging from southern Ontario to eastern British Columbia, and northwest into the subarctic boreal forest region; the distribution in more southern areas needs to be determined (Clarke 1981). *F. galbana* is characterized as a "cold-water" species, occurring in large northern lakes and rivers among submerged vegetation (Clarke 1981, Burch 1989). In British Columbia, it has been found at several locations in the northern region of the province and is listed as being "apparently secure" (Lee 2000). In Alberta, the species has been recorded from a small number of locations, generally from the Rocky Mountains, Foothills and Boreal Forest Natural Regions (Lepitzki 2001).

Surveys in the Central Parkland Subregion found *F. galbana* to be relatively uncommon and widely scattered across the southern half of the subregion (with one site in the northwestern part of the region at Edmonton). *F. galbana* was collected from 7 (3.6%) sites sampled, and was found exclusively in river and lake habitats. At the locations where it was found, the species was most frequently described as being "uncommon" or "common" (2-100 individuals). Living specimens were found over a pH range of 6.0 to 9.3, and conductivities of 0.30 to 3.65 mS.

Fossaria galbana is a relatively uncommon and sparsely distributed species in central Alberta. Its preference for larger waterbodies, which are relatively rare in this region, suggests that the current designation of "Sensitive" is likely appropriate.



Characteristics

Present at 7 (3.6%) of 197 sites
Alive at 5 (2.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	71.4%	+338.0%
Lake	28.6%	-15.9%
Creek	0.0%	-100.0%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 28.4 (range: 1-152)

Rare: 14.3% Common: 28.6%
Uncommon: 42.9% Abundant: 14.3%

Water Chemistry:

All Sites:
Mean pH: 8.2 (range: 6.0-9.3)
Mean conductivity: 0.82 mS (range: 0.30-3.65)

Sites With Live Specimens:
Mean pH: 8.1 (range: 6.0-9.3)
Mean conductivity: 1.01 mS (range: 0.30-3.65)

Fossaria modicella

Rock fossaria

Current Status: Secure

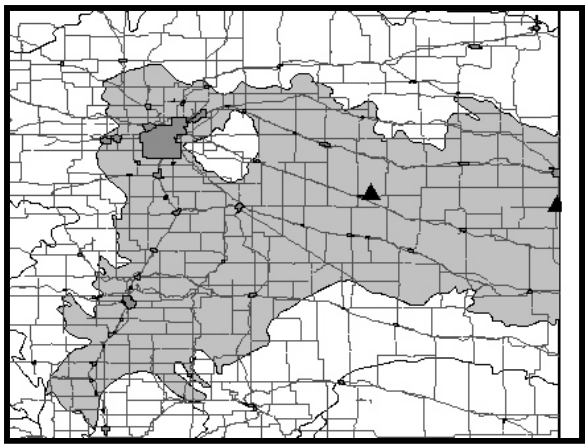
Fossaria modicella is a small lymnaeid with typical dextral coiling, elongated spire and shell length less than 11 mm. This species can be differentiated from the other fossarids by its moderately thin shell and flatly rounded, not shouldered, whorls that increase gradually (Clarke 1981). In addition, adult shells commonly reach a height greater than 7 mm.

The taxonomy of the *Fossaria* genus is particularly problematic. Burch (1989) lists this species, along with several others, as a member of the *Fossaria obrussa* group. He recommends that further research is required for accurate identification of *Fossaria* species. We therefore recognize that *F. modicella* may not be distinct from some other fossarid species in Alberta.

F. modicella has a broad distribution across North America, ranging across Canada from south of the tree line to the southern United States (Clarke 1981). The species occurs in a variety of vernal and perennial waterbodies where vegetation is present (Clarke 1981). *F. modicella* was observed to be drastically declining in southern Manitoba (Pip 2000). In British Columbia, the species occurs throughout the mainland and is listed as being "secure" (Lee 2000). In Alberta, *F. modicella* has been collected from at least 17 sites throughout the province, encompassing all natural regions (Lepitzki 2001).

In the Central Parkland Subregion, *F. modicella* has a very limited distribution. The species was collected from only 2 (1.0%) sites sampled. No living animals were found in either the creek or the pond where shells were found. A maximum of 8 specimens were found, so the species must be considered, at best, to be "uncommon". *F. modicella* was found over a pH range of 8.5 to 9.4, and conductivities of 1.64 to 8.65 mS.

Although the status of *Fossaria modicella* is rated as "Secure" in Alberta, it must be considered to be a rare species in the Central Parkland Subregion. However, the status of this, and other *Fossaria* species may remain uncertain until taxonomic issues are resolved.



Characteristics

Present at 2 (1.0%) of 197 sites
Alive at 0 (0.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	0.0%	-100.0%
Creek	50.0%	+129.4%
Pond	50.0%	+79.2%

***Abundance*:**
Mean #/sample: 4.5 (range: 1-8)

Rare: 50.0% Common: 0.0%
Uncommon: 50.0% Abundant: 0.0%

Water Chemistry:

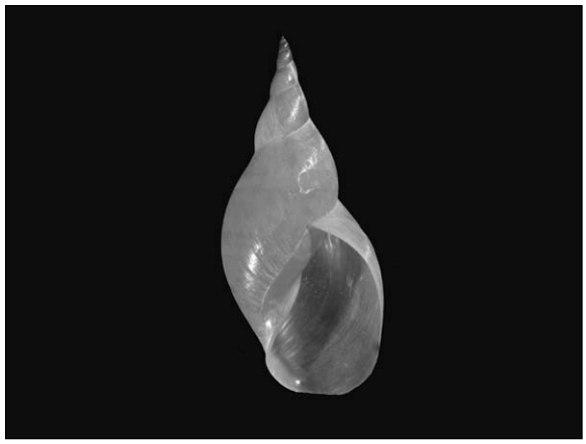
All Sites
Mean pH: 9.0 (range: 8.5-9.4)
Mean conductivity: 5.15 mS (range: 1.64-8.65)

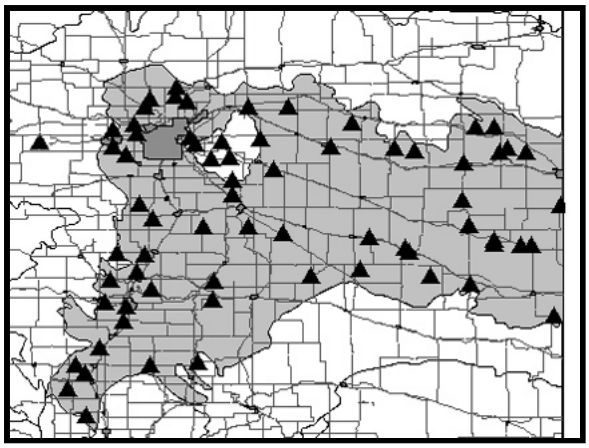
Sites With Live Specimens
Mean pH: N/A
Mean conductivity: N/A

Lymnaea stagnalis appressa

Swamp lymnaea

Current Status: Secure





Lymnaea stagnalis appressa is Alberta's largest aquatic gastropod, with adults reaching a maximum shell height of 56 mm. In addition to the large and thin shell, this species is easily identified by its dextral coiling, large capacious body whorl and long, narrow spire (Clarke 1981; referred to as *Lymnaea stagnalis jugularis*). Living individuals do not possess an operculum.

L. s. appressa has a broad distribution across North America and is common in most areas of its range. In Canada, the species is found from southern Quebec to British Columbia and north to the tree line (Clarke 1981). It generally lives in all types of perennial waterbodies that are vegetated (Clarke 1981). Pip (2000) describes *L. s. appressa* as being tolerant of a wide range of water conditions and as a species little affected by human disturbances. It is one of the most frequently encountered species in southern Manitoba (Pip 2000). It is common throughout British Columbia and is listed as "secure" (Lee 2000). In Alberta, the species has previously been found at numerous locations and in all natural regions of the province (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' broad and common distribution. *L. s. appressa* was found at 70 (35.5%) sites sampled. It was well represented in all wetland types, but was most frequently found in creeks. In the locations where it was found, the species was most often observed to be "uncommon" (2-10 individuals), but populations were sometimes "abundant" at a site (maximum of 579 individuals). Living specimens were found over a pH range of 7.0 to 10.7, which was amongst the widest ranges of all species encountered in the study (Table 3). Live animals occurred at conductivities of 0.29 to 3.65 mS.

Lymnaea stagnalis appressa has a broad distribution, is relatively common, and has a wide tolerance to water conditions. These factors suggest that the species is "Secure" in Alberta's Central Parkland Subregion.

Characteristics

Present at 70 (35.5%) of 197 sites
Alive at 44 (22.3%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	12.9%	-20.9%
Lake	35.7%	+5.0%
Creek	27.1%	+24.3%
Pond	24.3%	-12.9%

***Abundance*:**
Mean #/sample: 15.8 (range: 1-579)

Rare: 22.9% Common: 20.0%
Uncommon: 55.7% Abundant: 1.4%

Water Chemistry:

All Sites
Mean pH: 8.8 (range: 7.0-10.7)
Mean conductivity: 0.99 mS (range: 0.27-3.65)

Sites With Live Specimens
Mean pH: 8.8 (range: 7.0-10.7)
Mean conductivity: 1.04 mS (range: 0.29-3.65)

Stagnicola caperata

Wrinkled marshsnail

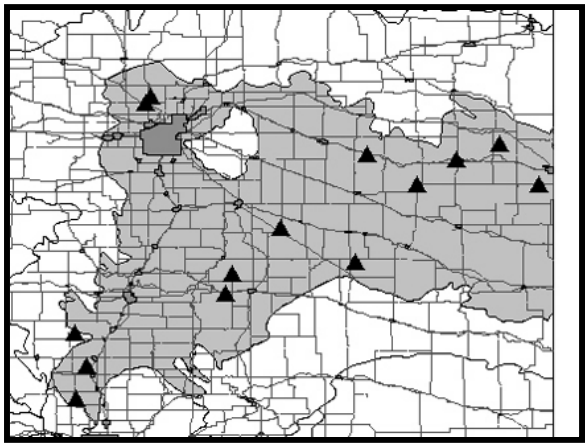
Current Status: Secure

Stagnicola caperata can be easily mistaken for a small *S. elodes*, but closer examination of the shell's surface will differentiate the two species. The shells of adult *S. caperata,* which do not exceed a height of 16 mm, have unique microscopic, spiral blade-like surface ridges that are best viewed under a microscope (Clarke 1981). In addition, the aperture of *S. caperata* is smaller and ovate and the body whorl is more inflated.

S. caperata is described as a "prairie species". It occurs from southern Manitoba to central Alberta, and extends south into the United States to Nevada and Utah (Clarke 1981). It is found in a wide range of habitats, but most frequently in temporary waterbodies such as ditches, shallow pools, vernal ponds or flooded areas (Clarke 1981). In British Columbia, the species was found to occur mostly in the northern region of the province and is listed as being "apparently secure" (Lee 2000). In Alberta, *S. caperata* is known to occur at numerous locations in the southern two-thirds of the province, and has been reported from all natural regions except the Canadian Shield (Lepitzki 2001).

Surveys in the Central Parkland Subregion suggest a broad, although relatively sparse, distribution in central Alberta. The species was collected from 14 (7.1%) sites sampled, most frequently from creek habitats. The species was, however, found in all wetland types sampled. At the locations where it was found, the species was observed to be "rare" or "uncommon" (1-10 individuals). Living specimens were found over a pH range of 8.0 to 9.5, and conductivities of 0.59 to 1.68 mS. These values fall in the intermediate range, relative to other species found in this study (Table 3).

Stagnicola caperata is a relatively uncommon species in the Central Parkland Subregion of Alberta, but the species has a fairly broad distribution in the area, and occurs over a range of water conditions. Given this, the current status of "Secure" is likely appropriate.



Characteristics

Present at 14 (7.1%) of 197 sites
Alive at 3 (1.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	14.3%	-12.3%
Lake	28.6%	-15.9%
Creek	35.7%	+63.8%
Pond	21.4%	-23.3%

***Abundance*:**
Mean #/sample: 9.1 (range: 1-62)

Rare: 50.0% Common: 14.3%
Uncommon: 35.7% Abundant: 0.0%

Water Chemistry:

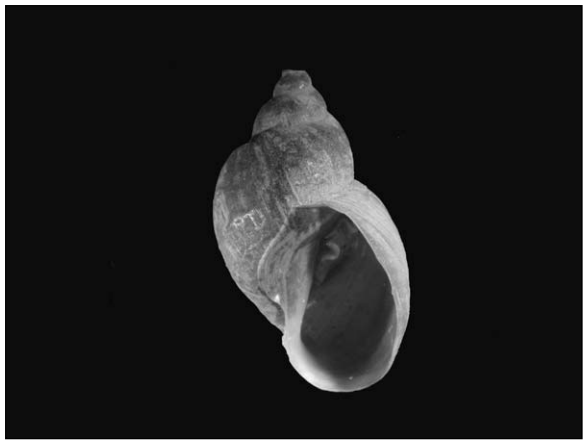
All Sites
Mean pH: 8.7 (range: 7.8-9.5)
Mean conductivity: 1.71 mS (range: 0.24-6.53)

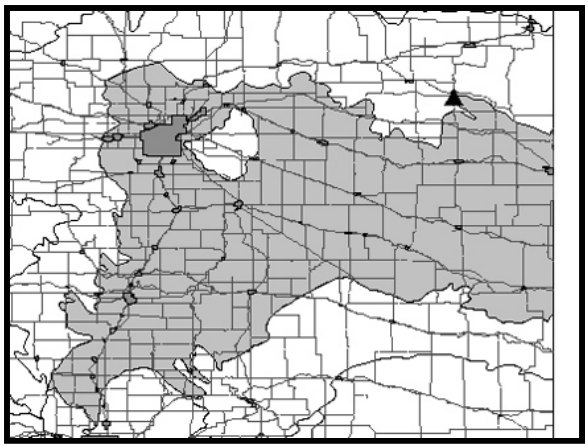
Sites With Live Specimens
Mean pH: 8.9 (range: 8.0-9.5)
Mean conductivity: 1.18 mS (range: 0.59-1.68)

Stagnicola catascopium catascopium

Woodland pondsnail

Current Status: Undetermined





Stagnicola catascopium catascopium resembles the widespread *S. elodes,* although there is substantial intrapopulation variation (Clarke 1981). Typically, *S. c. catascopium* is distinguished by the large and heavy shell, particularly low spire, rapidly increasing whorls, and heavily sculptured surface (Clarke 1981). In addition, the body whorl is large and dominant, whorls are globose or shouldered, and the aperture is large and flared (Clarke 1973). Identification of *Stagnicola* species is mostly based on shell morphology, and there is some uncertainty regarding the taxonomy and nomenclature of *S. catascopium* complex (Burch 1989, Lepitzki 2001). The current status of "Undetermined" in Alberta results from this uncertainty (Lepitzki 2001).

S. c. catascopium has a broad distribution across North America, extending from Nova Scotia and Quebec to central British Columbia. The species' range extends south in the United States to approximately 40°N (Clarke 1981). *S. c. catascopium* is associated with large lakes and rivers, but is occasionally found in smaller waterbodies (Clarke 1981). In British Columbia, the species is limited to central and southern interior regions of the province and is listed as being "apparently secure" (Lee 2000). In Alberta, *S. c. catascopium* has been found at a variety of locations in all natural regions of the province (Lepitzki 2001).

In this survey, *S. c. catascopium* was found at a single site, south of Elk Point on the North Saskatchewan River. Sixteen living specimens were retrieved, and a pH of 9.0, and conductivity of 0.34 mS were measured.

Stagnicola catascopium catascopium evidently has a very restricted range in the Central Parkland Subregion of Alberta. However, proper assessment of the species' status will require additional surveys in the province, as well as clarification of the taxonomy and nomenclature of this, and related, species.

Characteristics

Present at 1 (0.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	100.0%	+513.5%
Lake	0.0%	-100.0%
Creek	0.0%	-100.0%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 16.0 (range: N/A)

Rare: 0.0% Common: 100.0%
Uncommon: 0.0% Abundant: 0.0%

Water Chemistry:

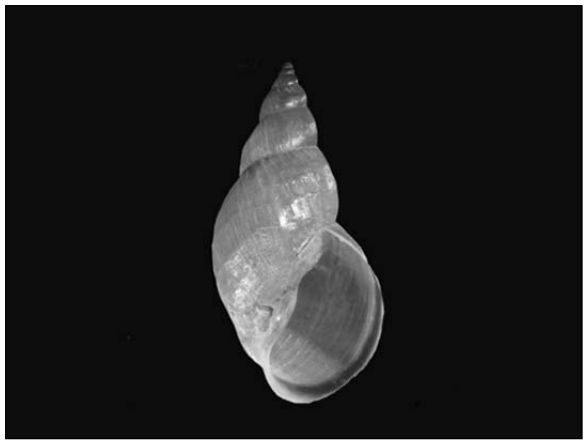
All Sites
Mean pH: 9.0 (range: N/A)
Mean conductivity: 0.34 mS (range: N/A)

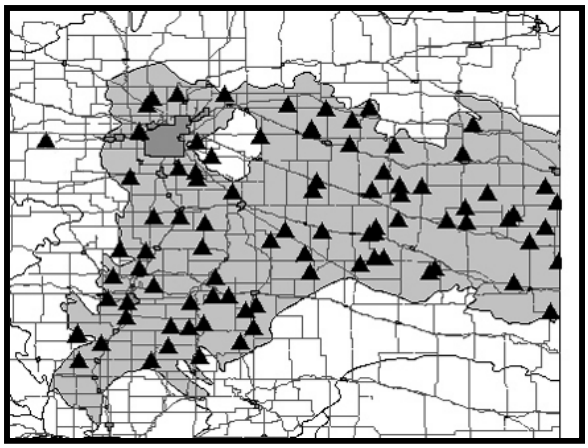
Sites With Live Specimens
Mean pH: 9.0 (range: N/A)
Mean conductivity: 0.34 mS (range: N/A)

Stagnicola elodes

Marsh pondsnail

Current Status: Secure





Stagnicola elodes is Alberta's most common *Stagnicola* species. This medium to large species can be identified by its dextral coiling, solid shell, conically elongated spire, and red lip band and apex (Clarke 1981). Individual adults exhibit heavily malleated or "hammered-like" shells, a heavy and twisted columella, and gradually increasing whorls.

S. elodes has a broad distribution across North America, occurring throughout Canada below the tree line and extending into the northern United States to approximately 38°N (Clarke 1981). The species is found in a variety of aquatic habitats, especially heavily vegetated types, and is abundant in all areas of its range (Clarke 1981). According to Pip (2000), *S. elodes* is tolerant of wide range of water conditions and is one of the species least affected by human disturbances. It is one of the most frequently encountered species in southern Manitoba (Pip 2000). In British Columbia, it occurs throughout the province and is listed as "secure" (Lee 2000). In Alberta, the species has been found in all natural regions (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' broad and common distribution. *S. elodes* was one of the most frequently encountered species (Table 2). The species was collected from 89 (45.2%) of all sites sampled, and was most frequently found in smaller waterbodies (creeks and ponds). Where it was found, *S. elodes* was most often observed to be "uncommon" or "common" (2-100 individuals), with a maximum of 308 individuals being collected at a site. Living specimens were found over a pH range of 6.0 to 9.8, and conductivities of 0.30 to 16.11 mS. These ranges are among the widest of all species observed in the study (Table 3).

Stagnicola elodes has a broad distribution, common occurrence, high abundance and a wide tolerance to water conditions. These factors confirm that the status of this species is "Secure" in the Central Parkland Subregion of Alberta.

Characteristics

Present at 89 (45.2%) of 197 sites
Alive at 41 (20.8%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	11.2%	-31.3%
Lake	22.5%	-33.8%
Creek	28.1%	+28.9%
Pond	38.2%	+36.9%

***Abundance*:**
Mean #/sample: 21.5 (range: 1-308)

Rare: 13.5% Common: 34.5%
Uncommon: 48.3% Abundant: 3.4%

Water Chemistry:

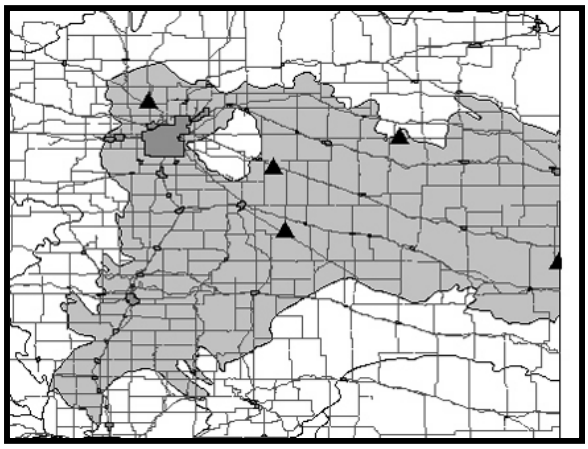
All Sites
Mean pH: 8.6 (range: 6.0-10.7)
Mean conductivity: 2.12 mS (range: 0.24-16.28)

Sites With Live Specimens
Mean pH: 8.5 (range: 6.0-9.8)
Mean conductivity: 1.93 mS (range: 0.30-16.11)

Stagnicola exilis

Flat-whorled pondsnail

Current Status: Undetermined



Stagnicola exilis is comparable to *S. elodes* and can be identified by similar shell features: medium height, dextral coiling and a long spire with gradually increasing whorls. However, *S. exilis* can be differentiated by its narrower pyramid-like form, flat-sided whorls, and zebra-like colored bands (Clarke 1981). There is some speculation that *S. exilis* might actually be a variant of *S. elodes* (Clarke 1973, 1981). This lack of taxonomic clarity led Lepitzki (2001) to assign an "Undetermined" status to S. *exilis* in Alberta. In the present study, we treated *S. exilis* as a distinct species, while recognizing the taxonomic uncertainty.

S. exilis has a scattered distribution, occurring across southern Canada from Quebec to Alberta, and south into the upper Ohio-Mississippi drainage to approximately 37˚N (Clarke 1981). The species occurs in a variety of perennial and vernal habitats such as lakes, ponds, swamps, ditches and some streams among vegetation where the substrate is mud (Clarke 1981). *S. exilis* is not listed as a species that occurs in British Columbia (Lee 2000). In Alberta, it has been previously found at a small number of sites, primarily in the Rocky Mountains, Foothills, Parkland and Grassland Natural Regions of the province (Lepitzki 2001).

The present study shows the species to have a sparse distribution across the northern and eastern parts of the Central Parkland Subregion. *S. exilis* was collected from 5 (2.5%) sites sampled, and occurred most frequently in creek and pond habitats. At the locations where it was found, the species was observed to be "rare" or "uncommon" (1-10 individuals). Living specimens were found at only one site where a pH of 9.2, and a conductivity of 0.46 mS were measured.

If our criteria for identifying *S. exilis* are correct, then the species should be considered to be uncommon in the Central Parkland Subregion. However, we concur with Lepitzki (2001) that the taxonomy of this, and similar species, must be clarified before a proper status assessment can be attempted.

Characteristics

Present at 5 (2.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	20.0%	-41.2%
Creek	40.0%	+83.5%
Pond	40.0%	+43.4%

***Abundance*:**
Mean #/sample: 4.6 (range: 1-16)

Rare: 40.0% Common: 20.0%
Uncommon: 40.0% Abundant: 0.0%

Water Chemistry:

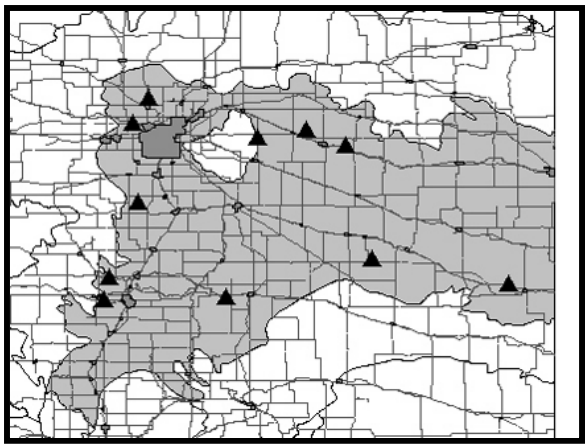
All Sites
Mean pH: 8.7 (range: 7.8-9.6)
Mean conductivity: 1.0 mS (range: 0.46-1.41)

Sites With Live Specimens
Mean pH: 9.2 (range: N/A)
Mean conductivity: 0.46 mS (range: N/A)

Aplexa elongata

Lance aplexa

Current Status: Secure



Aplexa elongata can be identified without difficulty by its medium-sized spindle-shaped shell, sinistral coiling, and long narrow spire (Clarke 1981; referred to as *Aplexa hypnorum*). The mantle edge of live individuals is smooth, without digitations (finger-like projections), and does not extend beyond the aperture (Burch 1989). As well, the shell surface appears to be glossy and blackish.

A. elongata is widely distributed across North America, ranging from Nova Scotia to James Bay, across to the west coast of British Columbia, and north to arctic Alaska (Clarke 1981). Most frequently, the species lives in vernal habitats but it can occasionally be found in large permanent rivers and lakes (Clarke 1981). In southern Manitoba, *A. elongata* consistently showed a high frequency of occurrence in agricultural areas (Pip 2000). In British Columbia, the species has been collected from several locations in central and eastern areas of the province and is listed as being "apparently secure" (Lee 2000). In Alberta, *A. elongata* has been recorded from a moderate number of lakes, rivers and sloughs throughout the province (Lepitzki 2001).

In the Central Parkland Subregion, *A. elongata* has a fairly broad, but sparse distribution. The species was collected from 11 (5.6%) sites sampled, representing all four wetland types. The species was, however, most common in creeks and ponds. At the locations where it was found the species was most often observed to be "rare" or "uncommon" (1-10 individuals), and no more than 12 specimens were retrieved from a site. Living specimens were found at only one site where a pH of 7.8 and a conductivity of 0.82 mS were measured.

Aplexa elongata is currently listed as a "Secure" species in Alberta. However, our survey found that the species is sparsely distributed in the Central Parkland Subregion, and populations at occupied sites are fairly low. The status of this species may require reconsideration.

Characteristics

Present at 11 (5.6%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	9.1%	-44.2%
Lake	27.3%	-19.7%
Creek	27.3%	+25.2%
Pond	36.4%	+30.5%

***Abundance*:**
Mean #/sample: 3.0 (range: 1-12)

Rare: 45.5% Common: 9.1%
Uncommon: 45.5% Abundant: 0.0%

Water Chemistry:

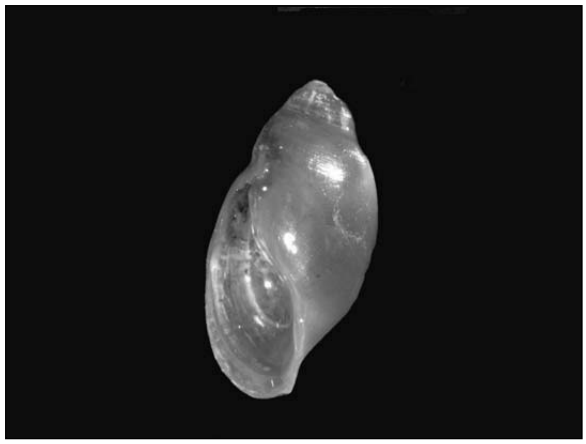
All Sites
Mean pH: 8.3 (range: 7.7-9.6)
Mean conductivity: 2.62 mS (range: 0.43-16.11)

Sites With Live Specimens
Mean pH: 7.8 (range: N/A)
Mean conductivity: 0.82 mS (range: N/A)

Physa skinneri

Glass physa

Current Status: Undetermined

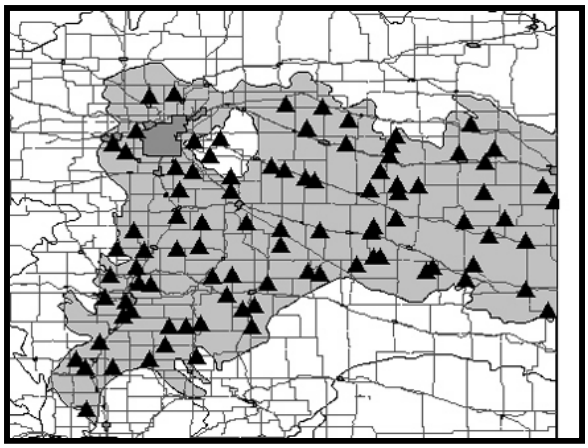


Physa skinneri can be identified by the thin and fragile shell, sinistral coiling, blunt apex, and laterally flatted body whorl (Clarke 1981; referred to as *Physa jennessi skinneri*). The mantle edge of live specimens is digitated and reflected over both sides of the shell (Burch 1989). According to Taylor (1988) *P. skinneri* looks similar to *P. megalochlamys,* a recently defined species that occurs in the northwestern U.S. and adjacent areas of Canada. Given this, Lepitzki (2001) suggests that identifications of *P. skinneri* in Alberta be re-evaluated, and he assigned a status of "Undetermined" to both species. We did not attempt to distinguish between the two species in this study. Some specimens identified as *P. skinneri* may therefore be *P. megalochlamys*.

P. skinneri has a broad distribution in North America, from eastern Ontario to Great Slave Lake and into British Columbia (Clarke 1981). The species occurs on muddy bottoms among vegetation in all types of slow moving waterbodies (Clarke 1981, Taylor 1988). In British Columbia, the species has been identified from one location, but is suspected to occur throughout the province. It is listed as being "apparently secure" in that province (Lee 2000). *P. skinneri* has been found in all natural regions of Alberta (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' broad and common distribution. *P. skinneri* was the second most-encountered species and the sixth highest in terms of abundance (Table 2). The species was collected from 93 (47.2%) sites sampled, and occurred in all wetland types (especially ponds). Where it was found, the species was usually observed to be "uncommon" (2-10 individuals), although a maximum of 228 individuals were found at one site. Living specimens were found over a pH range of 7.4 to 10.7, and at conductivities of 0.33 to 8.78 mS. Few species were found at higher values of pH and conductivity (Table 3).

Physa skinneri is a widespread and common species in the Central Parkland Subregion of Alberta. Populations are likely "Secure" in this area, although taxonomic confusion with *P. megalochlamys* requires resolution.



Characteristics

Present at 93 (47.2%) of 197 sites
Alive at 44 (22.3%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	5.4%	-66.9%
Lake	25.8%	-24.1%
Creek	25.8%	+18.3%
Pond	43.0%	+54.1%

***Abundance*:**
Mean #/sample: 15.1 (range: 1-228)

Rare: 14.0% Common: 28.0%
Uncommon: 55.9% Abundant: 2.1%

Water Chemistry:

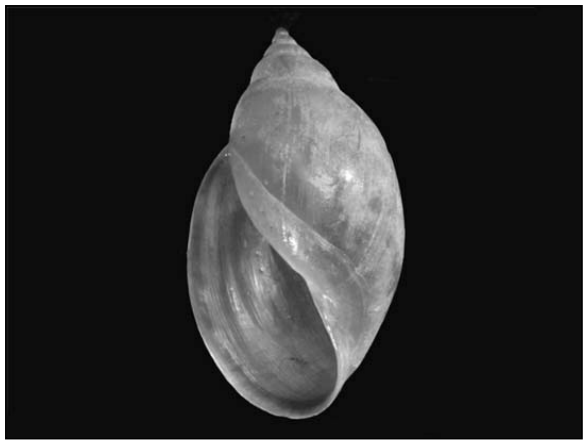
All Sites
Mean pH: 8.8 (range: 7.4-10.7)
Mean conductivity: 2.10 mS (range: 0.27-16.28)

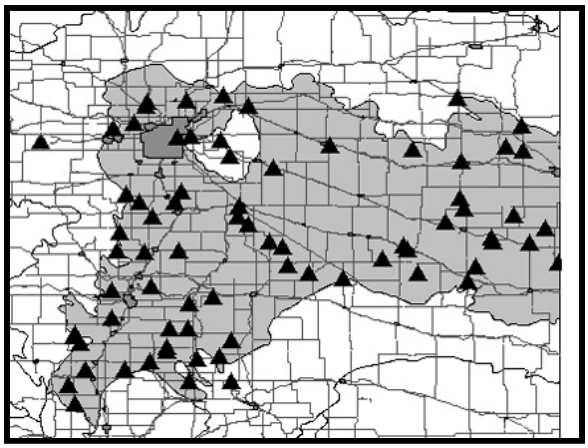
Sites With Live Specimens
Mean pH: 8.9 (range: 7.4-10.7)
Mean conductivity: 2.05 mS (range: 0.33-8.78)

Physella gyrina

Tadpole physa

Current Status: Secure





Physella gyrina is distinguished from the other physids in Alberta by the large inflated body whorl, pointed spire, and small, acute and reddish apex (Clarke 1981; referred to as *Physa gyrina gyrina*). In live individuals, the mantle edge is digitated (has finger-like projections) and is reflected over the outer lip of the aperture (Burch 1989). This is the largest physid species in Alberta, with adults attaining a maximum height of 24 mm (Clarke 1981).

P. gyrina is widely distributed across North America, and is described as being abundant in most areas of its range (Clarke 1981). The species has been found in ponds, rocky lakeshore areas and in intermediate habitat types, but always in very shallow water (Clampitt 1970). In southern Manitoba, it is one of the most frequently encountered species (Pip 2000). In British Columbia, it occurs throughout the province and is listed as "secure" (Lee 2000). In Alberta, *P. gyrina* has been found in perennial and temporary waterbodies, and is often abundant in areas with high organic pollution (Lepitzki 2001). According to Clampitt (1970), the species can withstand high water temperatures (35-40˚C), as well as significant dry periods. Pip (2000) describes *P. gyrina* as being tolerant of human disturbances and a wide range of water conditions.

Surveys in the Central Parkland Subregion confirm this species' broad distribution and common occurrence. Overall, *P. gyrina* was the fifth most-encountered species and the fourth highest in abundance (Table 2). The species was found at 74 (37.6%) sites sampled, and in a wide range of habitat types. The species was somewhat more common in rivers, and less common in ponds than in other habitats. *P. gyrina* was observed to be "uncommon" or "common" (2-100 individuals) at most sites where it was found. Living specimens were found at a higher percentage (25.4%) of sites (Table 2), and over a wider pH range (6.0 to 10.2), than any other species found in this survey (Table 3).

The broad distribution, common occurrence, high abundance and wide pH tolerance confirm that *Physella gyrina* is a "Secure" species in Alberta's Central Parkland Subregion.

Characteristics

Present at 74 (37.6%) of 197 sites
Alive at 50 (25.4%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	37.8%	+131.9%
Lake	31.1%	-8.5%
Creek	21.6%	-0.9%
Pond	9.5%	-65.9%

***Abundance*:**
Mean #/sample: 29.1 (range: 1-458)

Rare: 13.5% Common: 36.5%
Uncommon: 44.6% Abundant: 5.4%

Water Chemistry:

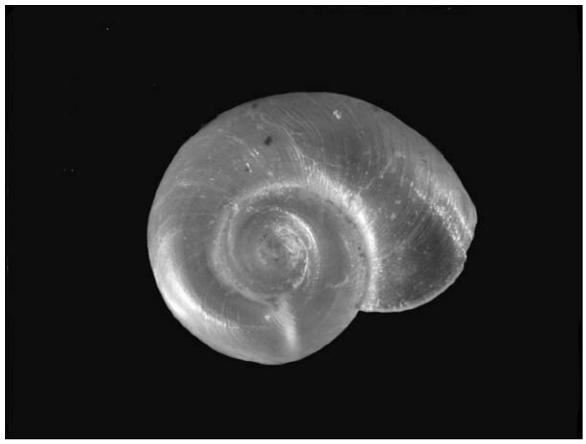
All Sites
Mean pH: 8.8 (range: 6.0-10.2)
Mean conductivity: 0.80 mS (range: 0.24-4.08)

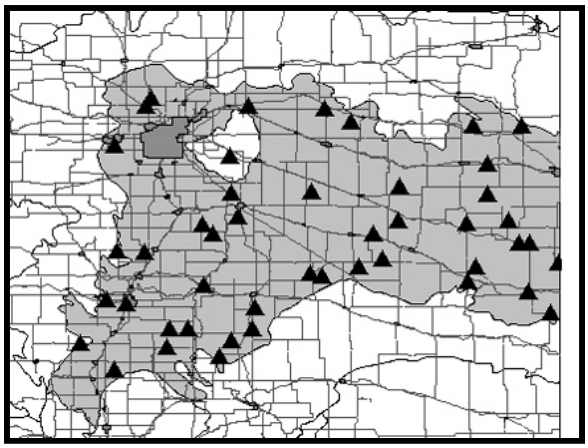
Sites With Live Specimens
Mean pH: 8.7 (range: 6.0-10.2)
Mean conductivity: 0.62 mS (range: 0.24-2.50)

Gyraulus circumstriatus

Disc gyro

Current Status: Secure





Gyraulus circumstriatus can be identified by its small size (shell <5 mm wide), planorbid form and dextral coiling, all of which are typical features of this genus. However, unlike *G. parvus* and *G. deflectus*, the apical and umbilical views of this species look very similar and the body whorl is evenly rounded (Clarke 1981). As well, the shell is semi-transparent (revealing the soft parts of the living animal) and the whorls increase slowly and symmetrically. However, the species is sometimes difficult to distinguish from other species of *Gyraulus* (Clarke 1981). Clarke (1973) believed that "revision of the difficult genus *Gyraulus* is especially desirable".

G. circumstriatus has a broad distribution across North America, from Prince Edward Island to New England, west to northern British Columbia and south in the Rocky Mountains to New Mexico (Clarke 1981). The species is found in vernal habitats such as woodland pools, marshes, roadside ditches, prairie ponds and intermittent streams, and is always associated with thick vegetation and muddy substrates (Clarke 1981). In British Columbia, it occurs throughout the province and is listed as "secure" (Lee 2000). In Alberta, *G. circumstriatus* has been found in all natural regions, but may be absent from the far northeastern corner of the province (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' wide distribution. *G. circumstriatus* was collected from 46 (23.4%) sites sampled, and was almost equally represented in the different wetland types. At the locations where it was found the species was observed to be mostly "uncommon" or "common" (2-100 individuals). Living specimens were found over a pH range of 7.8 to 10.7, and conductivities of 0.29 to 4.29 mS.

The broad distribution of *Gyraulus circumstriatus*, along with its relatively high abundance and equal representation in all habitat types confirms that this species is "Secure" in Alberta's Central Parkland Subregion.

Characteristics

Present at 46 (23.4%) of 197 sites
Alive at 22 (11.2%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	15.2%	-6.7%
Lake	32.6%	-4.1%
Creek	23.9%	+9.6%
Pond	28.3%	+1.4%

***Abundance*:**
Mean #/sample: 25.2 (range: 1-216)

Rare: 15.2% Common: 30.4%
Uncommon: 45.7% Abundant: 8.7%

Water Chemistry:

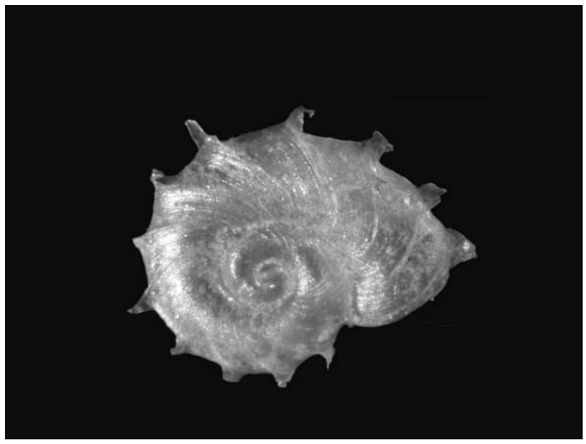
All Sites
Mean pH: 8.9 (range: 7.5-10.7)
Mean conductivity: 2.31 mS (range: 0.29-16.28)

Sites With Live Specimens
Mean pH: 9.1 (range: 7.8-10.7)
Mean conductivity: 1.28 mS (range: 0.29-4.29)

Gyraulus crista

Star gyro

Current Status: Sensitive

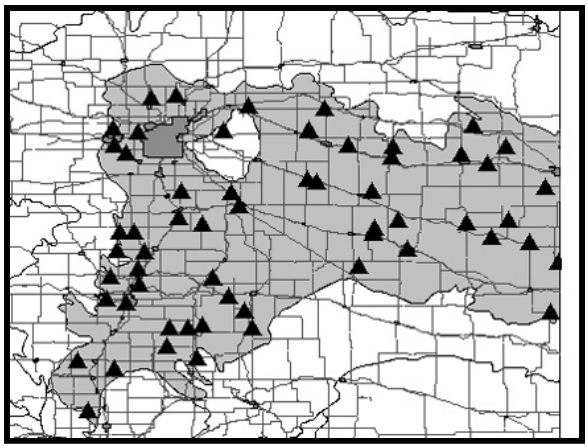


Gyraulus crista is Alberta's smallest aquatic gastropod. At a diameter of less than 3 mm and a height of 1 mm it can be easily overlooked. However, this minute species can be quickly identified by its prominent triangular ridges on the body whorl, flat spire, and continuous lip that surrounds the aperture (Clarke 1981; referred to as *Armiger crista*). Some specimens exhibit loose and partly detached coiling (Clarke 1981).

G. crista has a scattered distribution across North America, occurring in Alaska and the Northwest Territories, and from southern Ontario to western Alberta and south into the United States from Maine to Minnesota (Clarke 1981). It has been described as being "rare or occasional" in most areas of its range, but "common" in the Canadian Interior Basin (Clarke 1973, Lepitzki 2001). *G. crista* lives among dense vegetation in eutrophic ponds and slow moving streams (Clarke 1981). In southern Manitoba, populations of *G. crista* are thought to be declining (Pip 2000). In British Columbia, the species has been found only in central and eastern regions of the province and is listed as being "apparently secure" in that province (Lee 2000). In Alberta, *G. crista* has been collected mostly in the southern two-thirds of the province. Records are known for all natural regions in the province, with the exception of the Canadian Shield (Lepitzki 2001).

Surveys in the Central Parkland Subregion found *G. crista* to be relatively common and widespread. The species was collected from 59 (30.0%) sites sampled. Although it was found in all types of wetlands, the species was particularly associated with ponds. At the locations where it was found the species was most often observed to be "uncommon" (2-10 individuals), but occasionally reached high abundance (maximum of 778 individuals at a site). Living specimens were found over a pH range of 7.7 to 9.5, and conductivities of 0.45 to 3.01 mS.

Gyraulus crista is a common and widespread species in the Central Parkland Subregion, and should probably be considered to be "Secure" in the area.



Characteristics

Present at 59 (30.0%) of 197 sites
Alive at 15 (7.6%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	5.1%	-68.7%
Lake	30.5%	-10.3%
Creek	20.3%	-6.9%
Pond	44.1%	+58.1%

***Abundance*:**
Mean #/sample: 22.1 (range: 1-778)

Rare: 27.1% Common: 22.0%
Uncommon: 47.5% Abundant: 3.4%

Water Chemistry:

All Sites
Mean pH: 8.6 (range: 7.4-10.7)
Mean conductivity: 2.0 mS (range: 0.29-16.28)

Sites With Live Specimens
Mean pH: 8.7 (range: 7.7-9.5)
Mean conductivity: 1.34 mS (range: 0.45-3.01)

Gyraulus deflectus

Flexed gyro

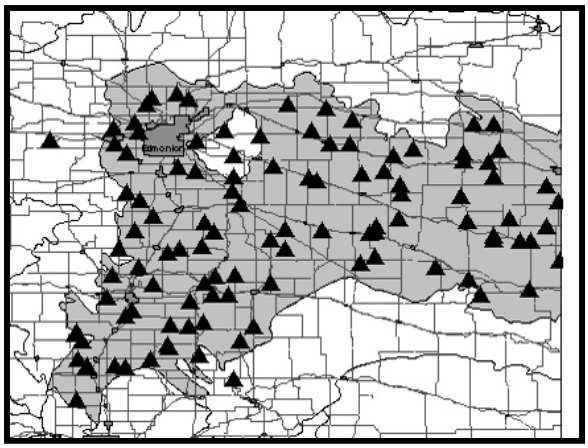
Current Status: Secure

Gyraulus deflectus is the province's largest *Gyraulus* species, with adults having 4 ½ whorls and attaining a maximum shell diameter of 8 mm (Clarke 1981). In addition to the large size, the species can be distinguished from other members of its genus by any combination of shell characteristics such as the hairy periostracum, peripheral keel, or surface malleations. Unlike *G. circumstriatus*, the apical and umbilical views look clearly different.

G. deflectus has a broad distribution across North America, ranging throughout all of Canada and Alaska, north to the central arctic, and south in the United States to Virginia and Nebraska (Clarke 1981). The species occurs in all types of permanent, eutrophic waterbodies and is not found in ditches or habitats that dry out (Clarke 1973). *G. deflectus* is found throughout British Columbia and is listed as "secure" in that province (Lee 200). In Alberta, the species has been previously found in lakes, creeks, rivers and sloughs and in all natural regions of the province (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' broad and common distribution. *G. deflectus* was the most frequently encountered species in this inventory, and the third highest in total abundance (3598 individuals; see Table 2). The species was collected from 108 (54.8%) sites sampled. *G. deflectus* was found in a wide variety of habitat types, but was over-represented in smaller waterbodies (ponds and creeks). At locations where it was found, the species was most frequently observed to be "uncommon" or "common" (2-100 individuals), with a maximum of 384 individuals being found at a site. Living specimens were found over a pH range of 6.0 to 9.9, and conductivities of 0.24 to 6.50 mS. These ranges are among the widest of all species recorded in the Central Parkland Subregion (Table 3).

The broad distribution, common occurrence, high abundance and wide tolerance to water conditions confirm that *Gyraulus deflectus* is a "Secure" species in the Central Parkland Subregion of Alberta.



Characteristics

Present at 108 (54.8%) of 197 sites
Alive at 29 (14.7%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	11.1%	-31.9%
Lake	30.6%	-10.0%
Creek	24.1%	+10.6%
Pond	34.3%	+22.9%

***Abundance*:**
Mean #/sample: 33.1 (range: 1-384)

Rare: 12.0% Common: 40.7%
Uncommon: 38.9% Abundant: 8.3%

Water Chemistry:

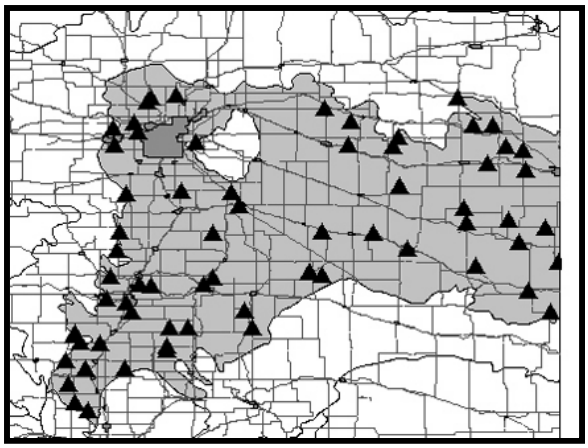
All Sites
Mean pH: 8.7 (range: 6.0-10.7)
Mean conductivity: 1.82 mS (range: 0.24-16.28)

Sites With Live Specimens
Mean pH: 8.6 (range: 6.0-9.9)
Mean conductivity: 1.58 mS (range: 0.24-6.50)

Gyraulus parvus

Ash gyro

Current Status: Secure



Gyraulus parvus is identified by its small shell size (<5 mm wide), planorbid form and dextral coiling which are typical features of this genus. Unlike *G. circumstriatus*, the apical and umbilical views of this species look very different. In addition, the shell lacks a peripheral keel, malleations, or hirsute periostracum (Clarke 1981). Despite these defining characteristics, there are sometimes problems with identification of this species. According to Clarke (1973), "even positive differentiation of *G. parvus* from some specimens of *G. circumstriatus* and *G. deflectus* is not always easy".

G. parvus has a broad distribution across North America, occurring throughout Canada and the United States south of the tree line. It is described as being abundant throughout its range (Clarke 1981). The species lives on submerged aquatic vegetation in various permanent or temporary waterbodies that support plant growth (Clarke 1981). In southern Manitoba, populations of *G. parvus* were observed to be drastically declining (Pip 2000). In British Columbia, the species is found throughout the province and the population size is believed to be large. It is listed as "secure" in that province (Lee 2000). In Alberta, *G. parvus* has been found at approximately 80 locations throughout the province, in all natural regions (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' wide distribution and high abundance. *G. parvus* was the second most abundant species encountered (Table 2). The species was collected from 67 (34.0%) sites sampled, and was well represented in all wetland types. At the locations where it was found the species was usually observed to be "uncommon" or "common" (2-100 individuals), and occasionally was very abundant (maximum of 1944 individuals). Living specimens were found over a pH range of 7.7 to 9.5, and conductivities of 0.24 to 0.77 mS.

The broad distribution, common occurrence, and high abundance of *G. parvus* suggest that this species is "Secure" in Alberta's Central Parkland Subregion.

Characteristics

Present at 67 (34.0%) of 197 sites
Alive at 4 (2.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	11.9%	-27.0%
Lake	40.3%	+18.5%
Creek	17.9%	-17.9%
Pond	29.9%	+7.2%

***Abundance*:**
Mean #/sample: 85.0 (range: 1-1944)

Rare: 7.5% Common: 34.3%
Uncommon: 44.8% Abundant: 13.4%

Water Chemistry:

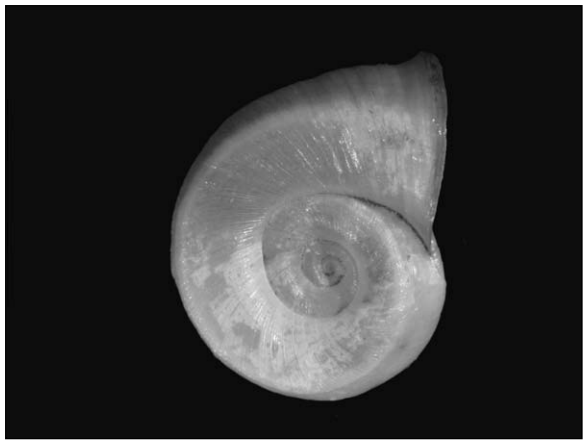
All Sites
Mean pH: 8.8 (range: 7.5-10.7)
Mean conductivity: 1.99 mS (range: 0.24-30.30)

Sites With Live Specimens
Mean pH: 8.9 (range: 7.7-9.5)
Mean conductivity: 0.48 mS (range: 0.24-0.77)

Helisoma anceps anceps

Two-ridge rams-horn

Current Status: Sensitive

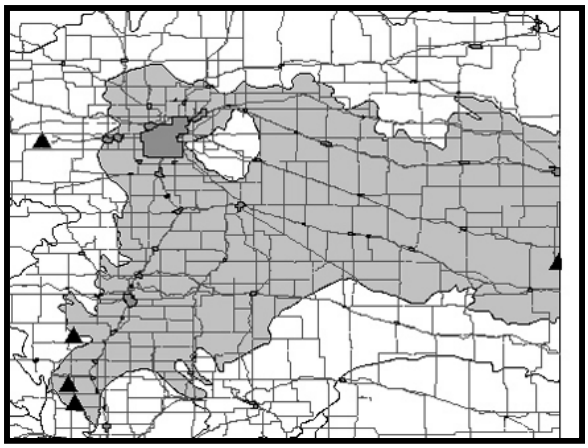


Helisoma anceps anceps is identified by its planospiral dextral coiling, large aperture, and deeply immersed umbilicus and spire (Clarke 1981). The most unique characteristic of this species is the prominent carinae present on the upper and lower surfaces of the body whorl (Clarke 1981). In addition, the apex is immersed rather than smooth-sided, and the aperture is sharply pointed above and below.

H. a. anceps has a wide distribution in North America. It occurs from southern Quebec to eastern British Columbia, extending north to the tree line and south into Georgia and northwestern Mexico (Clarke 1981). The species typically lives among vegetation in lakes, ponds, rivers and streams, and is absent from temporary waterbodies (Clarke 1981). In British Columbia, it occurs in the eastern part of the province and is listed as "secure" (Lee 2000). In Alberta, the species has been found in all natural regions of the province, although records are relatively sparse (Lepitzki 2001). It is suspected to occur in more locations than indicated by current records (Lepitzki 2001).

We found specimens of *H. a. anceps* at 5 locations (2.5% of sampled sites) in the Central Parkland Subregion, with live specimens being found at 2 sites (1.0%). Most locations were on the extreme western edge of the Subregion, and in the adjacent Dry Mixedwood Subregion. However, one location was on the Saskatchewan border. The species occurred most frequently in creeks and lakes. *H. a. anceps* was most often observed to be "uncommon" or "common" (2-100 individuals) where it occurred, with a maximum of 34 specimens being found at a site. Living specimens were found over a pH range of 8.6 to 9.2, and at relatively low conductivities of 0.24 to 0.41 mS.

Helisoma anceps anceps appears to have a sparse distribution in central Alberta. In addition, it occurs at relatively low abundance and lives in a fairly narrow range of water conditions. The current designation of "Sensitive" may be appropriate for this species.



Characteristics

Present at 5 (2.5%) of 197 sites
Alive at 2 (1.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	40.0%	+17.6%
Creek	40.0%	+83.5%
Pond	20.0%	-28.3%

***Abundance*:**
Mean #/sample: 13.2 (range: 1-34)

Rare: 20.0% Common: 40.0%
Uncommon: 40.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.9 (range: 8.5-9.2)
Mean conductivity: 0.42 mS (range: 0.24-0.51)

Sites With Live Specimens
Mean pH: 8.9 (range: 8.6-9.2)
Mean conductivity: 0.33 mS (range: 0.24-0.41)

Menetus opercularis

Button sprite

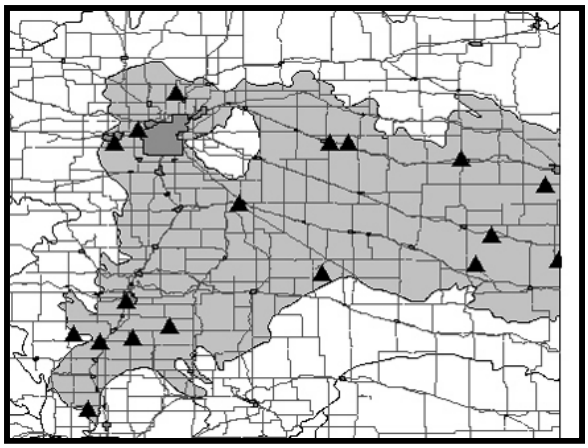
Current Status: May Be At Risk

Menetus opercularis is similar to *Promenetus exacuous* in having a small shell size (<8 mm in diameter), dextral planospiral coiling, flat spire and a prominent keel on body whorl (Clarke 1981; referred to as *Menetus cooperi*). However, *M. opercularis* differs in having the keel located high up on the body whorl (rather than at the middle), and the apex is slightly sunken.

M. opercularis has a scattered distribution across North America, occurring from southern Alaska to east-central Alberta (Clarke 1981). The species lives among vegetation in perennial waterbodies such as lakes, ponds and slow-moving portions of rivers and streams (Clarke 1981). In British Columbia, the species is found throughout Vancouver Island and the western region of the province to a northern limit of 56°N. It is listed as being "secure" in that province (Lee 2000). In Alberta, *M. opercularis* has been found at only a few locations in the Parkland region (Lepitzki 2001).

Surveys in the Central Parkland Subregion show that this species has a relatively broad distribution, and a more common occurrence than previously thought. The species was collected from 18 (9.1%) sites sampled. It was especially well represented in lakes, and relatively rare in rivers and creeks. At the locations where it was found, the species was most often described as being "rare" or "uncommon" (1-10 individuals), but was occasionally found to be "abundant" (maximum of 282 specimens at a site). Living specimens were found over a pH range of 7.8 to 9.5, and conductivities of 0.5 to 6.5 mS. Compared to other species, *M. opercularis* is fairly tolerant of high conductivities (Table 3).

Menetus opercularis has a fairly broad distribution in the Central Parkland Subregion of Alberta, and can be locally abundant. Given this, the species' status may warrant revision from the current designation of "May Be At Risk".



Characteristics

Present at 18 (9.1%) of 197 sites
Alive at 7 (3.6%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	5.6%	-65.6%
Lake	55.6%	+63.5%
Creek	11.1%	-49.1%
Pond	27.8%	-0.4%

***Abundance*:**
Mean #/sample: 26.9 (range: 1-282)

Rare: 38.9% Common: 5.6%
Uncommon: 44.4% Abundant: 11.1%

Water Chemistry:

All Sites
Mean pH: 8.9 (range: 7.8-9.5)
Mean conductivity: 1.17 mS (range: 0.24-6.50)

Sites With Live Specimens
Mean pH: 8.8 (range: 7.8-9.5)
Mean conductivity: 1.55 mS (range: 0.45-6.50)

Planorbella binneyi

Coarse rams-horn

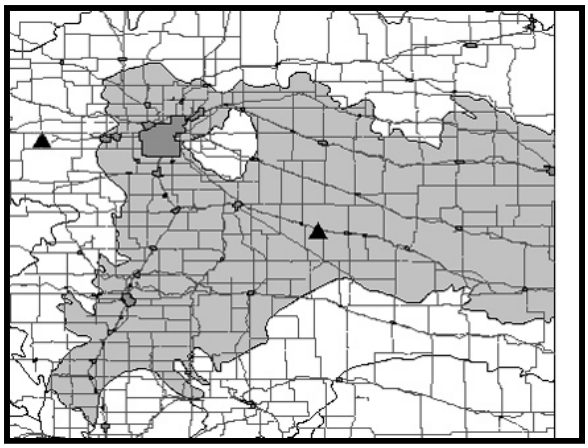
Current Status: Undetermined

Planorbella binneyi strongly resembles *P. subcrenata*. In fact, Clarke (1981) considered these species to be subspecies of *Helisoma trivolis (H. t. binneyi* and *H. t. subcrenatum).* Both species have large solid shells, sinistral coiling, a deep umbilicus and large, expanded ear-shaped apertures. Populations of the two species have been reported to intergrade, especially in western Alberta where their ranges overlap (Clarke 1981). As a rule, *P. binneyi* can be distinguished by its greater shell height (>10 mm), a more broadly expanded aperture, and a body whorl that is higher than the penultimate whorl (Clarke 1981)

P. binneyi has a limited distribution, occurring principally in western Alberta and in the Pacific drainage from southern British Columbia to California (Clarke 1981). The species has been found in eutrophic, well-vegetated lakes, although specific ecological information is scarce (Clarke 1981). In British Columbia the species is uncommon south of 55°N and is listed as "vulnerable/apparently secure" (Lee 2000). In Alberta, *P. binneyi* has been found at only a few locations in the Rocky Mountains and Boreal Forest Natural Regions (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm the presence of this species. Shells were found at 2 (1.0%) sites: Wabamum Lake west of Edmonton (actually in the Boreal Forest Natural Region), and in a pond east of Strome. No living specimens were found at these sites, where the pH ranged from 8.4 to 9.0, and the conductivity from 0.50 to 1.67 mS. At the locations where it was found, the species was observed to be "rare" or "uncommon" (1-10 individuals), with a maximum of 4 individuals being found.

Planorbella binneyi has a very limited distribution in the Central Parkland Subregion of Alberta. Where it is found, it occurs at low abundance. The paucity of specimens might be explained by the fact that central Alberta is at the eastern periphery of the species' range, where populations are thought to intergrade with those of *P. subcrenata* (Clarke 1981).



Characteristics

Present at 2 (1.0%) of 197 sites
Alive at 0 (0.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	50.0%	+47.1%
Creek	0.0%	-100.0%
Pond	50.0%	+79.2%

***Abundance*:**
Mean #/sample: 2.5 (range: 1-4)

Rare: 50.0% Common: 0.0%
Uncommon: 50.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.7 (range: 8.4-9.0)
Mean conductivity: 1.09 mS (range: 0.50-1.67)

Sites With Live Specimens
Mean pH: N/A
Mean conductivity: N/A

Planorbella pilsbryi infracarinatum

Greater carinate rams-horn

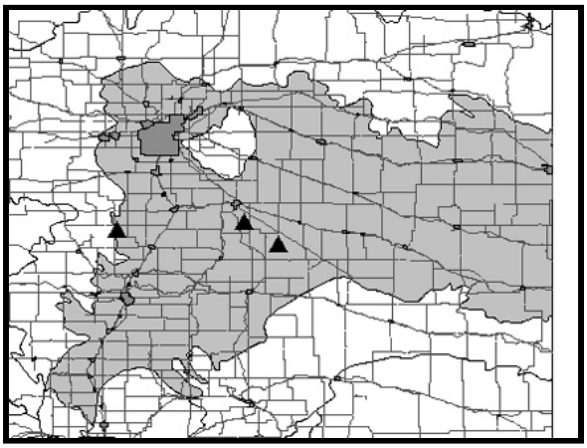
Current Status: Undetermined

Planorbella pilsbryi infracarinatum is identified by the large thick shell, planospiral sinistral coiling, and deep umbilicus (Clarke 1981; referred to as *Helisoma pilsbryi infracarinatum*). The species strongly resembles *P. subcrenata* but differs by the presence of a prominent carina on the upper body whorl and the depressed, smooth-sided bowl-like apex (Burch 1989). Although this subspecies is considered to be distinct in this study, it should be recognized that there is considerable debate about the taxonomy of this, and closely related species. Burch (1989) suspected that *P. pilsbryi* is not taxonomically distinct from *P. trivolvis*.

P. p. infracarinatum is described as a boreal species that occurs from southern Quebec and Ontario to east-central Alberta (Clarke 1981). The species is most frequently found among vegetation in lakes, ponds, or quiet backwaters of streams (Clarke 1981). The species has not been recorded in British Columbia (Lee 2000). In Alberta, *P. p. infracarinatum* has previously been found at only a single location, in the Boreal Forest Natural Region at Lac La Biche (Clarke 1981, Lepitzki 2001).

The present study confirms the species' occurrence in Central Parkland Subregion of Alberta. *P. p. infracarinatum* was collected from 3 (1.5%) sites sampled. All sites were along the mainstem of the Battle River, including two lotic sites, and in Driedmeat Lake. At the locations where it was found, the species was observed to be "rare" or "uncommon" (1-10 individuals), with a maximum of 8 individuals being found. The site where living specimens were collected had a pH of 9.9, and a conductivity of 0.64 mS.

This study found a southwesterly range extension of *Planorbella pilsbryi infracarinatum* from the previously known site at Lac La Biche. However the species evidently has a very limited distribution in the Central Parkland Subregion, and occurs at low abundance. The species must therefore be considered to be rare in central Alberta.



Characteristics

Present at 3 (1.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	66.7%	+309.2%
Lake	33.3%	-2.1%
Creek	0.0%	-100.0%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 4.0 (range: 1-8)

Rare: 33.3% Common: 0.0%
Uncommon: 66.7% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.8 (range: 8.1-9.9)
Mean conductivity: 0.50 mS (range: 0.41-0.64)

Sites With Live Specimens
Mean pH: 9.9 (range: N/A)
Mean conductivity: 0.64 mS (range: N/A)

Planorbella subcrenata

Rough rams-horn

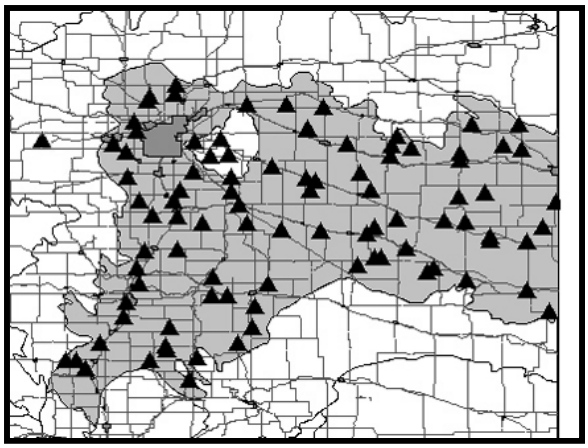
Current Status: Secure

Planorbella subcrenata can be easily identified by its large and solid shell, sinistral planorbid coiling, large ear-shaped aperture, deep umbilicus and lack of prominent carinae on the body whorl (Clarke 1981; referred to as *Helisoma trivolvis subcrenatum*). *P. subcrenata* strongly resembles *P. binneyi* (referred to as *H. t. binneyi*) and populations of the two species have been reported to intergrade in western Alberta (Clarke 1981). *P. subcrenata* can be differentiated by the smaller shell size (height not exceeding 10 mm), and looser irregular coiling (Clarke 1981). However, some authorities (e.g. Burch 1989) have recognized taxonomic and identification issues within the *Planorbella* genus that require clarification.

P. subcrenata occurs primarily in western North America, from the Yukon Territory to Manitoba and south to California and Utah. It is described as being common throughout its range (Clarke 1981). The species occurs in most perennial waterbodies that support rooted vegetation (Clarke 1981). *P. subcrenata* is one of the most frequently encountered species in southern Manitoba, and is described as being tolerant of a wide range of water conditions (Pip 2000). The species occurs throughout British Columbia, and is listed as "secure" in that province (Lee 2000). *P. subcrenata* has been reported from all natural regions of Alberta (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this species' broad distribution and common occurrence. *P. subcrenata* was collected from 93 (47.2%) sites sampled, which was the second highest frequency of occurrence among all species encountered in this inventory (Table 2). It was found in a wide range of aquatic habitats (but most commonly in creeks and ponds). At the locations where it was found the species was most often observed to be "uncommon" or "common" (2-100 individuals). Living specimens were found over a pH range of 7.0 to 10.7, and conductivities of 0.31 to 8.65 mS. These ranges are among the highest of all species encountered in this study (Table 3).

With its broad distribution, relatively high abundance, and tolerance to a wide range of water conditions, *Planorbella subcrenata* is apparently a "Secure" species in Alberta's Central Parkland Subregion.



Characteristics

Present at 93 (47.2%) of 197 sites
Alive at 44 (22.3%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	7.5%	-54.0%
Lake	28.0%	-17.6%
Creek	31.2%	+43.1%
Pond	33.3%	+19.4%

***Abundance*:**
Mean #/sample: 13.4 (range 1-107)

Rare: 9.7% Common: 32.3%
Uncommon: 57.0% Abundant: 1.1%

Water Chemistry:

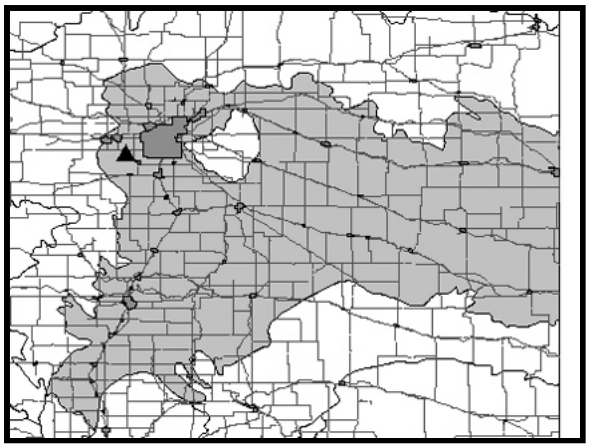
All Sites
Mean pH: 8.7 (range: 7.0-10.7)
Mean conductivity: 1.47 mS (range: 0.27-8.78)

Sites With Live Specimens
Mean pH: 8.6 (range: 7.0-10.7)
Mean conductivity: 1.33 mS (range: 0.31-8.65)

Planorbella campanulata

Bellmouth rams-horn

Current Status: Not Recorded in Alberta



Planorbella campanulata is easily distinguished by the planospiral sinistral coiling, flat or slightly raised spire, compressed whorls, and distinct bell-shaped aperture (Clarke 1981; referred to as *Helisoma campanulatum campanulatum*). Adult shells lack carinae and are smaller than other *Planorbella* species (typically <15 mm wide and <6 mm high). Live individuals can be identified by the reddish brown or blackish color of the animal and their slow-moving nature (Clarke 1981).

According to Clarke (1981), *P. campanulata* is distributed from Newfoundland through southern Quebec and into central Saskatchewan. It is described as being "common" throughout its range. In the United States it occurs from interior New Jersey and New York to Vermont and westward to Michigan (Emerson and Jacobson 1976). The species has not previously been recorded in British Columbia or Alberta (Clarke 1981, Lee 2000, Lepitzki 2001). *P. campanulata* occurs in vegetated still-water habitats such as ponds and lakes, as well as slow-moving or backwater areas of rivers (Clarke 1981). In southern Manitoba, the species was observed to be one of the few species that has increased in occurrence in recent years (Pip 2000).

Surveys in the Central Parkland Subregion produced the first record for this species in the province. *P. campanulata* was collected from a single site (0.5%), an unnamed wetland approximately 10 km southwest of Edmonton. At this location, the species was observed to be "common" (17 individuals, including live specimens). The site had a pH of 8.1, and a conductivity of 0.43 mS.

It is unclear whether *Planorbella campanulata* is a recent arrival to the province, or whether it was present but previously undetected. Regardless, the species is apparently rare and localized in the region. *Planorbella campanulata* was found only in the extreme northwest part of the subregion, and future collections in the adjacent Dry Mixedwood Subregion (Boreal Forest Natural Region) to the north and west will be required to clarify the species' status in the province.

Characteristics

Present at 1 (0.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0%	-100.0%
Lake	0%	-100.0%
Creek	0%	-100.0%
Pond	100.0%	+258.4%

***Abundance*:**
Mean #/sample: 17 (range: N/A)

Rare: 0.0%
Uncommon: 0.0%
Common: 100.0%
Abundant: 0.0%

Water Chemistry:

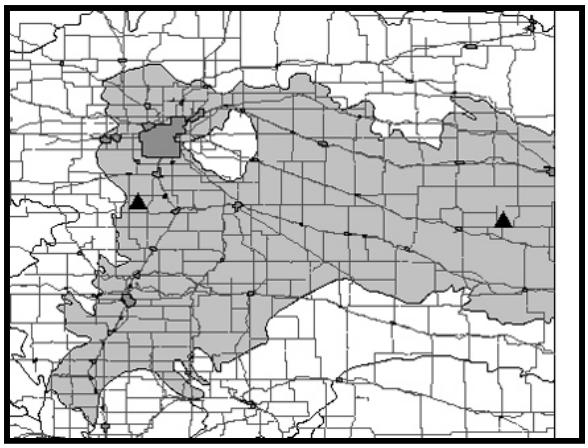
All Sites
Mean pH: 8.1 (range: N/A)
Mean conductivity: 0.43 mS (range: N/A)

Sites With Live Specimens
Mean pH: 8.1 (range: N/A)
Mean conductivity: 0.43 mS (range: N/A)

Planorbula armigera

Thicklip rams-horn

Current Status: Sensitive



Planorbula armigera is identified by the planospiral dextral coiling, flat spire, numerous whorls and deep, funnel shaped umbilicus (Clarke 1981). The most unique characteristic of this species is the presence of denticles (teeth-like projections), located inside the aperture of adults and juveniles (Clarke 1981). In addition, the shells of adults reach a maximum diameter of 8 mm and the last part of body whorl is expanded and deflected downwards (Clarke 1981).

P. armigera has a broad distribution across Canada, from New Brunswick to northeastern British Columbia, and north to the tree line (Clarke 1981). The species is abundant in subarctic muskeg but uncommon in rest of its range (Clarke 1981). In southern Manitoba, *P. armigera* has been reported to be one of the species that is declining dramatically (Pip 2000). In British Columbia, it is known to occur only in the far northeastern part of the province and is listed as being "rare or uncommon" (Lee 2000). In Alberta, *P. armigera* has been previously found at several sites in the northern two-thirds of the province, specifically the Foothills, Parkland and Boreal Forest Natural Regions (Lepitzki 2001).

P. armigera has a limited distribution in the Central Parkland Subregion. The species was collected from 2 (1.0%) widely separated sites in the region. Both sites were ponds. At the few locations where this species was found, it was observed to be "rare" or "uncommon" (1-10 individuals), with no more than 2 individuals being found at a site. Living specimens were not found, but *P. armigera* shells were found over a pH range of 7.7 to 9.0, and conductivities of 0.43 to 16.28 mS.

It is evident that *Planorbula armigera* is a sparsely distributed and uncommon species in Central Parkland Subregion. However, central Alberta is apparently at the southern edge of its range in the province, and the species is likely to be more common further north.

Characteristics

Present at 2 (1.0%) of 197 sites
Alive at 0 (0.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	0.0%	-100.0%
Creek	0.0%	-100.0%
Pond	100.0%	+258.4%

***Abundance*:**
Mean #/sample: 1.5 (range: 1-2)

Rare: 50.0% Common: 0.0%
Uncommon: 50.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.4 (range: 7.7-9.0)
Mean conductivity: 8.35 mS (range: 0.43-16.28)

Sites With Live Specimens
Mean pH: N/A
Mean conductivity: N/A

Planorbula campestris

Meadow rams-horn

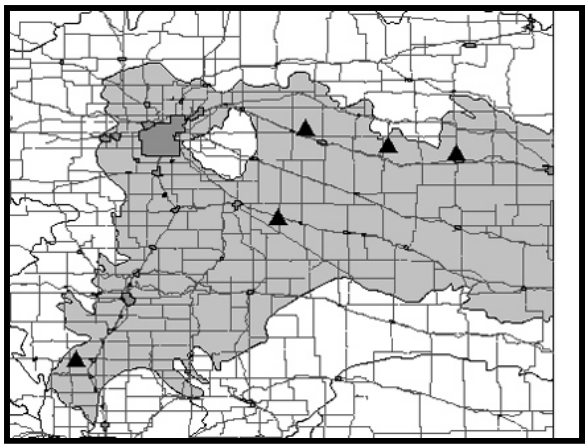
Current Status: Sensitive

Planorbula campestris is the larger of the two *Planorbula* species found in Alberta. This species can be easily recognized by the many, slowly increasing whorls, planospiral dextral coiling, flat spire, and funnel-shaped umbilicus (Clarke 1981). Unlike *P. armigera,* the adult stage of *P. campestris* does not have denticles, and the shell reaches a greater maximum diameter (>8 mm).

P. *campestris* has a broad distribution in western North America, occurring from southern Manitoba to northern Alberta and south through the United States to Utah and New Mexico. Isolated populations are also known from Vancouver Island and southwestern Yukon (Clarke 1981). The species is associated with highly vegetated vernal ponds, swamps and spring-flooded areas of permanent waterbodies (Clarke 1981). Studies done in southern Manitoba in the 1970s reported *P. campestris* to be rare, and further research carried out in 1989 failed to recover the species in the same region (Pip 2000). In British Columbia, the species occurs occasionally in the southern and eastern regions of the province and is listed as being "apparently secure" (Lee 2000). In Alberta, *P. campestris* has been found throughout the province in all natural regions except the Canadian Shield (Lepitzki 2001).

Surveys in the Central Parkland Subregion found *P. campestris* to be sparsely distributed and of low abundance. The species was collected from 5 (2.5%) sites in the southwestern and north-central parts of the region. All of these sites were ponds. In four of five sites, the species was found to be "rare", with only a single specimen being found. Living specimens were only found at one site. At this location, the pH was measured as 7.7, and the conductivity as 0.66 mS.

Planorbula campestris is an sparsely distributed and uncommon species in the Central Parkland Subregion of Alberta.



Characteristics

Present at 5 (2.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	0.0%	-100.0%
Creek	0.0%	-100.0%
Pond	100.0%	+258.4%

***Abundance*:**
Mean #/sample: 1.6 (range: 1-4)

Rare: 80.0% Common: 0.0%
Uncommon: 20.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.0 (range: 7.6-8.6)
Mean conductivity: 1.59 mS (range: 0.66-3.01)

Sites With Live Specimens
Mean pH: 7.7 (range: N/A)
Mean conductivity: 0.66 mS (range: N/A)

Promenetus exacuous exacuous

Keeled promenetus

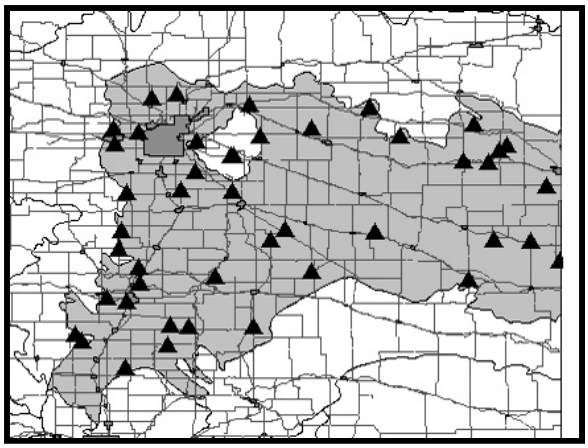
Current Status: Secure

Promenetus exacuous exacuous is recognized by its small size, planospiral dextral coiling, rather flat spire, and rapidly expanding whorls. *P. e. exacuous* can be differentiated from *M. opercularis* by the prominent keel located centrally on the body whorl (Clarke 1981). Turgeon et al. (1998) and Burch (1989) did not recognize subspecies of *P. exacuous.* Clarke (1973, 1981) distinguishes between *P. e. exacuous* and *P. e. megas* based on shell morphology and geographic distribution (*megas* replacing *exacuous* in most localities on the western prairies), remarking that *exacuous* adults have a smaller shell diameter (4-6 mm) than *megas* (6-9 mm). In the current study, shell size was used to distinguish between subspecies.

P. e. exacuous has a broad distribution across North America from Nova Scotia to eastern British Columbia. In the United States, it occurs in Alaska and east of the Rocky Mountains. It is described as being a "common" species (Clarke 1981). The species is known to live in a variety of temporary and permanent waterbodies where submersed vegetation is present (Clarke 1981). In southern Manitoba, *Promenetus exacuous* has been reported as one of the species that is drastically declining (Pip 2000). In British Columbia, *P. e. exacuous* occurs widely throughout the province, except in the southwestern region, and is listed as being "relatively secure" or "secure" (Lee 2000). In Alberta, *P. e. exacuous* has been found at numerous locations in all natural regions of the province (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm this subspecies' broad distribution and relatively high abundance. *P. e. exacuous* was collected from 45 (22.8%) sites sampled, and in a wide range of habitats. At the locations where it was found, the species was most often observed to be "uncommon" (2-10 individuals), but was occasionally considered to be "abundant" (maximum of 842 specimens). Living animals were found over a pH range of 7.5 to 10.7, and conductivities of 0.47 to 1.45 mS.

Promenetus exacuous exacuous is a common and widespread species in the Central Parkland Subregion, and should be considered to be "Secure".



Characteristics

Present at 45 (22.8%) of 197 sites
Alive at 13 (6.6%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	13.3%	-18.4%
Lake	37.8%	+11.2%
Creek	24.4%	+11.9%
Pond	24.4%	-12.5%

***Abundance*:**
Mean #/sample: 28.2 (range: 1-842)

Rare: 13.3% Common: 17.8%
Uncommon: 66.7% Abundant: 2.2%

Water Chemistry:

All Sites
Mean pH: 8.6 (range: 7.5-10.7)
Mean conductivity: 1.08 mS (range: 0.24-6.87)

Sites With Live Specimens
Mean pH: 8.5 (range: 7.5-10.7)
Mean conductivity: 0.93 mS (range: 0.47-1.45)

Promenetus exacuous megas

Broad promenetus

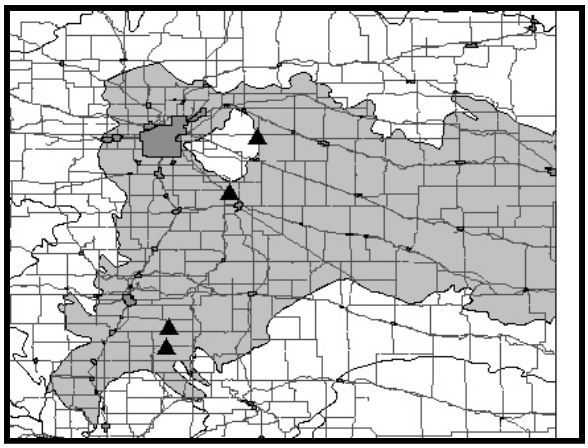
Current Status: Sensitive

Promenetus exacuous megas is similar to *P. e. exacuous* and can be identified by the same general features: small size, planospiral dextral coiling, rapidly increasing whorls and prominent keel located centrally on the body whorl. Turgeon et al. (1998) and Burch (1989) do not recognize subspecies of *P. exacuous*. However, Clarke (1973, 1981) distinguishes between the two subspecies, describing *P. e. megas* as having a larger (6-9 mm wide), heavier shell with a more prominent pinched peripheral keel. In this study, shell diameter was chosen as the characteristic differentiating these two subspecies.

P. e. megas occurs in the prairie provinces of Canada, extending from southeastern Manitoba to southeastern British Columbia and into the adjacent parts of the United States (Clarke 1981). The species is found in a wide range of aquatic habitats such as lakes, ponds, streams, ditches and swamps (Clarke 1981). In British Columbia, the species has been collected from only one site and its distribution is uncertain (Lee 2000). In Alberta, *P. e. megas* has been collected from all natural regions except the Canadian Shield (Lepitzki 2001).

Surveys in the Central Parkland Subregion suggest a limited distribution in central Alberta. *P. e. megas* was collected from 4 (2.0%) sites sampled, and was only found in lakes and creeks in the western half of the study area. At the locations where it was found, the species was most often observed to be "uncommon" (2-10 individuals), with no more than 20 specimens being identified at a site. Living animals were found over a pH range of 7.5 to 7.8, and conductivities of 0.82 to 1.30 mS.

Promenetus exacuous megas appears to be an uncommon subspecies with a limited distribution in the Central Parkland Subregion of Alberta. However, we acknowledge that its abundance and distribution might be underestimated, given that smaller (<6 mm) juveniles would have been recorded as the smaller subspecies, *P. e. exacuous*.



Characteristics

Present at 4 (2.0%) of 197 sites
Alive at 2 (1.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	50.0%	+47.1%
Creek	50.0%	+129.4%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 7.3 (range: 1-20)

Rare: 25.0% Common: 25.0%
Uncommon: 50.0% Abundant: 0.0%

Water Chemistry:

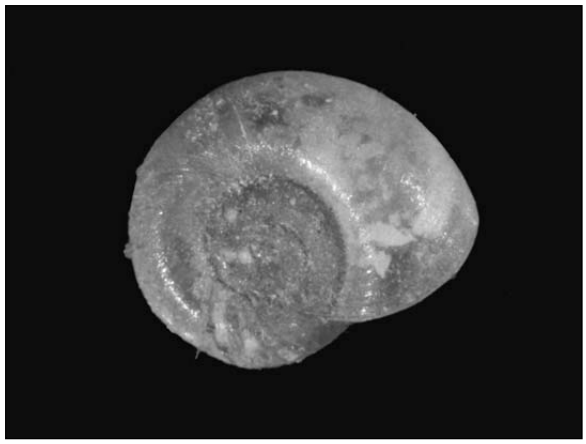
All Sites
Mean pH: 8.5 (range: 7.5-9.4)
Mean conductivity: 1.00 mS (range: 0.80-1.30)

Sites With Live Specimens
Mean pH: 7.7 (range: 7.5-7.8)
Mean conductivity: 1.06 mS (range: 0.82-1.30)

Promenetus umbilicatellus

Umbilicate sprite

Current Status: Sensitive

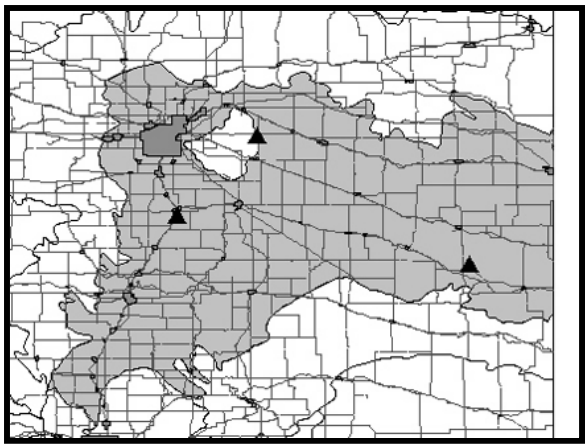


Promenetus umbilicatellus can be distinguished from the other planorbid snails by its small size (diameter ≤5 mm), thin and fragile shell, rounded whorls, and prominent deep umbilicus (Clarke 1981). In addition, the spire is flattened, with the first two whorls slightly immersed. Unlike other members of its genus, this species lacks a peripheral keel and the umbilicus is funnel-shaped.

P. umbilicatellus is primarily a "prairie species" being found from southern Manitoba to central Alberta and southern British Columbia. In the United States, the species occurs as far south as New Mexico. It is described as being "rather uncommon" throughout this range (Clarke 1981). The species is associated with vegetated vernal ponds, marshes, and intermittent streams (Clarke 1981). Studies done in southern Manitoba in the 1970s reported *P. umbilicatellus* as being rare, but subsequent research conducted in 1998 failed to find this species in the same areas (Pip 2000). In British Columbia, the species is found at few locations and is uncommon (Lee 2000). In Alberta, *P. umbilicatellus* has been reported from a variety of sites, mainly in southern two-thirds of the province. It has been recorded in all natural regions, with the exception of the Canadian Shield (Lepitzki 2001).

Surveys in the Central Parkland Subregion found *P. umbilicatellus* to be rare. The species was collected from only 3 (1.5%) widely separated sites, all in creek habitats. At the locations where it was found, the species was observed to be "rare" or "uncommon" (1-10 individuals), with no more than 2 individuals being found at any site. Living specimens were found over a pH range of 7.4 to 7.8, and conductivities of 0.82 to 1.62 mS.

Promenetus umbilicatellus is evidently a sparsely distributed and uncommon species in the Central Parkland Subregion of Alberta. Limited observations also suggest that the species is restricted to creek habitats.



Characteristics

Present at 3 (1.5%) of 197 sites
Alive at 2 (1.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	0.0%	-100.0%
Creek	100.0%	+358.7%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 1.3 (range: 1-2)

Rare: 66.7% Common: 0.0%
Uncommon: 33.3% Abundant: 0.0%

Water Chemistry:

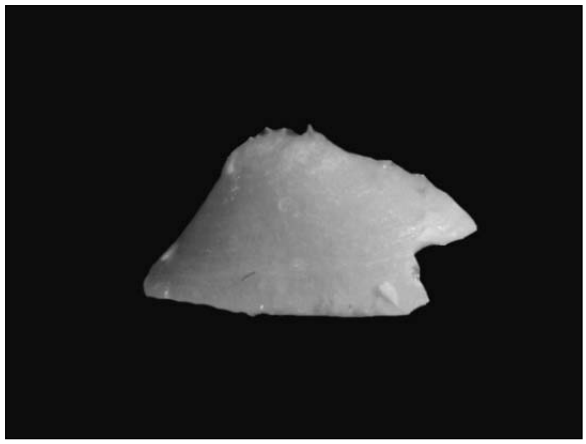
All Sites
Mean pH: 8.1 (range: 7.4-9.1)
Mean conductivity: 1.48 mS (range: 0.82-1.99)

Sites With Live Specimens
Mean pH: 7.6 (range: 7.4-7.8)
Mean conductivity: 1.22 mS (range: 0.82-1.62)

Ferrissia fragilis

Fragile ancylid

Current Status: Undetermined

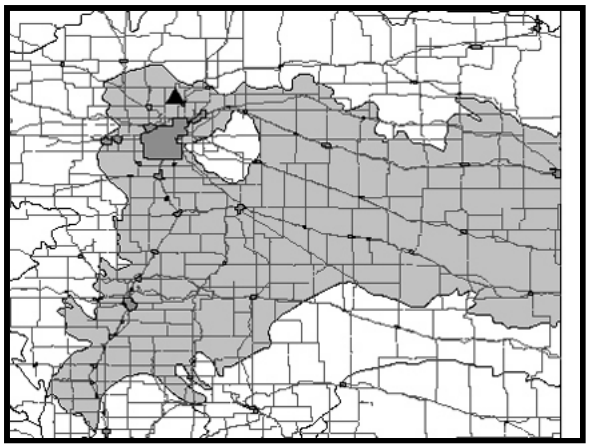


Ferrissia fragilis is Alberta's smallest limpet, reaching a maximum length of 5.5 mm and a height of 1.6 mm (Clarke 1981). It is distinguished by the small, thin, fragile shell, straight sides and distinctive oval aperture. The species is typically found in still- and stagnant-water habitats such as lakes, ponds and ditches, but it also occurs in slow moving streams (Clarke 1981, Burch 1989).

According to Clarke (1981), *F. fragilis* has a limited distribution in Canada, occurring in southwestern British Columbia and southern Ontario and Quebec. It is widely distributed in the United States. Clarke (1981) does not report this as a species encountered in Alberta during his 1960s surveys, although his collection techniques failed to record any *Ferrissia* species (Lepitzki 2001). The species is common in southern British Columbia and is listed as "apparently secure" (Lee 2000). *F. fragilis* has been previously recorded at one lake in northeastern Alberta, although identification of this specimen requires confirmation (Lepitzki 2001).

In this survey, a single, dead specimen of *F. fragilis* was found at one site. This location was an unnamed wetland approximately 15 km north of Edmonton where a pH of 8.6, and a conductivity of 1.45 mS were measured. *F. fragilis* is known for being attached to plants, rocks, debris and dead mussel shells (Emerson and Jacobson 1976). Therefore, it is not easy to observe or collect by generalized sample techniques such as were used in this study. This species likely occurs at more than the single site reported from the Central Parkland Subregion.

Additional studies, using more specialized sampling techniques, will be required to clarify the status of *Ferrissia fragilis* in this region. However, it is likely that the species is rare and sporadic in occurrence.



Characteristics

Present at 1 (0.5%) of 197 sites
Alive at 0 (0.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	0.0%	-100.0%
Creek	0.0%	-100.0%
Pond	100.0%	+258.4%

***Abundance*:**
Mean #/sample: 1.0 (range: N/A)

Rare: 100.0% Common: 0.0%
Uncommon: 0.0% Abundant: 0.0%

Water Chemistry:

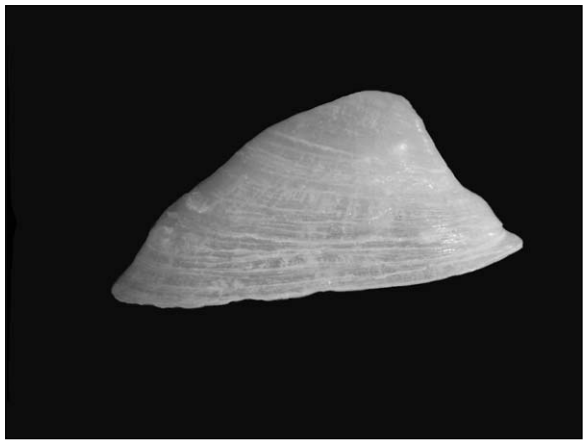
All Sites
Mean pH: 8.6 (range: N/A)
Mean conductivity: 1.45 mS (range: N/A)

Sites With Live Specimens
Mean pH: N/A
Mean conductivity: N/A

Ferrissia rivularis

Creeping ancylid

Current Status: Undetermined

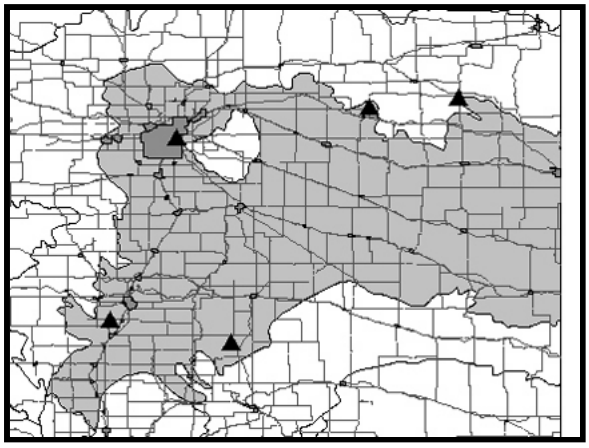


Ferrissia rivularis is a small limpet with a cap-shaped shell, a rounded apex and an oval aperture (Clarke 1981). This species, unlike *F. parallelus*, has an aperture with convex margins. Adult shells are thicker and larger than *F. fragilis,* reaching 7 mm in length and 3 mm in height. In addition, *F. rivularis* is typically associated with moving water.

F. rivularis has been reported to range from New Brunswick to Saskatchewan and south in the United States from Maine to North Dakota, and North Carolina to Wyoming (Clarke 1981). In western Canada, Clarke (1981) does not report this as a species encountered during his surveys in the 1960s, although his collection techniques failed to record any *Ferrissia* species (Lepitzki 2001). *F. rivularis* is found across southern British Columbia and is listed as "apparently secure" in that province (Lee 2000). A few *Ferrissia* specimens have been collected in the province, but species identification is required (Lepitzki 2001).

Surveys in the Central Parkland Subregion confirm that this species occurs in central Alberta. *F. rivularis* was collected from 5 (2.5 %) sites sampled, all from various locations along the North Saskatchewan and Red Deer rivers. In the areas where it was found, the species was most often observed to be "uncommon" (2-10 individuals), with no more than 4 individuals being found at a sample site. Living specimens were found at a single site, where a pH of 9.3 and a conductivity of 0.30 mS were recorded.

Ferrissia rivularis lives attached to plants, rocks, debris and dead mussel shells (Emerson and Jacobson 1976), and as such, is generally hidden and not easily observed or collected. Therefore, the species likely occurs at more than the five sites reported in this study. The species does appear to be restricted to larger rivers in the province, and would therefore be expected to have a rather localized distribution. More focused sampling is needed to clarify the status of this, and other species of *Ferrissia* in the province.



Characteristics

Present at 5 (2.5%) of 197 sites
Alive at 1 (0.5%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	100.0%	+513.5%
Lake	0.0%	-100.0%
Creek	0.0%	-100.0%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 2.6 (range: 1-4)

Rare: 20.0% Common: 0.0%
Uncommon: 80.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 8.7 (range: 8.1-9.3)
Mean conductivity: 0.33 mS (range: 0.30-0.36)

Sites With Live Specimens
Mean pH: 9.3 (range: N/A)
Mean conductivity: 0.30 mS (range: N/A)

Ferrissia parallelus

Oblong ancylid

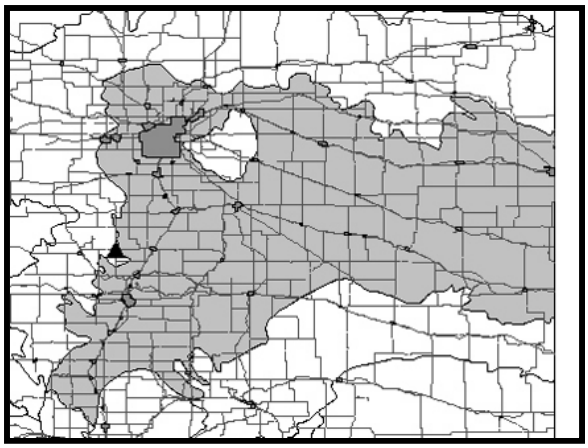
Current Status: Undetermined

Ferrissia parallelus is a small limpet with a cap-shaped shell, rounded apex and oval aperture. The species can be differentiated from the other two limpets found in the province by the straight, almost parallel, sides of the aperture and larger size, with adult shells attaining a length of 9 mm (Clarke 1981). The species lives on stems of cattails and sedges in standing waterbodies, including lakes and swamps, as well as in slow-moving rivers (Clarke 1981).

According to Clarke (1981), *F. parallelus* has an eastern distribution, ranging from Newfoundland and Prince Edward Island to southern Manitoba and into the northern United States. Studies done in southern Manitoba in the 1970s reported *F. parallelus* to be a rare species, but further research conducted in 1998 failed to locate this species (Pip 2000). In British Columbia, the species occurs throughout the province and is listed as being "secure" (Lee 2000). In Alberta, Clarke (1973) does not report this as a species encountered during his surveys during the 1960s, although his collection techniques failed to record any *Ferrissia* species (Lepitzki 2001). A few *Ferrissia* specimens have been previously collected in the province but species identification is required (Lepitzki 2001).

In the Central Parkland Subregion, *F. parallelus* was found at only one site. Three dead individuals were collected from Crestomere Lake, on the western edge of the Subregion, west of Ponoka. At this site, a pH of 9.1 and a conductivity of 0.57 mS were measured. *F. parallelus* lives attached to plants, rocks, debris and dead mussel shells (Emerson and Jacobson 1976), and is generally hidden and not easily observed and collected. Our generalized sampling techniques undoubtedly underestimated the occurrence of all limpet species.

It is suspected that *Ferrissia parallelus* occurs at more than the single location reported in this study. More focused sampling is needed to clarify the status of this, and other, species of *Ferrissia* in the province.



Characteristics

Present at 1 (0.5%) of 197 sites
Alive at 0 (0.0%) of 197 sites

Wetland Use:

Type	% of occupied sites	Relative to availability
River	0.0%	-100.0%
Lake	100.0%	+194.1%
Creek	0.0%	-100.0%
Pond	0.0%	-100.0%

***Abundance*:**
Mean #/sample: 3.0 (range: N/A)

Rare: 0.0% Common: 0.0%
Uncommon: 100.0% Abundant: 0.0%

Water Chemistry:

All Sites
Mean pH: 9.1 (range: N/A)
Mean conductivity: 0.57 mS (range: N/A)

Sites With Live Specimens
Mean pH: N/A
Mean conductivity: N/A

Appendix 2. Numbers of aquatic gastropods and characteristics of wetland collection sites in the Central Parkland Subregion of Alberta in 2001.

Site	Wetland type	Place Name	Latitude	Longitude	Conductivity (mS)	pH	*Valvata l. lewisi*	*Valvata s. sincera*	*Valvata tricarinata*	*Fossaria dalli*	*Fossaria galbana*	*Fossaria modicella*	*Lymnaea stagnalis appressa*	*Stagnicola caperata*	*Stagnicola c. catascopium*	*Stagnicola elodes*	*Stagnicola exilis*	*Aplexa elongata*	*Physa skinneri*	*Physella gyrina*	*Gyraulus crista*	*Gyraulus circumstriatus*	*Gyraulus deflectus*	*Gyraulus parvus*	*Helisoma a. anceps*	*Planorbella campanulata*	*Planorbella p. infracarinatum*	*Planorbella binneyi*	*Planorbella subcrenata*	*Menetus opercularis*	*Promenetus e. exacuous*	*Promenetus e. megas*	*Promenetus umbilicatellus*	*Planorbula armigera*	*Planorbula campestris*	*Ferrissia fragilis*	*Ferrissia parallelus*	*Ferrissia rivularis*
73D/01-1	CREEK	EYEHILL CREEK	52.180	110.076	1.94	8.5							5			13			15		3	4		6					25									
73D/05-1	RIVER	BATTLE RIVER	52.454	111.919	0.85	8.7														2																		
73D/05-2	POND	UNNAMED W OF ALLIANCE	52.522	111.742	2.98	8.5																																
73D/06-1	POND	UNNAMED E BATTLE RIVER	52.492	111.158	0.27	10.2							8			2			1										6									
73D/06-2	RIVER	BATTLE RIVER	52.489	111.250	1.14	8.5			1											50																		
73D/07-1	LAKE	PLOVER LAKE	52.281	110.679	42.65	10.0			2																													
73D/07-2	LAKE	CAPT EYRE LAKE	52.300	110.711	1.43	9.4																	1															
73D/07-3	CREEK	RIBSTONE CREEK	52.431	110.816	1.85	8.8							1						2	1		3	54						4		3							
73D/08-2	LAKE	HANSMAN LAKE	52.407	110.402	16.11	9.6										51		1																				
73D/08-3	POND	PROVOST PICNIC AREA	52.347	110.279	4.29	9.9													64			96	113	7					2									
73D/09-1	LAKE	DILLBERRY LAKE	52.575	110.008	0.46	9.2			5856		152					8	16			16	104	216	384	1944	16					64	8							
73D/09-2	LAKE	UNNAMED E OF EDGERTON	52.734	110.365	3.65	7.8			162		5		2									4	12	81														
73D/09-3	CREEK	RIBSTONE CREEK	52.726	110.270	0.73	8.0							7			36			1	4	2	3	8						19		4							
73D/09-4	LAKE	REFLEX LAKE	52.657	110.018	119.10	8.3																																
73D/10-1	CREEK	RIBSTONE CREEK	52.544	110.745	1.99	9.1													9	1		18		5						4			1					
73D/10-2	LAKE	LAKE S OF DAVID LAKE	52.550	110.607	4.65	10.0																																
73D/10-3	LAKE	ARM LAKE	52.744	110.594	0.35	8.9		8	38				22							10			96						10		46							
73D/11-1	LAKE	FISH LAKE	52.678	111.353	0.47	9.4							12							100	1			5					23								
73D/11-2	CREEK	IRON CREEK	52.711	111.383	1.28	8.3							11							1																	
73D/11-3	POND	UNNAMED WETLAND	52.521	111.107	1.26	9.9										6			1				4						3									
73D/12-1	POND	UNNAMED W OF SCHNEIDER L.	52.550	111.772	2.56	7.9				4			3	2		3			22		5	22	90						4									
73D/12-2	CREEK	UNNAMED INTO BELLSHILL L.	52.609	111.636	3.09	8.5										108		1	54				2						7									
73D/12-3	LAKE	BELLSHILL LAKE	52.609	111.573	4.08	8.5										1			1	4		2							38									
73D/13-1	LAKE	SEDGEWICK CAMPGROUND	52.793	111.693	1.00	9.3							1			2							71						17									
73D/13-2	CREEK	IRON CREEK	52.801	111.649	1.26	8.6										1			7		9	12	26	4							9							
73D/13-3	POND	UNNAMED WETLAND	52.843	111.635	1.50	8.5										30			7		2		8						107									
73D/14-1	LAKE	PENINSULA LAKE	52.853	111.472	19.17	8.7																																
73D/14-2	POND	UNNAMED W OF PENINSULA L.	52.902	111.434	4.20	9.8			1							14			83		33	4	81						2									
73D/14-3	RIVER	BATTLE RIVER	52.894	111.008	0.70	9.1										2				29									7									
73D/15-1	LAKE	CLEAR LAKE	52.771	110.602	0.45	9.1		169	145				579						1	39	13		229						9	102								
73D/15-2	RIVER	BATTLE RIVER	52.999	110.845	0.48	8.8										1				41				2														
73D/15-3	LAKE	BAXTER LAKE	52.926	110.731	60.40	10.1																																
73D/15-4	POND	UNNAMED N OF WAINWRIGHT	52.891	110.826	2.95	9.2							8			4			8		6	36	58	36					10									
73D/16-1	POND	UNNAMED	52.902	110.461	16.28	9.0										14			52		12	44	276	10										2				
73D/16-2	RIVER	BATTLE RIVER	52.944	110.410	1.10	8.8										1				2																		
73D/16-3	CREEK	RIBSTONE CREEK	52.845	110.133	0.77	7.7										3				3			3	13					5									
73E/01-1	CREEK	BLACKFOOT CREEK	53.160	110.126	1.46	7.8								1		1			20		2		18							1	23							
73E/01-2	LAKE	DEEP LAKE (LOCAL NAME)	53.133	110.365	26.03	9.7																																

Site	Wetland type	Place Name	Latitude	Longitude	Conductivity (mS)	pH	*Valvata l. lewisi*	*Valvata s. sincera*	*Valvata tricarinata*	*Fossaria dalli*	*Fossaria galbana*	*Fossaria modicella*	*Lymnaea stagnalis appressa*	*Stagnicola caperata*	*Stagnicola c. catascopium*	*Stagnicola elodes*	*Stagnicola exilis*	*Aplexa elongata*	*Physa skinneri*	*Physella gyrina*	*Gyraulus crista*	*Gyraulus circumstriatus*	*Gyraulus deflectus*	*Gyraulus parvus*	*Helisoma a. anceps*	*Planorbella campanulata*	*Planorbella p. infracarinatum*	*Planorbella binneyi*	*Planorbella subcrenata*	*Menetus opercularis*	*Promenetus e. exacuous*	*Promenetus e. megas*	*Promenetus umbilicatellus*	*Planorbula armigera*	*Planorbula campestris*	*Ferrissia fragilis*	*Ferrissia parallelus*	*Ferrissia rivularis*
73E/01-3	CREEK	BLACKFOOT CREEK	53.036	110.021	1.64	9.4						1	9			1			1				1						1									
73E/02-1	LAKE	STILL LAKE	53.241	110.597	6.21	9.1																	7															
73E/02-2	CREEK	GRIZZLY BEAR CREEK	53.108	110.643	4.00	9.4										34			4			1							2									
73E/02-3	LAKE	UNNAMED BY AUBURNDALE	53.080	110.885	1.10	9.5							4							6			4						6									
73E/03-1	POND	UNNAMED WETLAND	53.172	111.424	8.22	8.4										15			19			4	6	3														
73E/03-2	POND	UNNAMED WETLAND	53.103	111.410	12.44	9.5										5			5				7															
73E/03-3	CREEK	BUFFALO CREEK	53.161	111.228	2.32	8.5								1		1			2																			
73E/04-1	LAKE	THOMAS LAKE	53.104	111.701	20.66	9.6																															
73E/04-2	POND	UNNAMED WETLAND	53.132	111.665	8.65	8.5						8				86			136		2								2									
73E/04-3	LAKE	CAMP LAKE	53.126	111.527	2.24	9.5																															
73E/05-1	CREEK	TRIBUTARY TO BIRCH LAKE	53.259	111.760	1.60	8.0																	1						2									
73E/05-2	POND	UNNAMED WETLAND	53.278	111.570	2.21	8.7										7			5				21															
73E/05-3	LAKE	BIRCH LAKE	53.360	111.518	38.74	9.7																															
73E/05-4	LAKE	UNNAMED S OF RANFURLY	53.396	111.673	6.53	9.1				1				1																							
73E/06-1	RIVER	VERMILLION RIVER	53.454	111.304	1.15	9.1			5				4							14			2						13									
73E/06-2	POND	UNNAMED WETLAND	53.484	111.476	1.26	8.3							7			2			5		2			7					48					1				
73E/06-3	CREEK	BIRCH CREEK	53.396	111.482	0.86	7.8				3									3		1		1						3									
73E/07-1	LAKE	VERMILLION PARK LAKE	53.361	110.868	1.10	9.3			224				48	2						86			14						94	2	2							
73E/07-2	RIVER	VERMILLION RIVER	53.448	110.547	1.55	8.7							7						9				3								4							
73E/07-3	LAKE	HIDDEN LAKE	53.351	110.638	6.87	9.1													26		12	14	148	306							4							
73E/07-4	POND	UNNAMED W OF VERMILLION	53.418	110.866	3.01	8.0										8			1		79		24						1					1				
73E/08-1	RIVER	VERMILLION RIVER	53.484	110.483	1.54	8.6			108				8	4						62	2			34					2		6							
73E/08-2	POND	WETLAND BY STRETTON CR.	53.453	110.327	0.54	8.0				1			2							7				7					5									
73E/08-3	LAKE	UNNAMED SE OF KITSCOTY	53.301	110.299	30.30	9.7																		1														
73E/09-1	RIVER	VERMILLION RIVER	53.653	110.340	0.94	8.6			410											4		32							48									
73E/09-2	LAKE	PASATCHAW LAKE	53.512	110.112	3.92	8.7																															
73E/10-1	POND	UNNAMED WETLAND	53.651	110.768	0.77	10.							16			4			24		18	10	114	102					4		82							
73E/10-2	LAKE	RAFT LAKE	53.622	110.694	7.56	9.7																															
73E/10-3	CREEK	IRISH CREEK	53.655	110.596	0.60	7.9							1										6	2														
73E/11-1	POND	W. DMYTRIW PROJECT	53.551	111.428	1.41	7.8											2		1					3					9		10							
73E/12-1	LAKE	AKASU LAKE	53.496	111.845	14.81	9.5																															
73E/12-2	RIVER	VERMILLION RIVER	53.681	111.844	2.31	10.							2			1			15			4	13	182														
73E/12-3	POND	UNNAMED W OF AKASU LAKE	53.500	111.869	1.12	8.4										10		1	10		1		11	80					1	2								
73E/13-1	RIVER	NORTH SASK. RIVER	53.789	111.690	0.34	8.7			4							2															2							4
73E/13-2	LAKE	BROSSEAU LAKE	53.833	111.672	1.88	9.2																															
73E/15-1	RIVER	N. SASKATCHEWAN RIVER	53.863	110.900	0.34	9.0									16					15				1														3
82O/08-1	LAKE	NIER LAKE	51.413	114.182	0.45	9.5							4						2		2			4						1								
82O/08-2	CREEK	BEAVERDAM CREEK	51.474	114.287	0.51	8.5								1						2			11	23	1													
82O/09-1	CREEK	DOG POUND CREEK	51.621	114.343	0.41	8.6							1							3				5	5													
82O/09-2	LAKE	COPELEY LAKE	51.748	114.191	0.36	9.1							8										14															
82O/09-3	RIVER	ROSEBUD RIVER	51.743	114.191	0.74	9.5				1			5	1					8	5			9	4					7									

Site	Wetland type	Place Name	Latitude	Longitude	Conductivity (mS)	pH	*Valvata l. lewisi*	*Valvata s. sincera*	*Valvata tricarinata*	*Fossaria dalli*	*Fossaria galbana*	*Fossaria modicella*	*Lymnaea stagnalis appressa*	*Stagnicola caperata*	*Stagnicola c. catascopium*	*Stagnicola elodes*	*Stagnicola exilis*	*Aplexa elongata*	*Physa skinneri*	*Physella gyrina*	*Gyraulus crista*	*Gyraulus circumstriatus*	*Gyraulus deflectus*	*Gyraulus parvus*	*Helisoma a. anceps*	*Planorbella campanulata*	*Planorbella p. infracarinatum*	*Planorbella binneyi*	*Planorbella subcrenata*	*Menetus opercularis*	*Promenetus e. exacuous*	*Promenetus e. megas*	*Promenetus umbilicatellus*	*Planorbula armigera*	*Planorbula campestris*	*Ferrissia fragilis*	*Ferrissia parallelus*	*Ferrissia rivularis*
82O/16-1	CREEK	DOG POUND CREEK	51.795	114.363	0.33	9.3																		9					1									
82O/16-2	POND	UNNAMED WETLAND	51.795	114.274	0.76	8.6							19			4			8		45		31						7						1			
82O/16-3	LAKE	UNNAMED W OF BOWDEN	51.932	114.070	0.48	9.4							12			2			5					5					6	1								
82O/16-4	RIVER	LITTLE RED DEER RIVER	51.944	114.242	0.34	8.9					14									21		6	19	3							1							
82P/10-1	RIVER	RED DEER RIVER	51.650	112.901	0.29	9.2														40			3															
82P/11-1	CREEK	THREE HILLS CREEK	51.649	113.279	1.76	8.7														1									4									
82P/12-1	LAKE	BURNS LAKE	51.736	113.855	2.50	8.9														1			6	32							1							
82P/12-2	POND	UNNAMED WETLAND	51.745	113.949	6.50	8.8													9		1	52	25															
82P/13-1	CREEK	KNEESHILLS CREEK	51.795	113.629	2.80	9.8							2			5			3	7			2						2									
82P/13-3	POND	UNNAMED N OF DAVEY LAKE	51.969	113.781	6.50	8.2																								2								
82P/14-1	RIVER	RED DEER RIVER	51.835	113.014	0.29	9.1														14		1																
82P/14-2	LAKE	BIGELOW LAKE	51.887	113.467	1.15	9.1														198			2	1					1									
82P/14-3	CREEK	GHOSTPINE CREEK	51.824	113.205	2.85	9.2				1			2			3			7	1	1		37						15									
82P/14-4	LAKE	THREE HILLS CR. RESERVIOR	51.912	113.478	1.30	7.5										2			2	4	1	11	19	24					13		9	1						
82P/15-1	CREEK	BIG VALLEY CREEK	51.941	112.839	1.36	8.1										38							7						41									
82P/15-2	RIVER	RED DEER RIVER	51.972	112.909	0.30	9.3			51		8									41		2															3
83A/02-1	LAKE	WALL LAKE	52.230	112.695	1.69	9.2										40			9			1							7									
83A/02-2	CREEK	BIG VALLEY CREEK	52.056	112.717	3.20	8.4										8			5		11	10	14	60					2		4							
83A/02-3	LAKE	MUD LAKE	52.185	112.792	1.30	8.4										1			17		2			100														
83A/03-1	LAKE	UNNAMED N OF GOOSEQUILL	52.081	113.166	3.20	8.1										3			4		3		76															
83A/03-2	RIVER	RED DEER RIVER	52.249	113.282	0.30	9.1										2				10			3															
83A/03-3	POND	MIDDLE WOOD LAKE	52.052	113.294	0.90	8.0		83		3						15			23	10	11	5	166	49							3							
83A/03-4	LAKE	PINE LAKE	52.067	113.450	0.80	9.4			125	4						2			228	16	778	12	22	844					2	282	862	20						
83A/04-1	POND	UNNAMED S OF RED DEER	52.182	113.790	0.36	9.9													12				1	2														
83A/04-2	CREEK	WASKASOO CREEK	52.143	113.856	0.73	8.7							1			44			1				2						2									
83A/04-3	RIVER	RED DEER RIVER	52.143	113.967	0.36	8.1					5									9																		2
83A/05-1	RIVER	BLINDMAN RIVER	52.359	113.964	0.46	8.9														2																		
83A/05-2	LAKE	BLACKFALDS LAKE	52.398	113.723	1.50	8.9													7		2			13					1		2							
83A/05-3	POND	ON 32ND ST. (RED DEER)	52.251	113.838	1.36	9.0							5			3			12		2	5		9					2	1	3							
83A/05-4	POND	ELLIS BIRD FARM	52.390	113.611	0.54	7.9							3			62			2	1			2	10														
83A/05-5	LAKE	GULL LAKE	52.458	113.973	1.33	9.0							40			20		4	28		10		8	156														
83A/06-1	CREEK	TAIL CREEK	52.307	113.071	1.00	7.0				1			2							42									7									
83A/06-2	LAKE	HAUNTED LAKE	52.4	113.150	3.85	8.7																5	29	9														
83A/06-3	RIVER	RED DEER RIVER	52.306	113.075	0.30	6.0				2	14					3				193			20															
83A/06-4	POND	BUFFALO LAKE NARROWS	52.452	113.062	0.37	8.5		13	2				16			2			11		1		13	18					15		7							
83A/07-1	CREEK	RED WILLOW CREEK	52.398	112.572	1.56	8.0													13				4						1									
83A/07-2	LAKE	BUFFALO LAKE	52.463	112.883	1.68	9.3								1					3				1															
83A/07-3	POND	GREAT WEST POND	52.304	112.934	2.50	8.2								62		82		12	18		7		6						4									
83A/08-1	POND	UNNAMED WETLAND	52.491	112.211	0.60	8.7			40				5						5			3		4							7							
83A/08-2	CREEK	BIG KNIFE CREEK	52.490	112.221	0.81	8.4			2							1				23				1														
83A/08-3	LAKE	BATTLE RESERVOIR	52.468	112.110	0.85	9.0			207										4			2		8						5								

Site	Wetland type	Place Name	Latitude	Longitude	Conductivity (mS)	pH	*Valvata l. lewisi*	*Valvata s. sincera*	*Valvata tricarinata*	*Fossaria dalli*	*Fossaria galbana*	*Fossaria modicella*	*Lymnaea stagnalis appressa*	*Stagnicola caperata*	*Stagnicola c. catascopium*	*Stagnicola elodes*	*Stagnicola exilis*	*Aplexa elongata*	*Physa skinneri*	*Physella gyrina*	*Gyraulus crista*	*Gyraulus circumstriatus*	*Gyraulus deflectus*	*Gyraulus parvus*	*Helisoma a. anceps*	*Planorbella campanulata*	*Planorbella p. infracarinatum*	*Planorbella binneyi*	*Planorbella subcrenata*	*Menetus opercularis*	*Promenetus e. exacuous*	*Promenetus e. megas*	*Promenetus umbilicatellus*	*Planorbula armigera*	*Planorbula campestris*	*Ferrissia fragilis*	*Ferrissia parallelus*	*Ferrissia rivularis*
83A/09-1	POND	UNNAMED WETLAND	52.638	112.269	1.75	7.5										1																						
83A/09-2	CREEK	MEETING CREEK	52.554	112.411	0.55	7.8														8																		
83A/09-3	POND	UNNAMED WETLAND	52.666	112.446	1.26	9.7																	1															
83A/09-4	RIVER	BATTLE RIVER	52.696	112.450	0.46	8.4													2	3							1										
83A/10-1	LAKE	SITTINGSTONE LAKE (1ST)	52.579	112.932	5.26	9.8																															
83A/10-2	LAKE	BUFFALO LAKE (PELICAN	52.522	112.827	2.45	9.0																															
83A/10-3	CREEK	MEETING CREEK	52.596	112.567	0.73	8.2																															
83A/10-4	RIVER	BATTLE RIVER	52.744	112.566	0.53	9.4			3							1				1			4								3						
83A/11-1	RIVER	BATTLE RIVER	52.658	113.675	0.43	8.6		1	27	1			1			2			3	11	1	1						2									
83A/11-2	LAKE	CRESTOMERE LAKE	52.673	113.913	0.57	9.1		74		7			1			4			3		7	25	60	484							33					3	
83A/11-3	CREEK	UNNAMED N OF LACOMBE	52.521	113.736	0.51	7.8				1			3			10			10		5		11						23		3						
83A/12-1	POND	UNNAMED WETLAND	52.690	113.172	2.75	9.2										4			10				1														
83A/12-2	LAKE	NELSON LAKE	52.667	113.379	0.42	9.8													9	2			4						2								
83A/12-3	CREEK	WETLAND N OF CHAIN LAKES	52.637	113.474	0.76	8.0																	2														
83A/13-1	POND	UNNAMED (TILLICUM BEACH?)	52.814	113.768	2.55	7.7													10		1		1														
83A/13-2	RIVER	BATTLE RIVER	52.814	113.888	0.41	8.1		18	96											2	1			46			3				1						
83A/13-3	LAKE	BEARHILLS LAKE	52.932	113.602	0.51	9.1							6			2				3			15						18								
83A/14-1	CREEK	UNNAMED CREEK	52.930	113.376	1.62	7.4										14			5		1								27				2				
83A/14-2	POND	UNNAMED WETLAND	52.872	113.160	1.02	9.1							6			18			22		14	144	74						38								
83A/14-3	LAKE	RED DEER LAKE	52.800	113.070	1.51	10.5																13	46	11													
83A/15-1	LAKE	DRIEDMEAT L. (TILLICUM	52.877	112.757	0.64	9.9							7						9	9							8		1								
83A/15-2	RIVER	BATTLE RIVER	52.938	112.849	0.55	9.6			14											2		1															
83A/15-3	LAKE	MIRROR LAKE	53.018	112.834	0.55	9.4														58	3		22	18					41	1							
83A/16-1	CREEK	UNNAMED CREEK	52.824	112.447	1.26	8.0				1			7	46		25	1		5				2						11		1						
83A/16-2	POND	UNNAMED E OF STROME	52.814	112.107	1.67	8.4										3			5				16	41				1	3								
83A/16-3	POND	UNNAMED WETLAND	52.916	112.466	2.26	7.6																												1			
83B/01-1	LAKE	GLENNIFER LAKE	52.017	114.292	0.35	9.0			1							3				10			7	4													
83B/01-2	POND	DICKSON TROUT POND	52.001	114.300	0.24	9.2				10				2		12				102			296	298	34					2	2						
83B/08-1	LAKE	CYGNET LAKE	52.283	114.017	1.24	8.7							4			2		4	8		6	38	74	70							4						
83G/10-1	LAKE	WABAMUM LAKE	53.520	114.520	0.50	9.0			36	4			20			22				12			2		10			4	16								
83H/01-1	CREEK	UNNAMED CREEK/WETLAND	53.133	112.197	2.28	8.2										58						1							17								
83H/01-2	POND	UNNAMED WETLAND	53.205	112.153	8.78	9.3										5			25		3		1						2								
83H/01-3	POND	UNNAMED W OF HOLDEN	53.226	112.230	2.66	9.2													5		21		20						2								
83H/02-1	CREEK	CAMROSE CREEK	53.121	112.904	1.07	9.3							2			9			26		1	9	19	6					5		8	3					
83H/02-2	POND	MIQUELON PROV. PARK	53.238	112.897	0.67	9.3							9						6				8						35								
83H/02-3	LAKE	MIQUELON LAKE	53.249	112.890	8.65	9.4																															
83H/03-1	POND	UNNAMED WETLAND	53.229	113.221	5.69	8.4										3																					
83H/03-2	LAKE	COAL LAKE	53.133	113.357	0.47	10.0			16										8	25	1			26					2		3						
83H/03-3	CREEK	PIPESTONE CREEK	53.047	113.409	0.47	7.5														14									2								
83H/04-1	CREEK	CONJURING CREEK	53.236	113.820	0.55	7.7										73													5								
83H/04-2	LAKE	WIZARD LAKE	53.113	113.837	0.31	8.6	1		50											5			8	6							2						

Site	Wetland type	Place Name	Latitude	Longitude	Conductivity (mS)	pH	*Valvata l. lewisi*	*Valvata s. sincera*	*Valvata tricarinata*	*Fossaria dalli*	*Fossaria galbana*	*Fossaria modicella*	*Lymnaea stagnalis appressa*	*Stagnicola caperata*	*Stagnicola c. catascopium*	*Stagnicola elodes*	*Stagnicola exilis*	*Aplexa elongata*	*Physa skinneri*	*Physella gyrina*	*Gyraulus crista*	*Gyraulus circumstriatus*	*Gyraulus deflectus*	*Gyraulus parvus*	*Helisoma a. anceps*	*Planorbella campanulata*	*Planorbella p. infracarinatum*	*Planorbella binneyi*	*Planorbella subcrenata*	*Menetus opercularis*	*Promenetus e. exacuous*	*Promenetus e. megas*	*Promenetus umbilicatellus*	*Planorbula armigera*	*Planorbula campestris*	*Ferrissia fragilis*	*Ferrissia parallelus*	*Ferrissia rivularis*
83H/04-3	POND	UNNAMED WETLAND	53.047	113.716	0.43	7.7	3						1					1		2			2						3					1				
83H/05-1	RIVER	NORTH SASK. RIVER	53.372	113.753	0.31	8.7																																
83H/05-2	POND	UNNAMED WETLAND	53.425	113.834	0.43	8.1	20	13					8						1		1		8			17			9									
83H/05-3	LAKE	UNNAMED WETLAND	53.493	113.946	0.51	9.0							7						3		4	106	5	71					20	1	16							
83H/06-1	LAKE	COOKING LAKE	53.403	113.091	1.19	9.8							1			19			1										24									
83H/06-2	CREEK	CLEAR WATER CREEK	53.309	113.387	0.76	7.7										54			4				4															
83H/06-3	POND	UNNAMED WETLAND	53.280	113.234	1.32	7.8										3			2				3						20		1							
83H/07-1	CREEK	UNNAMED CREEK	53.316	112.538	1.08	9.6							7				3		7	20			50						50									
83H/07-2	POND	UNNAMED S OF HASTINGS	53.396	112.889	0.75	7.6																	7								7							
83H/07-3	LAKE	HASTINGS LAKE	53.407	112.920	0.91	9.6			19				26							85		4							3		5							
83H/08-1	LAKE	BEAVERHILL LAKE	53.454	112.436	2.87	9.8																																
83H/08-2	RIVER	VERMILLION RIVER	53.492	112.039	0.60	8.5							6							3			1							8								
83H/08-3	POND	UNNAMED NEAR RYLEY	53.289	112.417	1.12	7.4													1																			
83H/09-1	POND	UNNAMED NW OF VEGREVILLE	53.604	112.214	1.58	8.1										75			8		13		30						1									
83H/09-2	POND	UNNAMED NW OF VEGREVILLE	53.621	112.214	0.66	7.7										78		2	24		16								6		36			4				
83H/09-3	POND	UNNAMED NW OF VEGREVILLE	53.689	112.165	1.23	9.5																																
83H/10-1	POND	UNNAMED, ELK ISLAND NAT.	53.602	112.976	1.12	7.8															1		8															
83H/10-2	LAKE	BENNETT LAKE	53.533	112.999	0.33	10.2							4						1	1									40									
83H/10-3	CREEK	NORRIS CREEK	53.561	112.656	0.82	7.8				23			1			35		4					54								1	5	1					
83H/11-1	LAKE	BEAG LAKE	53.513	113.223	0.61	9.3							1			4			6				1	7					23		3							
83H/11-2	RIVER	NORTH SASK. RIVER	53.561	113.382	0.32	8.3					1									3																	1
83H/11-3	POND	LAKELAND VILLAGE POND	53.567	113.268	0.57	9.6							14							1																	
83H/12-1	RIVER	STURGEON RIVER	53.667	113.765	0.57	8.1	1	3	210	1			34					1		58			46	6					75									
83H/12-2	POND	UNNAMED NEAR BIG LAKE	53.600	113.738	1.04	7.5										9																					
83H/12-3	LAKE	MUIR LAKE	53.628	113.957	0.29	8.9		76	238				8							10	2		2	86							18							
83H/12-4	LAKE	BIG LAKE	53.596	113.737	0.67	8.5		2	104				6			16			60		4		114	226					2	4	28							
83H/13-1	CREEK	LITTLE EGG CREEK	53.861	113.620	0.98	7.9		1					1	1		52		2	10		2	7	8	19					12		3							
83H/13-2	LAKE	MORRINVILLE LAKE	53.802	113.668	0.59	9.5			120	4			4	2		52				458		164	18															
83H/13-3	POND	UNNAMED N OF MORRINVILLE	53.833	113.650	0.87	9.0											1			5				1					2									
83H/14-1	RIVER	STURGEON RIVER	53.849	113.298	0.61	8.3							1							12			1															
83H/14-2	LAKE	LILY LAKE	53.955	113.387	0.78	8.7							1																3									
83H/14-3	POND	UNNAMED WETLAND	53.889	113.397	1.45	8.6							1			107			17		3		16	9					6	1	7				1			
83H/15-1	CREEK	BEAVERHILL CREEK	53.803	112.757	0.31	7.8							1							2	1	1							3		2							
83H/15-2	RIVER	NORTH SASK. RIVER	53.889	112.975	0.32	8.5										308				84																		
83H/16-1	POND	UNNAMED WETLAND	53.774	112.080	3.18	8.1										9			18		5	2	8	24					4									
83H/16-2	CREEK	WHITFORD CREEK	53.803	112.411	1.12	8.0							18			3			6				49						10									

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