Observations on the Life History and Distribution of the Showy Pond Snail, *Bulimnea megasoma* (Say) (Gastropoda: Pulmonata) in Southeastern Manitoba

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This study examines the growth rate of the Showy Pond Snail *Bulimnea megasoma* (Say). The results indicate that this large gastropod is long lived with a four to five year life span. Egg laying begins in the second summer. Although in Manitoba the species is increasingly difficult to find, specimens can still be observed in the undisturbed relatively soft waters of larger streams and rivers along the western edge of the Canadian Shield.

Cette étude examine le taux de croissance de l'escargot bulimnée géant, *Bulimnea megasoma* (Say). Cet escargot a une durée moyenne de vie de quatre à cinq ans et commence à pondre ses oeufs durant l'été de la deuxième année. Bien qu'au Manitoba cette espèce devient de plus en plus difficile à trouver, des spécimens peuvent encore être observés dans les eaux douces et calmes des grands cours d'eau situés à la bordure ouest du bouclier canadien.

Key Words: Showy Pond Snail, *Bulimnea megasoma*, growth curve, distribution, water quality, threatened species, Manitoba.

Previous research on freshwater gastropods in Manitoba by McKillop (1985) and Pip (1978) indicated that little was known about the life history and distribution of the pulmonate snail *Bulimnea megasoma.*

In Manitoba, as in other areas of North America, this species is rare or locally extirpated (Grimm 1975; Pip 1978). In a study in northern Minnesota, Gilbertson et al. (1978) noted that the species was generally found in the prairie-forest ecotone (parkland), whereas in Manitoba both McKillop (1985) and Pip (1986) found the species in the southern fringe of the boreal biome and only infrequently in the parkland ecotone. Clark (1973) noted that Bell in 1881 found the species in central Manitoba, a finding supported by W. B. McKillop in 1992 during a Province-wide survey. Here, the bedrock, soils and waters are similar to that 350 km to the south where the species has been collected more frequently.

Pip (1985, 1986, 1988) studied gastropod and macrophyte diversity and relationships with selected water chemistry parameters. The present study supports Pip's findings and those of McKillop (1985) with regard to water chemistry, and provides additional data specifically for *Bulimnea megasoma.*

Gilbertson et al. (1978) noted that this species had an annual life cycle with individuals living 12 to 14 months, whereas McKillop (1985) suggested it was long-lived, with at least a triennial life history. In that study (McKillop 1985) the number of specimens taken was limited, preventing the construction of size-frequency tables from which adequate life history information could be drawn. Since the size-frequency tables developed in these earlier studies were incomplete, it was hoped that this inconsistency could be addressed. In the present study we have investigated the growth rate of this pulmonate in the laboratory and integrated this information with observations gathered in the field, thereby yielding a more accurate life history growth curve.

Materials and Methods

Ten sites known to contain *Bulimnea megasoma* were selected in southeastern Manitoba (Figure 1). Seven of these sites had been studied previously (McKillop 1985). In May and June of 1988 both water and biological samples were collected from these ten sites.

Water was collected in plastic bottles, kept cool and returned for analysis the same day. Water analyses were made by the Manitoba Technical Services Laboratory using methods outlined in the Analytical Methods Manual (Anonymous. 1980. Analytical Methods Manual. Technical Services Laboratory, Winnipeg, Manitoba. Unpaginated). To ensure accuracy, these data were used only when the charge balance error was less than 5.0%.

Snails were collected by vigorously sweeping a hand net, with mesh openings of 0.2 mm, through the submerged vegetation as described by McKillop and Harrison (1972). Samples were returned to the laboratory in plastic bags where *Bulimnea megasoma* specimens were removed and placed in covered, aerated aquaria. These aquaria were maintained at room temperature (approximately 21°C) on a

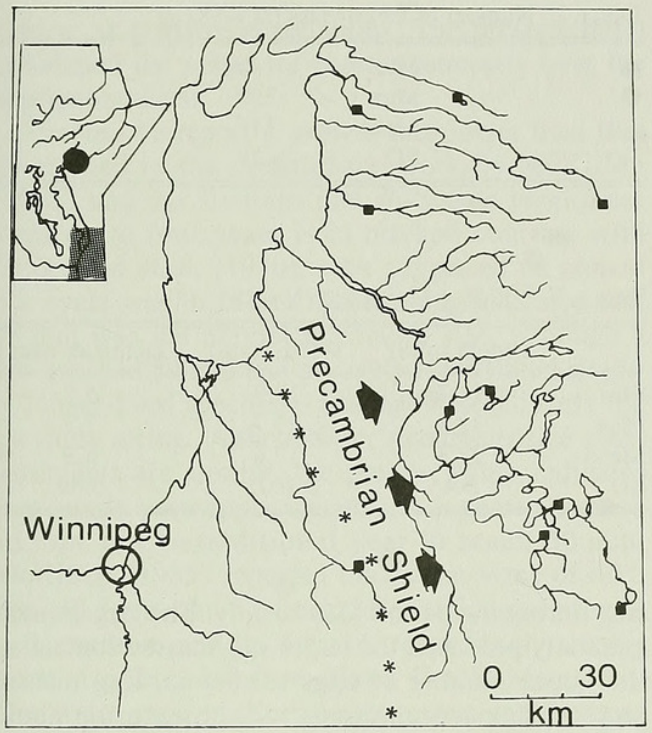

FIGURE 1. The study area, showing the 10 collection sites (●) in relation to the demarcated (*) Canadian Shield — dolomite interface. The north-central area of the Province where the species has been collected is shown on the inset map (●).

window sill subject to north ambient lighting. Because of the proximity to the laboratory, both water and specimens used in the laboratory were taken from Hazel Creek (49° 53'N; 96° 14'W) (site 17 of McKillop 1985). No experiments were undertaken using softer waters. Although considerable effort was made to locate the hatchling and juvenile stages in the field, no individuals smaller than 8 mm were found. Information on these stages was gained by raising young from egg masses derived from mature laboratory specimens. In addition, the simultaneous raising of a variety of larger specimens in the laboratory was necessitated by difficulties experienced with mark and recapture techniques, vandalism of containment cages, the slow growth rate and lack of distinct size classes in the field. Throughout the ice-free season creek water was collected approximately bi-monthly and stored in covered plastic containers. In autumn, larger amounts of water were collected for use throughout the winter.

Weekly, the snails were fed lettuce (*ad libitum*), faecal matter was removed, and fresh aerated creek water added. Complete water changes were made bi-monthly except during winter when more limited water supply allowed less frequent (approximately monthly) changes of water.

The laboratory growth experiments continued over a 24 month period, with the growth of individuals from various size classes being monitored. Measurement of shell height (spire tip to base) for the larger shells was made at approximately monthly intervals using a vernier caliper. The juvenile stages were measured bi-monthly and the hatchlings weekly, using a stereo microscope equipped with an eyepiece micrometer.

The aquaria were monitored daily and when egg masses were noted the adult snails were removed from these aquaria to prevent predation. The egg masses and the eggs therein were measured approximately bi-weekly.

Results

Water samples were taken from all ten sites twice but the charge balance error of 7 analyses exceeded 5.0 % and hence only 13 analyses were included in the statistics for water quality parameters (Table 1). The mean values for the two samples from Hazel Creek are presented as representative of the water used in the aquaria.

The growth curve (Figure 2) was derived from both laboratory raised hatchlings and from larger individuals brought from Hazel Creek and raised in the laboratory. For the smaller specimens it represents the mean size/age (growth rate) of multiple cohorts of hatchlings raised for upwards of a year. For specimens larger than 12 mm the curve was generated by calculating the mean growth rate of specimens brought from the field, categorized into 5 mm size classes and raised in the laboratory for periods of upwards of 18 months.

Specimens exceeding 24 mm and brought from Hazel Creek in spring commenced egg laying within a month of capture with peak egg production occur-

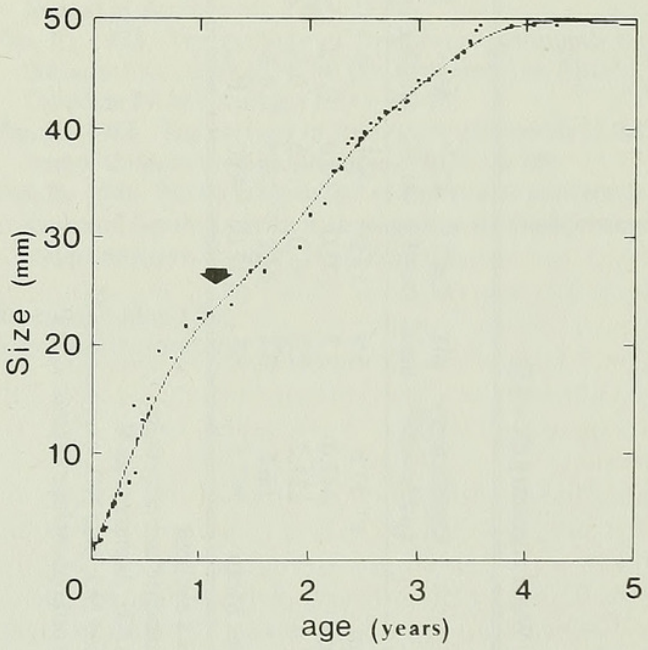

FIGURE 2. *Bulimnea megasoma* growth curve. The size at first egg production is indicated.

Table 1. Water chemistry (N = 13)

	Conductivity (µmho/cm)[a]	pH units	$CaCO_3$ (mg/L)	Ca^{2+} (mg/L)	Mg^{2+} (mg/L)	SO^{2-} (mg/L)	Residue Filtrate (mg/L)	Cl^- (mg/L)	Na^+ (mg/L)	Fe^{3+} (mg/L)	Mn^{3+} (mg/L)	Colour units	Turbidity (NTU)[b]	F^- (mg/L)	Total N (Kjeldhal) (mg/L)	NH_3^c (mg/L)	$NO_3 + NO_2^d$ (mg/L)	ortho-PO^e (mg/L)
Minimum	57.8	5.9	10.0	5.0	2.0	4.7	54.0	1.6	1.0	0.05	0.02	15.0	0.79	0.10	0.50	0.01	0.01	0.02
Maximum	347.0	8.7	202.0	56.0	19.2	34.2	290.0	55.0	26.0	6.40	0.29	100.0	8.20	0.19	4.00	0.42	5.90	0.50
Mean	121.2	7.2	50.0	14.5	6.5	11.5	136.4	6.1	7.1	1.00	0.09	45.4	3.13	0.11	1.45	0.05	0.26	0.08
SD	66.7	0.7	44.2	10.5	4.3	6.5	69.4	11.7	5.3	1.51	0.08	18.9	2.26	0.03	0.84	0.08	1.11	0.10
Lab Water Mean	307.5	8.1	187.0	45.0	19.2	9.6	270.0	2.6	8.1	0.29	0.16	37.5	1.95	0.17	1.50	0.03	0.01	0.04

[a]1 mho = 1 siemens.
[b]Nephelometric turbidity units.
[c]Soluble NH_3 expressed as N
[d]Dissolved NO_3 plus NO_2 expressed as N.
[e]Soluble orthophosphate expressed as P.

TABLE 2. Number of Eggs/Mass (N = 18)

Min	=	40
Max	=	350
Mean	=	116
SD	=	78

TABLE 3. "U" Egg Mass Size (N = 18)

	Length (mm)	Width (mm)	Diameter (mm)
Min	14.7	10.9	5.2
Max	32.8	29.7	7.7
Mean	22.3	17.6	6.3
SD	6.4	6.0	0.89

ring during the period May to July. The larger snails generally produced the larger egg masses containing the larger number of eggs (Table 2). Egg masses were U-shaped gelatinous tubes measuring about 22.3 X 17.6 mm with diameters of ca. 6.3 mm (Table 3). The oval eggs were ca. 1.0 X 1.4 mm and the embryos therein ca. 0.2 mm in diameter. The eggs took approximately 21 days to hatch, at which time the hatchlings' shell heights were ca. 1.2 mm.

Discussion

In Manitoba, *Bulimnea megasoma* is found along the western edge of the Canadian Shield. Waters in this area are, for the most part, relatively soft (McKillop 1985) and lie at the lower end of the water chemistry range. Specimens of *B. megasoma* were collected from ten stream and river ("lotic") sites in southeastern portion of the Province. All of these sites showed evidence of ponding with water depths exceeding 1 m locally and very slow flows were the norm. Clarke (1973) noted that Bell in 1881 had collected the species in the Echimamish River, part of the Nelson River system at 54° 20'N; 97° 27'W. Today, much of this area is dry having been impacted by a massive hydro-electric development. In 1992, during a Province-wide study, we collected this species from but one site north of those noted in Figure 1. This "lentic" site, on the Nelson River system at Ponask Lake, 53° 50'N; 96° 31'W, is approximately 80 km southeast of Bell's site. Here, as in the south where the species has been taken more frequently, both bedrock and soils lack the ability to neutralize acids.

In the present study, the results gathered in the field support previous work by Pip (1978, 1985, 1986, 1988) and McKillop (1985). Pip indicated that the species was sensitive to high values of phosphate, pH and total alkalinity, requiring in general low concentrations of inorganics. On the other hand, McKillop's regression predictors for this species showed nitrate and nitrite nitrogen, calcium and

colour, as positive correlations. The present study broadened the range for some parameters over the previous studies.

Herein, we report a growth rate lower than that mentioned in the preliminary work by McKillop (1985) and our findings that *Bulimnea megasoma* lives up to four years is in marked contrast with Gilbertson et al. (1978), who suggested an annual life cycle was the norm. Their study indicated that 45 mm was the normal maximum size, although a few reached 50 mm and probably represented slightly longer-lived specimens that had hatched early the previous spring. Although our maximum size measurements are similar, the present study indicates that snails take approximately 3.5 years to reach 45 mm and an additional year to reach 50 mm. McKillop (1985) reported maximum sizes of 40.0 mm, 48.5 mm and 53.4 mm for individuals living in soft, medium and hardwaters respectively (maximum size recorded from Hazel Creek, Manitoba). The water used in the laboratory was at the upper end of this range and has been previously classified as hard (McKillop 1985) since the site is located off the Shield, in the parkland ecotone, west of the Ordovician dolomite-Precambrian granite contact. While our laboratory findings support those of Gilbertson et al. (1978), in that the number of hatchlings peaked in the period May - July, we found that a full year elapses before the 20 mm size is attained. In Minnesota, this size is apparently reached within a couple of months. In the current study, we observed that egg laying did not commence until a shell height of 24 mm is reached, at which time snails were more than one year old. Nevertheless, as outlined above, snails living in softer water had a smaller maximum size and it is probable that these snails may start laying eggs at a somewhat smaller size than those from Hazel Creek. Unfortunately, we did not use softer waters in the current experiment and hence we are unable to determine at what size specimens living in soft water commence egg laying. Hatchlings measured approximately 1.2 mm and grow to less than 12 mm by autumn. As in our study, it is probable that Gilbertson et al. (1978) simply were unable to observe or collect hatchlings in the field as they do not record sizes smaller than 5 mm. Thus, the apparent lack of hatchlings in the field must be an artifact of sampling technique.

It is unfortunate, but *Bulimnea megasoma* is now rarely observed even at sites that harboured large numbers as recently as the mid 1970s. The deterioration of water quality appears to be the obvious factor affecting the species. Hence, in an effort to draw the plight of this animal to the attention of Government authorities, thereby providing some protection to the species, it has been recommended that *B. megasoma* be classified as vulnerable and added to the province's provisional listing of Endangered Plants and Animals.

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