THE EMPORIA STATE RESEARCH STUDIES

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Population Dynamics of *Physa Anatina* Lea in a Natural Spring Community

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Joyce F. Fleming *

ABSTRACT

A study of the population dynamics of *Physa anatina* Lea inhabiting Ross spring revealed the population density to be related to the amount of watercress present in the spring's pool. Seasonal density of snails ranged from 10 snails per m^2 of plant surface area in the early spring to 145 snails per m^2 in late July. The fluctuations in density and total standing crop of snails were found to be related to the peaks in reproductive activity.

It was found that the Ross population began its reproductive season in late April and continued through July and August with some reproduction year round. Two peaks in natality occurred, the first and greatest in mid-May and the second during July and August. The accumulative effect of these peaks in natality resulted in the July peak in density and standing crop.

Laboratory investigations showed eggs from the Ross population hatched in an average of 18 days from deposition. Hatchability averaged 72.3% while survivability of the young was 24% after the first 60 days. Specific natality ranged from an average of 12.6 young per adult during the winter to 85.1 during the summer.

Investigation of the population age structure further supported two peaks in natality and the effect of natality on the density and total standing crop of snails. Age structure of the Ross population remained stable during the winter and until late April. By May the percentage of young began increasing and reached a maximum in late May.

Reproductive activity was believed related to water temperatures occurring in the spring. Due to the relatively stable temperatures of this aquatic habitat the population showed some natality year round. The age structure investigations supported continuous reproduction since all four age classes were continuously present.

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* Joyce F. Fleming is a biology teacher, most recently at Neponset, Illinois, Junior-Senior High School.

This study originated as a master's thesis in the Division of Biological Sciences at Emporia State University under the direction of Dr. Carl Prophet. The author wishes to acknowledge support from the Biology Student Research Committee of Emporia State University.

INTRODUCTION

Physa anatina Lea is a common and widespread snail in Kansas, occurring in a variety of permanent and temporary freshwater habitats. Its probable range extends from Nebraska south to central Texas, and it is known to occur east as far as Illinois and west to New Mexico and Colorado (Leonard, 1959; Brown, 1937).

Leonard (1959) stated that *P. anatina* is found in much the same types of habitats as *P. hawnii* Lea and that there is little difference in life cycles and habits of these two species. The reproductive period of *P. hawnii* usually begins during February and continues into the fall.

There is no previous record of the occurrence of *P. anatina* on Ross Natural History Reservation. Basch, Bainer, and Wilhm (1961) compiled an annotated list of the molluscan fauna of the Ross Natural History Reservation and did not mention collecting *P. anatina*. Although they reported *P. hawnii* to be the most common aquatic gastropod found during their study, only a single specimen was collected from the spring, the study habitat for my research. During the fall, 1973, numerous *Physa* were observed in the small pool at the head of the spring. Specimens were collected and identified as *P. anatina*. Dr. W. J. Clench, Harvard Museum of Comparative Zoology, verified identification of the specimens.

Because of the small size of the habitat and the fact that no other species of gastropods were present, this spring presented an excellent opportunity to observe selected aspects of the population dynamics of *P. anatina*. In November, 1973, a study was initiated to record seasonal variations in population density, reproduction, and population structure of *P. anatina* inhabiting the pool area of the spring.

DESCRIPTION OF STUDY AREA

The Ross Natural History Reservation is operated by the Division of Biological Sciences of Emporia State University. It is located approximately 8.4 km west of Americus and 22.4 km northwest of Emporia. The history, topography, and vegetation of the area have been described by Hartman (1960), Wilson (1963), and Basch et al. (1961).

The study site, hereafter referred to as Ross spring, is located in the southeast corner of grid A39. It consists of an unshaded rectangular pool approximately 1.0 m x 3.5 m bordered by limestone rocks. The pool varies in depth from 8 cm near the spring outflow to 25 cm near the source. Outflow from the pool seeps down a northeast-facing slope, forming a marsh environment. The pool is matted with watercress (*Nasturtium officinale*), which sometimes fills the pool.

Water temperatures in the pool varied from 11 to 16 C during the study. Dissolved oxygen and methyl orange alkalinity also ex-

hibited slight seasonal variations during the period of this study (Table I).

Table I. Seasonal average of physicochemical characteristics of Ross Spring.

	Temperature C	Dissolved Oxygen ppm	M.O. Alkalinity ppm
Spring	11	5.3	413
Summer	16	4.1	348
Fall	15	6.1	367
Winter	11	6.6	*

* not obtained

METHODS AND MATERIALS

Physa anatina was found predominantly among the watercress plants, which necessitated the use of a special device to collect both snails and watercress. A metal cylinder 12.5 cm in diameter and 28.5 cm in height was used. The bottom of the cylinder had a sharp edge that would cut through the watercress mat. Watercress within the cylinder was then removed and placed in plastic bags, labelled, and returned to the laboratory. A small mesh strainer of approximately 0.08 mm mesh was passed through the water within the cylinder to collect loose plant materials and animals, which were added to the samples.

Field samples were collected periodically from November, 1973, through September, 1974. The pool was divided into fifteen 0.25 m^2 quadrats, using nylon twine. Quadrats were numbered and on each sampling date collections were made from two quadrats. The quadrats to be sampled were determined by drawing numbered cards. In general, field samples were collected at intervals of four weeks, with more frequent samples during spring (four day intervals) and summer (8 day intervals) to detect changes in population structure and reproduction. Each plastic bag was marked with the number of the quadrat sampled so that snails and egg masses could be returned to the same general location after the materials had been examined in the laboratory.

In the laboratory, samples were washed through soil sieves; the finest mesh used was 0.04 mm. The snails, egg masses, and watercress were separated. All snails in each sample were counted and examined with the aid of a binocular microscope. Using a vernier caliper, the maximum length of each shell was measured from the spire apex to the outer edge of the aperature. The greatest width of the aperature was also recorded. The product of the shell length and width was used as a size index.