TRANSACTIONS OF THE

ZIMBABWE SCIENTIFIC ASSOCIATION

founded 1899

Vo. 60 No. 4 : 18-23 ISBN 0 7974 0461 9 August, 1980

SEASONAL BREEDING ACTIVITY IN FRESHWATER MUSSELS *(LAMELLIBRANCHIATA : UNIONACEA)* IN LAKE KARIBA AND LAKE MCILWAINE, ZIMBABWE

by D.H.S. Kenmuir

Division of Aquatic Ecology, Department of National Parks and Wildlife Management, Zimbabwe.

Current address: McIlwaine Research Centre, P.B. 962, Norton, Zimbabwe.

Published by the Zimbabwe Scientific Association

Printed by Litho Services

Price Zimbabwe $0,60

Trans. Zimbabwe Scient. Ass. **60** *(4) : 18-23*

SEASONAL BREEDING ACTIVITY IN FRESHWATER MUSSELS *(LAMELLIBRANCHIATA : UNIONACEA)* IN LAKE KARIBA AND LAKE MCILWAINE, ZIMBABWE

D.H.S. Kenmuir

Division of Aquatic Ecology, Dept. of National Parks and Wildlife Management, Zimbabwe.

Present Address: McIlwaine Research Centre, P.B. 962, Norton.

Received 4th, July 1980

SUMMARY

The seasonal breeding pattern of three species of mussels in Lake Kariba and one species in Lake McIlwaine, as indicated by gravidity in females, is described. In Lake Kariba, two species *(Caelatura mossambicensis* and *Mutela dubia)* bred throughout the year, while one species *(Aspatharia wahlbergi)* bred in summer months only. In Lake McIlwaine, *M. dubia* appeared to breed for most of the year, but with a possible cessation or reduction of activity in winter. It is suggested that regional differences in breeding patterns might exist, and further research elsewhere is required to test this possibility.

INTRODUCTION

In temperate climates, work on annual breeding cycles of freshwater bivalves has shown the majority of species have seasonal breeding patterns. While there is considerable variation in brooding period and time of discharge amongst glochidia-bearing bivalves (Lefevre and Curtis, 1912; van der Schalie, 1963; Heard, 1975; Giusti *et al,* 1975) a common feature is the presence of one or two distinct breeding seasons terminating in discharge of glochidia at some period during the year. Giusti *et al* (1975), for example, showed that *Anodonta cygnea* started carrying eggs in October and from November to March fully developed glochidia were shed, as evidenced by the large numbers of glochidial infestations on fish at this time. Similarly, Castagnolo (1978) has shown that *Unio elongatulus* ejects glochidia throughout summer and *A. cygnea* throughout winter, in the Po River, Italy. Here the two species have distinct spawning seasons, out of phase with one another.

Fryer (1961) mentioned that *Mutela bourguignati* from the Victoria Nile in Uganda bred throughout the year, suggesting that some extended breeding seasons might exist in warmer parts of the world. This is also suggested by the work of Seshaiya (1969), who recorded glochidia in both the warm (29°C-30°C) and cold seasons (24°C-25°C) in mussels from streams in South India.

Lake Kariba, lying at a low altitude with a sub-tropical climate (water temperature 22°C-28°C) has a more consistent and equable environment than pertains in Northern Latitudes, and it was expected that seasonal breeding patterns could differ from those in temperate climates. Lake McIlwaine, although slightly cooler than Kariba (15°C-25°C), similarly presents an environment not subject to rigorous extremes of temperature, relative to those of northern climes.

METHODS

Due to a lack of facilities, detailed histological examination of gonads was not possible, and determination of seasonal breeding activity was made on the basis of monthly analyses of the gills for eggs or larvae. In Lake Kariba, monthly samples of the three species under study were collected by diving during 1976 and 1977, and the marsupia of the gills examined for eggs or larvae (or transitional stages). Those possessing either were designated "gravid". The proportion of the total sample showing gravidity was then plotted on a monthly basis over 16 months to show the seasonal breeding pattern.

In Lake McIlwaine, samples of *Mutela dubia* were collected by diving when lake level was high (July 1978 to January 1979) and by hand in the shallows when lake level had dropped sufficiently to expose the mussel population (May 1979 to November 1979). No mussels were collected between January and May as the author was indisposed at this time. No *Caelatura mossambicensis* were found when diving, because of their extreme scarcity, and results are only available for the few months when samples could be collected in the shallows.

RESULTS

Results are shown graphically in Fig. 1 and Fig. 2.

Caelatura mossambicensis

Reference to Fig. 1 shows that with the exception of a few months when no samples were collected, this species carried eggs or larvae in gills thoughout the year. While no absolutely clear pattern emerged, there appeared to be a gradual increase in the number of gravid animals from the beginning of the year until March/April when the number levelled off. The proportion carrying larvae also increased from the beginning of the year, being highest in April and June, and then levelling off until September. The samples were collected from different areas of the Sanyati Basin, which may explain the lack of a completely clear pattern if slight locality differences do exist. The glochidial larvae were in varying degrees of development, but samples of fully developed larvae freed from the egg membrane and showing "clapping" movement (i.e. the two valves opening and closing) were recorded throughout the year. On the evidence of gravidity, the species appears to breed throughout the year in Lake Kariba, with possible increased activity through the winter months.

In Lake McIlwaine, mussels were examined in early May, July, September, October and November 1979, and gravid mussels were present at all times.

Aspatharia wahlbergi

In Lake Kariba gravid mussels were recorded only during the summer months of September to March, and specimens with larvae only from December to March. From April to July no incubation of either eggs or larvae was noted. The species appears to be an annual breeder in Lake Kariba, as opposed to an all year breeder.

Two out of four specimens brought from Kariba in October, 1978, and placed in a shallow

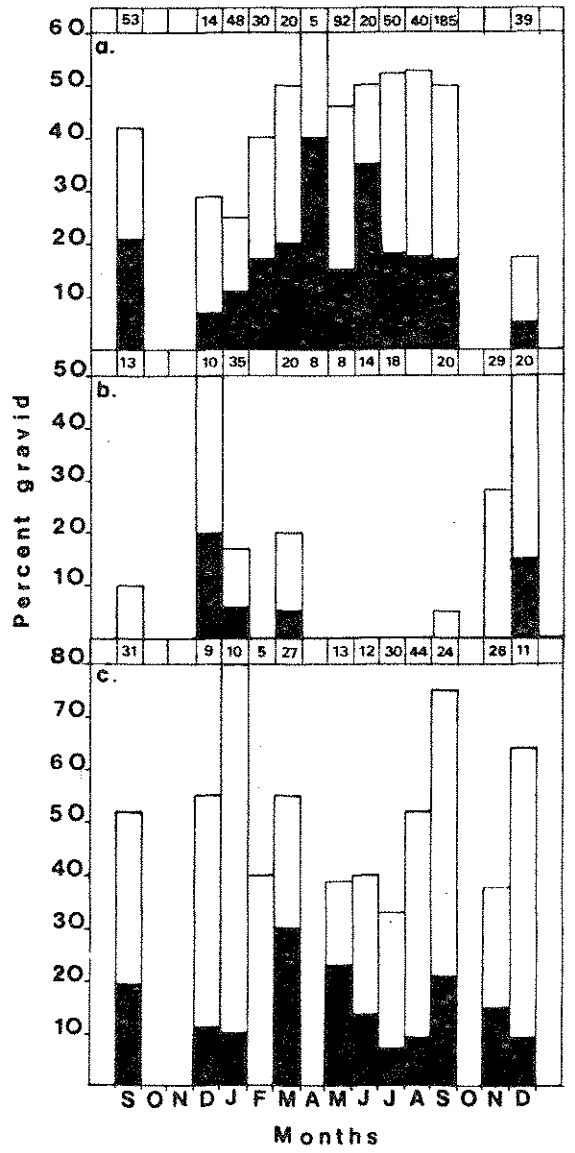

Fig. 1. Seasonal breeding activity in Lake Kariba in 1976/1977 shown by the percentage of gravid animals in the samples of *C. mossambicensis* (a), *A. wahlbergi* (b) and *M. dubia* (c). The number of specimens examined is indicated in boxes. Shaded portion represents the proportion carrying larvae only

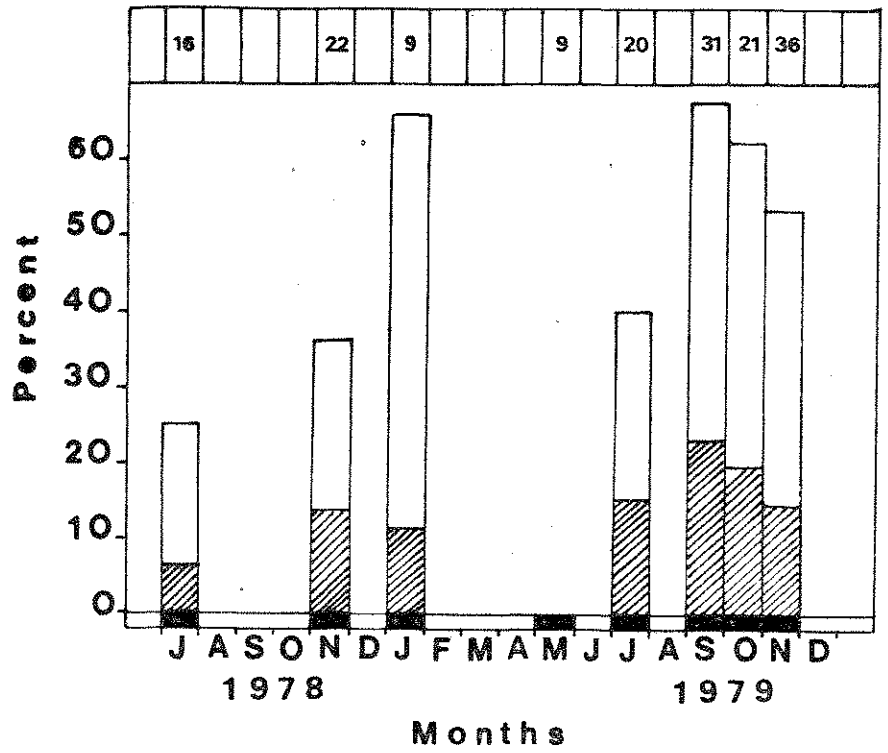

Fig. 2. Seasonal breeding activity in Lake McIlwaine in 1978/1979 shown by the percentage of gravid *M. dubia*. The number of specimens examined is indicated in boxes. Shaded portion represents the proportion carrying larvae only. Solid boxes show months sampled

pond at Lake McIlwaine were brooding larvae on 6th April, 1979, while in October, 1979, gravid specimens (eggs and larvae) were recorded from mussels collected close to the bank in the upper reaches of the lake (the river/lake confluence). There may be a different breeding cycle at Lake McIlwaine.

Mutela dubia

Like *C. mossambicensis* gravid mussels were recorded in all samples collected in Lake Kariba and larvae were present in all samples except the small February 1977 sample. While a pattern of increased or decreased activity is not clear, there could be a decrease in gravidity through the middle of the year as opposed to the possible increase shown by *C. mossambicensis* at this time. The two species may be out of phase with one another. Fully developed larvae, free from the egg membrane and showing both ciliary and muscular movements, were noted throughout the year.

In Lake McIlwaine, gravid mussels were recorded in all samples except the one collected by diving in May 1979. It seems possible, therefore, that breeding might cease for a short period during the winter months, although gravid specimens were collected in shallow water from July 1979 onwards. Because of the gap in the middle months of the year no clear seasonal trend is evident. However, an increase in activity in the summer months (September onwards) is suggested.

DISCUSSION

The results presented here show that, in Lake Kariba, two of the three species examined bred throughout the year with only *A. wahlbergi* having distinct breeding seasons separated by periods of inactivity. It has been shown that both *C. mossambicensis* and *M. dubia* are successive breeders, with individuals capable of producing several broods a year (Kenmuir, 1980). This would partially or wholly explain the year round presence of gravid mussels in the field populations of the two species. In Lake McIlwaine, with a cooler temperature regime, breeding in *M. dubia* was noted in the summer months of September, October, November and January, and also in the winter month of July. A small sample collected in May (winter) had no gravid mussels. There may be a cessation or at least reduction in breeding activity in winter. This possible difference, and the slight difference noted between the *A. wahlbergi* of Lake Kariba and a few specimens examined at lake McIlwaine suggest that there might be regional differences in breeding activities, possibly as a result of differences in temperature or some other factor. In the case of *A. wahlbergi,* flowing water might be a stimulus to breeding, since the specimens in the ponds at Lake McIlwaine were subject to periodic inflows of water to maintain water level, while the specimens collected at the river/lake confluence in Lake McIlwaine may have been subject to minor water currents.

While conclusions obviously cannot be drawn from only two species of mussels, these findings, and Fryer's (1961) observations, suggest that in the warmer climes of Africa year round breeding might be the norm, as opposed to the more seasonal breeding of many species in the cooler northern climes. That temperature could be a factor in influencing the duration of the season is suggested by Fuziwara (1978), who showed that year round breeding in *Corbicula leana* could be induced if winter water temperature was maintained above 19°C. Further research elsewhere will undoubtedly show whether any regional differences in breeding patterns exist.

ACKNOWLEDGEMENTS

I wish to thank Prof. J. Heeg for his critical commentary on my thesis, from which this paper is extracted, Mr. M.I. van der Lingen, Chief Ecologist (Aquatic Division), for his comments and criticism, and Mrs. M. Kenmuir, for typing the manuscript. This paper is part of Lake Kariba Fisheries research Institute Project Report No. 36, and is published with the approval of the Director of National Parks and Wildlife Management.

REFERENCES

Castagnolo (1978). The reproductive cycle of *Anodonta cygnea L.* and *Unio elongatulus* Pfeiff. In the Po River, Tolle area. *Riv. Idribid.* **17** (1-2) : 3-14

Fryer, G. (1961). The developmental history of *Mutela bourguignati (Ancey)* Bourguignat (Mollusca: Bivalvia) *Phil. Trans. Royal. Soc. Lond.* B **244** (711) : 259-298

Fuziwara, T. (1978). On the ovulation of *Corbicula leana* Prime. Venus **37** (1) : 22-28
Giusti, F., Castagnolo, L. Farina, L.M., & Renzoni, A. (1975).The reproductive cycle and the glochidium of *Anodonta cygnea* L. from lago Trasimeno (Central Italy). *Monitore zool. ital.* (N.S.) **9** : 99-118
Heard, W.H., (1975). Sexuality and other aspects of reproduction in Anodonta (Pelecypoda : Unionidae). *Malacologia* **15** (1) : 81-103
Kenmuir, D.H.S., (1980). Aspects of the biology and population dynamics of freshwater mussels in Lake Kariba and Lake Mcliwaine. L.K.F.R.I. Proj. Rept. No. 36 and Ph.D. thesis (in prep).
Lefevre, G. & Curtis, W.C., (1912). Studies on the reproductive and artificial propagation of freshwater mussels. (Document No. 756) From : *Bull. Bur. Fish. Wash.* **30**, 1910 : 105-201, 17 plates.
Seshaiya, R.V. (1969). Some observations on the life histories of South Indian freshwater mussels (Abstract). *Malacologia* **9** (1) : 286-287.
Van der Schalie, H. & A., (1963). The distribution, ecology and life history of the mussel *Actinonaias ellipsiformis* (Conrad), in *Michigan. Occ. Pap. Mus. Zool.* **633** : 1-17. University of Michigan, United States of America.