Notes on the Microhabitats of Unionid Mussels in some Michigan Streams

ABSTRACT: The 22 species of freshwater mussels living in small Michigan streams all occupy a wide range of microhabitats. With only one exception, there are no obvious interspecific differences in microhabitat use. These results are viewed as a consequence of the extensive dispersal of mussels over a heterogeneous stream environment in which intermussel competition is low.

INTRODUCTION

The streams of eastern North America support a rich fauna of unionid mussels. It is commc to find more than a dozen species at a site, and as many as 63 species may coexist in a sho stretch of stream (Ortmann, 1924). Very little is known of the niche relations of such coexistir species assemblages. Although many workers have noted the microhabitats of various species i the course of field surveys (*e.g.*, Baker, 1928; van der Schalie, 1938; Clarke and Berg, 1959), a tual data are rare, and published remarks are usually vague, subjective and often conflictir among studies (*see, e.g.*, Table 6 of Coker *et al.*, 1921). Furthermore, few authors have differe tiated between within-site and among-site microhabitat preferences (but *see* Cvancara *et al* 1966).

I collected data on microhabitat in a survey of the mussels of the Clinton River system Michigan (Strayer, 1980) and at stations 20 and 26 of Strayer (1979) in other nearby drainage These are fairly small (drainage areas of 25-520 km^2) warmwater streams of low gradient ar high bicarbonate content (Nowlin, 1973). Thirty-four species of mussels, all unionids, live in t streams, although it is unusual to find more than 15 species at a single site (van der Schalie, 193 Strayer, 1980).

It is important to remember that unionids spend a portion of their early lives as obligate fi parasites. Readers unfamiliar with this life cycle may wish to consult the reviews of Coker *et a* (1921), Fuller (1974) or Pennak (1978).

MATERIALS AND METHODS

All collecting was done by wading streams at low water in August 1978 and picking up all the mussels seen. For each mussel I recorded: species, shell length, water depth, substratum ty (recorded subjectively as mud, muddy sand, sand, sandy gravel, gravel, cobbles or bedrock), t presence or absence of vegetation, proximity to shore (recorded as mid-channel or the quart nearest either shore) and current speed (judged subjectively as none, slow, moderate, fast or ve fast). Although I obviously missed some mussels, particularly young ones, several checks on ef ciency showed that I found the bulk of the adult mussels (*cf.*, Haukioja and Hakala, 1974), so am confident that the collections are sufficiently representative to demonstrate the major featur of interest.

After collecting, I mapped each site to determine the availability of the various microhabita there. Voucher specimens from this work have been deposited in the University of Michig Museum of Zoology.

RESULTS AND DISCUSSION

I visited 37 sites and recorded the microhabitats of 2161 individuals of 22 species. Only 2.2 of the mussels were associated with trails in the substratum (indicating recent movement), most individuals had occupied their positions for at least several days, and probably much long (*cf.*, Isely, 1914).

The following conclusions may be drawn from the results (Fig. 1, Table 1): (1) most of t species coexisting at a site have similar mean microhabitats: only 37 of the 106 pairs of mea shown in Figure 1 are significantly different in either dimension (Table 2); (2) mussel speci have broad microdistributions within a site, resulting in great interspecific overlaps; (3) the loc tion of the mean microhabitat of a species is not consistent among sites. These properties hold f all of the sites and environmental features examined. *Villosa iris* was usually found nearer sho and in shallower water than were other species, but it also overlapped considerably with the oth species. Other than this, I could discern no consistent differences among the microhabitats of t various species. These results support the contention of Tevesz and McCall (1979) that unioni have broad microhabitat tolerances.

Two factors may be especially important in favoring wide tolerances in stream-dwe unionids. Young mussels are dispersed over a large area, both by the steam as free glochidi by their fish hosts as parasites. Because streams are heterogeneous on a small scale, this disp carries the offspring of a single mussel into a variety of microhabitats. Also, competition ar mussels is likely to be slight. Densities of adult mussels in streams such as the Clinton rarel ceed 15/m², and are usually < 1/m² (Bovbjerg, 1971; Strayer, 1980). It is difficult to envisic termussel competition at these densities; space is superabundant, and even dense mussel filter only a small portion of stream flow. For example, using the filtering rates found by Del and Davids (1970) and Lewandowski and Stanczykowska (1975) and the liberal estimate o mussel/m² for Stony Creek, Michigan (Strayer, 1980), mussels would filter less than 100m per km of stream. Mean stream flow is more than 25,000 m³/day and the minimum flow 3-year record was 2250 m³/day (Nowlin, 1973). Therefore, the strong pressure for generaliz arising from the action of the first factor probably overwhelms any gain from the compe edge associated with specialization.

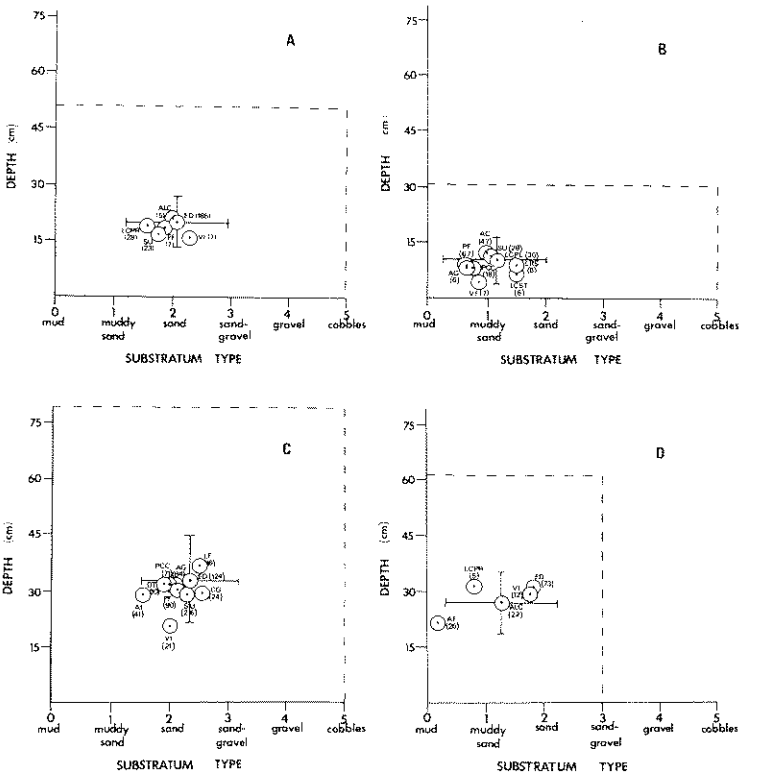

Fig. 1. — Microhabitats of various mussel species at four places in the Clinton River drai Michigan. Each labeled point represents the mean microhabitat conditions at which indivi of that species were found. The number of individuals observed is in parentheses. To sho broadness of species distributions, I have included bars of ± 1 SD in conditions for individual typical species. The dotted lines delimit the range of environmental conditions found at place; *i.e.*, the maximum water depth at A was 50 cm. (A) stations 57-58; (B) station 25; (C tions 9 and 11-15; (D) station 46, all of Strayer (1980).

Species abbreviations: AC — *Actinonaias carinata;* AF — *Anodontoides ferussacianus;* AG — *An grandis;* AI — *Anodonta imbecilis;* ALC — *Alasmidonta calceolus;* CG — *Carunculina* DT — *Dysnomia triquetra;* ED — *Elliptio dilatata;* FF — *Fusconaia flava;* LCPL — *Lasmigona compl* LCPR — *Lasmigona compressa;* LCST — *Lasmigona costata;* LF — *Lampsilis fasciola;* LRS — *Lan radiata siliquoidea;* PCC — *Pleurobema cordatum coccineum;* PF — *Ptychobranchus fasciolare; SU — Stro undulatus;* VI — *Villosa iris*

TABLE 1.—Microhabitats of *Elliptio dilatata* at 10 sites in the Clinton River drainage, Michigan. Figures given are the mean and standard deviation of microhabitat conditions occupied by individuals of *E. dilatata* at each site, along with the mean microhabitat conditions found at that site. N is the number of individuals observed. For substratum, 0 = mud, 1 = muddy sand, 2 = sand, 3 = sandy gravel, 4 = gravel, 5 = cobbles and 6 = bedrock. For current, 0 = none, 1 = slow, 2 = moderate, 3 = fast and 4 = very fast. Site locations given in Strayer (1980)

Station number	N	Substratum (*Elliptio*)	Substratum (site)	Water depth (cm) (*Elliptio*)	Water depth (cm) (site)	Current (*Elliptio*)	Current (site)
46	73	1.8 ± 1.0	1.4	31.5 ± 9.1	26.1	2.0 ± 0.4	1.7
47	23	1.5 ± 0.9	1.3	20.0 ± 6.2	10.9	2.6 ± 0.6	2.0
57	120	1.8 ± 0.6	1.4	21.3 ± 6.6	17.0	1.8 ± 0.5	1.4
58	65	2.6 ± 1.0	1.8	18.8 ± 7.6	13.0	2.0 ± 0.2	1.7
9	44	2.8 ± 0.6	2.9	30.5 ± 10.7	21.3	1.5 ± 0.5	1.5
11	16	1.4 ± 0.8	0.9	41.7 ± 22.1	29.7	2.1 ± 0.9	1.6
12	41	2.2 ± 0.9	1.8	25.4 ± 8.1	16.0	2.3 ± 0.6	2.0
13	6	2.3 ± 0.5	—	5.6 ± 2.5	—	3.0 ± 0.0	—
14	24	2.0 ± 0.7	1.2	36.8 ± 5.8	24.1	2.1 ± 0.4	1.4
18	14	3.2 ± 0.8	3.3	15.0 ± 11.4	15.2	2.4 ± 1.0	2.2

Acknowledgments. — I am grateful to Sam Pett for help in the field, and to Dr. Henry van Schalie and Judy Bondus for their support and encouragement. The critical reviews of an earl draft by Drs. R. Green, B. Peckarsky, G. Vermeij and R. Bilby are greatly appreciated. The I dangered Species Section of the Michigan Department of Natural Resources paid most of field expenses.

TABLE 2. — Statistical analysis of the species means shown in Figure 1 for differences in de (above the diagonal) and substratum (below the diagonal) usage, using Student's t-test, correc for continuity (Snedecor and Cochran, 1967, p. 132-134). * = $P < .05$, ** = $P < .01$. Spe abbreviations as in Figure 1

Fig. 1A

	ED	LCPR	SU	FF	VI	ALC
ED		—	*	—	—	—
LCPR	**		—	—	—	—
SU	—	—		—	—	—
FF	—	—	—		—	—
VI	—	—	—	—		—
ALC	—	—	—	—	—	

Fig. 1B

	PF	AC	LCPL	SU	PCC	LRS	VI	LCST	AG
PF		**	—	—	—	—	—	—	—
AC	—		—	—	*	—	**	*	—
LCPL	**	—		—	—	—	*	—	—
SU	*	—	—		—	—	*	—	—
PCC	—	—	—	—		—	—	—	—
LRS	*	—	—	—	—		*	—	
VI	—	—	—	—	—	—		—	—
LCST	*	—	—	—	—	—	—		—
AG	—	—	—	—	—	—	—	—	

Fig. 1C

	ED	PF	AG	PCC	AI	SU	CG	VI	DT	LI
ED		—	—	—	—	—	—	**	—	—
PF	—		—	—	—	—	—	**	—	—
AG	—	—		—	—	—	—	**	—	—
PCC	**	—	—		—	—	—	**	—	—
AI	**	**	**	*		—	—	*	—	—
SU	—	—	—	—	**		—	**	—	*
CG	—	*	*	**	**	—		**	—	—
VI	—	—	—	—	—	—	—		*	**
DT	—	—	—	—	—	—	*	—		—
LF	—	—	—	—	*	—	—	—	—	

Fig. 1D

	ED	AF	ALC	VI	LCPR
ED		**	—	—	—
AF	**		—	*	—
ALC	*	**		—	—
VI	—	**	—		—
LCPR	—	—	—	—	

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