BRIEF NOTE

FUNCTION OF CREEK CHUB (*SEMOTILUS ATROMACULATUS*) NEST-BUILDING.[1]

The creek chub is a small stream dwelling cyprinid distributed over much of the United States and southern Canada east of the continental divide (Blair *et al*, 1968). During the spawning season, which occurs in the spring when water temperatures warm to 12–16°C (Greeley, 1930; Washburn, 1948), male creek chubs move onto gravel runs to build nests; each male guards his nest and spawns with females that enter it. In small streams nests often occur singly, but in larger streams male chubs nest at the downstream edge of large pools. Five to 10 males may build nests at such locations (Ross, 1975). Although the spawning act is always conducted by a pair, numerous females may spawn with a single male during the two or more days that he is actively nesting.

The male forms a nest depression by carrying sand and gravel from the nest in his mouth. Once a depression is formed, the male removes gravel only from the downstream edge of the depression. This material is deposited on the upstream edge of the depression in the area where spawning occurs. Thus, eggs that are released in the nest are subsequently covered with a layer of gravel which is moved by the male. Nest-building activity slowly moves the depression downstream and forms a gravel ridge containing eggs in the area through which the nest has been moved. Reighard (1910) showed illustrations of a creek chub nest and related the adaptiveness of nest-building to egg protection. He indicated that nest-building is a continuous process, independent of spawning activity.

Male creek chubs appear to expend little energy maintaining a position in the nest depression, since the flow of water over a nest pit, "is such that eddys are formed, bringing water in the bottom of the pit to a relatively quiet condition even in fast riffles" (Raney, 1940). Males conducting nest-building activities work against swift currents, however, and probably expend large amounts of energy in this activity. If the major function of nest-building were to cover eggs with gravel for protection, such activity, during periods when no uncovered eggs are in the nest, would appear to be a non-adaptive expenditure of energy. Measurable differences should occur in nest-building rates of fishes actively spawning versus those not spawning.

Quantitative observations of nest building were made during April and May in 1973 and 1974 on three small streams in Ohio. One is a tributary of Grant's Run, Jackson Township, Franklin county, and the other two are tributaries of Clear Creek (located in Barnebey Center, a natural area maintained by the School of Natural Resources of Ohio State University), Madison Township, Fairfield County. Data were collected when spawning activity was initiated by using 7 x 35 mm binoculars from the stream banks. I observed 33 nesting male creek chubs and recorded for each fish the number of movements made per minute to the upstream edge of the nest depression with a mouthful of gravel. Observations were recorded and averaged for each male during a 30 or 60 minute observation period. Movements of males pushing gravel from place to place in a small area of the nest were not included in the data because this behavior occurred inconsistently and was not easily quantified. Males were separated into two groups: those that spawned at least once while being observed or had frequent contact with females in the nest (Group 1), and those that neither spawned nor had contact with females (Group 2).

The mean nest-building rate of Group 1 males was greater than that of Group 2 males (table 1). An analysis of variance indicated the means of the two groups were significantly different ($P < .01$). In one study, 2 male chubs were each observed for 2 consecutive 30-minute periods, the first during which no spawning

[1]Manuscript received March 3, 1976 and in revised form, as a note, June 29, 1976 (#76-23).

TABLE 1
The nest-building movements/minute of male creek chubs.

Group	No. Obs.	No. of Fishes	Average Movements/ Min.
Males spawning or contacting females	145	13	4.9*
Males not spawning	165	20	2.6

*Statistically different ($P<.01$; F is 17.6) from non-spawning males.

occurred, and the second during which each male spawned at least once. The nest-building rates of both males increased when spawning occurred (table 2).

Thirty-one percent (51 of 165) of the 1-minute nest-building counts for Group 2 males were scored 0, whereas 3% (4 of 145) of the 1-minute counts for Group 1 males were scored 0. Counts per minute of 0 were recorded at least once for 14 out of 20 Group 2 males, and for 2 out of 13 Group 1 males. In the 4 counts of 0 recorded for Group 1 males, numerous aggressive encounters with other nest-intruding fishes prevented the males from moving gravel to the upstream edge of the nest uninterrupted. Many of the 51 one minute scores of 0 for Group 2 males, however, were not recorded during periods of intensive aggressive activity. No consistent differences in activities other than spawning were observed around the nests of Group 1 versus Group 2 males.

TABLE 2
Nest-building movements/minute of 2 males before and after spawning.

Fish		No. of Counts	Movements/min ± S.D.
Male A	Before	10	0.0
	After	12	2.8±1.7
Male B	Before	11	3.4±0.9
	After	11	5.1±1.0

The nest-building activity of male creek chubs that spawned or had contact with females while being observed was greater than that of males that did not. Nest-building of non-spawning males was sporadic. An increase in nest-building activity normally follows spawning. Miller (1964) proposed that nest-building of the river chub, *Nocomis micropogon*, could function in attraction of females. Although sporadic nest-building activity of non-spawning creek chubs could function in this manner, the major time and energy expenditures relegated to nest-building by male creek chubs serve to cover freshly fertilized eggs with gravel, apparently to give them protection.

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Acknowledgment. I wish to thank Ted Cavender for the aid he provided during this investigation.

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