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DISTRIBUTION AND DENSITY OF SCULPINS IN A WISCONSIN COULEE STREAM

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ABSTRACT

The mottled sculpin, Cottus bairdi Girard, was successfully introducted into Trout Creek, a coulee stream, in southwestern Wisconsin. Eight years after they were stocked in Trout Creek, the sculpins occupied all trout water that flowed over gravel or rubble, and had increased from the number stocked by over 20 fold. The highest biomass attained by age 1+ sculpins in Trout Creek was 47 kg/ha in a 274-m section of the stream, six years after the sculpins had been introduced. All evidence indicates that the mottled sculpin in Trout Creek has not influenced the strength of wild brown trout year classes persent in the stream.

CONTENTS

INTRODUCTION

The mottled sculpin, Cottus bairdi Girard, is usually present in Wisconsin streams containing wild brook and brown trout populations. This fish, however, was absent from Trout Creek, Iowa County, before it was introduced in April 1968. The mottled sculpin is also commonly found in the stomachs of mature brown trout from Wisconsin streams and is used as bait by trout fishermen.

The principle objective of our study was to determine whether the mottled sculpin could be established in a stream, where the habitat appeared to be suitable for it, so that it could perhaps strengthen a weak link in the food chain of the mature (2 years and older) brown trout, Salmo trutta Linneaus, in Trout Creek. Available forage fish for brown trout were scarce in this stream compared to the abundance of forage fish in most trout streams in southwestern Wisconsin. The only common fishes in Trout Creek that may currently provide food to mature brown trout are white suckers, Catostomus commersoni (Lacepede), and the introduced mottled sculpin (Brynildson and Brynildson 1978 in press).

STUDY AREA

Trout Creek is a coulee stream in southwestern Wisconsin and much of it is prime brown trout water. Total length of the stream is 13 km but only the lower 8 km contains suitable water for trout and sculpins. The water (except for isolated ground water seepages) in the upper 5 km is too warm in summer for these fishes. The trout water begins at Arndt Springs (4,500 l/min) between stations 29 and 30 and continues downstream to the confluence of Mill and Trout Creeks near station 1 (Fig. 1). From station 14 upstream to the headwaters, the stream flows mainly over gravel and rubble of dolomite and chert. Below station 14, where trout spawning gravel is scarce, and rubble absent, the meandering stream flows over a substrate of silt. Here the water is relatively deep and slow flowing compared to the reach above station 14. The mean gradient of the 13-km course of Trout Creek is 11 m/km (Piening and Threinen 1968).

A slow release detention dam (Structure 8) was constructed on the lower 67 m of station 20 during 1964 (see Fig. 1). This dam is a barrier to upstream migration of all fishes in Trout Creek except trout (Brynildson and Brynildson 1978). Any sculpins drifting downstream through the tube of the dam cannot return to stream sections above the dam.

METHODS

Introduction of the Mottled Sculpin

On 18 April 1968, approximately 500 adult (8-10 cm TL) mottled sculpins were captured by electrofishing from Love Creek, a tributary of Mill Creek approximately 5 km above the confluence of Mill and Trout Creeks. Immediately after capture the sculpins were transferred to Trout Creek and released at station 25 (Fig. 1) where gravel, rubble, spring flow and water cress were abundant.

Determination of Sculpin Distribution and Density

The estimates of the sculpin populations in Trout Creek began in early May 1970, two years after their introduction, and continued to April 1976. These estimates were made in conjunction with estimates of the trout populations. The mark and recapture method was employed, making two runs with 230-volt DC electric shockers (Brynildson and Brynildson 1978). No estimates of the sculpin populations were made when trout population estimates were made annually in September because heavy instream vegetation (mainly water cress, Nasturtium officinale) made capture of sculpins too difficult for reliable population estimates. Sculpins captured were divided into 3 length groups and separate population estimates were made for each group by stations, which varied in length from 201 to 348 m. A representative sample of the sculpins captured within each station along Trout Creek were measured to the nearest tenth of an inch (2.5 mm) and weighed in grams.

RESULTS AND DISCUSSION

Distribution and Density of Sculpins

The 500 sculpins released at station 25 in Trout Creek during April 1968, had increased their numbers to an estimated 2,003 (age 1 and older) by early May 1970, and had extended their range down into station 24 and up into station 28, a distance of approximately 1100 m. By May 1972, the sculpin population age 1+ had tripled to an estimated 6,765 and extended down into station 20 and up into station 30 (Fig. 2). By late April 1976, the estimated number of sculpins age 1+ was 11,409 from station 15 to station 30.

The mottled sculpin is the most numerous fish in the sections of Trout Creek where it is found, with age 1+ sculpins reaching a numerical density as high as 185/100m^2 within stations 27-28 during April 1974 (Fig. 2). To date, however, mottled sculpins age 1+ in Trout Creek have not attained the numerical density of the well-established slimy sculpin, Cottus cognatus, in Valley Creek for which a May biomass as high as 275/100m^2 age 1+ sculpins has been reported (Petrosky and Waters 1975).

The near absence of sculpins below station 15 in Trout Creek is probably due to lack of gravel and rubble in that reach of the stream. During the dry year of 1976, water levels in Trout Creek were low and clear and more silt was removed from the stream bottom than was deposited, leaving pea gravel exposed on clay hardpan on the few riffles present below station 15. During the trout population estimate in September 1976, a sculpin was captured by electrofishing as far downstream as station 3, while others were observed in small numbers up to station 15 where they became common. During 1977, after water levels increased to normal levels and silt once more covered the pea gravel, no sculpins were observed below station 13 during electrofishing for trout population estimates.

When speculating on why the mottled sculpin was absent from Trout Creek prior to its introduction in 1968, we must take into account the environmental requirements of sculpins living in streams--abundant ground water discharging into streams with predominantly gravel and rubble bottoms. In studies on the association of various Cottidae with salmonids in streams, it has been established that such streams usually contain both gravel and rubble (Hunter 1959; Sheridan and Meehan 1962; Patten 1962, 1971; Hildebrand 1971; Clary 1972; Jones 1972; Pasch and Lyford 1972; Gard and Flittner 1974; Petrosky and Waters 1975; Horner and Bjorn 1976).

In the Great Lakes region, the mottled sculpin is a resident in most streams where abundant spring water flows over gravel and rubble. It prefers the riffles over gravel bottoms (Eddy and Surber 1944) and rocky (rubble) bottoms and retreats under stones during the day (Hubbs and Lagler 1947).

Competition Between Sculpins and Trout

In his extensive review of the literature on sculpin-salmonid interactions, Moyle (1977) states: "Competition between sculpins and salmonids may exist, but it has yet to be conclusively demonstrated. Even if it does exist, it seems unlikely that it would have a significant long-term effect on salmonid populations except under unusual circumstances. Since sculpins and salmonids apparently evolved together in cold water streams, it is likely that if a food item does become in short supply, prey switching by one or both species is likely to occur after perhaps a transitory period of competition."

Results of various studies show that the different species of sculpins living in streams feed on many of the aquatic vertebrates that trout (Brocksen et al. 1968; Clary 1972; Jones 1972; Gard and Flittner 1974; Petrosky and Waters 1975) and young salmon feed on (Patten 1962; Sheridan and Meehan 1962).

There is also considerable evidence that various species of sculpins prey on salmon eggs or fry (Hunter 1959; Sheridan and Meehan 1962; Patten 1962, 1971; Phillips and Claire 1966) and on trout fry (Phillips and Claire 1966; Clary 1972; Horner and Bjorn 1976). Petrosky and Waters (1975) reported that no trout eggs or fry were ever found in stomachs of the slimy sculpin, Cottus cognatus, in Valley Creek, Minnesota.

From the evidence then, we know that sculpins prey on trout and salmon fry in the wild environment. However, sculpins are also prey for brown trout (Jones 1972; Gard and Flittner 1974), for brown and lake trout in Lake Tahoe (Ebert and Summerfelt 1969) and sockeye salmon in Brooks Lake (Heard 1965). In Wisconsin, whenever streams contain both brown trout and the mottled sculpin, the larger trout prey on the sculpin. Whenever such streams (including Trout Creek) were electrofished for trout population estimates, we observed that some of the sculpins eaten by the brown trout would be regurgitated after the trout were captured and placed in holding tubs.

We do not have any evidence that brown trout age 2+ in Trout Creek have benefited by the introduction of sculpins. It is also unlikely that the sculpins have been a factor in the fluctuating year class sizes of wild brown trout in Trout Creek. The wild brown trout year classes were weak during years of winter floods and strong during years without winter floods, before and after the introduction of the mottled sculpin in 1968 (Brynildson and Brynildson 1978).

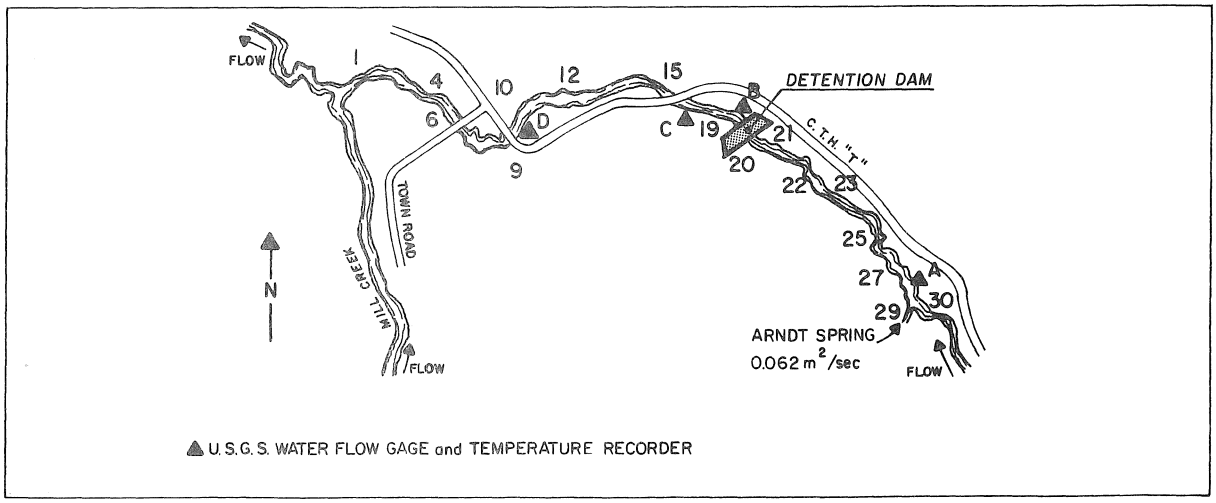

FIGURE 1. The 8-km study area of lower Trout Creek, stations 1-30.

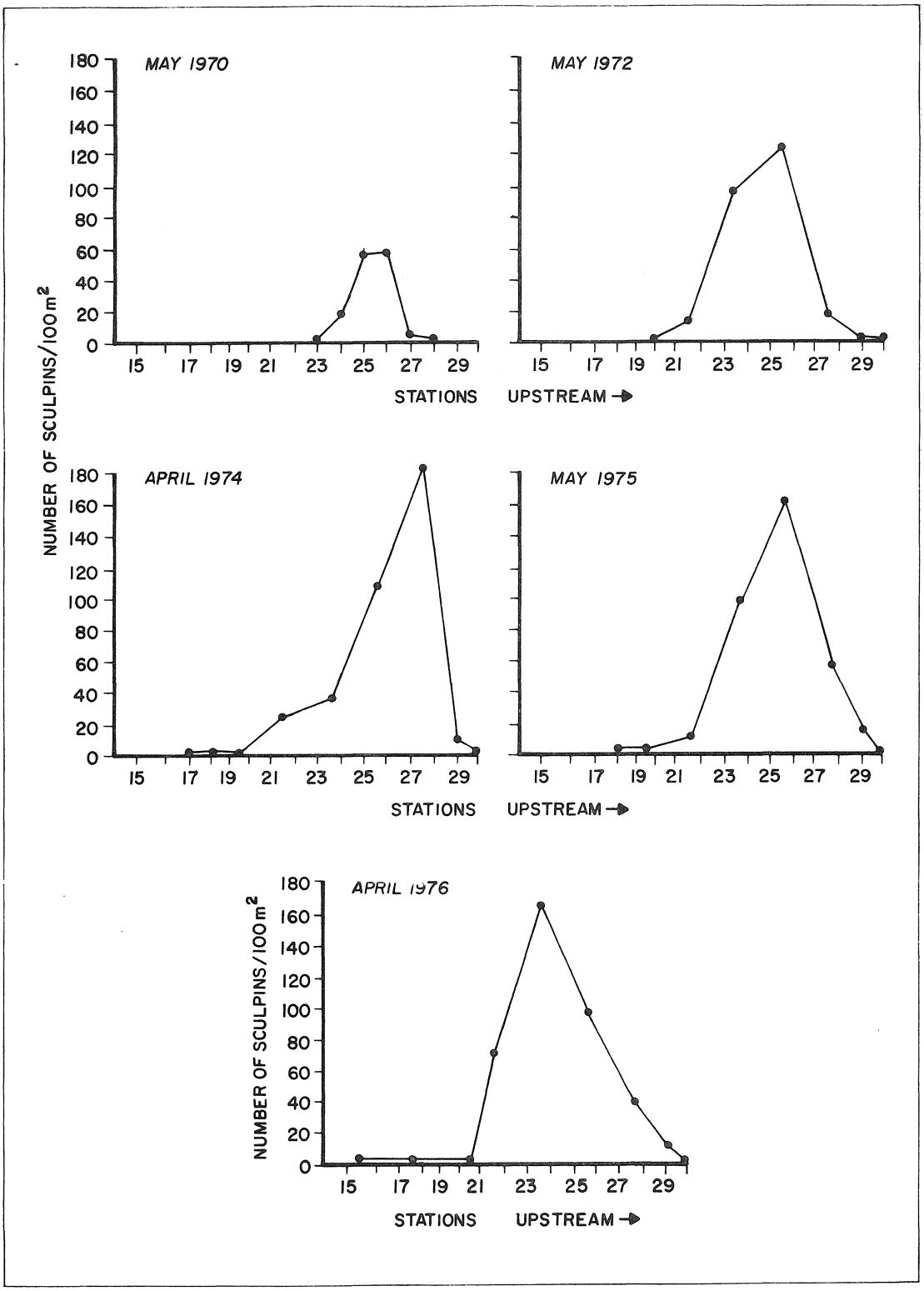

FIGURE 2. Distribution and numerical density of sculpins within the study are of Trout Creek between May 1970 and April 1976.

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