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HANDPICKING MACROINVERTEBRATES; THREE METHODS COMPARED

By CHARLES C. STARLING
Fish Management Specialist
Florida Game and Fresh Water Fish Commission,
Fisheries Research Laboratory, Eustis, Florida

ABSTRACT

Benthic samples were sorted by three methods: electrical stimulus applied to living organisms, preserved in rose bengal formalin solution, and preserved natural-colored. The rose bengal stained samples were picked most accurately and rapidly except in very low invertebrate concentrations where the electrical stimulus was more efficient. Natural-colored samples had the least accurate retrieval and were picked at a rate intermediate to the other two methods.

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INTRODUCTION

An aquatic environment may be assessed by using macroinvertebrates as indicators. Both qualitative and quantitative sampling are important, but Keup, Ingram, and Mackenthum (1966) pointed out that quantitative data would be best when a choice must be made because it incorporates at least a partial qualitative sample. With either choice, a method for quick separation of organisms from inert material is essential.

Bayless (1961) used an electrical stimulus to shorten sorting time. Mason and Yevich (1967) used phloxine b and rose bengal stains to facilitate sorting and found stained samples were sorted in half the time of unstained samples. They concluded the time saved would depend on amount of detritus, number of organisms, and skill of the sorter. Mason and Yevich (1967) and Bayless (1961) claimed their methods retrieved many organisms that otherwise would have been missed.

As part of Florida Dingell-Johnson project F-21, picking invertebrates (extraction from inert material) using a shocker, rose bengal stained samples, and natural-colored preserved samples was compared to determine which method was fastest and most accurate.

MATERIALS AND METHODS

Eighteen bottom samples were collected with a 6-inch Ekman dredge at six lentic stations (three from each station) to obtain diversity of numbers and types of organisms. Sample texture consisted of mud, sand, or peat. All samples were washed on a U. S. Standard No. 30 sieve (American Public Health Association, 1971) using a specially designed washing table at the Eustis Fisheries Research Laboratory. Volume of each washed sample was recorded.

Natural-colored samples received 5% formalin. Each was picked in 4-7 ml aliquots under a steroscopic dissecting microscope with adjustable lighting. Each aliquot was examined several times to be certain that all organisms were removed, but the picking time of the sample was considered to be only the initial examinations of the sample including exchange periods between aliquots. Data recorded were numbers of invertebrates removed during the first examinations, the total number found per sample, and the picking time of each sample.

Samples to be stained received 5% formalin and were mixed 1:1 with a stock solution of rose bengal stain (200 mg stain/L 5% formalin). Two days were allowed for the organisms' absorption of the stain and then excess solution was rinsed through a U. S. Standard No. 40 sieve with tap water before picking. Stained samples were picked in the same manner as natural-colored samples. Data recorded were as the natural-colored method, except picking time also included the second sieve rinse.

Organisms in the shocker samples were picked alive from a white enamel pan with the aid of an electrical stimulus as described by Bayless (1961) and a Dazor floating 2X scanning lens under direct lighting. The number of organisms removed from the pan and the time spent picking were recorded for each sample. The samples were retrieved and re-examined for missed organisms in the same manner used for other methods. The total number of organisms removed per sample was recorded.

RESULTS

Picking Accuracy

To determine accuracy, organisms removed during the first examination of a sample (enamel pan examination for shocker method) were expressed as a percent of all organisms found in that sample. As shown in Table I, at least 90% of all organisms were picked by one examination from five of six stained samples. Equivalent percent removal was achieved twice with the shocker and once from natural-colored samples in five efforts. This indicates greatest accuracy was achieved with least effort most consistently by using rose bengal stain.

TABLE I. Accuracy of methods expressed as percent of total organisms removed on first examination.

	mud (2 samples per method)		sand (3 samples per method)			peat (1 sample per method)
stained	100	94	96	93	92	81
shocker	*	94	84	64	69	98
natural-colored	*	68	97	78	64	89

* Zero organisms in sample.

Picking Rates

The number of organisms picked per unit of time by any method was high when sample quantity was small containing many invertebrates. Conversely, the number picked per unit time was low when picking from a large sample quantity having few invertebrates. Consequently, it seemed the picking rate was primarily associated with the concentration of invertebrates.

To show the relationship of picking rates by the compared methods, a graphical illustration (Figure I) was made by plotting the six known coordinates of picking rates and invertebrate concentrations for each method. A curve was drawn along the slower rate and another along the fast rate values for each method. The enclosure produced between the two curves of each method was assumed to represent rate variances

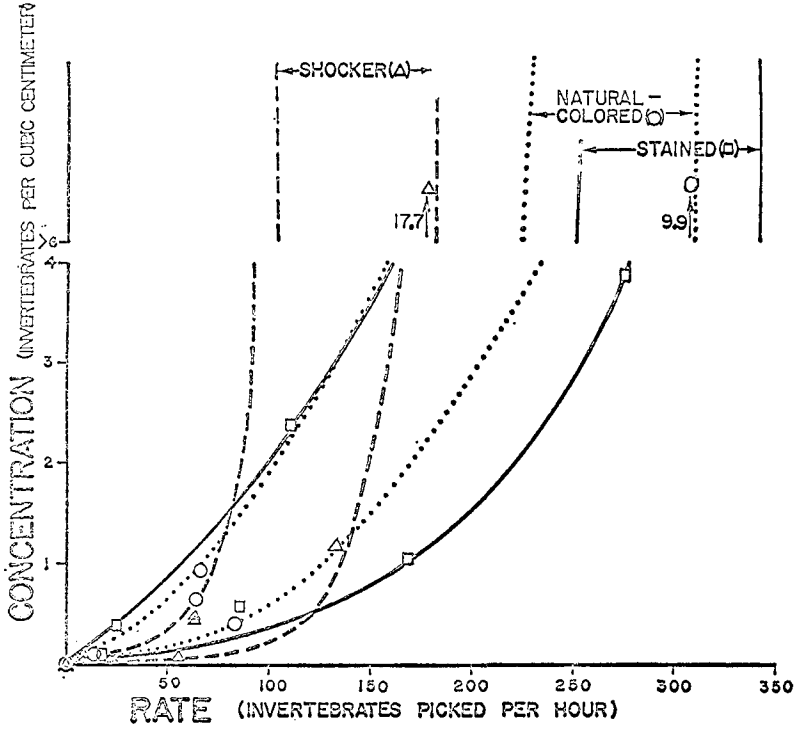

FIGURE I. Rate—concentration relationships using three invertebrate sorting methods.

due to secondary influences such as texture of inert material. As expected, mud samples were picked at a slower rate than sand, and in Figure I the stained mud samples were picked the slowest partially as a result of stained detritus interference. Also, the amount of sample affected the picking rate of stained samples. Occasionally, the time required to rinse stain from a small quantity of sample lacking invertebrates was longer than the sorting time and resulted in inefficiency by the stained method. Finally, familiar samples such as those taken repeatedly from one station may be picked faster than others since types and abundance of organisms could be anticipated.

Generally, in similar samples the shocker method was two to three times faster than the other methods below a concentration of 0.1 organisms per cc. It remained fastest to approximately 0.5 organisms per cc in sandy samples and about 2 per cc in mud, above which the stained method was fastest. The natural-colored samples were picked at a rate between extremes of the other two methods.

DISCUSSION

The reason the shocker was less accurate than the rose bengal stain method was because the shocker selected for larger, active macroinvertebrates such as amphipods, ephemeropterans, odonates, large dipterans, and large annelids, and against small or sedentary ones like trichopterans, nematodes, cladocerans, copepods, podocops, small gastropods, and small pelecypods. The high accuracy of the shocker in the mud and peat samples was because the samples' specimens mostly met this selective criteria. Such selection served Bayless' (1961) purpose of quick field results, but yielded bias and only a partial qualitative analysis in my work.

Though these comparisons were done with a small number of samples, the results favorably supported the results of Mason and Yevich (1967). As pointed out by Mason and Yevich, picking rate depends on amount of detritus and number of organisms, i.e., concentration of organisms. Yet, other than taking each sample series in close proximity, Mason and Yevich (1967) did not enumerate amounts of sample detritus in making comparison of picking stained and control organisms. Therefore, the validity of their experiment is questionable because volumes of washed samples were variable in this experiment even when taken from the same station.

Notably different from their technique was the use of a dissecting microscope in this experiment rather than a scanning lens. After finding macroinvertebrates could be picked faster with the aid of rose bengal stain, some stained samples were picked from a white enamel pan using a 2X scanning lens as in the shocker method. Many small organisms were overlooked in the pan, but were easily found when re-examined under the microscope. Since macroinvertebrates are those retained on a U. S. Standard No. 30 sieve by definition (American Public Health Association, 1971), a microscope should be used for picking to ascertain quality results.

That the stained samples were picked accurately at a faster rate in this experiment was probably due to using the microscope. Essentially, less effort was needed searching as some organisms were almost always in the field of view in high concentrations, and were being steadily picked. Without the microscope, effort was wasted trying to find and distinguish small macroinvertebrates from debris.

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CULTURING, A METHOD USED TO IDENTIFY ALGAE INGESTED BY TILAPIA

By CHARLES S. MANOOCH, III [1]

ABSTRACT

Bold's Basal and Gorham's media were used to culture algae removed from the digestive tracts of Blue Tilapia, *Tilapia aurea* (Steindachner). Nine fish representing three-size categories collected from Lake Parker, Florida, were used in the study. Samples extracted from three areas of the gut were introduced to the culture media within twenty-four hours after collection. Microscopic examination of the cultured materials was conducted over a four-week period to enable the completion of reproductive cycles and excystment of algal cells.

Twenty-one taxa of algae were identified by sampling the culture vessels. Planktonic green algae were the dominant foods of tilapia at the time of sampling. Species of *Scenedesmus, Pediastrum, Ankistrodesmus* and chlorococcoid algae appeared in all specimens. Colonial chlorophytes, pennate diatoms, flagellated unicells, and remains of filamentous algae occurred less frequently. *Spirulina sp.* was the only blue-green occurring in significant quantities. Two rotifers, two ostracods, and a cladoceran were the only zoplankters observed.

Both, type of media used and region of gut sampled, produced slight quantitative and qualitative differences in data obtained. Maximum taxonomic diversity was encountered in the anterior samples cultured in Bold's Basal medium. Bacterial conditions in the digestive systems had no inhibitory effect on culturing algae.

The method of culturing ingested materials definitely has a future in specialized fisheries research programs. It would be particularly useful in studying dietary habits of juvenile fish and other small aquatic organisms (crustaceans and mollusks).

INTRODUCTION

Blue tilapia, *Tilapia aurea* (Steindachner) has been described as the fastest spreading exotic fish in South Florida (Buntz and Manooch, 1968). In the Lakeland area concentration of the species has created a unique local sport fishery (Buntz and Manooch, 1969).

Although some work has been conducted on various life history aspects of the Florida population, no research has been initiated on the dietary requirements. Such a study is essential since food habits of tilapia are not only interspecifically different, but also habitat depedendent. Lowe (1955) found *Tilapia melanopleura* and *T. zilli* eat higher aquatic plants while other species are mainly algal feeders. In lakes, tilapia fed primarily on phytoplankton; yet in ponds, the same species utilized filamentous algae, insect larvae, tadpoles, and even eggs and fry of other fish. In aquaria tilapia are often omnivorous, eating a variety of food items. The ecological impact of this introduced species cannot be fully evaluated until a food habits study is made. The mutual relationship and effect of two organisms occupying the same environment depends considerably on whether or not there exists a competition for food.

1 Present address: North Carolina State University, Department of Zoology, Raleigh, N. C.