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PHOTOGRAPHIC METHOD FOR SURVEYING CLAM POPULATIONS [1]

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ABSTRACT

A photographic method for surveying softshell clam, Mya arenaria *beds is described and evaluated. The equipment, which includes an underwater camera affixed to an aluminum frame, is diver-operated and positioned during sampling. Some preliminary results concerning spacial arrangements in juvenile and adult beds are discussed.*

INTRODUCTION

Although a variety of adequate survey methods for estimating the density of clam populations are available, many possess specific disadvantages. The Maryland hydraulic dredge (Manning, 1959) has been successfully employed at our laboratory (Pfitzenmeyer, 1960; Pfitzenmeyer and Drobeck, 1963) as the primary sampling tool, but it, too, has limitations for certain types of research. Because of operational necessities (hydraulic jetting), *in situ* relationships can not be determined; and all sizes of clams are not equally collectable, due to selectivity of belt mesh size.

SCUBA or diving have been commonly employed (Forster, 1954; Morgans, 1959) as benthic survey tools as have photography (Owen, 1951; Veevers, 1952) and TV (Barnes, 1963). Carriker (1967 pg. 445) termed diving, underwater TV and other direct observational methods one of the ". . . most promising innovations in the study of benthos.", however, they have been infrequently applied in a quantitative manner. In order to study certain parameters of spacial arrangement in *Mya* beds, underwater photography, as a sampling tool was investigated. The present report gives construction and operational details of a photographic survey method.

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METHODS

A Nikonos "Amphibious" 35 mm camera was affixed by a utility clamp (E. H. Sargent & Co. S-19140) to an adjustable floodlight stand (Fuller and d'Albert Inc., "Picstand #122") that was, in turn, mounted on an aluminum frame (Fig. 1). The frame was fitted with a clamp cradle for the flash attachment (Fig. 1,a) and a wooden carrier for flashbulbs (b). Positional adjustments of the camera could be made in both the horizontal and vertical planes by loosening wing-bolts (c). A metric ruler, which could be extended into the photographic field was attached to the aluminum frame (d).

Even though an underwater close-up lens system for the camera was available, the land lens (Nikkor 1:2.5, f-35 mm) proved satisfactory for all operations. Camera settings were routinely held at the following: distance to subject = 2.75 feet, f =22, speed = 1/250, measured distance to subject = 0.5 meter. Three types of film were used in preliminary trials (Kodak Tri-X pan, Plus-X, and Panatomic-X) all with excellent results. Special negative developers, that increase ASA ratings, were unsuccessfully employed and Kodak "Microdol" was used thereafter. The latter, with slow development times, permitted sharp resolution of detail. Survey sample shots were taken both with and without flashbulbs (#6), depending on water clarity. Flash lighting occasionally produced "washed" negatives indicating that stoboscopic or diffuse lighting should be examined as a possible alternative. Low contrast

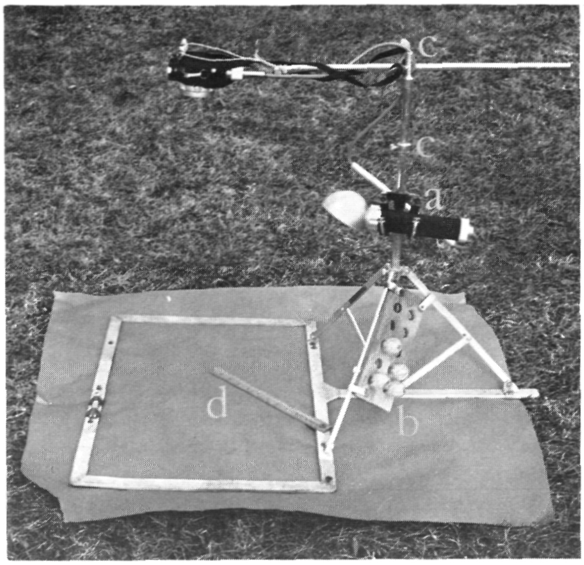

FIG. 1. *Photograph of the camera and stand used in surveying clam beds. Legend: (a) flash and cradle attachment, (b) flash bulb holder, (c) wing bolts and clamps used for adjustment of camera, (d) ruler shown extended into photographic field. Also shown (unlettered) are line levels used to adjust the camera in the horizontal plane. Photo credits: E. Dunnington and M. Reber.*

paper was not required with most sample negatives; it proved necessary when turbid conditions prevailed.

In sampling the camera and stand were manually transported and hand operated. Depending upon water depth, the operator used either a snorkel or SCUBA. Care was required in positioning the stand as slight movements caused localized turbidity that prevented clear photographs. With practice, however, it was possible to photographically survey (20-40 shots) a large area in less than an hour. The area included in a sample was approximately 120 cm^2 and photographic enlargement (8 x 11 in.) was essentially 1:1.

RESULTS

Typical photographic results show the siphons of young-of-the-year *Mya* (1967 year class) protruding from the substrate (Fig. 2). Young clams were extremely numerous in this sample. The two large spherical objects (one near center, one near left edge) are tunicates, *Mogula manhattensis.* The one near the center borders a typical adult *Mya* siphon hole and others may also be seen in the right half of the photograph. Adult siphon holes are characteristically non-circular in appearance. This may be due to substrate characteristics or to continual extension and retraction of the siphon with erosion of the edge. Regardless of the cause, it does not appear practicable to employ the siphon hole as an estimator of clam size as was initially hoped. Large clams retract their siphons at the slightest mechanical or visual disturbance. Merely occluding the ambient light caused retraction. Siphons of retracted clams could still be seen by the diver if the line of sight was directly over the siphon-hole. However, the siphons were usually re-extended (enough to be photographed) after a brief time period.

Although no actual measurements of clam shell length were made in the present study, approximate sizes are known from previous collections made at this station on a quarterly basis over a five year period. Examination of these collection data suggest that the juvenile and adult clams categories, used in the present study, represent shell lengths of approximately 25 and 80 mm respectively.

An extreme density of young clams has been emphasized by an enlargment of the photographs (Figs. 2, 3). Notice the abundance of these clams and the fact that many siphons are contiguous to each other. This pattern is in contrast to that characterizing adult beds in this area. Adult clams are more regularly spaced and the distance between clams (measured in a direct line from a given individual to the nearest neighbor) is about twice that of young clams. The average, between-clam distance for adults was approximately 20 mm while that for juveniles was 9 mm in a test series of 45 measurements.

Clam densities for both juvenile and adult beds were estimated by griding the photographic enlargement and counting the number per cell. The number of cells per sample counted varied from approximately 10-100. These estimates were expressed to the common base of a square meter sample. Density estimates obtained by different readers varied slightly, but there was fair agreement between estimates from different operators (5.6 vs 7.5 x 10^3 clams per M^2) for the densest samples which were the most difficult to quantify. In addition, the variances for these counts were small suggesting that highly accurate counts can be obtained and that the counts are reproducible, as long as samples are read by the same person. A concurrent hydraulic and photographic sampling has not been performed and this should be done for comparative purposes.

Clark and Evans (1954) suggested a technique by which spacial relationships between animals of the same species may be measured. This measure depends upon between-animal distance

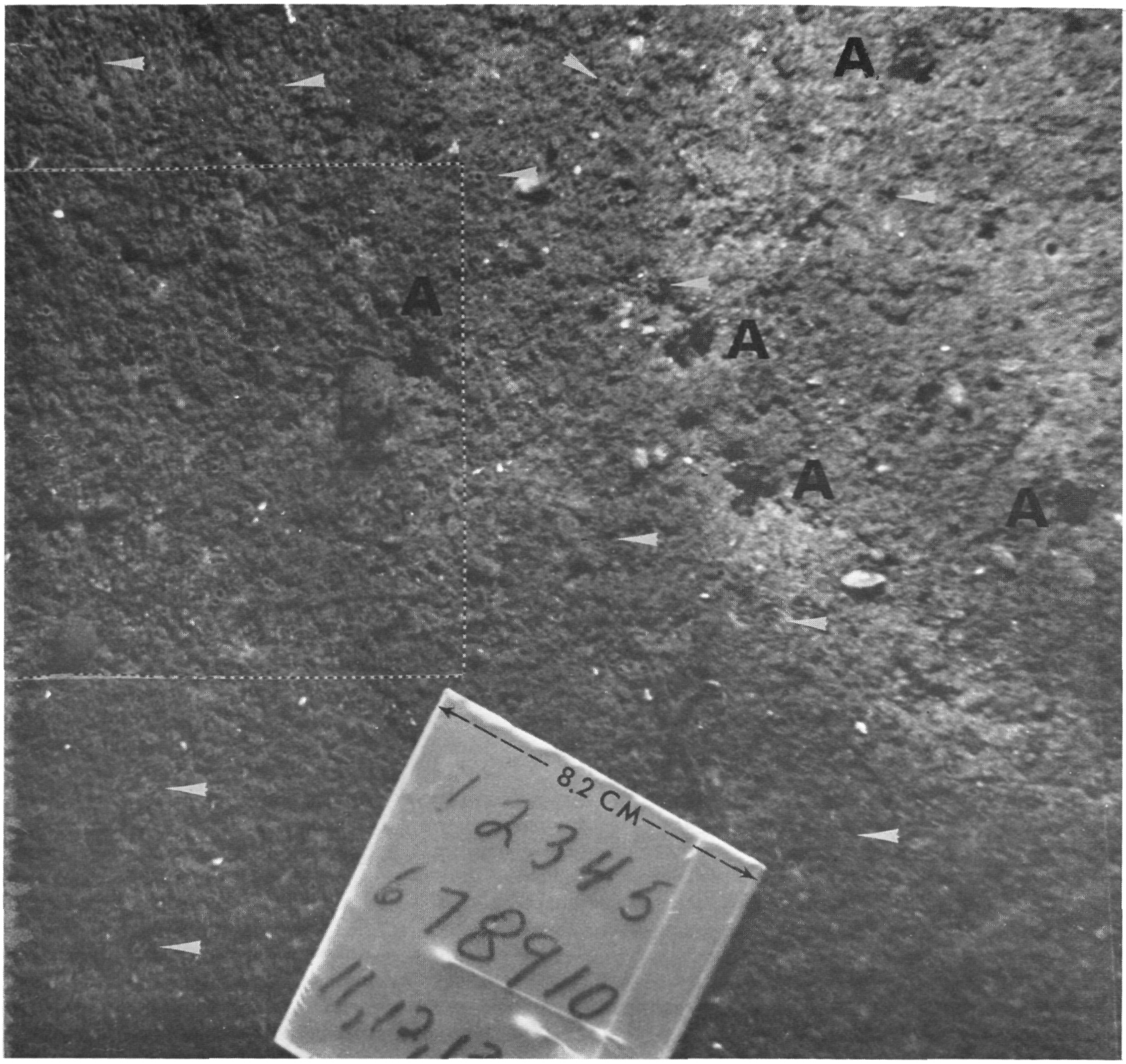

FIG. 2. *An example of a bottom photograph from Jack Bay Station. "A" denotes siphon holes of adult clams. The siphons have been retracted and are not visible. At bottom, center is a plastic plate used for numbering the survey series. A metric scale appears on the plate. Arrows mark some of the more obvious siphons of juvenile clams. Inset area is shown, enlarged, in Fig. 3.*

and density per unit area and is expressed as R, a number which ranges from 0 to slightly greater than 2. The maximum value occurs with a regular geometric lattice wherein all individuals are equidistant from each other. Values less than 1 suggest clumped distributions. Values close to 1 suggest a random distribution and those above 1 to the upper value indicate regularly spaced distributions. This measure was applied to both juvenile and adult photographic samples. Data for juveniles gave R values of slightly less than 1-1.5 and suggest that the spacial arrangement for this life history stage may be clumped or random with respect to its neighbors. In contrast, adult samples gave R values of about 1.8, indicative of a highly spaced condition i.e., clams are more uniformly positioned in relationship to each other.

By extension, this may mean that an individual adult clam inhibits or exerts some influence over its proximal neighbors. Also, since the juvenile pattern is close to random, as judged from the R value, it is possible that spacing of *Mya* is age-determined and the maturational pattern is from

FIG. 3. Enlargement of Inset area from Figure 2. Some extended siphons of juveniles are marked by arrows, but many more appear that have not been indicated. Siphons have the appearance of a figure "8" with darkened centers. Distance between the tunicates (labelled "m") is 8.9 cm.

nearly random to regularly spaced. These interpretations are speculative but may have application in stimulating research or in developing a theory of population control for this species.

DISCUSSION

These preliminary results indicate that the photographic method is useful as a survey tool. Many random samples in a particular locality may be taken in the time period required to take a single dredge sample. Additionally, since the photographic method does not disturb the animal or the substrate, it would be possible to monitor exact sites through time with high precision.

Preliminary measurements of between-clam distances (Clark and Evans, 1954) for both adults and juveniles suggest that the former are more regularly spaced. Whereas the juveniles are clumped or randomly placed in reference to each other, adults are more nearly geometrically arranged. Thus it may be that larger clams inhibit setting or continued growth in close proximity to themselves.

A possible disadvantage to the photographic method is its dependence upon moderately good water clarity. This is not true of the hydraulic dredge and most other benthic samplers.

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