NOTES

A SIMPLE TECHNIQUE FOR ESTIMATING CELL DENSITIES IN OUTDOOR MASS CULTURES OF PHYTOPLANKTON

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ABSTRACT

An important requisite for mass-rearing of prawn and fish larvae being easy estimation of cell densities of phytoplankton cultures used as feed, a simple method, involving a Secchi-disc principle, is developed, to be used, with due precautions, for rapid estimation of cell concentration in phytoplankton culture tanks.

The well-known relationship between algal biomass and water clarity of natural waters was used to predict production (Glooschenko et al 194) and other parameters useful for lake management (Dillon and Rigler 1975, Jones and Bachman 1976). In a different line of study this relationship had been applied in fishculture ponds, using small white porcelein disc for measuring transparency (Nakamura 1954). In the present study this last method is modified for application in phytoplankton cultures in tanks. The study was conducted in mixed mass cultures dominated by *Chaetoceros* spp., developed and maintained at the Field laboratory of the CMFR Institute at Kovalam, near Madras, for feeding prawn and mussel larvae in the hatchery.

Cultures were developed in fibreglass tanks of two kinds: one a brown-coloured type of diamensions 0.9 m x 0.6 m x 0.6 m and the other a white-coloured type of dimensions 4 m x 1 m x 0.5 m. Two kinds of Secchi-disc-type devices were used: a plain, brown glass disc with white polythene fitted below, designated 'A'; and a broadly corrugated brown glass disc fitted below with white polythene having a triangular gap in the centre, designated 'B'. The plain white disc was not used since the culture tanks were too shallow for such a disc to disappear.

The two discs, A and B, were lowered by means of strings into the algal cultures at different stages of growth and cell concentrations. The observations made were: (1) depth at which 'A' disappeared when viewed directly

from above (= a); (2) depth at which the central triangle in 'B' was no longer distinguishable(= b); and (3) concentration of cells in all cultures, which was determined using a haemocytometer (Σc). Regression of 'c' on 'a' and 'b' was calculated and trend lines were plotted (Fig. 1). Observations were made every month between September 1981 and March 1982.

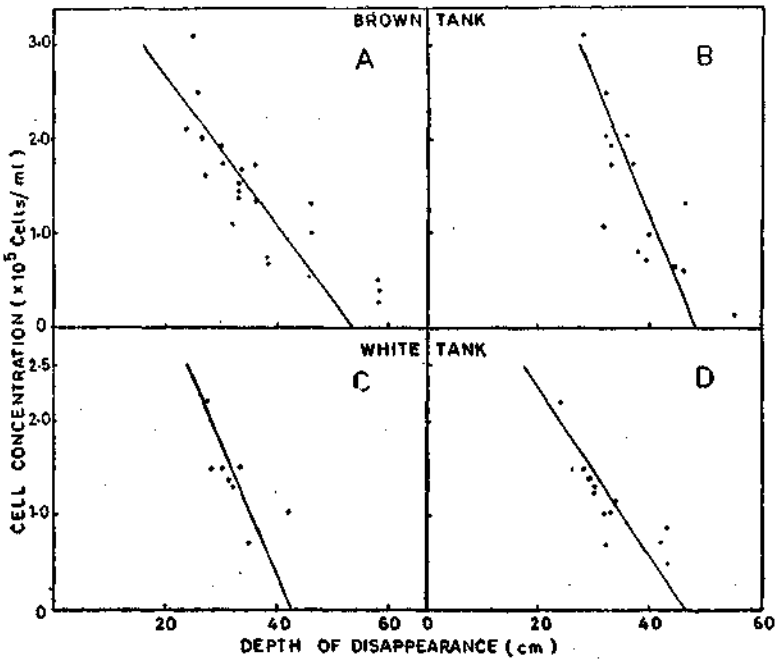

FIG. 1. Relationship between density of culture and depth of disappearance of disc 'A' in brown tank (A) and in white tank (C); and of disc 'B' in brown tank (B) and in white tank (D).

Scatter diagrams revealed that the relationship between cell density and the depth at which the disc disappeared was a straight line in all cases (Fig. 1). The two parameters were negatively correlated, with values of 'r' ranging from —0.72 to —0.83. The regression relations were as follows:

Brown Tank

Disc 'A': $Y = 54.51—12.67\ X$; $r = —0.83$; $r^2 = 0.69$, significant at 1% level.

Disc 'B': $Y = 48.01—6.86\ X$; $r = —0.79$; $r^2 = 0.62$, significant at 1% level.

White Tank

Disc 'A': $Y = 42.76—7.69\ X$; $r = —0.72$; $r^2 = 0.51$, significant at 5% level.

Disc 'B': $Y = 46.29—11.53\ X$; $r = —0.84$; $r^2 = 0.71$, significant at 1% level.

The regression relations revealed that sensitivity of this method varied according to the kind of disc and of tank used, which could be inferred from the slope in each case.

1. The value of 'b' was —12.67 when disc 'A' was used and only —6.86 when disc 'B' was used in the brown tank, indicating greater sensitivity of the method when disc 'A' being employed in this tank.

2. The situation was reversed when the test was conducted in the white tank. Values of 'b' were —7.69 and —11.53 for discs 'A' and 'B', respectively, showing greater sensitivity of disc 'B'. Further, $r^2 = 0.51$ in the case of disc 'A' was significant only at the 5% level.

From the above it may be concluded that disc 'A' went better with the brown tank, whereas disc 'B' was better with the white tank.

Because of the occurrence of detritus in natural waters, it is deemed more appropriate to consider photic depth to be a function of production rather than the reverse. The correlation between chlorophyll 'a' concentration and Secchi-disc transparency had been high ($r^2 = 0.83$) in natural lakes and low ($= 0.44$) in artificial lakes in Canada, this difference being due to the difference in detrital component (Canfield and Bachman 1981). But the present study was confined to culture systems, which are more controlled and better defined than natural systems. Shigeno (1978) had mentioned the problems (eg., organic detritus, dissolution of coloured substances from larval excreta) involved in using the method of Nakamura to regulate the water in prawn rearing tanks. However, these factors too did not interfere in the present study. Moreover, the present method does not claim to be an accurate means of estimating culture density, but to be one that can be adopted as a rule of thumb for feeding larvae.

The advantages of the method are: (1) it gives ease and quickness in estimation; (2) it is more objective than eye-estimation (which is usually resorted to owing to lack of time or technical personnel for feeding larvae. This is particularly important when one considers the long-term objective of developing hatchery technology into a cottage industry); and (3) species composition during hot, sunny months being practically same around Madras, it can be applied with some confidence.

The disadvantage of this method is that it is not very accurate. However, there is much scope for refining it. This could be done taking into account the following factors:

1. Effect of insolation: the light intensity prevailing at the time of observation should be related to the depth of disappearance of disc. All observations in this study were made on bright sunny days and not much variation was seen between observations made during different months.

2. The estimates would vary for different species or mixture of species. Therefore there is a need to standardize the method for each culture dominated by a different form. However, at Kovalam, as the species composition is found fairly uniform during the sunny months, this does not pose a great problem.

3. The estimates vary for different types of culture tanks and other such conditions. This is clear from the different results obtained for the two kinds of tanks studied here.

It may be concluded that this method can be applied under various conditions if care is taken at the outset to standardize the different parameters. Several observations under a wide variety of conditions need to be made before it can be applied. Once standardized, however, it can be utilized for obtaining a rough estimate of cell concentration in mass cultures of phytoplankton.

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