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Preliminary Observation on the Mussel Bed at Njarakkal

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Introduction

The present paper is a report on observations made on a single collection of mussels from Njarakkal, about 5 K. m. north of the Cochin bar mouth. The sea shore is situated with coconut groves. The shore is protected from erosion by sea walls built of blocks of granite. The walls project about 7 m. into the sea. Mussels settle on the walls to form moss like beds below the low tide horizon. One of the walls was chosen for the study and six samples of *Musculus spp.* were collected, each from a 25cm of area, on December 20, 1972. The collection was made only once and by hand with knife as far as possible. The present paper aims at pointing out, to the extent possible within the limitations of the study, the directions of probable development of the mussel beds.

General conditions of the Musculus bed

The biomass of *Musculus* (in wet weight) in the collection was between 6.8 and 15.2 g per 25 cm^2, ie. between 2720 and 6080 g per sq. m. The density varied from 29 to 90 per 25 cm^2. The bed contained an unexpected great amount of extraneous matter. The mud weight varied from 9.3 to 23.1 g/25 cm^2. This large amount of mud may influence the life history of the mussels. The amount of detritus consisting of byssus threads and vegitable matter caught in it was of the order of 3.7–7.6 g. per 25 cm^2. The total amount of matter adhering to the rocks varied from 20.9 to 49.4 g. per 25 cm^2 (Table 1).

Table 1 The Constitution of the *Musculus* Bed (All value are in 25cm^2.)

Samples	A	B	C	D	E	F
Total weight of sample (gr.)	38.2	37.0	30.1	39.4	32.2	20.9
Weight of *Musculus* (gr.)	12.3	7.4	15.2	14.0	11.1	6.8
Weight of mud (gr.)	22.2	23.1	9.3	27.8	16.7	10.2
Weight of detritus (gr.)	3.7	6.5	5.6	7.6	4.4	3.9
Number of *Musculus* (larger than 2mm)	90	29	51	55	43	38
Number of *Musculus* spat in mud (smaller than 2mm)	48	650	200	360	504	0

The green mussel *Perna viridis* occured sparsely in the *Musculus* bed. The former were not obtained in a square collection, but had to be collected by hand. The reason for the sparse settlement of *Perna viridis* may be the following. This species usually settle abundantly on artificial constructions, as do the common mussel, *Mytilus edulis* of temperate waters. According to Pauel (1941), the rate of growth in length of *Perna viridis*, is 56.5mm in 184 days, 77.5mm. in 241 days and 93mm. in 321 days. The average length of specimens was about 80mm (Fig. 2) which corresponds to a growth period of 241 days. Thus it would mean that spat settlement occured in or around April. As the spat grew up they encountered the monsoons. Philip and Mathew (1968) pointed out that immediately after the onset of south west monsoon, a conspicuous mud bank appears along the Kerala coast. The growing green mussels *Perna viridis* may have been smothered by thick mud. Moreover, during this season, the fishermen collect the mussels, even very smaller ones, for food. Thus most members of this species which settled on the sea walls may have disappeared. The mud falls off at the close of the monsoon, allowing *Musculus spp.* population to establish themselves. *Perna viridis* individuals which survive in the monsoon are scattered through these population. Such a replacement of one dominent species by another during the course of a single year would be impossible in the temperate zone. The reason for

such a phenomena occuring at Njarakkal may be the extremelly rapid growth of bivalves in the tropical zone.

Fig. 1 Above,……The length frequency distribution of *Musculus* spp. which number, N, is averaged into 25cm² from all samples and length, L, is in mm.
Below,……The lenght frequency distribution of *Perna viridis* of all collected samples. The length, L, is same as mentioned above.

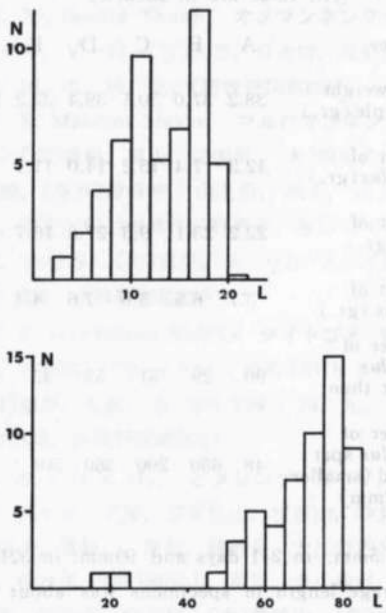
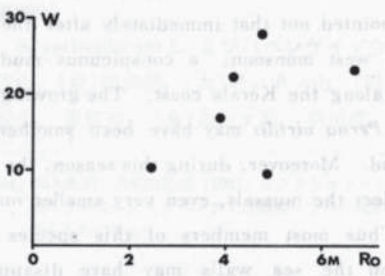


Fig. 2 The relation between the number of spat, N, in sampled square and areal occupied ate, Ro, of *Musculus* which is based on the unknown coefficient unit, M.



Nature of the Musculus population :

The *Musculus* bed may not survive for a long period. In representations of length frequency of *Musculus spp.* (Fig. 1), the main peaks are found from 16 to 18mm. and the subpeaks below 8mm. Further more, the spat of *Musculus* in the mud is 650 per 25cm in the greater number of samples. This number of younger mussels and of spat in the mud is too small for them to have survived in to the next generation. If the spat or younger mussels have the ability to survive as a second generation, the number of spat of 1mm. in length must be some 9000 and of the younger individuals of 5mm, 360 per 25 cm². This estimation is derived from the following calculation.

The density of number of *Mytilus edulis* living together is proportionate to the reciprocal of the square of bivalve length, is regarded as constant in the relative growth (Hosomi).

$$\text{Log } D = 2 \text{ Log } L + K$$

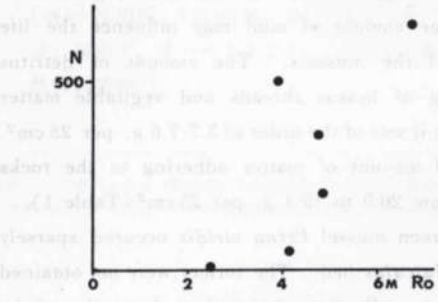
where, D is the density, L is length and K being a coefficient.

About 40 individuals of *Musculus spp.* of 15mm. in length can occupy on 25 cm² area. Because K is 9000 in the above expression, the spat of 1mm. in length is 9000 in number per 25 cm² and younger mussels of 5mm. in length is 360 per unit area. The real number of the younger mussels is far less than this estimate.

If the area occupied by a single mussel is shown to be ML^2 where M is a coefficient, the total area (At) of all numbers in the sampling square is the following :

$$At = M\sum L^2$$

Fig. 3 The relation between the gram weight of mud, W, in sampled square and a occupied rate, Ro, of *Musculus* which is based on the unknown coefficient unit, M.



Further if this expression is divided by sampling area, the value is obtained as the occupied rate(*Ro*).

$$Ro = M \cdot S^{-1} \sum L^2$$

This unknown coefficient is the characteristics of *Musculus* population.

The more the occupation rate of adults, the more

will the number of spat in the mud. If spat take the place of adults which fall off, the number of the spat must be inversely proportional to the occupation rate of adults. However, in practice, the number of spat increases with increasing crowding of adults. The relation is also the same between the quantity of mud, other extraneous matter and the occupation rate (Fig. 2 & 3). The number of spat is great when the mud and detritus are plentiful, when the adults which support the detritus fall off, the spat too disappear. Thus the *Musculus* bed does not survive beyond one generation. After its destruction, *Perna viridis* bed may form again.

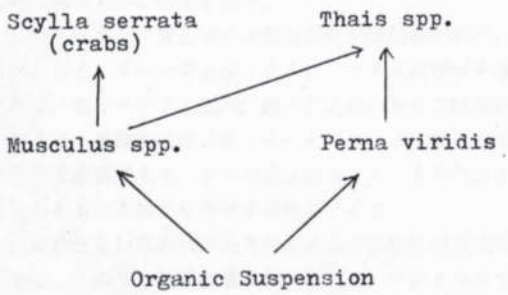
Community of the Musculus bed

Both *Musculus spp.* and *Perna viridis* are secondary producers. The tertiary producers like *Thais spp.* and *Seylla serata* appear after these beds are formed. Thus the *Musculus* bed is constituted by the following four species in the order of decreasing dominance:

Musculus sp.
Thais sp.
Perna viridis
Scylla serata

Other constituent species are a small number of sea annemone, a lung worms and a beach fleas. The reason for the scarcity of lung worms and beach fleas may be the great quantity of mud between the mussels. The main four species arrange themselves in the food chain as follows: (Table 2)

Table 2



Thais spp. feeds on the two species of mussels by boring. Crabs feed on *Musculus* whose shell is soft. *Perna viridis* has thick shells and grows larger, so crabs do not feed on it. The many edible crabs live on the mussel bed deserves special mention. If it is possible to provide artificial condition favourable for the formation of mussel beds, we may be able to culture crabs which feed on the mussels. The sea walls may be employed to advantage in this manner. The crabs may settle easily when the stones are established along this coast.

The biomass of *Musculus* which support crabs is as great as 2720 to 6080 gm. per m^2 as calculated from the wet weight of samples. This is remarkable even though the biomass and productivity of gregarious bivalves is generally great (Banes 1972, Nixon 1971, Reish 1964). Naturally the biomass of *Musculus* is about 1/10 compared to the mussel beds in the temperate zone. The growth rate being faster, the circulation of substance is also faster and the yield may be induced to become larger. It is known that the growth of bivalves in the tropics is extremely rapid compared to that in the temperate zone. Therefore the productivity may show an excess over biomass.

Directions for the future study

In the view of what has been said above, the following points may be especially interesting in planning future research in the area:

1) The mud upwelling in the south west monsoon season may influence the community on the rocky surface. Therefore comparison of the rocky habitat before, during and after the rains are needed. The knowledge of the relation between mud and the animals is important in considering the characteristic problems of this region.

2. The study of production of the artificial habitats provided by the sea walls is important in assessing crab culture possibilities. To start with the secondary production by *Musculus spp.* and *Perna viridis* must be studied by taking collection about six times an year, using the easy standard of biomass.

要　　約

インド，コーチンの海岸の投石によって作られた防波堤には，乾期中，ホトトギス個体群が繁茂する。またミドリイガイが点在する。この場所は雨期には厚い泥が堆積し，雨期あけとともに泥がさる。ホトトギスは雨期後に石面に付着したものが，約半年で成体にまでなり，個体群を形成したと考えられる。ホトトギス群集は雨期によって再新されるようで移入幼貝によって個体群が維持されるわけではない。それには群内の微少個体があまりにも少く，群内には泥がつまっていて幼貝の付着を許さ

ないようである。

ホトトギス群集上には，ノコギリガザミが多く集る。このカニはホトトギスの捕食者として存在するようである。この海岸に，人為的に投石することは，ノコギリガザミを育てる上で有効であろう。（細見彬文；モハメッド・サリー）

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