CHANGE OF FORM AND DIMENSIONAL RELATIONSHIP IN THE PEARL OYSTER *PINCTADA FUCATA* FROM GULF OF MANNAR

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ABSTRACT

Samples of the pearl oyster, *Pinctada fucata*, collected from Tholayiram, Pulipundu and Kudamuthu paars in the Gulf of Mannar were analysed to study the relationship among the linear dimensions, namely dorsoventral measurement, hinge length, anteroposterior measurement and thickness. A change of form occurs from subquadrate in the young to oblong in the adult oysters. The hinge length is about 1.22-1.26 times the dorsoventral dimension in the youngest size group, but both become equal at a size of about 35 mm. Thereafter, the dorsoventral dimension is always greater than the hinge line.

The dorsoventral, hinge-line, anteroposterior and thickness measurements are in linear relationship of the form $y = a + bx$. Equations describing the relationship have been derived. Consequent on the change of shell shape, the young and adult oysters are found to have significantly different regression coefficients, except in one locality. Comparison of regressions of all characters in young and adult oysters from the three paars brings out the heterogeneous nature of the population.

The length-weight relationship is described by the equation $W = 0.00001447 L^{3.042826}$ where W is the weight and L is the dorsoventral measurement of the pearl oyster. The equation holds good for the entire range of sizes, unlike in the case of the relationship among the linear dimensions.

INTRODUCTION

In pearl culture, the size or weight of oyster is one of the contributory factors in the selection of mother-oysters for 'seeding' operations. The relationship among the size of oysters, number and size of nuclei and the size of graft tissue pieces must be worked out to achieve optimum production of pearls (Alagarswami 1970). As the first step towards this, it is necessary to know if the pearl oysters from different pearl banks of the Gulf of Mannar, which are presently used in the experimental pearl culture work, are a homogeneous population or not. Hornell (1922, p. 96) stressed the need to have a knowledge of the "special growth peculiarities of the ground" since "some paars by reason of abundant food supply hasten the growth of their oysters to a surprising degree, while others where less favourable conditions prevail bear oysters of an unhealthy appearance and of stunted size". In the present study,

the relationship among the dimensions of the pearl oyster *Pinctada fucata* from three paars in the Gulf of Mannar has been investigated to elucidate the similarities and differences between the paars.

Previous works on aspects related to this study are very limited. Devanesen and Chidambaram (1956) attempted to study the age-length and age-weight relationship of the pearl oysters reared at Krusadai. Making use of the data appended to the above report, Alagaraja (1962) studied the length-weight relationship of oysters of different age groups. Narayanan and Michael (1968) worked out the relation between age and linear measurements of the pearl oysters from the Gulf of Kutch.

Material and Methods

Pearl oysters were collected from three pearl banks, namely Tholayiram paar, Pulipundu paar and Kudamuthu paar in the Gulf of Mannar at depths ranging 14.5-19 m during the period between November 1972 and June 1973 (see Alagarswami and Qasim 1973 for a map of the area). Of these, 457, 657 and 639 oysters respectively from the above paars were taken up for the present study. The oysters were cleaned of all the fouling organisms and encrustations. The linear measurements were taken correct to 0.1 mm with vernier calippers. The growth processes, whenever found, were excluded from measuring. The expressions of Hynd (1955) on the dimensions of pearl oyster were adopted (Fig. 1) in view of the different terminologies used by various

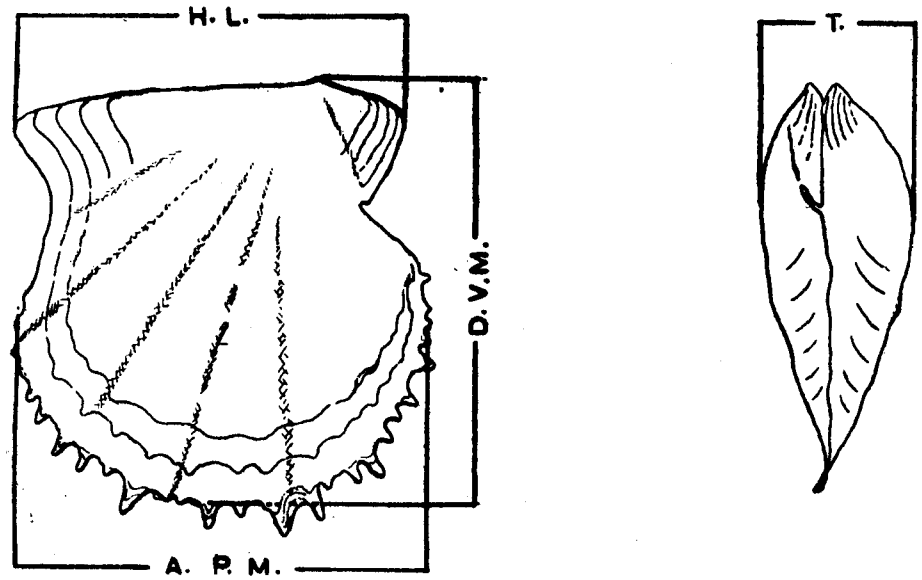

FIG. 1. Shell dimensions of pearl oyster referred to in the text. D.V.M. — dorsoventral measurement; A.P.M. — anteroposterior measurement; H.L. — hinge length; T. — thickness.

workers for some of the characters. The dorsoventral measurement (D.V.M.) is the greatest dimension of the oyster measured at right angles to the hinge line. Hinge length (H.L.) is the distance between the tips of the anterior and posterior ears along the hinge line. Anteroposterior measurement (A.P.M.) is the greatest horizontal distance between the anterior and posterior margins of the shell taken parallel to the hinge line. Thickness (T) is the maximum distance between the external surface of the two valves when both are closed. Weight (W) was taken correct to 0.5 g with a semi-self-indicating balance. Before weighing, the oysters were kept in sea water for a minimum of 30 minutes. They were taken out when the valves were tightly closed and the external moisture was wiped.

Appropriate statistical procedures were followed to derive the relationship of the different dimensions, taking the D.V.M. which is the greatest dimension of the pearl oyster as the independent variable. For the length-weight relationship, only the data from Tholayiram paar were used as the weight data from other paars were inadequate.

Change of Form in Pearl Oyster

A preliminary examination of a size-series of pearl oysters showed that a change of form occurs at a particular size. This change was well pronounced in respect of the hinge line and dorsoventral axis. The young ones are generally subquadrate with the hinge line longer than the dorsoventral axis. They grow up to an oblong form in which the latter dimension measures more than the former. To study the size at which the change takes place, the ratios of the different characters to the D.V.M. were calculated for the individual oysters. These were grouped for 5mm D.V.M. intervals. The averages of ratios, along with the mean D.V.M. values for each size group, are given in Table 1.

Considering the oysters of the Tholayiram paar, it is seen that the hinge length is 1.22-1.26 times the dorsoventral measurement in the youngest size group. The ratio shows a gradual decline and in the oldest oysters (of the present study) it ranges 0.79-0.82. The change of form from subquadrate to oblong can be assumed to take place when the ratio reaches the number 1. From graphs drawn of the data it was seen that unity is crossed at 36.5 mm, 35.0 mm and 27.0 mm for the oysters of Tholayiram, Pulipundu and Kudamuthu paars, respectively. Data on oysters in the middle range of sizes were limited for Kudamuthu paar and, hence, the size of 27.0 mm derived in the present study might need revision when more data become available. However, the ratios of the lower and higher size groups generally conform to those of the other two localities.

The ratios of A.P.M. to D.V.M. also show a similar trend (Table 1). In the youngest stage, the A.P.M. is 1.05-1.22 times more than the D.V.M. and in the oldest, the ratios range 0.86-0.89 in the three areas. However, the A.P.M.

TABLE 1. *Mean D.V.M. values and average ratios of H.L., A.P.M. and T. to D.V.M. of pearl oysters from different pearl banks.*

Size group	Mean D.V.M. (mm)			Average ratios to D.V.M.								
				H.L.			A.P/M.			T.		
D.V.M. (mm)	T.P.	P.P.	K.P.	T.P.	P.P.	K.P.	T.P.	P.P.	K.P.	T.P.	P.P.	K.P.
0-5	3.60	3.83	4.00	1.22	1.26	1.25	1.22	1.11	1.05	0.22	0.17	0.23
5-10	7.97	6.95	8.35	1.17	1.21	1.18	1.07	1.06	0.99	0.23	0.29	0.24
10-15	13.45	12.40	12.64	1.11	1.20	1.26	0.95	0.99	0.91	0.23	0.32	0 22
15-20	18.62	17.25	17.79	1.08	1.10	1.06	0.91	0.97	0.87	0.24	0.29	0.26
20-25	22.40	22.50	21.83	1.20	1.14	1.13	0.93	0.95	0.91	0.29	0.29	0 26
25-30	27.18	26.87	28.40	1.11	1.06	0.97	0.92	0.87	0.82	0.28	0.27	0.24
30-35	32.07	31.74	31.60	1.07	1.07	0.96	0.96	0.85	0.74	0.29	0.37	0.24
35-40	37.41	38.44	36.50	0.99	0.92	0.80	0.93	0.89	0.87	0.30	0.28	0.26
40-45	42.63	43.07	43.25	0.96	0.91	0.93	0.90	0.91	0.92	0.30	0.29	0.37
45-50	47.56	48.06	48.80	0.91	0.87	0.92	0.89	0.87	0.91	0.39	0.35	0.36
50-55	52.83	53.79	52.73	0.87	0.86	0.92	0.89	0.88	0.90	0.38	0.37	0 35
55-60	57.70	57.65	56.82	0.86	0.85	0.87	0.89	0.86	0.89	0.37	0.39	0.34
60-65	62.24	62.13	61.61	0.83	0.83	0.85	0.89	0.87	0.89	0.38	0.38	0 33
65-70	67.18	67.31	67.10	0.82	0.83	0.75	0.89	0 86	0.89	0.38	0.36	0.32

Explanations:— T.P. — Tholayiram paar; P.P. — Pul'pundu paar; K.P. — Kudamuthu paar

becomes shorter than D.V.M. even at an earlier stage than in the case of H.L., between 10-15mm D.V.M. The ratios of thickness to D.V.M. increase from the young to the old up to a particular stage and thereafter either remain about the same or show a slight decrease. The highest ratio is obtained when the D.V.M. of oysters is 45-50 mm in Tholayiram paar, 55-60 mm in Pulipundu paar and 40-45 mm in Kudamuthu paar. The data show that although there is an increase in thickness in absolute terms throughout the life of the oyster, the relative growth of this dimension with reference to D.V.M. slows down in the later stages.

DIMENSIONAL RELATIONSHIP

The values of hinge length, anteroposterior measurement and thickness were plotted against the dorsoventral measurement. The scatter diagrams showed that although a straight-line relationship was to be noticed, a single regression line would not describe the relationship in each case. In relation to the change of form already seen, the scatter of points suggested two different linear regressions for the younger and older groups. In deciding the dividing line between these two groups, the D.V.M. at which the ratio of H.L. crosses the value of one has been taken as the criterion. This happens at 36.5 mm for the oysters of Tholayiram paar, at 35.0 mm for Pulipundu paar and at 27.0 mm

for Kudamuthu paar. In view of the inadequacy of data for the Kudamuthu paar and the closeness of the other two values of D.V.M. for the rest of the paars, a D.V.M. of 35 mm has been taken as the dividing line in grouping the data into 'young' and 'adults'. These two terms have been used only with reference to the size groups and not in relation to condition of maturity of oysters. The linear regression equation of the form $y = a + bx$, where x is the independent variable, y is the dependent variable and a and b are constants, was fitted by the method of least squares for the two groups separately for all the paars. The equations derived are given below.

a. *Tholayiram paar*

i) for young oysters:

H.L. (y) on D.V.M. (x). $y = 0.968325 + 1.075151\ x$ .... (1)
A.P.M. (y) on D.V.M. (x). $y = 1.073420 + 0.876585\ x$ .... (2)
T. (y) on D.V.M. (x). $y = -1.061222 + 0.324062\ x$ .... (3)

ii) for adult oysters:

H.L. (y) on D.V.M. (x). $y = 13.688069 + 0.620439\ x$ .... (4)
A.P.M. (y) on D.V.M. (x). $y = 6.597248 + 0.772726\ x$ .... (5)
T. (y) on D.V.M. (x). $y = -3.044436 + 0.422760\ x$ .... (6)

The correlation coefficients of the relationship (1) through (6) above are, respectively, 0.930, 0.866, 0.879, 0.795, 0.920 and 0.780.

b. *Pulipundu paar*

i) for young oysters:

H.L. (y) on D.V.M. (x). $y = 1.580297 + 1.038056\ x$ .... (7)
A.P.M. (y) on D.V.M. (x). $y = 1.458174 + 0.854597\ x$ .... (8)
T. (y) on D.V.M. (x). $y = -0.302125 + 0.309249\ x$ .... (9)

ii) for adult oysters:

H.L. (y) on D.V.M. (x). $y = 2.843810 + 0.801241\ x$ .... (10)
A.P.M (y) on D.V.M. (x). $y = -3.628093 + 0.942453\ x$ .... (11)
T. (y) on D.V.M. (x). $y = -11.625963 + 0.571586\ x$ .... (12)

The correlation coefficients of the relationship (7) through (12) above are, respectively, 0.943, 0.986, 0.952, 0.638, 0.777 and 0.778.

c. *Kudamuthu paar*

i) for young oysters:

H.L. (y) on D.V.M. (x). $y = 5.070096 + 0.815612\ x$ .... (13)
A.P.M. (y) on D.V.M. (x). $y = 2.723563 + 0.740651\ x$ .... (14)
T. (y) on D.V.M. (x). $y = 0.775005 + 0.207346\ x$ .... (15)

ii) for adult oysters:

H.L. (y) on D.V.M. (x). $y = 4.516582 + 0.798056\ x$ .... (16)

A.P.M. (y) on D.V.M. (x). $y = 3.503006 + 0.835241\ x$ .... (17)

T. (y) on D.V.M. (x). $y = 6.925498 + 0.216804\ x$ .... (18)

The correlation coefficients of the relationship (12) through (18) above are, respectively, 0.839, 0.959, 0.816, 0.730, 0.827 and 0.724.

d. *Comparison of regression coefficients within paars and size groups*

The regression coefficients of the equations describing the relationship among the dimensions of pearl oysters showed apparent differences within the localities and with the size groups. It was found necessary to test the significance of the apparent differences statistically. The procedure of analysis of covariance was employed in all cases and the significance was tested at 5% level of probability.

The regression coefficients (b) of the relationship of H.L. on D.V.M. of oysters belonging to both groups (young and adults) and from different paars were compared (Table 2). The analysis at Part A of the table gave a F value of 29.10, indicating the presence of highly significant differences between the localities and groups. The analysis at Part B of the table resulting in a F value of 6.61 showed that there are significant differences among the young populations of oysters within the three localities. Similarly, the F value of 11.20 derived at Part C of the table showed significant differences among the adult populations.

Comparing the regression coefficients of the relationship of A.P.M. on D.V.M. (Table 3), it was seen that the differences among both size groups and all the paars were significant ($F = 6.10$). The differences among the young oysters ($F = 3.12$) and those among the adult oysters ($F = 11.75$) were also found to be significant.

Table 4 gives the results of comparison of regression coefficients of the relationship of thickness on D.V.M. Highly significant differences were noticed in all the three sets of tests with F values of 54.21, 12.72 and 86.24 for among both the groups (Part A), young oysters (Part B) and adults (Part C) respectively.

The regression coefficients of the young and adult groups were compared for each character and each paar separately to know whether the differences between the young and the adults are significant. The F values obtained with corresponding degrees of freedom are given in Table 5. It is seen from the table that significant differences do not exist between young and adult groups

of oysters from Kudamuthu paar. Oysters from the other two paars show significant differences which are more pronounced in respect of the relationship of H.L. and T. on D.V.M. Consequently, the data for young and adult groups of oysters from Kudamuthu paar were pooled together and the common relationship for each character was derived. The equations are:

$$\text{H.L. (y) on D.V.M. (x).} \quad y = 5.634701 + 0.777185\,x \quad \ldots\ (19)$$

$$\text{A.P.M. (y) on D.V.M. (x).} \quad y = 0.367265 + 0.893666\,x \quad \ldots\ (20)$$

$$\text{T. (y) on D.V.M. (x).} \quad y = -1.351851 + 0.371596\,x \quad \ldots\ (21)$$

The correlation coefficients of the relationship at (19) through (21) above are, respectively, 0.943, 0.975 and 0.965.

TABLE 2. *Comparison of regression coefficients (b) of the relationship of H.L. on D.V.M. in the young and adult groups of pearl oysters from different pearl banks.*

Areas & Group	*d.f.*	Reg. Coef.	Deviations from regression *d.f.*	S.S.	M.S.	F
A. Within						
1. Tholayiram paar — young	140	1.075151	139	1276.509568		
2. Pulipundu paar — "	191	1.038056	190	1879.818244		
3. Kudamuthu paar — "	62	0.815612	61	705.131050		
4. Tholayiram paar — adults	315	0.620439	314	4518.959971		
5. Pulipundu paar — "	464	0.801241	463	9435.274760		
6. Kudamuthu paar — "	575	0.798056	574	5334.074366		
Total Within			1741	23149.767959	13.296822	
Pooled	1747		1746	25084.140641		
Difference between slopes			5	1934.372682	386.874536	29.10*
B. Within 1-3, young						
Total Within			390	3861.458862	9.901177	
Pooled			392	3992.380671		
Difference between slopes			2	130.921809	65.460904	6.61*
C. Within 4-6, adults						
Total Within			1351	19288.309097	14.27706	
Pooled			1353	19608.249439		
Difference between slopes			2	319.940342	159.970171	11.20*

Explanations for all statistical tables:— *d.f.* — degrees of freedom; S.S. — Sum of squares; M.S. — Mean square. Asterisks denote significance at 5% level of probability.

TABLE 3. *Comparison of regression coefficients (b) of the relationship of anteroposterior measurement on dorsoventral measurement in young and old groups of pearl oysters from different pearl banks.*

Areas & Groups	*d.f.*	Reg. Coef.	Deviations from regression *d.f.*	S.S.	M.S	F
A. Within						
1. Tholayiram paar — young	140	0.876585	139	1808.637048		
2. Pulipundu paar — "	191	0.854597	190	286.204308		
3. Kudamuthu paar — "	62	0.740651	61	121.882389		
4. Tholayiram paar — adults	315	0.772726	314	2188.997364		
5. Pulipundu paar — "	464	0.942453	463	5896.682111		
6. Kudamuthu paar — "	575	0.835241	574	3075.730095		
Total Within			1741	13378.133315	7.684166	
Pooled	1747		1746	13612.679908		
Difference between slopes			5	234.546593	46.909319	6.10*
B. Within 1-3, young						
Total Within			390	2216.723745	5.683907	
Pooled			392	2252.200463		
Difference between slopes			2	35.476718	17.738359	3.12*
C. Within 4-6, adults						
Total Within			1351	11161.409570	8.261591	
Pooled			1353	11355.521682		
Difference between slopes			2	194.112112	97.056056	11.75*

* F significant at 5% level of probability.

Having treated the data from all the three localities together so far, it was sought to test the differences between pairs of paars. The results of comparisons are given in Table 6. It is observed that among the young group of oysters, there is no significant difference between Tholayiram paar and Pulipundu paar. In all other cases the differences are significant except for the relationship of A.P.M. on D.V.M. of young oysters from Tholayiram and Kudamuthu paars.

The regression lines describing the relationship of each character on D.V.M. for the three localities are represented in Fig. 2. The heterogeneous nature of the regressions, except in the case of A.P.M. on D.V.M. relationship in the young oysters, is evident from the figure. The results of statistical analysis also lend support to the above observation.

TABLE 4. *Comparison of regression coefficients (b) of the relationship of thickness on dorsoventral measurement in young and old groups of pearl oysters from different pearl banks.*

Areas & Groups	*d.f.*	Reg. Coef.	Deviations from regression *d.f.*	S.S.	M,S.	F
A. Within						
1. Tholayiram paar — young	140	0.324062	139	218.663725		
2. Pulipundu paar — "	191	0.309249	190	137.466485		
3. Kudamuthu paar — "	62	0.207346	61	54.561143		
4. Tholayiram paar — adults	315	0.422760	314	2320.138631		
5. Pulipundu paar — "	464	0.571586	463	2150.569669		
6. Kudamuthu paar — "	575	0.216804	574	406.435807		
Total Within			1741	5287.835460	3.03724	
Pooled	1747		1746	6111.117094		
Difference between slopes			5	823.281634	164.656327	54.21*
B. Within 1-3, young						
Total Within			390	410.691353	1.053055	
Pooled			392	437.485623		
Difference between slopes			2	26.794270	13.397135	12.72*
C. Within 4-6, adults						
Total Within			1351	4877.144107	3.610025	
Pooled			1353	5499.818695		
Difference between slopes			2	622.674588	311.337294	86.24*

* F significant at 5% level of probability.

TABLE 5. *'F' values, with d.f., resulting from the comparison of regression coefficients (b) of the different dimensions on D.V.M. between young and adult groups.*

Paar	Between groups	H.L. on D.V.M. *d.f.*	F	A.P.M. on D.V.M. *d.f.*	F	T. on D.V.M. *d.f.*	F
Tholayiram	Young & adult	1,453	84.79*	1,453	6.41*	1,453	9.12*
Pulipundu	Young & adult	1,653	18.95*	1,653	4.77*	1,653	114.97*
Kudamuthu	Young & adult	635,1	15.46	1,635	3.55	635,1	4.06

* F significant at 5% level of probability.

TABLE 6. *'F' values, with d.f. resulting from comparisons of regression coefficients (b) of the different body measurements on DV.M. of young and old groups of pearl oysters between pairs of pearl banks.*

Group of oyster	Paar	H.L. on D.V.M. *d.f.*	F	A.P.M. on D.V.M. *d.f.*	F	T. on D. V. M. *d.f.*	F
Young	Tholayiram & Pulipundu	329,1	1.48	329,1	2.80	329,1	1.05
"	Pulipundu & Kudamuthu	1,251	10.27*	1,251	17.07*	1,251	29.02*
"	Tholayiram & Kudamuthu	1,200	12.66*	1,200	3.56	1,200	18.57*
Adults	Tholayiram & Pulipundu	1,777	12.25*	1,777	18.63*	1,777	25.90*
"	Pulipundu & Kudamuthu	1037,1	255.13*	1,1037	6.51*	1,1037	250.28*
"	Tholayiram & Kudamuthu	1,888	18.42*	1,888	4.27*	1,888	89.50*

* F significant at 5% level of probability.

LENGTH-WEIGHT RELATIONSHIP

The scatter diagram of the actual values of weight (in grams) on the dorsoventral measurement (in mm) suggested a curvilinear relationship for the entire range of data (Fig. 3). Unlike in the case of linear dimensions the change of shape from subquadrate to oblong form did not seem to affect the parabola that would describe the relationship of weight on D.V.M. The logarithmic values of the two characters, when plotted, showed that a single straight line would describe the relationship for the entire length range. Hence the allometric growth equation $W = a L^n$, where W is the weight of oyster, L is the dorsoventral measurement and a and n are constants, was fitted to the data of pearl oysters of Tholayiram paar. The straight line equation was found to be

$$\log W = -3.839261 + 3.042826 \log D.V.M.$$

with its exponential form as

$$W = 0.00001447\ D.V.M.^{3.042826}$$

and the correlation coefficient was 0.991.

DISCUSSION

Galtsoff (1931) stated that, in the case of the Hawaiian pearl oyster *Pinctada* sp. (= *Pinctada maxima*), "small immature oysters (less than 4 cm long) are shorter than the adults" and there is no significant change in the

shape of the shell in the adult oysters. A similar phenomenon has been observed in the Indian pearl oyster, *Pinctada fucata,* in the present study. In the young oysters, the dorsoventral dimension is shorter than both the hinge line and anteroposterior dimension (Table 1). But subsequently, the D.V.M. shows a progressively faster growth and becomes about equal to the hinge line around 35 mm and outgrows the latter beyond that size. In relation to the A.P.M. it

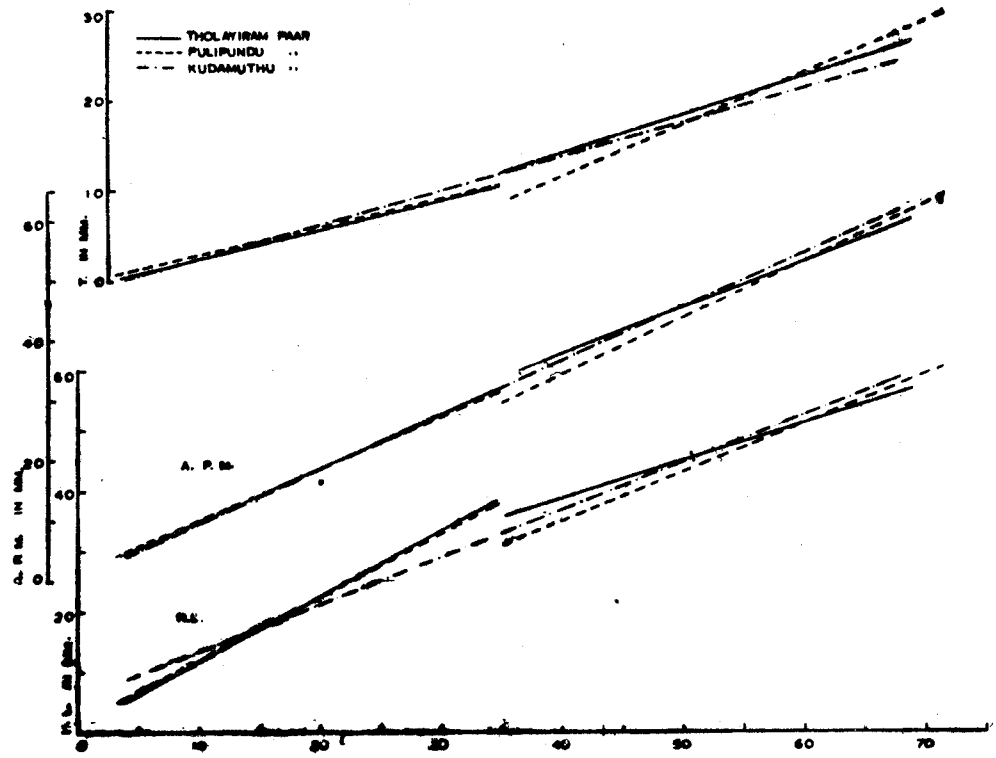

FIG. 2. Comparison of regression lines describing the relationship of the dimensions H.L., A.P.M. and T. on D.V.M. among young and adult groups of pearl oysters from different pearl banks of Gulf of Mannar. D.V.M. — dorsoventral measurement; H.L. — hinge length; A.P.M. — anteroposterior measurement; T. — thickness.

breaks even at an earlier size of 10-15 mm and thereafter remains longer. After attaining the oblong form there is no further change in the shape of shell in the adults, as in the case of *P. maxima.*

In other bivalve molluscs (*Meretrix* spp., *Cardium edule* etc.), differential growth of body parts resulting in change of form has been noticed (Hamai, 1938; Kristensen, 1957; Durve and Dharma Raja, 1969). Such changes have been attributed to the burrowing habits of the clams or cockles or the nature

of substratum. The pearl oyster always lives attached to rocks or other hard substrata by byssus and, hence, the causes attributed to the burrowing species would not apply to it. The change of shape of shell as noticed in the Hawaiian pearl oyster (Galtsoff 1931) and in *P. fucata* from the Gulf of Mannar should be considered a natural change in keeping with the growth of the soft parts of the oyster.

The study on comparison of regressions of different shell characters has shown that there is a tendency of heterogeneity among the populations of oysters in the three localities studied (Tables 2, 3, 4). The regression coefficients of the equations (1) to (18) indicate that, with reference to the dorsoventral

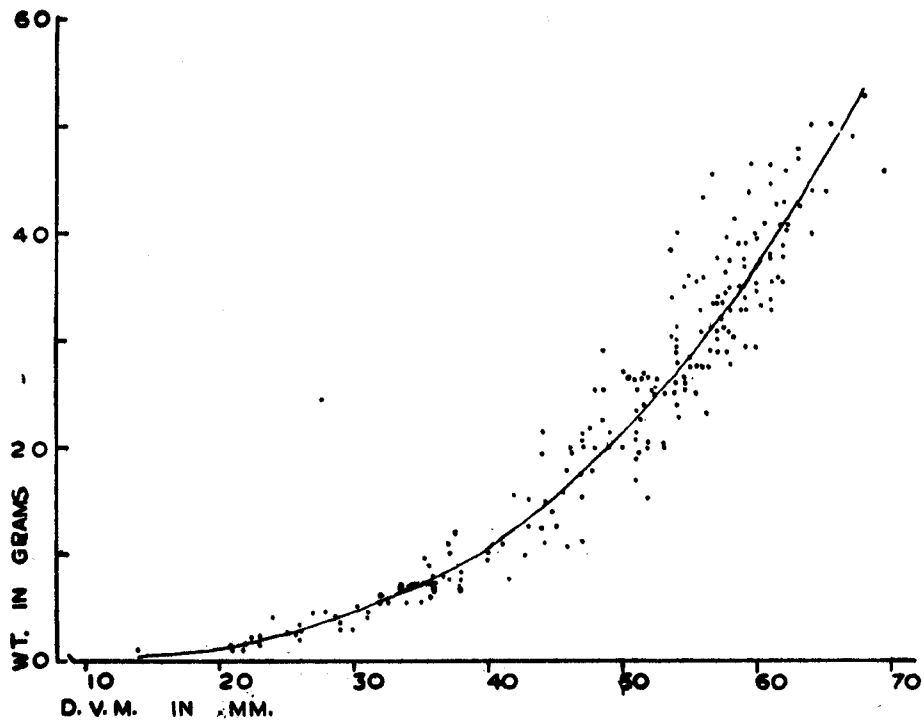

FIG. 3. Length-weight relationship in the pearl oyster, *Pinctada fucata*, from Tholayiram paar. (Length = D.V.M.)

dimension, the hinge line grows relatively faster in the young than in the adult oysters in all the paars; the anteroposterior dimension also grows relatively faster in the young than in the adults except in Tholayiram paar where a reverse trend is observed, and the thickness increases relatively faster in the adults than

in the young oysters in all the paars. The growth trends are found to be significantly different between the young and adult oysters in Tholayiram and Pulipundu paars, the difference being more pronounced in respect of hinge line and thickness; in Kudamuthu paar, homogeneity is evident from the non-significant values of F for all characters (Table 5). The comparison between pairs of pearl banks also reveals heterogeneity except the limited affinities found among the young oysters of Tholayiram and Pulipundu paars (Table 6).

The causes for overall heterogeneity and very limited similarities noticed among the pearl oysters from the pearl banks are not clear. Mahadevan and Nayar (1968) remarked that the general physical features and faunistic characteristics of the paars of the Central Zone (which includes all the three paars of the present study beside others) appeared to be the same throughout although interesting differences existed here and there. They also noticed a difference in the suspension of sediments between paars disposed shoreward and offshore, resulting in poor and good clarity in the two divisions respectively. While Pulipundu and Kudamuthu paars fall in the former category, Tholayiram paar falls in the latter. Pulipundu paar is proximate to the Tholayiram paar, and Kudamuthu paar lies further south. Conditions of substrata being similar, to what extent the differences in the suspension of sediments or other physical, chemical and biological factors of sea water over the three paars are responsible for the heterogeneity observed among the oysters remains to be investigated. The observation of Hornell (1922, p. 96) quoted earlier is worth noting here.

Alagaraja (1962) investigated the length-weight relationship of pearl oysters separately for different age groups and found that the straight line equation of the form $W = a + bL$ described the relationship. But Galtsoff (1931) found an allometric relationship expressed by the equation $W = 0.04209\ L^{3.21529}$ (L is equal to the D.V.M. of present study) for the Hawaiian pearl oyster. He also found the equation holding true for all sizes of shells ranging 2-26 cm in length and 1.33-1265.0 g in weight, in spite of the change of shape of shell from immature to adult stage. A similar result has been obtained in the case of the Indian pearl oyster. The regression coefficient of 3.042826 derived here is close to the value of the constant obtained for the Hawaiian species. It may, therefore, be said that the length-weight relationship in the pearl oyster is of an allometric form and follows the cube-law as in the case of fishes.

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