

CHAPTER III

RESULTS

Catch Data

From trawl surveys of the R/V Pramong Talay 12 and Pramong Talay 15 of the Eastern Marine Fisheries Development Center, Rayong Province, the highest catch of the scallop *Amusium pleuronectes* (Linn.) was obtained in October with the average rate of 2.36 kg per hour. High catching rate prevailed around April-May and September-November (Tables 3 and 4). The mean size of scallop caught in this study, as expressed by weight, is largest in sample of November which is 39.08 g. Details on monthly catch data of the species are shown in Appendix A.

I. Growth Parameters

The shell height frequency data of *A. pleuronectes* from Chang Islands, eastern part of the Gulf of Thailand, collected during January to December 1987 with the class interval of 0.5 cm from inner and outer regions are presented in Tables 5 and 7 respectively.

Determination of the growth parameters, asymptotic length; L_{∞} and growth coefficient; K , of the populations in both regions using the data with adjusted class interval to 1.0 cm (Tables 6 and 8) yields the estimation of $L_{\infty} = 11.5$ cm; $K = 1.5$ per year with $R_n = 0.533$ for the inner region, and $L_{\infty} = 10.6$ cm; $K = 1.54$ per year with $R_n = 0.487$ for the outer region population.

Table 3 Catch data of *Amusium pleuronectes* from Chang Island by R/V Pramong Talay 12 and 15, January-December 1987. (Unit: kg.)

STATION	MONTH												TOTAL PER STATION
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1	1.97	1.72	1.86	4.40	6.90	-	-	0.85	3.00	2.55	3.10	1.30	27.65
2	2.20	1.46	0.65	-	3.70	-	-	-	5.40	5.90	0.35	0.34	20.00
3	0.18	0.32	0.13	0.56	0.70	-	-	-	1.90	1.70	1.16	-	6.65
4	0.00	0.04	0.80	-	4.40	-	-	-	0.00	0.00	0.04	0.04	5.32
5	0.04	0.10	0.33	1.30	-	-	-	-	5.50	3.55	0.00	-	10.82
6	0.00	0.03	0.25	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.30
7	0.07	0.22	0.60	-	-	-	-	-	0.17	0.00	0.61	0.13	1.80
8	0.00	0.00	0.05	0.40	1.45	-	0.50	3.20	0.11	0.18	0.00	-	5.89
9	0.00	-	-	-	-	-	-	-	-	0.00	-	-	0.00
10	0.00	0.00	0.15	1.55	4.40	-	1.67	0.86	0.20	0.00	0.01	0.06	8.91
11	-	0.00	0.17	0.45	0.06	-	-	-	0.35	0.30	0.22	-	1.55
12	0.00	0.00	0.02	0.05	0.03	0.03	-	0.10	0.00	0.00	0.00	0.00	0.23
13	0.00	-	-	-	-	-	-	-	-	-	-	-	0.00
14	0.00	0.00	0.02	-	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.02
15	0.00	0.00	0.08	0.01	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.09
16	0.00	0.00	0.13	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	-	0.13
17	-	-	-	-	-	-	-	-	-	-	-	-	0.00
18	0.73	0.00	0.02	0.05	0.13	-	0.00	0.05	0.00	0.00	0.02	0.00	0.99
19	-	-	-	-	-	-	-	-	-	-	-	-	0.00
20	0.03	0.00	0.06	-	0.16	-	0.00	0.02	0.00	0.00	0.00	0.00	0.27
TOTAL PER MONTH	5.23	3.90	5.32	8.77	21.93	0.03	2.17	5.10	16.63	14.18	5.51	1.87	90.63

Note :

0 = no scallop caught
- = no trawling

Table 4 Summarized record on survey data of the scallop *Amusium pleuronectes* from Chang Islands, 1987. Each trawl performed for 1 hour period, except one of station 7 in November for half an hour.

MONTH	NO. TRAWL OPERATE	NO. TRAWL CATCH	TOTAL CATCH (kg)	CATCH PER TRAWL	AVERAGE CATCH/HR.	NO. PUNCHED	WEIGHT (kg)	MEAN WEIGHT (g)
January	17	9	5221	307.1	580.1	167	3205	19.19
February	16	10	3889	243.1	388.9	166	3780	22.77
March	16	16	5305	331.6	331.6	506	5035	9.95
April	11	9	8765	796.8	973.9	499	7515	15.06
May	14	10	21930	1566.4	2193.0	484	9630	19.90
June	2	1	30	15.0	30.0	2	30	15.00
July	8	2	2165	270.6	1082.5	140	2165	15.46
August	10	7	5095	509.5	727.9	143	3295	23.04
September	15	8	16625	1108.3	2078.1	316	10625	33.62
October	16	6	14180	886.3	2363.3	271	10330	38.12
November*	15	8	5510	367.3	688.8	141	5510	39.08
December	10	5	1870	187.0	374.0	54	1870	34.63

NOTE : * Accident happened during one trawling at station 7. Catch data obtained from half an hour at that station (610 g/1 trawl) was excluded when calculate average catch per hour.

Table 5 Shell height frequency data of *Amusium pleuronectes* from the inner region of Chang Islands, 1987; with 0.5 cm class interval.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.75														0
2.25														0
2.75														0
3.25				3										3
3.75				10								1		11
4.25				16	1							1		18
4.75			1	24	0							1		26
5.25			1	7	2									10
5.75				2	1	2								5
6.25				0	1	4								5
6.75		1		0		7			1					9
7.25		5		0		2	1		0					8
7.75		0		3		1	1		0					5
8.25		0		3					3					6
8.75		1							1					2
9.25		3												3
9.75		2												2
10.25		2												2
TOTAL :		14	2	68	5	16	2	0	5	0	0	3	0	115

Table 6 Shell height frequency data of *Amusium pleuronectes* from the inner region of Chang Islands, 1987; adjusted class interval to 1.0 cm.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.5														0
2.5														0
3.5				13								1		14
4.5			1	40	1							2		44
5.5			1	9	3	2								15
6.5		1		0	1	11			1					14
7.5		5		3		3	2		0					13
8.5		1		3					4					8
9.5		5												5
10.5		2												2
SUM:		14	2	68	5	16	2	0	5	0	0	3	0	115

Table 7 Shell height frequency data of *Amusium pleuronectes* from the outer region of Chang Islands, 1987; with 0.5 cm class interval.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.75			1											1
2.25			3	4										7
2.75		1	14	21	5			2				1		44
3.25		0	15	44	8			3				4		74
3.75		0	3	66	23	2		18				3	1	116
4.25		5	4	91	58	6		16	2	1		3	3	189
4.75		27	8	89	100	16		23	8	1		0	6	278
5.25		49	1	36	111	27		13	16	4		1	7	265
5.75		46	2	12	79	69		6	25	19	2	0	4	264
6.25		5	13	9	38	122		12	18	43	12	2	8	282
6.75		0	34	14	19	114		4	23	36	57	8	0	309
7.25		3	24	15	12	72		22	12	21	41	20	0	242
7.75		4	5	5	13	26		16	12	51	42	27	0	201
8.25		4	15	17	10	5		5	17	93	61	38	10	275
8.75		7	18	13	15	6			4	46	50	29	12	200
9.25		2	4	2	3	3			1	1	6	1	3	26
9.75														0
10.25														0
TOTAL :		153	164	438	494	468	0	140	138	316	271	137	54	2773

Table 8 Shell height frequency data of *Amusium pleuronectes* from the outer region of Chang Islands, 1987; adjusted class interval to 1.0 cm.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.5			1											1
2.5		1	17	25	5			2				1		51
3.5		0	18	110	31	2		21				7	1	190
4.5		32	12	180	158	22		39	10	2		3	9	467
5.5		95	3	48	190	96		19	41	23	2	1	11	529
6.5		5	47	23	57	236		16	41	79	69	10	8	591
7.5		7	29	20	25	98		38	24	72	83	47	0	443
8.5		11	33	30	25	11		5	21	139	111	67	22	475
9.5		2	4	2	3	3			1	1	6	1	3	26
10.5														0
SUM:		153	164	438	494	468	0	140	138	316	271	137	54	2773

Table 9 Shell height frequency data of *Amusium pleuronectes* from Chang Islands, 1987; original punched data of 0.5 cm class interval.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.75			1											1
2.25			3	4										7
2.75		1	14	21	5			2				1		44
3.25			15	47	8			3				4		77
3.75			3	76	23	2		18				5	1	128
4.25		5	4	107	59	6		16	2	1		4	3	207
4.75		27	9	113	100	16		23	8	1		1	6	304
5.25		49	2	43	113	27		13	16	4		1	7	275
5.75		46	2	14	80	71		6	25	19	2		4	269
6.25		5	13	9	38	126		12	18	43	12	2	8	286
6.75		1	34	14	19	121		4	24	36	57	8		318
7.25		8	24	15	12	74	1	22	12	21	41	20		250
7.75		4	5	8	13	27	1	16	12	51	42	27		206
8.25		4	15	20	10	4		5	20	93	61	38	10	280
8.75		8	18	13	15	7			5	46	50	29	12	203
9.25		5	4	2	3	3			1	1	6	1	3	29
9.75		2												2
10.25		2												2
TOTAL :		167	166	506	498	484	2	140	143	316	271	141	54	2888

Table 10 Shell height frequency data of *Amusium pleuronectes* from Chang Islands, 1987; adjusted class interval to 1.0 cm.

MIDHEIGHT cm	MONTH: DATE:	JAN 14	FEB 13	MAR 11	APR 15	MAY 20	JUN 19	JUL 22	AUG 11	SEP 22	OCT 16	NOV 26	DEC 22	TOTAL
1.5			1											1
2.5		1	17	25	5			2				1		51
3.5			18	123	31	2		21				9	1	205
4.5		32	13	220	159	22		39	10	2		5	9	511
5.5		95	4	57	193	98		19	41	23	2	1	11	544
6.5		6	47	23	57	247		16	42	79	69	10	8	604
7.5		12	29	23	25	101	2	38	24	72	83	47		456
8.5		12	33	33	25	11		5	25	139	111	67	22	483
9.5		7	4	2	3	3			1	1	6	1	3	31
10.5		2												2
SUM:		167	166	506	498	484	2	140	143	316	271	141	54	2888



The computed ϕ' values from each of those two parameters combinations showed similarity between both regions, thus, all catch data were lumped together and analyzed as one.

Combined data from both regions is shown in Table 9. Using the same data regrouped into 1.0 cm class interval (Table 10) leads to the following estimates: asymptotic shell height; $L_{\infty} = 11.4$ cm and growth coefficient; $K = 1.30$ per year with $R_n = 0.383$.

The data from both regions as well as from the whole area showed no obvious seasonally oscillating growth. Therefore, the parameters C and WP in this study were provided with zero value. The estimated growth parameters for each region and for the whole area, with corresponding R_n and ϕ' values are presented in Table 11.

Table 11 Growth parameters and computed ϕ' values of *Amusium pleuronectes* from Chang Islands, Eastern Gulf of Thailand, estimated by using ELEFAN I of the Compleat ELEFAN.

PARAMETER	INNER REGION	OUTER REGION	COMBINED
L_{∞}	11.5	10.6	11.4
K (per year)	1.50	1.54	1.30
R_n	0.533	0.487	0.383
ϕ'	2.297	2.238	2.228

From ELEFAN I, the growth curves, based on those estimated growth parameters, of the scallop populations are built up as shown in Figures 5, 6, and 7. Results also show the presence of secondary growth curves in every region.

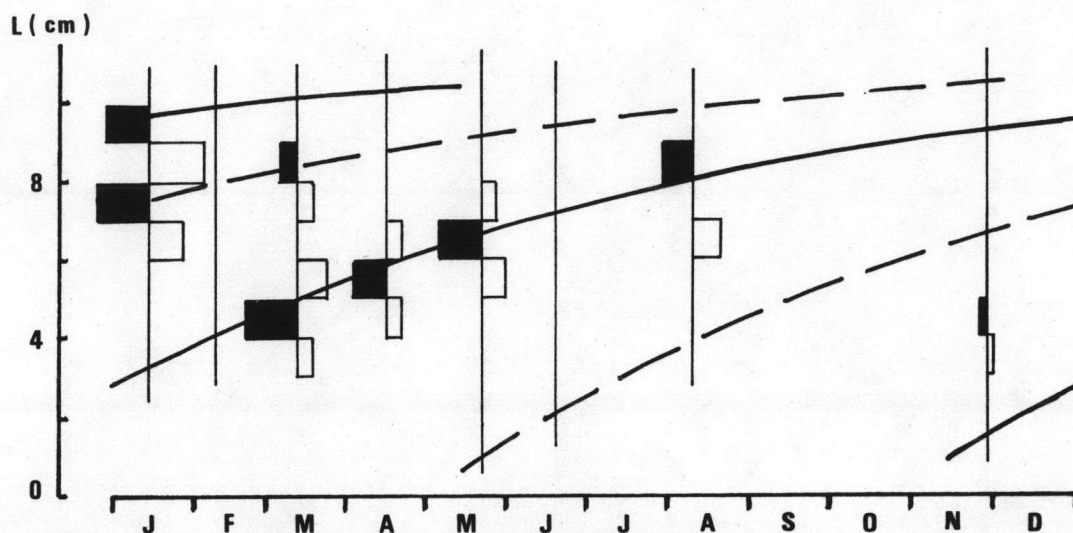


Figure 5 Growth curves of *Amusium pleuronectes* population from the inner region of Chang Islands ($L_{\infty}=11.5$ cm, $K=1.50$, $R_n=0.533$). Dotted line traces secondary growth curve, representing a second cohort in the population.

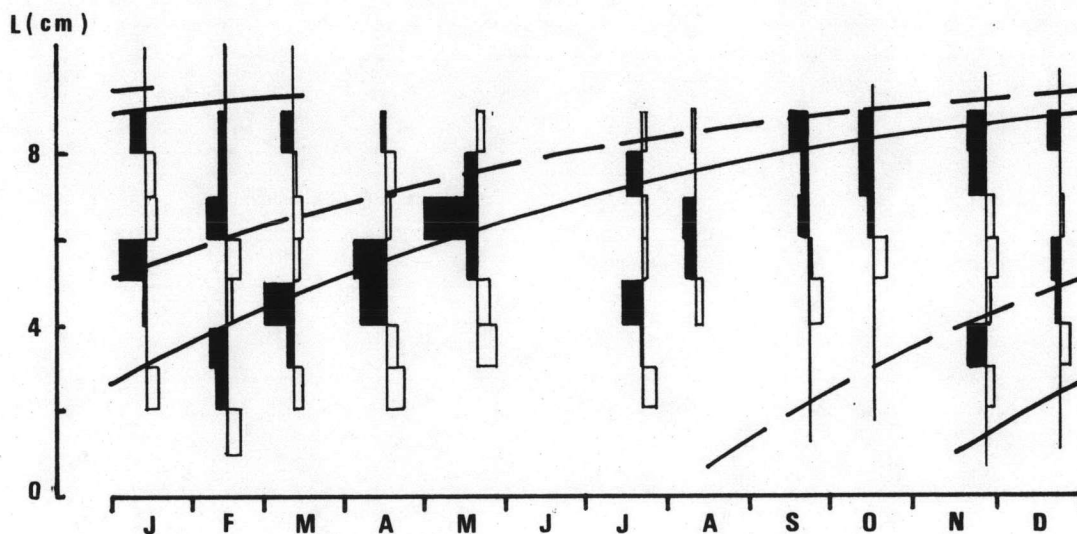


Figure 6 Growth curves of *Amusium pleuronectes* population from the outer region of Chang Islands ($L_{\infty}=10.6$ cm, $K=1.54$, $R_n=0.437$). Dotted line traces secondary growth curve, representing a second cohort in the population.

For the pooled population, with $L_{\infty} = 11.4$ cm and $K = 1.3$, growth curves are shown with 2 cohorts per year.

The growth performance index ϕ' for the pooled population of *A. pleuronectes* around Chang Islands, is 2.23.

From the growth parameters and the growth curve obtained, longevity or life-span of the species is estimated to be about 2 years.

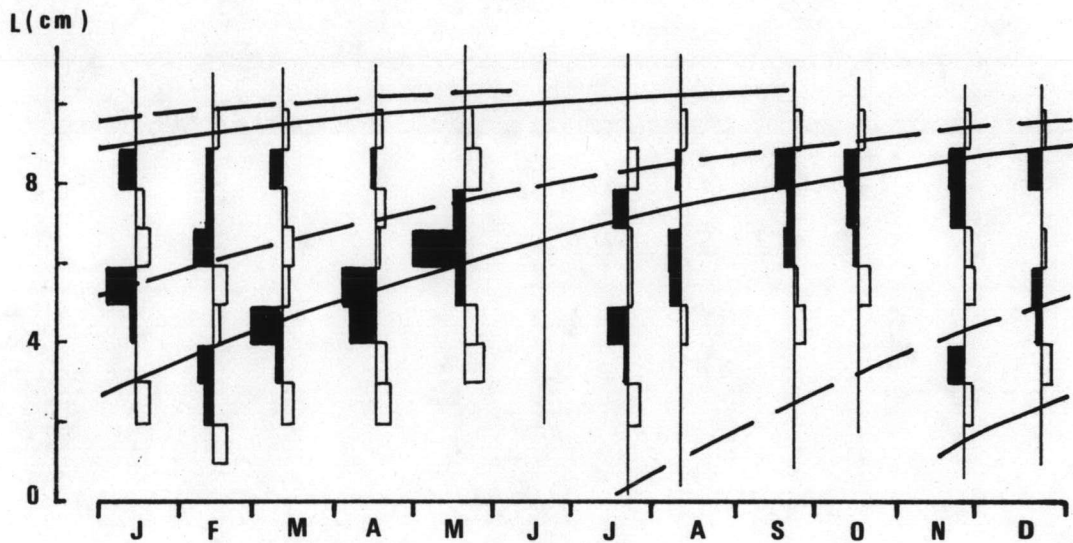


Figure 7 Growth curves of *Amusium pleuronectes* population from Chang Islands, combined data of inner and outer region, ($L_{\infty}=11.4$ cm, $K=1.30$, $R_n=0.383$). Dotted line traces secondary growth curve, representing a second cohort in the population.

The estimations of L_{∞} and Z/K by Wetherall's method lead to $L_{\infty} = 9.50$ cm which is considered too low, since the largest scallop found in the collected samples had shell height larger than 10 cm. The Z/K ratio estimated by this method is equal to 1.381. The result and output obtained from this routine of the ELEFAN II are shown in Table 12 and Figure 8.

Table 12 Data for estimation of L_{∞} and Z/K ratio using the modified Wetherall's method, by the ELEFAN II program.

L(mean)-L'	L'	N (cumulative)
5.200	1.000	2889
4.202	2.000	2888
3.268	3.000	2837
2.484	4.000	2632
1.962	5.000	2121
1.466	6.000	1577 ***
1.067	7.000	972
0.568	8.000	516
0.561	9.000	33
0.500	10.000	2

*** regression line is fitted from this point
 $Y = 3.99 + (-0.420) X$, $r = -0.989$

Estimate of $L_{\infty} = 9.500$ cm,
 Estimate of Z/K ratio = 1.381

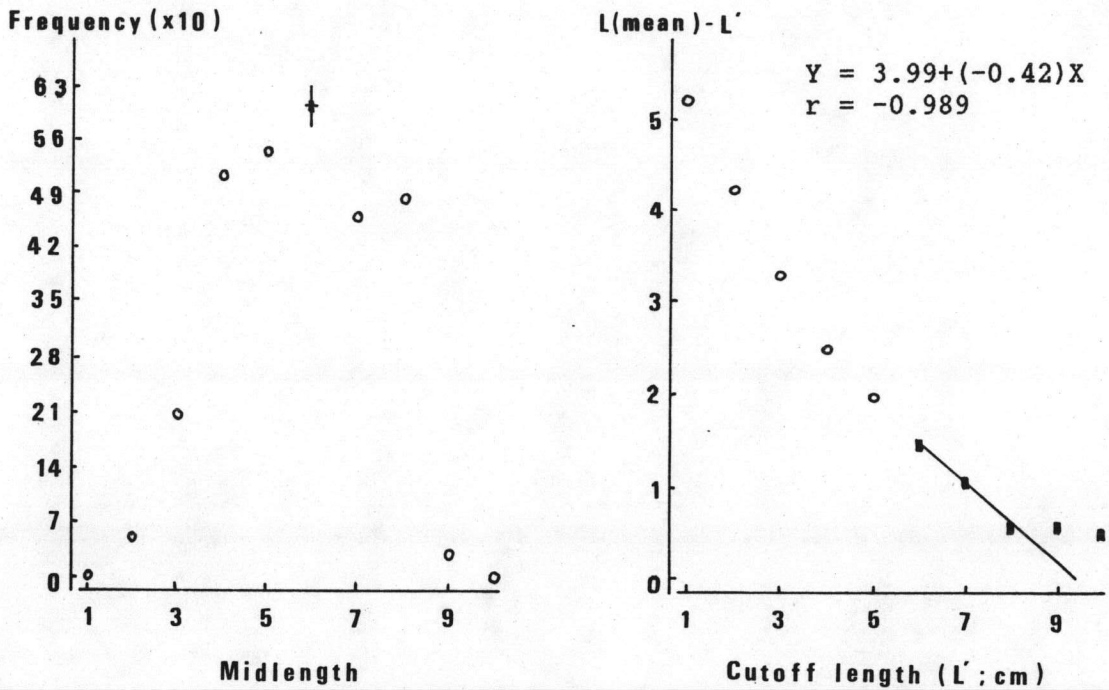
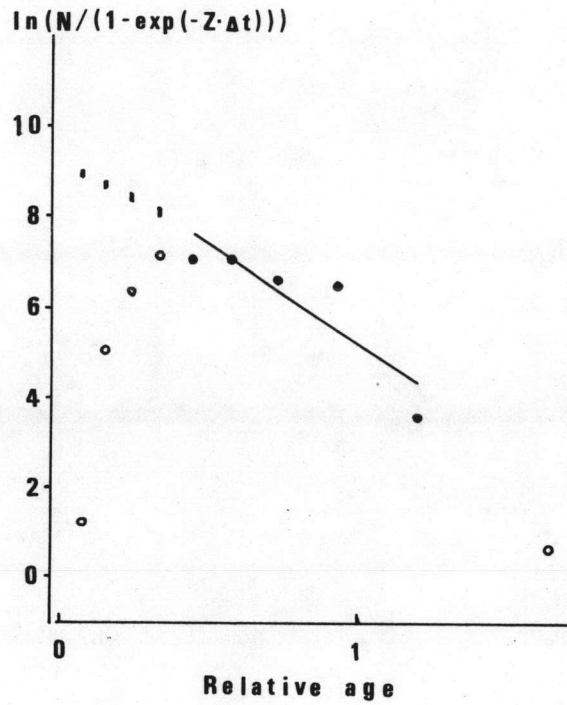


Figure 8 Result of the estimation of L_{∞} and Z/K ratio for *Amusium pleuronectes* population by Wetherall's method; from ELEFAN II program.

II. Mortality

The result calculated from catch curve through ELEFAN II gives the estimation of total mortality (Z) = 4.363. Natural mortality (M), derived by using $M/K = 1.4$ is estimated to be 1.82. Therefore, the fishing mortality (F) is equal to 2.543. Catch curve is shown in Figure 9.

From ELEFAN II, probabilities of capture are also provided. Results computed and the resultant curve produced by the program is shown in Table 13 and Figure 10.



cutoff length (L') = 5.000
 mean length (from L') = 6.962
 Z from mean length = 2.941
 Z from catch curve = 4.363
 M (estimated for $T=30$ C) = 2.868

Figure 9 Catch curve of the scallop *Amusium pleuronectes* around Chang Islands; from ELEFAN II program.

Table 13 Result on probability of capture for *Amusium pleuronectes* around Chang Islands, computed by the ELEFAN II program.

midlength (cm)	prob. selection	smooth prob.
1.500	0.0000	0.00100
2.500	0.0260	0.01000
3.500	0.1240	0.09600
4.500	0.3960	0.52500
5.500	1.0000	0.92000
6.500	1.0000	0.99200
7.500	1.0000	0.99900
8.500	1.0000	0.99992
9.500	1.0000	0.99999
10.500	1.0000	1.00000

L-25 = 3.990
 L-50 = 4.458
 L-75 = 4.926
 slope = 2.347

L_{∞} = 11.40
 K = 1.30

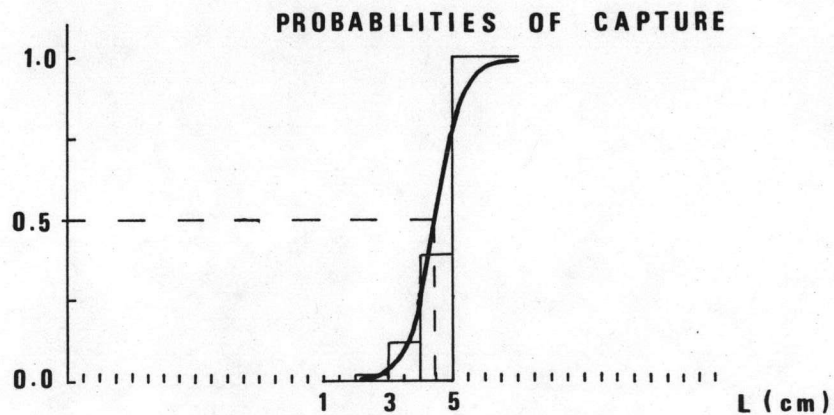


Figure 10 Resultant curve on probability of capture of *Amusium pleuronectes* from Chang Islands.

III. Recruitment

Results on percentage and pattern of recruitment in *A. pleuronectes* population of Chang Islands as obtained from ELEFAN II (Figure 11) show that there were some recruitment occurring throughout the year, but with 2 peaks. The maxima of the component distributions are consistently four months apart. The major recruitment pulse covered about 8 months with the percentage of 77.43 and the minor pulse covering the rest of the year, of 22.85 %.

Percentage of annual recruitment computed by ELEFAN II is presented in Table 14.

Table 14 Percentage of annual recruitment of *Amusium pleuronectes* population around Chang Islands.

Relative Time	% recruitment
1	2.22
2	5.79
3	7.42
4	12.00
5	21.75
6	20.14
7	13.90
8	7.09
9	4.84
10	3.35
11	1.49
12	0.00

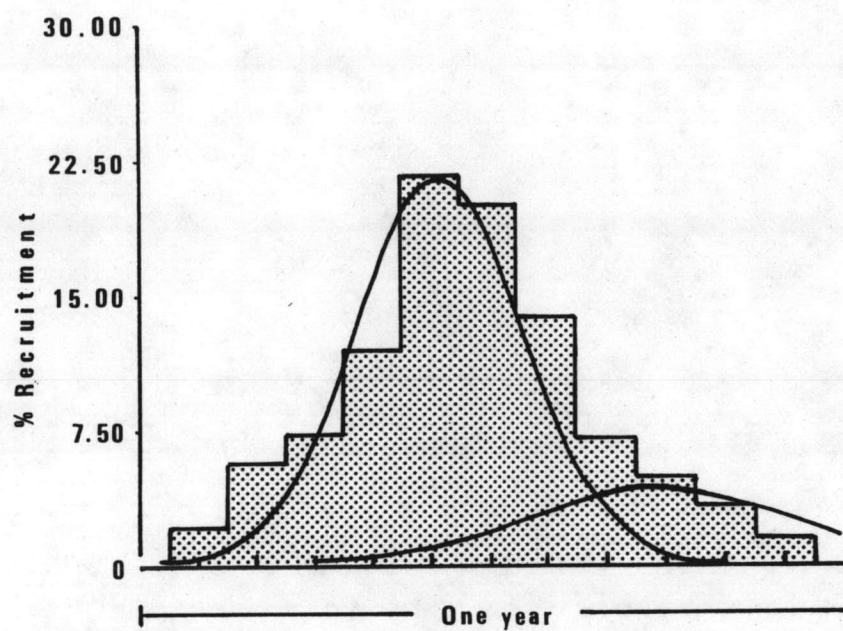


Figure 11 Recruitment pattern in *Amusium pleuronectes* population of Chang Islands; January-December 1987.
Comp 1: % Recruitment = 77.43
Comp 2: % Recruitment = 22.85

IV. Size and Weight Relationships

From measuring and weighing of 634 scallops collected from June 1987 to June 1988, the relationships of different shell dimensions and various weights of *A. pleuronectes* from Chang Islands while all measurements are in centimeters and weight in grams, yield the results as follows:

1. Relationships Between Different Shell Dimensions

All the relationships between different shell dimensions, i.e. shell height - shell length, shell height - shell depth, and shell length - shell depth are allometric and highly correlated. The relationships are expressed in the following formulas :

1.1 Shell Height - Shell Length Relationship :

$$L = -0.372 + 1.035738 H$$

with $r^2 = 0.9887$, $n = 634$ (Figure 12A)

1.2 Shell Height - Shell Depth Relationship :

$$D = -0.47502 + 0.2621 H$$

with $r^2 = 0.9132$, $n = 634$ (Figure 12B)

1.3 Shell Length - Shell Depth Relationship :

$$D = -0.38489 + 0.253624 L$$

with $r^2 = 0.9277$, $n = 634$ (Figure 12C)

2. Relationships Between Shell Height and Weights

Shell height - weight of each body portions relationships of *A. pleuronectes* are expressed as :

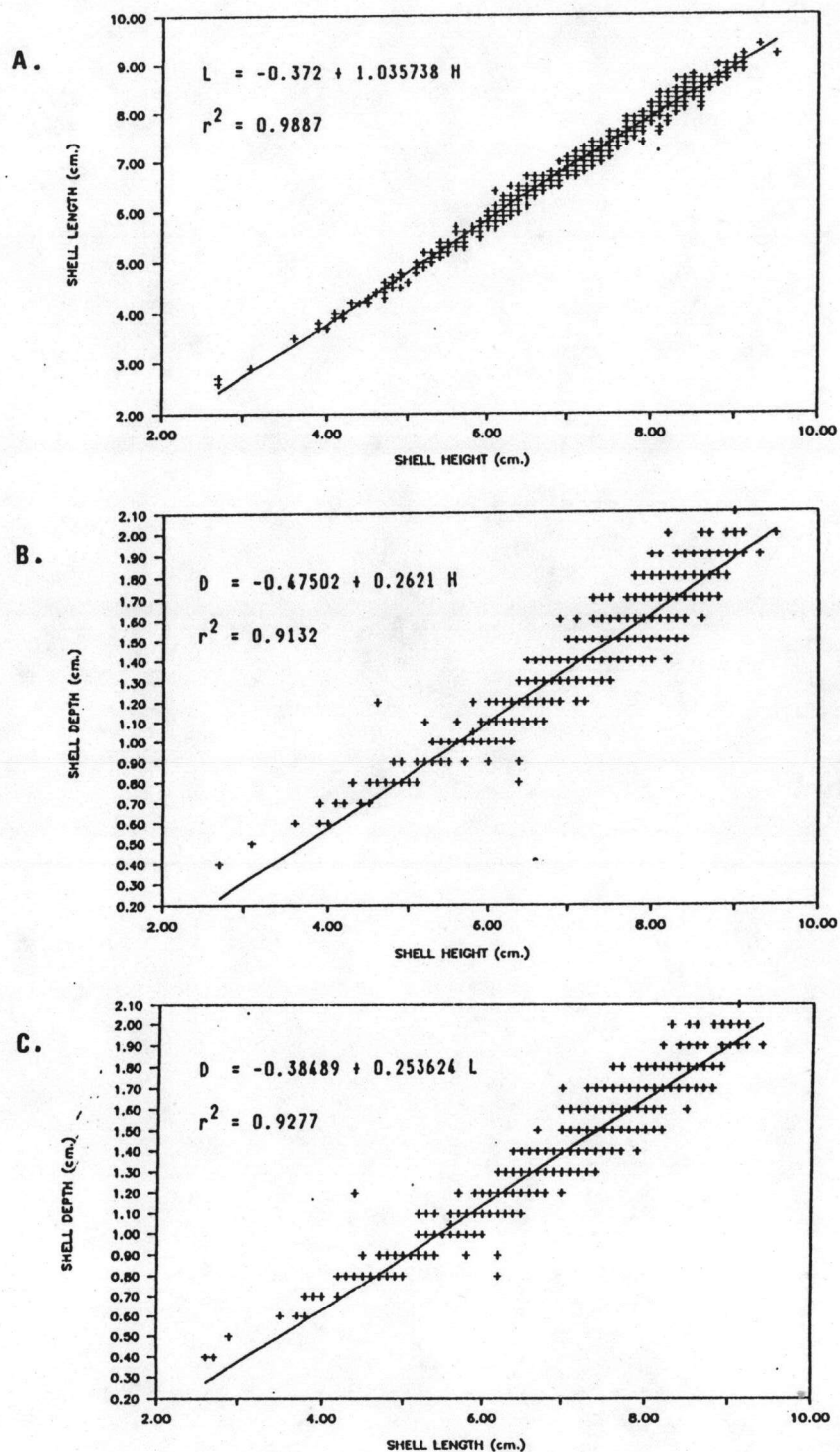


Figure 12 Relationships among different dimensions of the shell of *Amusium pleuronectes* from Chang Islands.

A. Shell height (H) - shell length (L) relationship.

B. Shell height - shell depth (D) relationship.

C. Shell length - shell depth relationship.

2.1 Shell Height - Total Weight :

$$TW = 0.045401 H^{3.184}$$

with the linearized form expressed as :

$$\log TW = -1.34293 + 3.18389 \log H$$

with $r^2 = 0.9609$, $n = 634$ (Figure 13)

2.2 Shell Height - Shell Weight :

$$SW = 0.0242298 H^{3.103}$$

and the linearized form :

$$\log SW = -1.61565 + 3.103249 \log H$$

with $r^2 = 0.9782$, $n = 634$ (Figure 14)

2.3 Shell Height - Flesh Weight :

$$FW = 0.0121668 H^{3.473}$$

and the linearized form :

$$\log FW = -1.91482 + 3.473018 \log H$$

with $r^2 = 0.9303$, $n = 634$ (Figure 15)

2.4 Shell Height - Adductor Muscle Weight :

$$AW = 0.004891 H^{3.561}$$

and the linearized form :

$$\log AW = -2.31063 + 3.561213 \log H$$

with $r^2 = 0.9124$, $n = 634$ (Figure 16)

2.5 Shell Height - Gonad Weight :

$$GW = 1.223 \times 10^{-6} H^{6.606}$$

and the linearized form :

$$\log GW = -5.91237 + 6.605859 \log H$$

with $r^2 = 0.6761$, $n = 576$ (Figure 17)



SHELL HEIGHT-TOTAL WEIGHT RELATIONSHIP

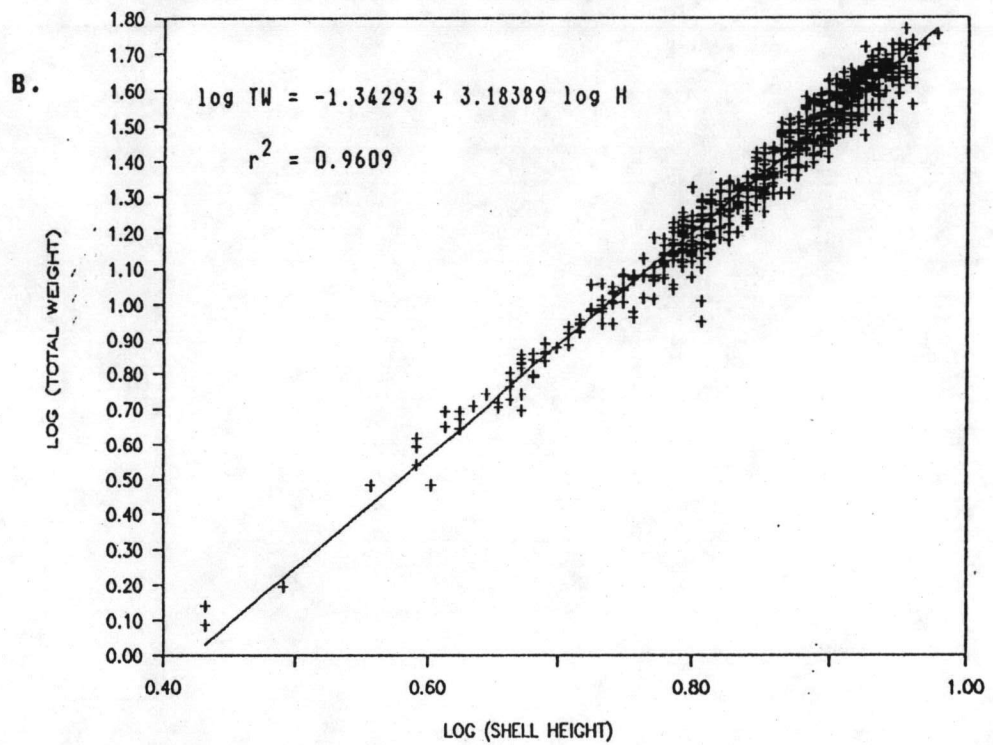
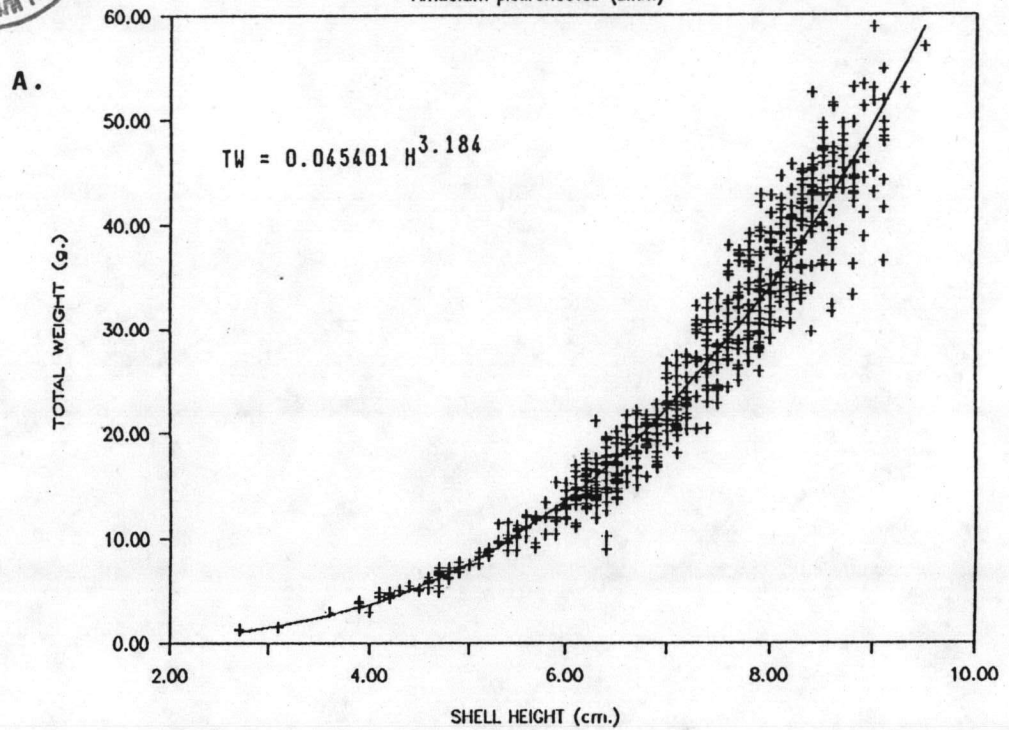
Amusium pleuronectes (Linn.)

Figure 13 Shell height (H) - total weight (TW) relationship of *Amusium pleuronectes* from Chang Islands.

A. Allometric relationship.

B. Linearized relationship

SHELL HEIGHT-SHELL WEIGHT RELATIONSHIP

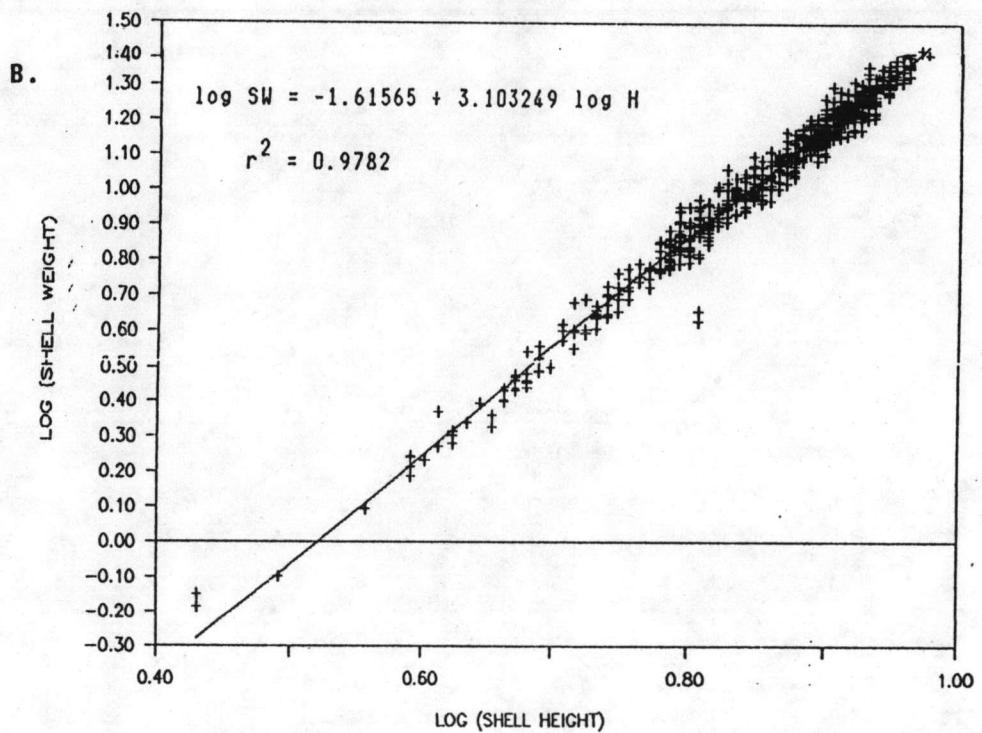
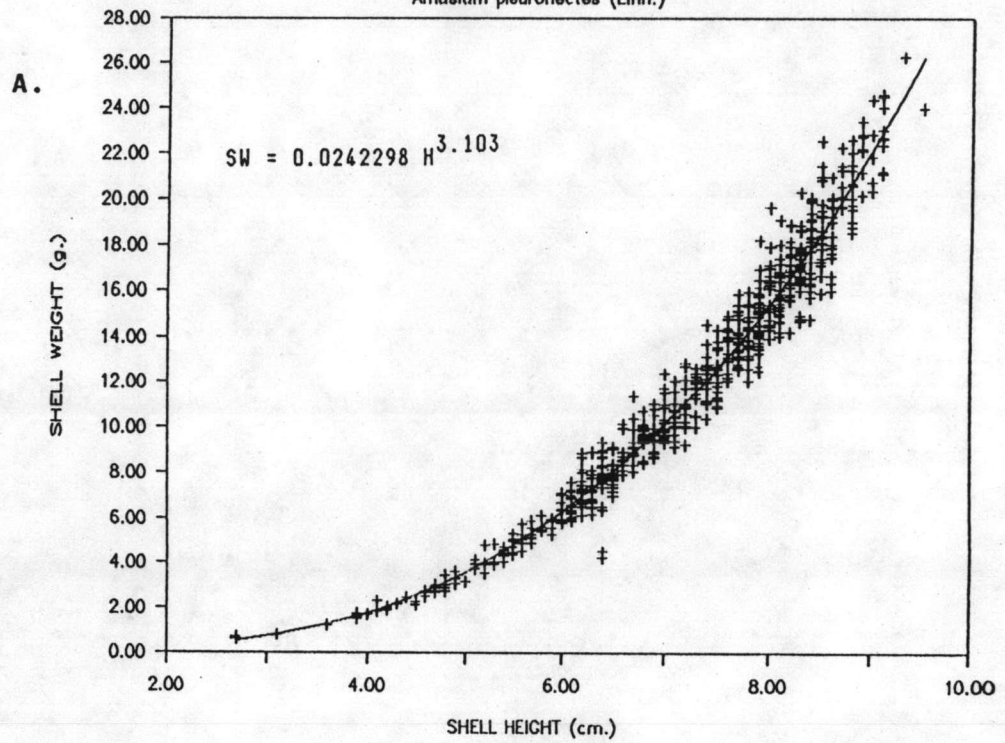
Amusium pleuronectes (Linn.)

Figure 14 Shell height (H) - shell weight (SW) relationship of *Amusium pleuronectes* from Chang Islands.
 A. Allometric relationship.
 B. Linearized relationship

SHELL HEIGHT-FLESH WEIGHT RELATIONSHIP

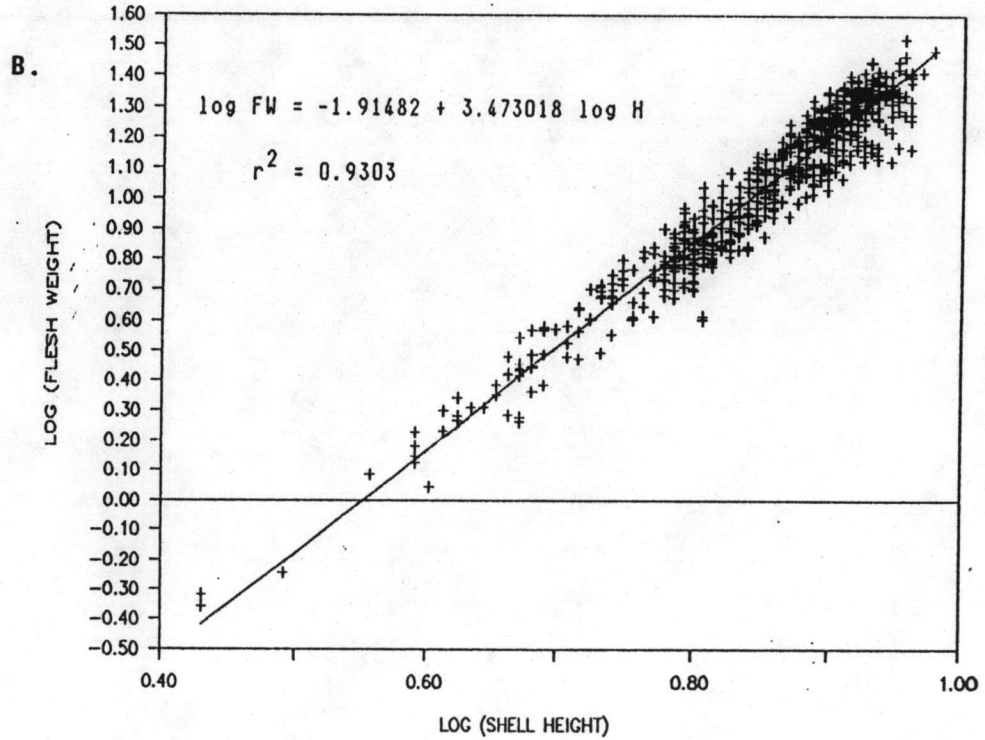
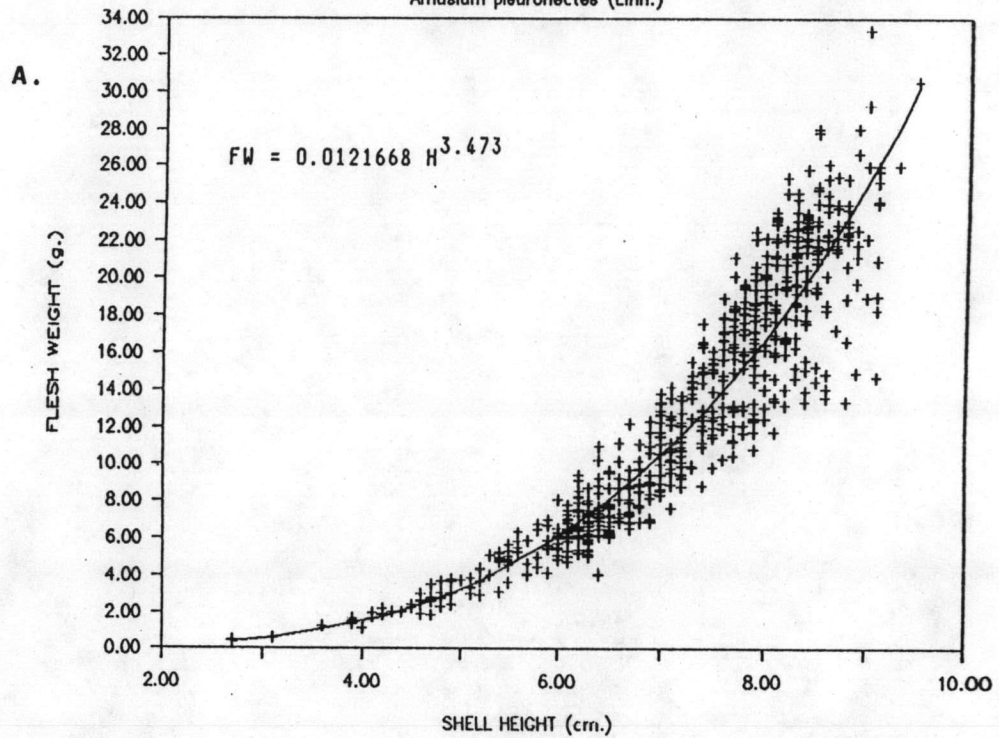
Amusium pleuronectes (Linn.)

Figure 15 Shell height (H) - flesh weight (FW) relationship of *Amusium pleuronectes* from Chang Islands.
 A. Allometric relationship.
 B. Linearized relationship

SHELL HEIGHT-ADM. WEIGHT RELATIONSHIP

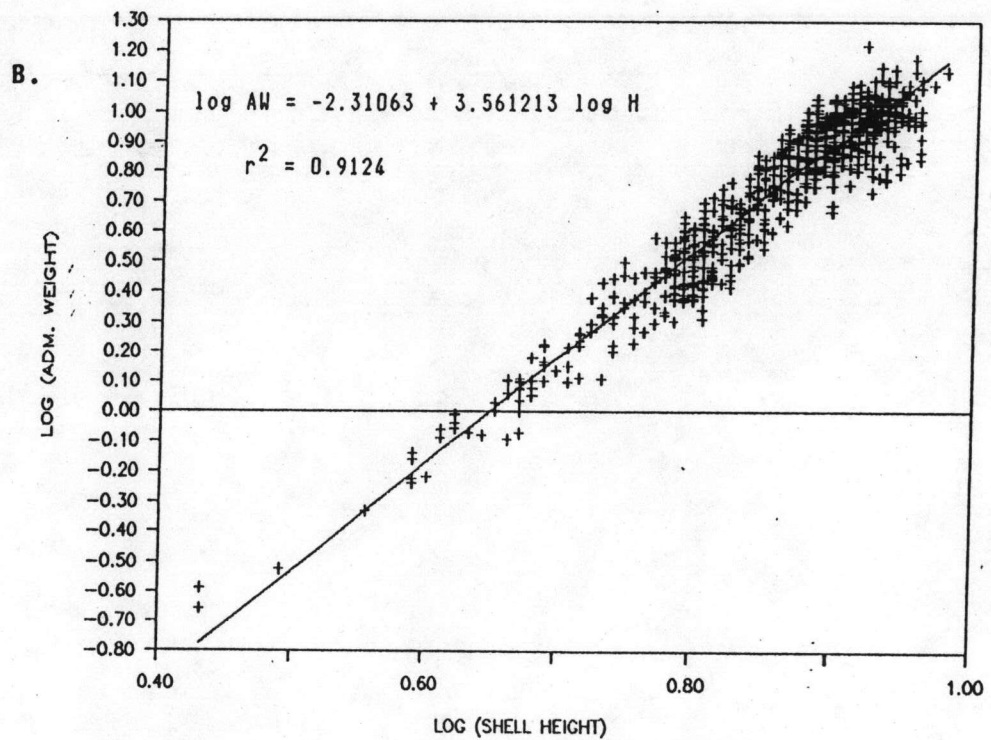
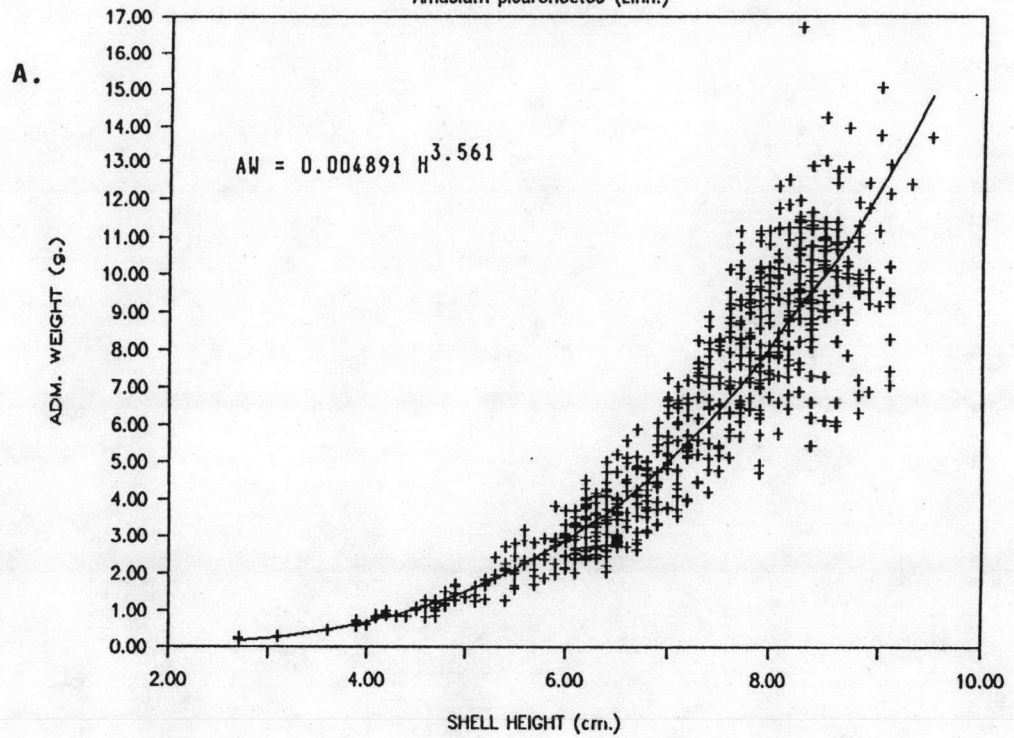
Amusium pleuronectes (Linn.)

Figure 16 Shell height (H) - adductor muscle weight (AW) relationship of *Amusium pleuronectes* from Chang Islands.

A. Allometric relationship.

B. Linearized relationship

SHELL HEIGHT-GONAD WEIGHT RELATIONSHIP

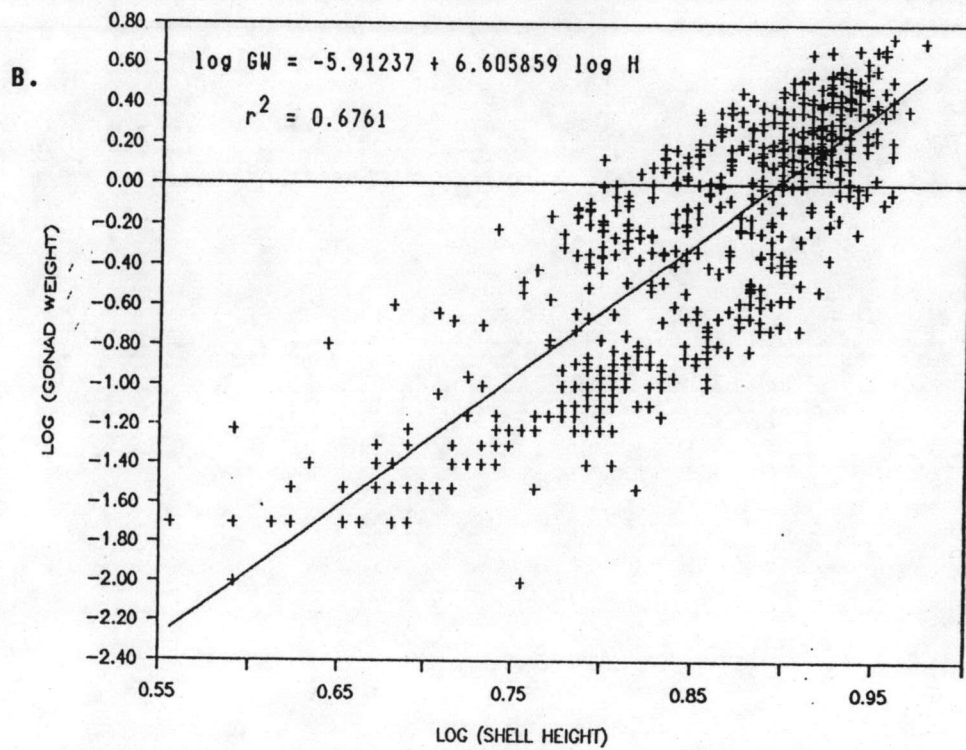
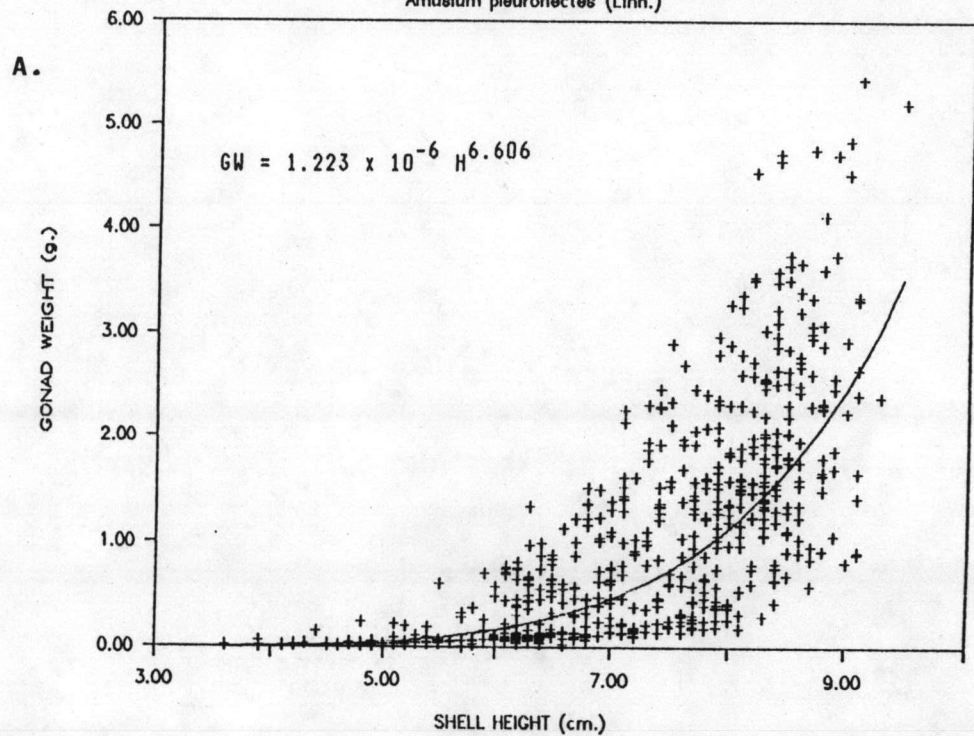
Amusium pleuronectes (Linn.)

Figure 17 Shell height (H) - gonad weight (GW) relationship of *Amusium pleuronectes* from Chang Islands.
 A. Allometric relationship.
 B. Linearized relationship

The results of the relationships between shell height and various weights performed by regression analysis are summarized in Tables 15, with corresponding t^* value.

Table 15 Relationships of shell height to various weights of *Amusium pleuronectes* around Chang Islands.

RELATIONSHIP X - Y	$Y = a X^b$						
	a	b	S_b	S_y	r^2	n	t^*
H - TW	0.0454	3.1839	0.0256	0.0525	0.9609	634	7.1836
H - SW	0.0242	3.1032	0.0184	0.0379	0.9781	634	5.6087
H - FW	0.0122	3.4730	0.0378	0.0778	0.9303	634	12.5132
H - AW	4.89×10^{-3}	3.5612	0.0439	0.0903	0.9124	634	12.7836
H - GW	1.22×10^{-6}	6.6059	0.1908	0.3533	0.6761	576	18.8988

Note : S_b = standard error of the regression coefficient; b
 S_y = standard error of Y estimates

The t-test statistics give the result that every of the coefficient b , for all of the above height-weight relationships, is significantly different from 3. As the calculated t^* values are all larger than the tabulated value of the student-t distribution, which is equal to 2.326 at the degree of freedom, $df > 120$ and 1% error level ($p = 0.01$). This result shows that the scallop growth is allometric.

The determinations of the relationships of shell height to total weight, flesh weight, adductor muscle weight and gonad weight in each monthly sample are also performed. The results are presented in Table 16, 17, 18 and 19 respectively.

Table 16 Monthly shell height-total weight relationship of *Amusium pleuronectes* from Chang Islands.

MONTH	SAMPLE SIZE (n)	IN TW = a H ^b		r ²
		a	b	
JUNE 1987	51	0.06591	2.9962	0.9612
JULY	60	0.03757	3.3517	0.9901
AUGUST	53	0.02917	3.4589	0.9896
SEPTEMBER	51	0.03936	3.3000	0.9751
OCTOBER	30	0.03894	3.2913	0.9628
NOVEMBER	31	0.03439	3.3521	0.9285
DECEMBER	47	0.05469	3.1172	0.9725
JANUARY 88	48	0.02764	3.4018	0.9808
FEBRUARY	59	0.04888	3.0653	0.9724
MARCH	61	0.05436	3.0565	0.9808
APRIL	42	0.04884	3.0846	0.9203
MAY	52	0.05616	3.0779	0.9444
JUNE 1988	49	0.05751	3.0631	0.9213
COMBINED	634	0.04540	3.1839	0.9609

Table 17 Monthly shell height-flesh weight relationships of *Amusium pleuronectes* from Chang Islands.

MONTH	SAMPLE SIZE (n)	IN FW = a H ^b		r ²
		a	b	
JUNE 1987	51	0.01789	3.3328	0.9609
JULY	60	0.01080	3.5829	0.9810
AUGUST	53	0.01049	3.6632	0.9859
SEPTEMBER	51	0.00886	3.7032	0.9735
OCTOBER	30	0.02094	3.2878	0.9615
NOVEMBER	31	0.01552	3.4325	0.9085
DECEMBER	47	0.01023	3.5703	0.9690
JANUARY 88	48	0.00845	3.6331	0.9725
FEBRUARY	59	0.01638	3.1892	0.9523
MARCH	61	0.01261	3.4067	0.9735
APRIL	42	0.01597	3.2333	0.9153
MAY	52	0.01047	3.5157	0.9421
JUNE 1988	49	0.00899	3.5776	0.8941
COMBINED	634	0.01217	3.4730	0.9303

Table 18 Monthly shell height-adductor muscle weight relationships of *Amusium pleuronectes* from Chang Islands.

MONTH	SAMPLE SIZE (n)	IN AW = a H ^b		r ²
		a	b	
JUNE 1987	51	0.00529	3.6202	0.9638
JULY	60	0.00283	3.9379	0.9855
AUGUST	53	0.00218	4.0715	0.9805
SEPTEMBER	51	0.00442	3.6854	0.9209
OCTOBER	30	0.00771	3.4208	0.9561
NOVEMBER	31	0.00559	3.5621	0.7960
DECEMBER	47	0.00369	3.6756	0.9569
JANUARY 88	48	0.00180	3.9681	0.9628
FEBRUARY	59	0.00744	3.1859	0.9431
MARCH	61	0.00869	3.1749	0.9719
APRIL	42	0.00629	3.3960	0.9073
MAY	52	0.00662	3.4107	0.9007
JUNE 1988	49	0.00670	3.4089	0.8823
COMBINED	634	0.00489	3.5612	0.9124

Table 19 Monthly shell height-gonad weight relationships of *Amusium pleuronectes* from Chang Islands.

MONTH	SAMPLE SIZE (n)	IN GW = a H ^b		r ²
		a	b	
JULY 1987	60	4.428 x10 ⁻⁶	5.7778	0.8660
AUGUST	53	0.344 x10 ⁻⁶	7.0082	0.8521
SEPTEMBER	51	0.27 x10 ⁻⁷	8.5351	0.8550
OCTOBER	30	1.121 x10 ⁻⁶	6.7944	0.8236
NOVEMBER	31	1.766 x10 ⁻⁴	4.3700	0.3910
DECEMBER	47	1.68 x10 ⁻⁴	4.5396	0.7896
JANUARY 88	48	2.206 x10 ⁻⁴	4.3385	0.8000
FEBRUARY	59	1.653 x10 ⁻³	3.1246	0.6858
MARCH	54	1.481 x10 ⁻³	3.5026	0.5622
APRIL	42	6.806 x10 ⁻⁶	5.2872	0.6914
MAY	52	0.77 x10 ⁻⁷	7.6772	0.7650
JUNE 1988	49	0.117 x10 ⁻⁶	7.2980	0.5638
COMBINED	576	1.223 x10 ⁻⁶	6.6059	0.6761

V. Reproduction

1. Reproductive Cycles

1.1 Gonadal Development

The gonad condition of *A. pleuronectes* is classified into six stages as immature, developing, ripe or mature, spawning, redeveloping, and spent. Classification of gonadal development stages of both ovarian and testicular regions are based on the following scheme:

1.1.1 **Immature Stage:** gonad small, flattened and elongated; colorless and either transparent or translucent; loop of intestine clearly visible; testicular and ovarian parts can not be macroscopically differentiated from each other. Histological study in some specimens can indicate slightly distinguishable developing in both regions, with follicular initiation. (Figure 18A)

1.1.2 **Developing Stage:** Gonad is slightly to moderately enlarged; still somewhat flattened but testicular and ovarian parts are differentiated from one another, the former whitish and the latter pale orange; loop of intestine visible. Microscopic examination shows development from proliferation of follicles which contain early gonial stages, to later phases when follicles contain all developmental stages of sex cells. This stage can be divided into two substages as:

1.1.2.1 **Early Developing:** with gonad contains very minute gonidia; follicles small, with thick wall. (Figure 18B)

1.1.2.2 **Late Developing:** follicles expands in size, with thinner wall; testicular region contains well developed spermatocytes, tailed spermatozoa are found in most follicles; ovarian region consists of nearly mature oocytes, polygonal or stalked shape, filling almost entire follicles. (Figure 18C)

1.1.3 **Mature or Ripe stage:** Gonad is considerably enlarged, crescent-shaped and with somewhat round margins; full of sex products; testicular part cloudy white or cream, ovarian part bright orange; loop of intestine usually not visible. Microscopic examination shows individual follicles large and fully packed with mature genital products. Testicular follicles swollen with sperms equally distribute in the lumen, sometimes still surrounded by a corticle layer of spermatogenic cells. Ovarian follicles is packed with free spherical to polygonal and few stalked oocytes with distinct nuclei and nucleoli. (Figure 18D)

1.1.4 **Spawning Stage:** gonad is somewhat enlarged and crescent-shaped, but not flattened as in former stage; testicular part pale white, ovarian part orange; loop of intestine sometimes visible. Microscopic examination shows loosely-packed follicles, with several residual genital products. Testicular follicles show streaming sperm appearance. Occasionally, sperm may be seen as spilled outside the follicles. Ovarian follicles show residual mostly mature female gametes detached from the follicle wall and lying free in the lumen. (Figure 18E)

1.1.5 **Redeveloping Stage:** gonad is not clearly distinguished from other stages when observed macroscopically, but



A

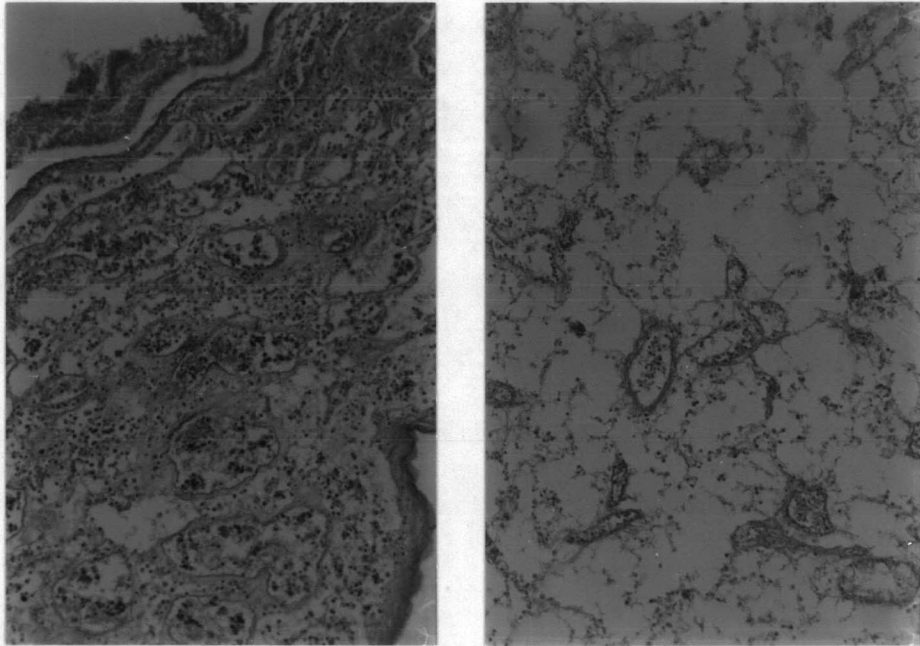
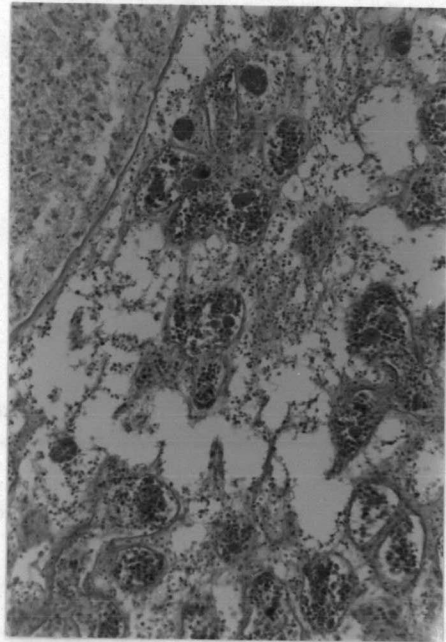
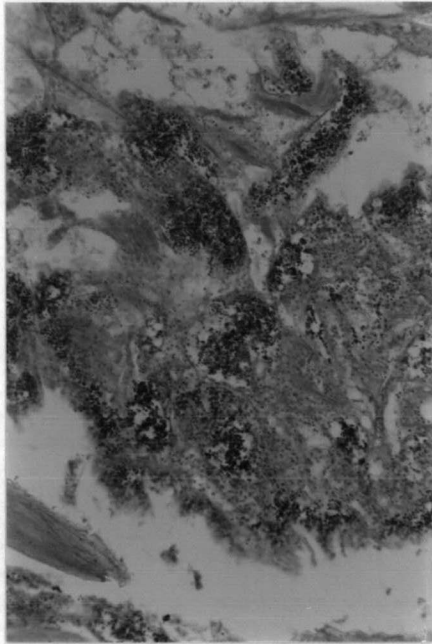


Figure 18 Histological identification of gonad stages of *Amusium pleuronectes*. (Left: testicular part; Right: ovarian part)
A. Immature

B



C

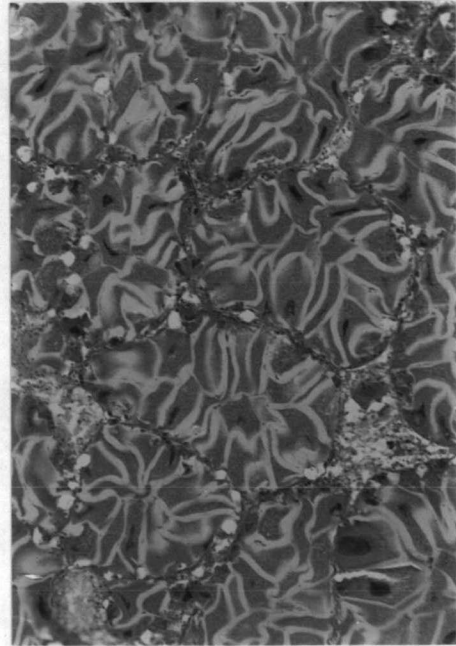
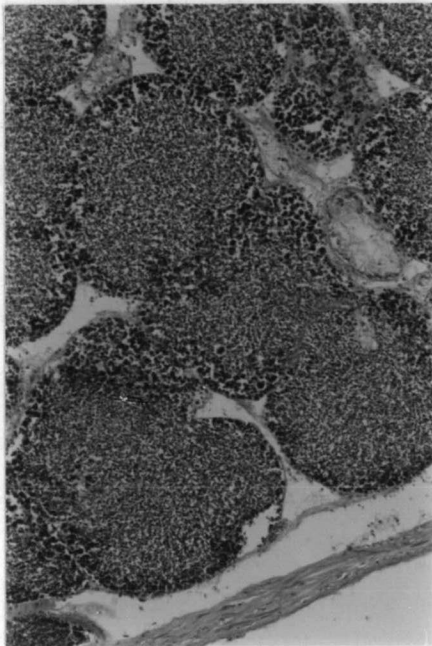
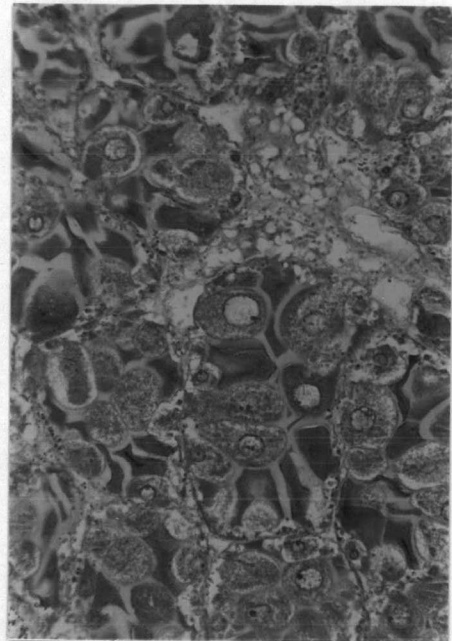
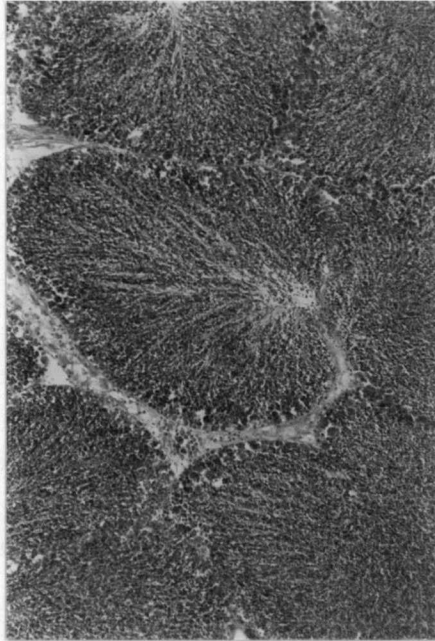


Figure 18 (continue) Histological identification of gonad stages of *Amusium pleuronectes*. (Left: testicular part; Right: ovarian part)

B. Early developing

C. Late developing

D



E

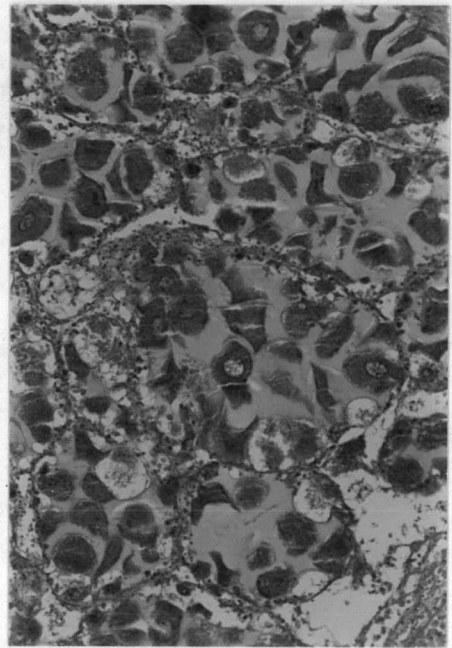
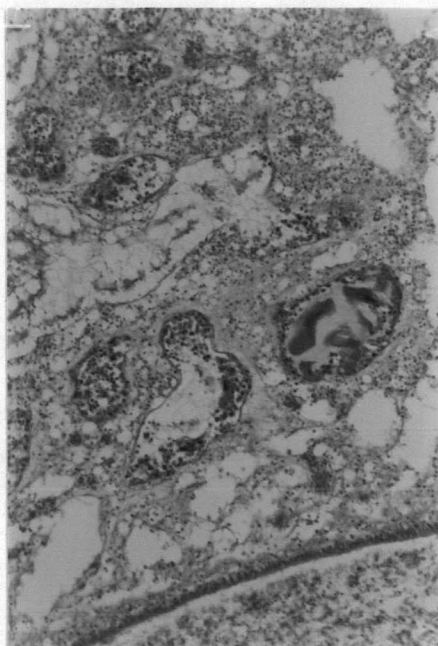
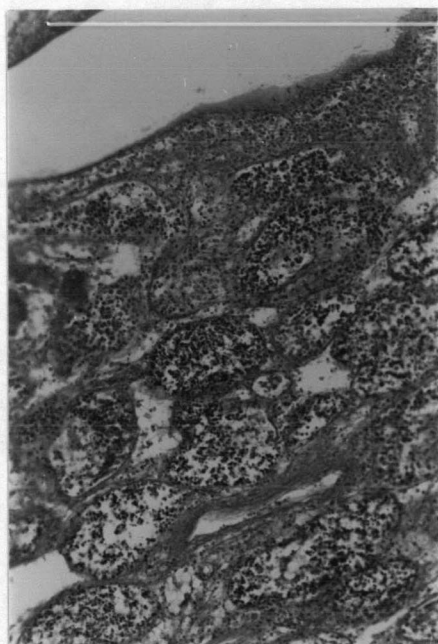


Figure 18 (continue) Histological identification of gonad stages of *Amusium pleuronectes*. (Left: testicular part; Right: ovarian part)

D. Mature or ripe

E. Spawning

F



G

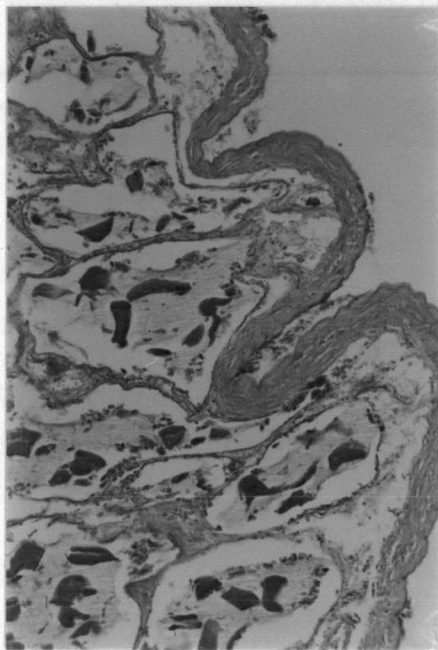
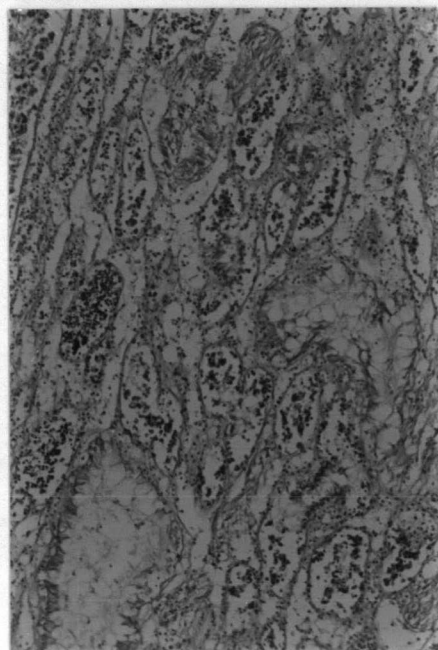


Figure 18 (continue) Histological identification of gonad stages of *Amusium pleuronectes*. (Left: testicular part; Right: ovarian part)
F. Redeveloping
G. Spent



histological examination shows early gametogenic stages redeveloping on open or elongated follicular walls, which indicates that it has passed through former spawning or spent stage; relict gametes may or may not present in the lumen. (Figure 18F)

1.1.6 **Spent Stage:** gonad is reduced in size and shrunken; testicular part whitish to colorless, ovarian part pale orange to colorless; sometimes the two parts cannot be differentiated from each other, loop of intestine clearly visible. Microscopic examination shows almost empty collapsed follicles, with a few residual reproductive products. (Figure 18G)

Results from the gonadal development study show that maturation and spawning of the scallop *A. pleuronectes* occur and continue throughout the year. Changes in gonadal development stages of *A. pleuronectes* from Chang Islands during July 1987-June 1988 are shown in Table 20 and 21. Highest percentage of ripe stage found in December for both testicular and ovarian parts, and highest percentage of spawning found in January for testis and January-March for ovary (Figure 19).

Development of testicular and ovarian portions of each individual gonads when determined from histological study sometimes show asynchronization, which is somewhat unable to detect if only observed macroscopically.

Table 20 Gonadal development of *Amusium pleuronectes* from Chang Islands, July 1987-June 1988

MONTH	n	TESTICULAR PART							OVARIAN PART						
		Im.	Ed.	Ld.	Ma.	Sp.	Rd.	St.	Im.	Ed.	Ld.	Ma.	Sp.	Rd.	St.
JUL 87	118	26	17	3	4	22	18	28	26	12	8	5	8	19	40
AUG	54	16	7	1	6	6	7	11	19	4	8	5	1	3	14
SEP	41	3	3	6	7	15	6	1	3	3	9	5	9	6	6
OCT	43	1	2	11	21	7	1	0	2	3	19	10	3	2	4
NOV	21	0	0	7	4	6	4	0	0	1	12	2	3	1	2
DEC	47	0	1	2	36	6	2	0	0	0	5	32	7	3	0
JAN 88	29	0	2	2	10	12	2	1	1	1	7	3	9	1	7
FEB	41	0	3	10	12	8	7	1	1	2	9	3	11	2	13
MAR	35	0	0	11	17	7	0	0	0	1	11	10	10	1	2
APR	35	6	0	3	2	4	10	10	6	1	1	1	7	2	17
MAY	38	2	2	6	3	3	10	12	2	2	3	1	9	2	19
JUN	44	4	2	1	2	1	11	23	4	2	0	1	3	8	26
TOTAL	546	58	39	63	124	97	78	87	64	32	92	78	80	50	150

Note: Im. : immature stage
 Ed. : early developing stage
 Ld. : late developing stage
 Ma. : ripe or mature stage
 Sp. : Spawning stage
 Rd. : redeveloping stage
 St. : spent stage

Table 21 Percentage of gonadal development stages of *Amusium pleuronectes* in monthly samples, July 1987-June 1988, Chang Islands, Eastern Gulf of Thailand.

A. Testicular Parts

MONTH	n	Im.	Ed.	Ld.	Ma.	Sp.	Rd.	St.
JULY 1987	118	22.03	14.41	2.54	3.39	18.64	15.25	23.73
AUGUST	54	29.63	12.96	1.85	11.11	11.11	12.96	20.37
SEPTEMBER	41	7.32	7.32	14.63	17.07	36.59	14.63	2.44
OCTOBER	43	2.33	4.65	25.58	48.84	16.28	2.33	0.00
NOVEMBER	21	0.00	0.00	33.33	19.05	28.57	19.05	0.00
DECEMBER	47	0.00	2.13	4.26	76.60	12.77	4.26	0.00
JANUARY 1988	29	0.00	6.90	6.90	34.48	41.38	6.90	3.45
FEBRUARY	41	0.00	7.32	24.39	29.27	19.51	17.07	2.44
MARCH	35	0.00	0.00	31.43	48.57	20.00	0.00	0.00
APRIL	35	17.14	0.00	8.57	5.71	11.43	28.57	28.57
MAY	38	5.26	5.26	15.79	7.89	7.89	26.32	31.58
JUNE	44	9.09	4.55	2.27	4.55	2.27	25.00	52.27
TOTAL&AVERAGE	546	7.73	5.46	14.30	25.54	18.87	14.36	13.74

B. Ovarian Part

MONTH	n	Im.	Ed.	Ld.	Ma.	Sp.	Rd.	St.
JULY 1987	118	22.03	10.17	6.78	4.24	6.78	16.10	33.90
AUGUST	54	35.19	7.41	14.81	9.26	1.85	5.56	25.93
SEPTEMBER	41	7.32	7.32	21.95	12.20	21.95	14.63	14.63
OCTOBER	43	4.65	6.98	44.19	23.26	6.98	4.65	9.30
NOVEMBER	21	0.00	4.76	57.14	9.52	14.29	4.76	9.52
DECEMBER	47	0.00	0.00	10.64	68.09	14.89	6.38	0.00
JANUARY 1988	29	3.45	3.45	24.14	10.34	31.03	3.45	24.14
FEBRUARY	41	2.44	4.88	21.95	7.32	26.83	4.88	31.71
MARCH	35	0.00	2.86	31.43	28.57	28.57	2.86	5.71
APRIL	35	17.14	2.86	2.86	2.86	20.00	5.71	48.57
MAY	38	5.26	5.26	7.89	2.63	23.68	5.26	50.00
JUNE	44	9.09	4.55	0.00	2.27	6.82	18.18	59.09
TOTAL&AVERAGE	546	8.20	5.04	20.32	15.05	16.97	7.70	26.73

Note: Im. : immature stage
 Ed. : early developing stage
 Ld. : late developing stage
 Ma. : ripe or mature stage
 Sp. : spawning stage
 Rd. : redeveloping stage
 St. : spent stage

Gonadal Development Stages *Amusium pleuronectes* (Linn.) July 1987 - June 1988

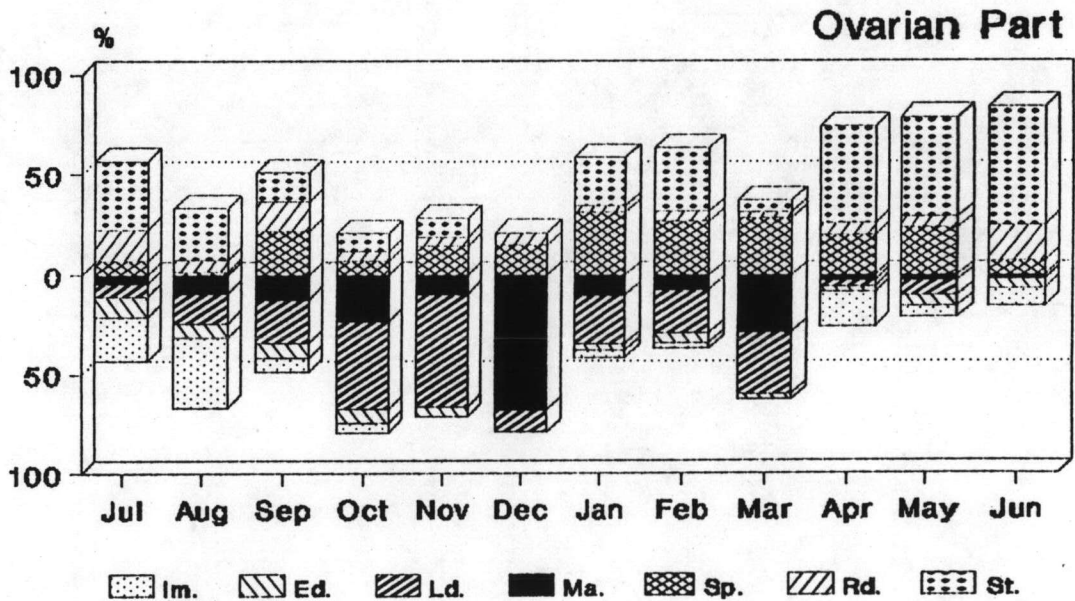
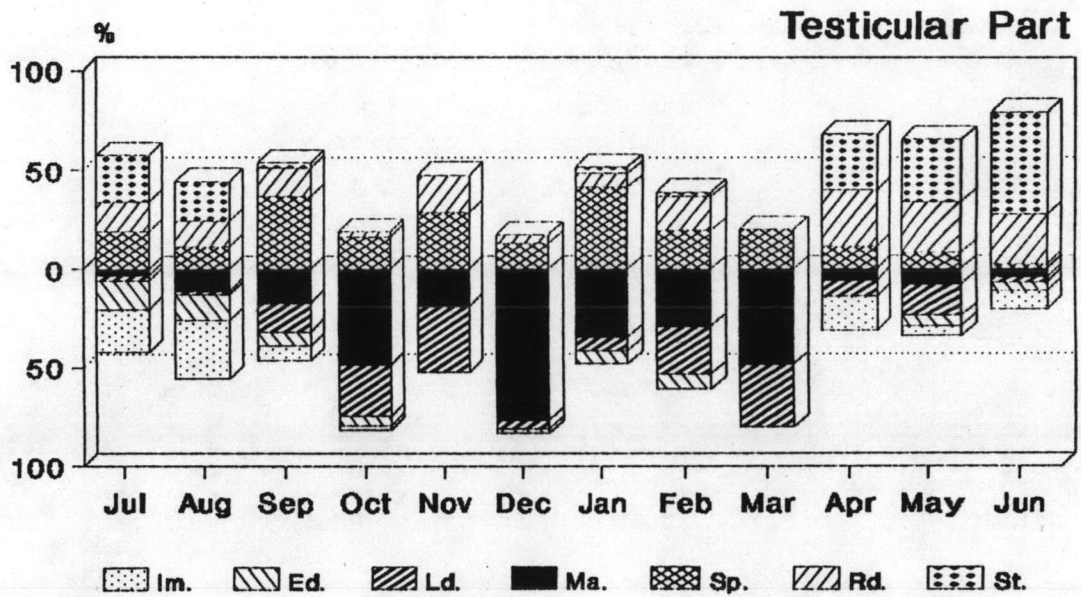


Figure 19 Frequency distribution of gonadal development stages in monthly samples of *Amusium pleuronectes* from Chang Islands, July 1987-June 1988. (Im.= immature; Ed.= early developing; Ld.= late developing; Ma.= mature or ripe; Sp.= spawning; Rd.= redeveloping; St.= spent)

1.2 Gonad Indices

Both gonad indices, in terms of quantitative and qualitative, determined from monthly samples of *Amusium pleuronectes* are presented in Table 22.

1.2.1 Quantitative Gonad Index (QT GI)

The quantitative gonad index, based on gonad weight (gonad weight/flesh weight x 100), of individual scallops from this study range from 0.22 in a tiny transparent gonad, to 21.70 in a large well-developed one. The highest value is found in a sample of December, and the lowest in a sample of June.

Monthly mean QT GI values range from 2.06 to 14.52 (Table 22 and Figure 20). The highest mean QT GI values are in the sample of March and December, and the lowest in June-August.

1.2.2 Qualitative Gonad Index (QL GI)

The qualitative gonad index, based on ranks assigned to observed developmental stages, shows that the mean monthly index ranges from 1.43 - 2.77 for testicular part and 1.34 - 2.68 for ovarian part (Table 22 and Figure 21). This indicates that at the population level, gamete production continues throughout the year. Monthly fluctuation of the QL GI values of testicular and ovarian parts are parallel, with the testicular index shows higher values than ovarian index of the same month. The qualitative gonad indices reach highest values in December, lowest in June for both testicular and ovarian parts.

Both gonad indices represent the reproduction in scallop. The highest values, found in December, are associated with high percentage of mature or ripe stage, while the lowest values are associated with high percentage of spent and redeveloping gonads.

Table 22 Monthly mean gonad indices of the scallop, *Amusium pleuronectes* from Chang Islands.
(number in brackets are standard deviations)

MONTH	QUANTITATIVE		QUALITATIVE		
	n	GI	n	TES	OVA
JULY 1987	120	2.90 (±2.24)	118	1.58 (±0.56)	1.48 (±0.58)
AUGUST	58	2.44 (±2.42)	54	1.61 (±0.68)	1.48 (±0.66)
SEPTEMBER	51	6.06 (±3.53)	41	2.07 (±0.51)	1.90 (±0.58)
OCTOBER	60	7.08 (±3.34)	43	2.47 (±0.54)	2.09 (±0.60)
NOVEMBER	31	8.49 (±3.22)	21	2.19 (±0.39)	2.00 (±0.44)
DECEMBER	47	13.34 (±3.74)	47	2.77 (±0.42)	2.68 (±0.47)
JANUARY 1988	48	11.20 (±3.21)	29	2.31 (±0.53)	1.83 (±0.59)
FEBRUARY	60	9.24 (±2.40)	41	2.27 (±0.50)	1.73 (±0.59)
MARCH	57	14.46 (±3.29)	35	2.49 (±0.50)	2.23 (±0.54)
APRIL	42	2.95 (±1.61)	35	1.60 (±0.60)	1.37 (±0.54)
MAY	52	4.29 (±3.39)	38	1.71 (±0.60)	1.47 (±0.55)
JUNE 1988	49	2.06 (±1.70)	44	1.43 (±0.58)	1.34 (±0.52)
COMBINED	675	6.63 (±5.06)	546	1.96 (±0.70)	1.75 (±0.69)

n = number
GI = quantitative gonad index
TES = testicular part
OVA = ovarian part

Quantitative Gonad Index
Amusium pleuronectes (Linn.)
July 1987 - June 1988

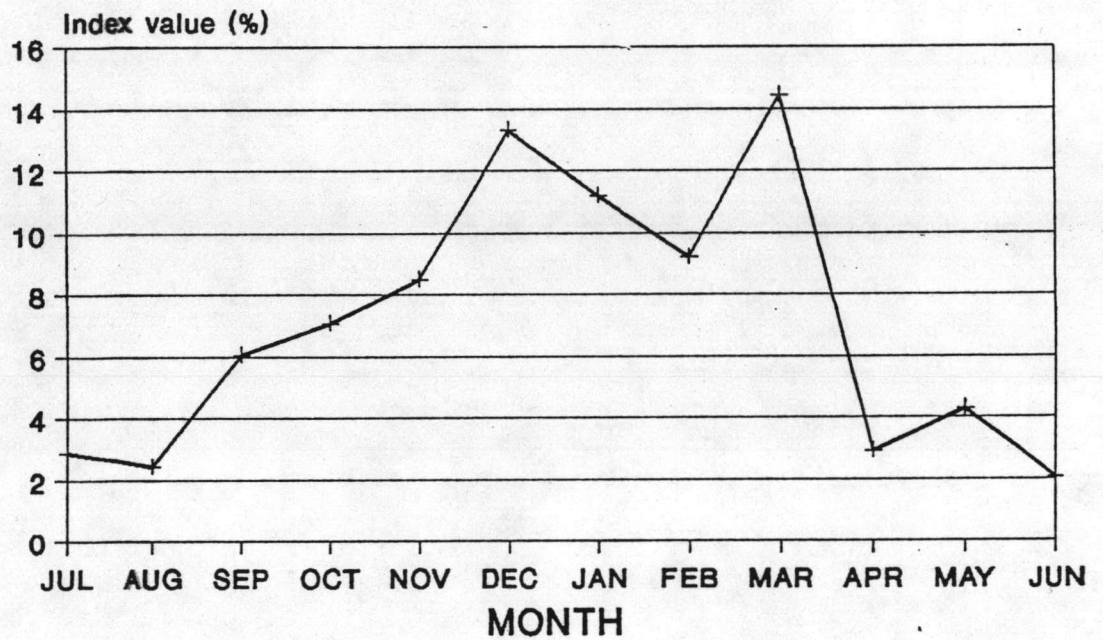


Figure 20 Change in the mean quantitative gonad index of *Amusium pleuronectes* around Chang Islands; July 1987 - June 1988.

Qualitative Gonad Index
Amusium pleuronectes (Linn.)
 July 1987 - June 1988

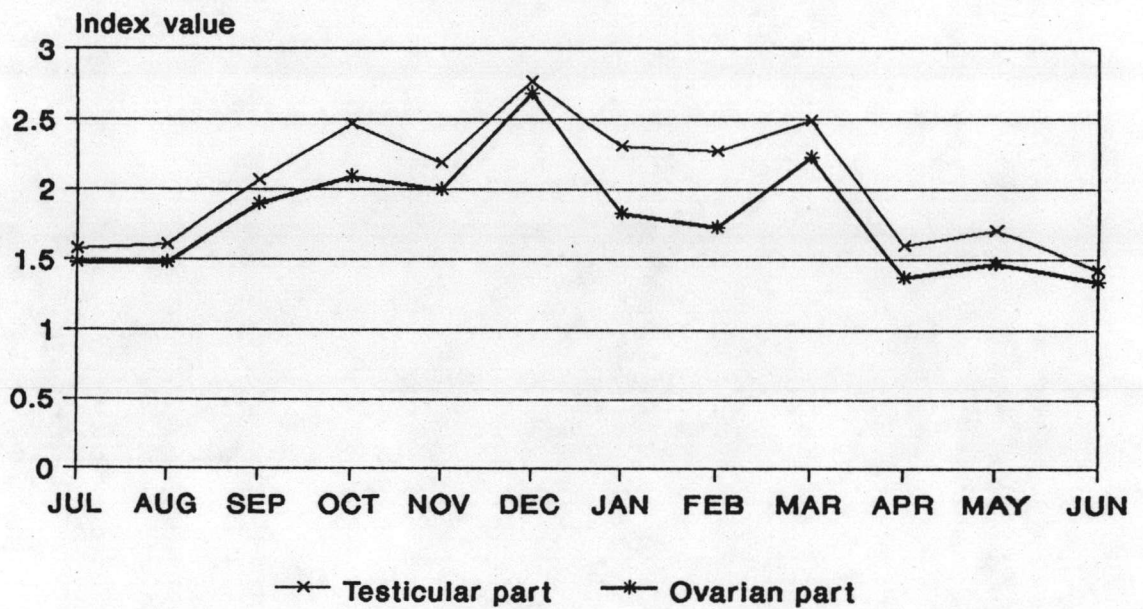


Figure 21 Change in the mean qualitative gonad index of *Amusium pleuronectes* around Chang Islands; July 1987 - June 1988.

2. Size at Maturity

The samples of scallop used in the reproductive study are of the size ranging from 2.7 - 9.5 cm in shell height. The gonads of scallops with the shell height smaller than 3.5 cm are undoubtedly immature, thus they are excluded from histological study.

From the samples examined through histological processes, some specimens possess different predominant development stages in both gonad regions, testicular and ovarian parts, besides alteration from follicles to follicles. Resulting from determination of the development stages of both gonad portions, the scallops are divided into 4 groups as immature, developing, mature, and post-mature. The immature group possesses the scallops which have totally immature gonads in both testicular and ovarian parts. The developing group incorporates the scallops with developing stage in either both parts or only one part of the gonad while the other one is in immature stage, thus, this group represents the pre-mature stages. The mature group incorporates the samples with either totally or partly mature, but never with any post-mature stages. The post-mature group includes the samples with any stages following the maturation; i.e. spawning, redeveloping, or spent. Out of the 546 scallops, the samples of 58 specimens with the size ranging from 3.6-7.9 cm in shell height are found to be in immature stage, 67 specimens of shell height 4.4-8.8 cm are in developing stage, 104 specimens with shell height 6.1-9.5 cm are reaching mature stage, and another 317 specimens of 4.8-9.3 cm shell height are in the group of post-mature stages. The size frequency distribution of scallop samples in those groups are presented in Table 23.

Table 23 Frequencies of the scallop *Amusium pleuronectes* samples in different gonadal development stages.

Height class (cm)	GROUP			
	Immature	Developing	Mature	Post-mature
3.5 - 3.9	5			
4.0 - 4.4	6	1		
4.5 - 4.9	13	5		1
5.0 - 5.4	8	6		2
5.5 - 5.9	9	3		7
6.0 - 6.4	11	8	7	48
6.5 - 6.9	4	12	4	39
7.0 - 7.4	1	10	9	41
7.5 - 7.9	1	7	14	77
8.0 - 8.4		10	41	60
8.5 - 8.9		5	21	32
9.0 - 9.4			6	10
> 9.5			2	
Total	58	67	104	317

The minimum size of scallop of the mature group found in this study is 6.1 cm in shell height, but some smaller specimens are found in the post-mature group indicating that *Amusium pleuronectes* should have reached sexual maturity at the size smaller than 6.1 cm. The smallest sample of the post-mature group is 4.8 cm in shell height which is found to be in spawning stage, following with a 5.1 cm scallop in redeveloping stage and a 5.4 cm scallop in spent stage. Therefore, the scallop *A. pleuronectes* is becoming sexually mature at the size of 4.8 cm or slightly smaller.

VI. Association with Pea Crab

From 737 scallops observed since June 1987-June 1988, 55 specimens were found infested with the pea crab *Pinnotheres* sp. (Figure 22), one each in every infested specimen. Those tiny pea crabs were found in mantle cavity specifically on the gonad of the scallops. The infested scallops were of sizes ranging from 3.9 - 9.1 cm in shell height. Their gonads were somewhat deformed in outline and the gonads were slightly smaller than those of uninfested individuals of the same size, as well as the mean sizes of scallops which were smaller in the infested samples than the uninfested ones (Table 24). The pea crabs sizes ranged from about 0.4 - 1.3 cm carapace length, or 0.05 - 2.06 g weight. All the pea crabs found were female and most of them were ovigerous. Occurrence of pea crab in the scallop was most abundant in August with the percentage of 18.97, and second peak of infestation was in June 1988, with 16.33 %. In December no pea crab was found infesting in the scallop samples. Monthly occurrence of pea crab is shown in Table 24 and Figure 23. The average infestation rate for the whole series of samples is 7.46 %.

Determination of infestation rate corresponding with scallop size gives the result as shown in Table 25 and Figure 24. Pea crabs were found in scallops of 3.5 cm or more in shell height. The infestation rates are high in scallops of the sizes smaller than 5.5 cm, and a decreasing incidence of infestation is found in the larger size classes.

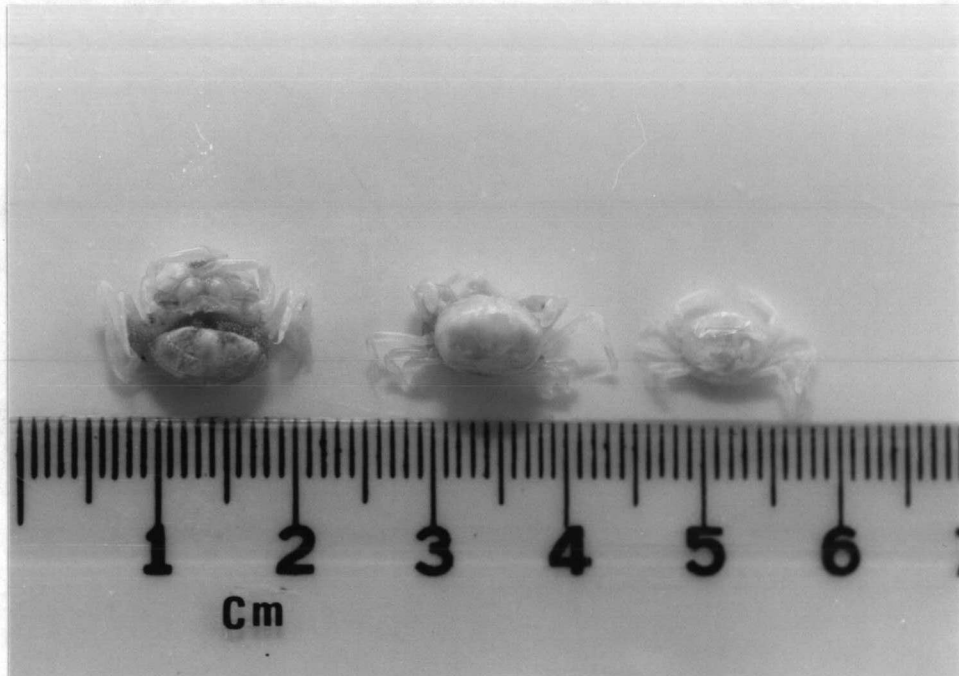


Figure 22 The pea crab *Pinnotheres* sp.

Table 24 Occurrence of the pea crab *Pinnotheres* sp. infestation in the scallop *Amusium pleuronectes* and comparison of mean sizes of infested and uninfested scallops. (number in brackets are standard deviations)

MONTH	NO. SCALLOP OBSERVED (ind.)	NO. INF. (ind.)	% INF.	MEAN SHELL HEIGHT (cm)		
				INF.	UN.	COMBI.
JUNE 1987	55	4	7.27	6.74 (±1.21)	7.14 (±0.83)	7.11 (±0.87)
JULY	120	6	5.00	5.37 (±1.07)	6.86 (±1.33)	6.79 (±1.35)
AUGUST	58	11	18.97	6.01 (±1.00)	6.69 (±1.21)	6.56 (±1.20)
SEPTEMBER	51	5	9.80	6.64 (±0.49)	7.47 (±0.94)	7.39 (±0.94)
OCTOBER	60	1	1.67	6.90	7.82 (±0.88)	7.81 (±0.88)
NOVEMBER	31	1	3.23	7.10	8.05 (±0.50)	8.02 (±0.52)
DECEMBER	47	0	0.00	-	8.37 (±0.84)	8.37 (±0.84)
JANUARY 88	48	6	12.50	7.90 (±0.81)	7.33 (±1.28)	7.40 (±1.24)
FEBRUARY	60	2	3.33	5.30 (±0.10)	7.07 (±1.04)	7.02 (±1.07)
MARCH	64	4	6.25	7.10 (±0.52)	6.99 (±1.36)	6.99 (±1.33)
APRIL	42	1	2.38	7.40	7.42 (±0.89)	7.42 (±0.88)
MAY	52	6	11.54	7.65 (±0.72)	7.56 (±0.90)	7.57 (±0.88)
JUNE 1988	49	8	16.33	6.65 (±0.51)	6.89 (±0.68)	6.85 (±0.66)
COMBINED	737	55	7.46	6.70 (±1.15)	7.31 (±1.16)	7.27 (±1.17)

INF. : samples infested with pea crab
 UN. : uninfested samples
 COMBI. : combined samples; infested & uninfested

Infestation of pea crab, *Pinnotheres* sp.
in scallop, *Amusium pleuronectes*.
June 1987 - June 1988

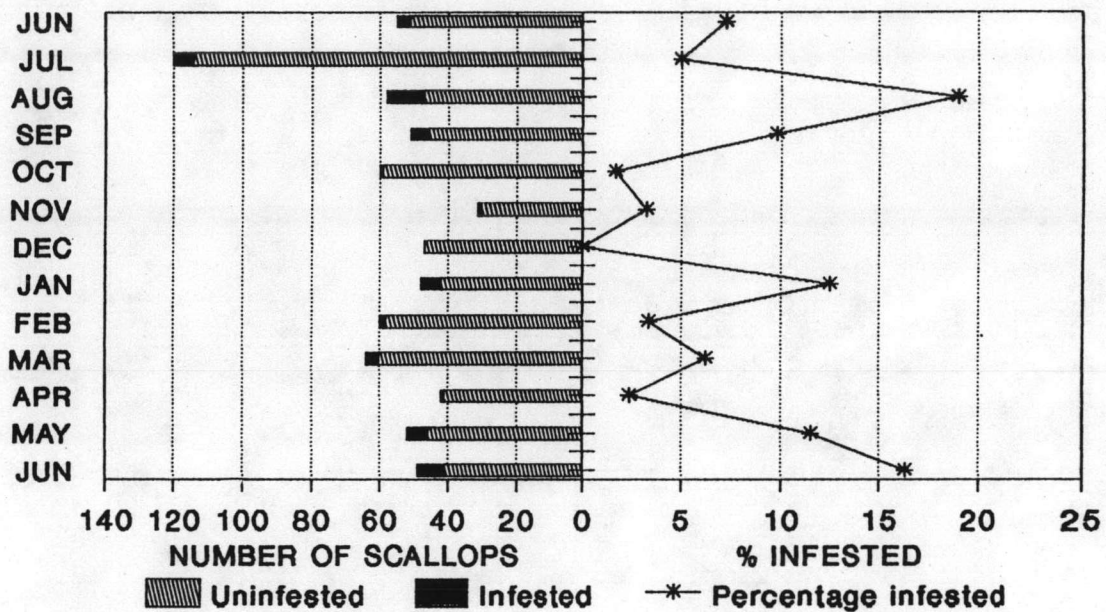


Figure 23 Occurrence of pea crab *Pinnotheres* sp. infestation in *Amusium pleuronectes* from Chang Islands; June 1987 - June 1988.

Table 25 Size frequency distribution of the scallop *Amusium pleuronectes* and infestation rates of the pea crab *Pinnotheres* sp. in different size classes of scallop.

HEIGHT CLASS (cm)	SCALLOP FREQUENCY	NO. WITH PEA CRAB	% PEA CRAB
2.50 - 2.99	2	0	0.00
3.00 - 3.49	1	0	0.00
3.50 - 3.99	5	1	20.00
4.00 - 4.49	8	1	12.50
4.50 - 4.99	23	3	13.04
5.00 - 5.49	19	4	21.05
5.50 - 5.99	29	4	13.79
6.00 - 6.49	101	11	10.89
6.50 - 6.99	80	8	10.00
7.00 - 7.49	95	7	7.37
7.50 - 7.99	139	8	5.76
8.00 - 8.49	142	7	4.93
8.50 - 8.99	73	0	0.00
9.00 - 9.49	18	1	5.56
> 9.50	2	0	0.00
TOTAL	737	55	7.46

**Infestation Rate of *Pinnotheres* sp.
in Different Size Classes of Scallop
Amusium pleuronectes (Linn.)**

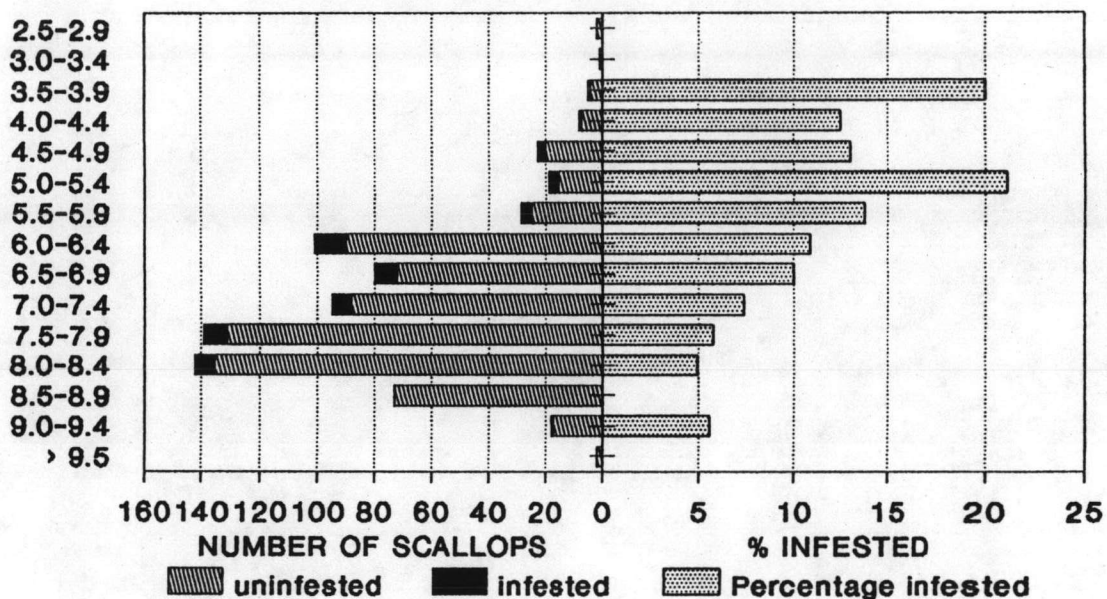


Figure 24 Pea crab infestation rate in different size classes of *Amusium pleuronectes*; June 1987 - June 1988.

Gonad indices separately determined for the infested and uninfested scallops show that the infested samples have generally lower values of both quantitative and qualitative indices than the uninfested, except in the sample of May 1988 for quantitative gonad index and the samples of September-October 1987 for the ovarian qualitative gonad index. Those exceptions occurred because there were only 1-2 individuals represented in the infested samples, and coincidentally they possessed gonads with high index values, thus, making the mean indices higher than in the uninfested group. Comparison of the gonad indices of scallops between with and without infestation are presented in Tables 26, 27 and Figures 25, 26.

One-way analysis of variance (ANOVA) shows that the sizes of infested and uninfested scallops from monthly samples are not significantly different ($P > 0.05$), as well as both quantitative and qualitative gonad indices are also not significant between those two, infested and uninfested, groups. The results of analysis are presented in Tables 28, 29 and 30.

Table 26 Monthly mean quantitative gonad index of the scallop, *Amusium pleuronectes* from Chang Islands; comparison between infested and uninfested samples. (number in brackets are standard deviations)

MONTH	INFESTED		UNINFESTED	
	n	GI	n	GI
JULY 1987	6	1.10 (±0.41)	114	2.99 (±2.26)
AUGUST	11	1.33 (±0.62)	47	2.70 (±2.61)
SEPTEMBER	5	2.61 (±1.73)	46	6.43 (±3.47)
OCTOBER	1	3.77	59	7.14 (±3.34)
NOVEMBER	1	5.09	30	8.60 (±3.21)
DECEMBER	0	-	47	13.34 (±3.74)
JANUARY 1988	6	10.81 (±2.56)	42	11.25 (±3.28)
FEBRUARY	2	6.73 (±0.34)	58	9.32 (±2.39)
MARCH	4	11.93 (±3.96)	53	14.65 (±3.15)
APRIL	1	1.70	41	2.98 (±1.62)
MAY	6	4.73 (±2.30)	46	4.23 (±3.50)
JUNE 1988	8	1.59 (±0.68)	41	2.15 (±1.82)
COMBINED	51	4.16 (±4.19)	624	6.83 (±5.07)

n = number

GI = quantitative gonad index ;
(gonad weight/flesh weight) x 100

Quantitative Gonad Index
Amusium pleuronectes (Linn.)
 July 1987 - June 1988

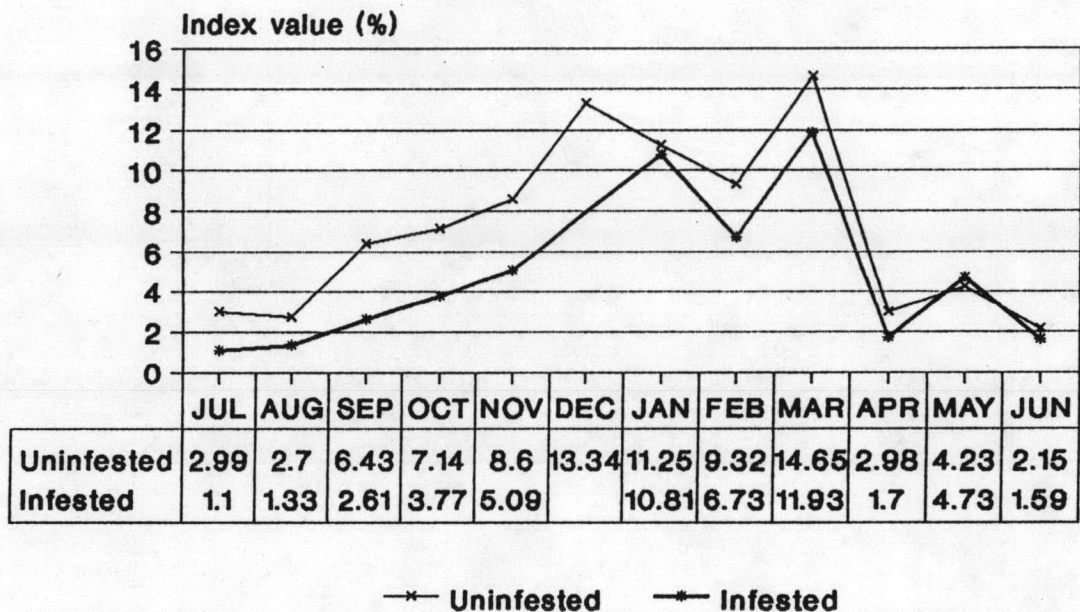


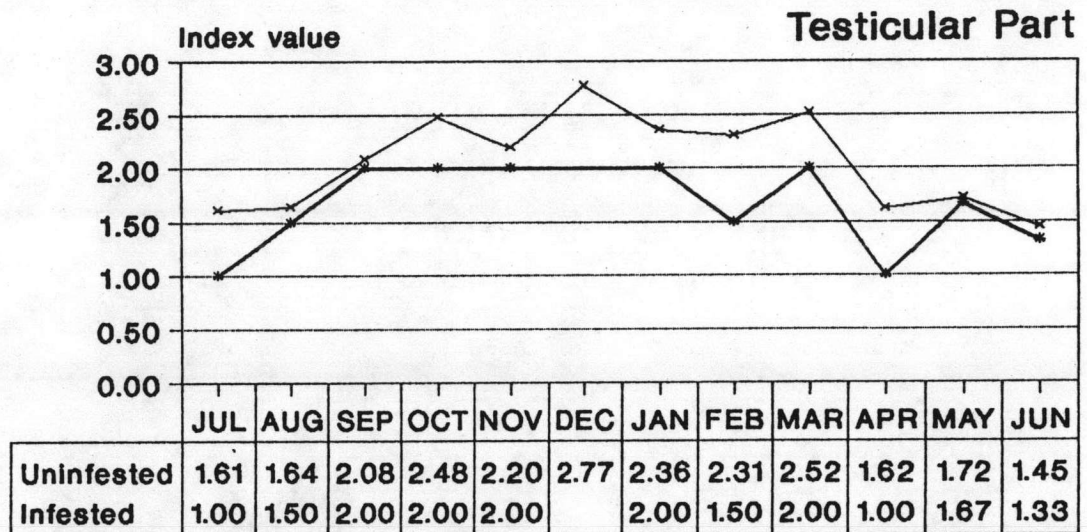
Figure 25 Comparison of monthly mean quantitative gonad index between scallop samples of infested and uninfested with pea crab *Pinnotheres* sp.

Table 27 Monthly mean qualitative gonad index of the scallop, *Amusium pleuronectes* from Chang Islands; comparison between infested and uninfested samples. (number in brackets are standard deviations)

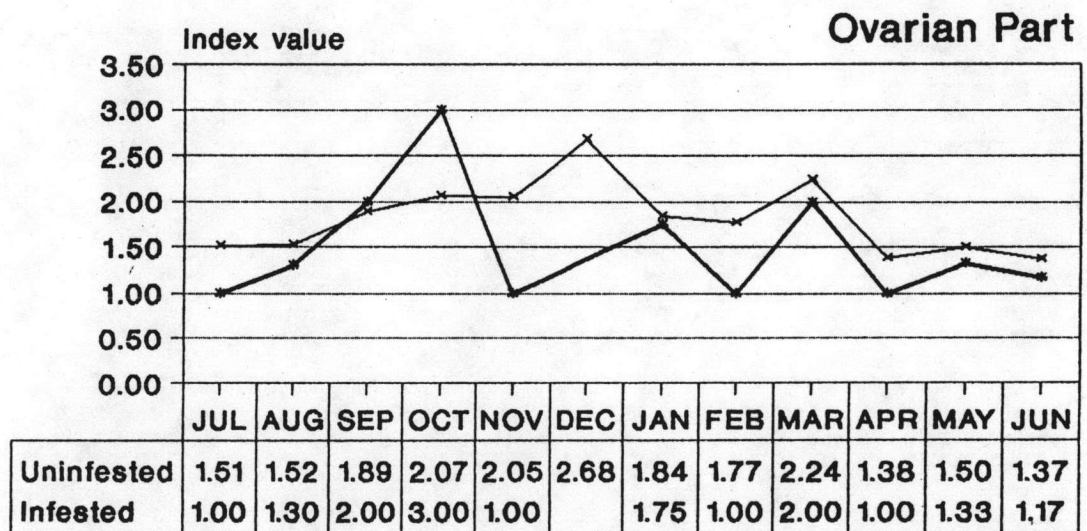
MONTH	INFESTED			UNINFESTED		
	n	TES	OVA	n	TES	OVA
JULY 1987	6	1.00 (±0.00)	1.00 (±0.00)	112	1.61 (±0.56)	1.51 (±0.58)
AUGUST	10	1.50 (±0.50)	1.30 (±0.46)	44	1.64 (±0.71)	1.52 (±0.69)
SEPTEMBER	3	2.00 (±0.00)	2.00 (±0.00)	38	2.08 (±0.53)	1.89 (±0.46)
OCTOBER	1	2.00	3.00	42	2.48 (±0.55)	2.07 (±0.59)
NOVEMBER	1	2.00	1.00	20	2.20 (±0.40)	2.05 (±0.38)
DECEMBER	0	-	-	47	2.77 (±0.42)	2.68 (±0.47)
JANUARY 1988	4	2.00 (±0.71)	1.75 (±0.43)	25	2.36 (±0.48)	1.84 (±0.61)
FEBRUARY	2	1.50 (±0.50)	1.00 (±0.00)	39	2.31 (±0.46)	1.77 (±0.58)
MARCH	2	2.00 (±0.00)	2.00 (±0.00)	33	2.52 (±0.50)	2.24 (±0.55)
APRIL	1	1.00	1.00	34	1.62 (±0.59)	1.38 (±0.54)
MAY	6	1.67 (±0.47)	1.33 (±0.47)	32	1.72 (±0.62)	1.50 (±0.56)
JUNE 1988	6	1.33 (±0.47)	1.17 (±0.37)	38	1.45 (±0.59)	1.37 (±0.53)
COMBINED	42	1.55 (±0.54)	1.38 (±0.53)	504	2.00 (±0.70)	1.78 (±0.69)

n = number
 TES = testicular part
 OVA = ovarian part

Qualitative Gonad Index *Amusium pleuronectes* (Linn.) July 1987 - June 1988



—x— Uninfested —*— Infested



—x— Uninfested —*— Infested

Figure 26 Comparison of monthly mean qualitative gonad index between scallop samples of infested and uninfested with pea crab *Pinnotheres* sp.
A. Testicular part.
B. Ovarian part.

Table 28 Result of one-way ANOVA for the mean shell height of the infested and uninfested samples of *Amusium pleuronectes*.

ANALYSIS OF VARIANCE					
SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F RATIO	PROB.
BETWEEN	1.777	1	1.777	4.230	.0518
WITHIN	9.239	22	.420		
TOTAL	11.016	23			

Table 29 Result of one-way ANOVA for the mean quantitative gonad index of the infested and uninfested samples of *Amusium pleuronectes*.

ANALYSIS OF VARIANCE					
SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F RATIO	PROB.
BETWEEN	20.141	1	20.141	1.312	.2655
WITHIN	307.000	20	15.350		
TOTAL	327.141	21			

Table 30 Result of one-way ANOVA for the mean qualitative gonad index of the infested and uninfested samples of *Amusium pleuronectes*.

ANALYSIS OF VARIANCE					
SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F RATIO	PROB.
BETWEEN	1.449	3	.483	2.389	.0831
WITHIN	8.087	40	.202		
TOTAL	9.536	43			