MATURATION CURVE OF THE OVARY OF *Pimelodus maculatus* Lac, (Siluroidei, Teleostei)*

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RESUMO

O presente trabalho tem como objetivo pesquisar, paralelamente ao estudo macro e microscópico dos estádios gonadais e dentro da metodologia mais objetiva possível, variáveis que, dependentes da evolução gonadal, chegassem a constituir função da mesma e assim, permitissem-nos, simultaneamente, representá-las através de expressões matemáticas. Dentre estas variáveis está o **índice gônado somático** (I.G.S.) ou de maturidade dos produtos sexuais.

Os resultados obtidos durante dois períodos reprodutivos (abril/71 a abril/73), permitiram estabelecer um I.G.S. definido para cada estádio de evolução gonadal e, através dos I.G.S. médios mensais, pôde ser representada a Curva de Maturação dos Ovários desta espécie.

INTRODUCTION

By observing the external morphology simultaneously with the cellular structure of the ovaries during their cyclical ripening process, on did obtain all data that were necessary for the establishment of an adequate maturation scale for **Pimelodus maculatus,** GODINHO et al. (1974).

It is the purpose of this paper to present data which are believed to provide an objective basis for the identification of the stage of gonadal evolution by macroscopic observation of the morphology of the ovary, as well as, to determine the (G S I) without to sacrifice the animal. Thus, it was important to establish a relationship between the morphological aspect and the histological structure of the gonads with the gonosomatic index (G.S.I.).

As ZUCKERMAN (1962) observes, for the teleostei there is a straight relation between the weight of the body and of the ovaries and an increasing of the gonad weight and volume is done by the growth of the ovocytes and not by the development of some accessory folicular structures. According to the same author, this is particularly evident in species with multiple spawning and with thelolecit oocytes. LE CREN (1951) affirms that at each season of the year the gonad weight is a constant percentage of the body weight.

AZEVEDO (1939), MORAIS & SCHUBART (1955), PIGNALBERI (1965) and SCHUBART (1947) did

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refer to the gonad weight as an expression of their development, but without the necessary statistical analysis, and NIKOLSKII (1963) considers that the data of the gonad weight are very important to indicate the reproductive stage of the fish.

MATERIAL AND METHODS

From April 1971 to April 1973, 220 females of the yellow "mandi" **Pimelodus maculatus** were collected in a section of 40 km of the Jaguari river, between the cities of Americana and Jaguariuna (22° 40' 30" S and 47° 00' 22" W, São Paulo State, Brazil).

As on needed to obtain samples of all age groups, the animals were captured every week using fish hook of different sizes, as well as, with nets of different types and mesh sizes.

In a laboratory near the river the living specimens were observed; an urogenital papilla in the males of this specie, becames possible the separation of the sexes. The animals were sacrified by cerebral commotion.

Total lenght and weight of the specimens were recorded and after a ventral incision and dissection, the ovaries were weighed and classified macroscopically according to their size, color, transparency, flabbility and presence or absence of oocytes visible by transparency at nacked eye.

Some pieces of the ovaries were fixed in Bouins' fluid for histological studies.

The gonosomatic index (G S I) or the maturity index, MEIEN (1944), was calculated as follows:

G S I = weight of gonads (wg)/total body weight (wt) x 100.

The data of weight of gonads were plotted against the data of weight of body, for each gonadal stage. The regression line was fitted by the method of least squares, of the form $Y = a + b X$ (where Y = weight of gonad; X = weight of the body).

To elaborate the maturation curve for this species, it was necessary to calculate the monthly mean value (including the standard deviation and the confidence interval) of all values of the G S I at the different maturity stages.

RESULTS

The mean G S I for each gonadal stage, during two reproductive cycles, are at Table I and figure 1.

The regression line, which represents the relationship between both variables, the weight of the ovaries and the total body weigth for the different stages of both reproductive cycles, are at figures 2, 3, 4, 5, 6, 7, 8 and 9, and the determination coefficients are at Table II.

With the mean month G S I of both periods (Table III), the maturation curve was established for the ovaries of **Pimelodus maculatus** (figure 10).

DISCUSSION

Our results agree with GHOSH & KAR (1952), HAYDOCK (1971), JAMES (1946), LE CREN (1951), MC INERVEY (1970), MALHOTRA (1970), MATHEWS (1938), MONTE (1964), NAUMOV (1959) and WELCOME (1967). All these authors report about a relationship between the G S I and the degree of maturation of the ovaries for the species that were studied. HAYDOCK (1971) affirms that the G S I measures the degree of sexual maturation, which, of course, varies with the species.

As we can observe on Table II and figures 2, 3, 4, 5, 6, 7, 8 and 9, our results suggets a correlation between both parameters considered, and it seems possible to conclude that the

G S I is typical for each stage of gonadal development. Such a correlation was not obtained by SANTOS (1972).

As we can observe, the results of the G S I established for each stage are very close on both reproductive periods considered.

Based on the data obtained, it is possible to suggets that the sexual products start their sexual maturity when the G S I is above 2% and that the females are well prepared for spawning when it reaches the level of 6%. HAYDOCK (1971) concludes that with an G S I around 5%, the success of hormonal induction for reproduction is assured for **Bairdiella icistia.**

By observing the maturation curve of both periods considered, it is possible to verify that the process of maturation begins at October with the highest point at December. Beginning at January on may observe a light decreasing that continues during February, March and April indicating, probably, a partial spawning or a spawning in successive parcels.

CONCLUSIONS

1. There is in this species a positive correlation between the gonads weight and the body weight.
2. The G S I, statistically calculated, varies in function of the maturation stages of the ovaries.
3. The maturation process of the ovaries begins at October with a G S I above 2%, becoming 8% at December and diminishing after this, indicating the occurrence of spawning.
4. As the G S I around 6% corresponds to the mature stage of gonadal development, on believes that it will be possible to obtain good results with hormonal induction of the reproduction at this level of the gonosomatic index.
5. The maturation curve for both periods considered may be represented by the mean G.S.I. of each month.

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TABLE I — Mean values of G.S.I. of each stage of gonadal development through two reproductive cycles april — 1971 to april 1973

STAGES	G.S.I. 1st cycle	nr. Speci.	G.S.I. 2nd cycle	nr. Speci.
Resting	1,01	58	0,93	67
Maturation	2,64	22	2,40	11
Mature	7,84	20	6,38	21
Spent	1,03	10	1,56	11

TABLE II — Data of the regressions between the weight of the gonads (Wg) and the total body weight (Wt). *Pimelodus maculatus* through two reproductives cycles april 1971 to april 1973

STAGES Wg x Wt	N	Ax	b	a	r^2
CYCLE — 71 — 72					
Resting	58	85,0 — 744,0g	0,0094 ± 0,0006	0,1251 ± 0,1923	0,80
Maturation	22	123,0 — 730,0g	0,0221 ± 0,0055	1,0365 ± 1,8996	0,44
Mature	20	206,0 — 623,0g	0,0751 ± 0,0141	1,0283 ± 5,3073	0,61
Spent	10	92,0 — 399,0g	0,0124 ± 0,0013	0,3597 ± 0,2964	0,92
	110				
CYCLE — 72 — 73					
Resting	67	103,0 — 995,0g	0,0082 ± 0,0005	0,4061 ± 0,2236	0,75
Maturation	11	165,4 — 1,362,6g	0,0221 ± 0,0026	0,8252 ± 1,4481	0,88
Mature	21	96,1 — 860,0g	0,0597 ± 0,0135	2,4492 ± 6,0522	0,51
Spent	11	141,4 — 1,015,5g	0,0126 ± 0,0039	1,2672 ± 2,0392	0,53
	110				

N = Number of specimens
Ax = Range of the variable X (smallest and biggest)
b = Value of the regression coeficient ± its standard deviation
a = Value of the constant of the regression ± its standard deviation
r^2 = Coefficient of determination

TABLE III — Mean values of the G.S.I. of each month from april 71 to april 73

MONTHS	G.S.I. 1st cycle 71–72	G.S.I. 2nd cycle 72–73
April	1,00	1,07
May	0,97	0,78
June	1,13	0,90
July	0,90	1,08
August	0,95	0,91
September	1,00	1,47
October	2,00	2,30 °
November	5,32	7,03
December	8,21	8,63 x
January	7,00	4,00
February	——	2,72
March	1,03	2,36
April	1,07	0,84

° Beginning of maturation

x Maximum value of G.S.I.

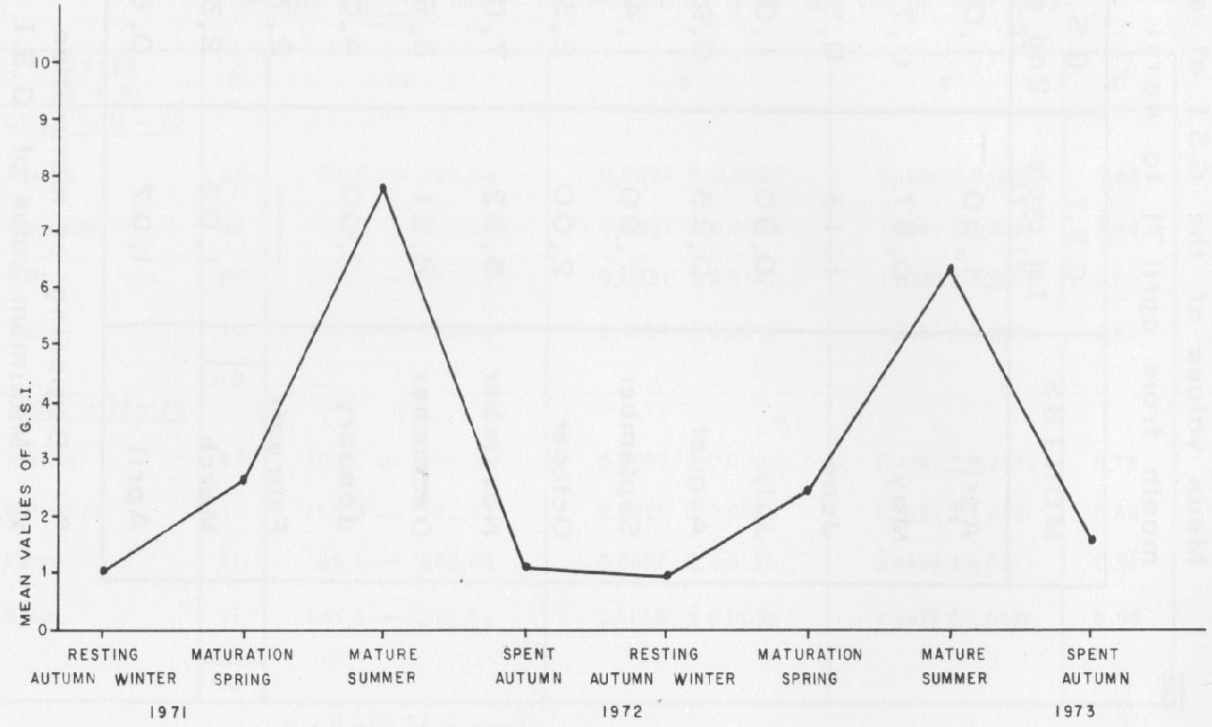


FIGURE: 1 ——— CYCLICAL VARIATIONS OF THE MEAN VALUES OF THE G.S.I. FOR P. maculatus FEMALES, THROUGH TWO REPRODUCTIVE CYCLES

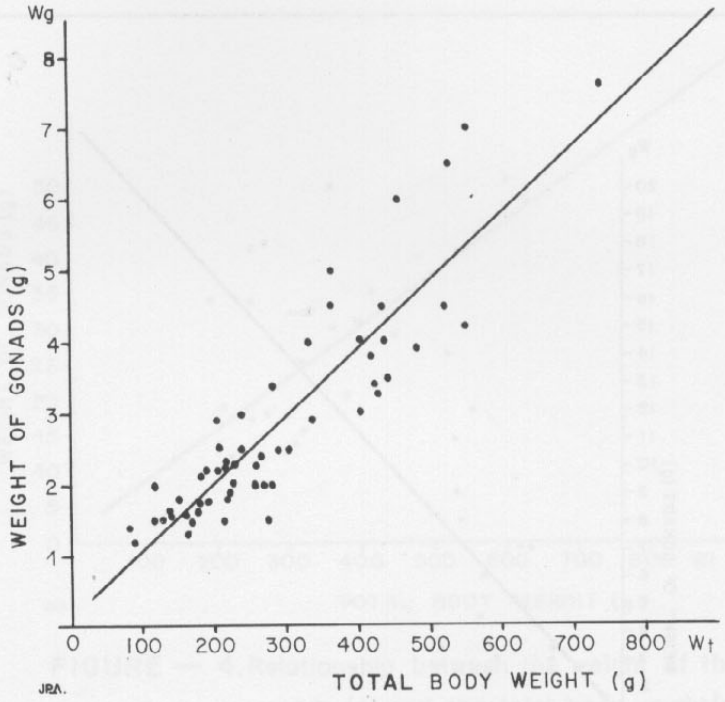


FIGURE — 2. Relationship between the weight of the gonads (g) and the total body weight (g) for P maculatus at the resting stage —1971

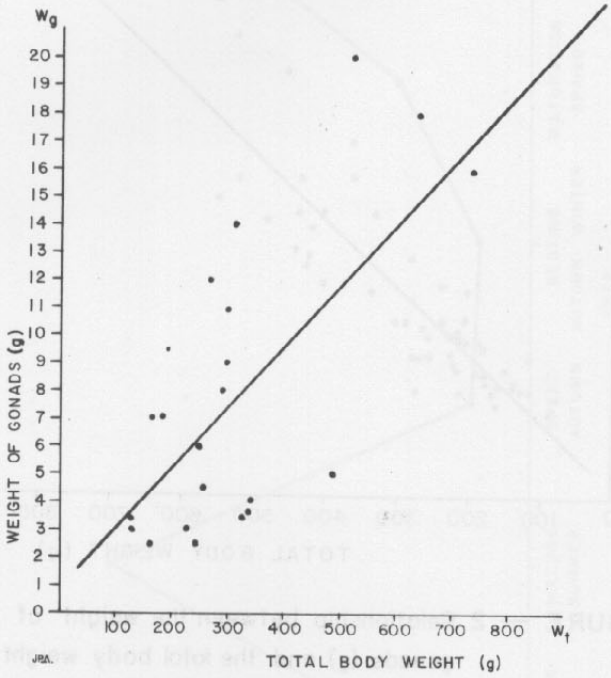


FIGURE — 3. Relationship between the weight of the gonads (g) and the total body weight (g) for P. maculatus at the maturation stage — 1971

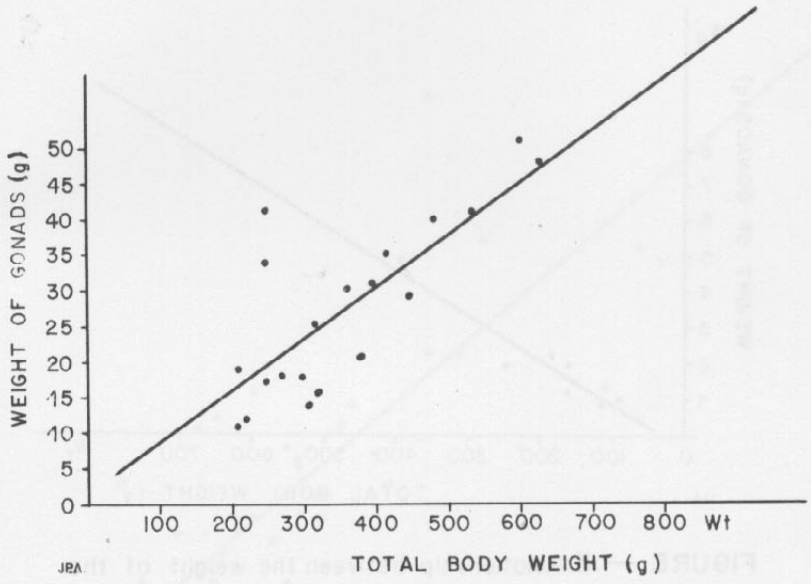


FIGURE — 4. Relationship between the weight of the gonads (g) and the total body weight (g) for P. maculatus at the mature stage — 1971–1972

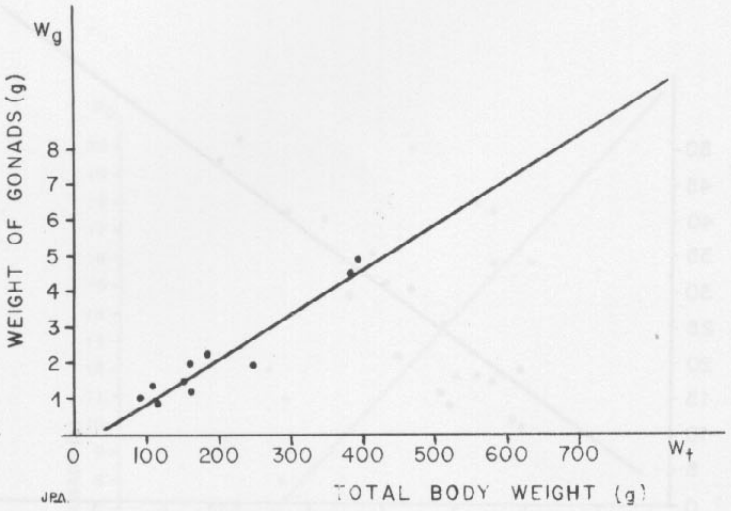


FIGURE — 5. Relationship between the weight of the gonads (g) and the total body weight (g) for P. maculatus at the spent stage —1972

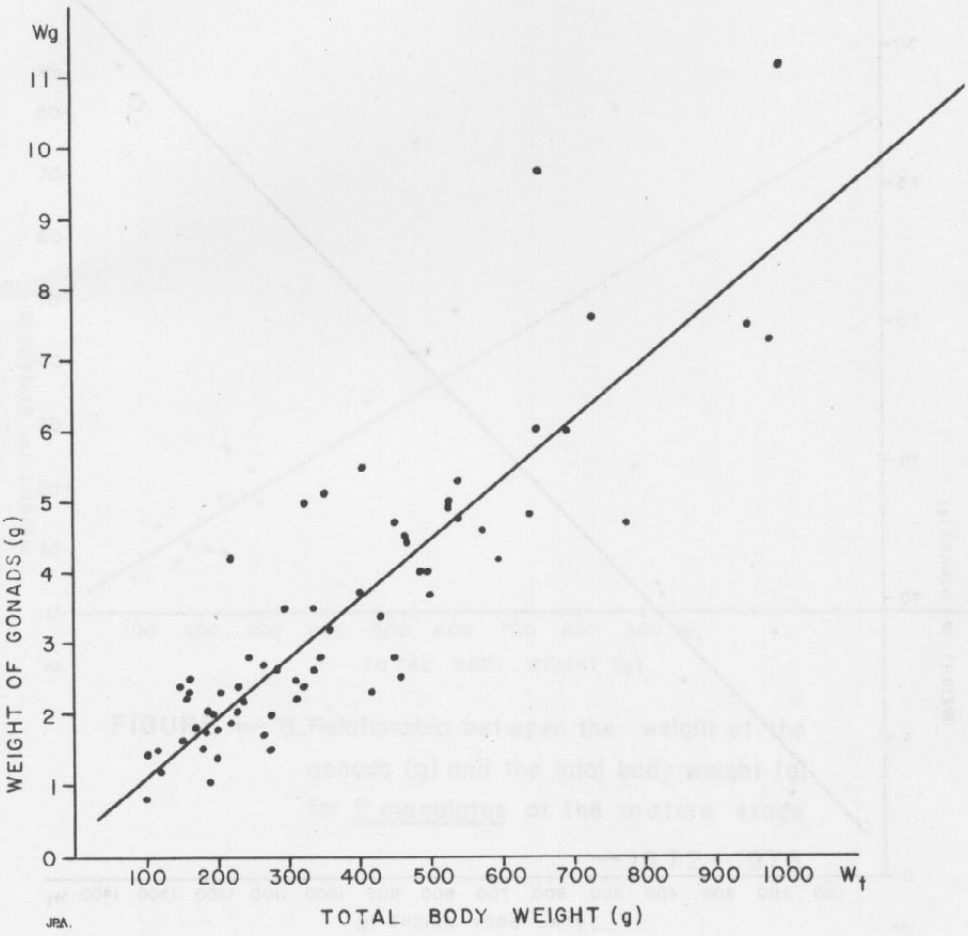


FIGURE — 6. Relationship between the weight of the gonads (g) and the total body weight (g) for P maculatus at the resting stage —1972

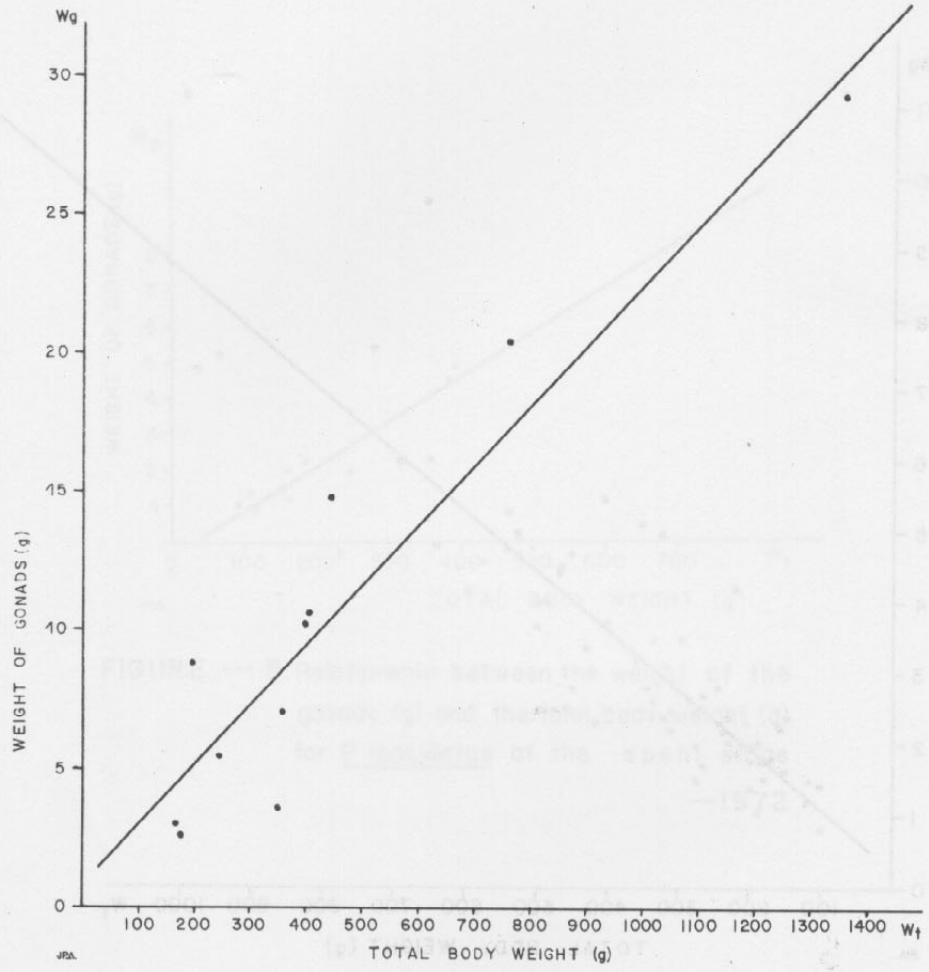


FIGURE — 7. Relationship between the weight of the gonads (g) and the total body weight (g) for P maculatus at the maturation stage —1972

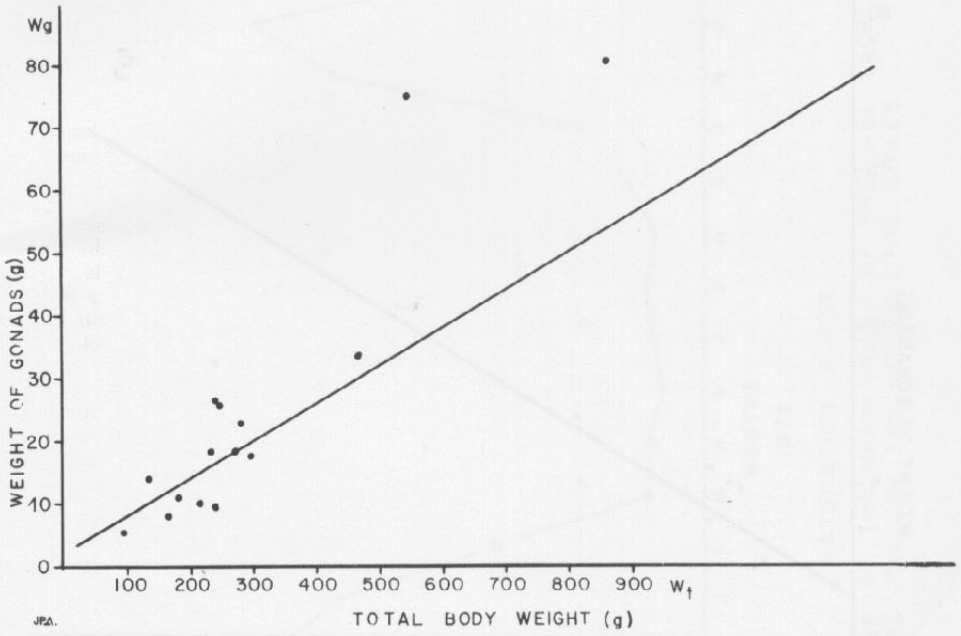


FIGURE — 8. Relationship between the weight of the gonads (g) and the total body weight (g) for P maculatus at the mature stage — 1972—1973

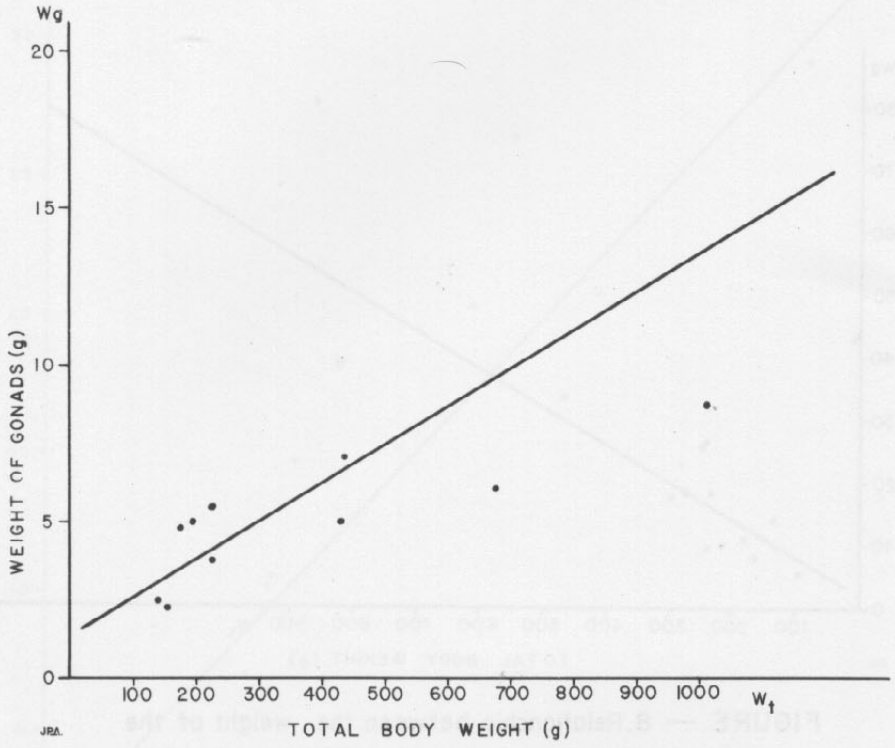
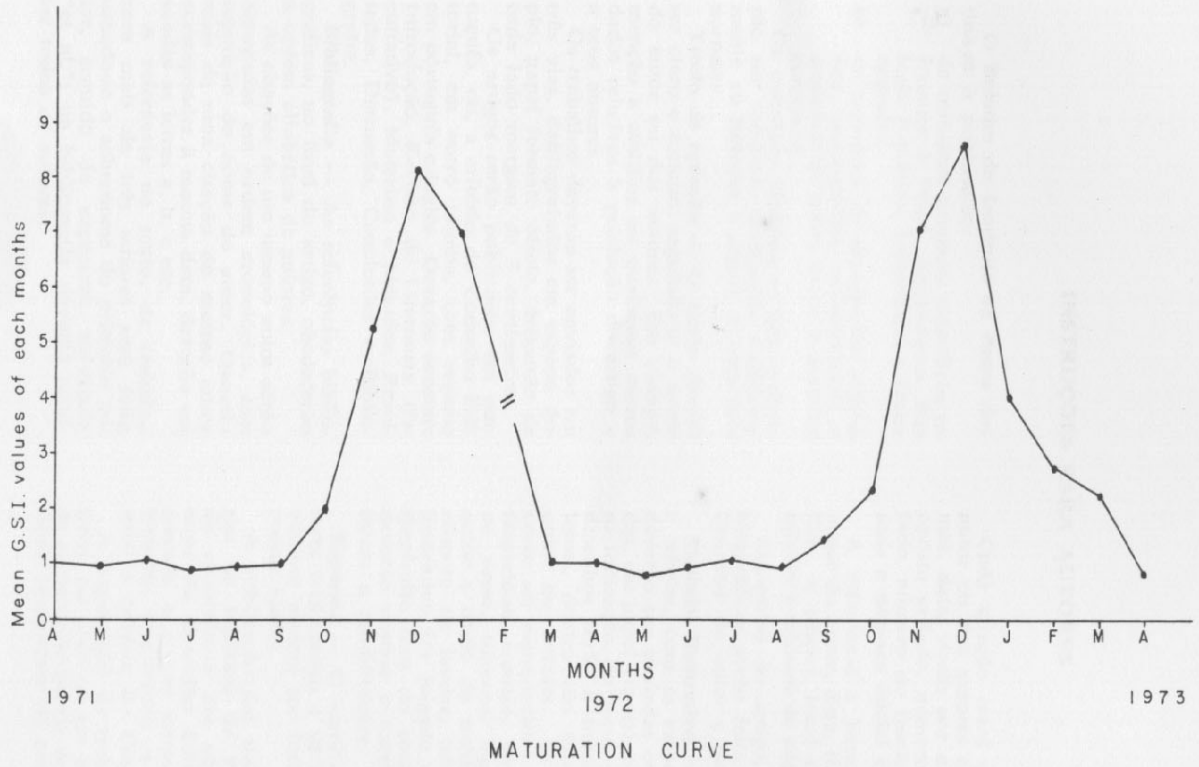


FIGURE — 9. Relationship between the weight of the gonads (g) and the total body weight (g) for P. maculatus at the spent stage —1973



MATURATION CURVE

FIGURE — 10. VARIATION OF THE MEAN VALUES OF THE G.S.I EACH MONTH FOR P. maculatus FEMALES THROUGH TWO REPRODUCTIVE CYCLES

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