



Age and Growth Rate of Gilt Sardine (Sardinella aurita Cuv. et Val.) from the North-West African Waters

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Introduction

Gilt sardine is understood to play a relatively important role in the world's fishery and the catches of it, particularly in waters off North-West Africa, tend to increase steadily. Investigations on this species indicate that there are considerable reserves of this fish in many regions which, until now, have not received due attention or have not been properly exploited.

The purpose of this paper is to determine the age and growth rate of the gilt sardine from North-West African waters during the 1968 to 1970 period. Age and length composition, the period of formation of annual rings on the scale, growth rate in length and weight, length/weight relationship and conditions were studied.

Materials and Methods

A total of 13 434 gilt sardines was investigated. While length measurements (l.t.) were taken for all fish studied, the weight was measured in 3 089 and age determined in 2 836 fish, back-calculations of length growth rate were made for 2 458, length/weight relationship was calculated for 3 089 and conditions were determined in 1 909 fish. The fish investigated had been caught in the region between 14°17'N to 24°51'N and from 17°42'W to the zone regarded as exclusive fishing grounds of Senegal and Mauritania.

The age was estimated from scales taken between the dorsal and pectoral fins. Due to poor legibility, otoliths and opercular bones were used only as comparative material. Back calculations of the length growth-rate were carried out on the scales by the Dahl-Lea method. No corrections were introduced, since it was found that the relation between the oral radius of the scale and the total length of the gilt sardine was quite closely approaching a direct proportionality. (Figure 1).

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Weight increment was calculated by employing the previously determined length/weight relationship.

The condition of gilt sardine was calculated by the Fulton coefficient.

### Results

The length of the investigated fish varied from 18 to 41 cm. The range of length and the numerically predominant length classes differed to a certain degree between years. In 1968 the length was 27 - 40cm with the prevailing length class at 33 cm. In 1969 the length ranged between 19 and 41cm, the class at 34 cm was prevalent. In 1970, the limits of length variations reached 18 and 41 cm and the class that dominated was at 35 cm.

The age was from 2 to 7 years. In 1968, the age group 4 dominated, in 1969 the groups 4 and 3 and in 1970 the groups 5 and 3. In total, the material examined were the groups 4, 3 and 5 which were best represented. The remaining age groups were markedly less numerous.

The period of annual ring formation on the scale was determined by calculating, in appropriate monthly tests, the percentage of fish with the annual ring on the scale fringe. The highest number of such scales was found in fish caught in the period June-November. The peak of that process was observed in August.

Comparing the lengths reached by the highest number of fish in the respective age groups, it was found that in August the gilt sardines are some centimetres shorter than compared with sardines of analogous age groups, but caught in July. This apparent drop in length may be explained by the formation of the annual rings on the scale just in August; and that is the reason why sardines in August were classified into the age groups 1 year higher than in July, while their length in fact underwent no changes. Therefore, the length of 4 year old fish in August is distinctly shorter than that of the 4 year old fish in July, and very much similar to the length of 3 year old individuals in July. It is felt that this way of determining the time of the annual ring formation on the scale may give even better results in the species whose period of annual ring formation is shorter than in the case of the gilt sardine.

The length growth rate in gilt sardine (Figure 2) is highest during its first year of life and in the following years the length increments decrease successively. In the first year of life, the sardines reach a mean length of 16.7 cm, in the seventh year they are 37.3 cm long, thus in the course of six years the sardine's length increases by 2.2 times.

On the basis of back calculations, and without taking into account the length of the first year of life, the parameters of von Bertalanffy's equation were calculated as follows :

$$l = 40.7 \text{ cm}$$

$$l_0 = 0.6283$$

$$k = 0.326$$

The growth curve plotted on the basis of these parameters is almost completely consistent with the results of back calculations. It should be noted that if the length of one year olds were taken into consideration, the parameters of von Bertalanffy's equation would have other values and the first years of life show quite serious differences which appear between the results of the back calculations and the results recorded from the von Bertalanffy equation.

The relationship between the length and the weight was found on the basis of direct measurements of the length and weight of the body which led to the following formula :

$$W_g = 0.01648 L_{cm}^{2.8386}$$

By means of this relationship, the weight growth rate was calculated. The body weight increases in a quite uniform manner (Figure 3), although in the first three years of life, the weight increments are somewhat higher, while in the next years a slight drop can be observed. In the first year of life, the gilt sardine reaches an average weight of 48.7 g, in the second it reaches 475.9 g, thus over a period of 6 years, the sardine's body weight increases almost ten times.

The sardine's condition is varying within the annual cycle. The Fulton coefficient value varied from 0.83 - 0.96. The lowest Fulton coefficient value was noted in December, June and September, the highest in March and July.

### Discussion

The length growth rate in gilt sardines proceeds in a manner typical for species of Clupeidae. Similar results were recorded by Postel (1955) as well as Rossignol (1955) (after Michoński, 1964) for sardines caught in the regions of the Congo, and Senegal. However, the gilt sardine caught close to the Canary Islands (Navarro, 1932, after Michoński, 1964), as well as in the Mediterranean Sea (Maghraby, Botros and Soliman, 1970) show a markedly slower growth rate than those from the region off North-West Africa.

The weight growth rate in the gilt sardine is almost uniform which is in contrast to the majority of fish species, where a considerable acceleration in the weight growth rate is, as a rule, observed during the first years of life, but there is a distinct slowing down by the end of the life.

### References

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- MICHOŃSKI, T., 1964. Sardynia atlantycka (Sardinella aurita) - biologia, rozmieszczenie, połowy na Atlantyku Środkowym. Maszynopis, MIR, Gdynia.

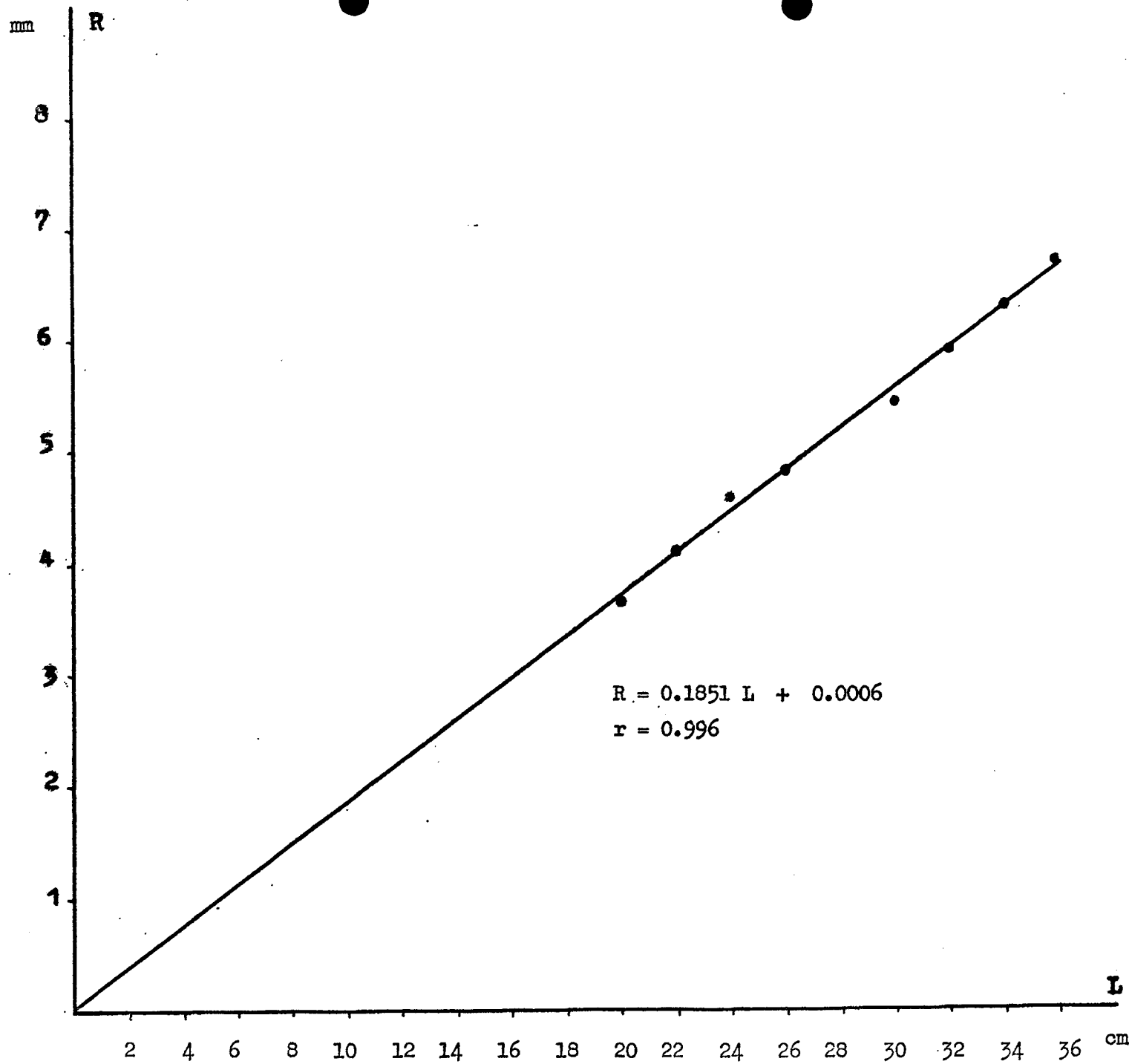


Figure 1. The correlations between scale oral radius (R) and total length (L) of gilt sardine.

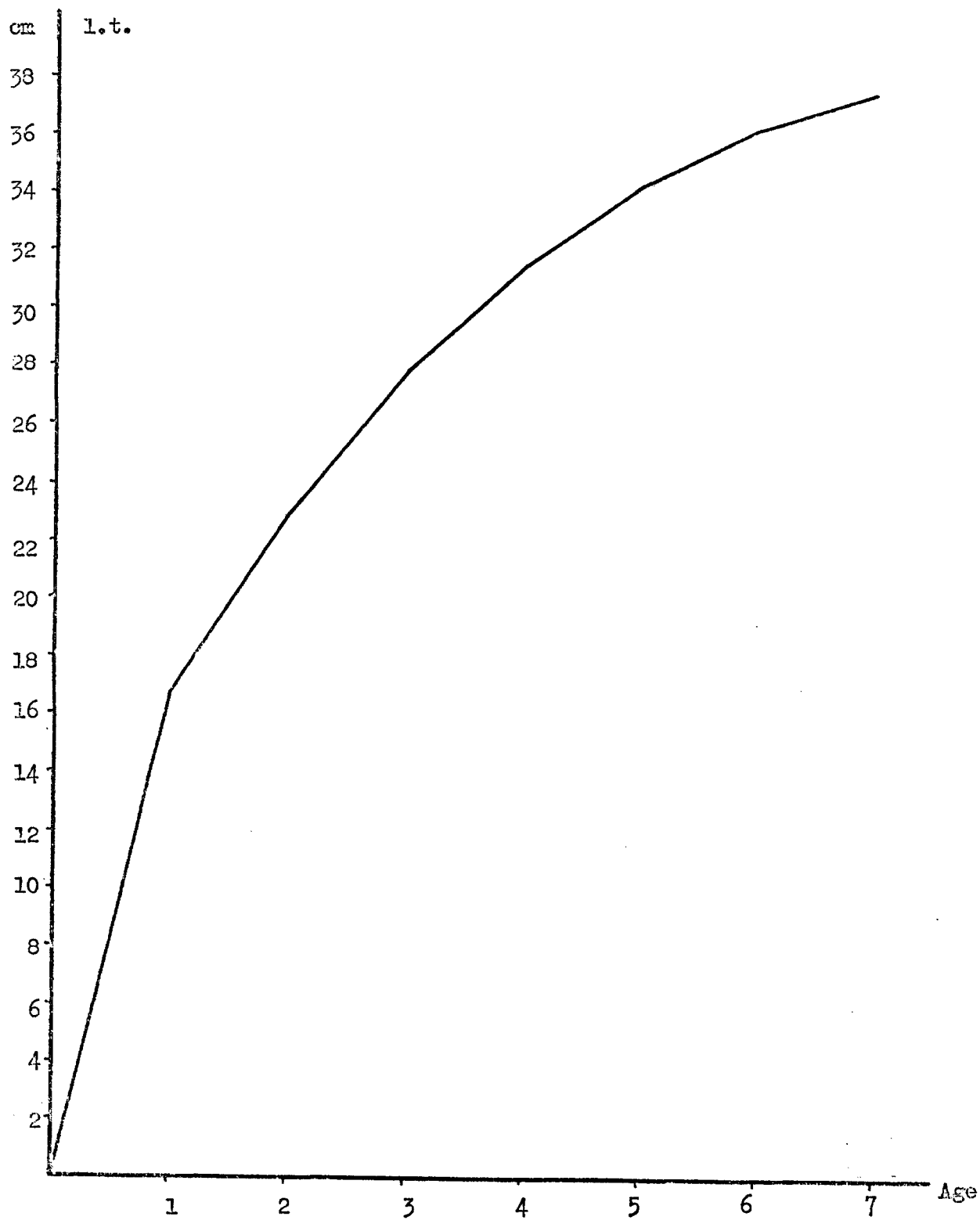


Figure 2. The rate of length growth of gilt sardine.

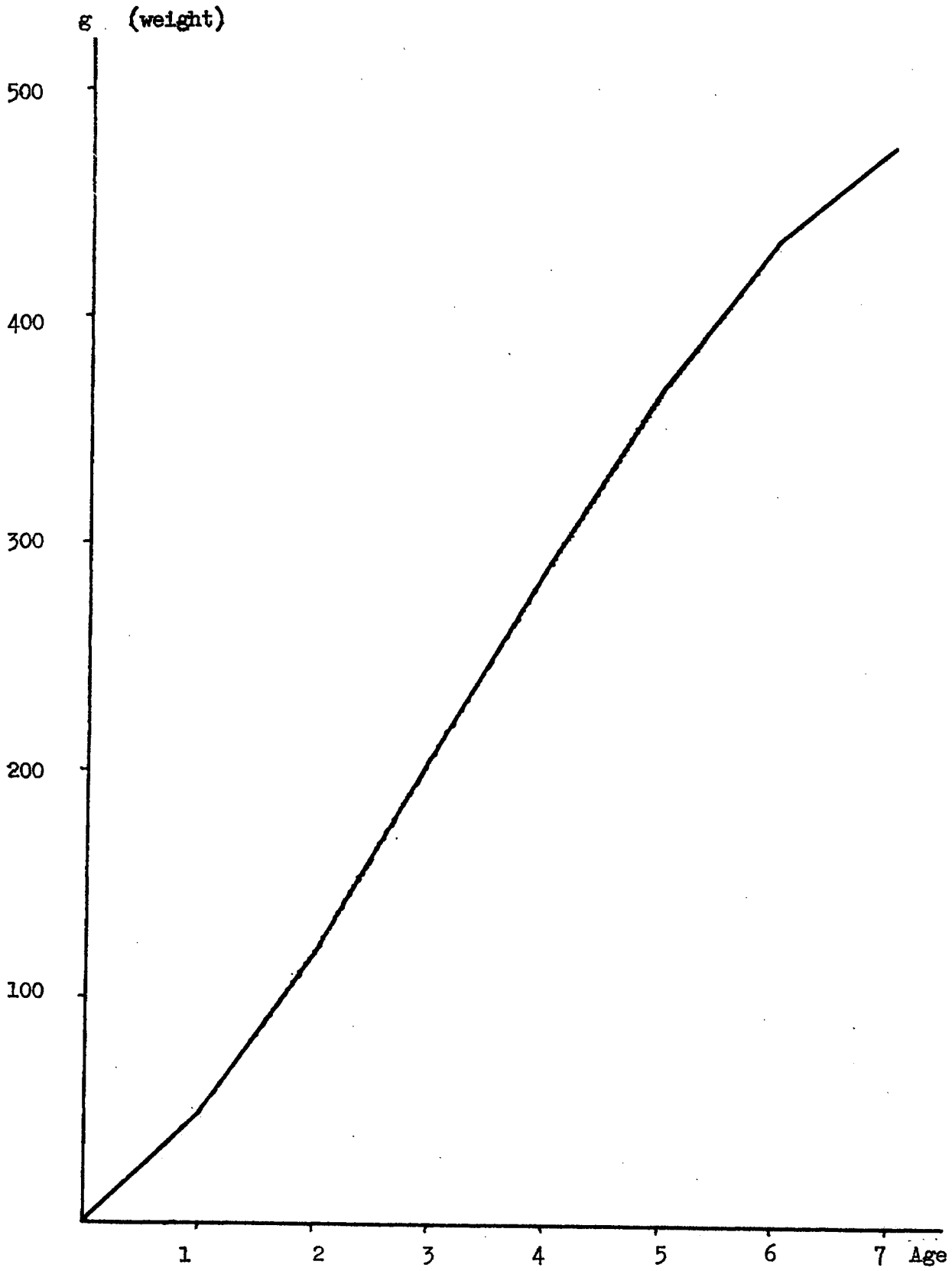


Figure 3. The rate of weight growth of gilt sardine.