Effect of different types of food on growth in captive grouper (*Epinephelus guaza,* L.)

*Effets de différents types d'alimentation sur la croissance en captivité du mérou (*Epinephelus guaza *L.)*

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ABSTRACT

*Castello-Orvay F., A. Fernandez-Vilar, F. Llaurado, R. Vinas, 1992 - Effect of different types of food on growth in captive grouper (*Epinephelus guaza *L.). Mar. Life* **1** *(2) : 57 - 62.*

*The effect of different types of food (EWOS, S.A. pellets, octopus, and half octopus/half mussel mixture) on growth rates G_p and G_t, on the conversion coefficient, on daily feeding ration R (%) and on P.E.R. (Protein Efficiency Ratio) were studied in this species in captivity. We experimented on wild grouper juveniles (*Epinephelus guaza *L) captured near the coast of the Maresme (Barcelona) over a period of ninety days. We used twelve 120-litre aquaria and nine 400-litre tanks. After a 3-week acclimatization period at 22°C and 36 g/l salinity, we began the experiment. The juveniles were fed "*ad libitum*" twice a day, except the day before weighing. The photoperiod was maintained at fifteen hours of light. The fish fed on artificial food showed a greater rate of growth after 82 days of experimentation ; a conversion coefficient of 1.2 was achieved in this case.*

RÉSUMÉ

*Castello-Orvay F., A. Fernandez-Vilar, F. Llaurado, R. Vinas, 1992 - Effets de différents types d'alimentation sur la croissance en captivité du mérou (*Epinephelus guaza *L.). Mar. Life* **1** *(2) : 57 - 62.*

*L'effet de différents types d'alimentation (granulés EWOS, S.A. poulpe, et mélange moitié poulpe moitié moule, sur les taux de croissance G_p et G_t sur le coefficient de conversion, le taux d'ingestion journalier R (%) et le P.E.R. (Protein Efficiency Ratio) a été étudié sur cette espèce en captivité. L'expérimentation a duré 90 jours sur des alevins de mérou sauvages (*Epinephelus guaza *L.) capturés sur la côte de Maresme (Barcelone). 12 aquariums de 120 litres et 9 bassins de 400 litres ont été utilisés. L'expérience a débuté après une période de 3 semaines d'acclimatation : eau à 22°C et 36 g/l de salinité. Les alevins ont été nourris "*ad libitum*" deux fois par jour, sauf le jour précédant les pesées. La photopériode à été maintenue à 15 heures de lumière par jour. Les poissons nourris avec des granulés montrent un taux de croissance supérieur après 82 jours d'expérience ; le coefficient de conversion s'est élevé à 1,2 dans ce cas.*

INTRODUCTION

The dusky grouper (*Epinephelus guaza* L.) is a species held in high esteem in the Mediterranean. Traditional exploitation techniques, diving and other environmental factors resulting from human activity have caused a sharp decrease in numbers, and indeed the occurrence of this species along our coasts is becoming rare.

Over the last six years, however, grouper juveniles along the Maresme coast in the province of Barcelona have shown a marked increase in numbers. With the help of Acuacultivos, S.A. we obtained numerous specimens. The aim of our research study was to examine the effect of three different types of food on the growth of small individuals. The breeding parameters that we used for our biological evaluation of the food were : rate of growth (weight and size) (G_p and G_t) daily intake coefficient (R %), Protein Efficiency Ratio (PER), Condition Factor (CF), conversion efficiency (K %) and conversion coefficient (CC).

MATERIAL AND METHODS

. *Fish* : two samplings were carried out, one in May 1990 and the other in February 1991 . We obtained 190 specimens, whose weight ranged from 7 to 16 g (*see figs 1 and 2*).
They underwent a period of acclimatization in our tanks, in sea water, and with structures that allowed them to hide.
. *Food* : at the beginning we used fresh food consisting of octopus and mussel ; when we saw that the food was accepted, we changed part of the fish to artificial feeding - A pellet produced by EWOS, S.A., initially with a protein concentration of 52 %, and three weeks later of 49 %. This food was immediately accepted. Feeding was *ad libitum* twice a day except the day before weighing. The amount consumed was monitored each time.
. *Installations and water* : fish were kept in 120 l aquaria for the first half of the experiment and later in 400 l tanks. The sea water was aerated by diffusors/sprayers and filtered continuously through a

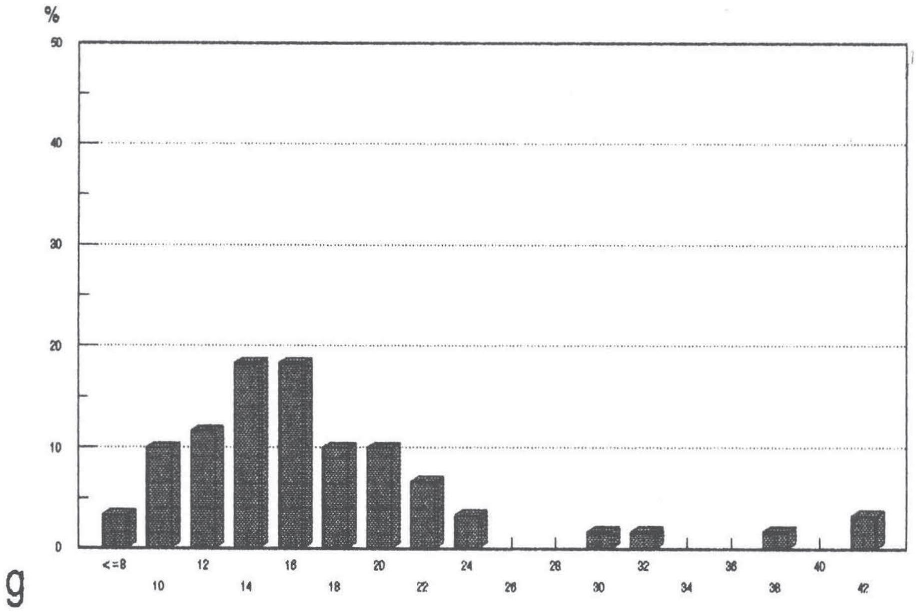

Fig. 1 : Weight histogram : May 1990 catches./*Histogramme des poids : captures du mois de mai 1990.*

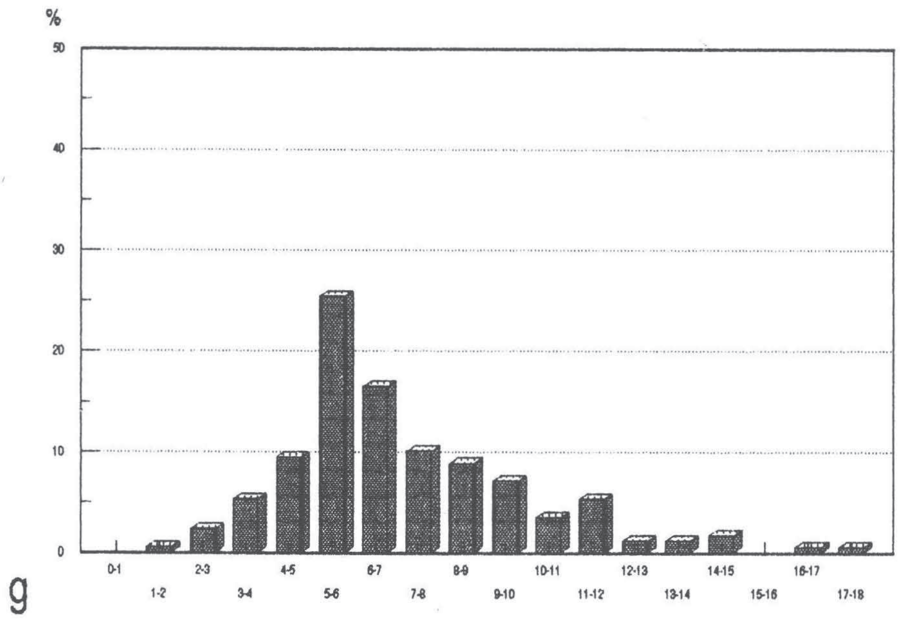

Fig. 2 : Weight histogram : February 1991 catches./*Histogramme des poids : captures du mois de février 1991.*

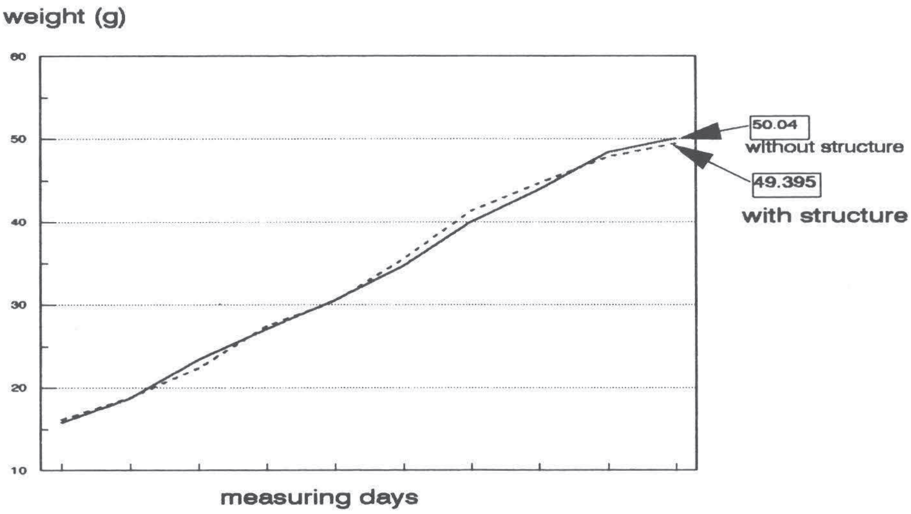

Fig. 3 : Effect of the use of structures in weight evolution./*Effet de l'utilisation d'installations sur la croissance.*

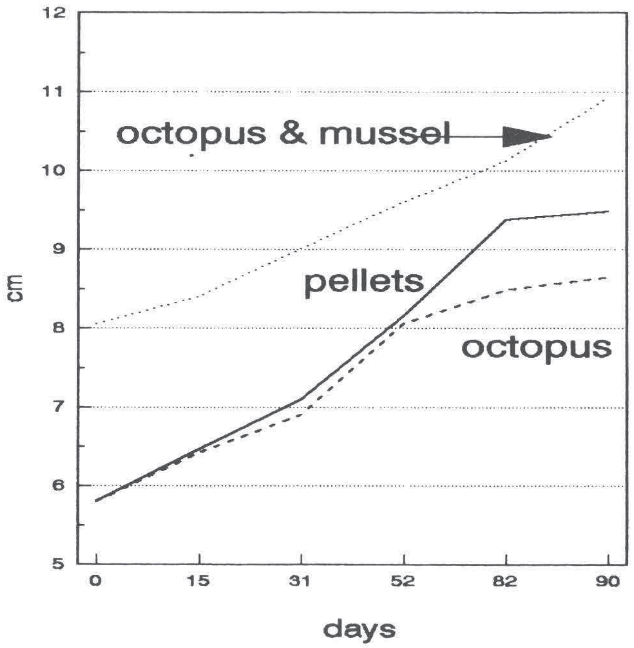

Fig. 4 : Growth in length./*Croissance en longueur.*

closed circuit of 400 l/h. We used a filtrant volume of 5 l of sand and 5 l of active carbon per tank. Salinity was maintained at 35 - 36 g/l. The water was completely renewed once a month.

. *Breeding conditions* : the photoperiod was maintained at 15 hours of light. The parameters temperature, O_2 and S ‰ per day were monitored. Once a week we took ammonium nitrogen values, which were always less thas 4 ppm due to the action of the filters and the water.

20 cm long PVC tubes with 6-10 cm apertures were the structures provided for the fish to hide. The fish fed on octopus and mussel were divided into two groups and one of them was not given these structures, to see if this feature had an effect on growth (*see fig. 3*).

. *Measurements* : we took data on biometrics, weight, standard length (L st) for each specimen every 15 days (*figs 4 et 5*). The fish were anaesthetized with MS 222 1 : 30 000.

. *Data treatment* : we used Microstat statistical analysis software to examine homogeneity in each of the groups : fish fed with pellets, octopus, octopus and mussel (P>0.05 ONE WAY ANOVA) ; statistical verifications were carried out for each of the biometrical variables studied.

The biological value of the food was expressed in the different parameters calculated from data on growth (*see fig. 6*).

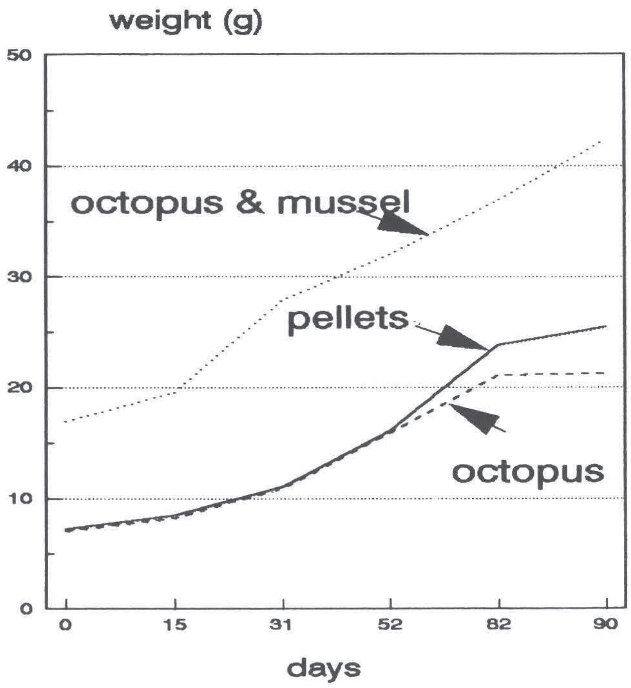

Fig. 5 : Growth in weight./*Croissance en poids.*

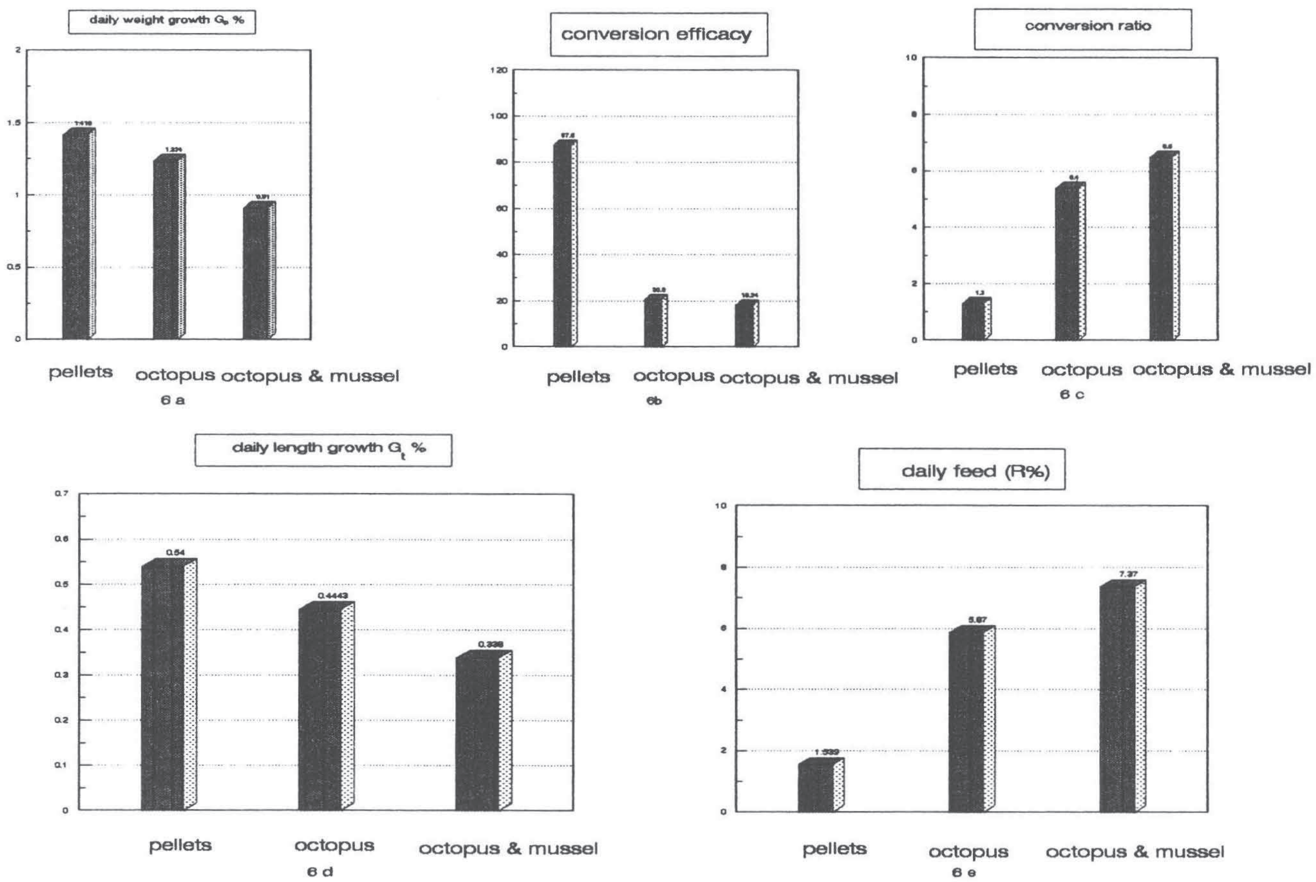

Fig. 6a : Gp, rate of growth in weight (% /day). $G_p (\%) = \frac{\text{Ln } W_f - \text{Ln } W_i}{\text{Temps}} * 100.$ / G_p *taux de croissance en poids (% /jour)*· $G_p (\%) = \frac{Ln\ W_f - Ln\ W_i}{Temps} * 100.$

Fig. 6b : K (%), conversion efficiency·$K (\%) = \frac{G_p (\%)}{R (\%)} * 100.$ / *K (%), efficience de conversion.* $K (\%) = \frac{G_p (\%)}{R (\%)} * 100.$

Fig. 6c : CC, conversion coefficient. $CC = \frac{\text{food ingested (g)}}{\text{growth (g)}}$ / *CC, coefficient de conversion.* $CC = \frac{\text{aliment ingéré (g)}}{\text{croissance (g)}}$

Fig. 6d : Gt rate of growth in length (% /day). $G_t (\%) = \frac{\text{Ln L st}_f - \text{Ln L st}_i}{\text{Days}} * 100.$ / G_t *taux de croissance en taille (% /day)* $G_t (\%) = \frac{Ln\ L\ st_f - Ln\ L\ st_i}{Temps} * 100.$

Fig. 6e : R (%) rate of daily intake $R (\%) = \frac{\text{food ingested (g)}}{1/2 (W_f + W_i) * \text{Days}} * 100.$ / *R (%) taux d'ingestion journalière* $R (\%) = \frac{\text{aliments ingérés (g)}}{1/2 (\text{Poids}_f + \text{Poids}_i) * \text{Jours}} * 100.$

RESULTS AND DISCUSSION

Comparison of the first two groups (pellet and octopus) shows significant differences ($P<0.05$ *"T STUDENT"* MEAN HYPOTHESIS TEST)) after 82 days of the experiment. We note that growth is affected quantitatively and qualitatively (that is, there are rhythmical and allometrical variations) in the case of feeding based only on octopus (*see table 1*).

We saw a clear difference between growth rates of G_p and G_t, with pellet giving the better results (*see table 1*). The Condition Factor calculated at the end of the experiment is higher in the case of octopus-fed fish ; they present more rounded morphologies than the others. Individuals fed octopus were longer and thinner ; this is also the case of fish at more advanced stages of growth, such as those fed octopus and mussel. Differences in Condition Factor can be seen from the regression study L st - weight (reduced major axis method) (Bruslé, 1985) :

Log Weight = A Log L st + B

Food	OCTOPUS	PELLET	OCTOPUS & MUSSEL
r	0.9756	0.9482	0.9919
st error	0.086	0.083	0.0169
A	2.816	2.553	2.988
B	-1.3372	-1.1092	-1.5415

OCTOPUS : weight : $0.046\ L\ st^{2.816}$
PELLET : weight : $0.079\ L\ st^{2.553}$
OCTOPUS & MUSSEL : weight : $0.028\ L\ st^{2.988}$

Table 1 : Comparison of three types of different foods on the growth of the grouper (*Epinephelus guaza* L. 1758). /*Comparaison de trois types d'alimentation sur la croissance du mérou (E. guaza* L. *1758*).

Culture Conditions		Temperature	22°C
		Salinity	36 ppt
		Photoperiod	15h light
Food	**Pellets**	**Octopus**	**Mussel & Octopus**
Initial Data			
Total Weight	795.7	397.2	161.86
Average	7.104	6.975	16.19
Standard Deviation	2.890	2.567	4.067
Average Stnd. Length	5.810	5.797	8.05
Standard Deviation	0.789	0.760	0.856
Factor Condition	3.622	3.580	3.103
Final Data			
Total Weight	2673.11	1186.1	331.63
Average	25.416	21.180	36.85
Standard Deviation	8.626	8.615	9.344
Average Stnd. Length	9.478	8.647	10.92
Standard Deviation	1.121	1.151	0.9
Condition Factor	2.980	3.275	2.829
Rate of Growth in Weight Gp (%)	1.416	1.234	0.91
Rate of Growth in Length Gt (%)	0.54	0.444	0.338
Conversion Coefficient	1.3	5.4	6.5
Daily Intake Coef. R.	1.539	5.87	7.37
Protein Efficiency Ratio (P.E.R.)	1.5	1.85	
Conversion Efficiency (K %)	92	21	12.397

Note : weight/g ; length/cm

With the octopus and mussel-fed fish, the growth rate is relatively low, as those fish are at later stages of growth. There are no significant differences related to the presence or absence of structures to enable fish to hide (*see fig. 3*). In spite of this, it would be interesting to see what happens with larger sizes of fish, as dominance and inhibition phenomena may be important. The presence of holes for hiding, or separation by size may affect the average growth or the histograms of the population. In this last respect, the nature of the food does not seem to affect the final weight distribution.

FINAL RESULTS : PELLET OCTOPUS OCTOPUS & MUSSEL
s.d. ± 8.626 ± 8.615 ± 9.344

The differences observed in R (%), K (%) and the conversion coefficient correspond to the degree of dehydration of the pellet (13 %) compared with the fresh food (over 90 %) (*table 1, fig. 1*). The high level of acceptance of the artificial food is shown in the PER, very similar to the figure for fresh food. In addition, the data from wild grouper caught at different times (*see figs 1 and 2*) seem to show a daily growth rate G_p of 1.3 over a 2-month period (from 7 to 16 g).

CONCLUSIONS

Results are positive as far as the adaptability of the grouper (*Epinephelus guaza,* L.) to dry pellet food is concerned. The conversion coefficient is highly acceptable and similar to that of bass (*Dicentrarchus labrax*) or of gilthead (*Sparus auratus*) in captivity. The grouper's social activity during intensive growth does not present problems, but may become an important factor which deserves study at later stages. Our data on wild grouper are only a reference for comparing the results obtained with a model of natural growth. We would need to make a constant and periodic study over several seasons to be able to confirm this model. We consider the specimens obtained during spring correspond to the new generation, and so we estimate their age at 8-10 months, since sexual maturity is reached in summer (Dieuzeide, 1954 ; Döderlein, 1882 ; Lalami, 1971 ; Domain, 1979 and 1980).

Chauvet (1981) established the law of growth :

$LT_t=113\ (1 - e^{-0.099(t+0.076)})$ (LT=L st + L caudal peduncle) ;

with the relation $W = 0.00738\ LT_{3.157}$ (Bruslé & Prunus, 1980) we estimate the weight of a one-year old grouper at 17.084 g. This figure is lower than that obtained in our installations at the end of the experiment (*see Final Results for twelve-month-old specimens*). These mathematical relations also give weights lower than those of wild grouper caught ; we believe, however, that the growth of this species over the first months is strongly influenced by environmental factors such as temperature and by the exploitation of highly productive systems. We do not know where these systems come from, but they are present in large numbers in

Acuacultivo S.A.'s oyster-catching installations in the Maresme, very near a deeper artificial reef, where the mature population is possibly to be found. Future observations will help us not only to understand the form of natural growth (in the particular conditions of this coastal region) but also to find an explanation for this apparent demographic explosion and to stress the importance of artificial reefs and underwater structures as reinforcing agents of this process.

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