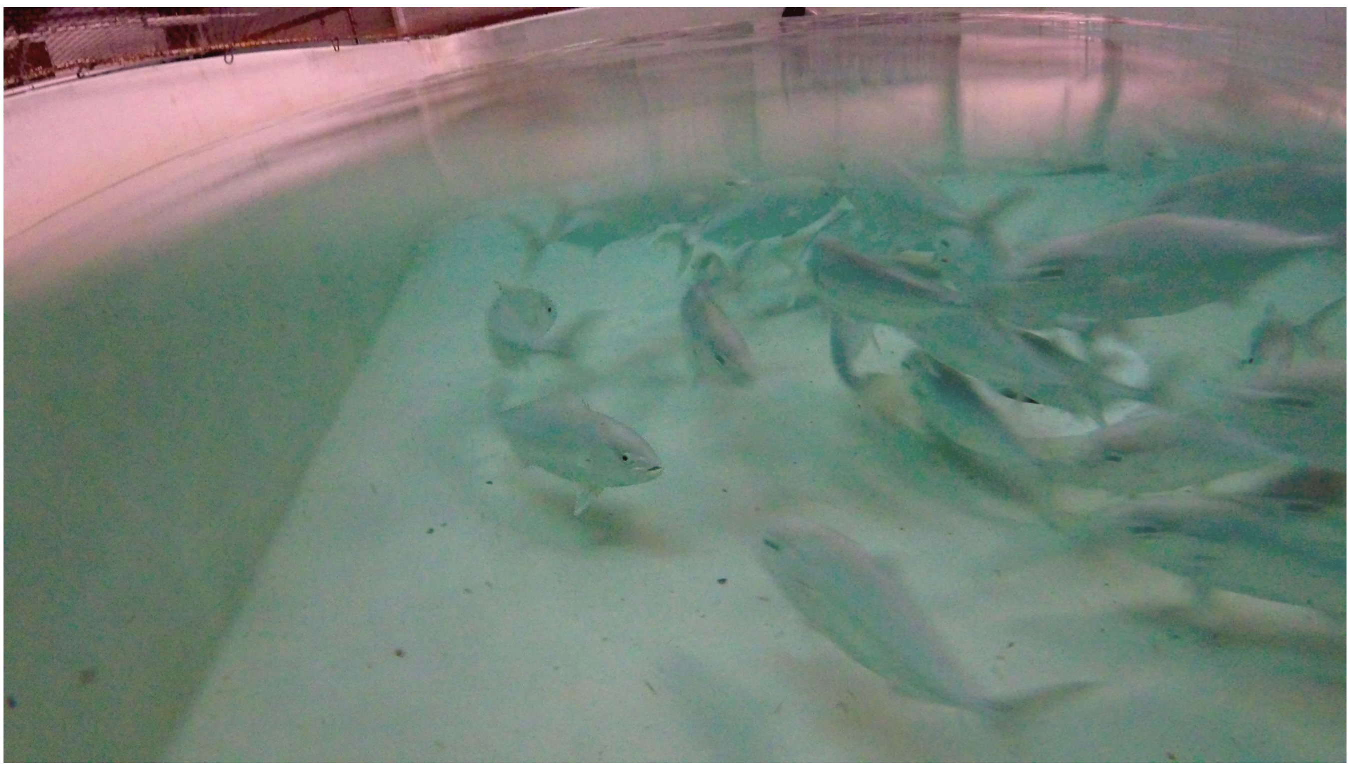
Evaluation of different feeding frequencies in the growth of greater amberjack juveniles

By Salvador Jerez Herrera, Centro Oceanográfico de Canarias, Instituto Español de Oceanografía, Tenerife, Islas Canarias, Spain.



Feeding the right way is fundamental to improve the growth performance and condition of reared greater amberjack, reduce the feed cost and prevent environmental deterioration.

Greater amberjack (*Seriola dumerili*) has recently attracted much attention and has been recognized as one of the more promising candidates to help diversify finfish aquaculture production. It is expected to increase in future production based on the successful progress achieved in recent years and due to the relevant results obtained in the recently concluded DIVERSIFY project.

The use of appropriate feed management strategies results in higher growth rates, improved feed efficiency and less feed wasted with the consequent economic and environmental advantages. There are a few previous studies on frequency and ration effects on greater amberjack growth performance (De la Gandara *et al*., 2004; Jerez, 2013), but the information is scarce. The results obtained during the project DIVERSIFY related to parameters that affect the use of feed on the farm (temperature, feeding rates, stocking densities) are of great importance for the industrial production of this species (Mylonas *et al*., 2019).

The present study was conducted in the frame of the project DIVERSIFY to investigate the effects of different feeding frequencies in larger greater amberjack juveniles (> 250 g). During the trial, fish growth performance and feed efficiency were evaluated.

Fig. 1. Facilities of IEO in Tenerife, Canary Islands (COC).

Fig. 2. Greater amberjack hand-fed.

Growth trial

One hundred and eighty greater amberjack juveniles (~250 g and 23.0 cm, initial body weight and length, respectively) produced in the facilities of the Centro Oceanográfico de Canarias (Instituto Español de Oceanografía) in Tenerife, Spain, were divided into 12 homogeneous groups and reared with a constant water exchange and aeration and under natural photoperiod, salinity and temperature during four months.

Triplicate fish groups were fed daily *ad libitum* with a commercial turbot diet (3-5 mm diameter; Skretting Ltd, Norway; 52 % crude protein and 20% crude fat) at a feeding frequency of 1 (08:00 h), 2 (08:00 and 18:30 h), 3 (08:00, 13:30 and 18:30 h) and 7 (08:00, 10:00, 12:00, 13:30, 15:00, 17:00 and 18:30 h) meals day^{-1}. The daily feed intake was calculated (FI).

Fish were sampled and weight gain (WG, g), percentage of weight gain (% WG, %), coefficient of variation for weight (CV, %, standard deviation by mean weight), feed conversion ratio (FCR, feed consumed by biomass produced) and condition factor (K, g cm^{-3}, body weight by cubic length) were estimated. Five fish at the beginning and six fish per treatment at the end of the trial (120 days) were slaughtered and hepatosomatic (HSI, %) and viscerosomatic index (VSI, %) were used as production performance indices.

Results

During the experiment, average DO was 92.4 ± 4.8 % (7.1 ± 0.4 mg O2 l^{-1}), and temperature decreased from 19.4 ºC to 18.1 ºC throughout the experiment (mean ± S.D. temperature of 18.8 ± 0.4 ºC).

In this study, greater amberjack juveniles fed 1 meal day^{-1} showed a lower final body weight (by 392 g) than the other three feeding strategies (2, 3 and 7 meals day^{-1}). However, the different feeding frequencies did not affect body weight variations of fish (P > 0.05), although fish fed 1 and 7 meals day^{-1} showed the higher coefficient of variation (CV) (Table 1).

The WG of fish fed 1 meal day^{-1} was lower (by 117 g) than the one shown by fish fed 2, 3 and 7 meals day^{-1}, which presented a percentage of weight gain of 53.3, 57.6 and 60.7 %, respectively, values between 10 and 17% higher than showed by fish fed 1 meal day^{-1} (by 43 %) (Table 1).

Fish fed 1 meal day^{-1} showed a significantly lower condition factor (K) compared to 7 meals day^{-1} (P < 0.05) at the end (120 days). Also, hepatosomatic index (HSI) was lower in 1 meal day^{-1} respect to 3 meals day^{-1} (P < 0.05) (Table 2).

Furthermore, fish fed 1 meal day^{-1} showed a marked decrease of K (13.7 %) and HSI (61.2 %) respect to the initial indices (2.12 ± 0.09 and 1.27 ± 0.14, for K and HSI, respectively). However, viscerosomatic index (VSI) was similar regardless of the feeding strategy and decreasing between 46.8 and 43.2 % respect to the initial value

Table 1. Initial and final body weight (g), and coefficient of variation (CV, %) of body weight of greater amberjack juveniles fed at 1, 2, 3 and 7 meals day^{-1} after 120 days. The data presented are mean ± S.D. of the 3 replicates.

Treatment	Initial Body Weight (g)			Final Body Weight (g)			CV (%)		
1 meal day^{-1}	266.3	±	9.4	392.2	±	32.6	19.6	±	6.0
2 meal day^{-1}	260.6	±	7.1	399.6	±	15.8	17.5	±	2.7
3 meal day^{-1}	256.0	±	14.6	404.9	±	11.6	17.5	±	3.0
7 meal day^{-1}	260.7	±	14.4	409.7	±	30.8	18.8	±	8.9

Table 2. Condition factor index (K; g cm^{-3}), hepatosomatic (HSI; %) and viscerosomatic index (VSI; %) and percentage of decrease with respect to the initial value of greater amberjack juveniles fed 1, 2, 3 and 7 meals day^{-1} after 120 days. The data presented are means of the three replicates. Different letters indicate significant differences (P < 0.05).

Treatment	K		Change vs. initial	HSI		Change vs. initial	VSI	Change vs. initial
	(g cm^{-3})		(%)	(%)		(%)	(%)	(%)
1 meal day^{-1}	1.83	b	13.7	0.49	b	61.2	3.19	45.7
2 meal day^{-1}	1.89	ab	11.3	0.68	ab	46.6	3.35	43.2
3 meal day^{-1}	1.83	ab	12.4	0.73	a	42.7	3.20	45.6
7 meal day^{-1}	1.91	a	11.2	0.69	ab	45.1	3.14	46.8

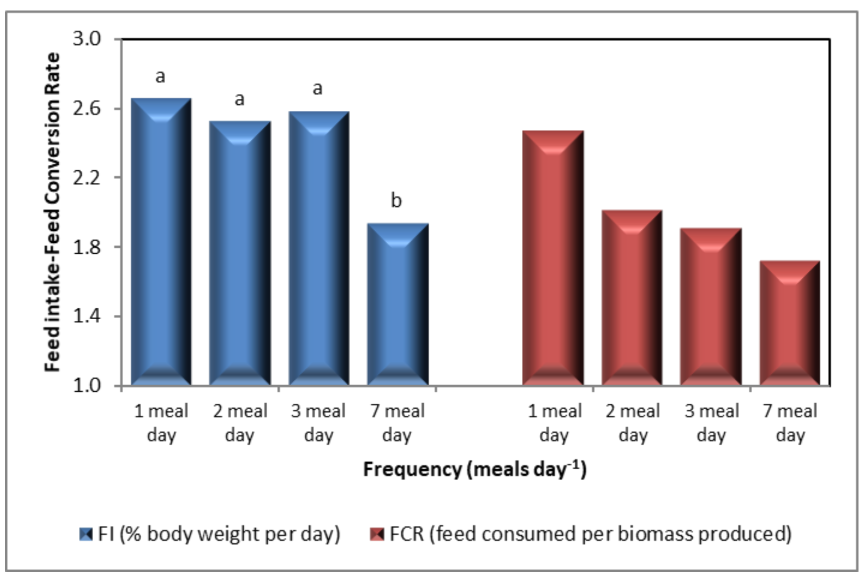


Fig. 4. Feed intake (FI) and feed conversion rate (FCR) of greater amberjack juveniles fed 1, 2, 3 and 7 meals day^{-1} after 120 days. The data presented are means of the three replicates. Different letters indicate significant differences (P < 0.05).

(5.89 ± 0.79).

Fish fed 1 meal day^{-1} showed the higher feed intake (FI), about 37% more feed compared to fish fed 7 meals day^{-1} (Fig. 2). Furthermore, they showed the worst food efficiency, resulting in reduced FCR (by 2.5 %).

For larger greater amberjack juveniles (> 250 g), the better results in growth performance and feed conversion rates were obtained when fish were fed from 2 to 7 meals day^{-1}. The findings of the current study have practical significance for establishing greater amberjack rearing practice. Furthermore, a technical "production manual" for greater amberjack has been also released by the project and is freely available in the project's website. It can be used by the industry to continue the study of the potential of greater amberjack as an alternative marine species for European warm-water aquaculture.

References available on request.

Acknowledgments

The project DIVERSIFY was funded by the European Union's Seventh Framework Program for research, technological development and demonstration (KBBE-2013-07 single stage, GA 603121, DIVERSIFY). Exploring the biological and socio-economic potential of new/emerging candidate fish species for expansion of the European aquaculture industry, six new/ emerging finfish species were identified with a great potential for the expansion of EU aquaculture. This EU funded project, which started in 2013, achieved all its objectives in the greater amberjack research. The knowledge achieved let greater amberjack to be considered as a feasible farmed species for the aquaculture industry.

Salvador Jerez Herrera
Senior Researcher
IEO, Centro Oceanográfico de Canarias, Spain
E: salvador.jerez@ieo.es
https://www.diversifyfish.eu.