

# A Cage Culture Trial of *Siganus randalli* on Guam

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**Abstract** - Rabbitfish (Siganidae) are a highly valued food fish in Micronesia and the Indo-western Pacific in general. This paper presents the first known cage culture growth trial of *Siganus randalli*, a newly described species. The fish grew in average weight from 13.6 to 121.7 g in 112 days at densities ranging from 25 to 50 fish per m<sup>3</sup>.

Rabbitfish (Siganidae) are a traditional and highly valued food-fish in the Indo-western Pacific. Work with a newly described species, *Siganus randalli* (Woodland 1990), is currently being conducted by the University of Guam's Marine Laboratory at the Department of Commerce's Guam Aquaculture Development and Training Center (GADTC). This species is considered to be one of the more promising rabbitfish candidates for aquaculture in Micronesia (Nelson, pers. comm.) Preliminary work on induced spawning and the subsequent successful raising of larvae through metamorphosis provided the opportunity to evaluate the growth rate of this species. Nelson et al. (1992) recently reported the results of some preliminary growth trials in ponds. The fish grew in average weight from 9.5 to 100.2 g in 85 days on Guam before they were lost to flooding from a typhoon.

On 12 December 1991, a group of 134 *S. randalli* juveniles which had been spawned and raised by Nelson at the GADTC hatchery to 93 days of age were anesthetized, weighed and measured. These fish were then acclimatized for 9

days in two 0.9-m<sup>3</sup> cages in a raceway. The surviving 128 fish were randomly placed in one of four 0.9-m<sup>3</sup> PVC-framed, half-inch plastic mesh cages. Two cages had "low" densities, i.e., 20 and 28 fish, and two cages had "high" densities, 40 fish each. The cages were placed on concrete construction blocks to raise them off the bottom and to prevent fouling, at the lower (deeper) end of a large raceway. The effective volume of each cage was 0.8 m<sup>3</sup>. The water exchange rate was kept as close as possible to 100% per day. Fish in each cage were fed by placing a commercial pelletized feed in a feeding tray placed on the bottom of each cage. The ration was determined as a percentage of the total weight of fish in each cage per day. This estimate was based on the cage weight at the start of a four-week period. Whenever there was excess food in two cages for more than two days, the feeding ratio was reduced by a percentage point. A commercial catfish feed (36% protein) was originally used by itself. Eventually this was supplemented with an addition of 7.5 g/fish/day of *Enteromorpha* spp., a green filamentous algae that the fish eat in the wild and which is readily available on the reef flat before the annual recruitment of juvenile rabbitfish in late spring. Low and high temperatures, oxygen levels and salinity were recorded daily and are summarized in Fig. 1. The growth trials began on 21 December 1991 and lasted until 14 April 1992, a total of 112 days.

After the initial mortalities during the conditioning period, survival was excellent. No fish were lost to natural mortalities. A total of 124 fish remained at the end of the experiment. Water quality data are shown in Fig. 1.

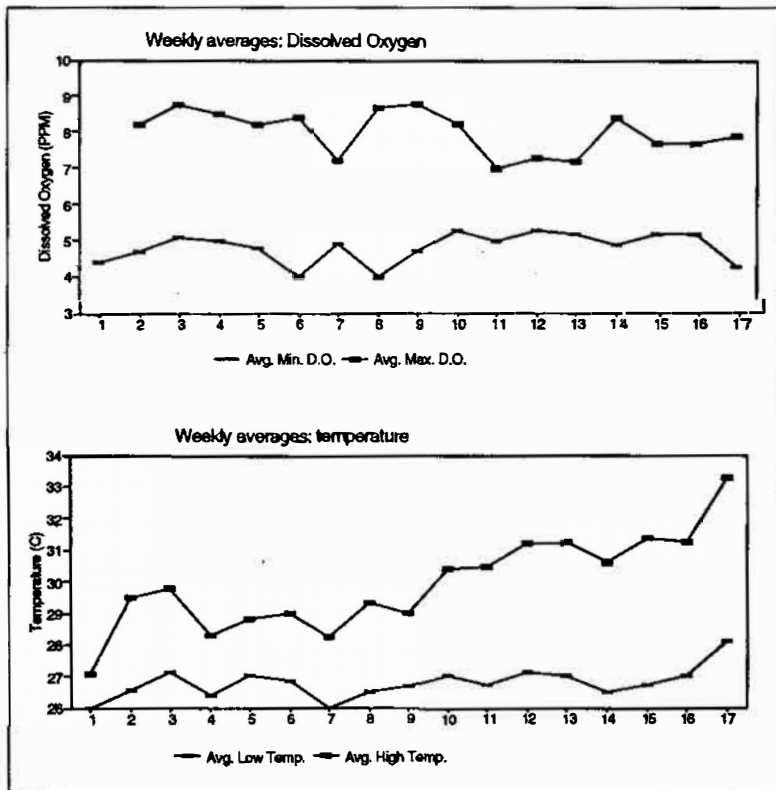


Fig. 1. Water quality parameters during the 112-day growth trial of *S. randalli* at GADTC, Mangilao, Guam.

Growth is summarized in Table 1. The fish initially weighed an average of 13.6 g and averaged 121.7 g at the conclusion of the experiment. This is an average weight gain of 0.97 g per day. The specific daily growth rates (calculated as  $[\text{final weight}/\text{initial weight}]^{1/\text{days}-1}$ ) generally declined as the fish grew. The overall specific growth rates from the four consecutive 28-day growth periods were 2.6, 2.5, 1.2 and 1.6 percent body weight per day. The fish averaged 2.0 percent body weight gain per day for the entire period.

Table 1. Results of a 112-day growth trial of *S. randalli* at the Guam Aquaculture Development and Training Center.

	Cage 1	Cage 2	Cage 3	Cage 4	Total
Initiated experiment 12/21/91					
Cage total weight*	258.8	489.7	588.7	409.7	1,746.9
Number of fish	20	40	40	28	128
Mean weight	12.9	12.2	14.7	14.6	13.6
Fish growth sample 1/18/1992					
Cage total weight	554.2	1,039.9	1,197.7	742.5	3,534.3
Number of fish	20	40	40	26	126
Mean weight	27.7	26.0	29.9	28.6	28.1
Specific daily growth**	2.8	2.7	2.6	2.4	2.6
Second growth sample 2/15/1992					
Cage total weight	1,189.9	2,212.4	2,230.8	1,447.2	7,080.3
Number of fish	20	40	40	26	126
Mean weight	59.5	55.3	55.8	55.7	56.2
Specific daily growth	2.8	2.7	2.2	2.4	2.5
Third growth sample 3/14/1992					
Cage total weight	1,772.9	2,776.6	3,135.6	2,059.9	9,745.0
Number of fish	20	38	40	26	124
Mean weight	88.6	73.1	78.4	79.2	78.6
Specific daily growth	1.4	1.0	1.2	1.3	1.2
Fourth growth sample 4/11/1992					
Cage total weight	2,791.0	4,335.0	4,760.0	3,207.0	15,093.0
Number of fish	20	38	40	26	124
Mean weight	139.6	114.1	119.0	123.3	121.7
Specific daily growth	1.6	1.6	1.5	1.6	1.6
Overall specific daily growth	2.1	2.0	1.9	1.9	2.0

\* in grams

\*\* in per cent body weight per day

A strong bimodality was observed in the distribution of individual weights at the conclusion of the experiment (Fig. 2). A total of 25 fish had weights ranging from 22 to 88 g with an average weight of 56.8 g. The remaining 99 fish ranged from 90 to 197 g with an average weight of 138.1 g.

*S. randalli* grew well at both the "low" and "high" densities used in this growth trial. There were sporadic episodes of the fish halting their feeding. The first time that this happened, the fish exhibited lateral line erosion associated with nutritional deficiency. This was alleviated by a supplement of *Enteromorpha* spp. Even after the erosion disappeared, the supplement was

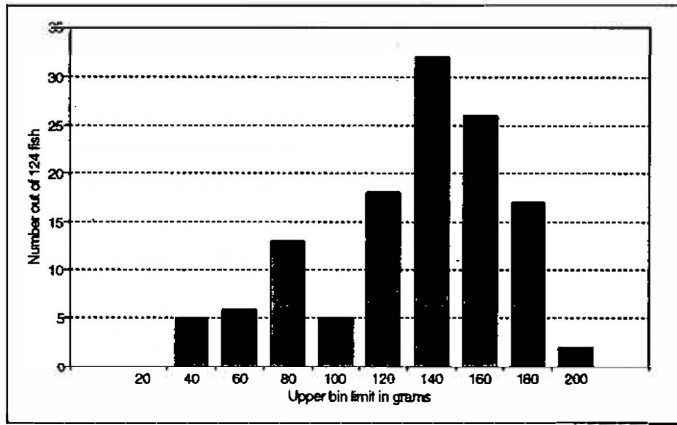


Fig. 2. Size distribution of *S. randalli* after 112 days of cage culture. The upper bin limit is the maximum weight of the fish in each grouping.

continued. During several of the latter feeding stoppages, it was noted that the fish continued to eat the supplement of *Enteromorpha* spp.

The overall average daily weight gain was estimated to be  $0.059 W^{0.71}$ , where  $W$  is the weight of the fish. The fish showed slower than expected growth during the third sampling period (days 57-84) when the specific daily growth rate dropped to 1.2 per cent per day. There was no obvious explanation for this reduction.

Finally, no significant differences were observed in the final weight of the fish due to density differences between the cages. This is not too surprising as the biomass in the cages was fairly low as compared to other studies. The maximum biomass density obtained in this experiment was  $5.29 \text{ kg}\cdot\text{m}^{-3}$  as compared to the approximately  $13.4 \text{ kg}\cdot\text{m}^{-3}$  calculated from Kungvankij et al. (1990) for *S. canaliculatus* in Indonesia.

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