

## The Effect of Stocking Density on the Growth of Ocellaris Clownfish (*Amphiprion ocellaris* Cuvier, 1830) With Recirculation

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### Abstract

The ornamental fish business is now an economic driver. The ocellaris clownfish (*Amphiprion ocellaris* Cuvier, 1830) is one of the leading commodities of marine ornamental fish that is in great demand, especially in foreign markets. One obstacle faced by farmers in determining the appropriate density for the ocellaris clownfish rearing stage. This study aimed to evaluate the effect of stocking density on production factors, which included survival rate, and growth rate of ocellaris clownfish. Three hundred fish were used as experimental fish with an average length of  $23.00 \pm 2.36$  mm and a weight of  $0.27 \pm 0.02$  g. The study was conducted using 4 treatment tanks with a volume of 120 L with densities of 0.17, 0.37, 0.67, and 0.80 fish/L. Observations showed that the density of 0.37 fish per L (K2) gave the best results with a survival rate of 98.18%. For the SGR parameter, the highest value was 1.14% per day in the K1 treatment. This indicated that the stocking density has a relationship with the factor of production in rearing ocellaris clownfish in the recirculation system.

### INTRODUCTION

Every year, the demand for marine ornamental fish continues to grow. However, many of these fish are caught from the wild using unsustainable methods using tranquilizers and nets that can damage the coral reef (Moorhead and Zeng, 2010; Chambel *et al.*, 2015a; Araujo *et al.*, 2014). The type of fish that is often the target is the ocellaris clownfish from the Pomacentridae family, especially the *Amphiprion* genus (Johnston *et al.*, 2003).

*Amphiprion ocellaris* Cuvier, 1830 is a tropical fish found in colonies and has a mutualistic symbiosis with anemones. This fish is commonly found in the waters of the Pacific Ocean, Indian Ocean, northwest Australia, South East Asia, and Japan and is the most popular ornamental

fish (Dhaneesh *et al.*, 2012). According to Sari *et al.* (2014), *A. ocellaris*, or often also called anemonefish (fish that live between anemones) have a brownish-yellow to the orange base with three white bands and a little black on the head, body, and base of the tail.

According to Dambo and Rana (1993), stocking density can have a direct effect on vital parameters such as the survival rate, growth, behavior, water quality, and feed consumption rate. In aquaculture, the stocking density can be defined as the concentration of fish maintained in the system at individual units per area or volume unit (Gomes *et al.*, 2006; de Oliveira *et al.*, 2012). Generally, an increased stocking density

would have a direct effect on the increased stress in the fish which in the end would decrease growth due to a decreased feeding response (Sharm and Chakrabarti, 1998).

However, too low of a stocking density would also affect the efficiency of space and resources; therefore, determining the right stocking density would not only improve efficiency and maximize production and profit, but it is also related to rearing (Leatherland and Cho, 1985).

This study was aimed to contribute to the development of rearing methods for *A. ocellaris* that had been previously developed (Setiawati and Hutapea, 2011). This study also evaluated the effect of the stocking density on the growth, and survival of *A. ocellaris*.

## METHODOLOGY

### Place and Time

The present study was conducted in the Laboratory of Aquaculture, Pangandaran Marine and Fishery Polytechnique. This study was conducted from June to December 2019.

### Research Material

The test materials included 300 *A. ocellaris* with an average length of  $23.00 \pm 2.36$  mm and an average weight of  $0.27 \pm 0.02$  g bred by the Lampung Center for Mariculture.

### Research Design

*A. ocellaris* were distributed into 4 aquariums with a volume of 120 L each using a controlled recirculation system. The study was conducted using 4 density treatments: 0.17, 0.37, 0.67, and 0.80 fish/L without replication. The acclimatizing process lasted 2 weeks at a temperature of 27-29 °C (Setiawati and Hutapea, 2011; Rushworth *et al.*, 2011).

### Work Procedures

*Amphiprion ocellaris* were kept for 61 days, sampling was conducted at the

beginning, in the middle, and at the end of the maintenance period. The parameters measured during sampling were the fish's total length and weight. The effect of stocking density on growth was evaluated using the following equation (Chambel *et al.*, 2015b):

$$SGR = \frac{100 \times (\ln W_t - \ln W_o)}{t}$$

Where

SGR = Specific Growth Rate (%)

W<sub>t</sub> = final fish weight (g)

W<sub>o</sub> = initial fish weight (g)

t = time (days)

Fish survival was observed daily until the end of the treatment. Calculation of the survival rate was done at the end of the treatment using the following equation:

$$SR = \frac{N_t}{N_o} \times 100\%$$

Where:

SR = Survival rate (%)

N<sub>t</sub> = Final number of fish (individuals)

N<sub>o</sub> = Initial number of fish (individuals)

The water quality was measured once a week with the following parameters: DO (dissolved oxygen) and temperature using a DO meter (Lutron DO 5510 HA), salinity using a refractometer (ABBE), and pH using a pH meter (Hanna). The feed was given *ad satiation* using the PF 1000 type feed. The feed was given twice daily in the morning and in the afternoon. Photoperiod was applied in this study at a 14:10 ratio (14 hours light, 10 hours dark) (Johnston *et al.*, 2003).

### Data Analysis

All the observation results were tabulated using the 2013 MS Office Excel program and were presented in the form of diagrams. The water quality data were analyzed descriptively and compared to the references.

## RESULTS AND DISCUSSION

The results of the observation showed that the survival rate for 60 days presented in Table 1 had the highest result for K 2 at 98.18%. The ocellaris clownfish in treatment K4 had the highest mortality

rate at 21.67% and was suggested to be due to parasitic infection in the form of

mold indicated by the white spots on the fish's body and tail.

Table 1. Survival rate and growth rate of the ocellaris clownfish during the experiment.

Parameter	K 1	K 2	K3	K4
Number (individuals)	25	55	100	120
Density (individuals per L)	0.17	0.37	0.67	0.80
Mortality	1	1	2	26
Nt	24	54	98	94
SR	96.00%	98.18%	98.00%	78.33%

*Amphiprion ocellaris* Cuvier, 1830 growth parameters during the rearing period can be seen in Figure 1. Differences in density affected the specific growth rate of *A. ocellaris* as seen in Figure 1 where the highest specific growth rate was found in

K1 which had the lowest stocking density at 0.17 individuals per L at 1.14% per day. This result corresponded with that of the study by Chambel *et al.* (2015b) where the stocking density with the highest growth was 0.5 individuals per L.

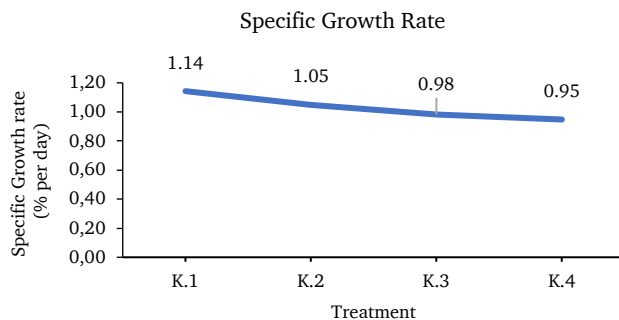


Figure 1. The Specific growth rate (SGR) of *Amphiprion ocellaris* during the rearing period.

The water quality parameters measured in this study are presented in Table 2. The results of the water quality measurements showed that the water quality of the rearing media for *A. ocellaris* was still within the optimum range for rearing. The similar values in the water

quality measurements indicated that the recirculation system worked well. The 21.67% mortality rate in treatment K4 was indicated to be due to parasites adhering to the fish's body and fins instead of being caused by water quality.

Table 2. The water quality parameters during the experiment.

Parameter	Value	Reference
Temperature (°C)	27 ± 0.3	27.9- 29.6 (Setiawati and Hutapea, 2011)
DO (mg/L)	4.23 ± 1.3	5.0-5.5 (Ghosh <i>et al.</i> , 2011)
pH	7.2 - 8.4	6.7-8.6 (Setiawati and Hutapea, 2011)
Salinity (g/L)	28 ± 1.3	33 (Chambel <i>et al.</i> , 2015b)
Water debit (L/minute)	0.42 ± 0.2	0.40±08 (Johnston <i>et al.</i> , 2003)

## CONCLUSION

The rearing of ocellaris clownfish *A. ocellaris* using a recirculation system

resulted in a high survival rate (averaging above 90%). The water quality parameters measured were still within the optimum

range for ocellaris clownfish maintenance. The highest specific growth rate was found in treatment K1 at 1.14% per day. The best survival rate was in treatment K2 with a stocking density of 0.37 individuals per L. Therefore, it could be concluded that the optimum stocking density for the maintenance of the ocellaris clownfish *A. ocellaris* is 0.37 individuals per L.

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