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# WATER QUALITY IMPROVEMENT AND ANALYSIS FOR CLOWN FISH (*Amphiprion ocellaris*) CULTIVATION IN A RECIRCULATION SYSTEM

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## ABSTRACT

The demand for ornamental fish is currently increasing while the availability in nature is decreasing due to overfishing. Clownfish (*Amphiprion ocellaris*) is a type of marine ornamental fish that is widely kept in aquariums, but the problem is the rapid decline in water quality due to the activity of these fish. The recirculation system is one way that can be used in water quality management. The study aimed to analyze the type of filter used to stabilize seawater quality in clownfish (rearing containers. This research was conducted from January to April 2021 at the Research Centre of Sibolga Fisheries College. The method used was an experimental method using a one-factor Completely Randomized Design (CRD) with four treatment levels and three replications. The treatments in this study were P0 (unfiltered), P1 (cotton filter), P2 (fiber filter), and P3 (activated charcoal filter). The fish used was 2 – 3 cm in size, kept in an aquarium measuring 60x40x40cm with a stocking density of 2 fish/L of water and fed tubifex 2 times a day, at 08.00 and 18.00 WIB as much as 5% of their body weight. Parameters measured were temperature, pH, DO, salinity, ammonia, and phosphate, abundance of bacteria, phytoplankton, and survival of clownfish. Water quality measurements are carried out every 7 days. The results obtained from the improvement and analysis of water quality for the cultivation of clownfish in the recirculation system provides an influence on water quality in the rearing container. The results obtained were temperature 27.9–28.0 0C, pH 8.3–8.4, DO 7.5–8.0 mg/L, salinity 33-34 ppt, ammonia 0.04–0.06 mg/L, phosphate 0.47–0.48 mg/L and bacterial abundance 2.35x104 CFU/mL with a survival rate of 95.55%.

**Keywords:** Cotton, Fibers, Activated Charcoal, Clownfish, Recirculation.

## 1. INTRODUCTION

The clownfish (*A. ocellaris*) belongs to the Pomacentridae family. The need for marine ornamental fish is currently getting higher because many people are interested in raising ornamental fish as a hobbyist. Meanwhile, its availability in nature is decreasing due to overfishing and damage to coral reefs which are the habitat of anemones and clownfish usually live side by side with anemones. At this time only 1% are new to cultivating clown fish[1].

One of the problems in clown fish farming is the decrease in water quality caused by fish such as the results of fish metabolism and excretion. One way that can be used to manage water quality to keep it optimal is to use a recirculation system. According to Nurhidayat et al.[2], A recirculation system is a system that is used to utilize water repeatedly through a filter, so this system saves water. Nurhidayat et al.[2] stated that the filter used in the recirculation system can act as a medium for the growth and development of bacteria that will utilize organic materials in the form of food waste and metabolic waste in the media so that it can function in a dual way, namely biological, chemical and physical processes for managing water

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quality in aquariums. Materials such as stone, palm fiber, sand, gravel, lime pulp, alum[3], activated charcoal, cotton, and sponges[4] are good for use as filter materials. Activated charcoal is a type of filter capable of removing color, chlorine, phosphate, chloramine, metals, and toxic materials, while cotton and palm fiber filters apart from being mechanical filters capable of filtering impurities such as dust, leftover feed, and colloids are also capable of being biological filters so they can be used in the improvement of water quality for clown fish farming in recirculating systems.

## 2. RESEARCH METHOD

### Time and Place

This research was carried out from January to April 2021 at the Sibolga Fisheries College Research Center, Sibolga City, North Sumatra Province.

### Methods

This study uses an experimental method with the design used is a Completely Randomized Design (CRD), the treatment given is the use of different filters, consisting of 4 levels, namely P0 (no filter) as control, P1 (cotton filter), P2 (palm fiber filter), and P3 (charcoal filter).

### Procedure

The procedures carried out during the research were the preparation of 12 aquarium research containers measuring 60 x 40 x 40 cm with seawater and aeration installations and drainage channels, fish rearing, water quality measurements (temperature, DO, pH, Salinity, Ammonia, and phosphate), bacterial analysis, analysis of phytoplankton and fish survival.

### Parameters Measured

Water quality parameters. The parameters measured in this study were temperature, DO, pH, salinity, ammonia and phosphate using water parameters.

Bacterial Abundance Analysis. According to Artianto[5], determining the number of bacteria can be done by the Coliform Test, which is done using the MPN (Most Probably Number) method.

Analysis of Plankton Abundance. Identification of the type and density of the phytoplankton population is still done manually using a microscope. Plankton samples are taken using a plankton net with a mouth diameter of 30 cm with a mesh size of 60 μm which has a 100 ml cod-end bottle according to Asmara[6], the number of individuals or phytoplankton cells in 1 $m^3$ of water is calculated using the sweeping method with 2 repetitions, as follows:

$$N = ni\ x \frac{1}{Vd} x \frac{Vt}{Vs}\ X\ 1000$$

Information:

N = Total number of individual or phytoplankton cells per $m^3$
ni = Number of individuals or cells of species I counted
Vd = The volume of filtered water (L)
Vt = the volume of the sample under glass cover (ml) conversion in $m^3$

Survival of the clownfish. The survival of clownfish fingerlings was carried out at the beginning and end of the study. The formula for calculating the survival rate uses the formula:

$$SR = \frac{Nt}{No} X\ 100$$

Information:

SR = Survival rate (%)
Nt = Living biota at the end of the study (fish)
No = Living biota at the start of the study (fish)

## 3. RESULT AND DISCUSSION

### Water Quality

In the process of fish farming, water has a very important role because it is a medium for fish to live so the water used must be of a quality that is following what the fish need. From the research results, the water quality parameters used as a medium for raising clownfish for 28 days can be seen in Table 1.

**Table 1.** Clownfish water quality values during the study

| Variable | Treatment | | | |
|---|---|---|---|---|
| | P0 | P1 | P2 | P3 |
| Temperature ($^0$C) | 27,0-27,9 | 27,9-28,0 | 27,9-28,0 | 27,9-28,0 |
| pH | 8,0-8,1 | 8,3-8,4 | 8,0-8,1 | 8,2-8,3 |
| DO (mg/L) | 6,2-6,5 | 7,5-8,0 | 6,5-6,9 | 7,0-7,4 |
| Salinity (ppt) | 32-34 | 33-34 | 33-34 | 33-34 |
| Ammonia (mg/L) | 0,17 | 0,04-0,06 | 0,12-0,14 | 0,11 |
| Phosphate (mg/L) | 0,49-0,50 | 0,47-0,48 | 0,47-0,49 | 0,47-0,48 |

Note: P0 (control); P1 (cotton filter); P2 (fiber filter); P3 (activated charcoal filter)

Based on Table 1, shows that the cotton filter can reduce the lowest ammonia, namely 0.04 – 0.06 mg/L because the cotton filter has a wider surface compared to the palm fiber and activated charcoal filters so that more solids in the water are filtered out in the cotton filter treatment. With a low ammonia value, the solubility of oxygen in the cotton filter treatment becomes higher than in the palm fiber filter treatment and activated charcoal filter. This is the opinion of Jang et al.[7], at high concentrations, ammonia is toxic, causing a large reduction in oxygen supply and unwanted changes in aquatic ecosystems

**Bacteria Abundance**

The results showed the abundance of bacteria in each treatment can be seen in Table 2.

**Table 2.** Bacterial abundance value during research

| Test | Bacteria Treatment ( bacterial Value x $10^4$ CFU/mL) | | | |
|---|---|---|---|---|
| | P0 | P1 | P2 | P3 |
| 1 | 1.21 | 2.30 | 1.30 | 2.00 |
| 2 | 1.23 | 2.40 | 1.25 | 2.48 |
| 3 | 1.19 | 2.35 | 1.26 | 2.24 |
| average | 1.21 | 2.35 | 1.27 | 2.24 |

Based on Table 2, it can be concluded that toxins in the cultivation media occur due to the buildup of nitrogenous waste resulting from the activities of fish and other organisms. Filters used in aquaculture with recirculation systems can help improve poor environmental conditions because filters installed in recirculation systems can be physical, chemical, and biological filters. In the filter, Nitrosomonas and Nitrobacter bacteria will grow by utilizing ammonia which will be converted into nitrites which then become nitrates.

The results showed that bacteria grew on the filter installed in each treatment with the highest total abundance of bacteria found in the cotton filter treatment, which was 2.35 x $10^4$ CFU/mL, while the lowest was in the control treatment, namely without filter with a value of 1.21 x $10^4$ CFU/mL. Treatment with filter cotton has the highest value compared to other treatments because the surface area of the cotton is larger than the surface area of activated charcoal. Therefore, when the dirt has covered the pores of the charcoal filter, the charcoal filter will be at a saturation point so that the growing bacteria cannot work optimally. According to Maldonado et al.[8], cotton is an adsorbent for organic and

inorganic compounds that has a high ion exchange capacity. This is supported by Papa et al.[9], the surface area of cotton is 300 $m^2$ while the surface area of charcoal is 235.37 $m^2$

**Phytoplankton Type Abundance**

The types of phytoplankton found during the study were; Bacteria, Bacillariophyceae, and Chlorophyceae. From these data, it shows that in improving water quality in fish farming with a recirculating system the availability of natural feed is not the main goal, but the optimization of water quality parameters is the most important thing that must be considered. Phytoplankton identification was found in 10 genera from 3 families. Classification and Analysis of Phytoplankton Diversity are presented in Table 3.

**Table 3**. Types and abundance of phytoplankton during the study

| No | Genus | Abundance (cell/L) | | | |
|---|---|---|---|---|---|
| | | P0 | P1 | P2 | P3 |
| 1 | *Bacillariaphyceae* | | | | |
| | Nitzchia | 120 | 360 | 102 | 312 |
| | Rhizosolenia | 126 | 660 | 542,4 | 480 |
| | Cymbella | 240 | 766,8 | 117,6 | 540 |
| | Asterionella | 399,6 | 480 | 289,2 | 240 |
| 2 | Bacteria | | | | |
| | Coelosphaerium | 146,4 | 180 | 122,4 | 108 |
| | Oscillatoria | 420 | 120 | 146,4 | 427 |
| | Anabena | 120 | 93,6 | 172,8 | 173 |
| 3 | Chlorphyceae | | | | |
| | Distyosphaerium | 60 | 121,2 | 72 | 245 |
| | Scenedesmus | 0 | 78 | 25,2 | 78 |
| | Oedogonium | 120 | 710,4 | 238,8 | 240 |
| | total | 1752 | 3570 | 1828,8 | 2843 |

Based on Table 3 analysis of total phytoplankton abundance the highest abundance was found in the filter cotton treatment (P2) with a value of 3570 cells/L and the lowest total phytoplankton abundance value was found in the control treatment (P0) with a value of 1752 cells/L. According to Isnaini[10], not only nitrogen content, phosphorus is also part of the elements that are needed in aquatic ecosystems which function for metabolic processes and the formation of protein compounds for organisms.

The results of the abundance of phytoplankton in the Cymbella genus with a value of 766.8 cells/L in treatment 1 (P1) can support life for clownfish. This is following Basmi's[11] statement, that the interaction of phytoplankton with physical, chemical, and biological factors will affect the presence and fertility of phytoplankton in an ecosystem

**Survival Rate**

Fish survival is influenced by biotic and abiotic factors. Biotic factors are competitors, parasites, population density, adaptability of animals, and human handling, while abiotic factors are the physical and chemical characteristics of water. The number of survivors in each container can be seen in Figure 1.

The highest survival rate was found in treatment 1 (cotton filter) which was 95.55%, followed by treatment 3 (activated charcoal filter), treatment 2 (fiber filter),

and control treatment, namely 91.11%, 88.89% respectively and 86.67%.

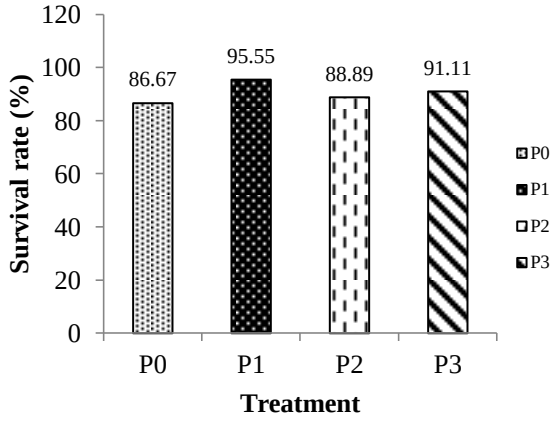


**Figure 1.** The survival rate of clownfish

## 4. CONCLUSION

The maintenance of a clownfish with a recirculation system affects the improvement of water quality such as temperature, pH, DO, salinity, ammonia, phosphate, abundance of bacteria, and abundance of phytoplankton. The best type of filter for keeping clown fish) with a recirculation system made of cotton with water quality results, namely; temperature 27.9-28.0 0C, pH 8.3-8.4, DO 7.5-8.0 mg/L, salinity 32 ppt, ammonia 0.04-0.06 mg/L, phosphate 0, 47-0.48 mg/L, bacterial abundance 2.35x104 CFU/mL and total phytoplankton abundance 3570 cells/L with clownfish survival rate of 95.55%.

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