Relationship of long weight between milkfish (*Chanos chanos* forsskal) and sea cucumber (*Holothuria leucospilot*) that are multi-trophic sea farming

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Abstract. Milkfish (*Chanos chanos* Forsskal) and sea cucumbers (*Holothurians leucospilot*), have high economic value, both to meet domestic and foreign consumption needs. This study examines the long-weight relationship of milkfish and sea cucumbers that are cultivated by multi-trophic sea farming at the Tablolong Fish Seed Center in West Kupang District which has been conducted in October to December 2018. Sampling is done every 15 days with a maintenance period of 45 days showed that the milkfish and sea cucumbers have a negative algometric growth pattern based on a value of b which is lower than 3. The water quality parameters at the Balai Benih Ikan Pantai are still in the normal range to support the growth of milkfish and sea cucumbers.

1. Introduction
Potential waters in Indonesia contain abundant biodiversity, one of which is milkfish (*Chanos chanos*). Milkfish is the mainstay of the development of marine aquaculture that has several advantages compared to other species, among others, is the hatchery technique controlled, its cultivation techniques are relatively easy and can be adopted by farmers, resistant to extreme environmental changes (salinity), responsive to commercially available artificial feed, can be maintained with high density and not cannibalism [1]. Besides that, milkfish also have delicious flavors and affordable prices, so that milkfish is very popular with the community, especially in Java and South Sulawesi.

Sea cucumber is a biota that has long been known and protected by the community. Sea cucumber prices currently range between IDR 150,000-300,000/kg [2]. The high market demand followed by high prices causes exploitation of sea cucumbers in nature to increase. Apart from the limited aquaculture sector, sea cucumber supplies still rely heavily on capture from nature. In addition, production that depends on the catch from nature will not be continuous, it is very season-dependent, and the size is not uniform. Sea cucumber habitat (*Holothurians leucospilot*) is sea water with a mud bottom. From field observations, captured local sea cucumbers are often found with a muddy body condition. Retrieval of eggplant by fishermen is no longer carried out on the coast, but rather to the center, to the middle in the direction of the high seas [3].

The current system of fish culture development can be carried out using a monoculture or polyculture system. Monoculture culture systems are aquaculture systems that only maintain one type...
of fish or organism. While a polyculture culture system is a culture system that maintains fish or organisms of more than one type very useful for efficient use of natural food in the pond [4].

Multi-tropic Sea farming is one of the fisheries development concepts in shallow water areas in the form of a merger between aquaculture and capture fisheries by utilizing superior commodities in potential cultivation areas [2]. Sea farming is a mariculture-based marine ecosystem utilization system with the aim of the end is to increase the stock of fish resources (fish resources enhancement) for the sustainability of capture fisheries and other marine-based activities such as ecotourism. In addition, sea farming is an activity of producing seeds (seed production), then releasing the seeds into the sea (releasing or restocking) and subsequently capturing return the fish (recapturing or harvesting) to be sold as a marine fishery product.

2. Materials and methods

2.1. Materials

Materials used in this study include: milkfish is 450 and 100 sea cucumbers, with a spacing of 20 cm.

2.2. Methods

The research study used an experimental methods with the variables observed being the growth of the milkfish and sea cucumber respectively. The two biological resources that were maintained in the three tanks were all of the same volume. The volume of the cultivation plants was 10 tons. Each tub was filled with 450 fish, and 100 sea cucumbers, with a spacing of 20 cm. Feeding was done using commercial feed with a weight of 2% of the weight of the milkfish cultivated.

2.3. Water Quality Measurement

The physical and chemical parameters of the waters observed during the study included temperature and pH of the water. Measurements were carried out every 15 days and accumulated every 45 days.

2.4. Data analysis

The length and weight relationships were analyzed by regression in Excel software. Long relationship with weight were analysed using the formula [5] namely:

\[
W = aL^b
\]

Information:

\( W \) = fish body weight (gr)
\( L \) = Total fish length (mm)
\( a \) = intercept (intersection of the length-weight curve with the y axis)
\( b \) = slope

The condition factor is expressed as \( W / L^3 \) where \( W \) = weight and \( L \) = length.

3. Results and discussion

3.1 Results

3.1.1 Measurement of length and weight of milkfish (Chanos chanos Forsskal)

Fish growth patterns can be known by analyzing the relationship of fish length. Measurement of fish length and weight aims to determine specific weight and length variations of fish individually or groups and physiological conditions [6]. This relationship can explain the growth of fish, loss and environmental change.

Based on the results of research that has been carried out for 2 months at the Tablolong Beach Fish Seed Hall, 30 milkfish samples have an average body weight of 20.23 grams and an average body length of 17.71 cm. The results of the analysis of the length weight relationship obtained \( b \) value of 0.5451. This shows that the pattern of milkfish growth is algometric negative (\( b < 3 \)) meaning that the growth of body length is faster than the growth of body weight.
Figure 1: Long weight relationship of milkfish (Chanos chanos Forsskal) which is cultivated in multi-tropic sea farming

Based on the results of regression analysis and the relationship between length and weight graph (Figure 1) has a regression equation \( y = 0.5451x + 1.4356 \) with the coefficient of determination is \( R^2 = 0.888 \) which means that 88% of milkfish body weight gain from aquaculture occurs due to the increase in fish body length, while 12% fish weight gain is influenced by other factors such as environmental and age factors. Fuadi et al [7] states that if the value of \( R^2 \) is close to 1, the total length of the fish will increase as the body weight of the fish increases. This also shows that the total body length does not significantly affect the total weight of milk fish.

3.1.2. Long sea cucumber weight relationship
Based on the value of sea cucumber cultivation taken as many as 30 tails has an average body weight of 208.16 grams and a total length of 16.46 cm. The results of regression analysis and weight length relationship graph (Figure 2) obtained the equation \( y = 1.7713x + 0.3608 \) with the coefficient of determination is \( R^2 = 0.837 \), which means 83% increase in body weight of sea cucumber cultivated occurs due to the increase in sea cucumber body length, while 17% increase sea cucumber weight is influenced by other factors such as environmental and age factors.

Figure 2: Relationship of sea cucumber weight length which is cultivated by multi-tropic sea farming
3.1.3. Physical Chemistry of Water

Water quality during maintenance is in a good range for the growth of milkfish and sea cucumbers. Aquatic biota has a certain temperature range for survival and growth [8]. Measurements are carried out once every 10 days and are accumulated every 45 days. The measured parameters include temperature and pH of water presented in Table 1.

| Tank | Sampling I | Sampling II | Sampling III |
|------|------------|-------------|--------------|
|      | Temperature| pH          | Temperature  | pH          | Temperature  | pH          |
| I    | 31.23      | 7.79        | 32.00        | 7.67        | 31.87        | 7.48        |
| II   | 30.67      | 6.67        | 30.89        | 6.89        | 30.76        | 6.52        |
| III  | 30.37      | 6.63        | 30.23        | 6.68        | 30.57        | 6.57        |

3.2. Discussion

The research proves that temperature is one of the parameters of water quality that affects the rate of fish metabolism. Temperature is very instrumental in controlling the condition of aquatic ecosystems. Increased temperature causes a decrease in the solubility of gases in water such as oxygen gas, N₂ and CO₂ [9]. Increasing the temperature to the maximum tolerance limit will be offset by an increase in metabolic rate. Metabolism is a physiological process carried out by fish in order to maintain body homeostasis in adjusting to stress factors by environmental changes that occur. If the metabolism of fish goes well, the fish will be able to reach the point of homeostasis which results in an increase in the degree of survival and growth rate. The temperature during the maintenance of milkfish and sea cucumbers ranges from 31.23°C - 32.38°C. According to Sari et al [10] the temperature range required for tropical fish farming ranges from 27°C to 32°C.

The degree of acidity (pH) of waters characterizes the expression of H⁺ ion concentrations, namely the balance between acids and bases anhydrase and Na⁺ / K⁺ ATP−ase. Enzyme activity in the gills is related to respiration rate, osmoregulation and excretion. Value of pH less than 4 and more than 11 can have an impact on fish mortality. The pH value depends on several factors namely physical (turbidity), chemical (CO₂ levels, salinity) and biological factors (reshuffle of organic matter and organism density). The pH value during the study ranged from 6.63-7.79. This value is included in the range of optimal values for the maintenance of milkfish and sea cucumber.

4. Conclusion

Based on the results of the study of milkfish and sea cucumbers cultivated by multitrophic sea farming, the average value of milkfish is 20.23 grams with an average body length of 17.71 cm and the average body weight of sea cucumbers 208.16 grams with a total length of 16.46 cm. The growth patterns of milkfish and sea cucumbers show a negative allometric growth pattern based on values lower than 3.

5. References

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