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Integrated Sci-Tech : The Interdisciplinary Research Approach Volume 1

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Preface

This book is all about the interdisciplinary research that integrates engineering, life and applied sciences, medical and biomedical engineering, agriculture engineering and food sciences. The aim was to provide the initial roadmap at a cross section basic research, technological and social developments, processes development, applications integrity, and real-world usage. The genuine motivation for the book was to provide a suitable reference text for those who interested in the multi and inter disciplinary studies which might be beneficial for basic and advance researches, enhancing the curriculum and enriching teaching and learning materials, mostly in the level of postgraduate studies.

In addition, the book was also planned to provide advanced orientation and understanding for related industries and governments to looking across industrial partnerships, business strategic, and policy and regulations. In general, the book is expected to be beneficial for a wide range of readers.

This book consists of twenty five chapters divided into four sections i.e., engineering, life and applied sciences, medical and biomedical engineering, agriculture and food science. Each chapter is a completely self-directed contribution in chained discussion which aims to bring academia, researcher, practitioners and students rise to speed with the novel developments within the particular area.

In order to enhance the reader experience, each book chapter contains its own abstract, instruction, main body, as well as conclusion sections. Moreover, bibliography resources are available at the end of each chapter.

To achieve all these aims and goals, the book should deliver a breadth of information. We are pleased and thankful for all distinguish authors and reviewers for their contribution that have made this book possible. We do hope that you will enjoy this book and find it as a useful guide and reference.

Editorial board:

Table of Contents

Fish Condition Factor as Bioindicator of Water Quality on Mangrove Ecosystems at Labuhan Maringgai, Indonesia.

Tugiyono[F] and Jani Master[S]

***Abstract*— This paper discuss on the use of fish Condition Factor (CF) as a bioindicator of water quality level in mangrove ecosystems at Labuhan Maringgai, Indonesia. The results shows that fish CF, in the research site, are mostly higher than one. The following are the value for each fish species: *Mystus nigriceps* (1,23), *Eleutheronema tetradactylus* (0,93), *Valamugil seheli* (1,09), *Mallotus villosus* (1,61), *Paraplagusia blochi* (0,56), *Lutjanus griseus* (2,22), *Epinephelus fuscoguttatus* (1,74), *Lutjanus campechanus* (1,74), *Argyrops bleekeri* (3,07), *Macrones microchus* (1,19), *Arius sagor* (1,03), *Lates calcarife* (1,23), *Plotusus canius* (0,52). Regarding to the measured CF, it is known that the water quality at the concerned mangrove ecosystem is suitable for fish survival (fish CF > 1). Measured water quality at the concerned site was considered as mild to moderately polluted, proved by Pollution Index values of 1.84 to 8.34. nitrate and turbidity, in particular, were failed to meet the water quality standard.**

***Keywords*— Condition factor, Labuhan Maringgai, Mangrove ecosystems, Pollution index**

I. Introduction

Lampung Mangrove Center consist of 700 Ha of mangrove forest located in the village of Margasari, Labuhan Maringgai which is part of East Lampung Regency. The Mangrove Center was established based on the regent letter No. 660/305/04/SK/2005/1546/J.26 /KL/2005 on May 10, 2005. Mangrove forest is a type of forest located in areas influenced by the tidal fluctuation (coastal and estuaries). Plant species that grow in the forest are mostly tolerant to high salinity level. In addition, mangrove ecosystem is a system consisting of organisms (plants and animals) that interact each other as well as with their habitat environmental factors [1,2].

It has been well known that there are two principal functions of mangrove ecosystems, namely the ecological function and economical function. Based on ecologically perspective, mangrove ecosystem play their role as the following a) a source of organic material for aquatic ecosystem, b) food source for marine organisms, c) habitat of marine organisms, d) spawning and nursing ground for marine organisms and e) protect land from abrasion. Mean while in term of economical point of view, mangrove forests provide a) source of building materials, b) firewood, c) raw materials of paper, d) food, medicine and textile, b) tourism spot [2,3].

It was presented by [4] that mangrove is considered as a very unique ecosystem since in the area it can be found two groups of organisms living and adapt in two difference side of the mangrove ecosystem as their habitat, namely a) terrestrial organisms living in the forest canopy or its land such as birds, snakes and monkey, their activity mostly during low tide so that they do not need special adaptation to see water. b) marine organisms live in the bottom of the tree or in saline water. The dominant animal group, in the area, is a kind of mollusks, shrimp, worms and some other kinds of fish.
Mollusks which are often found on the stem or roots of the mangroves is snails (Littorinidae) and oysters (Bivalvia) which are mostly lived in the rooting side of mangroves. It is well known that shrimp and particularly crab are very abundant on the mangrove ecosystem, they live with how to make a hole in the soft substrates, such as mangrove crabs (*Scylla*, sp), crab (*Uca* sp), small crab attaching (*Portunus* sp), soldier crabs (*Muctiris* sp), stone crabs (*Grapsus* sp) and various ghost crabs (*Dotia, Cleistostoma*). They life by eating any kinds of detritus from both the sea and land. They are also supports their life in the ecosystem by filtering both plankton and zooplankton. The mangrove area is suitable location for nursery grounds, feeding grounds, and spawning grounds of most shrimp and also for saltwater fish particularly mullet, before their lives and migrate to the deep sea [3,4,5].

A. Condition Factor (CF)

Condition Factor is the Fulton's formula [weight/length^3] x100, which is widely used to determine the nutritional state of fish and it is also used to evaluate the fattiness of fish [6]. The CF can also be used as an indicator of health status or fitness level of particular fish [7]. The CF can also be used as an indicator for monitoring the nutrition and health status of concerned fish populations during a long period of exposure time [8].

The value of CF is influenced by age, gender, season, maturity level of the gonads, the fulfillment of the gastric contents, type of consumed food, and development level of the fish muscles. On particular type of fish, the weight of its gonad is more than 15% of its total weight. In case of female fish, CF value will dramatically decrease after their eggs has been released from their ovaries [9].

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B. Pollution Index (PI)

Quality of water is commonly determined by using the pollution index (IP). Pollution index used to determine contaminants compare to the standard of water quality parameters.The pollution index is however only can be measured for specified sites, which then be used to interpret for wider area of water. The method will be able to be directly connected to the water quality standard both based on concerned parameter and particular water usage [10].

II. RESEARCH METHODS

A. Time and place

This research was conducted during period of June-July 2015. The research was performed in the Mangrove Centre located at Margasari, East Lampung Regency, Lampung, Indonesia. Sampling locations are showed at Figure 1.

Figure 1. Sampling location in Mangrove Forest of Margasari Village, East Lampung Regency.

B. Research Approach

1) *Diversity And Status Of Fish Condition*
Number of fish at different locations were collected during data collection, carried out supported by fishermen of Margasari. The fish were obtained by direct capture on research site or caught by fishermen within the area of mangrove ecosystems. Each type of fish was taken at least five samples. Number of cultivated fish (tilapia/*Oreochromis niloticus* and milkfish/*Chanos chanos*), were also taken as a comparison. All samples were measured their total length, and weight. Mean while species identification of fish was conducted in biology laboratory, the University of Lampung. In addition, water quality sampling were also performed at certain location as presented in Figure 1.The water quality parameters which were analyzed include: turbidity, total suspended solid (TSS), total dissolved solid (TDS), temperature, salinity, nitrates, nitrites, sulfides, ammonia, phosphate, sulfate, chemical oxygen demands (COD), biological oxygen demands (BOD), and dissolved oxygen (DO).

2) Determination Of Condition Factor
Analysis was conducted to define the status of the fish condition. The method was determined based on the value of the Condition Factor (CF), derived from the Fulton's formula, [gram/(centimeters)^3] x 100 [6].

3) Determination of the level of quality of waters with pollution index (PI).

$$PI = \sqrt{\frac{(C/L)_M^2 + (C/L)_R^2}{2}} \quad (1)$$

L = the concentration of water quality standrad
C= the concentrations of measured parameters
M = maximum
R = average
Evaluation of the value of the PI is :
$0 \le PI \le 1.0$: meet the quality standard (good condition)
$1.0 \le PI \le 5.0$: light polluted,
$5.0 \le PI \le 10$: moderately polluted
PI >10:heavily polluted [10].

III. RESULTS AND DISCUSSION

A. Diversity Index

Based on the sampling results, it was obtained 15 fish species with diversity index of 2.35. The diversity index 2.35 can be considered that the fish diversity in the concerned mangrove forest ecosystems is in a good category [11]. The fish species which was encountered most frequently (dominant) is Mystus nigriceps. The reason could be due to the fact that the main food of the species is a small shrimp which can be easily found in the area of study.

B. Fish Condition Status

Analysis of the status of fish condition was performed based on a value of condition factor. The calculationresults of the CF values both at the mangrove ecosystems and at fish cultivationpond, can be seen in Table 2.

Table 2. Value of Fish Condition Factor

Fish Species	Means	SD
Mystus nigriceps	1,229	0,251
Eleutheronema tetradactylus	0,933	0,160
Valamugil seheli	1,099	0,092
Mallotus villosus	1,608	0,289
Paraplagusia blochi	0,561	0,055
Lutjanus Griseus.	2,219	0,433
Epinephelus fuscoguttatus	1,420	0,117
Lutjanus campechanus	1,737	0,281
Argyrops Bleekeri	3,070	0,143
Macrones microchus	1,191	0,042
Arius sagor	1,033	0,055
Lates calcarifer	1,238	0,057
Plotusus canius	0,526	0,191
Chanos chanos	0,855	0,039
Oreochromis niloticus	1,980	0,544

Results of the study shows thatmost fish (10 species) has a value of CF more than one. While the rest three fish species has value of CF less than one, this is most probably due to the fish shape, which is more cylindrical compare to the other species. In particular, [6] mentioned that CF based on Fulton's formula was not suitable for the cylindrical–shaped fish. As a comparison, it was also carried out the CF calculations for cultivated, in ponds, fish (*Chanos chanos* and *Oreochromis niloticus*) with the value of CF are 1.98 and 0.85 respectively. The value was then used as an evaluation indicator of health and fitness conditions of fish [7]. Fish could be considered in a healthy condition if there are enough food and fish seem fatter/fleshy, so fish tends to be heavier compare to its visual length. Fish in those conditions will have a value of CF higher than one. On the other hands, fish that consume less food, skinny, and slender fish has a value of condition factor of less than one [12]. The CF value affected by many factors such as the condition of the organism itself, environmental conditions, the number of organisms, as well as the availability of food. The better condition of the environment, the higher factor conditions will be [13]. As stated by [14] waters within mangrove ecosystems can provide a natural system in maintaining fishery productivity.

Based on the collected CF values, it is proved that mangrove forest ecosystem is very essential in supporting the growth of fish populations. Similar research also indicated that the value of CF on two species of Tilapia namely *Tilapia zillii* and *Oreochromis urolepis* in full strength sea water was less than one (0.86; 0.53). On the other hands,it was more than one (2,81; 3.46) in fresh water. Both of these species grow well in fresh water [15]. Similar research conducted by [16] at PT. Gunung Madu Sugar Factory was concluded that value of CF of Tilapia (*Oerochromisni laticus*) were decreased at wastewater treatment pond compared to the fresh water ponds.

C. Pollution Index (PI)

The calculation results of the pollution index can be found in Figure 2.

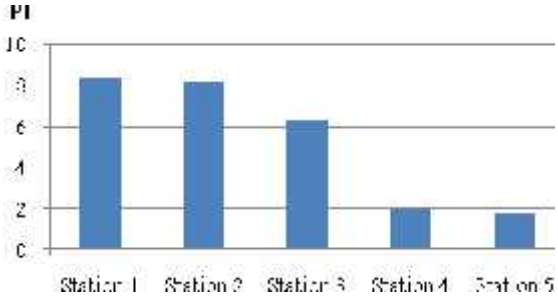

Figure 2. Value of Pollution Index (PI)

The water quality within mangrove ecosystems at the research site was considered to be, based on the PI values, a light polluted to moderately polluted. The criteria is based on the marine life quality standard according to [17]. The water quality parameters that exceed the standard are nitrates and turbidity. Nitrate, as an indicator of fertility levels, could be sourced from the decomposition of organic materials such as domestic waste, detritus of mangrove plants and other water plants [18].

IV. CONCLUSION

Mangrove forest ecosystem at the village of Margasari Village is strongly support the life of the fish populations in the area. Fish populations, based on the value of diversity index, is considered in a good condition (H=2.35).The condition status of the fish at the concerned site was mostly in a healthy condition and fleshy (CF > 1). In addition to that, Water quality conditions at the concerned site was considered in the high fertility rate and plenty of natural food available for the fish population.

V. ACKNOWLEDGEMENTS

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