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Dynamics of Endemic Habitats Microcrustacean Phronima Suppa (*Phronima* sp) as Determinants of Artificial Production Development

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Abstract—Phronima suppa found endemic in certain brackishwater pond in the Tasiwalie Village become an important part of a successful recovery of shrimp ponds. This study aims to analyze the dynamics of endemic habitat environment. Research conducted in the A, B, and C station as the endemic habitats and D station is not the endemic habitat or control. Phronima suppa density at A station very high during the first week of April and the third week of June. At B station reaches the level of high density in the first week of May. Dominance index ranged from 0.4740 to 0.5731 in April until June to explain the mechanism of predation among plankton. Phronima stability at A and B station for approximately two weeks, the availability of organic matter, and the type of plankton in the habitat of endemic become the main determinant in the development of artificial phronima suppa production.

Index Terms—dynamics, endemic, phronima, shrimp, production

I. INTRODUCTION

Black tiger shrimp (*Penaeus monodon* Fabricius) farming in Indonesia has stagnated during the period 1998 to 2007. Infectious pathogens, especially the type of white spot syndrome virus (WSSV) [1], [2] and *Vibrio harvey* [3]-[5] cause mass death in about two months cultivation period. These conditions causes approximately 39,022 ha (45.64 percent) ponds in South Sulawesi Province becomes marginal and unproductive (idle) [6]. Failed harvests in the South Sulawesi is predicted incur losses for farmers around 33.4 million USD per year. Indonesian shrimp disease infection caused losses estimated at more than 300 million USD or more than 3 billion IDR per year [7]. Approximately 84.5% of the population in the Tasiwalie Village or about 2,443 people working on shrimp farming potential loss of jobs and become poor [8].

Pond management which did not conform to the environmental balance causing pathogen populations increase and decrease of farmed shrimp immunity against environmental stress and pathogen infection [9]-[11]. Pond management which did not standardized, and the use of production inputs, especially antibiotics, pesticides, materials and other chemical substances in an uncontrolled manner which was originally intended for the prevention of disease and pest control has led to environmental degradation [6]. Feeding, use of fertilizers and soil processing improper pond bottom has led to an increase in organic contamination. Artificial feeding as much as twice the wet biomass conversion products only 10-12 per cent of which can be harvested into biomass. The remaining 88-90 percent of waste into the environment [12]. Artificial feed which most components are composed of organic material (especially organic and organic-C-N) flowing in the cycle of nutrients in the water flow [13].

In 2005 accidentally found microcrustacea living in endemic in certain ponds in the Tasiwalie Village, Pinrang District, South Sulawesi Province [14]. Local people call it "were" meaningful Buginese language blessing or grace and hereinafter referred to phronima suppa (*Phronima* sp) [15]. Applications of phronima suppa 47.00±2.12 days during the production period managed to increase the average production of tiger shrimp 285.00±88.02 kg/ha in size average of 39.67±0.71 fish/kg. Pond without phronima suppa application producing tiger shrimp an average 50.63±22.27 kg/ha with an average size 44.00±6.05 tail/kg and the production of fish on average 337.50±180.77 kg/ha for 112.50±21.21 days farming activities [16]. Phronima suppa important role in nutrient supply in accordance with the needs of tiger shrimp, improve water quality and pond bottom soil and boost immunity against infection tiger shrimp pathogens [14].

Exploiting Phronima to support the development of tiger shrimp farming constrained by the limited nature stock of phronima suppa [17]. Exploiting nature stock of

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phronima suppa inadequate because of the availability did not sustainable. The cultivation phronima suppa artificially have done but within about a week of massive death [18]. A shortage of information about appropriate environmental conditions cause massive death on phronima suppa production artificially. This study aims to analyze the dynamics of endemic habitat environment as an important determinant of production methods phronima suppa artificially.

II. MATERIALS AND METHODS

The experiment was conducted from March to September 2014 in the Village of Tasiwalie, Pinrang District, South Sulawesi Province. The collection of data representing dry and rainy seasons and periods of high and low tide [17]-[22]. Research conducted on ponds consisting of A, B, and C station represent endemic habitat conditions and D station which is not endemic habitat as a control (Fig. 1).

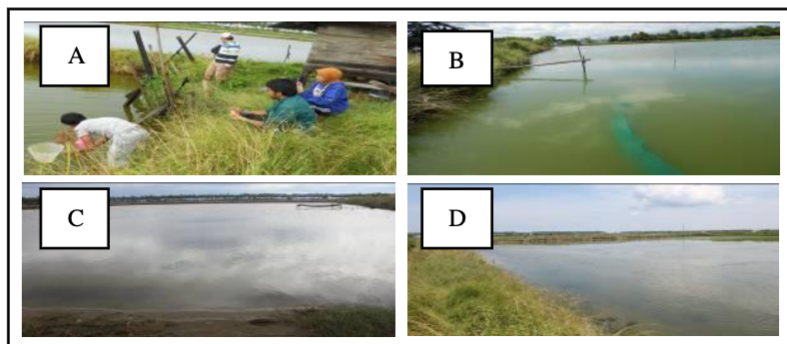


Figure 1. Research station

The parameters observed dynamics of endemic habitats consisting of (1) the dynamics of plankton [18], [23], [24], (2) physical and chemical parameters of water, and (3) the soil biophysical [17], [25], [27], (4) the dynamics of pattern management ponds covering (5) historical farm management [28]. Parameter observations made each tidal period [29]. Phronima suppa presented in Fig. 2.



Figure 2. Phronima suppa (*Phronima* sp) (100x) [14]

Plankton dynamics determined based on the density, diversity, and the dominance of plankton is calculated with the following formula:

Plankton density is calculated using a modified formula Microtransect Lackley Drop Counting (LDMC) by [18]:

$$\Sigma \text{ ind/l} = \frac{T}{L} \times \frac{P}{p} \times \frac{V}{v} \times \frac{1}{W}$$

- T = the number of boxes SRC = 1,000
- L = the number of boxes in the visual field SRC = 1
- P = the amount of plankton (individuals)

which look

- p = number of boxes observed SRC = 100
- V = volume of concentrate in bottles of 100 ml sample
- v = volume of concentrate in SRC = 1ml
- W = the volume of filtered water = 100 l

Plankton diversity is calculated based on the Shannon Index formula [23]:

$$H^1 = - \sum \left| \frac{ni}{N} \right| \ln \left| \frac{ni}{N} \right|$$

$$H \text{ maks} = \ln S$$

$$E = \frac{H^1}{H \text{ maks}}$$

E = plankton diversity index

H¹ = Shannon Index

ni = number of individuals in the species to i

N = number of individuals of all species

S = total number of species

Dominance of plankton calculated using Simpson Dominance Index [23]:

$$d = (1 - c)$$

$$c = \frac{ni}{N}$$

d = plankton dominance index

c = index Simpson

Ni = number of individuals in the species to i

N = number of individuals of all species

III. FINDINGS AND DISCUSSION

Endemic habitat dynamics in the research will be explained by the dynamics of phronima suppa, soil and water quality and plankton dynamics. Description of each parameter are described as follows.

A. Phronima Suppa Dynamics

Phronima suppa population in the four research stations fluctuated as presented in Table I and Fig. 3. Phronima suppa population at A station very high during the period of the first week of April and was not found during the period of the third week of May to the first week of June. In the third week of June period Phronima population becomes very high and the period of the first week of July decreased to very low populations.

TABLE I. POPULATION PHRONIMA SUPPA AT EACH STATION (PER WEEK)

Station	Population						
	1 st April	3 th April	1 st May	3 th May	1 st June	3 th June	1 st July
A	4	2	2	0	0	4	1
B	0	0	3	1	0	2	1
C	0	0	0	3	0	3	2
D	0	0	0	0	0	0	1

Description:

0 = not found; 1 = very low population; 2 = low population; 3 = high population; 4 = very high population

Phronima suppa population at B station is not found during the period of the first week of April to the third week of April. The first week of May period found phronima suppa population density were high and decreased sharply during the period of the third week of May and first week of June. The population at B station for a period of weeks latter may decline to very low and continues to decline to be found during the period of the first week of June. In the period from the third week of June increased so as to achieve a low population and becomes very low in the period of the first week of July.

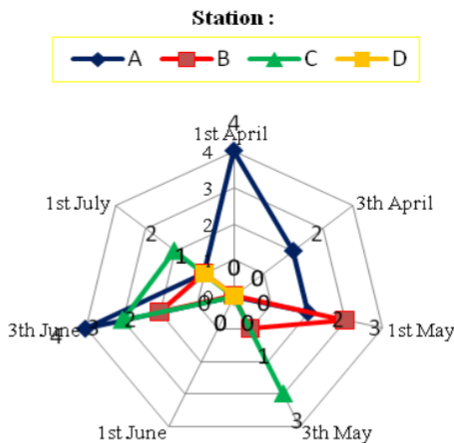


Figure 3. Fluctuations of phronima suppa population

Phronima suppa population at C station was not found during the period of the first week of April to the first week in May. The population increased to higher during the first week of June and declined to a low in the period of the first week of July.

Phronima suppa at D station was not found during the period of the first week of April to the third week of June. Phronima suppa found in the period of the first week in July but the population is very low. Dynamics of phronima suppa in the whole station is very volatile and phronima suppa population stationary phase occurred in the second week [14], [30].

B. Pond Water and Soil Dynamics

Water quality and pond bottom soil during the study are presented in Table II. Population of phronima suppa at A station very high during the period of the first week of April with levels of total organic carbon (TOC) and total organic matter (TOM) each 32 mg/l and 43.680 mg/l. TOC and TOM ratio or organic ratio in the first week of April period was 0.73. Phronima suppa population in the third week of June period is very high with organic ratio of 0.40.

Phronima suppa population at B station high during the period of the first week of May with TOC levels by 19 mg/l and TOM for 25.912 mg/l. Organic ratio during the period of first week of May at 0.73. During the period of the first and third week of April with the respective organic ratio 0.27 and 0.25. was not found phronima suppa at B station.

Phronima suppa found at C station content of TOC and TOM each 20 mg/l and 47.400 mg/l and organic ratio of 0.42. Population of phronima suppa low to very high with a range of organic ratio of 0.30 to 0.90 (Table II). Instead, phronima suppa was not found on station with interval organic ratio of 0.19 to 0.29. This shows

phronima suppa develop in ponds with relatively high organic matter. Dynamics of phronima suppa, TOC, TOM, and organic ratio at each station are described in Table II and Fig. 4.

TABLE II. WATER QUALITY IN RESEARCH STATION WAS FOUND PHRONIMA SUPPA

Time	Station	TOC (mg/L)	TOM (mg/L)	Organic Ratio (TOC / TOM)
1 st April	A	32	43.680	0.73
3 th April	A	34	37.920	0.90
1 st May	A	16	43.608	0.37
	B	19	25.912	0.73
3 th May	B	25	83.424	0.30
	C	20	47.400	0.42
3 th June	A	47	118.184	0.40
	B	25	71.416	0.35
	C	30	85.320	0.35

Phronima suppa population has a stronger correlation with organic ratio compared with the levels of TOC and BOT (Fig. 4). Organic ratio dynamics associated with phronima suppa population and can be an important and decisive part in the development of artificial production.

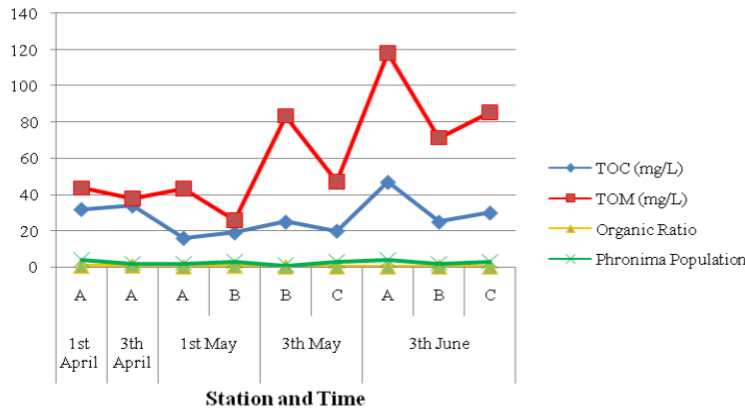


Figure 4. Correlation of organic materials and phronima suppa population

Pond bottom soil texture on A station consists of sand (92%), clay (0%), and dust (8%) are classified as poor of hara that organic materials are available dominated supply comes from outside the pond. The majority of farmers do fertilization using organic ingredients sourced from fine bran, urea, and phosphate respectively at a dose of 500 kg, 100 kg, and 50 kg per hectare and pond water supply from the Parepare Bay waters [15]. Organic material in the pond comes from the water that goes into the pond, fertilization, and liming [31], as well as protein catabolism results in the form of nitrogen excretion and decomposition of organic materials include food remains and dead organisms [32]-[34]. The availability of organic material into the determinant factor in the achievement of the phronima suppa population stationary phase [14].

TABLE III. SOIL QUALITY IN RESEARCH STATION

Station	Chemistry		Physical			
	C-Organic (%)	Organic Matter (%)	Sand	Clay	Dust	Texture
A	0.14	0.24	92	0	8	sand
B	0.04	0.06	88	4	8	sand
C	0.03	0.04	89	4	7	sand
D	0.02	0.03	89	3	8	sand

Organic matter-N through the process of amination and nitrification reformed into ammonia (NH_3), nitrite (NO_2) and nitrate (NO_3) [32], [33] and as well as organic matter-P converted into phosphate (PO_4) [34] which along with carbon dioxide (CO_2) as a product of respiration is necessary for the growth and survival of plankton into constituent chemical compounds TOC and TOM are a determinant of the phronima suppa density level at observation stations (Table III and Fig. 5). Phronima suppa population very high at A station due to the high levels of TOC and TOM that affect organic ratio and compounds of NO_3 , PO_4 , and CO_2 which determines the abundance of plankton that is required by the phronima suppa population.

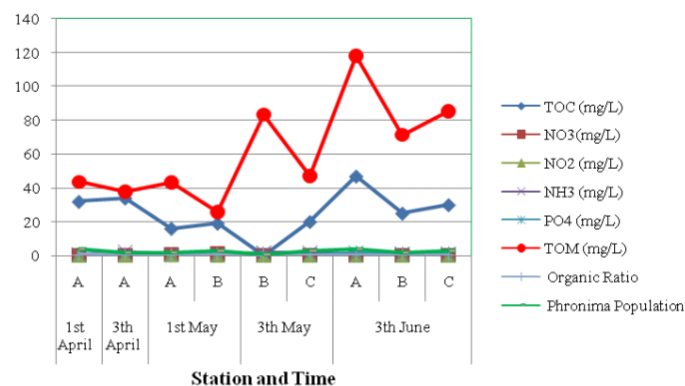


Figure 5. Organic materials and chemical compounds compiler and phronima suppa population

C. Plankton Dynamics

Types of plankton were found as many as 25 genera consists of 14 genera of phytoplankton and zooplankton 11 genera (Table IV). The dominant type of phytoplankton obtained during the study was Cyclotella, Skletonema, Oscillatoria, Coscinodiscus, and Microspora. The composition and abundance of plankton will change as a form of response to the dynamics of the environment [24]. Various previous studies showed plankton has an important role to phronima suppa population [35].

TABLE IV. COMPOSITION PLANKTON TYPE ON RESEARCH STATION

Phytoplankton	Zooplankton
<i>Cyclotella</i>	<i>Temora</i>
<i>Skletonema</i>	<i>Tortanus</i>
<i>Climcosphenia</i>	<i>Acartia</i>
<i>Lauderia</i>	<i>Microsetella</i>
<i>Labidocera</i>	<i>Nictora</i>
<i>Trachychloron</i>	<i>Oithona</i>
<i>Oscillatoria</i>	<i>Copepoda</i>
<i>Chaetococcus</i>	<i>Apocyclops</i>
<i>Coscinodiscus</i>	<i>Schmackeria</i>
<i>Labidocera</i>	<i>Acartia</i>
<i>Thalassionema</i>	<i>Cletocampus</i>
<i>Stichococcus</i>	
<i>Melosira</i>	
<i>Microspora</i>	

Genera of zooplankton dominated by Class Crustacea consisting of six types and Schmackeria and Oithona groups (Table V).

Plankton abundance fluctuated (Table V and Fig. 6). The highest phytoplankton abundance occurred in April (86 ind/l) and the lowest in May (2 ind/l) and June (2 ind/l).

TABLE V. PLANKTON DIVERSITY INDEX

Time	Diversity Index	Dominance Index
April	1.1407	0.4740
May	0.6365	0.5555
June	0.7646	0.5731
July	1.5228	0.2343

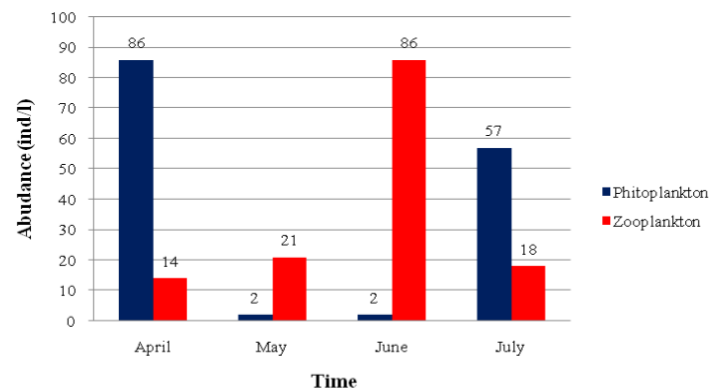


Figure 6. Phytoplankton and zooplankton abundance (ind / l)

In April the lowest zooplankton abundance (14 ind/l) and the highest in June (86 ind/l). Phytoplankton abundance of plankton mainly influenced by the availability of hara, especially nitrogen (N) and phosphorus (P) [36]. Fluctuations in the abundance of phytoplankton and zooplankton in turn are relevant to the theory of predation which states when a zooplankton population began to increase, the speed of predation on phytoplankton at a certain level so that the speed of phytoplankton development are not able to compensate for the growth of zooplankton. When the zooplankton population decline, phytoplankton will proliferate so abundant populations [23], [30].

Dominance index values in the range 0.2343 - 0.5731 means nothing dominating species predation could explain the mechanism that occurs in the plankton. Diversity index values during the study ranged 0.6365 - 1.5228 meaningful diversity of plankton unstable and be a determinant of achievement of the stationary phase. The existence of NO_2 describe the process of reform of the organic material has a very low dissolved oxygen levels [32], [33]. Plankton including highly sensitive biota that increased levels of NO_2 by 1 mg/l will decrease as much as 32.898 genera genus plankton. Increased levels of PO_4 at 1 mg/l will reduce as much as 2.156 plankton genera genus [24].

IV. CONCLUSION AND SUGGESTION

Phronima suppa stability at A and B stations lasted approximately two weeks. The ratio of organic, nitrate and phosphate availability and plankton dynamics that determine the abundance of phronima suppa at A and B stations. Phronima suppa population found in organic ratio between 0.30 to 0.90. Type the dominant phytoplankton are Cyclotella, Skletonema, Oscillatoria, Coscinodiscus, and Microspora. Stationary period, the ratio of organic, nitrate and phosphate as well as the type of dominant plankton become an important determinant in the development of production phronima suppa artificially.

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