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Original Research Article

Occurrences of *Acetes Paraguayensis* in Timpuk Lake, Barangay Su'uh, Panamao, Sulu, Philippines

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Abstract: *Acetes paraguayensis* is the only species of *Acetes* that occurs in freshwater. A genus of small, krill-like prawns occurs in Timpuk Lake, Barangay Su'uh, Panamao, Sulu. A Shrimp aquaculture is one of the vital parts that determine the world economy. However, a very small portion of *Acetes paraguayensis* catches are sold as fresh shrimp in the locality. The greater portion are sold dried. Statistical analysis (one factor ANOVA), showed no significant difference at five percent level of significance with a degree of freedom between of 3, degrees of freedom within 36. The tabular value is 2.92. For this study, the computed value is 0.41 which is far less than the tabular value, thus the null hypothesis that states no significant difference of the occurrences of shrimp fry (*Acetes p.)* at four quadrant or the catching station at Timpuk Lake, Barangay Su'uh, Panamao, Sulu is accepted. Interview surveys were conducted right after collecting samples from the wild. The occurrence of shrimp fry *(Acetes p.)* or the planktonic shrimps were present in the study showed a bi-modal peak of occurrences according to the fisher-folk or a tenant of the lake. The abundances of the said species is between August and September and on February to March. However, occurrences were present throughout the year and best fishing time for *Acetes paraguayensis* was during the dark phase of the moon. Indeed, *Acetes paraguayensis* (shrimp fry) occurred uniformly at all areas of lake. To date, published work on *Acetes* especially ecology, temporal distribution in the Philippines are still very scarce.

Keywords: Abundances, *Acetes*, Ecology. Krill, Mysids, Occurrences, Sergestidae.

INTRODUCTION

Acetes paraguayensis is the only species of *Acetes* that occurs in freshwater. [9]. A genus of small, krill-like prawns. *Acetes paraguayensis* sergested in afftuents of the Timpuk Lake located at Barangay Su'uh, Panamao Sulu (2018). The commercial importance of *Acetes* is derived from consumption by humans and its potential as a food for aquaculture. The production of shrimp paste in South East Asia, including *Acetes japonicus*, which is the world's most heavily fished species of wild shrimp or prawn in terms of total tonnage [5]. The freshwater shrimps are one of the most important groups of invertebrates in decaying organic matter. The shrimps also constitute a fundamental element in the aquatic ecosystem fauna, where they function as macro-consumers. *Acetes* is not a targeted catch and is caught as a by-catch in trawl gear.

In Sulu, very little quantity of *Acetes* landed is consumed in fresh form and due to poor handling most of the catch is degraded as it reaches the coast. Lack of proper storage facility caused the high portion of catch landed is in decomposed form. Thus, this raw material are either salted or dried. However, dried *Acetes p*araguayensis are mostly available in the Sulu market. Dry *Acetes* contains 15.55% moisture, 63.76% protein, 6.03% fat and 13.62% ash. Thus, this study was to provide information on *Acetes paraguayensis* locally known "Uyap" sampled along the Timpuk Lake, Barangay Su'uh, Panamao Sulu. Data from this study is limited on the Occurrences of Acetes paraguayensis on daily catch per day. The conservation and management of *Acetes paraguayensis* or shrimp fry along this area have not been studied as well the reproductive biology of this species in Sulu Province. Hence, reproductive biology of the genus *Acetes* such as the sex ratio, maturity, breeding patterns, and fecundity is essential information for developing the aquaculture industry and forming management policies for the *Acetes* fishery. Philippines has no data on the ecology of *Acetes paraguayensis.*

A very small portion of Acetes catches are sold as fresh shrimp fry in Asian countries. The greater portion are boiled, dried in the sun, dried after boiling and sometimes processed further by removing the carapace and fermented with salt (shrimp paste and shrimp paste) or pickled in salt [17]. Among these products, fermented shrimp paste ('Xiajiang ' in China, 'Memtep" in Vietnam 'Gapi', 'Ngapi' in Myanmar, 'Trasi','Terasi' in Indonesia , 'Kapi' in Thailand, 'Bagoong alamang" ***burong, dinailan and lamayo*** in Philippines, 'Belacan' or 'Belachan' in Malaysia and Singapore) and sauce ('Xiajou' in China, 'Nam-pla' or 'Nam-keow' in Thailand) are highly desirable in China and South East Asia. Apart from 'Belacan'.

Apart from high demand for human consumption, Acetes spp. Provide a major source of protein for coastal populations in Asia and East Africa. Acetes spp. As a food organism also play an important role in agriculture and aquaculture. Feed for livestock and poultry, feeds for different larval stages in prawn hatcheries [12] and a live feed for brood stock [7].

Locally fresh or dried mysids and *Acetes* are called "jembret" and "rebon", respectively. Both "jembret" and "rebon" are processed for making fermented shrimp paste called "terasi". This product is commercially important in Indonesia to make chili sauce "sambal terasi" or flavor cooking. "Rebon" is also utilized to make shrimp sauce 'petis'.

Fig 1: Dried Acetes *paraguayensis*

PRODUCTS OF *ACETES SPP.*

1. Shrimp Paste

If the shell shrimp paste is fermented for a long period of time, the shell eventually decomposes and the product becomes a semi-liquid paste. At the end of the manufacturing process, shrimp paste is usually dried to reduce the moisture content and to produce a semi-solid product. The semi-solid nature of the product means it needs only a little amount of salt and it has a strong umami taste.

Kapi, a typical traditional salted shrimp paste, has been widely consumed in Thailand as a condiment. Traditionally, salted shrimp paste is produced by mixing one part of salt with three to five parts of shrimp or krill. The mixture is salted, pounded and spread out on the ground to dry under sunlight. The paste is compacted and allowed to ferment in anaerobic condition at ambient temperature (25–35^{0}C) for at least 1 month or longer [4]. Shrimp tissues undergo enzymatic breakdown during the fermentation and bacterial action assist in proteolysis and flavor development. Various techniques used to produce belacan results in composition and quality differences among products. Dried shrimp is usually used for paste production. Salt is added with different individual's favorite ratio (5-20%) and mixed thoroughly. The darker colored shrimp paste is produced after it is being fermented for one week.

Petis-udang is also another local shrimp paste widely consumed in Indonesia. The shrimp wastes (heads and shells) are boiled to produce *petis-udan;* the waste is by-product of Indonesian shrimp crackers (*krupuk-udang)* processing, in which the shrimp meat is used. *Petis-udang* is used as a seasoning in various Indonesian-style salad dressings and other dishes [1]. The nucleotide content in *petis-udang* is not very high, but it contains a variety of free amino acids, such as glycine, alanine, and glutamic acid.

Bagoong-alamang is consumed raw or cooked and is generally used as flavoring or condiment in many traditional Filipino dishes. The characteristics of this product vary among different parts of the Philippines. In the Tagalog provinces, the paste is completely fermented and ground, with or without the addition of coloring matter. In the Ilocos and Pangasinan provinces, it is either partially or completely fermented. In the Visayas and Mindanao provinces, the product is slightly fermented without any liquid. Bagoong-alamang is normally fermented for 10 days. The content of L-glutamic acid in *bagoong-alamang* increased from 25.8 to 38.2 mg/100 g during the 10 days of fermentation. The

increase in free glutamic acid during fermentation enhances the desirable umami taste in the product. Prolonged fermentation of shrimp paste for more than one year brings about a decrease in free amino acids, especially free glutamic acid. The shrimp paste made in the Philippines was reported to contain higher free glutamic acid (814.15 mg/100 g) as compared to those made in other Southeast Asia countries.

2. Fermented

Fermented fishery products are extensively consumed in Southeast Asian countries since the fifteenth century, and consumed as staples, side dishes or condiments/seasonings in daily foods. The widespread consumption of fishery fermented products over a wide geographical area throughout Asia is due to the simplicity of the processing techniques and uniformity of the final fermented products .Those products impart delicacy and have high nutritional value [4]. Although some products have similar process, some ingredients used can be varied, leading to the different characteristics, especially flavor and taste. Fermentation process is also influenced by several variables including: Microflora present in the raw material and salt, Proteolytic activity of raw material and microorganism, Condition of the product entering the fermentation process, Presence or absence of oxygen, Nutritional state of the raw material, Temperature, pH of the fermentation mixture, Presence of visceral enzymes, Presence and concentration of carbohydrates and as well the Duration of the fermentation process

Table I: Fermented shrimp products in Southeast Asian Countries

Country	Shrimp sauce	Shrimp paste	Fermented shrimp
Burma	Ngan pya ye	Seinsanga-pi andHmyinnga-pi	
Cambodia	Nam tom	Kapi, Pra hoc and Mamruoc	
Indonesia		Terasiudang	
Malaysia		belacan	cencalok
Myanmar	Pazunggampya ye	Nga-pi, Seinza and Hmyannga pi	
Philippines	Alamang- patis	Bagoong-alamang, Buronghipon, Dinailan and Lamayo	Balao-Balao
Thailand	Namkapi and Nam khoei	kapi	Jaloo and Koongsom
Vietnam	Nam tom Nuocmam torn chat	Mam ruoc, Mam tom and Mam tep	

Source: Hajeb, *et al.*, 2012

Balao-balao in the Philippine is a lactic acid fermented rice/shrimp mixture, which is prepared by mixing boiled rice, raw shrimp and 3% of salt. *Penaeusindicus* or *Macrobrachium* shrimp species are usually used to produce balao-balao. The mixture is usually packed in an anaerobic container and allowed to be fermented for few days or weeks. During fermentation the mixture becomes acidic, and the shrimp shell reddens and softens. Balao-balao is well-preserved because it has low pH and is kept in the anaerobiosis environment; however, the product must be cooked before consumption [14]. It is commonly prepared for the table in sautéed form and is consumed as an appetizer or main dish.

Cencalok or pickled shrimp is a popular Malaysian product made from *Acetes* shrimp. To make cencalok, shrimp is usually washed and added with 10-20% salt and some amounts of rice powder. The mixture is then fermented for more than one month [2]. After it turns into a suspension of tiny pink shrimp in a sauce having a salty taste. The product has a very strong shrimp, briny smell which stings to the nose [2]. His product has rich umami taste and contains about 864 mg/100 g free glutamic acid [8].

Jaloo is an indigenous salt fermented krill shrimp (*Macrobrachium orientalis*) produced by the residents of the coastal areas in the south of Thailand. Jaloo is produced from fresh (un-dried) krill shrimp that has undergone anaerobic fermentation for 2–3 days. Koongsom is another fermented shrimp product of Thailand produced by mixing small shrimp (*Acetes sp*.) with salt and palm-sap-sugar concentrate as a source of carbohydrate. The mixture is usually fermented by lactic acid bacteria for the development of a sour taste and the typical flavor of fermented shrimp [15].

Table II: Shrimp of Acetes species used for fermentation in Southeast Asian countries

COUNTRY	SPECIES
Burma	*A. indicus, A. intermediuc* and *A. vulgaris*
Indonesia	*A. japonicas* and *A. sibogaesibogae*
Malaysia	*A. japonicas, A. erythraeus* and *A. sibogaesibogae*
Philippine	*A. erythraeus, A. intermedius, A. vulgaris* and *A. paraguayensis*
Singapore	*A. erythraeus, A. indicus* and *A. vulgaris*
Thailand	*A. japonicus*

Source: Ruddle

3. Dried Acetes

After drying, the product is marketed without proper packaging which further deteriorates the quality of the dried material. Only a small quantity of good quality dried. Dried *Acetes* has export market in Japan, Sri Lanka and other countries. Sun-dried which can be useful for developing new ready to eat products.

Acetes can serve as an important source of essential amino acids and that the sulphur-containing essential amino acids and lysine present in *Acetes* can supplement the corresponding deficiencies in plant proteins. Eight essential and five non-essential amino acids including glutamine, asparagine, lysine, leucine, arginine, glycine and valine were recorded in abundant qualities in the caridean prawn.

Table III: Amino acid profile of sun-dried *Acetes*

Amino acids	(per 1000 residues
Aspartic acid	134.97
Theronine	23.40
Serine	32.98
Glutamine	294.07
Proline	13.93
Glycine	19.31
Alanine	160.55
Valine	35.40
Methionine	12.12
Isoleucine	22.94
Leucine	90.41
Tyrosine	12.05
Phenylalanine	18.20
Histidine	54.85
Lysine	53.66
Arginine	30.79

MICROBIOLOGICAL QUALITY

Shrimps deteriorate due to improper handling, and further processing can never bring back its freshness. Low quality frozen foods are related with improper processing and poor hygienic conditions. Contamination in shrimp may be due to poor hygienic condition including inappropriate processing, preservation and storage condition. Consequently, shrimps may be contaminated with different types of bacteria such as *Vibrio spp*., *Salmonella spp*., coliform, fecal coliform, streptococci and Staphylococcus spp., those spoil fishes and are responsible for causing cholera and other food borne disease outbreaks [9, 19].

Shrimp or prawns, which are of far greater overall economic importance but die soon after capture. In addition to their endogenous microflora, shrimp are often contaminated with bacteria from the mud trawled up with them and are therefore subject to rapid microbiological deterioration following capture. Consequently they must be processed either by cooking or by freezing immediately on landing.

NUTRITIONAL COMPONENTS

Shrimps are high in protein, low in saturated fat [3]. A good source of quality protein, carotenoids Shrimps have low fat, less cholesterol and high PUFA content compared to eggs, and the current understanding on dietary cholesterol linked with egg consumption clearly confirms the nutritional value of shrimps. Shrimp identified as a rich source of vitamin $B_{12,}$ selenium, highly unsaturated fatty acids (HUFA) and astaxanthin, a potent natural antioxidant.

WHAT IS A SURVEY

Surveys are a very traditional way of conducting research. A survey approach used to establish the prevalence or incidence of a particular condition. Likewise, the survey approach is frequently used to collect information on attitudes and behavior. Some issues are best addressed by classical experimental design where participants are randomized to either an intervention group or a control group. In the real world it is not always a very practical design. There may be good reasons, either ethical or practical, why participants cannot be randomly assigned.

Explanatory or Correlational Surveys seek only to describe events and attitudes. It is also possible for surveys to take an explanatory or correlational approach. This means that by using survey data the researcher would try to explore causal relationships between two or more variables. Demonstrating a causal relationship using survey data will always be more difficult than using an experimental design. Nevertheless there will always be situations in which an experimental

design is just not possible. Using a longitudinal approach may also help in trying to identify a causal relationship. Statistical tests can be used to show statistically significant differences between groups in a survey. Confounding variables can also be controlled for in the data analysis

STATISTICAL ANALYSIS

A one- way ANOVA or analysis of variance was used for analyzing the data information output.

MATERIALS AND METHODS

Sampling Site

Timpuk Lake of barangay Suh, Old Panamao is a 4th class municipality, BARMM, Philippines. The estimate terrain elevation above sea level is 1 meters. Latitude: 6°2'17.02" and Longitude: 121°10'45.01"

Fig 2: Location site, Timpuk Lake, Barangay Su'uh, Panamao, Sulu

Fig 3: Aerial map of Timpuk Lake, Barangay Su'uh, Panamao, Sulu

METHODOLOGY

Data collected on this study were divided into group of survey. Assessment of the total catch and a personal interview with the tenants or the fisher-folk of the area were likewise considered. *Acetes paraguayensis* specimens were sampled from Timpuk Lake, Barangay Su'uh, Panamao Sulu, inshore catches using scope nets. Assessment as based on the small caretaker's house which serves as the quadrant per catch. Four quadrant were the basis for the computation per catch per day. Before going to the site, the researcher with the group went to the barangay captain Mr. Qayson Abdurajak for the courtesy call and for security reason.

Fig 4: Hall of Barangay Su'uh, Panamao, Sulu

ENVIRONMENTAL VARIABLES

Physicochemical variables such as water temperature, salinity, dissolved oxygen (DO), were recorded along the four (4) quadrant during the sampling time.

Fig 5: Sampled harvest of *Acetes paraguayensis* using scoop net and pH water monitoring

RESULTS AND DISCUSSION

The study site as the fishing grounds of *Acetes paraguayensi* located at Timpuk Lake, Barangay Su'uh, Panamao, Sulu. Only a very small portion of *Acetes paraguayensis* catches are sold as fresh shrimp in the locality. The greater portion are sold dried.

Statistical analysis (one factor ANOVA), showed no significant difference at five percent level of significance with a degree of freedom between of 3, degrees of freedom within 36. The tabular value is 2.92. For this study, the computed value is 0.41 which is far less than the tabular value, thus the null hypothesis that states no significant difference of the occurrences of shrimp fry (*Acetes p.)* at four quadrant or the catching station at Lake Timpuk Lake, Barangay Su'uh, Panamao, Sulu is accepted.

Considering the consumer health safety and economical sustain it is worth to maintain the microbiological quality of *Acetes paraguayensis*. On the contrary, *Acetes paraguayensis* possess the antimicrobial activity as well, depending on the composition of the polysaccharide chitin.

The Occurrence of shrimp fry *(Acetes p.)* or the planktonic shrimps were present in the study showed a bi-modal peak of occurrences according to the fisher-folk or a tenant of the lake. The abundances of the said species between (August and September) and (February to March). However, occurrences were present throughout the year.

SUMMARY AND CONCLUSION

Therefore concluded that the *Acetes paraguayensis* (shrimp fry) occurred uniformly at all areas of lake. There is no published work on *Acetes* especially ecology, temporal distribution in the Philippines. The purpose of this study is to get detailed information about fisheries of the shrimp *Acetes* in Sulu Province, as to the current issues of these fisheries has never been addressed since the contribution of [12]. In addition, we would like the Sulu Government to provide the

fisheries statistics of these crustaceans in consideration of its economic importance. The basis of this study is through field samplings and interview assessment as well.

RECOMMENDATION

Considering *Acetes paraguayensis* is a perishable fishery resources, the study suggested to:

1. Follow a proper guideline for the maintenance of microbiological quality of Acetes paraguayensis
2. Proper hygiene and sanitation should be maintained between capture and delivery to the consumers of the shrimps which thereby aid in the reduction of food borne disease outbreaks.
3. Area enclosure within the boundary for sustainable livelihood and as well for eco- tourism of the community.

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