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Socio-demographic profile and baseline information on Freshwater Clam (*Corbicula* spp.) "Bennek" in Alcala, Cagayan Valley: Policy recommendation

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Abstract

This study aims to acquire baseline data on the socio-economic profile of the Freshwater Clam "bennek" gatherers, their fishing techniques, conservational practices, and management plans in light of the increasing strain of development on biodiversity. This study used the descriptive-survey method of research. The bennek gatherers were discovered to be middle-aged, to have completed elementary and high school, to have two siblings living with them, and to have their fathers as the primary gatherers of their young. The gatherers had an average harvest of less than 5 gantas each day for 3–4 hours per day, 4-5 days per week, and use their own wooden boat and "Karadikad" as harvesting implement. Majority of bivalve gatherers earned less than 5000.00 pesos per month. Additionally, majority of bennek gatherers reside in concrete homes with electric lighting and deep wells for water source. In addition, the months of March through July are when the harvest is at its greatest. Most of the gatherers' harvest is used for domestic consumption. Majority of gatherers appreciate the varied management strategies' relevance. Quarrying and river siltation are two issues that the "bennek" gatherers frequently encounter. Policy recommendations were presented to the Local Government Unit of Alcala for a sustainable supply of Freshwater Clam locally known as bennek in the different study sites where this resource is thriving.

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Introduction

Due to extraordinary pressures brought by the increase in human population and socioeconomic expansion, freshwater environments are among the most vulnerable on the globe (Dudgeon *et al.*, 2006; Vorosmarty *et al.*, 2010; Vorosmarty *et al.*, 2015). The increasing global anthropogenic pressure causes habitat destruction, ecosystem changes and degradation, over-exploitation, pollution, the introduction of invasive alien species (IAS), and climate change (Malmqvist and Rundle, 2002; Strayer and Dudgeon, 2010; Hermoso *et al.*, 2016). Freshwater bivalves are among the species with high extinction levels as a result of the biodiversity crisis, which is one of the main repercussions of a sharply increasing human demand (Strayer *et al.*, 2004; Lydeard *et al.*, 2004; Regnier *et al.*, 2009; Lopes-Lima *et al.*, 2014, 2017). The species' possible survival is considerably impacted, and the wide range of ecological services it provides to researchers, managers, policymakers, and the general public will strengthen their cooperation in protecting this organism.

The Cagayan River, located in the Cagayan Valley area in the northeastern part of Luzon, is the longest in the Philippines. It flows across the provinces of Nueva Vizcaya, Quirino, Isabela, and Cagayan (Principe, 2012; Lopes-Lima *et al.*, 2018). The 505-kilometer-long headwaters of the Caraballo Mountains in central Luzon run north into the Babuyan Canal close to the town of Aparri, where the Cagayan River drops sharply to 91 meters at the river's mouth (Mayor and Ancog, 2016). It should be kept in mind that stream flooding may have contributed to the river's extension, and although this has not yet been confirmed, in some cases, loose and unconsolidated riverbank sedimentary deposits may have had an impact on the flora. It offers a variety of resources that support the livelihood of the fishermen and other activities that enable them to be productive. Given its wide area, it is one of the principal sources of freshwater fish such as the high-priced "Ludong", *Cestraeus plicatilis*, mollusks (unnok; *dalilea* spp., balinggasa; *anodonta woodiana*, tulya; *Corbicula manilensis*, and kabibe; *Batissa violacea*, etc.) and crustacean (*Aramang; Palaemon* and *Acetes* spp.,

etc.). One municipality that benefitted from the diversity of the Cagayan River is Alcala, Cagayan, which is a third-class municipality in the Cagayan province. It is located along a section of the Cagayan River where farming and fishing are two of the local population's main sources of income. The Cagayan River, also known as Rio Grande de Cagayan, is the longest and widest stream on the island of Luzon and is home to a variety of fish species. One of these fisheries' resources is the *Corbicula* spp. that thrives in the tributaries of the Cagayan River and is commonly referred to as "bennek" by the locals.

Considering current information about the environmental practices and socioeconomic profile of bivalve gatherers in the Cagayan Valley, Philippines this will be a significant contribution to the environmental protection of bivalve species. Similar to beliefs, affective reactions, and behavioral intentions, conservation practices cover activities and issues related to the environment (Schultz *et al.*, 2004; Geng *et al.*, 2015). Assessing environmental awareness is necessary to determine the level of knowledge held by the population being studied regarding the seriousness of environmental problems, their response to, and their interactions with, nature (Ziadat, 2010; Ayukekbong, Ntemgwa, and Atabe, 2017).

Worldwide, excessive human exploitation and frequently ill-considered state economic policies significantly and negatively influence biodiversity and the natural environment. According to some experts, the solution to this issue may lay in a thorough investigation and comprehension of human environmental knowledge and attitudes (Newbold *et al.*, 2015). Thus, the socio-demographic profile of the *Corbicula* spp. gatherers, their harvesting practices, and problems encountered while gathering this resource were assessed in this study.

Materials and methods

Study Site

This study was conducted in the four barangays of the municipality of Alcala namely: Tupang, Maraburab, and Carallangan which are adjacent to the Cagayan River, while Pinopoc is located within its tributaries.

Fig. 1. Map showing Alcala, Cagayan Valley.

Research Design

The descriptive-survey method of research was used in this study. It documented the demographic profile of the Corbicula spp. gatherers in the four barangays, their fishing practices and methods of collection, and problems they encountered in gathering the freshwater clam.

Respondents and Sampling Techniques

The researchers requested the list of respondents from the Municipal Agriculturist Office (MAO) of LGU Alcala which was generated from the Fish R system. The bennek gatherers in every site of the study were taken as respondents. Purposive sampling technique was adopted in identifying the Corbicula spp. gatherers involved in the study. Only those identified based on the list were given questionnaires and interviewed.

Research Instrument

A questionnaire was used to gather the necessary data. Part 1 of the questionnaire elicited data regarding clam gatherers' demographic and economic profile; Part II focused on clam gatherers' practices, gathering tools, and problems they encountered while gathering freshwater clam. The questionnaires were personally distributed by the researchers to the respondents.

The researchers assisted the respondents in answering by translating some questions into their dialect.

Data Collection

Before the research implementation, formal coordination and seeking permission from the authorities concerned were done. Upon the approval from the municipal mayor of Alcala was sought subsequent coordination was made with the barangay captain of the selected study sites. The agricultural technician assisted the researchers in floating questionnaires together with the barangay officials in the different communities involved in the study. An informal interview with the respondents was also performed to gather further details and validate data gathered from the questionnaires.

Data Analysis

The collected data were organized and tabulated for analysis. Descriptive statistics such as frequency counts and percentage rank were used in the study.

Results and discussion

Distribution of Respondents

The municipality of Alcala consists of 25 barangays. Out of the 25 barangays, 4 of them were identified as the sampling site. The lists of Registered Fisher folks were provided by the Municipal Agricultural Office of the municipality.

Based on the list, twenty-seven (27) came from Brgy Tupang, and Fifteen (15) came from Brgy. Maraburab, twelve (12) came from Brgy. Pinopoc and eight (8) were from Brgy. Carallangan.
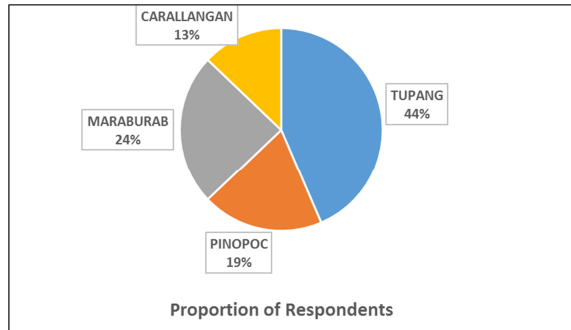

Fig. 2. The proportion of respondents in the different Barangay.

Gatherer's Profile
Table 1 shows the respondents' demographic profile. As for age, it was noted that 31-40 years of age was the highest which constitute 29.03% of the respondents, while the eldest group of 61 above was the lowest. Looking at the gender, most of the gatherers were male which constitute 75.81% while female has only 24.19%.

Table 1. Demographic profile of respondents.

Age	Frequency (n=62)	Percent
20-30 years old	14	22.58
31-40 years old	18	29.03
41-50 years old	14	22.58
51-60 years old	9	14.52
61-Above	7	11.29
Gender		
Male	47	75.81
Female	15	24.19
Educational Background		
Elementary Level	20	32.26
HS Level	20	32.26
College Level	6	9.68
No Schooling	4	6.45
Elementary Graduate	7	11.29
HS Graduate	5	8.06
Number of Years in Gathering "Bennek"		
0-10 Years	29	46.77
11-20 Years	24	38.71
20 Years Above	9	14.52

It denotes that the majority, the head of the family engaged mostly in looking for food and working to provide for the needs of the family. Concerning educational background, the table shows that most of the gatherers were at the elementary and high school level which constitutes 32.26%, about 6.45% did not attend school and there were 9.68% who are at the college level.

The data suggest that bennek collectors came from families that could not adequately support the education of their children. Furthermore, in terms of the number of years in gathering bennek, most of them are within less than ten years with a percentage of 46.77%, and more than 20 years being the lowest. According to the respondents during the interview, fathers help in transporting their harvest to the market and the children help mothers in doing the marketing and processing.

Socio-economic Status of the Respondents
Table 2 shows the socio-economic status of the respondents. As to the number of siblings in the family, most of the respondents have 1-2 siblings with a frequency count of 27 or 43.55% and only one respondent is having 7 siblings above. This finding indicates that most bennek gatherers had a small size family. In terms of house ownership, most of the gatherers owned their house 54.84% and most had a concrete type of house with a frequency of 20 and only 1 had a nipa/cogon house.

This shows that the respondents are aware that one of the basic needs of a family is a house. Moreover, most of the gatherers have electricity as lighting facilities and a deep well as a source of water. Further, fishing and farming are the major sources of income with a frequency of 30 and 26 respectively. For the monthly income of the bennek gatherers, 35 or 56.45% have an income of below P5, 000.00.

This finding implies that the respondents mostly belong to families whose living standards are below the poverty line. According to the latest report by the National Statistical Coordination Board (NSCB) of the Philippines, a Filipino family of five members needs PhP 5,458.00 monthly income to buy their minimum basic food needs and Php 7,821.00 monthly to include their minimum basic non-food needs.

Table 2. Socio-economic status of the respondents.

Number of Siblings	Frequency (n=62)	Percent
1-2 Siblings	27	43.55
3-4 Siblings	11	17.74
5-6 Siblings	5	8.06
7 Siblings Above	1	1.61
No Answer	18	29.03
House Ownership		
Owned	34	54.84
Not Owned	15	24.19
No Answer	13	20.97
Type of House		
Concrete	20	32.26
Nipa/Cogon Hut	1	1.61
Wood/Bamboo w/GI Roof	5	8.06
Half Nipa/Half Concrete	6	9.68
No Answer	30	48.39
Lighting Facilities		
Kerosene Lamp	2	3.23
Electric Light	51	82.26
Gasoline/Candle Light	1	1.61
No Answer	8	12.90
Source of Water Supply		
Pump Well	23	37.10
Deep Well	25	40.32
Nawasa	14	22.58
Source of Income		
Fishing	30	48.39
Farming	26	41.94
Construction	16	25.81
Others (e.g Driving,Labandera, Laborer)	22	35.48
Monthly Income		
5,000 below	35	56.45
5,000-10,000	11	21.15
10,000-15,000	3	5.77
15,000 above	3	5.77
No Answer	10	19.2

Gathering Management and Strategies

The gathering tools/implement by gatherers used and their management strategies are shown in Table 5. Most of the respondents with a frequency of 27 or 43.55% use the "karadikad" in gathering followed by gleaning or manual with a frequency of 17 or 27.42%. Out of 62 gatherers, fishing and gathering are done by the head of the family with a frequency of 20 or 32.26%.

Most of the time, their children also help the father in gathering bennek. It indicates that all family members cooperate and practice division of labor for their livelihood. Furthermore, most gatherers used their wooden boats in gathering bennek with a frequency of 21 or 33.87%.

Table 3. Gathering tools/implements.

Gathering Tools/Implements	Frequency (n=62)	Percent
Karadikad	27	43.55
Trawl	7	11.29
Tako	5	8.06
Karadikad w/ Net	2	3.23
Gleaning	17	27.42
No Answer	4	6.45
Family Involved in Gathering Bennek		
Father	20	32.26
Mother	7	11.29
Children	17	27.42
Other (e.g Partner, BF/GF)	18	29.03
Type of Boat used in Gathering Bennek		
Wooden Boat	21	33.87
With Engine	16	25.81
Without Engine	7	11.29
Owned	21	33.87
Shared/Rented	2	3.23
No Boat	1	1.61

Management strategies

Table 4 shows the management practices and strategies being employed by the respondents. Of all the identified strategies, most of the gatherers wanted to limit the catch with a frequency of 20 or 32.26%, followed by gear restriction (f=16 or 25.81%), size catch regulation (f=15 or 24.19%), close season (f=10 or 16.13%) and gear modification being the lowest with only one respondent.

It means that the gatherers who are mostly dependent on the bennek resource wanted to regulate the volume of catch to make it sustainable. This practice of the gatherers is very important to let resource reproduce thereby sustaining the standing stocks.

Looking at the likeliness of the different strategies, most of the bennek gatherers answered this as important for gear restriction with a frequency count of 16 or 25.81%, very important for limiting the catch (f=23 or 20.97%), they need to regulate the size being collected (f= 18 or 29.03%).

Most of the respondents responded that gear modification is also important (f=21 or 33.87%) as part of the management strategy and closed season should be implemented (f=21 or 33.87%). Findings revealed that the bennek gatherers are very vigilant in protecting the bennek resource and its habitat.

Table 4. Management practices/strategies.

Management Practices/Strategies	Frequency (n=62)	Percent
Gear Restriction	16	25.81
Limit Catch	20	32.26
Size Catch Regulation	15	24.19
Gear Modification	1	1.61
Close Season	10	16.13
Likeliness on the Importance of the Management Practices		
Gear Restriction		
Should be restricted	6	9.68
Slightly restricted	13	20.97
Important	16	25.81
Very important	9	14.52
Don't know	3	4.84
No Answer	15	24.19
Limit Catch		
Should be restricted	3	4.84
Slightly restricted	4	6.45
Important	17	27.42
Very important	23	37.10
Don't know	4	6.45
No Answer	11	17.74
Size Catch Regulation		
Should be restricted	3	4.84
Slightly restricted	3	4.84
Important	18	29.03
Very important	17	27.42
Don't know	10	16.13
No Answer	11	17.74
Gear Modification		
Should be restricted	7	11.29
Slightly restricted	6	9.68
Important	21	33.87
Very important	12	19.35
Don't know	3	4.84
No Answer	13	20.97
Close Season		
Should be restricted	21	33.87
Slightly restricted	3	4.84
Important	3	4.84
Very important	5	8.06
Don't know	10	16.13
No Answer	20	32.26

Table 5 shows the duration of implementation of the identified management strategies. For the gear restriction, most of the respondents wanted to implement this for 9 months to 1 year (f=7 or 11.29%), limiting the catch and size catch regulation should be implemented within 1-2 months only with a frequency of 13 or 20.97% and 17 or 27.42% respectively. For the gear modification, respondents wanted to implement it within 3-4 months and 7-8 months with a frequency of 3 or 4.84% while for close season, with a frequency of 2 or 3.23% wanted to implement it within 9 months to 1 year. Results revealed that respondents have different views and perceptions as to the duration of implementation of the given management strategies.

Table 5. Duration of management strategy implementation.

Duration of Management Strategy Implementation	Frequency	Percent
Gear Restriction	(n= 62)	
1-2 months	4	6.45
3-4 months	2	3.23
5-6 months		0.00
7-8 months	3	4.84
9 months-1 year	7	11.29
No Answer	46	74.19
Limit Catch		
1-2 months	13	20.97
3-4 months	5	8.06
5-6 months		0.00
7-8 months	3	4.84
9 months-1 year	1	1.61
No Answer	40	64.52
Size Catch Regulation		
1-2 months	17	27.42
3-4 months	5	8.06
5-6 months	2	3.23
7-8 months	1	1.61
9 months-1 year	1	1.61
No Answer	36	58.06
Gear Modification		
1-2 months	1	1.61
3-4 months	3	4.84
5-6 months	1	1.61
7-8 months	3	4.84
9 months-1 year	1	1.61
No Answer	53	85.48
Close Season		
1-2 months	1	1.61
3-4 months	1	1.61
5-6 months		0.00
7-8 months	1	1.61
9 months-1 year	2	3.23
No Answer	57	91.94

Fisheries Data
Gathering/Collection Sites
Table 6 shows the location of the gathering site for bennek gatherers. Most of the respondents gathered bennek within their barangay with a frequency of 49 or 79.03%, 6 respondents gathered bennek nearby barangay (f=9.68%), and 4 or 6.45% of the respondents collected in other municipality. In terms of the area of the gathering sites, most of the respondents had a fishing ground below 1 ha with a frequency of 36 or 58.06%. In terms of water depth, most of the respondents identified their gathering sites as below 5 foot with a frequency of 29 or 46.77%. It simply denotes that gatherers can only collect

bennek during low tide or when the water level is low. Moreover, respondents identified the type of sediments in the sites as sandy and muddy with a frequency count of 29 or 46.77 and 25 or 40.32 respectively. The observation of the respondents is a manifestation of the habitat structure of the bennek resource. Aside from bennek, other resources have been collected and majority of such are balinggasa (f=20 or 32.26%), lasik (f=11 or 17.74%), bisukul (f=10 or 16.13%), susu and cabibi with 6 or 9.68% and 2 or 3.23% respectively.

Table 6. Gathering areas.

Location of Gathering Sites	Frequency (n=62)	Percent
Within Barangay	49	79.03
Nearby Barangay	6	9.68
Other Municipality	4	6.45
No Answer	3	4.84
Approximate Area of Gathering Sites		
Below 1 ha.	36	58.06
1-5 has.	16	25.81
6-10 has.	2	3.23
No Answer	8	12.90
Water Depth		
Below 5 foot	29	46.77
6-10 foot	16	25.81
11-15 foot	5	8.06
16 foot above	2	2.23
No Answer	10	16.13
Types of Sediments		
Muddy	25	40.32
Sandy	29	46.77
Clay Loam	3	4.84
Stonny	5	8.06
Other Species Caught		
Cabibi	2	3.23
Lasik	11	17.74
Balinggasa	20	32.26
Bisukul	10	16.13
Susu	6	9.68
No Answer	13	20.97

Gathering Practices

Table 7 discloses the gathering practices, duration, volume of catch, and marketing strategies of the respondents. As shown in the table, most of the bennek gatherers spend 2-4 hours with a frequency of 20 or 32.26% followed by 5-6 hours (f=15 or 24.19%) and 10-12 hours with a frequency of 8 or 12.90%. It denotes that most of the gatherers collected bennek the whole daytime. For the gathering frequency, most of the respondents consumed 3-4 days in a week (f=23 or 37.10%), 1-2 days (f=11 or 17.74%), 5-6 days,

and a whole week with 10 or 16.13% and 7 or 11.29% respectively. As to the volume of catch per gathering/day 20 or 32.26% gathered less than 5 gantas, and 14 or 22.58% could gather 16-20 gantas. It implied that the amount of bennek being collected depends on the number of collection hours in a day. With regards to the marketing and post-harvest activity, 18 or 29.03% of the respondents utilized their catch for their household consumption, shared it with friends and relatives (f=14 or 22.58%), some respondents sold their harvest to traders (f=12 or 19.35%), sold to markets (f=11 or 17.74%) and 5 or 8.06% of the respondents processed their harvest. On the other hand, based on the given marketing problems encountered, most of the respondents answered that there are limited buyers of bennek with frequency of 27 or 43.55%.

Table 7. Gathering duration, volume of catch and marketing strategies.

Number of Hours in Gathering Bennek	Frequency (n=62)	Percent
2-4 hours	20	32.26
5-6 hours	15	24.19
7-9 hours	1	1.61
10-12 hours	8	12.90
13 hours above	1	1.61
No Answer	17	27.42
Number of Days per Week		
1-2 days	11	17.74
3-4 days	23	37.10
5-6 days	10	16.13
Whole week	7	11.29
No Answer	11	17.74
Volume of Catch		
Less than 5 salop	20	32.26
6-10 salop	5	8.06
11-15 salop	9	14.52
16-20 salop	14	22.58
21-25 salop	9	14.52
25 salop above	5	8.06
Marketing and Post-harvest Strategy		
Family Consumption	18	29.03
Sold to Traders	12	19.35
Shared to Friends/Relatives	14	22.58
Use as Alternative Feeds	1	1.61
Sold to Market	11	17.74
Sold to Regular Buyers	1	1.61
Processed	5	8.06
Problems in Marketing		
Difficult transportation	9	14.52
Non or low numbers of buyers	27	43.55
Small size of catch	7	11.29
Expensive transportation	5	8.06
Hagging from buyers	3	4.84
Others (e.g dark color, off season)	11	17.74

Gathering Seasonality

Table 8 depicts the seasonality of gathering bennek. The high gathering effort started in the month of April until the month of July when most of the respondents answered for the month of May (f=30 or 48.39%) and the low gathering of bennek started in the month of March until the month of April. While there was no gathering of bennek in the month of January to March. The data means that there was no gathering in those months due to the rainy season which affected the habitat of the resource. Moreover, the peak of harvest started in the months of March to July while the remaining months are considered lean season.

Table 8. Seasonality of gathering bennek.

Month	High Gathering (f)	Percent	Low Gathering (f)	Percent	No Gathering (f)	Percent	Peak Season (f)	Percent	Lean Season (f)	Percent
Jan					22	35.48			27	43.55
Feb					23	37.10	23	37.10	24	38.71
Mar	9	14.52	4	6.45	17	27.42	30	48.39	17	27.42
Apr	16	25.81	18	29.03	1	1.61	35	56.45	13	20.97
May	30	48.39	2	3.23			32	51.61	1	1.61
Jun	27	43.55					27	43.55		
Jul	23	37.10	2	3.23	3	4.84	28	45.16	1	1.61
Aug	2	3.23	2	3.23	9	14.52	13	20.97	18	29.03
Sep	1	1.61	1	1.61	17	27.42	19	30.65	25	40.32
Oct			2	3.23	17	27.42	19	30.65	24	38.71
Nov			1	1.61	17	27.42	18	29.03	13	20.97
Dec			2	3.23	17	27.42	19	30.65	15	24.19

Problems Encountered by the Gatherers

The common problems encountered by the bennek gatherers are presented in Table 9. The common problem of the respondents is quarrying in the collection sites with a frequency of 21 or 33.87%, followed by siltation of the river (f=13 or 20.97%) most especially during flooding. Some respondents identified typhoon/seasonal (f=9 or 14.52%), soil erosion (f=7 or 11.29%), and mining (f=6 or 9.68%). Most of the common problems identified by the respondents were relative to the habitat destruction of bennek.

Table 9. Common problems encountered of the gatherers.

Common Problems Encountered	Frequency (n=62)	Percent
Mining	6	9.68
Fish Cage	2	3.23
Destructive Fishing	3	4.84
Chemical Discharge	1	1.61
Soil Erosion	7	11.29
River Siltation	13	20.97
Quarrying	21	33.87
Others (e.g high water level, seasonal, typhoon)	9	14.52

Conclusion

This study was conducted to document local fishery methods of collection, and socio-economic aspects and to determine species and size composition, seasonality, and relative abundance of the freshwater clam "bennek" resource in Alcala, Cagayan. The findings of the study revealed that in terms of bio-demographic data, the bennek gatherers are mostly males with ages of 31-40 years old, elementary and high school level, compose of 4-6 members in every household with the father as prime gatherer with the help of the children in the collection. Most of the bennek gatherers owned their house, made of concrete structure with electricity as lighting facility, deep well as a source of water, fishing, and farming as the major source of income, and a monthly income of less than 5000.00 a month. Furthermore, most of the bennek gatherers used wooden boats, owned and "Karadikad" as the major implement/gear used in gathering bennek.

Furthermore, for the management strategies, most of the respondents perceived these as must be important and must be implemented in the short and long term.

Most respondents gathered bennek within their barangay, with less than 1 hectare area at a depth of below 5 foot, with less 5 gantas as harvest, and "balinggasa" is among the other collected harvest species aside from bennek. Most of the bennek gatherers spend 2-4 hours in a day, 3-4 days a week and most of them used their catch for family consumption. Low marketability was determined as the main problem. The high gathering effort is from April to July, the low gathering is from March until April and there was no gathering from January to March and between September to December. The peak of harvest is March to July while the remaining months are considered lean season. The common problems of the respondents is quarrying in the collection sites and siltation of the river especially during flooding.

Recommendation

The following recommendations are given based on the results of the study:

(1) To ensure the sustainability "bennek" stocks, size catch regulation should implement to allow the growth of small-size stock and for natural breeding;

(2) Strict and constant monitoring of the bennek resource should be done by the LGU concerned;

(3) Regulate quarrying activities as it may destroy the habitat of the "bennek" resource and other benthic organisms; and

(4) Strict implementation of the municipal and local ordinances about the gathering of bennek and other related activities in the Cagayan River.

Acknowledgement

and ordinances relevant to the conservation of the freshwater clam resource.

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