INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 16, No. 5, p. 57-67, 2020
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Socio-economic status and conservation practices of the Cagayan River Bivalve gatherers in one municipality of the Philippines

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Article published on May 30, 2020

Key words: Conservation practices, Environmental sustainability, Bivalves gatherers

Abstract

With the rising pressure of urbanization to biodiversity, this study aimed to obtain baseline information on the socio-economic profile of the Cagayan Bivalve gatherers, their fishing practices, conservational practices and awareness of environmental protection ordinances. Descriptive-survey method of research was employed in this study. Findings showed that the bivalves gatherers were in their middle adulthood, high school graduates, compose of 4-6 members in every household, with the father as prime gatherer; mother as the seller. Most of the bivalve gatherers earn an income of Php 4,501-Php 6,500 monthly with an average harvest of 3-5 sacks per harvest per group using their own harvesting equipment or tool. Furthermore, most of the bivalve gatherers live in a rough finish bungalow with farming as their other source of income. Moreover, the most abundant species collected in the Cagayan River is bennek or tulya with the use of improvised catching nets. The peak of harvest is from the months of March to May. Almost everybody gathers daily in their own and neighbouring towns. Some of the bivalve gatherers take a bath daily and sometimes wash clothes and only a few throw their garbage in the river. Although most of them bury dead animals, some still construct piggery and/or near the riverbank and connect their drainage to the river. The harvest of the gatherers is sold either wholesale and retail mode in the market, neighbourhood and to other buyers who sell to other towns during market days, while small ones are being made into vinutong or in the form of "narnar" (unshelled). The bivalve gatherers are aware that not all existing municipal ordinances are implemented. The study presents policy recommendations for sustainable supply of bivalves in Cagayan River.

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Introduction

Freshwater habitats are among the most endangered on the planet in unprecedented pressures associated with the rise in human population and socio-economic growth. (Dudgeon *et al.*, 2006; Vörösmarty *et al.*, 2010; Vörösmarty *et al* 2015). The rising worldwide anthropogenic pressure contributes to habitat destruction, ecosystem changes and degradation and over-exploitation (including water), pollution, introduction of invasive alien species (IAS) and climate change (Malmqvist and Rundle, 2002; Strayer and Dudgeon, 2010; Hermoso *et al.* 2016). One of the key effects of a steeply rising human demand is the biodiversity crisis, and fresh water bivalves (FB) are among the species with high extinction levels (Strayer *et al.* 2004; Lydeard *et al.* 2004; Régnier *et al.* 2009; Lopes-Lima *et al.* 2014, 2017). The FB's potential survival is significantly affected and the broad variety of ecological services it offers to scientists, administrators, policymakers and the public as a whole will enhance their collaboration to protect these organisms (Vaughn, 2017).

The Cagayan River is the longest and highest river in the Philippines which flows through the provinces of Nueva Vizcaya, Quirino, Iceland which Cagayan, situated in the Cagaya Valley area in the northeast portion of Luzon Island (Principe 2012; Lopes-Lima *et al.* 2018). The headwaters of the Caraballo Mountains of central Luzon are measured to be 505 kilometers long and flow north into the Babuyan Canal near the town of Aparri, where Cagayan drop rapidly to 91 meters at a mouth of the river (Mayor & Ancog, 2016). It should be remembered that the extension of the river can be due to stream flooding and, in certain cases, loose and unconsolidated riverbank sedimentary deposits can effect on vegetation, although this has not yet been verified. (Montchowui & Laleye, Akele, 2013)

The Cagayan River provides a wide range of resources that supply the fisherfolks with their livelihood and other activities that make them productive. These resources include the freshwater bivalves like the “nitidolellina minuta” betterknown as “unnok”, “corbicula fluminea”known as tulya and the “batissa children” locallyknown as “kabibi”. For years, “kabibi” was a lucrative source of livelihood for Lal-loquenos (Layugan, 2013; Mayor, Anastacio & Ancog, 2018). It is the most expensive freshwater bivalve in the region because of its delicious taste. There is a need to sustain the interest of the local government unit and the people as well in being able to revive this resource because of its market potential. Bivalve is currently categorized as endangered or threatened species in Cagayan River by the Bureau of Fisheries and Aquatic Resources (BFAR) Region 02 (because wild stocks in Cagayan River have dwindled in 2000 and continuously declined in 2012 due to over-harvesting (Layugan *et al.,* 2013; Mayor, Anastacio & Ancog, 2018).

Likewise, the daily tidal change affects salinity and temperature of river water and these changing conditions affect also the fish as well as bivalve habitat. Kabibi’s habitat extends from Camalaniugan to Gattaran about 40km from the mouth of the river. During floods the stream flows of Cagayan River provides sediment loads that are discharged in most parts of the study area. Stream erosion is enormous that flooded land may be intensely scoured and with river banks washed away. Habitat assessment is crucial in increasing freshwater bivalve population. If freshwater bivalve is to become a noted concern to provide livelihood opportunity for the fisherfolks bivalve habitats need to be identified and promoted. (Zieritz *et al.,* 2016)

As research gaps, there has been an increase in the awareness of the environmental effects that may result from the various stages of bivalve cultivation processes around the world. Most notably, adverse effects have been associated with mussel and oyster farms in Spain and France (Tenore *et al.*, 1985, Castel *et al.* 1989; Ollivier *et al.,* 2016) located at sites where hydrographical conditions were unsuitable for high-density cultivation (Castel *et al.*, 1989; Sharma *et al.,* 2015). To date, the majority of studies that have addressed the environmental impacts of bivalve cultivation have been largely concerned with the on-growing phase of cultivation.

However, commercial cultivation of bivalves involves three distinct processes: seed collection, seed nursery, and on growing, and harvesting. Reviewing current knowledge of bivalve gatherers in the Cagayan Province, Philippines with respect to their environmental practices and socio-economic profile will provide significant input in the environmental protection of bivalve species.

Likewise, conservation practices encompass the beliefs, affective responses, and behavioral intentions that people hold concerning environment-related activities and issues (Schultz *et al*., 2004; Geng, *et al*., 2015). To better understand conservation practices of bivalves gatherers, the level of knowledge possessed by the population under observation concerning the severity of environmental problems, their reaction to and their interactions with nature must be ascertained by assessing environmental awareness (Ziadat 2010; Ayukekbong, Ntemgwa, & Atabe, 2017).

This has long been recognized in the more industrialized and developed nations of the world where many studies of environmental knowledge have been conducted over the last three decades (Rauwald and Moore 2002; Otto & Pensini, 2017).

Currently, some of the areas covered in this review are yet to be addressed in a formal scientific manner. Biodiversity and the natural environment have suffered a huge negative impact around the world as a result of excessive exploitation by humans and the often-short-sighted economic policies of national governments. Some scientists have asserted that the resolution of this problem may lie in a proper examination and understanding of humanknowledge of, and attitudes toward, the environment (Newbold *et al.,* 2015). Hence, this study analyzed the socio-economic profile of the bivalve gatherers, their harvesting and marketing practices, conservation practices and awareness of the environmental protection ordinances. This study generally assessed the socio-economic profile, fishing conservation practices of Cagayan River Bivalve Gatherers. Specifically, it sought to: (1) determine the socio-economic profile of Cagayan River Bivalve Gatherers particularly on: (a) Biodemographic Data; (b) Economic Status. (2) determine the fishing practices of bivalve gatherers along harvesting, marketing, and preservation. (3) Assess the conservation practices of the bivalve Gatherers in terms of Habitat, Waste disposal, and Riverbank control system. (4) evaluate the level of awareness of the Bivalve Gatherers on the implementation of existing municipal environmental ordinances.

Materials and methods

Research Design

The descriptive-survey method of research was used in this study was. It documented the profile of the bivalve gatherers, their fishing practices, conservation practices, and awareness of environmental protection ordinances.

Study Site

This study was conducted in the different municipalities of Cagayan Province, the Philippines particularly the Rio Grande de Cagayan where it passes through, namely: Tuguegarao, Iguig, Amulung, Alcala, Gattaran, Lal-lo and Camalaniugan.

The Cagayan River is the longest and largest river in the Philippines located in the Cagayan Valley region in northeastern part of Luzon Island and traverses the provinces of Nueva Vizcaya, Quirino, Isabela, and Cagayan. With an estimated length of 505 kilometers, the river's headwaters are at the Caraballo Mountains of the Central Luzon at an elevation of approximately 1,524 meters and flows north to the Babuyan Channel near the town of Aparri, Cagayan dropping rapidly to 91 meters at the river mouth. Cagayan River Basin sinks into Type III environment region with no marked peak rainfall and a limited dry time (Bricelj *et al.*, 2012; Tunnell, 2017). This is fairly warm between November and April and damp all year round. According to PAGASA (2009) (Rasouli *et al.,* 2019), the total annual precipitation in the northern part of the basin in the southern mountain area is 1,000mm and 3,000mm. The annual surface temperature and relative humidity are

respectively 23.6-26.00C and 75-85 percent (DPWH, 2001; Franta *et al*., 2016), respectively.

Respondents and Sampling Techniques

The bivalve gatherers along the area of the study were taken as respondents. Purposive sampling techniques were adopted in identifying the Bivalve Gatherers involved in the study. Only those who gathered bivalves for the past years were interviewed and evaluated.

Research Instrument

The questionnaire used to gather necessary data consisted of two parts. Part 1 elicited data regarding the profile of the respondents such as sex, age, educational qualification and size of the family.

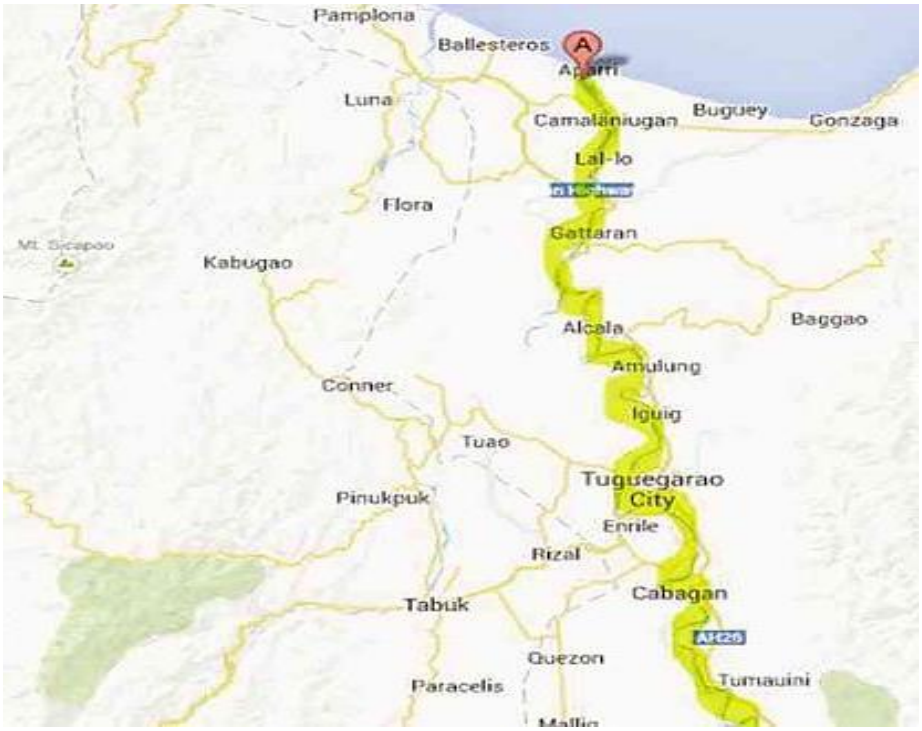

Fig. 1. Map showing the Cagayan River Traversing the Municipality of Lallo, Cagayan, Philippines.

Part 2 aimed to determine the economic status, fishing practices, conservation practices and the level of awareness of the bivalve gatherers on the municipal environmental ordinances. The questionnaires were distributed personally to the respondents by the researchers. The researchers assisted the respondents in answering by translating some questions in their dialect.

Data Collection

Prior to the research, approval was requested from the local mayors of the different communities involved in the analysis. The local mayors of the various towns helped the researchers in the municipal agricultural offices to organize the collection of data with the assistance of the technician. The researchers consulted the technicians for the data collection plan. Data processing took place between December 2017 and June 2018. The researchers provided the questionnaires to the bivalve collectors to ensure 100% recovery. An informal interview with the interviewees was also performed to gather further details by demanding additional study results.

Data Analysis

The collected data were tabulated for analysis. Descriptive statistics such as frequency counts, percentage rank, and weighted mean. The weighted means Likert scale was interpreted based on the following arbitrary scale. 1.00-1.66 Not implemented; 1.67-2.33 Implemented; 2.34-3.00- Strictly implemented.

Results and discussion

Table 1 indicates the respondents 'profile. As for age, 41-50 years of age was the largest amount. We constitute 32,89% of the respondents, while the youngest group of 30 below was the least numerous. The statistics indicate that the interviewees differed across the years of the research and often were medium-sized individuals. It can be concluded that the age of the collectors in their respective barangays is linked to their home. With respect to educational achievement, the table shows that the high school graduates constitute 52,44% of respondents. The data suggest that bivalve collectors come from families that could not adequately support the education of children. Furthermore, they too might become owners. As to the Size of Family, most of the respondents compose of 4-6 members in the family as indicated in the frequency of 109 or 48.44%. This finding indicates the common characteristics of large families in the rural communities. According to the respondents during the interview, fathers help in the transporting their harvest to the market and the children help mothers in doing the marketing and processing.

Table 1. Socio-Economic Profile of Cagayan River Bivalve Gatherers.

Age	Frequency (N=225)	Percent
51-60	61	27.11
41-50	74	32.89
31-40	59	26.22
21-30	31	13.78
Educational Attainment		
College Level	16	7.11%
High School Level	118	52.44%
Elementary Graduate	91	40.44%
Size of Family		
1-3	75	33.33%
4-6	109	48.44%
7-9	41	18.22%

Table 2 shows the Economic Profile of the Bivalve Gatherers. In terms of the income of the bivalve gatherers per month, 65 or 34.21 percent have the income of P4,501 – P6,500 and 61 or 32.10 percent represent earners of P2, 501-5,500. This finding implies that the respondents mostly belong to the families in whose living standard fall below the average.

Table 2. Economic Profile of the Bivalve Gatherer.

Income of the Bivalve Gatherer per harvest/month	Frequency	Percent
8501-10500	11	5.79
6501-8500	17	8.95
4501-6500	65	34.21
2501-4500	61	32.10
Below 1000 -2500	36	18.95
Other Sources of Income		
Farming	94	41.78
Daily wage earner	77	34.22
Tricycle driver	19	8.44
Sari-sari store	24	10.67
Kasambahay	11	4.89
Type of House		
Finished concrete bungalow	62	27.56
Rough finished	94	41.18
Combination of concrete and wood	46	20.44
Combination of wood and bamboo	26	10.22

The respondents are engaged in farming and earning on a daily wage basis as their other sources of income with a frequency and percentage of 94(41.78%) and 77(34.22%) respectively. As to Type of Housing, most of the respondents own a roughly finished bungalow with a frequency of 94 or 41.28%. This shows that the respondents are aware that one of the basic needs of a family is a house. According to the latest report on Natural Statistical Coordination Board (NSCB) of the Philippines, a Filipino family of five members need 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 3. Family Members' Involvement in Fishing Activities.

Family Members Involved in:	Frequency	Percent
a. Fishing	(N=225)	
Father	204	89.33
Father with son	21	10.67
b. Marketing	(N=204)	
Father	28	13.73
Father and Mother	165	80.88
Mother with Children/Grandchildren	11	5.39
c. Processing	(N=41)	
Father	15	36.59
Mother with Children/Grandchildren	26	63.41

Table 3 shows the Family Members' Involvement in Fishing Activities. Out of 225 gatherers, fishing and gathering are done by the head of the family with a frequency of 204 or 89.33%. Most of the time, mothers help the father in selling their harvest which

represents 165 or 80.88%. Furthermore, processing of their harvest is mostly done by the mother with the help of the children or grandchildren which comprise 26 or 63.41%. The table further reveals that all family members cooperate and practice division of labor for their livelihood.

Table 4. Kinds of Bivalves Harvested.

Category	Frequency *	Rank
December to February		
Tulya/Bennek	225	1st
Unnuk	75	2nd
Biyala/Cabibi	75	3rd
March to May		
Tulya/Bennek	225	1st
Unnuk	75	2nd
Biyala/Cabibi	75	3rd
January to September		
Tulya/Bennek	41	1st
Unnuk	30	2nd
Biyala/Cabibi	18	3rd

*Multiple Response

Table 4 presents the kinds of bivalves harvested. According to the gatherers, their harvest is dependent on the weather condition, river water condition, and availability or abundance of the bivalves in the river. Among the bivalves identified by the gatherers that tribe in Cagayan River, the bennek and tulya is the most abundant bivalve. The findings slightly vary with that of Mayor, A. *et al* 2016 and Columna, N. 2012, that a few years ago cabibi and unnok were still in abundance. According to many bivalve collectors consulted, the recent decrease in clam production compared with the previous five to ten years may be the result of constant dragging in the water. Such collector answers were almost similar with findings of an Environmental Investigation Mission (EIM) survey conducted at Rio Grande de Cagayan in September 2010 comprising of non-governmental groups (CEC-Phils, Kalikasan-PNE, Taripnong and the Association of the Cagayan Valley Provincial Advocates, representatives of the Protection Patrimony Alliance) and several leaders of Local people of the province of Lallo, Camalaniugan and other municipalities (Buguey, Aparri, Abulug, Ballesteros, Pamplona and Sanchez Mira) have registered numerous negative consequences since the dredging phase started in the province in 2006, for example the loss of villages, a contraction of the shoreline, a decline in the capture of fish and drop in production. The decline in the number of fish and cobblestone organisms was especially linked to the potential direct effect on the river ecology of the on-going dredging project, including significant siltation, loss of fish breeding grounds and river habitat disturbance. However, the dredging scheme spans for 65km along the river with five stages, including the mouth of the River Cagayan in Aparri and the river waters under the control of Camalaniugan, Lallo, Gattaran and Alcala municipalities.

The interviewed collectors claim in this study that because the clams reside in the sandy substratum, the machine used by dredging ships will heavily absorb the clams (no matter the size) and crash. The bivalve collectors noticed that dredging was often rendered in very shallow sandy parts of the channel, where the clam thrives with a shell attached to a sand absorbing unit. In addition, natural events such as typhoon, continuous preparation, weather fluctuations and floods are now and then triggering the low catches witnessed by several collectors.

The existence of such natural occurrences prevents the collectors to catch the clam in the water, otherwise their lives may be threatened. Furthermore, the collectors assume that the high water velocity during floods will carry the clams to the sand bar on the shore, which contributes to the death of clams. The higher number of collectors today was also a explanation for the low abundance observed. Table 5 shows the harvesting practices of the bivalve gatherers. Almost all of the respondents with a frequency of 204 or 91.67 percent use tools or equipment gathering in while 21 or 9.33 percent manually gather bivalves. Among the 204 gatherers using equipment, 158 or 77.45 percent prefer to use dredge or tako which mesh size ranges from 1.0 – 1.5cm. over the bivalve net or karwas and karudkud with a frequency and percentage of 21 or 10.67% and 25 or 12.25% respectively.

Table 5. Harvesting Practices of the Bivalve Gatherers.

Mode of Harvesting	Frequency (N=225)	Percent
Manual (Kakapa-kapa)	21	9.33
Use of tools or equipment	204	91.67
Kinds of Harvesting Tools	(N=204)	
Dredge	158	77.45
Bivalve Net/Karwas	21	10.67
Karudkud	25	12.25
Frequency of Harvesting	(N=225)	
Daily	128	56.89
Once a week	19	8.44
Twice a week	78	34.67
Time Spent in Harvesting		
1 – 3 hours	27	12.0
4 – 6 hours	97	43.11
7 – 9 hours	101	48.89
Place of Harvesting		
Own Town	104	46.22
Other towns	121	53.78
Gathering/ fishing equipment		
Owned	173	84.80
Hired	31	15.20
Harvesting Season	Frequency	Rank
December to February	180	2nd
March to May	220	1st
January to September	41	3rd

The peak of harvest are from months of March to May and December to Februaary with a frequency of 220 and 180 repectively. Among the three bivalves present in Cagayan River, the bennek or tulya dominates over the unnok and cabibi. Most of the bivalve gatherers spends 7-9 hours with a frequency of 97 or 43.11 percent. More than one-half which represents 128 or 56.89 percent harvest daily and nearly half among the 225 gatherers in their own town and in other towns with a frequency and percentage of 104 (46.22%) and 121 (53.78%) respectively.

For harvesting practices, the results support the findings of Columna 2012 that the peak of harvest is from February to July using dredge. This further indicates that there is no innovation or modification yet of gathering equipment or tool. However, the finding on the kind of bivalve collected slightly varies with the present study. In the study of Columna, there was an abundance of unnok and cabibi while in this study, bennek or tulya dominate the two bivalves mentioned. Table 6 shows the quantity of bivalve harvest and purpose. As to the volume of catch per harvest/ month, 88 or 39.1% gather more than three to five sacks per harvest and 55 or 24.44 percent could gather five to seven sacks. As regard to the use or purpose of harvest, nearly one hundred percent (204 or 90.67 percent) sell their harvest and for only 21 or 7.33 percent for home consumption.

Table 6. A quantity of Bivalve Harvest and Purpose.

A volume of catch per harvest	Frequency	Percent
More than 7 sacks	16	7.11
More than 5 sacks – 7 sacks	25	11.11
More than 3 sacks – 5 sacks	88	39.11
More than 1 sack – 3 sacks	41	18.22
Less than 1 sack	55	24.44
Use or purpose of Harvest		
For sale	204	90.67
For home consumption	21	9.33

In the interview with them, they mention that they acquire more profit through vinutong making than in selling their harvest with shells. In addition, they also mentioned that most of their fellow gatherers are selling their harvest with shells, so it is advantageous for them since there are only few who are engaged in vinutong making (salted unnok or bennek paste).

Table 7. Marketing Practices of Bivalve Gatherers.

Mode of Marketing	Frequency (N=204)	Percent
Wholesale	127	62.25
Retail	77	37.75
Frequency of marketing		
Right after harvesting	134	65.69
After a day	70	34.31
Place of Marketing		
a. Wholesale	(N=127)	
in the market	93	73.23
to a retailer	34	26.77
b. Retail marketing	(N=77)	
in the neighborhood (street)	29	37.66
another barangay	48	62.34
Pricing		
a. with shell	(N=204)	
P20 – P25/ganta	204	100
P500/sack	204	100
b. unshelled	(N=204)	
P15/glass	204	100
P 100 – 150/ganta	204	100
c. vinutung		
P 180 – 200/bottle	204	100

Table 7 presents the Marketing Practices of Bivalve Gatherers. As gleaned from the table, the bivalve gatherers either practice wholesale (127 or 62.25 percent) and retail (77 or 37.75 percent) modes of marketing their harvest. In terms of timing of selling their harvest (134 or 65.69 percent) sell their harvest right after harvesting while (70 or 34.31 percent) sell after a day. This means that the harvest is converted immediately to cash as it is their major source of livelihood. Among those who sell their harvest, through wholesale their harvest in the market (93 or 73.23 percent) and pass it on to another retailer (34 or 26.77).

In terms of retail marketing, the gatherers sell their harvest in the neighborhood or to another buyer. Those who sell through retail basis, they sell their harvest in the neighborhood (15 or 23.81 percent) and in another barangay (48 or 76.19 percent).

As to the pricing of the harvest, the gatherers sell their harvest at five hundred pesos (P500.00) per sack and twenty-five pesos (P25.00) per ganta with shells. The unshelled bivalve (narnar) is marketed at fifteen pesos (P15.00) per glass or one hundred fifty (P150.00) per ganta for retail or P100.00 for wholesale. This implies that the bivalve gatherers have the common selling price of their harvest.

Table 8. Bivalve Preservation Habitat Practices of the Bivalve Gatherers.

The frequency of river use for other purposes	Frequency	Percent
a. Bathing		
Daily	154	68.44
Sometimes	50	22.22
Occasional	21	9.33
b. Washing		
Daily	25	11.11
Sometimes	159	70.67
Occasional	35	15.56
Never	6	2.66
Mode of Garbage Disposal		
Compost Pit	80	35.56
River	42	18.67
Backyard	15	6.66
Garbage Gatherer	88	39.11
Mode of dead animals disposal		
Bury	134	59.56
Throw in the compost pit	63	28
Throw in the river	23	10.22
Throw in the irrigation canal	5	2.22
Bury		
Various construction near or connected in the riverbanks		
Drainage	11	4.89
Poultry and/or piggery	47	20.89
None	167	74.22

Table 8 shows the bivalve habitat preservation practices of the bivalve gatherers. Most of the respondents use the river for “bathing daily” (154 or 68.44 percent) and for washing purposes “sometimes” (159 or 70.67 percent). The bivalve gatherers dispose they're garbaging mostly through garbage collector (88 or 39.11 percent) and in their own compost pit (80 or 35.56 percent). In terms of disposing of dead animals, more than half (134 or 59.56 percent) bury them. As regards to the construction of structures near or connected in the river banks, (167 or 74.22 percent) do not have at all, (47 or 20.89 percent) constructed poultry and/or piggery and (11 or 4.89 percent) connected drainage. The table revealed that most of the gatherers follow ordinances on solid waste management.

Table 9. Level of Awareness of the Bivalve Gatherers on the Implementation of Municipal Environmental Ordinances.

Nature of the Ordinances	Weighted Mean	Description
1. Water quality	1.74	Implemented
2. Solid waste	1.80	Implemented
3.Cabibi Sanctuary	2.06	Implemented
4. Harvesting tool/ equipment	2.08	Implemented

Legend:

2.34-3.0 Strictly Implemented

1.67-2.33 Implemented

1.0-1.66 Not Implemented

Table 9 shows the level of awareness of the bivalve gatherers on the implementation of municipal environmental ordinances. Among the four related ordinances waste quality, solid waste, cabibi sanctuary, and harvesting tool or equipment are implemented with weighted means, 1.74, 1.80, 2.06 and 2.08 respectively. These findings revealed that the above-mentioned ordinances were implemented but not strictly followed by the barangay residents which contribute to the pollution of the water resources. The ordinance that 1.5-kilometre cabibi sanctuary situated at Magapit Lal-lo, Cagayan wherein gatherers who wish to collect must not use destructive gathering tool like the rotor is implemented with regards to an ordinance on a harvesting tool or equipment. The gatherers ware aware that the use of destructive fishing gear "rotor" in gathering different bivalves was prohibited since 2001 because it was seen to create the disturbance to the habitat of different mollusks and other fishery resources of the river. A rotor is a mechanism that pushes the sand on the back of the boat, to carry out the burrowing bivalves. The bivalve is then extracted by going through a tiny metal pipe. Such form of non-selective fishing gear affects the fishing ecosystem and disrupts certain species. Biological factors affecting Freshwater Clam and Gametogenesis and

Spawning Induction population density in Batissa Violaceated in the Cagayan River, the Philippines, water quality is the prerequisite for large bivalve community densidad.

Conclusion

This study surveyed the Socio-Economic Status and Conservation Practices of the Cagayan River Bivalve Gatherers in the Province of Cagayan, Philippines. Findings of the study revealed that in terms of biodemographic data, the bivalve gatherers are mostly 41-50 years old, high school graduate, compose of 4-6 members in every household with the father as prime gatherer; mother as the seller; the mother with the help of the children and grandchildren to process the harvest. Most of the bivalve gatherers earn an income of P4,501-P6,500 monthly with an average harvest of 3-5 sacks per harvest per group using their own harvesting equipment or tool. Furthermore, most of the bivalve gatherers live in a rough finish bungalow with farming as their other source of income.

Likewise, The most abundant species collected in the Cagayan River is bennek or tulya with the use of "karudkud" and "tako". The peak of harvest is from the months of March to May. Almost everybody gathers daily in their own and neighboring towns. Some of the bivalve gatherers take a bath daily and sometimes wash clothes and only a few throw their garbage in the river. Although most of them bury dead animals, some still construct piggery and/or near the riverbank and connect their drainage to the river. The harvest of the gatherers is sold either wholesale and retail mode in the market, neighborhood and to other buyers who sell to other towns during market days, while small ones are being made into vinutong or in the form of "narnar" (unshelled). Finally, the bivalve gatherers are aware that not all existing municipal ordinances are implemented.

Recommendations

The following suggestions are given based on the results of the study: (1) To insure that bivalve stocks in the Cagayan River remain safe, a proportion of mature individuals and small sizes should be required in the river to provide for natural breeding. (2) Local Government Units should coordinate DOST and DSWD in supporting or assisting bivalve gatherers on how their harvests are to be preserved or managed; (3) Sanction or punishment of offenders against municipal environmental ordinances shall be reviewed; (4) Strict monitoring for stocks in Cagayan River; ((5) Local harvest period and municipal legislation shall apply; and (6) Potential researchers shall update the survey of fishery status of bivalves in the Cagayan River every five or 10 years and define the direct and indirect effect of dredging operations, so as to make an estimate of the existence and absence of bivalve shells in the discarded dragged-sand.

Acknowledgments

Acknowledgments should be inserted at the end of the paper, before the references, not as a footnote to the title. Use an unnumbered section heading for the Acknowledgments, similar to the References heading.

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