CAMPUS JOURNAL

CAGAYAN STATE UNIVERSITY - APARRI

ISSN: 1656 – 7927

VOLUME 19

ISSUE 1

JANUARY–DECEMBER 2022

Cagayan State University Aparri Campus
Maura Aparri Cagayan 3515 Philippines

https://aparri.csu.edu.ph/

VOLUME 19 | ISSUE NO. 1 | ISSN NO: 1656 - 7927
JANUARY-DECEMBER 2022

CSU APARRI RESEARCH JOURNAL

VOL 19 | ISSUE NO. 1 | January-December 2022

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Published by the
CSU Aparri Research for Development and Extension Office
Administration Building
Maura, Aparri, Cagayan 3515 Philippines
Email communications thru: csuaparri@gmail.com

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JANUARY-DECEMBER 2022

EDITOR'S NOTE

Amidst adversities, the Cagayan State University at Aparri continuously engaged in the generation of new science-based knowledge, innovations in fisheries and aquatic sciences, as well as community-oriented researches.

The funded project of the team led by Dr. Molina was able to document existence and level of heavy metal content and other contaminants in freshwater clam caught from the wild and organically-cultured clams. The significance of the project greatly impacts food security and sufficiency in the area. Meanwhile, the team of Prof Del Rosario provided us robust insights and relevant findings on glass eel gathering at Gonzaga Cagayan. They concluded that glass eel gathering is both a livelihood opportunity and a threat to biodiversity, leaving recommendations for policy implementations. Processing procedure has been presented in the product development of fish powder by Dr. Molina based on locally produced flying fish. Still on product development, Dr. Velasco formulated an aramang-based spread and documented consumer acceptability in the paper. Dr. Javier revealed in his paper management practices, issues, and concerns relating to management of Aramang fisheries as basis for designing and developing IT solutions. Another product development project headed by Dean Battung has formulated aramang-based baked products with malunggay. The team headed by Dr. Javier presented an analysis of the assessments made in the study InFORMS – an IEC initiative to Knowledge-sharing and utilization. In support to food security, Dr. Malana ventured in her paper DNA barcoding of marine bivalve Meretrix Karibuyo in Northern Cagayan. Dr. Mata documented in her paper factors of sexual and non-sexual risk-taking behaviours of College students.

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Psychological Well-being of Young Fishers along the Coastal Barangays of Aparri, Cagayan: Inputs for LGU Intervention Program

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ABSTRACT: This study examined the psychological well-being of young fishers residing in the coastal barangays of Aparri, Cagayan, Philippines. Using a descriptive-correlational research design, the study involved 65 respondents aged 15–24, selected through stratified random sampling. Data were collected using Ryff's Psychological Well-Being Scale (PWBS) and a structured questionnaire. The PWBS evaluated six dimensions: autonomy, environmental mastery, personal growth, positive relations, purpose in life, and self-acceptance. Results revealed that the young fishers exhibited average psychological well-being overall. Significant relationships were found between psychological well-being and certain demographic factors: age, family size, and fathers' marital age influenced overall well-being, while educational status impacted autonomy and personal relations. Additionally, civil status and fathers' highest educational attainment were associated with purpose in life. These findings highlight the importance of addressing demographic and educational factors to improve the well-being of young fishers. The study emphasizes the need to prioritize programs promoting mental health, fostering positive relationships, and enhancing psychological functioning. Insights from this research can guide the development of targeted intervention programs for young fishers, aligning with the mandates of the Philippine Mental Health Law (RA 11036) and local government initiatives. This study contributes to addressing the mental health needs of a marginalized sector in a fishing-dependent community, providing valuable input for future policies and programs.

Keywords: *Profile, Psychological well-being, young fishers, Aparri, Intervention*

INTRODUCTION

Aparri has a vast area of aquatic resources, which is why fishing is one of the main sources of income for those who live near the coast. According to 2015 poverty statistics, fishermen are among the poorest sectors in the country (Philippine Statistics Authority, 2017). Senator Francis Pangilinan, likewise, stated that Filipino fishermen are among the poorest people in the country (PDI, 2016). Fishing is passed down from generation to generation, from parents to their children and their children's children. Aparri families are not exempt from this situation. There are some young people who enjoy fishing. The future of a country is in the hands of its youth, who are regarded as the country's backbone in the future. The type of youth a country has reflects the country's status. As evidenced by their research agenda, various government agencies now prioritize psychological wellness. Among the six priorities of the National Unified, Health Research Agenda (NUHRA) of the Department of Health is the Research to enhance and extend healthy lives (Department of Health, 2022); among CHED research agenda is short-term and long consequences on well-being (Commission on Higher Education, 2022); one of the National Economic and Development Authority's (NEDA) priority under Malasakit enhanced social fabric is to sustain and ensure the well-being of the people. Numerous activities are focused on intervention programs for youth, particularly those concerned with on psychological well-being. However, there is a scarcity of research on the psychological well-being of young fishers, particularly in Aparri.

In response to the national government's call for the promotion of mental health as stipulated in RA 11036 also known as The Philippine Mental Health Law, the findings of this study will serve as baseline data for designing mental health programs for young fishers, as well as a significant input for the Aparri Local Government Unit's Intervention Program.

Furthermore, Cagayan State University's flagship program at Aparri is BS Fisheries. It is only natural for the campus to conduct a study geared toward youth. The campus's advocacy is to focus on studies focusing on the community's fishing sector, thus this study.

Objectives

The study aimed to determine the psychological well-being of young fishers residing near the coastal barangays in Aparri, Cagayan. Specifically, it sought answers to the following questions:

1. What is the profile of the young fishers in terms of the following variables:
a. Sex

b. Age
c. Sibling Order
d. Civil Status
e. Family size
f. Highest Educational Attainment
g. Parents' Highest educational attainment
h. Parents' Occupation
i. Parents' Marital Age

2. What is the level of psychological well-being of young fishers in terms of:
a. Autonomy
b. Environmental mastery
c. Personal growth
d. Positive relations with others
e. Purpose in life
f. Self-acceptance
g. General Psychological Well-being

3. Is there a relationship between the profile of the young fishers and their level of psychological well-being?

Research Hypothesis

This study tested the null hypothesis:

1. There is no relationship between the profile of the fishers and their level of psychological well-being.

Conceptual Framework

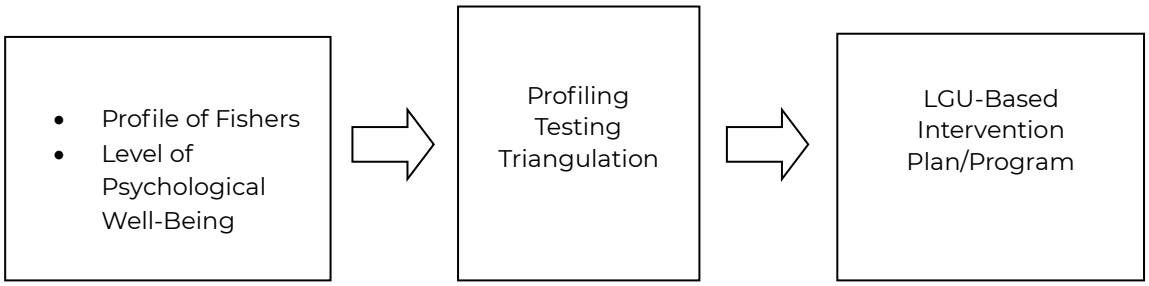

Figure 1. The relationship between the independent and the dependent variables.

Definition of Terms

Autonomy refers to the sense of self-determination and freedom from societal norms.

Environmental Mastery refers to the belief in one's ability to manage life events.

General Psychological Well-being refers to the total psychological well-being of a person.

Personal Growth refers to one's openness to new experiences and growth.

Positive Relations with others refer to the extent of having satisfying relationships with others.

Purpose in Life refers to the pursuit of meaningful goals and a sense of purpose in life.

Self-acceptance refers to one's attitude towards oneself.

Young Fisher refers to anyone who is engaged in fishing and belongs to the age bracket 15-24.

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REVIEW OF RELATED LITERATURE

Well-being is a multifaceted construct that is measured in a variety of ways. Living conditions (Schulte PA, 2015), life satisfaction (Salvador-Carulla L, 2014), and feelings of happiness are all measures (Boehm JK, 2012) of psychological well-being.

Findings of studies show the influences of various factors to a human's well-being. Bangladesh fishers' well-being is associated with cohesion (Sara Min˜arro, 2022). Social relationship has a great influence on an individual's well-being (Craig, 2019). Moreover, it was found that supportive friendships predict well-being beyond the effects of family support; supportive friendships influence general well-being via self-esteem; supportive work and non-work friendships influence well-being at work. Self-esteem and optimism are important ingredients on well-being (Makikangas, 2003).

Tambs, (2016) result, revealed that there was a direct relationship between family size and good mental health in his study of Norwegian women. The kind of job also has an influence on a person's well-being, as the risky aspects of the job have a positive influence on their happiness levels (Pollnac, 2008). Age affects well-being. The younger the person, the better is the wellbeing (Bowling, 2010)

Moreover, fishing brings happiness to people in small-scale fishing communities (Minarro et.al, 2021) and fishing fulfills the need for excitement (Pollnac, 2008). The most reported emotions by the Bangladesh fishers were well and happy (Minarro et al, 2021). General data such as education has a little influence to fishers (Khnerman et.al, 2004).

Methodology

Research Design

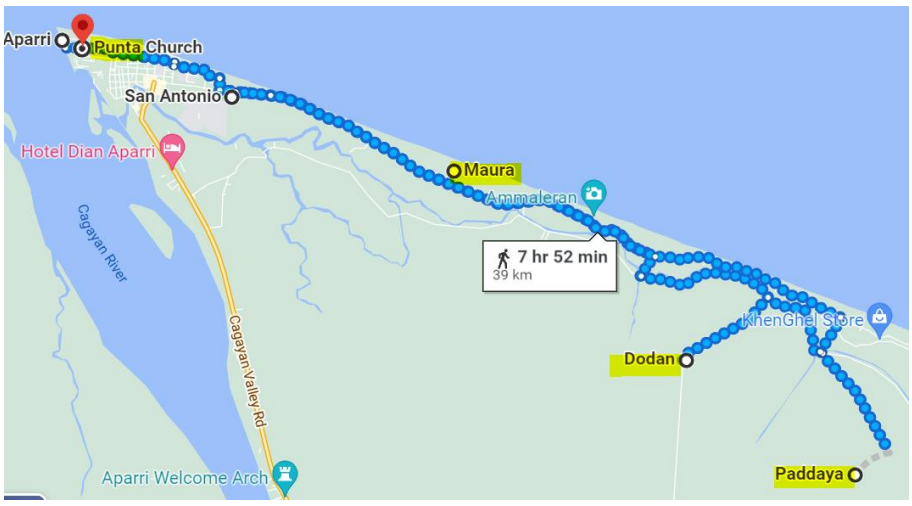
The descriptive correlational research design was used in this study, and the respondents' and their parents' profiles were correlated to their psychological well-being.

Respondents and Sampling Procedure

Respondents are those who have lived in Maura, Punta, Dodan, and Paddaya, Aparri, Cagayan for at least six months prior to the study and are between the ages of 15 and 24, regardless of whether they are studying or not, and who engage in the brackish water fishing. Cochran's formula was used for stratified random sampling. In total, 65 fishermen participated in this study as respondents.

Locale of the Study

The study was conducted in the four barangays of Aparri, Cagayan: Maura, Punta, Dodan and Paddaya. The four barangays are all located in the Eastern coastal area of Aparri, Cagayan. The map below depicts the four barangays involved in the study.



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Research Instrument

The researcher collected data from the respondents primarily through Ryff's Psychological Well-Being Scale (PWBS). The Ryff's PWBS was utilized to determine the psychological well-being of the young fishers. There are six dimensions in Ryff's PWB: Autonomy, Environmental Mastery, Personal Growth, Positive Relations with others, Purpose in Life, and Self-Acceptance. Moreover, a structured questionnaire was used coupled with an interview to probe responses.

The researchers collected data from the fishers primarily through a structured questionnaire which is composed of two parts:

A. Demographic profile of the fishers.

This section contained the fishers' personal information such as age, sex, civil status, and highest educational attainment.

B. Ryff's Psychological Well-Being Scale

The Ryff's PWBS was utilized to determine the psychological well-being of the young fishers. The adopted measure consists of forty-two items. There are six subscales corresponding to six aspects of positive functioning included in the study: autonomy, environmental mastery, personal growth, positive relations, purpose in life, and self-acceptance.

Data Analysis

The administration, scoring, and interpretation of Ryff's psychological Well-being Scale test were done by the researcher. Negative statements were recoded. For the descriptive part of the study, frequency counts, mean, and percentage were used. Pearson product-moment correlation rho (r) and t-test were utilized to determine relationships, utilizing a .05 level of significance.

DISCUSSION OF RESULTS

Profile of Young Fishers

As reflected in table 1, almost 100 percent of the fishers are males. Fishing is regarded as a job primarily for males. Interviews with the people in the locality showed that fishing activities that are focused on females are concentrated on fish drying and fish vending. There is a sequence of work, the males do the fishing, the female children and the wife, do the drying and vending. Fishing activities are done as a family affair. The only female fisher in this study is the only female child, hence she goes with her brothers so as not to be left at home.

When it comes to age, more than three-fourths of the fishers are on their age of majority. The Philippine Standard Occupational Classification states that 15 years old and older are considered fishers (PSA, 2022) which is consistent with the International Labor Organization's (ILO) mandate, stipulated in Article 2 that children under the age of fifteen shall not be employed or work on fishing vessels except for some valid circumstances (International Labor Organization, 2022). In Aparri, however, through the initiative of the Bureau of Fisheries and Aquatic Resources, children below the legal age are prohibited to participate in fishing. The findings of this study, however, indicate that there are children who are minors but engage in fishing or catching activities. The parents, claimed that these children are only.

Table 1. Profile of young fishers.

Category	**Frequency (n=65)**	**Percent**
Sex		
Male	64	98
Female	1	2
Age		
15 – 17	18	28
18 – 20	26	40
21 – 24	21	32
Mean = 19.4		
Sibling Position		

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Eldest	16	25
Middle Child	36	55
Youngest	13	20
Civil Status		
Single	58	89
Married	7	11
Family Size		
Small (1-2 children)	6	9
Medium (3-4children)	11	17
Large (5 & up)	48	74
Mean = 5.76		
Highest educational attainment		
Elementary Level	12	18
Elementary Graduate	1	2
High School Level	36	55
High School Graduate	8	12
College Level	7	11
College Graduate	1	2
Highest educational attainment of mother		
Elementary Level	28	43
Elementary Graduate	20	31
High School Level	12	18
High School Graduate	2	3
Vocational	1	2
College Level	2	3
Highest educational attainment of father		
Did not study	3	5
Elementary Level	26	40
Elementary Graduate	19	29
High School Level	11	17
High School Graduate	1	2
College Level	3	5
College Graduate	2	3
Occupation of father		Rank
Fishing	56	1

Allowed to participate in fishing when their father or older siblings are present and when the weather is favorable. The majority of the fishers are still single and their family sizes are “large,” which is way greater comparing it with the average Filipino family size of 4.1 in 2020 (Philippine Statistics Authority, 2022). Twenty-five percent of the fishers were able to finish at least finish high school education. The remaining 75 percent are either still studying or had already stopped. The young fishers, also engage in other productive activities such as construction work, carpentry, farming, and fish vending.

Table 1 Profile of fishers (continuation)

Other occupational engagement		**Rank**
Construction Work	22	34
Farming	18	28
Carpentry	1	2
Fish Vending	2	3
Technical job	1	2
None	23	35

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Educational attainment, occupation, and marital age of the young fishers' parents were also considered. There was no mother who completed college, and only two fathers (3 percent) completed college. The major occupation of their father is fishing which was ranked first. Many of the mothers are focused on doing household chores and engaged in fish drying and vending. The majority of the young fishers' parents got married/lived together when they were in the age of majority; there are more female parents which comprises 25 percent who cohabited/lived together below the age of eighteen.

Table 2. Profile of fisher's parents

Category	**Frequency (n=)**	**Percent**
Farming	18	2
Construction Work	7	3
Government Employee	1	6
Driving	1	6
Security Guard	1	6
None	3	4
Occupation of mother		
Housekeeping	29	1
Fish vending	19	2
Fish drying	11	3
Buy & sell (bakal)	2	4.5
Fishing	2	4.5
Housemaid	1	9
Fruit vending	1	9
Laundry woman	1	9
Manicurist	1	9
Age of father when got married		
17 & below	8	12
18 - 21	16	25
22 - 25	30	46
26 & above	11	17
Age of mother when got married		
17 & below	16	25
18 - 21	26	40
22 - 25	15	23
26 & above	8	12

Findings on the psychological well-being of young fishers show that in all the six subscales, majority of the fishers are categorized under "average." This means that when it comes to autonomy, the fishers, generally are able to resist social pressures, and able to regulate behavior from within. They generally are able to make use of opportunities in their environment and have a sense of control over the outside world. The young fishers are able to feel continued growth, they see themselves developing and they are open to new experiences.

Table 3. Psychological well-being of young fishers

Category	**Low**		**Average**		**High**	
Scales	F	%	F	%	F	%
Autonomy	11	17	50	77	4	6
Environmental Mastery	3	5	59	91	3	5
Personal Growth	10	15	53	82	2	3
Positive Relations	20	31	43	66	2	3
Purpose in Life	7	11	53	81	5	8
Self-acceptance	8	12	54	83	3	5
General	**10**	**15**	**52**	**80**	**3**	**5**

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When it comes to their relationship with others, they maintain a trusting relationship and are capable of strong empathy and affection. Fishing's relatively risky nature attracts and retains people who are active, adventurous, aggressive, and courageous; thus, the risky aspects of the job have a positive influence on their happiness levels (Pollnac, 2008).

Age is related to autonomy, positive relationships, life purpose, and self-acceptance. The findings show that the younger the fisher, the better he interacts with others, the greater his pursuit of life's meaning, and the more positive attitude he has toward himself. Young single fishermen have a more determined sense of direction and goals in life. The younger they are, the more intense their search for life's meaning. This could be because the majority of the young fishers are actively studying, implying that they have a brighter future ahead of them. This corroborates with Bowling's (2010) findings that on the self-report of her respondents, the younger the individual, the better is his well-being.

Family size has an impact on one's psychological well-being. The smaller the family size, the more freedom from social pressures, the pursuit of continued development, satisfying relationships with others, feeling the meaning of life, and accepting oneself for both good and bad qualities. This finding, however, negates Tambs, (2016) result, wherein there was a direct relationship between family size and good mental health in his study of Norwegian women.

Only autonomy and positive relationships are related to the educational status of young fishermen. Those who are currently studying or have graduated are more self-determined, able to evaluate themselves using personal standards, have trusting relationships with others, and can establish warm relationships with others than those who have stopped studying. This finding is in contrast with Khnerman (2004).

Table 3.1. Relationship between profile variables and psychological well-being.

Profile	**Scales**					
	Autonomy	Environmental Mastery	Personal Growth	Positive Relations	Purpose in Life	Self-Acceptance
Sex	0.453	0.786	0.596	0.671	0.725	0.239
Age	**0.005**	0.261	0.084	**0.000**	**0.013**	**0.005**
Sibling Position	0.471	0.294	0.561	0.587	0.733	0.893
Civil Status	0.307	0.879	0.437	0.064	**0.033**	0.275
Family size	**0.000**	0.097	**0.000**	**0.000**	**0.000**	**0.000**
Highest Educational attainment	0.483	0.067	0.111	0.708	0.055	0.074
Educational Status	**0.012**	0.122	0.289	**0.007**	0.679	0.795
Father's HEA	0.775	0.599	0.155	0.855	**0.039***	0.121
Mother's HEA	0.966	0.363	0.868	0.412	0.052	0.972
Father's Occupation	0.106	0.100	0.986	0.806	0.319	0.851
Mother's Occupation	0.364	0.451	0.734	0.411	0.715	0.983
Fathers' Marital age	0.522	0.657	**0.034**	**0.022**	0.151	0.368
Mother's Marital age	0.593	0.380	0.850	0.575	0.112	0.498

Only age, family size, and fathers' marital age have a significant relationship with the overall psychological well-being of young fishermen. The younger the fisher, the better his psychological well-being; the smaller the family, the better his psychological well-being; and the older the father marrying, the better his children's psychological well-being.

Majority of the young fishers in this study are actively enrolled, hence a greater possibility of a favorable future. The smaller families have a greater chance to satisfy their needs and the older the marital age of the father, the more mature he is, thus better guidance is provided to the children.

Table 3.2. Relationship between profile variables and total psychological well-being

Profile	Probability	Statistical Inference
Sex	0.786	Not significant
Age	0.001	**Significant**
Sibling Position	0.520	Not significant
Civil Status	0.126	Not significant
Family size	0.000	**Significant**
Highest Educational Attainment	0.457	Not significant
Educational Status	0.063	Not significant
Father's HEA	0.334	Not significant
Mother's HEA	0.916	Not significant
Father's Occupation	0.618	Not significant
Mothers' Occupation	0.592	Not significant
Father's Marital Age	0.018	**Significant**
Mother's Marital Age	0.657	Not significant

OUTPUT OF THE STUDY

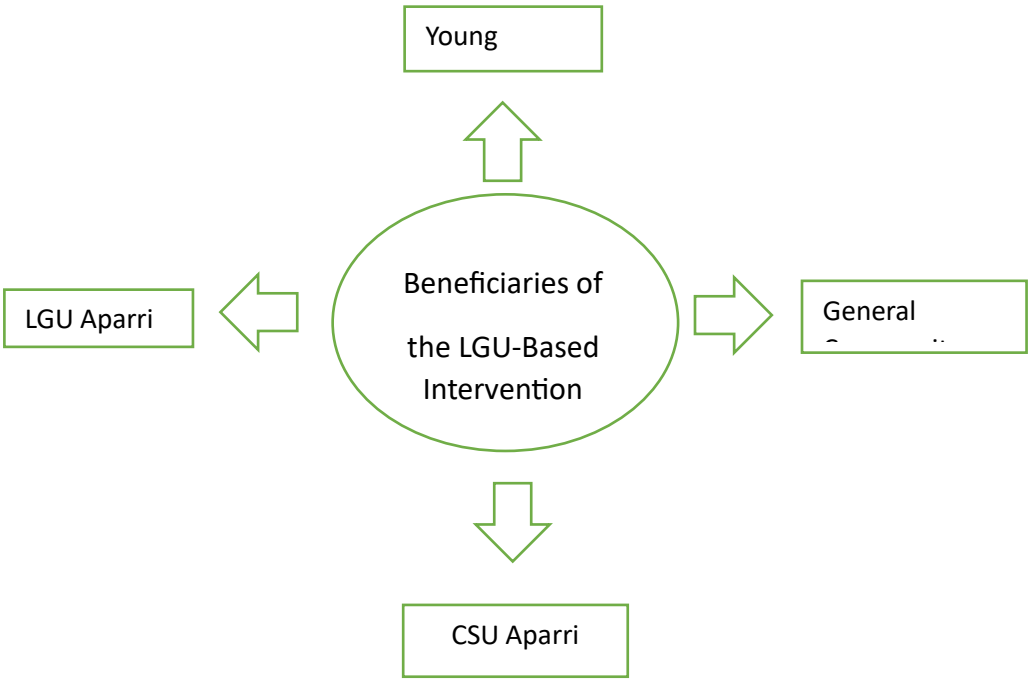
The expected output of this study is to propose to the Municipal Mayor and his constituents the LGU-Based Intervention Program in one of their periodic SB meetings for possible policy recommendations.

Below is the proposed intervention program.

Table 4. LGU-Based Intervention Program

MAJOR PROGRAMS AND ACTIVITIES	TARGET DATE OF IMPLEMENTATION	OUTPUT	IMMEDIATE OUTCOME	PERSON RESPONSIBLE
1. Profiling of Young Fishers (East & West)	1st Quarter 2023	Complete data of young fishers in Aparri, Cagayan		LGU Aparri, CBEA Research Coordinator
2. Character Building on Enriching Positive Relationships	2nd Quarter 2023	Activities to uplift character	Greater score on the positive relationship	LGU Aparri & CBEA Research Coordinator CSU Guidance Office
3. Launching of Young Fishers' Day	2nd Quarter 2023 (during the Feast Day of St. Peter Thelmo)	Established activities for young fishers to be celebrated every town fiesta	High self-esteem among young fishers	LGU Aparri
4. Awarding of scholarship/ financial assistance	2nd Quarter 2023 (Month of May during the Feast Month of Aparri)	Slots for young fishers	Secured young fishers	LGU Aparri
5. Fishers-focused program/ activities concerning family planning	3rd Quarter 2023	Standard program on family planning	Decreasing family sizes	LGU Aparri thru MSWD
6. Awareness Activities on Responsible parenthood	4th Quarter 2023	IEC Materials on Responsible Parenthood	Fishers' knowledge of responsible	CSU Aparri LGU Aparri MSWD

			parenthood is enhanced	
7. Capability Training on improving Psychological Well-Being for older young fishers	4th Quarter 2023	Established training programs for psychological well-being for older young fishers	Improved psychological well-being scores	LGU Aparri CSU Guidance Office & CBEA Research Coordinator



CONCLUSIONS:

This study has two major conclusions: First, age, family size, and fathers' marital age have a significant relationship with the overall psychological well-being of young fishers along the coastal barangays of Aparri, Cagayan. Second, educational status affects the level of autonomy, and personal relations; civil status and fathers' highest educational attainment affect the fishers' "purpose in life." However, young fishers along the coastal barangays have average psychological well-being.

Understanding the factors that influence the psychological well-being of young fishers is critical. Improvements in population well-being and functioning, as well as encouraging young fishers to develop and maintain positive relationships with others, should be prioritized.

RECOMMENDATIONS

- A comprehensive intervention program to improve the psychological well-being of young fishers is encouraged.
- In the future, parallel research must be conducted with the young fishers of Aparri West as respondents.

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EVALUATION OF THE PHYTOCHEMICAL COMPONENTS AND ANTIMICROBIAL PROPERTY OF Gracilaria edulis EXTRACTS AGAINST SELECTED AQUACULTURE PATHOGENIC BACTERIA

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ABSTRACT: With pathogenic bacteria in aquaculture becoming increasingly resistant to antibiotics, there is a compelling need to look into bioactive chemicals present in seaweed as novel treatment options for fish infections. The purpose of this study was to evaluate the phytochemical characteristics of G. edulis extracts and its antimicrobial activities against selected aquaculture pathogenic bacteria. Phytochemical screening of G. edulis was carried out following qualitative test tube screening methods. The antimicrobial activities of the methanolic and ethanolic extracts of G. edulis were tested using the paper disc agar diffusion method against Aeromonas hydrophila, Escherichia coli, and Staphylococcus aureus. Amoxicillin and distilled water were used as a positive and negative control respectively. Based on the phytochemical analysis, the methanolic crude extract of G. edulis contained tannins and flavonoids while the ethanolic crude extract included only tannins. Further, the results of the antimicrobial assay test showed that both methanolic and ethanolic extracts of G. edulis inhibited the bacteria with inhibitory activity comparable to that of the positive control (Amoxicillin). The study therefore suggests that G. edulis can further be investigated for the possible formulation of therapeutics and drugs in light of its potential as an antibacterial agent.

Keywords: *aquaculture pathogenic bacteria, ethanolic crude extract, methanolic crude extract, paper disc diffusion method, zone of inhibition*

INTRODUCTION

Several incidences of bacterial pathogens on cultured aquatic species have been reported worldwide. The occurrence of S. aureus in farmed shrimps required the development of a vaccine to prevent the disease caused by it (Arfatahery et al., 2015). Escherichia coli was also confirmed in Nile tilapia (Oreochromis niloticus) from a fish farm in Sylhet, Bangladesh (Reza et al., 2021). The bacteria E. coli is usually non-pathogenic inside the gut of fish, but when it spreads outside the intestine, it can cause disease, resulting in entero-toxigenic. There has also been an ample information documented on the impact of A. hydrophila on aquaculture, with significant mortality in recorded on silver carp (Hypophthalmichthys molitrix) (Rashid et al., 2013).

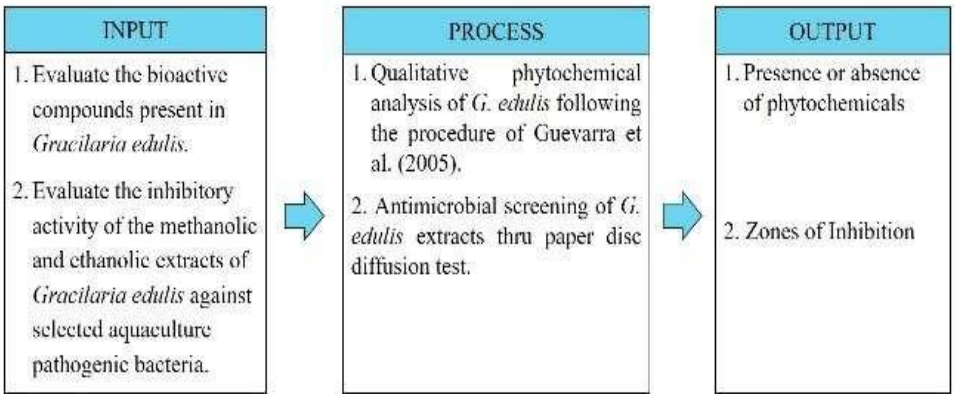
To treat bacterial diseases in fish farming, various chemotherapeutics, vaccines, immunostimulants, and probiotics have been used, but the emergence of mutants and drug- resistant microorganisms has become a major issue. Antibiotic-resistant bacteria are causing an increase in the number of infections worldwide (Levy and Marshall, 2004). Furthermore, decreased efficiency and pathogen resistance to antibiotics have necessitated the development or discovery of new mutations (Bolanos et al., 2017).

Studies revealed that seaweeds contain amino acids, terpenoids, phlorotannins, steroids, phenolic compounds, halogenated ketones and alkanes, and cyclic polysulphides (Anjum et al., 2014). They are a rich source of bioactive compounds, capable of producing secondary metabolites that can be used as antimicrobial agents, and have the potential to be used as new pharmaceutical materials (Maftuch et al., 2016). Such bioactive compounds are also referred to as phytochemicals which have potential biological activities (Ghannadi et al., 2016); and are primarily responsible for the protection of plants against insect infestations and microbial infections (Escobido and Orbita, 2016). Unlike pharmaceutical chemicals, such phytochemicals have no adverse effects; hence, they are considered as “friendly medicines” that play a vital role against numerous diseases (Banu and Cathrine, 2015). Some of these phytochemicals include, alkaloids, anthraquinones, tannins and polyphenols, saponins, flavonoids, steroids, terpenoids, cyanogenic glycosides, etc.

Antimicrobial activity, on the other hand, is thought to be a characteristic of seaweeds that allows them to synthesize bioactive secondary metabolites or organic compounds that are not directly involved in the normal growth, development, and reproduction of an organism. Different organic solvents such as aqueous, chloroform, methanol, acetone, petroleum ether, diethyl ether, ethanol, n-hexane, dichloromethane, ethyl acetate, and toluene have been used to test the bioactivity of various types of algae against a wide range of microorganisms such as gram positive and negative bacteria, fungus, and even viruses (Qari and Khan, 2019). According to Pérez et al. (2016), different solvent extracts of red seaweeds demonstrated potent antimicrobial activity.

Gracilaria edulis is widely distributed in coastal areas throughout the Philippines, particularly the coastal of Cagayan like Buguey, Sta. Ana, and Claveria, Cagayan. However, the research of G. edulis as antimicrobial substance against aquaculture pathogens and potential source of bioactive compounds is poorly documented yet which gives the impetus of this study. Therefore, in this study we focus on exploring the bioactive compounds contained within G. edulis found and cultured in Claveria, Cagayan, with the aim of using them as antimicrobial agents and natural immunostimulants for aquaculture.

CONCEPTUAL FRAMEWORK



Objectives of the Study

This study generally aimed to evaluate the phytochemical characteristics and antimicrobial properties of G. edulis extracts against selected aquaculture pathogenic bacteria. Specifically, it sought to evaluate the bioactive compounds present in the thallus of G. edulis and its antimicrobial activity against S. aureus, E. coli, and A. hydrophila using methanolic and ethanolic extraction.

METHODOLOGY

The seaweed samples used in the experiment were collected from the Bureau of Fisheries and Aquatic Resources – Claveria Brackishwater Technology Outreach Station (BFAR-CBTOS) located in Pata East, Claveria, Cagayan. For the bacteria, two of the microorganisms were requested from the Department of Agriculture – Bureau of Fisheries and Aquatic Resources Regional Office 2 (DA- BFAR R02) Regional Fish Health Laboratory (E. coli and S. aureus) while the A. hydrophila was obtained from the Central Luzon State University – College of Fisheries (CLSU-COF), Science City of Munoz, Nueva Ecija. The antimicrobial screening was also conducted at the BFAR-RO2 Regional Fish health Laboratory while the phytochemical analysis has been carried out in the Department of Science and Technology Regional Office 02 - Regional Standards and Testing Laboratory (DOST R02-RSTL). The flow process is shown in Figure 1. From field collection or gathering to air drying of G. edulis samples for a week, which have been pulverized for the maceration process. The solution was filtered and concentrated thru the vacuum-pressured rotary evaporator to obtain the crude extracts. Such crude extracts derived were eventually used for the phytochemical and antimicrobial analysis.

Phytochemical Analysis

About fifty milliliters (50 mL) of each extract of the G. edulis were brought to the DOST R02-RSTL for the phytochemical screening following the qualitative screening procedure of Guevarra et al. (2005): Ferric Chloride test for the detection of tannins; the Bate-Smith and Metcalf method for the test of Flavonoids; and the Froth test for the detection of saponins.

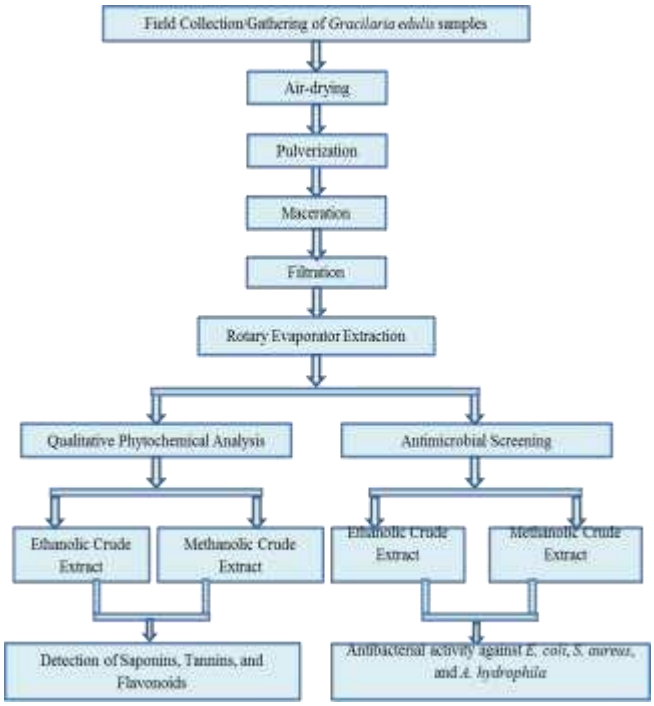


Figure 1. *Research Methodological Flow*

Antimicrobial Screening

Two test microorganisms have originated from the DA-BFAR RO2 Regional Fish Health Laboratory, where the experiment was conducted and another one has been obtained from the CLSU-COF. These test microorganisms are as follows: E. coli, S. aureus, and A. hydrophila cultured at the said laboratories.

The paper disc agar diffusion method was used to determine the antimicrobial properties of the sample. About 5 mL of ethanolic and methanolic crude extracts (assay solution), distilled water (negative control) and amoxicillin (positive control) were dispensed into the sterile paper discs and was performed in five trials or replicates. The impregnated discs were aseptically applied and pressed into the seeded nutrient agar in an equidistant manner. The assay plates were then labelled for antimicrobial potential. Sets of assay plates were arranged inside the laminar airflow or biosafety cabinet. The Petri dishes were incubated at 35 degrees Celsius for 18-24 hours.

After 18-24 hours of incubation, the diameter of zones of inhibition were measured in millimeters using the Vernier caliper with the aid of a black paper background. Clear and well-defined zones of inhibition (ZOI) around the discs were observed if the sample tested possessed antimicrobial potential while failure of the disc to exhibit zones of inhibition indicates the absence of antimicrobial effects.

Statistical Analysis

Mean values ± SD were used to present the antimicrobial efficacy of the various extracts of G. edulis against the selected aquaculture pathogens based on the average measurement of the "zones of inhibition," which were expressed in millimeters using a Vernier caliper. The data were initially tested for normality and homogeneity of variance using Shapiro-Wilk's and Kolmogorov-Smirnov tests, respectively. Whenever necessary, data are subjected to arcsine or square-root transformation to meet the parametric assumptions. Non-parametric data were analyzed using Kruskal-Wallis test followed by pairwise Mann-Whitney U test as post hoc comparison procedure. Parametric data were also analyzed using one-way ANOVA (Analysis of Variance) followed by Tukey's HSD Test.

RESULTS

Table 1 reveals the result of the phytochemical analysis of G. edulis extracts (i.e., ethanolic and methanolic crude extracts) showing the various test parameters such as flavonoids, tannins, and saponins. Based on the results of the phytochemical analysis, the ethanolic crude extract of the thallus of G. edulis contains tannins and does not contain flavonoids and saponins, whereas the methanolic crude extract has flavonoids and tannins and is deficient in saponins, that is, observed however in both extracts.

Table 1. Result of the Qualitative Phytochemical Analysis

Sample Description	Parameter	Result
Ethanolic Crude Extract	*Flavonoids Tannins Saponins*	- + -
Methanolic Crude Extract	*Flavonoids Tannins Saponins*	+ + -

Table 2 indicates the mean and standard deviation of zone of inhibition of *G. edulis* extracts against selected aquaculture pathogenic bacteria namely: *A. hydrophila*, *E. coli*, and *S. aureus*. Of the three selected aquaculture pathogenic bacteria, the *A. hydrophila* was found to be the most susceptible to the ethanolic crude extract as compared to the other bacteria, obtaining a mean ± SD zone of inhibition (ZOI) of 8 ± 1.32476, followed by *S. aureus* and *E. coli* with means and standard deviations of 6.44± 0.69857 and 6.425 ± 0.61305 respectively. The trend in the responses of these bacteria was also demonstrated to be similar to that of the methanolic crude extract of *G. edulis*, that is, sensitive with *E. coli* as the least susceptible (6.7 ± 0.65828), followed by *S. aureus* (8.1 ±0.68191) and *A. hydrophila* (8.26 ± 1.60717) as the most susceptible bacterium.

Table 2. Mean and Standard Deviation (Mean ± SD) of Zone of Inhibition of G. edulis Extracts against Selected Aquaculture Pathogenic Bacteria

Test Microorganism	Sample Code	Sample Description	Zone of Inhibition (mm)
A. Hydrophila	MCE	Methanolic Crude Extract	8.26 ± 1.60717
	ECE	Ethanolic Crude Extract	8 ± 1.32476
	+	Positive Control	7.1 ± 1.27083
	-	Negative Control	---
E. coli	MCE	Methanolic Crude Extract	6.7 ± 0.65828
	ECE	Ethanolic Crude Extract	6.425 ± 0.61305
	+	Positive Control	33.25 ± 0.07071
	-	Negative Control	---
S. aureus	MCE	Methanolic Crude Extract	8.1 ± 0.68191
	ECE	Ethanolic Crude Extract	6.44 ± 0.69857
	+	Positive Control	6.42 ± 0.57619
	-	Negative Control	---

Values are means of five replicates (n=5) ± standard deviation; No Inhibition Activity (---)

It is revealed, however, that at a significant level of 5 % (ANOVA), the sensitivity (ZOI) of each of the selected aquaculture pathogenic bacteria to the methanolic and ethanolic extracts of G. edulis, including the amoxicillin (positive control), has no significant differences ($p>0.05$); otherwise, it has no specific sensitivity and resistance to such antimicrobial agents. Nonetheless, E. coli was the most sensitive to the positive control or Amoxicillin relative to the other aquaculture bacteria which exhibit resistance to the commercially available antibiotic; not to mention that S. aureus was the most resistant to the commercially available antibiotic, i.e., likewise observed in A. hydrophila having however a lesser resistance.

DISCUSSION

In the present study, the two crude extracts (methanolic and ethanolic) of G. edulis were screened for the occurrence of three phytochemicals named saponin, tannins, and flavonoid. Based on the result, the methanolic crude extract has contained more phytochemicals or showed a higher number of bioactive compounds present than the ethanolic crude extract, which means that the methanol solvent used is more efficient in terms of extracting bioactive compounds from the sample compared to the other solvent used, which is ethanol. The ethanolic crude extract of the thallus of G. edulis contains tannins and no flavonoids or saponins, whereas the methanolic crude extract contains flavonoids and tannins but lacks saponins, as observed in both extracts. According to Rayapu et al. (2017), such flavonoids detected in the methanolic crude extract of G. edulis are compounds with various medicinal properties and health benefits. It can operate as an antibacterial because it can damage the bacterial cell wall, followed by the discharged intracellular compounds, which disrupts the permeability of cell membranes and the synthesis process for protein and DNA (Firdausy et al., n.d.). On the other hand, tannins are considered to be healing agents in inflammation and burns with antidote, anti- ulcer, and antioxidant properties (Escobido et al., 2016). Such

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saponins, however, which are absent in both extracts, are known to possess numerous biological properties like antimicrobial, anti-inflammatory, and antifeedant, as cited in the study of Qari and Khan (2019).

The current observation is also underpinned by the findings of Sobuj et al. (2021), who reported that methanolic extract contained a significant amount of phenolics and maximum quantity of total flavonoid content (TFC) when compared to ethanol and water extracts, which contained fewer amounts. It is important to note, however, that the degree of polarity affects the components of the extracted phytochemicals; otherwise, phytochemicals can be extracted with an appropriate solvent, not to mention phytochemical flavonoids, alkaloids, and saponins are capable of dissolving in polar solvents such as ethanol and methanol (Dayuti, 2018). Similarly, the fractionation and separation of different compounds such as pigments, alkaloids, and different groups of phenolic compounds, among others, is possible using different extraction solvents based on their polarity (Afonso et al., 2021).

Both extracts of the G. edulis exhibited inhibitory activity against the selected aquaculture pathogenic bacteria as opposed to the findings of Assaw et al. (2018), where the methanolic extract of Gracilaria sp. has possessed a moderate inhibitory activity against Bacillus subtilis, Staphylococcus aureus, S. epidermidis, Escherichia coli, Vibrio cholera, and Enterobacter cloacea, i.e., in agreement as well with the report of Qari and Khan (2019), where the ethanolic and methanolic extracts of selected Gracilaria spp. have exhibited good and greater zone of inhibition or antibacterial activity, respectively, against E. coli and Salmonella typhi (enteric pathogens).

However, it is interesting to note in the current investigation that the methanolic and ethanolic extracts resulted in higher ZOI for A. hydrophila and S. aureus when compared to the positive control. This can be due to the phytochemicals present in such extracts which have the potential to possess antibacterial activity, as reported in the study of Firdausy et al. (n.d.). The difference of inhibition zone, particularly in both extracts, where the ethanolic has shown lesser inhibitory activity when compared with methanolic is possible due to the presence of single bioactive compound (tannins), contrary to the latter with two constituents, namely flavonoids and tannins, exacerbated by the lack of saponins with antimicrobial properties (Dayuti, 2018; Qari and Khan, 2019). Dayuti (2018) further suggests that extracting G. verrucosa using more concentration of methanol can obtain bioactive compounds resulting in higher antibacterial activity and thereby producing more inhibitory potency than that produced by ethanol.

According to Salem et al. (2011), the discrepancies in results could be attributed to the differences in the susceptibilities of the microbial strains utilized. In general, earlier study indicated that seaweed extracts affected Gram-positive bacteria more than Gram- negative bacteria (Cagalj et al., 2022). Gram- negative bacteria's cell walls are more complex, making it more difficult for antibacterial chemicals to penetrate the cell, resulting in a firmer inhibitory zone (Gonelimali et al., 2018). This function of the outer cell wall explains why gram-positive species were more susceptible and less resistant to antibiotics than gram- negative bacteria (Alsenani et al., 2020). In the current investigation, the antibacterial activity of methanolic and ethanolic crude extracts of G. edulis were tested against a Gram-positive bacterium (S. aureus) and two Gram-negative bacteria (E. coli and A. hydrophila). Though G. edulis extracts demonstrated nearly similar inhibition zones against S. aureus (Gram- postive) and A. hydrophila (Gram-negative), it is worth noting that the Gram-negative bacterium E. coli was the least susceptible.

In view of the present study, knowledge of the inhibitory activity or zone of inhibition of G. edulis extracts against selected aquaculture pathogenic bacteria basically indicates or suggests its utilization as a possible antimicrobial agent in the future, in particular for diseases associated with aquaculture caused by certain bacterial pathogens; otherwise, its possible usage can be a potential source of natural therapeutics in the long term, thus beneficial for the pharmaceutical use.

SUMMARY OF FINDINGS

The present study was conducted to evaluate the phytochemical constituents and antimicrobial activity of the G. edulis extracts against selected aquaculture pathogenic bacteria. More specifically, its objective was to assess the bioactive compounds present in the thallus of such a seaweed sample and its antimicrobial activity against S. aureus, E. coli, and A. hydrophila using two different extraction solvents of the phytochemical analysis of the ethanolic and methanolic crude extracts of G. edulis, it has been revealed that the former contains tannins whereas the latter indicates presence of tannins and flavonoids. However, both extracts were also deficient in saponins.

With regard to the antimicrobial screening, the results showed that both extracts of G. edulis exhibited inhibitory activity against the tested microorganisms: A. hydrophila, E. coli, and S. aureus. The methanolic extract, however, resulted in a higher inhibition zone activity than the ethanolic extract based on the result. Nevertheless, both extracts demonstrated potential use as an antibacterial agent against selected species of bacteria.

CONCLUSION

On the basis of the findings of the study, the ethanolic and methanolic extracts of G. edulis showed inhibitory activity against the selected test microorganisms comparable to that of the positive control (Amoxicillin). However, it is interesting to note that such an extract comprised not one, but two phytochemicals (i.e. tannins and saponins)

which are compounds that encompass biological activities that can in particular induce antimicrobial approaches. The present study therefore implies that G. edulis can further be explored and developed for therapeutic or medicine production in view of its potential as an antimicrobial agent.

RECOMMENDATIONS

1. The government through its concerned departments, including the academic society or research institutions should sponsor programs or seminar workshops to train various stakeholders like the students on the appropriate and crucial applications of red seaweeds particularly G. edulis in food, animal feeds, fertilizer, medicine, and commercial or industrial use.

2. Otherwise, stronger policies and wider programs should be promulgated by the government to increase the level of awareness, knowledge, and understanding of the use of G. edulis.

3. That the antibacterial activity of G. edulis be tested in other species of bacterial pathogens of aquaculture or certain genera of fish pathogenic bacteria.

4. That other means of extraction, extraction solvents, and different methods of analysis be utilized in identifying and quantifying the phytochemical constituents including its antibacterial property.

5. That the extracts be further concentrated into an incipient dry, powdered form otherwise difference in the concentration of extracts be carried out in order to evaluate its efficacy or its property as an antibacterial agent.

6. That other antimicrobial susceptibility method or confirmatory test be conducted to detect the antibacterial activity of the G. edulis extracts.

7. Further studies should be conducted to determine other biological uses or activities of G. edulis extracts in order to escalate its aquaculture technology or intervention.

ACKNOWLEDGEMENT

The authors are significantly indebted to the DA-BFAR RO2 spearheaded by Regional Director Angel B. Encarnacion, for providing necessary facilities and equipment to carry out the research work, the BFAR-CBTOS for providing G. edulis samples, Dr. Emma L Ballad for free consultation, Dr. Jefferson K. Soriano, Head of DA-BFAR RO2 Regional Fish Health Laboratory, for critical monitoring and technical assistance, and the staff of Fish Health Laboratory for the exemplary guidance during the extraction and antimicrobial screening. Great acknowledgements are also due to the CLSU-COF for the microorganism A. hydrophila used in the study and the DOST R02-RSTL for the phytochemical screening of
G. edulis extracts.

The authors would also like to acknowledge the continuous motivation and support of their adviser, Prof. Glycinea de Peralta, throughout their research and writing. Profound appreciation and commendation are given to Cagayan State University-Aparri Campus, especially the College of Fisheries and Aquatic Sciences, which honed the authors through the years, and to the College Dean, Dr. Eunice A. Layugan, for her utmost guidance. The authors also owe a debt of gratitude to their families. Others may never realize the extent of their support, but the authors will never forget.

Last but not least, the authors give the highest glory to the Great Almighty for protecting and guiding them during the research process, despite the difficulties of this trying time.

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JANUARY-DECEMBER 2022

CULTURE PRACTICES AND VALUE CHAIN ANALYSIS OF MUD CRAB IN STA. TERESITA, CAGAYAN

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ABSTRACT: The municipality of Sta. Teresita has extensive brackish water and mangrove areas which inhabit the high-valued commodity in the market which is the mud crab. But the baseline data regarding the culture practices and value chain analysis of mud crab is still lacking in the municipality. This research was conducted to assessed the practices and techniques in culturing of mud crab and to analyze its value chain in Sta. Teresita, Cagayan. Data are gathered using questionnaires and mud crab farmers and value chain actors are interviewed. The results shows that most of the mud crab farmers are male while most of the value chain actors are female. The culture system utilize is pond culture for grow-out and fattening and is purposely used for polyculture, monoculture and box culture of mud crab. Mud crab are cultured from ≥ 3 to ≤6 months and most of the mud crab growers are not applying acclimatization but they are providing shelters in their ponds to minimize cannibalism. Apparently, the constraints that hinder the sustainability of mud crab are inconsistent supply of quality crab seeds, lack of professional knowledge in crab farming, flooding, and intra-species cannibalism. The key stakeholders involved in the value chain are the crab farmer, fattener, dealer, retailer, peddler and consumer and 6 chains are formed in terms of the distribution pattern of mud crab. Only live mud crabs are being transported and sold to the markets. The preferences in buying mud crab may vary for body size, body weight, intactness of limbs, gender, gonad maturity, and odor. As crabs moved through the chain their value increased based on its grade or weight. Mud crab weighed >200 grams are considered as marketable size and it is graded as small and mud crab weighed >350 grams are graded as medium and mud crab weighed >500 grams are graded as large. Seemingly, the selling of mud crab is divided in terms of trading season (off and peak season). The value chain actors stated that crabs during peak season (April- Lenten Season and December- Christmas season) are more expensive compared to off-season.

Keywords: *Acclimatization, Mud crab grading, Market distribution of Mud crab*

INTRODUCTION

Scylla spp., or mud crabs from the Portunidae family is widely distributed and consider as one of the top commodities in aquaculture (Rahman et al., 2020; Macintosh et al., 2002). The Philippines has a long history of mud crab farming and is the world's second largest producer (Quinitio, 2017). Mud crabs are tough and can survive for lengthy periods of time out of the water at lower temperatures, making them a good species for live export to other nations and to local market (Lalramchhani et al., 2019). The three commercially important species of mud crab, Scylla serrata, S. tranquebarica and S. olivacea are commonly found in the country Philippines, but S. serrata is the preferred species for farming (Quinitio, 2017).

Mud crab are raised in a pen, cage, or even simultaneously with shrimp in ponds (Chakraborty et al., 2018). As a result, shrimp producers are switching to crab farming, which is less prone to illness, easier to cultivate, more flexible to climatic change, and has a better market price than shrimp farming (Salam et al., 2012). And the soaring demand and higher price in the overseas markets further aggrandized the farmer's interest in ranching crabs (Rahman et al., 2017). There are three main culture systems in use (crab fattening, grow-out, and soft-shell crab production) that cater to various segments of the worldwide crab market (Rahman et al., 2017). All of these farming systems are entirely dependent on seed supply from the wild (Salam & Ross, 2000; Rahman et al., 2018). As a result, the seed shortage has tightly restricted the expansion of crab culture (Marichamy & Rajapackiam, 2001). The lack of hatchery facility to produce crablets has been a challenge for the continuous source of seed stock and hampers the expansion of crab industry, hence the dependence on wild stocks (Ballad & Bañarez, 2019).

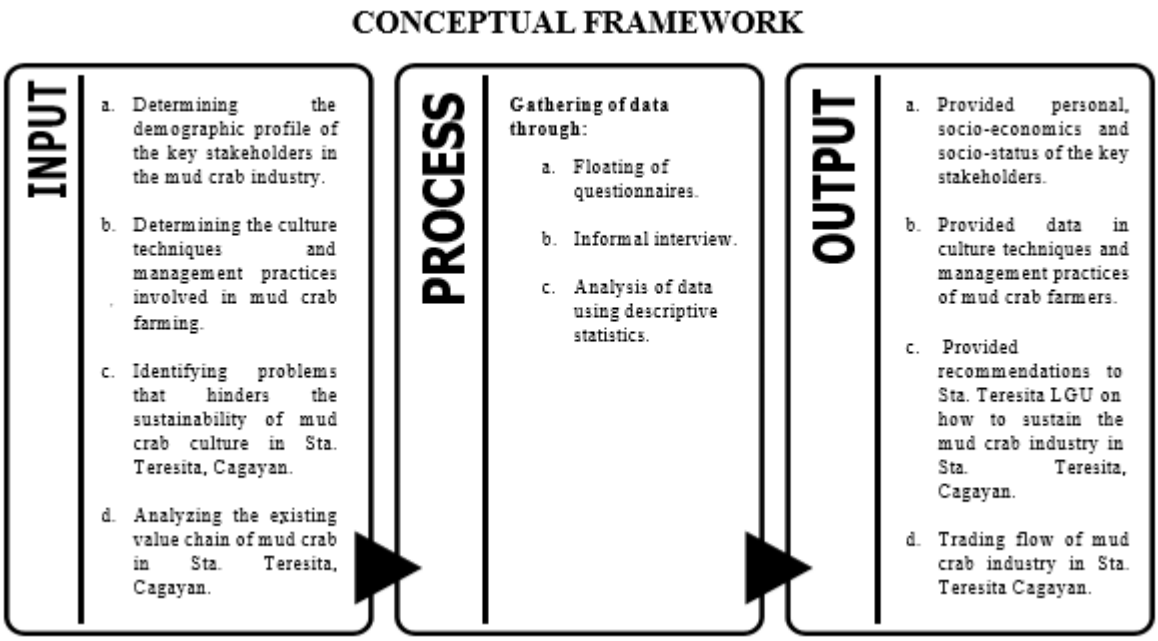
The mud crab value chain includes a number of intermediaries, including crab catchers, farmers, suppliers, exporters, and consumers (Sultana et al., 2019). It focuses on market collaboration between diverse suppliers, producers, processors, and purchasers with varying degrees of market power (Mangubhai et al., 2017). The current mud crab value chain is extended and unstructured, with too many parties making it a complicated system, and crab fisheries being abused by intermediaries and receive little government assistance (Sanoara, 2018).

The municipality of Sta. Teresita is situated at the northeastern region of Cagayan Valley. Its coastal area has wide area of brackish water and mangrove areas that are suitable for the culture of the high- valued commodity in the market which is the mud crab or mangrove crab. But the availability of data regarding on the culture practices and value chain analysis of mud crab is still deficient and not yet given much attention in the municipality. Thus, we conducted this study to determine the Culture Practices and Value Chain Analysis of mud crab in Sta. Teresita,

Cagayan. Specifically, it aimed to: (a) determine the demographic profile of the Mud crab farmers and value chain actors; (b) determine the culture techniques and management practices involved in mud crab farming; (c) identify problems that hinders the sustainability of mud crab culture and recognize ways that could help to enhance production, profitability, and sustainability of mud crab culture in Sta. Teresita; (d) analyze the existing value chain of mud crab in Sta. Teresita, Cagayan.

METHODOLOGY

This study utilized the descriptive method of research. Descriptive method was used in consideration of the objective of the study to determine the culture practices and value chain analysis of mud crab in Sta. Teresita, Cagayan. The study was conducted at Sta. Teresita, the coastal municipality of the province of Cagayan. This study involves forty (40) mud crab farmers (20% of total crab farmers population from MAO Sta. Teresita, Cagayan) for the assessment of culture practices and another forty (40) value chain actors were selected for value chain analysis. The researched used random sampling to obtain the number of samples. The data needed was gathered through questionnaires and it served as the main gathering instrument. It was used for individual interview of the stakeholders involved in the crab industry including. Two detailed study questionnaires were created (for crab farmers and value chain actors). Data from the Municipal Agricultural Office (MAO) and multiple scholarly articles and related literature through an online search was utilized as secondary data. Descriptive statistics in analyzing the data collected. Descriptive statistics like percentage was employed to analyze socio-economic data of the crab farmers, profit share among each actor in the traceability of the product in the value chain and other related information of sample respondents. Collated data were presented in tables and graphs prior to analysis and interpretation as part of a discussion and synthesis.



RESULTS

Demographic Profile of the Key Stakeholders

Table 1 shows the personal, socio-economic, and social status of the mud crab farmers and value chain actors.

Table 1. Demographic condition of the key stakeholders in the mud crab industry.

	Characteristics	Mud crab farmers	(%)	Value chain actors	(%)
Age	≤20	0	0	0	0
	21-30	1	2.5	3	7.5

	31-40	8	20	11	27.5
	41-50	12	30	13	32.5
	51-60	12	30	9	22.5
	61-70	5	12.5	4	10
	≥71	2	5	0	0
Sex	Male	28	70	1	2.5
	Female	12	30	39	97.5
Civil status	Single	2	5	2	5
	Married	37	92.5	35	87.5
	Widowed	1	2.5	3	7.5
Educational attainment	Elementary level	10	25	2	2.5
	Elementary graduate	7	17.5	5	12.5
	Highschool level	7	17.5	10	25
	Highschool graduate	4	10	8	20
	College Level	5	12.5	9	22.5
	College graduate	3	7.5	6	15
	Vocational	4	10	0	0
Monthly income	1000-5000	25	62.5	10	25
	6000-10,000	9	22.5	24	60
	11,000-15,000	1	2.5	4	10
	≥16000	5	12.5	2	5

Culture Techniques in Mud Crab Culture

Figure 1 presents the culture system, farming method and culture type of mud crab in Sta. Teresita. Data reveals that all of the mud crab farmers use pond as a culture system. Among those farmers, 33 (82.5 %) utilized grow-out and 7 (17.5ssssss%) utilized fattening. And most of them are applying polyculture (75%) as type of culture.

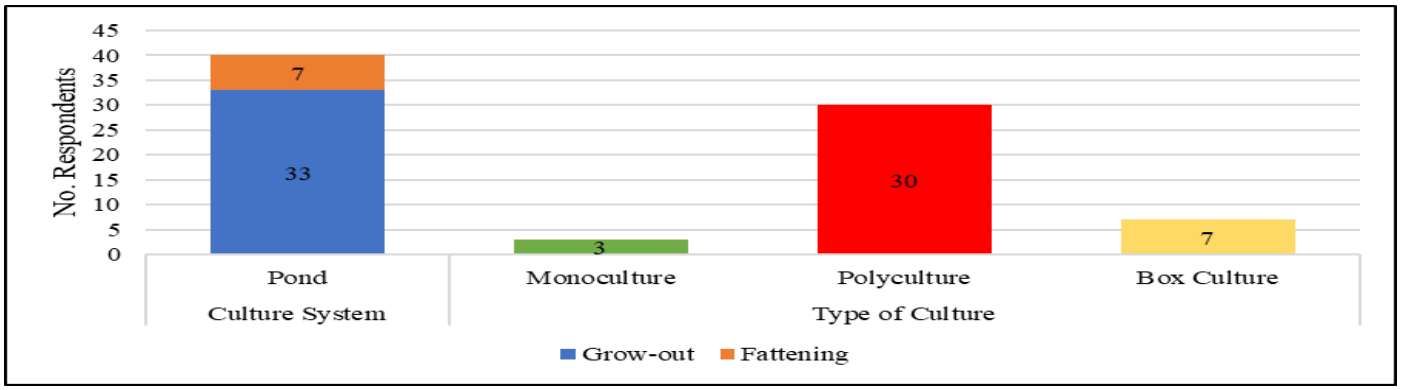


Figure 1. Culture system, farming method and culture type of mud crab in Sta. Teresita. Figure 2 shows the size of seed stock for Mud crab culture in Sta. Teresita, Cagayan. Crab farmers use double and single sized crab seeds but majority of them uses a single-sized crab seed with a total of (60%).

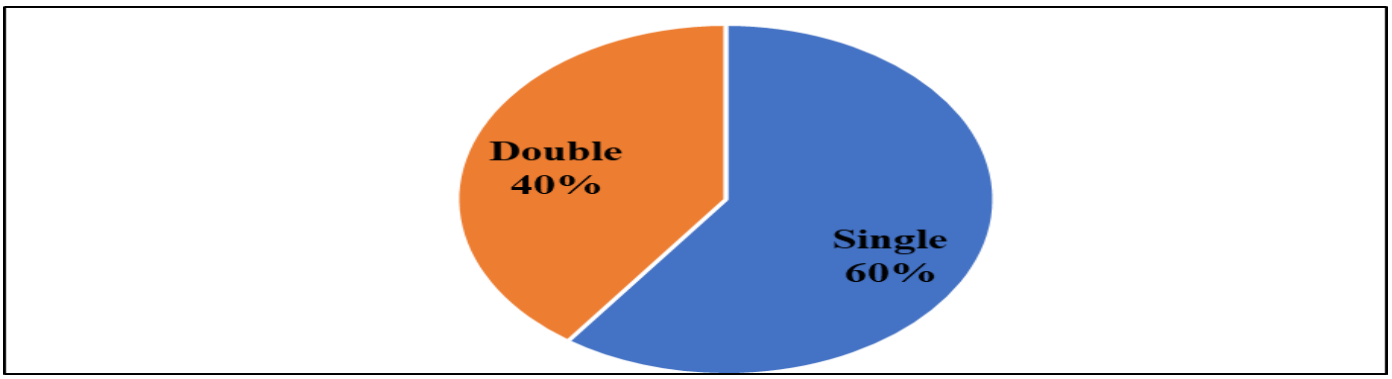


Figure 2. Size of Seed Stock for Mud crab Culture in Sta. Teresita

Management Practices in Mud Crab Culture

Figure 3 displays the feeding frequency and schedule for mud crab Culture in Sta. Teresita, Cagayan. It shows that most of the mud crab farmers feed their stocks once daily with a total of (55%). Some of them feed their stocks every morning and late in the afternoon.

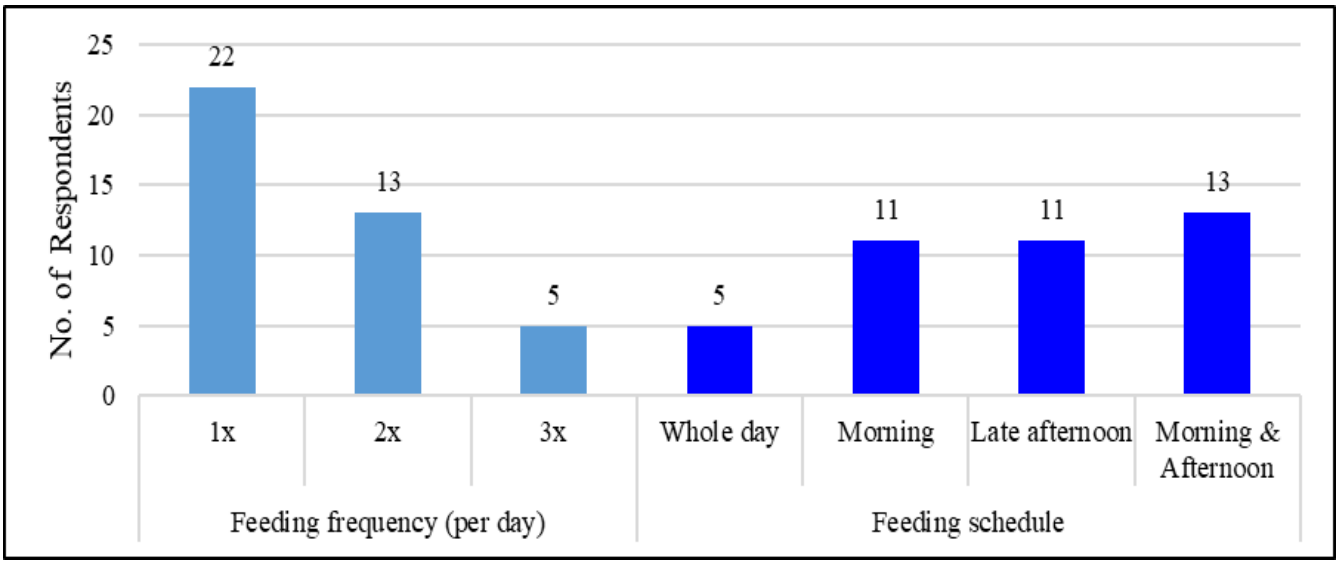


Figure 3. Feeding frequency and schedule for mud crab culture in Sta. Teresita, Cagayan

The respondents applying acclimatization and providing shelter in pond is shown in Figure 4. Result shows that most of the mud crab farmers are not applying acclimatization before stocking. However, most of them are providing shelter inside the pond.

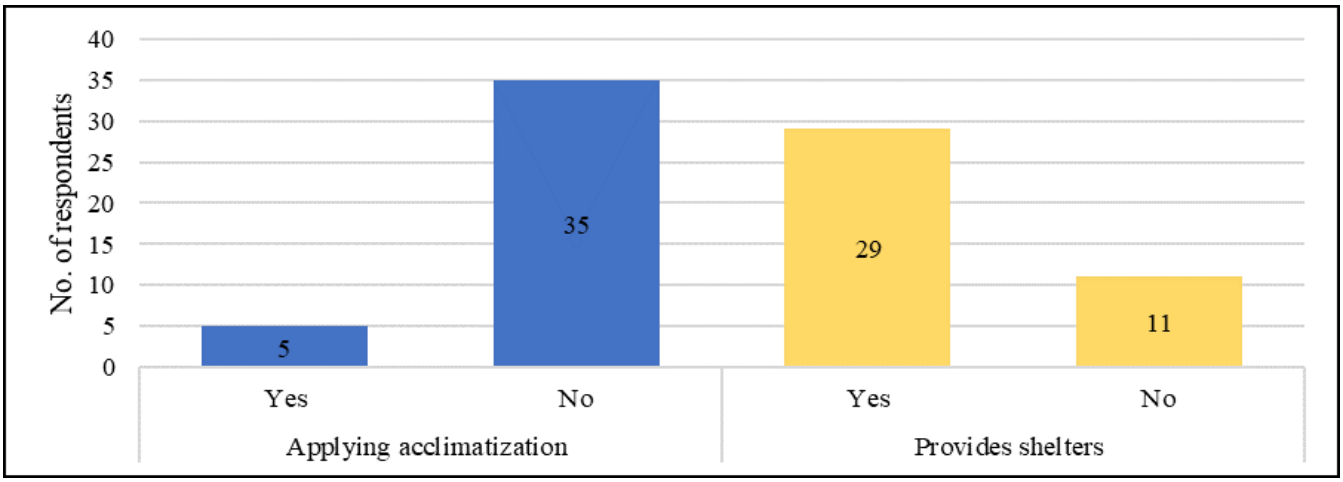


Figure 4. Respondents applying acclimatization and providing shelter in Ponds

Problems That Hinder the Sustainability of Mud Crab Culture in Sta. Teresita

Table 2 shows the summary of problems encountered by the mud crab farmers. The data reveals the four most common problems encountered by the mud crab farmers that hinder the sustainability and profitability of mud crab aquaculture in Sta. Teresita, Cagayan.

Table 2. Summary of problems encountered by the Mud crab Farmers

1.	Intra-species cannibalism during molting period.
2.	Lack of professional knowledge on mud crab farming.
3.	Flooding caused by long duration of rainfall.
4.	Inconsistent supply of good quality crab seeds.

Value Chain Analysis of Mud Crab

Figure 5 presents the distribution pattern and supply chain of Mud Crab in Sta. Teresita, Cagayan. There are 6 identified value chain actors (crab farmer, fattener, dealer, retailer, peddler and end consumer).

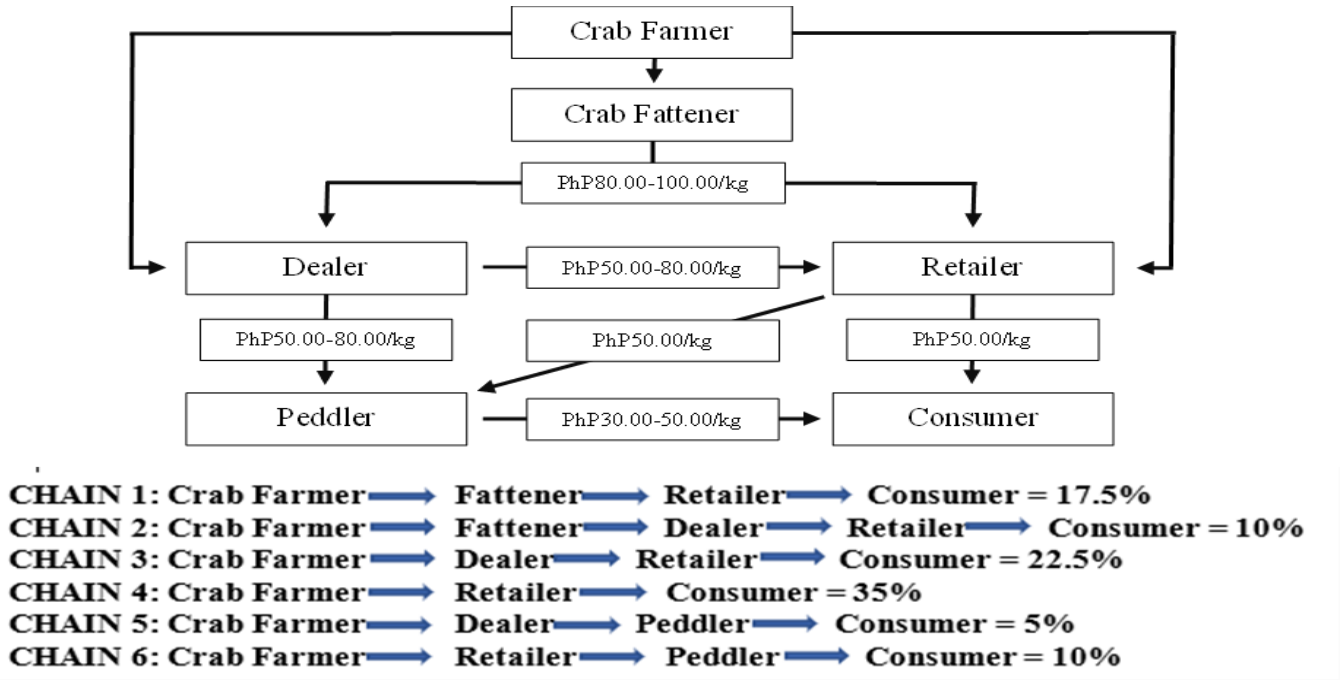


Figure 5. Distribution pattern and supply chain of mud crab in Sta. Teresita, Cagayan.

Figure 6 shows Preferences of Value chain actors in purchasing mud crab. Most of the respondents preferred to consider the body size, body weight, and color of mud crab.

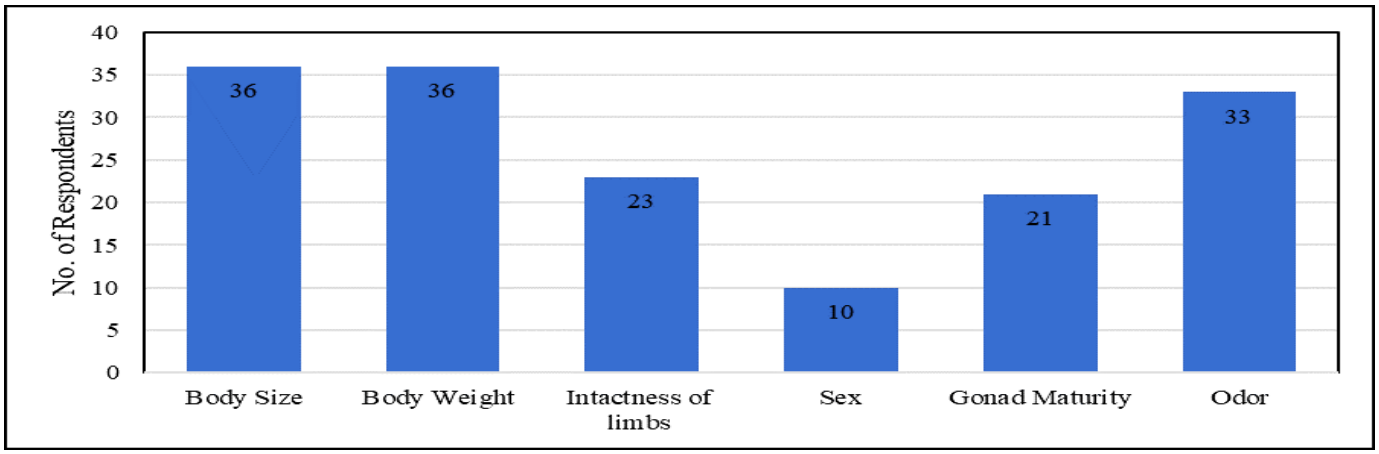


Figure 6. Preferences of Value chain actors in purchasing mud crab.

Table 3 shows the grading of mud crab along the value chain in Sta. Teresita. It was observed that the value of mud crab increased based on its grade or weight. Mud crab weighed >200 grams are considered as marketable size and it is graded as small and mud crab weighed >500 grams are graded as large.

Table 3. Grading of mud crab along the Value chain

Grade	Weight (g)	Price Range/ kg.	
		Off- Season	Peak- Season
Large	>500	500	800
Medium	>350	350	450
Small	>200	250	300

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DISCUSSION

Demographic profile of the Key Stakeholders

Demographic profile shows the details of the personal, socio-economic and social status of the respondents of this study. Table 1 highlights the salient outcomes and background information of Mud crab Farmers and Value chain actors. The key stakeholder's age ranged from 21 to 71 years old and above. This indicates the involvement of middle age group and old age group of people in mud crab aquaculture and mud crab value chain. In terms of gender and civil status, it was observed that majority of the mud crab farmers are male and married. It could be noted from the early results on age, that the age bracket of most of the respondents ranges from 41-60, these are legal age where people are ready to enter in a married life. The dominance of male in our study is similar to the findings of Akwanyi et al. (2019) who both observed the dominance of men in fish farming. However, this study found out that women also participate in mud crab farming. According to Pandey & Upadhayay (2012), fishponds that are located within and close to homesteads, women are able to work simultaneously on the fishponds and at their homes without forcing them to be away from their homes for long periods that might force them to neglect some of their roles at their homes. On the other hand, it was observed that majority of the value chain actors are females. Women are more trained in terms of vending and market negotiations. In aquaculture, women's roles and the extent of their participation in value chains are more significant than often assumed (Ndanga et al. 2013). Yap et al. (2017) also found out that women are active in all aspects of the fisheries value chain. In this study, most mud crab farmers only attained elementary level, elementary graduate and only few had finished college graduates. On the other hand, most of the farmers used their knowledge from training/seminars conducted by government organizations and NGOs and some used first-hand experience as preparation of skills in culturing mud crab. Also, majority of them had reported having attended seminars and workshops related to mud crab farming. These farmers said that because of these, they have been enlightened about mud crab farming and this has enabled them to improve their skills in mud crab aquaculture. These results are similar to the study of Amankwah et al. (2018) that being more educated gives a farmer the advantage in understanding improved farming practices with ease. While most of the value chain actors attained high school level, high school graduate, and college level. Data shows that most of the value chain actors have a higher educational attainment and this means that they had a capacity to understand the basics in marketing and selling of mud crabs. In general, family income is a key factor in determining the standard of living of people in the community or region (Pandey & Upadhayay, 2012). This study also revealed that majority of the mud crab farmers had a very low monthly income which fall under low-income group. According to Pandey & Upadhayay (2012), low level of income reflects their poor economic condition, which was not sufficient to maintain their normal livelihood and found it difficult to meet even their consumption requirements from their earnings. While most of the value chain actors had a medium income level compared to the majority of mud crab farmers. According to Heenkenda & Chandrakumara (2016), entrepreneurial skills obtained from small businesses, which in turn lead to higher income.

Culture Techniques in Mud Crab Culture

Brackish water ponds are the culture system that are being used in Sta. Teresita with an average pond size of 0.25 to 0.50 ha. The study revealed that most of the respondents utilized ponds for grow-out and some utilized ponds for crab fattening. It shows that grow-out culture is the most commonly practiced among mud crab farmers because it was long performed decades ago. These results are similar to the study of Ballad & Bañarez (2019) that grow-out culture was noted as being practiced in the municipality of Sta. Teresita. In ponds, polyculture or culture of juvenile crabs to market size with one or two more species in earthen brackish water ponds is also commonly practiced. According to SEAFDEC (2016), crabs were commonly cultured together with fish in an earthen pond. Farmers preferred polyculture by stocking crabs with other finfish species such as tilapia, bangus, siganids, mullet and prawn. It is recommended as an alternative farming approach to avoid the production loss of farming (Shelley & Lovatelli, 2011). In addition, high profit and production has already been established in polyculture experiments of mud crab with tiger shrimp, milkfish, and mullet (Rahman et al. 2020). It is also presented in figure 2 that most of mud crab farmers select single size (five-to-ten-peso coin/ >3 cm) of crab seed and some prefer to use double size crab seed (one peso coin/ 2.5- 3 cm) for stocking. Most of them utilized single size crab seed since this was the available crab seed from the wild stock collectors.

Management Practices in Mud Crab Culture

In feeding frequency, most of the mud crab farmers fed their stocks once a day. Based on findings, most of the farmers dispensed feed to the stocks every morning and late in the afternoon. The crabs that are being cultured are fed on different feed types according to the availability at the local level. Almost 90% of farmers fed their stocked crabs with trash fish, some used commercialized feeds and some utilized snails, carabao skin "caliente" and dried coconut meat. Indeed, low- cost trash fishes played a vital role as major feed components of protein sources in mud crab aquaculture and resulted in higher survival rates with better growth performance as compared to other feed types

(Hasanuzzaman et al., 2014; Huq et al., 2015). On the study of Rahman et al. (2020), feedstuffs, their sources and feeding strategies are critically important for aquaculture systems in general. In terms of culture cycle, most of the farmers have 2 to 3 culture cycles yearly since mud crab culture duration ranges from 3 to 4 months. Some have limited culture cycles yearly due to seasonal factors and incompatibility of weather to the desired culture period.

Survey also revealed that only few of the mud crab growers are applying acclimatization strategies before stocking and the rest just stocked their crab seed directly into ponds as shown in figure 4. Farmers are performing acclimatization by sprinkling the crab seeds with the water from the pond for 20 -30 minutes before releasing into ponds. The seeds stocked without proper acclimatization could result in higher mortality rates. Such preconditioning is expected to increase temperature tolerance and extend the range of passive tolerance (Rahman et al, 2020). On the other hand, majority of the mud crab farmers are providing shelters in crab farms. Farmers provide shelters in their crab farms because it serves as a safe place/ shelter for mud crabs during molting. Some are planting mangroves, putting PVC pipe and branches of trees inside their ponds. Reportedly, the shelters could contribute to avoid or minimize the cannibalism during molting (Rahman et al. 2020).

Problems that hinder the sustainability of mud crab in Sta. Teresita, Cagayan

One of the major targets in mud crab culture is to have a high survival and growth rate. But due to some constraints, objectives are not being met. Table 2 reveals that inconsistent supply of good quality crab seeds, lack of professional knowledge of crab farming regarding on improved crab aquaculture methods, flooding which causes the decline in water salinity, and insufficient feeding which promote intra-species cannibalism, resulting in reduced production are some of the critical challenges that hinder the production and profitability of crab aquaculture. Therefore, strategies and solutions are needed to lessen the bottle neck in mud crab culture. Development and dissemination of mud crab hatchery technology is desirable to resolve the problems of the farmers which can reach the gap in the sustainability of crab seed supply. Programs providing training and introducing farmers to the best management practices are strongly advised with higher potential to upgrade the performance of farmers. Lowering the stocking densities and providing enough shelters can minimize the cannibalism in mud- crab culture because through this, the chance of encounter among crabs are lessened and at the same time serve as hiding places when they are molting.

Value Chain Analysis of Mud Crab

The value chain analysis describes the full range of activities that are required to crab farmers in order to trade the mud crab to a certain value chain actor. Different sectors might benefit from mapping the distribution processes and activities that bring items to customers. Therefore, the value chain of mud crab in Sta. Teresita has been studied to make the whole chain more efficient by transpiring the information across the chain and enhance the relationships between the actors of the chain including crab collectors, farmers, retailers and other intermediaries.

Value Chain Actors, Market Channel and Distribution Pattern of Mud Crab

Value chain actors are those who are directly involved in value chain activities. As reflected in the gathered data, there are 6 identified value chain actors which include the crab farmer, fattener, dealer, retailer, peddler and consumer in figure 5. In addition, 6 chains are also formed in terms of the distribution pattern of mud crab. Thus, this research found that the mud crab trading pattern in Sta. Teresita involves a series of intermediaries. Chain 4 (crab farmers- retailer- consumer) with 35 percent of occurrence is the most occurring pattern for the trading of mud crab in Sta. Teresita. On the study of Ballad & Bañarez, (2019), it was also revealed that there is no collector in Sta. Teresita because there is no recorded crablet resources in the municipality. Indeed, crab farmers were the main actors and played the foremost role in the mud carb value chain, as they were the only source of harvest from their ponds. The fatteners sell the fattened crabs to the dealer and retailer makes a profit of 80.00 – 100.00/ kg. The dealers who sell live crabs to retailers and peddlers make a profit of 50.00 to 80.00/ kg. The retailers who sell live crabs to peddlers and to direct consumers can make a profit of 50.00/ kg. And the peddler who peddled live mud crabs directly to consumers is less profitable, they only make a profit of 30.00 – 50.00/ kg. The peddlers sold mud crabs for lower prices than in fish markets and had a minimal profit, but this enabled them to sell all their products and still earn from for their living. Peripheral practices (e.g., peddling) are typically less profitable than more established and central practices and are often done by those who are poor and cannot afford the costs of more profitable activities. According to Manlosa et al., (2021), they are also typically invisible to state planning and support of the government.

The primary role of value chain stakeholders

Crab Farmers- The crab farmers typically culture and harvest crabs in their pond or pens and then sell the collected crabs to Fatteners, Dealers and Retailers.

Crab Fatteners - Crab fattening is a secondary source of income for coastal residents and the fatteners who work in the industry. They bought eggless crab from mud crab farmers for a low price and then sold it to dealers or retailers for a premium price.
Consumers- consumers are at the last of the chain in product flow. Consumers are the most important, without the presence of consumers, all supply chains will not work.
Dealer – The dealer, who serves as the major link between gathered mud crabs and markets, is the second link in the chain. They bought crabs from farmers as well as fatteners and sold their wares to retailers and peddlers.
Peddlers - Peddlers are the ones who sell mud crab to their neighbors or nearby areas by walking. They purchase mud crabs from dealers or retailers and sell them to direct consumers.
Retailers - The retailers have their own outlet in the market. They purchase mud crab from mud crab farmers, dealers and fatteners and sell it to peddlers and consumers with minimal profit

Type and preferences in mud crab marketing

Based on the data, only live mud crabs are being transported and sold to the markets. Crabs are maintained wet by spraying brackishwater on them to reduce death, and hence do not require refrigeration or other facilities during shipping. The live mud crab was delivered to the local communities by motor boats, single motor, tricycle, or van, and a banana or betel-nut leaf was occasionally placed at the bottom to prevent moisture and keep the temperature low, according to the study. This study also revealed that most of them consider the body size and body weight, and followed by the intactness of the limbs. According to Quinitio et al. (2017), crabs with missing claw(s), spawned females ('berried') and lean crabs are still marketed locally at a lower price. Usually, hard shell and meat filled male crab and meat-filled female crab with hard carapace and the entire gonad were considered for shipping (Bhuiyan et al., 2021).

Adding value to Mud crab for Value Chain

On the gathered data, farm gate price of mud crab may vary based on seasonal factor. According to the farmers, the harvested marketable size mud crab is vending to different intermediaries during off and peak season and they are selling mixed grade mud crab. Farm gate price of mud crab is 200.00 -300.00/kg. during off season and 300. 00 – 400.00/ kg. during peak season. However, in general, as mud crabs moved through the chain their value increased because of the mark- up price added by the value chain actors. Table 2 shows that value of mud crab increased based on its grade or weight. Mud crab weighed >200 grams are considered as marketable size and it is graded as small and mud crab weighed >350 grams are graded as medium and mud crab weighed >500 grams are graded as large. Apparently, the selling of mud crab is divided in terms of trading season (peak and regular season). The value chain actors stated that crabs during peak season (April- Lenten Season and December- Christmas season) are more expensive compared to off-season. Based on the statement of the respondents, they considered Lenten Season and Christmas Season as peak season because mud crabs are very high in demand especially during this festive season. The most popular strategy for increasing crab value was grading or paying a greater price for better grade crabs and it is commonly practiced by dealers and retailers. For market sellers, the practice of sorting crabs into groups depending on quality is uncommon and some are marketing only the mixed grade mud crabs. Market sellers often offer crabs with a very low operational profit margin and they sell to individual consumers. According to anecdotal data (from all market vendors questioned and one exporter employee interviewed), mixed crabs, including those that are damaged, are given to the market as a last resort for sale by stakeholders along the value chain (Blue Ventures, 2019). According to Istiak (2018), the seasonal demand and supply, abundance, and other factors like (Chinese New Year, Christmas) had greatly affect the crab price (Chandra et al., 2012). Also, according to Joarder (2014), in a separate season, pricing variations were discovered according to grade.

SUMMARY

The study determined the culture practices and value chain analysis of mud crab in Sta. Teresita, Cagayan. Specifically, it aimed to determine the demographic profile of the Mud crab farmers and value chain actors; determine the culture techniques and management practices involved in mud crab farming; identify problems that hinders the sustainability of mud crab culture and recognize ways that could help to enhance production, profitability, and sustainability of mud crab culture in Sta. Teresita; and analyze the existing value chain of mud crab in Sta. Teresita, Cagayan.

The result of the study divulged that most of the key stake holders are composed of middle age group. Mud crab farmers are dominated by males while value chain actors are dominated by female.

The culture system utilize is pond culture for grow-out and fattening and is purposely used for polyculture, monoculture and box culture of mud crab. In management practices utilized by the crab famers, traps with bait,

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direct hand picking and draining the pond are used in harvesting. Farmers also apply acclimatization before stocking. In addition, farmers are providing shelters in crab farms which serves as a shelter for mud crabs during molting.

Pertaining on the common problems encountered by the mud crab farmers, intra-species cannibalism, lack of good quality crab seeds, improper management, and flooding were recorded. Hence, development of mud crab hatchery technology, identification of cheap feed source and adoption of climate resilient mud crab technology must be considered to resolve these problems in order to fill the gap in the sustainability of mud crab supply.

The actors involved in the value chain includes the crab farmer, fattener, dealer, retailer, peddler and consumer. Apparently, mud crab sold by the value chain actors are graded based on their weight and categorized as small, medium and large.

CONCLUSION

Most of the key stake holders are composed of middle age group. Mud crab farmers are dominated by males while value chain actors are dominated by female. The culture system utilize is pond culture for grow-out and fattening and is purposely used for polyculture, monoculture and box culture of mud crab. In management practices, traps with bait, direct hand picking and draining the pond are used in harvesting. Farmers also apply acclimatization before stocking. In addition, farmers are providing shelters in crab farms which serves as a shelter for mud crabs during molting. Common problems encountered are lack of good quality crab seeds, improper management, flooding, and intra-species cannibalism. Hence, development of mud crab hatchery technology, identification of cheap feed source and adoption of climate resilient mud crab technology are desirable to resolve the problems of the farmers which can fill the gap in the sustainability of mud crab supply. The key stakeholders involved in the value chain are the crab farmer, fattener, dealer, retailer, peddler and consumer. Mud crab are graded based on their weight and categorized as small, medium and large.

RECOMMENDATION

Based on the findings of the conducted study, the following are recommended;

1. Mud crab hatchery should be established to produce a healthy and sustainable crab seed supply and to minimize the dependence of seed stock from the wild.
2. The municipality of Sta. Teresita in collaboration with BFAR, should conduct more training and workshop regarding mud crab grow-out and fattening especially for the beginners to indulge them on the different crab farming methods for them to further improve their skills and knowledge for a more successful culture.
3. The Local or National Government should grant financial assistance or concessional loans with lower interest rate to lessen the burden on the expenses of the marginalized mud crab farmers.
4. Demand for mud crab, its market price and the number traded outside the municipality should be monitored throughout the year so that appropriate mud crab resources management policies will be crafted to ensure sustainability of the resources.
5. All actors (crab farmer, fattener, dealer, retailer and peddler) in crab trading should be organized into an association so that they will be given proper interventions by the government and be a strong partner in resource conservation, protection and management to sustain the mud crab industry in the municipality.
6. Mud crab farmers should maximize the 6- month grow-out period of mud crab for a bigger profit.
7. Grading should be implemented and practiced even at the local market vendors and peddlers as strategy to establish price ceiling for each grade.

ACKNOWLEDGEMENT

The researchers would like also to show their gratitude to the administrators and staffs of Cagayan State University at Aparri, especially to the faculty and staff of College of Fisheries and Aquatic Sciences for monitoring and guiding the researchers throughout the conduction of the study. Furthermore, to the Municipal Mayor of Sta. Teresita, Hon. Rodrigo P. De Gracia and the Barangay Captains of the selected barangays for allowing the researchers to conduct their study in the respective areas. Also, for the Municipal Agriculture Office, headed by Sir Edwin Madrid, for entertaining and providing us the needed documents for the conduction of the study. The crab farmers, as well as the value chain actors as their respondents for their cooperation and patience in answering the questionnaires. Without them, this research will not be possible.

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DESIGN, DEVELOPMENT AND ASSESSMENT OF AC-19 CONTACT TRACING WEB PORTAL USING LARAVEL FRAMEWORKS

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ABSTRACT: Several nations are developing digital contact-tracing systems to combat the SARS-CoV-2 epidemic. Traditional contact tracing is too slow to reach individuals before they transmit, but the scalability and rapidity of a digital technique, employing proximity sensors on smartphones, is hypothetically fast enough to end the pandemic. The AC-19 Contact Tracing Web Portal is designed and developed to help the whole community of Aparri to make the contact tracing easier, reliable, faster, better and efficient to use with no cost. Problems and issues were obtained thru observation and document review. The Waterfall Methodology encompasses the different activities towards the way of implementing the Application. The system can be used as an application for easy contact tracing. The system was coded with PHP programming language, Laravel 8 framework and stylized using CSS and Bootstrap framework compiled with Java Script to provide a better performance to its users. The system is powered by PHP for the server-side and MySQL for the database management and Visual Studio Code as a developer's tools application for the development of the system. Findings revealed the developed AC19 Contact Tracing Web Portal was compliant to ISO 25010 software quality standards at high extent. With the benefits it can deliver to various stakeholders, the AC19 Contact Tracing Web Portal is highly recommended for its full adoption and utilization with the LGU Aparri in its sincere efforts to combat COVID19 infections.

Keywords: *Laravel 8, Contact Tracing, Waterfall Software Development Model.*

INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) was originally discovered as pneumonia of unknown origin in Wuhan, Hubei Province, China, in December 2019. Later, the International Committee on Virus Taxonomy (ICTV) finds that COVID-19 is caused by a novel coronavirus known as SARS–CoV2. The World Health Organization (WHO) labeled the COVID19 outbreak a pandemic on March 12, 2020, because to its rapid expansion not only in China but around the world.

The government has taken a lot of precautions to keep disease from spreading. Examples of these measures include travel restrictions, forced travel quarantines, social distance, prohibitions on public gatherings, school and university closures, corporate closures, self-isolation, ordering persons to work from home, curfews, and lockdown. As a precaution against the virus's fast spread, authorities in some countries have instituted a lockdown or curfew. These policies have a negative influence on global commerce, education, health, and tourism.

The AC-19 Contact Tracing Web Portal is an important public health tool and a crucial component of comprehensive COVID-19 management measures. Contact tracing breaks the chain of human-to-human transmission by identifying those who have been exposed to verified cases, quarantining them, monitoring them to guarantee prompt isolation, and testing and treating them if they develop symptoms. When carried out carefully and efficiently, these procedures can keep the number of new cases created by each confirmed case below one. Contact tracing in the context of COVID-19 entails finding individuals who may have been exposed to a person infected with COVID-19 and following up with them daily for 14 days from the last point of exposure. Because COVID-19 transmission can occur before symptoms appear, contacts should stay in self- quarantine for 14 days to decrease the chance of infecting others if they get ill.

The challenge over maintaining a functional web portal to help aid the contact tracing activities of the health authorities is seen as motivating factor for the researchers to work on this capstone project.

Statement of the Problem

This capstone project generally aimed at analysis, design, and development of the "AC-19 CONTACT TRACING WEB PORTAL" to ease the burdens of traditional way of filling out contact tracing forms and logbooks. Specifically, this paper seeks to answer the following questions:

1. What are the practices, issues, problems, and disadvantages encountered or confronted by the different establishments for commodities with their current or existing manual system or procedure they have?
2. What design solution has been made to address the problems encountered in the current procedure? What are the features of the developed solution?
3. What is the extent of compliance of the developed project using ISO 25010:2011 Software Quality Standards in terms of Functionality and Suitability, Performance and Efficiency, Compatibility, Usability, Reliability, Security, Maintainability and Portability.
4. What is the usability evaluation of the developed system using the User Acceptance of the Developed System using the Unified Theory of Acceptance and Use of Technology?

Scope and Delimitations

The project entitled: "AC-19 Contact Tracing Web Portal" is focused on the following:

Participants and Users: The project's participants are only limited to the Owner or manager, employees, staff, customers, and visitors of the establishment within Aparri.
Availability and Accessibility: The proposed system is available online 24/7 with the administration of the owner or manager of the establishments.

Data: All records will be provided by the owner or manager, customers, and visitors of the establishments.

Functionality: The system's main functionality will be limited to the following: registration, login, viewing, updating, search, and archiving of the data of the establishments owners or managers, customers and visitors' profiles and records. These functions will be available to the project registered admin. While the user's functionality of the system will be limited only, this will include adding, editing, and viewing.

Significance of the Study

The study entitled "AC-19 Contact Tracing Web Portal" is beneficial for the following: To all administrators of the establishment within Aparri: it helps the establishment owner or employees to easily record the information of their customers who enter the establishment on the daily basis.

To the Users: it helps them know if they have close contact with the positive in COVID-19 and to easily fill up forms. To the municipal contact tracing team: it helps the municipality to be able to use the web app for easy contact tracing with the consent of the manager or owner.

To the researchers: to be able to create a web application to help the establishment for easy contact tracing.

METHODOLOGY

Research Design

The study used of systems development and descriptive research design. The waterfall software development framework will be used to show the researcher's way of implementing the web portal. The model covers the process in the making of the study. This includes gathering and collection of information needed, designing technical architecture, testing, deployment of the application and maintenance.

Figure 1Waterfall Software Development Model

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Waterfall Software Development Model

Applying the waterfall software development model, the researchers created the application with the different phases in place. Each phase should be performed and repeated in parallel with the system needs and user needs. As a result, the planning work should be managed in such a way that the anticipated work is sufficiently finished without the need to repeat the process.

Locale of the Study

The study was conducted within the town of Aparri, Cagayan. The focus of the project is the different establishments for commodities within Aparri including the Managers or Employees and Customer or Visitors.

Data Gathering Tools and Instruments

The study made use of a Survey Questionnaire, Internet Research, and Evaluation Questionnaire - (1) the ISO 25010:2011 for the IT Experts (2) User Acceptance and Use of Technology for User (Commuter/Driver).

Software Tools

The system was coded with PHP programming language, Laravel 8 framework and stylized using CSS and Bootstrap framework compiled with Java Script to provide a better performance to its users. The system is powered by PHP for the server-side and MySQL for the database management and Visual Studio Code as a developer's tools application for the development of the system.

RESULTS AND DISCUSSION

Practices, issues, and problems encountered or confronted by the establishment with the current or existing manual system they have are as follows:

1. The first and most obvious problem of pen and paper contact tracing is the amount of person-to-person contact this process creates, it provides no easy alert system for failed assessments.
2. Daily paper contact tracing demand significant storage space.
3. Contact tracing using paper is slow, inefficient, and unreliable, and it led to long lines of people. Hence, the traditional contact tracing or the use of Pen and Paper for contact tracing in establishments is ineffective.
4. Contact tracing is tedious and risking the health and safety of the health practitioners. A document paper trail of the COVID19 exposure becomes exposed to data loss or inaccuracies.

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Figure 3. Home page of the Users (Customer/Visitors)

Figure 4. QR code scanner for the users (Customer/Visitors) QR code of the Establishments.

Figure 5. Logs of User

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Figure 6. Dashboard of Admin

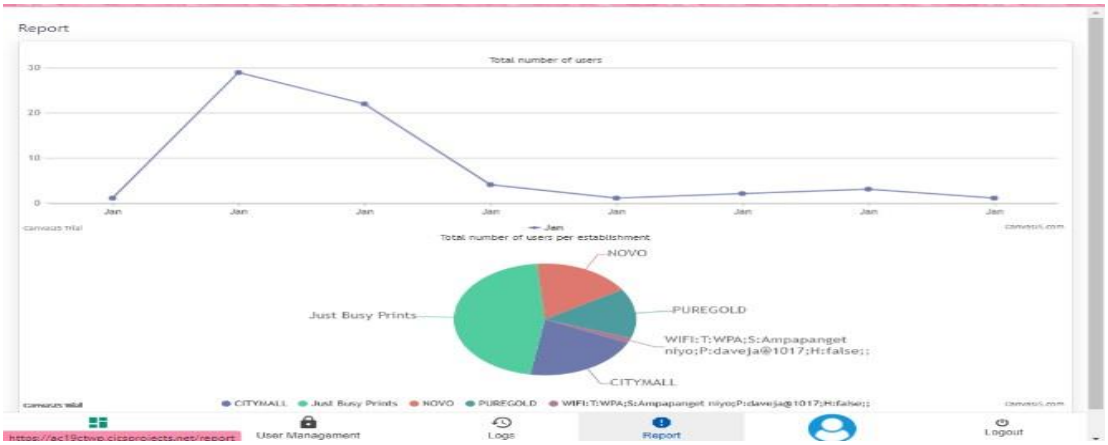
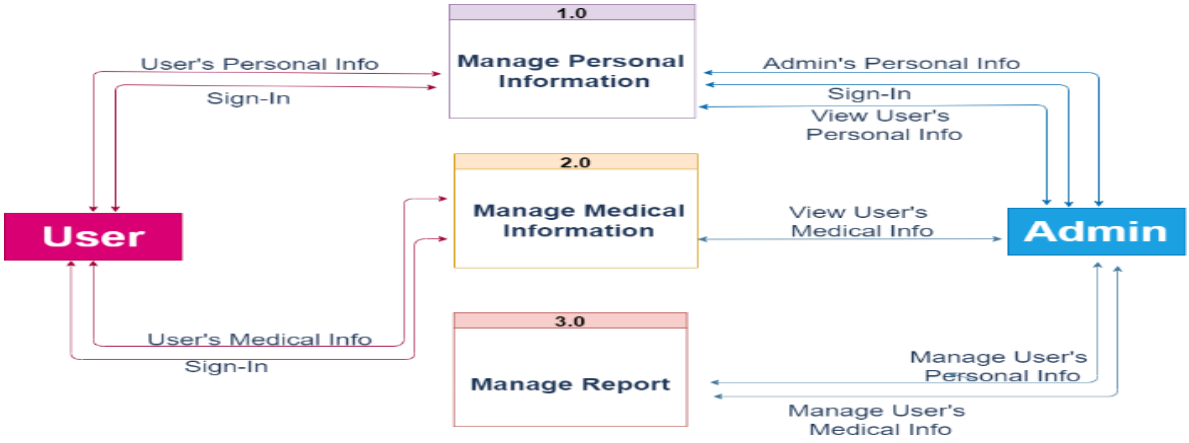
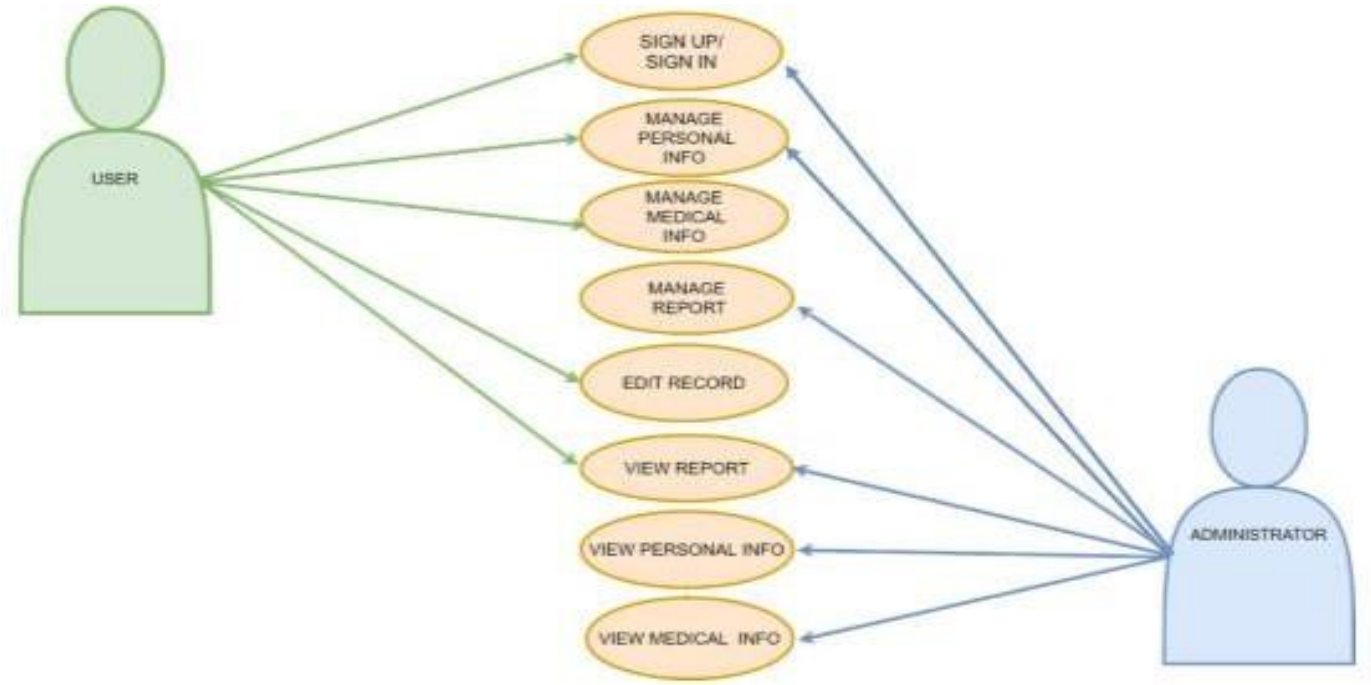


Figure 7. Reports of Admin



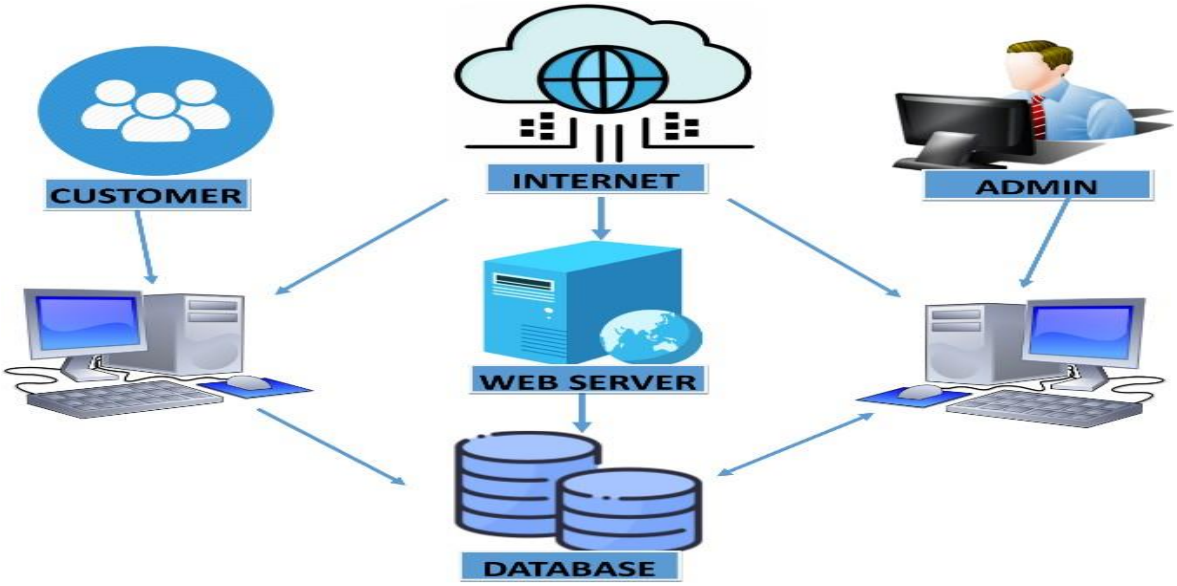
The AC-19 Contact Tracing Web Portal

The Developed website AC-19 Contact Tracing Web Portal that has been made to address the problems encountered in the current procedures are key pages, windows, and their features.



Use Case Diagram

The user engaged in utilizing the system are depicted in the figure above. First, the Administrator will sign-up or sign-in, manage personal info, manage the report, view report, view user's personal information, and view user's medical information. User's will sign in or sign up to the system, manage personal information, manage medical information, edit record, and can view report.



System Architecture

The Architectural Diagram above depicts the "AC-19 Contact Tracing Web Portal." The process of the web portal is that the Customer and the Admin can sign-up to the Web Portal. After registering, the data of the customer and the admin will be stored on the database. Web server is connected to the internet and allows data to be exchanged with other connected devices. The Admin is the one who can manage the profile of the customer. The transaction record is automatically saved in the database.

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Assessment of the IT Expert to the Developed AC19 Contact Tracing Portal

Table 1: Summary of Assessments of IT Experts

Statement	**W.Mean**	**Interpretation**
Functionality Suitability	4.33	High Extent
Performance Suitability	4.37	High Extent
Compatibility	4.38	High Extent
Usability	4.66	High Extent
Reliability	4.40	High Extent
Security	4.43	High Extent
Maintainability	4.42	High Extent
Portability	4.39	High Extent
Total Weighted Mean	**4.42**	**High Extent**

Table 1 presents the grand mean assessment of the IT Experts on developed system. It indicates that the assessment to functionality suitability, performance suitability, compatibility, usability, reliability security, maintainability and portability of the system was high extent with an overall mean of 4.42.

Assessment of the User to the Developed AC19 Contact Tracing Portal

Statement	**Weighted Mean**	**Interpretation**
Performance Expectancy	4.63	High Extent
Effort Expectancy	4.57	High Extent
Social Influence	4.47	High Extent
Facilitating Conditions	4.58	High Extent
Behavioral Intention	4.47	High Extent
Perceived Ease of Use	4.46	High Extent
Perceived Usefulness	4.41	High Extent
Self-Efficacy	4.49	High Extent
Adaption Intention	4.51	High Extent
Total Weighted Mean	**4.51**	**High Extent**

Table 1 presents the grand mean assessment of the IT Experts on developed system. It indicates that the assessment to functionality suitability, performance suitability, compatibility, usability, reliability security, maintainability and portability of the system was high extent with an overall mean of 4.42.

Assessment of the User to the Developed AC19 Contact Tracing Portal

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Behavioral Intention	4.47	High Extent
Perceived Ease of Use	4.46	High Extent
Perceived Usefulness	4.41	High Extent
Self-Efficacy	4.49	High Extent
Adaption Intention	4.51	High Extent
Total Weighted Mean	**4.51**	**High Extent**

Table 2 presents the grand mean assessment of the User on developed system. It indicates that the assessment to performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention, perceived ease of use, perceived usefulness, self- efficacy, and adaption intention of the system was high extent with an overall mean of 4.51.

CONCLUSIONS

In the aftermath of the COVID-19 outbreak, digital contact tracing apps have seen widespread international use. Although several research works have reviewed contract tracing applications and techniques, digital contact tracing is more scalable than manual contact tracing, with the potential of picking contacts that would otherwise be untraceable manually, such as encounters with strangers in public establishments.
In conclusion, our research demonstrates that the public strongly supports the use of AC-19 CONTACT TRACING WEB PORTAL to combat COVID-19. This is a significant result since public support is required for the technique to be viable. More study is needed to determine how much public support for WEB-based contact tracking translates into app usage and, more broadly, to assess its potential for epidemic management.

RECOMMENDATIONS

With the findings, the following are recommended:

1. To apply, register or deposit for applicable IP protection (i.e. Copyrights, Utility Model) prior its full utilization with assistance of the Knowledge and Technology Management Office.
2. It is highly suggested that the AC19 Contact Tracing Portal be implemented to make the contact tracing easier, reliable, faster, better, and efficient to use with no cost.
3. CSU Aparri College of Information and Computing Sciences may forge partnership with LGU Aparri for the sustained use of the AC19 Contact Tracing Portal thru a Memorandum of Agreement.
4. For future researchers, to improve the features of the website such as the one-time pin for the security purposes of users and other features involving data sciences and analytics.

ACKNOWLEDGEMENT

First, we would like to say, Thank God, for giving us the health and strength in doing this project work until it is done. Especially to our family for providing everything, such as money, to buy anything that is related to this project work and their advice which is the most needed for this project. Internet, books, computers, and all that as our source to complete this project. They also supported and encouraged us to complete this task so that they will not be procrastinating in doing it.

To Mr. Leo P. Paliuanan our capstone project advisor for the support, the new learnings and for encouraging us to finish our project, for getting us on track and keeping us focused on the right stuff. We deem ourselves very lucky to have worked with such a helpful adviser.

To Dr. Billy Javier for his knowledge, suggestions, and advice that greatly improved the study;

For their encouragement and advice, I thank Dr. Julieta Babas, dean of the college, and Dr. Simeon R. Rabanal Jr., Campus Executive Officer, Aparri Campus.

Last but not the least, to our friends who were doing this project with them and sharing their ideas. They were helpful that when they combined and discussed together, they had this task done.

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GENERAL POLICIES AND INSTRUCTION TO AUTHORS

Rationale:

The CSU Aparri Research Journal is the official journal that publishes annually faculty, students, and collaborative scientific articles ranging from fisheries and marine sciences, education and training, business management, information and communications technology, hospitality management, law and governance, industrial technology, as well as policy and impact studies contributing to the greater quest for new discoveries, innovation, and countryside development. The latest issue of the research journal was in October 2012 and with the urgency of various evaluation and monitoring schemes set by various standards-based organization, the research, and development office is challenged to produce quality and science-based publication that would enhance instruction, research, extension, and production. With the available resources to advance the conduct of research, as well as presentation and publication of these intellectual outputs, faculty and student as well as collaborators/contributors, are highly encourage to submit their articles for publication in the CSU Aparri Research Journal. Hence, through publication, CSU Aparri will be able to surpass performance indicators set forth by CHED Program Compliance, PBB, SUC Levelling, Institutional Sustainability Assessment, Program Accreditation by AACCUP, and possibly by international standards.

General Policies:

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2. Unpublished research papers of CSU Aparri Undergraduate Student will be given priority, as well as papers submitted by graduate students and collaborative CSU Faculty and Staff Researchers. A consent form shall be properly filled out by the authors prior it publication.
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5. Number of pages should be 7-10 pages, font family Times New Roman, point 12, and single spacing.
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1. The research and review papers must be condensed to at least possible, without sacrificing meaning and thoughts. Arrange the content as follows:
   a. Title - must be clearly stated ad straightforward, catchy, interesting and relevant. It must be able to stand alone to convey the importance of study and communicates its contents. Not more than 20 words, ALL CAPS, and written in "inverted" pyramid style. The author/s complete name (and titles, if any), their College, and contact details (preferably email address) will follow.
   b. Abstract - includes the summary of the introduction, methods, major results, conclusions, and implications of the study (IMRaD). It should not exceed 250 words in a single paragraph.
   c. Keywords - includes the relevant keywords or terms that depicts the study in genera. Keywords must be 3 to 5 words only.
   d. Introduction - includes the rationale, a brief statement of the problem and its significance, a short survey or relevant literature (at least past five years) and the objectives of the study. The framework or paradigm may be included.
   e. Methodology - includes the detailed description of the materials and methods employed or used. This includes the research design, participants or subjects, instrument/tools, data analysis, ethics approvals. Chronology of activities or steps should be observed.
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   g. Conclusions and Recommendations - includes the generalization (not summary of findings) and recommendations (or implications) of the study. Make this portion concise as possible. State conclusions based on the objective set. Possible areas for research can be included in the recommendation.
   h. Literature Cited - should be confined only to papers with direct bearing on the author's work. As much as possible from valid and reliable sources (i.e. journals, scientific proceedings). Follow the American Psychological Association (APA) 6th Format (refers to MS Word References -> Citations & Bibliography -> Style). No need to classify the listing, alphabetically arranged.

2. As to format, the journal adopts the usual format for semi-technical publications by simply using headings, sub-headings, and sub-titles for easier reading.

3. Research articles must be written in an 8 1/2 x 11" (Letter) bond papers, single-spacing between lines, with margins of 1 1/2" on the left and upper parts and 1" on the right and lower part of the sheet. Articles should not be more than 10 pages and should be submitted in two hard copies and 1 compulsory CD copy.

Prepared: BILLY S. JAVIER, Ph.D.
Research Coordinator

Noted: LENIMFA P. MOLINA, Ph.D.
Campus Director for RDE

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To intensively pursue the generation, development, sharing, utilization and application of science-based knowledge, information and innovations for the inclusive agro-industrial development and climate change resiliency of the Cagayan Valley Region.

CAMPUS JOURNAL

VOLUME 19 | ISSUE NO. 1 | ISSN NO: 1656 - 7927
JANUARY-DECEMBER 2022

Published by the
CSU Aparri Research for Development and Extension Office
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