Assessment of fisherfolk profile and their awareness and belief regarding introduced American largemouth bass *Micropterus salmoides* in Pantabangan reservoir

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Abstract. The Pantabangan reservoir serves as habitat for fish such as largemouth bass (*Micropterus salmoides*). Largemouth bass fishing in the reservoir became a source of food and livelihood for the fisherfolk community in the area. This study assessed the socio-economic profile, largemouth bass fishing experience of 27 fisherfolk individuals and their knowledge and beliefs regarding the negative impacts of the fish and their actions which they are willing to do in order to lessen these impacts. The socio-economic survey results revealed that the majority are male (81%) with an average age of 41.63 years. Most of them are engaged in fishing (89%) with a monthly income of Php 10,148.15 which was perceived to only suffice the basic food requirements of the reported average household size of 6. Most (89%) owned their houses built with strong materials installed with proper sanitation facility. Also, the needs for lighting, water and fuel were met. Many possess gadgets, appliances, and other assets. With a more than decade of experience in largemouth bass fishing, Pantabangan fisherfolk basically spends 10.04 hours to catch 9.63 kg in average. Gillnet (74%) is mostly used in largemouth bass fishing. The estimated earnings during peak season for largemouth bass is Php 7,308.89. Both largemouth bass catches and by-catches are sold entirely in fresh form within the locality's demand. Increased catch during full moon and new moon can be linked to the feeding behavior and activity of largemouth bass in the reservoir. It can be inferred that the identified fishing grounds probably meet the favorable conditions for either spawning or foraging needs of the species. Based on the beliefs and actions portrayed, it can be suggested that a thorough information dissemination about the status and possible interventions to be applied for largemouth bass within the locality must be considered if future control measures will be implemented. Furthermore, continuous data collection on the reservoir's catch composition and effective monitoring strategy for largemouth bass population are required to establish a reliable baseline data in determining its current status.
Key Words: fisherfolk, largemouth bass, Pantabangan reservoir, survey.

Introduction. Reservoirs are also known as man-made lakes primarily constructed for the generation of electricity and water storage for the purpose of irrigation (Sarkar et al 2015). They have contributed to industrial development by providing cheap sources of hydropower and hydroelectric power throughout the world (Thornton et al 1996). The Pantabangan reservoir is located in the northern part of Nueva Ecija which is known as the cleanest in the Philippines and acclaimed as the second largest dam in Asia that generates 112 megawatts of hydroelectric power and supplies the irrigation requirements of about 77,000 ha of agricultural lands in Central Luzon (Pantabangan LGU 2022).

Reservoirs also provide habitat for fish, plants, and wildlife as well as recreational opportunities such as fishing, boating, and swimming (Miranda & Krogman 2014). They play an essential role in the developmental process of a nation and also have an integral

role in fisheries and livelihood security of the local community (Sarkar et al 2015). The Pantabangan reservoir serves as a habitat for different species of fish which in return are caught as a source of livelihood of people living within its area. Two landing centers were identified by the National Stock Assessment Program (NSAP) in monitoring the landed catch data from the reservoir with a total production of 345.38 MT from October 2018 to December 2021 (BFAR-Region III 2022). From the landed catches, Nile tilapia (*Oreochromis niloticus*) is the dominant fish caught in the reservoir with a total volume of 78.39 MT followed by largemouth bass (*Micropterus salmoides*) with 73.49 MT, golden gobytank (*Glossogobius aureus*) with 70.84 MT, Tahitian prawn (*Macrobrachium lar*) with 62.38 MT, silver therapon (*Leiopotherapon plumbeus*) with 15.65 MT, blackchin tilapia (*Sarotherodon melanotheron*) with 14.92 MT, common carp (*Cyprinus carpio*) with 14.86 MT, snakehead mudfish (*Channa striata*) with 12.40 MT, and Philippine catfish (*Clarias batrachus*) with 0.92 MT (BFAR-Region III 2022).

The largemouth bass is a native fish species in North America, where it inhabits both rivers and still waters (Wheeler & Allen 2003). Largemouth bass is considered the main piscivorous fish of North American freshwater and one of the most important freshwater game fishes (Heidinger 1976; Doadrio 2001; Waters et al 2005). Outside the native range, globalization and demand for recreational fishing had turned largemouth bass into one of the highly introduced fish species in more than 50 countries across several regions worldwide such as Europe, Asia, South America, Pacific Islands, and Africa (Taylor 2012; Hall et al 2018; Pereira & Vitule 2019; Fujimoto et al 2021). In the Philippines, Guerrero III (2014) reviewed and assessed the impacts of the introduced exotic freshwater fishes using the available published and unpublished literatures from 1905 to 2013, wherein largemouth bass (from USA) was introduced in 1915 for recreational purposes and is considered to be 'beneficial' rather than invasive.

Largemouth bass fishing in Pantabangan reservoir became a source of staple food and livelihood which accommodates the basic needs of the fisherfolk individuals within the reservoir. This study assessed the socio-economic profile and largemouth bass fishing experience of the fisherfolk community in the area. This study also assessed the knowledge and beliefs of the fisherfolk individuals regarding the negative impacts of largemouth bass in the reservoir and the actions that they are willing to do in order to mitigate or lessen these impacts.

Material and Method

Description of the area study. The study was conducted on June 17, 2022 at Pantabangan Reservoir (Figure 1) which lies between 15°44' and 16°88' north latitude and 120°36' and 122°00' east longitude, and is located in the municipalities of Pantabangan and Carranglan in the province of Nueva Ecija, municipalities of Alfonso Castañeda and Dupax del Sur in the province of Nueva Vizcaya, and municipality of Maria Aurora in the province of Aurora. The watershed is about 170 km away from Manila (Saplaco et al 2001) and has an area of 84,500 ha. The surface area of the reservoir in the watershed covers around 7,605 ha while it covers 8,000 ha when full. Considering the topographical boundary of the whole watershed, the total area is about 97,433.41 ha including the reservoir.

Survey sampling. The survey sampling was done only once on June 17, 2022. A total of 27 respondents who are fisherfolk individuals were randomly chosen using haphazard sampling within the communities around the reservoir. A structured survey form was used to obtain the socio-economic, fisherfolk profile and their experiences in largemouth bass fishing. The survey form was also composed of questions assessing the knowledge and beliefs of fisherfolk individuals regarding the negative impacts of the said fish in the reservoir and the actions which they are willing to do in order to mitigate or lessen these impacts. The survey was conducted face to face while interviewing each of the respondents by the enumerators.

Data analysis. The survey sampling results or research data were converted into percentage and were shown on graphs, figures and tables.

Figure 1. Satellite image of the Pantabangan Reservoir (Google Maps 2022).

Results

Socio-economic profile of fisherfolks around Pantabangan reservoir. Twenty-seven respondents were randomly selected for the survey of the residents within the area. Most of the respondents were male (81%) meanwhile only 19% were female with a mean average age of 42 years. Most of the respondents were married (78%) meanwhile 22% were either single (11%), widowed (7%), or divorced (4%). Majority of the respondents were residing from Barangay Villarica (56%) followed by those from Barangay West Poblacion (30%). Meanwhile, 14% were either from Barangay Malbang (7%) and Barangay Intang (7%). Survey results showed that the majority of the respondents were either high school graduates or at high school level (59%), while 37% were either elementary graduates or at elementary level. Only 4% were college graduates and no respondents were on college level or post-graduate. The mean family size of the respondents was six members for every family. Most of the respondents were full-time fisherfolk (89%) followed by full-time fish vendors at the same time as part-time fisherfolk (7%) and full-time construction workers at the same time as part-time fisherfolk (4%). The mean monthly income of the respondents from their occupation was Php 10,148.15 for every month.

In terms of housing, most of the respondents owned their houses (89%) meanwhile 11% were either renting (4%) or living in a rent-free house (7%). Most of the respondents had a house roof made of galvanized iron (GI) sheet (96%) followed by those who had nipa/cogon grass (4%) as their roof. Many of the respondents had a house wall made of cement (78%) followed by out of wood or plywood (14%). A total of 8% have a house wall made of either tile (4%) or rubber (4%). Majority of the respondents have a house window made of wood (47%) followed by those who have a house wall made of glass (30%) and those who have a house wall made of bamboo (19%). Only 4% have a window made of rubber. Also, respondents had a flush toilet facility (96%) followed by those who had an open pit (4%) as their toilet. Most of the respondents get their water source in dugwell jetmatic (52%) followed by pump/artesian well (41%) and river/spring (7%) sources.

In terms of lighting and fuel, respondents reported to have one or more sources. The respondents had lighting sources that come from electricity (96%), batteries (7%) and solar panels (4%). Meanwhile, respondents get their fuel source from liquified petroleum gas (LPG) (67%), firewood (59%), electricity (4%) and charcoal (4%) .

Survey revealed that respondents reported to possess one or more gadgets/ appliances and assets. The most owned gadgets/appliances are the cellphone (85%),

television (70%), electric fan (48%), washing machine (37%), refrigerator (7%), radio (7%) and laptop (4%). The most owned assets by the respondents were tricycle (48%) and motorbike (48%). These are followed by assets such as motorized boats (37%), fishing gears (33%), bicycle (26%), non-motorized boats (11%) and jeepneys (4%).

Experiences in largemouth bass fishing of the respondents in Pantabangan Reservoir. Most of the respondents had first encounter of catching largemouth bass during the years 2001-2010 (52%), followed by 2011-2020 (19%), 2021 until present (15%) and 1990-2000 (14%). The latest year and month for all the respondents to catch the fish was on June 2022. Based on the survey result, respondents are fishing largemouth bass in the reservoir for more than a decade. The computed average daily catch was 9.63 kg. Multiple fishing gears are being utilized by the respondents. Respondents catch largemouth bass using gillnet (74%), cast net (24%) and hook and line (11%). With regard to practice/systems/beliefs regarding largemouth bass fishing, the majority (67%) of the respondents believe that when it is full or new moon there is an increased chance of catching more largemouth bass, followed by those who believe that there is more catch during early morning (4%). On the other hand, 29% of the respondents do not have any practice/systems/beliefs regarding largemouth bass fishing. The main barangay which serves as fishing ground for largemouth bass is Barangay Villarica (45%), followed by Barangay West Poblacion (26%) and Barangay Intang (7%). On the other hand, 22% of the respondents do not have any specific fishing ground for largemouth bass in the reservoir. The survey revealed that respondents spent an average of 10.04 hours daily for largemouth bass fishing. The species becomes a bycatch in a daily (63%), weekly (30%) and monthly basis (7%) of fishing. During harvest, the respondents reported one or more activities to what they do with their largemouth bass catch. All respondents (100%) either sell their largemouth bass catch to buyers or make it as food for their families and relatives. On the other hand, 89% of the respondents were using largemouth bass catch as a gift for friends and relatives. Around 7% of the respondents processed their catch into dried product. Based on whom and where fisherfolks do sell/supply their largemouth bass catch, all respondents (100%) sell their largemouth bass catch to local direct buyers who are mostly from Pantabangan. Also, around 19% of the respondents sell their catch in Pantabangan public market. The buyers usually demand an average of 16.18 kg of largemouth bass catch from the respondents. The estimated earnings of the respondents during peak season for largemouth bass fishing was Php 7,308.89 monthly.

The survey result about the knowledge and beliefs of fisherfolks regarding the negative impacts of largemouth bass in the reservoir and the actions that they are willing to do in order to mitigate or lessen these impacts are presented in Tables 1, 2, and 3, respectively.

The respondents were asked about their beliefs about the negative impacts of largemouth bass in Pantabangan reservoir and the results were shown in Table 1. For the first question, the respondents were asked if they have an idea on largemouth bass in the reservoir. The results showed that the majority (74%) of the respondents were very knowledgeable on the existence of the fish in the reservoir and all of them have at least a little knowledge about the fish. For the second question, the respondents were asked whether the largemouth bass have a negative impact on the reservoir. The results revealed that the respondents have different opinions about the question, however, most of them (40%) answered that the fish have no negative impacts on the reservoir. For the third question, the respondents were asked if they know that largemouth bass eats other fishes that might cause lower number of fish caught. The results revealed that majority (58%) of the respondents knew that largemouth bass are eating other fish in the reservoir and only few (19%) of them think that largemouth bass do not eat other fishes. For the fourth question, the respondents were asked how worried they are about what the largemouth bass can do in the reservoir. The results showed that the majority (59%) does not worry about the negative impacts of largemouth bass in the area while 4% do worry about it.

Table 1

Listed here are four items that were asked about the beliefs of the fisherfolks on the negative effects of largemouth bass in Pantabangan reservoir, Pantabangan Nueva Ecija, Philippines

Item	*Question*	*Response (%)*
1	Do you have any idea about largemouth bass in the Pantabangan reservoir	
	A. I am very knowledgeable about the existence of largemouth bass in the reservoir	74
	B. I know something about the existence of largemouth bass in the reservoir	19
	C. I know a little about the existence of largemouth bass in the reservoir	7
	D. I know almost nothing about the existence of largemouth bass in the reservoir	0
2	Do you think that largemouth bass has a negative impact/s on the reservoir?	
	A. I am sure about the negative impacts of largemouth bass in the reservoir	11
	B. I think there might be negative impacts of largemouth bass in the reservoir	30
	C. I don't know whether there are negative impacts of largemouth bass in the reservoir	19
	D. I think there are no negative impacts of largemouth bass in the reservoir	40
3	Do you think largemouth bass eats other fishes that might cause lower number of fish caught?	
	A. I am sure that largemouth bass is eating other fishes	58
	B. Largemouth bass might be eating other fishes in the reservoir	19
	C. I don't know if largemouth bass do eat other fishes	4
	D. I think largemouth bass don't eat other fishes	19
4	How worried are you about what largemouth bass might do in the reservoir?	
	A. I am very worried	4
	B. I am quite worried	7
	C. I am little bit worried	30
	D. I am not worried at all	59

The respondents were asked 10 items regarding their beliefs on how to reduce the negative effects of largemouth bass in Pantabangan reservoir. The results are shown in Table 2. For item number 1, the result revealed that the majority (48%) of the respondents believe that if people catch the largemouth bass in the reservoir then their number will decrease by a small but useful amount which is followed by those who think that it is very small and hardly noticeable (33%). For item number 2, both 33% of respondents believe that if people control the existence of largemouth bass in the reservoir then catch of other fishes will increase by quite a lot and by a small but useful amount. For item number 3, the majority (37%) of the respondents believe that not protecting the largemouth bass can only help on small amount or is hardly noticeable in controlling the fish. For item number 4, most (48%) of the respondents believe that spending money only helps on a small or hardly noticeable amount in the control of largemouth bass in the reservoir. For item number 5, the majority (81%) of the respondents believe that using chemicals to control largemouth bass in the reservoir only helps on a small amount or hardly noticeable change. For item number 6, 59% of the total respondents believe that using a modified fishing gear can help quite a lot in catching largemouth bass. For item number 7, the majority (41%) of the respondents believe that cooperation with government agencies can help quiet a lot in controlling largemouth bass in the reservoir. For item number 8, the majority (37%) of the respondents believe that it can help by a fair amount if the agencies who manage the Pantabangan reservoir strictly monitor the population of largemouth bass in the reservoir for easier control of the fish. For item number 9, 41% of the total respondents believe

that it helps quite a lot if studies are conducted to determine the factors that could help control the population of largemouth bass in the reservoir. For item number 10, the majority (48%) of the respondents believe that it helps quite a lot if largemouth bass caught is strictly recorded to know easier the current population of this fish in the reservoir.

Table 2

Listed here are 10 beliefs that were asked to the fisherfolks on how to reduce the negative effects of largemouth bass in Pantabangan reservoir, Pantabangan, Nueva Ecija, Philippines (response in each item are: A = by quite a lot; B = by a fair amount; C = by a small but useful amount; D = by a very small amount – hardly noticeable)

Item	*Beliefs*	*Response (%)*			
		A	*B*	*C*	*D*
1	If people catch the largemouth bass in the reservoir then their number will decrease	4	15	48	33
2	If people control the existence of largemouth bass in the reservoir then caught on other fish will increase	33	15	33	19
3	If largemouth bass will be controlled then it should not be protected	7	26	30	37
4	If money will be spent then it is easier to control the largemouth bass in the reservoir	26	19	7	48
5	If chemicals are used then it is easier to control largemouth bass in the reservoir	11	4	4	81
6	If you want to catch largemouth bass then modified fishing gear should be used	59	0	15	26
7	If people around the reservoir cooperate with government agencies then largemouth bass will be controlled in the reservoir	41	19	10	30
8	If the agencies who manage the Pantabangan reservoir strictly monitor the population of largemouth bass in the reservoir then it is easier to control the fish	33	37	22	8
9	If studies are conducted then it is easier to determine the factors that could help control the population of largemouth bass in the reservoir	41	19	11	29
10	If largemouth bass caught is strictly recorded then it is easier to know the current population of this fish in the reservoir	48	22	15	15

The respondents were asked 10 items regarding their actions on how to reduce the negative effects of largemouth bass in Pantabangan reservoir. The results are shown in Table 3. For item number 1, the majority (33%) of the respondents will definitely catch the largemouth bass in the reservoir to decrease their number. For item number 2, 37% of the total respondents were almost certainly willing to control the existence of largemouth bass in the reservoir to increase catch on other fishes. For item number 3, most of the respondents (33%) will almost certainly not help protect largemouth bass in the reservoir to help decrease their number. For item number 4, the majority (63%) of the respondents were not willing to spend money in order to control the largemouth bass in the reservoir. For item number 5, most (89%) of the respondents will probably not use chemicals in order to control largemouth bass in the reservoir because they feel that it might degrade the environment and could kill other fishes. For item number 6, the majority (52%) will definitely use modified fishing gears to catch largemouth bass in the area. For item number 7, the majority (33%) were willing to cooperate with government agencies to control largemouth bass in the reservoir while 26% of the total respondents will probably not cooperate with government agencies. For item number 8, most (37%) of the respondents definitely think that agencies that manage the Pantabangan reservoir should strictly monitor the population of the fish in the reservoir. For item number 9, almost all (96%) of the respondents were willing that studies should be conducted to

determine the factors that could help control the population of largemouth bass in the reservoir. For item number 10, the majority (93%) of the respondents were willing to strictly record the largemouth bass catch to know the current population of the fish in the reservoir.

Table 3

Listed here are 10 actions on how to reduce the negative effects of largemouth bass in Pantabangan reservoir, Pantabangan, Nueva Ecija, Philippines (response in each item are: A = definitely do it; B = almost certainly do it; C = probably do it; D = perhaps do it; E = probably not do it)

Item	*Action*	*Response (%)*				
		A	*B*	*C*	*D*	*E*
1	People need to catch the largemouth bass in the reservoir to decrease their number	33	19	30	11	7
2	People need to control the existence of largemouth bass in the reservoir to increase catch on other fishes	30	37	4	7	22
3	Largemouth bass should not be protected	15	33	15	26	11
4	I am willing to spend money to control the largemouth bass in the reservoir	4	7	22	4	63
5	Chemicals should be used to control largemouth bass in the reservoir	0	4	0	7	89
6	Modified fishing gears should be used to catch largemouth bass	52	15	0	3	30
7	People around the reservoir should cooperate with government agencies to control largemouth bass in the reservoir	33	22	15	4	26
8	The agencies who manage the Pantabangan reservoir should strictly monitor the population of the fish in the reservoir	37	26	15	3	19
9	Studies should be conducted to determine the factors that could help control the population of largemouth bass in the reservoir	37	37	22	4	0
10	Largemouth bass caught should be strictly recorded to know the current population of the fish in the reservoir	48	30	15	7	0

Discussion. The socio-economic profile of fisherfolk in terms of human capital, financial capital and physical capital in comparison to the latest data from other surveys are shown in Tables 4, 5, and 6, respectively.

Human capital. The large gap between genders from the result of the present study corresponds to the country's number of employed men and women in agriculture (including fisheries) in 2021 with 7.89 million and 2.77 million, respectively (PSA 2022). It was observed that men were more likely to be assigned to laborious activities involved in fishing while women participate as processors (mainly sun-drying) and as local traders. Similarly, Macusi et al (2022) reported women living in coastal areas around the Davao Gulf were supportive of their husbands' small-scale fishing activities through participation in the pre-fishing, post-fishing, and marketing activities. Comparably, in tuna industry in General Santos City, women are into tasks that require more attention to detail and thoroughness while men do the physically demanding and mechanical work (Prieto-Carolino et al 2021). On the otherhand, in the supply chain of seaweed farming, men are all present in the nodes of the chain while women have significant involvement in production, post-harvest, and marketing segments (Ramirez et al 2020). In the Philippines, gender roles are deeply integrated and unequal in the fishing communities

(Torell et al 2021). Numerous studies reported that fish trade is generally associated with women and heavy physical work is preferred for men (Bosma et al 2019; Siles et al 2019; Ramirez et al 2020; Prieto-Carolino et al 2021; Macusi et al 2022; Mutia et al 2020).

With a computed average age of 41.63, denotes that the fishing community has a large proportion of older individuals with dependent families to support. The State of Food and Agriculture (2014) reported that numerous from the farming population in developed countries borders on 60 to which the age of the respondents in the study ranged from 25 to 58 years. Meanwhile, Filipino farmers had an average age of 53 as declared by Secretary William Dar in 2013 (Songco 2022), and 57 in 2018 (DA 2021).

It was noted that most of the respondents' residences were 18.3 km away from the fishing ground. Brgy. Villarica is the third nearest to Pantabangan reservoir in terms of distance in comparison with Brgy. West Poblacion (299 km), Brgy. Malbang (8.8 km) and Brgy. Intang (4.3 km).

In 2015, Briones (2017) reported that the majority of workers in the Philippines had finished at least secondary school pointing out agriculture having the least educated workforce among the basic sectors. Further, the reported literacy rate in the present survey was found higher than the national functional literacy rate of 91.6% for ages 10 to 64 (PSA 2020). All of the respondents were educated up to primary, secondary, and/or above levels. Fortunately, no respondent was found illiterate.

Also, the reported mean family size of six individuals per family surpassed the national average household size of 4.1 in 2020 (PSA 2022). Among the seventeen administrative regions having the highest populations, Region III (Central Luzon) ranked third in 2020 (PSA 2021).

Table 4

Socio-economic profile of fisherfolk respondents in terms of human capital in comparison to the latest data from other surveys

Item	*Indicators*	*Present survey*	*Data from other surveys*			
			Numerical data	*Year*	*Description*	*Source*
1	Gender:					
	F	19%	7.89 M	2021	Country's number of employed men and women in agriculture (including fisheries)	PSA (2021)
	M	81%	2.77 M			
2	Age:	41.63	53	2013	Average age of Filipino farmers (including fisherfolk)	Songco (2022)
			57	2021		DA (2021)
			60 & above	-	Average age of farming population worldwide	FAO (2014)
3	Civil status:					
	Single	11%	-	-	-	-
	Married	78%	-	-	-	
	Widowed	7%	-	-	-	
	Divorced	4%	-	-	-	
4	Home address:					
	Villarica	56%	-	-	-	-
	W. Poblacion	30%	-	-	-	
	Malbang & Intang	14%	-	-	-	
5	Literacy rate:	(100%)	91.6%	2020	National literacy rate	PSA (2020)
	Tertiary	4%	-	-	-	
	Secondary	59%	-	-	-	
	Primary	37%	-	-	-	
6	Ave. household size:	6	4.1	2020	National household size average	PSA (2020)

Financial capital. According to PSA, the estimated income to meet the basic food requirements of a family of five is Php 8,379.00 for every month (PSA 2022). Hence, the

reported monthly income of the respondents which is Php 10,148.15 is sufficient to cover the basic food needs of the reported mean family size of six individuals in the study. In fact, fisherfolk group ranked second highest among the five basic sectors with a poverty incidence of 34% in 2015 (PSA 2017). Some of the respondents were full-time fish vendors and construction workers with fishing as a part-time occupation during largemouth bass peak season. Additional jobs help make ends meet for some respondents.

Table 5

Socio-economic profile of fisherfolk respondents in terms of financial capital in comparison to the latest data from PSA

Item	*Indicators*	*Present survey*	*Data obtained from PSA (2022)*	
			Numerical data	*Description*
1	Average income	Php 10,148.15	Php 8,379.00	Estimated income to meet the basic food requirement of a Filipino family of five

Physical capital. In terms of housing, a majority (89%) reported owning their dwelling places. Accordingly, Central Luzon ranked third highest among the families who owned the house and lot they occupied (77.5%) in 2020 (PSA 2021). Most of the respondents had a house roof made of galvanized iron (GI) sheet (96%), a house wall made of cement (78%), and a house window made of wood (47%). Generally, Filipino families (93.5%) had installed galvanized iron sheets or aluminum as roofing materials, including nipa and cogon grasses among the least installed in 2020 (PSA 2021). PSA (2021) recorded that concrete, brick, and stone walls were mostly used by families in both urban (69.3%) and rural areas (50.3%) in the Philippines. The type of house window used by the respondents complemented the house wall structures mentioned above.

Concerning sanitation, many (96%) of the respondents had a flush toilet facility. Central Luzon was included among the highest percentage (87.2%) of families with basic service sanitation facilities (PSA 2021). However, it was also noted that some respondents (4%) in the present study do belong to the 7 million Filipinos who are still practicing open defecating or using unimproved toilets as of 2020 (UNICEF 2021).

As presented, majority reported electricity (96%) as the main source of lighting. Based from the results of the 2020 Annual Poverty Indicators Survey, Central Luzon was reported to have a high proportion (96.9%) of households with electricity used as a lighting source.

With regard to water source, the respondents are more dependent to dugwell jetmatic and pump/artesian and least dependent from river/spring and other sources. These water sources are classified as Level I water supply facility/service point source. It is defined as a protected well or a developed spring with an outlet but without a distribution system, generally adaptable for rural areas where the houses are thinly scattered (PSA 2017). Besides, PSA presented that 46.1% and 58.7% of the total Filipino household use community water system as a source for drinking and cooking, respectively, in 2010 (PSA 2013). On the otherhand, a recent record of 54.1% Filipino families rely to water supply (Level III) piped into dwelling whereas Central Luzon (66.4%) surpassed the national rate in 2020 (PSA 2021).

As to the source of fuel, LPG and firewood are the most utilized. On the contrary, wood (44.1%) was the prevailing fuel used for cooking in the country followed by LPG (36.9%) and other sources of fuel in 2010 in exception of Central Luzon which widely used LPG (60%) the most (PSA 2013).

In the matter of household or modern conveniences, majority owned cellphones followed by televisions, electric fans, washing machines, refrigerators, radios and laptops. In the 2020 APIS, cellular phones appeared to be the most common household convenience/device reported by nine out of ten Filipino homes followed by television set (79.8%), refrigerator/freezer (45.7%), and washing machine.

In addition, the most owned assets reported were tricycle and motorbike. Primarily, these assets are used either for private use and public transport. About 42.7% Filipino households owned a motorcycle/tricycle in 2020 (PSA 2021).

Table 6

Socio-economic profile of fisherfolk respondents in terms of physical capital in comparison to the latest data from other studies

Item	*Indicators*	*Present survey*	*Data obtained from other surveys*		
			Numerical data	*Description*	*Source*
1	Housing:				
	House owned	89%	77.5%	House ownership rate in	PSA
	Renting	4%	-	Central Luzon	(2020)
	Rent-free housing	7%	-		
2	Type of h. roof mat.:				
	GI/aluminum	96%	93.5%	Rate of Filipino	PSA
	Nipa/cogon grass	4%	-	households with GI/aluminum as house roofing	(2020)
3	Type of h. wall:				
	Cement	78%	50.3%	Rate of Filipino	PSA
	Wood/plywood	14%	-	households in rural areas	(2020)
	Tile/rubber	8%	-	with concrete, brick and stone walls	
4	Type of h. window:				
	Wood	47%	-		
	Glass	30%	-	-	-
	Bamboo	19%	-		
	Rubber	4%	-		
5	Sanitation:	-	87.2%	Rate of households in Central Luzon with basic service sanitation facilities	PSA (2020)
	Flush toilet	96%	-		
	Open pit	4%	7 Million 7 Million	Number of Filipinos who are still practicing open defecating or using unimproved toilets	- UNICEF (2021)
6	Water source:				
	Piped into dwelling areas	-	54.1%	Rate of Filipino households relying from	PSA 2020
	Dugwell jetmatic	52%	-	water supply piped into	
	Pump/artesian well	41%	-	their dwelling areas	
	River/Spring	7%	-		
7	Lighting source:				
	Electricity	96%	96.9%	Rate of households in	PSA
	Batteries	7%	-	Central Luzon using	(2020)
	Solar panels	4%	-	electricity as source of light	
8	Source of fuel:				
	LPG	67%	60%	Rate of households in	PSA
	Firewood	59%	-	Central Luzon using LPG	(2010)
	Electricity	4%	-	as source of fuel for	
	Charcoal	4%	-	cooking	
9	Household con.:				
	Cellphone	85%	90%	Rate of Filipino	PSA
	TV	70%	79.8%	households with owned	(2020)
	Electric fan	48%	-	household/modern	
	Washing machine	37%	44.2%	conveniences	
	Fridge	7%	45.7%		
	Radio	7%	-		
	Laptop	4%	-		
10	Owned assets:				
	Tricycle	48%	(42.7%)	Rate of Filipino	PSA
	Motorbike	48%	(42.7%)	households owning a	2020
	Motorized boat	37%	-	motorcycle/tricycle	
	Fishing gears	33%	-		
	Non-motorized boat	11%	-		
	Bicycle	26%	-		
	Jeepneys	4%	-		

Experiences in largemouth bass fishing of the fisherfolk respondents in Pantabangan reservoir. Most of the respondents had first encounter of catching largemouth bass during the years 2001-2010 (52%). Therefore, largemouth bass fishing in the reservoir has been existing for more than a decade. As mentioned, the introduction of the species can be traced back in 1915 in the Philippines (Guerrero III 2014) but with little evaluation. Yet, no official records were accounted for its specific introduction in the said reservoir. Respondents reported an average daily catch of 9.63 kg. According to the data gathered by BFAR-Region III from 2018 to 2021, a total of 73.49 MT largemouth bass was monitored from the two landing centers namely Liberty and Villarica through the establishment of NSAP. Since there are no studies to confirm both ecological and economic harm being done by the species, the status on the impact of these introduced species in the reservoir is unclear. In terms of tourism, it currently caters anglers' demand for recreational fishing which can be perceived as beneficial to the industry other than its economic contribution as a fishery product (processed or fresh/whole fish).

Gillnets (74%) was reported to be the main fishing gear used followed by cast net and hook and line. According to the respondents, harvest from both gillnet and cast net are purposely for food consumption, either to market/trade or for household consumption. Hook and line are primarily used during angling. Conforming to the 2012 Census of Agriculture and Fisheries report (PSA 2018), hook and line and gill net were among the most common fishing gears used in household municipal fishing operations in the Philippines. Considering, Pantabangan reservoir is an inland municipal fishing area. Municipal fishing covers fishing operation carried out with or without the use of a boat weighing three gross tons or less (RA 8550 1998).

Further, the majority (67%) of the respondents believe that when it is full or new moon there is an increased chance of catching more largemouth bass without such specific time of the day for largemouth bass fishing mentioned. However, majority of them start fishing during dawn and morning and some in the afternoon. The peak month/s for largemouth bass fishing based on the respondents' response to the survey are hard to know since there is a good catch of largemouth bass in the reservoir throughout the year as acknowledged by the respondents during the conduct of the interview. Published studies may support the suspicions made by the majority of the respondents that can be linked to the belief of having an increased chance of catch when it is full or new moon. Mallison (1988) reported a high angling efficiency during the full moons. In a feeding laboratory trial conducted by McMahon & Holanov (1995), the foraging success of *M. salmoides* ranged from 95 to 100% at light intensities ranging from low intensity daylight (312 lx) to full moonlight ($3x10^{-3}$ lx) consuming most of the preys within 1 to 2 minutes. In a study done at Sundarban river, it was found out that an increased trend of finfish and prawn catches were observed from 12^{th} day after full moon and 6 days after new moon due to vertical movement of the organisms (Das et al 2015). Also, a study carried out in Warner lake Ecological Observatory located in Southern Ontario presented that daily depth distribution of largemouth bass followed a pattern in which they inhabit greater depths on the 26-50% and 51-75% waxing moon in spring and summer respectively (Hanson et al 2008). Furthermore, literatures also reported differences in the catch composition and efficiency under different lunar phases (Gliwicz 1986; Vergara et al 2017; Chakraborty 2020). It can be perceived that lunar cycle can be considered a factor in the feeding behavior and activity of largemouth bass affecting the catch of fishermen in Pantabangan reservoir during the occurrences of new moon and full moon.

In terms of fishing ground, Barangay Villarica, Barangay Poblacion and Barangay Intang serve as the location for fishing the target species. In Lucchetti reservoir (under tropical conditions), fluctuating waters were observed between the two spawning events (mid-January through March and late May through June) of largemouth bass (Waters & Noble 2004). It was found out that the availability of shallow, vegetated areas and high level of water was favorable for largemouth bass spawning. Wanjala et al (1986) discovered the differences in habitat use and foraging behavior of each of three size groups of largemouth bass in an Arizona reservoir, wherein small bass (< 25 cm TL) were found only in littoral areas to avoid predation, intermediate-sized bass (25-38 cm TL)

were too large to be predated and were found in aggregations in open limnetic waters while large bass (> 38 cm TL) were generally found as solitary individuals near submerged structures suitable for ambush feeding. From these, it can be inferred that fishing grounds along Barangay Villarica, Barangay West Poblacion and Barangay Intang probably have favorable conditions that meet either the spawning or foraging needs of largemouth bass. The average time spent (10.04 hrs) described by the respondents in fishing largemouth bass is an estimation that needs further validation. Without an accurate data on the catch-per-unit-of-effort (CPUE) of largemouth bass fishing in the reservoir, the status on the population abundance, either declining, stable or recovering, remains indeterminate.

In Pantabangan, unintentional fishing of largemouth bass holds a significant economic importance to which it contributes in generating revenue of the fisherfolk other than fishing tilapia. According to the result, largemouth bass becomes bycatch mostly in a daily basis. Bycatch is said to have significant consequences to populations, food webs and ecosystems (Crowder & Murawski 1998). As previously mentioned, due to lack of comprehensive monitoring of largemouth bass in the reservoir, levels of competition among other fishery species can't be defined.

As a fishery product, largemouth bass catches are mostly sold in fresh (whole) form within the locality of Pantabangan to buyers who usually demand an average of 16.18 kgs from the respondents. Still, no reliable data on the characteristics of the specific consumers and their level of acceptance is available. But even though, it can be clearly perceived that there is an existing and presence of demand for largemouth bass as a food within the locality. Without a doubt, largemouth bass fishing or kept bycatches benefit the fishing community in terms of food security besides recreational fishing. The reported earnings of the respondents can reach up to Php 7,308.89 during the peak season of fishing the said species.

Beliefs and actions. Majority of the respondents agreed on the statements, 'I am very knowledgeable about the existence of largemouth bass in the reservoir (74%)', 'I think there are no negative impacts of largemouth bass in the reservoir (40%)', 'I am sure that largemouth bass is eating other fishes (59%)' and, 'I am not worried at all (59%)' (Table 1). As observed, the respondents overestimated their positive views on the negative effects of largemouth bass in Pantabangan reservoir based from the first and fourth statements. Despite knowing the cannibalistic characteristics of largemouth bass based from the third statement, this negative impact was underestimated using the fourth statement 'I am not worried at all'. Many respondents displayed optimism bias. The fact that most of them are knowledgeable and do know about the negative impact (cannibalism) of largemouth bass, yet, the respondents were still unconcerned and optimistic towards it. Literature defines optimism bias as the difference between a person's expectation and the outcome that follows wherein expectations are better than reality (Sharot 2011). Thus, the bias is optimistic. Bracha & Brown (2012) discussed that the illusion to control is one of the main contributing factors to optimism bias. The illusion to control is the tendency to believe that one can skillfully influence and control the outcomes of chance events. In a case study done by Rogers et al (2017), it confirmed the association between optimism bias with the impersonal environmental risks. It revealed people living in highly infested areas with chestnut leaf miner (*Cameraria ohridella*) displayed smaller amounts of optimism bias than those living in areas with low infestation. In the same manner, knowing and identifying the status of largemouth bass in Pantabangan reservoir might probably correct the level of optimism bias of the majority's perception even if largemouth bass holds an impersonal environmental risk to the locality.

All of the presented interventions fall under the chemical and physical means of controlling and reducing the negative effects of largemouth bass (Powers & Bowes 1967; Lennon 1970; Fujimoto et al 2020, 2021). Majority portrayed positive attitude towards some of the control measure activities based from the statements, 'If people control the existence of largemouth bass in the reservoir then caught on other fish will increase' (66%), 'If you want to catch largemouth bass then modified fishing gear should be used'

(59%), 'If people around the reservoir cooperate with government agencies then largemouth bass will be controlled in the reservoir' (41%), 'If the agencies who manage the Pantabangan reservoir strictly monitor the population of largemouth bass in the reservoir then it is easier to control the fish' (37%), 'If studies are conducted then it is easier to determine the factors that could help control the population of largemouth bass in the reservoir' (41%), 'If largemouth bass caught is strictly recorded then it is easier to know the current population of this fish in the reservoir' and, 'If people catch the largemouth bass in the reservoir then their number will decrease' (48%) (Table 2). In contrast, most of them assumed disbelief to the following statements, 'If largemouth bass will be controlled then it should not be protected' (37%), 'If money will be spent then it is easier to control the largemouth bass in the reservoir' (48%) and, 'If chemicals are used then it is easier to control largemouth bass in the reservoir' (81%) (Table 2). Basically, the majority responded positively to statements with private and government agencies involved, physical means of control through fishing gears, and data-monitoring related phrases. Selective exposure hypothesis may have played a role in rating these statements. The selective exposure hypothesis states that people will seek out consonant, and avoid dissonant information (Smith et al 2008). In this context, people tend to seek out information that supports their views and avoid information that contradicts them. The respondents who have been used to fishing gears and has observed the programs, projects and activities by some agencies portrayed acceptance to the statements which are consistent to their decisions based from their actual experiences. Incongruently, they tend to be unbothered about the statements regarding the application of chemical means of controlling largemouth bass population, concern on the protection and spending money for largemouth bass. This could probably mean that they unheard and haven't yet encountered these unfamiliar interventions (chemical means and fisheries protection) which are new to them and spending is not a priority since largemouth bass bears an impersonal environmental risk to them.

In terms of action, majority selected statements 1, 2, 3, 6, 7, 8, 9, and 10 whilst many haven't approved to do statements 4 and 5 (Table 3). In sum, the physical means of controlling largemouth bass population, government and private agencies spearheading monitoring activities, and conduct of more studies were acceptable among the majority omitting the chemical means of approach and spending money for population control. Based from these, majority showed cognitive dissonance due to exclusion of the statements 'I am willing to spend money to control largemouth bass population' and 'Chemicals should be used to control largemouth bass in the reservoir' with the fact that many also opted to agree on the statement, 'People need to control the existence of largemouth bass in the reservoir to increase catch on other fishes'. Showing cognitive dissonance portrays unaligned beliefs to such actions (Festinger 1962; Chapanis & Chapanis 1964; Bem 1967; Grandin et al 2021). As aforementioned, chemical means of controlling largemouth bass population might probably unfamiliar and prioritizing largemouth bass in the expense of their own finances weren't considered. Thus, their need of a well-grounded picture of the information is vital in reducing their display of cognitive dissonance. Meanwhile, only a few (4%) reported the will to spend money to control largemouth bass in the reservoir who showed consonance to their beliefs on the need to control largemouth population. Cognitive consonance is the presence of consistency between beliefs and actions (Feather 1963; Zusne 1986; Dolgon 2002).

Conclusions. This assessment had successfully gathered an initial data on the socio-economic status and the awareness and belief of some fisherfolk individuals regarding the presence of American largemouth bass in Pantabangan reservoir. Based on the socio-economic profile, the fishing workforce mostly consists of men and a least number of women with varying roles during fishing activities. With an age of 41.63, majority of the respondents are low income earners. Most of them reside in their owned houses that are built with strong materials with proper sanitation facility, lighting source, water source and fuel source. Also, many possess household conveniences such as cellphones, televisions and electric fans whereas acquiring tricycle/motorbike for transportation needs. The presence of the largemouth bass in the reservoir has been existing for more

than a decade until present using gillnet the most. Both largemouth bass catches and by-catches are sold entirely in fresh form within the locality's demand. The belief of an increased catch during full moon or new moon can be linked to the feeding behavior and activity of largemouth bass in the reservoir. Also, it can be inferred that the three areas serving as fishing ground corresponding to Barangay Villarica, Barangay Poblacion and Barangay Intang probably meet the favorable conditions for either spawning or foraging needs of the species. Based from the beliefs and actions portrayed by the respondents, it can be suggested that a thorough information dissemination about the status and possible interventions to be applied for largemouth bass within the locality must be considered if future control measures (physical, chemical or other means) on the largemouth bass population will be adapted and implemented within the locality. This is to correct and/or reduce the optimism bias, selective exposure and cognitive dissonance displayed by the majority of the respondents, whereas community consultation, engagement and needs assessment are now established before further implementation of any project/s within a community. Nevertheless, continuous data collection on the reservoir's catch composition and effective monitoring strategy for largemouth bass population are required to establish a reliable baseline data in determining the current status of largemouth bass in the said reservoir.

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