

# Fishing and Rural Livelihood: A Philippine Context

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## Abstract

The Municipality of Lake Sebu in Mindanao, Philippines offers various opportunities for income-generating fishing activities with its abundant surface water bodies. Lake Sebu is particularly known for good quality tilapia, farmed in fish cages. This study employed primary data collection methods, namely key informant interview, focus group discussion and a comprehensive livelihood household survey to assess the conditions and problems constraining fishing households in Lake Sebu. The study found that fishing-related benefits were mainly derived from aquaculture. Capture fisheries are essentially very small-scale, low gear open fishing done by local fisher folk that generates only subsistence income. Local residents are mostly engaged in retail fish trading that likewise generate only subsistence income. Survey results also revealed large variations in the scale of aquaculture operations. Fish cage owners, who are not originally from Lake Sebu or have residences outside Lake Sebu, are usually the large-scale fish farm operators, while the locals are only engaged in small-scale aquaculture due to limited financial sources. The study found that on the average, fishing-dependent households earned an annual income of PHP 132,800 (US\$ 2619), which was 15% lower than the average for all household respondents, and that a substantial 63% of fishing-dependent households live below the poverty line. It appears, therefore, that the rich water resources in the municipality have not contributed substantially to poverty alleviation. These findings point to the need for government assistance such as aquaculture financing programs and the formation of fish farming cooperatives to enable locals to engage in large-scale fish farming and reap the benefits of economies of scale.

## Keywords

Fisheries, Aquaculture, Mindanao

## 1. Introduction

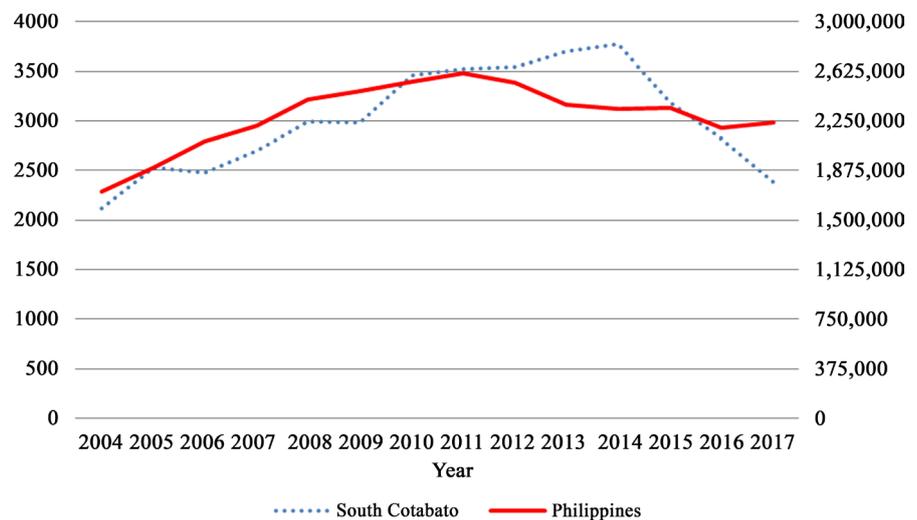
With abundant surface water bodies, Lake Sebu, a municipality in the southernmost portion of the Philippines, offers opportunity for income-generating fishing activities. There are several lakes in the municipality. The most notable and biggest among these lakes is Lake Sebu, with an approximate surface area of 354 hectares. The other lakes are Lake Lahit, Lake Seloton, and seven small lakes.

Lake Sebu is particularly known for good-tasting tilapia, farmed in fish cages in Lake Sebu and Lake Seloton. Tilapia farming expanded rapidly beginning in the 1980s due to the development of technologies for the breeding of Nile tilapia and of improved strains of tilapia—GIFT or Genetically Improved Farmed Tilapias (FAO, 2005 [1]). Recognizing the potential of aquaculture to address global food security concerns and poverty reduction challenges in developing countries (Bene, 2006 [2]), multilateral agencies have supported aquaculture development initiatives since the 1970s (ADB, 2005 [3]). Though tilapia fish ponds in Central Luzon and fish cages in Southern Luzon account for about 85% of tilapia production in the Philippines (Palanca-Tan, 2018 [4]), tilapia farming has also spread to fresh water bodies in Mindanao. In Southern Mindanao, tilapia farming in the Municipality of Lake Sebu in South Cotabato has grown more rapidly than total aquaculture production growth in the whole country. Aquaculture output in South Cotabato is mainly accounted for by tilapia farming in Lake Sebu. **Table 1** and **Figure 1** show the rapid increase in aquaculture output from South Cotabato from 2004 to 2010. The growth continues, albeit at a much slower pace until 2014. But

**Table 1.** Aquaculture production volume, 2004-2017.

Year	Philippines		South Cotabato		South Cotabato share in Phil (%)
	Volume (MT)	Growth rate (%)	Volume (MT)	Growth rate (%)	
2004	1,717,026.7	18.0	2117.2	-	-
2005	1,895,847.3	10.4	2527.8	19.4	0.13
2006	2,092,275.8	10.4	2478.3	-2.0	0.12
2007	2,214,826.2	5.9	2693.3	8.7	0.12
2008	2,407,697.9	8.7	2989.2	11.0	0.12
2009	2,477,392.0	2.9	2979.5	-0.3	0.12
2010	2,545,967.1	2.8	3457.5	16.0	0.14
2011	2,608,119.8	2.4	3526.5	2.0	0.14
2012	2,541,965.4	-2.5	3537.9	0.3	0.14
2013	2,373,386.5	-6.6	3701.6	4.6	0.16
2014	2,337,605.0	-1.5	3773.8	2.0	0.16
2015	2,348,161.2	0.5	3184.6	-15.6	0.14
2016	2,200,913.3	-6.3	2819.9	-11.5	0.13
2017	2,237,790.8	1.7	2380.9	-15.6	0.11

Data sources: PSA, Fisheries Statistics of the Philippines,  
<https://psa.gov.ph/sites/default/files/FSP%202015-2017.pdf>



Data source: Fisheries Statistics of the Philippines,  
<https://psa.gov.ph/sites/default/files/FSP%202015-2017.pdf>

**Figure 1.** Aquaculture fishing production volume.

thereafter, production declined as a result of massive fish kills attributed to deteriorated water quality of the lakes with overcrowding fish cages. Thus, in 2017, the provincial government assisted the municipal government in implementing an ordinance to dismantle fish cages so as to limit fish cage area to the mandated 10% maximum area.

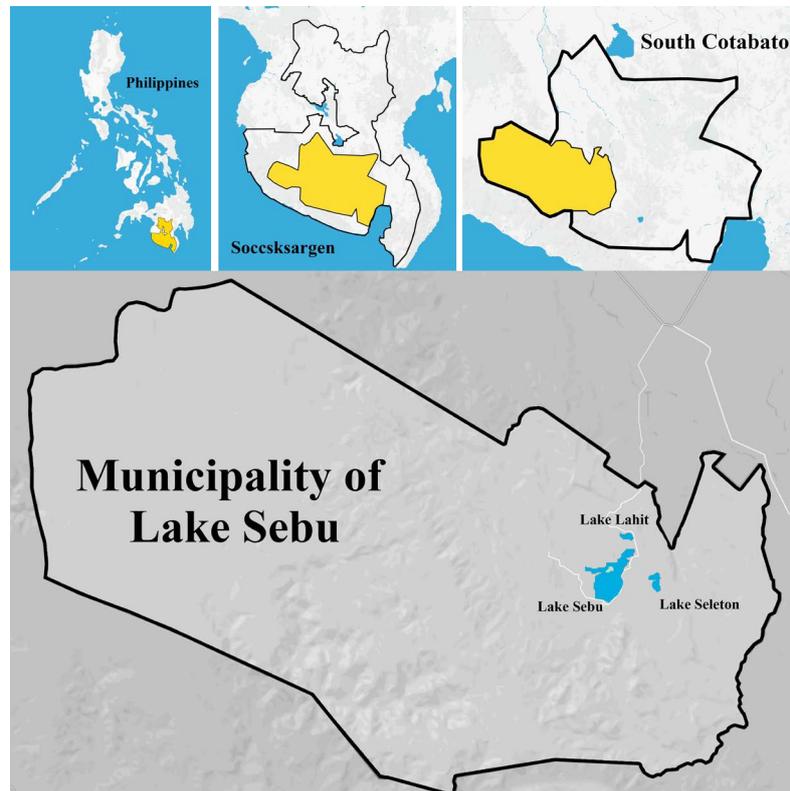
This paper looks into fishing as a major source of livelihood in the Municipality of Lake Sebu. A thorough understanding of the different aspects of fishing activities undertaken in the municipality is necessary for identifying policies and projects that can ensure maximum and sustainable fishing benefits for the residents of Lake Sebu. To date, studies on fishing in Lake Sebu have dealt mainly on water quality assessments (Natividad, *et al.*, 2015 [5]; Hingabay, *et al.*, 2016 [6]). To the authors' knowledge, there has been no study on the impacts of the lakes on the livelihood of surrounding communities and their behavioral responses to these impacts.

## 2. Methodology

This paper is part of a research project that aims to measure the total flow of benefits that can be derived from the natural ecosystem and cultural heritage in the Municipality of Lake Sebu. One methodology utilized for this research is the survey of livelihood sources of households in the municipality, one of which is fishing. This paper reports on the findings of the fishing portion of the questionnaire.

### 2.1. The Study Site

Lake Sebu (**Figure 2**), a municipality created in 1982, is one of 11 municipalities in the province of South Cotabato in Southern Mindanao. It is bounded on the northeast and southeast by the municipalities of Surallah and T'boli, respectively;



**Figure 2.** Study site: Municipality of Lake Sebu.

on the northwest by the province of Sultan Kudarat, and on the southwest by the province of Sarangani. Lake Sebu is approximately 40 km away from Koronadal, the capital city of South Cotabato and the regional center of Region XII, also referred to as Southern Mindanao.

Lake Sebu has a total land area of 89,138 ha, about 24% of South Cotabato's total land area. Lake Sebu has a predominantly rugged terrain with the mountain ranges of Daguma and Talihik and Mt. Talili (with an elevation of 1410 m) along its eastern portion, Mt. Busa (with an elevation of 2064 m) in its southeastern portion, and Pitot Kalabao Peak (with an elevation of 1600 m) along its central portion (LSMPDO, 2015 [7]).

There are several lakes in the municipality. The two largest lakes are Lake Sebu and Lake Seloton, both of which are utilized for productive and profitable tilapia farming. The municipality host 40 major rivers and is endowed with 103 springs located strategically throughout its boundary. Moreover, deep wells, shallow wells and free flowing wells are common along steep slopes and rolling valleys. The climate of Lake Sebu belongs to the 4th Climatic type under the Corona's Classification where rainfall is evenly distributed throughout the year. With a temperature ranging from 21° to 30° Celsius and supported by the hydrologic cycle of the lakes, it is relatively cool throughout the day (LSMPDO, 2016 [8]).

Lake Sebu is home to the indigenous T'boli which constitutes the majority 55% of its population. The Hiligaynon/Ilonggo migrants account for about a

fourth 25% of the population while the Cebuanos and Ubo-Manobo each account for about 5%. Due to its natural sights and the T-boli cultural heritage, tilapia and other agricultural products, and cool weather, Lake Sebu is fast becoming to be a prime eco-tourism destination in southern Philippines (Palanca-Tan, 2020 [9]).

## 2.2. Data Collection and Analysis

The study employed primary data collection methods, namely key informant interview (KII), focus group discussion (FGD) and a household livelihood survey. The FGDs with representative households from the target population in combination with KIIs with community leaders, local officials as well as non-government organizations present in the community were undertaken to obtain inputs for the drafting and finalization of the household livelihood survey instrument that asked detailed sector-specific questions on income sources of all household members. The respondent was asked which among the following six categories of income sources the household depends on: 1) fishing; 2) tourism; 3) crop farming; 4) livestock and poultry; 5) government/public service; and 6) others. After identifying one income source, a series of questions that would allow calculation of net income or revenues from each income source were asked.

A third of the livelihood survey was devoted to fishing-related income sources of households in Lake Sebu. Fishing-related income was categorized into five: fish grow-out operations, fish nursery operations, fish farm work, open fishing, and fish trading. Most of the questions dealt with details of fish farming and open fishing activities. For aquaculture, questions on type of fish farm, costs of construction, equipment, fingerlings and feeds used, growing period, type and volume of fish harvest were asked. For open fishing, questions on the most commonly used methods, equipment and materials used and their costs, and most frequently caught fish were asked. Problems facing the fishermen, future plans, and perceived impact of government projects and regulations were included in the questionnaire.

Apart from income, questions on consumption and subjected happiness were asked to assess the over-all welfare conditions of the households. For subjective happiness, the actual question posed in the survey instrument followed the 10-point numerical rating scale of Cantril (1965) [10]: “How happy or contented are you with your current living conditions. Please answer using a scale of 1 - 10 where 1 is very unhappy and discontented and 10 is perfectly happy and contented.”

A total sample of 489 households was generated through in-person interview by experienced enumerators of the Research Center of Notre Dame of Marbel University during the month of February 2019. All 19 *barangays* of Lake Sebu except for one (the distant and isolated *barangay* of Ned which is largely agricultural) were included in the sampling frame. The number of respondents in each *barangay* was set in proportion to the share of the *barangay* in the population of the municipality. Respondents in each *barangay* were chosen using systematic sampling. Permission and assistance to conduct the survey were secured

from the *barangay* captain's office. With maps obtained from the *barangay* office, starting points were identified and enumerators were instructed to approach the 10th house from the starting point. In case of refusal to participate, the next house would be approached. Every succeeding respondent approached had to be the 10th house from the last responding household.

### 3. Results and Discussion

Of the 489 households responding to the survey, 50 are engaged in fishing as the main source of livelihood. In terms of the number of household members actually involved in this form of livelihood, the figure slightly increases to 53. **Table 2** below indicates the particular forms of involvement of the household members in the fishing sector. The majority 55% (29 out of 53) are fish farm owners/operators. Only 10 out of 53 (19%) are engaged in open fishing. Slightly less than open fishermen are fish farm workers (7) and fish traders (6). Only one is engaged in fish nursery operations.

#### 3.1. Fish Farm Owner/Operator

The 29 fish farm operators in our sample represent 6.5% of the total population (450) of fish farm operators in the municipality. Aquaculture grow-out farms in Lake Sebu are done in fish cages, and not pens, because of the lake's depth<sup>1</sup>. Thus except for one fishpond, all aquaculture operations surveyed are fish cages. Aquaculture in Lake Sebu is mainly tilapia farming. All 29 fish farm operations are engaged in tilapia farming, but two farm operators grow other types of fish—one grow catfish ("hito") and the other grow a mix of different kinds of fish.

The foremost reason for engaging in fish farming in Lake Sebu appears to be the earning potential from this undertaking (90% of fish farm operators gave this reason). For the same reason, all except for one indicated they intend to continue aquaculture in the next five years. It also appears that aquaculture is the only source of income of five of the surveyed fish farming households. Of the 28 who are continuing fish farming in the next five years, a little less than half (13 or

**Table 2.** Fishing-related income sources.

	Proportion (%) of all fishing household members, n = 53	
Fish farm owner/operator	29	54.72%
Open fishing	10	18.87%
Fish farm worker	7	13.21%
Fish trading	6	11.32%
Fish nursery owner/operator	1	1.89%
Total	53	100.00%

<sup>1</sup>Both fish pen and cage are enclosures made of mesh or netting so as to allow a free exchange of water. The difference between the two is that a cage has the mesh or net enclosure at its bottom enclosure while a pen has the bottom of the lake or the sea (or any water body) as its bottom enclosure (Beveridge 1984) [11].

46%) would like to expand their operations (increase farm area). Majority (15 or 54%) would just maintain their current scale of operations, the main reasons being the local government's limits on farm area ownership in the lakes (9 out of the 15). Only three indicated insufficient funds for expansion and two do not seem to be very happy with their income from aquaculture.

**Table 3** reveals the scale of operations of the fish farming households. On the average, each fish-farming household has eight cages, each of about 118 m<sup>2</sup> or a total farm area 1019 m<sup>2</sup>. Average construction cost of the farms is about PhP 45,000.

The data reflect wide variations in the scale of operations of the surveyed farm operators with standard deviations exceeding the means. Number of farms owned by operators ranges from 1 to 45, the size of each farm from 36 m<sup>2</sup> to 600 m<sup>2</sup>, and construction cost from PhP 2000 to PhP 170,000. While there is an operator with a total farm area of only 50 m<sup>2</sup>, there is one with as large as 12,600 m<sup>2</sup>.

The only fishpond operator surveyed for this study has only one pond of size 300 m<sup>2</sup> constructed at a cost of only PhP 2000.

Of the 29 surveyed fish farming households, the earliest farm was set-up and started in 1987 while two were just started in 2018. Input and harvests data of the 27 farms (excluding the two recently constructed fish cages due to insufficient data) are shown in **Table 4**. The wide variation in the scale of operation is likewise reflected by data on farm inputs and harvests. But on the average, the fish farm operator in Lake Sebu seeds its farms four times in a year using about

**Table 3.** Fish cages and ponds.

	Fish farming households with		
	Cages, n = 28		Pond, n = 1
	Mean	Std dev	Mean
Number of farms	8.11	9.05	1.00
Size of each farm (m <sup>2</sup> )	117.51	111.99	300.00
Total area of all fish farms	1019.04	2323.50	300.00
Construction cost of fish farms (PhP)	45,163.57	45,361.22	2000.00

**Table 4.** Farm inputs and harvests.

	Min	Max	Mean	Std dev
No of times fingerlings are added in a year	2	36	4.19	6.63
Amount of fingerlings added each time (kg)	5	100	31.50	30.40
Monthly cost of feeds (PhP)	640	210,000	28,547.73	50,170.35
No of times of harvest in a year	1	20	3.26	4.17
Volume per harvest (kg)	25	4080	828.37	1096.93
Revenues per harvest (PhP)	3750	428,000	86,317.22	113,318.51

Note: Data exclude 2 fish farms which started in 2018 only, and hence n = 27.

32 kg of fingerlings each time, and harvests about 828 kg of fish three times a year. With an average revenue per harvest of PhP 86,317, total revenues generated by the farm operator in a year totals about PhP 281,394.

Fish farming households obtain funds for farm construction and daily farming activities from multiple sources. For farm construction, fish farm operator-owners augment household savings and financial help from relatives/friends with borrowings. With just 20% or 69% of farm operator-owners using their own savings to construct farms, about 31% relied completely on external sources. Almost half (14% or 48%) of fish farming households borrowed money, half of which from cooperatives, and about half also from relatives and friends. Only 1 (of the 14 borrowing households) obtained a loan from a government institution. There is no commercial bank, not even a rural bank in the municipality. Nonetheless, it may be possible that some fish farm owners/operators (some of them with residence outside of Lake Sebu) have borrowed funds from commercial banks in neighboring cities such as Koronadal. In this study's sample, however, no such case has been included. And as in most rural, predominantly agriculture and resource-dependent areas, formal source of financial capital mainly come from cooperatives.

For financing daily operations, only 62% of fish farm operators use their own household savings, and hence, 38% depend completely on external sources. The more common way of accessing external funds is through the operator-financier arrangement. The financier provides funds or inputs for farm operations and gets a share of the harvest.<sup>2</sup> Most of the financiers are involved in the aquaculture industry either as feeds and fingerlings supplier (5 out of 12) or fish buyer or trader (3 out of 12). Some are relatives (2 out of 12) or plain capitalists in Lake Sebu (2 out of 12).

The three biggest problems faced by fish farm operators are fish kill, lack of financial capital and typhoons. All 29 fish farm operators except for two have experienced fish kill with losses ranging from PhP 3 thousand to PhP 1.5 million, and averaging about PhP 161 thousand.

### 3.2. Nursery Owner/Operator

Fingerlings used by fish farm operators in Lake Sebu are mostly sourced from the neighboring municipalities of Banga and Surallah. But there are a few in Lake Sebu which have explored this business opportunity recently. The only one nursery operator in our sample produces tilapia fingerling for its own fish farms as well as for sale to other fish farm operators in Lake Sebu. This nursery operator intends to continue and expand its operations in the next five years as the enterprise has ensured a stable supply of fingerlings for its fish farms as well as proven to be a good source of income.

The nursery operator has a total pond area of 9600 m<sup>2</sup> (roughly about 1 ha) divided into 12 ponds, each pond is 800 m<sup>2</sup> big. The cost of construction in 2015

<sup>2</sup>The owner/operator-financier arrangement is common among small-scale aquaculture operations such as those in the seven crater lakes in the province of Laguna in Luzon (Palanca-Tan 2016).

was about PhP 150 thousand. The pond has 200 male and 800 female breeders with a total cost of PhP 1000. Monthly cost of feeds and other pond supplies amount to about PhP 30 thousand. The operators make three harvests in a year, each harvest of about 571 kg, generating revenues of P 200,000 (with price per kg of about PhP 350). The nursery operator obtains funds for pond construction and daily operations from a cooperative.

### 3.3. Fish Farm Worker

Many aquaculture operations in Lake Sebu are small-scale and involve household members only and no hired labor. However, some relatively large ones have regular caretakers. The seven fish farm workers surveyed work an average of 7 days each week and five hours a day. Six of the seven reported monthly salary ranging from PhP 700 to PhP 27,500 and averaging PhP 7446. This implies that aquaculture in Lake Sebu generates a variety of jobs, ranging from unskilled manual work to skilled, most likely, managerial work. Only one of six reported being paid on a daily basis at the rate of PhP 250. Of the seven, three are provided with free meals, two are provided with family housing, and one is given transportation allowance. None of the seven is given government-mandated benefits such as Social Security System and government-manadated medical insurance. None is also given any private medical insurance.

### 3.4. Open Fishing

In open fishing, tilapia is the most frequently and abundantly caught fish variety of 9 out of the 10 surveyed open fishermen. This is expected as escapees from tilapia fish farms would populate the open fishing areas, a positive externality from aquaculture. One indicated “agihis”, a native shellfish, as the variety he catches the most. It is likely that this fisherman concentrates his fishing effort on this shellfish as this entails a special fishing method. Only 8 indicated a second mostly caught fish: mixed fish (6), 7-color fish (1) and catfish (1), while 7 indicated a third: catfish (3), carp (2) and “Korean bangus”—a big-sized milkfish variety.

The most common methods used in open fishing are fish net and hooks (7 out of 10). Others use fish trap structures. The fisherman focusing on the shellfish make use of plastic basins. Fishing methods such as diving and trawling were not mentioned. Seventy percent indicated fish net as the primary method while 30% indicated hooks.

Six open fishing respondents own a boat that costs PhP 3133 on the average. Six respondents indicated using fishing nets that cost PhP 1870 on the average. Only two respondents indicated using frames with an average cost of PhP 1100. Seven of the 10 open fishermen surveyed use their own savings in acquiring their fishing gear. Only one relied on financial assistance from relatives/friends while two resorted to loans from relatives/friends and a cooperative.

Data on daily catch shown in **Table 5** reveal very small-scale open fishing undertaken by residents of Lake Sebu. On a bad day, fishermen catch an average of

less than 2 kg. Even on a good day, average catch is just 5.6 kg. Due to very little catch, fishing households consumer less than 1 kg of the daily catch, with most of the catch being sold generating and daily revenues of just about PhP 94 (bad day) to PhP 362 (good day).

### 3.5. Fish Trading

Of the six fish trader respondents, four are retail traders and two are wholesale traders.

All four retail fish traders get their fish from fish farms owners and sell to local markets in Lake Sebu. Their daily revenues range from PhP 1300 to PhP 6500 with a cost of PhP 1200 to PhP 5900, thus generating a net profit of PhP 100 - 1100.

The two wholesale fish traders likewise source their fish from fish farms. One wholesale trader respondent sells at Koronadal City while the other sells at Suralah. They make weekly transactions of about 50 - 180 kg per transaction and sell at a margin of about PhP 20 - 25 per kg of fish, thus generating a net income of PhP 1000 - 4500 per transaction.

### 3.6. Welfare

Welfare measures such as aggregate household income, poverty incidence, food consumption vulnerability and self-reported happiness are presented in **Table 6**.

**Table 5.** Daily open fishing catch.

	Bad day	Good day	Last fishing day
Catch (kg)	1.70	5.60	3.00
Of which			
Sold	1.10	4.83	2.55
Consumed by household	0.40	0.63	0.25
Given away to relatives/friends	0.20	0.15	0.20
Revenues from sold fish (PhP)	94.00	361.80	168.50
Price per kilogram (PhP)	85.45	74.91	66.08

**Table 6.** Welfare indicators.

	Household income			Proportion of households which have missed meal/s	Average happiness score
	Average annual (PhP/US\$)	Proportion of households			
		Below poverty threshold	Below food threshold		
Households whose main income source is fishing (8.18% of household respondents)	132,800/2619	62.50%	50.00%	30.00%	7.70
All households respondents in Lake Sebu	156,701/3090	61.15%	46.22%	43.76%	6.94

The table reveals that households whose main income source is fishing earn an average annual income of PHP 132,800 (US\$ 2619), 15% lower than the average for all household respondents. About 63% of fishing-dependent households are below the poverty line and half have income that is even lower than the food threshold. Further, 30% of fishing-dependent household respondents indicated they had experienced hunger in the past three months. Nonetheless, the average self-reported happiness of fishing-dependent household respondents is 7.70, almost one-point higher than the average happiness score of the entire sample of households. It then appears that fishing-dependent households are economically worse-off but happier than the average household in Lake Sebu.

#### **4. Concluding Remarks**

Fishing-related benefits from the lakes in the Municipality of Lake Sebu are mainly derived from aquaculture—the growing of tilapia in fish cages in Lake Sebu and Lake Seloton. Capture fisheries are essentially very small scale, low gear open fishing done by local fisherfolk that generates only subsistence income. Further, local residents are mostly engaged in retail fish trading within the municipality that likewise generate only subsistence income.

Survey results reveal large variations in the scale of operations in the case of aquaculture. As financial capital for fish farming operations are mainly internally sourced and not borrowed, the scale of operations depends on the financial resources of the households. During the FGDs, it has been found that a number of fish farm operators are not originally from Lake Sebu and have residences outside Lake Sebu. These are usually the large-scale fish farm operators, while those who are residents of the municipality are mostly engaged in small-scale aquaculture. A major reason for the limited scale of operations is the unavailability of financing options. To enable locals to engage in large-scale fish farming and hence, reap the benefits of economies of scale, alternative financing options may be made available or formation of fish farming cooperatives may be facilitated.

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#### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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