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RESEARCH ARTICLE

The small-scale tuna fishery in Leyte, Philippines: Fishing gears, practices, catch rate and composition

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ABSTRACT

The Philippines is a significant tuna producer globally and ranks among the major tuna-fishing nations. One of the various areas where tuna fishery occurs in the country is the province of Leyte in Eastern Visayas. However, available information on the fishery in the province is limited. Thus, this study aimed to provide comprehensive information on the current status of small-scale tuna fishery in selected municipalities in Leyte, particularly on the types of fishing gears used, practices employed by fishers, and the catch rate and composition of the gears. This study used a purposive sampling method, and data were gathered through face-to-face interviews with a total of 68 small-scale tuna fishers, and actual catch sampling. The respondents' involvement in tuna fishing ranged from 3 to 60 years with a mean of 26±13 years. A total of three different types of hook and line gear used in the fishery were recorded, namely: 1) paired troll line, 2) single troll line, and 3) single hook and line with float. The paired troll line is the most commonly used gear among tuna fishers. The mean catch per unit effort varies depending on the fishing gear type. The catch composition of the three gears based on the actual catch sampling was comprised of four tuna species including longtail tuna *Thunnus tonggol* (50.48%), big-eye tuna *T. obesus* (21.90%), eastern little tuna *Euthynnus affinis* (18.10%), frigate tuna *Auxis thazard* (3.81%), and two other species including *Megalapis cordyla* (3.81%) and *Scomberomorus commerson* (1.90%). The current major issues in the fishery include catch seasonality, illegal fishing, and border restriction.

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Introduction

The fishery of tunas is one of the most important marine fisheries in the Philippines. In the global scale, the country ranks among the major tuna-fishing nations (Llanto et al., 2018; Nepomuceno et al., 2020). Tuna consistently ranks first among the top commodities from both marine municipal and commercial fisheries (BFAR, 2023). In 2022, the overall tuna landings reached 475,313.47 mt, representing 23.90% of the total capture fisheries production in the country valued at PHP 54.32 billion. In the commercial fisheries subsector, tuna landings contributed 335,210.21 mt (38.86%) valued at PHP 35.42 billion. In terms of the marine municipal fisheries subsector, tuna landings contributed 140,103.26 mt (12.44%) valued at PHP 18.90 billion. Tuna also remained as the top exported commodity with a total value of USD 403.51 million. However, despite the economic importance of tuna resources in the Philippines, detailed documentation on the fishery in the various areas of the country is limited (Yutuc et al., 2018; Nepomuceno et al., 2020). In terms of regulations and fisheries management, Republic Act No. 10654, an Act to prevent, deter and eliminate illegal, unreported and unregulated fishing, amending Republic Act No. 8550, otherwise known as "The Philippine Fisheries Code of 1998," and for other purposes, sets out the general framework for the management of fisheries sector in the county including tuna fisheries (DA-BFAR, 2018). The Department of Agriculture-Bureau of Fisheries and Aquatic Resources is designated as the lead government agency responsible for the conservation and management of the fisheries beyond the municipal waters (>15 km from coastline). On the other hand, the local government units through Republic Act No. 7160 known as the "Local Government Code of 1991" are given the jurisdiction and responsibility to manage the fisheries within their municipal waters (municipal fisheries, within 15 km from the coastline).

The province of Leyte in Eastern Visayas, Philippines is one of the areas where tuna fishery occurs. It was reported that Leyte is one of the major sources of tunas caught by hook and line gears that are channeled to General Santos City in Mindanao – the center of tuna industry in the Philippines (DA-BFAR, 2018). From 2018-2022, the collective average tuna landings from the province ranged from 705.53 mt to 1,011.26 mt with a value of PHP 82.79 to PHP 130.37 million. The contribution of the municipal fisheries to the province's tuna landings varied from 17% to 55%.

The available updated data about the tuna fishery in the province is limited to the total production and the target species. A more comprehensive data about the fishery such as the various types of fishing gears used to include the designs, and the fishing practices employed is imperative to better understand the current status of the fishery in general. Records on the catch rate and composition are also an important input needed for the evaluation of the fishery's exploitation level and potential. This study aimed to provide an information about the current status of the small-scale tuna fishery in the selected municipalities in Leyte including the types of existing fishing gear used, the practices employed by the fishers, and the catch rate and composition of the gears to fill the information gap concerning the fishery. The results of this study may serve as baseline information that can be used by the concerned government agencies and other institutions in formulating better management plans for the said fishery resource.

Material and Methods

Study Area and Duration

This study was conducted in the three selected coastal municipalities in Leyte, Eastern Visayas, Philippines where small-scale tuna fishery occurs, namely: Tolosa, Dulag, and Mayorga from February to May 2023. The interviews with the tuna fishers started in February, while the actual catch sampling in March to coincide with the local tuna fishing season from March to June. These neighboring municipalities are geographically located along San Pedro Bay (Tolosa) and Leyte Gulf (Mayorga and Dulag), which are among the major fishing grounds in Eastern Visayas (Figure 1).

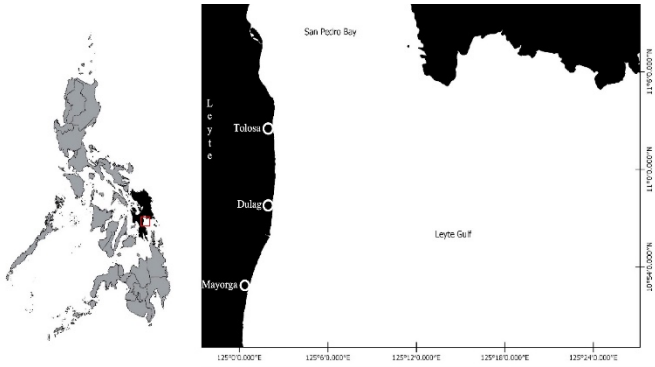

Figure 1. Map showing the study sites in the selected coastal municipalities of Leyte, Eastern Visayas Philippines

Study Design

A purposive sampling method was used in this study. The data were collected through face-to-face interviews with the target respondents using a semi-structured questionnaire. An actual catch sampling and field observation were also

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conducted for validation of the data gathered from the tuna fishers particularly on the catch rate and composition.

Before the interview, a consent form was provided to the target respondents to ensure their voluntary participation in the study. The fishing gears were photographed for proper identification and description. Gear illustrations and layouts featuring the gear design and structure based from the photographs taken during the conduct of the face-to-face interviews and actual field observation were also provided through AutoCAD –a computer aided design software.

The Survey Instrument

The survey instrument used in this study was mainly comprised of the respondent's fishery profile focusing on their involvement in the fishery, fishing gear/s used, methods employed, catch rate, and the size and species composition. The instrument was deployed through Kobo Collect, an offline android-based application that was used during the survey.

Catch Sampling Procedure and Species Identification

Catch sampling was done weekly from March to May 2023. Sampling was done as soon as the catch was landed. Collected data included the individual body weight to the nearest "g" using a 10,000-g capacity weighing scale. Fishing effort data including the number of hooks used, number of hours spent every fishing operation, and the total catch were also recorded though direct interviews with the fishers after landing. The different species composing the catch were determined on site with the direct assistance from the National Fisheries Research Development Institute—National Stock Assessment Program (NFRDI—NSAP) personnel (data enumerator) assigned in the three selected sites. A cross verification of the identification was done based on the taxonomic characters of each species following the identification guide of Froese and Pauly (2024) and White et al (2013).

Data Processing and Analysis

The gathered data from both the face-to -face interviews and the actual catch sampling were uploaded to the Kobo Toolbox server then downloaded in an excel format, and were processed accordingly. Data were further analyzed using descriptive statistics and results were presented in tables or charts. Catch rate was expressed through catch per unit effort in terms of kilogram per fishing hour (kg/h) and kilogram per hook (kg/hook) depending on the fishing gear type.

Results and Discussion

A total of 68 small-scale tuna fishers who were all males were interviewed from the three selected coastal municipalities of Leyte, Eastern Visayas, Philippines, in which, 16 where from Tolosa, 25 from Dulag, and 27 from Mayorga. These numbers represent about 27% to 100% of the total number of small-scale tuna fishers in the three municipalities who were available and had voluntarily participated during the face-to-face interviews.

The Small-scale Tuna Fishery in Leyte

According to the face-to-face interviews with the small-scale tuna fishers and from the actual field sampling, the tuna fishing season in Leyte starts in March but with limited catch. Later on, during the month of April until May, abundant catch of tuna species is observable. At the beginning of June, tuna landings in the three different sampling stations started to decline. The major fishing areas where tuna fishers operate were mostly in the waters between Leyte and Samar Islands, particularly in the Leyte Gulf and San Pedro Bay. According to the fishers, they operate in the waters of the municipalities of Tolosa, MacArthur and Abuyog in Leyte, Marabut in Samar, and Balangiga, Lawaan, Giporlos, Homonhon and Guiuan in Eastern Samar. They also fish as far as Dinagat Islands in Surigao.

Most of the respondents had their preferred "lab-asero" or "postor" or so-called middlemen to whom they sell their catch as soon as they land. The price of tuna at the landing site when catch is abundant during the fishing season ranges from PHP 150.00 – PHP 180.00, while up to PHP 200.00 – PHP 240.00 when catch is lesser.

Fishery Profile of Small-scale Tuna Fishers

The fishery profile of the small-scale tuna fishers is shown in Table 1. Out of the 68 respondents, a total of 52 (76.47%) were full-time while 16 (23.53%) were part-time tuna fishers. When the tuna fishing season in the localities is off, full-time fishers engaged in other fishery activities targeting other species such as *Caesio* spp. On the other hand, part-time tuna fishers are involved in either of the following: 1) fishery law enforcement; 2) fisheries, particularly fish peddling, and repair and production of fishing boat accessories such as propeller; 3) agriculture, particularly butchery, coconut harvesting and wine production, and rice production; 4) small retail of variety of goods; 5) labor and construction; 6) public transportation; and 7) local government unit as contractual worker. One tuna part-time fisher receives pension from his retirement as a policeman.

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Table 1. Fishery profile of small-scale tuna fishers in Leyte, Eastern Visayas, Philippines

Variables	Frequency of Response	Frequency Percentage (%)
Status as tuna fisher		
Full-time	52	76.47
Part-time	16	23.53
Total	68	100
No. of years in tuna fishing		
≤10	12	17.65
11 – 20	16	23.53
21 – 30	18	26.47
31 – 40	12	17.65
41 – 50	8	11.76
51 – 60	2	2.94
Total	68	100
Type of fishing vessel used		
Motorized	64	94.12
Non-motorized	4	5.88
Total	68	100
Fishing vessel material		
Fiberglass Reinforced Plastic	8	11.76
Wood	60	88.24
Total	68	100
No. of crew per vessel		
1 person only	50	73.53
2 persons	18	26.47
Total	68	100
Role in the fishing operation		
Captain/Operator	67	98.53
Crew	1	1.47
Total	68	100
Frequency of the conduct of fishing operation (days)		
5 – 10	8	11.76
11 – 15	17	25.00
16 – 20	15	22.06
21 – 25	20	29.41
25 – 30	8	11.76
Total	68	100
Average duration of fishing operation/trip (h)		
1 – 5	3	4.41
6 – 10	21	30.88
11 – 15	44	64.71
Total	68	100

Table 2. Recorded tuna-fishing gears used in Tolosa, Dulag and Mayorga in Leyte, Eastern Visayas, Philippines, the local names, and the number of users

Common Name	TOLOSA		DULAG		MAYORGA		Total No. of Users	% No. of Users per Fishing Gear Type
	Local Name	*No. of Users*	*Local Name*	*No. of Users*	*Local Name*	*No. of Users*		
Paired troll line	Sahid	8	Pakaras	20	Bahan	20	48	70.59%
Single troll line	Limbag/ Singgol/ Solo-solo	3	Limbag/ Singgol/ Solo-solo	4	Limbag/ Singgol/ Solo-solo	5	12	17.65%
Single hook and line with float	Palutaw	5	Palutaw	1	Palutaw	2	8	11.76%

The fishers' length of involvement in small-scale tuna fishing ranged from 3 to 60 years with a mean of 26±13.00 years. It can be noted that most of the fishers (82.35%) were already >10 years in the fishery. Most of the respondents stated that they started to join fishing operations at an early age of at least 10 years old together with their late fathers. According to the respondents, they preferred to go fishing instead of going to school since they perceived that tuna fishing provides them income and sustain their needs rather than studying.

Tunas are typically found in deeper areas farther than the shore. Allain et al. (2016) reported that tuna species including yellowfin and bigeye are usually found at depths of 250 m and 300-500 m, respectively. Thus, the use of powered vessels is critical in the fishing operations. In this study, 94.12% of the fishing boats used were motorized powered by 5.50 to 18 HP engine. The most common type of fishing boats used were made from wood (88.24%) while a few (11.76%) were made from fiberglass reinforced plastic. Almost all (98.53%) of the respondents were either boat captains or operators. The frequency of fishing operations ranged from 5 to 30 days monthly with a mean of 19±5.00 ($\bar{x}$±SD) days. The duration of the daily fishing operation lasts from 5 to 15 hours with a mean of 10.91±2.58 hours.

Fishing Gears Used

This study recorded a total of three different fishing gears used in catching tuna species in the municipalities of Tolosa, Dulag, and Mayorga, Leyte. These include: 1) paired troll line, 2) single troll line, and 3) single hook and line with float (Table 2). All of these fishing gears are basically hook and line. Similarly, Mendoza et al. (2023) recorded four types of fishing gear used in Infanta, Pangasinan in catching tuna species, which are also all hook and line gears including: 1) simple handline (*surrate*), multiple hook and line (*sibid-sibid*), troll line (*paguyod*) and bottom set long line (*kitang*). In Zambales Coast (part of the West Philippine Sea), Yutuc et al. (2018) recorded ten different types of fishing gears used in catching tuna species including three commercial (i.e., purse seine, ring net and Danish seine) and seven municipals (i.e., multiple handlines, handline, trammel net, bagnet, bottom set longline, otter trawl, and gillnet). Multiple handline and troll line are also used in Tawi-Tawi, Southern Philippines particularly for frigate tuna *Auxis thazard* and skipjack tuna *Katsuwonus pelamis*, respectively (Ajik & Tahiluddin, 2021; Mohammad et al., 2022). Hook gears locally known as "pasol/ taga" along with fish aggregating device known as "payao" are used in catching *A. thazard* in Sogod Bay, Southern Leyte (Ratilla et al., 2016).

The local names of the fishing gears reported are actually the same in all the municipalities except for the paired troll line. The paired troll line is locally termed as *sahid* in Tolosa, *pakaras* in Dulag and *bahan* in Mayorga. This gear is the most widely used (70.58%) among the three municipalities.

Paired Troll Line

The structure of the paired troll line gear is shown in Figure 2, and its specifications are presented in Table 3. Its mainline is made from a polyamide with a twine size ranging from 0.50 to 1 mm Ø and length ranging from 60 to 200 m. It consists 10 to 15 branch lines with twine size of 0.30 to 0.80 mm Ø and length of 0.50 to 1 m. The distance between branch lines measures 1.00 to 1.50 m. The line is coiled in a spool made from bamboo, or polyvinyl chloride (PVC) pipe. The sizes of the hooks vary from number 15, 16, and 17. The type of lures used varies in each municipality, and depends upon the preference of the fisher. Materials for the lures can be made from crystallite (metallic cloth) or silicone hose. Lures are typically customized to mimic the shape of small fishes that are preyed by tunas such as anchovies and sardines (Figure 2). Some specifications include

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metallic cloth being inserted inside the silicone hose to create a more attractive lure. Metallic cloth has various colors in order to lure tuna species. Some tuna fishers also prefer to buy ready-made lure from online shops.

Single Troll Line

Single troll line locally called as "limbag", "singgol" or "solo-solo" is also a type of troll line that consists of only a single hook operated in a single boat (Figure 3). The spool is typically made from either wood, plastic, or polyethylene (PE) pipe. As indicated in Table 4, the main line is made from a polyamide with a thickness of 0.15 to 0.60 mm Ø and length of 50 to 200 m. A swivel is attached between the main line and branch line for the purpose of allowing the lines to rotate independently and prevent undesirable tangling. Furthermore, the branch line is made from either stainless-steel wires or polyamide with a size of 0.10 to 0.30 mm Ø and length of 7 to 45 m. The lure is made from a metal which is shaped by the fishers into fish-like.

Single Hook and Line with Float

Single hook and line with float are a type of a passive fishing gear that is widely used in targeting large pelagic species including tunas. An illustration of the gear is shown in Figure 4. The gear is composed of a spool which also serves as the floater, a mainline, a branch line (but sometimes no branch lines are attached), a single hook, sinker, and a swivel. The spool which also serves as floater is made from various materials such as styrofoam, empty plastic bottles and galloons — which preference depends on the fisher. The specifications of the single hook and line with float are shown in Table 5. The main line is made from polyamide measuring from 0.40 to 0.50 mm in size and up to 110 to 140 m long. The branch line can be made from stainless-steel wires or polyamide with a measurement of 0.40 to 0.50 mm Ø in size and about 0.30 to 40 m in length. A lead sinker is also attached to set the gear vertically in the water column. A swivel is also attached connecting the main line and the branch line in order to prevent tangling. The most unique feature of this gear among the different types of hook and line gears recorded in this study is its utilization of live fish as a natural bait.

Fishing Practices

Fishing practice depends on the type of fishery, geographic location, and the technology used, among others. In Leyte, tuna fishing involves both active and passive fishing gears. Active fishing gears are the type of gears used to capture the fish based on an aimed chase to the target species (Bjordal, 2002). On the other hand, passive fishing gears also known as stationary fishing gears are those type of gears that generally depend on the behavior and movement of the target species towards the gear. In this study, paired troll line and single troll line are identified as active fishing gears, while the single hook and line with float is considered as passive. The first two gears use a trolling method while the last one employs attracting and setting. Dickson & Natividad (2000) reported that the introduction of fish aggregating device locally known as "payao" in tuna fishing in 1975 resulted to the rapid development of tuna and small pelagic fisheries in the country. However, the current study observed that fishers at the selected study sites in Leyte do not use payaos in the small-scale tuna fishery.

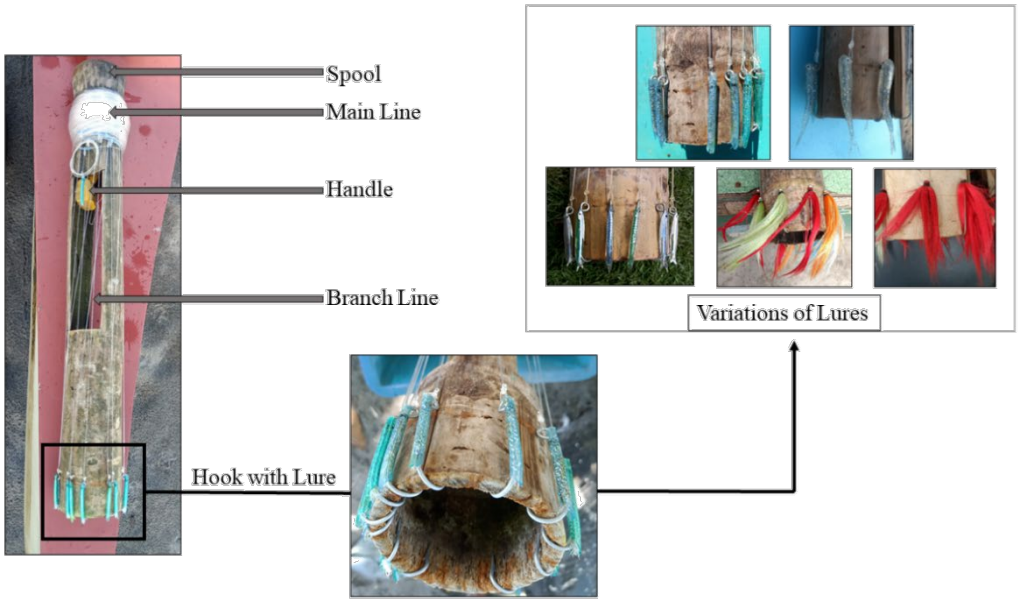

Figure 2. An illustration showing the parts of a paired troll line and the different types of lures used for the gear

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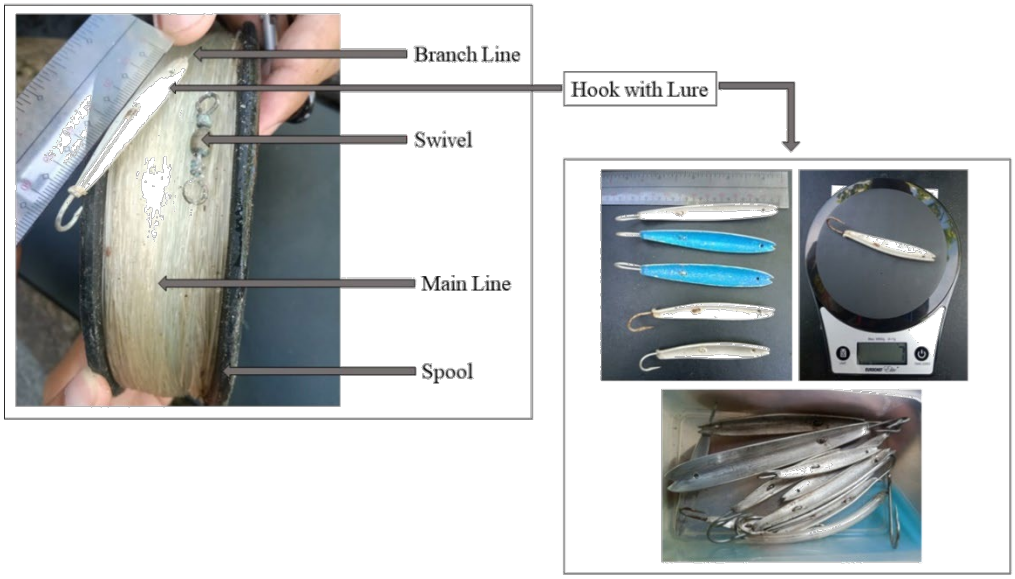

Figure 3. An illustration showing the parts of a single troll line

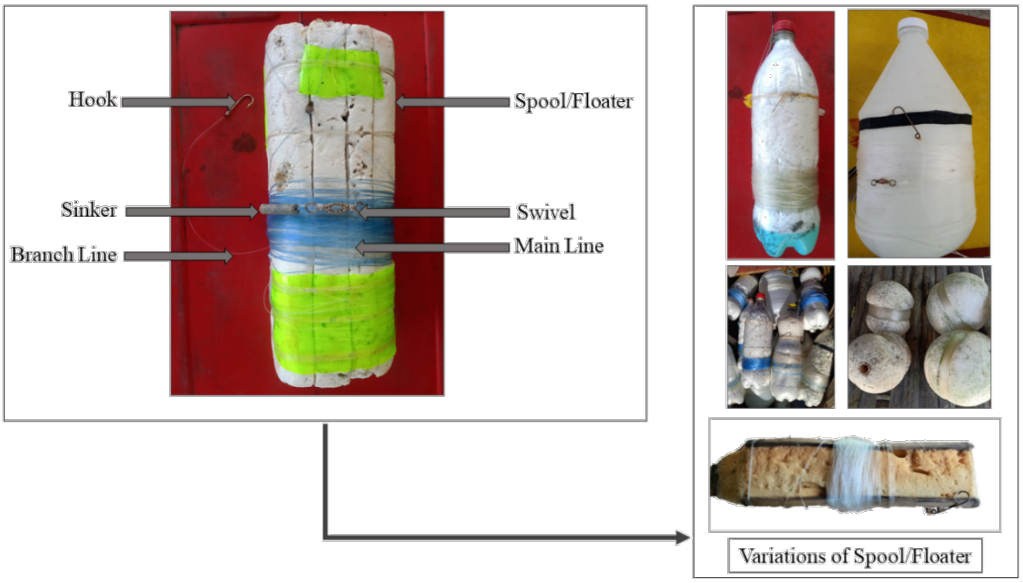

Figure 4. An illustration showing the single hook and line with float and its parts

Table 3. Parts and specifications of paired troll line used in tuna fishing

Parts	Materials	Description	Function
Spool	Bamboo, PVC pipe	2-3 feet long	It is where the entire line is being coiled.
Main line	Polyamide	Size: 0.50-1 mm Ø Length: 60-200 m	Serves as primary line where the branch lines containing the hooks with lures are attached.
Handle	Rubber, Styrofoam	Part of the gear held by fishers during fishing operations.	This is used in order to prevent hand abrasions/ injury to the fishers during operations.
Branch line	Polyamide	Size: 0.30-0.80 mm Ø Length: 0.50-1 m	It is where the hook with lure is attached.
Hook	Metal	Hook size: #15, #16, #17	Part of the gear where tunas and other species are actually caught.
Lure	Silicone hose, Crystallite (metallic cloth), Rubber	2-3 inches long	Used in attracting or luring tunas.

Table 4. Parts and specifications of a single troll line

Parts	Materials	Description	Function
Spool	Wood, Plastic, PE pipe	Cylindrical	It is where the entire line is being coiled.
Main line	Polyamide	Size: 0.15-0.60 mm Ø Length: 50-200 m	It is the primary line.
Swivel	Metal	Barrel swivel	Used to prevent undesirable tangling.
Branch line	Stainless-steel wires, Polyamide	Size: 0.10-0.30 mm Ø Length: 7-45 m	It is where the hook is attached.
Hook	Metal	Hook size: #14, #15, #16, #17, #19, #20, #22, #23, #60, #62, #64	Main part of the gear where tuna and other species are actually caught.
Lure	Metal (customized)	2-6 inches long	Used in attracting or luring tunas.

Table 5. Parts and description of single hook and line with float

Parts	Materials	Description	Function
Spool/Floater	Styrofoam, Plastic bottle, Galloon	Structure varies depending on the preference of the fisher.	It is where the entire line is being coiled. It also serves as the gear's floater when deployed.
Main line	Polyamide	Size: 0.40-0.50 mm Ø Length: 110-140 m	It is the primary line.
Swivel	Metal	Barrel swivel	Used to prevent undesirable tangling.
Sinker	Lead	Elongated, cylindrical	Used to make the line sink to the water column vertically.
Branch line	Stainless-steel wire, Polyamide	Size: 0.40-0.50 mm Ø Length: 0.30-40 m	It is where the hook is attached.
Hook	Metal	Hook size: #15, #16, #17	Used to catch large pelagic species including tuna.
Bait	Smaller fishes such mackerel and scads	Alive	Used to bait large pelagic species such as tunas.

Paired Troll Line/Two-Boat Troll Line

Paired troll line or two-boat troll line is operated using a pair of boats as shown in Figure 5. The fishers depart early in the morning at 4:00 AM to 5:00 AM, and travel for almost 2-3 hours to reach the fishing ground particularly in San Pedro Bay or the contiguous waters of Leyte Gulf. Both fishers scout for schools of feeding tunas on the surface of the water. Fishers use visual cues to detect the presence of tuna school locally termed as "bakal". One of the most common cues is the presence of birds gathering above the water. Once a school of tuna is found, the gear will be set and the pair of boats maneuver toward the school while maintaining considerable distance from each other to stretch the gear completely. When the gear is stretched on both ends, the two boats then continuously travel parallel to each other until the school of tuna passes between them. When there is already a catch, the pair of boats slow down and maneuver close to each other to retrieve the line by either one of them. After collecting the catch, they set out for another run and repeat the process for more trials as long as there are still school of tunas in the area. Later in the afternoon, if there is enough catch, the fishers may decide to travel back to the landing site in order deliver their catch as fresh as they can and also for them to land while it is still daytime -since their travel time from the landing site to the fishing area and vice versa ranges from 1-4 hours (depending on the location where the tunas are schooling). However, some fishers land late at around 6:00 PM to 8:00 PM especially when catch is lean. At the landing site, their preferred middleman locally known as "lab-asero" or "postor" are regularly waiting for them to purchase their catch at a set price. The profit will be divided fairly between the pair.

In the absence of a boat partner which happens rarely, paired troll line is operated with a floater/buoy. This trolling method is locally known as "surfing" (Figure 6). In this method,

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one end of the main line is tied to a floater/buoy while the other end is held by the fisher. As the boat is continuously moving, the gear tied to the buoy is dragged along. The advantage of this practice is it can be operated by a single fisher without depending on a partner. Also, the total catch of this operation is solely owned by the operator. However, since there is only a single boat involved, it moves slower and the gear is not towed parallel to the boat. Another disadvantage is that the fisher cannot totally control the stretched gear to where he wants it to be. Thus, catch could be lesser than the two-boat troll line.

Single Troll Line

Single troll line is operated by towing just like the paired troll line. However, this gear has only a single hook and only one boat does the fishing operation (Figure 7). Similar with the paired troll line, the fishing gear operation involves scouting for school of tunas. When a school is sighted, the gear is deployed and soaked to the water. After which, the gear is towed as the boat continuously chase the target school of tunas. This practice is used most often when the fisher departs and operates alone. This type of fishing practice along with the paired troll line is usually done during the peak season of tuna fishing (mostly from April to May). Once their contacts from nearby municipalities and from Samar area notify them that schools of tuna are already present, most of the small-scale tuna fishers in Leyte set out together the following day.

Single Hook and Line with Float

Compared to the previously mentioned fishing gears, the structure of single hook and line with float is much simpler (Figure 8). After the fisher departs from the shore at around 4:00 AM to 5:00 AM, he will first catch smaller fish species such as mackerel and scads that will be used as live bait using a multiple hook and line while still in shallower waters. The smaller fish catch will be hooked in its dorsal part to be used as bait while it is still alive. After which, the gear is deployed and is left in place while the floater remains on the surface of the water. As the live bait continuously moves, it may attract large pelagic species including tunas. While waiting for fish catch from the main gear, the fisher may use another type of gear to augment the catch. The fisher then comes back after some time of at least 30 minutes to check the single hook and line with float. The presence of catch is detected by the irregular movement of the gear's floater. When there's already catch the fisher then retrieves the gear.

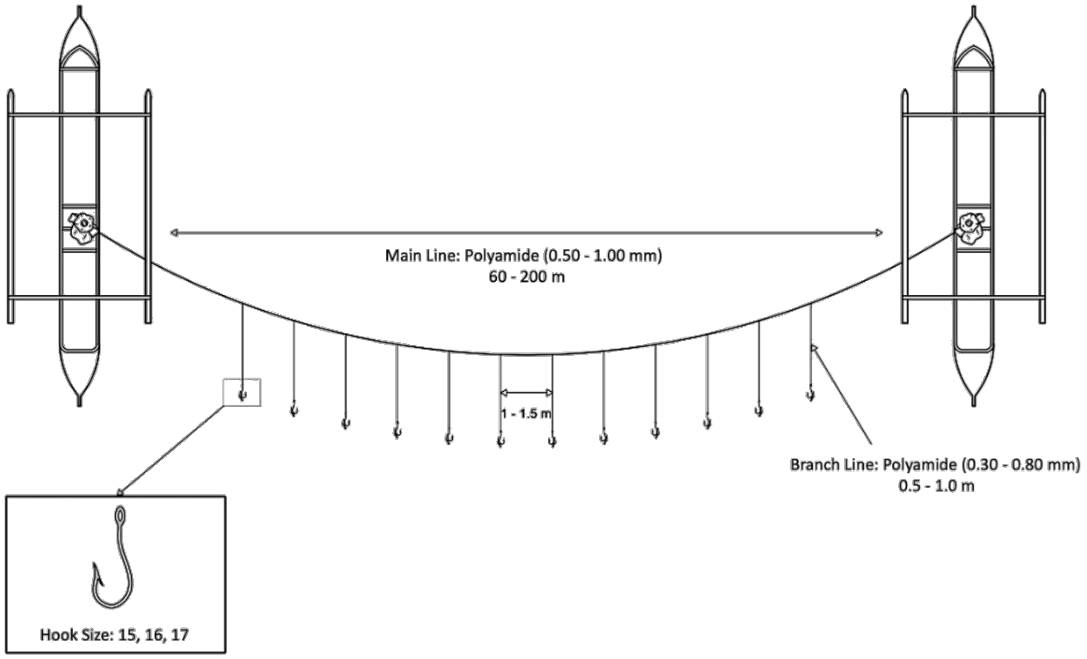

Figure 5. An illustration showing the operation and specifications of paired troll line/two-boat troll line

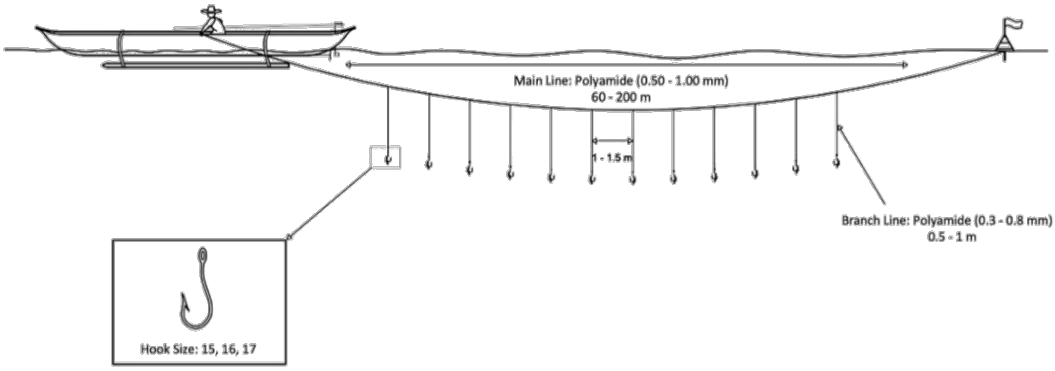

Figure 6. An illustration showing the operation and specifications of a paired troll line with a buoy/floater

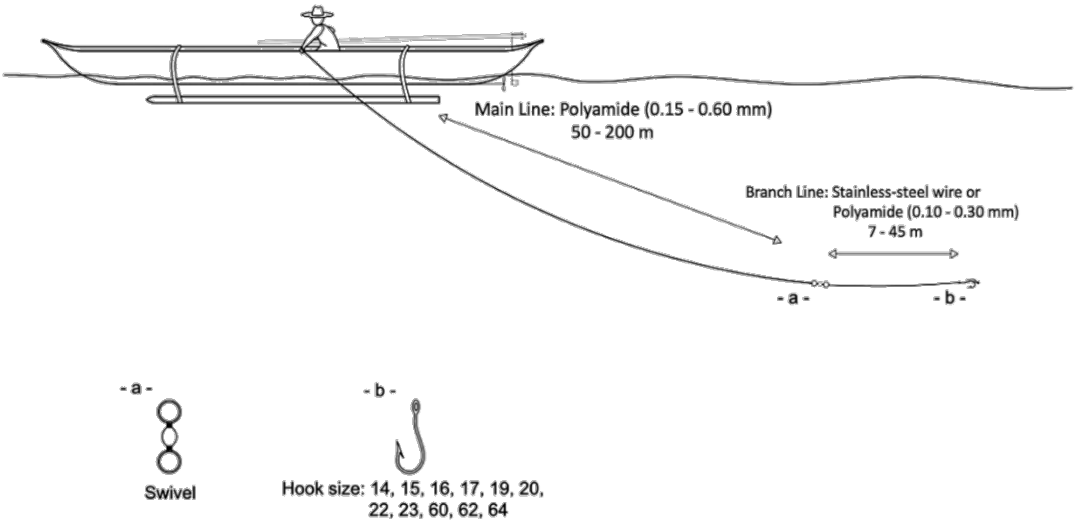

Figure 7. An illustration showing the operation and specifications of a single troll line

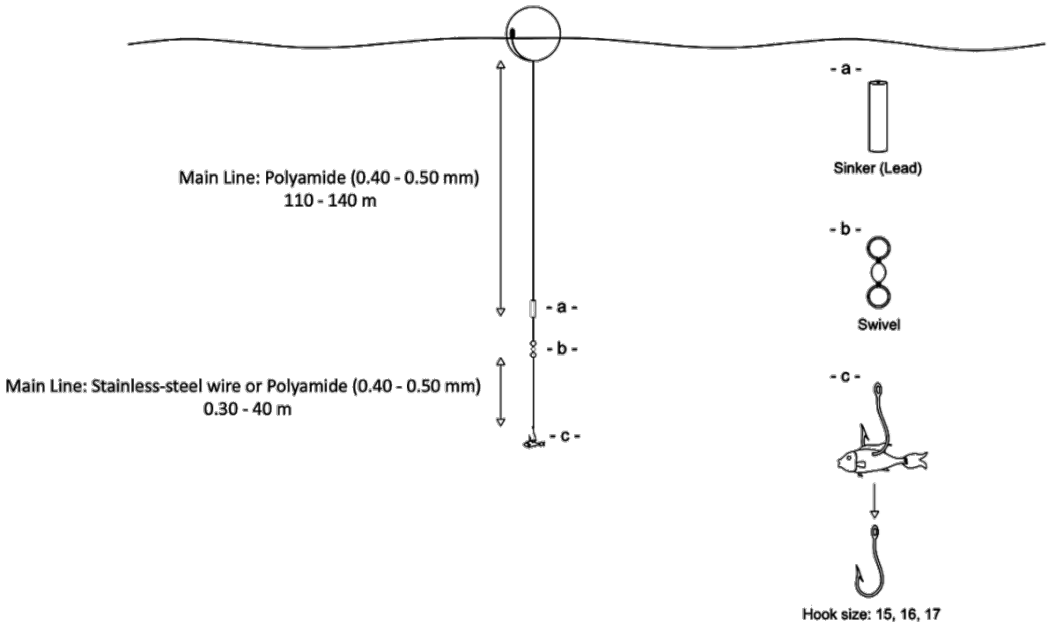

Figure 8. An illustration showing the operation and specifications of a single hook and line with float

Catch Rate

The catch rate of the small-scale tuna fishery in the selected study sites was expressed through catch per unit effort (CPUE) in terms of kilogram per hook (kg/hook) for the paired troll line, and kilogram per fishing hour (kg/h) for the single troll line. The most commonly used CPUE for hook and line gears is kg/h, however, kg/h is used for the latter gear since it has only one hook. Records on the fishers' fishing efforts which included the number of boats used, size and number of hooks used, number of hours spent every fishing trip, and their total catch (kg) were gathered through regular weekly field visits to the landing sites. Sampling was done randomly and data were recorded as soon as the fisher has landed from the fishing trip. The data on the fishing effort as well as the CPUE of the two fishing gears (paired troll line and single troll line) are shown in Table 6.

Table 6. Fishing effort and average catch per unit effort of small-scale tuna fishery in the selected landing sites in Leyte, Eastern Visayas, Philippines

Variables	Municipality		
	Tolosa	Dulag	Mayorga
Paired troll line			
Number of hooks used			
Average	11±1.00	12±0.00	13±1.00
Range	10 – 12		11 – 15
Number of hours spent			
Average	7±1.05	8±0.00	8.33±0.52
Range	6 – 8		8 – 9
Total Catch (kg)			
Average	24.90±13.23	5.88±0.53	15.83±9.09
Range	4 – 49	5.5 – 6.25	5.5 – 25.25
CPUE (kg/hook)			
Average	2.31±1.39	0.49±0.04	1.29±0.80
Range	0.33 – 4.70	0.46 – 0.52	0.46 – 2.16
Single troll line			
Number of hooks used	-		
Average	-	1±0.00	1±0.00
Range	-	1	1
Number of hours spent	-		
Average	-	6±0.00	8±.1.00
Range	-	6	7 – 9
Total Catch (kg)	-		
Average	-	2.25±0.00	7.25±3.85
Range	-	2.25	3 – 10.5
CPUE (kg/h)	-		
Average	-	0.38±0.00	0.89±0.44
Range	-	0.38	0.43 – 1.31

Table 7. Catch species composition recorded during the actual sampling

Local Name	Common Name	Scientific Name	Number of Individuals	Percentage Composition (%)
Tuna species				
Baragsikol	Longtail Tuna	*Thunnus tonggol*	53	50.48
Baragsikol	Bigeye Tuna	*Thunnus obesus*	23	21.90
Turingan/Bagaongon	Eastern Little Tuna	*Euthynnus affinis*	19	18.10
Mangko/Lison	Frigate Tuna	*Auxis thazard*	4	3.81
Sub-total	99	94.29		
Other species				
Kalapion	Torpedo Scad	*Megalaspis cordyla*	4	3.81
Tangige	Narrow-barred Spanish Mackerel	*Scomberomorus commerson*	2	1.90
Sub-total	6	5.71		
Total	105	100		

Catch Composition

Dickson & Natividad (2000) reported that the local tuna fishery in the Philippines is comprised of six major species including yellowfin tuna *Thunnus albacares*, skipjack tuna *Katsuwonus pelamis*, bigeye tuna *T. obesus*, bullet tuna *Auxis rochei*, eastern little tuna *Euthynnus affinis*, and frigate tuna *A. thazard*. This study recorded a total of six species during the entire actual catch sampling which included four tuna species and two other fish species (Table 7). The tunas which are the primary target species of the fishers included: 1) longtail tuna *T. tonggol*, 2) *T. obesus*, 3) *E. affinis*, and 4) *A. thazard*. The other two species included: 1) torpedo scad *Megalaspis cordyla* and 2) narrow-barred Spanish mackerel *Scomberomorus commerson*. However, it shall be noted that these samples were only from the paired and single troll line gears since during peak seasons, these gears are widely used for fishing tunas. No catch from single hook and line with float were recorded since this was not used by the fishers during the actual sampling period.

In the collective data during the actual sampling from the three municipalities regardless of the type of gear used, the samples were dominated by *T. tonggol* (50.48%) followed by *T. obesus* (21.90%) and *E. affinis* (18.10%). The least caught tuna species was *A. thazard* (3.81%). The remaining 5.71% was comprised of *M. cordyla* (3.81%) and *S. commerson* (1.90%). In a pole and line fishery in Indonesia, Nainggolan et al. (2017) reported that the catch was comprised of *K. pelamis* (72.7%), *T. albacares* (24.5%), *A. rochei* (2.8%). The *K. pelamis* was also the most dominant species caught in the Zambales Coast, followed by *T. albacares*, and *T. obesus* (Yutuc et al., 2018).

Though there were only two non-tuna species recorded during the actual sampling, fishers mentioned during the face-to-face interviews other species that are also caught by tuna fishing gears which include dolphin fish, blue marlin and shark. These results show that most of the bycatch species of the tuna fishery in the small-scale tuna fishery in Leyte are of commercial value.

Perceptions and Current Perceived Issues in Tuna Fishery

According to the face-to-face interviews with the respondents, tuna fishing is equally profitable in comparison to other fishery since tunas have high market value and are much larger. Thus, it has more weight and sells more expensive per piece. However, the most common challenge in tuna fishing is the seasonality of these species. Since these are migratory species, they do not occur permanently in a specific fishing area for a longer period of time. Recently, seasons of tunas are unpredictable since they depend on the availability of their food particularly smaller fishes such as anchovies and sardines. If preys are not available, so as tunas. One of the major reasons to such decline in the preys of tunas according to the fishers is the operation of illegal fishing particularly seining, trawling, as well as the operation of bag nets which target these smaller-sized fishes. Unfavorable weather conditions also hinder their fishing operation. Further, the continuous oil price hike affects the frequency of their fishing trips since they cannot afford to buy expensive fuel.

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Border restriction is also one of the issues raised by the tuna fishers since some reach to other municipal waters. Thus, these small-scale tuna fishers suggest to lift the strict ordinance about the border restriction of municipal waters. This ordinance restricts fishers to enter the municipal waters under other local government unit or municipality. The fishers added that they only have limited fishing areas due to this restriction, thus, they have lesser catch. They also suggested to strengthen the policies that prohibits illegal fishing in their localities. Minimal assistance on providing of materials for their fishing gear is also of great help for them. Similar issues were reported in the tuna fishing in Pangasinan wherein the high cost of fuel is also considered the primary issues of the fishers (Mendoza et al., 2023). Other issues included decline in fish catch, increasing number of fishers, illegal fishing activities, among others. In Sogod Bay, Southern Leyte, various issues and concerns in the frigate tuna industry including the presence of large-scale commercial fisheries, illegal fishing, pollution, and poor implementation of the fisheries laws were reported (Ratilla et al., 2016).

Conclusion

This study is the first to present a comprehensive information about the municipal or small-scale tuna fishery in the province of Leyte, Eastern Visayas, Philippines. The fishery can be regarded as selective and non-destructive, based on the types of fishing gear and practices employed by the fishers. The results may serve as a baseline for monitoring and understanding the status and performance of the fishery, aiding in the formulation of management plans for the development and sustainability of the small-scale tuna fishery in the province, and region-wide eventually. Continuous monitoring is necessary to better comprehend the dynamics of the fishery. Additionally, recognizing the migratory behavior of tuna species, adjacent municipalities and provinces surrounding the tuna fishing grounds particularly San Pedro Bay and Leyte Gulf are encouraged to collaborate in crafting and implementing a harmonized and holistic management strategy that ensures effective resource management and promotes equity among tuna fishers and other stakeholders.

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Compliance With Ethical Standards

Authors' Contributions

COR: Conceptualization, Investigation, Data curation, Formal analysis, Writing – original draft

RMPG: Conceptualization, Data curation, Formal analysis, Writing – review & editing

All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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Data Availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

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