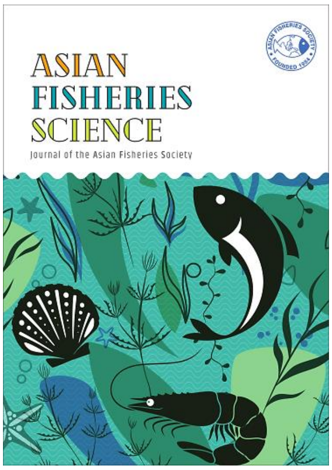

Design and Operation of "Siklob", a Mechanised Falling Gear Operated in Northern Iloilo, Philippines

CHRISTIAN JAMES MORALES
Institute of Marine Fisheries and Oceanology, College of Fisheries and Ocean Sciences, University of the Philippines Visayas, Miagao, Iloilo 5023, Philippines

E-mail: ccmorales2@up.edu.ph | Received: 29/07/2021; Accepted: 04/12/2021

E-ISSN: 2073-3720
https://doi.org/10.33997/j.afs.2021.34.4.003

Abstract

Fisheries in the Philippines is multispecies, and this is seen with the wide variety of fishing gears used in major and minor fishing grounds in the country. These gears constantly face modification and development to improve catch quality, quantity, and overall efficiency. This study investigated the features of "siklob", a mechanised falling gear operated along the municipal waters of Northern Iloilo, Philippines. Some coastal residents claimed that fishers use fine mesh nets for this gear, and this was because of some incidences of the capture of very small fish. Results of this study, however, indicate that the mesh size of nettings used for "siklob" is 4.35 cm, which is above the minimum set by the national law (3 cm). The gear is operated offshore, in a fishing vessel, with lights and fish-finding devices. The catch included an array of pelagic to benthic species, with *Sardinella gibbosa* (Bleeker, 1849) as the top species. The catch per unit effort values for two fishing operations were 17.40 kg.cast^{-1} and 16.5 kg.cast^{-1}, respectively. If a management plan for the gear is to be implemented in the area, it would be necessary first to study the spawning seasons of commercially important species and impose closed fishing seasons. Before any attempt to ban or control the use of the gear, it is necessary first to understand the gear design, performance, and selectivity.

Keywords: "siklob", falling gear, fine mesh net, small pelagics, CPUE

Introduction

The Philippines is an archipelagic country surrounded by bodies of water that serve as marine highways and provide food and livelihood to many coastal communities. About 70 % of Filipinos live in coastal areas (Santos, 2011), where fishing is the main occupation. However, Philippine capture fisheries continue to face decreased production caused by unsustainable use of resources. Driven by poverty in the face of the growing population, fishers are pushed further, and they must find ways to provide for their household. The ingenuity of fishers continues to drive the search for ways to generate high production in quality and quantity with minimal fishing effort and impact on the environment. This has caused significant development in fishing technology through the years and resulted in increased catch and better post-harvest practices. Some resort to illegal fishing with prohibited and dangerous gears and methods that cause harm to marine organisms, the environment, the fishers, and consumers.

The development of suitable fishing methods should maximise economic benefits and sustainable use of marine resources (Chando, 2005). In some cases, it will be necessary that technological improvement, active avoidance of areas and seasons of high bycatch rates, and other management actions be combined to achieve preferred results (Valdemarsen and Suuronen, 2002). The multispecies fishery in the Philippines hosts a wide variety of fishing gears and methods constantly evolving to fit the fishers' needs. Other factors considered include the characteristics of the fishing ground, behaviour of the target species, and economic viability. Fishing gears are modified – fishers use other materials as alternatives (such as netting, lines, and baits), gears are upscaled or downscaled, adjusting the net height (Picoy-Gonzales and Monteclaro, 2017), and advanced technologies such as lights and sonar are being integrated into traditional techniques, while preserving the basic principles of fish capture such as gilling, scooping, and covering. This is a common scenario in coastal communities, where artisanal and subsistence fisheries are prevalent. Advancement, however, also bear consequences, especially when its power is abused. In some cases, this may be seen as overharvesting or excessive extraction of a common natural resource in a typical fishing ground.

Along the municipal waters of Concepcion, San Dionisio, Batad, and Estancia in Northern Iloilo, Philippines, the western portion of the Visayan Sea lights up at night. These lights come from seasonal stationary lift nets, and cruising and anchored fishing boats. One of the gears giving light to the sea is "siklob" - an upscaled, mechanised cast net that uses lights to aggregate fish and capture small pelagic fish, such as sardines (Clupeidae), anchovies (Engraulidae), scads (Carangidae), mackerels (Scombridae), and ponyfishes (Leiognathidae). Though relatively undocumented, there were claims that "siklob" can catch very small fish due to the use of fine mesh netting. No regulations exist, as no recent scientific studies prove or disprove the existing claims. This study was conducted to review the performance of "siklob" as fishing gear. The specific objectives were a) to describe the gear, vessel, and fishing method; b) identify the species caught and present the length classes of the top species caught; and c) calculate the catch per unit effort (CPUE) of "siklob".

Materials and Methods

The study was conducted from 16–30 October 2017, with prior communication to a fishing vessel operator in Alinsolong, Batad, Iloilo, Philippines. The coastal community thrives by fishing with crab traps and nets, baby otter trawls. It is the only coastal community in the municipality that operate about 30 units of "siklob" aside from the neighbouring towns of Estancia, Concepcion, and San Dionisio, Iloilo. The adjacent Visayan Sea provides them with marine resources utilised as food, processed, or sold to the market for income. Some fisherfolk sell discards (small, low-value fishes) to fish farmers within the area or otherwise throw them away.

Description of fishing gear, vessel and accessories, and fishing method

Basic information on the fishing gear (material, operation, catch, and seasonality) was acquired by a one-on-one interview with a "siklob" boat captain. An actual visit of the fishing vessel was conducted to inspect the fishing gear and vessel's properties, including its accessories. The technical characteristics of the gear were recorded, including its accessories (sinkers, rings, and other accessories), and were validated by an interview with six "siklob" fishers in Barangay Alinsolong, Batad, Iloilo (Fig. 1). Mesh size was measured using a ruler. To observe and document the fishing method, the researcher joined fishing operations.

Fig.1. Map showing the coastal municipalities in Northern Iloilo where "siklob" is operated (in yellow). Star symbol indicates Barangay Alinsolong, Batad, Northern Iloilo, Philippines, where interviews and fishing vessel was boarded to inspect "siklob" and witness its use for fishing.

Catch identification and measurements

One of the vessels used for "siklob" was boarded to collect samples. The total weight of the catch per fishing operation was measured and recorded onboard. From thereon, a random number of samples were collected per species caught. Samples were put in a styrofoam box with iced seawater and transported to the mini laboratory near the study site. The samples' weight (in grams), standard length (SL, in mm) and total length (TL, in mm) were measured using a digital weighing scale (ELB3000, Shimadzu, Japan) and a digital Vernier calliper (ABSOLUTE Digimatic Calliper Series 551, Mitutoyo, Japan). Species identification was guided by the works of Matsunuma et al. (2011), Yoshida et al. (2013), and Motomura et al. (2017).

Catch per unit effort

To determine the effort needed to catch a kilogram of fish, catch per unit effort (CPUE) was calculated. The number of casts was used as a unit for effort, as recommended by FAO (1999) for cast nets, thus resulting in the formula:

$$\text{CPUE} = \frac{\text{Weight of catch (kg)}}{\text{Number of casts}}$$

Results

Interview with six fishers in Barangay Alinsolong in Batad, Iloilo revealed that "siklob" describes the fishing gear and methods. The technology owes its design and principle of fish capture to the traditional cast net, where fishes get trapped within the circular section that spreads out when the net is hurled (Edo, 2008). "Siklob" is used on a fishing vessel in deeper waters, aided by portable sonar (Humminbird PiranhaMAX 165PT, USA) that shows data on fish availability and depth. Identified fishing areas were within the municipal waters of San Dionisio, Concepcion, Batad, and Estancia (Fig. 1) – up to 15 km from the shore, with depths of 10–15 fathoms.

Fishing gear description

"Siklob" is divided into three main parts: the top layer (pocket), middle layer, and the bottom layer. The pocket and the bottom layer nettings are made of polyethene (PE, Ø 1.5 mm), while the middle layer is made up of monofilament polyamide (PA, Ø 0.60 mm) netting (knotted) (Fig. 2A). These sections are joined together to form a conical net (Fig. 3A). The lower layer is joined to the middle layer by a 1:2 hanging ratio, skipping one mesh in between. The same ratio is used to join the rest of the netting up to the pocket. The mainline (PE rope, Ø 12 mm) at the bottom layer is threaded with ~200 lead (Pb) barrel-type sinkers. Four five-kilogram and a seven-kilogram stones are wrapped in PE (Ø 1.5 mm) knotted netting and are tied into the mainline equal distances from each other. These stones provide more sinking force to the gear. Also, along the rope are stainless steel (SST) rings (Ø 10 mm) that support deployment and hauling. Table 1 presents a summary of the gear and vessel specifications.

Fishing vessel and accessories

Wooden fishing vessels are used for "siklob". Overall length (Loa) of vessels ranged from 7–9 m, powered by 22 hp (Kubota 950, Japan) engines. The design can be compared to "basing" (bag net), only that the capture mechanism of the supported gears is the exact opposite. As illustrated in Figures 2B and 3B, there are five bamboo poles (~5 m length) attached to the vessel, with pulleys at the ends where the stone sinkers are pulled into to spread the bottom layer of the gear before deployment (Fig. 4A). Two wooden mechanical hauliers (bow and stern) support gear deployment and hauling. Also on board is a 7 hp gasoline generator to support the 17 lights used for aggregating fish beneath the fishing vessel. Six were yellow (wattage not indicated), while 11 were white incandescent bulbs (100 W). Some vessel areas are dedicated for cooking and for placing styrofoam boxes (see Fig. 3B).

Fishing method

The fishing crew prepares the gear and necessities at late noon (1600–1700 h) before setting off to sea. During the cruise, one or two men begin to look for floating markers that indicate fishing areas. Common fishing areas for "siklob" are along the municipal waters of Concepcion, San Dionisio, Batad, Carles, and Estancia, which were among the list of illegal fishing hotspots in Northern Iloilo, Philippines (Tayona, 2019). The engine is stopped around an identified fishing area, and the anchor is lowered to maintain its position. Occasionally, the boat crew do squid jigging while the master fisherman monitors fish abundance beneath the vessel. When there is enough fish on the screen, the crew are ordered to prepare for the deployment of the gear.

The crew starts to pull in the lines that move the stone sinkers toward the pulleys at each pole's end. This spreads the bottom layer of the gear beneath the vessel (Fig. 4A). The master fisherman then turns off the lights onboard and switches on the lights directed to the water. He then observes fish aggregating beneath the vessel and signals to release the stones when there is enough fish aggregation. The bottom layer falls into the water in a circular form and continues to sink, bringing the rest of the gear to form an umbrella underwater that covers the fish (Fig. 4B). In about three minutes, the gear is hauled by pulling up the line attached to the pocket. This partially shortens the spread diameter of the gear and aggregates the four 5 kg stones toward the 7 kg stone until the mouth closes partially (Fig. 4C). As it goes up, a line connected to the bottom layer's mainline is pulled up to finally close the bottom layer and bring it onboard (Fig. 4D). The hauliers on the bow and stern assist hauling. The bottom layer of the gear is then pulled up closer to the pocket (Fig. 4E) to avoid the escape of fish captured by falling off. The rest of the gear is then taken onboard for catch retrieval. One of the crew members does the sorting and puts them in iced seawater in styrofoam boxes, while the others remove the fish entangled in the middle layer of the netting. If the catch is sufficient, a single cast is enough, and the fishers can go home early to sell their catch. If not, they get ready for another casting, depending on the availability of fish in the area. In times like these, other marked areas are visited in hopes of higher and better catch volumes. A single fishing operation lasts about 45 min.

Catch composition

Two of the six fishing operations have shown that "siklob" can capture species from top to bottom. This was demonstrated by the catch composition represented by both pelagic and demersal species (Table 2). The finfish family with the greatest number of species was Leiognathidae, with five species from four representative genera. The second was Carangidae, which had representatives from three genera. Mullidae had two representative species from two genera.

Ponyfishes (Leiognathidae) commonly made up the bulk of the catch, followed by some scads and trevallies (Carangidae). Other groups captured were

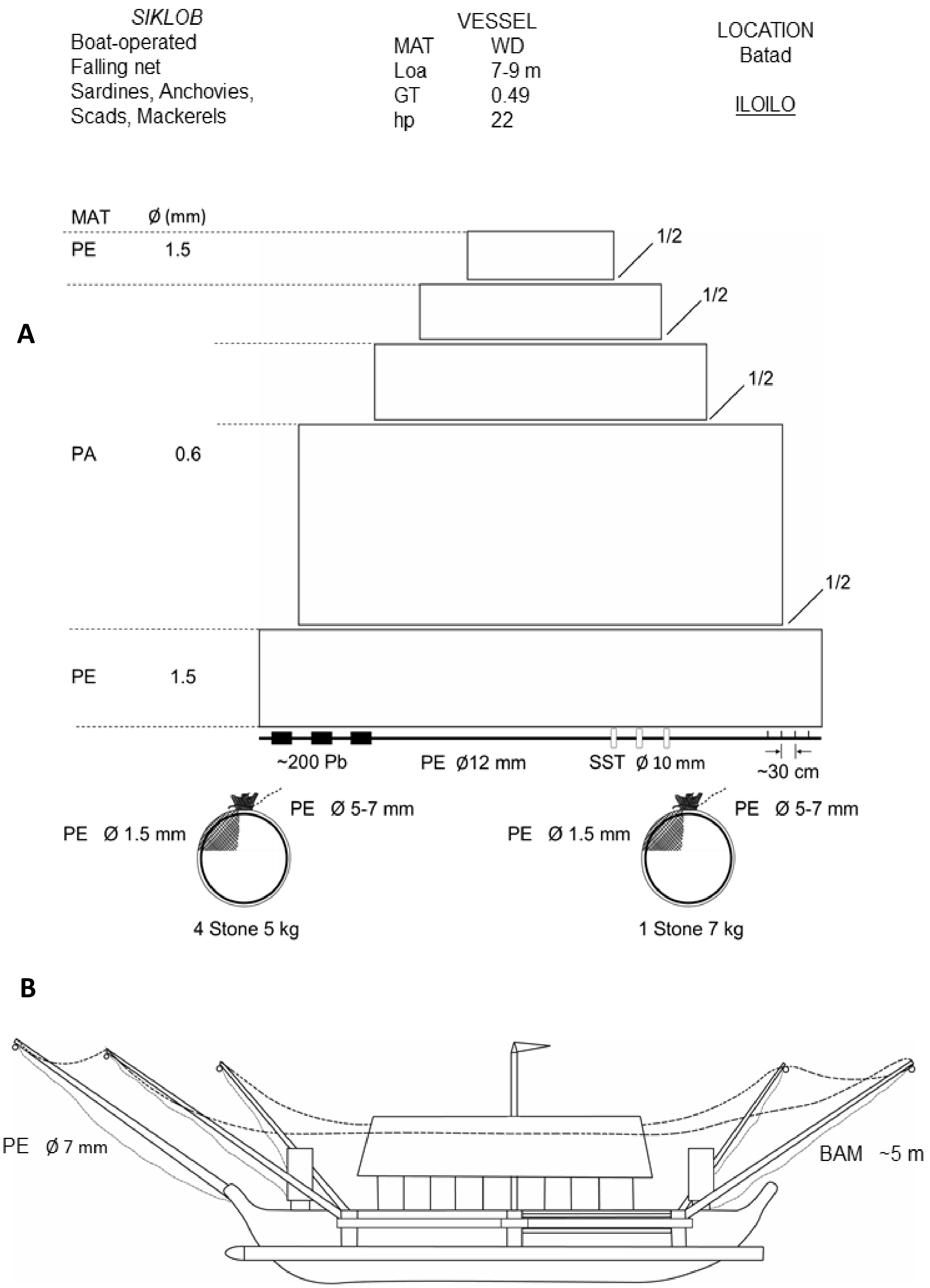

Fig. 2. "Siklob". A: Design and technical specifications of "siklob"; B: Lateral view of the fishing vessel used for "siklob". MAT-material; WD-wood; Loa-length overall; GT-gross tonnage; hp-horsepower; Ø-diameter; PE-polyethene; PA-polyamide; Pb-lead; SST-stainless steel; BAM-bamboo.

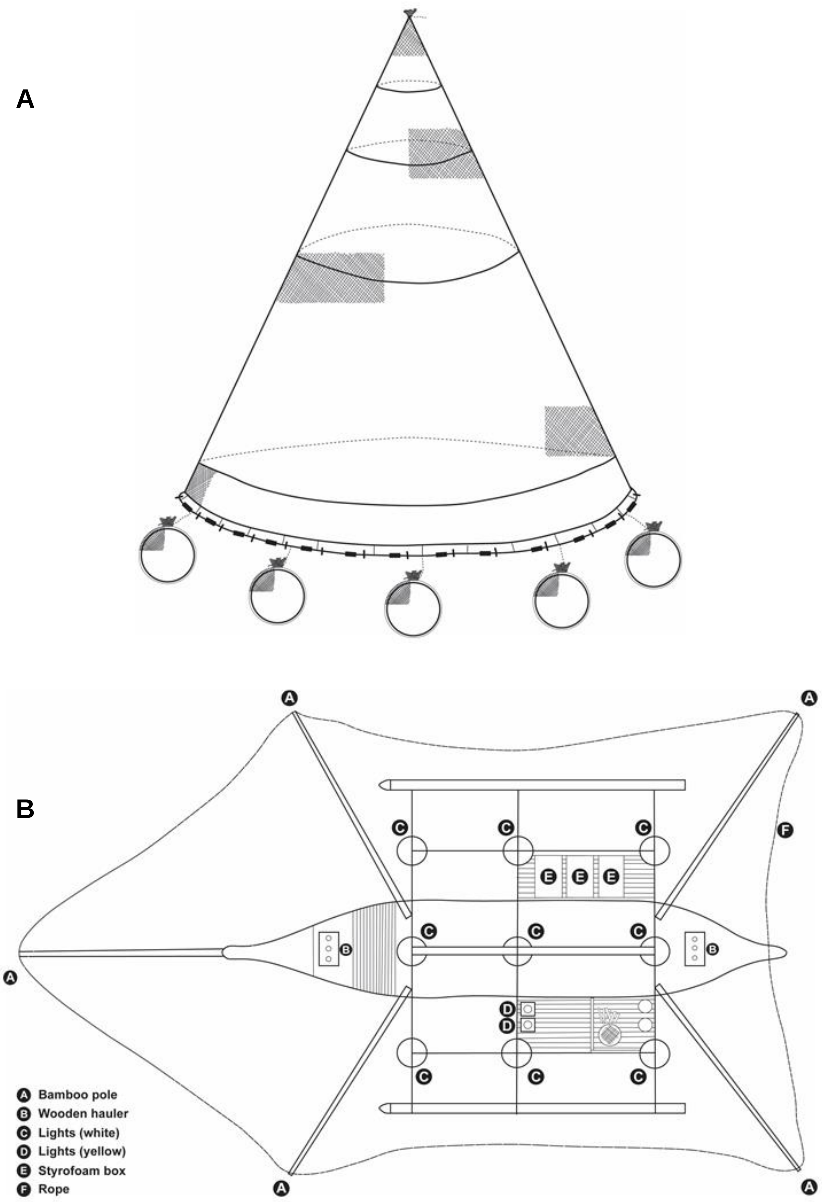

Fig. 3. A: Actual structure of "siklob"; B: Parts of the fishing vessel and its accessories.

Table 1. Summary of the gear and vessel specifications from interviewed fishers in Barangay Alinsolong, Batad, Iloilo.

Component	Description
Gear	
Netting	Polyethene (PE) Ø 1.5 mm Polyamide (PA) Ø 0.6 mm
Mainline	PE Ø 12 mm
Sinker	Lead (Pb)
Rings	Stainless
Mesh type	Upper and bottom layer (PE) = knotted Middle layer (PA) = knotted
Mesh size	Upper and bottom layer (PE) = 3 cm Middle layer (PA) = 4.35 cm
Total gear length	16–31 m
Net mouth opening (circumference)	~260 m
Vessel	
Overall length (LOA)	7–9 m
Horsepower (hp)	22
Gross tonnage (GT)	0.49

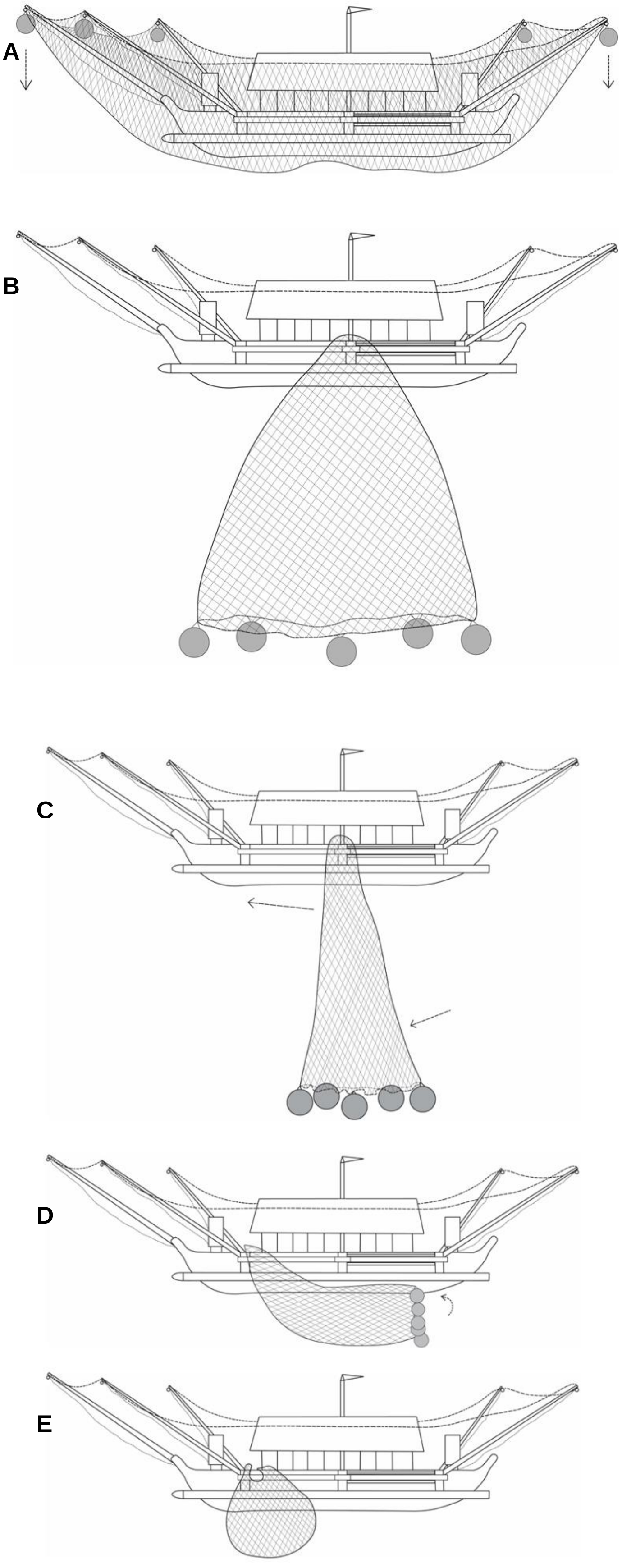

Fig. 4. Fishing with "siklob". A: Lines are pulled to bring the stones toward the pulleys at the end of each bamboo pole. This spreads the netting on the bottom of the vessel. B: The stones are lowered into the water at once, creating a circular, umbrella-like figure as it sinks to the bottom. C: Hauling. The pocket is pulled up into the vessel, which aggregates the four 5 kg stones toward the heaviest, 7 kg stone (1), then the pocket is brought towards the bow deck (2). D: The mainline is pulled upward toward the vessel to close the bottom layer and bring it onboard. E: The bottom layer is pulled closer to the pocket until the gear is entirely brought on board to unload the catch.

Table 2. Catch composition of "siklob" from the two fishing operations.

Family	Scientific name	English name
Carangidae	*Carangoides coeruleopinnatus* (Rüppel, 1830)	Coastal trevally
	Caranx sp.	
	Selaroides leptolepis (Cuvier, 1833)	Yellowstripe scad
Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Goldstripe sardinella
Leiognathidae	*Equulites oblongus* (Valenciennes, 1835)	Oblong ponyfish
	Equulites stercorarius (Evermann and Seale, 1907)	Slender ponyfish
	Eubleekeria jonesi (James, 1971)	Jones' ponyfish
	Leiognathus equulus (Forsskal, 1775)	Common ponyfish
	Secutor hanedai (Mochizuki and Hayashi, 1989)	Haneda's ponyfish
Mullidae	*Upeneus guttatus* (Day, 1868)	Two-tone goatfish
	Upeneus sulphureus Cuvier, 1829	Sulphur goatfish
Priacanthidae	*Priacanthus tayenus* (Richardson, 1846)	Purple-spotted bigeye
Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Jarbua terapon
Tetraodontidae	*Lagocephalus spadiceus* (Richardson, 1845)	Half-smooth golden pufferfish
Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Largehead hairtail
Sphyraenidae	*Sphyraena obtusata* Cuvier, 1829	Obtuse barracuda
Loliginidae	*Loligo vulgaris* Lamarck, 1798	European squid
	Loligo sp.	
Penaeidae	*Penaeus monodon* Fabricius, 1798	Tiger shrimp
Portunidae	*Portunus pelagicus* (Linnaeus, 1758)	Blue swimming crab

from the finfish families Clupeidae (sardines), Mullidae (goatfishes), Priacanthidae (bigeyes), Terapontidae (grunters, tiger perches), Tetraodontidae (pufferfishes), Trichiuridae (hairtails), and Sphyraenidae (barracudas). Among the bycatch and discards group were squids (Loliginidae), shrimps (Penaeidae), and crabs (Portunidae). These groups of molluscs and crustaceans are commonly caught in very small numbers (three to six individuals), along with some non-targeted fish species.

Length frequency distribution

The length frequency distribution for the three representative species, *Sardinella gibbosa* (Bleeker, 1849), *Equulites oblongus* (Valenciennes, 1835), and *Carangoides coeruleopinnatus* (Rüppell, 1830) are presented in Figure 5. Samples of *S. gibbosa* ranged from 106.63 mm–131.42 mm (total length, TL), with an average of 120.89 ± 5.25 mm (mean ± SD). For *E. oblongus*, the average TL was 95.78 ± 9.41 mm, with sizes that ranged from 76.69 mm–122.48 mm. Finally, for *C. coeruleopinnatus*, sizes ranged from 104.48 mm–162.52 mm. The average TL was 143.25 ± 8.86 mm.

Catch per unit effort

Computations for the catch per unit effort has given a picture of the volume of fish (in kilograms) that "siklob" can produce in a single fishing operation. In this

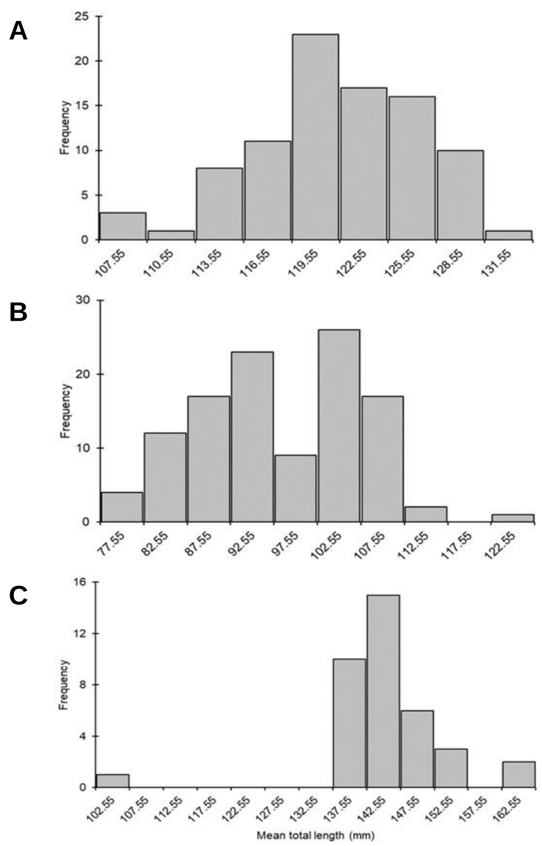

Fig. 5. Length frequency distribution of samples from the three most dominant species. A: *Sardinella gibbosa*; B: *Equulites oblongus*; C: *Carangoides coeruleopinnatus*.

study, the number of casts per fishing operation was used as a unit of effort. CPUE for the first and second fishing operations were 17.40 $kg.cast^{-1}$ and 16.5 $kg.cast^{-1}$, respectively, with an average value of 16.95 ± 0.64 $kg.cast^{-1}$. This shows increased production with an increase in the amount of fishing effort.

Discussion

Fisheries continue to grow, evolve, and emerge (Levesque, 2010). This was evident in the number of advancements that have appeared in fishing fleets, whose capabilities are expanded in terms of distance, fish-finding ability, better deck equipment, more durable materials, greater catch numbers, and better post-harvest handling practices. These changes seen are from years of studying fish behaviour, prevailing currents, topography, environmental variables and changes through time, and cost-efficiency. It is important, however, to consider the possible effects to marine organisms, habitats, and the environment, in general.

"Siklob" is a product of the fishers' ingenuity in developing ways to capture aquatic organisms. It is believed to have originated from Estancia, Iloilo, where "siklob" becomes a shifting path from *Likos* (encircling gill net) (Morales et al., unpublished data). The gear design and catching principle are comparable to the traditional cast net (Fig. 2A), only that it is upscaled and mechanised. The comparative differences between the traditional cast net and "siklob" are summarised in Table 3.

Cast nets are limited to nearshore in shallow waters and are manually cast by hand. "Siklob", on the other hand, relies on mechanical deployment and hauling with deck equipment for fishing offshore in deeper waters. Comparing the gear design and structure, cast nets and "siklob" are identical (Nedelec, 1975, pp. 104–105; this study, Fig. 2A). "Siklob" has upper and lower layers reinforced by PE nets – the former serves as pocket, the latter as support to the sinkers. The types of netting used in "siklob" allow two principles of capture: covering and entangling. The middle layer of the netting is made of PA (Fig. 2A), a material also used for gill nets and cast nets (e.g., Nedelec, 1975; Ruangsivakul et al., 2004). The top and bottom layers are made of polyethene (PE) netting that allows less entangling and easy retrieval of catch from the pocket. The PE netting at the bottom layer provides better support for carrying the weights.

Cast nets are among the oldest and most effective active gears to capture small to medium-sized fish (Emmanuel et al., 2008; National Geographic, 2012). It is one of the few fishing gears classified under "falling gears" (see He et al., 2021). Cast nets are exclusively artisanal and are operated at up to 4 m depths (Emmanuel et al., 2008). They can be operated all year round but are more productive during the dry season (Emmanuel and Kasemiju, 2005). "Siklob", on the other hand, is operated from a boat to be able to fish in deeper waters, a larger area, and with the aid of a fish-finding device. This makes it easier to locate fish, leading to less fishing effort (i.e., fishing time). The gear can be operated all year round, are most productive during the dry season. Cast nets can also be operated from a boat, but requires a high-precision throw and fish spotting ability from a skilled fisher to form a circular enclosure that will cover the target fishes. Falling nets have been operated in China and

Table 3. Comparison between the major properties of the traditional cast net and "siklob".

Component	Cast net (Traditional)	"Siklob"
Parts	Upper – net band[a]	Upper – pocket
	Middle – conical mesh[a]	Middle – conical mesh
	Lower – weighted[a]	Lower – weighted
Pocket	Present/absent	Present
Length and diameter (spread)	Length: 2.0–3.5 m[a]	Length: 16–31 m
	Length: 4.20–7.11 m[b]	
	Diameter: 3–7 m[a]	Diameter: 82.3 m
Weights	Lead, barrel-type, along bottom layer circumference	Lead, barrel-type, along bottom layer circumference; 5 stones [5 kg (4) + 7 kg (1)]
Netting material	Polyamide, cotton	Polyamide and polyethene
Fishing depth	1.0–1.5 m[a]; 4 m[c]	10–15 fathoms (18–27 m)
Fishing operation	Daytime[a]; with or without boat	Night-time; with boat
Gear deployment (casting) and hauling	By hand	Mechanised
Fish attraction device	Processed cassava (*Manihot utilisima*)[d]	Lights
Fish detection	Visual	SONAR (Fish finder)

a – Edo (2008); b – Azeez (1997); c – Emmanuel et al., 2008; d – Udolisa and Solarin (1979).

other Asian countries since the 1990s (Chen and Song, 2013; Zhao et al., 2017 - cited in He et al., 2021), and are operated on a larger scale. These also use lights that aggregate fishes underneath the fishing vessel. This takes advantage of phototaxis – the ability of organisms to move in response to light. This makes these gears, including "siklob", very effective during the dark moon phases. Moon phases are known to influence the availability of some marine species (Yan et al., 2015). Offshore operations of lighted falling nets (Zhang and Yang, 2010) are deemed less destructive to marine habitats and more species-selective (Wu et al., 2016). Lighted falling nets that are operated by Chinese fishing fleets along the Spratlys in the West Philippine Sea catch larger pelagic cephalopods and fishes, such as the purple flying squid *Sthenoteuthis oualaniensis* (Lesson, 1830), yellowfin tuna *Thunnus albacares* (Bonnaterre, 1788), skipjack tuna *Katsuwonus pelamis* (Linnaeus, 1758), and Japanese scad *Decapterus maruadsi* (Temminck and Schlegel, 1843) at commercial scales (Jiang et al., 2018). In this area, according to Wu et al. (2016), the months of February to June give the most favourable weather conditions for lighted falling net fishing.

"Siklob" was developed to capture small pelagic fishes such as the seasonal sardines (Clupeidae) and anchovies (Engraulidae), as well as ponyfishes (Leiognathidae) and scads (Carangidae). The main targets, according to Morales et al. (unpublished data), also include roundscads (*Decapterus* spp.) and mackerels (*Rastrelliger* spp.). Small pelagics are known for their short life cycles (Alheit, 2002) and very high potential productivity (Marshall, 1984). They make up 20–25 % of the total global annual catch (ICES, 2012). Small pelagics also serve as indicators of climate-influenced changes in the marine environment (Peck et al., 2013). In this study, catches were represented by pelagic to benthic array of species (Table 1). The demersal counterparts were represented by species known to inhabit sandy, rocky, and muddy substrates such as Mullids and Terapontids. Parts of these substrates are brought with the net onboard in some fishing episodes, especially in shallow fishing grounds. In events of cephalopod mollusc capture, the size and volume would dictate whether they stay on board or be thrown back into the sea.

The study was conducted during the onset of Northeast Monsoon. During this season (November to early March), cold, dry northeast winds predominate. These winds, according to fishers, affect their fishing activities and pose safety risks for the gear, the vessel, and most significantly, the fishing crew. Southwest monsoon, on the other hand, brings strong south-westerly winds. These times of the year, according to the fishers, are more favourable because the sea is calmer, hence the better catch volumes with less fishing times. Monsoon winds play a significant role in fish reproduction and recruitment (Abesamis and Russ, 2010), thus their abundance levels. They cause coastal upwellings that make waters more productive and nutrient rich.

The sizes of fish captured by "siklob" are the main concern of some citizens and implementing agencies in Northern Iloilo. This has led to assumptions that fishers are using fine mesh netting for their gears. However, an inspection of the nettings used has shown that the mesh size (4.35 cm) is above the legal mesh size (>3 cm) that is permitted by the law (Philippine Fisheries Code of 1998). Cast nets are selective to smaller size ranges (Welcomme, 2001). Deinye et al. (2018) reported that cast net catch decreases as the mesh size increases and juveniles make up most of the catch. Larger, faster-moving fish can escape while the net is falling, but during the process, they may become entangled (Welcomme, 2001). None of the fishing operations conducted during the study period could catch large, fast-swimming fish. Their detectability to the sonar is also limited, as their swimming speed is higher than the transmission of sound waves, hence they cannot be detected. Reports of the capture of very small fish by the gear were also proven untrue.

The length frequency distribution of the top three species caught is presented in Figures 5A, 5B, and 5C. These species were also selected based on commercial importance. The recorded length at maturity (L_m) and max length (L_{max}) of *S. gibbosa* were 128 mm and 296 mm, respectively (Mondol et al., 2017). The average length of *S. gibbosa* samples from this study is lower (120.89 ± 5.25 mm) and the size range is relatively narrow (106.63 mm–131.42 mm). For *E. oblongus*, there are no records on the L_m. The maximum recorded length was 100 mm (Randall, 1995), close to the average length of samples caught in this study (95.78 ± 9.41 mm). Samples of *C. coeruleopinnatus* in this study had sizes ranging from 104.48 mm–162.52 mm, which is far from the previously recorded maximum length for the species (410 mm; Allen and Erdmann, 2012).

The calculated catch per unit effort (CPUE) for "siklob" has shown that increasing the effort (number of casts) would reflect an increase in production. The unit of effort followed that of FAO (1999), which is used for cast nets. This is also because time spent for the entire cruise cannot represent the actual fishing time.

Limitations of "siklob"

The coastal communities adopted "siklob" in Northern Iloilo because they have seen its success in neighbouring towns. However, its use and effectivity are limited by different factors, such as natural events and its design. Some of the identified limitations of "siklob" are: a) the inability to catch larger, fast-swimming pelagic fishes; b) effectiveness only in water without obstacles; c) the small size of fishing vessel used, which means limited space for catch; and d) disadvantageous for fishers that are not using fish-finding devices – having less or no knowledge of bottom configuration in the fishing area may result to gear damage and less production.

Conclusion

The continuous decrease in fisheries production and prevalent poverty in the fisheries sector continues to seek solutions in various forms. While fishers are constantly needed to provide for their household, their creativity shows in the novel and innovative techniques they apply to improve their fishing capacity. Development is necessary, but it is also important to consider its direct and indirect effects on aquatic organisms and habitats.

"Siklob" is a falling gear operated along the municipal waters of Northern Iloilo, Philippines, targeting small pelagic fishes. Its design and principle of capture is identical to the traditional cast net, only that it is upscaled, mechanised, and aided by lights and a fish-finding device. It was assumed that fishers are using fine mesh nettings for the gear because of its ability to capture very small fish. Results of this study, however, indicate that the gear is unable to catch very small fish, and it complies with national regulations on the allowable mesh size for fishing gears. "Siklob" fishery is most productive during dry seasons and the Southwest monsoon months and most effective during the dark phases of the moon.

Scientific investigations are important as they are proven based on reliable evidence strengthening the facts. These facts based on the scientific investigation are important in formulating management plans and regulations to guide the optimal and sustainable use of specific fishery resources, gears, and fishing grounds. Based on the findings of this study, the presumption of the use of fine mesh nets for "siklob" was unfounded, as the mesh size applied is above the legal mesh size (>3 cm) permitted by the law. Furthermore, the capture of very small fish was not observed during the study. If a management plan for "siklob" is reviewed, such as partial or total banning, harvest control, or closed season, in that case, it should first consider the biological patterns of the species in concern. This would include spatial and temporal patterns, spawning cycles and seasons, and critical zones. This will guide the sustainable use of "siklob" and other gears exploiting a specific fishery, rather than banning gears that support the livelihood of coastal communities.

Conflict of interest: The author declares that he has no conflict of interest.

References

Abesamis, R.A., Russ, G.R. 2010. Patterns of recruitment of coral reef fishes in a monsoonal environment. Coral Reefs 29:911-921. https://doi.org/10.1007/s00338-010-0653-y

Alheit, J. 2002. Impact of climate variability on small pelagic fish stocks – a comparative view. Investigaciones Marinas 30:175. http://dx.doi.org/10.4067/S0717-71782002030100069

Allen, G.R., Erdmann, M.V. 2012. Reef fishes of the East Indies. Perth, Australia: University of Hawai'I Press, Volumes I-III. Tropical Reef Research. 1292 pp.

Azeez, L.O. 1997. A comparative study of cast net and gill net fishing gears in Lagos Lagoon. M.Sc. Dissertation. University of Lagos, Nigeria. 185 pp.

Chando, D.B. 2005. Gear modification to reduce by-catch in the Tanzanian shrimp fishery. The United Nations University - Fisheries Training Program, Final Project 2005. 30 pp.

Chen, W., Song, L. 2013. Application of light falling net in developing fisheries in Sansha. Ocean Development and Management. 2013:68–70. (in Chinese).

Deinye, H.E., Olopade, O.A., Toby, S.A. 2018. Species composition and diversity of cast net fisheries in New Calabar River, Niger Delta, Nigeria. Journal of Biodiversity Conservation and Bioresource Management 4:19-26. https://dx.doi.org/10.3329/jbcbm.v4i1.37873

Edo, K. 2008. Cast nets. https://www.wildsalmoncenter.org/content/uploads/2008/07/SFPH-Chapter-2-Cast-Nets.pdf (Accessed 13 October 2017).

Emmanuel, B.E., Chukwu, L.O., Azeez, L.O. 2008. Cast net design characteristics, catch composition and selectivity in tropical open lagoon. African Journal of Biotechnology 7:2081–2089. https://dx.doi.org/10.5897/AJB2008.000-5056

Emmanuel, B.E., Kasemiju, K. 2005. Variations in the cast net catch in a tropical brackishwater pond. Journal of Science, Technology, and Environment 5:6–14.

FAO. 1999. Guidelines for the routine collection of capture fishery data. FAO Fisheries Technical Paper 382. FAO, Rome. 122 pp.

He, P., Chopin, F., Suuronen, P., Ferro, R.S.T., Lansley, J. 2021. Classification and illustrated definition of fishing gears. FAO Fisheries and Aquaculture Technical Paper No. 672. FAO, Rome. 110 pp.

ICES (International Council for the Exploration of the Sea). 2012. Report of the working group on small pelagic fishes, their ecosystems and climate impact (WGSPEC). In: SCICOM Steering Group on Ecosystem Functions (27 February–2 March 2012, Fuengirola, Spain. ICES CM 2012/SSGEF:10. 63 pp.

Jiang, M., Ma, S., Ma, Z., Zou, J., Wu, S., Lin, F., Qin, J.G., Wu, Q. 2018. Economic benefit analysis of trawlers and light trap and falling net fishing vessels in South China Sea. Insights in Aquaculture and Biotechnology 2:1–4.

Levesque, J.C. 2010. Evolving fisheries: today's bycatch is tomorrow's target catch escolar (*Lepidocybium flavobrunneum*) catch in the US pelagic longline fishery. The Open Fish Science Journal 3:30–41. https://doi.org/10.7227/BJRL.30.1.2

Marshall, B.E. 1984. Small pelagic fishes and fisheries in African inland waters. CIFA Technical Paper 14. FAO, Rome. 25 pp.

Matsunuma, M., Motomura, H., Matsuura, K., Shazili, N.A.M., Ambak, M.A. 2011. Fishes of Terengganu – east coast of Malay Peninsula, Malaysia. National Museum of Nature and Science, Universiti Malaysia Terengganu and Kagoshima University Museum. 251 pp.

Mondol, M.R., Hossen, M.A., Nahar, D.A. 2017. Length-weight relationships of three fish species from the Bay of Bengal, Bangladesh. Journal of Applied Ichthyology 33:604–606. https://doi.org/10.1111/jai.13268

Morales, D.J., Aristo, W., Fernandez, V., Lazada, M., Maratas, C., Pescador, R. unpublished. Viability of *siklob* type of fishing: A shift from *Likos* type of fishing in Barangay Tanza, Estancia, Iloilo.

https://www.academia.edu/attachments/52038501/download_file?s=work_strip.

Motomura, H., Alama, U.B., Muto, N., Babaran, R.P., Ishikawa, S. 2017. Commercial and bycatch market fishes of Panay Island, Republic of the Philippines. The Kagoshima University Museum, Kagoshima, University of the Philippines Visayas, Iloilo, and Research Institute for Humanity and Nature, Kyoto. 246 pp.

National Geographic. 2012. Cast net fishing: Enduring Hawaiian tradition. https://www.nationalgeographic.org/media/cast-net / (Accessed 16 October 2017).

Nedelec, C. 1975. FAO catalogue of small-scale fishing gear. Fishing News (Books) Ltd., Farnham, Surrey, England, pp. 104–105.

Peck, M. A., Reglero, P., Takahashi, M., Catalàn, I.A. 2013. Life cycle ecophysiology of small pelagic fish and climate-driven changes in populations. Progress in Oceanography 116:220–245. https://doi.org/10.1016/j.pocean.2013.05.012

Picoy-Gonzales, R., Monteclaro, H.M. 2017. Effects of net height of crab entangling nets on the capture of targeted economically important portunid species and non-target species. Fisheries Science 83:907–915.

Randall, J.E. 1995. Coastal fishes of Oman. University of Hawaii Press, Honolulu, Hawaii. 439 pp.

Ruangsivakul, N., Prajakjitt, P., Chindakarn, S., Siriraksophon, S. 2004. Fishing gears and methods in Southeast Asia: III. Philippines, Part 2, Southeast Asian Fisheries Development Center, Training Department, Phrasamutchedi, Samutprakan 10290, Thailand, pp. 239–246.

Santos, M.D. 2011. Seasonality of commercially important pelagic fishes in the Philippines: Overfishing or climate change? International Workshop on Climate and Oceanic Fisheries, October 3-5, 2011, Cook Islands. 34 pp.

Tayona, G. 2019. N. Iloilo illegal fishing hotspot. Panay News. http://hdl.handle.net/20.500.12174/7275 (Accessed 23 July 2021).

Udolisa, R.E.K., Solarin, B.B. 1979. Design characteristics of cast nets and gillnets in Lagos Lagoon, Nigeria. NIOMR occasional paper No. 31. 24 pp.

Valdemarsen, J.W., Suuronen, P. 2002. Modifying fishing gear to achieve ecosystem objectives. In: Reykjavik conference on responsible fisheries in the marine ecosystem 3 Reykjavik, Iceland, 1–4 October 2001. https://community.plu.edu/~reimanma/doc/gear-restrictions.pdf (Accessed 29 November 2021).

Welcomme, R.L. 2001. Inland fisheries: Ecology and management. Fishing News Books, Oxford. 358 pp.

Wu, Q., Yu, G., Ma, Z., Ma, S., Wu, S. 2016. Preliminary study on the fisheries catches in South China Sea via light falling-net fishing method. International Journal of Innovative Studies in Aquatic Biology and Fisheries 2:1–4. http://dx.doi.org/10.20431/2454-7670.0205001

Yan L., Zhang P., Yang L., Yang B., Chen S., Li Y., Tan, Y. 2015. Effect of moon phase on fishing rate by light falling-net fishing vessels of *Symplectoteuthis oualaniensis* in the South China Sea. South China Fisheries Science 11:16–21.

Yoshida, T., Motomura, H., Musikasinthorn, P., Matsuura, K. 2013. Fishes of northern Gulf of Thailand. National Museum of Nature and Science, Tsukuba, Research Institute for Humanity and Nature, Kyoto, and Kagoshima University Museum, Kagoshima. 239 pp.

Zhang, P., Yang, L. 2010. The present status and prospect on exploitation of tuna and squid fishery resources in South China Sea. South China Fisheries Science 1:68–74.

Zhao F., Xie, J., Chen, Y., Zhen, J. 2017. Investigation and analysis on light falling-net fishing gear and art of fishing in Zhejiang Province. Journal of Zhejiang Ocean University (Natural Science) 3:268–273.