

Effects of the lunar cycle in the catch composition and total catch of stationary lift nets in the coastal waters of Miagao, Iloilo, the Philippines

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The catch composition of commercially important species of the stationary lift net at Barangay Gines, Miagao, Iloilo, the Philippines was investigated from December 2013 to May 2014 during the different phases of the moon. A total of 486 kg of fish coming from 12 different genera, including mollusk and crustaceans, was caught and identified from the catch of the stationary lift net. Among the 12 genera identified from the catch of stationary lift net, anchovy (*Stolephorus*), sardines (*Sardinella*), squid (*Loligo*) and mysid shrimp (*Acetes*) were considered to be commercially important due to their value. *Acetes* catch was highest during the new moon in the month of January. *Loligo* catch was also high during the new moon except in the month of May. *Stolephorus* catch was also highest during the new moon except in the month of January. *Sardinella* catch was highest during the first quarter in the month of February. Full moon had the lowest catch all throughout the duration of the study while new moon had the highest catch during December 2013 to March 2014 and first quarter was the highest in the months of April and May.

Keywords : Lunar periodicity, Stationary lift net, Moon phase, Catch composition

Introduction

The lunar cycle, or synodic month, takes place every 29.5 days in which the moon is able to complete its cycle, which is from full moon to another full moon (Morgan, 2001). During these times, the earth and moon change its distance in relation with the sun which affects the tide and moonlight intensity on the earth which in turn directly and indirectly affects the behavior of many marine organisms (Bornilla, 2011).

Many studies have been conducted on the effects of lunar cycle in various fishing operations such as in longline fishing (Poisson et al., 2010), fish traps (Yamane and Babaran, 2001) and sports fishing (Ortega-Garcia et al., 2008). These studies observed that there were differences in the catch composition and efficiency in different phases of the lunar cycle. Lunar periodicities also affect the behavior of many aquatic organisms. A study by Hanson et al. (2008) found out

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that largemouth bass has a uniform and repeatable depth distribution during the summer and spring months. Another study by Courtney et al. (1996) found out that the catch rate and reproductive condition of eastern king prawns, *Penaeus plebejus*, in coastal waters off southeastern Queensland vary depending on the periodicity of the lunar cycle. Also, the availability of reef fishes seen in the market in the Philippines is influenced by the lunar cycle (Bos and Gumanao, 2012). Furthermore, studies show that fish larvae are also affected by the lunar cycle (Rooker et al., 1996). A study in Taklong Island National Marine Reserve, southern Guimaras observed that there are fewer fish larvae caught during full moon compared to those caught during the new moon (Acabado et al., 2014). These studies may have implications that can improve various fishing practices that are influenced by the lunar cycle. The stationary lift nets, for instance, are operated during the night which may be affected by the lunar cycle.

Stationary lift net, or locally known as “bintahan”, is a passive fishing gear which is constructed with bamboo poles that forms a square structure that supports a net and has platforms. It can be seen along the coastal waters of Barangay Gines, Miagao from December to May or until it is destroyed by typhoons. Barangay Gines, Miagao (10°39'17"N, 122°15'53"E) is located in the Western Visayas region of the Philippines, approximately 35 kilometers southwest of Iloilo City. Brarangay Gines is one of the 22 coastal barangays of the town of Miagao. It is along the coastline where most of the stationary lift nets were constructed and is considered to be one of the major sources of fishery product such as anchovy fry, sardines and mysid shrimps in the area.

Stationary lift nets are operated during the night with the help of a kerosene lamp or a battery operated light bulb to attract fishes. When a group of fish has aggregated under the light, fisherman lift the net with the help of pulleys and improvised winches. They use a relatively fine-mesh netting to catch their target species which are juvenile anchovies and mysid shrimps.

However, the problem is that the catch does not only compose of the target species but also some larvae of other commercially important species which are considered as bycatch and are often discarded (Selorio et al., 2008). Furthermore, the number of stationary lift nets located in Barangay Gines, Miagao, Iloilo is increasing, thereby intensifying the quantity of wasted fish. Stationary lift nets can be considered to be unselective which makes it unsustainable and therefore calls for an immediate action to regulate its operation.

Information on the pattern and variation of catch of the stationary lift nets during the entire season of operation will help fishery managers to develop effective and practical solutions to conserve our fishery resources. Also, this will give more understanding on the effects of lunar cycle in the catch composition of stationary lift nets which can be used to improve the selectivity and sustainability of the fishing operation.

The aim of this study was to determine the catch composition caught by stationary lift nets in Barangay Gines, Miagao, Iloilo. This study was conducted over a period of six months from December 2013 to May 2014 during the different phases of the moon. Specifically, this study will determine: 1) the variation of salinity and temperature at different moon phases; 2) the commercially important species caught during the four moon phases; and 3) the abundance of catch during the four moon phases.

Materials and Methods

The study was conducted at Barangay Gines, Miagao, Iloilo (Fig 1). The catch of a stationary lift net was monitored once a week for six consecutive months during each lunar phase from December 2013 to May 2014. A total of 25 samplings with one to four hauls per sampling night were conducted for the whole sampling period.

The oceanographic condition where the stationary lift nets were located was typical of a near shore topography. Average depth from the sea floor to the water surface

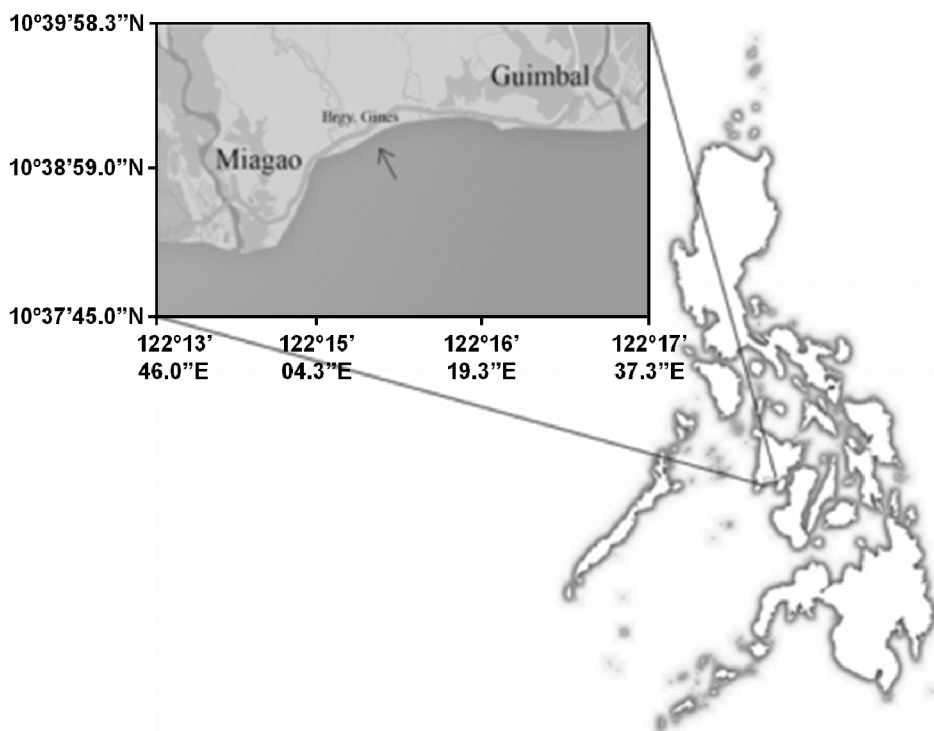


Fig. 1. Map showing the location of Barangay Gines, Miagao, Iloilo and its neighboring towns. Arrow shows the location of the stationary lift nets (Google Maps®).

during low tide were eight meters and ten meters during high tide. The substrate was made of fine sand and the average water transparency was down to four meters.

The stationary lift net in Barangay Gines was made of bamboo poles that were constructed to make a structure that supports a square net (Fig. 2). The bamboos used in the net had an average length of 12 m and a diameter of 10 cm. They were tied together using nylon ropes and rubber stripping. The structure had two platforms that were used to support the catch and devices such as the generator and the containers. The net used was 10×10 m knotless net with a 5 mm mesh size. The operation of the gear was done during the night with the help of four to five improvised lights, powered by pressurized kerosene which emits yellowish light, that were suspended just above the water to attract fishes. They were usually arranged in a manner where in the lights were concentrated in the center of the

structure. Additional lights were also placed along the two corners of the structure but were gathered towards the center if a school of fish gathered below it (Fig. 3). When a group of fish aggregated, the net was coordinately lifted by the crew with the help of two improvised winches and pulleys to catch the fishes.



Fig. 2. A stationary lift net in Barangay Gines, Miagao, Iloilo, Philippines.

The catch was then scooped by using a brail and was transferred on the platform. The net and lights were then set again for the next hauling. The catch was weighed and samples were obtained from the unsorted catch of each hauling. The catch was then sorted and placed in containers with crushed ice. Hauling of catch was 2.32±0.95 times per night, depending on the frequency of the fish aggregating under the light. A total of about one kilogram of unsorted sample and a water sample was obtained in every operation. The temperature of the seawater in every hauling was measured in situ by using a laboratory grade, red alcohol filled thermometer with 0°C to 150°C sensitivity range.

The seawater and catch samples were brought to the laboratory. The catch samples were then sorted and identified to the genus level. Each genus type of the sample were weighed using a digital top loading balance (*Sartorius®*) with 0.1 g sensitivity and the percentage of each genus present in the sample was calculated. The salinity of the seawater sample was measured using a salinity refractometer (*A.S.T. Japan*).

The data gathered were encoded and analyzed statistically at $p=0.05$. These were analyzed statistically using *Microsoft Excel 2010* and *IBM SPSS Statistics 20*. One-way ANOVA was used to compare means and

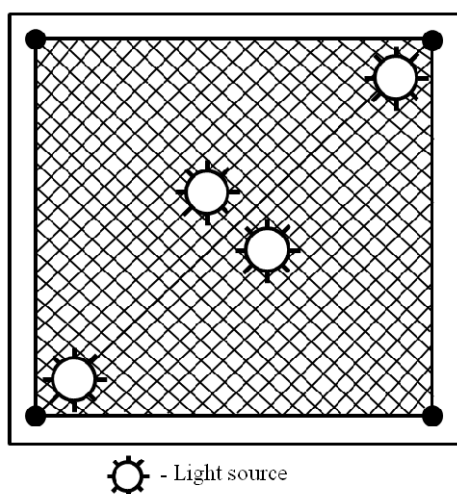


Fig. 3. Arrangement (top view) of the improvised light of the stationary lift net in Barangay Gines, Miagao, Iloilo, Philippines.

Tukey’s HSD was used for post hoc testing. at Barangay Gines, Miagao, Iloilo, Philippines

Results

A total of 486 kg of fish was caught from the stationary lift net at at Barangay Gines, Miagao from December 2013 to May 2014. The fish caught was composed of 12 different genera and a few were unidentified. *Sardinella* (163.23 kg) was the highest catch followed by *Stolephorus* (138.83 kg) then *Acetes* (47.08 kg) (Fig. 4). *Sardinella* and *Stolephorus* were not significantly different ($p=0.999$) and were both significantly different ($p=0.001$) to all other. *Acetes*, *Anguilla*, *Apogon*, *Benthoosema*, *Caranx*, *Leiognathus*, *Loligo*, *Lutjanus*, *Nealotus*, and *Sphyraena* were not significantly different ($p=0.890$) from each other. There were four genera that were considered to be commercially important during the season, namely: sardines (*Sardinella*), anchovies (*Stolephorus*), small shrimps (*Acetes*), and squid (*Loligo*).

Fig. 5 shows the change in temperature and salinity during each moon phase from December 2013 to May 2014. The salinity of the seawater did not change much over the duration of the sampling. It only varied from 35 ppt in December 2013 to 36 ppt in May 2014. The

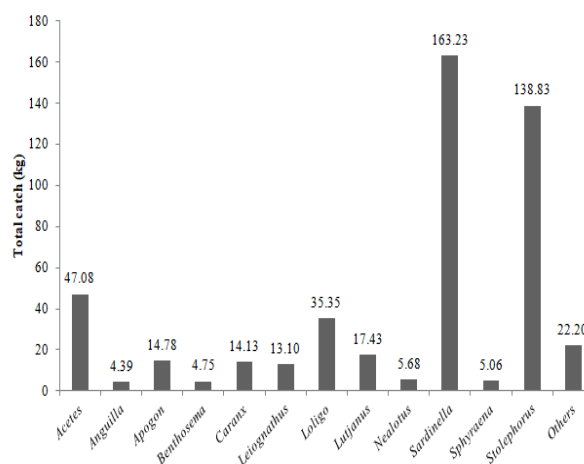


Fig. 4. Total catch of fish from each genus caught at Barangay Gines, Miagao, Iloilo from December 2013 to March 2014.

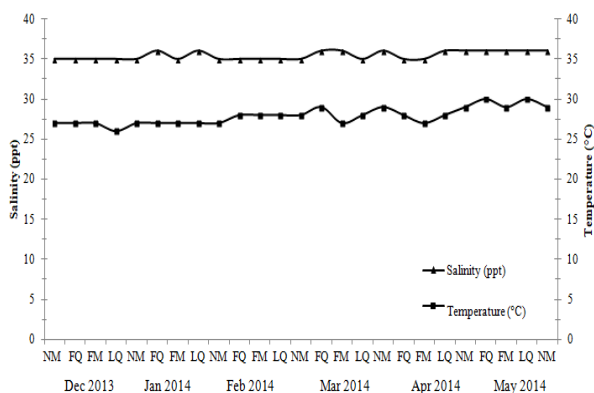


Fig. 5. Changes in temperature and salinity during each moon phase at Barangay Gines, Miagao, Iloilo from December 2010 to May 2014. NM, new moon. FQ, first quarter. LQ, last quarter. FM, full moon.

water temperature slightly increased from 26.75°C in December 2013 to 29.50°C in May 2014.

The total catch of the different commercially important species during the different moon phases is shown in Fig. 6. *Acetes* was the lowest catch during the full moon (3.42 kg) and peaked during the new moon (24.72 kg) phase. *Loligo* follows a similar trend with that of *Acetes*, peaking at new moon (12.22 kg) and lowest during the full moon (3.12 kg). *Sardinella* was the highest catch during the first quarter (60.02 kg) and last quarter (45.30 kg) but lowest during the full moon (2.52 kg). *Stolephorus* was the highest catch during new moon (62.06 kg) but lowest during full moon (8.71 kg) phase. The catch during full moon was significantly different ($p=0.022$) from the catch during new moon. Catch during new moon was not significantly different with the catch during last quarter ($p=0.750$) and first quarter ($p=0.996$). Also, catch during full moon was not significantly different with the catch during first quarter ($p=0.052$) and last quarter ($p=0.267$).

The total catch of stationary lift net during the different phases of the moon from December 2013 to May 2014 is shown in Fig. 7. Total catch was highest during the new moon phase in the month of January (60.00 kg), February (40.00 kg) and March (25.00 kg).

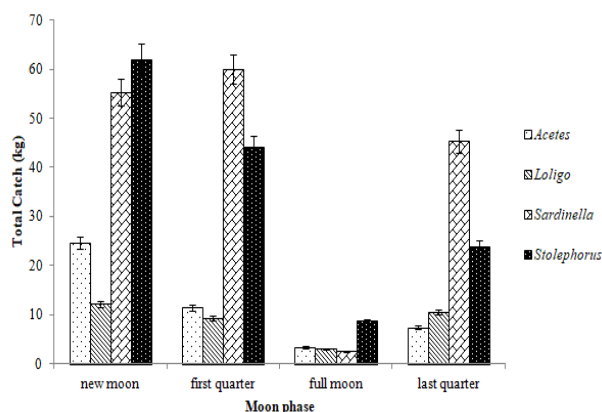


Fig. 6. Total catch of commercially important species by stationary lift net during the different moon phases at Barangay Gines, Miagao, Iloilo from December 2013 to May 2012. Values are expressed as mean \pm SEM.

However, it showed a decreasing trend in the amount of catch from January to April of 2014. Total catch during the first quarter was highest in the months of April (40.00 kg) and May (20.00 kg). The total catch during full moon was the lowest all throughout the duration. Total catch during the last quarter phase was the highest in the month of December (15.00 kg) and was the second highest in the month of January (56.00 kg). A decreasing trend was also observed in the total catch during the last quarter phase from January to March. The catch during new moon ($p=0.458$), first quarter ($p=0.820$), full moon ($p=0.809$), and last quarter ($p=0.183$) were not significantly different from January 2014 to May 2014.

Fig. 8 shows the total catch composition of commercially important species from December 2013 to May 2014. The total catch of *Acetes* was at its peak in the month of January (28.60 kg) and lowest in April (1.60 kg). The total catch of *Loligo* was the highest in May (13.96 kg) compared with other species but also the lowest in December (1.85 kg). The catch of *Sardinella* was the highest compared with the other species in February (55.81 kg) and April (28.26 kg). The total catch of *Stolephorus* was the highest compared with other species in the months of December (22.00 kg), January (57.05 kg)

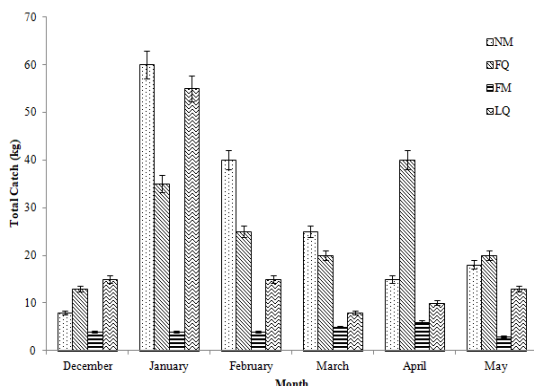


Fig. 7. Total catch of stationary lift net during the different phases of the moon at Barangay Gines, Miagao, Iloilo from December 2013 to May 2014. Values are expressed as mean ± SEM. NM, new moon. FQ, first quarter. FM, full moon. LQ, last quarter.

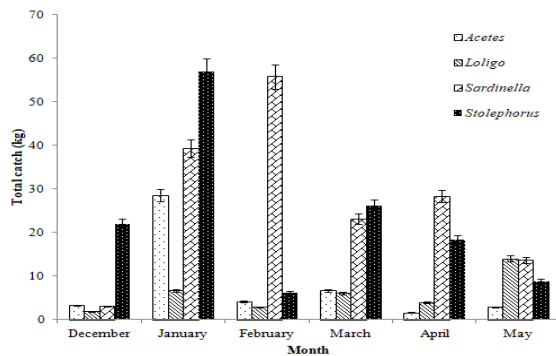


Fig. 8. Total catch of the different commercially important species by stationary lift net at Barangay Gines, Miagao, Iloilo from December 2013 to May 2014. Values are expressed as mean ± SEM.

and March (26.29 kg).

The catch of *Acetes* ($p=0.071$), *Sardinella* ($p=0.484$), and *Stolephorus* ($p=0.097$) were not significantly different from January 2013 to May 2014. The catch of *Loligo* during the month of May was significantly different ($p=0.008$) during the month of December.

Discussion

Catch composition

The catch composition of stationary lift nets at Barangay Gines, Miagao, Iloilo in the months of December 2013, January 2014, February 2014, March 2014, April 2014, and May 2014 was investigated. Most

of the catch were from 12 families of finfish, mollusks and crustaceans. This is quite few compared with the study of Selorio et al. (2008) where they identified fishes from 38 families including mollusk, annelids and crustaceans. The differences may be due to differences in the sampling duration and procedure of the two studies. However, for definite results, we should conduct more studies.

Sardinella (163.23 kg), *Stolephorus* (138.83 kg), *Acetes* (47.08 kg) and *Loligo* (35.35 kg) were considered to be commercially important. Accordingly, they were the highest catch compared with other genera. While other commercially important species were caught, they were caught irregularly and were considered as incidental catch. Some fishes were unidentified because they were too young to be identified or some of them were considered to be rare.

The catch composition in the study of Selorio et al. (2008) also composed mostly of sardines, anchovies and mysid shrimps. Similarly, the catches of stationary lift nets in Batan Bay, Aklan were anchovy, mullet, slipmouth, and barracuda (Kawamura et al., 1980). However, in this study, those were not the only catch of stationary lift nets. Many of the catch were considered as incidental catch or bycatch and some of them were deep sea species. Some of these incidental catch were also used for human consumption and some were discarded or made into animal feed.

Salinity and Temperature

There was only a slight increase in the salinity and temperature of the seawater from December 2013 (35 ppt, 26.75°C) to May 2014 (36 ppt, 29.50°C). These can be accounted in the change of season, from cold weather of December to the warm weather of summer in May. Due to the very minimal changes in the salinity and temperature of the surface water, it can be concluded that it has no evident effect in the total catch and catch composition of stationary lift nets in Barangay Gines, Miagao, Iloilo. Also, the change in moon phase does

not have a definite relation in the change of the salinity and temperature of the surface seawater.

Total catch

The results of this study showed that most of the target species were abundant during a certain moon phase and in certain month. *Acetes* was highest during the new moon (24.72 kg) and in the month of January (28.60 kg). *Loligo* catch was also higher during the new moon (12.22 kg) and in the month of May (13.96 kg). Whereas *Sardinella* catch was highest during the first quarter (60.02 kg) but was also considerably high during new moon (55.39 kg) and last quarter (45.30 kg) but very low during the full moon (2.52 kg). *Sardinella* catch peaks in the month of February (55.81 kg) and very low in the month of December (3.08 kg). *Stolephorus* catch was also highest during the new moon (62.06 kg) in the month of January (57.05 kg). There was a notable drop in the catch of *Stolephorus* in the month of February (6.27 kg) when the total catch of *Sardinella* greatly increased. A very similar study conducted by Castro (pers. comm.) in the year 2013 observed a slight difference in the catch data in which *Acetes* catch was also higher during the new moon (38.75 kg) but in the month of March (70.75 kg); *Loligo* catch was low but most of it were caught during the last quarter (1.55 kg); *Sardinella* catch was also high during the new moon (41.37 kg) and also abundant in the month of February (79.00 kg); *Stolephorus* catch was also high during the new moon (48.00 kg) but in the month of December (107.13 kg).

The data shows that the total catch was highest during the new moon (191.00 kg) phase, followed by the first quarter (153.00 kg) and lowest during the full moon (26.00 kg). These data coincides with a similar study conducted by Castro (pers. comm.) in 2013 which observed the catch of stationary lift nets in Barangay Gines, Miagao, Iloilo to be highest during the new moon and lowest during the full moon. Moreover, gill net and trawl in Tamil Nadu, India observed higher catch during

the new moon and lowest during the full moon (Libini and Khan, 2012). However, some other studies on lunar periodicity suggest that the catch during different moon phase depends on the species caught and the fishing gear used (Courtney et al., 1996; Salini et al., 2001; Poisson et al., 2010). In future studies, it can be suggested that sampling days will include the before and after days of the actual day of the moon phase. These will allow a better comparison on the total catch among the moon phases.

Conclusion

Based from the data gathered during the six months sampling (December 2013 to May 2014) of the catch by stationary lift net in Barangay Gines, Miagao, Iloilo, Philippines, the following were observed: there was only a very slight increase in the salinity and temperature of the seawater from December 2013 (35 ppt, 26.75°C) to May 2014 (36 ppt, 29.50°C); among the 12 genera identified from the catch of stationary lift net, anchovy (*Stolephorus*), sardines (*Sardinella*), squid (*Loligo*) and mysid shrimp (*Acetes*) were considered to be commercially important and were also the highest catch; *Acetes* catch was highest during the new moon (24.72 kg) in the month of January (28.60 kg). *Loligo* catch was also high during the new moon (12.22 kg) but was in the month of May (13.96 kg). *Stolephorus* catch was also highest during the new moon (62.06 kg) but in the month of January (57.05 kg). *Sardinella* catch was highest during the first quarter (60.02 kg) in the month of February (55.81 kg); and lowest catch was during full moon all throughout the duration of the study while new moon had the highest catch from December 2013 to March 2014 and first quarter was the highest in the months of April and May 2014.

Based on the results, the change in temperature and salinity is independent from the change of moon phase and does not directly affect the catch of stationary lift nets. However, the change in moon phase had a direct and indirect influence in the total number of catch and catch

composition of the stationary lift nets in Miagao, Iloilo.

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