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Relative abundance of flying fish gillnet fisheries in Maitum, Sarangani province

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Abstract
Flying fish (family Exocoetidae, or locally called as *"bangsi"*) are the most dominant catches of gillnets in the predominantly small-scale fisheries of the municipality of Maitum, Sarangani, Philippines. In this study, an assessment of flying fish was conducted from January 2013 to December 2015 based on fish catch surveys in the fish landing sites. On average, flying fish contributed about 84% of the annual catch production but showed a declining trend over the three year period. The estimated total flying fish production was 655.27 MT in 2013 but declined to 349.56 MT in 2014 and 300.04 MT in 2015. Surface gillnet was the gear used exclusively in catching flying fish. Genera of the flying fish were identified, namely, *Cheilopogon* (63.2%), *Cypselurus* (7.6%), *Hirundichthys* (6.5%), *Parexocoetus* (3.8%) and *Exocoetus* (1.5%). About 1.2% of the flying fish caught were unidentifiable to the genus level. Flying fishes were caught throughout the year, with monthly variations but the seasonality was not clearly observed during the three-year study period.

Keywords: flying fish (Bangsi), Maitum Sarangani province, catch abundance, dominant

1. Introduction
Flying fish, family Exocoetidae are small pelagic species that inhabit the epipelagic zone of tropical and subtropical waters. It is a common pelagic fish caught by small-scale fishers in the Philippines next to Carangidae (jacks and scads), Scombridae (tuna and mackerels), Engraulidae (anchovies) and Clupeidae (sardines). Fylingfish is among the most dominant catches in some areas in the Philippines like the western portion of the Verde Island Passages in the West Philippine Seaand around the Camotes Sea in the Visayan Seas. According to the Regional Fisheries Profile, Region 12, Philippines, where the Sarangani Bay and the study site is located, flying fish constitute the second most dominant fishes caught, next to round scads, from 2005-2015 with a total volume of 28,596.6 MT valued a Php1, 041,042,350.00 (BFAR 12).
The Sarangani Bay in southern Philippines is known for its tuna fishery because of the presence of the fish port in General Santos City, a major landing site for tuna in the Philippines. Tuna (family Scombridae) constituted nearly 89% of 1,012,488 metric tons catch landed at the General Santos City from 2008-2014 noted as tuna or a tuna-like species (*www.seafdec-oceanspartnership.org/learning-sites-philippines/).* However, most of the landed tuna are caught by commercial fishers, e.g. using boats of more than 3 gross tons, outside the Sarangani Bay to as far as the high seas bordering the Philippines and its neighboring countries such as Indonesia and Malaysia. Overall, the commercial fisheries sector constitutes about96% of landed catches in the Sarangani Bay (e.g. Genersal Santos City and the six coastal municipalities of the Sarangani province) and more than 99% are being landed at the fish port in General Santos City, which is known as the tuna capital of the Philippines. The fisheries in the other six other municipalities along the Sarangani Bay are mainly small-scale catching predominantly small pelagics like squids, scads, sardines and flying fish.
Flying fish is the most dominant fish caught in Maitum which is the westernmost municipality in Sarangani province. Because of its abundance, flying fish was chosen as the commodity in the "One Town, One Product" program, which is a livelihood assistance program of the Sarangani province in all the six municipalities under its jurisdiction. In Maitum, the program was specifically called "The Mighty Bangsi" as "bangsi" is the local name of flying fish. Despite the importance of flying fish to the local fisheries of Maitum, there is limited scientific study on

it. Thus, this paper assessed the flying fish fishery in Maitum based on a three-year landed catch data. Scientific insight is provided in order to ensure the sustainability of flying fish fishery, which is a very important source livelihood in Maitum, Sarangani and many coastal communities in the Philippines. BFAR data revealed that aside from gillnet, drive-in nets was also used in flying fish fishery. Between, 1982-1986 about 20,000 tonnes/year were recorded of flying fish landings, 93% of which is made with gillnets, and only 3% with drive-in nets (BFAR, 1987 as cited by Dalzell).

2. Methodology

2.1.1 Study site

The study was conducted in two fish landing sites in Maitum, Sarangani, Philippines (Figure 1). The landing sites are in Old Poblacion where the main port for flying fish landings fishing at Celebes Sea caught by surface gillnet; and Mabay for neritic and oceanic tunas fishing at Moro Gulf using multiple gears. Two enumerators were assigned in both landing centers with proper training on fish identification and landed catch monitoring.

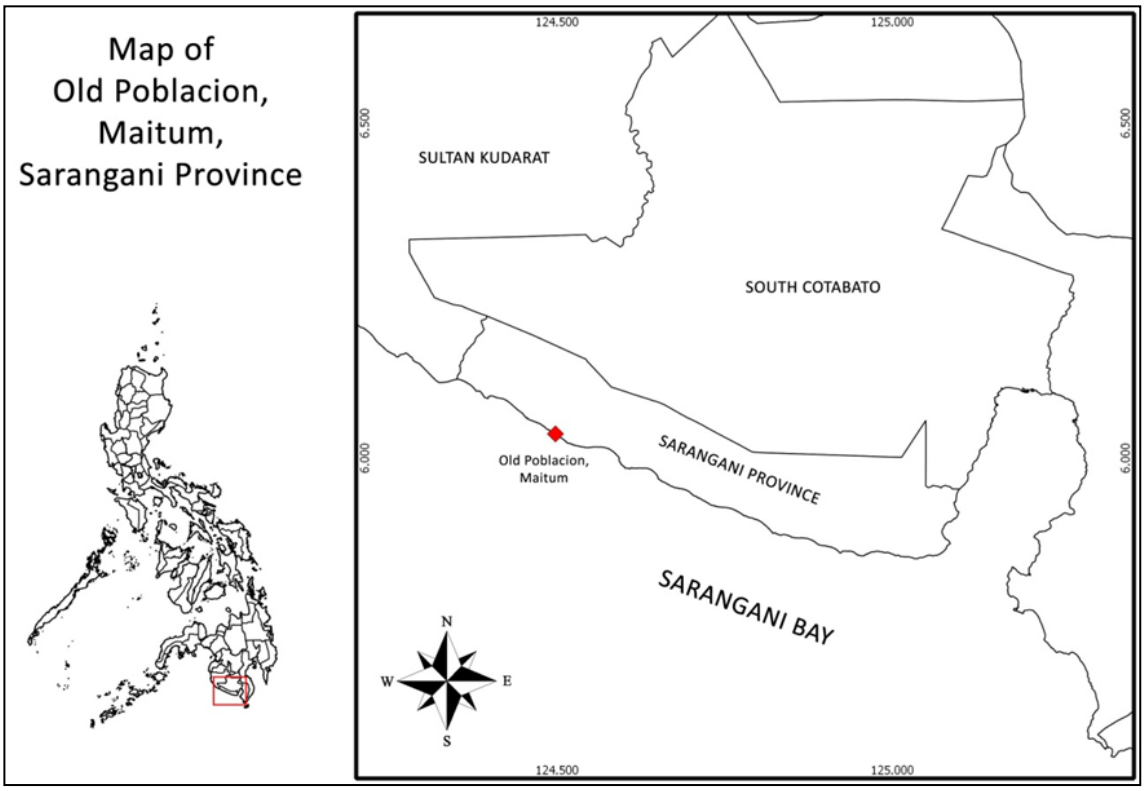

Fig 1: Map of Sarangani Province showing the study sites

2.1.2 Data Collection and Analyses

This study was part of the National Stock Assessment Program (NSAP) of the Bureau of Fisheries and Aquatic Resources (BFAR) of the Philippines. Landed catches were monitored every two days with one day interval from January 2013 to 2015. Total catches (in kg), fishing effort (no. of hours fishing/day or trip) and fishing gears used were obtained from the fishers at the landing sites. Catch composition and volume of catches by species were estimated from subsamples by randomly sampling at least 30% of fishes from the total catches. Monitoring was conducted by two professional fish catch enumerators who were properly trained in fish identification and landed catch monitoring.

2.1.3 Boat and Gear Inventory

The fishing boats and gears used in the study was conducted in 2013, 2014 and 2015 based on the actual count in Old Poblacion, Maitum Sarangani Province where the study site is located. Interviews were done by assigned enumerators utilizing Boat and Gear inventory form as to the gear specifications and operations.

2.1.4 Catch Composition and relative abundance

Catch composition is tabulated according to their fish classification, family, genera up to their species level using the three year data catch data. Relative abundance of species is obtained by taking the percentage share in relation to the total harvested catch at the sampling site.

3. Results and Discussion

A total of 604 fishing gears, were classified into eleven groups were recorded (Table 1). Surface gillnets or the Gillnet with a total of 192 and squids jigs of 180 were the most commonly used fishing gears (Table 1), and were the major gears used for catching flying fish (Exocoetidae) and squids (Loliginidae), respectively. Handline and Scoop Net were the minor gears contributed the catch, it was observed in 2015 only. Catches were predominantly small pelagic with flyingfish, anchovies (Engraulidae) and squids constituted the most dominant catches in terms of volume (Figure 2). The rest of the catches were composed of halfbeaks (Hemiramphidae) with 2.29% and tunas and mackerels (Scombridae) while demersal species constituted only less than one percent of total catches (Figure 4). In Hinatuan passage study of Baclayo *et al*., small pelagic fishes comprise 55% of the total fisheries production. In the Philippines, small pelagic fisheries contributed 35% of the total fisheries production in 2001. Countrywide assessments of small pelagic fisheries of the Philippines are given, among others, in the studies of various authors Munro (1986); Calvelo and Dalzell (1987) [5]; & Dalzell and Ganaden (1987) [5] as cited by Baclayo *et. al* study on small pelagic.

Table 1: Annual number of municipal fishing gears monitored in the landing center (2013-2015)

Gear Type	2013	2014	2015	Total
Multiple Hook and Line	16	22	25	63
Squid Jig	38	70	72	180
Squid Luring Device	26	14	19	41
Surface gillnet	36	98	58	192
Bottom Set Long Line	-	-	1	1
Hook and Line	-	15	19	34
Bottom Set Gill Net	-	7	9	16
Push Net	-	26	-	26
Drift Gill Net	-	2	18	20
Handline	-	-	11	11
Scoop Net	-	-	2	2
Total	116	254	234	604

Flying fish constituted from 69% to 93% of the annual catches, in terms of volume, from 2013 to 2015 or an average of about 84% during the three-year period (Table 2). Three genera of flyingfishes were identified, namely, *Cheilopogon* which constituted about 63% of the flying fish caught in terms of volume, followed by *Cypselurus* and *Hirundichtys* with 7.6%, with 6.5% contributions, respectively. About 1.2% of the flying fishes were unidentifiable to the genus level.

Table 2: Comparison of estimated annual fish catch estimates (MT) and relative percentage contribution of flying fish *"Bangsi"* to the total fish harvest in Sarangani Bay, 2008-2012.

Year	Est. Annual Catch(kg)	Flying fish Catch (kg)	%
2013	704,758	655,271	93
2014	508,591	349,559	69
2015	342,337	300,041	88
Total	1,555,685	1,304,911	84

At the species level, *Cheilopogon abeir*, was the most dominant species caught, constituting 21.45% of the total catches. This is followed by *Cheilopogon unicolor* (12.9%), *Cheilopogon furctatus* (12.4%), *Cheilopogon suttoni* (8.5%), *Cypselurus poecilopterus* (5.7%), *Cheilopogon atrisignis* (5.1%), *Hirundichthys Oxycephalus* (4.5%), *Parexocoetus mento* (3.8%), *Hirundichthys speculiger* (1.9%) and *Cypselurus callopterus* with (1.7%), respectively. Other fish species make up the remaining 22.1%.

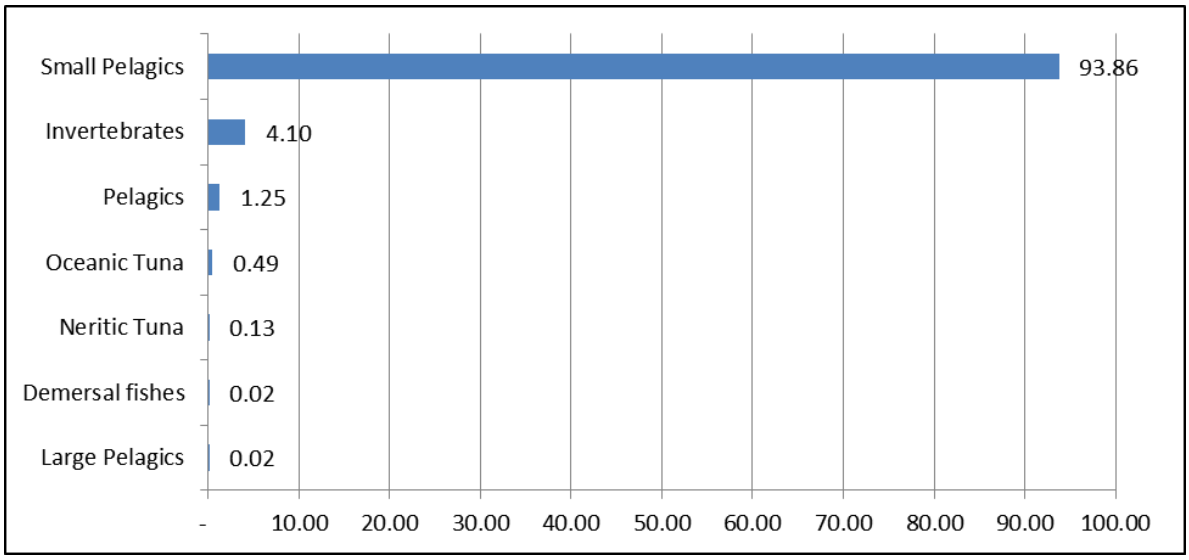

Fig 2: Relative Percentage by Fish Classification (NSAP Data 2013-2015)

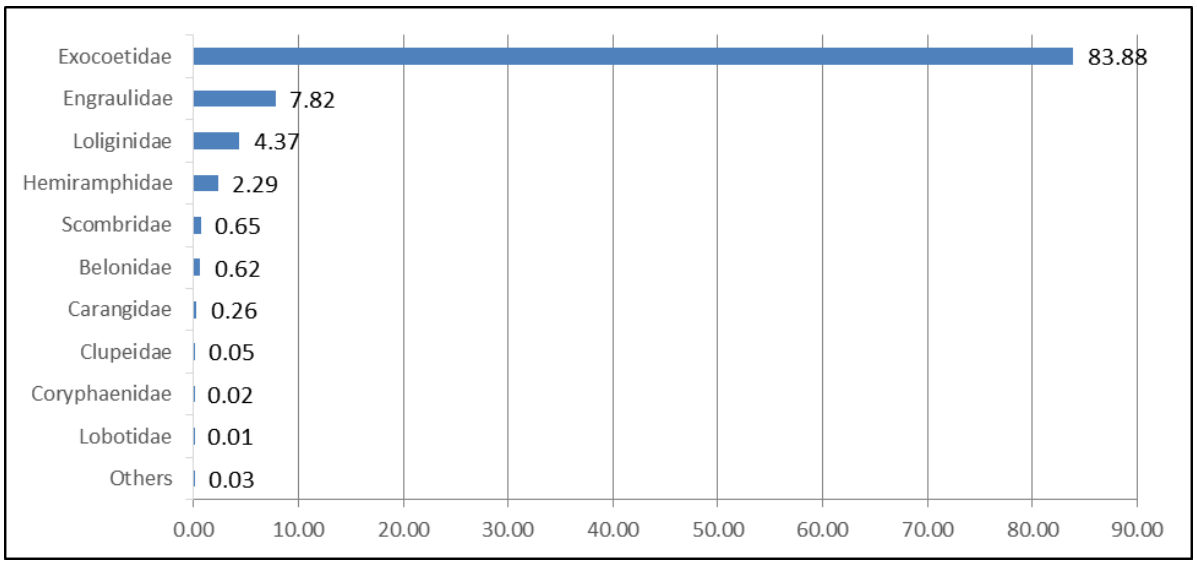

Fig 3: Relative Abundance of Fishes by Family

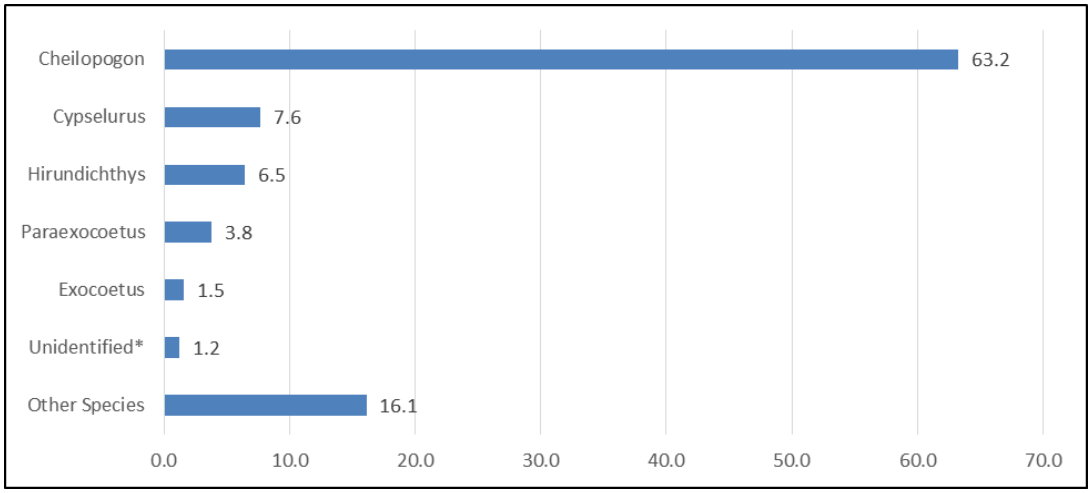

Fig 4: Relative Abundance of Flying Fish by Genera

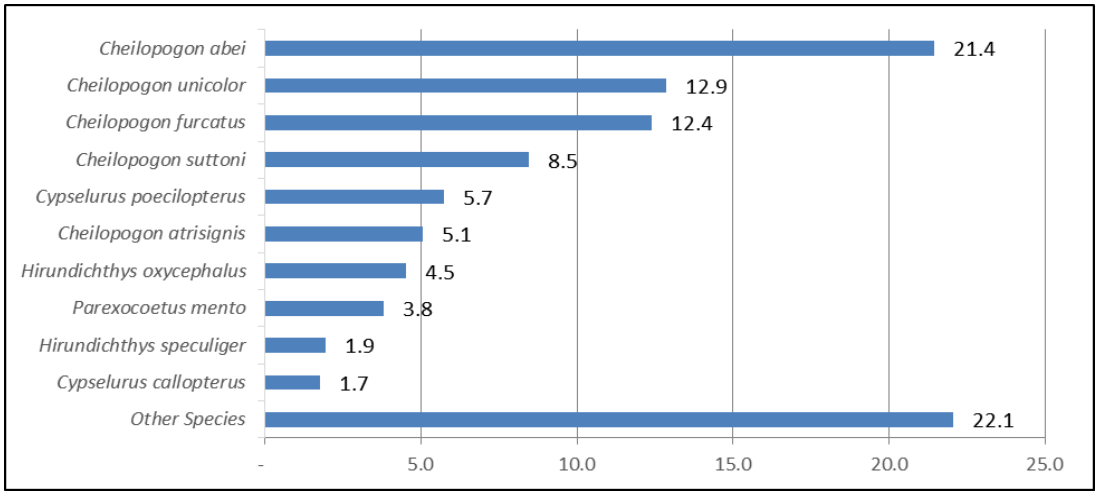

Fig 5: Relative Abundance of Flying Fish by Species

Flying fish were caught throughout the year using surface gill nets. It was observed that in 2013 and 2015 peak months occurred in the month of February to April and October to November in 2014 (Figure 5) similar to the pattern for *Amblygaster sirm (*Baclayo *et al*., 2016) [8]; *Cypselurus nigricans* and *Cypselurus poecilopterus* (Dalzell 1993) [4]. In a study in the Caribbean, it was reported that effects of daily variation in the environmental variables (rainfall, temperature, cloud cover, wind speed, relative humidity, and luminescence) on trip frequency, total catch, and catch per trip were either statistically insignificant or negligible (Boyce *et. al* 2007) [16]. Annual catches of flying fish showed a downward trend, from 655,271 metric tons in 2013 to 300,041 mt in 2015 (Table 2) indicating declining abundance and unsustainable state of flying fish fishery. Generally, there is a declining state of capture fisheries in the Philippines, thereby potentially undermining food security and overall being of the millions of fishers and their households in the country especially those in coastal fishing areas.

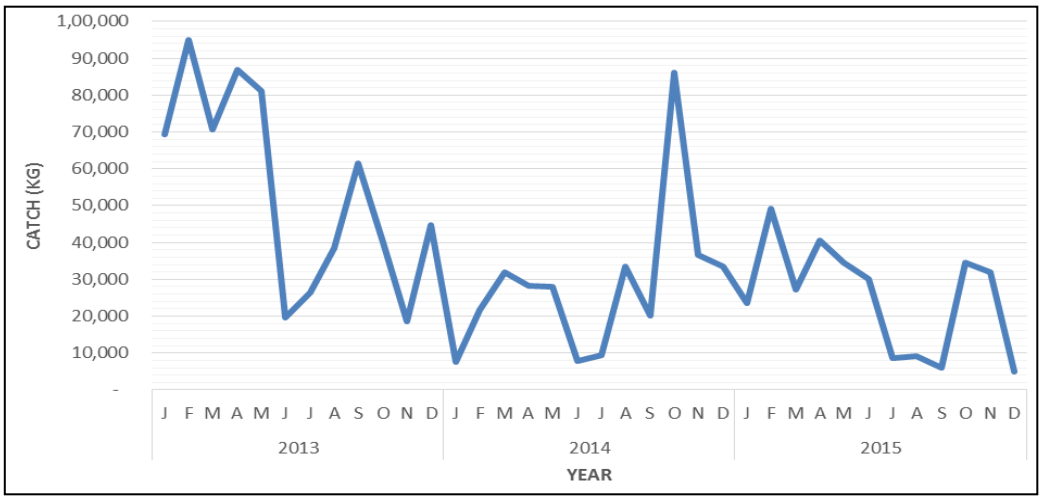

Fig 6: Seasonality of flying fish 2013-2015

6. Summary and Conclusion

Our study showed the importance of small pelagic fishes, particularly flying fish in Old Poblacion, Maitum Sarangani province where the fish observed as the most abundant species landed in the area caught in the Celebes Sea as the main fishing ground for the flying fish for gillnet fisheries. In terms of volume small pelagic exhibited the highest percentage with 93.86% while large pelagic contributed less than 1% only of the harvested catch. Flying fish (Exocoetidae) shared 83.88% to the total harvest, ranked the second most dominant species in town which Surface gillnet was the main gear used; a fishing gear was exclusively used for catching flying fish. Due to the abundance of the species, thousands of households in Maitum depend on the flying fish fishing industry as their main source of livelihood. Aside from being sold as fresh, local skills in fish processing, and unique technology on marinating flying fish was also practiced by the residents and turned-out the most potential business in town. Among the five genera, Cheilopogon obtained the highest rate of 63.2% which comprises of *Cheilopogon abei, Cheilopogon unicolor, Cheilopogon furcatus and Cheilopogon suttoni,*; Exocoetus and those unidentified species of flying fish were on the lowest point with 1.5% and 1.2 %, respectively. Unidentified species was subject for species identification to be submitted in National Fisheries Research and Development Institute who was expert in flying fish species ID. With the widespread deterioration of coastal ecosystems due to various anthropogenic and natural disturbances in additions to increasing privatization and closure of coastal waters from fishing, fishers in the country's capture fisheries maybe becoming more dependent on small pelagic fishes. Coral reefs and nearshore fisheries have drastically declined over the past few decades which undermine the livelihood and food security in the heavily fishery-dependent coastal communities in the Philippines. The declining catch trends indicate the alarming condition of the fisheries and that management actions, such as fishing regulation initiatives, are urgently neededin order to ensure the sustainability of the fisheries, which provide the major livelihood in Sarangani Province and in many coastal fishing communities in the Philippines.

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