Species Composition, Abundance, and Catch Trends of Roundscads *Decapterus* spp. in Iligan Bay, Northern Mindanao, Philippines

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ABSTRACT

Roundscads *Decapterus* spp., locally known as "galunggong or marot" are small pelagic fishes that form a major segment of the country's fisheries. These are tagged as the "poor man's fish" in the early 1990s because of their affordability. However, recently they have become more expensive for many Filipino families due to a sharp increase in market prices brought about partly by declining catch. Despite their contribution to fisheries production in Iligan Bay, scientific information on their stock, fishery, and reproductive attributes which are important in the formulation of fisheries management options are wanting. This paper presents the composition, abundance, and catch trends of roundscads in Iligan Bay. Among all fish groups landed, roundscads were the second most abundant next to the tuna group. The roundscad species identified in Iligan Bay were *Decapterus macrosoma*, *D. macarellus*, *D. kurroides*, *and D. tabl*, of which *D. macrosoma* was the most abundant at 40.10%. Samples were caught mainly by ring net, the only commercial gear operated in the area, and a variety of municipal gears. Roundscad landings which were contributed largely by commercial fishing showed seasonal patterns as probably influenced by monsoon seasons. High catches, totaling to 56.86MT, occurred during the Northeast Monsoon from October 2017 to May 2018 while low catches, amounting to 3.06MT, were monitored within the Southwest Monsoon from June 2018 to September 2018. The foregoing results provide basic information on roundscad resources in Iligan Bay that forms part of a scientific basis in crafting a suitable fisheries management plan.

Keywords: roundscads, galunggong, *Decapterus* spp., Iligan Bay, catch trends

INTRODUCTION

The roundscads, *Decapterus* spp. of family Carangidae, locally known as "galunggong, have formed one of the most important fisheries in the Philippines for decades (Shomura et al., 1970; Ronquillo, 1973). These species have become a source of cheap animal protein (Ronquillo, 1973) for many Filipino families and have been tagged as the "poor man's fish" because of their affordability (Garcia et al., 2010). They are commonly found in considerable quantities in local markets and are usually caught in large volumes with a 5% contribution to marine fisheries production a year from 2015 to 2017 (PSA, 2018). But in recent years, the productivity of some of the major fishing areas in the country has declined. In 2016, the decrease in the volume of catch posted a negative growth of 0.05% and continued to decline at 0.04% in 2017 (NFRDI, 2017).

Data cited from the Philippine Statistics Authority (PSA, 2018) disclosed that the combined roundscad production from commercial and municipal fisheries in 2017 totaling 183,077.67MT, showed a substantial decrease from 211,776.5MT in 2016 and from 225,101.69MT in 2015. Such has posted the biggest rate of decline by 13.5% from 2016 to 2017 which prompted the government to import around 17,000 MT of roundscads in September 2018 (Mogato, 2018). Furthermore, a sharp increase on their market prices makes the fish less affordable to some consumers and has impacted not only the food demand of the country but also the livelihood and source of income of the small-scale fishermen, commercial fishing operators and stakeholders across the fisheries sector (Ani, 2016).

Most major fishing grounds for pelagic fisheries are usually found in coastal and shallow seas throughout the Philippine archipelago (Ronquillo, 1973). The Bohol Sea is one of the traditional fishing grounds of roundscads in the country for both commercial and municipal fishing. Iligan Bay in Mindanao is the biggest bay that connects to the Bohol Sea. Commercial and municipal catch landings in this area are dominated by tunas, roundscads, big-eyed scads, and sardines (NFRDI, 2017), indicating their important contribution to the Bay's fisheries production. Despite their economic importance, no studies focused on roundscads have been carried out in Iligan Bay. To contribute to the current pool of information on roundscads in Northern Mindanao which is essential in determining management options to improve their production in the future, an assessment on their stock, fishery, and reproductive characteristics in Iligan Bay was conducted from October 2017 to September 2018. This paper presents the composition, abundance, and catch trends of roundscads in

Iligan Bay. The generated information is an important input in a site-specific ecosystem-based fisheries management plan for roundscads in Iligan Bay.

MATERIALS AND METHODS

Description of the study site

Iligan Bay, with an area of 1,811.16km^2, is the largest bay in the western part of Northern Mindanao that connects to the Bohol Sea (PSA, 2018). It is bounded by the three provinces of Misamis Oriental, Lanao del Norte, and Misamis Occidental (Fig. 1).

Species identification and Verification

The preliminary identification of roundscad species made use of their morphometric and meristic characteristics as described in FishBase (2000). To confirm the identification, tissue samples for each identified species were sent to DNA Sequencing and Bioinformatics Facility, Philippine Genome Center for DNA analysis. The neighbor-joining method was used to generate the phylogenetic tree.

Landed Catch Monitoring

Dockside surveys of landed catches were conducted from October 2017 to September 2018 in 11 sampling stations around the Bay (Fig. 1). Landed catches were recorded by field enumerators every other day for 20 days in a month using the standard fish landing survey form (de Guzman et al., 2015). The data gathered included the type of boat, gear type and specification, number of hours per fishing trip, number of fishers per boat, number of hauls per fishing operation (ring net), number of hooks per fishing operation (hook and line), fishing ground, total catch per fishing operation, the total weight of catch in kilograms per species and selling price per kilogram.

Data Analysis

Landed Catch Estimates

Estimates of total landed catch were extracted from the catch data recorded from dockside/landing surveys based on the methods by Sparre (2000).

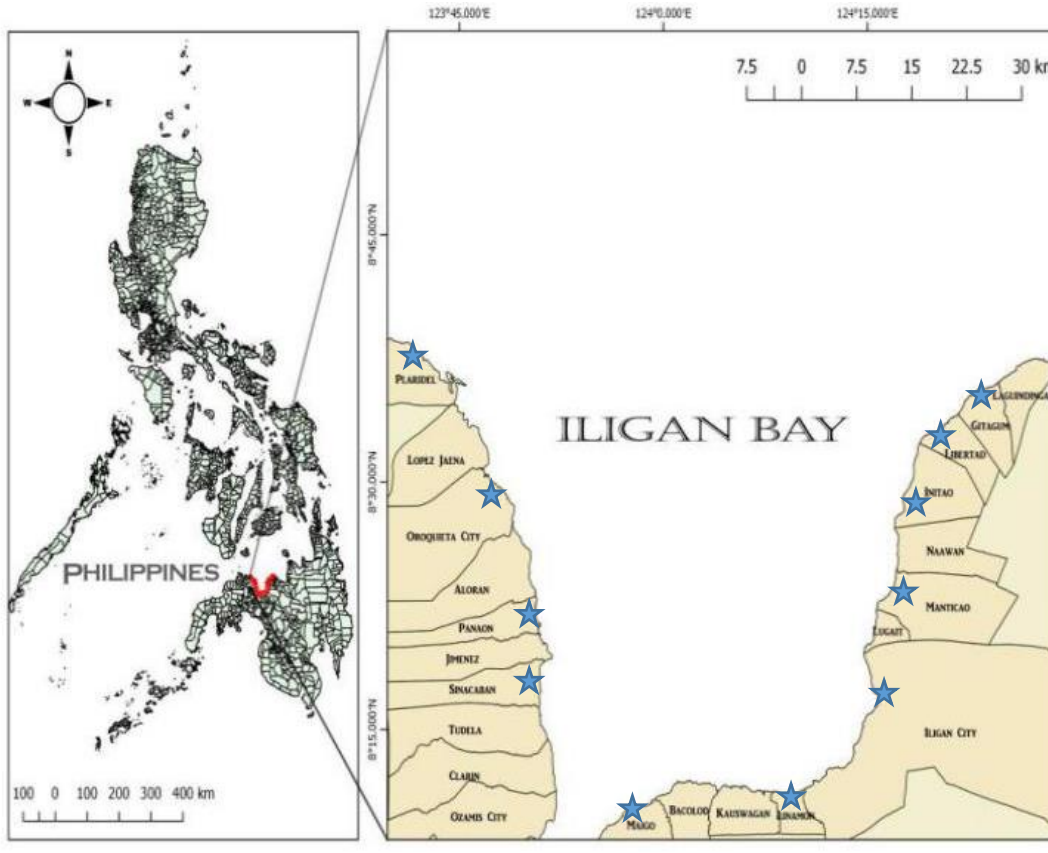


Figure 1. Map of Iligan Bay showing the various monitoring stations (★).

Total production estimates of roundscads were calculated following the formula using Raising Factor (*RF*):

RF = N(T)/n(t); where

N is the total number of units per gear type that catch roundscads

T is the total number of fishing days per month for that particular gear type

n is the actual number of units monitored per gear type

t is the actual number of days monitored per month

Monthly production estimate per gear type = *RF* x total monthly recorded catch for each gear type

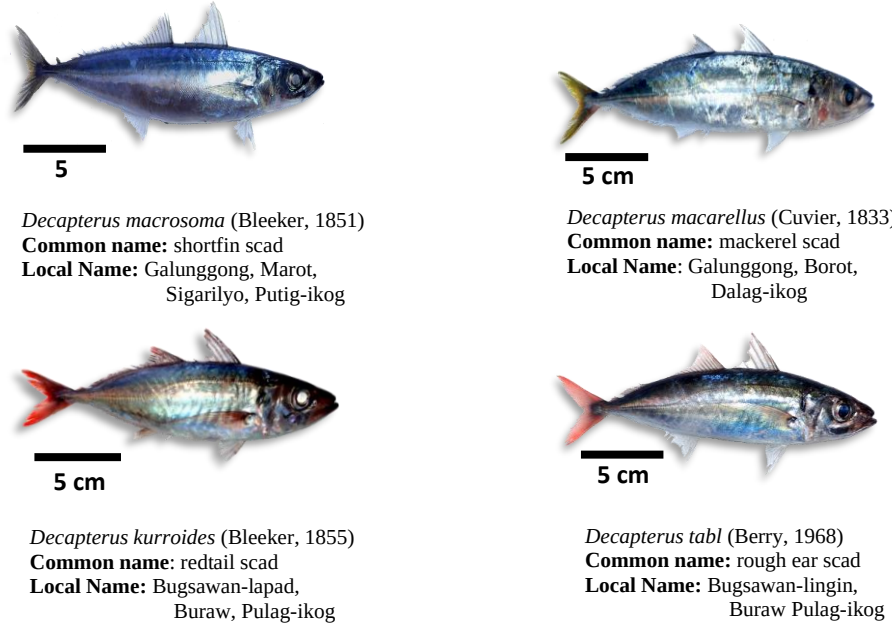
The total production estimate of roundscads is the sum of monthly production estimates of all gear types.

RESULTS AND DISCUSSION

Iligan Bay, considered as the biggest bay in the western part of Northern Mindanao connecting to the Bohol Sea, is recognized as one of the traditional fishing grounds of roundscads in the Philippines (Pastoral et al., 2000; NFRDI, 2017). Thus, the information generated in the present study is very timely and relevant en route for the sustainable management of commercially important fish resources in the Bay such as roundscads.

Species Composition

Four species of roundscads were recorded out of the 165 fishery resources caught in Iligan Bay from October 2017 to September 2018 as shown in Fig. 2. These species are also among the six roundscad species documented in Philippine waters (Herre, 1953; Lavapie-Gonzales et al., 1997; Narido et al., 2016). Taxonomic identification of the species was based on their external anatomy and verified through DNA analysis of tissue samples.



Decapterus macrosoma (Bleeker, 1851)
Common name: shortfin scad
Local Name: Galunggong, Marot, Sigarilyo, Putig-ikog

Decapterus macarellus (Cuvier, 1833)
Common name: mackerel scad
Local Name: Galunggong, Borot, Dalag-ikog

Decapterus kurroides (Bleeker, 1855)
Common name: redtail scad
Local Name: Bugsawan-lapad, Buraw, Pulag-ikog

Decapterus tabl (Berry, 1968)
Common name: rough ear scad
Local Name: Bugsawan-lingin, Buraw Pulag-ikog

Figure 2. Roundscad species recorded in Iligan Bay from October 2017 to September 2018.

A detailed description of the external anatomy of each species is provided in FishBase (2000). However, their external features in actual field observations are rather challenging as all species appeared to be very similar especially the two *Decapterus*

species; *D. kurroides* and *D. tabl* and only someone with a keen eye can distinguish them one from the other. For example, the redtail scad *D. kurroides* is much broader while the rough ear scad *D. tabl* is more rounded. Both species also have red-colored caudal fins except that it is much brighter in *D. kurroides*. On the other hand, *D. macarellus* and *D. macrosoma* have a yellow-green and a whitish caudal fin, respectively, the latter being the most slender among the four species.

The DNA analysis using the *cyt b* gene marker verified the identification of the three species except for *D. tabl* which could not be supported by the phylogenetic analysis performed (Fig. 3). It can be observed that *D. kurroides* and *D. tabl* share the same node and lineage indicating their nearness or close relatedness and is proof why they also share many common external anatomical features than any other *Decapterus* species. However, the tissue sample from *D. tabl* sent for DNA analysis labeled as RT1 deviated from that of *D. kurroides* and *D. tabl* suggesting an inconclusive identification of the former species using the *cyt b* marker. As a consequence, the taxonomic identification of *D. tabl* in the present study was solely based on the existing name of the fish found and described in FishBase (2000). The relationship between *D. muruadsi* and *D. macarellus* is not resolved in this tree. Further studies on the molecular characterization of the *Decapterus* species is recommended.

Landed Catches

During the study period, the landed catches for all 165 fishery resources monitored from Iligan Bay obtained a total of 288.53MT. Of these, 20.77% or 59.92MT was recorded for all four roundscad species, next to the tuna family with 29.91% (Fig. 4). This 59.92MT of roundscads is 93.97% of the 63.77MT composite roundscad landings recorded in the entire survey while the remaining 6.03% represented the catches from the neighboring waters of Siquijor, Dipolog, and Camiguin (Fig. 5).

Decapterus macrosoma and *D. kurroides* were more frequently sampled in the Misamis Occidental side of the Bay while *D. macarellus*, D. *kurroides*, and *D. tabl* were commonly collected across the Misamis Oriental-Lanao del Norte side. Based on the recorded landed catches for all species of roundscads totaling to 59.92MT, *D. macrosoma* was the most abundant at 40.10% (24.03MT) and D. tabl was the least abundant at 0.46% with 0.28MT (Fig. 6). Decapterus macrosoma also appears to be consistently abundant in many fishing grounds in the country particularly in Palawan (Ronquillo, 1973); Tawi-Tawi (Aripin and Showers, 2000); offshore waters in Candon, Ilocos Sur, Dasol, Pangasinan, Subic Bay, Zambales and Paluan, Mindoro (Pastoral et al., 2000); and in Hinatuan passage, Northeastern Mindanao (Baclayo et al., 2016).

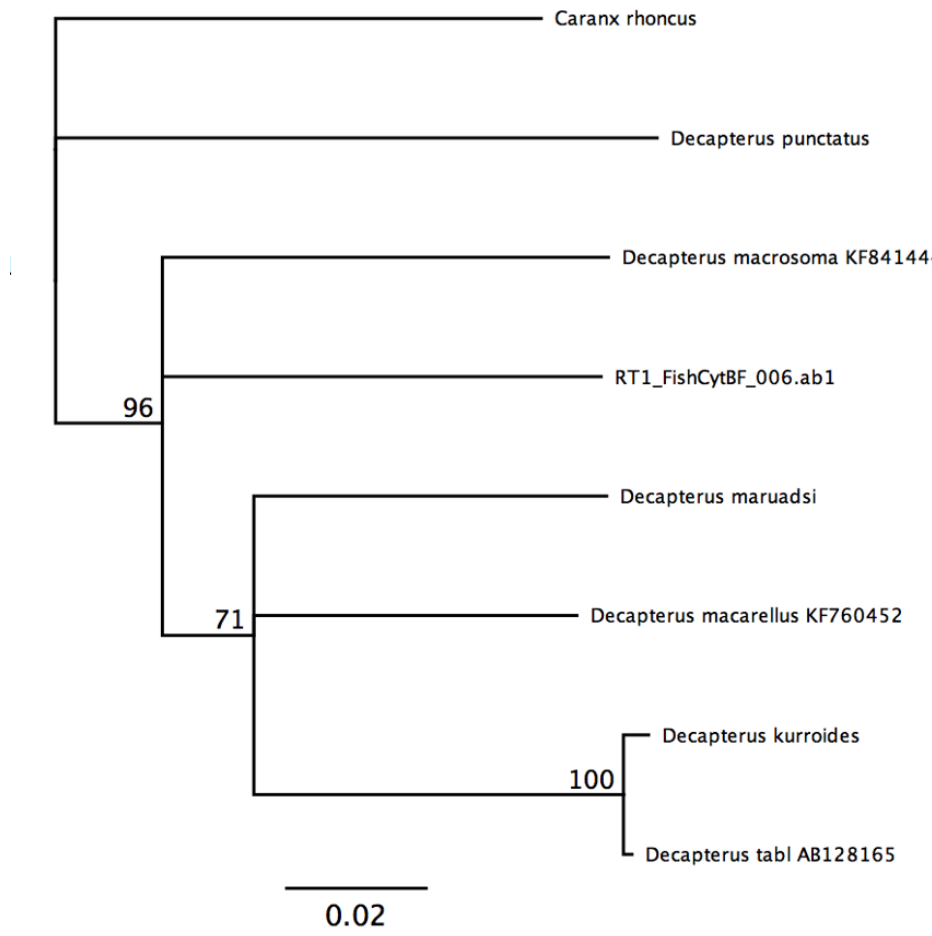


Figure 3. Overall phylogenetic tree showing agglomerative hierarchical clustering of the six *Decapterus* species using the *cyt b* marker. The vertical scale represents the branch length.

Similarly, the Philippine Statistics Authority also reported this species as the most abundant and even ranked 4th among the top 20 species observed in marine artisanal landings in Regions IX-XIII and ARMM from 1981-2006 (Parducho and Palomares, 2014). Other studies also documented the abundance *of D. macrosoma* in the South Sulawesi Sea, Indonesia (Dahlan et al., 2014) and along Karnataka coast, India (Reuben et al., 1992; Rohit and Shanbhogue, 2005).

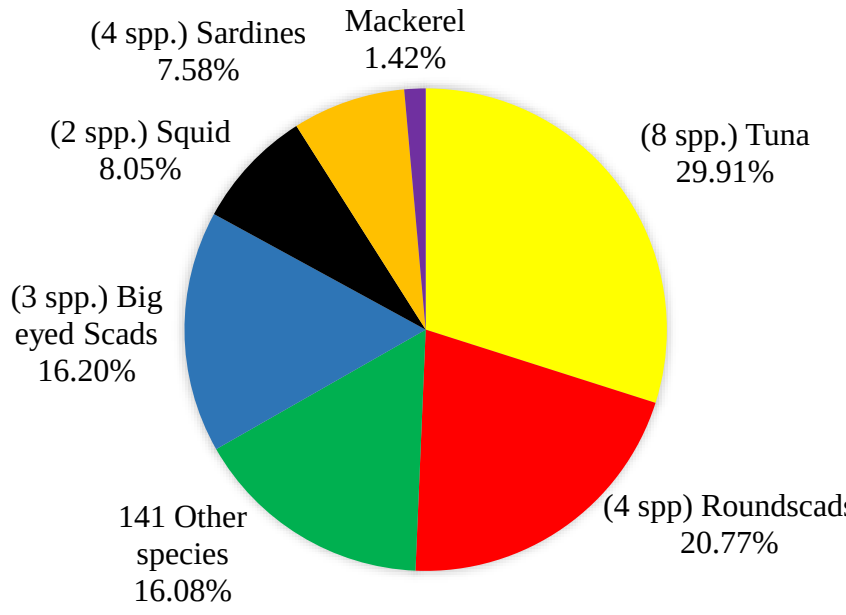


Figure 4. Major fish resources in Iligan Bay from October 2017 to September 2018 landings.

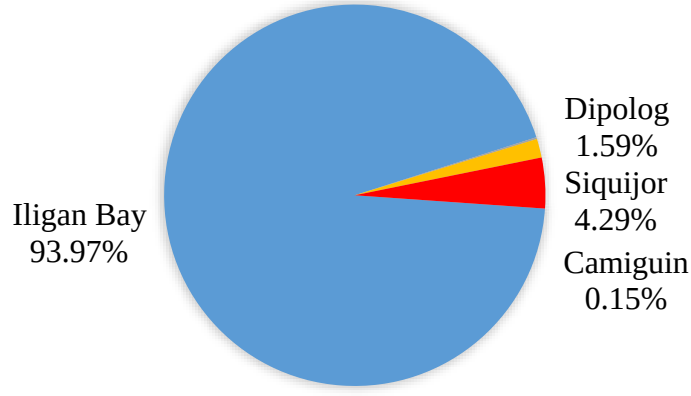


Figure 5. Sources of roundscad landings recorded in Iligan Bay from October 2017 to September 2018.

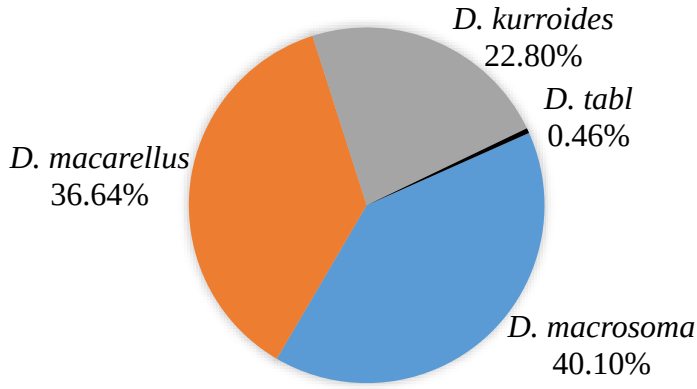


Figure 6. The abundance of roundscad species in Iligan Bay.

While *D. macrosoma* was observed to be abundant in landings during the sampling period, previous studies, however, recorded the abundance of *D. macarellus* and another species *D. russelli* in commercial and municipal landings in Iligan Bay in 2014 (NFRDI, 2017). The latter species has also been reported to occur in the neighboring bays of Gingoog (MSUN-FSDTI, 2000) and Butuan (MSUN-FSDTI, 2004). Conversely, the present study did not observe *D. russelli* from the landings in Iligan Bay.

These landings were contributed collectively by ring net (*kubkob*, *kubkuban*, *lantsa*), the only commercial fishing gear operated in the Bay and eight municipal fishing gears namely the drift gillnet (*palutaw*), bottom set gillnet (*palugdang*), simple handline (*pasol*), troll long line (*subid*), multiple handline (*bundak*, *lampurnas*, *lapris*), and bottom set longline (*palangri*). Of these gears, the ring net provided the large bulk of the landings at 50.75MT as compared to landed catches from the municipal fishing gears which accounted for only about 9.18MT. Among the municipal fishing gears, 3.14MT was attributed to the multiple handline "*bundak*" catches and a much smaller volume of composite landed catches for the other remaining seven gear types. The large catch volume generated by the ring net suggests its efficiency in catching fish as compared to the traditional municipal fishing gears.

Figure 7 shows the monthly roundscad landings fluctuations throughout the study period. High catches were recorded from October 2017 to May 2018 with the highest volume observed in May when all species, except for *D. tabl*, registered their highest catches. Meanwhile, low volumes of catch were monitored in June 2018 to September 2018. As shown in Fig. 7, roundscads are caught throughout the survey but, data on catch landings suggest seasonal patterns as probably influenced by monsoon

seasons. The Philippines and other countries in the Southeast Asia region are affected by two monsoon systems, the Southwest Monsoon, SWM, and the Northeast Monsoon, NEM (Loo et al., 2015; Matsumoto et al., 2020;). The onset of monsoon seasons can be defined in several ways and this paper subscribes that SWM covers the months of June to September (Cayanan et al., 2011; Cruz et al., 2013). The SWM, locally known as "habagat", brings sporadic moderate to torrential rains in a particular time and place (https://weatherph.org) in the country. In Iligan Bay, strong winds, big waves, and frequent rainfall are prevalent during SWM which according to local fishermen put limitations on their fishing operations resulting in lower catches. The transition period from the SWM ("habagat") to NEM ("amihan"), though may vary from year to year, usually occurs in October through early November (Cruz et al., 2013; https://weatherph.org). During November through April, the dry winds bring an overall relatively good weather with scanty rainfall (Matsumoto et al., 2020; https://weatherph.org). Around the Bay at this period, good weather with lesser rainfall is widespread, thus providing fishermen better fishing opportunities resulting in higher catches.

Accordingly, the peak season in fishing varies in different fishing areas in the Philippines (Masthawee, 1986). For instance, in Palawan waters, it occurs during the SWM and in the Visayan waters during NEM. Similarly, in Iligan Bay, the peak season also occurs during NEM ("amihan") which can be correlated to the relatively good weather prevailing over the area during this period.

Roundscad Production Estimates

From the recorded landed catch, the study estimated the total roundscad production of Iligan Bay from October 2017 to September 2018 at 934.10MT, which is much lower than the reported production estimates for the same Bay at 37,003.47MT as well as for the adjacent Macajalar Bay at 25,176.72MT, from 2004-2007 (Santos, 2011). Of the 934.10MT, roughly 79.85% or around 745.88MT was contributed by commercial fishing while only 20.15% or 188.22MT by municipal fishing. In parallel with the landed catch trends, roundscad production from commercial fishing was also quite high from October 2017 to May 2018 with minor peaks in October and February and a major peak in May.

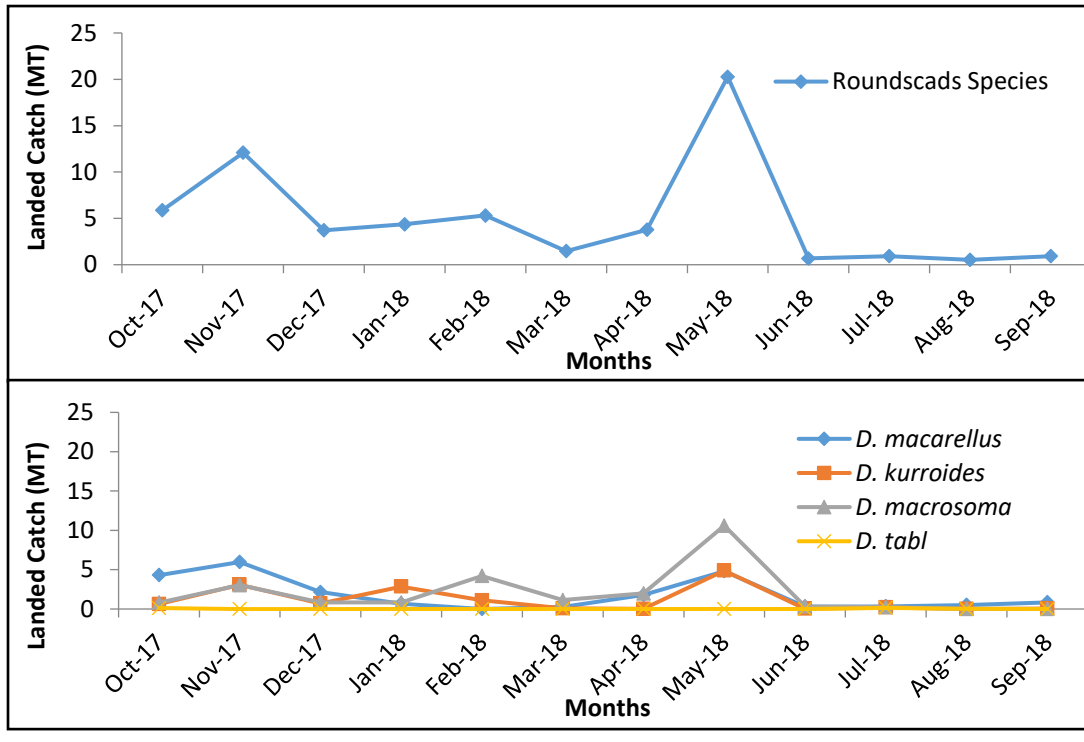


Figure 7. Total roundscad landings in Iligan Bay recorded from October 2017 to September 2018 (top). Landings of the roundscad species (bottom).

Furthermore, estimates of production from municipal fishing during the same months were also high with a peak in May, although of lesser proportions as those from commercial fishing. Low production estimates from both sectors were noted in June 2018 to September 2018 (Fig. 8), similar to the trend observed in landed catches which could also be relatively associated with monsoon seasons.

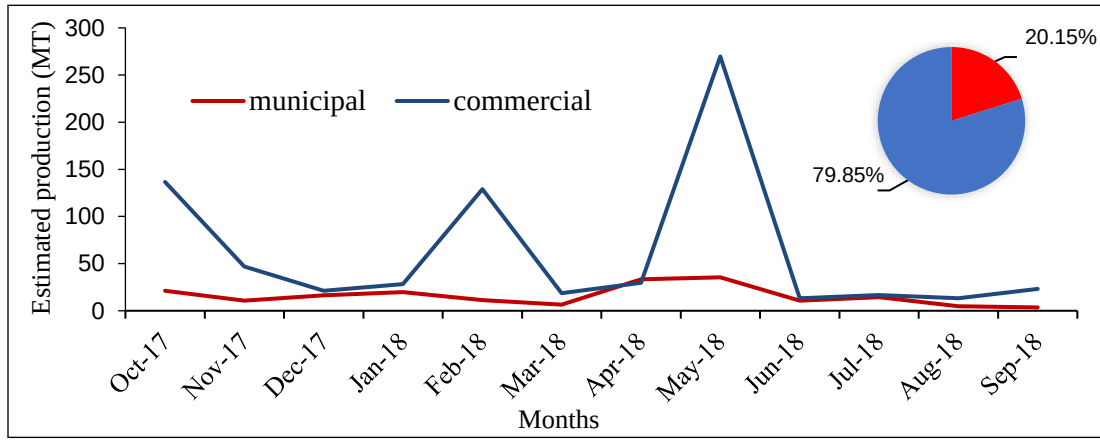


Figure 8. Estimated roundscad production from commercial and municipal fishing.

The total roundscad production in the Philippines reported at 168,150MT is primarily produced by commercial fisheries comprising 70.26 % of the country's total production in 2018 and only a fraction is attributed to marine municipal fisheries (Philippine Statistics Authority, 2018) and suggestive of its significant contribution to the total fishery production. In this study, as displayed in Fig. 8, the same trend is also documented, validating the assertions made by local fishers at the start of the survey that catches between commercial and municipal fishing differed substantially.

CONCLUSION AND RECOMMENDATION

Four species of roundscads were recorded in Iligan Bay from October 2017 to September 2018 and ranked second to the tuna group at 20.77%. This may suggest the importance of roundscads in terms of their contribution to the total fishery of the Bay during the sampling period. Although the identification of *Decapterus tabl* still needs additional DNA analysis using the CO1 marker for final verification, it is distinct and separate from the other three genetically verified species in the study site.

Among the four species, the shortfin scad, *D. macrosoma* is the most abundant while the rough ear scad, *D. tabl* is caught less frequently. The landed catches of all roundscad species exhibited a seasonal pattern where high landings coincided during the NEM (*amihan*) months while low catch landings occurred in the SWM (*habagat*). A large bulk of the catches at 79.85% of the total is contributed by a commercial fishing gear – the ring net or "kubkuban" and a small fraction of 20.15% is provided collectively by eight municipal fishing gears.

The results of this one-year monitoring on catch landings only provided initial insights on trends but are already useful information that can be used as framework for site-specific ecosystem-based fisheries management plan for roundscads in the Bay. However, further dockside monitoring of longer duration is recommended to generate a more comprehensive picture of the status of the resource in Iligan Bay.

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