Cephalopod Fishery of the Northern Sulu Sea, Philippines

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ABSTRACT

The cephalopod fisheries of the northern Sulu Sea based on Malalison Island, Culasi and in Tibiao, Antique, Philippines were monitored over a period of two years from April 2018 to March 2020, where catch (kg), species caught by gear, and fishing effort, were recorded daily *in situ* from a fixed and representative number of fishers. From these, catch, corresponding value, and fisher income were estimated. Of the three gears, the jigger fully (100%) targets cephalopods, while spearfishing catch fish slightly more than cephalopods. A total of five cephalopod species are exploited by the fishery i.e., two squids (*Sepioteuthis lessoniana* & *Sthenotheuthis oualaniensis*), one cuttlefish (*Sepia latimanus*), and two species of octopods (*Callistoctopus nocturnus*, and *Octopus cyanea*). Of these, the octopod species dominated the catch (71%) with *S. lessoniana* comprising the least (2%). Hook and line showed the highest catch (41.98%) of all gears, responsible for catching the two octopod species the most. Annual fisher income proved to be highest (annual mean PhP 54,508.84 yr^{-1}) among those employing jiggers to exploit *S. oualaniensis*, the most expensive (PhP200 kg^{-1}) species. The fishers' annual income may not be much, but is augmented by other forms of fishing, specifically gleaning. Studies on these species' population biology (age, growth, and mortality) and reproductive biology are necessary to further elucidate the level of exploitation towards ensuring their sustainable utilization.

KEYWORDS:

Cephalopod fisheries, Northern Sulu Sea, species population biology

INTRODUCTION

Aside from being significant components of most marine ecosystems, cephalopods more importantly, represent many valuable fisheries (Boyle & Rodhouse, 2007). The Philippine Statistical Authority (PSA) reported that between the years 2002 and 2017 (a period of 15 years), squid catch in the Philippines was equivalent to 895,000 MT (or 59,500 MT yr^{-1}) of which the highest portion (17.9%) or 10.7 MT yr^{-1} (= US$17, 777.8 yr^{-1}) was landed in Western Visayas region (PSA, 2020). These are, however underestimates because from a study between April 2018 to March 2020, total squid catch in a portion of the Western Visayas region (Panay Island) alone was equivalent to 1,827.1 MT yr^{-1} or $5.3M yr^{-1}. (del Norte-Campos et al., in prep.), equivalent to US$5.3M in value. Furthermore, PSA statistics do not provide information on the species and fishing gears concerned. This highlights the general lack of knowledge on the identity of the cephalopod species occurring in the country where misidentifications (del Norte-Campos et al., 2003) and/or lack of correct identification (e.g., Armada et al., 1983) also exist in the literature. Due to the lack of the minimum information of what species are being exploited, it is likewise difficult to plan biological studies that will support management measures for these species.

The northern portion of the Sulu Sea, basically serving the main fishing grounds of Antique province fishers, hosts a number of gears which exploit cephalopods, mostly as target species. Aside from documentation of the catch of trawl in other parts of Panay Island whereby cephalopods are included (del Norte-Campos, et al., 2000; 2003) and the account on the chambered nautilus fishery of Tibiao, Antique (del Norte-Campos, 2005), no other papers have tackled the cephalopod fisheries of Antique. This paper thus aims to characterize the cephalopod fisheries of the northern Sulu Sea. It specifically aims to a) determine the species composition and relative frequency (%)

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of catches, b) present gears, their corresponding catch composition, and relative importance (%), and c) estimate annual catch by gear and species, corresponding mean annual value and annual income of individual fishers.

MATERIAL and METHODS

Study Area, Data Collection and Processing

The study was conducted in the northern Sulu Sea, Philippines where catches are landed in two sites: Malalison Island, Culasi and Tibiao, Antique (Fig.1). After determining which gears operate in each area, fishery monitoring was established covering a period of two years, between April 2018 and March 2020. This consisted of recording the daily catch (kg) and fishing effort of a fixed, representative number of fishers for each gear and site. As much as possible, data were recorded from the catches of the same fishers, taken to be representative, for the entire sampling period. Mean daily catch rates by species and gear were computed, averaged on a monthly basis and plotted against months. Total annual catch (kg yr^{-1}) by gear and species was computed by multiplying mean monthly catch rate with the total number of fishers and twelve months. Corresponding total annual value (PhP yr^{-1}) was computed by multiplying total annual value with the respective price (PhP kg^{-1}) of each species.

RESULTS

A total of three gears are used in the area, namely jigger, hook and line, and spear with the latter two having identical catches in terms of species (Table 1). These 3 gears catch a total of 5 cephalopod species (Tables 1 & 2), namely two squid species: the bigfin reef squid *Sepioteuthis lessoniana* (Loliginidae) and the purpleback flying squid *Sthenoteuthis oualaniensis* (Ommastrephidae), one cuttlefish (Sepiidae) species: the broadclub cuttlefish *Sepia latimanus*, and two octopus species (Octopodidae): the old woman octopus *Callistoctopus nocturnus* and the day octopus *Octopus cyanea* (common names from Dunning et al., 1998). Number of fishers by gear are as follows: spearfishing and hook and line, 70 each and jigger (50).

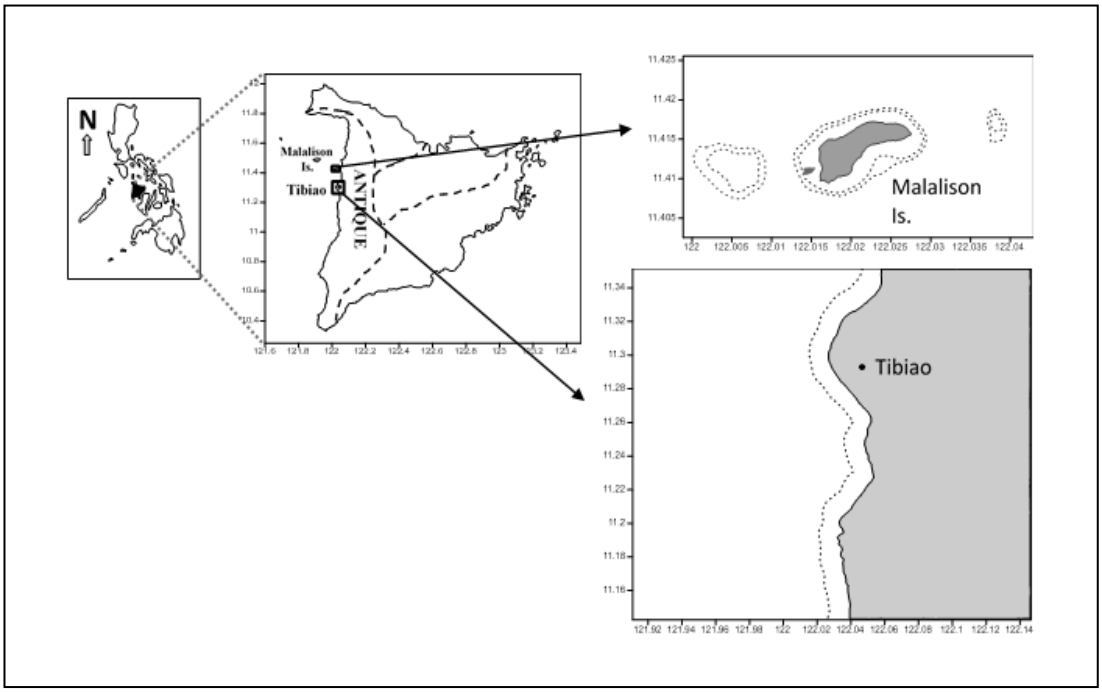

Figure 1. Location of the two sites (Malalison Island and Tibiao, Antique) in the northern Sulu Sea where fishery monitoring was conducted between April 2018 and March 2020.

Table 1. Cephalopod species caught by the three monitored gears used in the waters of Tibiao and Malalison Island, northern Sulu Sea.

Gear	Cephalopod Species Caught				
	Fishing Location	*Sepia latimanus*	*Sepioteuthis lessoniana*	*Octopus species**	*Sthenoteuthis oualaniensis*
Jigger	Tibiao				✓
Hook & line spearfishing	Malalison	✓	✓	✓	✓
	Malalison	✓	✓	✓	✓

*consists of 2 species ***Callistoctopus nocturnus*** and ***Octopus cyanea***

Table 2. Cephalopod species caught by all three gears in the northern Sulu Sea, with their English common and Filipino local names

Cephalopod Species and Family	***English Common Name (Dunning et al., 1998)***	**Filipino Local Name** *(del Norte-Campos et al. 2020)*
Squids		
Sepioteuthis lessoniana (Loliginidae)	Bigfin reef squid	"kulambutan"
Sthenoteuthis oualaniensis (Ommastrephidae)	purple back flying squid	"pansutan"
Cuttlefish		
Sepia latimanus (Sepiidae)	Broadclub cuttlefish	"bagulan"
Octopus (Octopodidae)		
Callistoctopus nocturnus	Old woman octopus	"pugita"
Octopus cyanea	Day octopus	"pugita"

Of the three gears, the jigger was the most specialized (100%) for cephalopods, followed by hook and line while non-cephalopods slightly exceed (50.2%) cephalopods in the catch of spearfishing (Fig. 2). Non-cephalopod catches included are usually fish.

Overall total catch from Years 1 and 2 increased from 53.7 to 62.1 MT yr^{-1} due to the increase in the catches of octopuses by 17,451.41 kg yr^{-1} whereas catches decreased in all species for the same period of time (Table 3). Of the 3 gears, hook and line showed the highest catch (almost 42%) in terms of total catch (Fig. 3) due mainly to the high catch of the 2 octopod species, which likewise showed the highest catch (71%) of all the 5 species (Fig. 4). On the other hand, least catch (23.5%) was shown by the jigger, which only catches the offshore species *S. oualaniensis* (also Tables 1 & 2). This species however was the 2nd

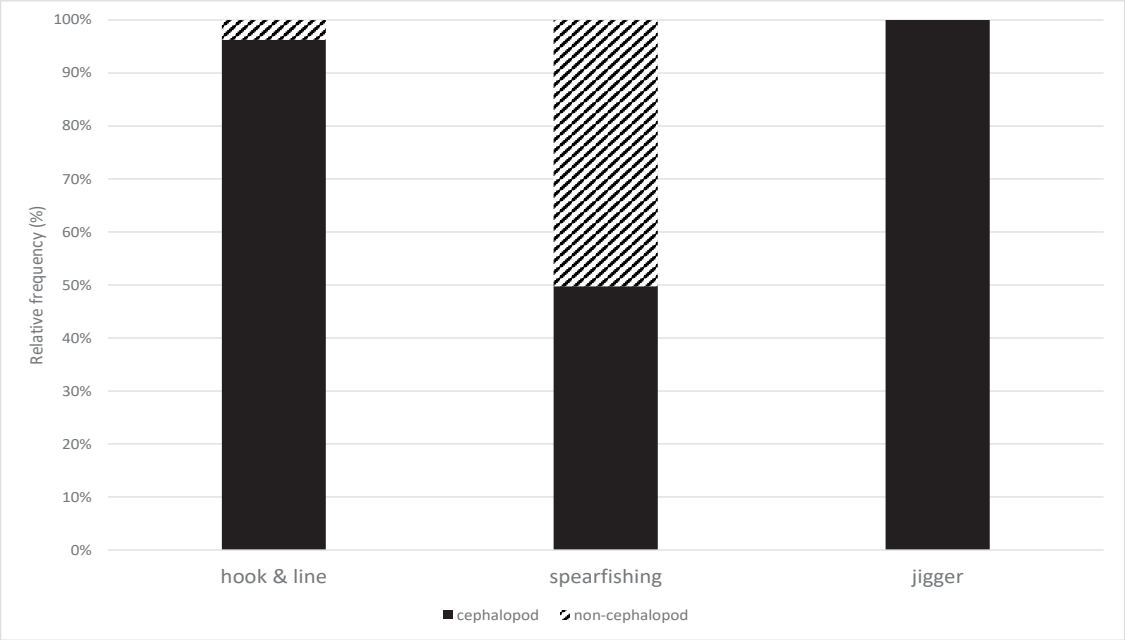

Figure 2. Relative proportion (%) of cephalopods and non-cephalopods in the catches of the fishing gears operating in the Northern Sulu Sea.

Table 3. Total and mean annual catch (kg yr^{-1}) of cephalopods by species for Years 1 (Apr 2018-Mar 2019) and 2 (Apr 2019-Mar 2020), corresponding value (PhP yr^{-1}), and income by gear as caught in the northern Sulu Sea, Philippines. (**HKLN** = hook & line; **SPF** = spearfishing; **JGR** = jigger).

Species	Fishing Gear	Price (PhP)	Annual Catch (kg yr-1)		Annual Value (PhP yr-1)		Annual Income Per Fisher (PhP yr-1)	
			Yr 1	Yr 2	Yr 1	Yr 2	Yr 1	Yr 2
Sepia latimanus	HKLN	90.00	362.64	924.06	31,737.38	83,165.38	453.39	1,188.08
	SPF		1,653.30	904.93	148,797.25	81,443.88	2,126.67	1,163.48
	Total		**2,005.94**	**1,828.99**	**180,534.63**	**164,609.26**	**2,579.06**	**2,351.56**
	Mean		**1,917.47**		**172,571.95**		**2,465.31**	
Sepioteuthis lessoniana	HKLN	100.00	859.59	45.91	85,958.60	4,591.32	1,227.98	65.59
	SPF		474.4	967.01	47,439.80	96,701.34	677.71	1,381.45
	Total		**1,333.99**	**1,012.92**	**133,398.40**	**101,292.66**	**1,905.69**	**1,447.04**
	Mean		**1,173.46**		**117,345.53**		**1,676.37**	
Octopus species (2) ***Callistoctopus nocturnus & Octopus cyanea***	HKLN	80.00	20,194.93	26,137.36	1,615,594.27	2,090,988.54	23,079.92	29,871.26
	SPF		12,193.35	23,702.33	975,468.14	1,896,186.54	13,935.26	27,088.38
	Total		32,388.28	49,839.69	2,591,062.41	3,987,175.08	37,015.18	56,959.64
	Mean		**41,113.99**		**3,289,118.75**		**46,987.41**	

Table 3 continued

Sthenoteuthis oualaniensis	JGR	200.00	17,872.67	9,381.74	3,574,534.44	1,876,348.89	71,490.69	37,526.98
	HKLN		97.57	0	19,514.93	0	278.78	0
	SPF		36.77	0	7,354.12	0	105.06	0
	Total		18,007.01	9,381.74	3,601,403.49	1,876,348.89	71,874.53	37,526.98
	Mean		13,694.38		2,738,876.19		54,700.76	
OVERALL TOTAL			**53,735.22**	**62,063.34**	**6,506,398.93**	**6,129,425.89**	**113,374.46**	**98,285.22**
OVERALL MEAN			**57,899.28**		**6,317,912.41**		**105,829.84**	

(23.7%) in terms of catch (Fig. 4) while of all the five species, *S. lessoniana* was caught least (2%) (Fig. 4).

The highest priced species (PhP 200.00 kg^{-1}) *S. oualaniensis* was also the highest in value (mean = PhP2.7M yr^{-1}), despite its low catches (Table 3). The catch of the two octopus species, on the other hand if halved, amounts relatively low (PhP1.6M yr^{-1}) despite their high catches and this is attributed to being the cheapest of all species. The low price of octopus reflects the low preference for these as food. Finally, mean individual income of fishers was observed to be highest (PhP54,700.76 $fisher^{-1}$ yr^{-1}) in the most expensive species (*S.oualaniensis*) despite the erratic catches followed by that of octopod species (PhP 46,987.41 fisher yr^{-1}). On the whole, individual income of the fishers may still be not much but are augmented by gleaning on the reefs. (Villarta et al. 2021).

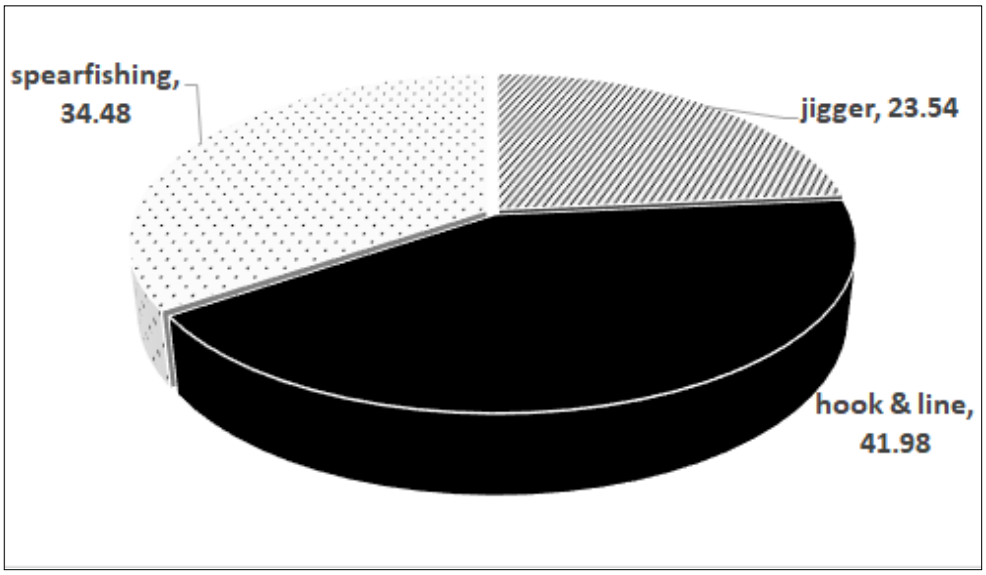

Figure 3. Relative fishing gear importance (%) in the cephalopod fishery of the northern Sulu Sea based on total catch.

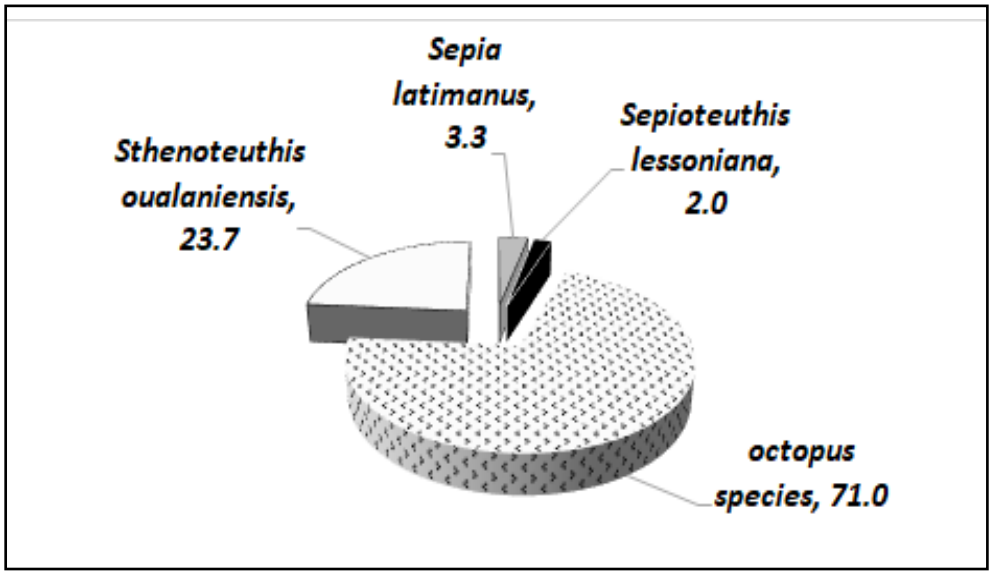

Figure 4. Relative species importance (%) in the cephalopod fishery of the northern Sulu Sea based on total catch.

DISCUSSION

The catch of the two species of octopus have not been segregated into species due to the inability of fishers in identifying them reflecting the inherent difficulty in identifying such cephalopods in the field. The field guide of del Norte-Campos et al. (2020) pointed out that the main morphological difference between the two species is the length of the dorsal arms relative to the other arms, a more subtle trait that fishers can easily omit. Fishers however reported much later that *C. nocturnus* is only caught at night (hence the scientific name) (Dunning et al., 1998), and *O.cyanea* only during the day (hence the local name). It was however, too late to re-construct the data. However, despite having not been able to separate the species, the comparison of the two species with the other species is still valid considering the magnitude of the higher catch and value of the two octopuses. Even dividing the mean overall catch for both species (41.1 MT yr^{-1}) (Table 3) into 2 (20.6 M yr^{-1}) will still make them the most highly abundant species in this fishery. In comparison however, the Malalison estimated octopus catch is very small compared to say, the octopus fishery of Lanuza Bay, NE Mindanao with a reported mean annual catch of 4,480MT,most of which is exported (Campos, et al. unpublished). Furthermore, corresponding value of the octopus fishery in Malalison is comparable small (PhP3.3M yr^{-1}) due to their low price (the lowest of the species caught in this fishery). More innovations are clearly needed to find better ways to increase their market value and make them more acceptable to consumers. Aside from these 2 species, another octopus species (*Cistopus indicus*) is caught by trawls in more northern fishing grounds of the island (del Norte-Campos et al., in prep.), bringing the total number of octopus species in Panay to three, the most numerous for one island, so far reported in the Philippines. Increase in overall catch from Yr 1 to 2 was clearly due to the consistent increase in catch rates of these 2 species especially from hook and line **(**Fig.5a), not observed in the other species except only in *S. latimanus* **(**Fig.5b), with a much smaller abundance compared to the octopuses (Fig. 4). The overall value of the catch increased from PhP53.7M yr^{-1} to 62 M yr^{-1}, proving that the increase in the catch of the octopus species was able to offset the decrease in the others.

Catches of *S.oualaniensis,* being an offshore species, proved to be erratic and irregular, being absent in the catches of hook and line and spear in Yr 2. This explains its lower overall catch compared to the octopus species (Table 3) and more so, its lower value, despite its higher price (Table 3). Basir (2000) first reported it to occur in the west coast of the South China Sea which is contiguous with the northern Sulu Sea, the study site of the present paper. Still, fishers who catch *S.oualaniensis* earn slightly more than

those who catch octopus. Clearly, the purple back flying squid's high price (PhP200.00 kg^{-1}) coupled by the lowest number of fishers (50) engaged in jigger activity were the reasons that explain this.

The third species with the highest mean annual catch *Sepia latimanus* has been reported as likewise exploited by the trawl fisheries in northern Panay, specifically in the Pilar and Capiz Bays (del Norte-Campos, et al., 2003) but not in Banate Bay (del Norte-Campos et al., 2003) on the opposite side of the island. More recent data show the species to constitute 17.2% of squid pot catches in the Gigantes Island, northern Panay Island with a corresponding value of PhP14.1M yr^{-1} (del Norte-Campos, 2023), again higher than in the present study. The least catch shown by *S. lessoniana* may reflect not only its lower abundance in the somewhat limited reef area of Malalison Island, but also the less efficient catch efficiency of the gears used in this area, compared to Bolinao, Pangasinan where it is caught more efficiently by jiggers (Campos et al., 1994). In contrast, *S. lessoniana* is a target species in Gigantes Islands, where it is solely caught by jiggers, and predominantly (82.&%) by squid pots (del Norte-Campos, 2023). The catches of the Malalison fishery may be small compared to those of other cephalopod fisheries, but the lack of other opportunities available for the fishers on this island makes it more critical that these are sustainably preserved and the first step to this is this documentation of its magnitude as baseline information.

Management and regulation of these gears remain unattainable without data on the population and reproductive biology of most of these species. Knowledge on their growth, mortality, exploitation, size at sexual maturity, and spawning seasons or biological data is necessary to provide rational guidelines on their sustainable utilization.

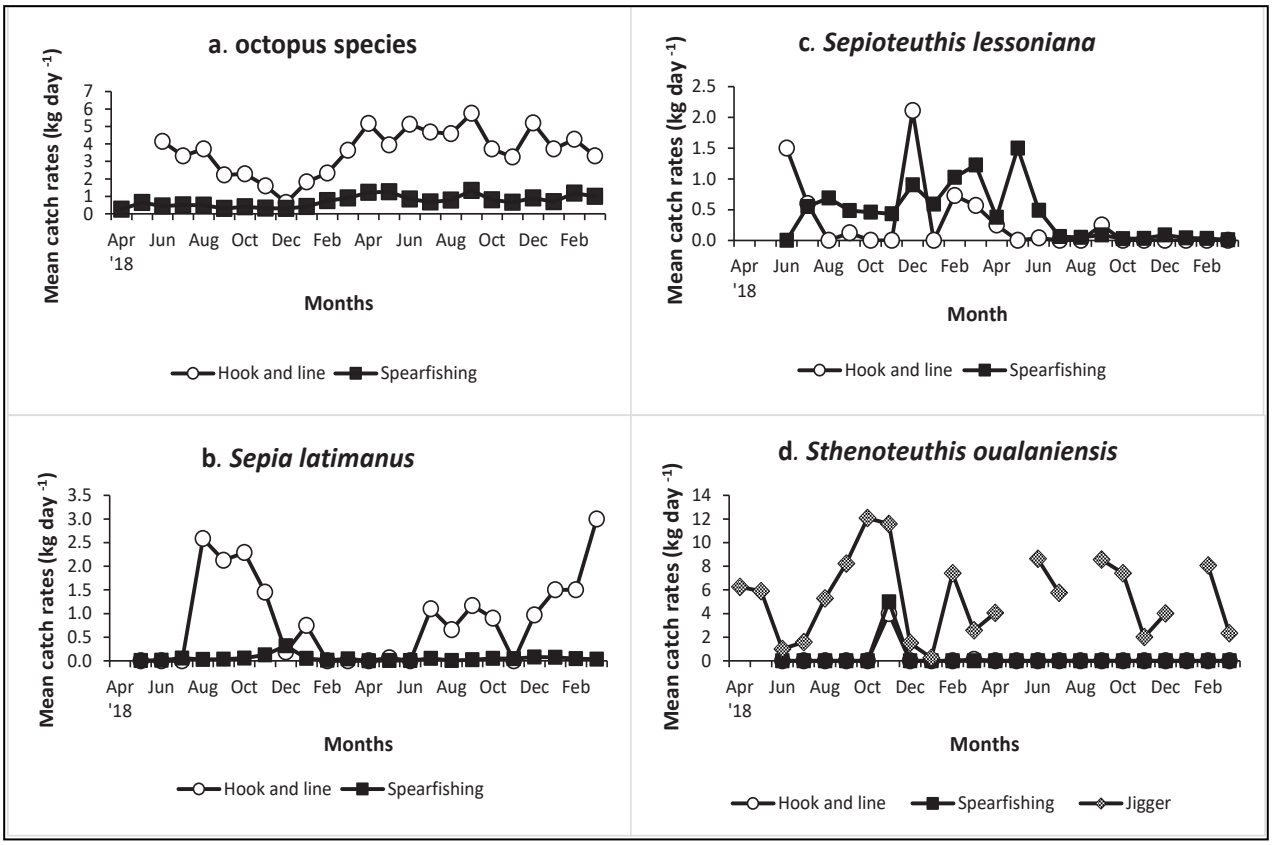

Figure 5. a-d. Daily catch rates of a) octopus species; b) *Sepia latimanus*; c) *Sepioteuthis lessoniana*; and d) *Sthenoteuthis oualaniensis* caught by fishing gears in the northern Sulu Sea, Philippines from April 2018 to March 2020.

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