TREND OF CATCH AND EFFORT ON THE BLUE SHARK (*Prionace glauca*) AS BYCATCH OF INDONESIAN TUNA LONGLINE FISHERY

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ABSTRACT

The blue shark or BSH (*Prionace glauca*) is one of bycatch species caught by Indonesian tuna longline fishery in the Indian Ocean. Updated on the catch per unit effort (CPUE) are needed to reduce an uncertainty for assessing the stocks as an input for the species management and conservation. This study provide an update on the nominal CPUE changes and spatial distribution of BSH in the eastern Indian Ocean. Data were gathered by a scientific observer program placed in commercial tuna longline of Indonesia operated in the eastern Indian Ocean from August 2005 to December 2019. Overall, the abundance of BSH increased substantially during the period of observation. The abundance of BSH also showed a variation according to latitudinal gradient where CPUE increased in high lattitude. However, the downward trend of CPUE observed in 2019 compared to 2018 suggests a precautionary approach is needed in BSH fisheries.

Key Words: Blue shark, nominal CPUE, eastern Indian Ocean.

INTRODUCTION

Blue shark or BSH (*Prionace glauca*) is one of the shark species that commonly caught as a bycatch by longline fishery. As a highly migratory species, the BSH widely distributed in tropical and subtropical waters (Compagno, 1984). To date, assessing of BSH are carried out by various countries through RFMOs i.e. the Indian Ocean Tuna Commission (IOTC) for stocks inhabited in IO waters.

The last stock assessment was carried out in 2017 resulted that the species was

evaluated in healthy condition (not to be overfished nor subject to overfishing) (IOTC, 2019). Although BSH is categorized as a near threatened species globally, its vulnerability in IO waters, specifically in the eastern IO, was undefined (IOTC, 2019). However, since the decline of annual catch in 2012 from IO areas, there is a growing concern that the decline of biomass in the future. As BSH is the highest by-catch shark species of Indonesian industrial longline fishery in the eastern IO, it is necessary to examine its recent stock abundance trend.

CPUE is frequently define as the key information used in fisheries stock assessments and usually assumed to be proportional to the fish abundance and is used as a relative index of abundance (Campbell, 2004). Hence, this study aimed to update CPUE of BSH to describe abundance indices of BSH in the eastern Indian Ocean.

MATERIAL AND METHODS

Data Collection

The data was collected from scientific observer program by following commercial tuna longline of Indonesia from 2005 to 2019. The program documented fishing operations between 07°-25° S and 98°-117° E (Figure 1). The dataset includes information concerning the number of BSH caught by tuna longline, the total number of hooks, and geographic position (latitude and longitude) where the longlines deployed into the water.

Catch Per Unit of Effort

Catches per unit of effort are calculated according to an equation by Klawe (1980):

$$U = (C / f) \times 1{,}000$$

where C is the number of BSH captured, f is the number of hooks, and U is CPUE in the number of fish caught per 1,000 hooks. Spatial distibution of CPUE described in the map with 5x5 degree coordinate in R-statistical software (R Core Team, 2019)

RESULTS AND DISCUSSION

The scientific observer program recorded a dataset comprised 127 trips, 3,263 sets, and more than 4 million hooks deployed, respectively. The average number of total hooks per set varied between years ranged from 1,040 to 1,490 hooks per set (Table 1). The abundance of BSH showed a variation according to latitudinal gradient. The spatial catch rate of BSH observed in high latitude in the area around 20°-35° S and 85°-105° E (Figure 2). The CPUE also fluctuated and showed an increasing pattern temporally in the last 15 years. The average of CPUE increased substantially from 0/1,000 hooks in 2011 to 1.0/1,000 hooks in 2012, then dropped to 0.2/1,000 hooks in 2013 and rise to the peak around 1.2/1,000 hooks in 2018 (Figure 3). In general, the unsuccessful catch for BSH showed a high proportion, with the average around 63% per year. The minimum and maximum zero proportion of catch were recorded in 2018 (30%) and 2011 (99%) respectively (Figure 4).

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Table 1. Summary of observed fishing effort from Indonesian tuna longline fishery during 2005–2019.

Year	Trip	Sets	Total Hooks	Mean±sd of hooks per set	Mean±sd of hooks per float
2005	9	117	171,717	1,468 ± 114.6	19 ± 1.5
2006	13	474	675,829	1,426 ± 216.7	12 ± 4.2
2007	13	274	407,617	1,488 ± 317.1	14 ± 4.4
2008	17	406	531,536	1,309 ± 390.4	12 ± 4.7
2009	14	289	330,126	1,142 ± 234.6	12 ± 4.9
2010	6	165	219,858	1,332 ± 458.8	14 ± 5.1
2011	5	133	138,360	1,040 ± 172.9	11 ± 1.8
2012	9	193	285,369	1,479 ± 561.0	14 ± 2.3
2013	7	241	269,628	1,119 ± 204.1	12 ± 2.7
2014	7	184	216,849	1,179 ± 180.7	15 ± 1.9
2015	5	150	172,982	1,153 ± 162.6	14 ± 3.2
2016	3	130	175,209	1,348 ± 209.0	11 ± 3.3
2017	4	139	193,916	1,395 ± 388.1	15 ± 1.8
2018	6	199	268,421	1,349 ± 229.1	15 ± 2.5
2019	9	169	222,866	1,319 ± 193.6	11 ± 4.6

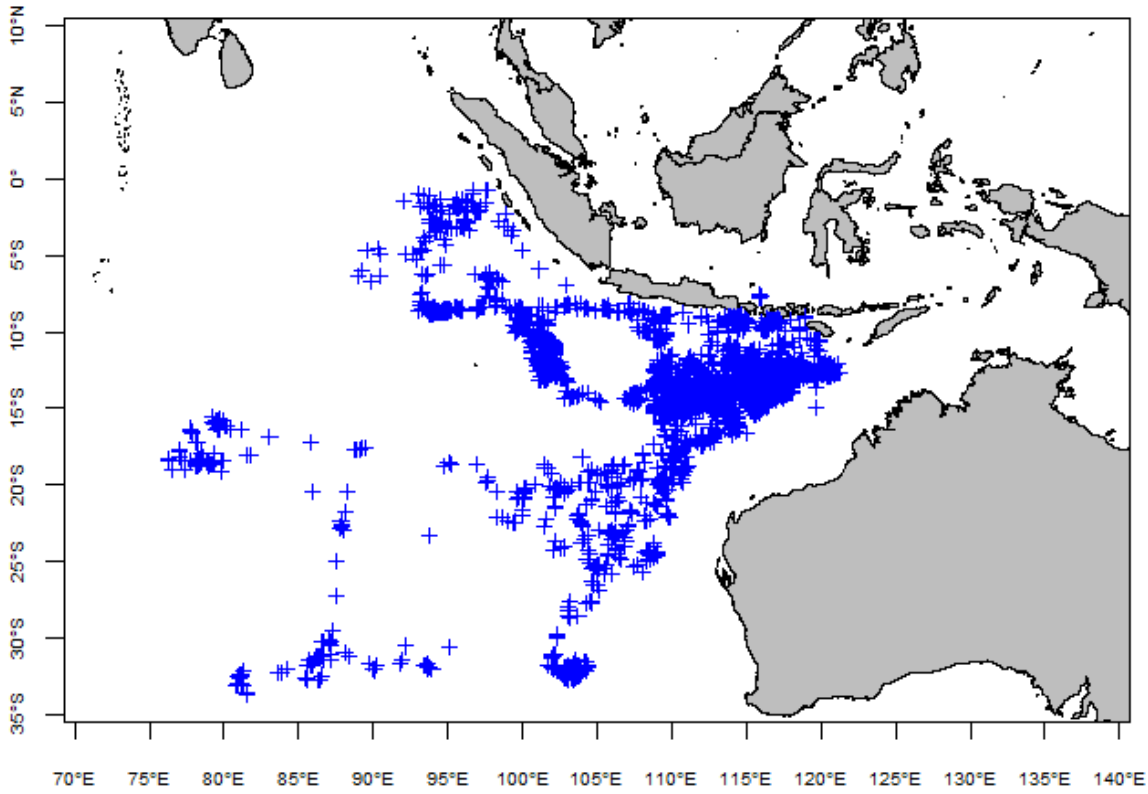

Figure 1. Observed setting position of Indonesian tuna longline in the eastern Indian Ocean from 2005 to 2019.

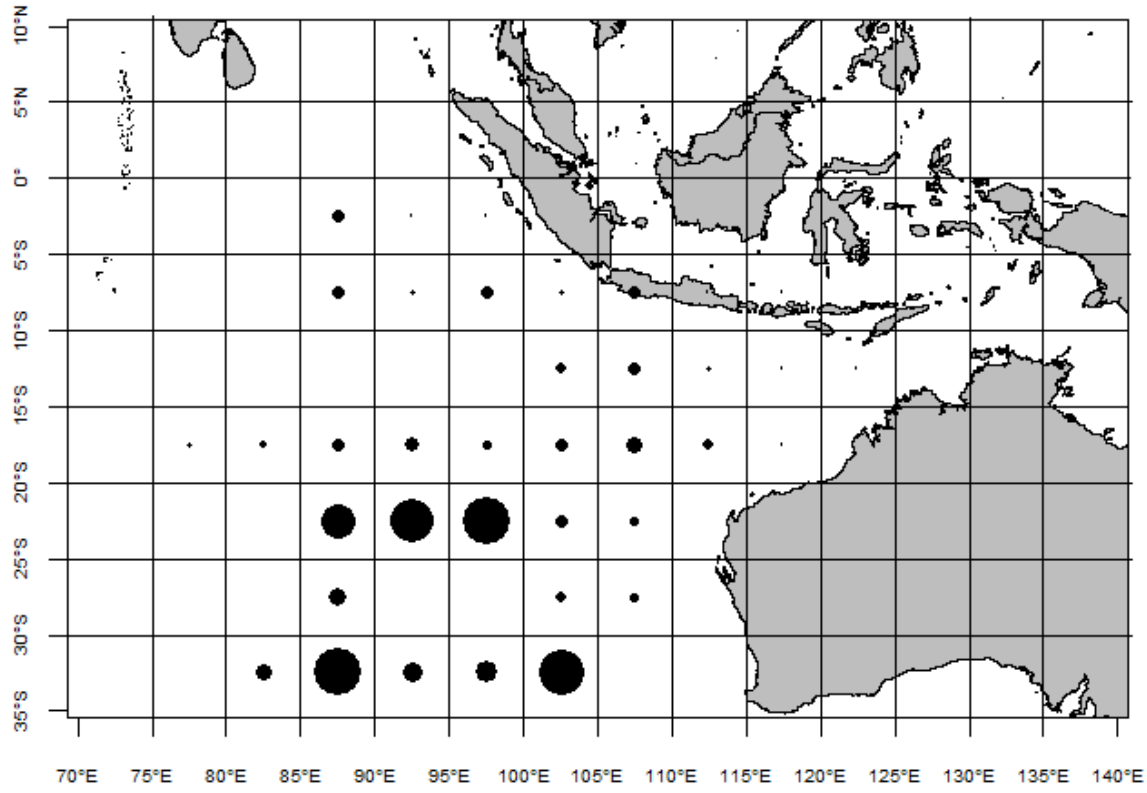

Figure 2. Spatial distribution of observed CPUE (N/1000 hooks) for BSH grouped onto 5x5-degree grid-based map in the eastern Indian Ocean

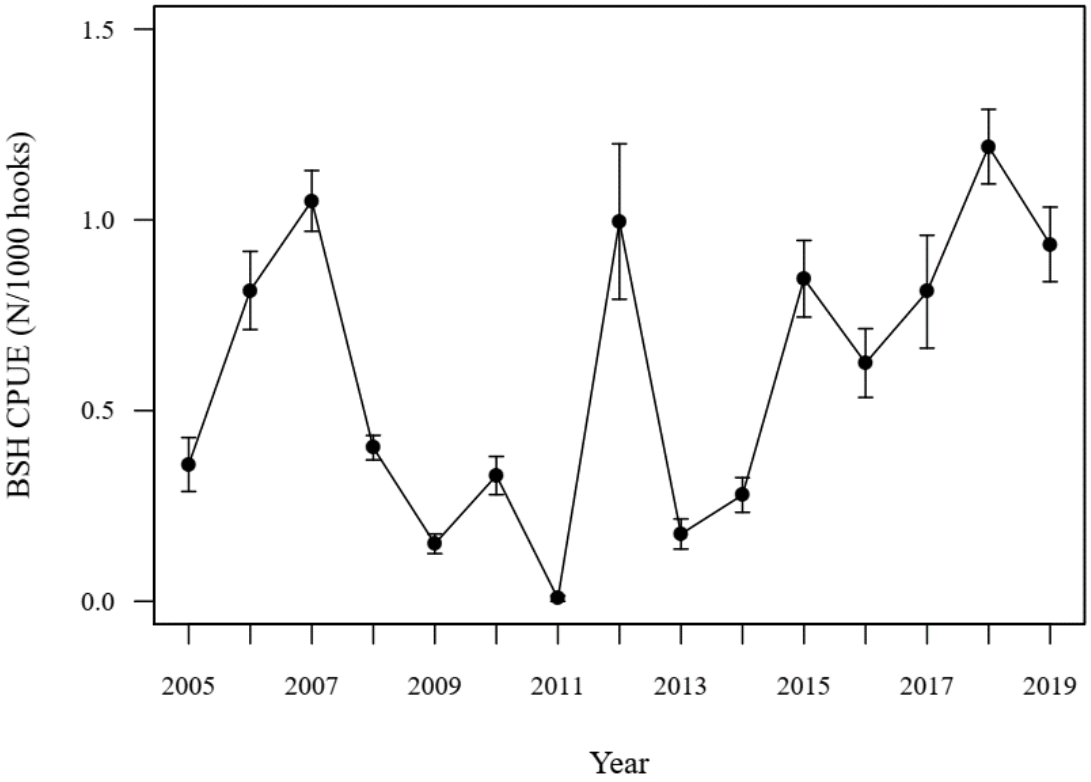

Figure 3. Nominal CPUE series (N/1,000 hooks) for BSH from 2005 to 2019. The error bars refer to the standard errors.

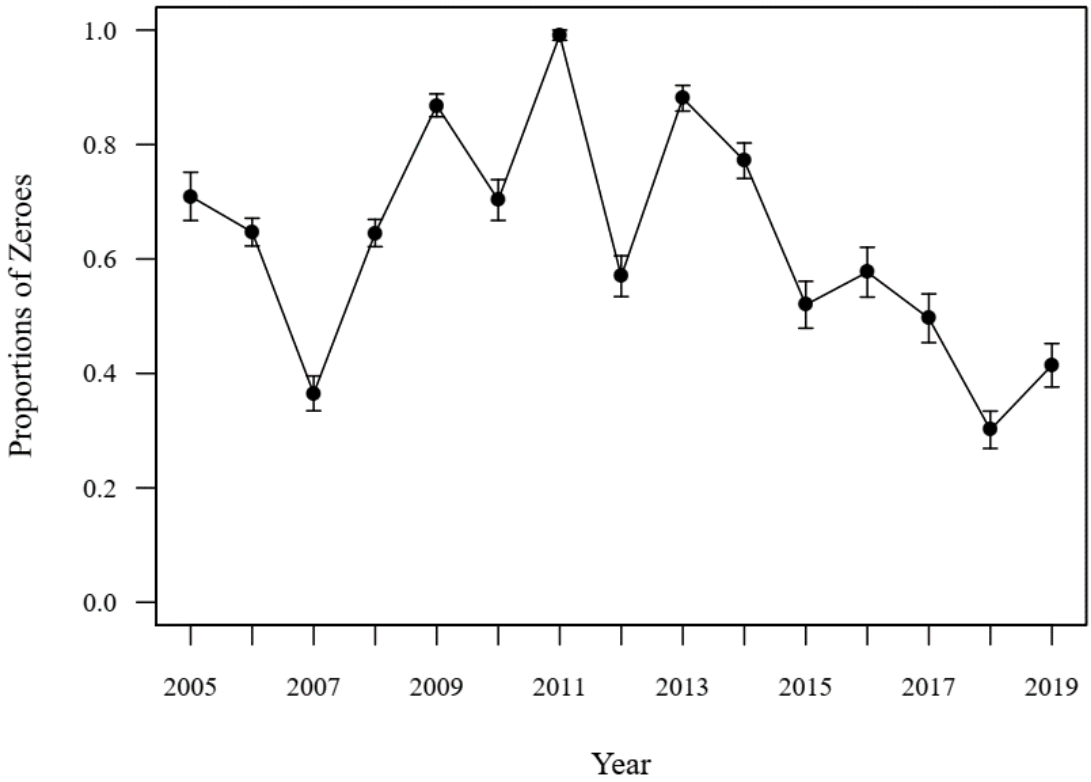

Figure 4. Proportion of zero BSH catches from 2005 to 2019. The error bars refer to the standard errors.