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Growth pattern and size of oilfish, *Ruvettus pretiosus* (Cocco, 1833) landed in southwestern coast of Surigao del Norte, Philippines

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Abstract
The growth pattern and size of oilfish, *Ruvettus pretiosus* landed in the Southwestern Coast, Surigao del Norte, Philippines were studied from February to April 2019. A total of 157 samples were recorded with a mean total length and weight of 77.79±0.93 cm and 5344±2296 g, respectively. The total length of the samples ranged from 53.3 to 107.3 cm. The class interval of 70-74.9 cm obtained the highest frequency of 28 individuals. The relationship between length and weight of the oilfish resulted to a negative allometric growth (b = 2.8162; r^2 = 0.9674) with an established equation of Log W = Log 0.0239 + 2.8162 Log L. This study concludes that there was a decrease in size composition of the oilfish species in the study area.

Keywords: Length-weight, length-frequency, oil fish, *Ruvettus pretiosus,* Surigao del Norte, Philippines

1. Introduction
The Oilfish, *R. pretiosus* (Cocco, 1833) of family Gempylidae is a marine, benthopelagic and oceanodromous species [1] inhabiting temperate and tropical waters around the world. They migrates far offshore [2] usually solitary or in pairs near the bottom [3]. It is locally known as "malapinya" which can be caught by using a simple handline requiring minimal expenses. This species has low market value because of the purgative qualities of oil on its flesh. However, it becomes of great importance for it provides vital contributions to food supplies and influence employment to the small-scale fisheries in the Southwestern Coast of Surigao del Norte, Philippines. The growing demand for this species has caused excessive harvesting, which changes its size composition and growth pattern.

The growth pattern of the fish species can be determined through its length and weight measurements. Fish grows both in length as well as in bulk and length is easier to measure and so often used along with weight in growth studies [4]. Abowei and Hart [5] reported that the length-weight relationship of fish also known as growth index is an important management tool used in estimating the average weight at a given length growth.

The oilfish is sold to buyers gutted, headless or without the elongated jaw. Hence, live weight and length could not be easily determined. This issue can be resolved if there is a predetermined length-weight relationship available to estimate the live body-weight of the oilfish species with the given length or vice-versa. The length-weight regressions have been used frequently to estimate weight from length because direct weight measurements can be time-consuming in the field [6]. Data on its length and weight are also needed in the management and protection of the oilfish. Length-weight relationship is an important tool for adequate exploitation and management of the population of fish species [7]. The length-weight relationship is of great importance in any fishery venture because it gives information on the stock composition, size increment, growth patterns and wellbeing of the fish [8]. It was also used to estimate the status of a particular species because such estimation was relevant for its management [9]. Thus, it is important to have updated biological-fishery information on this species to serve as a basis for management. The length-weight relationship and size composition of oilfish were determined for it is the information needed to manage fisheries. Further, it is an indicator of the changes in fisheries and the sustaining power of this species.

The results gathered would be the basis for management, the legislation of local policies, and ordinances.

2. Materials and Methods

The present study was conducted in the fish landing area of Cagtinae, Malimono, Surigao del Norte, Philippines (Figure 1). Malimono is situated in the southwestern coast of Surigao del Norte and facing the Bohol Sea.

The fresh oilfish samples were collected weekly from the fishermen in three (3) months period from February to April 2019. Every sampling, 10-15 individuals of oilfish were randomly selected regardless of their sizes.

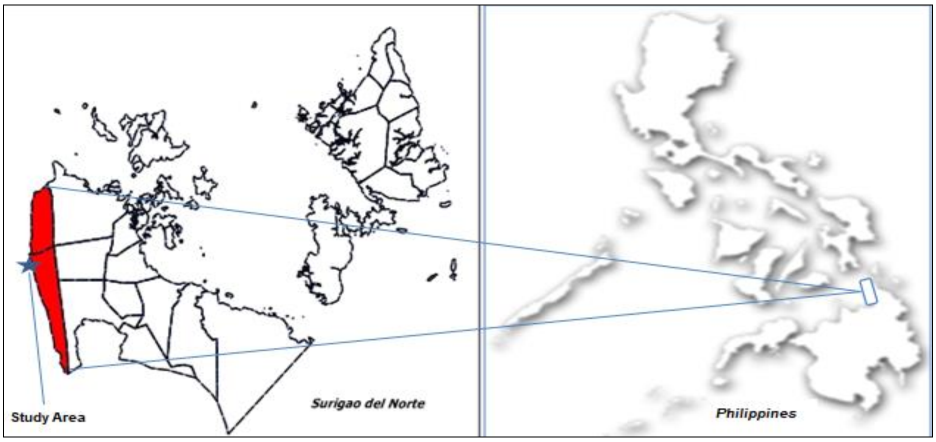

Fig 1: Location map of the study area in the Southwestern Coast of Surigao del Norte, Philippines.

The total length for each sample was measured in centimeter using measuring board. The fish **w**eight was also obtained by the use of digital balance in grams after wiping off water with a dry cloth. The sample with broken tail was rejected.

The length of all the samples was carefully recorded and tallied in group distribution in the interval of 5 cm to determine which length of oilfish occurs most frequently. The length-weight relationship was also estimated by applying the formula of Pauly [10];

$$W = a L^b$$

Where, W = weight of oilfish (g), L = total length of oilfish (cm), a = regression constant and b = regression coefficient. The logarithmic transformation of the equation (Log W = Log a + b Log L) was made to obtain the value of 'a' and 'b'. The data were processed using Microsoft Excel 2010 and Minitab 17. The correlation coefficient *'r'* was calculated by using the equation:

$$r = \frac{\sum xy}{\sqrt{\sum x^2 y^2}}$$

3. Results and Discussions

3.1 Length-Weight Relationship

Table 1 presents the sample size, parameter estimates 'a' and 'b' and the correlation coefficients (r^2) and Figure 2 shows a scatter plot diagram to illustrate the relationship between the length and weight of the 157 oilfish samples (combined sexes). The result revealed that oilfish species exhibited (b=2.8162), which indicates negative allometric growth. According to Wootten [11], growth is said to be negative allometry when the length of an organism increases more than weight (b<3) and positive allometry when weight increases more than length (b>3). Pauly and Gayanilo [12] emphasized that the *b* values may range from 2.5 to 3.5. The result of the present study was similar to the report of Keller and Kerstetter [13] that the b-value of *R. pretiosus* from the Gulf of Mexico and the western North Atlantic Ocean was 2.881. Nakamura and Parin [3] also reported a positive allometric growth (b=3.134) pattern for oilfish, *R. pretiosus*. The values of *a* and *b* vary not only between different species but also within the same species depending on sex, stage of maturity and food habits [14, 15]. Differences in the b values can be attributed to the combination of one or more factors such as: number of specimens examined, area/ seasonal effect, habitat, degree of stomach fullness, gonodal maturity, sex, health and differences in the observed length ranges of the specimens caught [16].

The table also revealed that the regression equation for the 157 oilfish samples (combined sexes) is $W = 0.0239\ L^{2.8162}$. The value $r^2 = 0.9674$ means that the length and weight of oilfish displayed a very high correlation or it is a very dependable relationship.

3.2 Length - frequency data

The *R. pretiosus* obtained a mean length of 77.79±0.93 cm and a mean weight of 5344±2296 g (Table 2). The total length ranged from 53.3 to 107.3 cm and the class interval of 70-74.9 cm got the highest frequency of 28 individuals (Figure 3). The common total

Table 1: Length-weight relationship data of oilfish, *R. pretiosus* landed in the Southwestern Coast of Surigao del Norte, Philippines, February to April 2019.

Species	n	a	b	r^2
R. pretiosus	157	0.0239	2.8162	0.9674

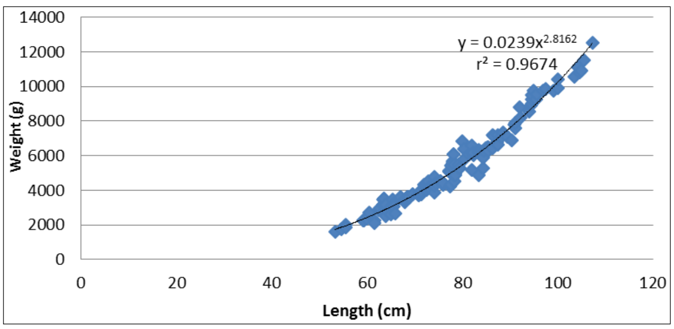

Fig 2: Scatter plot diagram showing the length-weight relationship of oilfish, *R. pretiosus* landed in the Southwestern Coast of Surigao del Norte, Philippines, February to April 2019.

Table 2: Mean, minimum and maximum length and weight of oilfish, *R. pretiosus* landed in the Southwestern Coast of Surigao del Norte, Philippines, February to April 2019.

Variable	N	Minimum	Maximum	Mean
Length (cm)	157	53.3	107.3	77.79±0.93
Weight (g)	157	1625	12500	5344±2296

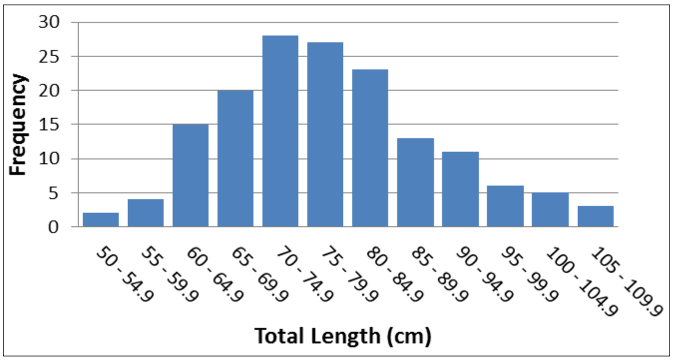

Fig 3: Length-frequency data of oilfish, *R. pretiosus* landed in the Southwestern Coast of Surigao del Norte, Philippines, February to April 2019.

length of oilfish in the present study is lower compared to the report of Nakamura and Parin [3]. They observed that the common length of *R. pretiosus* (unsexed) was 150 cm SL with a maximum published weight of 63500 g [17]. The oilfish species has a maximum total length of 300 cm (male/unsexed) [18]. This finding is attributed to the following factors: too much fishing activity, the continued increase of municipal and commercial fishing boats due to the increasing population and continued use and degradation of coastal habitats. These activities contributed to the Philippines fisheries decline [19]. Excessive fishing efforts caused a decrease in fish production, the size of individual fish caught and changed in composition of fish [20].

4. Conclusions

The present study concludes that the oilfish, *R. pretiosus* exhibited negative allometric growth pattern. The length-weight relationship was established as Log W = Log 0.0239 + 2.8162 Log L with a very high correlation or a dependable relationship exists between total length and body weight of the samples. It is also concluded that there was a decrease in the size composition of the oilfish species in the study area.

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