



Biological Review of Squid (*Stenoteuthis oualaniensis*) in North Sulawesi (Case Study of Squid Caught in Motto Waters, North Lembeh, Bitung City)

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Abstract

*Fishing for squid, a hereditary cultural practice among fishermen in Motto Village, has been ongoing for a long time. Research on the biology of squid in Motto Village is crucial to support this fishing activity. The purpose of this study was to identify the squid caught based on their biology in the waters of Motto Village. The method used in this research is the descriptive research method. The research was conducted from September to November 2021. Data was collected through observation and interviews. The results obtained indicated that the squids caught in Motto waters were *Stenoteuthis oualaniensis*. Maximum mantle length 23 cmML, minimum mantle length 9.6 cmML, with an average of 11.80 cm ML. Maximum weight of 500 grams, minimum weight of 10 grams, with an average of 70 grams. The results of the length-weight ratio yielded an R^2 value of 0.7929, indicating that the determination or effect of the length variation of the mantle on the weight variation of the squid was 79.29%. The growth pattern of squid is negative allometric, or length increases more dominantly than weight increases.*

Keywords: Length-weight ratio, Negative allometry, Mantle length, Motto village, *Stenoteuthis oualaniensis*

1. INTRODUCTION

Capture fisheries are the activity of producing fish, including squid, by catching (capture) both from inland fisheries [1] and marine fisheries [2]. The economic potential of squid in Indonesia, as well as North Sulawesi, is quite large [3], [4], [5], [6]. The squid also becomes notable prey for other marine predators [7]. According to statistical data of Bitung Ocean Fishing Port (BOFP) 2023, the catch of squid landed at BOFP for seven years (2016 to 2022) respectively: 27,179 tons, 53,588 tons, 161,998 tons, 313,488 tons, 128,502 tons, 98,591 tons, 110,796 tons.

The water area in Bitung has a significant amount of squid resources, particularly in the waters of Motto Village. Motto Village squid fishermen are traditional fishermen who catch to fulfill the needs of food or dishes, and some portion for sale. The fishing conducted by fishermen in North Sulawesi waters generally uses simple tools, namely squid fishing rods (jigs), and the fishing technique is also still traditional, by pulling up and down the fishing gear.

According to the explanation above, it is necessary to review the biology of squid caught in the waters of Motto Village to support the fishing activities that have been carried out.

2. METHODS

2.1. Materials

Research materials used included boats, scales, squid fishing gear, squid, buckets, stationery, a measuring ruler, a camera, and data worksheet paper.

2.2. Methods

The research was conducted in Motto Village, North Lembeh Subdistrict, Bitung City from September to November 2021. Data collection was done through interviews and direct observation. The types of data



collected were the mantle length and weight of squid, and the species. Data obtained from the field were analyzed and discussed descriptively.

3. RESULTS AND DISCUSSION

3.1. General conditions of Motto Village, Bitung City

According to the Central Bureau of Statistics of Bitung 2023, Motto Village is in the North Lembah Sub-district, Bitung City, North Sulawesi. Its area reaches 410 hectares. This area represents 14.22% of the total area of the North Lembah sub-district. Kelurahan Motto consists of 2 neighborhoods (RW level) and 6 RTs. The total number of residents is 676, consisting of 348 men and 328 women. The average density of Motto Village is 164.88 people/km. The main livelihood of the residents is as fishermen, especially squid fishermen [5], which also states that the squid fishing profession is the profession of most residents of Motto Village. Other activities of the residents besides fishing are taking care of fields and gardening on their respective lands. The border of the western part of the Motto area is Binuang Village, the border of the eastern part is the waters of the Maluku Sea, the border of the northern part is Nusu Village, and the border of the southern part is Posokan Village

3.2. Biological aspects

Species Naming, the type of squid caught by fishermen in the waters of Motto Village, based on literature studies and morphological approaches to body shape, is the *Sthenoteuthis oualaniensis* (Lesson, 1830) as a valid name, with the common name is Purpleback flying squid.

The history of naming this species was first described by Lesson in 1830 with the original name *Loligo oualaniensis*. The nomenclature or naming history of this species, in its journey, has experienced several other names, so it has several synonymous names that several researchers have used according to ITIS - Report: *Sthenoteuthis oualaniensis*, namely:

1. *Loligo brevitentaculata* (Quoy & Gaimard, 1832)
2. *Loligo oualaniensis* (Lesson, 1830)
3. *Loligo vanikoriensis* (Quoy & Gaimard, 1832)
4. *Symplectoteuthis oualaniensis* (Lesson, 1830)
5. *Ommastrephes ayresii* (Carpenter, 1864)
6. *Ommastrephes tryonii* (Gabb, 1863)
7. *Ommastrephes oceanicus* (D'Orbigny, 1839-1842 in Férussac and D'Orbigny, 1834-1848)

The valid name used to describe this species is *Sthenoteuthis oualaniensis* based on Synonyms of *Sthenoteuthis oualaniensis* (Lesson, 1830) (sealifebase.ca), (ITIS - Report: *Sthenoteuthis oualaniensis*), and WoRMS - World Register of Marine Species - *Sthenoteuthis oualaniensis* (Lesson, 1830).

Search results through the Integrated Taxonomic Information System - Report institution on the ITIS - Report website: *Sthenoteuthis oualaniensis* found that based on the taxonomic status and valid name or status, *Sthenoteuthis oualaniensis* has Taxonomic Serial Number (TSN) No: 556248, with the following taxonomic hierarchy:

Kingdom	: Animalia
Subkingdom	: Bilateria
Infrakingdom	: Protostamia
Superphylum	: Loprozoa
Phylum	: Mollusca
Class	: Cephalopoda
Subclass	: Coleoidea
Superorder	: Decabrachia
Order	: Teuthida
Suborder	: Oegopsina
Family	: Ommastrephidae
Subfamily	: Ommastrephinae
Genus	: <i>Sthenoteuthis</i>
Species	: <i>Sthenoteuthis oualaniensis</i> (Lesson, 1830)



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Morphology Display, diagnostic features of Mantle Length of *Sthenoteuthis oualaniensis* (Lesson, 1830) [8] : mantle highly muscular, posterior part muscular, fins muscular and broad, fin width about 79% (69% to 86%) of mantle length, length 43% (39 to 50%) of mantle length; single fin angle 64° (61 to 71°); males have broader fins than females; mantle and funnel fused in cartilaginous arrangement; large oval photophores patch on anterodorsal mantle surface. Size: Maximum mantle length 35 cm. The size of mature females with dorsal light organs is about 18 cm, males are less than 13.6 cm, and females without light organs at 10.7 cm long.

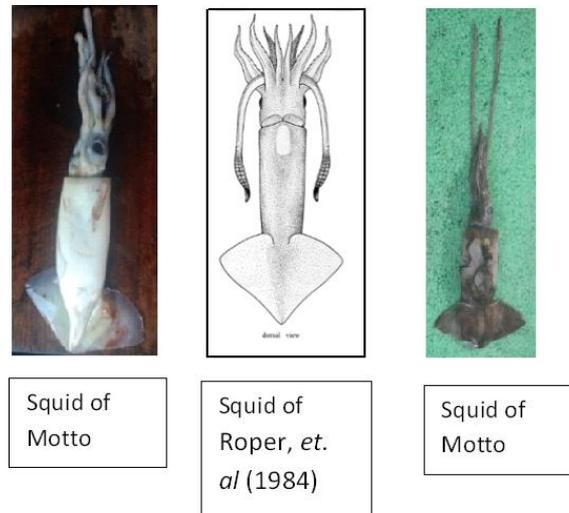


Figure 1. Squid Caught in Motto

Length-Weight Relationship, the maximum mantle length (ML) caught in Motto Waters by fishermen of Motto Village (figure 5) reached 23.00 cmML, and the minimum size was 9.60 cmML, with an average of 11.80 cmML. These results were quite similar to the results of research on growth, resources, and environmental influences on *Sthenoteuthis oualaniensis* in Manado Bay, which obtained a mantle length range between 6.8 - 11.9 cmML with a mean of 8.9 cmML [9]. The maximum weight of squid caught by fishermen of Motto Village was 500.00 g, and the minimum weight was 10.00 g, with an average of 70.02 g (Figures 3 and 4). The weight was within the range of the results of *Sthenoteuthis oualaniensis* in the northwest Indian Ocean, where the range of body weight was 78-6268g (females) and 82-518 g (males) [10]. Based on the results of the analysis of the length-weight relationship of *Sthenoteuthis oualaniensis* (Figure 6) known that length and weight have a close relationship, with a coefficient of determination (R^2) of 0.7929, the determination of mantle length to squid weight is 79.29%.



Figure 2. Weighing and measurement of squids' mantle length



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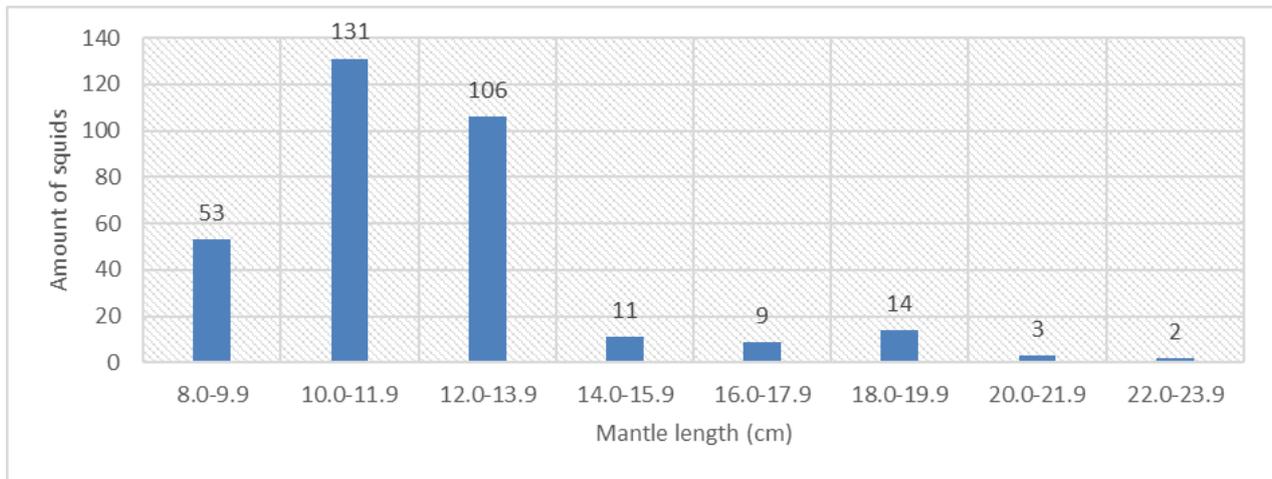


Figure 3. Mantle length distribution of squid caught in the waters of Motto Village

The mantle length of Motto's Squid was relatively small. This result is in line with the *Sthenoteuthis oualaniensis* in the South China Sea with a maximum mantle length size of less than 19,4 cmML [11]. In the northwest Indian Ocean, the size of mantle length is broader reaching up to 56,2 cmML (female) and up to 27,3 cmML (male) [10].

The equation of the relationship between mantle length and weight in squid (Figure 6) obtained $W = 0.03781 L^{2.9685}$ with a sample size of 329 squid and R^2 value of 0.7929 which means that the variation in squid weight can be explained or influenced by variations in mantle length by 79%, 29% and the Standard Error b (SEb) value of 0.08389 which explains that the small deviation of the regression coefficient of the mantle length variable and has made a significant contribution to the squid weight variable, with a significant value in the F test obtained $p < 0.05$.

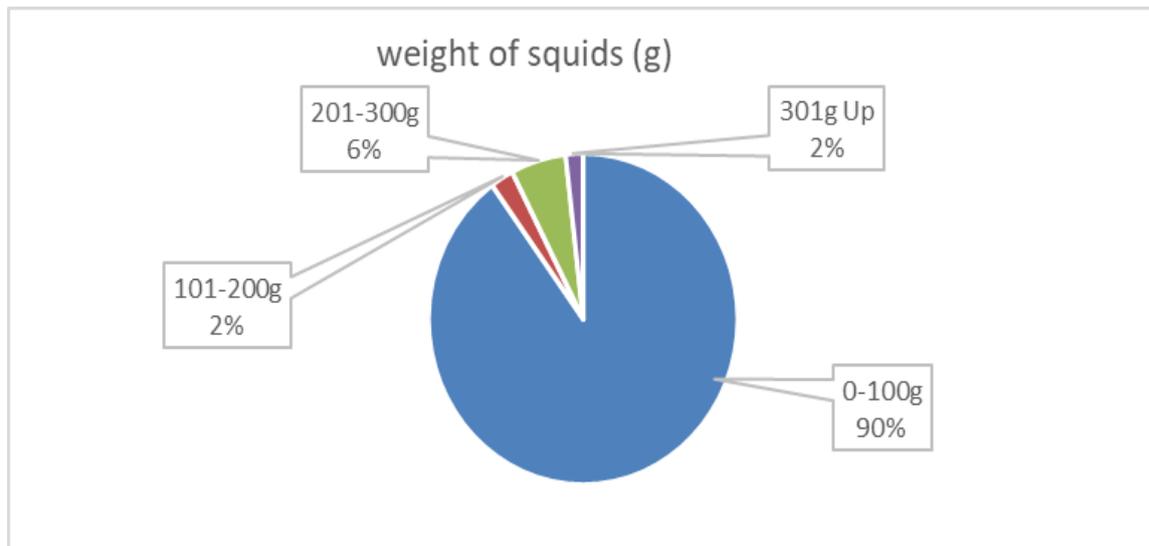


Figure 4. Weight distribution of squid caught in the waters of Motto Village

Based on the results presented in Figure 4, it is known that the weight of squid is dominated by the size range of 0-100g. 0-100g size dominates with a percentage of 90% of the total of all existing samples, namely a total of 329 samples. The range of weight of this result is within the range of *Sthenoteuthis oualaniensis* research that has been done in the South China Sea, body weight ranges from 13 to 435 grams (females) and 7 to 152 grams (males) [12].

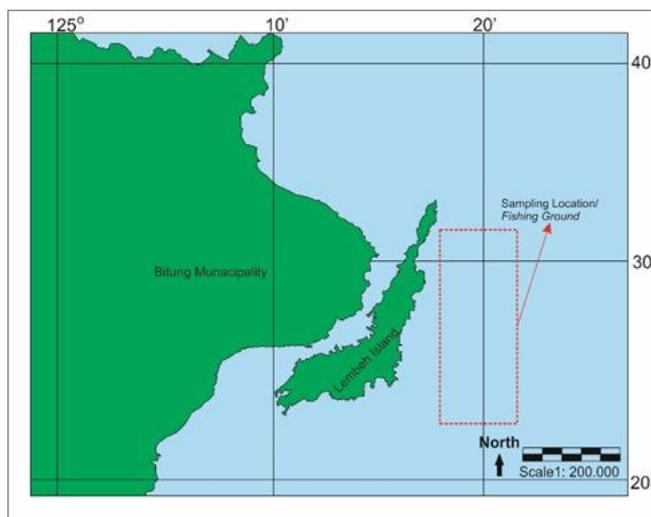


Figure 5. Sampling location in the waters of Motto Village, Bitung, North Sulawesi

Based on the statistical calculation of t-test on the value of b of 2.9685 ($\alpha = 0.05$), it was found that the growth pattern of the body shape of *Sthenoteuthis oualaniensis* has a negative allometric growth pattern, which in this case the growth pattern of the body or the increase in mantle length is more dominant than the increase in weight (flat), the variation of the size of mantle length and body weight could be affected by fishing season [13]. The results of the t-test calculation of the value of b ($\alpha = 0.05$) in squid obtained a t-count of 35.3821 with t-table (0.05; 329) of 1.9672, so that $t\text{-count} > t\text{-table}$, which means that the squid growth pattern is negative allometric with a range of b values of 2.8034 - 3.1335. These results are quite different from those of *Sthenoteuthis oualaniensis* in Blanakan and Pelabuhanratu Bay, which showed an isometric growth pattern [6]. Furthermore, some research related to the length-weight relationship of squid may vary, especially the value of (b), which has been conducted, getting the value of b for female squid 2.316 and male 2.104 [14]. The results of squid research (*Photololigo duvaucelii*) in Teluk Jakarta showed the value of $b = 2.3216$ [15]. Research on *Sthenoteuthis oualaniensis* species in the waters of the southwest coast of India, for small size, the value of $b = 2.67$ (negative allometric), while the medium size value of $b = 3.05$ (positive allometric) [16]. Research in China showed that the type of *Sthenoteuthis oualaniensis* had a value of $b = 3.498$ (positive allometric) with a value of $R^2 = 0.910$ [11]. The different growth patterns *Sthenoteuthis oualaniensis*, as mentioned above, showed variations in ontogenic, environmental, and trophic ecology conditions [6].

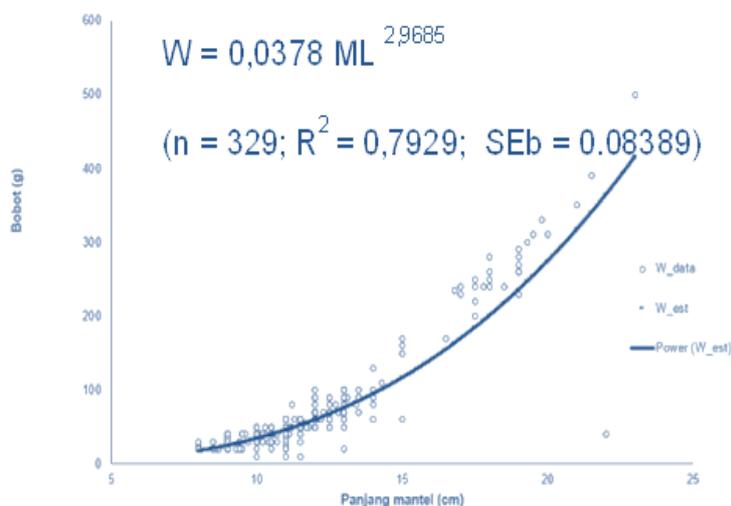


Figure 6. Length-weight relationship of squid caught in the waters of Motto village

A study about *Sthenoteuthis oualaniensis* in the area near Southeast Asia in the South China Sea shows positive allometry. The differentiation in the growth rate is the response to changes in ocean conditions [11].



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4. CONCLUSION

Based on the data obtained, it is known that the squid found in Motto waters is *Sthenoteuthis oualaniensis*. The maximum mantle length is 23 cmML, and the minimum mantle length is 9.6 cmML, with an average of 11.80 cmML. The maximum weight is 500 g, the minimum weight is 10 g, with an average of 70 g. The results of the length-weight relationship yielded an R² value of 0.7929, where the determination of mantle length on squid weight is 79.29%.

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