

**FIRST DISTRIBUTION RECORDS OF *Acetes intermedius*
(DECAPODA: SERGESTIDAE) FROM THE COASTAL WATERS OF BINTULU,
SARAWAK: POPULATION STRUCTURE, LENGTH-WEIGHT AND LENGTH-LENGTH
RELATIONSHIP**

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Abstract: Sergestid shrimp *Acetes intermedius* was recorded for the first time from the Bintulu coastal waters in Sarawak. The morphological characters of the species were examined. Population structure, length-weight and length-length relationship of *A. intermedius* was estimated based on specimens collected from the site during February-March 2006. A total of 857 specimens (473 males and 384 females) of *A. intermedius* were measured for the study of size frequency structure. The mean length of the male and female was 25.6 ± 2.52 mm and 27.02 ± 3.24 mm, respectively. The sex ratio was found to be 1: 0.81 (males: females). Total length of female was on an average 1.41 mm longer than the male ($P < 0.01$). The equations calculated for length-weight relationship were $W = 0.0025 TL^{3.1484}$ ($r^2 = 0.80$) for male, $W = 0.0033 L^{3.044}$ ($r^2 = 0.77$) for female. The value of b for males ($b = 3.148$) and females ($b = 3.044$) were closest to 3 which was not significantly higher than isometric value (3) indicating that the growth in males and females were isometric. The estimated co-efficient of correlation (r) between the total length and body weight was 0.99 for combined sexes of the species, indicating that the relationship was highly significant ($P < 0.01$).

KEYWORDS: First distribution records, *Acetes intermedius*, population structure

Introduction

In Peninsular Malaysia, *Acetes* locally known as 'Udang garagau' supports a considerable subsistence fishery (Tham, 1950), which is mainly based on two species *A. indicus* and *A. japonicus* (Omori, 1975), although two other species *A. erythraeu* and *A. sibogae* also recognized to be present (Pathansali, 1966 and Johnson, 1976) in the country.

Species of the genus *Acetes* live in the estuaries and coastal waters of the tropical and subtropical regions. *Acetes* range from 10 - 40 mm in total length and are widely distributed in the world (Omori, 1975 and Holthuis, 1980). They are economically very important shrimps in Asian and east African waters. During certain parts of the year, they form conspicuous aggregations near the shore and are fished mainly with push net and fixed bag net set near the shore against the flow of the tide. The fishing is generally done during the day. In Asian countries, only a small proportion of the catch is marketed as fresh shrimps; the greater proportion is dried, salted or fermented in various ways for food. Shrimp paste and sauce are manufactured extensively throughout Southeast Asia and are esteemed in their taste and nourishment (Xiao and Greenwood, 1993).

There are several accounts of the *Acetes* fishery from West Malaysia or Malay Peninsula (Tham, 1950; Pathansali, 1966; Omori, 1975; Johnson, 1976 and Ahamad, 1993). All are very brief except those of Omori (1975) and Ahamad (1993). Most of the previous works were directed toward taxonomic diagnosis, resulting in a lack of basic biological information.

In the present study, the occurrence of *A. intermedius* in the Bintulu coastal waters was recorded and the morphological characteristics of the specimens were compared to that of the specimens described by Omori (1975). The species is a new distribution record to the coastal waters of Bintulu. Aspects on length-weight relationship, sex ratio and length-frequency distribution are discussed. The specimens are housed in the Laboratory of Marine Science and Aquaculture, Institute of Bioscience, Universiti Putra Malaysia.

Materials and Methods

Sample collection and identification

Specimens of sergestid shrimp of the genus *Acetes* were collected between February and March 2006 from the coastal waters of Bintulu (3° 31' 20" N and 113° 10' 32.39" E), Sarawak (Fig.1). Fisherman used push net for *Acetes* fishing in the coast of Bintulu. Samples were preserved with 10% formalin immediately after collection of *Acetes* shrimps from the fisherman. In the laboratory, *A. intermedius* was identified using a dissecting microscope (Nikon). For the identification of *A. intermedius*, the work of Hansen (1919), Omori (1975) and Zafar (2000) were followed and consulted.

Length-frequency analysis

Total length of *A. intermedius* from tip of the rostrum to the end of telson was measured to the nearest millimeter and total weight was taken by an electronic balance of 0.01 mg accuracy. Carapace length (CL), the shortest distance between posterior margin of the orbit and the mid-dorsal posterior edge of the carapace, was also measured to the nearest 0.01 mm. Then length-frequency analysis was done using the SPSS Version 11.5.

Length-weight relationship

To establish the length-weight relationship, the commonly used relationship $W = aL^b$ was applied (Ricker, 1975; Quinn II and Deriso, 1999), where W is the weight (mg), L is the total length (mm), 'a' is intercept (condition factor) and 'b' is the slope (growth coefficient, i.e., shrimp relative growth rate). The parameters 'a' and 'b' were estimated by least squares linear regression on log-log transformed data: $\text{Log } W = \text{Log } a + b \text{ Log } L$. The coefficient of determination (r^2) was used as an indicator of the quality of linear regression (Scherrer, 1984). Additionally, 95% confidence limits of the parameter b and the statistical significance level of r^2 were estimated.

Sex ratio

Sex of adult *A. intermedius* was determined by the presence or absence of clasping spine (Fig.2) and petasma (Fig.3) on the first pleopods and on the lower antennular flagellum (Omori, 1975). Following this, the male and female sex ratio was determined.

Result and Discussion

Descriptive remarks

The specimen is easily identified and agreed well with the description given by Omori (1975). The petasma agreed in having pars astringens and capitulum of petasma with 4 subsequently large hooks along the outer margin (Fig.3). Appendix masculinae hold 3 hooks. In female, first segment of antennular peduncle at most as long as second and third segments combined (Fig.4). The apex of the telson is sharply pointed and triangular (Fig.5).

Length-frequency structure

A total of 473 males and 384 females of *A. intermedius* were measured for the study of size frequency distribution. The size frequency distribution (Fig.6) obtained from the study showed that the total length range of exploited sizes was 20 - 32 mm for male and 20 - 35 mm for female. The mean total length of male and female was 25.60 mm and 27.02 mm, respectively (Table 1). Standard deviations were 2.52 and 3.24 and standard errors were 0.11 and 0.16 for male and female, respectively. The female was on an average 1.416 mm longer than the male (Fig.7). The mean total length of female was 1.416 mm longer than that of the male and the difference between means was significant ($p < 0.01$). The 95% confidence interval of the difference between the two means was 1.03 to 1.80.

Sex ratio

A total of 857 specimens were examined; among them 473 were males and 384 were females, indicating a sex ratio of male: female was 1:0.81. Sex ratio was calculated out to know the ratio in the number of male and female individuals, so that appropriate number of male and female can be mated during spawning. In general, sex ratio is known to be close to 1: 1 (males: females) in nature (Fisher, 1958), but in the population of *A. intermedius* from the coastal waters of Bintulu, it was in favour of males.

Length-weight relationship

The length-weight relationship for male and female of *A. intermedius* showed linear lines in logarithmic scale and parabolic curves were obtained by plotting the values of total length against their weight (Figs. 8 and 9). The length-weight equations calculated were $W = 0.0025 TL^{3.1484}$ ($r^2 = 0.80$) for male and $W = 0.0033 L^{3.044}$ ($r^2 = 0.77$) for female. In all cases, the exponent b lies in between the expected range of 2.5 - 3.5 reported for most fish and shrimp (Amin and Zafar, 2004; Carlander, 1977; Le Cren, 1951 and Zafar *et al.*, 1998) and is closest to 3 in both sexes indicating that growth is isometric (Table 2). Length-length relationship presented in Fig.10 were highly significant ($P < 0.01$), with the coefficient of determination values (r^2) being > 0.44 (Table 3).

Conclusion

In the present study, the presence of *A. intermedius* in the coast of Bintulu, is recorded for the first time. The presence of this species at other sites should be investigated since it is a very cryptic species in the coastal waters of Sarawak. The results indicate that the mean length of female was significantly higher than male of *A. intermedius*. Proportionate occurrence of the number of the two sexes of *A. intermedius* (males to females, 1: 0.81) was observed in the investigated area which is very near to the hypothetical value 1: 1. The relationship between length and weight of the *A. intermedius* was highly significant.

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REFERENCES

- Ahamad, M., (1993). The biology of *Acetes* in the Klang strait waters, Straits of Malacca. M.Sc thesis, Department of Zoology, Universiti of Malaya, 59100 Kuala Lumpur, Malaysia.
- Amin, S.M.N., Zafar, M., (2004). Studies on age, growth and virtual population analysis of *Coilia dussumieri* from the neritic water of Bangladesh. *Journal of Biological. Science*, 4: 342 - 344.
- Carlander, K., (1977). Handbook of freshwater fishery biology, Vol.1. Iowa State University Press, Ames, IA.
- Fisher, R.A., (1958). The genetical theory of nature selection. 2nd Edn., Dover, New York.
- Hansen, H.J., (1919). The Sergestidae of the Siboga Expedition, Siboga-Expeditie. Monographie 38 of Uitkomsten op Zoologischsch, Botanisch, Oceanographisch en Geologisch Gebied, 65 pp.
- Holthuis, L.B., (1980). FAO species catalogue: shrimps and prawns of the world, an annotated catalogue of species of interest to fisheries. FAO fisheries synopsis No. 125, 1, 1-271.
- Johnson, D.S., (1976). Prawns of the Malacca Straits and Singapore waters. *Journal of the Marine Biological Association of India*, 18: 1-54
- Le Cren, E.D., (1951). The length-weight relationship and seasonal cycle in gonadal weight and condition in the perch (*Perca fluviatilis*). *Journal of Animal Ecology*, 20: 271-279.
- Omori, M., (1975). The Systematics, biogeography and fishery of epipelagic shrimps of the genus *Acetes* (Crustacea, Decapoda, Sergestidae). *Bulletin of the Ocean Research Institute, University of Tokyo*, 1-91 pp.
- Pathansali, D., (1966). *Acetes* (Sergestidae) from the Malay Peninsula. *Bulletin of the National Museum of Singapore*, 33 (8): 59-63.
- Quinn II, T. and Deriso, R.B., (1999). Quantitative fish dynamics. Oxford University Press, New York, 542 pp.

Ricker, W.E., (1975). Computation and interpretation of biological statistics of fish populations. Bulletin of Fisheries Research Board, Canada, 191, 382 pp.

Scherrer, B., (1984). Biostatistique. Morin, Montreal, Paris.

Tham, A.k., (1950). The food and feeding relationships of the fishes of Singapore straits. Colonial Office Fishery Publications, No.1. His Majesty’s Stationery Office, 35 pp.

Xiao, Y. and Greenwood, J.G., (1993). The biology of *Acetes* (Crustacea; Sergestidae). In, Ansell, A. D. Gibson, R. N. and Margaret Barnes. (eds.) Oceanography and Marine Biology Annual Reviews, UCL Press, London, pp. 259 - 444

Zafar M, Mustafa, M.G., Amin, S.M.N., (1998). Studies on age and growth, length-weight relationship and relative condition factor of two *Acetes* shrimps from Bangladesh coast. The Chittagong University Journal of Science 22 (II): 109-116.

Zafar, M., (2000). Study on Sergestid shrimp *Acetes* in the vicinity of Mathamuhuri river confluence, Bangladesh. Ph. D. Thesis, University of Chittagong, pp. 223

Table 1. Basic population characteristics of *A. intermedius* from the coastal waters of Bintulu, Sarawak

| Population characters | Male | Female |
|-----------------------------|--------------|--------------|
| Mean total length ± SD (mm) | 25.60 ± 2.52 | 27.02 ± 3.24 |
| Standard error (mm) | 0.11 | 0.16 |
| Length range (mm) | 20 - 32 | 20 - 35 |
| Total number (N) | 473 | 384 |

Table 2. Length-weight relationship parameters of *A. intermedius* from the coastal waters of Bintulu, Sarawak

| Sex | N | L -W equation | r ² | 95% CI of b | Relationship |
|--------|-----|--------------------------------|-----------------|---------------|--------------|
| Male | 473 | W = 0.0025 L ^{3.1484} | 0.80 (p < 0.01) | 3.01 - 3.287) | Isometric |
| Female | 384 | W = 0.0016 L ^{3.0441} | 0.78 (p < 0.01) | 2.912 - 3.241 | Isometric |

N = sample size; L = total length (mm); W = body weight (mg); r² = determination coefficient; CI = confidence interval; b = slope

Table 3. Morphometric relationship between total length and carapace length of *A. intermedius* from the coastal waters of Bintulu, Sarawak

| Sex | N | L-L equation | Determination coefficient (r ²) |
|--------|-----|-------------------------|---------------------------------------------|
| Male | 473 | TL = 10.552 + 2.9895 CL | 0.44 (p < 0.01) |
| Female | 384 | TL = 10.491 + 3.0399 CL | 0.48 (p < 0.01) |

Fig.1. Geographical location of the sampling station at Bintulu, Sarawak

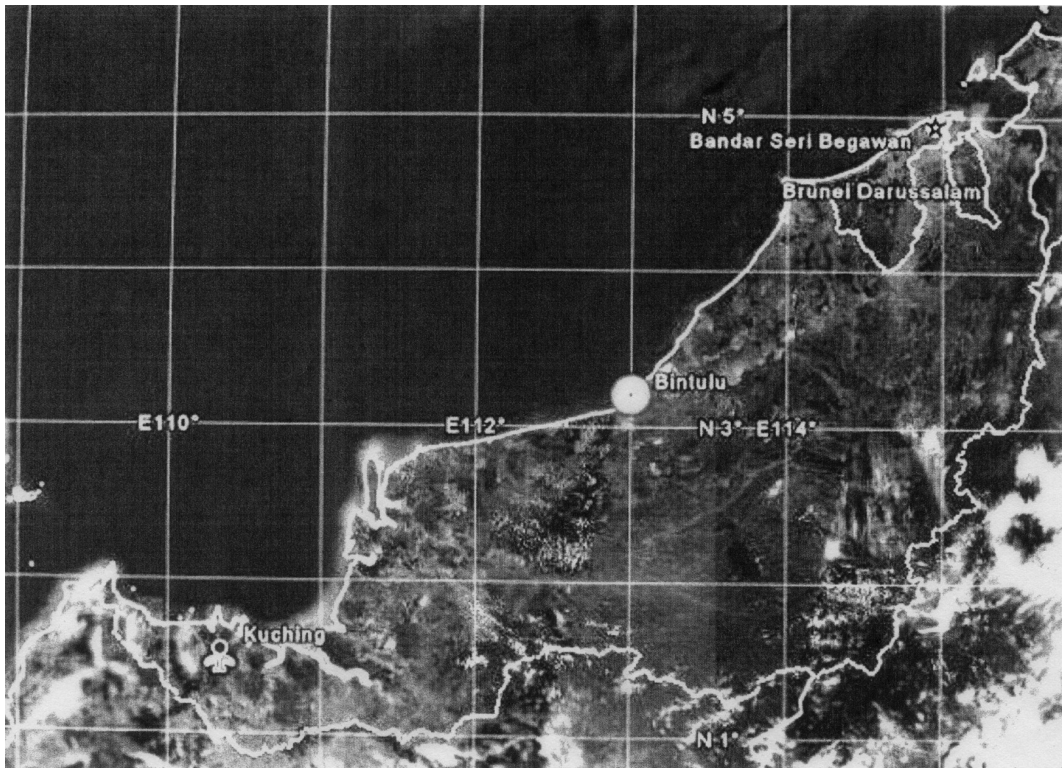


Fig.2. Clasp spine of *A. intermedius* from the coastal waters of Bintulu, Sarawak

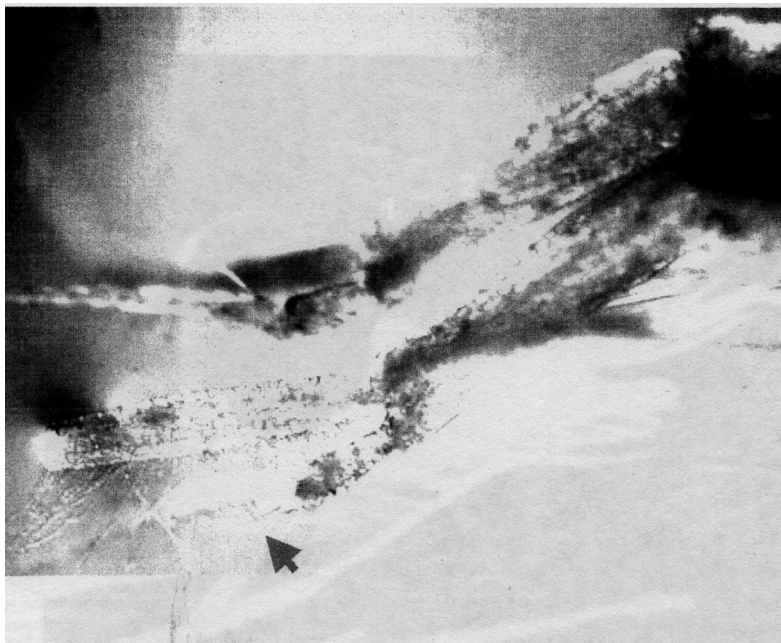


Fig.3. Capitulum of petasma bearing 4 subsequent large hooks of male *A. intermedius* from the coastal waters of Bintulu, Sarawak

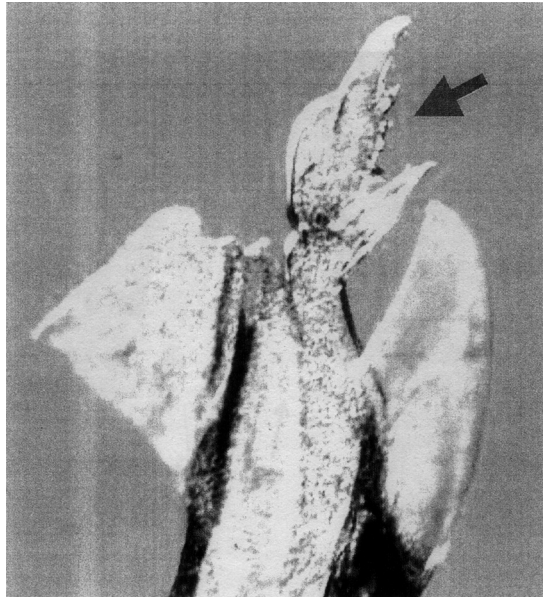


Fig.4. Segments of antennular peduncle (x 20) of female *A. intermedius* (1-1st segment, 2-2nd segment; 3-3rd segment)

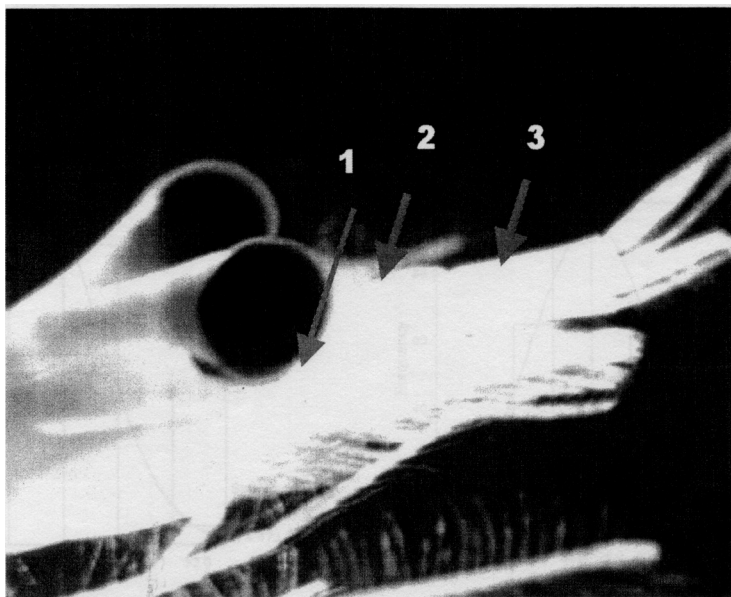


Fig.5. Apex of the telson (x 30) triangular of male *A. intermedius* from the coastal waters of Bintulu, Sarawak

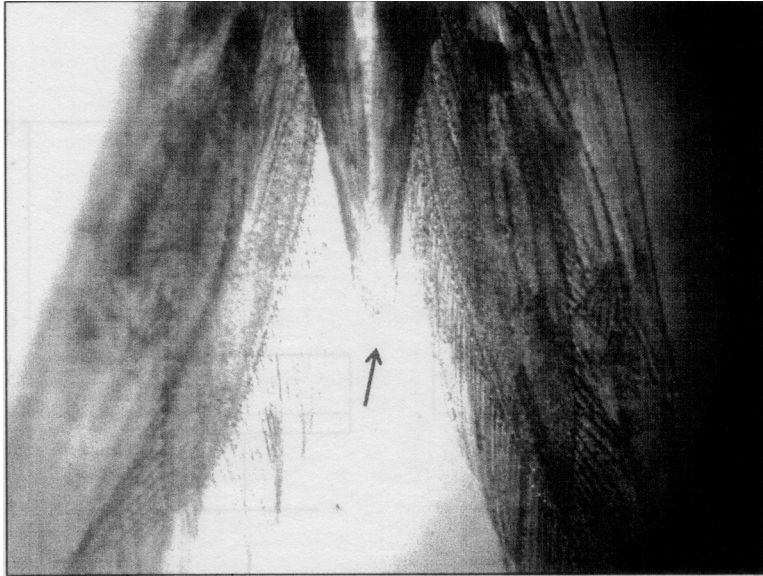


Fig.6. Length-frequency structure of male and female *A. intermedius* from the coastal waters of Bintulu, Sarawak

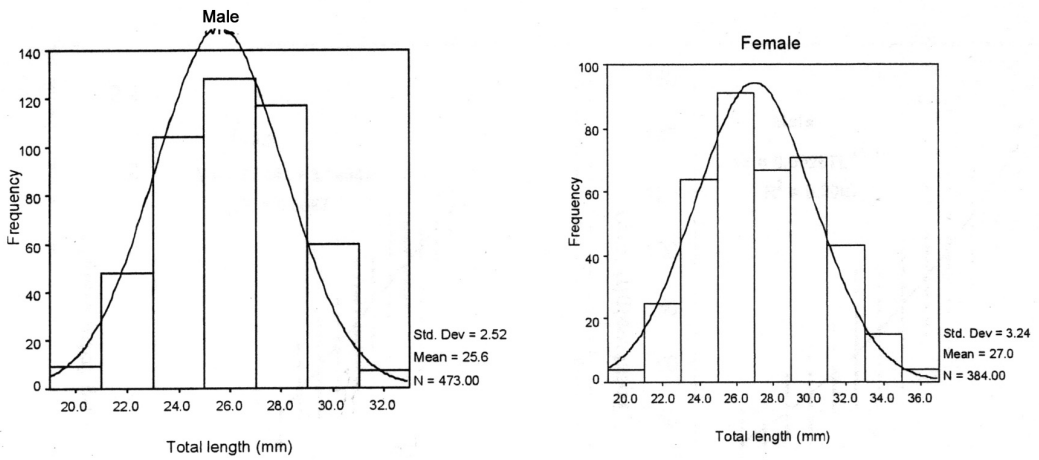


Fig.7. Mean total length of male and female *A. intermedius* from the coastal waters of Bintulu, Sarawak

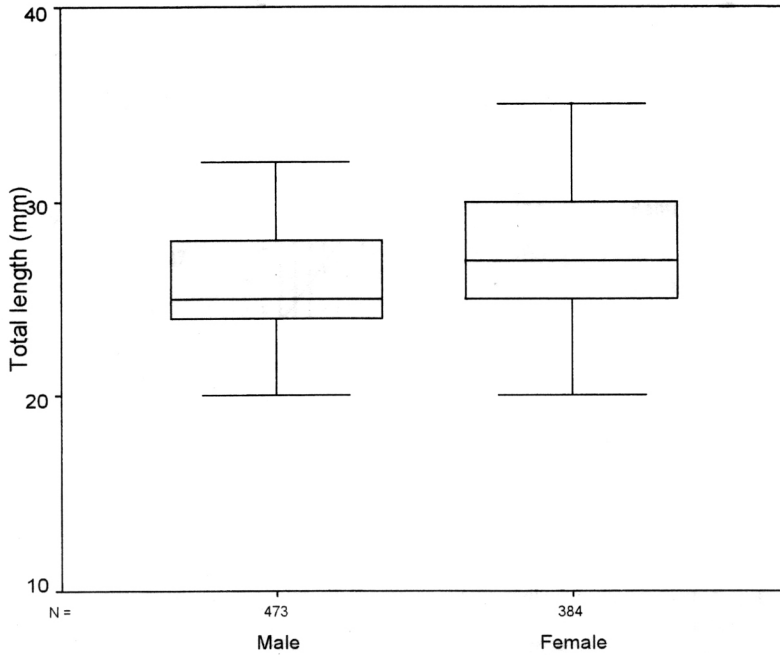


Fig.8. Length-weight relationship of male *A. intermedius* (Logarithmic and arithmetic) from the coastal waters of Bintulu, Sarawak

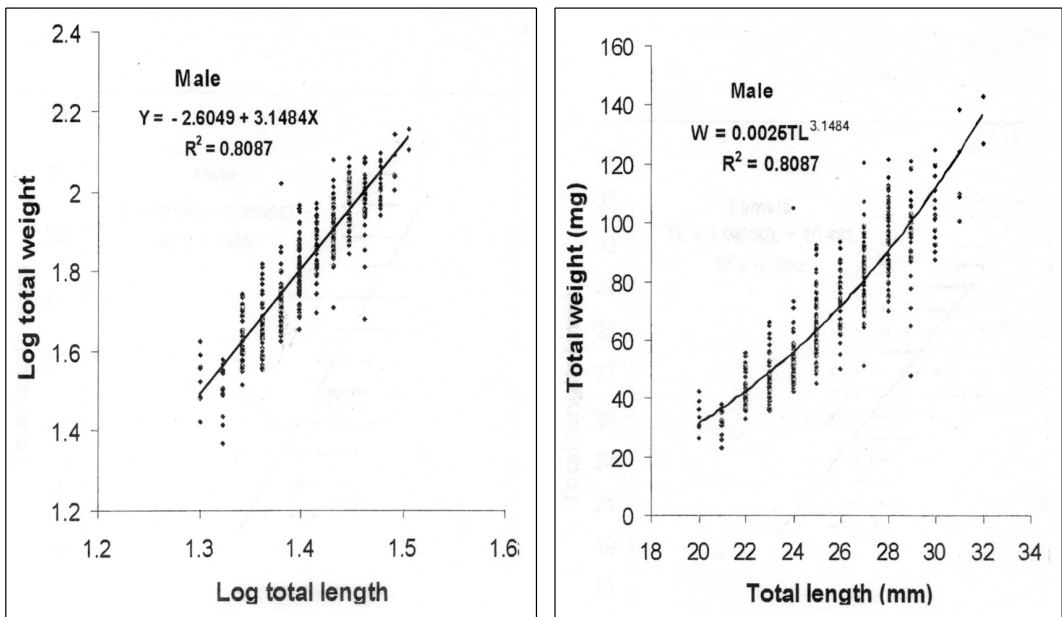


Fig.9. Length-weight relationship of female *A. intermedius* (Logarithmic and arithmetic) from the coastal waters of Bintulu, Sarawak

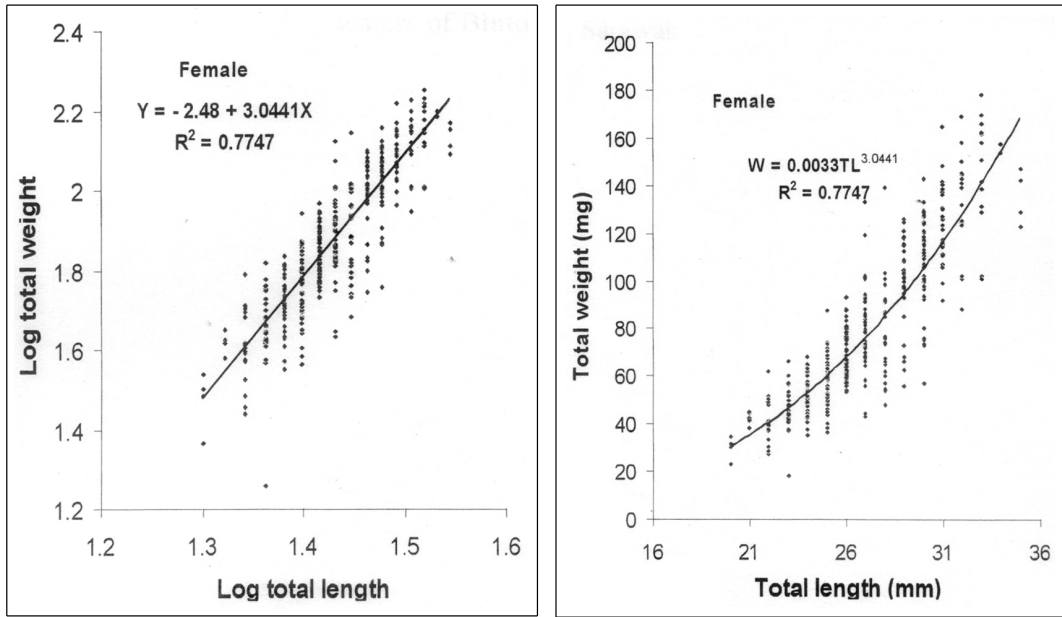


Fig.10. Length-length relationship of male and female of *A. intermedius* from the coastal waters of Bintulu, Sarawak

