Population Study, Length-weight Relationship, Size and Movement of *Acrossocheilus Deauratus* (Cuvier & Valenciennes) in Two Malaysian Streams

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RINGKASAN

Satu tinjauan telah dibuat mengenai anggaran populasi ikan daun (Acrossocheilus deauratus) *di Sungai Batu dan Sungai Tua masing-masing didapati mengandungi 3,969 dan 1,932 ikan daun di sepanjang kawasan sepanjang 1.5 km. Panjang ikan-ikan ini berbeza di antara 53 hingga 115 mm dan hubungan panjangberat badannya ialah seperti berikut :*

Sungai Batu, $Log_e\ W = Log_e\ 0.0006 + 2.2956\ Log_e\ L.$

Sungai Tua , $Log_e\ W = Log_e\ 0.0001 + 2.7003\ Log_e\ L.$

Keadaan ekologi di Sungai Batu adalah sesuai untuk kehidupan populasi ikan daun. Tidak ada bukti pergerakan beting dikedua-dua sungai ini, tetapi, walau bagaimanapun terdapat juga pergerakan individu.

SUMMARY

A survey of the population estimation of 'ikan daun' (Acrossocheilus deauratus) *on Sungai Batu and Sungai Tua in Selangor, Malaysia was done. A small stretch of 1.5 km each in Sungai Batu and Sungai Tua represented 3,969 and 1,932 'ikan daun' respectively. The length of the fishes varies from 53–115 mm and the length-weight relationship was represented by the formulae :*

Sungai Batu, $Log_e\ W = Log_e\ 0.0006 + 2.2956\ Log_e\ L,$ and
Sungai Tua , $Log_e\ W = Log_e\ 0.0001 + 2.7003\ Log_e\ L.$

Ecological conditions in Sungai Batu were favourable for the 'ikan daun' population. There is no evidence of shoal movements occurring in these two streams but some individual movement did occur.

INTRODUCTION

Sungai Batu in Selangor, Malaysia, once supported a good population of many food fish (Bishop, 1973) who observed the presence of *Acrossocheilus deauratus* (C. & V.), *Hampala macrolepidota* (van Hasselt), *Mastacembelus maculatus* (C. & V.), *Glyptothorax major* (Boul.), *Puntius binotatus* (C. & V.), *Macrones wycki* (Bleeker), *Clarias batrachus* (Linn.), *Dermogenis pusillus* (Kuhl & van Hasselt) and *Poecilia reticulata* (Peters) at the confluence of Sungai Batu and Sungai Gombak. The present study reveals the relative abundance of the most dominant species, *Acrossocheilus deauratus,* their length frequency and length-weight relationships in the two fast flowing streams, namely Sungai Batu and its tributary, Sungai Tua.

The study of population size of a species can help determine the future of that fishery; and since the population study can be influenced by individual or shoal movements, this study also attempts to investigate this aspect of behaviour. Northcote (1967) suggests that movements are related to freshwater fish production.

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Length frequency studies reflect the frequency of occurrence of the maximum and minimum size of the fish and the mathematical formulae established during the study of the length-weight relationships has the advantage of converting length into weight and vice versa (Bennett, 1967).

Acrossocheilus deauratus, commonly known as 'ikan daun', and although seldom found in fish markets, is a desirable fish among the Malays. Belonging to the family Cyprinidae it is characterised by tubercles on the snout, subinferior mouth and continuous upper and lower lip.

Literature dealing with the population estimation of Malaysian fishes is scanty. Law and Mohsin (1980) have studied the physical and chemical parameters of the Kelang and Gombak rivers; Mohsin and Law (1980) have predicted their effect on fishes in these rivers.

DESCRIPTION OF STUDY AREA

Sungai Batu originates from the Gombak highlands to the North East of Kuala Lumpur and flows south-westerly for 8 km where it reaches Sungai Tua, its tributary. Further 12.8 km down it empties into Sungai Gombak near Kuala Lumpur's wholesale market. Upstream up to the point where Sungai Batu and Sungai Tua meet, water is clear and fast flowing. Fourteen kilometers north of Kuala Lumpur Sungai Batu passes through human settlements of Kampong Sungai Tua, Kampong Nakhoda, Taman Selayang and Kampong Baru Batu Caves, where it receives heavy loads of raw untreated domestic sewage. Pollution is enhanced further downstream as it reaches the industrial area of Batu Caves. Further downstream the river is again polluted by tin mining wastes from the Kampong Batu area.

The study area, which is about 17.7 km north of Kuala Lumpur, is between point 'X' downstream and point 'Y' upstream of Sungai Batu and point 'Z' upstream of Sungai Tua as indicated in Figure 1. The total length of the study area extends to about 3 km.

Both streams are about 10 m wide but Sungai Batu is relatively deeper than Sungai Tua. The average depth of Sungai Batu is about 0.7 m while Sungai Tua is less than 0.5 m deep. The flow rate of both streams is almost similar, ranging between 0.6 to 0.8 m per second. Sungai Batu is, however, relatively cooler (water temperature averages 24.5°C) than Sungai Tua (water temperature averages 26°C) probably because

Sungai Batu flows through a dense forested area and is provided with a thick canopy while Sungai Tua flows through a clear secondary forest with no canopy. Dissolved oxygen content is almost similar for both streams ranging between 7–8 ppm. The pH for both streams is also similar ranging between 6.8–7.1. Both streams have more or less a similar bed which is sand-gravel with intermittent granite boulders. Sungai Batu, however, has more granite boulders than Sungai Tua.

With regard to ichthyofauna, both rivers are dominated by *Acrossocheilus deauratus* followed by *Rasbora sumatrana, Puntius binotatus* and *Channa lucius.* These fishes, however, are not found downstream due to reduced flow and heavy pollution.

METHODS AND MATERIALS

Since small *A. deauratis* are not caught, the population estimates were confined to fishes over 60 mm long. The fish were caught with cast nets with 2.5 cm mesh. Population estimation was made by 'mark and recapture' method. On February 1, 1980 the first sampling was done in Sungai Batu and Sungai Tua using six cast nets. Fishes were marked by cutting the upper caudal fin lobe for Sungai Tua and the lower caudal fin lobe for fishes of Sungai Batu. Prior to this, 30 *A. deauratus* were placed in one tank in the laboratory. Ten had their upper caudal fin lobes cut; the remainder were used for comparison. No noticeable changes in swimming behaviour were observed in both groups. Complete regeneration of the caudal fins (with resultant scars) was observed after ten days in 80% of the fishes. Mortality rate was zero.

On February 14, 1980 a second sampling was done. Marked fishes caught were recorded and the following equation was used to estimate the population size:

$$N = \frac{MC}{R}$$

where,

N = estimated number of fish in population

M = number of fish caught and marked in the first sampling

C = number of fish captured in the second sampling

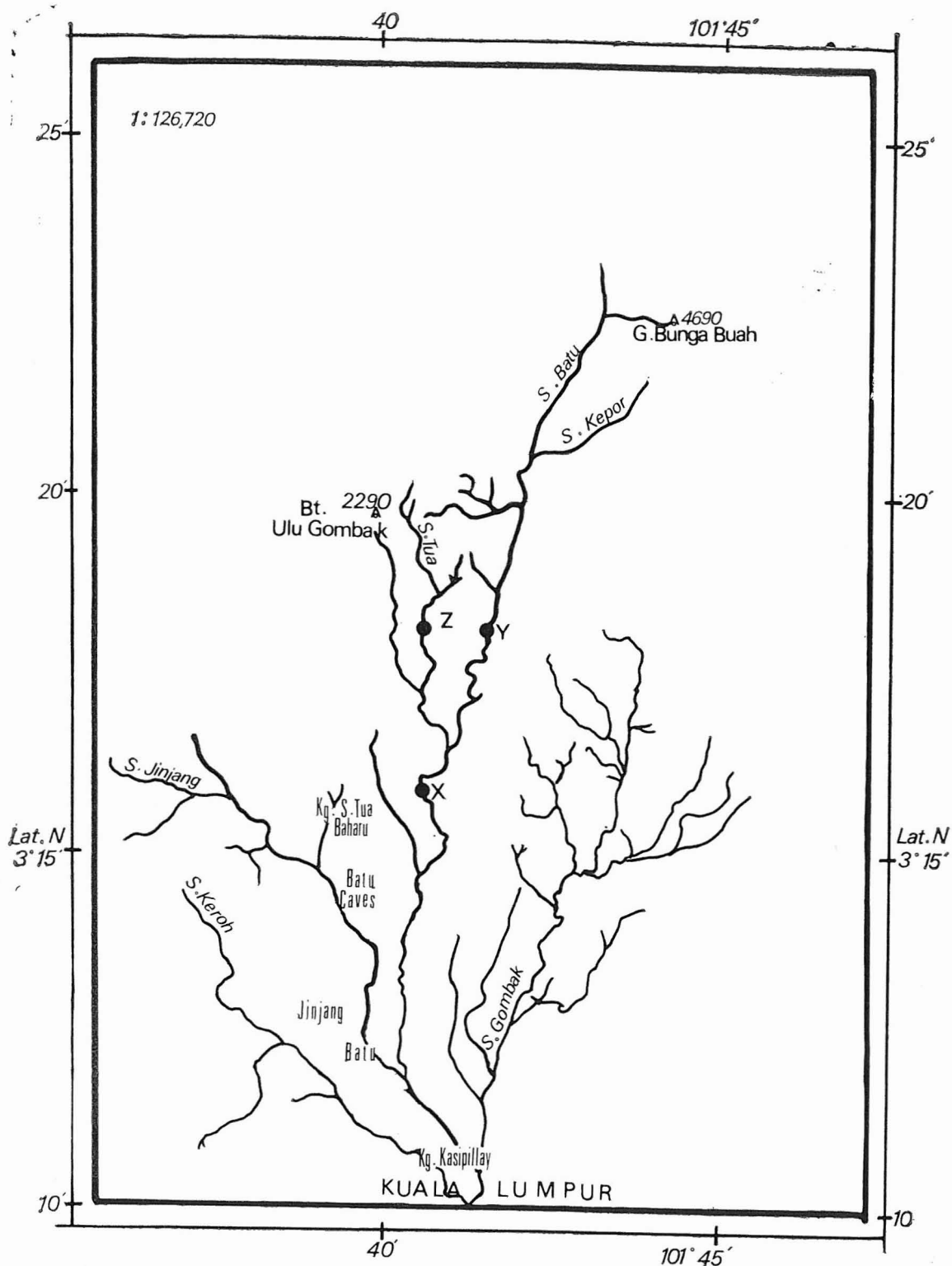R = number of marked fish recaptured in the second sample

Fig. 1. *Course of Sungai Batu and Sungai Tua and its vicinity. The study area is represented by X, Y and Z.*

Variance for N was estimated by formula:

$$V(N) = \frac{N^2(N-M)(N-C)}{MC(N-1)}$$

From variance, the standard error of N was:

$$S.E.(N) = \frac{N}{\sqrt{MC(N-1)}} \sqrt{(N-M)(N-C)}$$

Length-weight relationships were calculated by using the formula:

$$W = aL^b$$

where W = weight (gm), L = standard length (cm), a = intercept of y axis and b = regression coefficient (Le Cren, 1951). Linear transformation was made by using the natural logarithms of the observed length and weight:

$$Log_e W = Log_e a + b \ Log_e L$$

RESULTS AND DISCUSSION

In the first sampling period 153 *A. deauratus* ranging from 58–111 mm in standard length (Fig. 2) were caught in Sungai Tua, all of which were marked and released. In Sungai Batu 204 *A. deauratus* ranging from 60–115 mm in standard length were marked and released. In the second sampling 202 *A. deauratus* were caught from Sungai Tua, 16 of which had distinct markings from the first sampling. In Sungai Batu 214 *A. deauratus* were caught, out of which 11 were found to have the markings.

Using Petersen's formula, the estimated *A. deauratus* population of Sungai Tua was 1932 (point estimate) while that of Sungai Batu is 3969 (Table 1).

The accuracy of this estimate depends on the assumption that (1) the population is closed to recruitment and immigration; (2) marked fish do not lose their marks (3) marked fish are in every way the same as unmarked fish, i.e. same mortality, behaviour to gear etc.; (4) there is a random mixing of marked and unmarked fish.

Cooper and Lagler (1956) indicated that in a relatively small sample, population estimation can be biased. However, according to Robson and Rogier (1971) this bias can be considered negligible if at least $r \geqslant 7$ recaptures are made. This method has advantage over the multiple sampling techniques, since during the study period mortality of the fish can take place in the population without making the estimate biased, as long as the mortality rate of marked and unmarked fish is equal (Mc Cann, 1960).

Sungai Batu seems to support more fish than Sungai Tua. One likely reason is that the habitat in the former stream is more favourable. Sungai Batu has more rocks and boulders thus giving more shelter. Furthermore, the water is deeper and cooler. Since the Sungai Batu passes through a dense forested area, it is also likely that more fish food, especially insect larvae, are found there. On the other hand Sungai Tua is affected by cultivation while Sungai Batu (at the sampling area and further upstream) is not.

In the second sampling, one fish from Sungai Batu was recaptured in Sungai Tua about 50 m upstream from the point of the confluence. This movement can be considered as a localised individual movement, although the authors could not find further evidence to confirm this.

Length frequency distribution *(Fig. 2)* of *A. deauratus* caught in the sampling period indicates that the standard length of the fishes varied from 58–115 mm. The maximum number of fishes in both the streams were 75 mm long.

TABLE 1

Population estimation of ikan daun in Sungai Tua and Sungai Batu, Selangor.

	No. captured and released in first sampling	No. captured in second sampling	No. of marked fish caught in second sampling
Sungai Tua	153	202	16
Sungai Batu	204	214	11

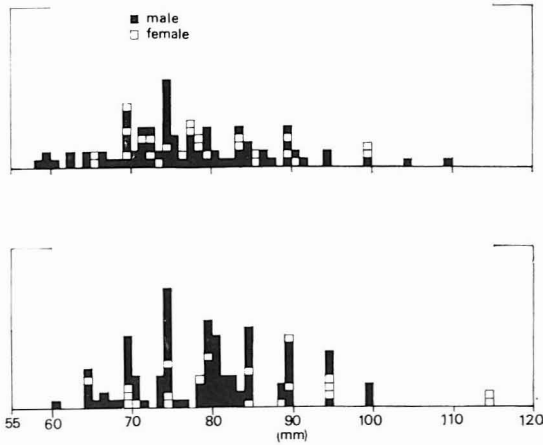Sungai Tua : N = 1932 ± 439   Sungai Batu : N = 3969 ± 1134

Fig. 2. Length Frequency of A. deauratus *in Sungai Batu (Upper) and Sungei Tua (Lower).*

Males and females, detected by cutting the abdomen, in the two places showed no specific variation.

A. deauratus usually weigh 10 gm at 70 mm, 17.5 gm at 85 mm, 37.7 gm at 115 mm. Length-weight relationships of these fishes are represented by the formulae below and the regression line drawn from the above is represented in *Fig. 3.*
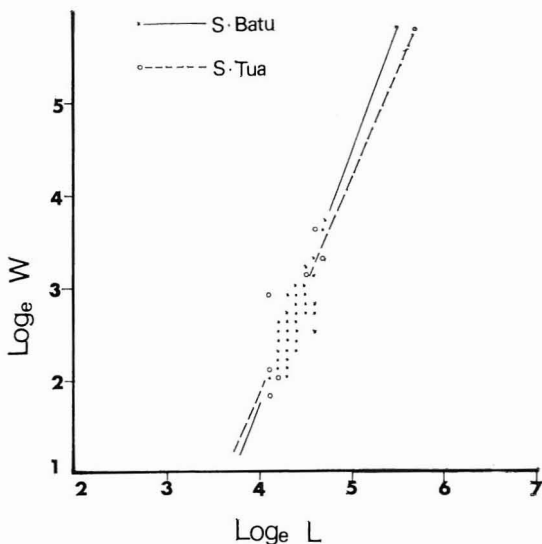

Fig. 3. A plot of the Log_eW on Log_eL and the Common Regression Line.

Sungai Tua, $Log_e W = Log_e 0.0001 + 2.7003 Log_e L$
$(n = 98)$
Sungai Batu, $Log_e W = Log_e 0.0006 + 2.2956 Log_e L$
$(n = 101)$

CONCLUSION

Bishop (1973) found several food fishes where Sungai Batu meets Sungai Gombak. Conversation with the local people around the study area revealed that fishes such as 'sebarau' *(Hampala macrolepidota)* and 'ikan baung' *(Mystus* spp.) were found in the streams in the early 70's. At present, however, most fishes are confined to the upstream areas and 'ikan sebarau' and 'ikan baung' are no longer found. The population of 'ikan daun' will probably also be reduced in the future unless the quality of the stream is maintained. Sungai Tua is already showing a diminished population of 'ikan daun'. In order to increase the fish population in these two streams and to see 'ikan sebarau' and 'ikan baung' again, management procedures such as deepening of the stream beds, checking on pollution and stocking of 'ikan sebarau' and 'ikan baung' will have to be taken.

ACKNOWLEDGEMENTS

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