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Some Aspects of the Biology of 'Ikan Kelabau' *Osteochilus melanopleura* (Bleeker)

Z.A. AIZAM, S. CHE ROOS and K.J. ANG
Department of Fisheries Biology and Aquaculture,
Faculty of Fisheries and Marine Science,
Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia.

Key words: **'Ikan Kelabau',** ***Osteochilus melanopleura*** **(Bleeker); biology.**

RINGKASAN

Susutan yang nyata bagi jenis-jenis ikan sungai dalam perairan kita pada amnya telah menggalakkan kajian mengenai biologi ikan Osteochilus melanopleura *atau ikan kelabau, sejenis spesis indigen yang sangat disukai ramai.*

Perhubungan panjang-berat ikan ini boleh dinyatakan dalam persamaan Log W = 3.0596 Log L −4.5330. Faktor kondisi adalah lebih tinggi di musim kemarau daripada musim hujan. Kesemua perut yang dianalisiskan mengandungi isi dan ini menunjukkan bahawa ikan tersebut memakan dengan aktifnya sepanjang tahun. Isi kandungan gut juwana ikan-ikan ini menunjukkan banyak algae hijau dan fitoplankton telah dimakan. Pada amnya ikan kelabau adalah sejenis ikan herbivor.

Tidak ada perbezaan yang ketara bagi jenis-jenis makanan yang dimakan oleh beberapa kumpulan kelas saiz. Dari pemerhatian yang dibuat, ikan betina mencapai kematangan seks pada ukuran panjang penuh 290 mm, sementara ikan jantan pula pada 260 mm. Ini telah disahkan secara pemeriksaan histologi gonad-gonad mereka. Peringkat-peringkat pembesaran oosit menunjukkan proses pembiakan berlaku pada musim hujan iaitu di antara bulan November hingga Mac dan kemuncaknya pada bulan Februari. Indeks gonadosomatik mencapai maximanya pada bulan ini.

SUMMARY

This study reports on the biology of 'ikan kelabau', Osteochilus melanopleura, *a popular indigenous food fish.*

The length-weight relationship of this fish can be expressed by the equation, Log W = 3.0596 Log L −4.5330. The condition factor was higher during the dry season than during the wet. None of the stomachs examined were empty, suggesting that the fish feeds actively throughout the year. The guts of the juvenile fishes showed substantial quantities of green algae and phytoplankton. Both the maturing and adult 'ikan kelabau' are predominantly herbivores.

There is no significant variation in the kinds of good consumed by the various size groups. It was observed that females reached sexual maturity at 290 mm (total length) and the males at 260 mm. This was verified by the histological examination of the gonads. The developmental stages of the oocytes indicated that spawning took place during the wet months between November and March with a peak in February. The gonadosomatic index reached a maximum of 3.1 during this month.

INTRODUCTION

'Ikan Kelabau' is scientifically known as *Osteochilus melanopleura* (Bleeker). Although they were caught in abundance a decade ago, their numbers in recent years have dwindled so that they have become rare and expensive (Anon, 1977 and 1980). The 'Kelabau' fetches a price of $4.00 per kg. (1982) which is higher than the price for Chinese carp at $3.00 per kg. and most of the other local riverine fishes which are priced at $1.50 to $4.00 per Kg. (personal communication

Key to authors' names: Z.A. Aizam, S. Che Roos and K.J. Ang

with fish retailers in markets at Kuala Kangsar, Perak).

The depletion of *Osteochilus melanopleura* in the river systems may be due to: (1) changes in the ecological systems such as the clearing up of jungles which normally result in soil erosion and heavy siltation which is detrimental to the fish fauna (Bishop, 1973); (2) over-fishing due to the increase in demand for fish as food by the population; and (3) use of non-selective methods of fishing which may be destructive to the young fishes.

No published information is available on the biology of this fish. This study was initiated to obtain some biological information on this species.

MATERIALS AND METHODS

A total of 197 specimens used in this study were bought from fish retailers in the market at Kuala Kangsar, Perak. A small proportion of them were obtained from fishermen near the fishing grounds around Tasek Chenderoh and Sungai Perak *(Figure 1)*. Tasik Chenderoh (Lat. 5° 55'N; Long. 101° E) is a lake formed as a result of the dam built across Sungei Perak for hydroelectric power generation. The river is the second longest in Peninsular Malaysia (approximately 460 km long). These specimens were studied from January to December, 1982. The total and standard lengths were measured on a measuring board and the body weight readings were done on a triple beam balance (Model Ohaus 4004). The guts and ovaries were removed from the abdominal cavity. The weights of the ovaries were then recorded. The guts were preserved in 5% formalin solution while the gonads were introduced into Bouin's fixative for histological studies. Before preservation the gonads were first cut into small portions of approximately 1 cm^3 for easy penetration of the fixative. They were kept in the fixative for at least 12 hours before being processed in an automatic duplex processor (Model Shandon Southern CE 0540). After processing, the gonads were embedded in paraffin wax, sectioned at a thickness of 6μm and stained with Mayers Haematoxylin and alcoholic eosin (Pantin, 1969).

The gonadosomatic index was computed by the formula,

$$\text{G.S.I.} = \frac{\text{gonad weight}}{\text{weight of fish}} \times 100$$

Morphological staging of the various maturity levels in the fishes was done according to the method used in the Fisheries Technical Paper, FAO, (1975).

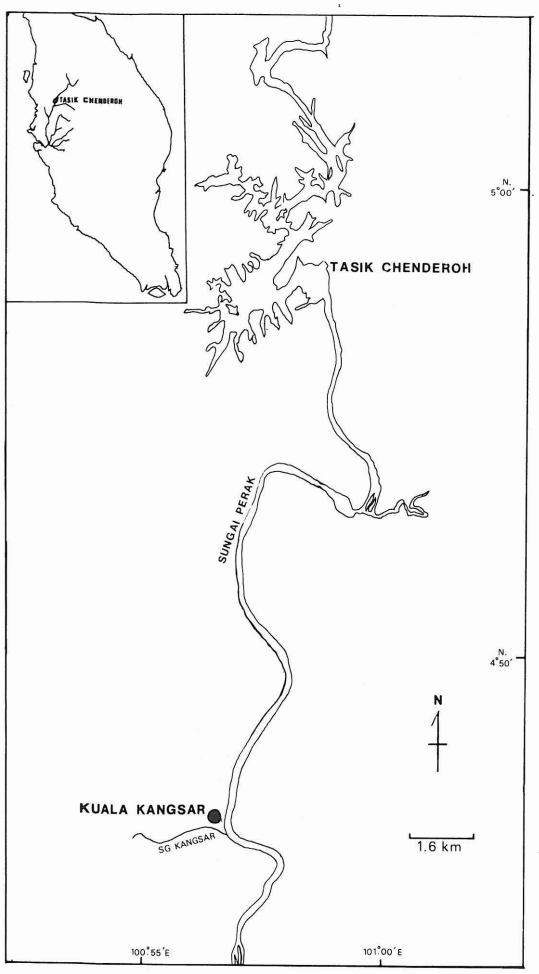

Fig. 1. Map showing the location where specimens were obtained in Perak, Malaysia.

The stomach and gut contents of 20 maturing and 14 matured fishes were analysed by the percentage occurrence method (Hynes, 1953). The length of the gut was measured and the relative gut index (R.G.I.) was computed for the different length groups using the formula:–

$$\text{R.G.I.} = \frac{\text{Length of gut (mm)}}{\text{Total length (mm)}} \times 100$$

The relationship between fish length and fish weight was derived by using the formula:–

$$W = aL^b \qquad \text{(LeCren, 1951)}$$

where W = weight in g; L = length in mm; b = exponent describing of the rate of change of weight with length, and a = weight at unit length.

The logarithmic transformation of the above equation was:–

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

The relative condition factors were calculated by the formula:–

$$K_n = \frac{W}{\hat{W}} \qquad \text{(LeCren, 1951)}$$

where K_n = relative condition factor,

W = the mean of the observed weight,

and $\hat{W}$ = the mean of the calculated weight using the logarithmic transformation equation mentioned above.

RESULTS

Classification and description of the species:

The position of *Osteochilus melanopleura (Figure 2)* in the class teleostomi is as follows:–

Order: Cypriniformes
Family: Cyprinidae
Genus: Osteochilus Gunther
Species: *O. melanopleura* (Bleeker)

It is the largest of the local species of *Osteochilus* and is easily recognised by its abruptly ascending mouth, fringed lips, long dorsal fin, generally grayish-green colour of the body, with numerous irregularly disposed shall silvery spots and a large blackish transverse blotch on the anterior part of the body (Smith, 1945).

The fish is widely distributed throughout South-east Asia. It is found in Borneo and Sumatra, the Malay Peninsula and Central and Eastern regions of Thailand. However, this species is not found in the Northern and Western mountain regions of Thailand (Smith, 1945). In Thailand, fish with lengths of 27 cm. to 30 cm. are frequently found. In Malaysia, this fish is mostly caught in the state of Perak and are sold in the local markets at Kuala Kangsar and the surrounding areas.

Length-weight relationship:

To study length-weight relationship, 197 specimens ranging from 158 mm to 395 mm in total length were used. The relationship between fish length and weight is given in *Figure 3.* The

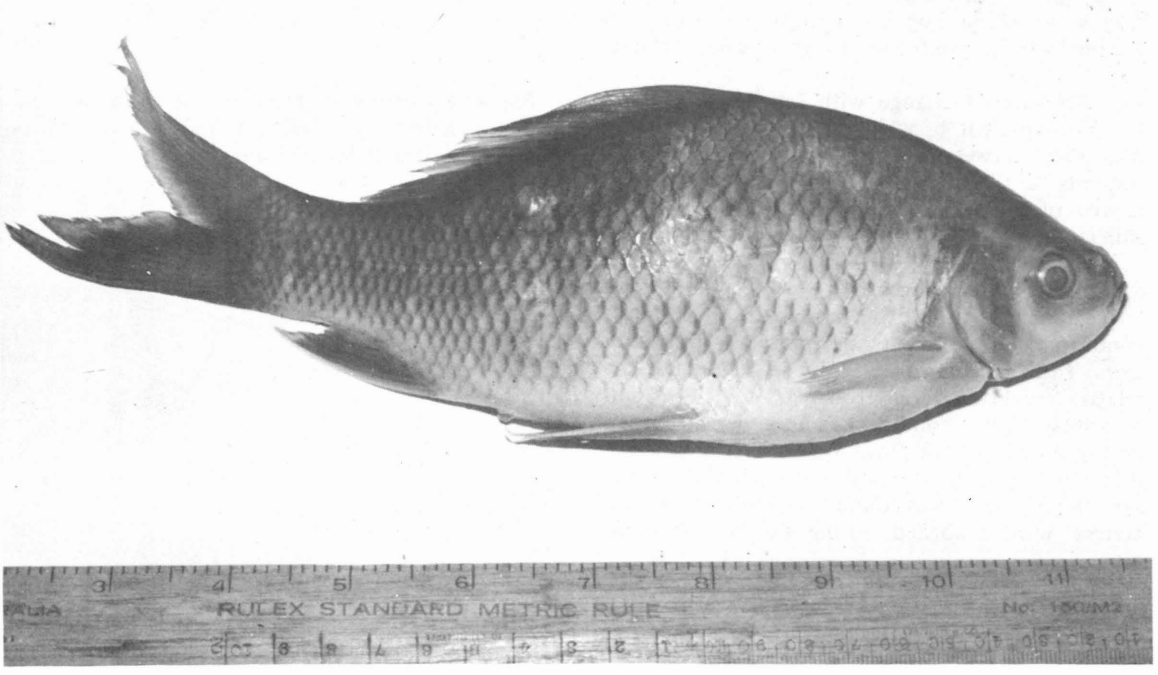

Fig. 2. Ikan kelabau – Osteochilus melanopleura *(Bleeker).*

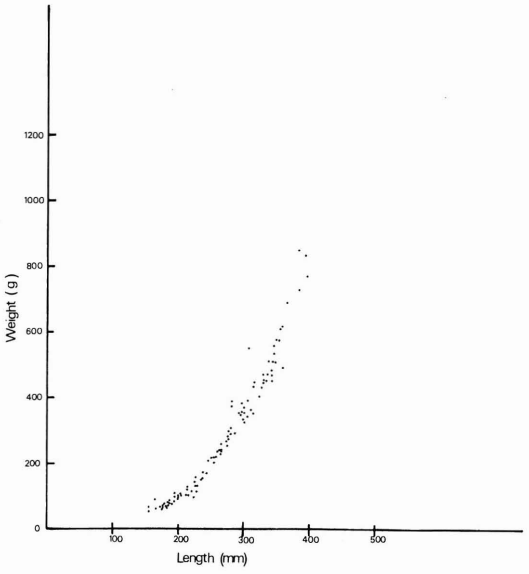

Fig. 3. Relationship between length and weight of ikan kelabau (Osteochilus melanopleura) *showing parabolic curve. n = 197.*

plot of the relationship between Log W on Log L and the common regression line is shown in *Figure 4.* The logarithmic relationship of weight on length of *O. melanopleura* was found to be Log W = 3.0596 Log L –4.5330. The exponent 3.0596 nearly conforms to the cube formula.

The rate of change with length is reflected by the exponent b, which LeCren (1951) stated may vary between 2.5 to 4.0. Since growth represents an increase in three dimensions, the degree of isometry in the length-weight relationship is reflected by the closeness of b to 3.0.

Relative Condition Factor:

The mean monthly changes in the relative condition factor of *Osteochilus melanopleura* from Tasik Chenderoh is given in *Figure 5.* The relative condition varies from 1.09 to 1.44. Comparatively higher condition factors were recorded during the dry months from April to October, 1982. Although feeding intensity was high throughout the whole year, it was found that higher condition factors were recorded during the dry months.

Food and Feeding Habits:

Gut contents from 34 specimens with total lengths varying from 158 mm to 395 mm were examined. It was observed that none of the guts were empty. To determine and differentiate the

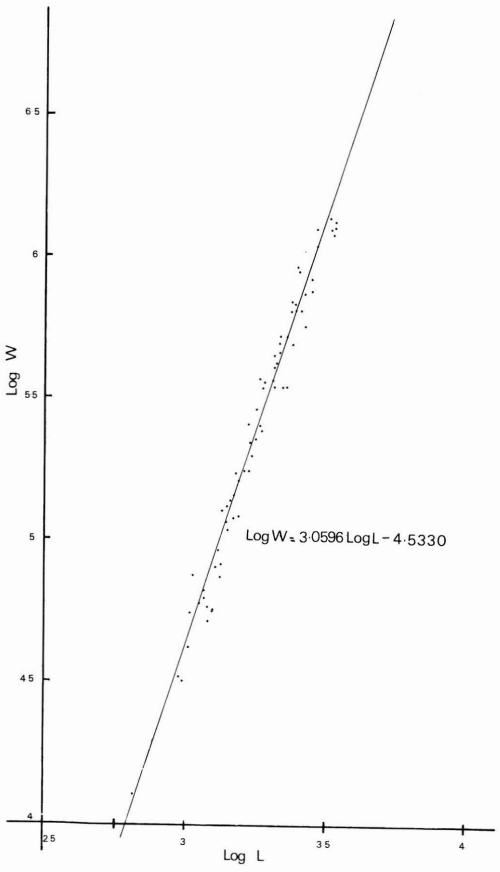

Fig. 4. Logarithmic relationship between total length and weight of ikan kelabau (Osteochilus melanopleura).

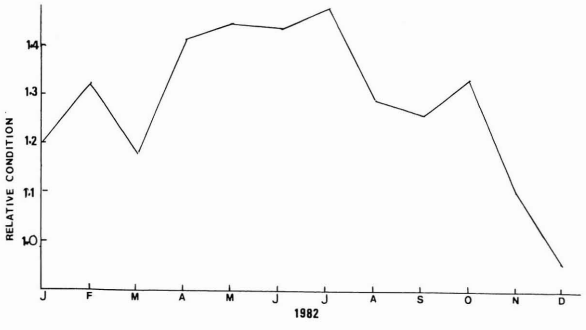

Fig. 5. Mean monthly relative condition in Osteochilus melanopleura.

types of food eaten by the fishes in relation to their sizes, the fish were classified into three groups. These were: 1) those with total lengths measuring up to 199mm, 2) those with total lengths ranging from 200mm to 299mm and 3) those whose total lengths were 300mm and above.

The study on the gut contents of the various size groups is given in Table 1. It could be summarized as follows:–

Higher Plants

Guts with fragments of higher plants were found in all the length groups in varying percentages. The frequency of occurrence of this food item varied from 60% in the maturing group to 100% in the matured group.

Phytoplankton and Algae

The percentage of occurrence of phytoplankton varied from 35.7% to 87.5% while the percentage of occurrence of algae was found to fluctuate between 28.6% in the matured fish group to 75% in the smaller fish group.

Debris and sand particles

Debris were found in all the length groups. However, sand particles were found only in the smaller fish group (less than 199 mm) where 25% of the guts contained sand particles.

The Relative Gut Index (R.G.I.)

The results of the R.G.I are given in Table 2. The R.G.I. of the matured fish was found to be significantly higher than those of the other groups ($P>0.01$).

TABLE 2
Relative Gut Index (R.G.I.)
(Sexes combined)

Total length range (mm)	N	Mean R.G.I. ± S.E.
< 199	10	4.31 ± 0.38
200 – 299	16	5.22 ± 0.31
> 300	8	7.34 ± 0.33
Total	34	5.62 ± 0.34

Reproduction

Morphology of the ovary

The ovaries are paired, elongated bodies situated in the posterior half of the body cacity and suspended from the body wall by the mesovarium. The anterior two limbs of the ovary are free but the posterior ends bend inwards to join medianly forming a single oviduct. The ovary is round in cross-section.

Oogenesis

Oogenesis include all stages of oocyte development. In *O. melanopleura,* nine oocyte development stages could be recognised *(Figure 6).* These were:

TABLE 1
The Percentage gut content Composition of *Osteochilus melanopleura* in different size categories
(Percentage occurrence method)

Items	Fish Size (mm)		
	0 – 199	200 299	300 and above
No. of stomach examined	8	12	14
No. of empty stomachs	0	0	0
Plant materials	62.5(%)	83.3(%)	100(%)
Phy toplankton	87.5	66.7	35.7
Algae	75.0	58.3	28.6
Sand particles	25.0	–	–
Debris/Unidentified plant materials	100.0	100.0	100.0

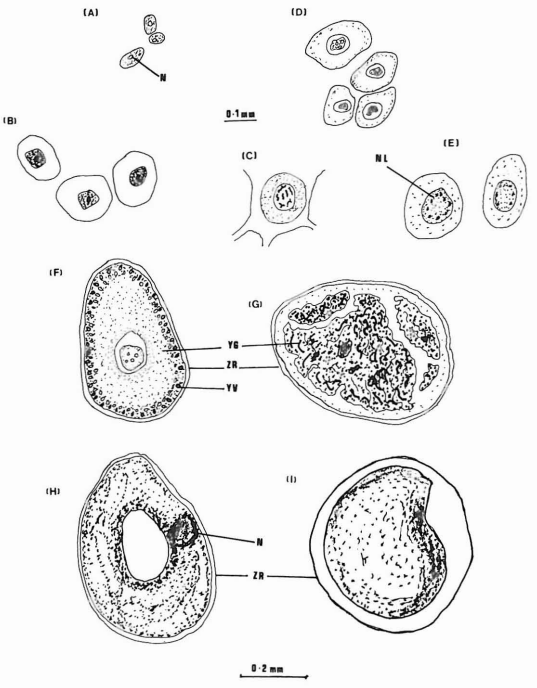

Fig. 6. Stages of maturity of oocyte in Osteochilus melanopleura.

OG – *oogonia*
N – *nucleus*
NL – *nucleolus*
YG – *yolk globules*
ZR – *zona radiata*
YV – *yolk vacuoles*

1. *Oogonia stage (Figure 6A)*

The oocytes were round or oval and they lay singly in the ovarian lamellae. Oogania were observed in all ovaries examined histologically. Their numbers were found to decrease markedly in the ovaries prior to spawning.

2. *Single nucleolus stage (Figure 6B)*

The oocytes in this stage measured about 0.1 to about 0.15mm in diameter. The chromosomal materials of oocytes in this stage were quite distinct.

3. *Chromatin stage (Figure 6C)*

The nuclear membrane were normally broken. Oocytes at this stage were found throughout the course of the study and were abundant in maturing ovaries.

4. *Multinuclealar stage (Figure 7D)*

Oocytes in this stage measured about 0.15mm. The nucleli were very distinct.

5. *Perinucleolar stage (Figure 6E)*

Oocytes in this stage had all the nucleoli around the periphery of the nucleus. The ooplasm had a 'reticulate' appearance. The number of nucleoli had increased in number and the follicular layer became noticeable. The fact that these oocytes were not found in abundance at any time suggested this to be a transient stage and the development from this stage to the next was rapid.

6. *Yolk vesicle stage (Figure 6F)*

Yolk vesicles appeared during this stage. Oocytes measured from 0.3mm to 0.35mm in diameter. The yolk vesicles were found mostly in the periphery of the cytoplasm and the perinucleolar arrangement within the nucleus still persisted.

7. *Yolk globule stage (Figure 6G)*

Oocytes in this stage measured around 0.4mm in diameter. Yolk globules were readily distinguishable. In the early phase of this stage, the yolk globules were largely confined to the peripheral cytoplasm but eventually they became more evenly distributed.

8. *Mature stage (Figure 6H)*

In mature oocytes, both yolk vesicles and globules were present. The nucleoli could still be seen and their shapes were irregular. Empty follicles could be seen indicating that some oocytes had been ovulated into the lumen of the ovary.

9. *Ripe Stage (Figure 6I)*

Ripe oocytes were found lying freely in the ovarian lumen. They measured from 0.6mm to 0.7mm. Most of these oocytes were heavily laden with yolk and this made their histological study difficult.

Size at first maturity

The females examined during the spawning season were grouped together to determine the size at first maturity. The presence of stages 7, 8 and 9 oocytes in the ovaries were taken as an indication that these fishes would spawn in the same season. The percentage of juvenile, maturing and matured fishes were grouped separately. It was observed that fishes with matured ovaries were first observed in the 290 mm – 300 mm group. Female fishes smaller than 290 mm in total length were all immature. Male fishes mature at 260 mm.

All males at this size and above were found to milt easily when the stomach is pressed gently.

Gonadosomatic Index

The gonadosomatic index for *Osteochilus melanopleura* for a one year cycle is presented in *Figure 7.* It was observed that the G.S.I. for both sexes was high during the month of December to March the following year. The female G.S.I. attained a peak of 3.1 while the male attained a peak of 2.5 during the month of February. These months coincided with the rainy period brought about by the North-East monsoon which apparently triggered the onset of spawning.

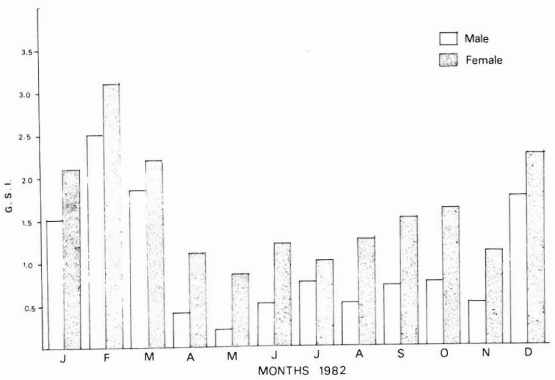

Fig. 7. The Monthly average of gonadosomatic indices of O. melanopleura.

DISCUSSION

The relationship between length and weight of *Osteochilus melanopleura* was curvilinear which became linear on double log transformation, thus suggesting the acceptance of the allometric form $W = aL^b$.

Nikolski (1969) however, suggested that weight increase to length increase might be linear before maturity. He further suggested that increase in weight during maturity increased the potential fecundity of the population since fecundity is more closely related to body weight than to body length.

The major component of the gut content consisted of highly digested plant matured which were beyond identification. No animal food was found in any of the guts examined. The high relative gut indices of 4.3, 5.22 and 7.34 for juvenile, maturing and matured fishes respectively thus support the hypothesis that this fish is herbivorous. Odum (1970) stated that herbivores have relative gut index values greater than 3.

The factors which triggered gonad maturation and breeding could not be accurately deduced from field observations. Laboratory studies have amply demonstrated that temperature and photoperiod are of prime importance in stimulating gonad maturation and breeding (Wiebe, 1968). The onset of the rainy days after a dry spell would normally result in a cooler climate. Coupled with rising water levels this could have triggered breeding and gonad maturation in the fish. Most fishes in the tropics breed during the rainy season. Alikunhi (1966), noted that carps in the tropics are perennial spawners. A matured carp would breed five or six times in the course of a year. This could occur if conditions conducive for the fish to spawn are evenly spread throughout the year.

Histological examination of gonads from matured female fishes showed that nine stages of oocyte development were present. The various stages of oocyte development as shown in *Figure 6,* indicated that this development occurred progressively. In some matured ovaries, it was found that about 55% of the oocytes were in stages 6, 7 and 8 of development while the rest were in the earlier stages. Okada (1960) noted that in tropical carps all the eggs in the ovary were not deposited at one spawning. Similarly, Matsui (1957) also found that the number of eggs in carp ovaries were reduced by 15.4 to 51.9% as a result of the first spawning. The same could also be true for the fish under investigation. Oocytes in the late stages of development would be released at one spawning time and they would be replaced by those which were then in the earlier stages. The spawning period was protracted and coincided with the rainy months from November to March. This clearly showed that spawning is partial. However, verification of this by ova-diameter frequency studies was not carried in this study. Temperature and water levels seemed to regulate the time of spawning. Schields (1957) found that a rapidly rising water level and flooding of the vegetative areas surrounding it provided the natural spawning ground; and this triggered the mechanism of spawning in carps. The coolness of the water in the lake and river surrounding it, and changes of water levels during the rainy season would have triggered *Osteochilus melanopleura* to spawn during these months.

Feeding intensity was lower during the wet months because heavy rains brought a lot of organic matter into the river systems and this resulted in reduced water transparency and low

temperatures. As a result feeding activity became less active during this time. Similar results were reported in the condition factors of *Ethmalosa fimbriata* of Lagos Lagoon, Nigeria. (Fagede and Olaniyan, 1972).

CONCLUSION

The depletion of many indigenous species has been observed for a number of years. Data obtained from the Annual Fisheries Statistics, Ministry of Agriculture, Malaysia (1977, 1980) showed a decline in the catch of most fish species. One way of rectifying this is to restock the water bodies with young fishes. At present this may not be possible because of the inability to breed most of them artificially. It is hoped that with the knowledge gained from studies made on the biology of our local species, we may in future be able to induce breed some of the fishes that are gradually facing depletion. Knowledge of the biology of these fishes may also help us in formulating regulations that can ensure their survival in our waters.

The main findings of this study were:–

1. The female fish matures at a length of 290 mm while the males mature at 260 mm.
2. The fish is predominantly a herbivore with plant materials as the main food item and green algae and phytoplankton as the second important food item.
3. The spawning period is protracted. The spawning period coincides with the wet monsoon season from November to March.
4. The females are partial spawners releasing only a portion of their ripe eggs at any one time. The remaining oocytes will develop continually and are released at the next spawning period.

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