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Population Dynamics of Tinfoil Barb, *Barbonymus schwanenfeldii* (Bleeker, 1853) in Pedu Reservoir, Kedah

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Abstract

The physico-chemical and biological parameters, species composition and population dynamic of dominant fish species were conducted in Pedu Reservoir in Kedah. The reservoir is considered safe from human activities, although the level of ammonia concentration (3.84 ± 2.65 mg/L) was exceeded the class recommended in Malaysia. 82.94% of fish families were contributed by Cyprinidae, 11.04% of Notopteridae, 3.01% of Bagridae and 2.51% for others. Twenty-four fish species were recorded in the reservoir and were dominated by *Barbonymus schwanenfeldii* (38.9%), followed by *Oxygaster anomalura* (12.4%) and *Notopterus notopterus* (11.0%). The length-weight relationships of *B. schwanenfeldii* was an isometric (b = 2.992) form with Kn ranging between 0.75 and 1.01. This fish could attain $L\infty$ = 30.95 cm at growth rate of K = 0.66 yr^{-1}, given the growth performance index ($Ø'$) of 2.801 that was represented from two cohorts occurred in August and February, respectively. The cohorts were strongly correlated to rainfall distribution in the area. The total mortality coefficient (Z) was 2.01 and natural mortality coefficient (M) was 1.37 yr^{-1} given the fishing mortality coefficient (F) and exploitation rate (E) was at 0.64 and 0.32 yr^{-1}, respectively. The exploitation rate of 0.32 yr^{-1} was lower than the 75% of B'/R ($E_{0.1}$ = 0.41) or optimum Y'/R (E_{max} = 0.53) indicating the yield per recruit of *B. schwanenfeldii* could be increased slightly by increasing the E.

Keywords: *Barbonymus schwanenfeldii,* length frequency, population parameters, management, Pedu Reservoir; Kedah

1. Introduction

Tinfoil barb or *Barbonymus schwanenfeldii* is classified under the family of Cyprinidae, locally known as "Lampam Sungai". This species is also synonymus to *Barbus schwanenfeldii* or *Puntius schwanenfeldii* (FishBase, www.fishbase.org). This species is distributed widely, particularly in Asia; Mekong River and Chao Phraya, Borneo and Sumatra and found in all rivers and lakes of the Peninsular Malaysia (Mohsin & Ambak 1983, Rainboth 1996) and man-made lake (Taki 1978, Ali & Lee 1995). McConnell (2004) suggested that cyprinids distribution largely reflects faunal exchanges early in the Pleistocene. Zulkafli *et al.* (1999) noted that this species dominated in the open water of Kenyir Lake (in Terengganu) as compared to Semenyih Reservoir (in Selangor) which was distributed more in the riverine systems. *B. schwanenfeldii* is a freshwater fish inhibits lakes and rivers at pH range between 6.5 and 7.0, in tropical areas at temperature 20.4 – 33.7ºC (Christensen 1992). Average size were between 10 and 25 cm and weights about 200 – 600 g. The fish is possible to reach a maximum size of 30 centimeters and weights more than 1.0 kg (Christensen 2007). They are fast breeding fish; two times in 15 months. According to Steven *et al.* (1999), females greater than 160 g had mature or rematuring ovaries whiles males of all sizes had mature testes throughout the year. The spawners are known to shed their eggs in the upstream of rivers. The young's will remain in the rivers until they become fingerlings before migrates to other parts of the lake. Most fish tend to colonize the rivers while some move to the open water of the lake to colonize (Mohsin & Ambak 1983, Ali & Lee 1995). The diet of the fish consists of filamentous algae, insects and debris (Rainboth 1996, Fartimi 2008). The fish has an economic importance, dominantly landed by fishermen from lakes, reservoir and river systems. They are readily accepted by locals due to its tasty meat. Market price ranges from RM4.00 to RM6.00 per kg and has potential for aquaculture especially in ponds, lakes or aquariums.

The dynamics of fish population especially from the lakes is seldom conducted by researchers, despite this information is vital for the sustainable development and management of the inland capture fisheries of the lake. Methods in fish stock assessment require data input and produces output information (Bagenal 1978, Sparre & Venema 1992) as the result for management options. Therefore a comprehensive understanding of efficient fisheries management practices requires biological information on the life history, growth, mortality and recruitment of fish species (Hoeing and Bruber 1990). The information of the important of tinfoil barb, *B. schawanenfeldii* to inland fisheries management can be considered scarce. Although Mohd-Shafiq *et al*. (2012) have attempted to assess the suitability of the freshwater environment using relative condition factor of fish species, however studies very much needed in assessing the fish population in freshwater including reservoirs. Therefore, the present paper is attempts to provide a preliminary assessment of the population parameters; emphasis on the length-weight relationships, size structure, growth and mortalities and yield and biomass per recruit using the length-frequency data set of the species which were collected from the Pedu Reservoir. This preliminary assessment was also involved observation on environmental parameters during the study periods.

2. Materials and Methods

2.1 Study Area

Pedu Reservoir, Kedah, lies at Latitude: 6º15'N, Longitude: 100º46'E at the height of 59.0 meters above mean sea level. This man-made lake is 64.8 km^2 in area with maximum water level 97.5 m deep with mean depth is 16 m, surrounded by primary tropical rainforests (Kean & Meng 1996). It is a part of the catchments area for the Pedu Reservoir in which water is stored to irrigate the paddy fields on the flat plains of Kedah (Fig. 1a).

2.2. Sampling Gears and Data Collection

The physico-chemical and biological parameters were collected from eight sampling stations (Fig. 1b) in Pedu Reservoir from April to December 2008. Samples of fish species were obtained by using a pair of gillnets with different mesh sizes (2.5, 3.1, 5, 7.5, 8.1, 9.3 cm and 10 cm). The nets were soaked in the river mouth and in the vegetation area of the littoral zone for day (0600 – 1800 hrs) and night (1800 – 0600 hrs) catching. All fishes collected were identified using standard taxonomic keys by Mohsin & Ambak (1983), Kotellat *et al.* (1993), Rainboth (1996) and Ambak *et al*. (2010). The measurement of the length and weight were made *in situ* and the samples that need further examination were kept in ice and transported to the laboratory.

2.2. Data Analysis

Length-weight relationships was estimated using the power equation $W = aL^b$ (Le Cren 1951, Ricker 1973, Cinco 1982, Froese 2006, King 2007), where W is the total weight of individual *B. schwanenfeldii* in gram and L is the total length in cm.

The length frequency data set was developed by grouping them into 1.0 cm intervals. The group or cohort was separated by using Bhattacharya's method and the growth coefficient (K) and asymptotic length ($L\infty$) were estimated using the FiSAT software (Gayanilo *et al.* 1997) following to the reference's manual developed by Gayanilo & Pauly (1997).

Pauly & Munro (1984) formula was applied to estimate the growth performance index: $Ø' = \text{Log } K + 2 \text{ Log } L\infty$, and the Beverton & Holt's (1956) equation were used to obtain the total mortality coefficient (Z):

$$Z = K^*(L\infty - L)/ (\acute{L} - L'),$$

where; $\acute{L}$ is the mean length of fish above L', while L' is the lower limit of the length class of highest frequency.

The natural mortality coefficient (M) was calculated using Pauly (1980, 1986); $\log (M) = -0.0066 - 0.279 \log (L\infty) + 0.6543 \log (K) + 0.4634 \log (T)$, where; T is the average temperature in the study area.

The fishing mortality coefficient (F) was computed as $F = Z - M$, while the exploitation rate (E) was computed from the ratio F/Z (Gulland 1971).

Catch curve analysis (Pauly 1984) was used to estimate the length at first capture. While the recruitment patterns were obtained by projecting length frequencies backward onto a one-year time scale that is available in FiSAT software (Gayanilo *et al*. 1997).

The relative yield per recruit (Y'/R) and relative biomass per recruit (B'/R) were estimated by using the model of Beverton & Holt (1966) as modified by Pauly & Soriano (1986). This model is defined by:

$$(Y'/R) = E*U^{M/K} * [1 - (3U/1 + m) + (3U^2/1 + 2m) - (U^3/1 + 3m)] \quad \text{and}$$

$$(B'/R) = (Y/R)'/F,$$

where; the fraction of deaths caused by fishing is $m = (1 - E)/(M/K) = (K/Z)$ and $U = 1 - (Lc/L\infty)$.

All of the population parameters were computed using the incorporated FiSAT software package (Gayanilo *et al.* 1997) and the routines of the FiSAT were followed thoroughly as recommended by the FiSAT user's manual (Gayanilo *et al.* 1996) and reference's manual (Gayanilo and Pauly 1997).

3. Results

3.1. Physicochemical and Biological Parameters

The physicochemical and biological parameters (Table 1) indicated that the Pedu Reservoir was not exceeded the class I of INWQS (DOE 2010), except the level of ammonia concentration (3.84 ± 2.65 mg/L) which was slightly higher then the standard set by the DOE. The factor that contributed to this result is still unknown and needed further analysis. Based on the Secchi depth (3.45 ± 0.46 m), Pedu Reservoir can be considered mesotrophic lake.

A total of 20 species, comprises of 797 individuals had been recorded in the study, where *B. schwanenfeldii* was the dominant species caught, represented of about 38.9%, followed by 12.4% *Oxygaster anomalura*, and 11.0% of *Notopterus notopterus* (Fig. 2). Cyprinids were the dominant family which represented about 82.94% followed by 11.04% of Nototeridae, 3.01% of Bagridae and 2.51% of others (Appendix 1).

Based on Shannon-Wiener Diversity, station C recorded the highest Diversity Index; 0.8901, followed by station D (0.8469), E (0.7935), A (0.7301), B (0.6875), F (0.6842), G (0.6294) and H (0.5340) (Table 2). On the other hand, station D recorded the highest Evenness Index (0.8133) where the lowest was at station G (0.5832) (see Table 2). The highest species richness has been recorded at station C and G whereas the lowest were recorded at station B and H (see Appendix 1).

3.2. Length-weight Relationships

A total of 310 *B. schwanenfeldii* sampled from eight stations in April-December 2008 recorded their total lengths and weights were varied from 6.7 to 28.0 cm and 3 to 258 g, respectively. The length-weight relationship was calculated from transformation of the real data to the linear equation of $\ln W = \ln a + b \ln L$, resulted the value of $\ln a = -4.4029$ and $b = 2.992$, and were better fitted at $R^2 = 0.98$. The parabolic form of the length-weight relationships was $W = 0.0122 L^{2.992}$ (Fig. 3). The value of b is closed to 3 indicated that *B. schwanenfeldii* was an isometric form of growth in weight. Whereas the Kn value (0.718) recorded in July was lower as compared to Kn values from other months (1.000 - 1.008) were probably associated with the rainfall distributions in the area.

3.3. Cohort Separation

Cohort separations by using the Bhattacharya's method indicated that the samples of *B. schwanenfeldii* collected from the reservoir in April-December were composed of three groups at mean length (TL) 10.78 ± 0.99, 16.31 ± 1.59 and 27.5 ± 0.85 cm, respectively.

3.4. Growth Parameters

The mean $L\infty$, Z and K estimated from the length frequency data set of *B. schwanenfeldii* using the Power-Wetherall plot (FiSAT software pakage) were gave the value of $L\infty$ = 29.12 cm and Z/K = 1.254, respectively (Fig. 4). The value of $L\infty$ from this routine was then seeded to the ELEFAN-I of the K-scan (Fig. 5) followed by the automatic search routine yielded the value of K and $L\infty$ at 0.66 yr^{-1} and 30.95 cm, respectively. These final values were than fitted to the von Bertalanffy Growth Function (vBGF) as shown in Fig. 6a representing the first cohort spawned in October and of the second cohort spawned in March (Fig. 6b).

3.5. Growth Performance Index

Growth performance index of Pauly & Munro (1984) indicates a method used to compare the growth performance of various stocks by computing the Phi index (*Ø*'). The results indicated that the *Ø*' of *B. schwanenfeldii* from Pedu Reservoir was found to be 2.801.

3.6. Mortality and Exploitation Rates

The Z, M and F were estimated as 2.01, 1.37 and 0.64 yr^{-1}, respectively (Fig. 7). The E was estimated to be 0.32 yr^{-1}. The values of E were relatively lower than 0.5 indicating a low level of exploitation rates of *B. schwanenfeldii* from Pedu Reservoir.

3.7. Recruitment Patterns

The recruitment patterns of the stocks of *B. schwanenfeldii* from the Pedu Reservoir suggest that there were two main pulses of annual recruitment (Fig. 8) with the major cohort appeared in August and the second was observed in February. These situations were strongly correlated to the rainfall distribution (see Fig. 8) that may triggered the spawning biomass of the species, furthermore recorded the *Kn* value in July was slightly lower as compared to other months.

3.8. Probability of Capture

Gillnet selection plot (Fig. 9) showed that the probability of capture of the smaller sizes group of fish found to be at a greater level at sizes mode between 10.5 and 16.5 cm as compared to the bigger sizes fish.

3.9. Length at First Capture (Lc)

The length at first capture (the length at which 50% of the fish are vulnerable to capture) was estimated as a component of the length converted catch curve analysis (FiSAT). The value obtained was Lc = 9.01 cm (Fig. 10).

3.10. Yield and Biomass Per Recruit

Plot in relative yield per recruit (Y'/R) and biomass per recruit (B'/R) were determined as a function of $Lc/L\infty$ and M/K (Fig. 11), respectively. The exploitation rate at E = 0.32 (see Fig. 7) from the catch curve for *B. schwanenfeldii* is lower than that generated 75% of B'/R ($E_{0.1}$ = 0.41) or maximum Y'/R (E_{max} = 0.53). This indicates that (Y'/R) could be increased slightly by increasing E. However, maximisation of yields would lead to relatively low stock biomass, *i.e.* to low catch per effort.

4. Discussion

Generally, there were not much different in water quality parameters of Pedu Reservoir when compared to previous study by Shah *et al.* (2006). This may due to a lacking in land activity in catchments area of Pedu reservoir as resulted the water quality were considered in healthy stage except the ammonia level that exceeded INWQS of the National Water Quality Standards for Malaysia (DOE 2010). The high level of ammonia were believe to be closely related to the nearby intensive aquaculture activity in the Reservoir. However the Secchi depth and other parameters analysis such as nitrite, nitrate and phosphate indicated that the Pedu Reservoir can be classified as mesotrophic lake and these conditions should be maintain at an average values (Sutela *et al.* 2010).

Twenty species from seven families were recorded in the study as compared to 22 species recorded in the previous study by Shah *et al.* (2006). The two new species added to the list were *Parambasis wolfii* and *Oxyleotris marmorata* which make up a total of 24 species found in the Pedu reservoir. The exotic species such as *Oreochromis niloticus* and *O. mossambicus* are not present in the samples even though they were recorded to be caught by local fishermen. During the study periods it was noted that the culture cages in the Pedu reservoir have broken several times due to strong wave and wind, where most of the cultured tilapia have been accidentally released to the wild (*Per. Comm.*). The other reason was probably due to inability of this species to adapt to the reservoir as noted in Chenderoh Reservoir (Ali 2006). In comparison, Shah *et al.* (2006) noted that these species were the dominant group caught by the local fishermen in Timah Tasoh and Muda Reservoir suggesting the species is well established and they were successfully adapted to the nature conditions in Timah Tasoh and Muda Reservoir but not in the Pedu Reservoir.

A total of 797 individual fishes with a biomass of 43.6 kg were caught with gill nets during experimental fishing (see Table 2). Fifteen species have been caught by 2" gillnet sizes followed by 13 species in 1" gill net size, 11 species (3") and 3 species (4"). Out of the total individual fish caught from the Pedu reservoir, 310 specimens or 13.1 kg was represented by *B. schwanenfeldii*. These were followed by *Oxygaster anomalura* and *Notopterus notopterus*. The present study also showed that 51.6% of *B. schwanenfeldii* were captured by 1" gillnets mesh size, where by 35.4%, 12.0%, and 1.0% were caught from 2", 3", 4" gill nets, respectively. The study conducted by Kong & Ali (1995) at Chenderoh Reservoir noted that *B. schwanenfeldii* was the dominant species followed by *Cyclocheilichthys apogon* and *Osteochilsu hasselti,* while Zulkafli *et al.* (1999) found that *B. schwanenfeldii* was the dominant species caught in Kenyir Reservoir followed by *Hampala macrolepidota* and *Hemibagrus nemurus. B. schwanenfelddi* was found dominant in open water in Kenyir Reservoir compared to the Semenyih Reservoir which was dominantly found in the riverine system (Zulkafli *et al.* 1999).

The present study conducted in the Pedu reservoir was found differed to the previous study conducted by Shah *et al.* (2006), where they noted that *O. hasselti* was the dominant species. This was probably due to the differences in conditions of water level during the previous study where the reservoir experienced serious water shortage in 2005 compared to the present study with less significance changes of water level. As a result the fish population of the Pedu Reservoir tend to changed and adapted to the situation throughout by adjusting their reproduction strategy. The fish species such as *B. schwanenfeldii*, *Cyclocheilichthys apogon* and *O. hasselti* were classified as "*r*" strategy fishes, as the changes of fish population were the most common (Ali 2006).

The LWR of *B. schwanenfeldii* from Pedu reservoir was found confirmed to isometric growth (Mansor *et al.* 2010) in weight with low relative condition in July, probably correspond to lesser rainfall from April to August which less triggered the productivity in the reservoir. The populations of *B. schwanenfeldii* was emerged from two major cohorts; one cohort was spawned in March and the other cohort was in October (see Figs. 6a and b), inline to McAdam (1987) which noted that female of this species spawned more than one within years at size greater 160 g associated with increased water level in the environment. It is interesting to note that these periods were positively correspond to the rainfall recorded in October where relatively heavy rain started after August with increasing water level while early rainy season started in February with decreasing water level towards July (see Fig. 8).

The growth rate of *B. schwanenfeldii* at $K = 0.66$ yr^{-1} from the Pedu reservoir suggesting that this species takes 5 year to reach $L\infty$ at 30.92cm was found to be shorter in longevity than the finding reported by Christensen (1992); 8 – 10 years. Lower number of fish sampled in the present study however may contribute to the different of the value as compared to Christensen (1992). The population parameters indicated that, the present level of exploitation rate (E = 0.323) of *B. schwanenfeldii* was lower than the exploitation rate at $E_{0.1}$ (0.406) and E_{max} (0.525) from the yield per recruit suggesting the stock biomass of *B. schwanenfeldii* in the Pedu Reservoir were under-exploited and base on the above analysis, there is room for expansion. However these results are more evidently pronounced if the catch and effort data from fishing activities by the local fishermen operating in the Pedu reservoir, beside greater number of individual fish used are taken into consideration in the analysis.

5. Conclusion

In conclusion, Pedu Reservoir is considered safe from human activities and it is capable to support twenty fish species, mainly dominated by *B. schwanenfeldii*. This species exhibits an isometric growth in weight and could attains to $L\infty = 30.95$ cm at growth rate of $K = 0.66$ yr^{-1}. The population of this species was represented from two distinctive recruits that are in August and February with strong correlation to the rainfall. They entered the fishery at length of 10 cm. The exploitation rates at 0.32 suggesting some room for expansion. However the status of the fish stock in the reservoir is not conclusively evidenced due to the fact that other sources of data such as the catch and effort from the fishermen activities in the area are required for further assessment. Overall, the population parameters as estimated for *B. schwanenfeldii* could be used for future comparison if the fishing efforts or fishing pressure is planned to be deployed in the reservoir.

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Table 1. Physical, chemical and biological parameters observed from Pedu Reservoir from April to December 2008.

Parameters		Measurement
Physical parameters	Temperature	28.85 ± 0.98ºC
	pH	7.18 ± 0.36
	DO	5.93 ± 1.19 mg/L
	Conductivity	46.22 ± 2.56 µS/m
	TDS	21.50 ± 1.00 mg/L
	TSS	16.32 ± 13.00 mg/L
	Secchi disk depth	3.45 ± 0.46 m
Chemical parameters	Nitrite	0.62 ± 0.64 mg/L
	Nitrate	0.97 ± 0.97 mg/L
	Ammonia	3.84 ± 2.65 mg/L
	Phosphate	0.30 ± 0.21 mg/L
Biological parameters	Chlorophyll *a*	0.005 ± 0.002 µg/ L
	Net primary productivity.	76.250 ± 60.77 mg C/m^3/h

Table 2. Shannon-Wiener Diversity and Evenness Index of fish population by sampling stations.

Sampling Station	Diversity Index	Evenness Index	Species Number (n)
A	0.7301	0.7301	10
B	0.6875	0.7613	8
C	0.8901	0.7991	13
D	0.8469	0.8133	11
E	0.7935	0.7619	11
F	0.6842	0.6142	13
G	0.6294	0.5832	12
H	0.534	0.5913	8

(a) (b)

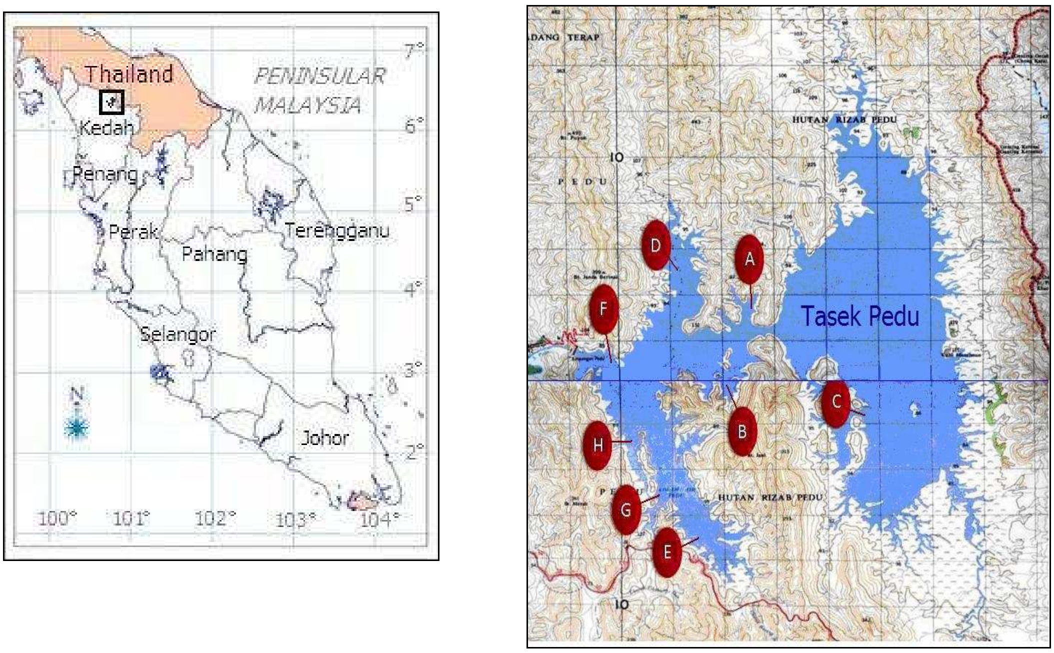


Fig. 1. Map of Pedu Reservoir in the state of Kedah (a) showing the 8 sampling locations from A to G (b), where the gill nets were stretched in the outlets of the rivers and also in the area closed to vegetation of the littorial zone.

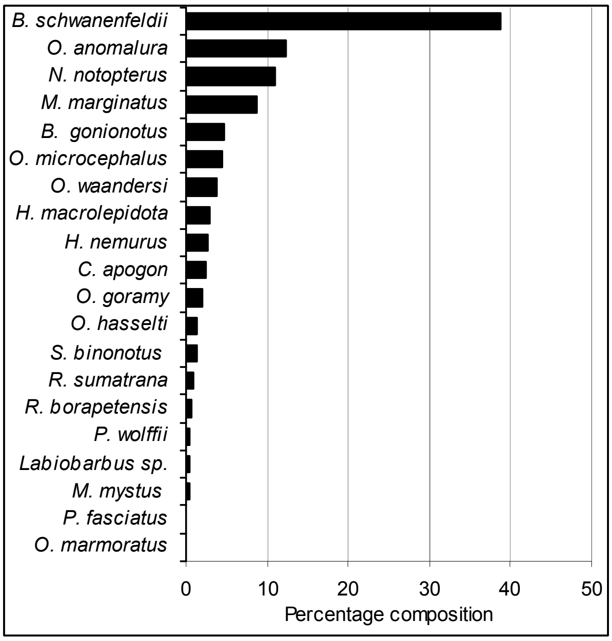


Fig. 2. Fish species compositions captured from Pedu Reservoir using various mesh sizes (2.5 - 10 cm) of gill nets.

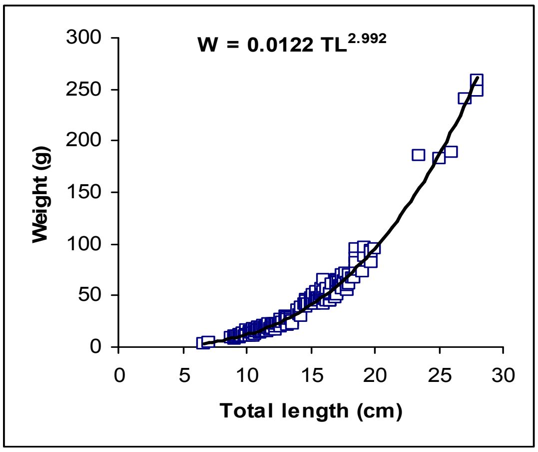


Fig. 3. Length-weight relationships of *Barbonymus schwanenfeldii* sampled from Pedu Reservoir in April-December 2008.

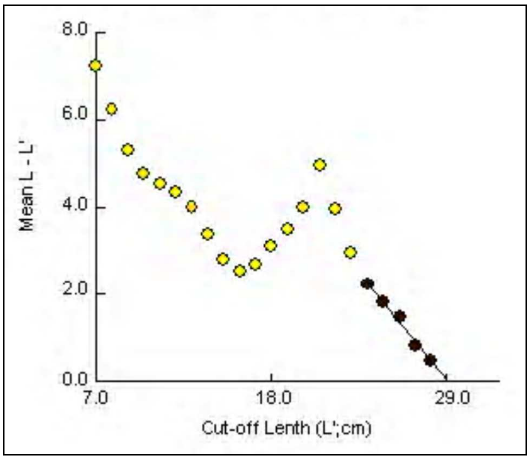


Fig. 4. Estimation of $L\infty$ = 29.12 cm with K = 0.444 and Z/K = 1.254, R^2 = 0.98 of *Barbonymus schwanenfeldii* from Pedu Reservoir using the Power-Wheterall method (Wetherall *et al*. 1987).

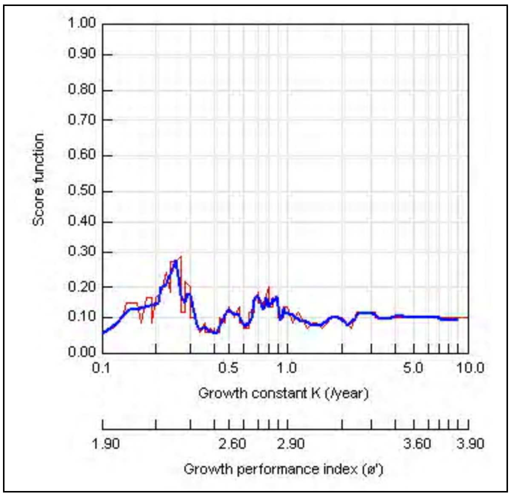
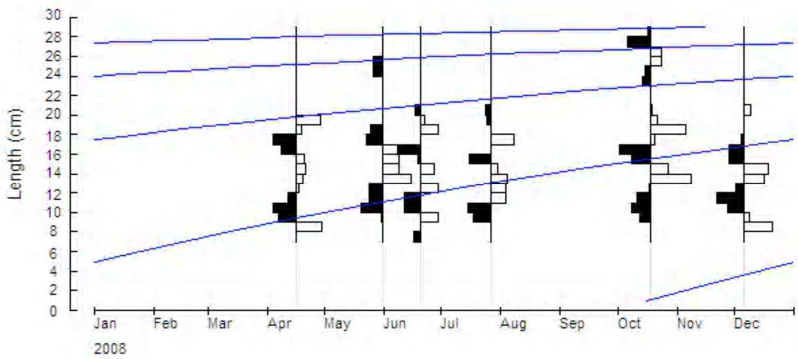


Fig. 5. *K*-scan computed to obtain initial combination of $K = 0.26$ yr^{-1}, $L\infty = 29.93$cm with Starting Sample at 1 and Starting Length at 20.5 cm, Rn = 0.29 for *Barbonymus schwanenfeldii* from the Pedu Reservoir.

(a)



(b)

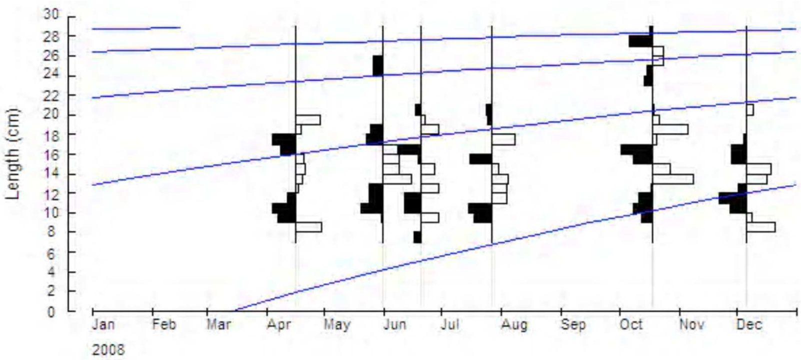


Fig. 6. von Bertalanffy Growth Function fitted using $K = 0.66$ and $L\infty = 30.95$, Rn = 0.228 for *Barbonymus schwanenfeldii.* The growth curve is referring to the first major cohort of the population which indicates the origin of the growth curve started in October (a) and the second cohort in March (b).

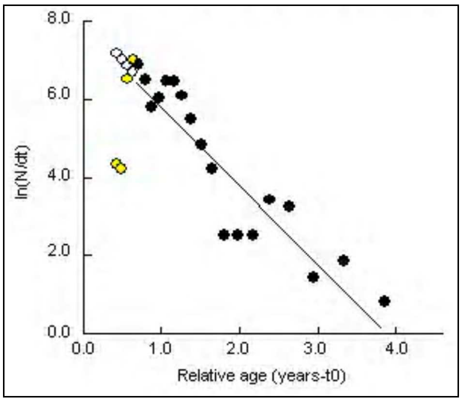


Fig. 7. Extrapolate length-converted catch curve *of Barbonymus schwanenfeldii* resulted from $Z = 2.01$ yr^{-1}; $a = 7.903 \pm 0.426$ with 95% C.I. at 7.001 - 8.806 and $b = -0.212$ with 95% C.I. between -2.458 and -1.558 at regression coefficient (R^2) = 0.85, M at 29°C = 1.37, $F = 0.64$ and $E = 0.32$.

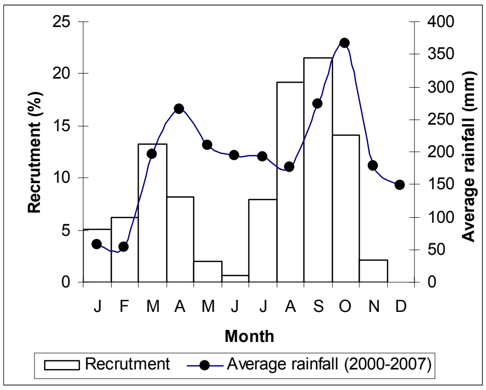


Fig. 8. Two groups of *Barbonymus schwanenfeldii* in Pedu Reservoir in August and second recruits in March with positively corresponded to the starting periods of heavy rainfall.

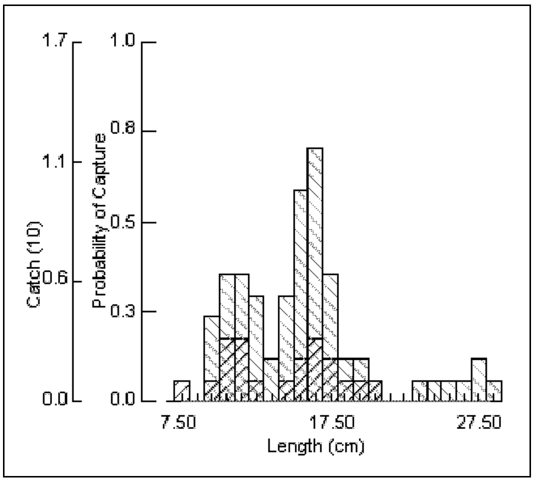


Fig. 9. Selection curves (diamonds shaded) for *Barbonymus schwanenfeldii* caught with gill nets from Pedu Reservoir of mesh sizes of 2.5 cm with $L_A = 12.5$ cm and largest mesh size 9.4 cm with $L_B = 16.5$ cm.

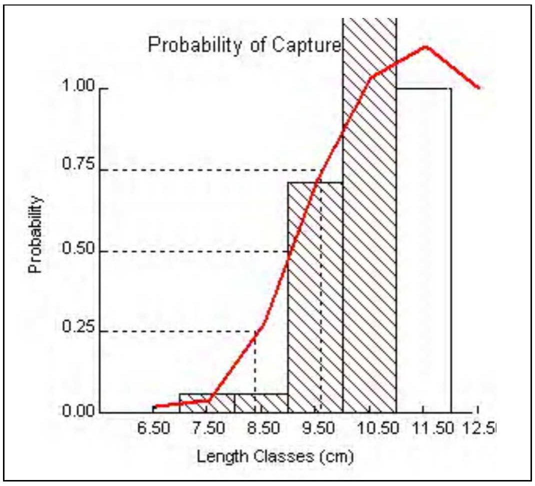


Fig. 10. Probability of capture of *Barbonymus schwanenfeldii* from Pedu Reservoir at $L_{0.25} = 8.39$, $L_{0.50} = 9.01$, $L_{0.75} = 9.6$ cm.

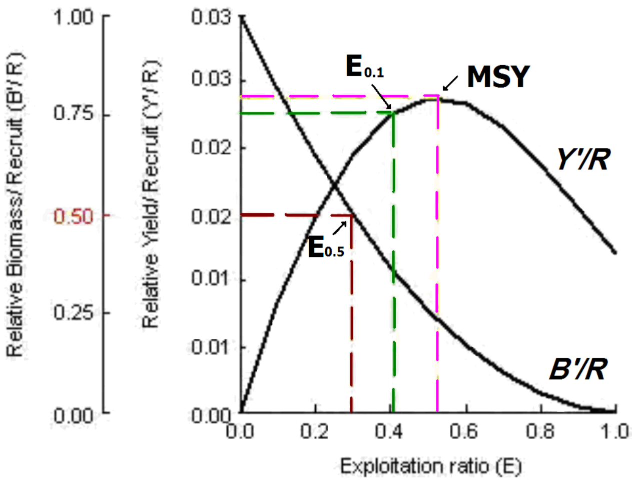


Fig. 11. Relative yield per recruit (Y'/R) and relative biomass per recruit (B'/R) of *Barbonymus schwanenfeldii* in Pedu Reservoir at B'/R = 75% ($E_{0.1}$ = 0.406) and optimum Y'/R (E_{max} = 0.525) and B'/R = 50% ($E_{0.5}$ = 0.298), respectively with the input of $Lc/L\infty$ = 0.291 and M/K = 2.076.

Appendix 1. Freshwater fish species captured from Pedu Reservoir using various mesh size of gill nets.

Family	**Species**	**Local name**	**Sampling stations**								**Total Number**	**Percentage Number**
			A	**B**	**C**	**D**	**E**	**F**	**G**	**H**		
Bagridae	*Hemibagrus nemurus*	Baung	1	2	2	9	4	2	1	-	21	2.63
"	*Mystus mystus*	Baung Akar	2	-	-	-	-	-	1	-	3	0.38
Ambassidae	*Parambassis wolffii*	Cermin	-	-	4	-	-	-	-	-	4	0.50
Cyprinidae	*Barbonymus gonionotus*	Lampam Jawa	19	-	10		5	2	1	1	38	4.77
"	*Barbonymus schwanenfeldii*	Lampan Sungai	71	15	18	25	36	65	28	52	310	38.90
"	*Cyclocheilichthys apogon*	Temperas	8	-	1	3	3	1	1	2	19	2.38
"	*Hampala macrolepidota*	Sebarau	3	-	1	8	5	2	1	3	23	2.89
"	*Labiobarbus* sp.	Kawan	-	-	-	2	1	-	-	-	3	0.38
"	*Mystacoleucus marginatus*	Sia-sia	54	3	1	6	-	4	1	-	69	8.66
"	*Osteochilus hasselti*	Terbui	-	-	-	1	2	7	1	-	11	1.38
"	*Osteochilus microcephalus*	Rong	-	-	-	-	-	10	-	25	35	4.39
"	*Osteochilus waandersi*	Ekor Merah	-	-	-	-	29	-	1	-	30	3.76
"	*Oxygaster anomalura*	Lalang	55	22	8	1	4	1	5	3	99	12.42
"	*Rasbora borapetensis*	Seluang	-	-	1	4	-	-	-	-	5	0.63
"	*Rasbora sumatrana*	Seluang	-	4	-	-	-	2	-	2	8	1.00
"	*Systomus binonotus*	Tebal Sisik	-	11	-	-	-	-	-	-	11	1.38
Eleotridae	*Oxyeleotris marmoratus*	Ketutu	-	-	2	-	-	-	-	-	2	0.25
Nandidae	*Pristolepis fasciatus*	Patong	-	-	1	-	-	1	-	-	2	0.25
Notopteridae	*Notopterus notopterus*	Selat	8	42	7	10	9	8	1	3	88	11.04
Osphronemidae	*Osphronemus goramy*	Kalui	3	1	1	1	3	5	2	-	16	2.01
		Total	224	100	57	70	101	110	44	91	797	100