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Reproductive Characteristics of *Nemipterus peronii* (Valenciennes) from the East Coast of Peninsular Malaysia

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ABSTRAK

Pengumpulan sampel N. peronii *di Pantai Timur Semenanjung Malaysia dilakukan setiap bulan menggunakan kapal tunda. Dari jumlah sampel sebanyak 3608 ekor, dapat disimpulkan bahawa keberhasilan* N. peronii *adalah kerana ciri-ciri reproduksinya. Ikan betina dominan pada ukuran kecil dan ikan jantan dominan pada ukuran besar. Penyelidikan ini menunjukkan adanya perbezaan khas dalam pembesaran menurut jenis seks, di mana ikan jantan membesar lebih cepat daripada ikan betina. Variasi yang besar pada fekunditi, dihubungkan dengan frekuensi pemijahan juga diamati. Data juga menunjukkan satu kitaran tahunan aktiviti reproduksi di mana aktiviti puncak berlaku di permulaan tahun.*

ABSTRACT

Sampling for N. peronii *was conducted monthly on the East Coast of Peninsular Malaysia using a trawler. From a sample size of 3608 individuals, it can be deduced that the success of* N. peronii *is due to its reproductive characteristics. Females predominate the population at small sizes while males at larger sizes. This study indicates the existence of sex-specific differences in growth, with males growing faster than females. Wide variation in fecundity, associated with spawning frequency was also observed. The data indicated an annual cycle of reproductive activity with the peak activity occurring early in the year.*

INTRODUCTION

Though detailed investigations on the reproductive biology of a few species of *Nemipterus* are available from different geographical localities (Eggleston 1968; Kuthalingam 1969; Murthy 1982; Said *et al.* 1983 and Sainsbury and Whitelaw 1984), information on *N. peronii* which is the most common of the nemipterid species and most abundant in the trawl catches of Malaysian waters is scanty. Hence, the present study was undertaken on *N. peronii* to examine its reproductive capability and relate it to its stock abundance.

MATERIALS AND METHODS

Sampling was carried out once a month covering an area of 1,200 sq. km off the East Coast of Peninsular Malaysia within 5°44' to 5°50'N latitude and 102°59' to 103°5'E longitude (*Fig. 1*), using a 40-tonne commercial trawling vessel, powered by a 180-hp 'Yanmar' engine with a stern type hydraulic winch. The gear used was a German standard type otter trawl which has a 37.8 m headline and cod-end stretch mesh size of 38.1 mm.

An average of five hauls were made for every monthly trip. Each haul lasted for 3 h at a trawling speed of 3 knots. When the catch was landed on deck, the fishes were sorted out, weighed, packed in ice and kept in the refrigerated fish hold before bringing them to the laboratory for further examination.

In the laboratory, each fish was measured for its standard length, reproductive characteristics according to month of collection and various lengths (midlength) classes. Analyses included weighing of the gonads, fixing the ovaries in a modified Gilson fixative, sub-sampling eggs from the central region of the ovaries and egg-counting.

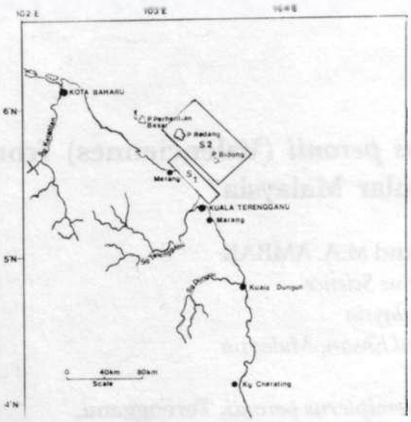

Fig.1: Map showing the study area S1 = Subarea I, S2 = subarea II and S3 = subarea III

The gonado-somatic index (GSI) was calculated as follow :

$$GSI = \frac{\text{gonad weight}}{\text{body weight} - \text{gonad weight}} \times 100$$

To estimate the Von Bertalanffy Growth parameters in both sexes, length frequency data were used and the ELEFAN I programme (Pauly *et al.* 1980) was adopted.

RESULTS AND DISCUSSION

Sex Ratio

A total of 3608 fishes comprising 1636 males (45%) and 1972 females (55%) were analyzed. The overall ratio of males to females was 1:1.21 and was significantly different from the hypothetical 1:1 ratio (X^2 = 31.29. P<0.05). However, when the samples were analyzed by month, the sex ratios were found to be insignificant in June, July, August, December, February and April (Table 1). Sex ratios were also found insignificant in 6 midlength classes, ranging from 85 to 115 mm and 185 to 195 mm (Table 2). From midlength 105 to 185 mm, however, females were dominant with male-to-female ratio ranging from 1:1.13 to 1:1.92. The situation was reversed from midlengths 195 mm and above with males dominating the samples.

Sainsbury and Whitelaw (1984) found similar results working on *N. peronii* in the Northwest shelf of Australia and suggested that the size specific sex-ratio in smaller fishes was probably due to sex-specific difference in growth, whereas for larger fishes, they believed that females undergo higher mortality than males.

Sex Linked Growth

An attempt to estimate Von Bertalanffy Growth parameters using the ELEFAN I programme showed slight differences in growth parameters according to sex (Male : L^∞ = 279 mm, K = 0.365; Female : L^∞ = 266 mm, K = 0.293). It is therefore very likely that the size specific sex ratio is due to sex-specific differences in growth.

TABLE 1
Monthly sex ratio of threadfin fish, *N. peronii* sampled off the Terengganu Coast

Month	Males	Females	Ratio (Male : Female)	Chi-Square
May	73	227	1.0 : 3.11	79.05 *
June	119	138	1.0 : 1.16	1.40
July	116	133	1.0 : 1.15	1.16
August	85	111	1.0 : 1.31	3.45
September	143	238	1.0 : 1.66	23.69 *
October	209	256	1.0 : 1.22	4.75 *
November	147	212	1.0 : 1.44	11.77 *
December	167	161	1.0 : 0.96	0.11
January	202	161	1.0 : 0.80	4.63 *
February	123	141	1.0 : 1.15	1.23
March	157	124	1.0 : 0.79	3.88 *
April	95	70	1.0 : 0.74	3.79
Total	1636	1972	1.0 : 1.21	31.29 *

* Significant at the 5% level of probability

TABLE 2
Sex ratio of threadfin fish, *N. peronii* in various length classes (midlengths), sampled off the Terengganu Coast

Midlengths (mm)	Males	Females	Ratio (Male : Female)	Chi-Square
75	1	0		
85	6	3	1.0 : 0.50	1.00
95	23	13	1.0 : 0.57	2.78
105	31	39	1.0 : 1.26	0.91
115	64	80	1.0 : 1.25	1.78
125	103	172	1.0 : 1.67	17.31 *
135	67	286	1.0 : 1.71	31.26 *
145	184	315	1.0 : 1.71	34.39 *
155	146	280	1.0 : 1.92	42.15 *
165	175	152	1.0 : 1.44	13.89 *
175	143	197	1.0 : 1.38	8.58 *
185	136	153	1.0 : 1.13	1.00
195	127	114	1.0 : 0.90	0.70
205	142	55	1.0 : 0.39	38.42 *
215	95	21	1.0 : 0.25	47.21 *
225	19	4	1.0 : 0.21	9.78 *
235	6	0		

* Significant at the 5% level of probability

Time of Spawning

The GSI values ranged from 1.18% to 4.3% (*Fig. 2*) with lower values in September, October and November and higher values in January, February, March, April and May.

Both the GSI values and percentage occurrence of mature females coincide with lower values in September, October and November and higher values in January, February and March. It can be inferred that spawning periodicity exists

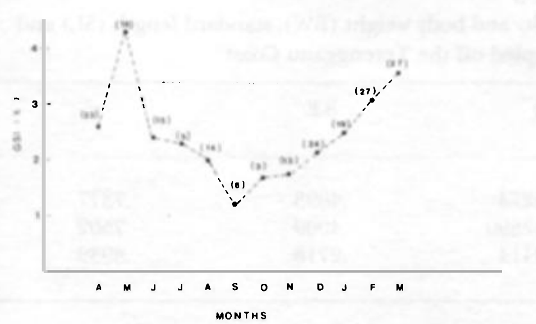

Fig. 2 : Graph showing the changes in the Gonado-Somatic Index of the female during the study period

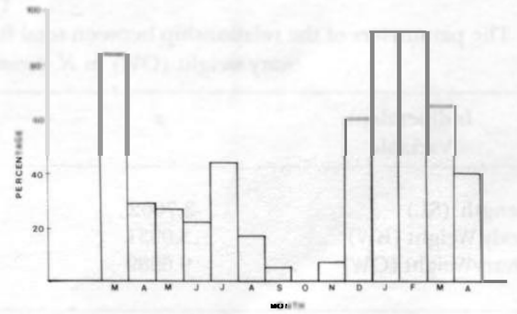

Fig. 3: The percentage of mature females of Nemipterus Perroni *in various months during the study period*

The percentage of mature females (ovary at stage III and above) ranged from 1% to 92% during the twelve-month period (*Fig. 3*). The lowest percentage occurrence was in October (1%), rising rapidly from November to May with peaks in January, February (both at 92%) and May (84%).

in *N. peronii* with peak reproductive activity occurring during the earlier part of the year. Extended spawning periods in nemipterid fish have been reported elsewhere (Krishnamoorthi 1973; Eggleston 1972 and Murthy 1982).

Fecundity

There seemed to be a great variation in the fecundity estimates, ranging from 10,179 to 91,029 eggs for fish samples within 144 mm to 202 mm standard length range. A paired t-test showed no significant difference in the number of maturing ova in samples from the left and right ovaries ($t = 1.3626$, d.f = 19, P<05 = 1.729).

Length, body weight and ovary weight against fecundity indicate curvilinear relationships for length and body weight and a linear relationship for ovary weight. In stabilising the variance, these relationships were transformed into a straight line and are presented in Table 3. The correlation coefficients indicate that although both length and body weights are closely related to fecundity, ovary weight provides the best prediction of fecundity.

In general, the success of *N. peronii*, i.e. dominating in the trawl catches, may be attributed to its reproductive characteristics. The overall sex-ratio of *N. peronii* showed that females outnumbered males. For several months, the catches of females were substantially high and these periods coincided with the months of high gonado-somatic indices and high percentage of occurrence of mature fish. The observed sex ratio clearly indicates its reproductive behaviour, with dominance by females at small sizes changing to dominance by males at larger sizes. The change in size-specific sex ratio could be caused by several reasons, namely sex specific difference in growth, sex differences in mortality, sex-reversal, sex differences in activity and in or out migration from the sampling area by one sex. In this study we were able to prove only the sex specific differences in growth as indicated by L_∞ and K values.

The variation in fecundity estimates for N. *peronii* in this study appears to coincide with other nemipterid species as reported by other workers (Dan 1977; Eggleston 1968; Liu and Su 1971 and Kao and Liu 1979). The wide variation in fecundity could be associated with the frequency of spawning. Spawned serially, the eggs are shed in batches rather than all at once. The high fecundity estimate at one end of the period probably represents the number of eggs at the onset of the spawning season and the low fecundity estimate at the other end would indicate that the remaining eggs are released in subsequent batches. The gonado-somatic index and the occurrence of mature females further indicate that spawning occurs over an extended period which coincides with the north-east monsoon (December to March).

TABLE 3
The parameters of the relationship between total fecundity and body weight (BW), standard length (SL) and ovary weight (OW) in *N. peronii* sampled off the Terengganu Coast

Indipendent Variable	a	b	S.E	r^2
Length (SL)	-2.7002	4.5274	.4093	.7377
Body Weight (BW)	3.0931	1.42890	.4009	.7502
OvaryWeight (OW)	9.6589	0.9414	.2718	.8939

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