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Reproductive Biology of Sailfin Molly, *Poecilia latipinna* (Lesueur, 1821) in Wadi Haneefah Stream, Riyadh, Saudi Arabia

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Abstract.- The reproductive biology of *Poecilia latipinna* inhabiting Wadi Haneefah stream, Riyadh, Saudi Arabia was studied. The fish (*P. latipinna)* were found reproductively active round the year. The highest reproductive activity occurred from February to May and August to November which defined two distinct annual periods of reproduction. There was a monthly variation in sex ratio. More females than males were registered during the whole period of study. Males mature at the total body length of 51 mm, while the female maturity was attained at 48 mm. Fifty percent male and female population achieved maturity at the length of 67 mm and 65 mm body length, respectively. The absolute fecundity of *P. latipinna* ranged from 35 to 161 eggs, the value of co-relation coefficient (r) indicates that the fish's fecundity has stronger relation with weight than with the length.

Key words: *Poecilia latipinna*, reproductive biology, *maturity, sex ratio*, fecundity

INTRODUCTION

Reproduction is the process which occurs for the continuity of the gender. It differs according to fish type and environment; cold water fish reproduce once a year and have a short reproductive season, while warm water fish (tropical and sub-tropical) usually have a longer reproductive season which may extend from 7 to 9 months every year (Qasim, 1973). Reproduction of bony fish has attracted many researchers around the world (Ruzyeki, 1998; Pusey *et al.*, 2001; Aday *et al*., 2002; Heibo and Vollestad, 2002; Machado *et al*., 2002; Privitera, 2002; Arlinghaus and Wolter, 2003; Orlando *et al*., 2007; Dominguez-Petit *et al*., 2008).

Poecilia latipinna is an ornamental fish, originally occurring in North- Eastern area of USA and South America. It is widely distributed around the world and is a protein source (food) in some countries (Al-Ghanim, 2005) inspite of its small size. Besides that it serves as biological control for insects. *P. latipinna* was first record in Saudi Arabia in 1983 in Ank, the Eastern Sector (Ross, 1985), and in Wadi Haneefah stream, Riyadh (central sector) by Siddiqui and Al-Harbi (1995).

Many previous studies carried out on *P. latipinna* (an exotic species) in Wadi Haneefah stream have focused on its genetic nature and some biological aspects like feeding, age and growth besides the effects of salinity and temperature on behaviors of this species (Abrahams, 1988). The reproductive biology of this species, introduced in this environment, has not yet been studied. The present work aims at studing the reproduction of *P. latipinna* which includes sex ratio, monthly variations in gonado-somatic index , variations in the maturity stages and the relation between fecundity and total body weight and total length of the fish.

MATERIALS AND METHODS

Fish sampling and biological data:

Monthly samples of *P. latipinna* were collected from Wadi Haneefah stream by cast net. A total of 360 specimens of *P. latipnna* were collected over a period of 15 months. Morphometric characteristics *viz*., wet weight and total length of each fish were recorded. All specimens were dissected, sexed and their gonads were removed and weighed to the nearest mg. Stage of maturity of each individual fish was determined and classified into following five

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stages depending on its morphological conditions (Pusey *et al*., 2001).

Stage I (Resting or Immature): Gonads look gray in color, small in size and stripe shape.

Stage II (Early developing-stage): Ovary is pale or orange in color with few eggs. The testis extends inside a white casing.

Stage III (Developing-stage): Ovary is orange in color with red spots; eggs are dark, can be seen by naked eyes and there were also droplets in the eggs. Testis is of white gray color.

Stage IV (Late developing-stage): Ovary is of orange color and eggs are clearly visible. There are oily spots in a larger scale of the egg. Testes are of dark color between gray and white, no sperms are seen.

Stage V (Gravid-stage): Color of ovaries tends to appear between yellow and orange and eggs are round and full of yolk, form small single drop. The testes are transparent and white; sperms are ejected by pressing the aperture genitals.

Gonado-somatic index

The monthly gonado-somatic index (GSI) was calculated from the following formula:

$$GSI = \frac{\text{Weight of gonads (g)}}{\text{Total weight of the fish (g)}} \times 100$$

These indices were expressed as the monthly averages and plotted against months.

Sex ratio (SR)

The sex ratio was calculated from the formula given below:

$$SR = \frac{\text{Number of male or female}}{\text{Total number of male and female}} \times 100$$

Length at first maturation and 50% maturation

The length of smallest matured fish is considered as length at first maturity. To estimate the size at 50% maturity (the size at which 50% fishes got matured) the fishes were grouped in 1mm group. The percentage of mature fishes were plotted against their corresponding lengths. The Lt_{50}, the length at which 50% fishes were mature, was then calculated as described by Caputo *et al*. (2003).

Fecundity

Fecundity was estimated by counting all the eggs found in the female ovary during the spawning season. Fish ovary was taken and put in small petri dish and the ova were separated from the ovarian tissue with the aid of dissecting needle, and all ripe ova were counted under the binocular microscope. Fish length and total weight were recorded separately for individual fish and plotted graphically against fecundity. The relationship between these variables and fecundity were estimated according to the following formula: $F= aX^b$, Where F is fecundity, X is body weight in g or body length in mm, 'a' is intercept and 'b' is slope (Lagler, 1978). This equation became linear when transformed in logarithm as follows: Log F = log a + b log X.

RESULTS

Monthly variation in sexual maturity stages

Data of monthly changes in the stages of sexual maturity is presented in Table I. It has been observed that part of *P. latipinna* population in Wadi Haneefah stream is reproductively active round the year. The highest reproductive activities seem to be occurring from February to May and August to November defining two distinct annual period of reproduction coinciding with the period of reduced water current and high availability of food (Lower water level and high planktonic population was reported by Al-Ghanim, 2005 in these months period). An irregular pattern of distribution of different maturity stages (I-V) was observed (Table I).

Variations in gonado-somatic index (GSI)

The monthly changes in GSI are presented in Figure 1. Male GSI remained lower as compared with females. GSI started to increase from February and attained the maximal value in May, decreased in June corresponding to their spawning season (Table I). The second spawning season was prolonged; it started from August till November with the peak value of gonado-somatic index in September.

Table I.- Frequency of occurrence (percent) of different maturation stages for male and female of *P. latipinna* in different months.

Months	No. of fishes	Maturity stages in male					No. of fishes	Maturity stages in female				
		I	II	III	IV	V		I	II	III	IV	V
Feb 2003	12	16.67	25.00	25.00	16.67	16.67	10	20.00	70.00	0.00	0.00	10.00
Mar	9	0.00	0.00	22.22	222.22	55.56	13	0.00	38.46	7.69	23.08	30.77
Apr	7	0.0	0.00	0.00	42.86	57.14	15	33.33	0.00	13.33	13.33	40.00
May	6	0.00	0.00	0.00	0.00	100.00	16	0.00	6.25	6.25	12.50	62.50
Jun	6	16.67	66.67	16.67	0.00	0.00	16	62.50	12.50	6.25	6.25	6.25
Jul	13	23.08	30.77	38.46	7.69	0.00	9	33.33	11.11	22.22	33.33	0.00
Aug	8	12.50	0.00	12.50	12.50	62.50	14	7.14	0.00	7.14	28.57	57.14
Sep	7	0.00	0.00	14.29	14.29	71.43	15	0.00	13.33	6.67	6.67	73.33
Oct	8	0.00	0.00	25.00	25.00	50.00	14	0.00	0.00	21.43	28.57	50.00
Nov	6	0.00	0.00	16.67	16.67	66.67	16	6.25	0.00	12.50	25.00	56.25
Dec	7	71.43	28.57	0.00	0.00	0.00	15	40.00	13.33	6.67	20.00	20.00
Jan 2004	10	10.00	40.00	40.00	0.00	10.00	13	61.54	0.00	15.38	15.38	7.69
Feb	9	0.00	0.00	44.44	22.22	33.33	14	0.00	35.71	42.86	14.29	7.14
Mar	9	11.11	11.11	22.22	22.22	33.33	13	0.00	15.38	7.69	30.77	38.46
Apr	7	14.29	14.29	14.29	28.57	28.57	15	20.00	13.33	13.33	20.00	33.33

Sex ratio

Data of monthly changes in the sex ratio are presented in Figure 2. Generally, the females were higher in numbers than males during the whole period of the study except in February and July.

Length at first maturation and 50% maturation

The total length of smallest specimens of *P. latipinna* netted from Wadi Haneefah Stream was 39 mm (male) and 45 mm (female). They achieved the first maturity at total length of 51 mm and 48 mm (male and female, respectively). It is registered that 50% of the fish matured at the length of 65 mm (male) and 67 mm (female). Both male and female fish at around 80 mm of body length showed 100% maturation in active reproductive periods (Fig. 3A and B).

Fecundity

The observed and calculated fecundity of *P. latipinna,* on the basis of length, ranged between 35 - 161 and 29.03 - 185.95 eggs respectively. The relative fecundity in relation to length ranged between 0.55 - 2.05 (egg/mm), whereas the range in relation to weight was 2.10 - 13.30 (eggs/g).

Logarithmic relationship between the mean length and absolute or calculated fecundity is represented in Figure 4 A & B. The relationship obtained was as follows: Log F = - 3.112 + 2.721 Log L, whereas the correlation coefficient (R) is 0.67 which showed a significant relationship.

Similarly, Figure 5 A and B shows the relationship between wet body weight of the fish and absolute fecundity as follows: Log F= 1.049 +1.11 Log W, with significant correlation coefficient (R = 0.85).

The relationship between mean weight and calculated fecundity is as follows: Log F = 1.049 + 1.114 log W. This relationship is highly significant (correlation coefficient, R = 1.0).

Regression analysis of total weight with absolute fecundity and relative fecundity of *P. latipinna* indicated that absolute fecundity has a good relation with total weight (r=0.64) and total length (r=0.56).

DISCUSSION

Limitations of breeding to a particular season was postulated for temperate zone fishes where the habitat is dominated by pronounced annual cycles of photoperiodicity, thermal variations and food availability (Bagenal and Erich,1978; Scott, 1979). Continuity of breeding seems well suited the tropical freshwater fishes where the stability of essential conditions tend to prevail for most of the year.

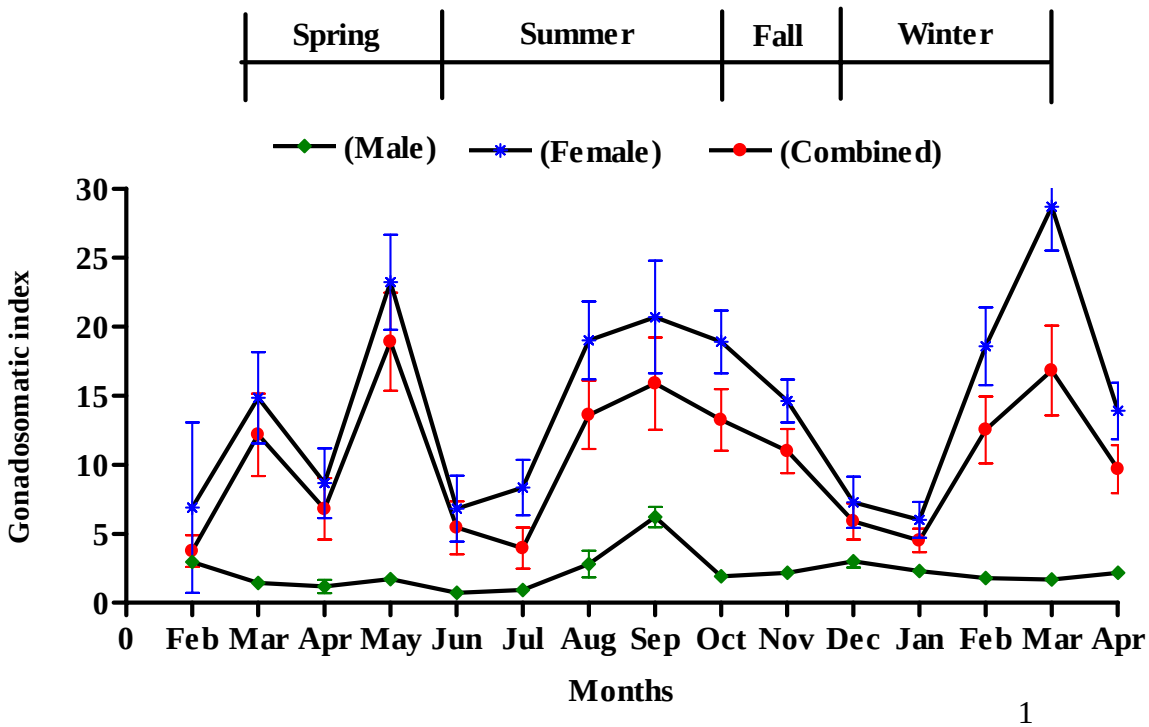

Fig. 1. Monthly changes in gonadosomatic indeces of males, females and combined sexes of *P. latipinna* in Wadi Haneefah stream,Riyadh.

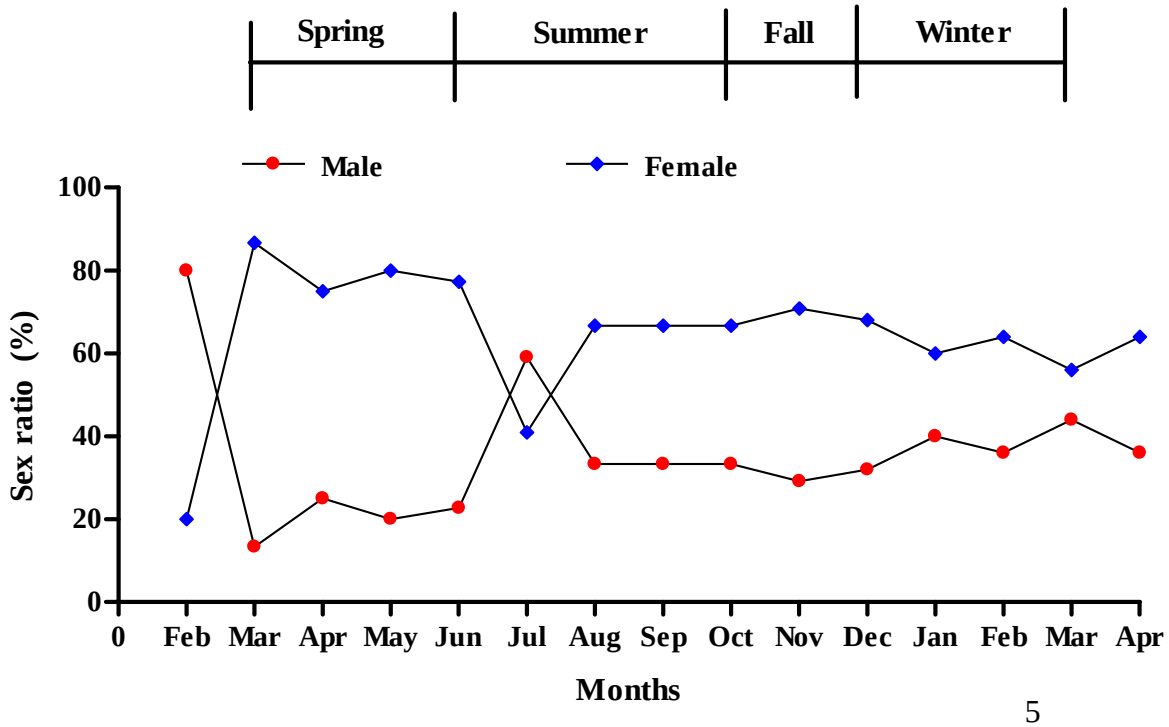

Fig. 2. Sex ratio in (percent) of *P. latipinna* in Wadi Haneefah stream, Riyadh.

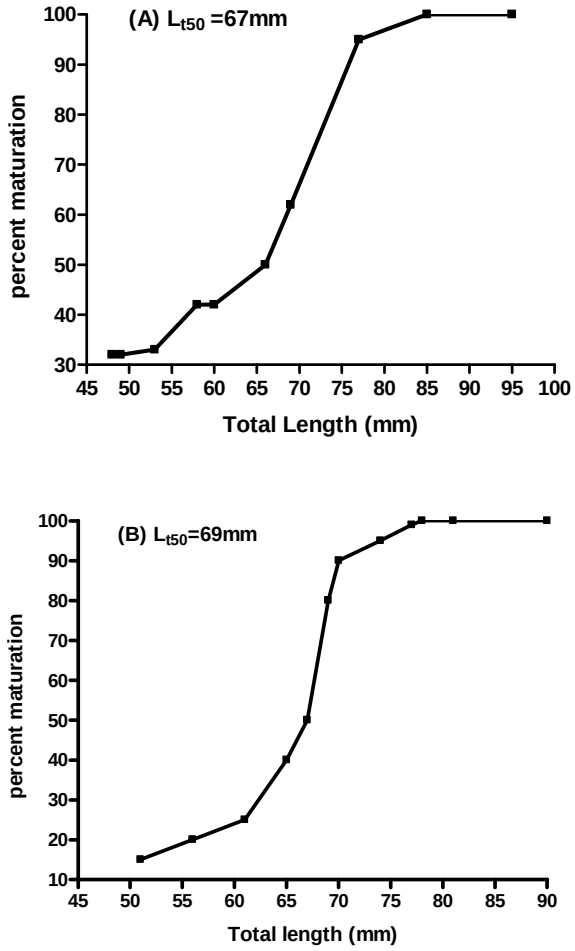

Fig. 3. Relationship between total length and percentage of matured females (A) and males (B) of *P. latipinna.*

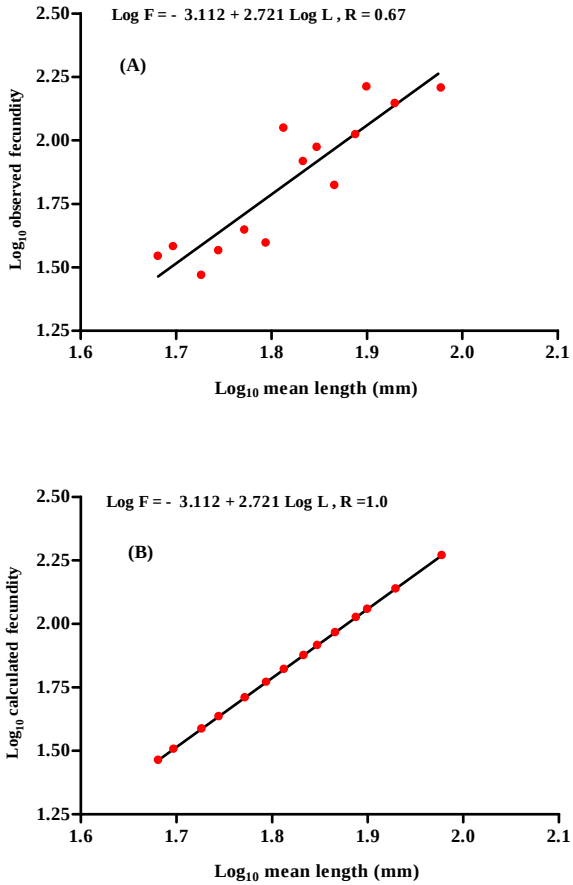

Fig. 4. Logarithmic relationship between length and observed (A) and calculated fecundity (B) of *P. latipinna* in Wadi Haneefah stream, Riyadh.

Fish ovaries showed periodic seasonal changes in weight. In the present work, the monthly changes in gonado-somatic-index indicated two prolonged seasons; the first spawning season extended from February till May, the GSI started to increase from February, attained the maximal value in May and then decreased sharply in June. The second spawning season was longer; it started from July till November with a peak in September. This observation coincides well with stage V (mature fish) found from February to May and August to November, and corresponds to the period of reduced water level and high availability of food (Al-Kahem *et al*., 2007).

Welcomme (1979), Tomasson *et al*. (1984) and Townshend and Wooton (1984) have studied the spawning of *P. latipinna* and suggested that flooding, water current, elevated silting, lower visibility and availability of breeding ground as well as food may trigger or induce breeding in fishes. The reduced reproductive activities of *Poecilia latipinna* in June, July , December and January is probably related to above mentioned factors. A concentrated reproductive efforts in the months which witnesses minimum discharge is reported for subtropical stream dwelling fishes (Milton and Arthington, 1985) and this is acceptable in the sense that larvae produced at this time were less likely to experience high mortality than during elevated flow (Pusey *et al*., 2001).

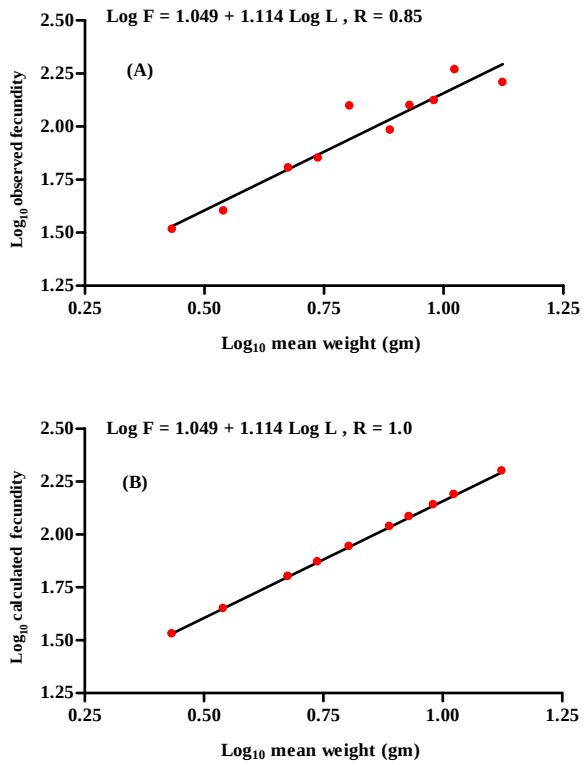

Fig. 5. Logarithmic relationship between weight and observed (A) and calculated fecundity (B) of *P. latipinna* in Wadi Haneefah stream, Riyadh.

The sex ratio indicates the proportion of males with females in the population which is expected to be 1:1 in nature. This type of study indicates segregation or aggregation of sexes according to feeding, breeding and migratory behaviour. Previous studies indicate that the females dominate over males (Bhatt, 1972; Thompson and Munro, 1978; Ghorab *et al*., 1986; Zabala *et al.*, 1997). Equal number of males and females were reported by Yabe (1954). Disparities in assumed sex ratio (1:1) were also reported by Marr (1948), Wade (1950) and Raju (1963). Domination of females over males in all the months except in the peak spawning period was reported by Hashim and Salamah (1985) and Coleman *et al*. (1996). Tamaru *et al*. (1996) have reported that male of *Epinephelus microdon* dominates (4:1) over female. In the present study females outnumber males in all the months of the year. The variations in the sex ratios depend mainly upon the size of the samples analyzed, spawning migration, exploitation, weather condition at the time of catch, gear used and sex reversal (Batts, 1972; Thomson and Munro, 1978; Hashim and Salamah, 1985; Ghorab *et al.*, 1986).

Majority of fishes are oviparous but few like sharks and guppies (live bearer) are ovo-viviparous. Parental care is apparent in ovo-viviparous fishes as they produce little number of eggs. On the other hand, oviparous fishes are more fecund (produce more eggs) probably because of the less survival chance due to environmental hazards. The detrimental effect of this low fecundity is probably mitigated by parental care behaviour which is a common feature of molly, *P. latipinna* (Moyle and Cech, 1982). This parental care behaviour and low fecundity was also reported in gobiis, *Economidichthys pygmaeus* and *Crystallogobius linearis* by Daoulas *et al.* (1993) and Caputo *et al*. (2003), respectively, and extend considerable support to present investigation.

Hence, the energetic investment in reproduction tends to be higher, where the smaller fishes spend more energy on growth thus producing less and smaller eggs (Moyle and Cech, 1982; Al-Dhahi, 2000). Results of Ghorab *et al*. (1986) and Al-Dhahi (2000) indicate that the environmental conditions also affect the fecundity of fishes as *E. chlorostigma* have different fecundity in two different environments (Red Sea and Arabian Gulf).

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