

A Preliminary Study on Fecundity of Fresh water Crayfish (*Astacus leptodactylus*) in Arass Water Reservior, I.R. Iran

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Abstract: A research study was conducted to investigate the number of ovarian eggs and estimate potential egg production of *A. leptodactylus*. In this study, mean number ovarian eggs were 420.41 ± 42.51 with the average total length of 121.93 ± 4.27 mm (n=58). The mean pleopodal eggs were 322.04 ± 29.61 with average total length of 119.14 ± 3.94 mm (n=67). Comparison of the fecundity rate in different population of *A. leptodactylus* in different areas revealed that the Arass crayfish has a greater fecundity rate than others. The discrepancy between ovarian eggs and pleopodal eggs were 21% in Arass reservoir.

KEY WORDS: Crayfish, *Astacus leptodactylus*, Fecundity, Monitoring programmes

Introduction

The freshwater crayfish *Astacus leptodactylus* was present in the catch of Arass reservoir fisheries in recent years. An important part of reproductive potential in a population is fecundity which is usually given as the number of eggs carried per female (Cobb and Wang, 1985). Several studies have showed great variability in maturity and fecundity both between and within population (Abrahamsson, 1971; Brinck, 1975; McGriff, 1983). Water quality, temperature and available food seem to be the most important parameters for fecundity. Although the number of ovarian eggs gives an estimation on potential egg production, but pleopoda eggs provide more accurate estimation of fecundity (Hessen *et al.*, 1987). Determination of the number of pleopoda eggs gives some indication in fecundity of individuals under particular circumstances. However, comparison between the number of ovarian eggs and pleopoda eggs have revealed that full reproductive potential of female is rarely reached in the wild (Lowery, 1988). In *A. astacus* it is reported that the number of ovarian eggs is 125-400, from which only 50 - 60% become attached (Hoffman, 1971; Abrahamsson, 1972; Taugbol *et al.*, 1987). *A. leptodactylus* likewise has high fecundity with 200-400 normal pleopod eggs

(Henssen *et al.*, 1987). Fecundity varies with environmental condition and geographic region in the most lobster and crayfish species studied (Morrisy, 1975 ; Aiken and Waddy, 1980 ; Campbell and Robinson, 1983). Reproductive potential of *Orconectes virilis* showed a reduced fecundity when crowded (Momot and Gowing, 1977). Removing the fishes such as common carp, crucian carp, roach, bream by high fishing pressure occurring in Arass water reservoir may changes the prey- predator relationship in the ecosystem, since the juvenile crayfish are important diet of those fish species. The drastic reduction of the density of these species caused the crowding of the crayfish. Draw down of Arass water levels by using agriculture and power generation, jeopardize the life cycle of crayfish. Therefore, the present study could provide a baseline information for future monitoring programmes in order to control crayfish fishery in Arass.

Materials and Methods

Arass reservoir is situated in 39° 8' N and 45° 22' E across the river Arass which flows eastward from Bingol Mt. Of Turkey (Dill, 1990). It is located between Iran and autonomous republic of Nakhjavan of Azerbaijan Republic.

The crayfish was captured by baited traps. Depth of sampling were 2.5 - 17.5 m at different parts of this water-body. Samples were sent to Belarus republic for species identification. Sexually mature *A. leptodactylus* were collected during the period of September 5 to 20, 1997 for ovarian egg counting (n=58). For pleopodal eggs numberation crayfish were caught from December 20 to 31, 1997 (n=67). The trilobed ovary lies between the floor of the pericardial sinus and the hindgut (Holdich and Reeve, 1988). To remove the ovary from crayfish, the animal was boiled and the abdomen was completely removed. Numbers of pleopodal eggs on each female were counted by removing eggs with forceps. In this stage the eggs are spherical, dark brown in colour and there is no sign of an embryo (Koksal, 1988). Statgraph and Quattro pro software packages were used for statistical analysis.

Results

The environmental parameter in Arass reservoir were measured as follows : Minimum water temperature was 1.5°C in February and maximum was 29.7°C in August, pH varied between 7.91-8.8 and dissolved oxygen in the bottom reached 4.7 mg/l during summer season. Calcium content was 30-90.5 mg/l and total hardness between 204-406 mg/l. The mean number of ovarian eggs was 420.41 ±

42.51. The smallest female (87 mm in total length) had 141 eggs and the largest female (164 mm in total length) had 889 eggs in their ovaries. The regression equation based on comparison of total length with ovarian eggs was :

F ovary = $-794.02 + 9.25 \text{ T.L.}$ ($r=0.97$), $P<0.01$, $n=58$ (Fig. 1).

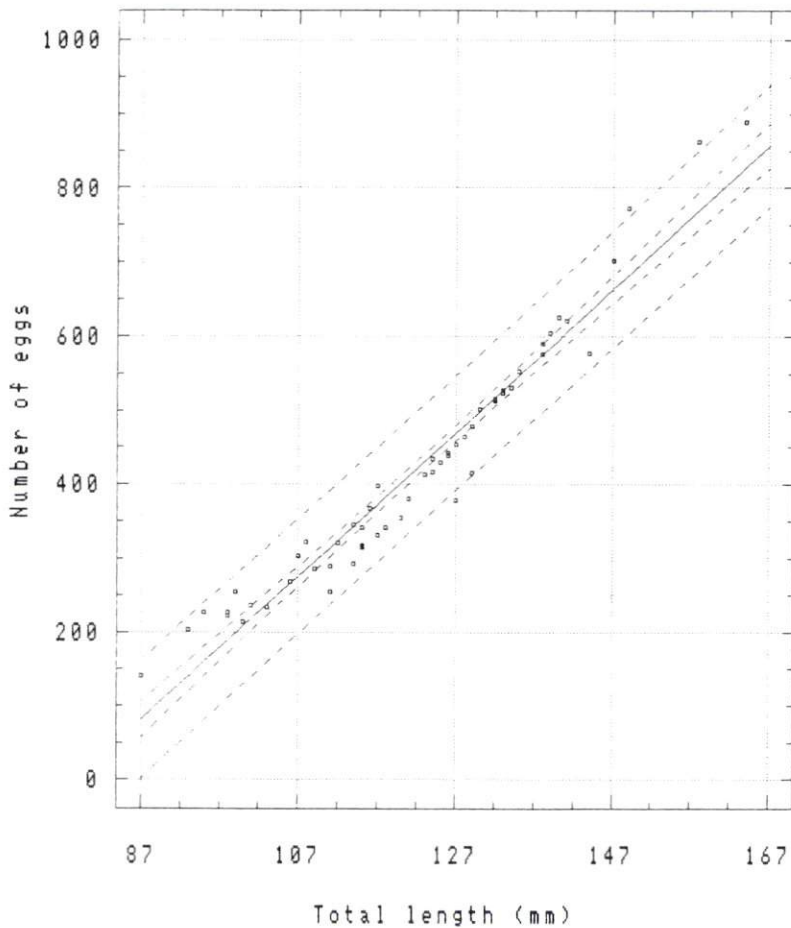


Fig. 1 : Relationship between total length and ovarian eggs of *A. leptodactylus*

The average number of pleopodal eggs were 322.04 ± 29.61 . The smallest female (81 mm in total length) had 112 eggs and the largest female (153 mm in total length) 786 eggs. Regression equation comparing total length with pleopod eggs was : F pleopod = $-575.36 + 7/53 \text{ T.L.}$ ($r=0.88$), $P<0.05$, $n=67$ (Fig. 2).

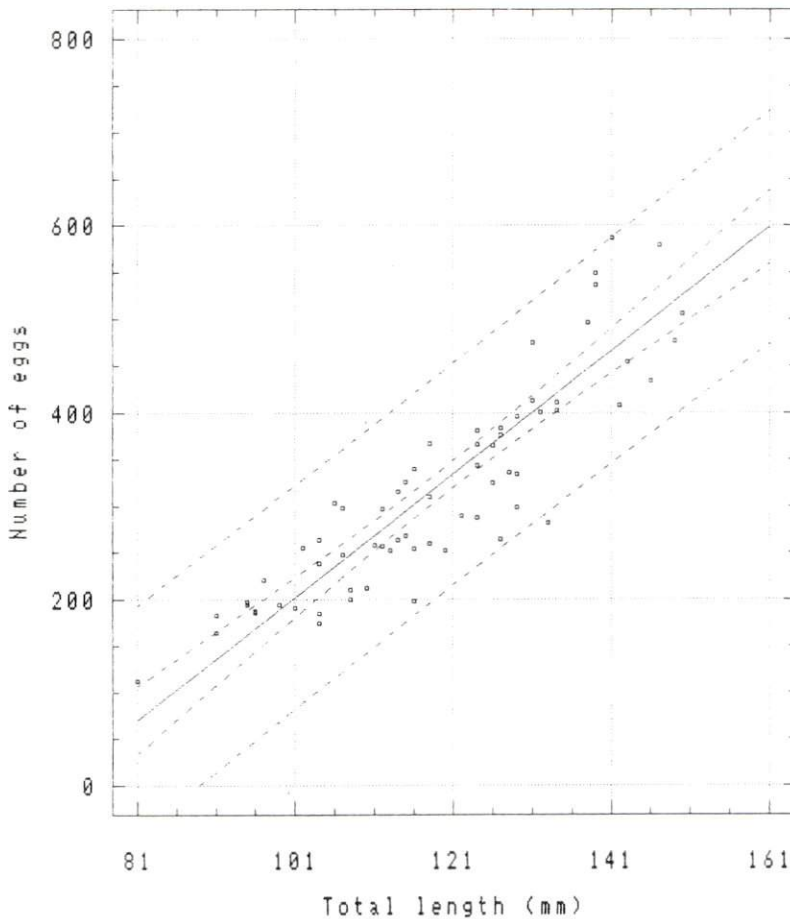


Fig. 2 : Relationship between total length and pleopodal eggs of *A. leptodactylus*

There was a positive correlation between body size of females and both ovarian and pleopodal eggs. Mean number of pleopodal eggs fecundity in relation to gram of body weight of ovigerous females was 5.92 ± 0.31 . The minimum number of eggs belonged to those crayfish with a total length of 127 mm and weight of 61.3gr. In these individuals the number of eggs per gram of body weight was 4.3. Maximum number of eggs was observed in a crayfish with a total length of 120mm and weight of 29.3 gr which per gram of body weight was 8.7. Relationship between body weight and relative pleopodal eggs was as follows :

$$F \text{ plepod} = 7.36180.02438 W (r = -0.47), P < 0.05, n = 67 \text{ (Fig. 3).}$$

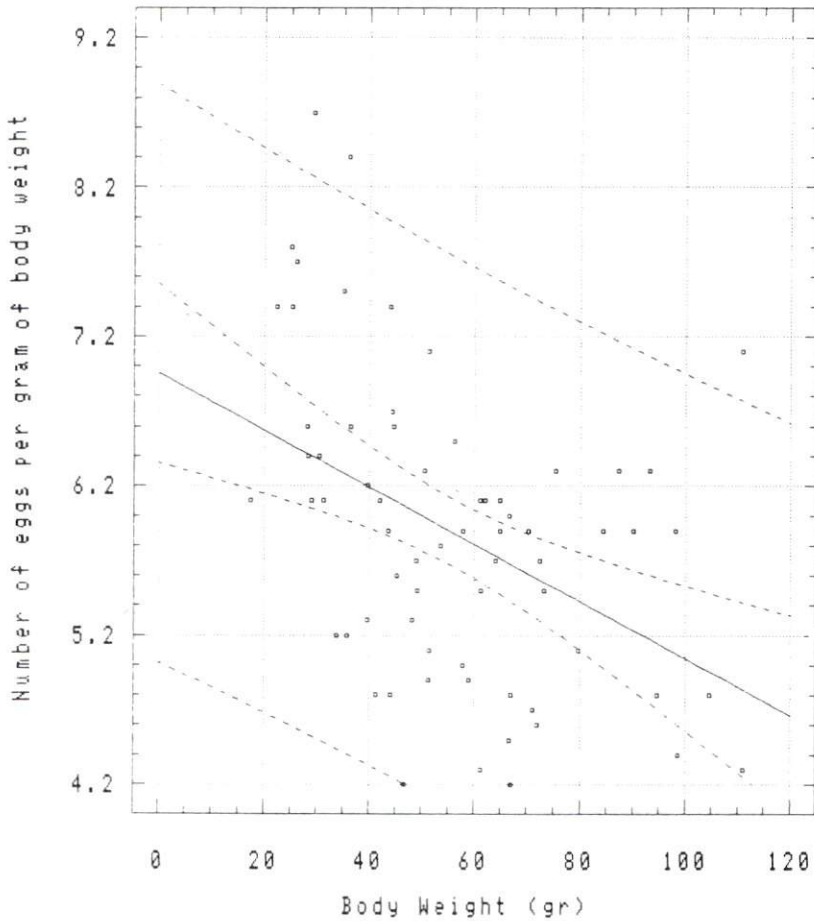


Fig. 3 : Relationship between body weight and relative pleopodal eggs of *A. leptodactylus*

Although the statistical test between two average length (mean T.L. 121.93 ± 4.27 mm for ovarian eggs, and mean T.L. 119.14 ± 3.94 mm for pleopodal eggs) assert no significant differences, but mean number of ovarian eggs differed significantly with those of pleopodal eggs. Female crayfish ranging between 110-119 mm in length have developed a higher percent of pleopodal eggs (84%) than

females between 140 - 149 mm in length (74.2%). The development rate of ovarian eggs to pleopodal eggs in Arass crayfish was 79% (Table 1).

Table 1: Number of ovarian and pleopodal eggs in different length group showing development rate between ovarian and pleopodal eggs (Arass crayfish , 1997)

Length groups (T.L.) mm	Ovarian eggs				Pleopodal eggs				Development Rate
	Max	Min	X	n	Max	Min	X	n	%
	141	141	80 - 89	1	112	112	112	1	79.5
90 - 99	254	203	227	5	220	164	191	9	84.1
100-109	322	214	266	9	303	185	221	10	83.1
110-119	398	289	329	11	367	198	278	16	84.5
120-129	478	355	428	15	396	252	328	15	76.6
130-139	604	502	544	10	549	282	438	9	80.5
140-149	772	578	660	5	586	408	490	6	74.2
150-159	862	862	862	1	786	506	646	2	74.9
160-169	889	889	889	1	---	---	---	---	-----
Total	889	141	420.41	58	786	112	332.04	67	79

Discussion

In lake Egridir (Turkey) the smallest female with pleopodal eggs was 90 mm and largest one was 150 mm (T.L.) (Koksal, 1977). In Anzali coastal lagoon (North of Iran), the smallest female crayfish (*A. leptodactylus*) with pleopoda eggs was 84 mm (T.L.) and the largest was 121 mm (Karimpour *et al.*, 1991). In Arass reservoir according to this study, the size of mature female with pleopodal eggs was smaller than Egridir lake and Anzali lagoon crayfish. The largest size of mature female in Arass reservoir was bigger than those of mentioned lagoons. Mean number of ovarian and pleopodal eggs for crayfish in lake Egridir were 210.08 ± 8.73 (range, 148 - 474) and 183.06 ± 9.047 (range, 101 - 369) respectively (Koksal, 1979).

In Anzali lagoon crayfish population, mean number of pleopodal eggs were reported to be 211 ± 22 ranging between 92 to 412 (karimpour *et al.*, 1991). Stypinskaya (1972, 1978) reported that the number of ovarian eggs of female crayfish in lake Dluzed in Poland with total length of 95 - 135 mm ranging

between 210 and 410. He also noted that the average number of eggs was 374 in *A. leptodactylus* from Majuran lake district. In Turkman water - body the average ovarian eggs was reported as 276 eggs (Runyantsev, 1989).

Comparison of the fecundity with a number of different populations of *A. leptodactylus* in various areas revealed that the Arass crayfish have a greater fecundity. It is stated surprisingly by Alekhnovich (Personal communication) in Blearus Republic, that *A. leptodactylus* do not attain such a size of Arass crayfish, but peculiarities of the relationship between the fecundity and total length of individuals are comparable with *A. leptodactylus* in Belaru Republic. Discrepancy between ovarian eggs and plepodal eggs in Egridir crayfish population were 13% while for Arass reservoir crayfish was 21%. Differences between ovarian and plepodal eggs prior to incubation may be attributed to failure in attachment and incomplete extrusion of eggs at spawning (Abrahamsson, 1971). The response of fecundity due to increased exploitation of crayfish in Arass could be studied by using the present study data and data which will be collected in future monitoring programmes.

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