

The First Report of an Unusual Freshwater Crayfish (*Astacus leptodactylus*) in Aras Dam of Iran - A Case Study

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Abstract: Aras is one of the largest rivers in northwest Iran and Caspian sea basin. Aras dam reservoir with max capacity = $1350 \times 106 \text{ m}^3$, max area = 153 km^2 , mean depth = 20 m and height = 36 m was established on this river in 1972. It is one of the most important inland water fish stocks and aquaculture resources in Iran. More than 700 people working on two cooperative fisheries companies in the area. Freshwater crayfish (*Astacus leptodactylus*) of Aras Dam is of a great interest in Europe as a luxury and delicious food. The purpose of the present study was to distinguish an unusual morphological abnormality in freshwater crayfish forks and its probable causes. The results of this research were obtained during the crayfish study project aiming to assess stock and biological status in Aras Dam Reservoir in 2016. Crayfishes caught with funeral and foldable traps and the biometry and morphological characteristics of specimens were measured in laboratory. This is the first report of the unusual growth of freshwater crayfish (*Astacus leptodactylus*) fork in Aras Dam. A male crayfish was caught with a total length of 153mm and weighing 154 g had a fork length of 190 mm with 7 left finger straps. The probable cause can be attributed to any small lesions created in the ligaments (wound, amputation), stimulation to growth (reconstruction) of additional ligaments.

Keywords: *Astacus leptodactylus*, Aras Dam, Unusual Growth

1. Introduction

Astacus leptodactylus is an aquatic species that is found some area of the world and has been seen in the food cycle of the people of the world since ancient times. Freshwater crayfish has been served among ordinary people since the third century and has been used as a luxury food especially in Switzerland, France, Italy, Finland, Spain and Germany [23]. These animals are widely distributed in Eastern Europe and Western Asia and are one of the 5 native species in Europe [8]. This species is mainly distributed in Turkey, Ukraine, Turkmenistan, southwestern Russia, Iran, Kazakhstan, Georgia, Uzbekistan, Slovakia, Bulgaria, Romania and Hungary and main distribution points of this crayfish in Iran is in Aras dam reservoir, Anzali lagoon and Caspian Sea. The

high nutritional value of aquatic species especially freshwater crayfish has led to increasing tendency for people to consume them. Freshwater crayfish of Aras reservoir has a great export importance as a luxury and delicious meals in most countries. Aras reservoir with a total area of nearly 5000 ha is the habitat of *Astacus leptodactylus* [14]. The first introduction and stocking to Aras dam included a total of 20000 crayfish (15-25g in weight) was carried out in 1988 from Anzali lagoon into Aras by Iranian Fisheries Research Organization [17]. In Iran, its fishing and export started in 1986. It was caught by large quantities (200 tones) annually from the Aras dam lake and exported to European countries. *A. leptodactylus* harvest from Aras dam were 68, 5.5 and zero in 2015, 2017 and 2018, respectively [6]. As mentioned earlier the fishing rate of this species reached zero in 2018

and the fishing license for this species has been revoked [18]. These crustaceans have the ability to repair and rebuild all of their skeletal organs and can rebuild damaged and amputated limbs. In the crustacean *Parhyale*, embryonic and regenerating legs differ in gene expression dynamics but produce apparently similar mature structure. This is the first record of unusual freshwater crayfish with 7 finger strips.

2. Materials and Methods

Capture site was Aras dam Lake in West Azarbaijan province, Iran. Crayfish was caught randomly by local fishermen at autumn 2016 through fishing with funnel and foldable traps (Figure 1).



Figure 1. Foldable and funnel traps for catching *A. leptodactylus*.

Captured live sample was randomly collected and transported in ice inolits to the laboratory of National

Artemia Research Center, Urmia, Iran and stored in prepared plastic tubes with aeration. Then biometry of Crayfish was implemented and measured total length, left and Right fork (claw) length, abdomen width, number of finger straps. Sex identification of *A. leptodactylus* is very simple as males have longer, stronger claws and their bellies are elongated and narrower and females have shorter, wider claws to carry eggs. In the male *A. leptodactylus*, the first pair of swimming legs is used to transfer sperm and is tubular [21].

3. Results

An unusual sample was observed among the bioassays performed so that one of its forks was seven parts and unusual. The characteristics of this king prawn was shown in Table 1 and Figure 2.



Figure 2. An image of unusual male and usual male *A. leptodactylus* captured from Aras Dam Lake (2016). Note the 7 straps and increased length of left finger.

Table 1. Characterization of unusual male *A. leptodactylus* captured from Aras Dam Lake.

factor	Total length (mm)	Total weight (g)	Abdomen weight (mm)	Number of Right finger straps	Number of left finger straps	Right claw length (mm)	left claw length (mm)
Unusual <i>A. leptodactylus</i>	153	154	4.6	4	7	210	6

Table 2. Water Physico-chemical parameters of Aras Dam Lake measured during fishing time [7].

Parameter/Season	Autumn
Year	2013
Air Temp (°C)	15±8
Water Temp (°C)	14±9
PH	8.5
Do (ppm)	10.7±3.34
TN (ppm)	3.39±3.45
TP (ppm)	0.09±0.043
Ca (ppm)	54.3±5.2
Hardness (ppm)	426±96
Chl-a (µg/l)	8.01±1.7
BOD (ppm)	5.76±1.44
EC	248±20

4. Discussion and Conclusion

Some physico-chemical parameters of water of Aras dam

Lake during fishing time in 2016 were shown in table 2. As observed, most of the physico-chemical factors of Aras dam water were at normal levels.

The ability to regenerate varies widely among animals. On one extreme of the spectrum, planarians and hydrozoans are thought to be capable of perfect regeneration, using fission and regeneration as means of asexual reproduction. In many cases regeneration produces organs of normal appearance that carry subtle defects [3-5, 9, 12], but in most instances it is unknown whether cellular composition, detailed morphology and function of regenerated organs are fully restored.

Almazán, et al [1] addressed this question in the crustacean *Parhyale hawaiiensis*, an experimental system in which legs typically regenerate within 1-2 weeks after amputation [2, 11]. [1] data's revealed that the regenerated legs of *Parhyale* were indistinguishable from uninjured legs. This conclusion was based on complementary approaches interrogating the microanatomy, sensory function, cellular composition and

molecular profiles of cells. While they could not excluded the existence of subtle patterning or functional defects in regenerated Parhyale legs, at the current level of morphological and molecular resolution these legs appeared to be perfect replicas of the original legs prior to amputation.

But we found the first case observed with 7 number of left finger straps. Scientists have cited several factors regarding the change in the size of freshwater crayfish (length and weight) in aquatic systems including: The various populations of crayfish vary in size depending on environmental conditions and geographical location [20]. The length-weight frequency and sex ratio of crayfish in Aras reservoir was revealed that crayfish had a critical condition in Aras reservoir and their stocks much reduced, so that the mean total length and weight for the crayfish were 106.43mm and 35.81g, respectively. 18.99% of caught crayfish exceeded the national standard commercial size (120mm) and only 16.3% of the catches weighted higher than national standard common weight (50g). Also, males were dominated and heavier than females with the same size [15]. The length-weight of 182 *A. leptodactylus* samples in Shian dam Kermanshah Province (Iran) was studied so that sex ratio as 2.25:1 (males/females), the average length and weight in males and females as 137.80, 133.86mm and 75.21, 91.98 g, respectively [7]. Also, the maximum length and weight in males and females were 182, 160 mm and 244, 120 g, respectively. It has been made clear that length and weight of males were more than females [7]. Sex ratio and some biometrical characteristics of *A. leptodactylus* in Aras Dam Lake was determined so that male ones dominated in captured samples (M: F=7.1:1). Also, their mean total length and weight were 106.26mm and 38.79 g, respectively. Among captured crayfish only a 13.67% and 19.9% exceeded than 120mm and 50g, respectively [16]. It is concluded that *A. leptodactylus* had a critical condition and enhancing stocking density and conservation of this species in Aras Dam must be considered [16]. Possible reasons for the addition and lengthening of finger joints can be attributed to any small lesions created in the joints (wound, amputation), stimulation to the growth (reconstruction) of additional joints.

The morphological and morphometric characteristics of Aras dam Reservoir freshwater crayfish was studied and revealed that its population had a morphological differences isolating 3 populations [22]. Two subspecies crayfish were determined in north waters of Iran including *A. l. leptodactylus* dominated in Anzali wetland and Aras dam and *A. leichwaldi* in Anzali region [14]. They found differences in the number of first propods and edge of their carapace spines and rostrum shape [14].

The difference in crayfish size may be partially due to changes in the ecological condition of the Lake, the type of food available to members of the population, the sex composition of the population, the sampling times during the year, and the sexual maturation stage of crayfish [13]. The high population density of freshwater crayfish in an aquatic system creates food competition among them and affects their size [19]. Fishing pressure, overfishing, implicit fishing

by fishermen, noncompliance with fishing season and fishing standards, drought, water pollution and unfavorable ecological conditions are the reasons for changes the size of *A. leptodactylus*.

Conflicts of Interest

The authors declare that they have no competing interests.

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