

Distribution and conservation status of the Persian Brook Salamander, *Batrachuperus (Paradactylodon) persicus* (Amphibia: Caudata:Hynobiidae) in north-western Iran

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The Persian Brook Salamander, *Batrachuperus persicus*, an endemic amphibian species, is found in north and northwest of Iran (south and west of the Caspian Sea in Mazandaran and Ardabil Provinces). It has a limited range and its current situation is unknown. So, a survey was conducted from Oct. 2006 to Nov. 2007 to know more about conservation status, habitat future and threats based on field works in two most known habitats, Weyser, southeast of Chalus in Mazandaran province and Delmadeh village, southeast of Khalkhal in Ardabil province. In four times of visiting, the senior author just found four living salamanders. The result showed that most wild populations are threatened and even going into extinction. Habitat loss, severe droughts, deforestation and of people's lack of knowledge are among the most important threats. It is evident that this species is vulnerable and deserves strict protection at national and international levels. It is clear that for a virtual conservation plan, we need to support the streams and habitats of this species in long time.

Key words: *Batrachuperus persicus*, Salamander, Delmadeh, Weyser, Conservation, Iran

INTRODUCTION

The Persian mountain salamander, *Batrachuperus persicus* Eiselt and Steiner, 1970 is an endemic species occurring in north and northwest of Iran (Balouch and Kami, 1995). In the east a possible second species *Batrachuperus gorganensis* (Clergue-Gazeau and Thorn, 1979) is found. Only three localities for *B. persicus* are known: Weyser, southeast of Chalus in Mazandaran Province and Delmadeh village, southeast of Khalkhal on road Khalkhal to Asalem(type locality) in Ardabil Province.

Information on taxonomy, biology and ecology of *B. persicus* is limited to a handful of papers (Balouch and Kami, 1995; Kami and Vakilpour, 1996; Kami, 1999; Stock, 1999) and there is even less information on the current status of the habitats in these two locations (Kami, 2004; Ebrahimi *et al.*, 2004). However, on the other hand, this species status is categorized as Near Threatened (NT) in the IUCN Red list (IUCN 2007) and it is also protected by wildlife conservation laws of Iran (Department of the Environment, 2006).

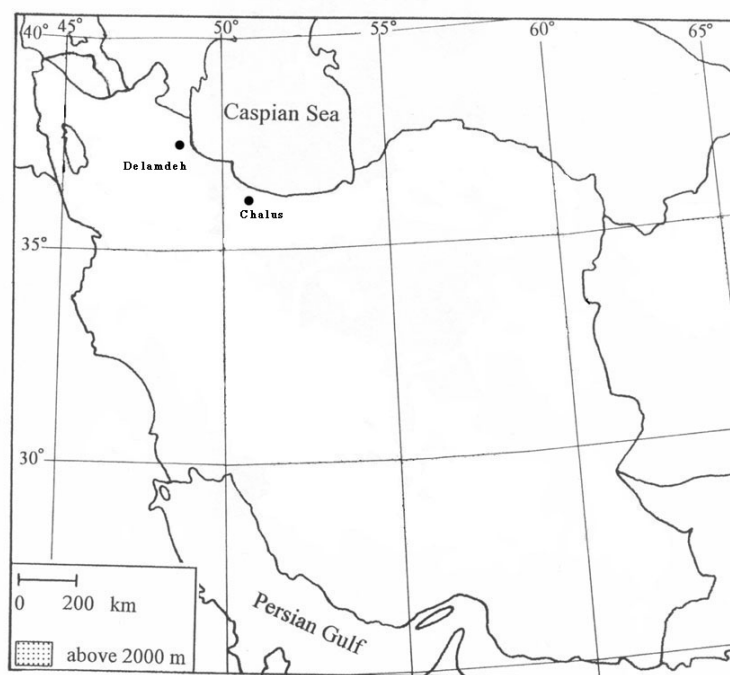


FIG. 1.-. Two most known habitats of *Batrachuperus persicus* in Chalus and Delmadeh

In this paper we describe the current situation in these localities and surrounding area's (Ardabil, Guilan and Mazandaran provinces) based on a one year observation and propose necessary actions for future research and conservation.

MATERIAL AND METHODS

STUDY AREAS

The area of study in the north and northwest of Iran, specifically, two most known localities, Weyser, southeast of Chalus in Mazandaran province ($36^{\circ} 30' 35''$ N and $51^{\circ} 26' 38''$ E) and Delmadeh village, southeast of Khalkhal in Ardabil province ($37^{\circ} 22' 34''$ N and $48^{\circ} 47' 35''$ E) and some mountainous areas in Mazandaran province, all of them located on Alborz Mountains (Fig. 1). The study was carried out between October 2006 to November 2007. The senior author searched habitats in two-month periods, at night and day times. Night searching was done with a flashlight. Many questions were asked from villagers especially about Delmadeh weather and whether they know about this salamander or not. All of the streams and springs (10 springs) were searched for newts near to two most known habitats. Of the streams and springs in which newts were present, width, type of substrate in the streams, vegetation and presence of human activities were noted. Some biometric characters of specimens: such as head length, head width, upper eyelids, between eyelids, trunk length, tail length, cloaca, forelimb length and hind limb length were taken by using dial calipers with an accuracy of 0.02 mm.

VEGETATION

Two most known habitats are located in the Hyrcanian region. The Hyrcanian region as a phytogeographic province in the north of Iran is restricted to northern slopes of the Elborz Mountains. This province is divided into three habitats, alpine and subalpine slopes and meadow parts. These ecological-geographical zones having specific plant formation are composed of

different plant species. In physiognomic approach, dominant formation is the forest structure named broad-leaved summer green forests and dominant species are: *Mespilus germanica*, *Diospyrus lotus*, *Alnus subcordata*, *Punica granatum*, *Carpinus betulus*, *Carpinus orientalis*, *Quercus castaneifolia*, *Zelkova carpinifolia*, *Ruscus hyrcana*, *Buxus hyrcana*, *Parrotia persica*, *Fagus orientalis*, *Hedera pastuchovii*, *Prunus spibosoa*, *Crataegus melanocarpa*, *Crataegus pentagyna*, *Celtis caucasica*, *Ilex aquifolium*, *Jasminum officinale*, *Populus canescens*, *Acer velutinum*, *Pterocarya fraxinifolia*, *Ficus carica*, *Tilia platyphyllos*. At the bottom of this forest, a diverse flora occurs in which the dominant species are *Polypodium vulgare*, *Fragaria vesca*, *Viola odorata*, *Ciurcea lutetana*, *Corydalis angustifolia*, *Equisetum maxima*, *Campanula latifolia*, *Danae racemosa*, *Poa pratensis*.

RESULTS

During field survey we found just four living salamanders in all of the streams, one adult on 22 April 2007 in Weyser and three subadults on 6 June 2007 in Delmadeh on sunny days. They were not active. It is important to mention that in Delmadeh springs we found them after caving of spring about two meters by villagers for more water. It seems that the animal lives among small stones. We released them to their main habitat after biometric measurements (Table 1). However, our attempt to find salamander at night by flashlight failed. So, population size estimate was not possible, or salamanders were inactive during these times and dates.

DISTRIBUTION

Both most known localities, Weyser, southeast of Chalus in Mazandaran Province and Delmadeh village, southeast of Khalkhal in Ardabil province are located on an *ecotone* region between two important and special Hyrcanian forest and Alborz Mountain ecosystems in high elevations, 2034m in Delmadeh and 1526 m in Weyser. Therefore, Delmadeh village and Weyser are located in alpine and subalpine slopes of the Hyrcanian province, respectively. It is important to mention that Yeilagh-e-Sarasi is different from Delmadeh, but they are considered as same localities (as administratively they are located in Guilan Province). No salamander found in this habitat, but it has been reported by Kami (1999) and according to reliable natives, nowadays, salamander does not occur in Yeilagh-e-Sarasi, but it lives in two springs in Delmadeh named as Gebleh-Belaghi (all of the last specimens removed from this spring) and Ortachokhor that last habitats in Delmadeh village are addressed as new locality. Ortachokhor is comprised of three separate springs that are located close together.

Based on all the available evidence, for example talking to villagers and rangers, it is proposed that there should be more locations. Local people believe that they have observed this animal in other areas as well. The word salamander in Talesian language is called "*Kereghdem*". There is an unpublished report stating that a few juvenile specimens have been collected by a student in Shaft in summer 2007. So, there are surely unknown localities in the Elborz Mountains especially between Asalem and Chalus. The other areas bordering Weyser and Delmadeh were searched, but no new record was found and all streams and springs had the same situation. A little water flows in streams and springs. Compared to the bordering area the main streams and springs are still flowing.

HABITATS

Unlike some Asiatic salamanders, the Persian brook salamander lives only in the mountains. This salamander lives mainly in the mountainous streams and brooks, with cool, fast-flowing water. During daylight hours, they stay under stones in the water. Sometimes they hide under large stones on the shore, but they are never found far from water. Generally *Batrachuperus persicus* occurs in the forested and shrubby habitats, on hillsides and mountainous areas. Like most amphibians, *Batrachuperus persicus* require fairly moist habitat to survive. The Persian brook salamander is

nocturnal and it is hard to find it during day times. Habitat substrate is composed of small stones and sands. Its environment is covered with specific vegetation.

TABLE 1. Biometric characters of adult and subadult forms of *Batrachupers persicus* collected from their habitats.

Number	Head length	Head width	Upper eyelids	Between eyelids	Between nostrils	Trunk	Tail	Cloaca	Forelimb	Hind limb
1 (adult)	24.20	15.6	3.6	5.7	6.2	70.12	85.06	4.08	26.46	32.68
2 (subadult)	16.04	11.90	2.00	3.20	4.08	56.00	64.02	3.04	17.06	23.38
3(subadult)	14.22	10.98	2.34	3.00	4.00	50.08	56.82	3.00	16.24	22.52
4(subadult)	12.66	9.36	2.00	2.60	3.36	47.92	52.62	2.98	16.00	20.30

TABLE 2. Some Physicochemical Characters of Water in three springs, Gebleh-Belaghi and Ortachokhor in Delmadeh and weyser. Temperature (TEM), Conductivity (CON), Salinity (SAL), (TDS), PH and some elements: Phosphorus (P), Calcium(Ca), Chloride (Cl), Sodium (Na), Potassium (K) and Magnesium(Mg).

Habitat name	PH	CON (µs/cm)	SAL (0.00)	TEM (C°)	TDS mg/l	P (mg.100m ⁻¹)	Ca (mg.100m ⁻¹)	Cl (mg.100m ⁻¹)	Na (ppm)	K (ppm)	Mg (mg.100m ⁻¹)
Weyser	8.02	438	0.2	9.2	219	0.04	8.23	1.77	8.86	1.26	0.85
Gebleh-Belaghi	8.05	402	0.2	11.5	201	0.04	2.16	1.77	6.87	0.35	1.01
Ortachokhor	7.72	318	0.2	9.5	159	0.04	4.58	1.77	3.46	0.01	1.43

In Delmadeh it inhabits on a sharp slope with a spring and some plants (Fig. 3). The formation of this area is composed of shrub land and woodland. The dominant species including: *Sorbus gracera*, *Prunus divaricata*, *Berberis vulgaris*, *Lonicera floribunda*, *Acer campester*, *Robus hyrcanus*, *Ceracus pseudoprostrata*, *Palirus spina-christi*. Widths of springs in Delamdeh were approximately one meter (Fig 4). The salamander habitat in Weyser has located near to Lashkanar village, with one Hundred families that mostly migrate down place during cold seasons. In comparison to habitats of Delmadeh, it is a relatively long brook with 2 meters width in a completely forested area. Some plant species found around the springs are: *Fagus orientalis*, *Alnus subcordatus*, *Acer velutinum*, *Acer hyverconum*, *Zelkova carpinifolia*, *Betula pindula*, *Symbacus ebulus*, *Rubus* spp. This stream has water flow rate faster than Delmadeh (Fig 5). We found a living adult salamander under old fallen leaves in forest area in this habitat.



FIG. 2.- A Specimen, *Batrachuperus persicus* from Chalus Weyser.

FIG. 3.- Delmadeh spring in 45 km Southeast of Khalkhal.

FIG. 4.- Ghebleh-Belaghi in Delmadeh.

FIG. 5.- Weyser is located in the Hyrcanian forest area.

PHYSICOCHEMICAL CHARACTERS OF WATER

We also measured some physicochemical characters of water in 3 springs, Gebleh-Belaghi and Ortachokhor in Delmadeh and Weyser. Temperature, conductivity, salinity, TDS, pH and some elements such as Phosphorus, Calcium, Chloride, Sodium, Potassium and Magnesium were measured (Table 2).

THREATS

The Persian Mountain Salamander is very sensitive to environmental change because it lives in a special situation. According to local people in Delmadeh, they were unaware until two unknown researchers removed 2 living salamanders in 1982. Some springs have been dried up in Delmadeh after famous Earthquake in Roodbar (A city which is located on Alborz mountain range in Guilan Province) in 1990. But the most important threat for these springs is human activities. In last years, due to several droughts they caved for more water three times from 1991 to 2006. In Gebleh-Belaghi, people brought back all of the living salamanders to spring but most of them were killed. On the other hand, 70 families live in this village and have more than 300 head of sheep and goats. Due to over grazing in summer and fall springs are threaten by these domestics. In Chalus, Man-

made habitat destruction is most important threat. Deforestation threatens the main habitat of these animals. Unfortunately, last year a student collected more than five living salamanders from this stream. It is a great threat to see that some researchers and their students remove Salamanders, but in recent years the Department of Environment has protected more habitat manipulation.

DISCUSSION

For the first time, this salamander was reported as a new species by H. M. Steiner and J. Eiselt based on five larvae collected in Guilan province, Iran (Eiselt and Steiner, 1970). Subsequently, new localities were addressed by other researchers (Schmidtler and Schmidtler, 1970; Baloutch and Kami, 1995; Kami and Vakilpour, 1996). Regarding less conservational studies about this endemic species the present study was conducted. Our results showed that its populations have declined. However, there is not enough status information, but seeing just four living salamanders in four visiting times is not really much. Because of its hidden, nocturnal and cryptic life, it seems that population estimate is so difficult. Finding larvae is easier than adult but no larvae was found during field study. Worldwide amphibian decline is well documented (Pounds et al., 1997; Houlihan et al., 2000, Stuart et al., 2004; Beebe and Griffiths, 2005). Based on our findings, The Persian Brook Salamander population decline is due to several reasons.

Habitat loss as a result of human activities is the most important problem. Due to salamander's special life history, it is more sensitive to any environmental change. As mentioned in results, also, several droughts in recent years have affected streams (Fig 3). Water physicochemical character measurements indicated that all factors are relatively normal. It is important to mention that we could not find any source of chemical pollutants (fertilizers, insecticides, herbicides etc.) in these habitats. Most of these kinds of pollutants are produced by human activities as cultivated grounds. There is no agriculture activity in these habitat environments.

Furthermore, it seems that the Persian Brook Salamander is on the verge of extinction and it will become extinct in Iran if no new conservation actions are undertaken in the near future. Based on this study some conservation activities are offered. However, the Persian Brook Salamander is a strictly protected species by wildlife conservation laws of Iran, but it is categorized as Near Threatened (NT) in the IUCN Red (IUCN 2007). So it is necessary to review its status in the IUCN category. It is also necessary to make Iranian Department of Environment aware of taking effective action plan for protection of this species and its habitat.

It is important to consider that taxonomic position of *B. persicus* is disputed. According to the publications (Ebrahimi et al, 2004; Kami, 2004; Stock, 1999) and other information especially personal communication, it seems *Batrachuperus gorganensis* and *Batrachuperus persicus* are conspecific, but at two ends of the distribution range (Sergé Bogaerts, per. Communication). It seems that within this range the populations are probably very isolated. Therefore, we can consider more known localities for this species. Consequently, status and conservation will be different. Considering this, it is necessary to carry out more future studies especially modern molecular markers to identify species exactly. Stock (1999) has assumed that both taxa are rare and such studies should be limited. We should be use modern sample collection techniques which do not require the removal of all studied animals from their natural habitats. Enforcement of existing laws that prohibit the illegal collection of animal should become a priority. National support helps local people to use less natural resources.

We think new protection laws need to be made and it should be executed as soon as possible. Old laws have some executive problems, for example , there is no ranger in Delmاده. National support helps local people to use less natural product. The Persian brook salamander can be regarded as a symbol for natural pure mountain streams and brooks. Educating local people about good water management is for the benefit of both the salamander as well as for the villagers. Both

need natural and pure water sources to survive for the future. Protecting and conservation of this salamander can therefore also benefit the local villagers. In future we will conduct a wide field excursion to explore new localities within its distribution range.

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