Report

“Current protection status of Armenian amphibians and elaboration of measures of their conservation including public awareness rising”

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INTRODUCTION

Armenia is a small mountainous country with developed infrastructure, agriculture and industry, including mining industry. This has led to deep changes in majority of Armenia's ecosystems, sometimes - to their degradation and destruction, which threats almost all components of biota, including amphibians. Amphibian species are rather sensitive to some environmental factors, and worsening of conditions in the containing ecosystems is a major threat to their fauna of the country. Amphibians in Armenia are represented by seven species (Arakelyan et al., 2011). All they are assessed in the IUCN Red List, and two species – *Ommatotriton ophryticus* and *Pelobates syriacus* are included into the Red Book of Armenia. There are numerous works dedicated to the fauna of Amphibia of Armenia (Nikolsky 1913; Gumilevsky, 1939, Chernov, 1926; Papanian, 1956, 1957, 1959; 1961; Danielian and Egiasarian, 1973; Pipoyan 1998; Danielyan et al., 1998; Egiasarian 2002, 2007; Aghasyan et al., 2009; Arakelyan et al., 2011; Pipoyan et al., 2012). But some of them are outdated, do not cover all the issues of amphibian distribution, ecology, etc., and our knowledge on the fauna is not full enough. Moreover, during the last decades abrupt changes take place in the country's economy, including land utilization, enlargement of mining territories, some changes in water consumption, which have led to new changes in the conditions of amphibian fauna. At the same time capacities of scientific researches noticeably decrease which does not allow carrying out enough comprehensive studies of Armenian fauna as a whole and fauna of amphibians in particular. As a result, studies on amphibians' current distribution, peculiarities of species ecology in modern conditions, as well as assessment of their conservation status and monitoring of their populations were carried out fragmentarily.

Besides scientific component, public awareness rise was considered as another important issue of our work. It is well known that there is obviously negative attitude of the majority of the humans, including children, to amphibians. Change of such kind of attitude needs goal-directed work on dissemination of information about these animals, their role in the ecosystems, necessity of their conservation, etc. among all stakeholders and local communities, with special attention to young generation.

Project goal and objectives

The general **goal** of the project is improvement of conservation of amphibian fauna of Armenia, which include research and analysis (completion of data on distribution and conservation status of Armenian amphibians), planning (elaboration of measures dedicated to their conservation) and public awareness rising issues.

The following objectives were envisaged:

- Create GIS-based database on current distribution, assessment of abundance and conservation status of amphibians of Armavir, Ararat, Aragatsotn, Kotayk, Vayots Dzor, Lori, Tavush, Syunik Provinces of Armenia;
- Collect data on current distribution, some ecological and biological data on two threatened amphibian species of Armenia;
- Carry out assessment of current conservation status for each amphibian species in eight Provinces of Armenia;
- Perform public awareness rising activity;
- Develop recommendations and draft Action plan for conservation of amphibian fauna, particularly for 2 threatened species which must include, among other, establishment of new Protected Areas.

PROGRESS IN OBJECTIVES ACHIEVING

Research and planning

Field work

The work was dedicated to whole Armenian fauna of amphibians, but taking into account level of investigation of different territories in the Project, the following rather poorly surveyed provinces were selected:

Northern Armenia – Lori, Tavush; Central Armenia – Kotayk, Ararat; Southern Armenia – Vayots Dzor, Syunik.

During project implementation the preliminary data on occurrence of Red Book species *Pelobates syriacus* in two other provinces (Armavir and Aragatsotn) were got from our colleagues (Dr. M. Arakelyan, Dr. T. Tadevosyan and Prof. S. Pipoyan) and so these two provinces were added to the territory surveyed.

In all the provinces territories most appropriate for amphibians' surveys were selected.

Field surveys were carried out in August-October, 2013, and March-beginning of August 2014). One extra expedition note anticipated in the Working Plan was carried out in last decade of August, 2014 to cover some additional areas of amphibian distribution.

Amphibian's fauna was observed in the following localities of Armenia (Fig. 1):

Debed river gorge and basin – **"Alv" –** vicinities of Alaverdi town, **"Odz"** – vicinities of Odzun village, **"Ds" –** vicinities of Dsegh village, **"Shg" –** vicinities of Shamlugh village, **"Tgh" –** vicinities of Teghut village, **"M A" -** vicinities of Mets Ayrum village, **"Nmb" –** vicinities of Noyemberyan town;

Lori plateau – **"P" –** NE vicinities of Tashir;

Pambak river gorge and basin - **"Vndz" –** vicinities of Vanadzor town and adjacent villages;

Aghstev river basin – **"Dlj" –** vicinities of Dilijan town and adjacent villages; **"Ij"** - vicinities of Ijevan town;

Getik **river** gorge – "**Gt**" - vicinities of Aygut village;

Marmarik river gorge and basin – "**Hrzd**" – along river from Hrazdan town to Ankavan village;

Hrazdan river gorge – "**Bjn**" - vicinities of Bjni town;

Azat river gorge – "**Grn**" - vicinities of Garni and adjacent villages;

Kasagh river basin – "**Vsk**" - vicinities of Voskehat village; "**Htgh**" - vicinities of Haytagh village; "**Ejm**" – vicinities of Ejmiatsin town and adjacent villages, "**Nrv**" - vicinities of Noravan village, "**Arm**" – vicinities of Armavir town and adjacent villages;

Araks river basin – "**Rchp**" – vicinities of Ranchpar village, "**Art**" – vicinities of Ararat town, "**Vd**" – vicinities of Vedi town and adjacent villages;

Arpa river gorge and basin – "**Yeg**" – vicinities of Yeghegnadzor town and adjacent villages; "**Gnd**" - vicinities of Gndevaz and adjacent villages;

Vorotan river gorge and basin – "**Kdj**" – vicinities of Kajaran town and adjacent villages;

Voghchi river gorge – **"Kp**" – surroundings of Kapan town and adjacent villages

Meghri river gorge – "**Megri**" – surroundings of Megri town and adjacent villages

Figure 1. Map of field survey areas.

During expeditions the transect method (line and perimeter transects) was applied. For catching adult animals and tadpoles the different nets were used. For finding of newts special traps were applied. Besides, during the surveys, the males were counted according to their voice at appropriate time. Abundance of each species was estimated by different ways depending of

the peculiarities of species ecology and behavior. Floating egg masses of amphibians and tadpoles also were detected visually and identified to the species level.

Morphometric characters of animals in representative number were obtained also (according to Bannikov et al., 1977; Lada, Sokolov, 1999). The tadpoles and adult amphibians were measured on site and immediately released. In doubtful cases the tadpoles were identified in the lab and then measured.

For characterization of ecosystems, in particular, their vegetation, the photographs of plants were taken and herbarium was collected if necessary. Photographs of habitats were taken as well.

Observations on habitat peculiarities and quality (the level of anthropogenic pressure, pollution, habitats destruction) were made to assess the current and potential threats to the ecosystems. Data on this issue were collected also during discussions with local people.

Together with principal investigator, Dr. Ilona Stepanyan, the group of Project team students (Bachelors and Masters: Meri Arzumanyan, Gayane Nikoghosyan, Meri Hovhannisyan, Anush Arakelyan) is participated in field surveys. Young participants got practical knowledge, skills and experience in field research and nature conservation.

Figure 2. The members of our group during field survey.

Laboratory studies and data analysis

The GIS-based database was designed with sections partly correspond to the requirements of IUCN Red List (IUCN, 2012 a, b) and some other appropriate sections. Preliminarily all available literature data, data on collection materials as well as personal information from colleagues were included.

During laboratory work morphometric data revealed in the field were analyzed using MS EXCEL and ANOVA software. Tadpoles not identified in the field were identified using keys from Kuzmin, 1999, and then measured and the data were analyzed as well.

Some data on vegetation and geobotanical characteristics of the habitats studied were kindly provided by Dr. Ivan Gabrielyan (Institute of Botany, National Academy of Sciences of Armenia).

All the data revealed (field protocols data concerning each species with respective GPS-data, morphometric data, description of the habitats, assessment of abundance, illustrative materials, assessment of threats, etc.) were incorporated into database above mentioned.

Using the database the lists and maps both for Armenia as a whole and for each region studied were prepared with assessment of conservation status and threats for each amphibian species.

Achieved outcomes

Due to our work data on current distribution, some peculiarities of biology, morphometric and other characters, etc. of 7 species of amphibians in 8 Provinces of Armenia were obtained, abundance of them as well as condition of habitats were assessed and conservation status was identified. Some scientific results were obtained and already published or prepared for publication (see References). Respective data are presented below.

Northern Banded Newt - *Ommatotriton ophryticus* Berthold, 1846

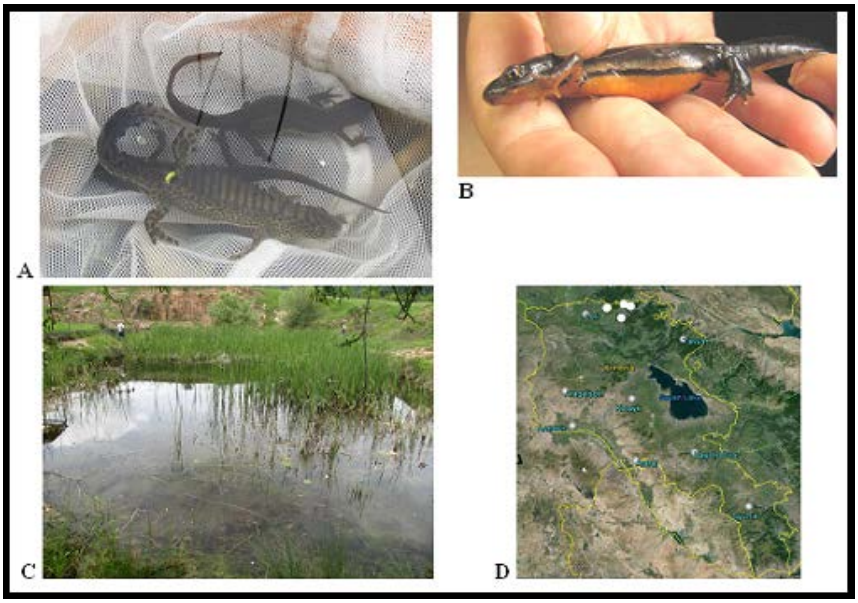

Figure 3. ***Ommatotriton ophryticus***. A – male and female; B – female; C – pond in the vicinities of Shamlugh village (habitat of *Ommatotriton ophryticus*, *Hyla orienthalis*, *Rana macrocnemis*, *Pelophylax ridibundus*); D- found localities.

General distribution

The species is endemic of Caucasus Eco-region, occurring in most NE Turkey (Anatolia), in Western Caucasus and in Russia (NW and SW slopes of the Main Caucasian Ridge).

Current distribution in Armenia

In Armenia *O. ophryticus* Berthold, 1846 was known from few localities in Northern Armenia, Lori Province (Pipoyan 1998; Danielyan et al., 1998 – recorded as *Triturus vittatus*). During our survey newt was observed in several habitats within Debed river basin (Lori Province) (see Map in Fig. 3D). Its populations in Armenia are very small and isolated. In 2002 group of animals were released in Parz Lich Lake, in the vicinities of Dilijan town (Tavush Province).

Ecological and biological notes

Newt lives in close and small ponds situated in the glades in broadleaf forest and partly covered by aquatic vegetation.

Adults have both aquatic and terrestrial phases, are active mainly during twilight hours. After hibernation in March or April, dependent from winter character newts enter pond. Females enter ponds later than males. Males stay in ponds 1-3 months during the breading season. The breading season take place in April-May. Females lay eggs, which are singly attached to aquatic vegetation, usually at a depth of 10-30 sm. Embryogenesis lasts 12-30 day. Metamorphosis occurs from July to September. Hibernation occurs in September-October, usually on land.

Some morphological peculiarities of adult newts from Armenian populations were studied (Stepanyan et al., manuscript).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (during May). It was low in all populations surveyed: from 1-2 (Shamlugh population, perimeter of pond =76 m) to 5 (NE of Tashir (=50 m) and NW of Alaverdi (304 m) populations) individuals per day.

All of the habitats were more or less threatened. First of all overgrowing and shoaling of ponds can be mentioned. Besides, cutting was registered in the forests surroundings the ponds which can lead to worsening of hydrological conditions as well. High abundance of predators – native *Pelophylax ridibundus* and somewhere also introduced *Carassius sp., Leuciscus* sp. etc. is another threatening factor for newt. Usually the coastal part of water bodies is polluted by

household garbage being popular places for picnics of local people. Finally, somewhere newts are the object of pet trade.

Current conservation status

Included into IUCN Red List (ver 3.1) as Near Threatened. Introduced in the Red Data Book of Armenia as Critically Endangered CR B2ab (iii, v) (Aghasyan, Kalashyan. (eds), 2010).

According to our study species can estimated as CR (Critically Endangered) according to local isolated distribution (A -1c; B-2ab (ii), (iii)) and low abundance (A -1b, B-2b, (iv),(v), 2C – a,(i)).

Major threats

1. 1.3.3.2.: selective logging, 1.3.3.3.: clear-cutting;
2. 2.2.: predators (fishes, *Phelophylax ridibundus*);
3. 3.5.1.: subsistence use/local trade;
4. 9.5.: low density; 9.9.: restricted range.
5. 10.1.: recreation/tourism.

Conservation measures.

Though the species is registered in the Red Data Book of Armenia, no special conservation measures are proposed or implemented yet. In particular, the range of newt in the country is completely outside of protected areas. In 2002 several specimens of newt were released in Parz Lich Lake (Tavush Province).

Proposed conservation measures.

- In Shamlugh village' vicinities: prevention of illegal collection for pet trade and disturbance of population during mass going out of the under yearling (in August-September).
- In the vicinities of Alaverdi town: control and prevention of possible pond' shoaling and eutrophication.
- Collection of larvae from the ponds with high abundance of fish predators for further releasing into other appropriate water-bodies.
- Creation of Specially Protected Areas in the localities with rather good conditions and/or abundance of newt (NE of Tashir, NW of Alaverdi and Shamlugh populations).

Eastern Spadefoot Toad – ***Pelobates syriacus*, Boetter, 1889**

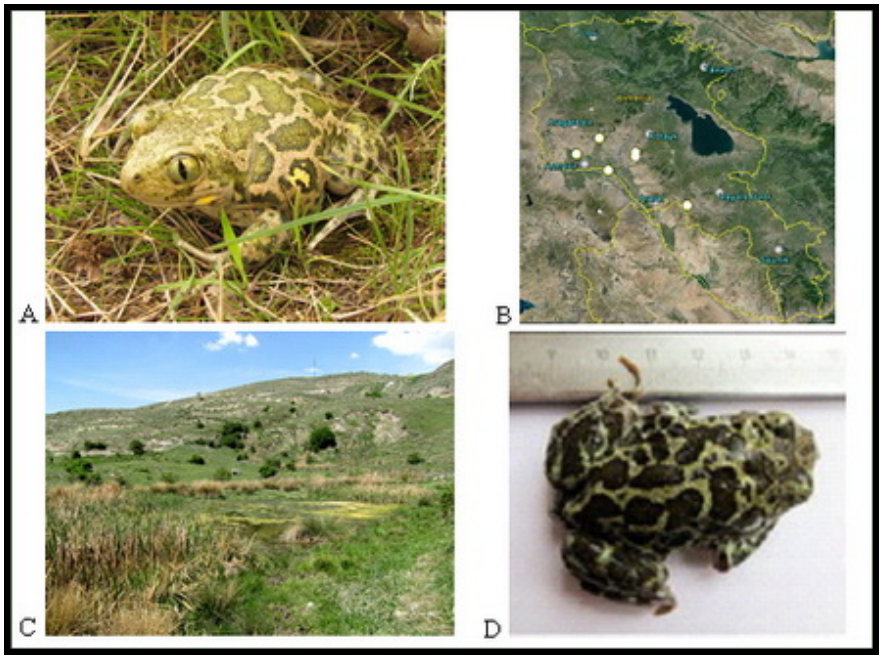

Figure 4. ***Pelobates syriacus,*** A – female; B - found localities; C- pond in the vicinities of Voghjaberd village (habitat of *Pelobates syriacus, Hyla savignyi, Rana macrocnemis, Pelophylax ridibundus, Pseudepidalea viridis,* Kotayk Province); D – male.

General distribution

Occurs in the South-East Balkans, east to South-Eastern Transcaucasia, Northern Iran, and to south – to the Levant.

Current distribution in Armenia

The species distribution is scatter and local. Known from Central and Southern Armenia (Ararat, Armavir, Kotayk, Vayots Dzor, Syunik Provinces) (Chernov 1926, 1929; Gumilevsky 1939; Papanian 1959, 1956; Darevsky 1975; Egiasaryan 2002; 2007 Arakelyan et al, 2011). We found several new localities in Armavir, Kotayk and Aragatsotn Provinces (Fig 4D).

Ecological and biological notes

Generally, *Pelobates syriacus* occupies terrestrial habitats, such as open uncultivated lands, in mountain steppe and semi desert belts in the lowland of Araks river basin. In Armenia it is known up to elevations of 1935m. Species prefers soft soils, particularly friable clay with pebbles and grassy slopes. Species usually can be found near permanent water bodies (large permanent pools, lakes, irrigation reservoirs, etc.), which are necessary for reproduction as matting and spawning sites.

In spring adults emerge at mid or late March depending of site elevation. Adults are fossorial and spent daytime underground coming to the surface only at night. Breeding take place during March-beginning of May, depending of elevation as well. Females lay eggs us multi-row, jelly strings, which anchored to aquatic plants or send to the bottom. Embryogenesis lasts ~7 days, larval – 65-85 days. Metamorphosis takes place in June; size of under yearling is 33-35 mm. Adults are active until early November. Winter is spent underground.

Some morphological peculiarities of adult *Pelobates syriacus* were studied. For the first time we presented the morphological description of the body and erythrocytes of population from the vicinities of the village Ranchpar (Petrosyan et al., 2014).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (in May) by accounting from twilight and through the night. Near Ranchpar village were observed 3-4 individuals per night. Nearly the same data was registered in the vicinities of Hatsavan - Geghadir villages near Azat reservoir (3-5 individuals). As to tadpole's abundance, we observe over 300 individuals in small pond (perimeter of pond = 14 m) near Voghjaaberd vill (Kotayk Province) in May. There were no special counting in other localities but according to our visual assessment the density of tadpoles were much lesser in all the water bodies surveyed.

Area of distribution of *Pelobates* in Armenia is severely fragmented, and all the localities of species occurrence are under strong anthropogenic pressure. Majority of them are situated near or even inside of settlements, most of water bodies are stocked by fish sometimes by their predator species. Permanent pollution of water by agricultural and domestic sewage is threatening the tadpoles. Besides in all water bodies comfortable for breeding and larval development was registered high abundance of *Pelophylax ridibundus* which is hunting tadpoles of early stages and somewhere introduced *Carassius sp., Leuciscus* sp. etc. Being situated in arid and semi-arid landscapes many of breeding water bodies are under the threat of drying.

Current conservation status.

Included into IUCN Red List (ver 3.1) as Least Concern. Included into the Red Data Book of Armenia as Vulnerable VU B2ab (ii, iii) (Aghasyan, Kalashyan. (eds), 2010).

According to our estimation, the species belongs to the same category (VU) due to the following criteria: scatter distribution (B-2ab ii, iii) and low abundance (B-2b, v) according to our study.

Major threats

1. 1.1.1.2.: small – holder farming, 1.1.7.: freshwater aquaculture; 1.3.6.: groundwater extraction; 1.4.2.: human settlement; 1.4.4.: transport – land;
2. 2.2.: predators (fishes, *Phelophylax ridibundus.*);
3. 6.2.1.: agricultural; 6.2.2.: domestic; 6.3.1.: agricultural; 6.3.2.: domestic; 6.3.8.: sewage; 6.3.9.: solid waste;
4. 9.3.: high juvenile mortality (especially tadpoles); 9.9.: restricted range.

Conservation measures.

In 1985-1986 1500 individuals of *Pelobates syriacus* reared in the lab (natively originated from Vayots Dzor and Syunik Provinces) were released in the surroundings of Azat artificial water body (Kotayk Prov), from where the species was not known previously. The introduction was successful and the toad rapidly acclimated itself to its new locality. But it must be stressed that range of toad in the country is completely outside of protected areas.

Proposed conservation measures.

- Creation of Protected Areas in the vicinities of Hatsavan (Kotayk Province), Voskehat (Aragatsotn Province) and Ranchpar (Ararat province) villages.
- Enlargement of "Jrvezh" forest park with inclusion of surrounding cavy semi desert areas in the vicinities of Voghjaberd village (Kotayk Province).

Green toad – *Pseudepidalea viridis* Laurenti, 1768 (= *Bufo variabilis* Laurenti, 1768, = *Bufo viridis* Laurenti, 1768)

General distribution

From Eastern Mediterranean (Balkans, Levant, Sinai) to N Iraq and W Iran southeastwards and trough Caucasus and South European Russia to NW Kazakhstan northeastwards. Isolated populations known from SW Saudi Arabia, N Germany, S Sweden.

Current distribution in Armenia

Common species in Armenia known from all Provinces of Armenia (Bedriaga, 1882 Nikolsky 1913; Gumilevsky, 1939, Chernov, 1926; Papanian, 1957; Egiasarian 2002, 2007; Arakelyan et al., 2011; our survey data). It prefers open landscapes with moderately dry climate.

Ecological and biological notes

Pseudepidalea viridis inhabits open landscapes, such as shrubs, subalpine meadows, steppes, cultivated lands, but can be found in the forest belt in glades. Can inhabit urbanized and mining industry areas (in Lori, Ararat and Syunik Provinces). Toads are found at the distance from water bodies, coming to them in the breeding season.

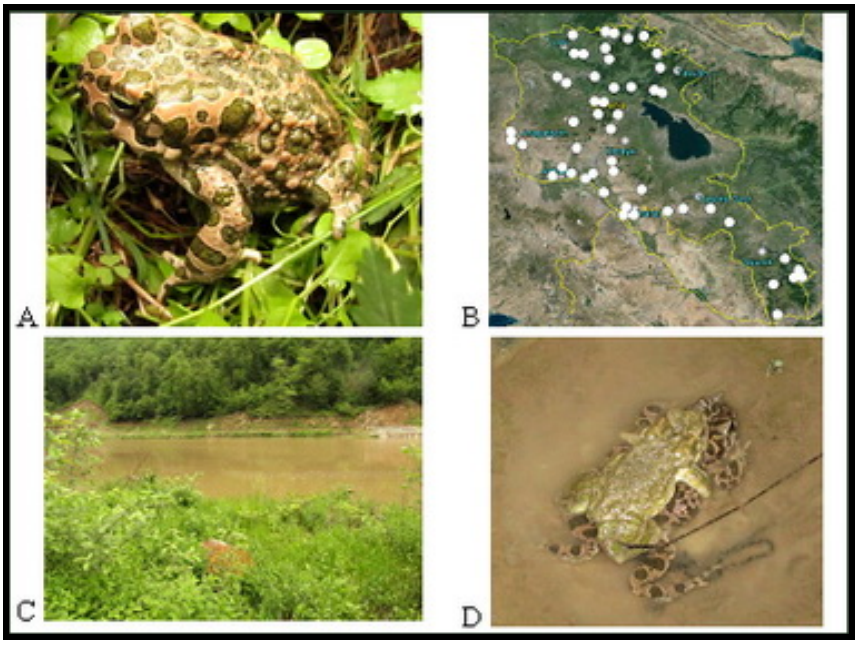

Figure 5. ***Pseudepidalea viridis.*** A – male; B - found localities; C – pond near Teghut village (habitat of *Bufo variabilis, Pelophylax ridibundus, Rana macrocnemis, Hyla orientalis*); D- toads mating.

Toads are nocturnal, but during the breeding season they are active also through the day.

Toads emerge from hibernation at the beginning of March-April depending of elevation. Breeding season takes place in April-May. In high-mountain populations this season is much shorter than in lowland populations. Females lay eggs in long stings, sometimes twisted around water vegetation. Embryogenesis lasts 3-6 day. Metamorphosis occurs during June-August. Mass emerging of under yearling of toads was observed in June-August. The length of the under yearling is 14-18 mm. Toads are going to hibernation in October-November.

Abundance and habitats' condition

Abundance of adults was assessed in breading season (May- June) by accounting from twilight and through the night. Near Teghut village (Lori Province) were observed 10 individuals per 400 m, per night. Nearly the same data was registered in the vicinities of Shaumyan village (9 individuals, Suynik Province) and Artavaz village (7 individuals, Kotayk Province).

Most of the localities of species occurrence are under anthropogenic pressure. Majority of them are situated near or even inside of settlements, most of water bodies are stocked by fish sometimes by their predator species. Permanent pollution of water by agricultural and domestic sewage is threatening the tadpoles. Besides in all water bodies comfortable for breeding and larval development was registered high abundance of *Pelophylax ridibundus* which is hunting tadpoles of early stages. Being situated in arid and semi-arid landscapes many of breeding water bodies is under the threat of drying.

Current conservation status.

Included into IUCN Red List (ver 3.1) as Least Concern; listed in Appendix II of the Bern Convention (as *Bufo viridis*). Armenian population can be estimated as LC.

Major threats

1. 1.1.1.2.: small – holder farming, 1.1.7.: freshwater aquaculture; 1.3.3.2.: wood selective logging, 1.3.3.3.: clear-cutting; 1.3.6.: groundwater extraction; 1.4.2.: human settlement; 1.4.4.: transport – land;
2. 2.2.: predators (fishes, *Phelophylax ridibundus.*);
3. 6.2.1.: agricultural; 6.2.2.: domestic; 6.3.1.: agricultural; 6.3.2.: domestic; 6.3.8.: sewage; 6.3.9.: solid waste.

Conservation measures.

Species protected in following Armenian Protected Areas: “Khosrov Forest” and “Shikahogh” State reserves; “Dilijan”,”Sevan”, “Arpi” and “Arevik” National Parks, in several sanctuaries and dendroparks.

Proposed conservation measures.

- Out of protected areas at the time of breading of toads and mass way out on bank of their under yearling some restriction of visit to the territory by humans it should be done.
- Manage control of use of pesticides and fertilizers in the vicinities of the water-bodies of toads’ breeding.

Caucasian Tree Frog - ***Hyla orientalis* Bedriaga, 1890 (=*Hyla arborea shelkovnikovi* Chernov 1926).**

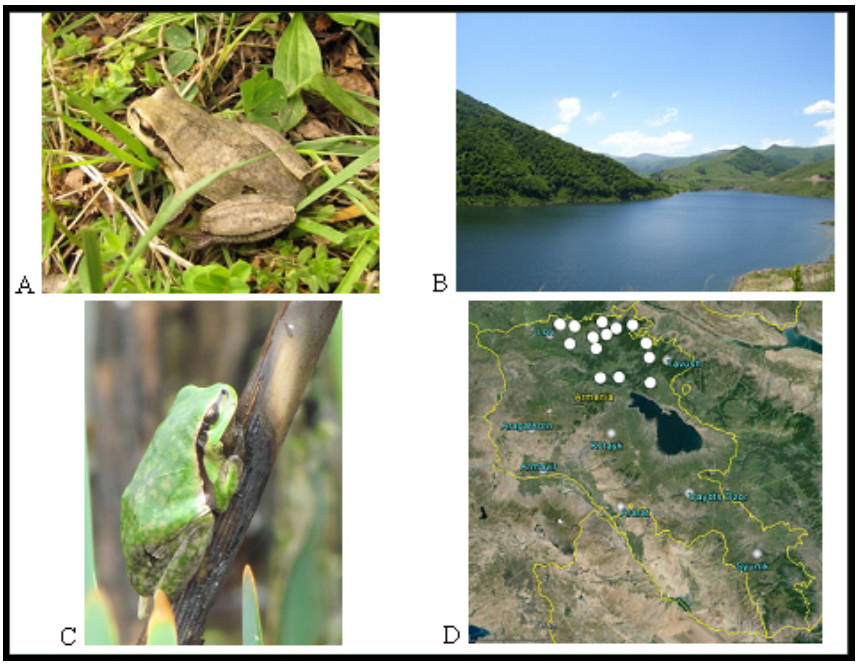

Figure 6 *H. orientalis* A - phenotype *brown- grey spot-less*; B – the artificial water body near Artavaz village (habitat of *Hyla orienthalis, Rana macrocnemis, Pelophylax ridibundus, Pseudepidalea viridis*); C - phenotype *green, white, spotted*, D - found localities.

General distribution.

Specific name *H. orientalis* was recently resurrected from the synonym of *H. arborea*, and the range of this taxon is characterized as follows: "Eastern Europe (Black Sea region), western and northern Anatolia, Caucasus (Crimea, S Ciscaucasia, Georgia, N Armenia, and adjoining Azerbaijan), northern Iran along the Caspian coast" (Arakelyan et al. 2011).

Current distribution in Armenia

H. orientalis is known from the North of Armenia (Lori, Tavush Provinces), where it is rather widespread and abundant (Gumilevsky, 1939, Chernov, 1926; Egiasarian 2002, 2007; Danielian and Egiasarian, 1973, Arakelyan et al., 2011; Pipoyan et al., 2012 – reported as *"H. arborea"* or *"H. arborea shelkownikowi*"). Besides, it was introduced in the Kotayk Province by Prof. F.D. Danielian and Dr. E.M. Egiasarian in past century. Recently was found in Syunik Province (Pipoyan, Ananyan, 2012; M. Kalashian, pers. comm.). We have found several new localities in Lori Province (Fig 4. D).

Ecological and biological notes

Species occurs mainly in broadleaf forest zone near ponds and lakes, sometimes can be found in the gardens. They can occur at altitudes up to 1850 m.

Tree frogs emerge from hibernation in March. Frogs are primarily active at evening and night. During daytime tree frogs usually registered on tree and bush leaves or on grass steams. Frogs reproduce mainly in stagnant water bodies of natural or artificial origin, with rather dense surrounding and coastal vegetation. Breeding starts in April-May. Females lay eggs in small clumps. Embryogenesis lasts 4-10 day, dependent of water temperature. Metamorphosis occurs from June to September. Length of the juveniles after metamorphosis is 2.5- 3 sm. Hibernation starts in October-November.

During our survey some peculiarities of dorsal color and dorsal patterns of *Hyla orientalis* from Armenian population were studied for the first time (Nikogosyan et al., 2014).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (during May-June). It was high in all populations assessed: 20-22 individuals per day (Lori and Kotayk Provinces, including introduced population in Marmarik river gorge).

The condition of containing forest ecosystems can be assessed as rather good; only somewhere cutting was registered in the forests surroundings the water-bodies which can lead to worsening of hydrological conditions. High abundance of predators – native *Pelophylax ridibundus* and somewhere also introduced *Carassius sp, Leuciscus sp.,* etc is another threatening factor for tree frogs.

Current conservation status

Due to quite recently changed taxonomic position the species was not assessed for IUCN Red List. Armenian population of *H. orientalis* can be estimated as LC (Least Concern) taking into account species' rather wide distribution and abundance.

Major threats

1. 1.3.3.2.: selective logging, 1.3.3.3.: clear-cutting;
2. 2.2.: predators (fishes, *Phelophylax ridibundus*);
3. 10.1. recreation/tourism.

Conservation measures.

It preserved in: "Dilijan" and "Sevan" National Parks; "Sochut" and "Ijevan" dendroparks and in several State Sanctuaries.

Proposed conservation measures.

The same with above mentioned species.

Savigny`s Tree Frog - *Hyla savignyi* Audouin, 1827

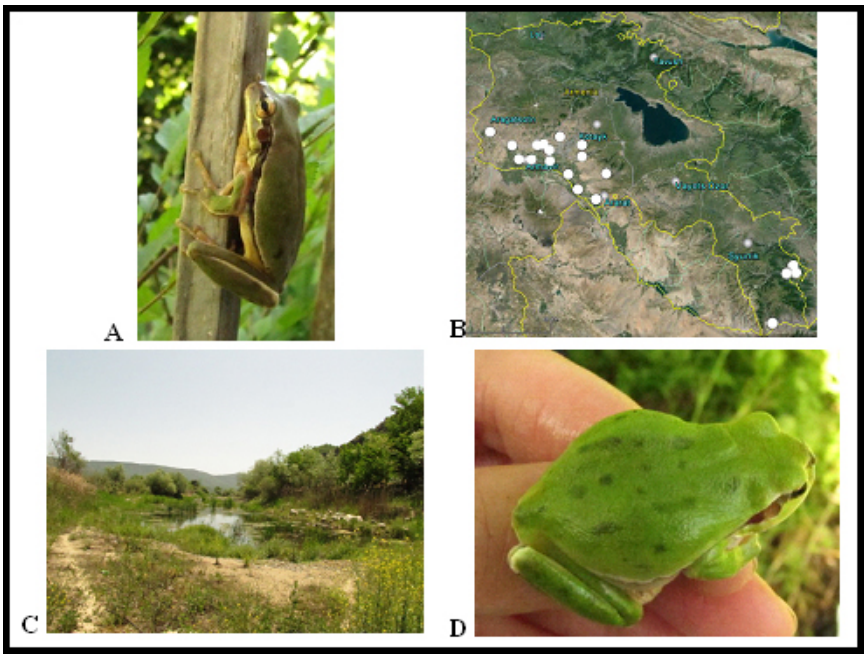

Fig 7. *Hyla savignyi.* A - phenotype *yellow-dark- green, spot-less*; B – found localities; C – the small pond near Syunik village (habitat of *Hyla savignyi, Rana macrocnemis, Pelophylax ridibundus, Pseudepidalea viridis*); D- phenotype *green, spotted.*

General distribution

This species is widespread in Western Asia, east to Southern Transcaucasia and Northern Iran, south-east to Iraq and Arabian Peninsula, south-west to Levant; reported from Northeastern region of Sinai, Egypt.

Current distribution in Armenia

Savigny`s Tree Frog is widely distributed in Ararat, Armavir, Vayots Dzor, Suynik Provinces (Kessler, 1878; Nikolsky, 1913; Chernov, 1926; Gumilevsky 1939; Danielian, Egiasarian, 1973; Egiasarian, Schneider 1990; Egiasarian 2002, 2007; Arakelyan et al., 2011).

Ecological and biological notes

Savigny`s Tree Frog prefers rather dry habitats, including semi desert and dry steppe. It can occur on treeless mountain slopes, at mountain forest edges, in gardens.

Frogs are active from April until October, hibernating during the winter underground or beneath stones. Adults are active at night, spending the day time in holes of the ground or in the thick shrubs or at the lower surface of leaves. Reproduction usually takes place in April-May, in standing water. Females lay eggs in clumps which free-floating or anchored to submerged vegetation. Depending of altitude the under yearling of *Hyla savignyi* were observed in June-beginning of August. The length of the under yearling is 17-20 mm.

During our survey dorsal coloration and dorsal patterns of *Hyla savignyi* from different parts of Armenia were studied and compared with literature data on frogs from Turkey, Syria and Lebanon (Gvoždík and Moravec, 2003) (Nikogosyan et al., 2014, see Referenses).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (during May-June). It was high in all populations' surveyed (vicinities of Syunik and Shahumyan villages, Megri town in Syunik Province; several localities in Armavir and Ararat Provinces) consisting 20-22 individuals counted from twilight and through the night.

According to our survey data the habitats of *Hyla savignyi* in Armenia are in different condition in the different parts of the country. In Central Armenia species range is severely fragmented, the small–holder farming, the freshwater aquaculture, the infrastructure development and human settlements are induced the water and land pollution and habitats destruction of Savigny`s tree frog. In the south of Armenia the anthropogenic pressure on the habitats of *Hyla savignyi* is lower, only somewhere takes place habitat destruction due to mining activity.

Current conservation status

Included into IUCN Red List (ver 3.1) as Least Concern.

According to our data the status of Armenian population of *Hyla savignyi* can be estimated as LC (Least Concern) based on species wide distribution and high abundance. But some populations in Ararat plane can extinct due to the threats mentioned below.

Major threats

1. 1.1.1.2.: small – holder farming, 1.1.7.: freshwater aquaculture; 1.3.6.: groundwater extraction; 1.4.2.: human settlement; 1.4.4.: transport – land;
2. 2.2.: predators (fishes, *Phelophylax ridibundus.*);
3. 6.2.1.: agricultural; 6.2.2.: domestic; 6.3.1.: agricultural; 6.3.2.: domestic; 6.3.8.: sewage; 6.3.9.: solid waste.

Conservation measures.

Hyla savignyi is protected in the following Armenian Protected Areas: "Khosrov Forest" and "Shikahogh" State reserves, "Arevik" National Park, "Jrvezh" dendropark; and in several State Sanctuaries.

Proposed conservation measures.

- Out of protected areas it should be managed some restriction of visit to the territory by humans at the time of breading of tree frogs and mass way out on bank of their under yearling.
- Manage control of use of pesticides and fertilizers in the vicinities of the water-bodies of frogs' breeding, especially in Ararat valley which is important for all the components of wild biota as well.

Caucasian Brown Frog - *Rana macrocnemis* Boulenger, 1886

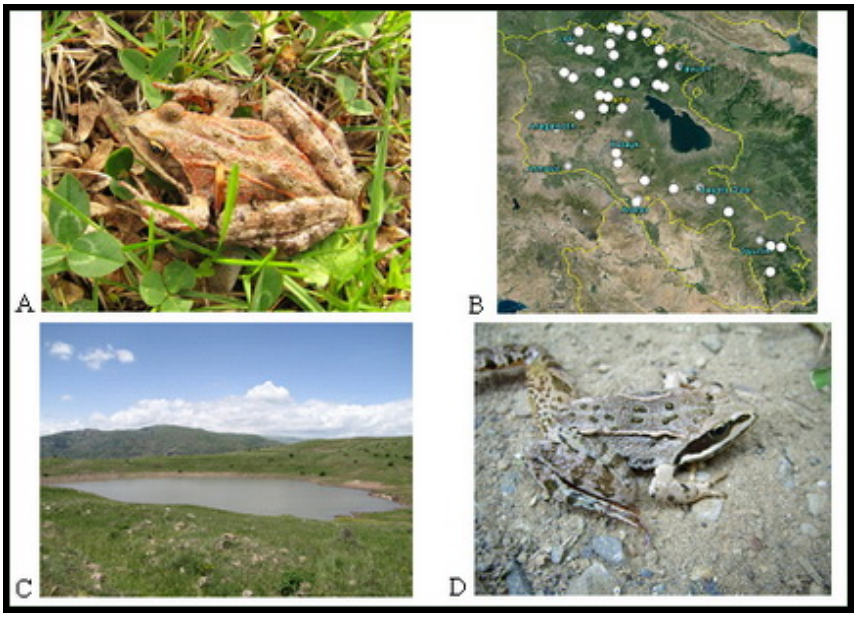

Figure 8. ***Rana macrocnemis*** A, D – phenotypes of different color and dorsal patterns (Lori Province); B - found localities; C – the water body near Gndevaz (habitat of *Rana macrocnemis*, *Pseudepidalea viridis*, *Pelophylax ridibundus*).

General distribution

Area of distribution includes Caucasus, Anatolia, NW Iran, N Iraq. An isolated population exists on the Strizhament Mountain in the Stavropolskii Region of Russia.

Current distribution in Armenia

This species is widely distributed in Armenia. Common species in Lori, Tavush, Shirak, Aragatsotn, Kotayk, Ararat, Vayots Dzor, Syunik Provinces (Boettger, 1892; Nikolsky 1913; Gumilevsky, 1939, Chernov, 1926; Melkumian and Pisanets, 1987; Papanian, 1961; Egiasarian 2002, 2007); we found some new localities in Ararat, Lori and Syunik Provinces.

Ecological and biological notes

Species inhabits mountain forest, subalpine meadows, mountain steppe, and subnival zones. Also occurs in fields, uncultivated lands, glades, in the vicinities of human settlements. It was found at 1200-3000 m above sea level except of newly revealed unexpected population in semi desert at the ~880 m altitude near Yeraskh village in Ararat Province. Not so tightly related with water habitats except of breeding season.

Frogs emerge from hibernation between March and May and are active until late October or early November, depending of elevation. Breading season starts in April or May, depending on elevation as well. Females lay eggs in a clump form. Metamorphosis usually occurs in June-July. In the vicinities of Teghut village (forest zone, 975 m above sea level), the under yearling of the *Rana macrocnemis* in mass were observed in July. The length of the under yearling is 16-18 mm.

During to Project implementation the types of dorsal color and dorsal patterns of *Rana macrocnemis* were observed from several localities of Armenia (Stepanyan, Nikoghosyan, manuscript).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (May-July) by accounting from day and through the night. Near Dsegh village (Lori province) were observed 4-5 individuals per day. Nearly the same numbers were registered in the vicinities of Artavaz village (Marmarik river gorge, Kotayke Province) (3-5 individuals).

Area of distribution of *Rana macrocnemis*in Armenia is large and covers nearly all suitable territories of whole territory of country. Majority of habitats of *Rana macrocnemis*in in Armenia are in rather good condition. Only some of them are threatened by infrastructure development, deforestation, water and land pollution induced by human settlements, somewhere takes place habitat destruction due to mining activity.

Current conservation status.

Included into IUCN Red List (ver 3.1) as Least Concern. According to our data the status of Armenian population of *Rana macrocnemis* can be estimated as LC (Least Concern) due to wide distribution and high abundance.

Major threats

1. 1.1.1.2.: small –holder farming, 1.1.7.: freshwater aquaculture; 1.3.6.: groundwater extraction; 1.4.2.: human settlement; 1.4.4.: transport – land;

2. 2.2.: predators (fishes, *Phelophylax ridibundus.*);
3. 6.2.1.: agricultural; 6.2.2.: domestic; 6.3.1.: agricultural; 6.3.2.: domestic; 6.3.8.: sewage; 6.3.9.: solid waste

Conservation measures.

Species protected in following Armenian Protected Areas: "Khosrov Forest" and "Shikahogh" State reserves; "Dilijan","Sevan", "Arpi" and "Arevik" National Parks, in several sanctuaries and dendroparks.

Proposed conservation measures.

- Out of protected areas it should be managed some restriction of visit to the territory by humans at the time of breading of frogs and mass way out on bank of their under yearling.
- Manage control of use of pesticides and fertilizers in the vicinities of the water-bodies of frogs' breeding.

Special attention has to be paid to Yeraskh population which is distinctly isolated from the main species range; further study could reveal some peculiarities of this population and, if so, special conservation measures will be necessary.

Eurasian Marsh Frog - *Pelophylax ridibundus* Pallas, (1771), (=*Rana ridibunda* Pallas, 1771)

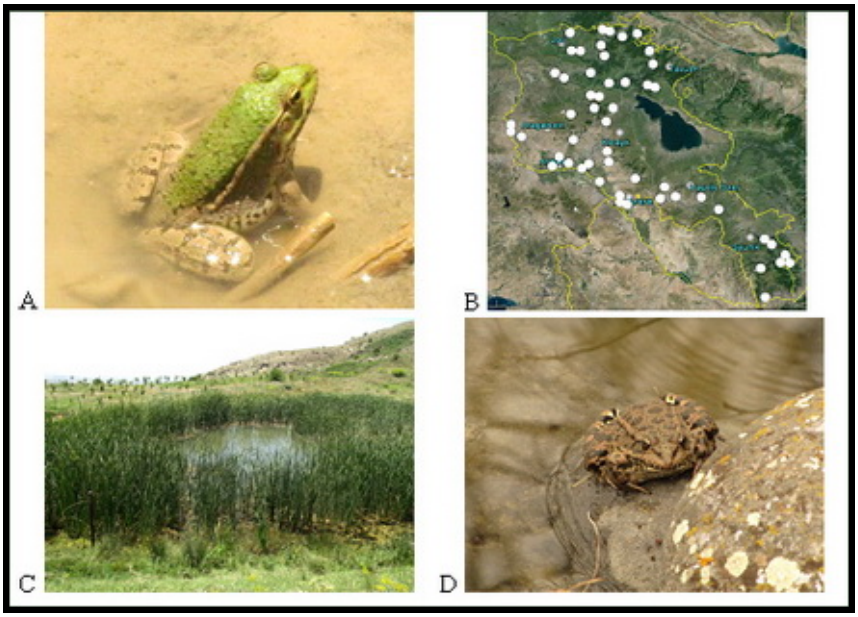

Figure 9. *Pelophylax ridibundus*. A – phenotype *nonstriata, punctata;* B – found localities; C – pond near Voghjaberd village (habitat of *Pelophylax ridibundus, Rana macrocnemis, Pseudepidalea viridis, Pelobates syriacus, Hyla savignyi*); D- phenotype *nonstriata, maculata,* protective coloration example.

General distribution

Distributed from France throughout Central Europe, to the Ural and NW Kazakhstan; most part of Balkans, Anatolian peninsula, Caucasus, N Syria, and N Iraq, W Iran, scattered localities in Arabia. Introduced elsewhere.

Current distribution in Armenia

Widely distributed and abundant in Armenia (Boettger, 1892; Nikolsky 1913; Gumilevsky, 1939, Chernov, 1926; Papanian, 1952; Egiasarian 2002, 2007, Arakelyan et al., 2011; our survey data).

Ecological and biological notes

This species occurs more or less close to various freshwater habitats in nearly all landscape belts of the country situated at 400-3000 m altitude. Can inhabit highly urbanized and polluted areas and even mining territories (in Lori, Ararat and Syunik Provinces).

Active from March to the beginning of November. In lowlands the breeding period starts in early March. Females lay eggs in the pile form. Metamorphosis lasts 58-75 days depending on altitude, habitat and weather. The underlings can be observed from June. In some regions second breeding season can occur and tadpoles can be observed in August for the second time. Animals are active during the whole day, being more active in the evening, especially at the breeding season.

In some water-bodies with high species abundance is one of the major threats for cohabitant *Ommatotriton ophryticus, Pelobates syriacus, Hyla savignyi, H. orientalis*, hunting their young.

During our observation the types of dorsal patterns and dorsal coloration of *Pelophylax ridibundus* from Kotayk, Ararat and Aragatsotn Provinces were studied (Arzumanyan et al., 2014, see References).

Abundance and habitats' condition

Abundance of adults was assessed in breading season (May-July) by accounting both during the day and through the night. 10-100 individuals per 100 m were observed in most localities of *Pelophylax ridibundus* in Lori, Tavuh, Kotayk, Aragatsotn, Ararat, Syunik Provinces.

Area of distribution of *Pelophylax ridibundus* in Armenia is large and covers whole territory of country. Habitat conditions can be assessed like for previous species.

Current conservation status.

Like in previous species.

Major threats

The same with above mentioned species.

Conservation measures.

Pelophylax ridibundus is protected in the majority of Armenian Protected Areas, including all State Reserves, National Parks and majority of sanctuaries.

Proposed conservation measures.

As for previous species.

The major threats

The same with above mentioned species.

Conservation measures.

Species is protected in the majority of Armenian Protected Areas, including all State Reserves, National Parks and several sanctuaries.

Proposed conservation measures.

As for previous species.

***

Thus, in eight Provinces of the Republic of Armenia was surveyed condition of amphibian fauna, clarified the data on current distribution of all seven Armenian species, assessed habitats' condition, estimated status of each species using IUCN Red List Criteria.

Some new scientific data were obtained as well.

Analysis and generalization of data allowed to identify some areas most important for amphibian's fauna, in particular, endangered species conservation. Some of them can be proposed for territorial conservation, meaning creation of protected areas of appropriate type (State Sanctuaries, Natural monuments or Protected landscapes). The following territories were selected to protect most threatened Armenian species, as follows:

For *Ommatotriton ophryticus*:

Water bodies and their immediate surroundings near NE of Tashir, NW of Alaverdi and Shamlugh (Lori Province) which are characterized by rather good habitats' conditions and

abundance of newt. Besides protection of the newt itself it will allow to save local populations of *Hyla orientalis* and *Rana macrocnemis*, as well as biotope as a whole.

For *Pelobates syriacus*:

Water bodies and their immediate surroundings near Hatsavan (Kotayk Province), Voskehat (Aragatsotn Province) and Ranchpar (Ararat Province) villages and enlargement of "Jrvezh" forest park with inclusion of surrounding cavy semi desert areas in the vicinities of Voghjaberd village (Kotayk Province). Besides protection of the frog itself it will allow to save local populations of *Hyla savignyi, Rana macrocnemis* and *Pseudepidalea viridis* as well as biotope as a whole.

For both threatened species it would be quite desirable collection of larvae from the ponds with high abundance of fish predators for further releasing into other appropriate water bodies.

As general measures common to all amphibian species it can be proposed:

- Out of protected areas it should be managed some restriction of visit to the territory by humans at the time of breading of frogs and mass way out on bank of their under yearling.
- Manage control of use of pesticides and fertilizers in the vicinities of the water-bodies of frogs' breeding.

PUBLIC AWARENESS RISING AND CAPACITY BUILDING ISSUES

In the framework of **public awareness program** step-by-step publication of informational flyers, posters, calendars and other materials with generalized information on amphibians was done.

This program was carried out during **October-December 2013, and January-August 2014. T**he following activities were carried out:

1. Elaboration of the information programs for schools and local communities' members on themes: "Know and protect Armenian Amphibians"; "Amphibians as a useful animals", "Importance of conservation of our Amphibians", "Armenian endangered amphibian species" and "Negative influence because of amphibians extinction" with preparation of slide-show and illustrative material.
2. Lecturing on the themes above mentioned with distribution of the posters, informational flyers, pocket calendars and booklets in Secondary schools of Yerevan, Vedi, Ararat, Alaverdi, Tashir, Yeghegnadzor, Sisian, Kapan, Dilijan towns and Voghjaberd, Surenavan, Goravan, Haitag, Khanjan, Noravan, Rind, Dsegh, Odzun, villages of Kotayk, Ararat, Armavir, Vayots Dzor, Lori, Tavush, Syunik Provinces.

3. Holding the series of lessons in selected schools in 3 cities of Armenia (Alaverdi, Ararat, Armavir) and in some villages situated near habitats of endangered amphibian species (Dsegh village – *Ommatotriton ophryticus*, Haytagh village – *Pelobates syriacus*).
4. Meetings with authorities to elucidate importance and benefits of amphibians conservation were conducted in Surenavan, Goravan, Ararat, Haitag, Dsegh villages, Yeghegnadzor, Alaverdi, Sisian, Vedi, Kapan and Yerevan towns (Ararat, Vayots Dzor, Armavir, Lori, Syunik Provinces). Poster "Know and protect Armenian Amphibians", information flyers, dedicated to each species of Armenian amphibians and pocket calendars presenting Armenian amphibians were distributed.
5. Meetings and consultations with authorities and staff of Armenian Protected Areas were conducted ("Khosrov Forest" and "Erebuni" State reserves, "Sevan" National Park, "Vordan karmir" sanctuary, "Sochut" and "Idjevan" dendroparks, etc.); the same information material was distributed.

As for **capacity building** issues, the following results were obtained:

1. In the framework of the Project Bachelor and MSc students were trained in both field and laboratory methods of amphibian investigation. Also, they got experience in presentation of conservation issues in the schools and local communities.
2. Two Bachelor diplomas were successfully presented by Ms. Meri Arzumanyan ("Morphological diversity of marsh frogs (*Pelophylax ridibundus* (Pallas, 1771) in Armenia", Faculty of Biology, Yerevan State University) and Ms. Meri Hovhannisyan ("Current status of amphibians in some Provinces of Armenia", Department of Biology, Armenian State Pedagogical University).
3. The 1st year of MSc students - Ms. Meri Arzumanyan and Ms. Gayane Nikoghosyan presented results of their researches conducted in the framework of the Project in the conference "Biological diversity and conservation problems of the fauna of the Caucasus" Yerevan, Armenia on 23-26 September, 2014, getting experience of scientific presentations and discussions.

Some scientific results of the work were published in the Proceedings of the Conference above mentioned (4 articles); some data are prepared for further publication in scientific magazines.

Figure 10. A – F - Lecturing and distribution of illustrative material among school and authorities of different villages of different Provinces of Armenia. G - Presentation of results of the work in the conference “Biological diversity and conservation problems of the fauna of the Caucasus”

Figure 11. Poster (the title in Armenian is “Interesting facts about amphibians’ life”).

Figure 12. Booklet "Amphibians are useful!" (Cover and inside pages).

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