ZSL
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EDGE

EVOLUTIONARILLY DISTINCT & GLOBALLY ENDANGERED

# Survival Blueprint

## Taylor's Salamander, *Ambystoma taylori*


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## 1. STATUS REVIEW

### 1.1 Taxonomy:

Chordata > Amphibia > Caudata > Ambystomatidae > *Ambystoma taylori*

Originally described as *Ambystoma subsalsum* (Taylor, 1943, Copeia, 1943: 151), from Laguna Alchichica. However that description was mistakenly based on a specimen of "*Ambystoma tigrinum*", according to Brandon, Maruska, and Rumph, 1982 "1981", Bull. S. California Acad. Sci., 80: 112, who provided the new name *Ambystoma taylori* for this population.

Common names:
Spanish: Salamandra de Taylor, Ajolote de Alchichica
English: Taylor's Salamander, Axolotl

### 1.2 Distribution and population status:

#### 1.2.1 Global distribution:

| Country | Population estimate (plus references) | Distribution | Population trend (plus references) | Notes |
|---|---|---|---|---|
| Mexico | No known population estimate | Lake Alchichica, Puebla, Mexico | Unknown (IUCN, 2015) | Personal observations from divers report a decrease in species abundance. |

#### 1.2.2 Local distribution:

| Country | Region / province | Site | Level of Protection | Population size | Reference(s) | Notes |
|---|---|---|---|---|---|---|
| Mexico | Puebla | Lake Alchichica (2290 masl) | None | No known population estimate | | Personal observations from divers report a decrease in species abundance. |

**1.3 Protection status:**

Global category of threat (IUCN): Critically Endangered B1ab(iii) ver 3.1

Listed as Critically Endangered by the IUCN because its extent of occurrence is 16 $km^2$, all individuals are in a single threat-defined location, and there is continuing decline in the extent and quality of its habitat in Laguna Alchichica.

Taylor's salamander is protected under the category Pr (Special protection) by the Mexican Government. However, this category does not mean that any specific conservation action is being developed to protect the species.

**1.4 Ecology, behaviour and habitat requirements:**

*Ambystoma taylori* is a nocturnal species, coming to shallow areas after sunset and escaping from sunlight during the day, hiding inside stromatolites or moving into deeper water. Salamanders are passive foragers feeding on whatever moves in front of their mouth, mainly fish and invertebrates. Breeding behaviour is poorly known, but males are more active during winter and their gonads grow during this time. It is highly likely that the salamanders use stromatolites to hide their eggs from potential predators but there is currently no evidence of this. Salamaders are more abundant below 15 meters deep, but the pattern changes during the year. During the coolest months, they remain below 15 meters, but during the warmest months they are more abundant above 15 meters deep. Oxygen concentration can explain this pattern, since cold water from the surface moves to the bottom during autumn and winter, oxygenating the deeper water. Ambystomatid salamanders usually develop functional lungs because they are unable to breathe through their gills and skin. However, *Ambystoma taylori* has significantly reduced lungs, which are not functional, so they use only gills and skin to breath. Taylor's salamander has no known predator, but digestive parasites (nematodes) seem to be the most common disease as well as the main population control.

Taylor's salamander inhabits Laguna Alchichica, a crater lake with a surface of 1.81$km^2$ and a maximum depth of about 64.6m. Alchichica is a special habitat because it is a saline lake with a total salt content of 8.3% and an alkaline pH ranging between 8.7 and 9.2. Water temperature ranges between 15°C during winter to 21°C during summer. The environmental variables in Alchichica allow the development of stromatolites, which provide refuge to salamanders. Silversides (*Poblana alchichica*) and invertebrates are the source of food for salamanders.

**1.5 Threat analysis:**
*The degree of threat to the species is prioritised as low, medium, high, critical and unknown (?).*

Taylor's salamander distribution is restricted to just one lake: Laguna Alchichica. Because of this, any damage to the habitat could lead to the extinction of this species. We have found two direct threats for *Ambystoma taylori,* both related to habitat loss: water pollution and desiccation. Each threat has its own causes and they are explained below.

**Water pollution** (High)

There are many different sources of water pollution:

- Tourism (Critical): Laguna Alchichica is a popular place for tourists. Some people visit the lake on weekends and holidays. However, the highest number of visitors come during Easter; about 9000 people visit Alchichica on Holy Saturday alone. Most people visiting Alchichica come from other cities and come inside the crater with all sort of vehicles carrying food and beverages. Most visitors drop their rubbish on the ground transforming the perimeter of the lake into a giant rubbish bin.
- Highway (High): There is a highway right next to the crater. The problem with the highway is that people sometimes drop rubbish from their vehicles and the wind drags it towards the lake. Rubbish includes car tires which are a big problem all along the shore of Alchichica.
- Local inhabitants (High): Because of the accumulation of rubbish in some areas of the lake, it seems that people take rubbish bins or bags and drop the contents in the water.
- Agriculture (Medium): Although quality tests have not shown presence of chemical pollutants in the lake, ecotoxicology tests done in some salamanders have shown evidence of biomarkers for exposure to chemical pollutants. It is still unknown as to why these markers show up in tests conducted on salamanders but not water quality testing. Products used in agriculture might cause this, however they have not been identified yet.

**Desiccation** (High)

Alchichica has suffered a continuous decrease in its water level mainly due to water extraction for agriculture. Moreover, due to the expansion of agriculture, human settlements have cleared almost all the remaining forest in the region. This has caused precipitation to be lower than evaporation, and the six crater lakes have lost a significant amount of water during the last 50 years. Climate change may well be effecting the amount of rainfall that is occurring in the area, as well as warmer temperatures causing the glacier that feeds the lake to get smaller.

**1.6 Stakeholder analysis:**

| **Country** | **Stakeholder** | **Stakeholder's interest in the species' conservation** | **Current activities** | **Impact** *(positive, negative or both)* | **Intensity of impact** *(low, medium, high or critical)* |
|---|---|---|---|---|---|
| Mexico | Municipal authorities | Tourism in the lake / conservation | Collaboration in reforestation, regulation of activities in the lake | Positive | Critical |
| Mexico | Africam Safari Zoo | Conservation / Research | Population monitoring, habitat restoration, community work | Positive | Critical |
| Mexico | Ministry of environment | Conservation | Collaboration in reforestation. Support the project with equipment. | Positive | High |
| Mexico | Landowners / farmers | Agriculture / cattle | Agriculture, change of land use | Negative | High |
| Mexico | National Water Commission | Water availability for people | N/A | Potentially positive | Medium |
| Mexico | Local students | - | N/A | Potentially positive | Medium |
| Mexico | Tourists | Recreation at the lake | Littering the lake | Negative | Critical |
| Mexico | Drivers | Use of highway | Littering the highway | Negative | Low |

**1.7 Context and background information that will affect the success of any conservation action for this species:**

| | Description | Barriers to conservation | Opportunities for conservation |
|---|---|---|---|
| **Socio-cultural effects and cultural attitudes** | A big number of visitors to the lake during the Easter period | Pollution | Creating awareness among visitors |
| **Existing conservation measures** | Protected area with restricted access of vehicles and cattle to two thirds of the lake perimeter.<br>Reforestation around the lake. Creation of an assurance colony (a captive colony to enable species survival). | Desiccation rate is faster than restoration of the lake perimeter (and subsequently the lake) | Creation of a Natural Protected Area by the Government will attract more attention and resources to the region |
| **Administrative/political set-up** | Alchichica is located between two States: Puebla and Veracruz, and in consequence, belongs to two different Municipalities. | This situation complicates the territorial administration because there is a lack of communication between both Municipalities. | It is important and necessary to involve authorities from both States and Municipalities in order to improve the legislation in the lake territory. |
| **Local expertise and interest** | The National University of Mexico has developed a long term study of the lake's limnology over the past 15 years | | The information generated from this study represents a perfect baseline to understand the changes that are occurring in the salamander's habitat |
| **Cultural attitudes** | Traditionally about 10,000 people visit Alchichica during the Easter period. | Visitors have a negative impact by littering around the lake. | This tradition represents an excellent opportunity to develop a Community, Education & Public Awareness (CEPA). |

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| **Appeal of species** | Locally the species is popular and there is interest in protecting it | Nationally there may not be such high level interest, which may hinder conservation impacts on a larger scale. | Taylor's Salamander can be used as a flagship species for protecting the lake |

## 2. ACTION PROGRAMME

| **Vision (30-50 years)** | |
|---|---|
| Protect and restore Taylor's Salamander habitat in order to avoid its extinction | |
| **Goal(s) (5-10 years)** | |
| Guarantee the stability of salamander population through habitat restoration and community engagement. | |
| **Objectives** | **Prioritisation** *(low, medium, high or critical)* |
| Establish permanent monitoring of the salamander's population and its habitat. | Critical |
| Create an assurance colony of salamanders | High |
| Protect and restore terrestrial habitat surrounding Alchichica and the neighbouring crater lakes (La Preciosa and Quechulac). | Critical |
| Engage local communities to mitigate the threats affecting Taylor's Salamander habitat. | Critical |
| Reduce littering and pollution of the water body in Alchichica. | Critical |
| Create awareness among drivers to reduce littering from the highway. | High |
| Reduce water consumption in the region | Critical |

| Activities | Country / region | Priority *(low, medium, high or critical)* | Associated costs (GBP) | Time scale | Responsible stakeholders | Indicators | Activity type |
|---|---|---|---|---|---|---|---|
| **Objective 1: Establish permanent monitoring of the salamander's population and its habitat.** | | | | | | | |
| 1.1 Field sampling to evaluate salamanders' abundance. | Mexico / Alchichica | Critical | £4,000 | Bi-annually for at least five years. Annually for and additional five years. | Africam Safari Zoo | Salamander's abundance estimates each year | Improving knowledge |
| 1.2 Disease screening of salamanders collected during field sampling. | Mexico / Alchichica | Critical | £10,000 | Annually for ten years. | Africam Safari Zoo | Annual records of presence and prevalence of infectious diseases and proportion of individuals affected by chemical pollution | Species management |
| 1.3 Complete water quality tests twice a year. | Mexico / Alchichica | Critical | £3,000 | Bi-annually for ten years. | Africam Safari Zoo | Results of water quality tests. | Water management |
| **Objective 2: Establish an assurance colony of Taylor's salamander** | | | | | | | |
| 2.1 Replicate water conditions of Alchichica | Mexico / Africam Safari Zoo | High | £1,000 | Three months (In progress) | Africam Safari Zoo | Comparison between the composition of synthetic and natural water | Water management |
| 2.2 Collect a group of 40 salamanders and bring them to captivity | Mexico / Alchichica | High | £400 | Three weeks | Africam Safari Zoo | Number of salamanders collected – ideally 40 | Species management |

| Activities | Country / region | Priority *(low, medium, high or critical)* | Associated costs (GBP) | Time scale | Responsible stakeholders | Indicators | Activity type |
|---|---|---|---|---|---|---|---|
| 2.3 Breed the species in captivity | Mexico / Africam Safari Zoo | High | Unknown | Two years | Africam Safari Zoo | Success rate of breeding (survival of young >70%) during the two-year timescale. However captive breeding on-going | Species management |
| **Objective 3: Protect and restore terrestrial habitat surrounding Alchichica and the other crater lakes.** | | | | | | | |
| 3.1 Maintain protection of two thirds of the perimeter of the lake by stopping access to vehicles and cattle | Mexico / Alchichica | Critical | £1,000 | Two months (DONE) | Municipal Authorities | Physical barriers to close the access to vehicles and reduce the amount of litter in the protected zone by at least 50%. | Land / Water protection |
| 3.2: Reforestation around the agricultural plots' in the towns adjacent to Alchichica. | Mexico / Alchichica | Critical | £3,400 | Six months | Municipal Authorities, Africam Safari Zoo and Ministry of Environment | Number of trees planted / Number of trees surviving | Land management |

| Activities | Country / region | Priority *(low, medium, high or critical)* | Associated costs (GBP) | Time scale | Responsible stakeholders | Indicators | Activity type |
|---|---|---|---|---|---|---|---|
| 3.3: Reforestation around the water body of the crater lakes closer to Alchichica: La Preciosa and Quechulac. | Mexico / Guadalupe Victoria | High | £5,800 | One year | Municipal Authorities, Africam Safari Zoo and Ministry of Environment | Number of trees planted / Number of trees surviving | Land management |
| 3.4: Reforestation around the agricultural plots' in the towns adjacent to the lakes La Preciosa and Quechulac. | Mexico / Guadalupe Victoria | High | £5,800 | Two years | Municipal Authorities, Africam Safari Zoo and Ministry of Environment | Number of trees planted / Number of trees surviving | Land management |
| **Objective 4: Engage local communities to mitigate the threats affecting Taylor's Salamander habitat.** | | | | | | | |
| 4.1: Workshops and talks in local schools to recruit volunteers and form teams of guardians for the lake. | Mexico / Alchichica | Critical | £1,000 | Every year | Africam Safari Zoo, Local Students, Municipal Authorities | Number of teams formed- more teams would indicate a larger success level. | Education & Awareness |

| Activities | Country / region | Priority *(low, medium, high or critical)* | Associated costs (GBP) | Time scale | Responsible stakeholders | Indicators | Activity type |
|---|---|---|---|---|---|---|---|
| 4.2: Train the teams of guides/guardians with information from Alchichica and the salamander and teach them how to approach visitors. | Mexico / Alchichica | Critical | £1,000 | Every year | Africam Safari Zoo, Local Students, Municipal Authorities | Evaluation of all the volunteers regarding the information they provide to visitors and their performance approaching visitors. | Education & awareness / Livelihood, Economic & other incentives |
| 4.3: Launch the teams of guides / guardians in Alchichica and evaluate their performance. | Mexico / Alchichica | Critical | £1,000 | Yearly | Africam Safari Zoo, Local Students, Municipal Authorities | Surveys with visitors measuring the impact of the guardians. Whether people have stopped littering and going past boundaries, | Livelihood, Economic & other incentives |
| 4.4: Reduce the use of pesticides and chemical fertilizers around Alchichica | Mexico / Alchichica | High | £8,000 | Five years | Municipal Authorities, Ministry of Environment | Amount of farmers changing the use of pesticides and chemical fertilizers by organic ones | Law & policy |

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| **Objective 5: Reduce littering and pollution of the water body in Alchichica.** | | | | | | | |
| 5.1: Organise litter clearance campaigns with participation from local authorities and communities. | Mexico / Alchichica | Critical | £5,000 | Three times / year for at least five years | Municipal Authorities, Africam Safari Zoo | Amount of litter collected | Education & Awareness |
| 5.2: Develop CEPA campaign during Easter in order to reduce littering | Mexico / Alchichica | Critical | £500 | Yearly at Easter. Initial plan developed by first Easter | Municipal Authorities, Africam Safari Zoo | Number of litter bags recovered / number of bags given | Education & Awareness |
| 5.3: Hire a diving team to clean the bottom of the lake(up to 15m). | Mexico / Alchichica | High | £3,800 | Three years | Municipal Authorities, Africam Safari Zoo | Amount of litter collected | Livelihood, Economic & other incentives |
| **Objective 6: Create awareness among drivers to reduce littering from the highway** | | | | | | | |
| 6.1 Install signage with messages against littering on the roadside. | Mexico / Alchichica | High | £3,000 | Two years | Municipal Authorities, Africam Safari Zoo | Signage will be installed on each side of a 2km stretch of road leading to the lake with short messages against littering. | Education & Awareness |

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| 6.2: Produce a short video with information of the lake and the salamander, and show it on buses between Puebla, Mexico City and Veracruz. | Mexico / Puebla / Veracruz | High | £750 | Three years | Africam Safari Zoo | Number of bus routes on which the video is shown to passengers. Surveys or questionnaires applied to people traveling on the buses to assess impact. | Education & Awareness |
| **Objective 7: Reduce water consumption in the region** | | | | | | | |
| 7.1: Improve watering systems for agriculture | Mexico / Alchichica | Critical | GBP unknown | Ten years | Ministry of environment, Municipal Authorities, National Water Commission | Number of farms with new watering systems | Livelihood, Economic & other incentives / Water protection |
| 7.2: Create regulation for water extraction and land use | Mexico / Alchichica | Critical | £1,000 | Five years | Ministry of environment, Municipal Authorities, National Water Commission | Regulations for water extraction and land use around Alchichica, such as water quotas. | Law & Policy / Water protection |
| 7.3: Develop a CEPA for responsible water use in local communities | Mexico / Alchichica | Critical | £1,500 | Three years | Ministry of environment, Municipal Authorities, National Water Commission and Africam Safari | Surveys to evaluate the effect of CEPA campaign on people's attitudes and whether their attitude is becoming more positive. | Water Protection / Education & Awareness |