Final Rufford Report

Population status of Rufous-throated Dipper (*Cinclus schulzi*), its importance in the conservation of mountain rivers in Yungas of Jujuy and Salta, Argentina.

Rufous-throated Dipper (*Cinclus schulzi*) is an endemic species of the subtropical mountain forests of Southern Bolivia and Northwestern Argentina or Southern Yungas. It is part of the Cinclidae family, which is constituted by only one genus, with five species distributed worldwide. Dippers of different species are remarkably similar in their general appearance, behavior and nesting habits; they only differ in size, plumage, and some behavior features. Dippers are aquatic birds that inhabit mountain streams and rivers. Rufous-throated Dipper contrary to the rest of the congeners of North America, Europe, and Asia does not show a diving foraging behavior. Rufous-throated Dipper feeds in shallow waters or submerges partially. It seeks macroinvertebrates between the rocks, on their surface, or directly feeds on the edge of waterfalls. *C. schulzi* preys are generally larvae of insects and other invertebrates of the families Ephemenoptera, Simuliidae, Plecoptera and Trychoptera (Tyler and Ormerod 1994, Malizia 1997). The presence of these invertebrates indicates a good health of mountain rivers. Consequently, the presence of Rufous-throated Dipper can be an indicator of the presence of these invertebrates. Rufous-throated Dipper is the rarest, least known, and with the smallest distribution of the Cinclidae Family.

In Argentina, the Rufous-throated Dipper's is distributed in the provinces of Jujuy, Salta, Tucuman, and Catamarca (Tyler and Ormerod 1994). In the Neotropic there are 56 bird species that depend on fresh water, nine are restricted to one zoogeographic region, and Rufous-throated Dipper is only found in rivers of the subtropical montane forest (Stotz et al. 1996), in sectors with rocks, pools, riffles and waterfalls. These places are characterized for having steep slopes, large stones, and cold, clear, and well oxygenated waters. Rufous-throated Dipper is irregularly distributed, like its habitat, with a global population of less than 4000 individuals (Birdlife 2004). In Argentina, its populations are very fragmented and it is estimated to be less than 2000 individuals (Ergueta and Morales 1996). The species is considered to be declining at a global scale due to habitat transformations (i.e., dam construction), river pollution, and deforestation of river basins. The species is currently categorized as Vulnerable by IUCN and Birdlife International.

The Southern Yungas is the only habitat where the Rufous-throated Dipper occurs. Unfortunately, they are disappearing at an alarming annual rate of 1.1 and 60% has already been lost (FAO 2001, Vervoorst 1997) due to timber harvesting and land transformation for agriculture (WWF/IUCN 1997). The Southern

Yungas is a region of high biodiversity (Cinti 2000), high level of endemism, and is recognized as an Endemic bird Area of the World with urgent priority for conservation (Dinerstein et al. 1995). The Southern Yungas includes nine restricted range bird species (Stattersfield et al. 1998). Argentine Southern Yungas represents 2% of the country's surface (4,890,000 ha) but harbors 50% of the total avifauna (Kappelle and Brown 2001).

Objectives

- Determine the distribution range of *Cinclus schulzi* and record its presence or absence in 30 mountain rivers of Yungas in Jujuy and Salta.
- Estimate the population density of *Cinclus schulzi* in each of these surveyed rivers and at a regional level.
- Estimate the degree of anthropogenic impacts in each of the rivers surveyed.
- Develop educational resources with information on the importance of dippers, biodiversity, and watersheds in montane forests.
- Propose management guidelines and laws to assure the conservation of dippers and watersheds.

Study Area

The Yungas is a subtropical montane cloud forest of Bolivia and Argentina (Fig. 1) with a marked dry season. In Argentina, the Yungas is distributed from the border with Bolivia (22º S) to the north of Catamarca Province (29º S), passing through Salta, Jujuy, and Tucumán Provinces. These forests are distributed along the sub-Andean mountain range in a discontinuous manner forming isolated patches. The area has 700 km long and less than 50 km wide, with an estimated area -in Argentina- of 4 million of hectares (Brown 1995). Yungas is the area with highest regional priority for conservation (Dinerstein et al. 1995) and has the highest diversity of Argentina (Cinti 2000), although it represent less than 2% of the territory (Brown et al. 1993). Yungas harbors large mammals such as: *Panthera onca, Leopardus pardalis, Tapirus terrestris, Lontra longicaudis,* and *Hippocamelus antisensis*. It is likely that the climatic history and the confinement of the different regional parts have contributed to the actual biological composition, which is reflected in the geographical pattern of endemism (Brown 1986). To judge from the high number of endemic species from different taxa (trees, epiphytes, birds, amphibian, mollusks) it has been suggested that this area has acted as a biodiversity refuge in past times (Brown et al. 2001). The Yungas has been recognized as an Endemic Bird Area of the world with urgent priority of

conservation, with nine restricted range bird species: *Amazona tucumana, Penelope dabbenei, Cypseloides rothschildi, Grallaria albigula, Elaenia strepera, Scytalopus supercilliaris, Atlapetes citrinellus, Cinclus schulzi*, and *Eriocnemis glaucopoides* (Stattersfield et al. 1998). The Yungas has an altitudinal gradient that determines three different vegetation communities:

1) Premontane forest. The premontane forests are distributed from 400 to 700 meters with semideciduous trees, 41 species of trees and succulent plants are endemic of this forest (Brown and Grau 1993), unfortunately, 90% of this stratum has already been transformed to agriculture and the forests remnants are under an intense and destructive timber harvesting. Since Santa Bárbara Mountain range has a rain shadow effect therefore the premontane forest is replaced by a drier Chaco forest.

2) Montane forest. The montane forest can be found from 700 to 1500 meters with evergreen trees and very steep slopes with an extractive timber harvesting.

3) Cloud forest. From 1500 to 1900 meters is the distribution of the cloud forest with two main tree species: Alder and Podocarpus forest. This elevation is mainly being threatened by an extractive timber harvesting.

Until now, there are no management plans for the Yungas nor the necessary information to conduct sustainable economic activities (Brown et al. 2001).

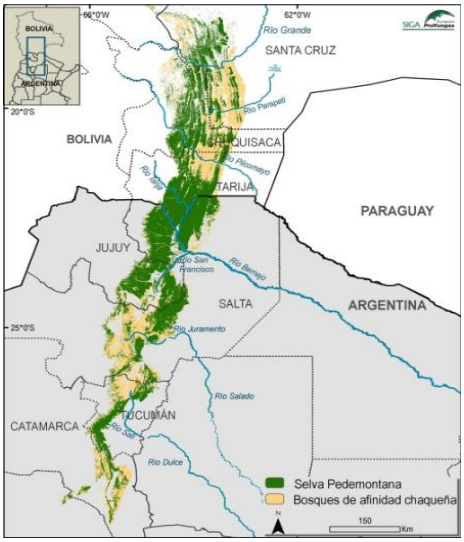

Figure 1. Distribution of subtropical montane forests (or sourthern Yungas) in Argentina and Bolivia (shown in green).

Methodology

We conducted a bibliographic search, requested information to authors that worked in Yungas rivers, and analyzed the altitudinal gradient of Yungas rivers that could potentially harbor the Rufous-throated Dipper. A list of 51 Yungas rivers with potential habitat to harbor Rufous-throated Dipper (Appendix 1) was developed. From this list we selected 30 rives located in the provinces of Jujuy and Salta to survey. Surveys were conducted during the dry season, from April to November 2008. This season was chosen due to the accessibility to the rivers. The surveys were conducted in an altitudinal belt that ranges from 1400 to 1800 m above sea level. This range was chosen because during this season the species migrates to lower altitudes.

The census technique used was Census Count and Direct Observation (Fra and Silverio 2002, Rabinowitz 2003, Canepa and Aguirre 2007). We conducted transects of 6 kilometers long (Murgui 1997, Rabinowizt 2003, Canepa and Aguirre 2007). The daily sampling effort was of about 4 hours, during the morning from 9:00 to 11:00 and in the afternoon from 14:30 to 16:30, these period was chosen to match the species peak activities. For sighting and identification of the Rufous-trhoated Dipper individuals we used binoculars and each encounter was geoposicionated. In each encounter we recorded the number of individuals sighted, time of the sighting, and altitude. At each encounter we also recorded the type of river bank –recording (1) dominant vegetation formation (forests of Alder and/or Walnut trees), (2) accumulation of stones or rocks eroded by water, (3) rock walls of 90º, and (4) the presence of shrubs or grasses (Rabinowizt 2003, Vila and Aprile 2005, Canepa and Aguirre 2007).

We also recorded the main human activities encounterd in each river:

1. Presence of locals or tourists: number of people was recorded.
2. Livestock: Numbers of animals and type (bovine, ovine, equine, etc.).
3. Urbanization degree: It was defined as the sum of infrastructures (houses, bridges, water extraction devices and channels) present in each river.

Data Analysis

The abundance of Rufous-trhoated Dipper along the survey transect for each river was estimated taking the highest number of encounters during morning or afternoon. This was done through the Relative Abundance Index (N° of individuals / km) –defined as the number of individuals recorded per kilometer of river covered (Vila and Aprile 2005), also called Bird Kilometric Index (BKI) (Telleria 1986). For the comparison of the recorded encounters and the relative abundance in each river, a variance statistic analysis test was used (Kruskall-Wallis ANOVA, depending on the normality and homocedasticity of the

data). A simple linear regression analysis and Spearman correlation were applied to the set of environmental variables corresponding to the predominant human activities and the abundance of Rufous-trhoated Dipper in each river. This analysis allowed to see how the variables behave and the way they are related. For these analysis Systat 12 software was used.

Results

From the preliminary list of 51 rivers obtained through the interviews (Appendix 1), 29 rivers were visited in the provinces of Jujuy and Salta. Of the 29 visited rivers, four were dry or with low levels of water and three presented major difficulties, therefore they were discarded to survey (Table 1). A brief description of the surveyed rivers was made, obtained from field observations:

1. **Valle Colorado river**

Located near the town of the same name, Valle Grande department, Jujuy province. Slope: Medium (41.83 meters / km). Presence of *Alnus*. A heavy flowing river, with clear waters, rocky, frequent canyons, with rock walls and pools and low disturbance. Extraction of water.

2. **Valle Grande**

Located near the town of the same name, Valle Grande department, Jujuy province. Slope: Medium (38 meters / km). Presence of *Alnus.* A heavy, fast flowing river, clear waters but by portions cloudy due to sand-mining. Rocky, open banks with pebbles and presence of rock walls. Presence of garbage.

3. **Canas river**

Located in the town of Pampichuela, Valle Grande department, Jujuy. Slope: Medium (36 meters / km). Cloudy waters. Presence of algae, few rock walls, with open banks, pebbles, absence of *Alnus*.

4. **Tesorero river**

Located in Jujuy province. Slope: Low (25.5 meters). Presence of *Alnus*. Clear waters, good flow, slow flowing, open banks with pebbles and rock walls in portions with closed banks. No presence of crops nor garbage.

5. **Tiraxi river**

Located in Jujuy province. Slope: medium (35 meters / km). Presence of groves of *Alnus*. Cold, clear waters, good flow, closed banks with rock walls and canyons. No presence of crops nor garbage.

6. **Leon river**

Located in Dr. Manuel Belgrano department, Jujuy province. Slope: Medium (48.5 meters / km). It is a river with a lot of water, fast flowing, cold and clear waters, open banks with pebbles and presence of *Alder*. No presence of tourism and garbage.

7. Lozano river

Located in Dr. Manuel Belgrano department, Jujuy province. Slope: Medium (56 meters / km). It is a river with good amount of water, fast flowing and clear waters, by portions with open banks with pebbles and closed banks with groves of *Alder.* No presence of garbage and tourism.

8. La Horqueta River

Located in the Dr. Manuel Belgrano in the Jujuy province. Slope: High (65.6 meters / km) It is a heavy, fast flowing river, clear waters, closed banks with presence of rock walls and Alder. At the end of the transect a big cascade forming little pools. Presence of commercial trees, no signs of garbage.

9. Yala river

Located in the Dr. Manuel Belgrano department, Jujuy province. Slope: Medium (50 meters / km) It is a heavy, fast flowing river with clear waters, in portions with open banks with stone walls and in portions with canyons and groves of Alder and Walnut tree. Presence of camping and inorganic garbage.

10. Reyes river

Located in Dr. Manuel Belgrano department, Jujuy province. Slope: Low (53 meters / km). It is a heavy, fast flowing river with clear waters, with portions of width open banks with few rock walls and close costs with groves of *Alnus*. There is no presence of organic rubbish but a hotel drainage is present, and also tourism.

11. La Quesera-Guerrero river

Located in Dr. Manuel Belgrano department, Jujuy province. Slope: Medium (42.6 meters / km). It is a river with a good caudal, fast flowing, cold, clear waters, open banks with pebbles and closed banks with *Alnus*. Presence of sand-mining. There is no presence of garbage nor tourism.

12. La Almona river

Located in San Antonio, Jujuy province. Slope: Medium (42 meters / km). Low water flow. Cold, clear waters with presence of groves of *Alnus* and few rock walls, with land slides. Presence of garbage.

13. Los P**anos river**

Located in San Antonio, Jujuy province. Slope: Low (27 meters / km). Low water flow and in portions inexistent (completely infiltrated). Located in a closed ravine, presence of rock walls, warm and clear waters. Presence of groves of *Alnus* and *Juglans*, with land slides. Presence of garbage.

14. El Morado river

Located in San Antonio, Jujuy province. Slope: Low / Medium (30 meters / km). A heavy flow river, with clear waters, rocky, presence of canyons and open banks with frequent rock walls. Presence of *Alnus*. Absence of crops and garbage. Low disturbance.

15. Cerro Negro river

Located in San Antonio, Jujuy province. Slope: High (100 meters / km). A heavy, fast flowing river with clear waters, rocky, close banks with presence of *Alnus*. No presence of crops nor garbage. Low disturbance.

16. Morro Bola river

Located in San Antonio, Jujuy Province. Slope: Medium (48 meters / km). Settled in a ravine of approximately 40 meters width. It possesses good a caudal, rocky, with clear waters forming frequent cascades, closed banks with groves of *Alnus*, with patches of more mature *Alnus* trees. No presence of crops nor garbage. Low disturbance.

17. Los Noques river

Located in Pampichuela town, Valle Grande Department, Jujuy. Slope: High (67.6 meters / km). Settled in a narrow ravine, with bank walls, no presence of *Alnus*, with clear waters, rocky. Pampichuela town obtains drinking water from this river.

18. La Caldera river

Located in La Caldera department, Salta province. Slope: Low (22 meters / km). Presence of *Alnus'* groves. Good water flow, banks with pebbles.

19. Yacon river

Located in Salta province. Slope: Low (17 meters / km). Clear waters and good water flow. Settled in a very width ravine, open banks with pebbles, no presence of crops nor garbage.

20. Quebrada Grande

Located in department, Salta province. Slope: Low. It is a heavy, fast flowing river, with clear waters, closed banks with rock walls and presence of groves of *Alnus*. Presence of garbage.

21. San Lorenzo river

Located in the Touristic Village of San Lorenzo, 8 km away from Salta's Capital city. Slope: High (151.6 meters / km). River with low water flow and by portions inexistent (total infiltration). Settled in a narrow ravine, rocky with abundant rock walls, cold, clear waters. Presence of groves of *Alnus*, with land slides.

22. El Alisal river

Located in Salta province. Slope Presence of *Alnus*. It is a heavy, fast flowing river with cloudy waters, open costs with pebbles, abundant presence of *Cinclodes*. No records of garbage nor tourism.

Only in 14 of the 22 surveyed rivers the presence of individuals of Rufous-trhoated Dipper was recorded (Table 1, Fig. 2). A total of 73 individuals were recorded in these 14 rivers (Table 1). The river with the

highest abundance of Rufous-throated Dippers was Valle Colorado with 11 individuals (Fig. 3). The BKI for all the rivers with presence of Rufous-trhoated Dipper was of 0.92 ind/km, and the relative abundance was of 5.00 ± 2.94 dippers / river. The relative abundance did not differ significantly among the 14 rivers with dippers' presence (Kruskall-Wallis = 16.71, p=0.213).

The model of linear regression was applied to the number of Rufous-trhoated Dipper and to the following variables: number of livestock (p= 0.3732), number of people (p= 0.01), and infrastructure (p=0.003). This indicates that we were not able to detect a linear relation between the abundance of dippers and anthropogenic variables. The abundance of Rufous-trhoated Dipper was no significantly correlated with the livestock (R-Spearman = -0.2023, P = 0.3665), locals (R-Spearman = 0.185, P = 0.4098) and infrastructure (R-Spearman = -0.1952, P = 0.3839). A trend exists, although not statistically detected, in rivers with high livestock charge (>40 head), such as El Alisal, Quebrada Grande, Los Panos and La Caldera where we did not record Rufous-trhoated Dipper and in rivers with low livestock charge (<10 head) there is a larger number of recorded Dippers (Fig. 4). From the 14 rivers where the presence of Rufous-throated Dipper individuals was recorded, four rivers (28.57%): La Horqueta, Yala, Lozano and La Quesera-Guerrero, presented crops. In these rivers we recorded 26% of Rufous-trhoated Dipper individuals recorded was found. In the other 10 rivers (71,43%) no crops were registered and 74% of the individuals recorded were found (Fig. 5).

Table 1. List of the visited rivers with presence and absence of *Cinclus schulzi* in mountain rivers of Jujuy and Salta.

River	Province	Latitude	Longitude	Dippers Nº
Valle Colorado	Jujuy	23.395528	64.925806	11
Valle Grande	Jujuy	23.457500	64.966028	8
Las Cañas	Jujuy	23.535611	65.004833	0
Tesorero	Jujuy	23.932150	65.338900	6
Tiraxi	Jujuy	23.973433	65.372417	1
León	Jujuy	24.016050	65.498500	4
Lozano	Jujuy	24.072117	65.471650	4
La Orqueta	Jujuy	24.122608	65.487100	4
Yala	Jujuy	24.126500	65.489217	4
Reyes	Jujuy	24.164083	65.520367	9
La Quesera	Jujuy	24.234117	65.462233	7
La Almona	Jujuy	24.272933	65.457436	0
Los Paños	Jujuy	24.295261	65.445594	0
Morado	Jujuy	24.323850	65.455483	6
Cerro Negro	Jujuy	24.342639	65.451111	2
Morro Bola	Jujuy	24.402600	65.460967	6
Noques	Jujuy	23.544083	65.025000	1
La Caldera	Salta	24.546550	65.427383	0
Yacón	Salta	24.616500	65.474083	0
Quebrada Grande	Salta	24.698167	65.605100	0
San Lorenzo	Salta	24.709850	65.524150	0
El Alisal	Salta	24.836050	65.758533	0
Yerba Buena	Jujuy	23.457588	64.936585	Non Surveyed
Sunchales	Jujuy	….	….	Non Surveyed
Jordan	Jujuy	23.714881	64.9486	Non Surveyed
Lesser	Salta	24.669367	65.482739	Non Surveyed
Castellanos	Salta	24.699628	65.478778	Non Surveyed
Vaqueros	Salta	24.710581	65.409369	Non Surveyed
Arias	Salta	24.766919	65.529458	Non Surveyed

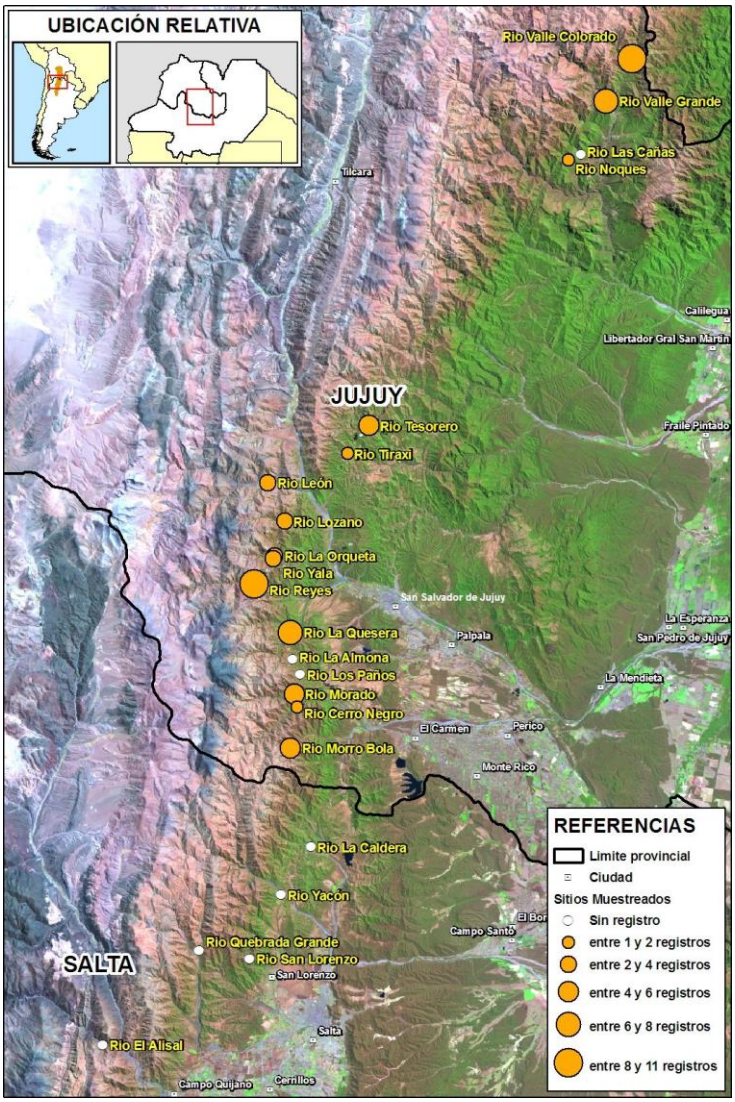

Figure 2. Surveyed rivers and abundance of dippers recorded.

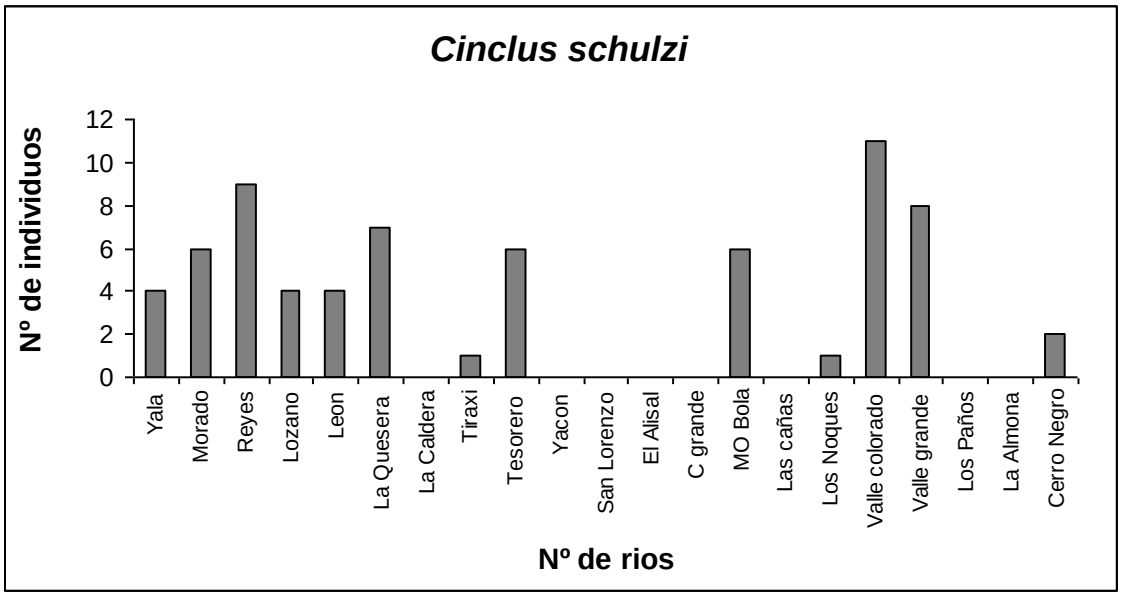

Figure 3. Number of individuals of *Cinclus schulzi* recorded in the surveyed rivers in the provinces of Jujuy and Salta.

Table 2. Number *C. schulzi* individuals, number of livestock, persons and infrastructure in mountain rivers surveyed in Jujuy and Salta, Argentina.

River	Dipper Nº	Livestock	Persons	Infrastructure
Valle Colorado	11	10	2	2
Valle Grande	8	4	6	1
Las Cañas	0	11	0	2
Tesorero	6	9	4	0
Tiraxi	1	8	5	9
León	4	64	5	1
Lozano	4	55	0	1
La Orqueta	4	2	8	3
Yala	4	11	9	8
Reyes	9	3	3	8
La Quesera	7	21	0	3
La Almona	0	8	1	2
Los Paños	0	48	9	6
Morado	6	14	2	3
Cerro Negro	2	2	0	1
Morro Bola	6	18	0	0
Noques	1	0	0	1
La Caldera	0	12	1	2
Yacón	0	12	0	4
Quebrada Grande	0	52	3	7
San Lorenzo	0	11	2	1
El Alisal	0	42	0	4

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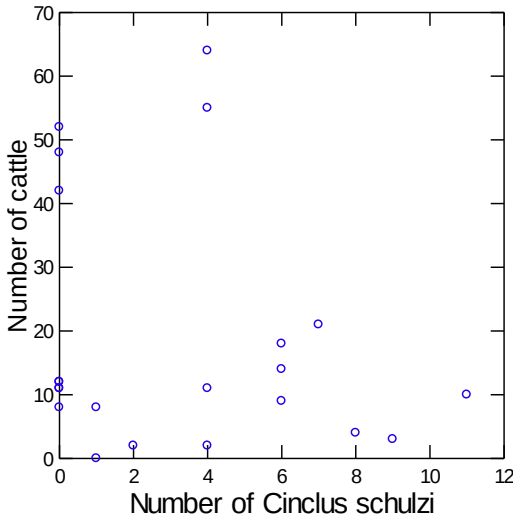

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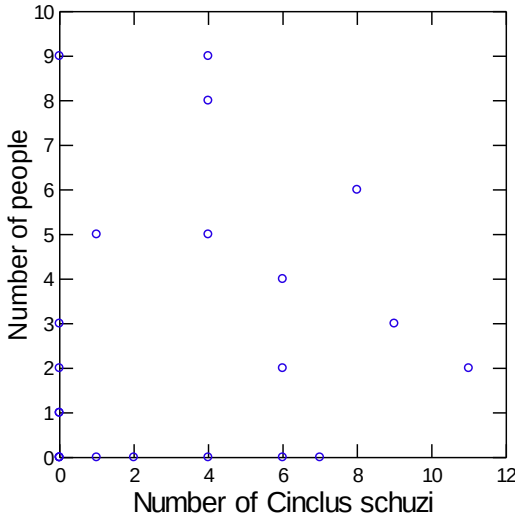

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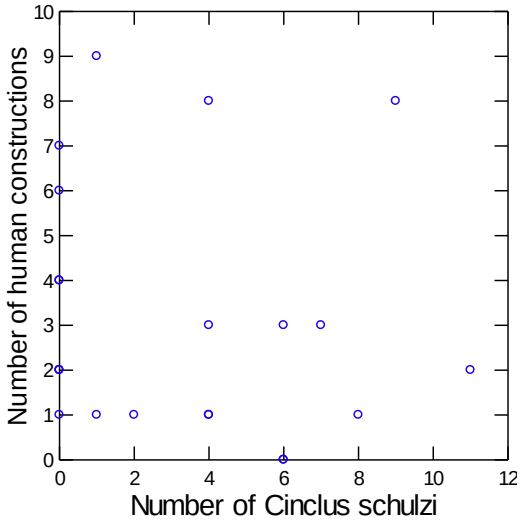

Figure 4. Correlation between the number of *Cinclus schulzi* and the number of human activities recorded.

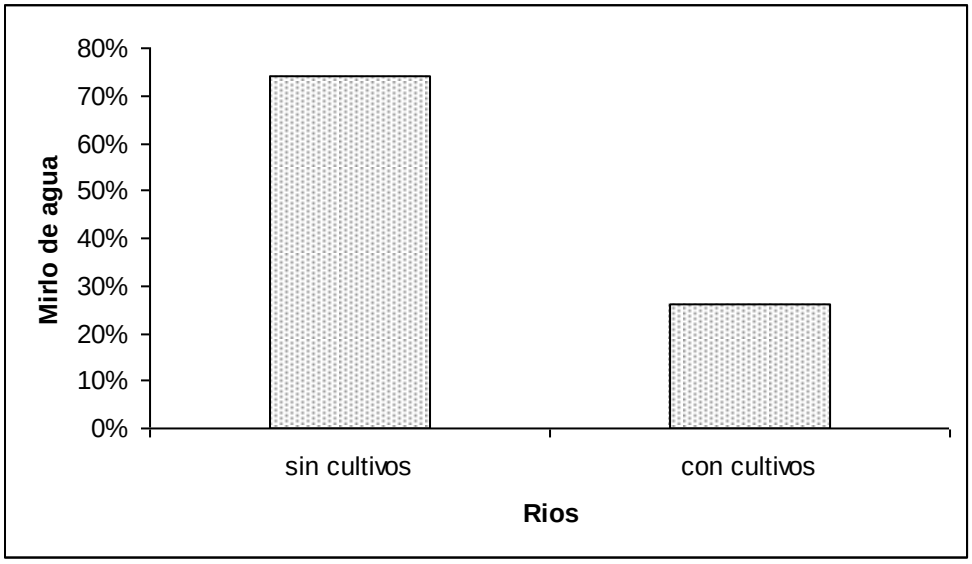

Figure 5. Relative percentage of Rufous-throated Dippers (*C.schulzi)* numbers in rivers with crop presence and absence.

We developed an educational poster (Fig. 6) that was distributed among twelve schools in communities near important rivers with dippers. Posters were also distributed in the Environmental Agency, Tourism Agency, Water Agency and in four municipalities. We have also proposed to the Environmental Agency, through a document to restrict human activities in important rivers for dipper (according to dipper density) until further information can be gathered on reproductive success on each river. We also suggest to the Environmental Agency to initialize a monitoring program to assess the effect of different human activities on the population of Dippers.

Figure 6. Poster developed for the educational campaign.

Discussion

The relative abundance of Rufous-throated Dipper (*Cinclus schulzi*) recorded in this work (0.92 ind/km) is similar, although lower to the one registered for rivers in Tarija, Bolivia (1.3 ind/km) (Zambrana et al. 2005). No significant differences were found in the relative abundance of Rufous-throated Dippers between the 14 rivers where the dipper was found. The presence of Dipper's individuals in only 14 rivers (out of 22 surveyed) can be attributed, in part, to the suitable environmental characteristics of these rivers for harboring stable populations of the species. Some determinant factors in the Dippers abundance along the ravines could be: the availability of appropriate river sectors with good offer of resources such as nesting (rock walls), foraging (waterfalls), and resting sites (emergent rocks). The regularity and permanence of adequate water levels in the 14 rivers with dippers' presence allows the development and availability of a wide diversity of aquatic invertebrates, providing a permanent food supply (Tyler and Ormerod 1994). Researches conducted in rivers in the Valleys area of Jujuy, sampling

biophysical and chemical characteristics such as pH, conductivity, temperature, percentage of dissolved oxygen, etc. verify the high quality of their waters (De Vega 1995, 1998). These characteristics facilitate the maintenance of the aquatic invertebrates' reproductive cycles that comprise the Rufous-throated Dipper specialized diet (Tyler and Ormerod 1994), such as larvae from Simuliidae, Ephemeroptera, Plecoptera and Trycoptera families (Ergueta and morales 1996, Tyler 2005). According to De Vega (1995, 1998), all the rivers located in Jujuy province where Rufous-throated Dipper was recorded would meet the biophysical and chemical optimum conditions to be considered as providers of high quality water.

The absence of individuals of the Rufous-throated Dipper in some Jujuy and Salta rivers could be attributed to the lack of one or more of the suitable characteristics required for the presence of the species. The marked intensity of anthropogenic activities in the surveyed rivers, such as presence of people, infrastructures, crops and specially the livestock impact (Fig. 2), agrochemicals used in forestry and fruit crops spilled into the water, impact negatively in the abundance of the Rufous-throated Dipper. Previous studies confirm that the presence of livestock has negative impacts in rivers, like soil erosion, changes in the surrounding landscape (Villar Cleves 2006, Munoz Pedreros and Larrin 2002), lack of soil permeability can cause hydrological disequilibrium and affect the normal regime of the rivers (Brown and Grau 1993). We suggest that the anthropogenic activities should be properly planned and managed in the basins to avoid the negative impacts in species whose habitat is associated and restricted to mountain rivers, such is the case of the Rufous-throated Dipper.

Conclusions

- Only some rivers harbor the Rufous-throated Dipper. This study enabled us to define its distribution and abundance in Jujuy and Salta provinces. This information will be used for planning and developing management and conservation strategies for this species.
- The disturbances in the rivers and the non planned activities of land use on the river banks that lead to contamination of the waters, deforestation of forests surrounding the basins, or the removal and extraction of river material (primarily rocks) from the water courses, may have a negative effect for the populations of Rufous-throated Dipper with the consequent degradation or in the worst scenario, the destruction of its habitat.
- This study allowed us to determine that during the non reproductive season, *Cinclus schulzi* is not found in all the cited rivers, therefore it would be of major importance to continue with the surveys in both reproductive and non reproductive seasons.

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Appendix 1

List of rivers with potential presence of *Cinclus schulzi*: Visited rivers, non visited rivers and surveyed rivers in Salta and Jujuy.

Nº	Rivers	Province	Visited	Surveyed
1	Valle Colorado	Jujuy	Yes	Yes
2	Valle Grande	Jujuy	Yes	Yes
3	Las Cañas	Jujuy	Yes	Yes
4	Tesorero	Jujuy	Yes	Yes
5	Tiraxi	Jujuy	Yes	Yes
6	León	Jujuy	Yes	Yes
7	Lozano	Jujuy	Yes	Yes
8	La Orqueta	Jujuy	Yes	Yes
9	Yala	Jujuy	Yes	Yes
10	Reyes	Jujuy	Yes	Yes
11	La Quesera	Jujuy	Yes	Yes
12	La Almona	Jujuy	Yes	Yes
13	Los Paños	Jujuy	Yes	Yes
14	Morado	Jujuy	Yes	Yes
15	Cerro Negro	Jujuy	Yes	Yes
16	Morro Bola	Jujuy	Yes	Yes
17	Noques	Jujuy	Yes	Yes
18	Yerba Buena	Jujuy	Yes	no, difficult
19	Jordan	Jujuy	Yes	no, difficult
20	Ocloya - Río Las Piedras	Jujuy	no	No
21	Sunchales	Jujuy	Yes	No, difficult
22	Aguas Negras	Jujuy	No	No
23	Arroyo Oculto	Jujuy	No	No
24	Santa Rosa	Jujuy	No	No
25	La Caldera	Salta	Yes	Yes
26	Yacón	Salta	Yes	Yes
27	Quebrada Grande	Salta	Yes	Yes
28	San Lorenzo	Salta	Yes	Yes
29	El Alisal	Salta	Yes	Yes

Nº	Rivers	Province	Visited	Surveyed
30	Lesser	Salta	Yes	No, dry
31	Rió castellanos	Salta	Yes	No, dry
32	Río Vaqueros	Salta	Yes	No, dry
33	Río Arias	Salta	Yes	No, dry
34	Los sauces	Salta	No	No
35	Las Pavas	Salta	No	No
36	Colorado Cafayate	Salta	No	No
37	Quebrada Aguirre	Salta	No	No
38	Duraznal	Salta	No	No
39	Alto Campanario	Salta	No	No
40	Infiernillo	Salta	No	No
41	Pulares	Salta	No	No
42	Blanco	Salta	No	No
43	Afluente de río Santa Victorioa	Salta	No	No
44	Quebrada de Acambuco	Salta	No	No
45	Lipeo, Los toldos	Salta	No	No
46	Santa Victoria	Salta	No	No
47	Aguas Blancas	Salta	No	No
48	La Quesera	Salta	No	No
49	Manzano		No	No
50	Saladillo		No	No
51	Cuevas		No	No

FINANCIAL EXPENDITURES

Item	Total £
Pre-field expenses	
GPS	178
Camera	298
Maps	157
Binoculars	250
Field expenses	
Food	825
Miscellaneous (stove gas, batteries)	225
4-wheel vehicle rental	900
Vehicle fuel	425
Local transportation	440
Local guides	900
Educational material	
Posters	340
Recommendations report	50
TOTAL	**4988**