Ichthyological and limnological observations on the Sali river basin (Tucuman, Argentina)

Amalia Maria Miquelarena *, Roberto C. Menni **, Hugo L. Lopez and Jorge R. Casciotta *

The ichthyofauna of the Sali river basin, Tucuman, Central Argentina is analyzed. Twenty three species and two subspecies were collected, of which nine species and one subspecies are new for the Sali river basin: Cheirodon interruptus, Odontostilbe microcephala, Cyphocharax cf. modestus, Jobertina rachowi, Pimelodus albicans, Trichomycterus alterum, Corydoras paleatus, Jenynsia lineata alternimaculata, Bujurquina vittata and Cichlasoma portalegrense. This represents a 37% increase in the known diversity of the Sali river fish fauna. The Paranensean composition of this fauna lends support for a western extension of the Parano-platense zoogeographic province. The hypothesis is advanced that the lack of tributaries and therefore the lack of environments of creek type in the Dulce river explains the observed impoverishment in the number of species compared with the Sali. Physicochemical data obtained at ten localities show that the mean pH is higher in the Sali river than in the upper Parana and Paraguay rivers, but is nearly the same as that in Cordoba environments. Total dissolved solids are less than in Pampean lakes or Cordoba creeks. At all localities in the Sali river CO3 H-, Ca2+ and Na+ were the most abundant ions.

Introduction

Many authors (Lachner et al., 1976; Margalef, 1983; Lowe-McConnell, 1987) have mentioned the need for research relating to the faunistic composition and ecology of South American fresh water environments. Bohlke et al. (1978) emphasized the need for studies of the ichthyofauna in many areas, and for collecting in many regions before fish become rare or disappear.

In spite of a considerable amount of research done on Argentine fishes during the last twenty years (see Lopez et al., 1981, 1982, 1987) an extensive area of central Argentina has only been studied in recent years. Menni et al. (1984) provide a complete list of the ichthyofauna from the highlands in Cordoba and San Luis provinces, including a faunal comparison among several basins and limnological observations of sampled streams in eleven basins. Casciotta et al. (1989) report the first fish fauna known from the Salado river in Santiago del Estero province, as well as new species from the Dulce river, and also discuss the limnology of the Salado basin.

The Sali river basin (Fig. 1) includes Tucuman province and parts of Salta and Catamarca provinces. Its main tributaries arise in the Calchaquies and Aconquija highlands. The river is called Tala until its confluence with the

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Fig. 1. Localities sampled in the Sali river basin. Numbers as in Appendix.

With the name Sali it crosses through 250 km of Tucuman province. In Santiago del Estero province it is named the Dulce river (Mazza, 1961; see Casciotta et al., 1989).

In this paper we report the composition of the Sali river basin ichthyofauna, compare the composition of the fish fauna in different sections of the Sali-Dulce river system and discuss the distribution of species. Water physicochemical characteristics are compared with those from other Argentinian basins. The information is analyzed within the zoogeographic framework provided by Ringuelet (1961, 1975) and Arratia et al. (1983).

Material and methods

Most of the material was collected by the authors during two trips to the Sali river basin in May 1980 and April 1983 and deposited in the ichthyological collection of the Museo de La Plata (MLP). Additional material was obtained from Mrs. Butti de Lozano, from the Museo de La Plata and from the Instituto Miguel Lillo, Tucuman (IML). When no collector is mentioned, the material was gathered by RCM, HLL and JRC. Detail of localities is listed in the Appendix, together with the material examined.

The sampled environments are mountain creeks, rivers with rocky bottom and transparent waters, and plain creeks and rivers. In rivers with large flow, the banks or marginal environments were sampled. Sampling was made with a beach seine 15 m wide with a 10 mm mesh, hand nets and the ichthyocide Pronoxfish.

The systematic arrangement used in Tables 1 and 2 mainly follows Greenwood et al. (1966), but Géry (1977) is used within the Characoidei. For the comparison of different sections of the river, Long’s (1963) index was used (see Matson, 1976 and Menni et al., 1984). For the obtention of physicochemical parameters, one liter water samples fixed with chloroform were taken at the collecting place just before fishing. The analysis were made by the Laboratory of Chemistry of the La Plata Institute of Limnology according to APHA (1971) methods.

Results

The composition of the fish fauna from the Dulce and Sali rivers is shown in Table 1. The table has been composed with data from Ringuelet (1975) on the Sali river basin, those provided by Casciotta et al. (1989) on both rivers, and our own data on the Sali river. Table 2 shows the species gathered by the authors from the Sali river basin environments, detailing new records for the basin and presence of species in each locality. Table 3 includes the physicochemical data of the water.
Discussion

Distributional and ecological conclusions. In a zoogeographical sense, the Sali basin fish fauna belongs in the Paranensean dominion of the Subtropical province (Ringuet, 1961, 1975). Ringuet (1975) reports from the Sali river basin twenty six species and an undetermined species of Trichomycterus, to which Loricaria tucumanensis described by Isbrücker (1981) must be added.

We have found thirteen species already reported by Ringuet. Besides, we have captured nine species and a subspecies which are new reports for the basin, namely Cheirodon interruptus, Odontostilbe microcephala, Cyphocharax cf. modestus, Jobertina rachowi, Pimelodus albicans, Trichomycterus alterum, Corydoras paleatus, Jenynsia lineata alternimaculata, Bujurquina vittata and Cichlasoma portalegrense (Table 2). This represents an increase of 37% for the Sali river basin and hence for the Tucuman province. These fishes are typically Paranensean species; T. alterum being the only Andean species. Ringuet (1975) comments that «With the exception of the trichomycterids and some species, as Rineloricaria catamarcensis, which do not live in the Paranensean territory, all the ichthyofauna from Tucuman rivers is composed by the same species that could be found in any place of the Subtropical pampasia» and that «There are ecotonal sympatry among highlands (or Andean) and Paranensean forms, with a clear dominance of the latter» (in the studied area). This situation does not change with the new reports which have low percentage (1 sp. = 10%) of Andean forms.

The Sali and Dulce rivers are physically divided by the Rio Hondo dam, which forms a lake of 330 km². Data from Casciotta et al. (1989) and those gathered for this paper show the following number of species. For the Sali river 28 species were known. Twenty five were obtained by us, of which 10 are new reports for the basin. Total number of species for the Sali river is 38 species (the introduced Gambusia affinis is not considered).

These data show that the Dulce river is somewhat poorer than the Sali. The similarity value obtained applying Long’s index is 44.8%. It seems too low for sections of the same river. An explanation of this difference is suggested below:

The Sali river samples have been collected mainly in tributary creeks, presumptively stable and not disturbed by human action, which constitute marginal environments different from the main course. In the Dulce river basin, sampling has been made in artificial or altered locations, due to the absence of such tributaries or other small environments related to the river. We suggest that the above diversity pattern reflects the amount and quality of habitats available in each section, not only for sampling but for the organisms as well. Supporting this interpretation, Mazza (1961) mentions that the Sali basin in Tucuman is formed by tributaries from the Calchaqui and Aconquija highlands, whereas the Dulce river in plain region in Santiago del Estero receives almost no tributary. Considering Table 1 in this ecological context and Ringuet’s (1975) opinion quoted above, the absence in the Dulce river of three species of Trichomycterus must be noted. They are usually living in fast current and well oxygenated waters in Subandean environments but are lacking in the Dulce basin.

Faulal conclusions. Lopez et al. (1984) mention that it was certain that new searches in Argentina would increase the known distribution of many groups, an assumption confirmed by the new extensions of distribution found during the last years (Lopez et al., 1980; Miquelarena et al., 1981; Lopez et al., 1984 and Menni et al., 1984). The more than 35 % increase of fish species for the Sali basin based on the present small collection supports this conclusion.

Distributional novelties can be summarized as follow:

Cheirodon interruptus was found at the Cadillal dam and in Calimayo creek. This species has been reported from the lower Uruguay, La Plata and lower Parana rivers, from Tala in Salta (Ringuet et al., 1967a), from the Salado basin in Buenos
Our records for the occurrence of *Odontostilbe microcephala* in the Marapa and Calera rivers suggests a larger distribution for this species in north-west Argentina, where it seems to be more com-mon than in the middle and lower Parana river. The species has been reported from the Piedras river in Salta, the Parana delta environments, Corrientes province and the Paraguay and upper Parana rivers (Ringuet et al., 1967a). Additional records are also reported for the Paraguay and La Plata rivers and the Juramento river in Salta (Ringuet, 1975).

*Cypiocharax cf. modestus*, formerly reported from Paraguay, is a new report for Argentina, but the identification needs to be confirmed.

The presence of *joberina rachowi* in the Sali basin largely extends its distribution southward. Several reports (Pozzi, 1945; Travassos, 1952; Bonetto et al., 1969; Ringuet et al., 1978 and Lopez et al., 1980) show that *J. rachowi* seems to have a relatively wide distribution in north eastern and eastern Argentina, from Resistencia to the La Plata city neighborhood.

*Pimelodus albicans* has been found at the Calera river, 400 km west from the Parana river, agreeing with the reports from the Dulce river (Mastrarrigo, 1947; Casciotta et al., 1989). Distribution of this species in Argentina as reported by Ringuet et al. (1967a) and Ringuet (1975) comprises the Paraguay river, middle and lower Uruguay river, middle and lower Parana river and La Plata river.

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**Table 1.** Species composition of the Dulce and Sali rivers basin.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Dulce river</th>
<th>Sali river</th>
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| *Aires province and the Pampean plain south of the Salado river basin. Menni et al. (1984) summarize distribution records from San Juan province, the Desaguadero river in Mendoza and the Colorado river in Rio Negro province, and also report it from several rivers basins in Cordoba. Recently Casciotta et al. (1989) cited the occurrence of *C. interruptus* in the Salado river in Santiago del Estero province (this is not the Salado river quoted above). *Cheirodon interruptus* is more widely distributed than indicated in Ringuet et al. (1967a). Available data show that it is common both in lotic and lentic environments. Probably as a result of the interruption of previous wide distributions, species of the genus have remained isolated in small basins (see Ringuet, 1975 and Menni et al., 1984).**

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Lopez (1985) has found it at the Bermejo river in the Salta province.

We extend the distribution of *Trichomycterus alterurn* east to the Sali river basin at least down to about 500 m a.s.l. The species was known (Ringuelet et al., 1967a; Arratia et al., 1983) from Los Sauces river and the Hunachi valley in La Rioja province, and from the Rio Grande basin in Jujuy province, at heights between 1,000 and 3,000 m.

The presence of *Corydoras paleatus* in the Sali river basin extends its distribution in central Argentina northern than previous localities (see complete references in Menni et al., 1984). It has been found neither in the Dulce river nor in the Salado river in Santiago del Estero (Casciotta et al., 1989).

*Jenynsia lineata alternimaculata* is here reported for the Sali basin, southern of previously known localities. The species, described from Bolivia, has a rather restricted distribution in that country and northwestern Argentina. Ringuelet et al. (1967a) report it in Argentina from the Lipeo river, a tributary of the Bermejo, and Ringuelet (1975) from the same and the Juramento river. Arratia et al. (1983) report it from the Bermejo river.

Specimens of *Bujurquina vittata* here examined come from «Tucuman» (no detailed locality). This report gives continuity between the northern references and that of Berg (1895) from the El Tala creek in Catamarca province. This species is well represented in the upper and middle Paraná river and its tributaries in Misiones, Corrientes, Chaco and northern Santa Fe. Inside Formosa it is found in the Paraguay, Pilcomayo and Bermejo rivers tributaries (Casciotta, pers. comm.).

*Cichlasoma portalegrense* is a new report from the Sali river basin and from «Tucuman» (without precision). This species, recently reported from the Salado and Dulce rivers in Santiago del Estero (Casciotta et al., 1989), is widely distributed in...
Table 3. Sali river basin, physico-chemical parameters of waters.

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Acknowledgments

This report has been written with support from the SECYT and the CONICET (Argentina). The authors wish to thank Richard Madden (Duke University) and Alicia Escalante (La Plata University) for their help with the English text, Mrs. Butti de Lozano for loaning material and the staff of the Chemistry Laboratory, ILPLA, for water analysis.

Appendix. Sampled localities and material examined. Locality numbers refer to Figure 1. ChD means a locality where physicochemical parameters were obtained.

Loc. 2. Marapa river, across the Route 157. May 1980. ChD. Astyanax binaculatus paraguayensis, MLP 15-IX-88-5: 40.5-51.4 mm SL. Odontostilbe microcephala, MLP 7-111-89-2, 2: 35.7-45.0 mm SL.

Loc. 3. Calera river. May 1980. ChD. Oligosarcus jenynsi, MLP 21-11-90-7: 35.7-45.0 mm SL. Acrobranch tarije, MLP 3-X-88-2: 33.7-45.0 mm SL. Characidium fasciatum (sensu Ringuelet et al.)
1967a), MLP 3-X-88-4, 4: 39.0-55.0 mm SL. Heptapterus mustelinius, MLP 21-11-90-2, 1: 53.1 mm SL. Pimelodus albicans, MLP 19-X-88-1, 5: 91.5-149.0 mm SL. Trichomycterus alteratum, MLP 14-IX-88-1, 2: 68.3-105.0 mm SL. Hypostomus cordovae, MLP 1-X-86-16, 16: 119-301 mm SL. Jenynsia lineata alternimaculata, MLP 14-IX-88-8, 2: 32.4-37.2 mm SL.

Loc. 4. Artaza creek. May 1980. ChD. Heptapterus mustelinius (not preserved). Trichomycterus alteratum, MLP 14-IX-88-2, 7: 32.7-42.6 mm SL.


Loc. 6. El Cadillal dam. May 1980. ChD. Oligosarcus jenynsi, MLP 21-11-90-6, 3: 53.7-80.4 mm SL. Astyanax bimaculatus paraguayanensis, MLP 21-11-90-5, 32: 23.4-66.6 mm SL. Bryconamericanus iheringi, MLP 15-IX-88-3, 12: 20.4-49.2 mm SL. Cheirodon interruptus, MLP 14-IX-88-6, 1: 41 mm SL. Characidium fasciatum, MLP 3-X-88-6, 1: 52.4 mm SL. Hypostomus cordovae, IML 01001, 1: 123.3 mm SL.

Loc. 7. Las Tipas river. May 1980. ChD. Trichomycterus spegazzinii, MLP 5-X-88-8, 3: 33.4-80.4 mm SL. Jenynsia lineata alternimaculata, MLP 14-IX-88-4, 2: 37.5-41.7 mm SL.

Loc. 8. Tapia river at Raco (shallow water along road sides). May 1980. ChD. Heptapterus mustelinius, MLP 6-X-88-1, 9: 65.0-117.0 mm SL. Trichomycterus spegazzinii, MLP 5-X-88-3, 5: 52.8-72.4 mm SL.

Loc. 9. Bridge at Vipo (pool under the bridge). May 1980. ChD. Oligosarcus jenynsi, MLP 5-X-88-1, 2: 80.3-85.4 mm SL. Astyanax bimaculatus paraguayanensis, MLP 15-IX-88-6, 10: 40.5-50.9 mm SL. Bryconamericanus iheringi, MLP 15-IX-88-1, 4: 35.2-44.2 mm SL. Cheirodon interruptus, MLP 14-IX-88-7, 1: 36 mm SL. Heptapterus mustelinius, MLP 6-X-88-2, 9: 50.0-134.0 mm SL. Trichomycterus alteratum, MLP 14-IX-88-3, 7: 36.0-44.4 mm SL. T. spegazzinii, MLP 3-X-88-1, 3: 36.4-52.3 mm SL. Jenynsia lineata, MLP 14-IX-88-9, 1: 24.9-42.4 mm SL.

Loc. 10. Calimayo creek, near Lules. May 1980. ChD. Astyanax bimaculatus paraguayanensis, MLP 5-X-88-2, 5: 43.5-63.6 mm SL. Bryconamericanus iheringi, MLP 15-IX-88-2, 6: 24.0-50.4 mm SL. Cheirodon interruptus, MLP 14-IX-88-5, 15: 28.0-40.0 mm SL. Cypohoras cf. modestus, MLP 7-111-89-3, 2: 61.6-86.0 mm SL. J. rachowi, MLP 3-X-88-5, 16: 17.1-33.5 mm SL. Pimelodella laticeps, MLP 21-11-90-4, 7: 18.4-48.9 mm SL. Corydoras paleatus, MLP 14-IX-88-11, 15: 17.7-37.0 mm SL. Cheirodon decemmaculatus, MLP 21-11-90-3,3:15.4-19.7 mm SL. Cichlasoma portalegrense, MLP 17-I-84-58,3:48.3-91.0 mm SL.

Loc. 11. La Ramadita creek, on the road to Tafi del Valle, 5 km from Route 38. April 1983. ChD. Astyanax fasciatus, MLP 15-IX-88-9, 10: 59.0-76.0 mm SL. A. bimaculatus paraguayanensis, MLP 15-IX-88-7,1: 43.2 mm SL. Brycon-mericanus iheringi, MLP 21-11-90-1, 2: 47.8-49.6 mm SL.

Loc. 12. A creek on the road from Tafi del Valle to Amachita del Valle, about 10 km from Tafi del Valle, between the pine forest and the road. April 1983. ChD. Trichomycterus cordovae, MLP 3-X-88-7, 7: 23.0-51.9 mm SL.

Loc. 13. Los Gomez, Reales department. A little creek related to the Sali river. July 1984. (pers. coll. of Mrs. Buttello de Lozano). Astyanax fasciatus, 8:41.8-69.8 mm SL. A. bimaculatus paraguayanensis, 7: 24.5-59.3 mm SL. Bryconamericanus iheringi, 1: 52.9 mm SL. Prochilodus platensis, 1: 119.2 mm SL. Corydoras paleatus, 1: 25.0 mm SL. Gambusia affinis, 1: 18.9 mm SL.


Loc. 15. El Tala creek (no collection date, coll. J. M. Chani). Hypostomus cordovae, IML 01009,1:152 mm SL.


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