Composition and diversity of Trichoptera (Insecta) larvae communities in the middle section of the Jacuí River and some tributaries, State of Rio Grande do Sul, Brazil[1]

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ABSTRACT. The taxonomic composition and diversity of Trichoptera larvae communities were studied in four lotic sites in central region of State of Rio Grande do Sul. Sampling was done monthly from June, 2001 to May, 2002 in four sites located at the middle section of Jacuí River (Point 4) and in three tributaries (Carijinho River – Point 1; Lajeado da Gringa – Point 2 and Lajeado do Gringo – Point 3), with a Surber sampler. The total number of larvae collected was 29,143, belonging to 25 genera distributed in nine families; twenty of these genera are new records for the State. The highest abundance was found at Point 2 (n = 12,547). The highest standardized richness, for a 1,177 specimens sample chosen by chance, was recorded at Point 1, followed by Point 4 (17.7 and 16 genera, respectively). The highest diversity was found at Point 1, and the lowest at Point 3 (H' = 1.31 and H' = 0.77, respectively). Point 1 had the lowest anthropic influence and the best preserved riparian vegetation, while Point 3 presented the highest anthropic impact, and a very reduced riparian vegetation. The diversity of Trichoptera observed in this study is low, compared to the estimated maximum theoretical diversity. Low diversity values are related to the low evenness, since the richness was relatively high. The Trichoptera larvae communities seem to be related to the food availability and physical features (riparian vegetation and anthropic influence) of the study sites.

KEYWORDS. Faunistic composition, larvae assemblage, caddisflies, physical features, State of Rio Grande do Sul.

RESUMO. Composição e diversidade de comunidades de larvas de Trichoptera (Insecta) no trecho médio do rio Jacuí e alguns tributários, Estado do Rio Grande do Sul, Brasil. A composição taxonômica e a diversidade de comunidades de larvas de Trichoptera foram estudadas em quatro ambientes lóticos na região central do Estado do Rio Grande do Sul. As amostras foram coletadas mensalmente de junho de 2001 a maio de 2002 em quarto pontos, localizados no trecho médio do Rio Jacuí (Ponto 4) e em três tributários (Rio Carijinho – Ponto 1; Lajeado da Gringa – Ponto 2 e Lajeado do Gringo – Ponto 3), com amostrador de Surber. O número total de larvas coletado foi 29.143, pertencentes a 25 gêneros distribuídos em nove famílias; vinte destes gêneros constituem registros novos para o Estado. A maior abundância foi encontrada no Ponto 2 (n = 12.547). A maior riqueza padronizada, para uma amostra de 1.177 espécimes retirados ao acaso, foi registrada no Ponto 1, seguida pelo Ponto 4 (17,7 e 16 gêneros, respectivamente). A maior diversidade foi encontrada no Ponto 1 e a menor no Ponto 3 (H' = 1,31 e H' = 0,77, respectivamente). O Ponto 1 possui a menor influência antrópica e a vegetação ripária melhor conservada, enquanto o Ponto 3 apresentou o maior impacto antrópico e a vegetação ripária muito reduzida. A diversidade de Trichoptera observada neste estudo foi baixa, comparada com a diversidade teórica máxima estimada. Os baixos valores de diversidade registrados estão relacionados à baixa equidade, pois a riqueza foi relativamente alta. As comunidades de larvas de Trichoptera parecem estar relacionadas com a disponibilidade alimentar e as características físicas (vegetação ripária e influência antrópica) dos ambientes estudados.

PALAVRAS-CHAVE. Composição faunística, taxocenose de larvas, Trichoptera, características físicas, Estado do Rio Grande do Sul.

Trichopteran larvae are important in food webs of running waters, both because of the abundance of some species as due to the diversity of niches they occupy (ANGRISANO, 1995b; 1998). Silk production and the related behavioral adaptations led to high levels of taxonomic and ecological diversification (MACKAY & WIGGINS, 1979). Silk is used for many purposes (e.g., retreat construction, collecting nets, portable cases and the anchoring line of predators), allowing a more refined choice of habitats and food resources. As a result, the larvae present a strong potential as bioindicators (WIGGINS & MACKAY, 1978).

Diversity and richness of the caddisfly fauna of an area are mostly related to the types of aquatic habitats present. In general, mountainous areas, with swift flowing waters, sustain a larger diversity than areas with a more uniform relief (FLINT, 1982). Heterogeneity and productivity of an environment, among other factors, determine the number of species that can live there. Successful communities depend on the complex interactions between species and food resources (Janzen, 1976, *apud* MACKAY & WIGGINS, 1979).

Brazil has a vast hydrographic system but few surveys of lotic macroinvertebrates have been made, in part due to difficulties in taxonomic identification of immatures (OLIVEIRA & FROEHLICH, 1997a). Recently the interest on the study of Trichoptera has been growing, including ecological works (e.g. OLIVEIRA & FROEHLICH, 1996, 1997b; OLIVEIRA *et al.*, 1999; OLIVEIRA & BISPO, 2001; HUAMANTINCO & NESSIMIAN, 1999; BISPO *et al.*, 2004). Some of these works (DINIZ-FILHO *et al.*, 1998; BISPO *et al.*, 2004) have discussed the role of some physical features of the habitat, such as canopy cover and anthropic influence, in the Trichoptera larvae distribution in streams, when the chemical features of the water are not limiting to fauna survival.

Studies on caddisfly larvae in the State of Rio Grande do Sul are almost absent. There are only a few articles that refer to the macroinvertebrate communities of Sinos River basin (STERNERT *et al*., 2002; SANTOS *et al*., 2003) and of Tainhas and Taquara streams (BUENO *et al*., 2003), all located in the northeast of the state. Here a survey of the Trichoptera larvae of the central area of the state is presented, considering: 1) the taxonomic composition, at genus level, of Trichoptera assemblage in the middle course of Jacuí River and some tributaries; 2) the monthly variation in abundance of the genera between June 2001 and May 2002; 3) local diversity and its monthly variation, and the total diversity.

MATERIAL AND METHODS

The middle course of Jacuí River is located in the transition zone between the physiographic regions of the Northeastern Lower Slope and Central Depression, with elevations varying from 50 to 500 m (PEREIRA *et al*., 1989). According to Köppen's classification the climate is Cfa, humid subtropical with hot summer or warm and rainy temperate.

Rainfall is regularly distributed along the year; the annual rainfall ranging from 1,500 to 1,750 mm (PEREIRA *et al*., 1989). A Deciduous Seasonal Forest was the original vegetation, now mostly destroyed and represented by small fragments, secondary growth and riparian forest distributed sparsely along rivers and in mountain slopes (DURLO *et al*., 1982; LONGHI *et al*., 1982; MARCHIORI *et al*., 1982).

In 2000 the Jacuí River was dammed for hydroelectric purposes (Dona Francisca Power Station, UHDF, 29°26'50" S; 53°16'50" W). The reservoir flooded 1,337 ha in six municipalities, contributing to the environmental alterations in the region.

Four sampling points were chosen, one in Jacuí River and three in left margin tributaries (Fig. 1) belonging to different municipalities, all affected by the dam. The hydrologic classification of the rivers follows STRAHLER (1957).

Point 1: Carijinho River (29°20'32" S; 53°09'58" W), at an elevation of 111 m, a 4th order tributary, located in Arroio do Tigre Municipality. In some places, stones in

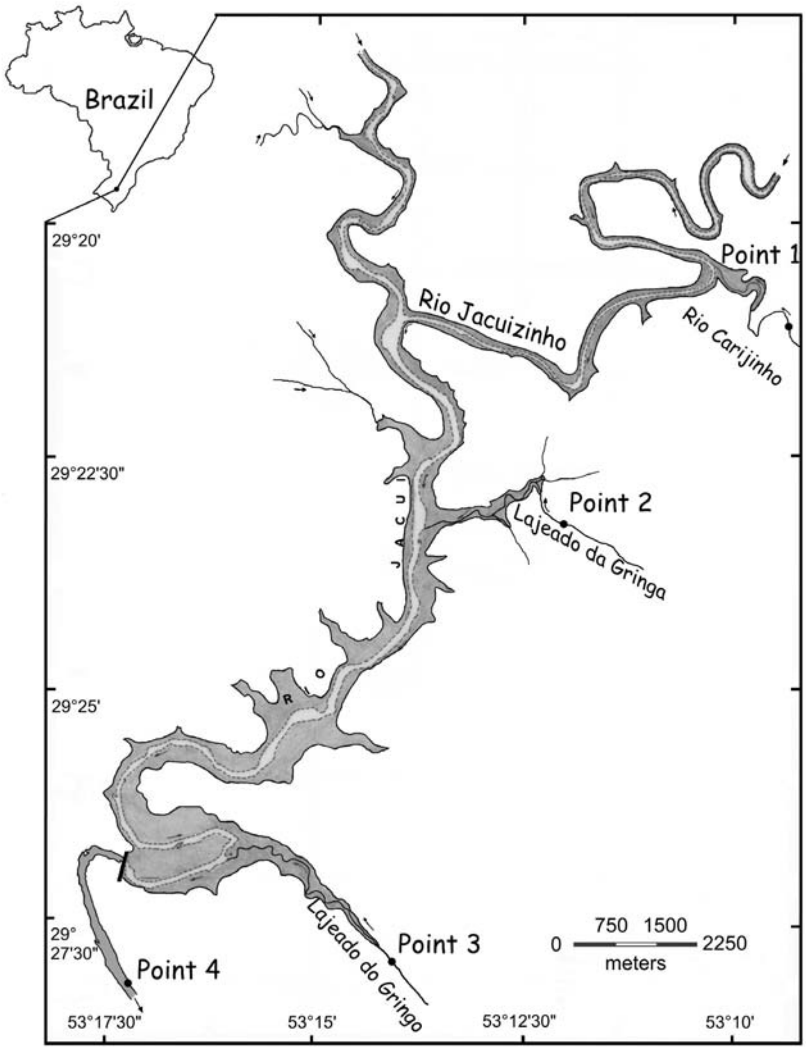

Fig. 1. Map of the study site, indicating the four sampling points in the River Jacuí middle section and in three tributaries, State of Rio Grande do Sul (RS). The central tracing represents the former river and the dark spotting represents the area flooded by the Dona Francisca dam.

the river are covered with *Podostemum* Michaux (Podostemaceae).

Point 2: Lajeado da Gringa (29°22'57" S; 53°12'08" W), at an elevation of 100 m, a 3rd order tributary, located in Ibarama Municipality. Many stones in the river are covered with *Podostemum*.

Point 3: Lajeado do Gringo (29°28'03''S; 53°13'28''W), at an elevation of 136 m, a 4th order tributary, located in Ibarama Municipality. The point, placed near a farm house, is very affected by human activities (sewage, domestic animals).

Point 4: Jacuí River (29°28'45" S; 53°16'51" W), at an elevation of 70 m, in a 7th order stretch in Agudo Municipality, ca. 2 km downstream from the dam. In some months, collections were made in a bay formed during high waters.

For the degree of canopy cover and degree of anthropic influence scales from 1 to 3 were set as follows, based on a subjective evaluation: 1, low; 2, medium; 3, high (Oliveira *et al*., 1999). For turbidity, a scale from 1 - low to 2 - high, was based on a subjective evaluation (Tab. I).

The larvae were collected monthly from June 2001 to May 2002 with a Surber sampler (area of 0.36 m^2 and 1 mm mesh). At each point three units were collected in riffles in the channel, except at Point 4, where samplings were made in the left margin, in shallow water. Macrophytes present on stones in the sampler area were scraped off and collected. The collected material was fixed and kept in 80% ethyl alcohol. Sorting, identification and counting of specimens were done under a stereomicroscope (or microscope, when needed). For family and genus-level identifications the keys of Angrisano (1995b), Angrisano & Korob (2001) and Wiggins (1996) and the articles of Angrisano (1993, 1995a); Flint (1963, 1972); Flint & Wallace (1980); Flint & Bueno-Soria (1982) and Pes & Hamada (2004) were used.

Larvae of Glossosomatidae, due to their small size, had to be identified under a microscope and, due to the large number of specimens collected (16,230), a subsampling procedure was used, ca. 10% of specimens of each sample being chosen randomly and then extrapolated to the total number. Very small larvae of the tribe Leucotrichiini (Hydroptilidae) could not be recognized to genera. Their numbers were apportioned to genera based on the percentages of the larger specimens.

Voucher specimens are deposited in the Invertebrate Collection of the Zoology Section of the Department of Biology, Federal University of Santa Maria (UFSM), State of Rio Grande do Sul, and in the Museum of Zoology, University of São Paulo (MZSP), State of São Paulo.

The diversity of genera of each point and the total diversity were estimated by Shannon-Wiener Index, using natural logarithms, and by Pielou's Evenness Index (Magurran, 1989; Krebs, 1999) using the program Biodiversity Pro (McAleece *et al*., 1997).

The cumulative genera richness was calculated as the mean collector curve, based on 100 curves generated by random addition from the samples. The analysis was made for each point and for the total area using the program EstimateS, version 7.0 (Colwell, 2004). This method was chosen to smooth the curve (Colwell & Coddington, 1994). Rarefaction curves were built for each point based on Hurlbert (1971) and Simberloff (1972). The number of genera was estimated for 1,177 individuals, the smallest number of individuals among the four points, and the mean was estimated based on 1,000 iterations, with the help of the program EcoSim 700 (Gotelli & Entsminger, 2001). The Mann-Whitney test (U; Zar, 1999) was utilized to compare the total Trichoptera abundance between two distinct periods of the year *a priori* by the abundance distribution graphic: October to March and April to September. The genera richness among the sites was compared by variance analysis (One-way ANOVA) and *a posteriori* multiple comparisons by Dunnet (Zar, 1999).

Table I. Physical characterization of the four sampling points in the Jacuí River and three affluents, Rio Grande do Sul, studied between June 2001 and May 2002.

Point	Sites	Degree of canopy cover	Degree of anthropic influence	Degree of turbidity
Point 1	Jacuí River	1	3	2
Point 2	Lajeado do Gringo	2	3	1
Point 3	Lajeado da Gringa	2	2	1
Point 4	Carijinho River	3	1	1

RESULTS

Twenty-five genera in nine families, with a total o 29,143 larvae, were collected (Tab. II). In Point 1, 20 genera were registered, and *Itauara* Müller, 1888 and *Smicridea* McLachlan, 1871 were the most abundant (64% and 19%, respectively). Point 2 had the largest abundance, 12,547 larvae, in 20 genera, of which *Smicridea* (56%) and *Itauara* (37%) were the most frequent. At Point 3, 10,237 larvae in 17 genera were collected, with *Itauara* representing 77% of the larvae. Point 4 had the lowest abundance, 1,177 specimens in 16 genera (Tab. II); *Smicridea*, with 83% of larvae, was the most abundant. In July 2001 no collection was made in this point because it was flooded.

Itauara and *Smicridea* comprised 90% of the total, the former with 54% and the second with 36%. There was an alternation of the dominance of these genera among the points, as shown above.

Seasonally, the period with larger abundances was October to March (U = 2.88; p < 0.01) (Fig. 2). Peaks

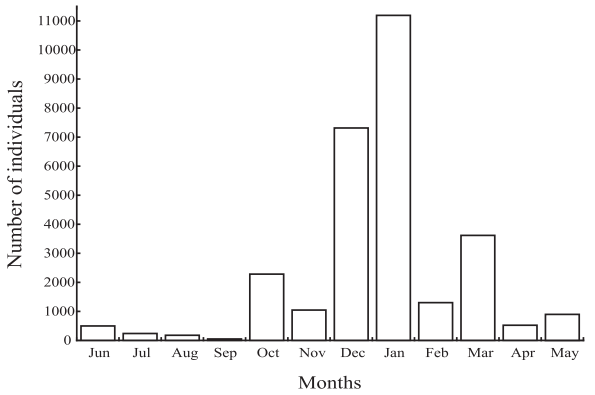

Fig. 2. Monthly variation of the total abundance of Trichoptera larvae, from June 2001 to May 2002, in the River Jacuí middle section and in three tributaries, State of Rio Grande do Sul.

Table II. Taxonomic composition, functional feeding groups (FFG) and genera abundance of the Trichoptera larvae communities in the Jacuí River and tree affluents (RS), sampled between June 2001 and May 2002 (C, collector; Sc, scraper; Sh, shredder; P, predator; Pi, piercing).

Taxa	FFG	Point 1	Point 2	Point 3	Point 4
HYDROPSYCHIDAE					
Blepharopus Kolenati, 1859	C	0	0	0	5
Macronema Pictet, 1836	C	13	2	0	12
Synoestropsis Ulmer, 1905	C	8	14	0	0
Smicridea McLachlan, 1871	C	969	**6,990**	1,699	**972**
POLYCENTROPODIDAE					
Cernotina Ross, 1938	P	9	5	1	16
Cyrnellus Banks, 1913	C	1	28	1	16
Polyplectropus Ulmer, 1905	C	78	110	31	1
GLOSSOSOMATIDAE					
Itauara Müller, 1888	Sc	**3,296**	**4,629**	**7,915**	18
Mexitrichia Mosely, 1937	Sc	0	0	161	2
Protoptila Banks, 1904	Sc	14	12	182	1
HYDROPTILIDAE					
Hydroptila Dalman, 1819	Sc/Pi	246	306	8	34
Oxyethira Eaton, 1873	Pi/Sc	0	1	0	3
Abtrichia Mosely, 1939	Sc	64	35	3	68
Ceratotrichia Flint, 1992	Sc	35	0	0	0
Leucotrichia Mosely, 1934	Sc	0	0	3	8
Neotrichia Morton, 1905	Sc	42	43	10	9
Metrichia Ross, 1938	Pi	5	30	6	1
Ochrotrichia Mosely, 1934	Sc	94	12	0	0
CALAMOCERATIDAE					
Phylloicus Müller, 1880	Sh	5	0	2	0
LEPTOCERIDAE					
Nectopsyche Müller, 1879	Sh/C	76	33	3	11
Grumichella Müller, 1879	Sc	25	1	0	0
Triplectides Kolenati, 1859	Sh	0	3	0	0
ODONTOCERIDAE					
Marilia Müller, 1880	Sh	2	12	2	0
PHILOPOTAMIDAE					
Chimarra Stephens, 1829	C	158	196	187	0
HELICOPSYCHIDAE					
Helicopsyche Siebold, 1856	Sc	43	85	22	0
Total		5,183	12,547	10,236	1,177
Relative abundance		18%	43%	35%	4%

occurred in December at Point 1, January at Points 2 and 3, and October at Point 4 (Fig. 3).

There was significant difference among sites regarding genera richness and total abundance ($F = 4.99$; $H = 10.23$ and $p < 0.01$, respectively). Point 4 had the lowest richness and abundance ($p < 0.05$). Points 1 and 2 presented the largest genera richnesses, while points 2 and 3 had the largest abundance ($p < 0.05$). Points 3 and 1 did not present significant difference to the other sites regarding richness and abundance ($p > 0.05$), respectively (Tabs. II, III).

Hydroptilidae had the greatest number of genera (8) representing 32% of the total number of genera collected, followed by Hydropsychidae, with four genera and 16% of the total. Calamoceratidae, Helicopsychidae, Odontoceridae and Philopotamidae, presented a single genus (Tab. II).

Collector curves, estimated for the four points, indicate that asymptotes were not attained; the curve of Point 1, although showing a trend to stabilization, still had a large confidence interval (Fig. 4). The collector curve for all points, however, stabilized from April on wards, presenting a null confidence interval, indicating that the asymptote was reached and that the effort was adequate to sample the assemblage of Trichoptera larvae in the area (Fig. 5).

Table III. Richness and diversity index (H'), Hmax and equity (e) for the four sampled stations and the total of the site in the Jacuí River middle section and tributaries (RS), registered from June 2001 to May 2002. The highest values are in bold.

Index	Point 1	Point 2	Point 3	Point 4	Total
Richness	20	20	17	16	25
Shannon-Wiener (H') ln	**1.31**	1.04	0.77	0.83	1.14
Hmax ln	3.00	3.00	2.83	2.77	**3.22**
Equity (e)	**0.44**	0.35	0.27	0.30	0.35

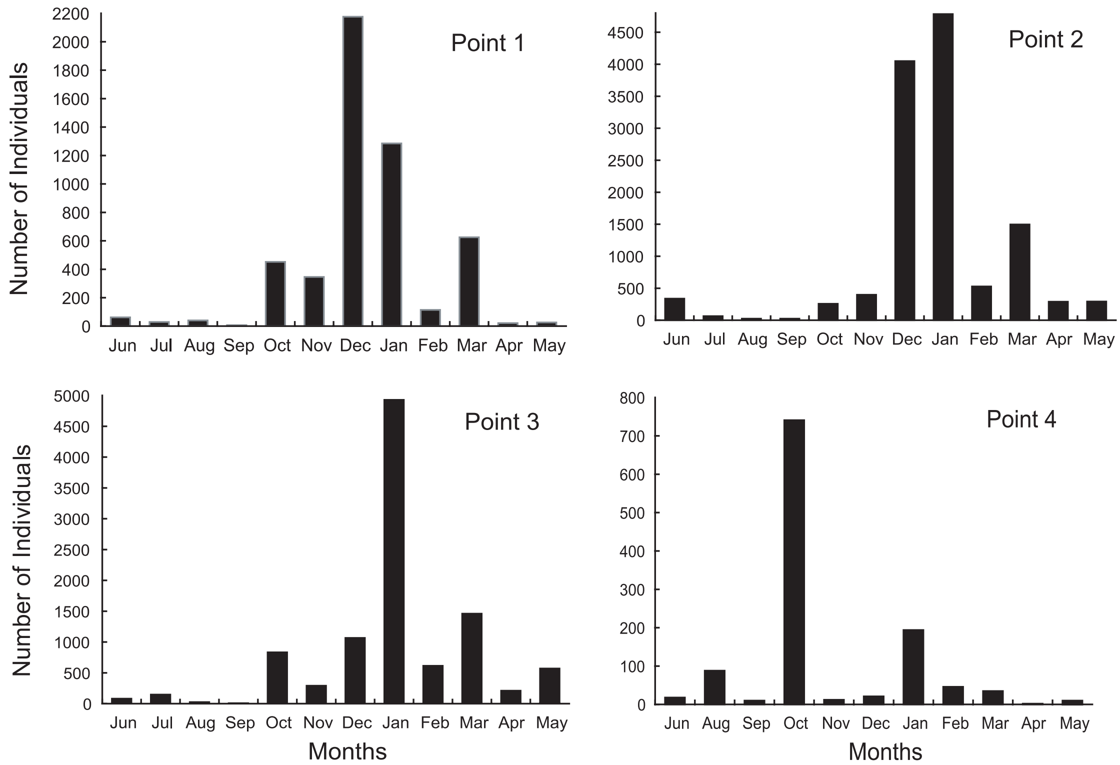

Fig. 3. Monthly variation of the abundance of Trichoptera larvae, by sampling point, from June 2001 to May 2002, in the River Jacuí middle section and in three tributaries, State of Rio Grande do Sul.

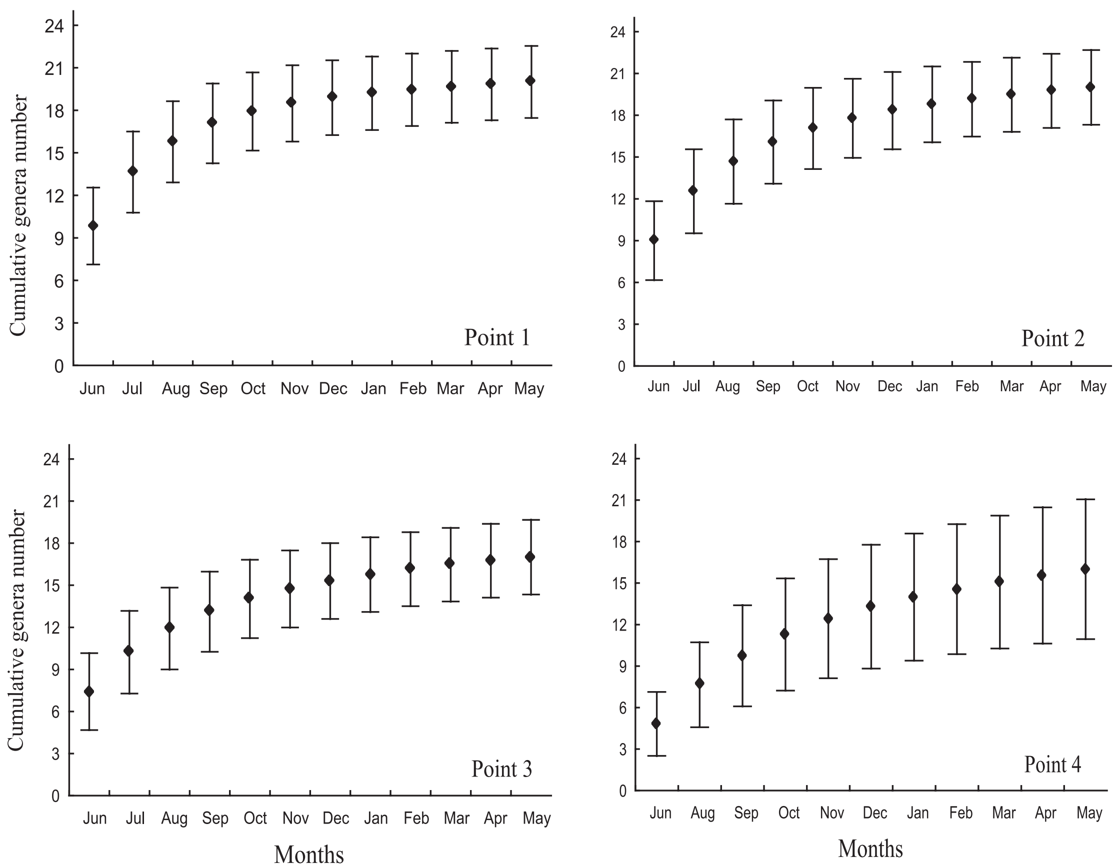

Fig. 4. Curves of accumulation of genera for the four studied points in the Jacuí River, State of Rio Grande do Sul, built from data obtained between June 2001 and May 2002. Each point express an average from 100 points generated by EstimateS version 7.0, the level bars indicate confidence intervals (95%) computed for each point.

Table IV. Comparative table of Trichoptera larvae genera richness in some Brazilian streams sampled riffles with Surber sampler: the river order is stated.

Author	Water sites	River hydrology classification	Number of taxa	Abundance
OLIVEIRA & FROEHLICH (1997b)	Córrego Pedregulho, Pedregulho, SP	4th order	10	5,631
HUAMANTINCO & NESSIMIAN (1999)	Rio Paquequer, Teresópolis, RJ	1st order	14	219
OLIVEIRA & BISPO (2001)	Córrego do Inferno, Pirenópolis, GO	1st order	24	2,048
OLIVEIRA & BISPO (2001)	Córrego Vagafogo, Pirenópolis, GO	1st order	24	3,475
This work	Rio Carijinho, Arroio do Tigre, RS	4th order	20	5,183
This work	Lajeado da Gringa, Ibarama, RS	3rd order	20	12,547
This work	Lajeado do Gringo, Ibarama, RS	4th order	17	10,236
This work	Rio Jacuí, Agudo, RS	7th order	16	1,177

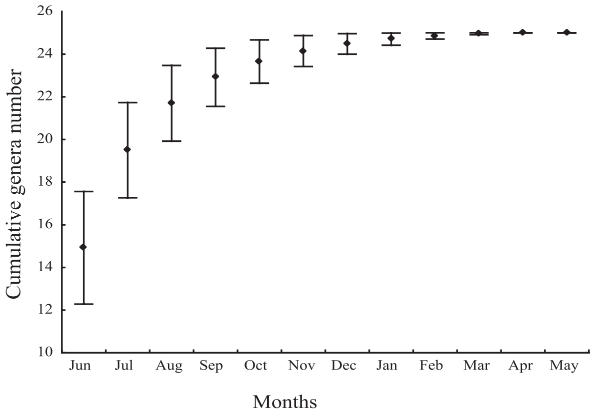

Fig. 5. Curve of accumulation of genera for the full site, Jacuí River and tree affluents, Rio Grande do Sul, built from data obtained between June 2001 and May 2002. The level bars indicate confidence intervals (95%) computed for each point.

The richness estimated by rarefaction for the four points, for a sample of 1,177 individuals, showed that Point 1 had the largest value (17.7 genera), followed by Points 4 and 2 (16 and 14.6 genera, respectively), and with a much lower value, Point 3 (10.3 genera) (Figs. 6, 7).

Point 1 showed the largest Shannon-Wiener's diversity and Pielou's evenness indices and Point 3 the lowest ones. For the sum of the four points, the diversity was 1.14 and the evenness 0.35 (Tab. III).

DISCUSSION

In Brazil, 66 genera of Trichoptera in 16 families are known to occur (PES & HAMADA, 2003, 2004; PAPROCKI *et al*., 2004; HOLZENTHAL & PES, 2004; HUAMANTINCO & NESSIMIAN, 2004, BLAHNIK, 2005). An additional undescribed genus is referred to in PES *et al*. (2005). In the study area, nine families and 25 genera were found. From the State of Rio Grande do Sul, only six genera were previously reported (STERNERT *et al.*, 2002; PAPROCKI *et al*., 2004), of which five were found in the study area: *Nectopsyche* Müller, 1879, *Oxyethira* Eaton, 1873, *Polyplectropus* Ulmer, 1905, *Phylloicus* Müller, 1880 and *Synoestropsis* Ulmer, 1905. For the neighboring States of Santa Catarina and Paraná, the numbers are 24 and 36, respectively, showing the lack of surveys in Rio Grande do Sul in contrast to these states (*e.g*., MÜLLER, 1880a,b; ALMEIDA & MARINONI, 2000; MARINONI & ALMEIDA, 2000; BLAHNIK *et al*., 2004).

Hydroptilidae is cosmopolitan, but especially diverse in the Neotropical Region, with both widely distributed and endemic genera (FLINT *et al*., 1999). With 22 genera, this is the most diversified family in Brazil (PES & HAMADA, 2003, 2004; PAPROCKI *et al*., 2004), as was also in the study area, with eight genera. In number of genera, Hydroptilidae is followed by Leptoceridae (eight), Hydropsychidae (six), Polycentropodidae (five) and Glossosomatidae (four) (PAPROCKI *et al*., 2004). In the study area, Hydropsychidae was represented by four genera, followed by Glossosomatidae, Leptoceridae and Polycentropodidae, with three genera each. These differences may be due to the types of habitat sampled riffles. It may also explain the low diversification and abundance of the leptocerids, whose shredders larvae live mostly in pools (FLINT *et al.,* 1999).

Hydropsychidae larvae are mainly collectors/ filterers (FLINT *et al*., 1999). Two subfamilies were found, Macronematinae and Smicrideinae. The first, with the genera *Macronema* Pictet, 1836, *Blepharopus* Kolenati, 1859 and *Synoestropsis* Ulmer, 1905, seems to be better adapted to larger rivers with warm waters. The second, with *Smicridea*, occurs from headwaters down to large rivers and may be locally very abundant (FLINT *et al*., 1999), which could explain the diversity and abundance of the family in the study area.

Communities in general have few abundant species and many rare species (ODUM, 2001). These patterns were corroborated in this study area, with dominance by the genera *Itauara* and *Smicridea*. The dominance patterns observed in the sampled points could possibly be explained by their physical characteristics, by the availability of food resources (MERRITT & CUMMINS, 1996; RESH & ROSENBERG, 1984) and by the functional feeding groups (VANNOTE *et al*., 1980).

The feeding habits of *Itauara* are unknown, but it is probably a scraper, as the larvae live on stones in the current and are morphologically similar to the rest of the family (MERRITT & CUMMINS, 1996). Such scrapers feed mostly on periphyton, with its algae and associated microorganisms (CUMMINS & KLUG, 1979). Points 1 and 3, where *Itauara* was dominant, had sparse vegetation cover, allowing good light incidence, stony bottom and were shallow; Point 3, however, presented a larger canopy, which did not cover the river. This combination favors the development of periphyton (CUMMINS & KLUG, 1979) and, as a consequence, the high populations of *Itauara*.

Smicridea larvae belong to the collectors/filterers

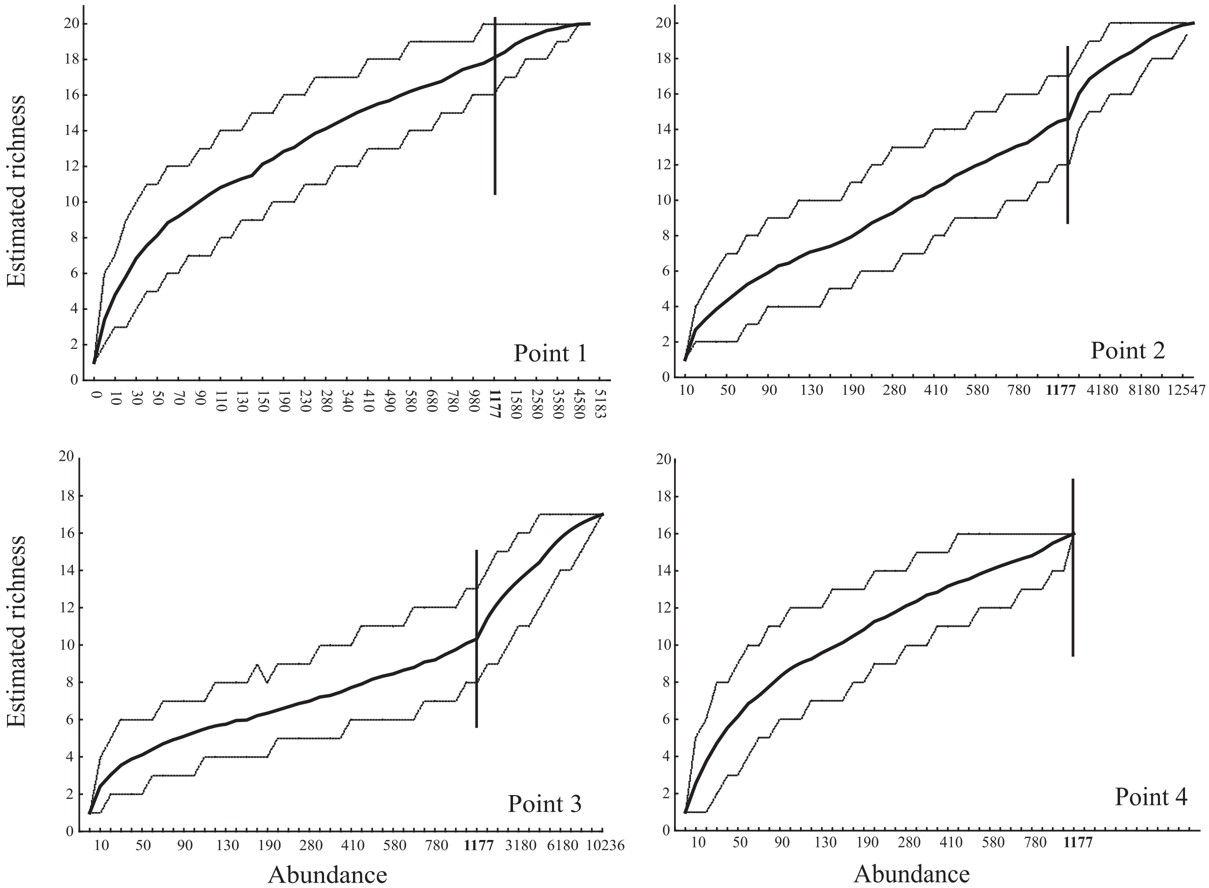

Fig. 6. Rarefaction curves of Trichoptera larvae genera registered between June 2001 and May 2002, for the four points, in the River Jacuí middle course and in the three tributaries, State of Rio Grande do Sul. The upper and lower lines indicate confidence intervals (95%) computed for each point, and the bars represent a 1,177 - individuals sub-sample, except for Point 4, which refers to the whole sample.

category (Merritt & Cummins, 1996; Oliveira & Froehlich, 1996), they build capture nets facing the current and feed on the fine particulate organic matter (FPOM) caught. Besides detritus, this includes, diatoms, green algae and insect remnants (Flint, 1974; Cummins & Klug, 1979; Oliveira & Froehlich, 1996; Wallace & Webster, 1996). FPOM prevails in large rivers, characterized by greater turbidity and poor light penetration (Wiggins & Mackay, 1978). Collectors are common in rivers of all sizes but tend to be the main functional feeding groups in large ones (Vannote *et al.*, 1980). The capture net of larval *Smicridea* has a medium-sized mesh allowing them to occupy almost all running water habitats (Wiggins & Mackay, 1978). The great abundance of *Smicridea*, especially at points 2 and 4, may be due to the physical conditions of the points and the related food availability. At Point 4, where the largest numbers were observed, there is a large quantity of suspended particles (Tab. I), a condition that favors collectors (filterers) against scrapers, because the turbidity attenuates light penetration and restricts periphyton growth.

The monthly variation of the larvae abundances in the middle course of Jacuí River was strongly marked by high values from October to March (Fig. 2). These are the summer months where higher temperatures and insolation occur, which potentially promotes periphyton growth and offers more food to the larvae, specially for the scrapers.

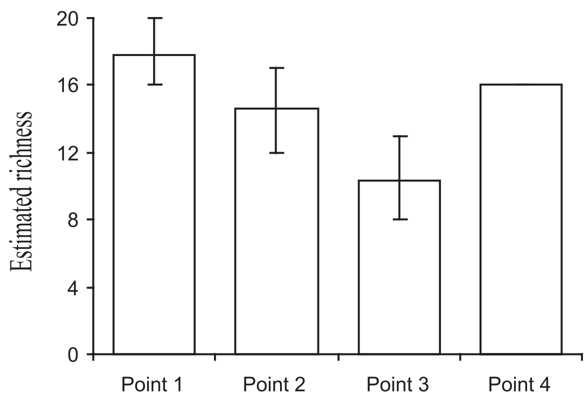

Fig. 7. Estimated richness comparison for 1,177 individuals sampled between June 2001 and May 2002 for the Trichoptera larvae assemblages in four studied sites in the Jacuí River and affluents, State of Rio Grande do Sul; for Points 1-3 the confidence intervals (95%) are indicated.

The highest abundance occurred at Point 2, where both *Smicridea* and *Itauara* were numerous (Tab. II). This point is sunny and many stones are covered with macrophytes. These plants could offer good refuges for the former, whereas stones without macrophytes could have a large periphyton growth, good for the scrapers.

The low numbers recorded at Point 4 are probably related to the high turbidity and the sparse riparian cover. The high turbidity hinders the development of periphyton and the lack of riparian vegetation limits the influx of CPOM, conditions unfavorable to the development of populations of both scrapers and shredders (WIGGINS & MACKAY, 1978). In addition, more sediment is found on the stones as a consequence of the large areas of land recently flooded by the dam. MELO & FROEHLICH (2001) noticed that in two streams that had sediments on the rocks, the macroinvertebrate fauna was less rich and abundant.

Species (or taxa) accumulation curves are an excellent indicator of how efficiently a survey captures the total richness of an area. In tropical ecosystems, however, a curve rarely stabilizes, resulting in that more samplings are needed (SANTOS, 2003). Here, the curves had not stabilized but for the total value, suggesting that some genera found in one point could also occur in others. These results, of course, are valid only for riffles.

The comparison of richnesses by the rarefaction technique showed Point 1 to be the richest, followed by Point 4. This point, however, had the smallest number of genera. This result is probably due to the low number collected, as richness is strongly related to the number of individuals collected (ALLAN, 1995; MELO, 2003).

Comparing the results of the present study to other Brazilian streams (Tab. IV), the sampling method was the same, but the area sampled varied and, in some works, the subfamily Protoptilinae was not identified to genus. Comparing richness among 3rd and 4th order streams, those studied here (Points 1, 2 and 3) had larger richnesses. However, OLIVEIRA & BISPO (2001), studying two 1st order streams, found a larger richness of 24 genera in each, but with lower abundances. Point 4 (7th order) cannot be compared to other studies but its richness is relatively high, as, according to VANNOTE *et al*. (1980), in higher order rivers richness should lower due to food constraints. This may be due to the stony substrate, and not, as in most larger rivers, soft bottoms made up of sand and/or silt. Taking the four points as a whole, the richness was comparable to those found in well preserved streams, e.g., 25 genera found by OLIVEIRA & BISPO (2001).

Communities with highly dominant species are considered as less diverse (ODUM, 2001). Here, the highest diversity, that of Point 1, is related to the highest evenness. Point 2, with the same richness, has lower evenness and diversity. The lowest evenness was that of Point 3, which, together with Point 2, have farms nearby and the riparian vegetation is poor, with some shrubs or only herbs. Point 4 had also a low evenness and is characterized by the quantity of sediments transported from upstream since the closure of the dam. The anthropic influence shows to be an important factor in reducing the diversity of Trichoptera by its destabilizing effect on ecosystems (OLIVEIRA *et al*., 1997).

The diversity of genera of caddisfly larvae for the middle course of the Jacuí River was considered low, taking into account the theoretical maximum diversity (Tab. III). Although no comparisons are possible, the use of diversity indices is important by their widespread use in environmental evaluations (e.g., CHARVET *et al*., 1998; RABENI *et al*., 1999). GOTELLI & GRAVES (1996), however, criticized the joint consideration of both richness and relative abundance, suggesting that they be treated separately.

Some theories have been proposed to explain differences in richness and diversity in lotic environments (VANNOTE *et al*., 1980). According to the River Continuum Concept, they are related to the physical conditions of the river, which present a continuum of changes from the source down to the mouth. Maximum richness would be found in rivers of medium orders (3rd and 4th), where the environmental variability is larger, including the diversity of food resources and the daily variation in temperature (VANNOTE *et al*., 1980). Here, however, it is not possible to evaluate this concept because only a few areas of the river catchment were studied.

The highest richness and diversity found at Point 1 are probably related to the riparian vegetation and food availability. In this point the riparian vegetation is relatively well preserved, providing some shade and supplying CPOM. In addition, there are macrophytes growing on the rocks, making available refuges for animals living in the current. Carijinho River receives upstream a load of sewage but, running on a long and hilly stretch, arrives depurated at the sampling point.

In summary, the taxonomic composition of the four places studied in the Middle Jacuí River showed a high richness of genera, similar to that of preserved areas. There was a strong dominance of the genera *Itauara* and *Smicridea*, more of the former at Points 1 and 3 and of the latter at Points 2 and 4. The highest standardized richness and diversity were found at Point 1, the lowest at Point 3. The study indicates that the Trichoptera communities are adjusted to the physical and biotic conditions, including food availability, riparian vegetation and anthropic influence, of the points studied.

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