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Prey Selection and Energy Value of Main Food Items of the Torrent Duck (*Merganetta armata*) in Northwestern Patagonia, Argentina

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Abstract. – The Torrent Duck (*Merganetta armata*) is one of four species of waterfowl that live in fast flowing rivers. Torrent Ducks feed on benthic invertebrates in mountain rivers from Venezuela to Argentina. Prey selection by Torrent Ducks was investigated by comparing the proportion of prey taxa in their feces with the proportion available in river benthos. Feces and benthos were sampled during spring and autumn, in northwestern Argentine Patagonia, in sites with different precipitation levels. Energy value of the most important prey items were evaluated and the results adjusted for the amount of chitin body proportions. The average energy value of each individual prey item was 3.60 J in Gripopterygidae, 5.88 J in Simuliidae, 11.48 J in Atalophlebiinae and 12.25 J in *Smicridea* spp. These four invertebrate taxa represented approximately 80% of Torrent Duck diet. Prey availability and energy value alone could not explain the total Torrent Duck diet and it was necessary to consider other factors such as including aspects of prey natural history and their distribution in the benthos. Most consumed items were filter-feeding species (Simuliidae and *Smicridea* spp.) that inhabited rock surface that were more accessible to Torrent Ducks. However, Gripopterygidae and Atalophlebiinae were less accessible, as they inhabit in the lower part of rocks. Diet information can be used to assess the availability of the most important prey items of Torrent Ducks in different rivers, and thus to estimate an important feature of habitat quality.

Keywords. – Energy values, feeding habits, food availability, habitat quality evaluation, *Merganetta armata*, Torrent Duck

Running Head: PREY SELECTION OF TORRENT DUCKS

Optimal foraging theory states that organisms forage in such a way as to maximize their net energy intake per unit time (Stephens and Krebs1986). In this respect, suitable habitat and food availability are important resources determining persistence of a given species through time (Wiens 1989). Resource availability can be a limiting factor to individual fitness and/or population dynamics (Wiens 1989). Thus, the study and understanding of food and habitat quality requirements of the species are important to develop effective management measures.

The Torrent Duck (*Merganetta armata*) is one of four river specialist anatids (Carboneras 1992) that inhabit Andean fast flowing mountain rivers from Tierra del Fuego in Argentina and Chile to Venezuela (Carboneras 1992). Adult pairs defend territories of 1-2 km of river (Moffett 1969), typically composed of a mix of rapids, waterfalls, and pools (Carboneras 1992). The Torrent Duck is listed as a 'Species of Least Concern' globally (International Union for Conservation of Nature 2012), although contemporary data suggest that the population is declining.

Torrent Ducks feed on immature benthic aquatic insects (Naranjo and Ávila 2003; Cerón *et al.* 2010). Torrent Ducks use their flexible, slender, conical bill to forage on larvae attached to and between submerged rocks by diving in fast currents in shallow and deep water (Navas 1977). Male and female Torrent Ducks feed together and use the same two techniques to obtain their prey (Cerón and Trejo 2009): a) using their bill to 'scrape' top, side, and downstream facing rock surfaces (it opens and closes their bill repeatedly, peeling insects adhering to them); and b) searching on the bottom and between rocks. Fast flowing insect communities are composed of species that are well adapted to be fixed on the substratum. These insects can be filtering species exposed to river current or detritivorous and hunter species, that live added at the bottom of riverbed rocks (Cummins 1974). The absence of nektonic organisms forces Torrent Ducks to dive in fast flowing waters to feed, spending high amounts of energy in each foraging immersion. For this reason, knowing the balance between the energy values, availability and accessibility of Torrent Duck prey is important to understand their feeding ecology.

While feeding behavior has been studied in the past (Naranjo and Ávila 2003; Cerón *et al.* 2010), those studies did not take into account the unique feeding techniques used by Torrent Ducks. These studies collected invertebrates from smaller rocks in the riverbed but did not sample the submerged rocky surfaces, and did not take into account the proportion of each kind of substratum in the river bottom. Our objectives were to fill these gaps of our knowledge and to characterize the energy values of main prey taxa per square meter of river bottom within current Torrent Duck territories in Nahuel Huapi National Park, northwestern Argentine Patagonia.

METHODS

Study Area

The study area (71º 49'-71º 10'W, 40º 46'-41º 35' S), is situated in the Nahuel Huapi National Park, in the austral temperate forests of the northwestern Argentine Patagonia (Fig. 1). Average annual temperature in the area is 10 ºC, annual precipitation varies between 500-3,000 mm, mainly concentrated as rain and snow in winter and summers are hot and dry (Mermoz *et al*. 2009). Samples were taken in four Torrent Duck territories with differing annual rainfall average, elevation, vegetation, river width and depth (Fig. 1 and Table 1). Each territory was occupied permanently by a Torrent Duck pair, and all sample sites had rapid currents with whitewater sections and emergent rocks.

Samples were taken in November, during the austral spring (2010), corresponding to duckling hatching and highest annual river flowrate (end of wet season) and again in March, early austral autumn (2011), corresponding to juvenile dispersal and lowest water flow rates (end of dry season). We considered our sampling periods as representative of two key periods in the Torrent Duck life cycle because seasonal flow rate variation could have significant effects on observed aquatic insect communities. We did not sample during the winter because although some Torrent Duck territories are defended year round, in other cases due to low water levels or freezing of the streams, territories are only active during the breeding season.

Diet and Food Availability

To estimate food availability in each identified territory, aquatic invertebrate samples were taken using a Surber net (0.09 m^2, 1 mm mesh). To sample invertebrates that Torrent Ducks capture using the \`scraping´ feeding technique, we brushed 900 cm^2 on the top, sides or downstream faces of big boulders (> 50 cm diameter). To obtain the invertebrates that Torrent Ducks capture with the second feeding technique ('searching'), we removed 900 cm^2 of river bed (rocks < 15 cm diameter) and brushed the small rocks into the net held in the current downstream. Each process was repeated five times on the same day on different rocks in each territory in sites where Torrent Ducks had been observed to be feeding, and invertebrate abundances were added taking into account the proportion of each kind of substratum present in each territory. To estimate this proportion, the entire territory was registered, recording visually the ratio between big rocks and medium to small ones. All invertebrate samples were stored in 80% alcohol. Macroinvertebrates were identified to the lowest taxonomic level possible (Lopretto and Tell 1995; Merritt and Cummins 1997; Fernández and Domínguez 2001). Individuals of each taxon were counted to estimate their abundance in each territory. We excludes items that together did not total > 3% of the total sample (abundance or biomass). We made a reference collection using insects' head capsules, legs and/or mandibles from food samples, to compare with sclerotized body parts resistant to Torrent Duck digestion and used this to determine diet composition.

To study the diet, we collected Torrent Duck feces from each territory (*n* = 10) where we gathered the river invertebrate samples. Feces were preserved in 80% alcohol until its laboratory analysis. Fresh feces (moist feces, located in river sections without splashing water) were found on emergent boulders and were identified by size (approximately 2.5 cm long) and content (large proportion of sand and little pebbles mixed with invertebrates), being impossible to confuse with droppings from other birds. Dry feces were avoided to reduce the possibility of losing sample material due to weathering.

Feces were disaggregated under a stereoscopic microscope and prey items were identified by comparison with the reference collection. We counted two mandibles, one head capsule, or six legs (depending on species) as representing one individual. We excluded items that together that were < 3% of the sample (abundance or biomass). We assumed that feces found during the study were from territorial birds and not from floaters (individuals without a specific territory) since Torrent Ducks are very intolerant to territorial intruders, especially during the breeding season. Floaters are expelled very quickly from territories by aggressive actions. Territorial individuals never leave their territories, ensuring that they always feeding in the sampled area.

Energy Values

After analyzing the diet based on our feces examinations, main prey (Simuliidae, *Smicridea* spp., Gripopterygidae, and Atalophlebiinae) were collected from territories and kept in water, counted, weighed and dried at 60 ºC for 48 h. Dried samples were weighed again, finely ground, and pellets were made using a press (Parr Instrument Co. 2812). The caloric content of each sample was obtained by burning pellets in a micro-bomb calorimeter (Parr Instrument Co. 1425). The values obtained were corrected for ash and acid content and expressed as energy values (kJ/g AFDW, ash-free dry weight) (Boy *et al.* 2009). Differences in energy values between the four main prey items were analyzed with a Kruskal-Wallis test, using the language R 2.15.1 (R Development Core Team, 2012).

Torrent Ducks have a low capability to digest chitin and worm cuticles (G. Cerón, pers. obs.). To yield a realistic estimate of prey energy values actually assimilated by our study species, we calculated the chitin percentage of two main prey (Atalophlebiinae and Gripopterygidae) that possess a complete exoskeleton. Most sclerotized prey were weighed (0.1 mg) and then we carried out an artificial digestion of soft structures using potassium hydroxide (10% m/m). Remaining structures were washed in distilled water and weighed again. We repeated this process three times (*n* = 45 insects) and calculated mean chitin composition for each prey type. Adjustments for digestibility over most sclerotized prey items were made assuming similar values between chitin and soft structures.

Number of prey per m^2 of river and their energy density per area (kJ/m^2) were estimated for each territory. Results were adjusted by stream width, taking into account the proportion of big boulders and medium to small rocks. Results were expressed as total energy density (kJ/m^2*m). To estimate the river width of each territory, 10 measures were taken in 100 m intervals and results averaged.

Statistical Analysis

For each territory and season combination, we used a goodness of fit test (Zar 1996) to compare the proportion of prey types in feces with the proportion collected by netting. When a significant difference was detected, Bonferroni confidence intervals were used to identify differences between each prey and its availability (Neu *et al.* 1974; Byers and Steinhorst 1984): $p_i - z_{\alpha/2k} \sqrt{p_i (1-p_i)/n} \leq p_i \leq p_i + z_{\alpha/2k} \sqrt{p_i (1-p_i)/n}$, where *pi* is the proportion of the *i* prey type in the diet, *n* is the total number of prey individuals in the diet, *k* is the number of categories (prey types), and $z\alpha/2k$ is the upper standard normal table value corresponding to a probability tail area of α/2. When the available invertebrates (p0) did not lie within the interval, we concluded that the expected and actual use differed at the 0.05 level of significance. To perform both analyses, we considered only the most common species in the diet that made up > 95% of total prey numbers from each territory in each season.

RESULTS

Diet and prey selection

A total of 11,578 prey items were identified from 78 feces. Fewer fecal samples (n = 8) were collected in Cuyín Manzano during autumn due to weather conditions (rains disaggregated most feces). From a total of 24 invertebrate families found in the environments (almost all insects), 14 were consumed by Torrent Ducks, and only four of that families represented between 80-99.4 % of their diet (Tables 2 and 3). We found significant differences between diet and availability in all sampled sites in both seasons. Goodness of fit test values ranged between 570 and 741 ($P < 0.001$ in all cases). Bonferoni intervals showed that main prey were consumed in different proportion to their benthos availability, being some prey over or under consumed depending on the sample site or season (Table 4).

In Cuyín Manzano, during spring, the most abundant invertebrates in river samples were members of the families Gripopterygidae (Plecoptera), Atalophlebiinae (Ephemeroptera), and Simuliidae (Diptera) (Table 2). During autumn, the most abundant insects were members of the families Gripopterygidae, Beatidae (Ephemeroptera), and Atalophlebiinae (Table 2). Of the most frequently consumed insects, Simuliidae larvae and pupae were preyed in similar proportions within the diet in both wet and dry seasons (Table 3).

In Villegas, during spring, the most abundant insects in river samples were members of the families Atalophlebiinae, Simuliidae, Blephariceridae (Diptera), and Gripopterygidae (Table 2). During autumn, the most abundant insects were members from taxa Beatidae, *Smicridea* spp. (Hydropsychidae, Trichoptera), and Chironomidae (Diptera) (Table 2). Main prey items in the diet differed between wet and dry seasons. During spring, Simuliidae larvae represented 83.2 % of the diet (Table 3). During autumn, invertebrate consumption was more equally distributed among four prey taxa (*Smicridea* spp., Chironomidae, Atalophlebiinae, and Gripopterygidae) (Table 3).

In Manso Medio, during spring, the most abundant prey in river samples were members of the family Simuliidae (Table 2). During autumn, the most abundant insects were *Smicridea* spp., (Table 2). During spring, both taxa were strongly consumed (Table 3). However, in autumn samples only Simuliidae appeared to be an important item (Table 3).

In Los Cántaros, during spring, the most abundant insects in river samples were members of the families Chironomidae and Atalophlebiinae (Table 2). During autumn, the most abundant insects were members of the taxa *Smicridea* spp., Chironomidae, Simuliidae, and Gripopterygidae (Table 3). During spring, the most important prey items were Simuliidae, Gripopterygidae, and Atalophlebiinae (Table 3); and during autumn, *Smicridea* spp. and Atalophlebiinae became the most important food items (Table 3). Los Cántaros was the only site where the main prey was not Simuliidae throughout the year.

Prey energy values

Main prey items of Torrent Ducks were Simuliidae, *Smicridea* spp., Gripopterygidae, and Atalophlebiinae. Together, these four taxa represented between 82% (Villegas, autumn) and 100% (Manso Medio, autumn) of the Torrent Duck diet (excluding 3% from less consumed preys). Energy density of these prey items did not differ significantly (Kruskal-

Wallis, H = 8.774, *P* = 0.067), and ranged between 23.10 to 24.29 kJ/g (AFDW). Nevertheless, for Atalophlebiinae and Gripopterygidae chitin represented 38% and 48% of their body mass, respectively. Taking into account the adjustments because of differing chitin values, the average energy value of each individual prey item was 3.60 J in Gripopterygidae, 5.88 J in Simuliidae larvae, 11.48 J in Atalophlebiinae, and 12.25 J in *Smicridea* spp. Including chitin values, the number of individuals of each family needed to be consumed to reach one dry gram varied between taxa: *Smicridea* spp. (1,155), Atalophlebiinae (1,228), Simuliidae pupae (1,924), Gripopterygidae (3,361), and Simuliidae larvae (3,918).

Each territory presented different proportion of substratum, between big boulders and riverbed (Table 5). In all study sites, the total energy density per area of main prey items increased in autumn, especially in Manso Medio, where its value increased more than 6,400 percent than in spring. Nevertheless, if we take into account changes in river width, the total energy density of territories varied in a different way. In Cuyín Manzano (site with least rainfall) the total energy density was less in autumn than in spring (Table 5).

DISCUSSION

Torrent Ducks feed on immature benthic invertebrates from orders Diptera, Trichoptera, Ephemeroptera, and Plecoptera. The main prey items were Simulidae and *Smicridea* spp. (Cerón *et al.* 2010), the same prey families that Harlequin Ducks (*Histrionicus histrionicus*) feed upon (Rodway 1998). Harlequin Duck is another species that is adapted to feeding in fast flowing waters during their breeding season (Bengtson 1972; Robert and Cloutier 2001). Similarly, the Blue Duck (*Hymenolaimus malacorhynchos*), another river specialist that lives in New Zealand, feeds on the same orders of insects as Torrent Ducks (Collier 1991; Wakelin 1993; Veltman *et al.* 1995), but their main prey item is Chironomidae larvae (Collier 1991; Veltman *et al.* 1995). Variation between seasons in the main prey items consumed by Torrent Ducks (except in Cuyín Manzano) has been seen in Harlequin (Rodway 1998) and Blue (Collier 1991) duck diets, and it is probably due to variations in food availability related to floods changes in feeding places or in insect life cycles (Rodway 1998; Cerón *et al.* 2010), or other factors such as lake proximity or distance between river origin and sample site location.

Nevertheless, we detected strong differences in diet between sites. Given that we sampled only one couple for each study site, individual differences in foraging techniques and food selection could contribute to differences in diet among sites. Previous studies (Naranjo and Ávila 2003; Cerón *et al.* 2010), due to having failed in sampling food availability, should only be taken as descriptions of the diet of these birds, without taking into account conclusions about selectivity. Now, we can confirm that Torrent Duck is a specialist bird species, not only in the environments where it lives, but also in its feeding. We always found differences between diet and availability, as opposed to both Blue and Harlequin Ducks, which feed according insects availability (Rodway 1998; Collier 1991). While diet analysis technique using feces has its limitations by not detecting soft-bodied organisms (Rosenberg and Cooper 1990; Rodway and Cooke 2002), available food sampling conducted in this study and in previous studies (Ceron *et al*. 2010) never found organisms that do not possess at least one structure resistant to digestion that can be identified.

Prey selection probably arises from the interaction of the behavior and morphology of both predators and prey (Endler 1991). Although main prey are associated with rock surface, there seems to be a second level of selection within Torrent Ducks feeding patch. While Simuliidae and *Smicridea* spp. were the most consumed prey, Chironomidae larvae was consumed in very low proportion despite its high availability on rock surface. This situation can best be explained because of the small size of Chironomidae larvae, which could not be preyed upon efficiently by Torrent Ducks. Taking into account availability and energy value between filter feeding insects, the most commonly consumed food item of Torrent Ducks should have been *Smicridea* spp. larvae. Nevertheless, only in Los Cántaros and during autumn was this item the main prey. In addition, Simuliidae larvae and pupae, despite their low availability and energy value per individual was the most important prey item. *Smicridea* spp. larvae are arranged parallel to the rock, build shelters with sand or small rocks, and show scattered placement on the boulder surface. On the other hand simulids are oriented perpendicularly to the rock face, completely exposed to the current, and commonly grouped (G. Cerón, pers. obs.), thus constituting high density feeding patches. These differences could make *Smicridea* spp. a more difficult prey to capture, involving a significant consumption of indigestible material, with its consequent extra energy expenditure by the Torrent Duck.

The energy density per area varied sharply between spring and autumn, indicating that throughout the year there are fluctuations in food availability (and also energy) for Torrent Ducks. Narrowing of streams at the end of the dry season is compensated by an increase in density of prey. Slowing rivers with more food concentrated in a reduced area could be a beneficial situation to juvenile Torrent Ducks when they are expulsed from paternal territories during austral autumn and need to gain weight before winter. Apparently, in rivers with smaller seasonal size fluctuations, this balance remains positive for birds, but in other environments, such as in Cuyín Manzano, this relationship becomes negative.

Based on our the results, we propose the use of Simuliidae, *Smicridea* spp., Atalophlebiinae, and Gripopterygidae (which represent ≥ 80% Torrent Duck diet in the area), as a simple tool to evaluate an important aspect of habitat quality in northwestern Argentine Patagonia, by calculating their availability per m^2 of river, and categorizing different river environments according to Torrent Duck food availability. Nevertheless, habitat quality is a result of several factors such as availability and accessibility of food, Torrent Duck energy intake and predation risk, as well as environmental stability (Godfrey 2003). Nevertheless, if we consider only feeding areas (those with rapids) territories with higher proportion of large rocks were smaller (Manso Medio and Los Cántaros) than those possessing a riverbed with smaller rocks. A smaller substratum size would be more unstable during a flood, whereby a larger territory could indicate a compensation to the effects in the reduction of food after flood, being this phenomenon cited as problematic for the species (Pernollet *et al.* 2013). In the case of Cuyín Manzano, territory size could also compensate for declining food availability during autumn. Finally, it is important to note that the study sites surveyed may not represent the optimal habitat for these birds.

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Table 1. Mean/year physical features in Cuyín Manzano, Villegas, Manso Medio and Cascada de los Cántaros.

Parameters	Cuyín Manzano	Villegas	Manso Medio	Cascada de los Cántaros
Altitude (MASL)	1,050	585	823	908
Precipitation (mm)	900	1,200	1,800	3,000
River Depth (cm)	50	50	180	70
River Width (m)	16	17	27	9
Velocity (m^2/s)	1.3	1.5	1.1	1.6

Table 2. Torrent Duck (*Merganetta armata*) food availability during spring and autumn in Cuyín Manzano, Villegas, Manso Medio, and Cascada de los Cántaros. Proportion of each taxon is expressed as percentages. Frequency is calculated as % of total number of prey S = spring; Au = autumn; L = larvae; P = pupae; N = nymphs; A = adult.

	Frequency (%)							
Prey item	Cuyín Manzano		Villegas		Manso Medio		Cascada de los Cántaros	
	S	Au	S	Au	S	Au	S	Au
Plecoptera								
Klapopteryx sp. (N)			1.15	9.75			0.94	0.58
Gripopterygidae (N)	24.58	37.20	13.35	6.95	3.55	1.90	0.88	15.52
Ephemeróptera								
Atalophlebiinae (N)	50.95	18.75	27.80	8.65	5.55	8.67		4.52
Beatidae (N)	3.30	22.65	2.05	21.9	2.05		0.46	
Trichoptera								
Smicridea spp. (L)			1.05	15.9	2.70	74.80	5.76	
Smicridea spp. (P)								33.40
Hydrobiosidae (L)							3.76	0.78
Ecnomidae							4.62	
Díptera								
Simuliidae (L)	11.47	0.30	21.10	0.45	79.15	7.65	1.10	18.32
Simuliidae (P)	0.17	0.25	3.90		5.00	0.90		
Blephariceridae (L)	2.30		17.65					

Chironomidae (L)	0.33	20.85		17.70			61.20	26.88
Athericidae (L)	5.25			1.55				
Empididae (L)			1.95	15.9				
Empididae (A)				1.25	4.05			
Coleoptera								
Elmidae (L)	1.65					4.03		
Basommatophora								
Chilinidae							7.98	
Total prey numbers	205	551	148	267	285	4,929	212	1,693

Table 3

Diet of Torrent Ducks (*Merganetta armata*) during spring and autumn in Cuyín Manzano, Villegas, Manso Medio and Cascada los Cántaros. Proportion of each taxon is expressed as percentages. Frequency is calculated as % of total number of prey. S = spring; Au = autumn; L = larvae; P = pupae; N = nymphs; A = adults.

	Frequency (%)							
Prey item	Cuyín Manzano		Villegas		Manso Medio		Cascada de los Cántaros	
	S	Au	S	Au	S	Au	S	Au
Gripopterygidae (N)			0.10	8.50	0.10	0.10	29.50	4.50
Atalophlebiinae (N)			-	13.90	-	0.03	22.50	9.40
Smicridea spp. (L)			3.60	21.90	35.00	2.10	0.40	79.90
Hydrobiosidae (L)							6.60	2.40
Simuliidae (L)	54.60	53.70	79.90	34.30	57.90	88.87	17.40	2.40
Simuliidae (P)	45.20	45.60	3.40	3.40	6.80	8.90	17.00	1.00
Blephariceridae (L)	0.10	-	4.70	-				
Blephariceridae (P)			8.00	0.30				
Chironomidae (L)	0.10	0.70	0.20	14.30			3.90	-
Others (5 spp.)			0.10	3.40	0.20		2.70	0.20
Number of feces	10	10	10	10	10	8	10	10
Total prey numbers	1,854	1,483	1,014	614	1,055	3,751	488	1,319

Table 4

Prey selection calculated using Bonferroni (Bonf.) confidence intervals for the proportion of use of main prey types by Torrent Ducks (*Merganetta armata*) in Nahuel Huapi National Park. In all cases, a difference at the 0.05 level of significance was found. (+) consumed more than expected, and (-) consumed less than expected. A = percentage of taxon found in the river; O = percentage of taxon found in feces; L = larvae; P = pupae; N = nymphs.

Site	Prey item	Spring			Autumn		
		A	O	Bonf.	A	O	Bonf.
Cuyín Manzano	Simuliidae (L)	11.47	54.60	(+)	0.30	53.70	(+)
	Simuliidae (P)	0.17	45.20	(+)	0.25	45.60	(+)
	Other	88.36	0.20	(-)	99.45	0.70	(-)
Villegas	Gripopterygidae (N)				6.95	8.50	(+)
	Atalophlebiinae (N)				8.65	13.90	(+)
	Smicridea spp. (L)				15.90	21.90	(+)
	Simuliidae (L)	21.10	79.90	(+)	0.45	34.30	(+)
	Simuliidae (P)	3.90	3.40	(0)	0.00	3.40	(+)
	Blephariceridae (L)	17.65	4.70	(-)			

	Blephariceridae (P)	0.00	8.00	(+)			
	Chironomidae (L)				17.70	14.30	(-)
	Other	47.35	4.00	(-)	50.35	3.70	(-)
Manso Medio	*Smicridea* spp. (L)	2.70	35.00	(+)			
	Simuliidae (L)	79.15	57.90	(-)	7.65	88.87	(+)
	Simuliidae (P)	5.00	6.80	(+)	0.90	8.90	(+)
	Other	13.15	0.30	(-)	91.45	2.23	(-)
Cascada de los Cántaros	Gripopterygidae (N)	0.88	29.50	(+)	15.52	4.50	(-)
	Atalophlebiinae (N)	13.30	22.50	(+)	4.52	9.40	(+)
	Smicridea spp. (L)				0.00	79.90	(+)
	Hidrobiosidae (L)	3.76	6.60	(+)			
	Simuliidae (L)	1.10	17.40	(+)	18.32	2.40	(-)
	Simuliidae (P)	0.00	17.00	(+)			
	Chironomidae (L)	61.20	3.90	(-)			

Other	19.76	3.10	(-)	61.64	3.60	(-)

Table 5

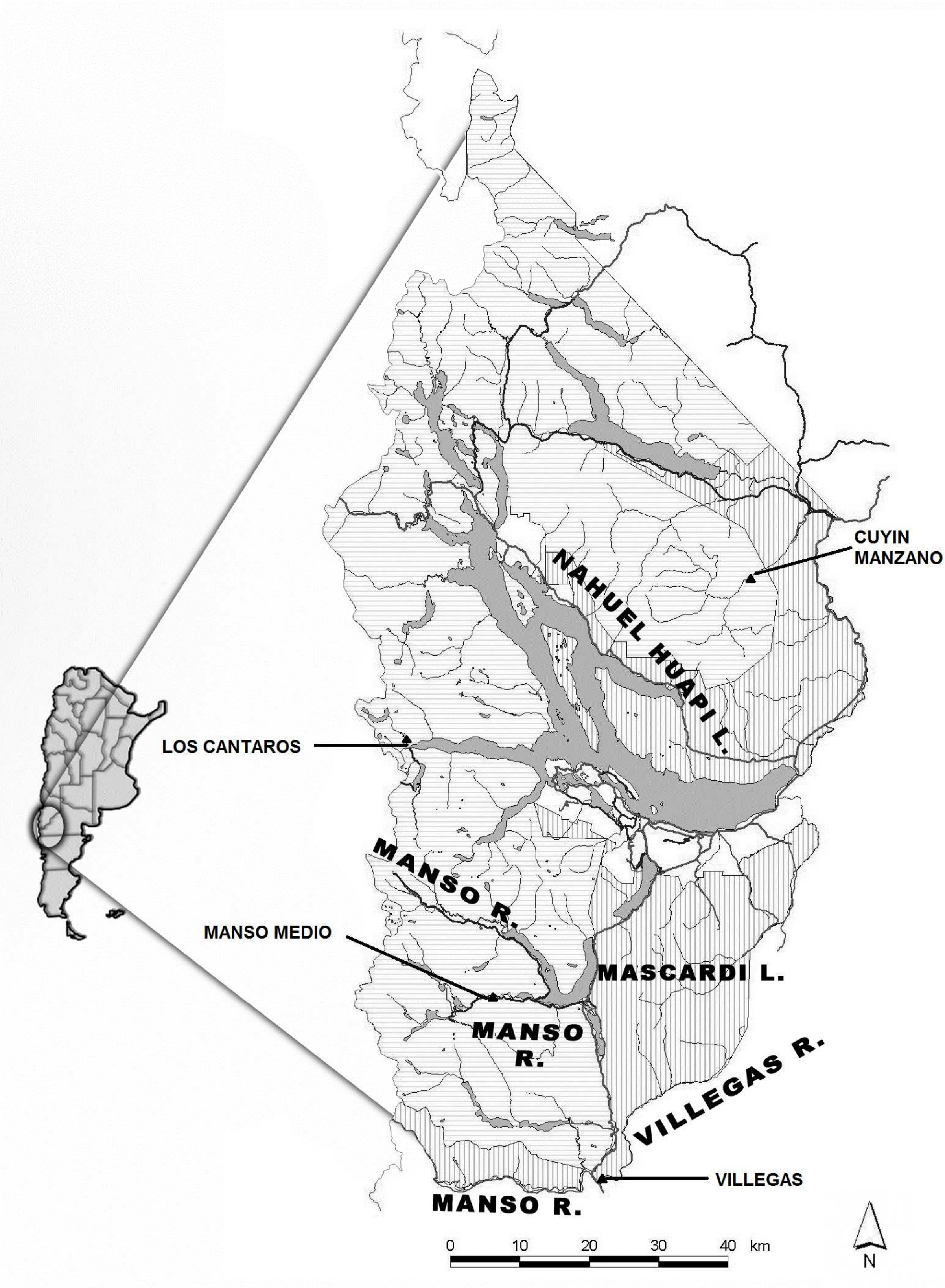
Energy density per area EDA (kJ/m²) of main prey of Torrent Ducks (*Merganetta armata*) in four territories in Nahuel Huapi National Park. S= spring; A= autumn; R. width: river width; TED: EDA weighted by width; BB-RV = Proportion between big boulders and medium to small rocks in the riverbed.

	Cascada de los Cántaros		Manso Medio		Villegas		Cuyín Manzano	
Season	S	A	S	A	S	A	S	A
EDA (kJ/m^2) Riverbed	1.47	0.43	1.91	5.35	1.59	5.38	1.79	2.14
EDA (kJ/m^2) Rock surface	0.44	31.38	2.41	194.00	0.45	0.31	1.08	3.63
BB-RV	4-1		3-1		1-1		1-3	
Total EDA (kJ/m^2)	0.65	25.19	2.28	146.80	1.24	2.85	1.61	2.51
R. width (m)	9.30	8.10	33.72	28.63	13.67	10.98	30.67	12.00
TED (kJ/m^2 * width)	6.04	204.00	76.88	4,203	16.95	31.29	49.38	30.12

FIGURE CAPTIONS

Figure 1: Territories of Torrent Duck sampled in Nahuel Huapi National Park, Northwestern Patagonia, Argentina. L = Lake; R = River. Triangles mark sample sites.

Figure 1



CUYIN MANZANO
NAHUEL HUAPI L.
LOS CANTAROS
MANSO R.
MANSO MEDIO
MASCARDI L.
MANSO R.
VILLEGAS R.
VILLEGAS
MANSO R.
0 10 20 30 40 km
N