

## REPORT

# TROPHIC SPATIAL VARIATIONS IN THE SOUTHERN RIVER OTTER, *Lontra provocax*, IN FRESHWATER HABITATS, CHILE

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(received 23<sup>rd</sup> March 2011, accepted 4<sup>th</sup> August 2011)

**Abstract:** We assessed spatial differences composition between different water bodies in diet of southern river otter (*Lontra provocax*, Thomas, 1908) from 196 scats collected between years 2003-2006 during surveys in freshwater environments in south of Chile (39° and 40° S and 71.5° and 73° W). For the whole study area, crustaceans from two genera (*Samastacus* sp. and *Aegla* sp.) were the otter's main food category, representing almost 100 % frequency of occurrence of the consumed preys. Fish can be considered as secondary item in a general approximation to otter diet. Predation upon others vertebrates (amphibians, birds and mammals) and invertebrate (mussels and insects) were rather rare in the diet of the otter, while no reptiles were observed. We described occurrence, frequency of occurrence and quantity of prey items to compare the otter diet between freshwater habitats (rivers, streams and lakes). We discuss implications of our results and compare it with similar diet studies on the species.

Keywords: *Lontra provocax*, Southern river otter, crustaceans, diet.

## INTRODUCTION

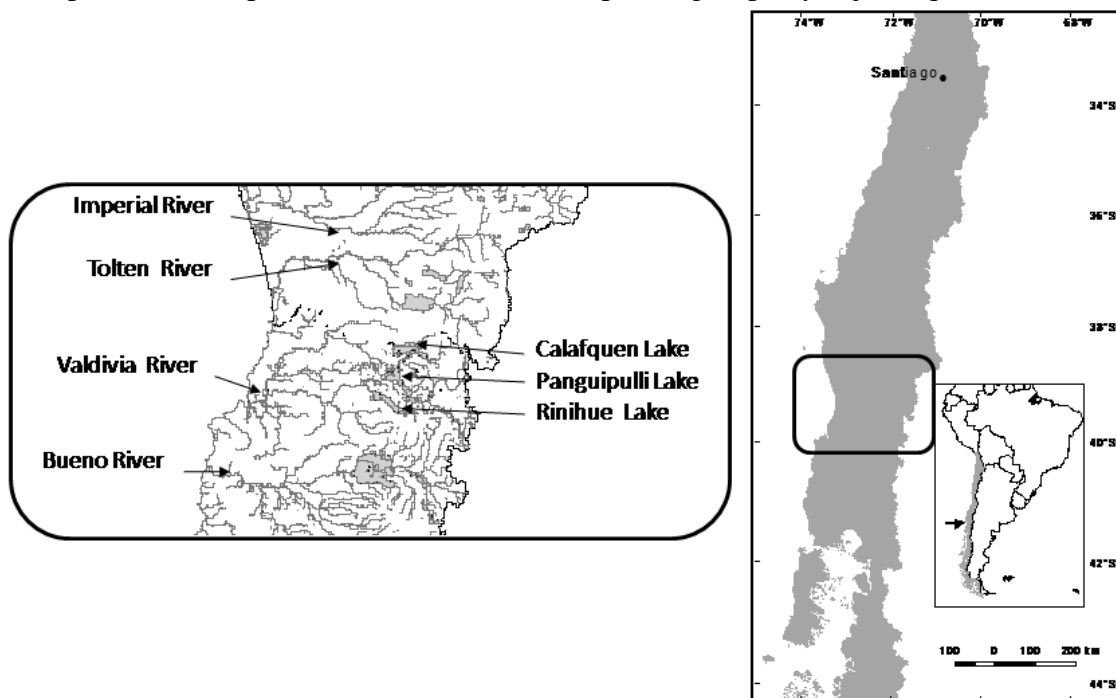
The Southern river otter (*Lontra provocax* Thomas 1908) is one of the two otter species that inhabits Chile. The conservation status of the southern river otter in Chile is of concern mainly due to the dramatic decline in the last 100 years of its freshwater distribution (Medina, 1996). The comparison of the diet composition between different habitats determines patterns in resources use that is a trophic indicator of species needs (Fasola et al., 2006). We compared the diet components of southern river otter scats collected from 3 different types of water courses (rivers, stream and lakes), because each of these types of water courses have different traits in magnitude and represents a different quality of habitat available for the southern river otter.

## MATERIALS AND METHODS

The vegetation characteristics for this area are Evergreen Forest in the Coastal Range, associations of *Nothofagus* species Roble-Raulí-Cohiue in the Coastal Range and Pre-Andean Range and Araucaria and Lenga Forest in the highest parts of the Andean Range (CONAF et al., 1999). As part of the research work of the Southern river otter Conservation Project (ROCP) 196 otter scats were collected in different watersheds in Chile during August 2003 to March 2006. The study area represents part of the Imperial, Tolten, Queule, Lingue, Valdivia and Rio Bueno watersheds and extends from 38° 20' to 40° 30' South and from 71° 40' to 73° 30' West covering the XIV District and the southern part of the IX District in Chile (Fig. 1).

The survey method was based on the classic methodology used for the European otter (Reuther et. al., 2000). Scats collected year around were stored in paper bags until dry at ambient temperature (20 °C approx.) and re-stored in newer paper bags for latter analysis. The prey identification was made by comparisons to reference material and expert identification from the Instituto de Ecología y Evolución, Universidad Austral de Chile, identifying to genus level when possible using reference material. The results were tabulated as occurrence (number of scats in which a species occurred) and frequency of occurrence (number of scats in which a species occurred divided by the total number of scats collected) (Erlinge, 1968) and the amount of identifiable items.

We used GIS software Arcview 3.2 (ESRI) to categorize types of lotic water bodies using Strahler's order method (1964) to assign a water course order number; we compiled these in three groups: stream (water bodies with 1 to 3 order), river (water bodies with 4 to 6 or up order) and lakes. To test differences between water bodies and diet composition we use Chi-square test of goodness of fit ( $\alpha=0.05$ ). After this process we explored differences between paired groups by adjusting the  $\alpha$  level.



**Figure 1.** Study area: on the left map is detail of the area covered with major river basins named; on the right is the position with respect to the South American continent.

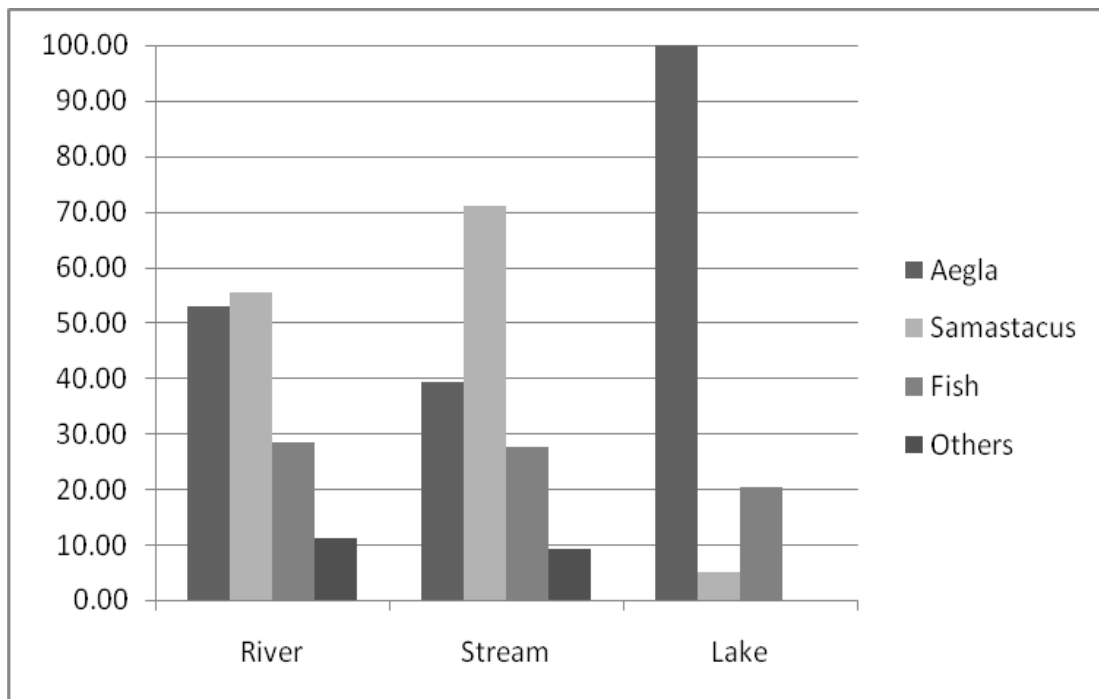
**RESULTS**

We collected a total of 196 otter scats, 81 from rivers, 76 from streams and 39 from lakes. A maximum of eight species/classes were found ranging from three species/classes in lakes, seven in streams and eight in rivers (Table 1). For all the sites crustaceans were represented by two genera, namely *Aegla* sp. and *Samastacus spinifrons* that were the most important component with a frequency of occurrence of 99% and 46% respectively, followed by fish representing 16% frequency of occurrence.

**Table 1.** Occurrence (O) and frequency of occurrence (FO) of southern river otter scats collected at 3 different water bodies; number of collected scats are in parentheses.

Prey species	River (n=81)		Streams (n=76)		Lakes (n=39)	
	O	FO(%)	O	FO(%)	O	FO(%)
<i>Aegla</i>	44	54	30	39	39	100
<i>Samastacus</i>	45	56	54	71	2	5
Fish	23	28	21	27	8	20
Mammals	2	2	2	3	-	-
Amphibians	2	2	2	3	-	-
Birds	2	2	1	1	-	-
Insects	2	2	2	3	-	-
Mussels	1	1	-	-	-	-

Within crustaceans *Aegla* sp. represent 100% of frequency of occurrence in scats from lakes sites, vs. 54 % in rivers and 39% in streams. The otters also consumed the crustacean *S. spinifrons*, but this represents only 5% in lakes, 55 % in rivers and 71% in streams. Fish item were more frequent in scats collected at the running waters course than at the lakes sites, in this order: rivers > streams > lakes (frequency of occurrence of 28%; 27%, and 20% respectively) (Table 1, Fig. 2). The other items (mammals, birds, amphibians, insects and mussels) presented marginal values (Table 1).



**Figure 2.** Frequency of occurrence of various components of otter's diet for different aquatic systems.

To assess differences between groups we grouped mammals, birds, amphibians, insects and mussels into a single group, thus totalling four groups. The Chi-square test showed significant differences between watercourses and diet composition (Chi square= 48.883,  $df=6$ ,  $P<0.0001$ ). The differences between paired groups were significant for all cases except rivers and streams (adjusted  $\alpha$  error:  $P>0.0170$  (Figure 2, Table 1).

## DISCUSSION

As described in previous studies of southern river otter's diet from freshwater habitats our results confirmed that crustaceans were the most important component (Chehébar, 1985; Medina, 1997; 1998; Fasola et al., 2006). Contrary to Medina (1997) we did not find significant differences between rivers or lakes for fish, but marked differences were observed in the crustaceans between rivers/streams and lakes. We found great amounts of *S. spinifrons* in scats from running waters vs. the almost absent occurrence in lakes where the diet was mainly composed by *Aegla* sp. crustaceans.

The older diet studies of southern river otter in freshwater habitats suggest that crustaceans are the most important food items, followed by mussels (Chehébar et al., 1986; Medina, 1991). However, the later studies (Medina, 1997, 1998; Gonzalez and Medina, 2006; Fasola et al., 2006) observed that the second major item detected was fish, just as we observed in our results. We attribute this difference mainly to an error in sample collection where prey debris was considered the same as otter scats, but which could probably have been consumed by other species as rats (*Rattus* sp.) (Sepúlveda pers. observ.).

The diet composition in the studied lakes depends almost exclusively on *Aegla* genus and as observed in other studies the diet composition on lakes was less diverse than that on rivers (Medina, 1998), suggesting a major dietary vulnerability of the otters in this habitat compared to rivers. However, otter diet studies in Todos los Santos Lake inside the Vicente Perez Rosales National Park in Chile (Medina, 1998; Ruiz et al., in prep) reported higher presence of *S. spinifrons* in the otter's diet. Probably these differences could be attributed to better habitat conditions for otter prey as woody debris cover and riparian vegetation necessary to maintain *S. spinifrons* populations is more common in those lakes with protected status. The lakes in our study are without protection and experience large amounts of tourist activity that could be affect the habitat in a similar way to that described for northern hemisphere temperate lakes, where lake development with tourist cabins affect these habitat variables (Christensen et al., 1996). The prey relationship in oligotrophic lakes could explain in part the absence of otters from Villarrica, Rupanco, Caburga, Colico and Llanquihue, where otters do not occur at present (Sepúlveda et al, in prep).

In the last 25 years, *Aegla* sp. have experienced progressive reductions in their population due to severe deterioration of Chilean stream environments (Jara, 1996; Bahamonde et al., 1998; Jara, 2005). The distribution and conservation status of all Chilean Aeglidæ freshwaters crabs (17 species and subspecies) classifies two of the species as "extinct in the wild", three as "critically endangered" and six as "vulnerable" (Perez-Losada et al, 2002). *Samastacus spinifrons* faces similar threats to the otter mainly based in habitat deterioration (Rudolph, 2002; Bahamonde et al., 1998). In the case of freshwater fish the situation in Chile is very critical, being one of the most threatened taxa (Campos et al, 1998; Habit et al., 2006).

The implications for the southern river otter and its prey species conservation are complex. In general it seems that as predator and prey share similar traits, local extinctions of the river otter and its prey can be expected.

**Acknowledgements** - We are grateful to the Frankfurt Zoological Society for funding this research (Project FZS 1247/98). Thanks to L. Castaneda and R. Barbare for statistical advice, to M. Franco and M. Soto for access to laboratory facilities, and special thanks to the Southern River Otter Conservation Project's volunteers that helped in fieldwork. M. A. Sepúlveda is supported by a Fulbright-CONICYT scholarship.

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## RÉSUMÉ

### VARIATIONS GEOGRAPHIQUES DU REGIME ALIMENTAIRE DE LA LOUTRE DU CHILI, *Lontra provocax*, EN EAU DOUCE AU CHILI

Nous avons étudié les différences de régime alimentaire de la Loutre du Chili (*Lontra provocax*, Thomas, 1908) en fonction de divers types de milieux aquatiques et ce à partir de 196 épreintes collectées entre 2003 et 2006 à l'occasion d'enquêtes en milieux dulçaquicoles dans le sud du Chili (39° et 40° S et 71.5° et 73° W). Sur l'ensemble de l'aire d'étude, les crustacés de deux genres (*Samastacus* sp. et *Aegla* sp.) constituent la première catégorie de proies des loutres. Le poisson peut être considéré comme la seconde catégorie de proies. La consommation d'autres vertébrés (amphibiens, oiseaux et mammifères) et d'invertébrés (moules et insectes) s'est révélée relativement rare tandis qu'aucun reste de reptile n'a été retrouvé. Nous nous sommes attardés à décrire l'occurrence, la fréquence d'occurrence et l'abondance de chaque proie afin de comparer les régimes des loutres sur différents habitats d'eau douce (rivières, ruisseaux et lacs). Nous avons enfin discuté des implications de nos résultats et les avons comparés à d'autres études similaires de régimes alimentaires.

## RESUMEN

### VARIACIÓN DE LA ECOLOGÍA TRÓFICA DEL HUILLÍN *Lontra provocax* EN DIFERENTES AMBIENTES DE AGUA DULCE, CHILE

Evaluamos la composición de la dieta del huillín (nutria de río del sur; *Lontra provocax*, Thomas, 1908) a partir de 196 fecas recogidas en prospecciones realizadas entre los años 2003-2006 en diferentes cuerpos de agua dulce en el sur de Chile (39 °S y 40 °S y 71,5 °W y 73 °W). Para el área de estudio, los crustáceos de dos géneros (*Samastacus* sp. y *Aegla* sp.) fueron la categoría de alimentos principales de del huillín, representando casi el 100% de frecuencia de ocurrencia de las presas consumidas. Los peces se observaron como un item secundario en importancia general en la dieta del huillín. La depredación sobre otros vertebrados (anfibios, aves y mamíferos) e invertebrados (moluscos e insectos) fueron bastante raros en la dieta de la nutria, mientras que no se observaron reptiles. Se describe la ocurrencia, la frecuencia de ocurrencia y los tipos de presas para comparar la dieta del huillín entre distintos tipos de hábitats de agua dulce (ríos, arroyos y lagos). Se discuten las implicaciones de nuestros resultados y se comparan con estudios de dieta similares para la especie.