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Short Note

First Detection of *Lontra provocax* in an Unexplored Hydrological Basin of Central-Southern Chile

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The Family Mustelidae in Chile includes five species belonging to four genera. The quique (*Galictis cuja*) and the huroncito patagónico (*Lyncodon patagonicus*) are terrestrial species that occur in arid and semi-arid forested environments (Sade et al., 2012; Formoso et al., 2016), while the chungungo (*Lontra felina*) and the huillín (*Lontra provocax*) are semi-aquatic species that live in rocky intertidal coastal habitats and lentic and lotic freshwater systems, respectively. Furthermore, these otters can coexist in coastal ecosystems on the inland sea of southern Chile (Medina, 1996; Córdova et al., 2009; Sanino & Meza, 2016). Lastly, the American mink (*Neogale vison*) is an exotic species that has been present in the extreme south of Patagonia, Chile, since the 1930s. It has successfully expanded its distribution, currently reaching the Araucanía Region, more than 2,000 km north of the first reports of the liberation in Tierra del Fuego. It has also been observed in sympatry with both species of native otters (Medina, 1997; Sielfeld & Castilla, 1999; Jaksic et al., 2002; Fasola et al., 2009).

Since the first nominal description of *L. provocax* (Thomas, 1908; Carnivora: Mustelidae) from type specimens from Lake Nahuel Huapi in Argentina, this species has been scarcely recorded in nature because its population densities are less than one individual/km^2 (Medina, 1996; Sielfeld & Castilla, 1999). For this reason, most of the ecological knowledge on this species comes from studies that used non-invasive methods—for example, locating latrines, feces, and burrows to analyse their trophic ecology and camera traps to record and infer aspects of their population ecology (Medina, 1998; Medina-Vogel & Gonzalez-Lagos, 2008; Franco et al., 2013; Sepúlveda et al., 2014; Sanino & Meza, 2016). This also explains their scarce records in the largest biodiversity online portal Global Biodiversity Information Facility (GBif). There are also few molecular records in GenBank, mainly because obtaining molecular information requires a careful, expensive, and very elaborate intervention protocol to reduce damage to the few individuals captured (Vianna et al., 2011; Cianfrani et al., 2018; Pizarro et al., 2021).

L. provocax was historically distributed in Chile between 34° and 54° S; however, high poaching intensity in the past coupled with habitat degradation and fragmentation reduced its northern distribution by approximately 570 km (Chehébar, 1986; Medina-Vogel et al., 2021). The decline of the Valdivian temperate rainforest, with which this species is closely associated, contributed to its status as an "Endangered Species" under the A3cde criteria of the *Red List* of the International Union for Conservation of Nature (Carmanchahi et al., 2006; Sepúlveda et al., 2015; IUCN, 2017). Therefore, increasing our understanding of the presence, distribution, and abundance of *L. provocax* is essential for furthering our biological and ecological knowledge and for facilitating the planning of more effective conservation and management strategies for this species and its habitat (Sepúlveda et al., 2007).

We report the presence of *L. provocax* in a complex and little-studied hydrographic network from central southern Chile, specifically on the westernmost edge of the Río Bueno basin. The main channel of this basin runs 130 km to empty at latitude 40° 14' S of the eastern South Pacific, approximately 300 km south of the current northern limit of their distribution. Most of the hydrographic basins that originate in the largest lakes of the southern Araucanian district (i.e., Ranco, Maihue, Puyehue, Rupanco, Llanquihue, and Todos Los Santos; Caspers, 1963) converge in the study area (Figure 1). Its adjacent drainage area used in forestry and agricultural activities helps to maintain a riparian forest diverse in native species dominated by swampy Myrtaceae forests known as pitranto due to the dominance of pitra or patagua (*Myrceugenia exsucca*) along with temu (*Blepharocalyx cruckshanksii*), chequén (*Luma chequen*), and tepú (*Tepualia stipularis*) (Ramírez et al., 1983). Although this area shares its northern border with two important protected areas, Valdivia Coastal Reserve and Alerce Costero National Park, the Río Bueno basin is little known in its biodiversity and environment. However, the underlying biodiversity of the region is beginning to be scientifically demonstrated. For example, 29 species of aquatic birds coexist in the wetlands associated with the main channel of the basin (Tobar et al., 2021). In addition, the Río Bueno basin supports the greatest richness of freshwater fish species of the hydrographic systems of the Araucanian lakes and is the type locality of the recently described *Diplomistes habitae* (Soto & Arismendi, 2005; Muñoz-Ramírez et al., 2023).

During spring 2022 (September through December) and summer 2023 (January through April), ten sampling stations were established (Figure 1; Table 1), which cover approximately 70 km total starting in the mouth of the river. At each station, a Bushnell Model 119876 camera trap (Bushnell Outdoor Products, Overland Park, KS, USA), programmed to capture photographic images through motion detection, was installed and directed towards points of otter activity (i.e., zone where tracks, faeces, and latrines and/or burrows were found; Medina-Vogel et al., 2003; Cursach et al., 2022). Images obtained within periods separated by ≥ 1 h were considered independent records; and when several photographs were obtained at shorter time intervals, only the first photograph was considered an analytically valid record (Srbeck-Araujo & Garcia Chiarello, 2013; Hernández et al., 2015). During spring sampling, the cameras accumulated 636 d of activity, ranging between 109 d (Station 6) and 15 d (Stations 7 to 10). This disparity in sampling effort was due to the fact that the cameras at the last stations had battery problems. During the summer sampling, the cameras accumulated 607 d of recording, with ranges varying

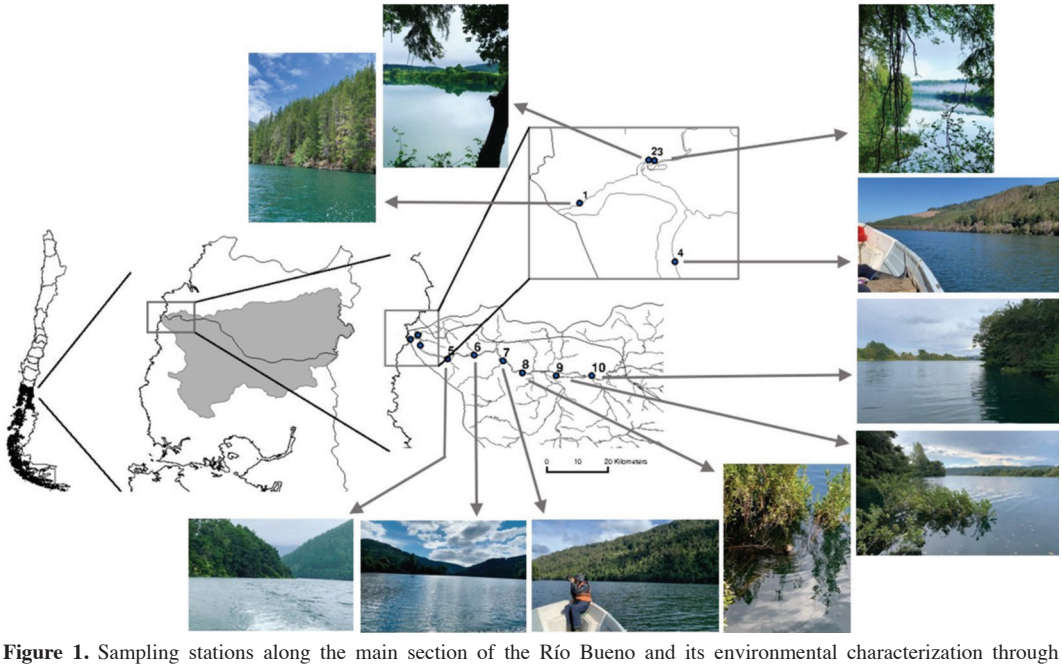

Figure 1. Sampling stations along the main section of the Río Bueno and its environmental characterization through photographic images of each point

Table 1. Geographic position and results of the observations obtained with the camera traps along the section of the Río Bueno during spring 2022 and summer 2023. *The observations of three and two individuals of *Lontra provocax* observed at Stations 7 and 10, respectively, during summer observations are accompanied by the images in Figure 2.

			Spring 2022			Summer 2023		
Sampling station	Latitude	Longitude	Camera trap activity time (d)	Number of records	Number of individuals	Camera trap activity time (d)	Number of records	Number of individuals
1	40° 14' 32.0"	73° 42' 33.6"	99	0	0	--	--	--
2	40° 13' 45.8"	73° 41' 12.2"	103	0	0	--	--	--
3	40° 13' 45.1"	73° 41' 18.6"	50	1	1	--	--	--
4	40° 15' 35.4"	73° 40' 50.1"	108	0	0	92	0	0
5	40° 17' 59.3"	73° 36' 03.0"	107	0	0	99	0	0
6	40° 17' 16.3"	73° 31' 21.0"	109	0	0	91	0	0
7	40° 18' 17.9"	73° 26' 15.4"	15	1	1	92	29	3*
8	40° 20' 24.6"	73° 22' 51.0"	15	0	0	69	4	1
9	40° 20' 53.6"	73° 16' 53.3"	15	3	1	73	36	1
10	40° 20' 53.6"	73° 10' 38.0"	15	2	1	91	46	2*

between 99 d (Station 5) and 73 d of activity (Station 9). The cameras from the first three stations disappeared, so we do not have data for them (Table 1). The photographed individuals were identified using identification keys and specialized field guides (Iriarte, 2008; Iriarte & Jaksic, 2017), and were validated by taxonomic specialists of the Centro de Investigación para la Sustentabilidad (CIS), Facultad de Ciencias de la Vida, Universidad Andrés Bello, Chile.

We recorded four and seven individuals of *L. provocax* in spring and summer, respectively. The westernmost record was an individual in spring located approximately 30 km from the coast (Station 3). The remaining records were observed further inland, specifically between Stations 7 and 10. In fact, in both sampling periods, the largest number of independent records occurred in Stations 9 and 10. Although the number of records was noticeably greater in summer at these stations, it is important to note that the spring recording was comparatively underestimated because the cameras worked five to six times less often in the spring than in the summer. Additionally, 29 independent records were obtained at Station 7 during the summer, some of which showed three individuals simultaneously (Table 1; Figure 2A). Of the 46 independent records at Station 10, some of them showed the presence of two individuals simultaneously (Table 1; Figure 2B). The places with the greatest records coincide with the areas best known by the locals, who for years have orally reported sightings of *L. provocax* in the river and facilitated the discovery of these sites of activity. In contrast, the westernmost stations are more inaccessible and have therefore been less explored, making it extremely difficult to find evidence of activity of *L. provocax* at these sites (Santibañez, pers. comm.).

Based on the frequency of independent records and the number of observed individuals, there was a trend towards higher levels of activity in the summer period (January through April). The largest number of independent records are of single individuals because *L. provocax* is a rare species with solitary habits except during mating, which generally occurs between late autumn and winter, and during rearing in late spring and summer (Sepúlveda et al., 2007; Iriarte, 2008; Dougnac et al., 2022). However, we recorded a group of three *L. provocax* individuals with a camera trap for the first time (Station 7, summer sampling; Figure 2A). The differences in individual size suggest that this could be a family group composed of a larger mother and two smaller juveniles (Medina-Vogel, pers. comm.). This finding, together with the record of two individuals simultaneously at Station 10 during the summer (Figure 2B), suggests that the easternmost sector of the sampling area is not only a zone of high activity of *L. provocax*, but it also contains conditions that may stimulate the breeding and reproduction of this species. The highest density and activity of otters are located in an environmentally heterogeneous area, where

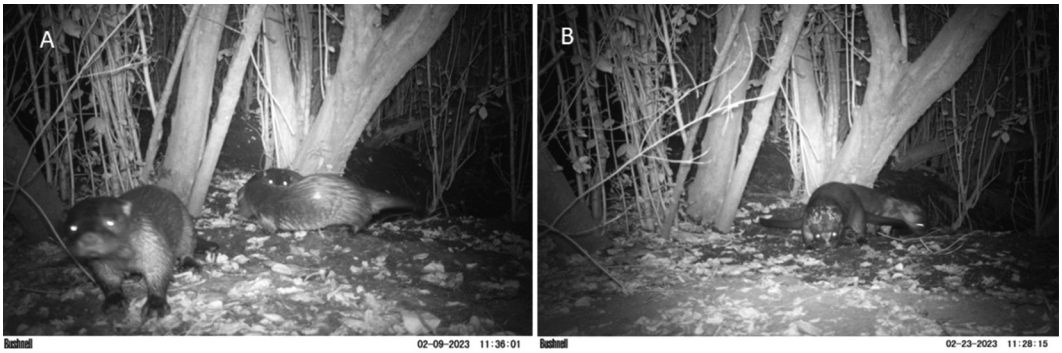

Figure 2. The records of three (A) and two (B) individuals of *Lontra provocax* observed in the sampling sites, Stations 7 and 10, respectively (photographs taken with camera traps)

patches of swampy forests are combined with temporary and permanent wetlands. These sampling stations were located on Momberg Island, which divides the flow of the main channel, modifying their hydrodynamic patterns with probable local bottom-up consequences associated with variations in nutrient accumulation dynamics (Tobar et al., 2021). On the other hand, the high navigability of the study site due to its depth, width, and slow flow speed constitutes an environment of low hydrodynamic energy that favors the establishment of *Aegla denticulata denticulata* (Parra et al., 2011), the most abundant freshwater crab in the area, while the structure of the swampy forest formed by the pitranto offers an adequate refuge and food environment for the river shrimp (*Samastacus spinifrons*; Rudolph, 2002). Considering that decapod crustaceans constitute an important fraction of the diet of river otters, including *L. provocax* (Medina, 1997, 1998; Medina-Vogel & Gonzalez-Lagos, 2008; Fasola et al., 2009; Rodríguez-Jorquera & Sepúlveda, 2011; Franco et al., 2013; Fuentes & Arriagada, 2023), it is feasible to hypothesize that the environmental conditions of the study area optimally adjust to their trophic and reproductive niche requirements.

These data not only increase knowledge about the presence of *L. provocax* within its current distribution but also highlight the study area as an ecologically relevant site for the feeding and reproduction of this species. This promotes additional studies that would include the entire hydrographic network of the Río Bueno to establish priority areas for habitat conservation and sustainability of underlying ecosystem services—for example, the Recovery and Conservation Action Plan (RECOGE) by the Chilean Ministry of Environment (https://mma.gob.cl/biodiversidad/planes-de-recuperacion-conservacion-y-gestion-de-especies) or additional strategies for integrated management of hydrographic basins (Cassini et al., 2010; Campbell, 2016).

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