MORPHOLOGY AND PHYSIOLOGY

The cephalic lateral line system of temperate perches (Perciformes: Percichthyidae) from Argentinean Patagonia

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ABSTRACT. The species of *Percichthys* (Percichthyidae) are endemic to southern South America. Some authors have pointed out that the genus includes four valid species, based on the morphology of the head, jaws, and fins. A phylogenetic analysis published by other authors suggests that three of them are morphotypes belonging to the same species, *Percichthys trucha* (Valenciennes, 1833). The aim of this study is to describe for the first time the morphology of the cephalic seismosensory system of Patagonian perches, and how these characters vary in the three morphotypes, in order to provide morphological elements to analyze the taxonomy of these fish species. Comparisons of the cephalic seismosensory system between juveniles and adults were also conducted. Juvenile and adult specimens were collected in the northwestern Argentinean Patagonia. Specimens were bleached in 5% H_2O_2 and the canal systems of their cephalic lateral line were filled with hematoxylin. Specimens were deposited in the Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Argentina. The cephalic lateral line of the studied specimens is a widened type of canal systems, is not connected to the trunk lateral line, and consists of preopercular-mandibular canal, infraorbital canal, supraorbital canal, temporal canal, supratemporal canal, and a supraorbital commisure. The number of pores increases during the ontogeny, while their diameters decrease. The number, position and size of infraorbital canal pores showed significant differences among morphotypes and juveniles. The interpopulation variation regarding the number, position, and size of pores seems to signal an ongoing process of speciation, which is the result adaptations to different environmental conditions. Our study contributes to the knowledge of the morphology of percichthids and describes for the first time the seismosensory system of temperate perches.

KEY WORDS. Lateral line, morphology, morphotype, Patagonia, *Percichthys trucha*.

Species of Percichthyidae (Perciformes) occur in South America (Chile and Argentina) and Australia (Nelson 2006). The species of *Percichthys* Girard, 1855 are endemic to southern South America (López-Arbarello 2004, Ruzzante et al. 2006). In Argentina, three species of *Percichthys* have been recognized: *Percichthys trucha* (Valenciennes, 1833) (small-mouth perch), *Percichthys colhuapiensis* MacDonagh, 1955 (large-mouth perch), and *Percichthys laevis* (Jenyns, 1840) (Nelson 2006, López-Arbarello 2004). Of these, Koerber (2011) validated only two: *P. trucha* and *P. laevis*. Ruzzante et al. (2006, 2011), based on molecular studies of mitochondrial and nuclear DNA markers, suggested that all Patagonian *Percichthys* populations living east of the Andes belong to the same species, *P. trucha*. They also found important morphological differences between populations after morphometric analysis of the dorsal spines, gill rakers, and jaws. Considering the inclusion of the three species, *P. colhuapiensis*, *P. laevis*, and *P. trucha* into the *Percichthys* complex, made by

Ruzzante et al. (2011), the three species are believed to be morphotypes that overlap in their distribution. These morphotypes cannot be recognized at their early stages of development due the fact that their phenotypes differ according to environmental variables (Crichigno et al. 2014).

The lateral line is a mechanoreceptor system found in fish and amphibians (Northcutt 1989). It allows the animals to perceive the movements of the water around them (Dijkgraaf 1962). The cephalic lateral line canals of bony fish are contained in dermal skeletal elements of the cranium. There are four general types of cephalic lateral line canal systems: narrow-simple, narrow-branched, reduced, and widened (Webb 2000). These types of systems can be differentiated by the number and location of their pores, the shape of their canals, and the relationship between the canals and ossification of the head (Webb 2000). Variations in the morphology of the lateral line canals, the bones where they are contained, and the number and the

distribution of canal pores on the head, have been used extensively as characters in species descriptions and in phylogenetic reconstructions (Webb 2000, Kasumyan 2003, Fujita & Hosoya 2005, Takeuchi et al. 2011). The morphology of the lateral line system, and specifically of the cephalic lateral line, has already been described for many fish families of Cypriniformes (Fujita & Hosoya 2005, Takeuchi et al. 2011), and Perciformes (Iwami et al. 1999, Ahnelt 2001, Ahnelt et al. 2004, Fraser & Allen 2006, Senou & Aonuma 2007, Nakae et al. 2013). However, there are no studies of this structure for the members of Percichthyidae (Perciformes). In the taxonomic review by Arratia (1982), the cephalic canal system of *Percichthys* species are barely mentioned in relation to the cranial bones. López-Arbarello (2004) separated *P. colhuapiensis* from the other species based on the mandibular canal completely enclosed in the anguloarticular bone, among other features. In *P. trucha* and *P. laevis* the mandibular canal is partially enclosed in the bone. Taking into account the need for studies on the morphology of the cephalic lateral line canal system of *Percichthys*, and temperate perches in general, the aim of this study is to describe the morphology of the cephalic seismosensory system of Patagonian perches for the first time, and to document how it varies in the three morphotypes. We hoped to provide morphological elements to analyze the taxonomy of these fish. Moreover, comparisons between juveniles and adults from different lakes and rivers were performed, to provide additional information on the ontogenetic development of the cephalic lateral line system.

MATERIAL AND METHODS

Juvenile perches from 30 to 60 mm standard length (SL) were collected using seine nets from the littoral zone in three locations: five from the Limay River (40°42′S, 71°04′W), five from the Epuyen Lake (42°11′S, 71°30′W), from December 2010 to March 2011, and eight from the Musters Lake (45°25′S, 69°11′W) during April 2016. They were distributed into three morphotypes on the base of their geographic distribution (Ruzzante et al. 2006, 2011) and the following characters (López Arbarello 2004): the first morphotype (the small-mouth perch) corresponds to *P. trucha*, and is characterized by having the posterior border of the maxilla at the anterior border of the orbit or further forwards; the shortest upper jaw; and intermediated dorsal fin spine. The second morphotype (the large-mouth perch) corresponds to *P. colhuapiensis*, and is characterized by having the posterior border of the maxilla reaching the middle of the orbit or, more frequently, beyond, at the posterior half of infraorbital 2 or further; the longest upper jaw; and the shortest dorsal fin spine. The third morphotype (the intermediated-mouth perch) corresponds to *P. laevis* from Musters lake, and is characterized by the posterior border of the maxilla reaching the anterior border of the pupil, between the posterior border of the lacrhymal and the anterior half of infraorbital 2; an intermediate (in size) upper jaw; and the longest dorsal fin spine (López-Arbarello 2004, Ruzzante et al. 2011).

Six adult specimens (240 to 375 mm SL) of the large-mouth, and six of the small-mouth morphotype were collected from the Limay (39°17′S, 68°48′W) and Neuquén (38°34′S, 68°24′W) rivers (Rio Negro Drainage). Four specimens of the large-mouth morphotype were collected during October 2011 and two during May 2016, four specimens of the small-mouth morphotype during November 2011, and two in May 2016. Six adult specimens (160 to 360 mm SL) of the intermediate-mouth morphotype were collected from the Musters Lake (45°25′S, 69°11′W) (Chubut River Drainage), four during November 2011 and two during April 2016.

Juvenile perches of the small-mouth and large-mouth morphotypes (Epuyen-Limay juveniles) could not be separated because the characters used by Lopez-Arbarello (2004) are similar at the early stages of the fish (Crichigno et al. 2014). Therefore, for the morphological study, we analyzed them as a group. Juveniles of the intermediate-mouth morphotype can be identified since specimens can only be found in Musters Lake (Musters juveniles).

The specimens were preserved in 4% neutral buffered formalin. To clear the strongly pigmented skin, the fish were bleached in 5% H_2O_2. After that, the cephalic lateral line canal (CLLC) system was filled with hematoxylin following the method of Jakubowski (1967). All specimens were dehydrated and stored in 96% alcohol. The terminology used to describe the cephalic lateral line canals follows the works of Iwami et al. (1999) and Webb (2000). Pores were counted from one side of the fish. Capital letters were used to name the canals and lowercase letters and numbers to name the pores. The total number of pores was obtained by adding two times the number of pores of one side of the fish head to the supraorbital commisure (SOCom) pores. The standard length and the head length (distance from the tip of the snout to the distal point of the opercular spine) were measured from formalin preserved specimens sensu Ruzzante et al. (2011). The longest pore diameters were measured using the program Image ProPlus 4.0. For the analysis of the relationship between pore diameters and head length, only the mandibular canal pores and the first three preopercular pores were used, since this number remains the same during ontogeny and among the morphotypes. We used the terminology "canal segment" for any virtual section of a canal delimited by two pores.

Percichthys trucha specimens were deposited in the Ichthyological Collection of the Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (MACN-Ict). Juvenile: 10380 MACN-Ict (1 specimen, 43 mm SL). *Percichthys trucha,* small-mouth morphotype: 10377 MACN-Ict (1, 325 mm SL); large-mouth morphotype: 10378 MACN-Ict (1, 290 mm SL); the Musters morphotype: 10379 MACN-Ict (1, 230 mm SL).

A Kruskal-Wallis test with a 0.05% level of significance was used to compare: a) the number of pores; and b) the mean of pore diameters and head length ratio, among morphotypes (adults an juveniles). Additionally, a Wilcoxon non-parametric paired comparison test was performed to compare all perch groups.

RESULTS

Cephalic lateral line canal system (Figs. 1-11). The cephalic lateral line canal (CLLC) system of *Percichthys* sp. consists of the preopercular canal (POC), the mandibular canal (MC), the infraorbital canal (IOC), the supraorbital canal (SOC), the supraorbital commissure (SOCom), the temporal canal (TC), and the supratemporal canal (STC). The POC and the MC are confluent, forming the preopercular-mandibular canal (PMC). The cephalic canal system is separated from the trunk lateral line system. The number of pores at both sides of the head is the same. Juvenile perches, smaller than 30 mm SL, have an incomplete CLLC system, since not all the canals are developed.

Relation to cranial bones. The POC is located in the preopercular bone and the MC in the dentary and the anguloarticular bones. The IOC is located in the lachrymal and infraorbital bones. The SOC is located in the nasal and frontal bones, the TC is in the frontal and the pterotic bones, and the SOCom is in the frontal bone. The STC is located in the pterotic and the parietal bones. In adult perches, the MC is partially or totally enclosed in the dentary and the anguloarticular bones, as described LÓPEZ-ARBARELLO (2004). In addition, we found that the SOC is partially enclosed in the nasal and frontal bones, and the TC in the pterotic bone in the three morphotypes.

CLLC in juveniles (Figs. 1-6, Table 1). The canals are composed of an array of soft, ballooned-out segments, with 55 to 67 pores that communicate with the exterior. The POC joins the MC. The POC have six pores and the MC have four pores, one of which is terminal and is located under the mouth. During ontogeny, the POC can extend and merge with the TC. In this case, there is one more pore (po7) at the connecting point over the POC. The SOC has three pores, the first pore immediately posterior to the upper lip, the second pore dorsal to the nares, and the third pore dorsal to the eye. The SOCom joins the right and the left SOC, and at the middle of the canal connection, a *canaliculum* extends with a single terminal pore. The IOC has 10 to 11 pores, located as follows: io1 superior, io2 and io3 inferior, io4 superior, io5 inferior that could be branched in the Epuyen-Limay juveniles, io6 to io10 posterior. The IOC is joined to the SOC. At the convergence of these two canals, the
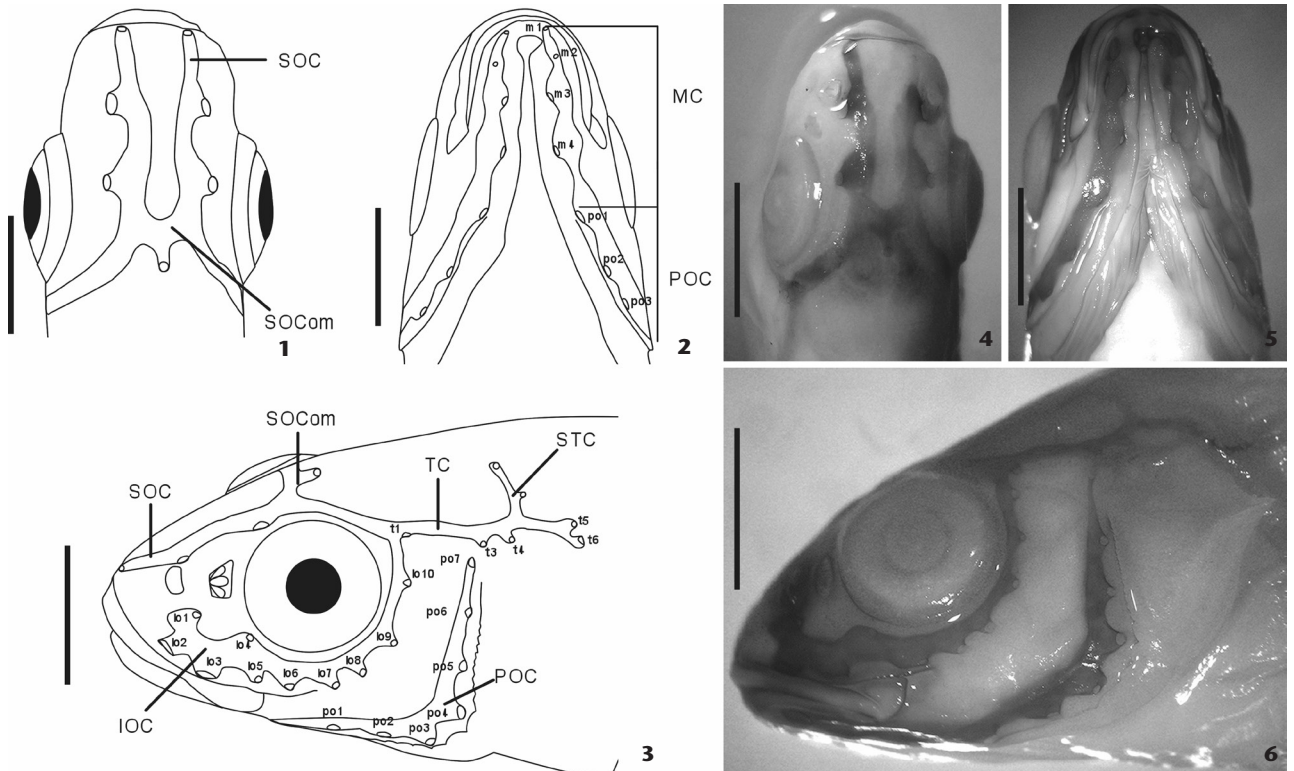
Figures 1-6. Cephalic lateral line canal system of juvenile perches. Diagram of dorsal and ventral view based on one specimen of *Percichthys trucha*, 43 mm SL (10380 MACN-Ict): (1) dorsal view showing the supraorbital canal (SOC) and the supraorbital commissure (SOCom); (2) ventral view showing the anterior part of the preopercular-mandibular canal (PMC); (3) lateral view based on a composite of specimens, showing the infraorbital canal (IOC), the preopercular section of the PMC, the temporal canal (TC), and the supratemporal canal (STC). (4-6) Photograph of the cephalic lateral line canal system of a *P. trucha* juvenile (43 mm SL) stained with hematoxylin: (4) dorsal view; (5) ventral view; (6) lateral view. Scale bars: 4 mm.
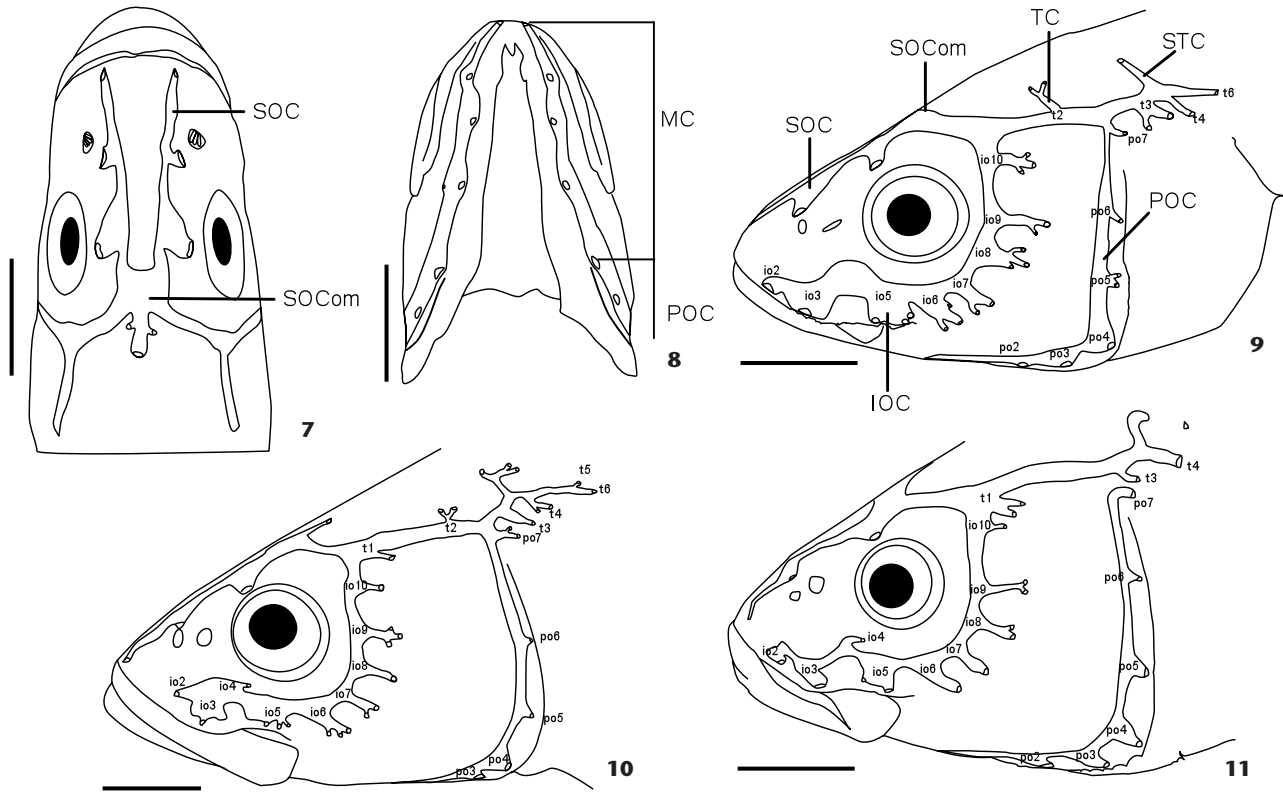
Figures 7-11. Cephalic lateral line canal system of adult perches. Diagram of dorsal and ventral view based on a composite of specimens: (7) dorsal view showing the supraorbital canal (SOC) and the supraorbital commissure (SOCom); (8) ventral view showing the mandibular and preopercular canals (MC, POC). (9-11) Diagram of lateral views based on specimens of each morphotype: (9) small-mouth morphotype (10377 MACN-Ict, 325 mm SL), lateral view showing the infraorbital canal (IOC), the preopercular section of the PMC, the temporal canal (TC), and the supratemporal canal (STC); (10) lateral view of the large-mouth morphotype (10378 MACN-Ict, 290 mm SL); (11) lateral view of the intermediated-mouth morphotype (10379 MACN-Ict; 230 mm SL). Scale bar: 20 mm.

Table 1. Body/head length and the number of pores in cephalic canals (from one side of head) in juveniles and three morphotypes of *Percichthys* (average ± standard deviation, range limits).

| | N | Standard length (mm) | Head length (mm) | IOC | SOC | PMC | | TC | STC | SOCom |
						MC	POC			
Epuyen-Limay juvenile perches	10	44.7 ± 10.0, 30-60	14.6 ± 2.2, 11-17.6	10.3 ± 0.5, 10-11	3 ± 0	4 ± 0	6.5 ± 0.5, 6-7	3.9 ± 0.9, 3-5	2.7 ± 0.5, 2-3	1 ± 0
Musters juvenile perches	8	40.7 ± 3.64, 36-46	12.8 ± 1.3, 11.2-15	10 ± 0	3 ± 0	4 ± 0	6.4 ± 0.5, 6-7	3.4 ± 0.5, 3-4	1.8 ± 0.5, 1-2	1 ± 0
Small-mouth perches	6	291.7 ± 163.8, 240-375	77.1 ± 8.8, 66-92	19 ± 3.6, 14-24	3 ± 0	4 ± 0	6.8 ± 1, 6-8	4.3 ± 2, 2-6	2.2 ± 1, 1-3	2.4 ± 1.6, 1-5
Large-mouth perches	6	301.8 ± 45.4, 260-365	95.1 ± 19.3, 71-126	14.5 ± 3.2, 11-20	3 ± 0	4 ± 0	7.2 ± 0.4, 7-8	5.2 ± 1.9, 3-8	2.2 ± 0.8, 1-3	2 ± 1.3, 1-4
Intermediated-mouth perches	6	235 ± 70.9, 160-360	67.6 ± 19.3, 50.3-90.6	11 ± 0.7, 10-12	3 ± 0	4 ± 0	7 ± 0.8, 6-8	3 ± 1, 2-4	2.5 ± 0.8, 1-3	2.2 ± 1.6, 1-5

TC begins. The TC has three to five pores, located as follows: t1 inferior, t2 is closed, and when presents, t3 to t4 inferior, t5 and t6 posterior. Posterior to the POC-TC connection, the STC begins. The STC has one to two pores in Musters juveniles and two to three pores in Epuyen-Limay juveniles. The number of pores at both sides of the head is symmetrical. The number of pores in the canals is the same in the MC, the SOC, and the SOCom in all specimens observed.

CLLC in adults (Figs. 7-11, Table 1). The canals are composed of an array of slightly inflated segments, some of which are branched into several *canaliculi* ending in pores. The POC joins with the MC. The POC has three single pores plus three *canaliculi*, bearing one to two pores. The MC has four pores. The POC merges with the TC and has a *caniculum* with one to two pores (po7) at the connecting point, except in some specimens of the Musters morphotype. The SOC has three pores, the first pore immediately

posterior to the upper lip, the second pore dorsal to the nares, and the third pore dorsal to the eye. The SOCom joins the right and the left SO canals, and at the middle of the canal connection, a *canaliculum* extends with a single terminal pore or the *canaliculum* divided into three to five pores. The IOC joins with the SOC and has two to three single pores, over the eye, and six branched *canaliculi*, ended in one to four pores posterior to the eye. In the convergence of these two canals, the TC begins. It has two to eight pores. Posterior to the joining of the POC with the TC, the STC begins. The STC has one to five pores and can be branched in *canaliculi*.

Variations among morphotypes. The pattern of number, position and size of pores in the infraorbital and temporal canals differs among the three morphotypes (Figs. 9-11). The pores in the small-mouth perch are located as follows: in the infraorbital canal, io1 is absent, io2-3 inferior, io4 is closed, and io5 to io10 pores have branched *canaliculi*; and in the temporal canal, t1 inferior or absent, t2 superior and has branched *caniculum*, t3-t4 posterior, t5 absent, and t6 posterior. The pores of the large-mouth perches are located as follows: in the infraorbital canal, io1 is absent, io2-io3 inferior, io4 superior, io5 inferior, and io6 to io10 pores have branched posterior *caniculi*; in the temporal canal, t1 inferior, t2 superior with branched *caniculum* or can be absent, t3 posterior, t4 posterior with branched *caniculum*, t5 superior, and t6 posterior. The pores in the Musters perches are located as follows: in the infraorbital canal, io1 superior when present, io2-io3 inferior, io4 superior, io5 inferior and could be branched, io6-io7 posterior, io8-io9 posterior and could be branched, and io10 posterior; in the temporal canal, t1 inferior, t2 is absent, t3 to t5 posterior. Only the number and position of the SOC, the MC, and the first three pores of POC remain constant among the three morphotypes.

There are significant differences among the 3 morphotypes and the two groups of juveniles in the total number of pores (Fig. 12): 75-89 in the small-mouth perch, 69-79 in the large-mouth perch, and 61-71 in the intermediated-mouth perch, 55-61 in the Musters juveniles 59-67 in the Epuyen-Limay juveniles ($H_{4,36}$ = 29.756, p = 0.0001). The paired comparison showed significant differences in all cases except for the intermediated-mouth adults and Epuyen-Limay juveniles perches (Fig. 12).

Additionally, there are significant differences in the relationship between the mean pore diameters and head length ratio between both groups of juveniles and adult perches ($H_{4,36}$ = 29.481, p = 0.0001) (Fig. 13). The analysis showed clearly that juvenile perches have pores proportionally larger in relation to the size of the fish head, while the adults have relatively smaller pores, except for adult fish from Musters lake, which have a intermediate pore diameter/total head length index and comparable to that of juveniles. The paired comparison showed significant differences for all pairs except for the Epuyen-Limay and Musters juveniles, and between small-mouth and large-mouth perches (Fig. 13).

DISCUSSION

The cephalic lateral line canal system of the studied specimens belongs to the "widened" general type of WEBB (2000). The canal segments are ballooned out with incompletely ossified walls, according to the description of this type of canal system (WEBB 2000). The system of the three morphotypes (adults and juveniles) is composed of preopercular, mandibular, infraorbital, supraorbital, and temporal canals; and is characterized by the following features: it has the supraorbital commissure, which joins the left and the right supraorbital canals, and the supratemporal canal, which does not join in the middle dorsal region. In this study, in addition to those reported by LÓPEZ-ARBARELLO (2004), we found that the supraorbital and temporal canals are also partially enclosed by the bones in the three morphotypes.

Unlike the Argentinean temperate perches described herein, other perciform species exhibit different patterns of CLLC:

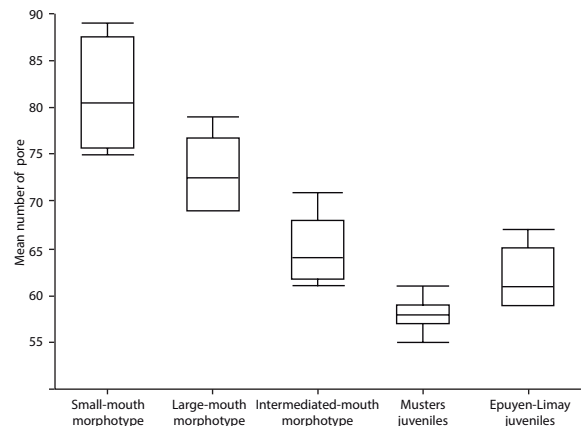| Paired Comparison		Z	p-values
Epuyen-Limay juveniles	Musters juveniles	2.75214	0.0059*
Epuyen-Limay juveniles	Intermediated-mouth morphotype	-1.77368	0.0761
Large-mouth morphotype	Small-mouth morphotype	-2.08898	0.0367*
Intermediated-mouth morphotype	Large-mouth morphotype	-2.48634	0.0129*
Intermediated-mouth morphotype	Small-mouth morphotype	-2.80224	0.0051*
Musters juveniles	Intermediated-mouth morphotype	-2.99910	0.0027*
Musters juveniles	Small-mouth morphotype	-3.06086	0.0022*
Musters juveniles	Large-mouth morphotype	-3.06429	0.0022*
Epuyen-Limay juveniles	Small-mouth morphotype	-3.23561	0.0012*
Epuyen-Limay juveniles	Large-mouth morphotype	-3.23805	0.0012*

Figure 12. Paired comparison and box plot showing the mean values for the total number of pores among the small-mouth morphotype, the large-mouth morphotype, the intermediated-mouth morphotype, and the Musters and Epuyen-Limay groups of juveniles. *Shows significant differences. Significance level: 0.05%.

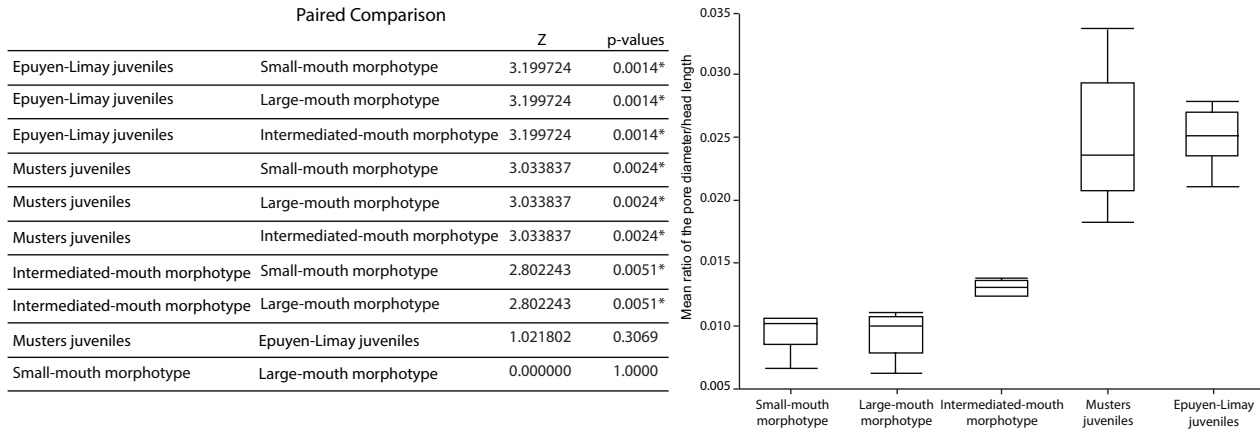| Paired Comparison		Z	p-values
Epuyen-Limay juveniles	Small-mouth morphotype	3.199724	0.0014*
Epuyen-Limay juveniles	Large-mouth morphotype	3.199724	0.0014*
Epuyen-Limay juveniles	Intermediated-mouth morphotype	3.199724	0.0014*
Musters juveniles	Small-mouth morphotype	3.033837	0.0024*
Musters juveniles	Large-mouth morphotype	3.033837	0.0024*
Musters juveniles	Intermediated-mouth morphotype	3.033837	0.0024*
Intermediated-mouth morphotype	Small-mouth morphotype	2.802243	0.0051*
Intermediated-mouth morphotype	Large-mouth morphotype	2.802243	0.0051*
Musters juveniles	Epuyen-Limay juveniles	1.021802	0.3069
Small-mouth morphotype	Large-mouth morphotype	0.000000	1.0000

Figure 13. Paired comparison and box plot showing the mean of the relation of pore diameter/head length ratio comparing the first seven pores of the horizontal part of the preopercular-mandibular canal among the small-mouth morphotype, the large-mouth morphotype, the intermediated-mouth morphotype, and the Musters and Epuyen-Limay groups of juveniles. *Shows significant differences. Significance level: 0.05%.

they lack some canals, or possess unpaired pores, or do not have the canals interconnected. For example, *Eucyclogobius newberryi* (Girard, 1856) (Gobiidae) only presents the supraorbital canal, which may be reduced or absent, as in other gobiids, but has no connection between the right and left SO canals (Ahnelt et al. 2004). *Neamia articycla* Fraser & Allen, 2006 (Apogonidae) has many unpaired minipores. However, the authors did not mention the continuity or connection among the canals (Fraser & Allen 2006). *Pterogobius elapoides* (Günther, 1872) (Gobiidae) has a discontinuous temporal canal and the POC is not joined to TC (Asaoka et al. 2011), and *Scomberomorus niphonius* (Cuvier, 1832) (Scombriidae) presents a similar pattern of CLLC system to *P. trucha*, but the left and right SO canals are not joined by the SOCom (Nakae et al. 2013).

Regarding the development of the cephalic lateral line canal system of temperate perches, only the supraorbital canal and the horizontal part of the preopercular-mandibular canal keep the same number of pores among populations, and during ontogeny. The head length in fish usually decreases allometrically during ontogeny, although the length of the head remains large in relation to diameter of pores. The reduction in the size of pores protects the neuromasts from large particles entering the canal (Kasumyan 2003), as occurs with the CLLC system of *Solea vulgaris* (Linnaeus, 1758) (Appelbaum & Schemmel 1983, Nelson 2006). Meanwhile, increasing the number of pores, as occurs in the large-mouth and the small-mouth perches, would prevent loss of efficiency in the perception of external stimuli. However, intermediated-mouth adult perches have fewer and relatively large pores, as those observed in juveniles, a feature that could be considered paedomorphic.

The morphology of the cephalic lateral line can show interpopulation variability, as that observed among 16 populations of *Gasterosteus aculeatus* Linnaeus, 1758 (Nelson 2006)

in the Pacific Northwest and Japan (Wark & Peichel 2010), or in the 26 populations of *Eucyclogobius newberryi* (Girard, 1856) in California (Ahnelt et al. 2004, Nelson 2006). In the present description, we also found variability in the number of pores and in the degree of branching of the canals among different morphotypes. The differences observed in the number of pores and the degree of branching could be an adaptive response to the dietary habits and habitat selection, as the intraspecific differences observed in *G. aculeatus* and in *Gobiomorphus cotidianus* McDowall, 1975 (Nelson 2006, Wark & Peichel 2010, Vaderpham et al. 2013). The divergence in the morphology of the CLLC system would accompany the phenotypic variation observed among populations of Patagonian perches (López-Arbarello 2004, Ruzzante et al. 2003, 2011, Crichigno et al. 2014). The temperate perches analyzed in this study come from water bodies with different environmental features. The small-mouth and large-mouth perches were collected from oligotrophic Andean lakes with deep and clear waters, while the Musters perches were collected from a lake located in the Patagonian plateau, with shallow water and high turbidity. Moreover, perch populations show marked differences in eating habits (Ruzzante et al. 1998, Logan et al. 2000). Juvenile perches feed primarily on microcrustaceans and small insect larvae (pers. obs., Ruzzante et al. 2006). Adult perches include, in their diets, larger prey, for instance macrocrustaceans, Odonata larvae, and small fish (Macchi et al. 1999, Logan et al. 2000, Ribeiro Guevara et al. 2006, Ruzzante et al. 2011). However, adult perches from Lake Musters feed mainly on amphipods and cladocerans (Ruzzante et al. 2011), similar to the diet of juvenile perches. Coincidently, the Musters and juvenile perches shared similar features, as the number and the relative size of pores. This resemblance may be due to their similar diets and to the fact that they inhabit shallower waters. Ruzzante et al. (2006) stated that the trophic polymorphism within the

Perichthys complex in recently deglaciated lakes of Patagonia indicate different modes of feeding. It is possible that the morphology of the cephalic lateral line canal system of adult fish, as other features like the size of the dorsal spines and the upper jaw (Ruzzante et al. 2011, Crichigno et al. 2014), adapt during ontogeny to the new features offered by the environment, as habitat and food supply. For adult fish from the Musters Lake, such adaptations appear to have been unnecessary, since those adults have similar living conditions to those of the juveniles from any morphotype.

In their study, Ruzzante et al. (2006) stated that the variation in morphology among populations is substantial; however, their molecular analysis using mitochondrial DNA control region haplotypes and nuclear GnRH3-2 intron allele sequence divergences support the validity of only one species of *Perichthys*, at the east of the Andes, *P. trucha*. The variability observed in the morphology of the seismosensory systems of the Patagonian perches provides additional morphological information to the taxonomy of the genus, and helps to discriminate the supposed species of the complex. The variation in relation to the length of the gill rakers, the upper jaw, and the dorsal fin spine (Lopez-Arbarello 2004, Crichigno et al. 2014), combined with the variation in number, position and size of the pores of the CLL, suggests that the *Perichthys* complex is undergoing an adaptive radiation driven by trophic adaptation to different environmental conditions. In that way, molecular studies using other genetic markers are necessary. Our study contributes to the knowledge of the morphology of perichthids, describing for the first time the cephalic lateral line system of the temperate perches.

ACKNOWLEDGMENTS

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