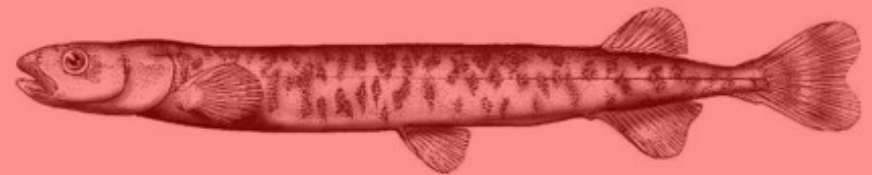


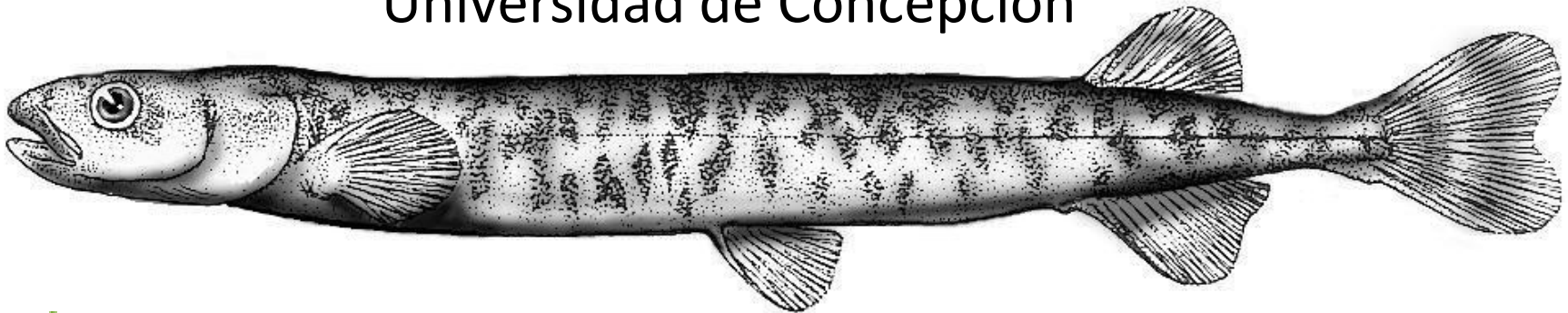
# ¿Cuánto conocemos los peces Chilenos de agua dulce?



Dra. Evelyn Habit

Facultad de Ciencias Ambientales y Centro EULA-Chile

Universidad de Concepción



¿Cuánto conocemos los peces Chilenos de agua dulce?



Cuánto conocemos depende de:

¿Qué entendemos por conocimiento?

## **FUENTES DEL CONOCIMIENTO (INFORMACIÓN)**



# ¿Cuánto conocemos los peces Chilenos de agua dulce?

## Fuentes de información:

### PUBLICACIONES CIENTÍFICAS

RIVER RESEARCH AND APPLICATIONS  
River Res. Applic. 27: 312–327 (2011)  
Published online 3 February 2010 in Wiley Online Library  
(wileyonlinelibrary.com) DOI: 10.1002/rra.1358

DOWNSTREAM ENVIRONMENTAL EFFECTS OF DAM OPERATIONS: CHANGES IN HABITAT QUALITY FOR NATIVE FISH SPECIES

ALEX GARCÍA,<sup>1,2\*</sup> KLAUS JORDE,<sup>3</sup> EVELYN HABIT,<sup>4</sup> DIEGO CAAMAÑO<sup>4,5</sup> and OSCAR PARRA<sup>6</sup>  
<sup>1</sup>Center of Environmental Sciences FSEA-Chile, Universidad de Concepción, Barrio Universitario s/n, Casilla 160-C, Concepción, Chile  
<sup>2</sup>Center for Ecological Modelling Research, University of Idaho, 222 East River Street, Suite 160, Boise, ID 83725, USA  
<sup>3>J.P. Schneider and Jorde, Ecological Engineering GmbH, Vöcklabruck 12, 76509 Statzart, Germany</sup>

**ABSTRACT**  
Hydropneumatic dam operation and water extractions for irrigation have been broadly stated but have also been noticed in the Biobío Watershed, in Central Chile, since 1996. In the endemic and very little it is known about them. Their ecological and social value for information about their habitat preferences. Furthermore, changes on fish habitat availability have not been evaluated. In this study, eight native fish species, in a representative river preferred habitats were surveyed and characterized. A hydrodynamic model was built: CASMRK. Fuzzy rules and fuzzy sets were developed for describing habitat preferences used to simulate how physical habitat conditions vary due to flow control (i.e. open quality, expressed as weighted usable area (WUA) and hydraulic habitat suitability (i) operation) and how the daily hydropneumatic influencing quantity, quality and location. i analysed fish are highly susceptible to flow control, as dams are currently operated. proposed. Copyright © 2010 John Wiley & Sons, Ltd.

**KEY WORDS:** fish habitat modeling; CASMRK; hydropneumatic; native fish species; multi-use river; river

Received 15 April 2009; Revised 14 July 2009; Accepted 15 December 2009

**INTRODUCTION**  
Hydropneumatic dam operation and water extractions for irrigation have been broadly stated as alterations to natural flow regimes (Ward and Stanford, 1983; Potts, 1984; Poof and Allan, 1997; Magilligan and Nislow, 2005; Jorde *et al.*, 2008), i.e. changes in flow magnitude, frequency, duration, timing and rate of change (Junk *et al.*, 1989). These alterations change physical and chemical habitat conditions for fish species, and therefore could decrease fish and other animals' abundance (Travnicko and Maceina, 1994; Lamouraux *et al.*, 2006). They also could alter some ecosystem services like regulation of the trophic web (Rooney *et al.*, 2005), 'mosquito' control (Howard *et al.*, 2007), biodiversity (de Mérona *et al.*, 2005), pollution (Knight *et al.*, 2005) and biomass either for gaming or as a food source, provided directly or indirectly by water bodies. The Biobío River basin, located in central Chile (Figure 1), with 24 371 km<sup>2</sup>, is one of the most important centres for economical developments in the country (Parrá, 1996; TWINBAS, 2007), and classified as one of the world's largest river systems (Figure 1), an impacted river. Nevertheless, the dynamical all changes in two altered and flat of Rakos, and overlapping the used for hydroly from monthly to dam. Furthermore, River and tributaries watershed

\*Correspondence to: Alex Garcia, Center of Environmental Sciences FSEA-Chile, Universidad de Concepción, Barrio Universitario s/n, Casilla 160-C, Concepción, Chile. E-mail: alexgarcia@udec.cl

Diversity and Distributions, (Diversity Distrib.) 2010, 18, 1153–1165



### Native and introduced fish species richness in Chilean Patagonian lakes: inferences on invasion mechanisms using salmonid-free lakes

Evelyn Habit<sup>1,2\*</sup>, Jorge González<sup>3</sup>, Daniel E. Ruzzante<sup>4</sup> and Sandra J. Walde<sup>5</sup>

**ABSTRACT**  
Aim: Geographic patterns of species richness have been linked to many physical and biological drivers. In this study, we document and explain gradients of species richness for native and introduced freshwater fish in Chilean lakes. We focus on the role of the physical environment to explain native richness patterns, for patterns of introduced richness and dominance, we also examine the biotic resistance and human activity hypotheses. We were particularly interested in identifying the factors that best explain the persistence of salmonid-free lakes in Patagonia.

**Location:** Chile (39° to 54°S).

**Methods:** We conducted an extensive survey of 63 lakes, over a broad latitudinal range. We tested for the importance of temperature, ecosystem size, current and historic aquatic connectivity as well as measures of human activity (road access and land use) in determining patterns of native and introduced richness.

**Results:** Introduced species richness was positively correlated with native richness. Native and introduced richness declined with latitude, increased with temperature and ecosystem size. Variation in native richness was related to historic drainage connections, while introduced richness and salmonid dominance were significantly affected by current habitat connectivity. We found a total of 15 salmonid-free lakes, all located in remote areas south of 48°S, and all upstream of major naturally occurring physical barriers.

**Main conclusions:** Temperature, as a correlate of latitude, and lake size were key determinants of native and introduced species richness in Chilean lakes and were responsible for the positive correlation between native and introduced richness. We found no evidence for biotic resistance by native species to salmonid expansion, and although the original introductions were human mediated, current patterns of introduced richness were not related to human activity, as measured by road access or land use. Rather, environmental factors, especially habitat connectivity and temperature, appear to limit salmonid expansion within Chilean freshwater lakes.

**Keywords:** Biological invasions, Chile, connectivity, introduced salmonids, latitudinal gradients, Patagonia, species richness.

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\*Correspondence: Evelyn Habit, Centro de Ciencias Ambientales, FSEA, Universidad de Concepción, Barrio Universitario s/n, Concepción, Chile. E-mail: ehabit@udec.cl

Ecology of Freshwater Fish 2010

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ECOLOGY OF FRESHWATER FISH

### Ecology of *Galaxias platei* in a depauperate lake

Mark C. Bell<sup>1</sup>, Evelyn Habit<sup>2</sup>, Juan J. Ortiz-Sandoval<sup>3</sup>, Caterina Sobone<sup>4,5</sup>, Elias A. Combs<sup>6</sup>

<sup>1</sup>Department of Biology, Brigham Young University, Provo, UT 84602, USA  
<sup>2</sup>Centro de Ciencias Ambientales, FSEA, Universidad de Concepción, Barrio Universitario s/n, Concepción, Chile  
<sup>3</sup>Department of Environmental Engineering and Natural Resources, Universidad Católica de la Barriera Concepción, Concepción, Chile

Accepted for publication October 26, 2010

**Abstract** – *Galaxias platei* is widespread and common in southern South America, but its ecology is poorly documented relative to other native species, especially those of commercial importance. *Galaxias platei* occurs across a large range of environmental conditions, including hydrologically isolated lakes. Consequently, there were several lakes in the Patagonian region where it was the first introduction of salmonids into almost all lakes in Patagonia where *G. platei* occurs changes in its ecology and behaviour. Thompson Lake is a small, high-elevation lake (Chile) where *G. platei* still occurs essentially in isolation. We collected *G. platei* to characterize the ecology of the species in the absence of other native and introduced species and growth patterns from otolith analysis and characterised size- and age-specific growth in Thompson Lake. *G. platei* is long-lived and grows to comparatively large size (TL = 348 mm). As it grows, it exhibits an ontogenetic niche shift in habitat use, it adults are piscivorous, and they occupy deep benthic habitats. Persistence of the *G. platei* in isolation is an important priority for maintaining the full export variability in this species.

**Key words:** Patagonia; stable isotopes; diet; cannibalism; age and growth

**INTRODUCTION**  
Numerous non-native fishes have been introduced throughout southern South America during the last 100 years (Cambridge 2003; Casal 2006; Habit *et al.* 2010). Introductions of non-native species into depauperate and ecologically isolated systems can lead to rapid local extinction and dramatic changes in ecology of native species (Clavero & Garcia-Berthou 2005). Salmonids, introduced to rivers and lakes of Chile and Argentina at the beginning of the 20th century, have led to numerous local extinctions and decreases in occupied range of the majority of the native species of freshwater fishes in this area (McDowall 2006; Habit *et al.* 2010; Correa & Hendry 2012). Introduced salmonids now constitute the dominant fish species in many lakes, and there are few lakes that have not been colonised by non-native salmonids (Habit *et al.* 2012). To understand the threat of introduced species and potential

management activities of introduced species the ecology and native to the introduction of *Galaxias platei* in Patagonian province is one of the most in this region. Dyer species exhibits seven it to tolerate extreme benthic zones of lake adopted to dark on cephalic, lateral line reduce absorption in the oxygen concentration (Cassata *et al.* 2004), persist in refugia wet gullies during the late dry (Ruzzante *et al.* low latitudes within

Correspondence: M. C. Bell, Department of Biology, Brigham Young University, Provo, UT 84606, USA. E-mail: mcbell@byu.edu

Global Ecology and Biogeography, (Global Ecol. Biogeogr.) 2010, 19, 697–710



### Changes in the distribution of native fishes in response to introduced species and other anthropogenic effects

Evelyn Habit<sup>1,2\*</sup>, Priscila Pedraza<sup>3</sup>, Daniel E. Ruzzante<sup>4</sup>, Sandra J. Walde<sup>5</sup>, Mark C. Bell<sup>6</sup>, Victor E. Cassata<sup>7</sup>, Jorge González<sup>8</sup> and Nicola Colini<sup>9</sup>

**ABSTRACT**  
Aim: Changes in the distribution of native fishes is the loss of biodiversity that can result from the introduction of exotics. Here we document recent changes in the distribution of five common fish species that are linked to introductions in Chile.

**Location:** Chile from 38°S to 54°S.

**Methods:** We assess the extent of changes in distribution of galaxiid species by comparing their historical and current distributions based on the results of the most extensive survey of freshwater fishes in Chile to date, a range that encompasses the full latitudinal and elevational range of the Galaxiinae in Chile. We test for relationships of the distributions and abundance of native fishes with the incidence of introduced species.

**Results:** The latitudinal range of *Galaxias maculatus* has declined by 26%, and most of this reduction has occurred in the northern part of its range. *Aplocheilichthys aerosoma* and *Percopygaster hudsoni* have experienced reductions (4–17%) loss in total drainage area occupied, and they have disappeared from, or are now extremely difficult to find, in latitudes 36° to 41°S, coincidently with areas of urban growth and intense economic activities. The distribution of *Galaxias platei* has, instead, increased considerably. In northern basins, *G. maculatus* has apparently been replaced by an introduced poeciliid *Gambusia sp.* High-elevation systems remain dominated by native Galaxiinae species, whereas systems at intermediate elevations, especially rivers, are now dominated by introduced salmonids. Within drainages, native galaxiids remain abundant where exotic salmonid abundance is low.

**Main conclusions:** We suggest that negative interactions between introduced and native fish are responsible for some of the range reductions among Galaxiinae in Chile. The severity of the impacts varies with latitude and altitude and is probably related to temperature. The effects of *Gambusia* are restricted to warmer systems. Native fish also appear to have found temperature refugia from salmonids impacts are low in the warmer northern and coastal systems, as well as in high-altitude relatively cold systems. Native fish also appear less vulnerable to salmonids in lakes than in rivers. This study identifies watersheds critical for the conservation of biodiversity within the Galaxiinae.

**Keywords:** Anthropogenic impacts, conservation, Chile, distribution, Galaxiinae, introduced salmonids, Patagonia, temperature refugia.

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A Journal of Conservation Biogeography

Diversity and Distributions

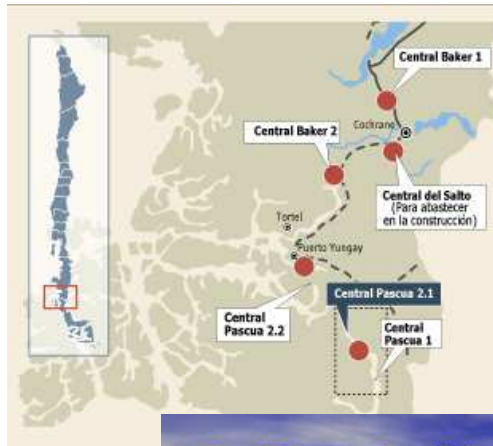
A Journal of Macroecology

Global Ecology and Biogeography

# ¿Cuánto conocemos los peces Chilenos de agua dulce?

## Fuentes de información:

**“LITERATURA GRIS”**



## ESTUDIO DE IMPACTO AMBIENTAL



### 5. Plan de Manejo Ambiental



- Diseño e implementación de un **Plan de Manejo Ambiental** para el monitoreo y evaluación de los impactos ambientales causados por las actividades de Maricultura
- Esto se realizará según los lineamientos establecidos por las autoridades ambientales

¿Cuánto conocemos los peces Chilenos de agua dulce?

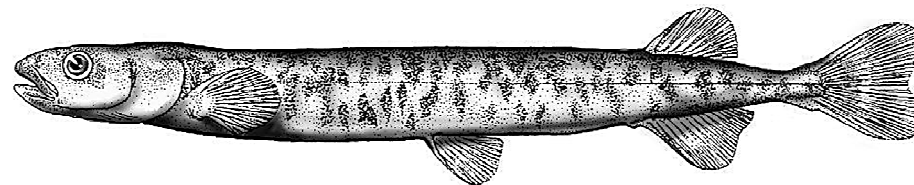
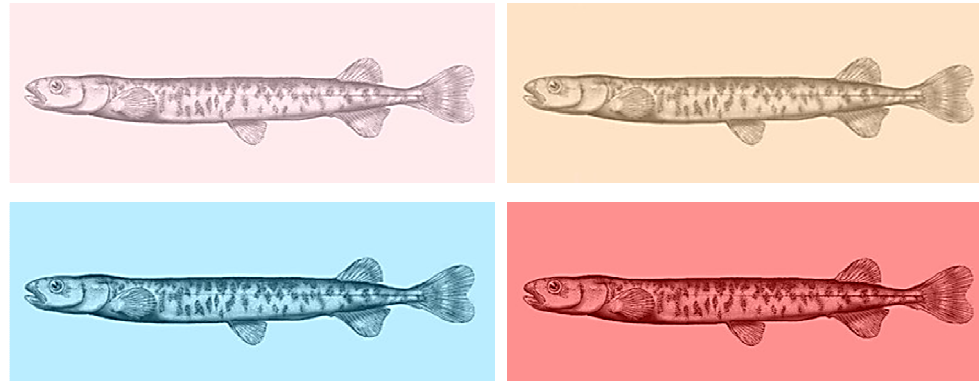
Fuentes de información:

**“Conocimiento de Expertos”**



# Conclusión hasta aquí:

## Entenderemos por Conocimiento sólo aquello que esté publicado en una revista científica



¿Cuánto conocemos los peces Chilenos de agua dulce?

Lo básico:

¿Cuántas especies hay en el país y cuáles son?



Dr. HUGO CAMPOS (q.e.p.d.)



Dra. GLORIA ARRATIA





# PECES LÍMNICOS DE CHILE

IRMA VILA<sup>1</sup>, LEOPOLDO FUENTES<sup>2</sup> y MANUEL CONTRERAS

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Estud. Oceanol. 19: 77 - 98, 2000

ISSN 0071-173X

SYSTEMATIC REVIEW AND BIOGEOGRAPHY OF THE FRESHWATER FISHES OF CHILE

REVISION SISTEMÁTICA Y BIOGEOGRÁFICA DE LOS PECES DULCEACUICOLAS DE CHILE

2000

Brian S. Dyer

2006

CAPÍTULO III

Peces límnicos: diversidad, origen y estado de conservación

IRMA VILA, RODRIGO PARDO, BRYAN DYER, EVELYN HABIT

Capt. Libro

2008

DIVERSIDAD DE ESPECIES

# PECES LÍMNICOS

IRMA VILA Y RODRIGO PARDO

Gayana 70(1): 100-113, 2006

2006

ISSN 0717-65

ESTADO DE CONOCIMIENTO DE LOS PECES DULCEACUICOLAS DE CHILE

*CURRENT STATE OF KNOWLEDGE OF FRESHWATER FISHES OF CHILE*

Evelyn Habit<sup>1</sup>, Brian Dyer<sup>2</sup> & Irma Vila<sup>3</sup>



Universidad de Concepción



EULA-CHILE  
Centro de Ciencias Ambientales



FACULTAD DE CIENCIAS  
AMBIENTALES



UNIVERSIDADE  
POSITIVO

## ¿Cuántas y qué especies de agua dulce existen en Chile?

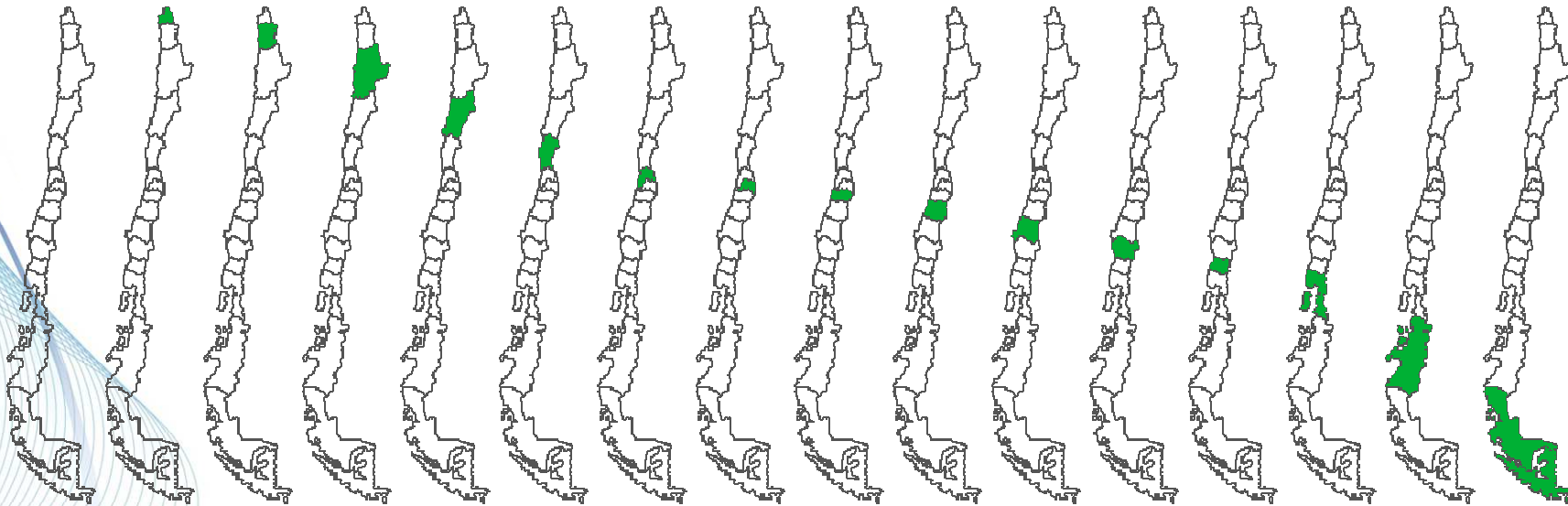
ESPECIE	Procesos de Clasificación de Conama	Categoría
<i>Geotria australis</i> Gray, 1851	8vo Proceso	Vulnerable
<i>Mordacia lapicida</i> Gray, 1851	DS 51 de 2008	En Peligro
<i>Cheirodon pisciculus</i> Girard, 1855	DS 51 de 2008	Vulnerable
<i>Cheirodon australe</i> Eigenmann, 1928	DS 51 de 2008	Vulnerable
<i>Cheirodon kiliani</i> Campos, 1982	DS 51 de 2008	En Peligro y Rara
<i>Cheirodon galusdae</i> Eigenmann, 1928	DS 51 de 2008	Vulnerable
<i>Nematogenys inermis</i> (Guichenot, 1848)	DS 51 de 2008	Vulnerable
<i>Bullockia maldonadoi</i> (Eigenmann, 1928)	DS 51 de 2008	En Peligro
<i>Trichomycterus areolatus</i> (Valenciennes, 1840)	DS 51 de 2008	Vulnerable
<i>Trichomycterus chiltoni</i> (Eigenmann, 1928)	DS 51 de 2008	En Peligro y Rara
<i>Trichomycterus rivulatus</i> (Valenciennes, 1840)	DS 51 de 2008	En Peligro y Rara
<i>Trichomycterus chungaraensis</i> Arratia, 1983	DS 51 de 2008	En Peligro y Rara
<i>Trichomycterus laucaensis</i> Arratia, 1983	DS 51 de 2008	En Peligro
<i>Hatcheria macraei</i> (Girard, 1855)	8vo Proceso	Vulnerable
<i>Diplomystes chilensis</i> Molina, 1782	DS 51 de 2008	En Peligro y Rara
<i>Diplomystes nahuelbutaensis</i> Arratia, 1987	DS 51 de 2008	En Peligro
<i>Diplomystes camposensis</i> Arratia, 1987	DS 51 de 2008	En Peligro
<i>Diplomystes</i> sp	Sin clasificación	-
<i>Galaxias maculatus</i> (Jenyns, 1842)	8vo Proceso	Maule al Norte: Vulnerable Biobío al Sur: Preocupación Menor
<i>Galaxias globiceps</i> Eigenmann, 1928	DS 51 de 2008	En Peligro y Rara
<i>Galaxias alpinus</i> ? (Jenyns, 1842)	Sin clasificación	-
<i>Galaxias platei</i> Steindachner, 1898	8vo Proceso	Preocupación Menor
<i>Brachygalaxias bullocki</i> (Regan, 1908)	8vo Proceso	Casi Amenazada
<i>Brachygalaxias gothei</i> Busse, 1982	8vo Proceso	= <i>B. bullocki</i>
<i>Aplochiton zebra</i> Jenyns, 1842	5to Proceso	En Peligro
<i>Aplochiton marinus</i> Eigenmann, 1928	10mo Proceso	En Peligro
<i>Aplochiton taeniatus</i> Jenyns, 1842	5to Proceso	En Peligro
<i>Mugil cephalus</i> Linnaeus, 1758	Sin clasificación	-
<i>Orestias agazissii</i> Valenciennes, 1846	DS 51 de 2008	En Peligro
<i>Orestias chungarensis</i> Vila & Pinto, 1986	DS 51 de 2008	En Peligro
<i>Orestias laucaensis</i> Arratia, 1982	DS 51 de 2008	En Peligro
<i>Orestias ascotanensis</i> Parenti, 1984	DS 51 de 2008	En Peligro
<i>Orestias parinacotensis</i> Arratia, 1982	DS 51 de 2008	En Peligro
<i>Orestias piacotensis</i> Vila, 2006	6to Proceso	En Peligro Crítico
<i>Orestias gloriae</i> Vila, 2011	Sin clasificación	-
<i>Basilichthys australis</i> Eigenmann, 1928	8vo Proceso	Maule al Norte: Vulnerable Biobío al Sur: Preocupación Menor
<i>Basilichthys microlepidotus</i> (Jenyns, 1841)	DS 51 de 2008	Vulnerable
<i>Basilichthys cf. semotilus</i> (Cope, 1874)	DS 51 de 2008	En Peligro
<i>Odontesthes hatcheri</i> (Eigenmann, 1909)	10mo Proceso	Casi Amenazada
<i>Odontesthes (Cauque) mauleanum</i> (Steindachner, 1896)	DS 51 de 2008	Vulnerable
<i>Odontesthes (Cauque) brevianalis</i> (Günther, 1880)	DS 51 de 2008	Vulnerable
<i>Odontesthes (Cauque) itatanum</i> (Steindachner, 1896)	10mo Proceso	= <i>O. mauleanum</i>
<i>Percichthys trucha</i> (Valenciennes, 1833)	8vo Proceso	Maule al Norte: Casi Amenazado Biobío al Sur: Preocupación Menor
<i>Percichthys melanops</i> Girard, 1855	DS 51 de 2008	Vulnerable
<i>Percilia irwini</i> Eigenmann, 1928	DS 51 de 2008	En Peligro
<i>Percilia gillissi</i> Girard, 1855	5to Proceso	En Peligro

Ojo: Procesos de Clasificación de Estados de Conservación liderados por MMA

# ¿Cuánto conocemos los peces Chilenos de agua dulce?

Lo básico:

¿Sabemos dónde se distribuyen cada una de esas especies?



## El caso del género *Diplomystes*



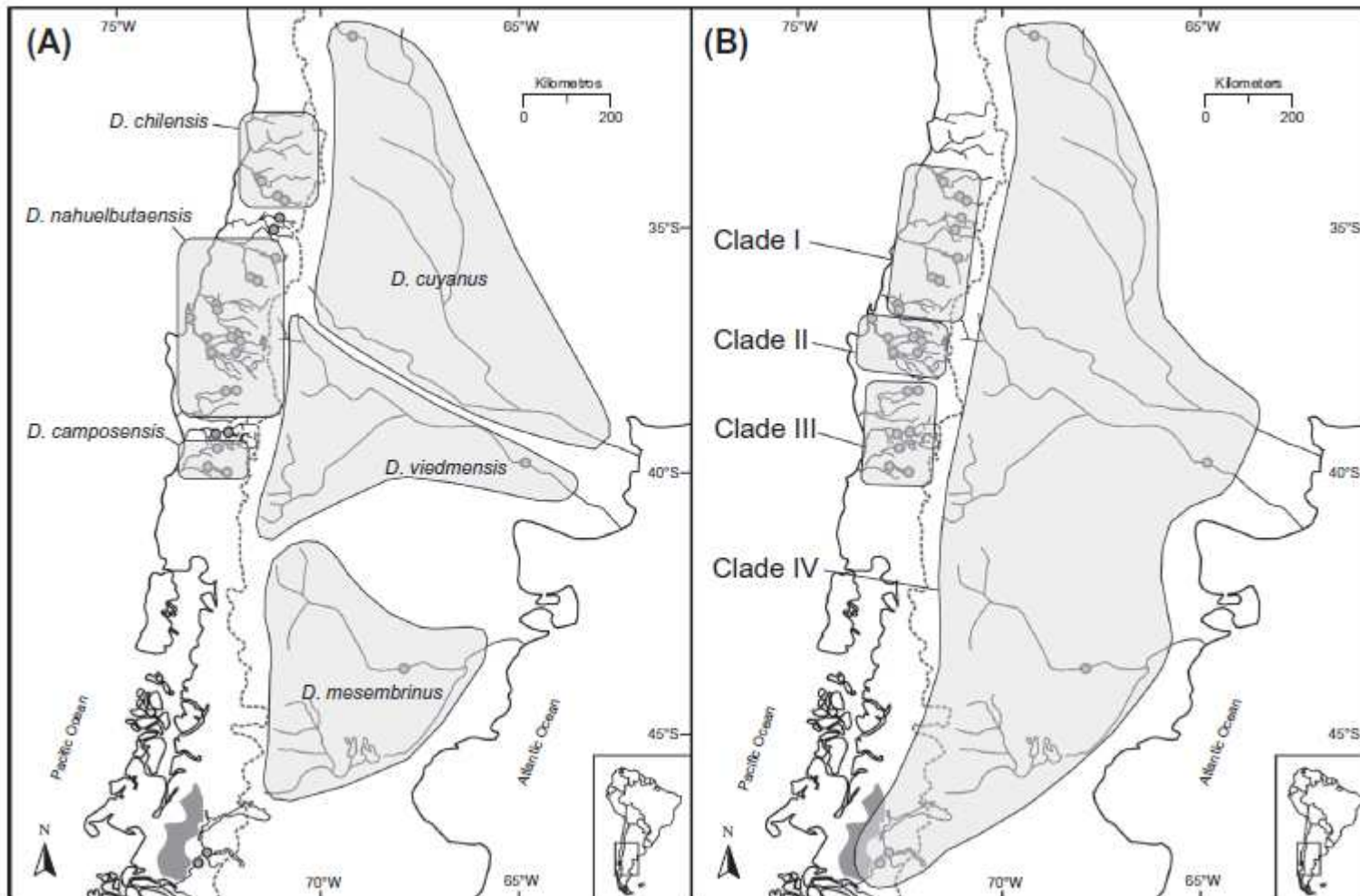
Contents lists available at ScienceDirect

Molecular Phylogenetics and Evolution

journal homepage: [www.elsevier.com/locate/ympev](http://www.elsevier.com/locate/ympev)

Phylogeography of the ancient catfish family Diplomystidae:  
Biogeographic, systematic, and conservation implications

C.P. Muñoz-Ramírez<sup>a,\*</sup>, P.J. Unmack<sup>b</sup>, E. Habit<sup>c,d</sup>, J.B. Johnson<sup>b</sup>, V.E. Cussac<sup>e</sup>, P. Victoriano<sup>a,d</sup>



Muñoz et al. (2014)

RESEARCH ARTICLE

The genus *Basilichthys* (Teleostei: Atherinopsidae) revisited along its Chilean distribution range (21° to 40° S) using variation in morphology and mtDNA

El género *Basilichthys* (Teleostei: Atherinopsidae) analizado a lo largo de su distribución en Chile (21° a 40° S), utilizando rasgos morfológicos y variabilidad del ADN mitocondrial

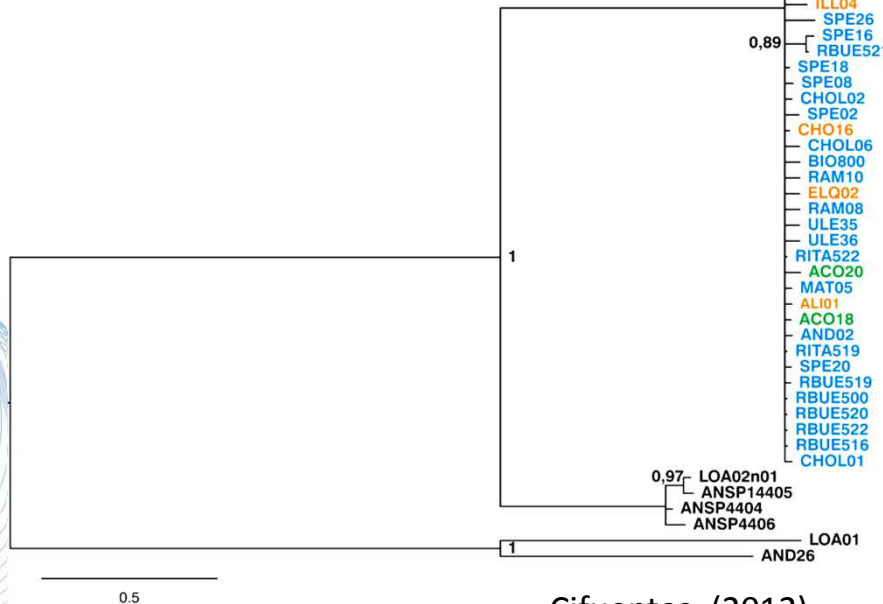
DAVID VÉLIZ<sup>1,2</sup>, LAURA CATALÁN<sup>1,2</sup>, RODRIGO PARDO<sup>3</sup>, PATRICIO ACUÑA<sup>4</sup>, ANGIE DÍAZ<sup>1,2</sup>, ELIE POULIN<sup>1,2</sup> & IRMA VILA<sup>1,\*</sup>

*Basilichthys microlepidotus*

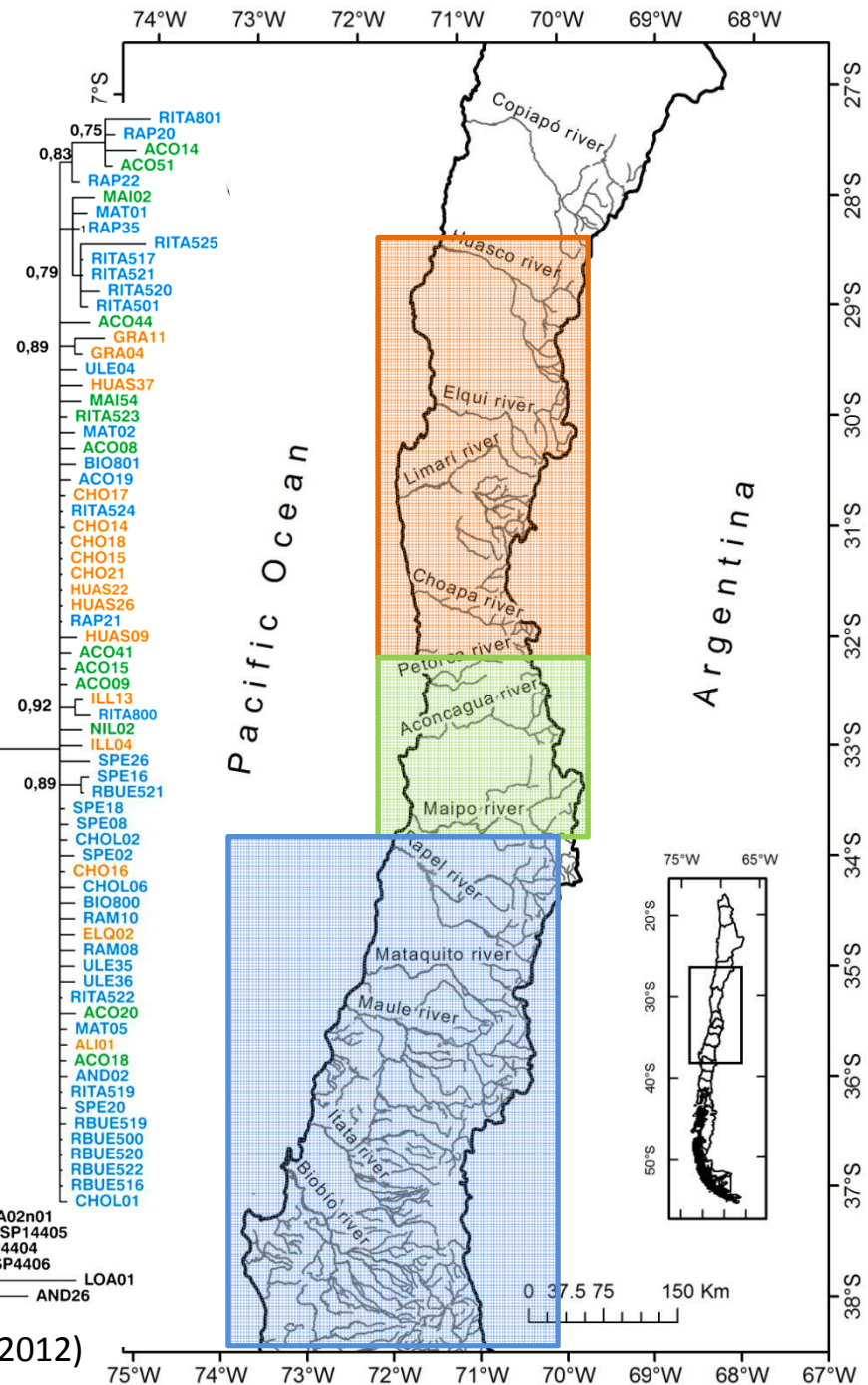
*Basilichthys australis*



Sólo existe: *Basilichthys microlepidotus*



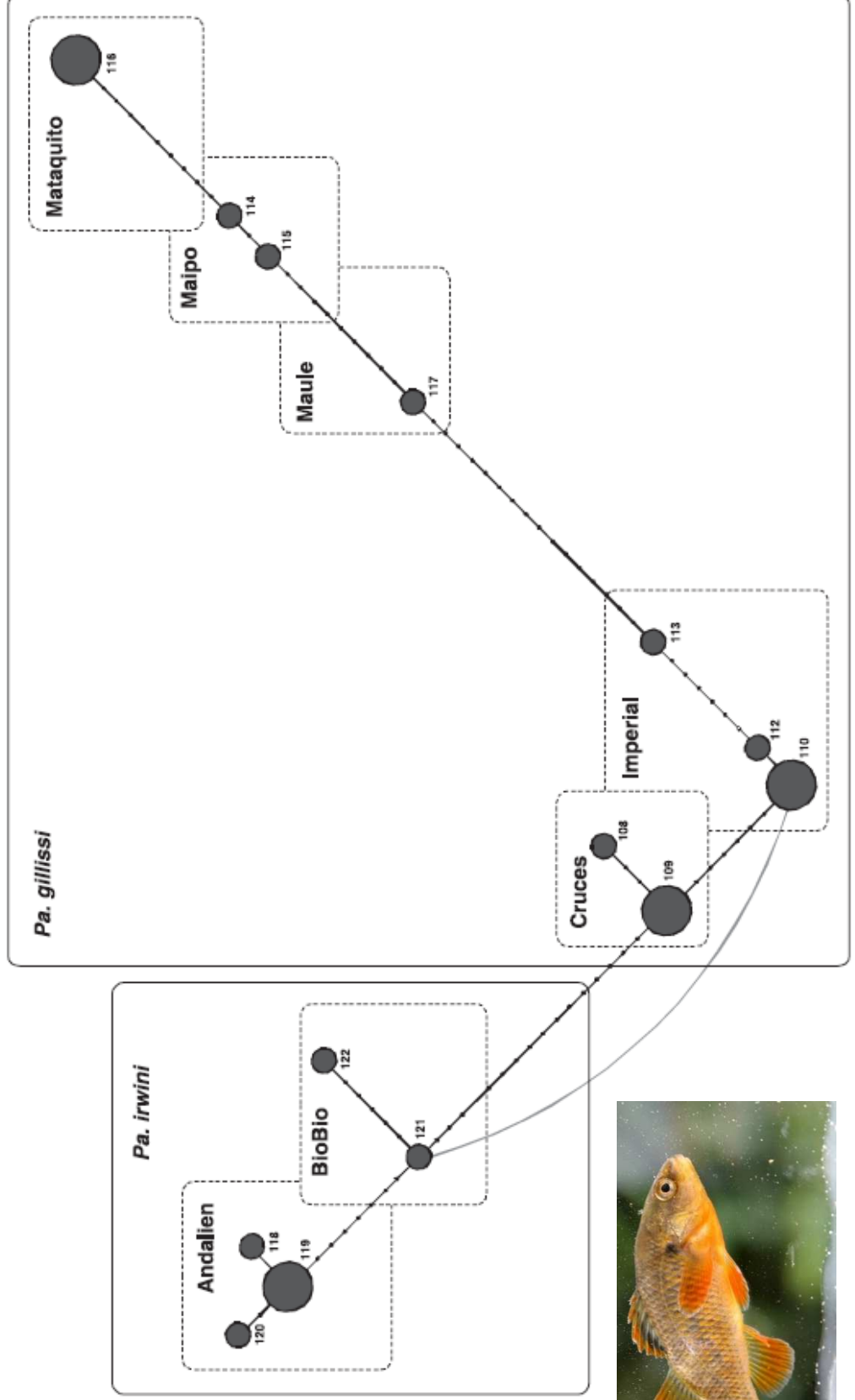
Cifuentes. (2012)



# Phylogeography of the Percichthyidae (Pisces) in Patagonia: roles of orogeny, glaciation, and volcanism

DANIEL E. RUZZANTE,\* SANDRA J. WALDE,\* VÍCTOR E. CUSSAC,† MEREL L. DALEBOUT,‡  
JACOB SEIBERT,\* SILVIA ORTUBAY ‡ and EVELYN HABIT\$

b)



# Y hay varios otros ejemplos:

- *Aplochiton marinus*

OPEN ACCESS Freely available online



## Diversity of *Aplochiton* Fishes (Galaxiidea) and the Taxonomic Resurrection of *A. marinus*

Dominique Alò<sup>1\*§</sup>, Cristián Correa<sup>2\*§</sup>, Carlos Arias<sup>2,3</sup>, Leyla Cárdenas<sup>4</sup>

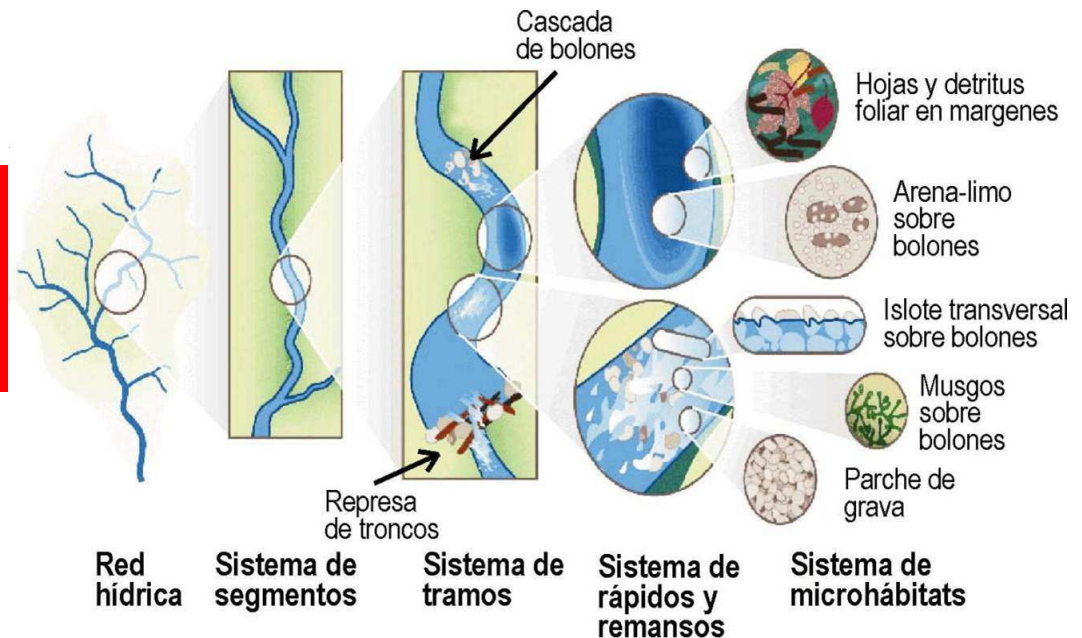
- *Galaxias alpinus*
- *Odontesthes itatanum*
- ....

## ¿Cuánto conocemos los peces Chilenos de agua dulce?

Lo básico (en el ámbito de este Workshop):

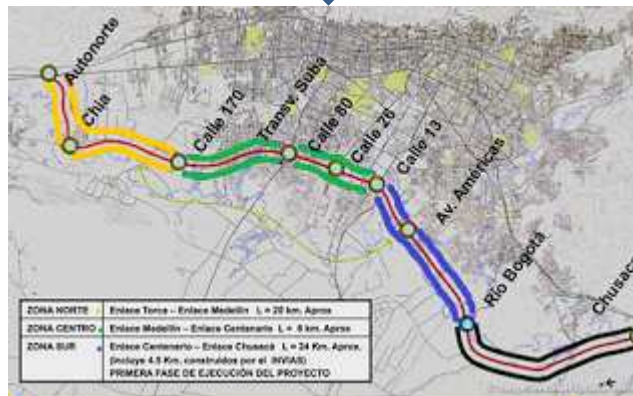
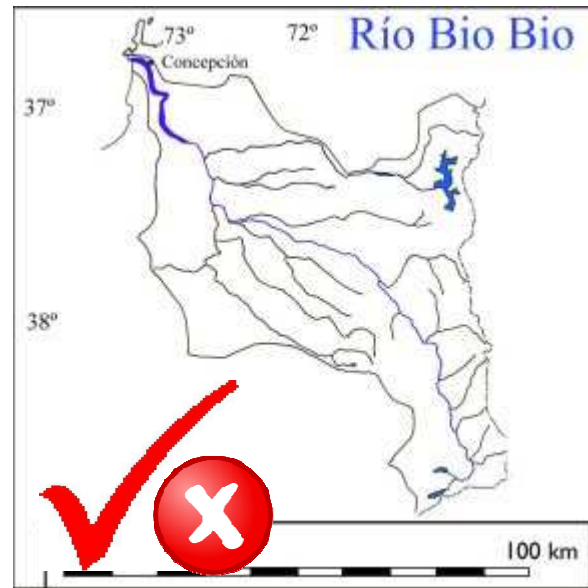
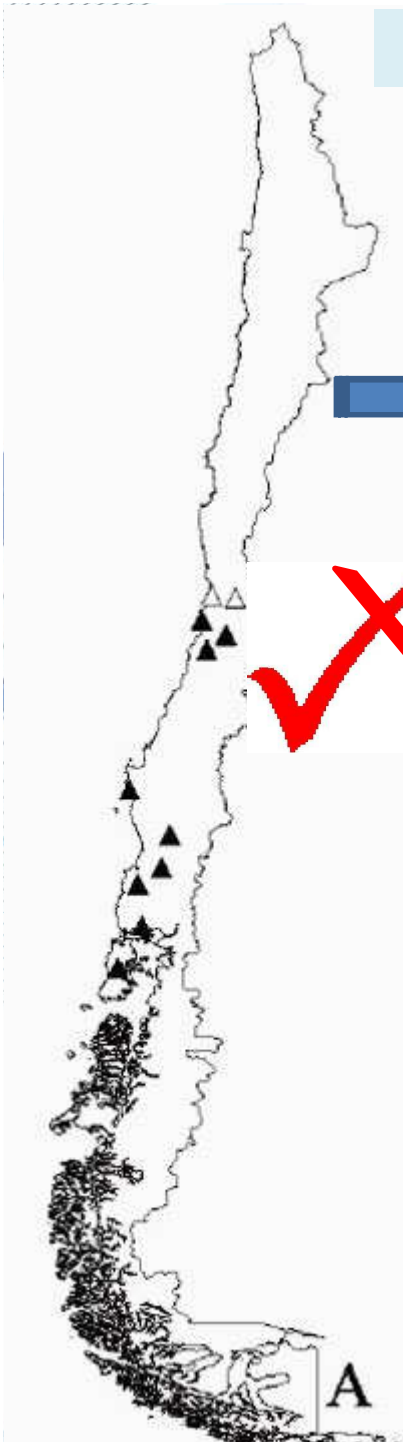
¿Sabemos dónde se distribuyen cada una de esas especies?

**La respuesta es  
ESCALA-ESPECÍFICA**





# ¿Cuál es su distribución?



¿Cuánto conocemos los peces Chilenos de agua dulce?

Lo básico (en el ámbito de este Workshop):

¿Conocemos la biología-ecología de cada una de esas especies?

La respuesta es  
**ESPECIE, SITIO Y ESCALA-  
ESPECÍFICA**



Universidad de Concepción



EULA-CHILE  
Centro de Estudios Acuáticos



FACULTAD DE CIENCIAS  
AMBIENTALES

# ¿Cuánto conocemos los peces Chilenos de agua dulce?

Por ejemplo:

¿Conocemos su dieta?

Item	<i>Oncorhynchus mykiss</i>	<i>Salmo trutta</i>	<i>Trichomyterus areolatus</i>	<i>Cheirodon gahusidae</i>	<i>Percichthys trucha</i>	%
Chironomidae	41.9	42.29	86.41	69.71	98.29	67.72
Algas indet.	0.03		0.08	27.62		5.55
Aegidae	5.02	6.36	11.16			4.51
Hydropsychidae	12.18	5.76	1.75	0.87	0.29	4.17
Coleoptera indet.	12.81	5.26	0.1		0.04	3.64
Diptera indet.	1.6	13.35		1		3.19
Baetidae	6.01	5.68	0.31	0.53	0.69	2.64
Leptocendae	3.67	7.84	0.01		0.02	2.31
Leptophlebiidae	3.41	4.09	0.06		0.43	1.80
Hymenoptera indet.	5.57	1.94				1.50
Gripopterygidae	2	1.09			0.03	0.62
Tipulidae	0.29	2.2	0.06		0.11	0.53
Sericostomatidae	1.91					0.38
Odonata indet.		1.7				0.34
Philorhethridae	1.06	0.02				0.22
Corydalidae	0.87					0.17
Simuliidae	0.3	0.32	0.03			0.13
Hydroptilidae	0.15	0.32	0.01		0.002	0.10
Cordulidae		0.42				0.08
Corixidae		0.08		0.28	0.01	0.07
Diamplyphnoidea		0.33				0.07
Pisidae	0.26	0.03				0.06
Araneida indet.	0.19	0.02				0.04
Gomphidae	0.01	0.17				0.04
Helicophidae	0.15	0.02	0.004			0.03
Hydrophilidae	0.08	0.09				0.03
Hemiptera indet.	0.14					0.03
Limnchiidae	0.02	0.11				0.03
Chiliniidae		0.11				0.02
Onisogastridae		0.11				0.02
Curculionidae	0.07	0.03				0.02
Elmidae	0.09		0.003			0.02
Empididae			0.01		0.07	0.02
Gordidae	0.07					0.01
Blephariceridae		0.07				0.01
Helodidae	0.003	0.06				0.01
Physidae		0.05				0.01
Eustheniidae	0.05					0.01
Amnicolidae		0.03			0.01	0.01
Acari indet.	0.03					0.01
Hyalellidae		0.03				0.01
Trichoptera indet.	0.03					0.01
Gerridae		0.02				0.00
Amphipoda indet.			0.01			0.00
Glossosomatidae	0.01					0.00
Athericidae	0.01					0.00
Ceratopogonidae	0.01					0.00
Ephyridae					0.01	0.00
Hydrobiosidae	0.004					0.00
Notonemouridae	0.003			6	13	0.00
Total	36	32	15	6	13	

Table 2  
Index of Relative Importance (% IRI)  
of each prey item for five studied fish  
species, Chilán River.

# AQUATIC

Revista AquaTIC, n° 24, pp. 50-53. Año 2006

ISSN 1578-4541

<http://www.revistaaquatic.com/aquatic/art.asp?t=p&c=194>

## Caracterización de la alimentación endógena en cautiverio y en ambiente natural para larvas tempranas de Puye (*Galaxias maculatus* Jenyns, 1842). Una comparación

Andrés Rodríguez Aguilera, Gunther Hernán Domke

Ecología trófica y aspectos reproductivos de *Trichomycterus areolatus* (Pisces, Trichomycteridae) en ambientes lóticos artificiales

Evelyn Habit<sup>1</sup>, Pedro Victoriano<sup>2</sup> & Hugo Campos<sup>3</sup>



Journal of Applied Ichthyology

J. Appl. Ichthyol. 26 (2010), 78–83

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Journal compilation © 2010 Blackwell Verlag, Berlin

ISSN 0175-8659

Received: April 8, 2009

Accepted: May 11, 2009

doi: 10.1111/j.1439-0426.2009.01347.x

## Trophic ecology of native and introduced fish species from the Chillán River, South-Central Chile

By R. Figueroa<sup>1</sup>, V. H. Ruiz<sup>2</sup>, P. Berrios<sup>3</sup>, A. Palma<sup>3</sup>, P. Villegas<sup>1</sup> and A. Andreu-Soler<sup>4</sup>

PRUEBA DE PAGINA

Revista Chilena de Historia Natural  
80: ???-???, 2007

Trophic niche overlap between two Chilean endemic species of *Trichomycterus* (Teleostei: Siluriformes)

Gayana 76(2): 102-111, 2012.

Sobreposición de nicho alimentario de dos especies endémicas chilenas de *Trichomycterus* (Teleostei: Siluriformes)

SERGIO SCOTT\*, RODRIGO PARDO & IRMA VILA

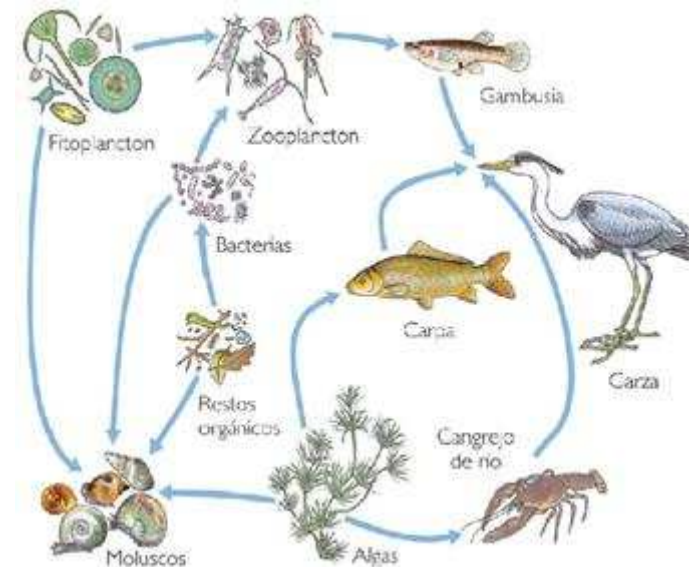
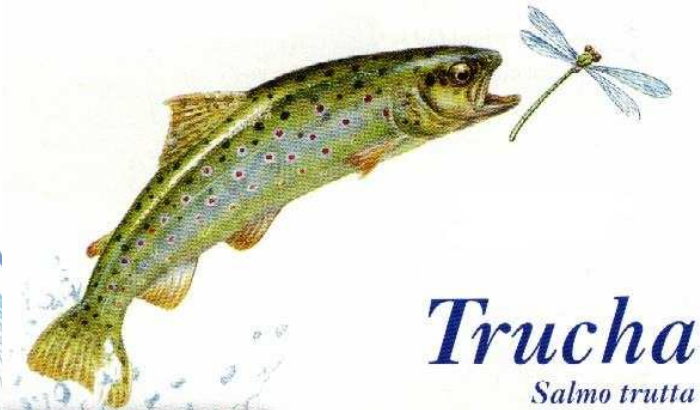
## Análisis de la dieta de *Diplomystes* (Siluriformes: Diplomystidae) de Chile

## Dietary analysis of *Diplomystes* (Siluriformes: Diplomystidae) from Chile

BELTRÁN-CONCHA M.<sup>1\*</sup>, MUÑOZ-RAMÍREZ C.<sup>2</sup>, IBARRA J.<sup>1</sup> & HABIT E.<sup>1,3</sup>

## ¿Cuánto conocemos los peces Chilenos de agua dulce?

Pero, conocemos  
¿sus hábitos o comportamiento alimentario?  
o ¿y cómo las tramas tróficas en las que participan?



## ¿Cuánto conocemos los peces Chilenos de agua dulce?

¿Conocemos su biología/ecología reproductiva?

- ¿Cuándo se reproducen?
- ¿Dónde se reproducen?
- ¿Cuál es la edad de la maduración sexual?
- ¿Cuál es su fecundidad?



## Aspectos Reproductivos de *Trichomycterus areolatus* Valenciennes, 1846 (Pisces: Teleostei: Siluriformes) en Rio Angostura, Chile

Adelina MANRIQUEZ, Laura HUAQUÍN,  
Mila ARELLANO y Gloria ARRATIA

FISH and FISHERIES, 2006, 7, 153-164

The possible adaptive advantages of terrestrial egg deposition  
in some fluvial diadromous galaxiid fishes (Teleostei:  
Galaxiidae)

R.M. McDowall<sup>1</sup> & S.C. Charrin<sup>2</sup>

J. Appl. Ichthyol. 23 (2007), 547-554  
© 2007 The Authors  
Journal compilation © 2007 Blackwell Verlag, Berlin  
ISSN 0175-8659

## Studies on Neotropical Fauna and Environment

Publication details, including instructions for authors and subscription information:  
<http://www.tandfonline.com/loi/nmfe20>

Seasonal changes in reproductive endpoints  
in *Trichomycterus areolatus* (Siluriformes):  
Trichomycteridae) and *Percilia gillissi* (Perciformes,  
Perciliidae), and the consequences for environmental  
monitoring

Gustavo Chiang<sup>a</sup>, Kelly R. Munkittrick<sup>b</sup>, M. Fernanda Saavedra<sup>a</sup>, Felipe Tucca<sup>a</sup>, Mark E.  
McMaster<sup>c</sup>, Roberto Urrutia<sup>a</sup>, Gerald Tetreault<sup>c</sup> & Ricardo Barra<sup>a</sup>

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ECOLOGY OF  
FRESHWATER FISH

## Reproduction of landlocked *Aplocheilichthys zebra* Jenyns (Pisces, Galaxiidae)

Lattuca ME, Brown D, Castiñeira L, Renzi M, Luizon C, Urbanski J,  
Cussac V. Reproduction of landlocked *Aplocheilichthys zebra* Jenyns (Pisces,  
Galaxiidae).

M. E. Lattuca<sup>1</sup>, D. Brown<sup>2</sup>,  
L. Castiñeira<sup>3</sup>, M. Renzi<sup>2</sup>, C. Luizon<sup>4</sup>,  
J. Urbanski<sup>3</sup>, V. Cussac<sup>1,5</sup>

Received: April 7, 2006  
Accepted: August 20, 2006  
doi: 10.1111/j.1439-0426.2006.00842.x

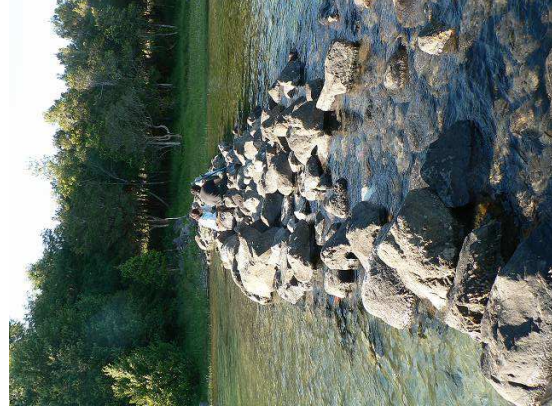
## Reproduction in puyen, *Galaxias maculatus* (Pisces: Galaxiidae), in the southernmost extreme of distribution

Bv C. C. Rov. F. Morriconi and J. Calvo

## Primeros estadíos del ciclo de vida de peces nativos del Río San Pedro (Cuenca del Río Valdivia, Chile)

First stages of the life cycle in native fish from the San Pedro River (Valdivia River Basin, Chile)

GERMÁN MONTOYA<sup>1\*</sup>, ALFONSO JARA<sup>1</sup>, KATHERIN SOLIS-LUFI<sup>1</sup>, NICOLE COLIN<sup>1,2</sup> & EVELYN HABIT<sup>1</sup>





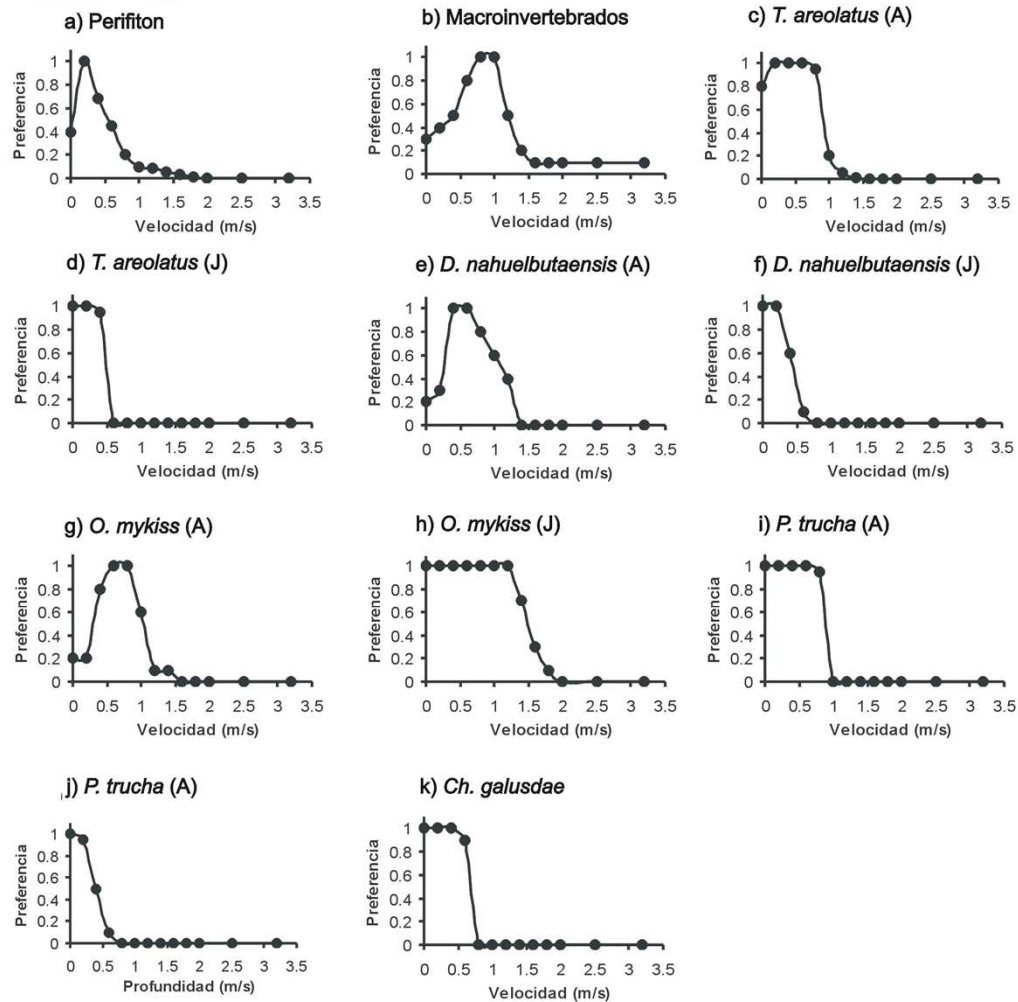
## ¿Cuánto conocemos los peces Chilenos de agua dulce?

### ¿Conocemos sus preferencias de hábitat?

- ¿Qué tipo de sustrato prefieren?
- ¿Qué velocidad de corriente prefieren?
  - ¿qué profundidad prefieren?







**FIGURA 13.** Curvas de preferencia de hábitat para la variable velocidad de la corriente (m/s) de las especies estudiadas con PHABSIM. a) perifiton, b) macroinvertebrados bentónicos, c) *Trichomycterus areolatus* adultos, d) *T. areolatus* juveniles, e) *Diplomystes nahuelbutaensis* adultos, f) *D. nahuelbutaensis* juveniles, g) *Oncorhynchus mykiss* adultos, h) *O. mykiss* juveniles, i) *Percichthys trucha* adultos, j) *P. trucha* juveniles, k) *Ch. galusdae* adultos y juveniles.

EULA, 2000  
**INFORME TÉCNICO**



¿Cuánto conocemos los peces Chilenos de agua dulce?

Y así, muchísimas preguntas más:



## ¿Cuánto conocemos los peces Chilenos de agua dulce?

- ¿Cuál es su diversidad genética y flujo génico?
- ¿Qué tolerancia tienen a factores ambientales como la temperatura o salinidad, etc.?
- ¿Cuáles son sus depredadores y competidores?
  - ¿Qué parásitos tienen?
  - ¿Cuál es su capacidad de nado?
- ¿Cómo los afecta la invasión de especies? ¿y la contaminación acuática?



¿Cuánto conocemos los peces Chilenos de agua dulce?

Todas las respuestas son:



**ESPECIE Y ESCALA-ESPECÍFICAS**

Y muchas además:



**SITIO-ESPECÍFICAS**



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## Por qué tenemos tantas preguntas sin respuesta:

- Falta de financiamiento a lo largo de décadas para este tipo de investigación.
- Reducidos grupos de investigación generando información científica validada.

Investigadores Chilenos  
Publicando sistemáticamente  
en los últimos 10 años sobre  
peces nativos de Chile

Fuera de Chile

Gloria Arratia  
Doris Soto  
Iván Arismendi

Irma Vila, U. de Chile  
David Véliz, U. de Chile

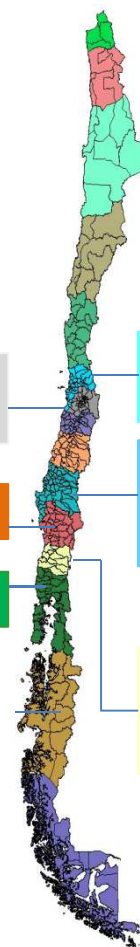
Iván Valdebenito, U. Cat. Temuco

Gonzalo Gajardo, U. de los Lagos

Brian Dyer, U. del Mar  
Sergio Quiroz, Museo Hist. Nat. Valpo.

Pedro Victoriano, U. de Concepción  
Ricardo Barra, U. de Concepción  
Evelyn Habit, U. de Concepción

Hugo Campos U. Austral Chile †  
Germán Pequeño U. Austral Chile  
(retirado)



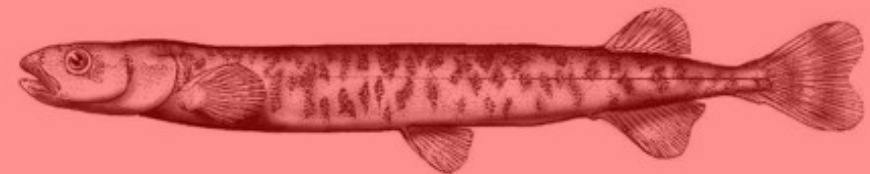
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**ENTONCES....**



**¿Cuánto conocemos los peces Chilenos de agua dulce?**



- La información es desigual entre especies.
- Faltan especialistas.
- Faltan fuentes de financiamiento para preguntas básicas.
- Se requiere de información específica a cada una de las preguntas de investigación o gestión que se planteen.