

Diversity and conservation status of *Aegla* spp. (Anomura, Aeglidae): an update

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ABSTRACT

The speciose genus *Aegla* Leach, 1820 is the only valid extant genus of the anomuran family Aeglidae, bearing 83 known species. This diversity may be even greater since there is some evidence for cryptic speciation. The genus is endemic to southern South America, occurring in freshwater habitats. We assessed the conservation status of 82 species of *Aegla* and found almost 70% of them under some level of threat, which represents a concerning proportion. Major threats to the group include freshwater pollution with urban, agricultural and industrial effluents, habitat modification and fragmentation, riparian forest removal, among others. Conservation measures are required to mitigate the major threats to freshwater ecosystems along rivers where the group occurs.

KEY WORDS

Anomuran crabs, Decapoda, freshwater crabs, South American creeks.

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SUBMITTED 10 March 2016
ACCEPTED 1 October 2016
PUBLISHED 27 April 2017

Guest Editors

Maria Lúcia Negreiros-Fransozo
and Adilson Fransozo

DOI 10.1590/2358-2936e2017011

INTRODUCTION

Taxonomically, the family Aeglidae was formerly included within the anomuran superfamily Galattheoidea, but morphological and molecular evidence (Martin and Abele, 1986; Tudge and Scheltinga, 2002; Pérez-Losada *et al.*, 2002a; Ah Yong and O'Meally, 2004) questioned this position. A reappraisal by McLaughlin *et al.* (2007) elevated Aeglidae to superfamily rank (Aegloidea).

Aegla Leach, 1820 is the only extant genus of the family Aeglidae and can be found in rivers, streams, and lakes of southern South America, occurring from the Rio Grande basin, on the border of São Paulo and Minas Gerais states, Brazil (Bueno *et al.*, 2007), to Duque de York Island, South River basin, Chile (Oyanedel *et al.*, 2011). This genus includes 83 described species (Bond-Buckup *et al.*, 2008; 2010a; 2010b; Santos *et al.*, 2012; 2013; 2015; Moraes *et al.*, 2016) and probably new species will be uncovered in the next years (Fig. 1).

The use of molecular techniques together with traditional systematics has helped to confirm several new species, as the number of morphological characters for taxonomic use is limited by the conservative morphotype of the group (Bond-Buckup and Buckup, 1994; Pérez-Losada *et al.*, 2004; Santos *et al.*, 2009; 2010; 2012; 2013). Moreover, the existence of cryptic species cannot be ruled out since molecular markers and geometric morphometrics have already pointed to this possibility (Bartholomei-Santos *et al.*, 2011; Marchiori *et al.*, 2014; 2015). This level of diversity is greater than that observed for crayfishes of the family Parastacidae (Almerão *et al.*, 2015) and brachyuran crabs of the genus *Trichodactylus* Latreille, 1828 (Yeo *et al.*, 2006), other crustacean groups inhabiting southern South American continental waters. Bond-Buckup *et al.* (2008) estimated that 36.5% of the 63 species described at that time were under threat of extinction. Pérez-Losada *et al.* (2009) assessed the conservation status of 66 aeglid species and found that 32% of them were threatened, that is, species falling within the International Union for Nature Conservation (IUCN) categories Vulnerable (VU), Endangered (EN), and Critically Endangered (CR). Many factors contribute to threat the group along its distribution in southern South America, such as decline in habitat quality, water contamination by extensive

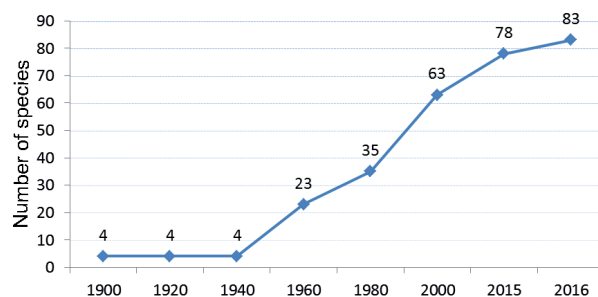


Figure 1. Cumulative number of known species of the genus *Aegla* Leach, 1820, since 1900.

use of pesticides in agriculture or by urban sewage, silvicultural practices, construction of hydroelectric plants, among others (Pérez-Losada *et al.*, 2002b; Bond-Buckup *et al.*, 2008; Baumart and Santos, 2010; Santos *et al.*, 2012). The presence of some species in restrict areas, as in headwaters, several of them with a few records of occurrence, highlights even more the level of threat to the group's conservation (Magris *et al.*, 2010).

In this study, we present data on the diversity of species of the genus *Aegla*, as well as updated information on the distribution of these species in different South American hydrographic basins. Moreover, based on data from several scientific collections and from years of work and experience of the authors, we evaluated the conservation status of the aeglid species and discussed the main threats to the genus diversity.

MATERIAL AND METHODS

We assessed and updated the distribution of 82 species of *Aegla*. Based on the updated distribution data, we revised the conservation status for each species previously assessed until 2016, according to the rules established by the International Union for Conservation of Nature (IUCN, 2012). There are five quantitative criteria (A – E) to be applied in order to evaluate if a taxon is under threat, and in which category the taxon should be included (EX – extinct; EW – extinct in wild; CR – critically endangered; EN – endangered; VU – vulnerable; NT – near threatened; LC – least concern; DD – deficient data; and NE – not evaluated; CR, EN and VU represent threat categories). The assessment employs sub-criteria to justify the assignment of a taxon to a certain category. Each species was evaluated in relation to its Extent Of Occurrence (EOO; sub-criterion B1) and Area Of Occupancy

(AOO; sub-criterion B2), using data from literature (Bond-Buckup and Buckup, 1994; Jara and Palacios, 1999; Jara *et al.*, 2003; Galves *et al.*, 2007; Santos *et al.*, 2009; 2010; 2012; 2013; 2014; 2015; Bond-Buckup *et al.*, 2010a; 2010b; César and Damborenea, 2010; Oyanedel *et al.*, 2011; Rocha and Bueno, 2011; Boos *et al.*, 2012; Satterlee *et al.*, 2012; Giri and Collins, 2014; Moraes *et al.*, 2016) and from sampling records in scientific collections (Universidade Federal do Rio Grande do Sul, Universidade Federal de Santa Maria, Pontifícia Universidade Católica do Rio Grande do Sul, Fundação Zoobotânica do Rio Grande do Sul, Universidade Regional do Alto Uruguai e das Missões – Campus Erechim, Universidad Austral de Chile). We determined the AOO for species with less than four records, using an area measure unit (each pixel corresponds to an area of 1 km²). In this case, AOO ranged from 1 to 3 km². For species with four or more records, we calculated the EOO. We assessed data for land-use classification for the whole occurrence area of Aeglidae from the Harmonized World Soil Database (<http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/>), from the World Land Use – Land cover from Food and Agriculture Organization of the United Nations (FAO) (<http://www.fao.org/geonetwork/srv/en/metadata.show?id=12749&currTab=simple>), as well as from SOS Mata Atlântica and Instituto Nacional de Pesquisas Espaciais, 2011 (<http://mapas.sosma.org.br>).

RESULTS

The list of species, with author(s) and year of description, as well as their distributions, are presented in **Tab. 1**. Records indicate the presence of aeglids in rivers, lakes and streams in catchments in Argentina (14 species), Bolivia (1 species), Brazil (52 species), Chile (22 species, considering *Aegla intermedia* Girard, 1855), Paraguay (1 species) and Uruguay (4 species), some species occurring in more than one country (**Figs. 2, 3**).

Based on our assessment, 17 species were classified as critically endangered (CR), 21 as endangered (EN), 19 as vulnerable (VU), one as near threatened (NT), 21 as least concern (LC), three had deficient data (DD), and one was not evaluated (NE). Current and previous conservation status and the criteria used to assign each species to an IUCN category are also shown in **Tab. 1**.

DISCUSSION

There are currently 83 known species of the genus *Aegla*, although the existence of *A. intermedia* is questioned. This species was described based upon specimens collected by the “U. S. N. Astronomical Expedition”, in tributaries of Maipu River, near to Santiago, Chile. Despite the effort of various researchers, the species has never been found again in nature and its type-series has disappeared (Bond-Buckup and Buckup, 1994). Hence, the conservation status of this species was not evaluated.

Using updated data from the species distribution, we found 57 species of *Aegla* under threat or almost 70% of the 82 species evaluated. This proportion represents a significant increase in relation to previous assessments for the genus *Aegla*, which estimated nearly half of the present value (Bond-Buckup *et al.*, 2008; Pérez-Losada *et al.*, 2009). Considering the most recent conservation status assessment for each species, from the 32 species previously assessed as LC, only 20 kept the same status; nine species changed the category to some level of threat and three have deficient data. Twenty-nine species kept the same threat category, but seven previously threatened species raised the threat level. Only one species changed from a threat category to NT status (**Tab. 1**).

Eighteen new species were described in the last decade (see **Tab. 1**). It is noteworthy that all the recently described species are under some level of threat (Santos *et al.*, 2009; 2010; 2012; 2013; 2014; 2015; Bond-Buckup *et al.*, 2010a; 2010b; Moraes *et al.*, 2016). Two species previously considered extinct in the wild, *Aegla expansa* Jara, 1992 (Pérez-Losada *et al.*, 2002a) and *Aegla lata* Bond-Buckup & Buckup, 1994 (Pérez-Losada *et al.*, 2009), have been found again (Galves *et al.*, 2007; Ministerio del Medio Ambiente, Chile, 2013) and are currently categorized as endangered and critically endangered, respectively.

The high rate of endemism presented by many aeglid species, in association with habitat loss/fragmentation or even climatic events, has led many populations to decline (Maia *et al.*, 2013; Bueno *et al.*, 2014). Forty years ago, many species were found in several streams and rivers within a basin, but currently, most of them are restricted to low order creeks (Bond-Buckup and Buckup, 1994).

Threats to conservation of aeglids and other freshwater organisms in southern South America

Table 1. Known species of the genus *Aegla* Leach, 1820, distribution, previous and current conservation status assessments according to IUCN (2012) Red List categories (CR – critically endangered; EN – endangered; NT – near threatened; LC – least concern; DD – deficient data; EX – extinct and NE – not evaluated). The numbers in parentheses, after the name and author of the species, indicate their location in the maps of figures 2 and 3.

Species	Country: Hydrographic basin (main rivers)	Previous assessment (Reference)	Current Status: Criterion
<i>Aegla abtao</i> Schmitt, 1942 (1)	Chile: Tolten River basin (Colico, Allipen, Toltén, Donguil, Pedregoso rivers, Caburgua, Colico lakes); Valdivia–Cruces River basin (Cruces, Pirén rivers); Valdivia–Calle Calle River basin (Huanehue river); Queule River basin (Queule River); Bueno River basin (Curileufu, Ralitrán, Huilma, Pilmaiquen, Negro, Rahue rivers, Mihue Lake); Maullín River basin (Maullín River, Llanquihue, Todos Los Santos lakes); Chamiza River basin (Chamiza River), Puelo River basin (Puelo River), Chiloe Island (San Juan, Huicha, Butalcura rivers, Huillinco Lake).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla affinis</i> Schmitt, 1942 (2)	Argentina: Colorado River basin (Colorado, Barrancas, Chico rivers); Desaguadero River basin (Atuel, Tunuyan, Chico, Barrancas, Malargüe rivers, La Matancilla, El Salto, Claro creeks).	LC (Pérez-Losada <i>et al.</i> , 2009)	CR: B1ab(iii)+2ab(iii)
<i>Aegla alacalufi</i> Jara & López, 1981 (3)	Chile: Maule River basin (Maule Lake, Maule River).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla araucaniensis</i> Jara, 1980 (4)	Chile: Reloncaví River basin (Reloncaví Fiord); Petrohué-Puelo River basin (Cochamó River); Huequi River basin (Huequi River); Chiloe Island (Puchagrán, Chadmo rivers, Huilique, Tarahuin lakes); Palena River basin (Palena River); Yelcho River basin (El Amarillo River, Yelcho Lake); Madre di Dios Island; Duke of York Island (North, South, Pollux, Thompson rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
	Chile: Valdivia River basin (Leufucade, Calle Calle rivers, Challahuin, Chesque, Coihueco, Quilquil, Quilen, Puquiñe, Huillilefufu, Puente Negro, Nancul creeks, Rinihue lake); Bueno River basin (Curileufu, Puquitré, Coinco, Lumaco, Sagllue, Pichimaule rivers, Cañal creeks); Petrohué River basin (Caytute River, Todos los Santos Lake); Maullín River basin (Lahuen Nadi, Machete creeks); Chiloe Island (Caulín, Huicha, Gamboa creeks, Tarahuin Lake).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla bahamondai</i> Jara, 1982 (5)	Chile: Bío Bío River basin (Rafael River); Lebú-Paicavi River basin (Caramávida-Tucapel, Pingueral, Caramávida, Cayucupil, Butamalal rivers).	VU: D2 (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)
<i>Aegla brevivalma</i> Bond-Buckup & Santos 2012 (6)	Brazil: Uruguay River basin (Matador River).	CR: B2ab(iii) (Santos <i>et al.</i> , 2012)	CR: B2ab(iii, iv)
<i>Aegla camargoi</i> Buckup & Rossi, 1977 (7)	Brazil: Uruguay River basin (Apuatê-Inhandava, Pelotas rivers).	EN: B1ab(iii,iv) (Brasil, 2014)	EN: B1ab(iii, iv)
<i>Aegla carinata</i> Bond-Buckup & Gonçalves, 2014 (8)	Uruguay: Uruguay River basin (Cuñapiru Creek).	NE	CR: B2ab(iii, iv)
<i>Aegla castro</i> Schmitt, 1942 (9)	Brazil: Paraná River basin (Upper Paranapanema, Tibagi, Ivaí Rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla cavernicola</i> Türkay, 1972 (10)	Brazil: Southeastern Atlantic system (Ribeira do Iguape River basin, Areias Grot and Areias de Baixo Cave).	CR: B2ab(iii,v) (Maia <i>et al.</i> , 2013)	CR: B2ab(iii, v)
<i>Aegla cholchol</i> Jara & Palacios, 1999 (11)	Chile: Imperial River basin (Pichilumaco, Pichi-Cautín, Traiguén, Colpi, Quillen, Chol Chol, Boroa, Cautín, Quepe rivers); Toltén River basin (Donguil River).	VU: A2ae (Pérez-Losada <i>et al.</i> , 2009)	VU: B1ab(iii)+2ab(iii)
<i>Aegla conceptionensis</i> Schmitt, 1942 (12)	Chile: Bío Bío River basin (Manantiales, Arabian Stadium creeks); Andalién River basin (unnamed creek at Villa Vergara, Nonguén River, Pineda Lake); Itata River basin (creek in Cerro Cayumanqui).	CR: A2ae+B1ab(i,iii,v) (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)

Cont.

Table 1. Cont.

Species	Country: Hydrographic basin (main rivers)	Previous assessment (Reference)	Current Status: Criterion
<i>Aegla denticulata denticulata</i> Nicolet, 1849 (13)	Chile: Bio Bio River basin (Malleco River); Budi River basin (Budi Lake); Toltén River basin (Mahuindanche, Donguil, Huiscaji, Curileufu rivers); Lingue River basin (Lingue River); Valdivia River basin (unnamed creek at Villa Calafquen, Calafquen Lake); Bueno River basin (Bueno, Negro rivers); Maullín River basin (Llanquihue Lake); Chilolé Island (Caulín, Huicha creeks, creeks affluent to Huillínco Lake, Tarahuín Lake).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla denticulata lacustris</i> Jara, 1989 (14)	Chile: Bueno River basin (Rupanco Lake).	NT (Pérez-Losada <i>et al.</i> , 2009)	CR: B1ab(iii)+2ab(iii)
<i>Aegla expansa</i> Jara, 1992 (15)	Chile: Bio Bio River basin (Hualqui River).	EX (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)
<i>Aegla franca</i> Schmitt, 1942 (16)	Brazil: Paraná River basin (Grande River).	VU (Bueno <i>et al.</i> , 2007)	CR: B2ab(iii)
<i>Aegla franciscana</i> Buckup & Rossi, 1977 (17)	Brazil: Uruguay River basin (Apuáé-Inhandava, Pelotas rivers); South Atlantic system (Caf, Sinos, Taquari-Tainhas, Tramandai, Mampituba rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla georginae</i> Santos & Jara, 2013 (18)	Brazil: Uruguay River basin (Perau Creek).	EN: B1ab(iii) (Santos <i>et al.</i> , 2013)	CR: B2ab(iii)
<i>Aegla grisella</i> Bond-Buckup & Buckup, 1994 (19)	Brazil: South Atlantic system (Upper Jacuí, Taquari-Tainhas, Jiuá, Passo Fundo rivers).	VU: B1ab(iii,iv) (Brasil, 2014)	VU: B1ab(iii, iv)
<i>Aegla hueicollensis</i> Jara & Palacios, 1999 (20)	Chile: Valdivia River basin (Futa, Chahuín, Colín, Hueicolla rivers).	VU: B1ab(iii,iv) (Pérez-Losada <i>et al.</i> , 2009)	NT
<i>Aegla humahuaca</i> Schmitt, 1942 (21)	Argentina: Paraná River basin (Bermejo, Dulce, Juramento, Grande rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	VU: B1ab(iii, iv)
<i>Aegla inconspicua</i> Bond-Buckup & Buckup, 1994 (22)	Brazil: South Atlantic system (Guaíba, Caf, Taquari-Antas, Sinos, Gravataí, Tramandai rivers).	VU: B1ab(iii,iv) (Brasil, 2014)	VU: B1ab(iii, iv)
<i>Aegla inermis</i> Bond-Buckup & Buckup, 1994 (23)	Brazil: South Atlantic system (Sinós, Caf, Tramandai rivers).	EN: B1ab(iii, iv) (Brasil, 2014)	CR: B1ab(iii, iv)
<i>Aegla intercalata</i> Bond-Buckup & Buckup, 1994 (24)	Argentina: Mar Chiquita system (Las Lajas River); Dulce River basin (Los Sojas River tributaries); Valle Central River basin (Las Trancas River).	LC (Pérez-Losada <i>et al.</i> , 2009)	VU: B1ab(iii, iv)
<i>Aegla intermedia</i> Girard, 1855	Chile: Maipo River basin (Maipo River; record not confirmed after description).	NE	NE
<i>Aegla itacolomienis</i> Bond-Buckup & Buckup, 1994 (25)	Brazil: South Atlantic system (Gravataí, Sinos rivers).	VU: B1ab(iii,iv) (Brasil, 2014)	VU: B1ab(iii, iv)
<i>Aegla itipi</i> Moraes, Tavares & Bueno, 2016 (80)	Brazil: Paraná River basin (Tietê River).	VU: B2aD2 (Moraes <i>et al.</i> , 2016)	VU: B2aD2
<i>Aegla jaraguá</i> Moraes, Tavares & Bueno, 2016 (81)	Brazil: Paraná River basin (Tietê River).	CR: A4eB2a (Moraes <i>et al.</i> , 2016)	VU: B2aD2
<i>Aegla jaráí</i> Bond-Buckup & Buckup, 1994 (26)	Brazil: Uruguay River basin (Canoas, Pelotas rivers); South Atlantic system (Itajaí-Açu River).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla jujuyana</i> Schmitt, 1942 (27)	Argentina: Paraná River basin (Chico, Grande, Huasamayo rivers, Peco Creek).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla jundiat</i> Moraes, Tavares & Bueno, 2016 (82)	Brazil: Paraná River basin (Tietê River).	VU: B2aD2 (Moraes <i>et al.</i> , 2016)	VU: B2aD2
<i>Aegla laevis</i> (Latreille, 1818) (28)	Chile: Maipo River basin (Maipo River); Maule River basin (Maule, Putagán rivers).	CR: A2ae (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)
<i>Aegla lancinhas</i> Bond-Buckup & Buckup, 2015 (30)	Brazil: Southeastern Atlantic system (Upper Ribeira do Iguape River sub basin, Lancinhas Grot).	EN: B1 B2ab(iii) (Santos <i>et al.</i> , 2015)	EN: B2ab(iii)
<i>Aegla lata</i> Bond-Buckup & Buckup, 1994 (31)	Brazil: Paraná River basin (Tibagi River, Apertados Creek).	EX (Pérez-Losada <i>et al.</i> , 2009)	CR: B1ab(i, iii, iv)
<i>Aegla leachi</i> Bond-Buckup & Santos 2012 (32)	Brazil: Uruguay River basin (Galafre River, Marombas River tributaries, Passo Fundo Creek).	VU: B1ab(iii) (Santos <i>et al.</i> , 2012)	VU: B1ab(iii, iv)
<i>Aegla leptochela</i> Bond-Buckup & Buckup, 1994 (33)	Brazil: Southeastern Atlantic system (Ribeira do Iguape River sub basin, Paivás Grot).	CR: B2ab(iii,v) (Maia <i>et al.</i> , 2013)	CR: B2ab(iii, v)
<i>Aegla leptodactyla</i> Buckup & Rossi, 1977 (34)	Brazil: Uruguay River basin (Silveira River); South Atlantic system (Itaquari-Antas River).	EN: B1ab(iii,iv) (Brasil, 2014)	EN: B1ab(iii, iv)
<i>Aegla ligulata</i> Bond-Buckup & Buckup, 1994 (35)	Brazil: South Atlantic system (Itaquari-Tainhas, Tramandai rivers).	EN: B1ab(iii,iv) (Brasil, 2014)	EN: B1ab(iii, iv)
<i>Aegla longirostri</i> Bond-Buckup & Buckup, 1994 (36)	Brazil: Uruguay River basin (Ibicuí River); South Atlantic system (Vacacai-Mirim, Jacuí, Paró, Itaquari-Tainhas, Antas, Caf, Sinos rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	DD
<i>Aegla loyolai</i> Bond-Buckup & Santos 2015 (37)	Brazil: Paraná River basin (Pajandubas River).	EN: B1B2ab(iii) (Santos <i>et al.</i> , 2015)	EN: B2ab(iii)

Cont.

Table 1. Cont.

Species	Country: Hydrographic basin (main rivers)	Previous assessment (Reference)	Current Status: Criterion
<i>Aegla ludwigi</i> Santos & Jara, 2013 (38)	Brazil: Uruguay River basin (Cambará Creek, branch of Potiribu River).	CR: B1ab(iii) (Santos <i>et al.</i> , 2013)	CR: B2ab (iii)
<i>Aegla manni</i> Jara, 1980 (39)	Chile: Valdivia River basin (Futa River, Buenaventura, Joaquines creeks); small Coastal basins (Millalafquén, Huiiko creeks).	VU: D2 (Pérez-Losada <i>et al.</i> , 2009)	VU: B1ab(iii)+2ab(iii)
<i>Aegla manuilata</i> Bond-Buckup & Santos, 2009 (40)	Brazil: Uruguay River Basin (Ibicuí-Mirim, Toropi rivers, Taquara, Itaimbé creeks).	EN: B1ab (iii, iv) (Brasil 2014)	EN: B1ab(iii, iv)
<i>Aegla marginata</i> Bond-Buckup & Buckup, 1994 (41)	Brazil: Paraná River basin (Parapanema, Upper Iguacu rivers); Southeastern Atlantic system (Ribeira do Iguape River, Paranaguá Bay).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla meloi</i> Bond-Buckup & Santos 2015 (42)	Brazil: Paraná River basin (tributary of Iguacu River).	CR: B2ab(iii) (Santos <i>et al.</i> , 2015)	CR: B2ab (iii)
<i>Aegla microphthalma</i> Bond-Buckup & Buckup, 1994 (43)	Brazil: Southeastern Atlantic system (Ribeira do Iguaçu River sub-basin, Santana Cave).	CR A4e+B2ab(iii,y) (Maia <i>et al.</i> , 2013)	CR: A4e+B2ab(iii,y)
<i>Aegla muelleri</i> Bond-Buckup & Buckup, 2010 (44)	Brazil: South Atlantic system (Passa Quatro River, Espingarda Creek).	NE	VU: B2ab(iii)
<i>Aegla neuquensis</i> Schmitt, 1942 (45)	Chile: Simpson River basin (Simpson, Pollux rivers). Argentina: Neuquén River basin (Neuquén River); Negro River basin (Negro, Limay, Alumíné, Collón Curá rivers, Nahuel Huapi, Tromen, Alumíné, Huechilafquen, Lolog lakes); Chubut River basin (Chubut, Mayo, Chico, Tecka, Senguerr rivers; Fontana Lake).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla oblata</i> Bond-Buckup & Santos 2012 (46)	Brazil: Uruguay River basin (Caronas, Lava-Tudo, Périco Redondo rivers, Engenho Velho Creek).	VU: B1ab(iii) (Santos <i>et al.</i> , 2012)	EN: B1ab(iii, iv)
<i>Aegla obstipa</i> Bond-Buckup & Buckup, 1994 (47)	Brazil: South Atlantic system (Guaíba Lake, Lower Jacuí, Ratos, Camaquã rivers).	EN: B1ab(iii) + 2ab(iii, iv) (Brasil, 2014)	EN: B2ab(iii, iv)
<i>Aegla occidentalis</i> Jara, Pérez-Losada & Crandall, 2003 (48)	Chile: Paicavi River basin (Caramávida, Tucapel rivers, Lanalhue Lake); Lleu Lleu River basin (Lleu Lleu Lake).	LC (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)
<i>Aegla odebrechtii</i> Müller, 1876 (49)	Brazil: Uruguay River Basin (Irani, Peixe, Canoas, Pelotas rivers); South Atlantic system (Itajai-Açu River).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla papudo</i> Schmitt, 1942 (50)	Chile: Choapa River basin (Choapa, Illapel rivers); Ligua River basin (Ligua River, Papudo Creek); Catapilco River basin (Catapilco River); Aconcagua River basin (Aconcagua River); Marga Marga River basin (Marga Marga River); Maipo River basin (Mapocho River).	CR: A2ae (Pérez-Losada <i>et al.</i> , 2009)	EN: A2ae
<i>Aegla parana</i> Schmitt, 1942 (51)	Brazil: Paraná River basin (Upper and Lower Iguacu, Timbó, Canoinhas rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla parva</i> Bond-Buckup & Buckup, 1994 (52)	Brazil: Paraná Basin (Upper, Middle and Lower Iguacu River); South Atlantic system (Itajai-Açu, Cubatão do Sul, Cedro rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla paulensis</i> Schmitt, 1942 (53)	Brazil: Southeastern Atlantic system (Cubatão River).	VU: B2AD2 (Moraes <i>et al.</i> , 2016)	VU: B2AD2
<i>Aegla perobae</i> Hebling & Rodrigues, 1977 (54)	Brazil: Paraná River basin (Peroba Grot, Tietê-Pracibaba River).	VU: B2ab(iii) (Pérez-Losada <i>et al.</i> , 2009)	CR: B2ab (iii)
<i>Aegla pewencha</i> Jara, 1994 (55)	Chile: Rapel River basin (Claro, Cachapoal rivers, Chimbarongo Creek); Mataquito River basin (Mataquito River); Maule River basin (Maule, Lircay, Longavi, Putagán rivers); Itata River basin (Cato, Ñuble, Chillán rivers); Bio Bio River basin (Bio Bio, Laja rivers); Imperial River basin (Traiguén, Quino rivers); Tolitén River basin (Donguil River).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla plana</i> Buckup & Rossi, 1977 (56)	Brazil: South Atlantic system (Cai, Taquari-Taimhas rivers).	EN: B1ab(iii,iv) (Brasil, 2014)	EN: B1ab(iii, iv)

Cont.

Table 1. Cont.

Species	Country: Hydrographic basin (main rivers)	Previous assessment (Reference)	Current Status: Criterion
<i>Aegla platensis</i> Schmitt, 1942 (57)	Argentina: La Plata River basin (La Plata River, Garupá Creek); Mar Chiquita system (Dulce River, Tipas, Loro, Singuil rivers); Uruguay River basin (Itacaruaré River, Santa Maria Creek); Martín García Island. Brazil: Uruguay River basin (Parizinho, Passarinhos, Chapeco, Guaraim, Moimho, Ibituí, Ijuí, Passo Fundo, Piratini, Quaraí, Santa Maria, Turvo-Santa Rosa-Santo Cristo, Várzea, Jacutinga rivers); South Atlantic system (Lower Jacuí, Cai, Sinos, Camaquã, Gravataí, Mirim-São Gonçalo, Sinos, Butuí-Icamaquã rivers, Guaíba Lake). Paraguay: Paraguay River basin (Jejuí River). Uruguay: La Plata River Basin (La Plata River, Miguelete Creek); Uruguay River Basin (Uruguay, Negro, Tacuarembó, Quaraí rivers); South Atlantic system (Cebollati River).	LC (Pérez-Losada <i>et al.</i> , 2009)	DD
<i>Aegla pomperana</i> Bond-Buckup & Buckup, 2010 (58)	Brazil: South Atlantic system (Itajaí-Açu, Itapocu rivers).	NE	VU: B1ab(iii, iv)
<i>Aegla prado</i> Schmitt, 1942 (59)	Brazil: South Atlantic system (Mirim Lagoon, Jaguarão River). Uruguay: Uruguay River basin (Negro River); La Plata River basin (Miguelete, Malvin creeks).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla renana</i> Bond-Buckup & Santos, 2010 (60)	Brazil: South Atlantic system (Cai River).	CR: B1ab(iii, iv) (Brasil, 2014)	CR: B2ab(iii, iv)
<i>Aegla ringueleti</i> Bond-Buckup & Buckup, 1994 (61)	Argentina: Paraná River basin (Salado River).	LC (Pérez-Losada <i>et al.</i> , 2009)	CR: B2ab(iii)
<i>Aegla riolmayana</i> Schmitt, 1942 (62)	Argentina: Negro River basin (Limay, Aluminé, Chimehuin rivers, Moquehue, Huechlatquen, Aluminé lakes, Jones Creek); Valdivia River basin (Lácar Lake). Chile: Valdivia River basin (Crucés, Leufucade, Antilhue, Reyehuetco, San Pedro-Calle Calle rivers); Bueno River basin (Lake Puyehue); Chilóe Island (Huinchica, Butalcura rivers, Huillincó Lake).	NT (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla rosanae</i> Campos Jr., 1998 (78)	Brazil: Southeastern Atlantic system (Paraíba do Sul River).	CR: B2abiii (Moraes <i>et al.</i> , 2016)	CR: B2abiii
<i>Aegla rossiana</i> Bond-Buckup & Buckup, 1994 (63)	Brazil: South Atlantic system (Araingá, Tramandai rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii, iv)
<i>Aegla rostrata</i> Jara, 1977 (64)	Chile: Tolten River basin (Caburga, Colico, Villarica lakes); Valdivia River basin (Huanehue, San Pedro, Cau Cau rivers, Calafquén, Neltume, Panguipulli, Rimihue lakes).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla saltensis</i> Bond-Buckup & Jara, 2010 (65)	Argentina: Paraná River basin (Pasaje, Juramento rivers).	NE	VU: B2ab(iii, iv)
<i>Aegla samlorenzo</i> Schmitt, 1942 (66)	Argentina: Paraná River basin (San Lorenzo River, Los Berros Creek).	LC (Pérez-Losada <i>et al.</i> , 2009)	EN: B2ab(iii)
<i>Aegla scamosa</i> Ringuelet, 1948 (67)	Argentina: Colorado River basin (Mendoza, San Juan rivers, Uspallata, Villa, El Infiernillo, Água Negra creeks).	LC (Pérez-Losada <i>et al.</i> , 2009)	DD
<i>Aegla schmitti</i> Hobbs III, 1979 (68)	Brazil: Paraná River basin (Parapanama, Upper Iguacu, Paraná, Tibagi, Ivai, Timbó rivers); Southeastern Atlantic system (Ribeira do Iguape River).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla septentrionalis</i> Bond-Buckup & Buckup, 1994 (69)	Bolivia: Paraná River basin (Salo, Sella rivers). Argentina: Paraná River basin (Bermejo, Pilcomayo, Arenales rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii, iv)
<i>Aegla serrana</i> Buckup & Rossi, 1977 (70)	Brazil: Uruguay River basin (Peixe, Santa Rita rivers); South Atlantic system (Cai, Taquari-Tainhas, Sinos, Tramandai rivers).	VU: B1ab(iii, iv) (Brasil, 2014)	VU: B1ab(iii, iv)
<i>Aegla singularis</i> Ringuelet, 1948 (71)	Argentina: Uruguay River basin (Pindapoy Creek). Brazil: Uruguay River basin (Apuatê-Inhandava, Turvo, Ijuí, Passo Fundo, Várzea, Jacutinga, Peixe rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC

Cont.

Table 1. Cont.

Species	Country: Hydrographic basin (main rivers)	Previous assessment (Reference)	Current Status: Criterion
<i>Aegla spectabilis</i> Jara, 1986 (72)	Chile: Imperial River basin (Chol Chol, Perquenco, Quepe, Cautín rivers); Toltén River basin (Donguil River).	CR: A2ae+B1ab (j,iii,y) (Pérez-Losada <i>et al.</i> , 2009)	VU: B1ab(iii)+2ab(iii)
<i>Aegla spinipalma</i> Bond-Buckup & Buckup, 1994 (73)	Brazil: South Atlantic system (Jacuí, Taquari-Tainhas, Sinos, Upper and Lower Jacuí rivers); Uruguay River basin (Jjuí River).	VU: B1ab(iii, iv) (Brasil, 2014)	VU: B1ab(iii, iv)
<i>Aegla spinosa</i> Bond-Buckup & Buckup, 1994 (74)	Brazil: Uruguay River basin (Apuatê-Inhandava, Jacutinga, Canoas, Pelotas rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
<i>Aegla strinatii</i> Turckay, 1972 (75)	Brazil: Southeastern Atlantic system (Ribeira do Iguape River, Diabo Cave, Tapagem Grot).	LC (Pérez-Losada <i>et al.</i> , 2009)	EN: B2ab(iii)
<i>Aegla talcahuano</i> Schmitt, 1942 (29)	Chile: Cachapoal River basin (Antivero River); Tinguiririca River basin (Chimbarongo River); Maule River basin (Maule, Lircay, Putagán, Liguay, Perquillauquén rivers).	VU: A2ae (Pérez-Losada <i>et al.</i> , 2009)	EN: B1ab(iii)+2ab(iii)
	Argentina: Paraná River basin (Areco, Dulce, Tercero, Paraná, Baradero rivers); Uruguay River basin (Yerúa, Molino creeks); Martín García Island; La Plata River basin (Cepeda, Manantiales creeks).		
<i>Aegla uruguayana</i> Schmitt, 1942 (76)	Brazil: Uruguay River basin (Ibicuí, Quaraí, Santa Maria rivers); South Atlantic system (Guaíba, Lower Jacuí, Negro, Mirim, São Gonçalo, Icamacá rivers).	LC (Pérez-Losada <i>et al.</i> , 2009)	LC
	Uruguay: Uruguay River basin (Uruguay River); La Plata River basin (Rosario River, Las Vacas, San Carlos creeks); South Atlantic system (Cebollati River).		
<i>Aegla vanini</i> Moraes, Tavares & Bueno, 2016 (79)	Brazil: Southeastern Atlantic system (Claro River).	VU: B2aD2 (Moraes <i>et al.</i> , 2016)	VU: B2aD2
<i>Aegla violacea</i> Bond-Buckup & Buckup, 1994 (77)	Brazil: South Atlantic system (Lower Jacuí, Lake Guaíba tributaries).	EN: B1ab(iii, iv) + 2ab (iii, iv) (Brasil, 2014)	EN: B1ab(iii,iv)

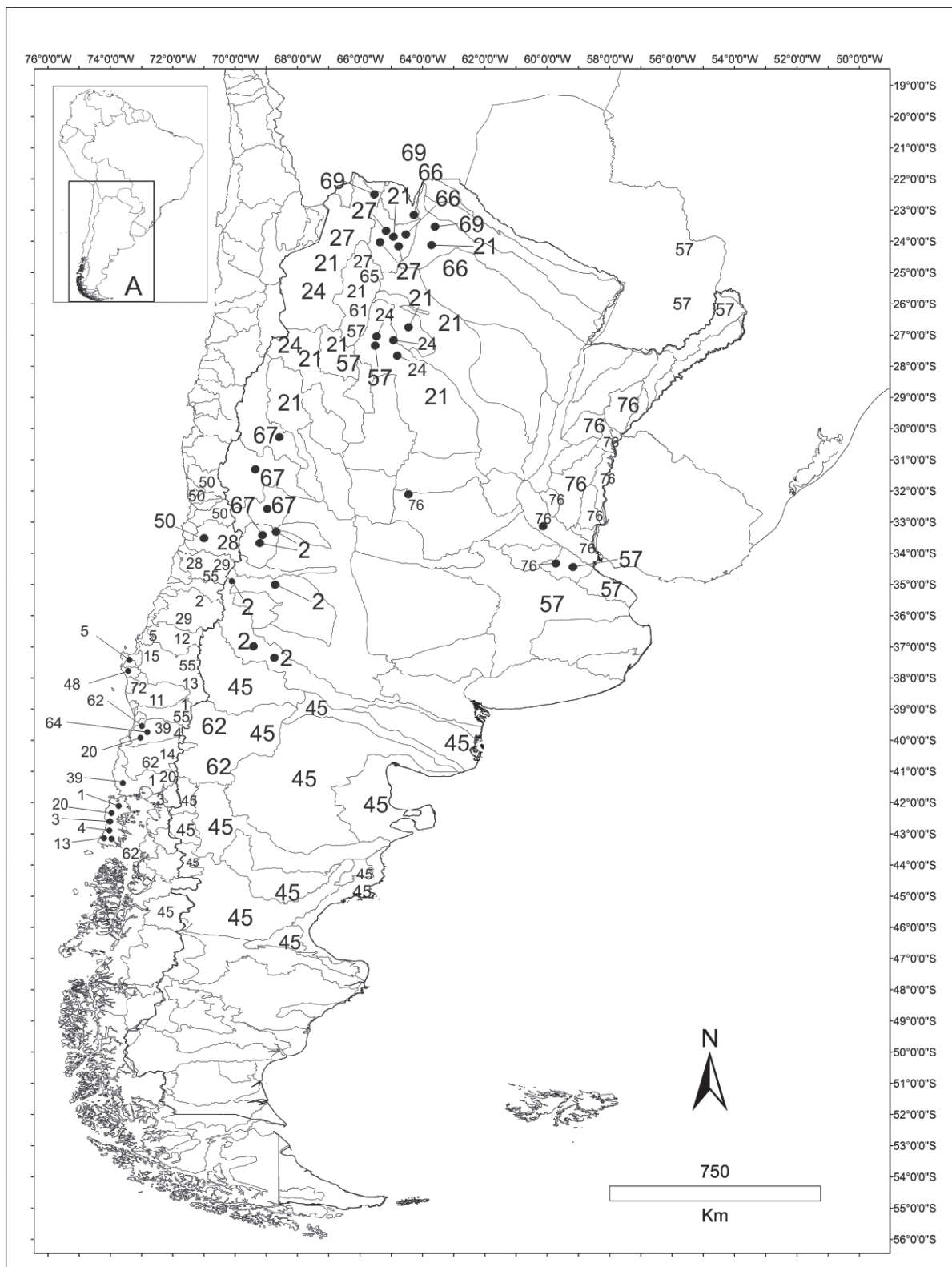


Figure 2. Distribution of *Aegla* Leach, 1820 in Argentina, Bolivia, Chile, and Paraguay (see Tab. 1 for the corresponding species number). In areas with less species diversity, we used a larger font size to facilitate the localization in the map. However, where diversity is high, to avoid overlapping the numbers, we reduced the font size, and if necessary we used a point with a line indicating the respective number.

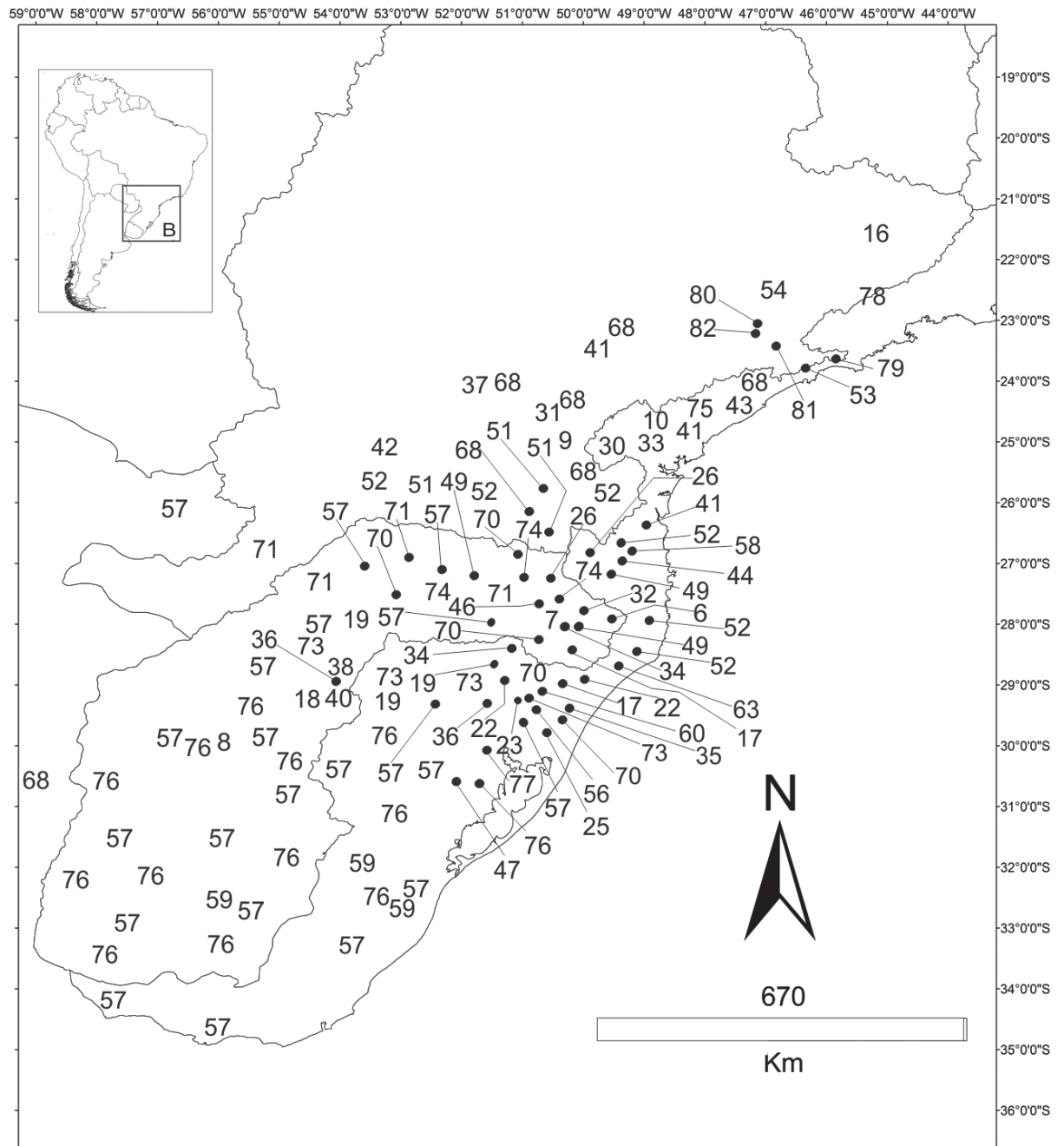


Figure 3. Distribution of *Aegla* Leach, 1820 in Brazil and Uruguay (see [Tab. 1](#) for the corresponding species number). In areas with less species diversity, we used a larger font size to facilitate the localization in the map. However, where diversity is high, to avoid overlapping the numbers, we reduced the font size, and if necessary we used a point with a line indicating the respective number.

derive from different sources: removal of riparian forest, causing siltation (Magris *et al.*, 2010); habitat modification, fragmentation and destruction (Cumberlidge *et al.*, 2009; Reid *et al.*, 2013); freshwater contamination with agricultural pesticide (Magris *et al.*, 2010; Negro *et al.*, 2015; Stehle and Schulz, 2016); construction of dams that alter the flow and sometimes the temperature of the water as well (Olsson, 2015); urban and agricultural activities which modify the physical and chemical characteristics of water bodies and freshwater biota composition (Milesi *et al.*, 2008; Hepp and Santos, 2009; Hepp *et al.*, 2010; Magris *et al.*, 2010); invasive species (Palaoro *et al.*, 2013; Loureiro *et al.*, 2015), among others.

Threats to the family Aeglididae, specifically, have been identified and listed, as the use of biocides in wine and fruit farms in Chile, silviculture of exotic species, large-scale cultivation of potatoes and apples with extensive use of pesticides, and hog raising activities along southern rivers in Brazil (Bond-Buckup *et al.*, 2008), beyond severe deforestation in Paraguay (Satterlee *et al.*, 2012). Irrigated rice crops are responsible for the entrance of great amount of pesticides into the hydric systems (Bhuiyan and Castañeda, 1995), what may constitute a threat to aeglids in southern Brazil, Uruguay, Paraguay and northwestern Argentina. These activities, although doubtless important, negatively impact the aquatic environment, and it is imperative that they respect the principle of sustainability (Santos *et al.*, 2012). In Argentina, the exotic golden mussel *Limnoperna fortunea* Dunker, 1857 was reported to settle on *Aegla platensis* Schmitt, 1942 affecting its populations (Darrigran and Damborenea, 2006). In Bolivia, anthropic activity and indiscriminate extraction by local people affect populations of *Aegla septentrionalis* Bond-Buckup & Buckup, 1994 (Flores, 2010), the only aeglid species occurring in that country.

It should also be taken into account that many aeglid species present a narrow distribution, and two species with a relatively wide distribution, *Aegla longirostri* Bond-Buckup & Buckup, 1994 and *Aegla platensis*, may represent a complex of cryptic species as supported by genetic and morphogeometric evidence (Bartholomei-Santos *et al.*, 2011; Marchiori *et al.*, 2014; 2015). If this is true, so the distribution area of each cryptic species will be narrower than the “grouped” species, which can result in different conservation status for each cryptic

species, the reason for which data were considered deficient for these two current recognized species.

Our assessment of the conservation status of all the currently known species of Aeglididae is worrisome, with 70% of the species under some level of threat and 20% critically endangered. Measures to protect the aeglid fauna are urgent, such as the frequent monitoring of water quality in systems where the threatened species occur, following-up the species to obtain information on possible population fluctuation or decline, protecting and restoring habitats, and information spreading among the population on the importance of water courses for conserving the native fauna, as well as encouraging agricultural practices that do not harm the water quality.

Aeglids live preferentially in clean waters (Bond-Buckup and Buckup, 1994), presenting a high demand for oxygen (Dalosto and Santos, 2011), and thus making these crustaceans potential good indicators of water quality. Policies for continental water quality control will help to protect not only the aeglids but also the limnetic fauna as a whole.

ACKNOWLEDGEMENTS

We are grateful to Dr. Nilton Hebling, the first author’s “scientific grandfather”, for his wise teachings and wonderful legacy. We would like to thank CNPq for the productivity grant for SS (311142/2014-1).

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