Thaís Pires Miranda

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Aos meus pais e ao meu irmão

“It is unwise to be too sure of one’s own wisdom. It is healthy to be reminded that the strongest might weaken and the wisest might err.”
MAHATMA GANDHI

“Look up at the stars and not down at your feet. Try to make sense of what you see, and wonder about what makes the universe exist. Be curious.”

STEPHEN HAWKING

“The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge.”

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Índice

Capítulo1. Introdução Geral

BIODIVERSIDADE MARINHA E ENDEMISMO NA COSTA AUSTRAL DA AMÉRICA DO SUL E ANTÁRTICA

Regiões polares são tradicionalmente consideradas como áreas de baixa diversidade marinha, em especial por serem compreendidas como ambientes de fatores abióticos extremos (Clarke, 2008). No Oceano Austral (OA), por exemplo, o padrão classicamente aceito é que a biodiversidade marinha aumenta em latitudes menores como, por exemplo, nas ilhas subantárticas – entretanto, há poucos estudos empíricos que contrastem a variação latitudinal com a riqueza de espécies para esta região (Clarke & Johnston, 2003). Em uma outra perspectiva sobre a questão, Clarke & Johnston (2003) revisaram listas com a diversidade marinha antártica e consideraram o OA como detentor de um alto grau de diversidade e de endemismo em sua fauna.

Estudos com inferências em áreas endemismo para a fauna do OA são escassos (*viz.*, revisão em Marques & Peña Cantero, 2010 e Miranda et al., 2013), mesmo com o aumento dos estudos sobre a biodiversidade antártica nas últimas décadas (Arntz, 1997; López-González & Gili, 2000). Como causa/consequência desta escassez, há uma defasagem metodológica, numérica e de extensão geográfica dos estudos em biogeografia marinha, em geral na comparação com o equivalente para o ambiente terrestre. A escassez de estudos em biogeografia marinha pode estar relacionada, talvez, a uma compreensão implícita de uma aparente inexistência de barreiras geográficas no ambiente, ou na dificuldade em caracterizá-las, inclusive sob uma perspectiva histórica (Miranda & Marques, 2011).

Estudos biogeográficos esbarram em dificuldades taxonômicas como, por exemplo, a confiabilidade das identificações das espécies e, consequentemente, a determinação dos pontos geográficos em que há a real presença de um táxon. Outra dificuldade é a existência de cladogramas no nível específico baseados em dados confiáveis da identificação das espécies, que permitam a inferência das distribuições em um contexto filogenético. Desta forma, o aprofundamento de estudos taxonômicos é fundamental para inferências de áreas de endemismo da biota como um todo ou de comunidades específicas (Miranda & Marques, 2011). Estas áreas de endemismo constituem a fase inicial dos estudos biogeográficos (Crisci et al., 2000), podendo ser consideradas hipóteses de homologia biogeográfica primária (Morrone, 2001) – por consequência, sua confiabilidade é um passo necessário para inferências posteriores, tais como estudos filogeográficos, ecológicos e evolutivos.

O alto grau de endemicidade da fauna do OA sugere a ocorrência de uma série de processos de especiação em um longo período de isolamento do continente antártico (Clarke & Crame, 1992; López-González & Gili, 2000; Clarke & Johnston, 2003; Clarke et al., 2005; Marques & Peña Cantero, 2010). Embora majoritariamente isolada, há evidências que sugerem uma afinidade da fauna da Península Antártica com a fauna subantártica da América do Sul (Clarke & Johnston, 2003; Clarke et al., 2005; Marques & Peña Cantero, 2010), particularmente devido à presença do Arco Scotia, o qual apresenta uma feição que eventualmente permitiria a comunicação entre as faunas americana e antártica (Clarke & Johnston, 2003).

Alguns estudos recentes sobre a fauna antártica enfocam comparações entre esta fauna e a subantártica, levando em conta diversos táxons marinhos, tais como briozoários, crustáceos, equinodermos, hidroides, moluscos, poliquetos, poríferos e sipunculídeos (*viz.*, Brandt et al., 1999; De Broyer & Rauschert, 1999; Cañete et al., 1999; Gerdes & Montiel, 1999; Mühlenhardt-Siegel, 1999; Peña Cantero & García Carrascosa, 1999; Saiz-Salinas & Pagola-Carte, 1999).

Entretanto, a fauna marinha subantártica, particularmente a da região magalhânica, é negligenciada em comparação com o conhecimento acumulado para o OA (Brandt et al., 1999; De Broyer & Rauschert, 1999; Montiel et al., 2005), principalmente em relação aos hidroides bentônicos.

O sudoeste do Atlântico (SOA) e sudeste do Pacífico (SEP) não ficam longe deste quadro de desconhecimento da fauna de hidroides bentônicos, inclusive para regiões mais profundas (*viz.*, Migotto & Marques, 2006; Galea, 2006a, 2007; Genzano et al., 2009). Estudos faunísticos sobre hidroides bentônicos têm sido feitos há pelo menos sete décadas para a costa da Argentina-Uruguai (Blanco, 1976, 1994; Genzano & Zamponi, 1997, 2003; Genzano et al., 2009; Rodriguez et al., 2012), Brasil (Vannucci Mendes, 1946; Vannucci, 1949, 1951; Migotto, 1996; Grohmann et al., 2003, 2011; Marques et al., 2003, 2013; Cunha & Jacobucci, 2010; Miranda et al., 2011) e, mais recentemente para o Chile (Galea, 2006a, 2006b, 2007; Galea et al., 2007a, 2007b, 2007c, 2009a, 2009b; Galea & Schories, 2012a; Galea et al., 2014). Entretanto, Galea (2006a, 2007) por exemplo, enfatiza que a fauna chilena é negligenciada e pouco documentada em relação ao que se conhece mundialmente, concentrando-se os registros principalmente em trabalhos mais antigos, tais como Jäderholm (1904), Hartlaub (1905) e Leloup (1974). Dados da literatura compilados até o final de 2013 para o subcontinente sul-americano revelam o registro de 615 espécies nominais de hidroides, sendo que destas, 435 foram registradas para a costa austral da América do Sul (CAAS, *i.e.*, região acima dos 22°S; *viz.*, Oliveira et al., in press). Estes números correspondem a aproximadamente 20% e 14%, respectivamente, do total de espécies de hidroides (pólipos e medusas) descritos mundialmente (Schuchert, 1998; Bouillon et al., 2006; Cartwright & Collins, 2007), o que corrobora o fato do conhecimento taxonômico destas espécies para o SOA e SEP estar longe do ideal.

'Hidroide bentônico' é o termo coloquial que se refere à fase séssil dos organismos das subclasses "Anthoathecata" (não-monofilética) e Leptothecata, ambas inseridas na classe Hydrozoa (filo Cnidaria). Estes organismos têm grande importância no bentos marinho devido ao seu crescimento rápido por reprodução assexuada, seu pioneirismo na colonização de substratos naturais e artificiais, sua enorme diversidade de estratégias reprodutivas sexuadas, além de sua associação com diversos organismos marinhos (*cf.*, Gili & Hughes, 1995; Rosso & Marques, 1997; Genzano, 1998, 2001, 2002; Genzano & Rodriguez, 1998; Migotto et al., 2001; Genzano & San Martín, 2002; Genzano et al., 2003; Oliveira, 2003; Oliveira et al., 2006; Oliveira & Marques, 2007; Shimabukuro, 2007).

A biodiversidade de hidroides bentônicos não é pouco conhecida somente para a CAAS (*i.e.*, SOA e SEP). Amplas áreas da região antártica também apresentam desconhecimento da fauna de hidroides bentônicos, tornando-se necessário aumentar os conhecimentos faunísticos para ambas as áreas. Dados da literatura desta fauna compilados até 2004 para a Antártica revelam um total de 153 espécies registradas, a maior parte delas apresentando ampla distribuição batimétrica, com ocorrência em regiões de maior profundidade (Peña Cantero, 2004). Em termos taxonômicos, a dominância relativa entre antoatecados e leptotecados ocorre de maneira inversa, ou seja, as populações/espécies de antoatecados concentram-se mais em regiões rasas, enquanto que as de leptotecados concentram-se mais em regiões profundas (Peña Cantero, 2004). Em levantamentos faunísticos extensos é frequente o registro de uma menor ocorrência de antoatecados em relação à leptotecados (Millard, 1975; Schuchert, 2000, 2001; Miranda, 2009). Peña Cantero & García Carrascosa (1999), por exemplo, ressaltam que, para as regiões magalhânica e antártica, os antoatecados têm sua fauna pouco conhecida, independentemente do esforço e uniformidade amostral.

Algumas semelhanças entre as faunas da Península Antártica e da região magalhânica vêm sendo documentadas (De Broyer & Rauschert, 1999; Pagès & Orejas, 1999; Peña Cantero &

García Carrascosa, 1999; Saiz-Salinas & Pagola-Carte, 1999) e associadas à separação tardia entre os continentes antártico e americano (Gerdes & Montiel, 1999; Lawver & Gahagan, 2003). Em geral, a interpretação da distribuição desta fauna tem um viés dispersionista, com discussões sobre a localidade de origem e sentido de migração destas faunas, *i.e.*, origem magalhânica e dispersão para a Antártica ou vice-versa (*cf.*, Peña Cantero & García Carrascosa, 1999).

Estudos envolvendo a origem e evolução de organismos marinhos para o SOA, SEP e OA (*e.g.*, Clayton, 1994; Brandt, 1999; Clarke et al., 2004) não possuem, em geral, um enfoque biogeográfico que inclua o uso de diferentes metodologias e análises estritas. Recentemente, Marques & Peña Cantero (2010) propuseram quatro áreas de endemismo para o OA, usando PAE e uma base de dados de distribuição geográfica do gênero *Oswaldella* (Leptothecata, Kirchenpaueriidae). Já Miranda et al. (2013) reanalisaram os dados de *Oswaldella* juntamente com dados adicionais dos gêneros *Antarctoscyphus*, *Mixoscyphus* e *Staurotheca* (Leptothecata, Sertulariidae), e propuseram a existência de oito áreas de endemismo para o OA. Entretanto, estudos focados no uso e comparação de diferentes metodologias para busca de áreas de endemismo ainda são preliminares e raros em biogeografia marinha, talvez devido à necessidade da existência de uma grande quantidade de dados geográficos disponíveis para sua realização. Desta forma, é necessário um aumento no número de estudos taxonômicos que visem comparar e entender o relacionamento entre as faunas antártica e subantártica, sob um contexto biogeográfico e evolutivo, tomando como modelo os hidroides bentônicos.

OBJETIVOS GERAIS

O estudo teve por principais objetivos:

1) Atualizar os status taxonômico de riqueza das espécies de hidroides bentônicos da CAAS e OA;
2) Reunir informações sobre seus substratos biológicos, endemismo, distribuições geográfica e batimétrica;
3) Investigar a (dis)similaridade entre as assembleias de hidroides bentônicos para a CAAS e OA;
4) Inferir áreas de endemismo para a CAAS e OA usando os hidroides bentônicos como modelo e a Análise de Endemicidade (AE) aplicada pelo software NDM-VNDM.
5) Reanalisar os dados de Marques & Peña Cantero (2010 por meio da Análise de Parcimônia de Endemicidade (PAE) aplicada com registros complementares da distribuição de 61 espécies endêmicas de hidroides bentônicos para a região acima de 45°S dos oceanos Atlântico e Austral.

ORGANIZAÇÃO DA TESE

Esta tese é apresentada em cinco capítulos. Este capítulo faz uma introdução geral ao estudo, lista os principais objetivos da tese e descreve a forma como foi organizada. Os capítulos 2 a 4 são apresentados na forma de artigos científicos, um deles já publicado (capítulo 4), os quais possuem objetivos, resultados e discussões específicos e independentes, porém relacionados. O capítulo 5 apresenta as considerações finais e conclusões do estudo.

REFERÊNCIAS

Arntz, W.E. 1997. Investigación antártica en biología marina: situación actual, proyectos internacionales y perspectivas. Boletín de la Real Sociedad Española de Historia Natural, 93, 13–44.

Blanco, O. 1976. Hidrozoos de la expedición Walther Herwig. Revista del Museo de La Plata, 12, 27–74.

Blanco, O.M. 1994. Enumeración sistemática y distribución geográfica preliminar de Hydroida de la República Argentina: suborden Athecata (Gymnoblastea, Anthomedusae), Thecata (Calyptoblastea, Leptomedusae) y Limnomedusae. Revista del Museo de La Plata, 14, 181–216.

Bouillon, J., Gravili, C., Pagès, F., Gili, J.-M. & Boero, F. 2006. An introduction to Hydrozoa. Mémoires du Muséum National d'Histoire Naturelle, 194, 1–591.

Brandt, A. 1999. On the origin and evolution of Antarctic Peracarida (Crustacea, Malacostraca). Scientia Marina, 63, 261–274.

Brandt, A., Linse, K. & Mühlenhardt-Siegel, U. 1999. Biogeography of Crustacea and Mollusca of the Subantarctic and Antarctic regions. Scientia Marina, 63, 383–389.

De Broyer, C. & Rauschert, M. 1999. Faunal diversity of the benthic amphipods (Crustacea) of the Magellan region as compared to the Antarctic (preliminary results). Scientia Marina, 63, 281–293.

Cañete, J.I., Leighton, G.L. & Aguilera, F.F. 1999. Polychaetes from Aysén Fjord, Chile: distribution, abundance and biogeographical comparison with the shallow soft-bottom polychaete fauna from Antarctica and the Magellan Province. Scientia Marina, 63, 243–252.

Cartwright, P. & Collins, A.G. 2007. Class Hydrozoa. In: Daly, M., Brugler, M.R., Cartwright, P., Collins, A.G., Dawson, M.N., Fautin, D.G., France, S.C., McFadden, C.S., Opresko, D.M., Rodriguez, E., Romano, S.L. & Stake, J.L. The phyllum Cnidaria: a review of phylogenetic patterns and diversity 300 years after Linnaeus. Zootaxa, 1668, 127–182.

Clarke, A. 2008. Antarctic marine benthic diversity: patterns and processes. Journal of Experimental Marine Biology and Ecology, 366, 48–55.

Clarke, A. & Crame, J.A. 1992. The Southern Ocean benthic fauna and climate change: a historical perspective. Philosophical Transactions of the Royal Society of London Series B Biological Sciences, 338, 299–309.

Clarke, A. & Johnston, N.M. 2003. Antarctic marine benthic diversity. In: Gibson, R.N. & Atkinson, R.J.A. (Eds) Oceanography and Marine Biology: an Annual Review. Taylor & Francis, 41, 468p.

Clarke, A., Aronson, R.B., Crame, J.A., Gili, J.M. & Blake, D.B. 2004. Evolution and diversity of the benthic fauna of the Southern Ocean continental shelf. Antarctic Science, 16, 559–568.

Clarke, A., Barnes, D.K.A. & Hodgson, D.A. 2005. How isolated is Antarctic? Trends in Ecology and Evolution, 20, 1–3.

Clayton, M.N. 1994. Evolution of the Antarctic marine benthic algal flora. Journal of Phycology, 30, 897–904.

Crisci, J.V., Katinas, L. & Posadas, P. 2000. Introducción a la teoría y práctica de la biogeografía histórica. Sociedad Argentina de Botânica, Buenos Aires, 169p.

Cunha, A.F. & Jacobucci, G.B. 2010. Seasonal variation of epiphytic hydroids (Cnidaria: Hydrozoa) associated to a subtropical *Sargassum cymosum* (Phaeophyta: Fucales) bed. Zoologia, 27, 945–955.

Galea, H.R. 2006a. On two new species of *Halopteris* Allman, 1877 (Cnidaria, Hydrozoa) from Chile. Zootaxa, 1165, 57–68.

Galea, H.R. 2006b. Rediscovery and redescription of *Hybocodon chilensis* Hartlaub, 1905 (Cnidaria, Hydrozoa) from Comau Fiord, southern Chile. Zootaxa, 1258, 57–68.

Galea, H.R. 2007. Hydroids and hydromedusae (Cnidaria: Hydrozoa) from the fjords region of southern Chile. Zootaxa, 1597, 1–116.

Galea, H.R. & Schories, D. 2012. Some hydrozoans (Cnidaria) from Central Chile and the Strait of Magellan. Zootaxa, 3296, 19–67.

Galea, H.R., G. Försterra & V. Häussermann. 2007a. Additions to the hydroids (Cnidaria: Hydrozoa) from the fjords region of southern Chile. Zootaxa, 1650, 55–68.

Galea, H.R., Försterra, G. & Häussermann, V. 2007b. Hydrozoa, fjord Comau, Chile. Check List, 3, 159–167.

Galea, H.R., Försterra, G. & Häussermann, V. 2007c. Cnidaria, Hydrozoa: latitudinal distribution of hydroids along the fjords region of southern Chile, with notes on the world distribution of some species. Check List, 3, 308–320.

Galea, H.R., Försterra, G. & Häussermann, V. 2009a. New additions to the hydroids (Cnidaria: Hydrozoa) from the fjords regions of southern Chile. Zootaxa, 2019, 1–28

Galea, H., Häussermann, V. & Försterra, G. 2009b. Hydrozoa. In: Häussermann, V. & Försterra, G. (Eds) Marine benthic fauna of Chilean Patagonia. Nature in Focus, 1000p.

Galea, H.R., Schories, D., Försterra, G. & Häussermann, V. 2014. New species and new records of hydroids (Cnidaria: Hydrozoa) from Chile. Zootaxa, 3852, 1–50.

Genzano, G.N. 1998. Hydroid epizoites on hydroids *Tubularia crocea* and *Sertularella mediterranea* from the intertidal of Mar del Plata (Argentina). Russian Journal of Marine Biology, 24, 123–126.

Genzano, G.N. 2001. Associated fauna and sediment trapped by colonies of *Tubularia crocea* (Cnidaria, Hydrozoa) from the rocky intertidal of Mar del Plata, Argentina. Biociências, 9, 105–119.

Genzano, G.N. 2002. Associations between pycnogonids and hydroids from the Buenos Aires litoral zone, with observations on the semi-parasitic life cycle of *Tanystylum orbiculare* (Ammotheiidae). Scientia Marina, 66, 83–92.

Genzano, G.N. & Rodriguez, G.M. 1998. Association between hydroid species and their substrates from the intertidal zone of Mar del Plata (Argentine). Miscellània Zoològica, 21, 21–29.

Genzano, G.N. & San Martín, G. 2002. Association between the polychaete *Procerastea halleziana* (Polychaeta: Syllidae: Autolytinae) and the hydroid *Tubularia crocea* (Cnidaria: Hydrozoa) from the Mar del Plata intertidal zone, Argentina. Cahiers the Biologie Marine, 43, 165–170.

Genzano, G.N. & Zamponi, M.O. 1997. Frecuencia de estudio y diversidad de los hidrozoos bentónicos de la plataforma continental argentina. Ciencias Marinas, 23, 285–302.

Genzano, G.N. & Zamponi, M.O. 2003. Hydroid assemblages from Mar del Plata, Argentina, at depths between 0 and 500m. Distribution and biological substrata. Oceanologica Acta, 25, 303–313.

Genzano ,G.N., Excoffon, A.C., Acuña, F.H. & Zamponi, M.O. 2003. Hydroid colonies as primary substrata for recruits of the mussel *Mytilus edulis platensis* front off Mar del Plata, Argentina. Ophelia, 57, 53–61.

Genzano, G.N., Giberto, D., Schejter, L., Bremec, C. & Meretta, P. 2009. Hydroid assemblages from the Souhwestern Atlantic Ocean (34–42°S). Marine Ecology, 30, 33–46.

Gerdes, D. & Montiel, A. 1999. Distribution patterns of macrozoobenthos: a comparison between the Magellan region and the Weddell Sea (Antarctica). Scientia Marina, 63, 149–154.

Gili, J.-M. & Hughes, R.G. 1995. The ecology of marine benthic hydroids. Oceanography and Marine Biology, an annual review, 33, 351–426.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A. 2003. Hydroids (Cnidaria, Hydrozoa) collected on the continental shelf of Brazil during the Geomar X Oceanographic Operation. Zootaxa, 299, 1–19.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A.P. 2011. Hydroids (Cnidaria, Hydrozoa) collected on the inner continental shelf of the state of Rio de Janeiro, Brazil, during the Oceanographic

Operations GEOCOSTA RIO I and II. Biota Neotropica, 11, 193–201.

Hartlaub, C. 1905. Die Hydroiden der magalhaensishen region und chilenischen küste. Zoologische Jahrbücher, 6, 497–714.

Jäderholm, E. 1904. Hydroiden aus den Küsten von Chile. Arkiv för Zoologi, 2, 1–7.

Lawver, L.A. & Gahagan, L.M. 2003. Evolution of Cenozoic seaways in the circum-Antarctic region. Palaeogeography, Palaeoclimatology, Palaeoecology, 198, 11–37.

Leloup, E. 1974. Hydropolypes calyptoblastiques du Chili. Report no. 48 of the Lund University Chile Expedition 1948–1949. Sarsia, 55, 1–62.

López-González, P.J. & Gili, J.-M. 2000. A new octocoral genus (Cnidaria: Anthozoa) from Antarctic waters. Polar Biology, 23, 452–458.

Marques, A.C. & Peña Cantero, A.L. 2010. Areas of endemism in the Antarctic – a case study of the benthic hydrozoan genus *Oswaldella* (Cnidaria, Kirchenpaueriidae). Journal of Biogeography, 37, 617–623.

Marques, A.C., Morandini, A.C. & Migotto, A.E. 2003. Synopsis of knowledge on Cnidaria Medusozoa from Brazil. Biota Neotropica, 3, 1–18.

Marques, A.C., Klôh, A.S., Migotto, A.E., Cabral, A.C., Rigo, A.P.R., Bettim, A.L., Razzolini, E.L., Cascon, H.M., Bardi, J., Kremer, L.P., Vieira, L.M., Bezerra, L.E.A., Haddad, M.A., Oliveira Filho, R.R., Gutierre, S.M.M., Miranda, T.P., Franklin Jr., W. & Rocha, R.M. 2013.

Rapid assessment survey for exotic benthic species in the São Sebastião Channel, Brazil. Latin American Journal of Aquatic Research, 41, 265–285.

Migotto, A.E. 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. Zoologische Verhandelingen, 306, 1–125.

Migotto, A.E. & Marques, A.C. 2006. Invertebrados marinhos. In: Lewinsohn, T.M. (Ed.) Avaliação do estado do conhecimento da diversidade brasileira. Ministério do Meio Ambiente, 1, 149–202.

Migotto, A.E., Marques, A.C. & Flynn, M.N. 2001. Seasonal recruitment of hydroids (Cnidaria) on experimental panels in the São Sebastião Channel, Southeastern Brazil. Bulletin of Marine Science, 68, 287–298.

Millard, N.A.H. 1975. Monograph on the Hydroida of Southern Africa. Annals of the South African Museum, 68, 1–513.

Miranda, T.P. 2009. Faunística e distribuição geográfica de hidróides bentônicos (Cnidaria, Hydrozoa) do sudoeste do Atlântico. Dissertação de mestrado. Instituto de Biociências, Universidade de São Paulo, 206p.

Miranda, T.P., Haddad, M.A., Shimabukuro, V., Dubiaski-Silva, J. & Marques, A.C. 2011. Fauna de hidroides (Cnidaria, Hydrozoa) da região de Bombinhas, Santa Catarina, Brasil. Biota Neotropica, 11, 331–353.

Miranda, T.P., Peña Cantero, A.L. & Marques, A.C. 2013. Southern Ocean areas of endemism: a reanalysis using benthic hydroids (Cnidaria, Hydrozoa). Latin American Journal of Aquatic Research, 41, 1003–1009.

Montiel, A.S.M., Gerdes, D. & Arntz, W.E. 2005. Distributional patterns of shallow-water polychaetes in the Magellan region: a zoogeographical and ecological synopsis. Scientia Marina, 69, 123–133.

Morrone, J.J. 2001. Homology, biogeography and areas of endemism. Diversity and Distributions, 7, 297–300.

Mühlenhardt-Siegel, U. 1999. On the biogeography of Cumacea (Crustacea, Malacostraca). A comparison between South America, the Subantarctic Islands and Antarctica: present state of the art. Scientia Marina, 63, 295–302.

Oliveira, O.M.P. 2003. Diversidade e sazonalidade de hidróides (Cnidaria, Hydrozoa) epifíticos do Canal de São Sebastião, SP. Dissertação de Mestrado. Instituto de Biociências, Universidade de São Paulo, 109p.

Oliveira, O.M.P. & Marques, A.C. 2007. Epiphytic hydroids (Hydrozoa: Anthoathecata and Leptothecata) of the world. Check List, 3, 21–38.

Oliveira, O.M.P., Marques, A.C. & Migotto, A.E. 2006. Chave de identificação dos hidróides (Cnidaria, Hydrozoa) epifíticos do Canal de São Sebastião (SE, Brasil). Biota Neotropica, 6, 1–18.

Oliveira, O.M.P., Araújo, E.M., Ayón, P., Cedeño-Posso, C.M., Cepeda, A.A., Córdova, P., Cunha, A.F., Galea, H., Genzano, G.N., Haddad, M.A., Mianzan, H.W., Migotto, A.E., Miranda, L.S., Miranda, T.P., Morandini, A.C., Nagata, R.M., Nascimento, K., Nogueira Jr., M., Palma, S., Quiñones, J.A.D., Rodriguez, C., Scarabino, F., Schiariti, A., Tronolone, V. & Marques, A.C. Census of the Cnidaria (Medusozoa) and Ctenophora from South American marine waters. Zootaxa [in press].

Pagès, F. & Orejas, C. 1999. Medusae, siphonophores and ctenophores of the Magellan region. Scientia Marina, 63, 51–57.

Peña Cantero, A.L. 2004. How rich is the deep-sea Antarctic benthic hydroid fauna? Polar Biology, 27, 767–774.

Peña Cantero, A.L. & García Carrascosa, A.M. 1999. Biogeographical distribution of the benthic thecate hydroids collected during the Spanish "Antártida 8611" expedition and comparison between Antarctic and Magellan benthic hydroid faunas. Scientia Marina, 63, 209–218.

Rodriguez, C.S., Miranda, T.P., Marques, A.C., Mianzan, H. & Genzano, G. 2012. The genus *Hybocodon* (Cnidaria, Hydrozoa) in the southwestern Atlantic Ocean, with a revision of the species recorded from the area. Zootaxa, 3523, 39–48.

Rosso, S. & Marques, A.C. 1997. Patterns in intertidal hydrozoan distribution along the coast of São Paulo State, Southeastern Brazil. In: den Hartog, J.C. (Ed.) Proceedings of the 6th International Conference on Coelenterate Biology. National Natuurhistorisch Museum, 1st edition, 415–422.

Saiz-Salinas, J.I. & Pagola-Carte, S. 1999. Sipuncula of the Magellan area compared with adjacent regions of Antarctica. Scientia Marina, 63, 227–232.

Schuchert, P. 1998. How many hydrozoan species are there? Zoologische Verhandelingen, 323, 209–219.

Schuchert, P. 2000. Hydrozoa (Cnidaria) of Iceland collected by the BIOICE programme. Sarsia, 85, 411–438.

Schuchert, P. 2001. Hydroids of the Greenland and Iceland (Cnidaria, Hydrozoa). Meddelelser om Grønland, Bioscience, 53, 1–184.

Shimabukuro, V. 2007. As associações epizóicas de Hydrozoa (Cnidaria: Leptothecata, Anthoathecata e Limnomedusae): I) Estudo faunístico de hidrozoários epizóicos e seus organismos associados, II) Dinâmica de comunidades bentônicas em substratos artificiais. Dissertação de Mestrado. Instituto de Biociências, Universidade de São Paulo, 275p.

Vannucci Mendes, M. Hydroida Thecaphora do Brasil. 1946. Arquivos de Zoologia do Estado de São Paulo, 4, 535–598.

Vannucci, M. 1949. Hydrozoa do Brasil. Boletim da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo, 99, 219–266.

Vannucci, M. 1951. Distribuição dos Hydrozoa até agora conhecidos nas costas do Brasil. Boletim do Instituto Paulista de Oceanografia, 2, 105–124.

Capítulo 2. Biodiversity and ecological assemblages of benthic hydroids (Cnidaria, Hydrozoa) from southern South America and the Southern Ocean

ABSTRACT

The benthic hydroid fauna from southern South America (SSA) and the Southern Ocean (SO) is heterogeneous and unevenly distributed. We surveyed 5,621 samples, comprising 359 morphospecies of benthic hydroids, updated their taxonomy, provided information on species richness, biological substrate and geographic distributions. Assemblages were described through cluster and nMDS using Bray-Curtis similarities. Endemism at SSA is 65% and at SO is 88% of the endemic species. Leptothecate species have wider horizontal and vertical distributions than "anthoathecates"; and most of the benthic hydroids surveyed are substrate-generalists. Thirteen assemblages of benthic hydroids were found along the SSA and SO. These assemblages are compared with previous hypotheses of ecoregions, realms, assemblages and areas of endemism in the region. Ecological biogeographic information described here is discussed based on the oceanographic dynamics in the SSA and SO.

INTRODUCTION

The southern South America (SSA) coast extends from ~22°S to 56°S in the Atlantic and Pacific oceans (~10,000 km of coastline). The Pacific side is influenced by the Humboldt upwelling system, and the Atlantic side by the warm Brazil Current and the cold Falklands/Malvinas Current, flowing in opposite directions along the Atlantic Patagonian shelf (Acha et al., 2004; Miloslavich et al., 2011). The SSA comprises several different marine ecosystems, including archipelagos, channels, estuaries, lagoons, mangroves, rocky shores, sandy beaches, and seagrass beds, which together encompass a high, but poorly known, marine biodiversity (Acha et al., 2004; Costello et al., 2010; Miloslavich et al., 2011). Many marine species have not yet been described here, and many will be extinct before being described (Costello & Wilson, 2010; Costello et al., 2010), especially smaller invertebrates such as the benthic hydroids (Cnidaria, Hydrozoa).

This is similar to the situation in the Southern Ocean (SO). With an area of ~35 million km^2, the SO plays a fundamental role in the oceanographic circulation system of the planet because of the large effects of the Antarctic Circumpolar Current (ACC) – the only marine current connecting, in one continuum, the Atlantic, Indian and Pacific Oceans (Clarke & Johnston, 2003; Barker & Thomas, 2004; Griffiths, 2010; Kaiser et al., 2013). The circum-antarctic current system, including the ACC, originated during the Cenozoic, and was responsible for the biogeographic and thermic isolation of the SO (Barker & Burrell, 1977; Lawver & Gahagan, 2003). Consequently, SO marine benthic communities are characterized by high levels of endemism and isolation (Clarke & Johnston, 2003; Brandt et al., 2007a, 2007b), representing an excellent natural laboratory in which to study biodiversity, biogeography and evolution (Clarke et al., 2004; Kaiser et al., 2013).

Some of the SO fauna is shared with the SSA fauna, due to the past connection between Antarctica and South America, and because of the Scotia Arc between them (De Broyer & Rauschert, 1999; Pagès & Orejas, 1999; Peña Cantero & García Carrascosa, 1999; Saiz-Salinas &

Pagola-Carte, 1999; Gerdes & Montiel, 1999; Clarke & Johnston, 2003; Lawver & Gahagan, 2003). Both faunas remain poorly known when compared to other marine faunas (*e.g.*, Mediterranean Sea). Amphipods, bryozoans, gastropods, isopods, polychaetes, and sponges are among the relatively well known groups for the SO (Arntz et al., 2005; Brandt et al., 2007a). However, few species (sometimes none) of benthic hydroids (the polyp stage of the hydrozoan "Anthoathecata" and Leptothecata) have been reported in large areas (*e.g.*, East Antarctica) and in deep-sea regions of the SO (Peña Cantero & García Carrascosa, 1999; Peña Cantero, 2004, 2012; Peña Cantero & Gili, 2006). Indeed, the eastern coast of Antarctica and deep-waters of the SO are frequently reported as poorly known (Clarke & Johnston, 2003; Peña Cantero & Gili, 2006; Peña Cantero, 2012), which is probably due to the difficult access for sampling (Clarke et al., 2007).

Many benthic hydroids have a patchy geographic distribution as a result of their dispersal capabilities, biotic relationships, availability of substrata, and environmental preferences (Cornelius, 1992; Gili & Hughes, 1995). Other benthic hydroid species however, have wide geographic distributions, are frequently associated with other organisms (*e.g.*, algae, bivalves, caprellids, corals, gorgonians, polychaetes, pycnogonids, sponges, zooxanthellae; Genzano, 2002; Genzano & San Martín, 2002; Dougherty & Russell, 2005; Gravier-Bonnet & Bourmaud, 2005; Gili et al., 2006; Oliveira & Marques, 2007, 2011; Ronowicz et al., 2008; Cunha & Jacobucci, 2010; Bo et al., 2011; Campos et al., 2012) and can grow on a wide variety of artificial and natural substrates (Migotto et al., 2001; Oliveira & Marques, 2007, 2011; Genzano et al., 2009a; Fernandez et al., 2014a, 2014b, in press). Few hydroid species are substrate specialists (*e.g.*, species of *Zyzzyzus*; Campos et al., 2007, 2012), most are substrate generalists (Gili & Hughes, 1995; Migotto et al., 2001; Genzano, 2002; Genzano & San Martín, 2002; Dougherty & Russell, 2005; Gravier-Bonnet & Bourmaud, 2005; Gili et al., 2006; Oliveira & Marques, 2007, 2011; Ronowicz et al., 2008; Genzano et al., 2009a; Cunha & Jacobucci, 2010; Bo et al., 2011; Campos et al., 2012; Ronowicz et al., 2013a, 2013b; Fernandez et al., 2014a).

Although substrate specialist species are less common, their strategy of colonization should be advantageous because potential competition with other species is reduced (Gili & Hughes, 1995). Substrate specialists can be epiphytic (see synthesis in Oliveira & Marques, 2007) or epizoic. Epiphytic species should be less limited by substrate availability because algae and seagrasses are common and can be abundant during the growing seasons (Gili & Hughes, 1995; Oliveira & Marques, 2011). Larvae of epizoic species tend to be more restrictive concerning substrate selection: benthic hydroids associated with sponges (*e.g.*, species of *Zyzzyzus*; Campos et al., 2007, 2012), molluscs (*e.g.*, *Eutima sapinhoa*; Migotto et al., 2004) and other hydroids (*e.g.*, some species of *Filellum*; Genzano et al., 2009a; Marques et al., 2011) are most common.

While poorly known in the SO and SSA, benthic hydroids are well-known in other areas (*e.g.*, Chilean Patagonia, southeastern and southern Brazil, Río de La Plata and Buenos Aires, Antarctic Peninsula), with continual studies since the 19th century (Allman, 1888; Nutting, 1900, 1904, 1915; Hartlaub, 1904, 1905; Jäderholm, 1904a, 1904b, 1905, 1917, 1920; Ritchie, 1909; Vannucci Mendes, 1946; Vannucci, 1949, 1951; Blanco, 1963, 1964, 1967, 1976, 1994; Genzano, 1990, 1994; Migotto, 1996; Genzano & Zamponi, 1997, 2003; Genzano et al., 2002, 2009a, 2011; Marques, 2001; Migotto et al., 2002; Grohmann et al., 2003, 2011; Marques & Migotto, 2003; Marques et al., 2003; Galea, 2007; Galea et al., 2007a, 2007b, 2007c, 2009a, 2009b; Cunha & Jacobucci, 2010; Miranda et al., 2011; Galea & Schories, 2012a, 2012b; Oliveira et al., in press). However, these many studies have heterogeneous taxonomical quality, because of poor taxonomy and misidentification. Many geographic records are contradictory, or of cryptic species (*e.g.*, *Clytia* spp.; Lindner et al., 2011), and thus require extensive taxonomic review prior to being suitable for biological analyses. As taxonomy is the basis for all biological sciences, mistaken identifications will lead to incorrect biology (Lozier et al., 2009). Recent compilations of the literature (Oliveira et al., in press) help to fill information gaps, but the validity of several species have not yet been confirmed and further study is necessary. To begin filling these geographical gaps of knowledge based on consistent taxonomy of hydrozoans, the goals of this study are: 1) to update the status of the taxonomy of the benthic hydroid fauna (except hydrocorals) from the SSA and SO, 2) to determine and describe their biological substrates, geographic and bathymetric distributions, levels of endemism, and 3) to investigate the similarity between the different benthic hydroid assemblages in the SSA and SO.

Material and methods

In 1,351 geographic locations within the SSA (*i.e.*, the southwestern Atlantic Ocean – SWAO, and the southeastern Pacific Ocean – SEPO) and the SO, 5,621 samples of benthic hydroids (not including hydrocorals) were collected, taxonomically reviewed and checked (Figure 1). Records of benthic hydroids from the SSA and SO from the literature were not included to maintain reliable taxonomical standards, thereby avoiding propagation of taxonomic errors. The only exceptions are the Antarctic species *Monocaulus microrhiza* (Hickson & Gravely, 1907) and *M. parvula* (Hickson & Gravely, 1907), recorded by Svoboda & Stepanjants (2001), of which we have studied specimens at the Smithsonian Institution National Museum of Natural History (NMNH). The taxonomy of all morphospecies was standardized and identifications followed the appropriate literature (Blanco, 1963, 1964; Vervoort, 1972; Cornelius, 1979, 1982, 1995; Calder, 1988, 1991a, 1997; Migotto, 1996; Peña Cantero et al., 1999; Blanco et al., 2000; Marques, 2001; Svoboda & Stepanjants, 2001; Peña Cantero & Vervoort, 2003, 2004a, 2004b, 2005a, 2005b; Galea, 2006a, 2006b, 2007; Svoboda et al., 2006; Galea et al., 2007a, 2009a, 2009b; Galea & Schories, 2012a, 2012b; Rodriguez et al., 2012). This effort resulted in a consistent taxonomy, avoiding issues commonly found in meta-analyses (see Lozier et al., 2009).

Records in the data bank are from specimens collected in the field and reviewed and checked by us at institutional collections: Departamento de Zoologia, Universidade Federal do Paraná (DZOO-UFPR); Facultad de Ciéncias Naturales y Museo, Universidad Nacional de La Plata (FCNyM-UNLP); Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul (MCN-FZB); Museo Nacional de Historia Natural del Uruguay (MNHNU); Muséum d'Histoire Naturelle de la Ville Genève (MHNG); Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ); Museu de Zoologia, Universidade de São Paulo (MZUSP); Universidad Nacional Mar del Plata (UNMdP); National Museum of Natural History, Smithsonian Institution (USNM); Universidad de Valencia (UV); Zoologisches Museum, University of Hamburg (ZMH). Type of substrate used by each morphospecies, latitudinal distribution range, and depth were compiled (Table 1). Endemism for the SSA and SO was determined based on the worldwide geographic records reported in literature for each species and the proportion of endemism for each ocean (SWAO, SEPO and SO) was calculated.

We present a matrix of presence-absence of benthic hydroid species based on quadrants of 10° latitude by 10° longitude. Only morphospecies that were identified were included in the databank to avoid geographic inaccuracies (Appendix 1). Analyses of similarity of species composition of quadrants were performed using PRIMER (Clarke & Warwick, 2001). All analyses used Bray-Curtis similarity between quadrants of square root transformed data. The transformation was done to remove the effect of non-homogeneous sampling effort (*i.e.*, different methods and sampling efforts according to collection sites, depths). For that, we standardized the total frequency of species in each quadrant by dividing the presence of any given species within a quadrant by the total number of species in that quadrant (see Genzano et al., 2009a for a similar approach). A square root was applied to each frequency before the calculation of the Bray-Curtis similarity index. Quadrants with less than five species were excluded from the similarity analysis to avoid issues due to sampling (Clarke & Warwick, 2001; Proches, 2005; Rueda et al., 2013).

Similarities in species composition among quadrants were inferred using a hierarchical cluster analysis followed by a similarity profile test (SIMPROF), which estimates the internal statistical probability of the groups formed. To visualize patterns of gradual change among quadrants, we plotted a non-metric multidimensional scaling (nMDS, Clarke, 1993), using 50 iterations to guarantee a minimum value of stress due to representation of the ordination in two-dimensional space. The statistically significant groups of the cluster (SIMPROF test) were superimposed on the nMDS and on a map to better delineate the similarities among the benthic hydroid assemblages.

A percentage similarity (SIMPER) analysis was carried out to identify which species are responsible for the similarities between and within the quadrants grouped on the cluster. This procedure was performed only for less inclusive groups with at least two quadrants clustered. We also performed a BVSTEP analysis to identify the smallest subset of species that better characterize the ordination patterns of the nMDS (Clarke & Warwick, 2001).

Results

Richness, endemism, distribution, and substrate use

The survey of the SSA and SO resulted in 359 morphospecies of benthic hydroids, of which 256 species were identified at the species level (and so included in the analyses), 40 at the genus level, 44 with dubious taxonomic status and 19 unidentified because of poor morphological condition (Table 1). Three of the species are new records for the SWAO (*Nemertesia ciliata, Sertularella leiocarpa, Zygophylax sibogae*; Table 1). The SWAO had the greatest richness of benthic hydroids (187/256 species), corresponding to 73% of the total of species analysed, followed by the SO (101/256 species) and the SEPO (41/256 species, Tables 1, 2).

Fifty four percent of the species (137 species of 256) is endemic to the SSA and SO (Table 1, 2). Most of the endemic species (89 of 101 species, 88%, Table 2) are in the SO. Among the endemic species, 92% are Leptothecata, with the families Sertulariidae (45%) and Kirchenpaueriidae (20%) having the highest levels of endemism (Figure 2). Three leptothecate genera are endemic in the SO: *Antarctoscyphus, Mixoscyphus* (both Sertulariidae), and *Oswaldella* (Kirchenpaueriidae), representing 49% of the benthic species of the hydroids of the SO (49 of 101 species, Tables 1, 2). "Anthoathecates" tend to occur in warmer areas (from 20°S to 45°S, Table 1), with few species in colder waters (from 50°S to 70°S; *e.g.*, *Bouillonia denhartogi, Eudendrium tottoni, Hybocodon chilensis*, and species of *Clathrozoella* and *Monocaulus*, Table 1). Leptothecata tend to be more widely distributed between 20°S and 70°S (Table 1). However, many leptothecates are found between 50°S and 70°S (Haleciidae, Halopterididae, Lafoeidae, and Plumulariidae; mainly the genera *Acryptolaria, Lytocarpia, Phialella, Sertularella, Stegella, Symplectoscyphus*), some of which belong to genera endemic to the area (*Antarctoscyphus, Mixoscyphus, Oswaldella, Schizotricha, Staurotheca*, Table 1).

Most species were from shallow waters (up to 200m depth), while deep-sea samples (> 200m depth) were in the SWAO and especially the SO, with Sertulariidae, Kirchenpaueriidae, Schizotrichidae, Lafoeidae, and Plumulariidae being the most common families (Table 1). Between 200 and 4,000m deep, many species of benthic hydroids have robust and bushy colonies (*e.g.*, *Bouillonia denhartogi*, and species of *Clathrozoella, Monocaulus, Sertularella*; Table 1), many with erect, branched and polysiphonic colonies (*e.g.*, species of *Acryptolaria, Abietinella, Antarctoscyphus,* *Lafoea, Oswaldella, Schizotricha, Staurotheca, Symplectoscyphus*).

A wide diversity of substrates are used by benthic hydroids, including artificial (*e.g.*, boats, buoys, long lines, metallic structures, net, polyethylene plates, ropes, rubber bands, submarine floating, wood) and natural (*e.g.*, egg mass, gravel, rock, sand, shingles, and several taxa). Natural substrate uses was more common than artificial, including epibiotics on algae, ascidians, barnacles, bivalves, bryozoans, corals, hydroids, mussels, polychaetes, scallops, and sponges. Benthic hydroids tended to be substrate-generalists (*Bougainvillia, Ectopleura, Eudendrium, Halecium, Halopteris, Sertularella, Sertularia*, lafoeids). Exceptions were *Corymorpha januarii, Eutima sapinhoa, Orthopyxis* spp., *Silicularia rosea*, and *Zyzzyzus warreni* (Table 1).

Geographic similarities: cluster and nMDS analyses

We found 13 statistically supported assemblages (= groups of quadrants) of benthic hydroids (Figure 3). There are two assemblages that are clearly more inclusive in the nMDS plot: assemblage SSA, and assemblage SO (Figures 3–5). The main subset of species contributing to the nMDS patterns are *Antarctoscyphus elongatus, A. spiralis, Halecium ovatum, Lafoea dumosa, Obelia longissima, Plumularia setacea, Sertularella gaudichaudi, S. tenella, Staurotheca antarctica, S. dichotoma, S. glomulosa, Symplectoscyphus glacialis*, and *Tulpa tulipifera*. SIMPER analysis shows that the species composition of the assemblages varied considerably along SSA and SO (Figures 3–5; Tables 1, 3).

Discussion

Richness and endemism

Recently, 780 species of Hydrozoa (29% recorded herein), including 622 species of hydroids from SWAO and SEPO (37% recorded herein), were reported from a compilation of the literature of Medusozoa and Ctenophora from South America (Oliveira et al., in press). The knowledge on the hydroid fauna of the region is heterogenous, with some better known regions, like the Southeastern coast of Brazil (Vannucci Mendes, 1946; Vannucci, 1949, 1951; Migotto, 1996; Marques, 2001; Grohmann et al., 2003, 2011; Cunha & Jacobucci, 2010; Miranda et al., 2011; Marques et al., 2013; Fernandez et al., 2014a), the Buenos Aires coast (Blanco, 1994; Genzano et al., 2009a, 2009b, 2011; Rodriguez et al., 2012), and the Chilean coast (Galea, 2006a, 2006b, 2007, 2010; Galea & Leclère, 2007; Galea et al., 2007a, 2007b, 2007c, 2009a, 2009b; Galea & Schories, 2012a, 2012b). SO fauna are listed as 177 species of benthic hydroids for the area (Schuchert, 2014a; Peña Cantero, 2014b), where we recorded 101 species (57% of the total). Although with the accumulated information in the last fifty years (*e.g.*, Naumov & Stepanjants, 1962, 1972; Blanco & Bellusci de Miralles, 1972; Blanco, 1976, 1977, 1978, 1984; Stepanjants, 1979; Peña Cantero & García Carrascosa, 1999; Svoboda & Stepanjants, 2001; Peña Cantero, 2004, 2006, 2008, 2010a, 2010b, 2012, 2013; Peña Cantero & Gili, 2006; Peña Cantero & Ramil, 2006; Svoboda et al., 2006; Watson, 2008; Peña Cantero & Vervoort, 2009), many regions are still poorly studied, such as the Bellingshausen Sea and deeper waters (Peña Cantero, 2004, 2012, 2014b). However, the number of studies on benthic hydroid species has increased in the SSA and SO, as well as the number of checklists and richness assessments for the area (Migotto et al., 2002; Marques et al., 2003; Peña Cantero, 2004, 2014b; Oliveira et al., in press).

Endemism at the SWAO area we studied (22°S-60°S) is 39%, in contrast to the 2.4% of the hydroid species that was to be endemic to the SWAO from 34°S to 42°S (Genzano et al., 2009a). Clearly, the area we studied is four times larger, but this difference is most likely because the benthic hydroid fauna was poorly known (and may still be) in the last few years. Endemism for the benthic hydroids of SEPO is 39%, but knowledge of this area remains incipient. Despite the many species of benthic marine invertebrates and the high levels of endemism reported for some taxa (Lee et al., 2008; Miloslavich et al., 2011), endemism studies for SEPO are rare (Moreno et al., 2006; Miloslavich et al., 2011). Although benthic hydroids from SEPO comprise only 16% of the total species recorded for the SSA and SO (Table 2), many of them are endemic.

South American marine biodiversity is clearly underestimated, and fish, crustaceans, molluscs, polychaetes, echinoderms, and macroalgae are usually reported. Yet, 22% of the entire marine fauna is probably endemic (Miloslavich et al., 2011). Hydroid endemism is at first apparently quite surprising (many of which are widely distributed worldwide, *e.g.*, *Obelia dichotoma, O. geniculata, Plumularia setacea*, Cornelius, 1975, 1995; Calder, 1991a, 1997; Schuchert, 2014b). Nonetheless, endemic hydroids occur in many locations worldwide, such as the Mediterranean Sea (Bouillon et al., 2004), the southern African coast (Millard, 1975), the SWAO (Galea, 2007; Genzano et al., 2009a; El Beshbeeshy & Jarms, 2011; Oliveira et al., in press), the southeastern Pacific Ocean (Galea, 2007; Galea et al., 2007c) and the SO (Stepanjants, 1979; Peña Cantero & García Carrascosa, 1999; Peña Cantero, 2004).

Concerning the SO, the marine biodiversity is relatively well known and with greater endemism than South America (Clarke & Johnson, 2003), with endemicity of 90% (*e.g.*, pycnogonids, Arntz et al., 1997). SO benthic hydroid fauna is highly endemic (80%, Peña Cantero, 2014b), and its level of endemicity increased even more through our survey in the region (88%, Table 2). Some supraspecific taxa are endemic to the region (*Antarctoscyphus, Mixoscyphus, Oswaldella*) representing ca. 32% of the SO fauna (49 out of the 155 species in Peña Cantero, 2004). The high rate of endemism in the SO has been accompanied by its greater biodiversity, gigantism, longevity, and slow growth and late maturity of many species (Brandt et al., 2007a, 2007b).

Depth and latitudinal distribution

Inferences about latitudinal gradients in species richness are restricted to few, small groups, based on secondary data without statistical analysis. For instance, Genzano et al. (2008) surveyed the hydromedusae of the SWAO suggesting that richness decreases with latitude. For benthic hydroids species, Mendoza-Becerril & Marques (2013) compiled historical data of Bougainvilliidae species and inferred that richness decreases as latitude and depth increase. A clear pattern of latitudinal gradients requires the combination of ecological and biogeographical information (life cycles, morphology and size of the species along the latitudinal and/or depth gradients, etc.).

Depth is even more poorly studied, and there are many fewer deep-sea invertebrate than coastal studies (Calder, 1998), especially over large areas such as SSA and SO. Hydroid species richness was suggested to be greater in coastal than deep areas (Gili & Hughes, 1995), as may occur in the Mediterranean Sea (Gili, 1981) and SWAO (Zamponi et al., 1998; Genzano & Zamponi, 2003; Genzano et al., 2009a). The richness of other marine invertebrates (*e.g.*, amphipods, decapods, polychaetes, sponges) also decreases towards deeper areas (Pérez-Mendoza et al., 2003; De Broyer et al., 2004; Samaai et al., 2010; Rosa et al., 2012). Deep-sea hydroids began to be examined in the 1800s (Allman, 1877; Clarke, 1879; Fewkes, 1881; Nutting, 1900). Although studies are increasing, they are still fragmented, insufficient and in small areas (Kramp, 1956; Vervoort, 1966, 1985; Calder, 1996, 1998; Calder & Vervoort, 1998; Watson & Vervoort, 2001; Watson, 2003; Peña Cantero, 2004; Henry et al., 2008; Stepanjants, 2013). Combining our sampling in shallow waters (< 200m depth), along with scattered better-sampled deep-sea areas of SWAO and SO, we have begun to fill in these lacunae with a continuum of depths (Table 1). Lack of sampling in deep-sea areas is often due to difficult access (*e.g.*, hydrothermal vents), and to the need for sophisticated and very expensive procedures such as oceanographic ships and ROVs. Samples in the deep-sea areas of SO, however, have been carried out recently through many special oceanographic campaigns (*e.g.*, ANDEEP I, II, III; Clarke et al., 2004; Brandt et al., 2007a, 2007b).

Large colonies should be more frequent in deep-sea areas (Gili et al., 1989). Indeed, most of the benthic hydroids collected in deep waters are in taxa with taller and more robust colonies, generally polysiphonic and branched, with a strong perisarc. Among these, the leptothecate Sertulariidae, Lafoeidae, Haleciidae, Kirchenpaueriidae, Schizotrichidae and Aglaopheniidae and the anthoathecate Clathrozoellidae are the most species-rich families in the deep sea (Vervoort, 1966, 1985; Calder, 1996, 1998; Calder & Vervoort, 1998; Watson & Vervoort, 2001; Watson, 2003; Peña Cantero, 2004; Altuna et al., 2013). In our study, species richest was also greatest in the Sertulariidae below 200m, followed by Schizotrichidae and Plumulariidae (Table 1). On the other hand, Bougainvilliidae, Clathrozoellidae, Corymorphidae, Eudendriidae, Hydractinidae and Tubulariidae are "anthoathecate" families commonly reported for deep-sea areas (Vervoort, 1985; Calder, 1998; Calder & Vervoort, 1998; Watson, 2003; Peña Cantero, 2004). These families also have species with polysiphonic and branched colonies, with robust habit and strong perisarc (Millard, 1975; Peña Cantero et al., 2003; Genzano et al., 2009a, 2009b). Leptothecates seem to dominate "anthoathecates" in the deep sea (Vervoort, 1966, 1985; Calder, 1996, 1998; Calder & Vervoort, 1998; Watson & Vervoort, 2001; Watson, 2003; Peña Cantero, 2004; Ronowicz et al., 2013a), yet no large-scale studies have addressed that possibility. Adressing this question is not within the scope of this study, but we call attention to the possibility that sampling methods for deep-sea (*e.g.*, trawling, dredging) may damage the unusually delicate "anthoathecates". Therefore, the predominance of leptothecates in deep-sea areas could be a sampling artifact.

Substrate use

Substrate use is obviously important because it can constrain species distributions, mainly over large-scales with a strong weather gradient, as found in the ACSA and SO. Species of the ACSA and SO tend to be substrate generalists (Table 1), but some specialists have been noted, *e.g.*, *Corymorpha januarii* usually on soft bottoms (Silveira & Migotto, 1992; Genzano et al., 2009a; Table 1), *Eutima sapinhoa* exclusively on the tissues of *Tivella mactroides* (Migotto et al., 2004; Table 1), and *Orthopyxis* spp. and *Silicularia rosea* predominantly on algae (Oliveira & Marques, 2007; Cunha, 2011; Table 1). Although *Zyzzyzus warreni* is considered to be an exclusive epizoic on sponges (Campos et al., 2012), we found them on small fragments of algae, hydroids (*Eudendrium* sp.) and ascidians (Table 1).

Benthic hydroids are more abundant on hard substrates, and colonization of different substrates depends on morphology (Gili & Hughes, 1995; Genzano et al., 2009a). For instance, bushy forms and dense clumps (*e.g.*, *Amphisbetia operculata, Sertularella mediterranea, Plumularia setacea, Aglaophenia acacia*) attach directly to rocks or shells (Genzano et al., 2009a), as observed with *Ectopleura crocea, Hybocodon chilensis, Clytia gracilis, Obelia dichotoma* and species of Eudendriidae, Aglaopheniidae, Sertulariidae, and Thyroscyphidae (Table 1). Soft, muddy and sandy substrates are common in the deep sea, and colonies stay erect and develop a polysiphonic hydrocauli inserted into the soft substrate through an anchoring system, forming a rachis-like structure (Gili & Hughes, 1995; Genzano et al., 2009a). The Atlantic continental shelf between 35°S and 42°S is dominated by soft sediments and thin sediments below 200m (Genzano et al., 2009a). We found *Corymorpha januarii, Lytocarpia canepa* and *Plumularia insignis* on soft and sandy bottoms and *Amphisbetia operculata* and *Plumularia setacea* on scattered rocky outcrops southwards (extending up to 57°S, *viz.*, Genzano et al., 2009a; Table 1).

Continental shelves are usually narrow in SO waters between 60°S and 80°S (except for some areas of the Ross and Weddell Seas of up to ~125km; Clarke & Johnston, 2003), and so the bottom is deep in the SO (Griffiths, 2010; Clarke, 1996; Clarke & Johnston, 2003). Seabeds here are also soft, comprising different proportions of sand, gravel and mud (Clarke, 1996; Brandt et al., 2007a, 2007b). Erect, robust, branched and polysiphonic specimens we studied from 200 to 4,000 m deep are from museum collections and substrate information is not useful (Table 1). However, in the literature, Antarctic benthic hydroids and their colony morphology support the supposition that species with anchoring system (*e.g.*, *Bouillonia denhartogi* and species of *Clathrozoella* and *Monocaulus*) occurred on both soft/sandy bottoms and on rocky outcrops of the SO (Vervoort, 2000; Svoboda & Stepanjants, 2001; Peña Cantero et al., 2003; Svoboda et al., 2006). Associations between benthic hydroids and other organisms are common and many SO samples were epibiotic on algae, bivalves, bryozoans, hydroids, mussels, polychaetes and sponges (Table 1).

Geographic distribution and biogeography

Two distinct assemblages of benthic hydroids formed clear clusters: SSA and SO. Eleven subgroups can be seen within these two assemblages (Figures 4–6). Overall, assemblages are congruent with previously proposed ecoregions (Spalding et al., 2007), as well as with other assemblages in smaller areas of the SSA and SO (Montiel et al., 2005; Carranza et al., 2008; Genzano et al., 2009a). The only exception is assemblage SSA 1 (Figures 4–6), composed by quadrants of deep-sea areas, which is a faunal group poorly explored in the SWAO.

Assemblage SSA 1 (Figures 4–6) includes quadrants between 200 and 800m, oceanographically under influence of the Brazil/Malvinas-Falkland Confluence (Acha et al., 2004). This assemblage comprises three widely distributed families, Aglaopheniidae, Lafoeidae and Sertulariidae (SIMPER results; Tables 1, 3). Except for *Sertularella tenella* (frequently an epibiont on sponges and hydroids among others; Table 1), the other species that contributed to this assemblage (*Acryptolaria conferta, Lytocarpia canepa, Sertularella tenella* and *Symplectoscyphus subdichotomus*, Table 3) are commonly found in the deep sea and cold waters (Peña Cantero et al., 2007; Peña Cantero, 2010b; Genzano et al., 2009a). These species have robust, erect and branched colonies, with a strong perisarc and an anchoring root system on the soft bottom, typical of deep-sea areas (Genzano et al., 2009a).

The SSA assemblage includes the subgroups, assemblages SSA 1 to SSA 6 (Figure 3–5). SSA assemblage corresponds to Warm Temperate Southeastern Pacific, Warm Temperate Southwestern Atlantic and Magellanic (Spalding et al., 2007). It is oceanographically influenced by the Humboldt current (in the Pacific, Acha et al., 2004; Lucas et al., 2005), and by the Malvinas/Falkland and Brazilian currents (in the Atlantic, Matsuura, 1986; Acha et al., 2004; Lucas et al., 2005), and it includes upwellings, estuaries, bays, and fjords.

Assemblages SSA 2, SSA 3 and SSA 4 encompass Southern Brazil, Río de La Plata and Argentinean Patagonia shelves (Figures 4–6). Several assemblages of benthic invertebrates have been described between 33°S and 56°S of the SWAO coast (Montiel et al., 2005; Carranza et al., 2008; Genzano et al., 2009a). For instance, two areas under the influence of environmental gradients (inner shelf and shallow zone influenced by the Río de La Plata, and outer shelf marine zone including magellanic and subtropical faunas) were important for species composition and abundance of gastropods (Carranza et al., 2008). Nine hydroid assemblages were found between 35° and 42°S and were associated with oceanographic regime and availability of substrates (Genzano et al., 2009a). In the Magellanic area, groups of species of polychaetes in the Atlantic and Pacific were either related to the Antarctic fauna or restricted to South America, suggesting that dispersion would be responsible for these patterns because currents of the West Wind Drift (WWD) could transport larvae from Antarctic to the South American continent (Montiel et al., 2005). All these patterns are congruent and inserted in the large-scale assemblages of benthic hydroids proposed herein.

Assemblages SSA 2, SSA 3 and SSA 4 are Patagonian in Argentina and Chile and characterized by unique biodiversity and oceanographic regimes (Acha et al., 2004; Lucas et al., 2005). They are in the Warm Temperate Southwestern Atlantic and Magellanic provinces, specifically the Uruguay-Buenos Aires Shelf, North Patagonian Gulfs, Patagonian Shelf, Channels and Fjords of Southern Chile, and Chiloense ecoregions (Spalding et al., 2007). This area is influenced by the abundant marine fronts generated by winds, tides, freshwater discharges and oceanic currents, and the fronts of the Chiloé zone would flow southwards through the Magellanic province transporting organisms to the Atlantic Patagonia (Acha et al., 2004). Our analysis supports this scenario, especially because assemblages SSA 2, SSA 3 and SSA 4 (Table 3) are unique compositions of species. For instance, *Clytia gracilis* is shared by all the assemblages; *Plumularia setacea* is shared between assemblages SSA 2 and SSA 3, and *Phialella belgicae* is shared by assemblages SSA 2 and SSA 4 (Table 3). All these assemblages have at least one species with distribution extended to the SO (Tables 1, 3).

Assemblage SSA 5 is in the ecoregions Central Chile and Araucanian, both in the province Temperate South America (Spalding et al., 2007). High primary productivity is resultant from the periodical upwellings, which is the cause of the diversity of the organisms of the region (Acha et al., 2004). Its benthic hydroid fauna is rich, especially in the southern fjords (Galea, 2006a, 2006b, 2007; 2010; Galea & Leclère, 2007; Galea et al., 2007a, 2007b, 2007c, 2009a, 2009b; Galea & Schories, 2012a).

Although assemblage SSA 6 was well supported (SIMPROF test, Figure 3), it was not evaluated by SIMPER because of the minimum requirement of two quadrants (Clarke & Warwick, 2001). However, biologically, assemblage SSA 6 represents a clear cluster comprising the southeastern and southern coast of Brazil. This assemblage coincides with ecoregions Southeastern Brazil and Rio Grande, both inserted in the Warm Temperate Southwestern Atlantic province (Spalding et al., 2007). It is strongly influenced by wind-induced processes of resurgence, and receives the cold and nutrient-rich waters of the South Atlantic Central Water (SACW) through seasonal upwellings (Matsuura, 1986; Castro & Miranda, 1998; Acha et al., 2004). This upwelling results in high diversity of the benthic communities, mainly composed by rich algae banks, mussels, barnacles and detritivorous bivalves of the inner shelf (Acha et al., 2004). Many of these organisms are substrates for benthic hydroids, and define this assemblage: *Acryptolaria conferta, Dynamena dalmasi, D. disticha, Hincksella cylindrica, Lafoea coalescens, Monostaechas quadridens, Sertularella tenella, Sertularia distans* and *Synthecium tubithecum* (Table 1, 3). These species belong to the Halopterididae, Lafoeidae, Sertulariidae, and Syntheciidae (Table 1), and are typically and frequently found on the southern coast of Brazil (Migotto, 1996; Grohmann et al., 2003, 2011; Cunha & Jacobucci, 2010; Miranda et al., 2011; Fernandez et al., 2014a, 2014b). Exceptions are deep-sea species poorly known from the Brazilian coast, some of them recorded for the first time for this area (*A. conferta* and *L. coalescens*).

Alternative methods of analysis showed from 13 to 16 areas of endemism for the SWAO, and are associated with the ecological and oceanographic conditions of the region (Miranda et al., unpublished). These areas were basically on the Brazilian coast, the Uruguay-Argentina coast and disjunctively both, coinciding with the assemblages SSA 2, SSA 4 and SSA 6 (Figure 3–5).

The SO assemblage is a large group that encompasses assemblages SO 1 to SO 5 (Figures 3–5). The SO oceanographic regime depends on the wind-driven Antarctic Circumpolar Current (ACC), the largest current in the world, that connects all the southern oceans: Atlantic, Pacific and

Indian (Barker et al., 2007). The ACC is a strong barrier to water exchange between southern and northern areas (Clarke et al., 2005). However, the SO is not completely isolated, with large-scale eddies that are responsible for transportation and exchange of organisms from the Antarctic to the sub-Antarctic areas (Clarke et al., 2005). Additionally, eastward flowing waters of the deep and cold waters of the Weddell Sea were predicted to carry water, and therefore organisms, to the other oceans, allowing the interchange between different marine environments (Brandt et al., 2007a). These predictions help explain the disjunctive patterns of the quadrants of the assemblages SO 1 and SO 5, uniting the Weddell with the Ross Sea (assemblage SO 1; Figures 3–5), and the East coast of Antarctica with part of the Weddell Sea (assemblage SO 5; Figures 3–5), although these two assemblages share only two species (*Antarctoscyphus* spiralis and *Staurotheca* antarctica; SIMPER analysis, Table 3). Assemblages SO 2, SO 3 and SO 4 are well defined and isolated, each with its specific fauna (Figures 3–5; Table 3). Assemblage SO 2 is Bouvet Island, a biogeographically unique site because of its isolation (Barnes, 2006; Peña Cantero & Gili, 2006). The Bouvet assemblage is within an ecoregion of the SO province (Spalding et al., 2007). The poorly known benthic fauna of Bouvet Island has affinities with the Scotia Arc and Weddell Sea faunas (Barnes, 2006). Concerning benthic hydroids, most species from Bouvet Island are typical of the SO waters (Peña Cantero & Gili, 2006). Also, species characterizing Bouvet assemblage are typically found in the SO (Table 3), with *Staurotheca australis* as the only species with its northernmost distribution at Bouvet Island (Table 1).

Assemblage SO 3 encompasses the Scotia Arc, a transition zone between the Antarctic Peninsula and the Magellan region (Clarke & Johnston, 2003; Lawver & Gahagan, 2003; Clarke et al., 2005; Linse et al., 2006, 2008; Marques & Peña Cantero, 2010; Miranda et al., 2013). Also considered as a province by Spalding et al. (2007), the Scotia Arc assemblage includes the South Sandwich Islands, South Georgia and South Oarkney Islands ecoregions. Species best characterizing the Scotia Arc assemblage (sertulariids of genera *Antarctoscyphus* and *Staurotheca*, and the schizotrichid *Schizotricha turqueti*; Table 3) are distributed along the Patagonian and Antarctic coast, except for *Staurotheca multifurcata* (only on the Patagonian coast, Table 1).

The assemblage SO 4 includes quadrants of the Antarctic Peninsula, among the best-sampled areas of the SO (Clarke & Johnston, 2003; Brandt et al., 2007; Clarke et al., 2007), including the South Shetland Islands and Antarctic Peninsula (province of Scotia Sea) ecoregions of Spalding et al. (2007). Most of the species in this assemblage are Sertulariidae, Kirchenpaueriidae, and Haleciidae (Table 1, 3), leptothecate families that are widely distributed and species-rich in the SO (Peña Cantero, 2007, 2010b, 2014a; Peña Cantero & Vervoort, 2004a, 2004b, 2005a). Few species occur exclusively in the SO, most of them distributed along the Patagonian and Antarctic coast (Table 1), supporting the supposition of a connection between the South American and Antarctic benthic fauna.

All assemblages discussed have particular species compositions (SIMPER analysis). However, due to the BVSTEP algorithm, a similarity matrix including only 13 benthic hydroids (*Antarctoscyphus elongatus, A. spiralis, Halecium ovatum, Lafoea dumosa, Obelia longissima, Plumularia setacea, Sertularella gaudichaudi, S. tenella, Staurotheca antarctica, S. dichotoma, S. glomulosa, Symplectoscyphus glacialis*, and *Tulpa tulipifera*) has 95% correlation with the original matrix (that is, explains most of the total assemblage). So, the 13 species matrix provide the same basic ordination of the nMDS resultant from the analysis of a 256 species matrix. The 13 species have wider horizontal and vertical distribution and may represent key-species for the maintenance of the assemblages. Their actual ecological role in the assemblages however, can only be elucidated with study focusing on their abundance through time, their tolerance to abiotic factors (*e.g.*, temperature, salinity, substrate), and biotic interactions with the other organisms of the assemblages (hydroids and non-hydroids).

Several connections between the faunas of the SSA and SO have been proposed, involving different evolutionary processes, such as dispersal and vicariance (Knox & Lowry, 1977; Beu et al., 1997; Lawver & Gahagan, 2003; Clarke et al., 2005; Marques & Peña Cantero, 2010; Miranda et al., 2013). For the benthic hydroids of the SO, recently proposed areas of endemism correlated them with different evolutionary scenarios (Marques & Peña Cantero, 2010; Miranda et al., 2013). The assemblages we found concur with some of these areas, mainly the Magellan zone, Scotia Sea, Antarctic Peninsula, Weddell Sea, Ross Sea and East coast of Antarctica (Marques & Peña Cantero, 2010; Miranda et al., 2013 and Figures 4–6). However, considering that vast areas of the SO are unknown, especially in deeper waters (Brandt et al., 2007b), additional and complementary data are required to further elucidate these patterns we propose. Understanding these patters will require more integrative analyses of the SSA and SO marine fauna based on evolutionary and distributional hypotheses. Relationships between the ecological assemblages proposed herein and the historical areas of endemism previously reported for the SSA and SO are also fundamentally important to a better understanding of the biogeographic patterns of these marine regions.

FINAL REMARKS

Large-scale studies of ecological assemblages using benthic hydroids are rare, even for the northern hemisphere, where studies of distributions and biogeography are much older and more abundant (Lees, 1986; Calder, 1991a, 1992, 1995; Ronowicz, 2007; Di Camillo et al., 2008; Henry et al., 2008; Puce et al., 2009; González-Duarte et al., 2013; Megina et al., 2013). For the southern hemisphere, the few studies on benthic hydroid assemblages are concentrated in the northeast and southeast of Brazil, Buenos Aires and the South African coast (Millard, 1978; Calder & Mayal, 1998; Genzano & Zamponi, 2003; Genzano et al., 2009; Fernandez et al., 2014a, 2014b).

Studies on benthic hydroids usually examine species abundance, substrate preference, distribution and seasonality (*e.g.*, Calder, 1991b; Migotto et al., 2001; Cunha & Jacobucci, 2010; Genzano et al., 2009a; Ronowicz et al., 2011, 2013a, 2013b; Gravili et al., 2013; Megina et al., 2013; Fernandez et al., 2014a, 2014b). Analysis of richness and diversity were examined in the context of different physical factors (substrate type, depth), composition and structure of assemblages, life cycle strategy, dispersive capacity and general distribution (Genzano et al. 2009a; Gibbons et al., 2010a, 2010; Ronowicz et al., 2011, 2013a, 2013b; Fernandez et al., 2014a, 2014b). Fewer studies examine levels of endemism, vertical distribution, abundance, composition and structure of assemblages, and this is the first in such a large scale as the SSA and SO.

The overall importance of hydroids on benthic communities of the SSA and SO is still understudied. Benthic hydroids are pioneer organisms in the colonization of natural and artificial substrates, with rapid growth by asexual reproduction (Millard, 1975; Gili & Hughes, 1995; Rosso & Marques, 1997; Migotto et al., 2001; Megina et al., 2013: Fernandez et al., 2014a, 2014b). Additionally, hydroids may be key group for understanding the establishment and maintenance of benthic marine communities because of the wide diversity of strategies of sexual reproduction and their association with many marine organisms (Gili & Hughes, 1995; Genzano, 1998, 2001, 2002; Genzano & Rodrigues, 1998; Genzano & San Martín, 2002; Genzano et al., 2003, 2009a; Migotto et al., 2004; Puce et al., 2004, 2005; Di Camillo et al., 2005, 2006; Oliveira & Marques, 2007; Ronowicz et al., 2008, 2013a, 2013b). Biogeographical patterns, like the disjunction between the SSA and SO assemblages of benthic hydroid species are clear (Figures 4–6). Also, several smaller assemblages within SSA and SO (Figures 4–6) coincide with previously proposed ecoregions, provinces and areas of endemism (Spalding et al., 2007; Marques & Peña Cantero, 2010; Miranda et al., 2013; unpublished). Many of these assemblages, such as the Scotia Arc (assemblage SO3; Figures 4–6), will be important to examine the biogeographic role of the evolutionary and ecological processes of the marine communities and ecosystems. Here we examine species richness, substrates, distributions and endemism of benthic hydroids from SSA and SO. We find large-scale and distinct assemblages related to the oceanography of the area and, in part, concur with previously observed biogeographic patterns. This enlarged picture allows a better understanding in the evolution of biodiversity and benthic community structures in a region under constant and increasing environmental impact.

REFERENCES

Acha, M.E., Mianzan, H.W., Guerrero, R.A., Favero, M. & Bava, J. 2004. Marine fronts at the continental shelves of austral South America: physical and ecological processes. Journal of Marine Systems, 44, 83–105.

Allman, G.J. 1877. Report on the Hydroida collected during the exploration of the Gulf Stream by L.F. Pourtalès, assistant United States coast survey. Memoirs of the Museum of Comparative Zoology at Harvard College, 5, 1–66.

Allman, G.J. 1888. Report on the Hydroida dredged by H.M.S. Challenger during the years 1873-76. Part II. The Tubularinae, Corymorphinae, Campanularinae, Sertularinae, and Thalamophora. Report on the Scientific results of the voyage of H.M.S. Challenger during the years 1873-76. Zoology, 23, 1–90.

Altuna, A., Murillo, F.J. & Calder, D.R. 2013. Aglaopheniid hydroids (Cnidaria: Hydrozoa: Aglaopheniidae) from bathyal waters of the Flemish Cap, Flemish Pass, and Grand Banks of Newfoundland (NW Atlantic). Zootaxa, 3737, 501–537.

Arntz, W.E., Gutt, J. & Klages, M. 1997. Antarctic marine biodiversity: an overview. In: Battaglia, B., Valencia, J. & Walton, D.W.H. (Eds) Antarctic communities: species, structure and survival. Cambridge University Press, 484p.

Arntz, W.E. 2005. The Magellan-Antarctic connections: links and frontiers at southern high latitudes. Summary review. Scientia Marina, 69, 359–365.

Barker, P.F. & Burrell, J. 1977. The opening of Drake Passage. Marine Geology, 25, 15–34.

Barker, P.F. & Thomas, E. 2004. Origin, signature and palaeoclimatic influence of the Antarctic Circumpolar Current. Earth-Science Reviews, 66, 143–162.

Barker, P.F., Filippelli, G.M., Florindo, F., Martin, E.E. & Scher, H.D. 2007. Deep-Sea Research Part II, 54, 2388–2398.

Barnes, D.K.A. 2006. A most isolated benthos: coastal bryozoans of Bouvet Island. Polar Biology, 29, 114–119.

Beu, A.G., Griffin, M. & Maxwell, P.A. 1997. Opening of Drake Passage gateway and Late Miocene to Pleistocene cooling reflected in Southern Ocean molluscan dispersal: evidence from New Zealand to Argentina. Tecnophysics, 281, 83–97.

Blanco, O.M. 1963. Sobre algunos sertularidos de la Argentina. Notas del Museo de La Plata, 20, 163–180.

Blanco, O.M. 1964. Algunos campanularidos argentinos. Revista del Museo de La Plata, 8, 149–171.

Blanco, O.M. 1967. Contribución al conocimiento de los hidrozoarios argentinos. Revista del Museo de La Plata, 9, 243–297.

Blanco, O.M. 1976. Hidrozoos de la expedition Walter Herwig. Revista del Museo de La Plata, 12, 27–74.

Blanco, O.M. 1977. Nuevos hidrozoos antárticos. Contribución del Instituto Antártico Argentino, 205 , 3–20.

Blanco, O.M. 1978. Adición a los hidrozoos antárticos argentinos. Neotropica, 24, 155–160.

Blanco, O.M. 1984. Contribución al conocimiento de hidrozoos antárticos y subantárticos. Contribución del Instituto Antártico Argentino, 294, 2–53.

Blanco, O. 1994. Enumeración sistemática y distribución geográfica preliminar de los Hydroida de la Republica Argentina. Suborden Athecatha (Gymnoblastea, Anthomedusae), Thecata (Calyptoblastea, Leptomedusae) y Limonomedusae. Revista del Museo de La Plata, 14, 181–216.

Blanco, O.M. & Bellusci de Miralles, D.A. 1972. Hidrozoos de la Isla Pedro I. Contribución del Instituto Antártico Argentino, 145, 3–43.

Blanco, O., Zamponi, M.O. & Genzano, G.N. 2000. Campanulinidae de la Argentina (Coelenterata, Hydrozoa, Hydroida). Revista del Museo de La Plata, 14, 267–278.

Bo, M., Di Camillo, C.G., Puce, S., Canese, S., Giusti, M., Angiolillo, M. & Bavestrello, G. 2011. A tubulariid hydroid associated with anthozoan corals in the Mediterranean Sea. Italian Journal of Zoology, 78, 487–496.

Bouillon, J., Medel, M.D., Pagès, F., Gili, J.-M. & Boero, F. 2004. Fauna of the Mediterranean Hydrozoa. Scientia Marina, 68, 5–438.

Brandt, A., De Broyer, C., De Mesel, I., Ellingsen, K.E., Gooday, A.J., Hilbig, B., Linse, K., Thomson, M.R.A. & Tyler, P.A. 2007a. The biodiversity of the deep Southern Ocean benthos. Philosophical Transactions of the Royal Society, 362, 39–66.

Brandt, A., Gooday, A.J., Brandão, S.N., Brix, S., Brökeland, W., Cedhagen, T., Choudhury, M., Cornelius, N., Danis, B., De Mesel, I., Diaz, R.J., Gillan, D.C., Ebbe, B., Howe, J.A., Janussen, D., Kaiser, S., Linse, K., Malyutina, M., Pawlowski, J., Raupach, M. & Vanreusel, A. 2007b. First insights into the biodiversity and biogeography of the Southern Ocean deep sea. Nature, 447, 307–311.

De Broyer, C., Nyssen, F. & Dauby, P. 2004. The crustacean scavenger guild in Antarctic shelf, bathyal and abyssal communities. Deep-sea Research II, 51, 1733–1752.

De Broyer, C. & Rauschert, M. 1999. Faunal diversity of the benthic amphipods (Crustacea) of the Magellan region as compared to the Antarctic (preliminary results). Scientia Marina, 63, 281–293.

Campos, C.J.A., Marques, A.C. & Migotto, A.E. 2007. A taxonomic revision of the genus *Zyzzyzus* Stechow, 1921 (Cnidaria: Hydrozoa: Tubulariidae). Zootaxa, 1627, 1–22.

Campos, C.J.A., Migotto, A.E., Pinheiro, U. & Marques, A.C. 2012. Sponges as substrata and early life history of the tubulariid *Zyzzyzus warreni* (Cnidaria: Hydrozoa) in the São Sebastião Channel, Brazil. Marine Biology Research, 8, 573–583.

Calder, D.R. 1988. Shallow-water hydroids of Bermuda: the Athecatae. Royal Ontario Museum Life Sciences Contributions, 148, 1–107.

Calder, D.R. 1991a. Shallow-water hydroids of Bermuda: the Thecatae, exclusive of Plumularioidea. Royal Ontario Museum Life Sciences Contributions, 154, 1–140.

Calder, D.R. 1991b. Abundance and distribution of hydroids in a mangrove ecosystem at Twin Cays, Belize, Central America. Hydrobiologia, 216/217, 221–228.

Calder, D.R. 1992. Similarity analysis of hydroids assemblages along a latitudinal gradient in the western North Atlantic. Cannadian Journal of Zoology, 70, 1078–1085.

Calder, D.R. 1995. Hydroid assembages on holopelagic *Sargassum* from the Sargasso Sea at

Bermuda. Bulletin of Marine Sciences, 56, 537 – 546.

Calder, D.R. 1996. Hydroids (Cnidaria: Hydrozoa) recorded from depths exceeding 3000m in the abyssal western North Atlantic. Canadian Journal of Zoology, 74, 1721–1726.

Calder, D.R. 1997. Shallow-water hydroids of Bermuda: superfamily Plumularioidea. Royal Ontario Museum Life Sciences Contributions, 161, 1–85.

Calder, D.R. 1998. Hydroid diversity and species composition along a gradient from shallow waters to deep sea around Bermuda. Deep-Sea Research I, 45, 1843–1860.

Calder, D.R. & Mayal, E.M. 1998. Dry season distribution of hydroids in a small tropical estuary, Pernambuco, Brazil. Zoologische Verhandelingen, 323, 69–78.

Calder, D.R. & Vervoort, W. 1998. Some hydroids (Cnidaria: Hydrozoa) from the Mid-Atlantic Ridge, in the North Atlantic Ocean. Zoologische Verhandelingen, 319, 1–65.

Carranza, A., Scarabino, F., Brazeiro, A., Ortega, L. & Martínez, S. 2008. Assemblages of megabenthic gastropods from Uruguayan and northern Argentinean shelf: spatial structure and environmental controls. Continental Shelf Research, 28, 788–796.

Castro, B.M. & Miranda, L.B. 1998. Physical oceanography of the Western Atlantic Continental Shelf located between 4°N and 34°S. In: Robinson, A.R. & Brink, K.H. (Eds) The Sea. John Wiley & Sons, 11, 1090p.

Clarke, A. 1996. Benthic marine habitats in Antarctica. In: Ross, R.M., Hofmann, E.E. & Quetin, L.B. (Eds) Foundations for Ecological Research West of the Antarctic Peninsula. American Geophysical Union, 448p.

Clarke, A. & Johnston, N.M. 2003. Antarctic marine benthic diversity. In: Gibson, R.N. & Atkinson, R.J.A. (Eds) Oceanography and Marine Biology: an Annual Review. Taylor & Francis, 41, 468p.

Clarke, A., Aronson, R.B., Crame, J.A., Gili, J.-M. & Blake, D.B. 2004. Evolution and diversity of the benthic fauna of the Southern Ocean continental shelf. Antarctic Science, 16, 559–568.

Clarke, A., Barnes, D.K.A. & Hodgson, D.A. 2005. How isolated is Antarctica? Trends in Ecology and Evolution, 20, 1–3.

Clarke, A., Griffiths, H.J., Linse, K., Barnes, D. & Crame, J.A. 2007. How well do we know the Antarctic marine fauna? A preliminary study of macroecological and biogeographical patterns in Southern Ocean gastropod and bivalve molluscs. Diversity and Distributions, 13, 620–632.

Clarke, K.R. 1993. Non-parametric multivariate analyses of changes in community structure. Australian Journal of Ecology, 18, 117–143.

Clarke, K.R. & Warwick, R.M. 2001. Change in marine communities: an approach to statistical analysis and interpretation. 2nd edition. PRIMER-E: Plymouth.

Clarke, S.F. 1879. Report on the Hydroida collected during the exploration of the Gulf Stream and Gulf of Mexico by Alexander Agassiz, 1877-78. Bulletin of the Museum of Comparative Zoology at Harvard College, in Cambridge, 5, 239–252.

Cornelius, P.F.S. 1979. A revision of the species of Sertulariidae (Coelenterata: Hydroida) recorded from Britain and nearby areas. Bulletin of the British Museum (Natural History), 34, 243–321.

Cornelius, P.F.S. 1981. Life cycle, dispersal and distribution among the Hydroida. Porcupine Newsletter, 2, 47-50.

Cornelius, P.F.S. 1982. Hydroids and medusa of the family Campanulariidae recorded from the eastern North Atlantic, with a world synopsis of genera. Bulletin of the British Museum (Natural History), 42, 37–148.

Cornelius, P.F.S. 1995. North-west European Thecate hydroids and their medusae. v. 50 (Part 1, 2). The Linnean Society of London and the Estuarine and Coastal Sciences Association, 733p.

Costello, M.J. & Wilson, S.P. 2010. Predicting the number of known and unknown species in European seas using rates of description. Global Ecology and Biogeography, 20, 319–330.

Costello, M.J., Coll, M., Danovaro, R., Halpin, P., Ojaveer, H. & Miloslavich, P. 2010. A Census of marine biodiversity knowledge, resources, and future challenges. PLoS ONE, 5, e12110.

Cunha, A.F. 2011. O gênero *Orthopyxis* (Cnidaria, Hydrozoa) no Atlântico sul-ocidental: caracterização dos limites inter e intraespecíficos a partir de dados morfológicos e moleculares. Dissertação de mestrado. Instituto de Biociências, Universidade de São Paulo, 111p.

Cunha, A.F. & Jacobucci, G.B. 2010. Seasonal variation of epiphytic hydroids (Cnidaria: Hydrozoa) associated to a subtropical *Sargassum cymosum* (Phaeophyta: Fucales) bed. Zoologia, 27, 945–955.

Di Camillo, C., Puce, S., Romagnoli, T., Tazioli, S., Totti, C. & Bavestrello, G. 2005. Relationships between benthic diatoms and hydrozoans (Cnidaria). Journal of Marine Biological Association of the United Kingdom, 85, 1373–1380.

Di Camillo, C.G., Bavestrello, G., Valisano, L. & Puce, S. 2008. Spatial and temporal distribution in a tropical hydroid assemblage. Journal of Marine Biological Association of the United Kingdom, 88, 1589–1599.

Dougherty, J.R. & Russell, M.P. 2005. The association between the coquina clam *Donax fossor* Say and its epibiotic hydroid *Lovenella gracilis* Clarke. Journal of Shellfish Research, 24, 35–46.

El Beshbeeshy, M. & Jarms, G. 2011. Thekate hydroiden vom Patagonischen Schelf (Cnidaria, Hydrozoa, Thecata). Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg, 46, 19–233.

Fernandez, M.O., Navarrete, S. & Marques, A.C. 2014a. Temporal variation in richness and composition of recruits in a diverse cnidarian assemblage of subtropical Brazil. Journal of Experimental Marine Biology and Ecology, 460, 144–152.

Fernandez, M.O., Navarrete, S. & Marques, A.C. 2014b. A comparison of temporal turnover of species from benthic cnidarian assemblages in tropical and subtropical harbours. Marine Biology Research [in press].

Fewkes, J.W. 1881. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Caribbean Sea, in 1878, 1879, and along the Atlantic coast of the United States, during the summer of 1880, by the U.S. Coast Survey Steamer “Blake”, Commander J.R. Bartlett, U.S.N., Commanding. XI. Report on the Acalephae. Hydroida. Bulletin of the Museum of Comparative Zoology at Harvard College, 8, 127–140.

Galea, H.R. 2006a. On two new species of *Halopteris* Allman, 1877 (Cnidaria, Hydrozoa) from Chile. Zootaxa, 1165, 57–68.

Galea, H.R. 2006b. Rediscovery and redescription of *Hybocodon chilensis* Hartlaub, 1905 (Cnidaria, Hydrozoa) from Comau Fiord, southern Chile. Zootaxa, 1258, 57–68.

Galea, H.R. 2007. Hydroids and hydromedusae (Cnidaria: Hydrozoa) from the fjords region of southern Chile. Zootaxa, 1597, 1–116.

Galea, H.R. 2010. Notes on a small collection of thecate hydroids (Cnidaria: Hydrozoa) from Tristan da Cunha, south Atlantic. Zootaxa, 2336, 1–18.

Galea, H.R. & Leclère, L. 2007. On some morphologically aberrant, auto-epizootic forms of *Plumularia setacea* (Linnaeus, 1758) (Cnidaria: Hydrozoa) from southern Chile. Zootaxa, 1484, 39–49.

Galea, H.R. & Schories, D. 2012a. Some hydrozoans (Cnidaria) from Central Chile and the Strait of Magellan. Zootaxa, 3296, 19–67.

Galea, H.R. & Schories, D. 2012b. Some hydrozoans (Cnidaria) from King George Island, Antarctica. Zootaxa, 3321, 1–21.

Galea, H.R., G. Försterra & V. Häussermann. 2007a Additions to the hydroids (Cnidaria: Hydrozoa) from the fjords region of southern Chile. Zootaxa, 1650, 55–68.

Galea, H.R., Försterra, G. & Häussermann, V. 2007b. Hydrozoa, fjord Comau, Chile. Check List, 3, 159–167.

Galea, H.R., Försterra, G. & Häussermann, V. 2007c. Cnidaria, Hydrozoa: latitudinal distribution of hydroids along the fjords region of southern Chile, with notes on the world distribution of some species. Check List, 3, 308–320.

Galea, H.R., Försterra, G. & Häussermann, V. 2009a. New additions to the hydroids (Cnidaria: Hydrozoa) from the fjords regions of southern Chile. Zootaxa, 2019, 1–28

Galea, H., Häussermann, V. & Försterra, G. 2009b. Hydrozoa. In: Häussermann, V. & Försterra, G. (Eds) Marine benthic fauna of Chilean Patagonia. Nature in Focus, 1000p.

Genzano, G.N. 1990. Hidropolipos (Cnidaria) de Mar del Plata, Argentina. Nerítica, 5, 35–54.

Genzano, G.N. 1994. La comunidad hidroide del intermareal de Mar del Plata (Argentina). I. Estacionalidad, abundancia, y periodos reproductivos. Cahiers de Biologie Marine, 35, 289–303.

Genzano, G.N. 1998. Hydroid epizoites on hydroids *Tubularia crocea* and *Sertularella mediterranea* from the intertidal of Mar del Plata (Argentina). Russian Journal of Marine Biology, 24, 123–126.

Genzano, G.N. 2001. Associated fauna and sediment trapped by colonies of *Tubularia crocea* (Cnidaria, Hydrozoa) from the rocky intertidal of Mar del Plata, Argentina. Biociências, 9, 105–119.

Genzano, G.N. 2002. Associations between pycnogonids and hydroids from the Buenos Aires litoral zone, with observations on the semi-parasitic life cycle of *Tanystylum orbiculare* (Ammotheiidae). Scientia Marina, 66, 83–92.

Genzano, G.N. & Rodriguez, G.M. 1998. Association between hydroid species and their substrates from the intertidal zone of Mar del Plata (Argentine). Miscellània Zoològica, 21, 21–29.

Genzano, G.N. & San Martín, G. 2002. Association between the polychaete *Procerastea halleziana* (Polychaeta: Syllidae: Autolytinae) and the hydroid *Tubularia crocea* (Cnidaria: Hydrozoa) from the Mar del Plata intertidal zone, Argentina. Cahiers the Biologie Marine, 43, 165–170.

Genzano, G.N. & Zamponi, M.O. 1997. Frecuencia de estudio y diversidad de los hidrozoos bentónicos de la plataforma continental argentina. Ciencias Marinas, 23, 285–302.

Genzano, G.N. & Zamponi, M.O. 2003. Hydroid assemblages from Mar del Plata, Argentina, at depths between 0 and 500m. Distribution and biological substrata. Oceanologica Acta, 25, 303–313.

Genzano, G.N., Zamponi, M.O., Excoffon, A.C. & Acuña, F.H. 2002. Hydroid populations from sublittoral outcrops off Mar del Plata, Argentina: abundance, seasonality and reproductive periodicity. Ophelia, 56, 161–170.

Genzano ,G.N., Excoffon, A.C., Acuña, F.H. & Zamponi, M.O. 2003. Hydroid colonies as primary substrata for recruits of the mussel Mytilus edulis platensis front off Mar del Plata, Argentina. Ophelia, 57, 53–61.

Genzano, G., Mianzan, H., Diaz-Briz, L. & Rodriguez, C. 2008. On the occurrence of *Obelia* medusa blooms and empirical evidence of unusual massive accumulations of *Obelia* and *Amphisbetia* hydroids on the Argentina shoreline. Latin American Journal of Aquatic Research, 36, 301–307.

Genzano, G.N., Giberto, D., Schejter, L., Bremec, C. & Meretta, P. 2009a. Hydroid assemblages from the Souhwestern Atlantic Ocean (34–42°S). Marine Ecology, 30, 33–46.

Genzano, G., Rodriguez, C., Pastorino, G. & Mianzan, H. 2009b. The hydroid and medusa of *Corymorpha januarii* (Cnidaria: Hydrozoa) in temperate waters of the Southwestern Atlantic Ocean. Bulletin of Marine Science, 84, 229–235.

Genzano, G., Giberto, D. & Bremec, C. 2011. Benthic survey of natural and artificial reefs off Mar del Plata, Argentina, southwestern Atlantic. Latin American Journal of Aquatic Research, 39, 553–566.

Gerdes, D. & Montiel, A. 1999. Distribution patterns of macrozoobenthos: a comparison between the Magellan region and the Weddell Sea (Antarctica). Scientia Marina, 63, 149–154.

Gibbons, M.J., Janson, L.A., Ismail, A. & Samaai, T. 2010a. Life cycle strategy, species richness and distribution in marine Hydrozoa (Cnidaria: Medusozoa). Journal of Biogeography, 37, 441–448.

Gibbons, M.J., Buecher, E., Thibault-Botha, D. & Helm, R.R. 2010b. Patterns in marine hydrozoan richness and biogeography around southern Africa: implications of life cycle strategy. Journal of Biogeography, 37, 606–616.

Gili, J.-M. 1981, Estudio bionómico y ecológico de los cnidarios bentónicos de las islas Medes (Girona). Oecologia Aquatica, 5, 105–123.

Gili, J.-M. & Hughes, R.G. 1995. The ecology of marine benthic hydroids. Oceanography and Marine Biology, an annual review, 33, 351–426.

Gili, J.-M., Murillo, J. & Ros, J. 1989. The distribution pattern of benthic cnidarians in the Western Mediterranean. Scientia Marina, 53, 19–35.

Gili, J.-M., López-González, P.J. & Bouillon, J. 2006. A new Antarctic association: the case of the hydroid *Sarsia medelae* (new sp.) associated with gorgonians. Polar Biology, 29, 624–631.

González-Duarte, M.M., Megina, C., Piraino, S. & Cervera, J.L. 2013. Hydroid assemblages across the Atlantic-Mediterranean boundary: is the Strait of Gibraltar a marine ecotone? Marine Ecology, 34, 33–40.

Gravier-Bonnet, N. & Bourmaud, C. 2005. Cloning by releasing specialized frustules in a successful epiphytic zooxanthellate haleciid (Cnidaria, Hydrozoa, Haleciidae), with comments on stolonization and frustulation. Invertebrate Reproduction and Development, 48, 63–69.

Gravili, C., Di Camillo, C.G., Piraino, S. & Boero, F. 2013. Hydrozoan species richness in the Mediterranean Sea: past and present. Marine Ecology, 34, 41–62.

Griffiths, H.J. 2010. Antarctic marine biodiversity – what do we know about the distribution of life in the Southern Ocean? PLoS ONE, 5, e11683.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A. 2003. Hydroids (Cnidaria, Hydrozoa) collected on the continental shelf of Brazil during the Geomar X Oceanographic Operation. Zootaxa, 299, 1–19.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A.P. 2011. Hydroids (Cnidaria, Hydrozoa) collected on the inner continental shelf of the state of Rio de Janeiro, Brazil, during the Oceanographic Operations GEOCOSTA RIO I and II. Biota Neotropica, 11, 193–201.

Hartlaub, C. 1904. Hydroiden. Expédition Antartique Belge. Résultats du voyage du S. Belgica en 1897, 1898, 1899 sous le commandement de A. de Gerlache de Gomery. Zoologie, 1–19.

Hartlaub, C. 1905. Die Hydroiden der magalhaensishen region und chilenischen küste. Zoologische Jahrbücher, 6, 497–714.

Henry, L.A., Nizinski, M.S. & Ross, S.W. 2008. Occurrence and biogeography of hydroids (Cnidaria: Hydrozoa) from deep-water coral habitats off the southeastern United States. Deep Sea Research I, 55, 788–800.

Jäderholm, E. 1904a. Hydroiden aus den Küsten von Chile. Arkiv för Zoologi, 2, 1–7.

Jäderholm, E. 1904b. Mitteilungen ueber einige von der Schwedischen Antarctic-Expedition 1901-

1903 eingesammelte hydroiden. Archives de Zoologie Expérimentale et Générale, Notes et Revue, 4, 1–14.

Jäderholm, E. 1905. Hydroiden aus antarktischen und subantarktischen Meeren, gesammelt von der schwedischen Südpolarexpedition. Wissenschaftliche Ergebinisse der Schwedischen Südpolar-Expedition 1901-1903, 5, 1–41.

Jäderholm, E. 1917. Hydroids from the South Seas. Redogörelse för Norrköpings Högre Allmänna Lävoverk Läsaret, 1917, 1–25.

Jäderholm, E. 1920. On some exotic hydroids in the Swedish zoological state museum. Arkiv för Zoologi, 13, –10.

Kaiser, S., Brandão, S.N., Brix, S., Branes, D.K.A., Bowden, D.A., Ingels, J., Leese, F., Schiaparelli, S., Arango, C.P., Badhe, R., Bax, N., Blazewicz-Paszkowycz, M., Brandt, A., Brenke, N., Catarino, A.I., David, B., De Ridder, C., Dubois, P., Ellingsen, K.E., Glover, A.G., Griffiths, H.J., Gutt, J., Halanych, K.M., Havermans, C., Held, C., Janussen, D., Lörz, A.-N., Pearce, D.A., Pierrat, B., Riehl, T., Rose, A., Sands, C.J., Soler-Membrives, A., Schüller, M., Strugnell, J.M., Vanheusel, A., Veit-Köhler, G., Wilson, N.G. & Yasuhara, M. 2013. Patterns, processes and vulnerability of Southern Ocean benthos: a decadal leap in knowledge and understanding. Marine Biology, 160, 2295–2317.

Knox, G.A. & J.K. Lowry. 1977. A comparison between the benthos of the Southern Ocean and the North Polar Ocean with special reference to the Amphipoda and the Polychaeta. In: M.J. Dunbar (Ed.) Polar Oceans. Proceedings of the Polar Ocean Conference, Calgary, pp. 432–462.

Kramp, P.L. 1956. Hydroids from depths exceeding 6000 meters. Galathea Report, 2, 17–20.

Lawver, L.A. & Gahagan, L.M. 2003. Evolution of Cenozoic seaways in the circum-Antarctic region. Palaeogeography, Palaeoclimatology, Palaeoecology, 198, 11–37.

Lee, M.R., Castilla, J.C., Fernández, M., Clarke, M., González, C., Hermosilla, C., Prado, L., Rozbaczylo, N. & Valdovinos, C. 2008. Free-living benthic marine invertebrates in Chile. Revista Chilena de Historia Natural, 81, 51–67.

Lees, D.C. 1986. Marine hydroid assemblages in soft-bottom habitats on the Hueneme Shelf off Southern California, and factors influencing hydroid distribution. Bulletin of the Southern California Academy of Sciences, 85, 102–119.

Lindner, A., Govindarajan, A. & Migotto, A.E. 2011. Cryptic species, life cycles, and the phylogeny of *Clytia* (Cnidaria: Hydrozoa: Campanulariidae). Zootaxa, 2980, 23–36.

Linse, K., Griffiths, H.J., Barnes, D.K.A. & Clarke, A. 2006. Biodiversity and biogeography of Antarctic and sub-Antarctic mollusca. Deep Sea Research II, 53, 985–1008.

Linse, K., Walker, L. & Barnes, D.K.A. 2008. Biodiversity of echinoids and their epibionts around the Scotia Arc, Antarctica. Antarctic Science, 20, 227–244.

Lozier, J.D., Aniello, P. & Hickerson, M.J. 2009. Predicting the distribution of Sasquatch in western North America: anything goes with ecological niche modelling. Journal of Biogeography, 36, 1623–1627.

Lucas, A.J., Guerrero, R.A., Mianzan, H.W., Acha, E.M. & Lasta, C.A. 2005. Coastal oceanographic regimes of the Northern Argentine Continental Shelf (34–43°S). Estuarine Coastal and Shelf Science, 65, 405–420.

Marques, A.C. 2001. O gênero *Eudendrium* (Hydrozoa, Anthomedusae, Eudendriidae) no Brasil. Papéis Avulsos de Zoologia, 41, 329–405.

Marques, A.C. & Migotto, A.E. 2003. Hidrozoários (Cnidaria) marinhos bentônicos da estação ecológica Juréia-Itatins. In: Marques, O.A.V. & Duleba, W. (Eds) Estação Ecológica Juréia-Itatins, ambiente físico, flora e fauna. Holos Editora, 384p.

Marques, A.C. & Peña Cantero, A.L. 2010. Areas of endemism in the Antarctic – a case study of the benthic hydrozoan genus *Oswaldella* (Cnidaria, Kirchenpaueriidae). Journal of Biogeography, 37, 617–623.

Marques, A.C., Morandini, A.C. & Migotto, A.E. 2003. Synopsis of knowledge on Cnidaria Medusozoa from Brazil. Biota Neotropica, 3, 1–18.

Marques, A.C., Peña Cantero, A.L., Miranda, T.P. & Migotto, A.E. 2011. Revision of the genus *Filellum* Hincks, 1868 (Lafoeidae, Leptothecata, Hydrozoa). Zootaxa, 3129, 1–28.

Marques, A.C., Klôh, A.S., Migotto, A.E., Cabral, A.C., Rigo, A.P.R., Bettim, A.L., Razzolini, E.L., Cascon, H.M., Bardi, J., Kremer, L.P., Vieira, L.M., Bezerra, L.E.A., Haddad, M.A., Oliveira Filho, R.R., Gutierre, S.M.M., Miranda, T.P., Franklin Jr., W. & Rocha, R.M. 2013. Rapid assessment survey for exotic benthic species in the São Sebastião Channel, Brazil. Latin American Journal of Aquatic Research, 41, 265–285.

Matsuura, Y. 1986. Contribuição ao estudo da estrutura oceanográfica da região sudeste entre Cabo Frio (RJ) e Cabo de Santa Marta Grande (SC). Ciência & Cultura, 38, 1439–1450.

Megina, C., González-Duarte, M.M., López-González, P.J. & Piraino, S. 2013. Harbours as marine habitats: hydroid assemblages on sea-walls compared with natural habitats. Marine Biology, 160, 371–381.

Mendoza-Becerril, M.A. & Marques, A.C. 2013. Synopsis on the knowledge and distribution of the family Bougainvilliidae (Hydrozoa, Hydroidolina). Latin American Journal of Aquatic Research, 41, 908–924.

Migotto, A.E. 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. Zoologische Verhandelingen, 306, 1–125.

Migotto, A.E., Marques, A.C. & Flynn, M.N. 2001. Seasonal recruitment of hydroids (Cnidaria) on experimental panels in the São Sebastião Channel, Southeastern Brazil. Bulletin of Marine Science, 68, 287–298.

Migotto, A.E., Marques, A.C., Morandini, A.C. & Da Silveira, F.L. 2002. Checklist of the Cnidaria Medusozoa of Brazil. Biota Neotropica, 2, 1–31.

Migotto, A.E., Marques, A.C. & Oliveira, O.M.P. 2004. Classe Hydrozoa. In: Amaral, A.C.Z. & Rossi-Wongtschowski, C.L.B. (Eds) Biodiversidade bentônica da região sudeste-sul do Brasil– plataforma externa e talude superior. Instituto Oceanográfico. 216 p.

Millard, N.A.H. 1975. Monograph on the Hydroida of Southern Africa. Annals of the South African Museum, 68, 1–513.

Millard, N.A.H. 1978. The geographical distribution of Southern African hydroids. Annals of the South African Museum, 74, 159–200.

Miloslavich, P., Klein, E., Díaz, J.M., Hernández, C.E., Bigatti, G., Campos, L., Artigas, F., Castillo, J., Penchaszadeh, P.E., Neill, P.E., Carranza, A., Retana, M.V., Díaz de Astarloa, J.M., Lewis, M., Yorio, P., Piriz, M.L., Rodríguez, D., Yoneshigue-Valentin, Y., Gamboa, L. & Martín, A. 2011. Marine biodiversity in the Atlantic and Pacific coasts of South America: knowledge and gaps. PLoS ONE, 6, e14631.

Miranda, T.P., Haddad, M.A., Shimabukuro, V., Dubiaski-Silva, J. & Marques, A.C. 2011. Fauna de hidroides (Cnidaria, Hydrozoa) da região de Bombinhas, Santa Catarina, Brasil. Biota Neotropica, 11, 331–353.

Miranda, T.P., Peña Cantero, A.L. & Marques, A.C. 2013. Southern Ocean areas of endemism: a reanalysis using benthic hydroids (Cnidaria, Hydrozoa). Latin American Journal of Aquatic Research, 41, 1003–1009.

Miranda, T.P., Genzano, G.N. & Marques, A.C. Endemicity in benthic hydroids (Cnidaria, Hydrozoa) in the Southwestern Atlantic ocean: an NDM-VNDM hypothesis [unpublished].

Montiel, A.S.M., Gerdes, D. & Arntz, W.E. 2005. Distributional patterns of shallow-water polychaetes in the Magellan region: a zoogeographical and ecological synopsis. Scientia Marina, 69, 123–133.

Moreno, R.A., Hernández, C.E., Rivadeneira, M.M., Vidal, M.A. & Rozbaczylo, N. 2006. Patterns of endemism in south-eastern Pacific benthos polychaetes of the Chilean coast. Journal of Biogeography, 33, 750–759.

Naumov, D.V. & Stepanjants, S.D. 1962. Hydroida (Thecaphora) collected by the Soviet Antarctic Expedition on the M/V “Ob”, in antarctic and subantarctic waters. Biological Reports of the Soviet Antarctic Expedition, 1955-1958, 1, 69–104.

Naumov, D.V. & Stepanjants, S.D. 1972. Marine invertebrates from Adelie Land, collected by the XIIth and XVth French Antarctic Expeditions. 3. Hydroida. Tethys, 4, 25–60.

Nutting, C.C. 1900. American hydroids. Part I. The Plumularidae. Smithsonian Institution, United States National Museum Special Bulletin, 4, 1–285.

Nutting, C.C. 1904. American hydroids. Part II. The Sertularidae. Smithsonian Institution, United States National Museum Special Bulletin, 4, 1–325.

Nutting, C.C. 1915. American hydroids. Part III. The Campanularidae and the Bonneviellidae. Smithsonian Institution, United States National Museum Special Bulletin, 4, 1–126.

Oliveira, O.M.P. & Marques, A.C. 2007. Epiphytic hydroids (Hydrozoa: Anthoathecata and Leptothecata) of the world. Check List, 3, 21–38.

Oliveira, O.M.P. & Marques, A.C. 2011. Global and local patterns in the use of macrophytes as substrata by hydroids (Hydrozoa: Anthoathecata and Leptothecata). Marine Biology Research, 7, 786–795.

Oliveira, O.M.P., Araújo, E.M., Ayón, P., Cedeño-Posso, C.M., Cepeda, A.A., Córdova, P., Cunha, A.F., Galea, H., Genzano, G.N., Haddad, M.A., Mianzan, H.W., Migotto, A.E., Miranda, L.S., Miranda, T.P., Morandini, A.C., Nagata, R.M., Nascimento, K., Nogueira Jr., M., Palma, S., Quiñones, J.A.D., Rodriguez, C., Scarabino, F., Schiariti, A., Tronolone, V. & Marques, A.C. Census of the Cnidaria (Medusozoa) and Ctenophora from South American marine waters. Zootaxa [in press].

Pagès, F. & Orejas, C. 1999. Medusae, siphonophores and ctenophores of the Magellan region. Scientia Marina, 63, 51–57.

Peña Cantero, A.L. 2004. How rich is the deep-sea Antarctic benthic hydroid fauna? Polar Biology, 27, 767–774.

Peña Cantero, A.L. 2006. Benthic hydroids from the south of Livingston Island (South Shetland Islands, Antarctica) collected by the Spanish Antarctic expedition Bentart 94. Deep-Sea Research II, 53, 932–948.

Peña Cantero, A.L. 2007. Breaking molds: *Oswaldella laertesi*, sp. nov., a unique Antarctic species of Oswaldella Stechow, 1919 (Cnidaria: Hydrozoa: Kirchenpaueriidae). Zootaxa, 1612, 63–68.

Peña Cantero, A.L. 2008. Benthic hydroids (Cnidaria: Hydrozoa) from the Spanish Antarctic expedition Bentart 95. Polar Biology, 31, 451–464.

Peña Cantero, A.L. 2010a. Benthic hydroids (Cnidaria: Hydrozoa) from Peter I Island (Southern Ocean, Antarctic). Polar Biology, 33, 761–773.

Peña Cantero, A.L. 2010b. On a new Antarctic species of *Symplectoscyphus* Marktanner-Turneretscher, 1890 (Cnidaria, Hydrozoa, Sertulariidae), with an annotated checklist of the Antarctic species of the genus. Zootaxa, 2494, 29–44.

Peña Cantero, A.L. 2012. Filling biodiversity gaps: benthic hydroids from the Bellingshausen Sea (Antarctica). Polar Biology, 35, 851–865.

Peña Cantero, A.L. 2013. Benthic hydroids from off Low Island (Southern Ocean, Antarctica). Marine Ecology, 34, 123–142.

Peña Cantero, A.L. 2014a. Revision of the Antarctic species of *Halecium* Oken, 1815 (Cnidaria, Hydrozoa, Haleciidae). Zootaxa, 3790, 243–280.

Peña Cantero, A.L. 2014b. Benthic hydroids (Cnidaria: Hydrozoa). In: De Broyer, C., Koubbi, P., Griffiths, H.J., Raymond, B., Udekem d'Acoz, C. et al. (Eds) Biogeographic atlas of the Southern Ocean. Scientific Committee on Antarctic Research, 498p.

Peña Cantero, A.L. & García Carrascosa, A.M. 1999. Biogeographical distribution of the benthic thecate hydroids collected during the Spanish "Antártida 8611" expedition and comparison between Antarctic and Magellan benthic hydroid faunas. Scientia Marina, 63, 209–218.

Peña Cantero, A.L. & Gili, J.M. 2006. Benthic hydroids (Cnidaria, Hydrozoa) from off Bouvet Island (Antarctic Ocean). Polar Biology, 29, 764–771.

Peña Cantero, A.L. & Ramil, F. 2006. Benthic hydroids associated with volcanic structures from Bransfield Strait (Antarctica) collected by the Spanish Antarctic expedition GEBRAP96. Deep-Sea Research II, 53, 949–958.

Peña Cantero, A.L. & Vervoort, W. 2003. Species of *Staurotheca* Allman, 1888 (Cnidaria: Hydrozoa: Sertulariidae) from US Antarctic expeditions, with the description of three new species. Journal of Natural History, 37, 2653–2722.

Peña Cantero, A.L. & Vervoort, W. 2004a. Two new Antarctic species of *Schizotricha* (Cnidaria: Hydrozoa: Leptothecata) from US Antarctic expeditions. Journal of Marine Biological Association of the United Kingdom, 84, 29–36.

Peña Cantero, A.L. & Vervoort, W. 2004b. Species of *Oswaldella* Stechow, 1919 (Cnidaria: Hydrozoa: Kirchenpaueriidae) from US Antrarctic expeditions, with the description of three new species. Journal of Natural History, 38, 805–861.

Peña Cantero, A.L. & Vervoort, W. 2005a. *Mixoscyphus antarcticus* gen. nov., sp. nov. (Cnidaria, Hydrozoa, Sertulariidae), the first truly endemic genus of Antarctic benthic hydroids. Polar Biology, 28, 956–963.

Peña Cantero, A.L. & Vervoort, W. 2005b. Species of *Schizotricha* Allman, 1883 (Cnidaria: Hydrozoa: Halopterididae) from US Antarctic expeditions with the description of two new species. Journal of Natural History, 39, 795–818.

Peña Cantero, A.L. & Vervoort, W. 2009. Benthic hydroids (Cnidaria: Hydrozoa) from the Bransfield Strait area (Antarctica) collected by Brazilian expeditions, with the description of a new species. Polar Biology, 32, 83–92.

Peña Cantero, A.L., Svoboda, A. & Vervoort, W. 1999. Species of *Antarctoscyphus* Peña Cantero, García Carrascosa and Vervoort, 1997 (Cnidaria, Hydrozoa, Sertulariidae) from recent Antarctic expeditions with R.V. Polarstern, with the description of two new species. Journal of Natural History, 33, 1739–1765.

Peña Cantero, A.L., Marques, A.C. & Migotto, A.E. 2007. Revision of the genus *Acryptolaria* Norman, 1875 (Cnidaria, Hydrozoa, Lafoeidae). Journal of Natural History, 41, 229–291.

Pérez-Mendoza, A.Y., Hernández-Alcántara, P. & Solís-Weiss, V. 2003. Bathymetric distribution and diversity of deep water polychaetous annelids in the Sigsbee Basin, northwestern Gulf of Mexico. Hydrobiologia, 496, 361–370.

Proches, S. 2005. The world's biogeographical regions: cluster analyses based on bat distributions. Journal of Biogeography, 32, 607–614.

Puce, S., Arillo, A., Cerrano, C., Romagnoli, R. & Bavestrello, G. 2004. Description and ecology of *Cytaeis capitata* n. sp. (Hydrozoa, Cytaeididae) from Bunaken Marine Park (North Sulawesi, Indonesia). Hydrobiologia, 530/531, 503–511.

Puce, S., Calcinai, B., Bavestrello, G., Cerrano, C., Gravili, C. & Boero, F. 2005. Hydrozoa (Cnidaria) symbiotic with Porifera: a review. Marine Ecology, 26, 73–81.

Puce, S., Bavestrello, G., Di Camillo, C.G. & Boero, F. 2009. Long-term changes in hydroid (Cnidaria, Hydrozoa) assemblages: effect of Mediterranean warming? Marine Ecology, 30, 1–14.

Ritchie, J. 1909. Supplementary report on the hydroids of the Scottish National Antarctic Expedition. Transactions of the Royal Society of Edinburgh, 47, 65–101.

Rodriguez, C.S., Miranda, T.P., Marques, A.C., Mianzan, H. & Genzano, G. 2012. The genus *Hybocodon* (Cnidaria, Hydrozoa) in the southwestern Atlantic Ocean, with a revision of the species recorded from the area. Zootaxa, 3523, 39–48.

Ronowicz, M. 2007. Benthic hydroids (Cnidaria: Hydrozoa) from Svalbard waters–biodiversity and distribution. Journal of Marine Biological Association of the United Kingdom, 87, 1089–1094.

Ronowicz, M., Włodarska-Kowalczuk, M. & Kukliński, P. 2008. Factors influencing hydroids (Cnidaria: Hydrozoa) biodiversity and distribution in Arctic kelp forest. Journal of Marine Biological Association of the United Kingdom, 88, 1567–1575.

Ronowicz, M., Włodarska-Kowalczuk, M. & Kukliński, P. 2011. Patterns of hydroid (Cnidaria, Hydrozoa) species richness and distribution in an Arctic glaciated fjord. Polar Biology, 34, 1437–1445.

Ronowicz, M., Włodarska-Kowalczuk, M. & Kukliński, P. 2013a. Depth- and substrate-related patterns of species richness and distribution of hydroids (Cnidaria, Hydrozoa) in Arctic coastal waters (Svalbard). Marine Ecology, 34, 165–176.

Rosa, R., Boavida-Portugal, J., Trübenbach, K., Baptista, M., Araújo, R. & Calado, R. 2012. Descending into the abyss: bathymetric patterns of diversity in decapod crustaceans shift with taxonomic level and life strategies. Deep-Sea Research I, 64, 9–21.

Rosso, S. & Marques, A.C. 1997. Patterns in intertidal hydrozoan distribution along the coast of São Paulo State, Southeastern Brazil. In: den Hartog, J.C. (Ed.) Proceedings of the 6th International Conference on Coelenterate Biology. National Natuurhistorisch Museum, 1st edition, 415–422.

Rueda, M., Rodríguez, M.A. & Hawkins, B.S. 2013. Identifying global zoogeographical regions: lessons from Wallace. Journal of Biogeography, 40, 2215–2225.

Saiz-Salinas, J.I. & Pagola-Carte, S. 1999. Sipuncula of the Magellan area compared with adjacent regions of Antarctica. Scientia Marina, 63, 227–232.

Samaai, T., Gibbons, M.J., Kerwath, S., Yemane, D. & Sink, K. 2010. Sponge richness along a bathymetric gradient within the iSimangaliso Wetland Park, South Africa. Marine Biodiversity, 40, 205–217.

Schuchert, P. 2014a. Hydrozoa. World Register of Marine Species. Available from http://www.marinespecies.org at VLIZ. Accessed 2014-08-04.

Schuchert, P. 2014b. High genetic diversity in the hydroid *Plumularia setacea*: a multitude of cryptic species or extensive population subdivision? Molecular Phylogenetics and Evolution, 76, 1–9.

Silveira, F.L. & Migotto, A.E. 1992. Rediscovery of *Corymorpha januarii* Steenstrup, 1854 (Hydrozoa, Corymorphidae) on the southeastern and southern coasts of Brazil. Steenstrupia, 18, 81–89.

Spalding, M.D., Fox, H., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A.

& Robertson, J. 2007. Marine ecoregions of the world: a bioregionalization of coastal and shelf areas. BioScience, 57, 573–583.

Stepanjants, S.D. 1979. Gidroidy vod Antarktikh i Subantarktikh. Rezultaty Biologieskikh Issledovaniy Sovetskikh Antarkticheskikh Ekspedtsiy, Akademiya Nauk SSSR, 22, 1–200.

Stepanjants, S.D. 2013. Deep-water Hydrozoa (Cnidaria: Medusozoa) in the Sea of Japan, collected during the 51st Cruise of R/V Akademik M.A. Lavrentyev, with description *Opercularella angelikae*, sp. nov. Deep-Sea Research II, 86–87, 231–237.

Svoboda, A. & Stepanjants, S.D. 2001. Redescription of two Antarctic Corymorphidae species and the reestablishment of the genus *Monocaulus* (Cnidaria: Hydrozoa). Marine Ecology, 22, 53–70.

Svoboda, A., Stepanjants, S.D. & Ljubenkov, J. 2006. The genus *Bouillonia* (Cnidaria: Hydrozoa: Anthoathecata). Three species from the northern and southern hemispheres, with a discussion of bipolar distribution of this genus. Zoologische Mededelingen, 80, 185–206.

Vannucci Mendes, M. 1946. Hydroida Thecaphora do Brasil. Arquivos de Zoologia do Estado de São Paulo, 4, 535–598.

Vannucci, M. 1949. Hydrozoa do Brasil. Boletim da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo, 99, 219–266.

Vannucci, M. 1951. Distribuição dos Hydrozoa até agora conhecidos nas costas do Brasil. Boletim do Instituto Paulista de Oceanografia, 2, 105–124.

Vervoort, W. 1966. Bathyal and abyssal hydroids. Galathea Report, 8, 97–174.

Vervoort, W. 1972. Hydroids from the Theta, Vema and Yelcho cruises of the Lamont-Doherty geological observatory. Zoologische Verhandelingen, 120, 3–247.

Vervoort, W. 1985. Deep-water hydroids. In: Laubier, L. & Monniot, C. (Eds) Peuplements profonds du golfe de Gascone. IFREMER, 630p.

Vervoort, W. 2000. Additional notes on *Clathrozoella drygalskii* (Vanhöffen, 1910) (Cnidaria, Hydrozoa). Scientia Marina, 64, 237–240.

Watson, J.E. 2003. Deep-water hydroids (Hydrozoa: Leptolida) from Macquarie Island. Memoirs of Museum Victoria, 60, 151–180.

Watson, J.E. 2008. Hydroids of the BANZARE expeditions, 1929 – 1931: the family Haleciidae (Hydrozoa, Leptothecata) from the Australian Antarctic Territory. Memoirs of Museum Victoria, 65, 165–178.

Watson, J.E. & Vervoort, W. 2001. The hydroid fauna of Tasmanian seamounts. Zoologische Verhandelingen, 334, 151–187.

Zamponi, M.O., Genzano, G.N., Acuña, F.G. & Excoffon, A.C. 1998. Studies of benthic cnidarian taxocenes along a transect off Mar del Plata (Argentina). Russian Journal of Marine Biology, 24, 7–13.

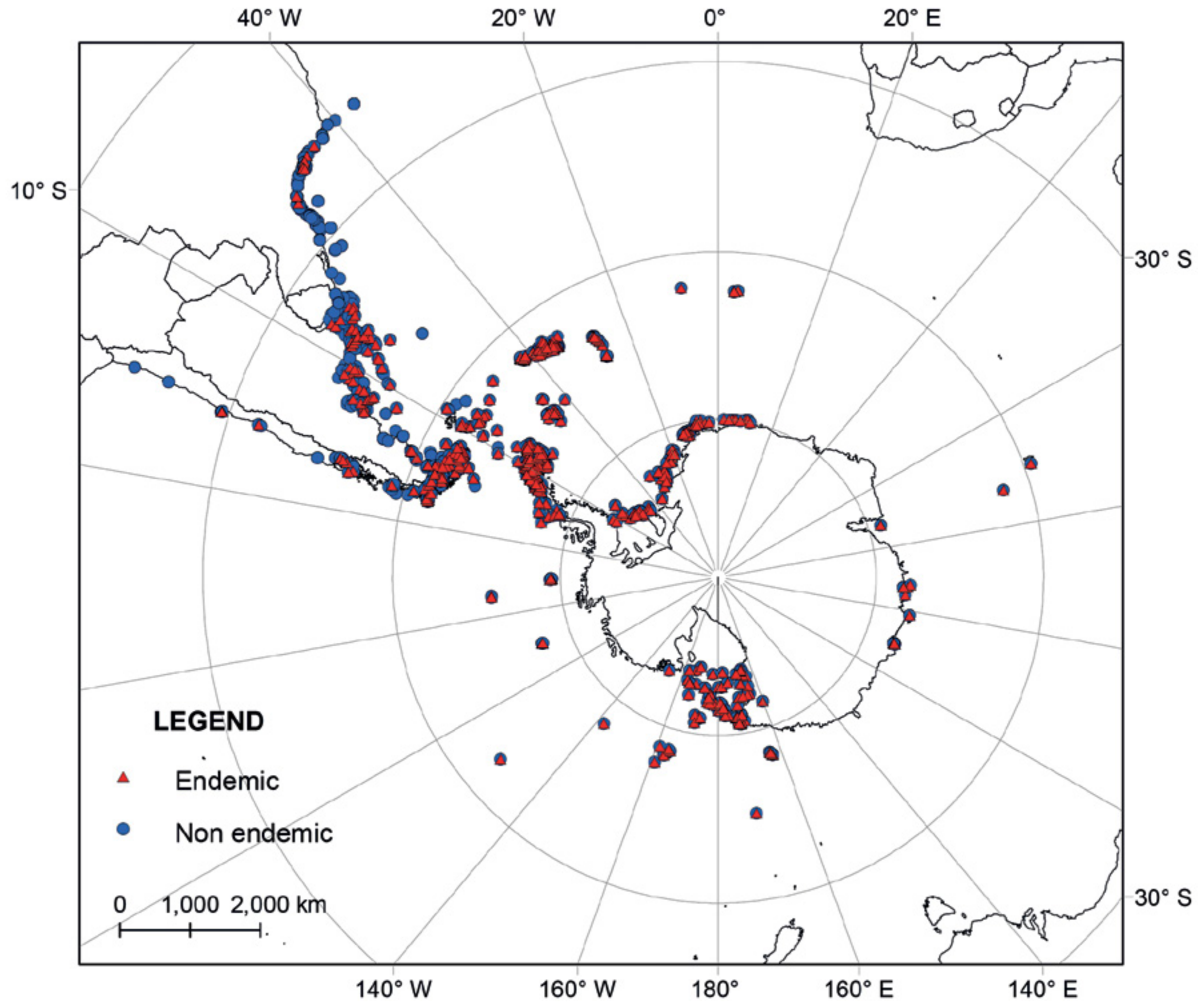

Figure 1. Sampling locations (n = 1,351) of the morphospecies examined herein of benthic hydroids of the southern South America (SSA) coast and the Southern Ocean (SO).

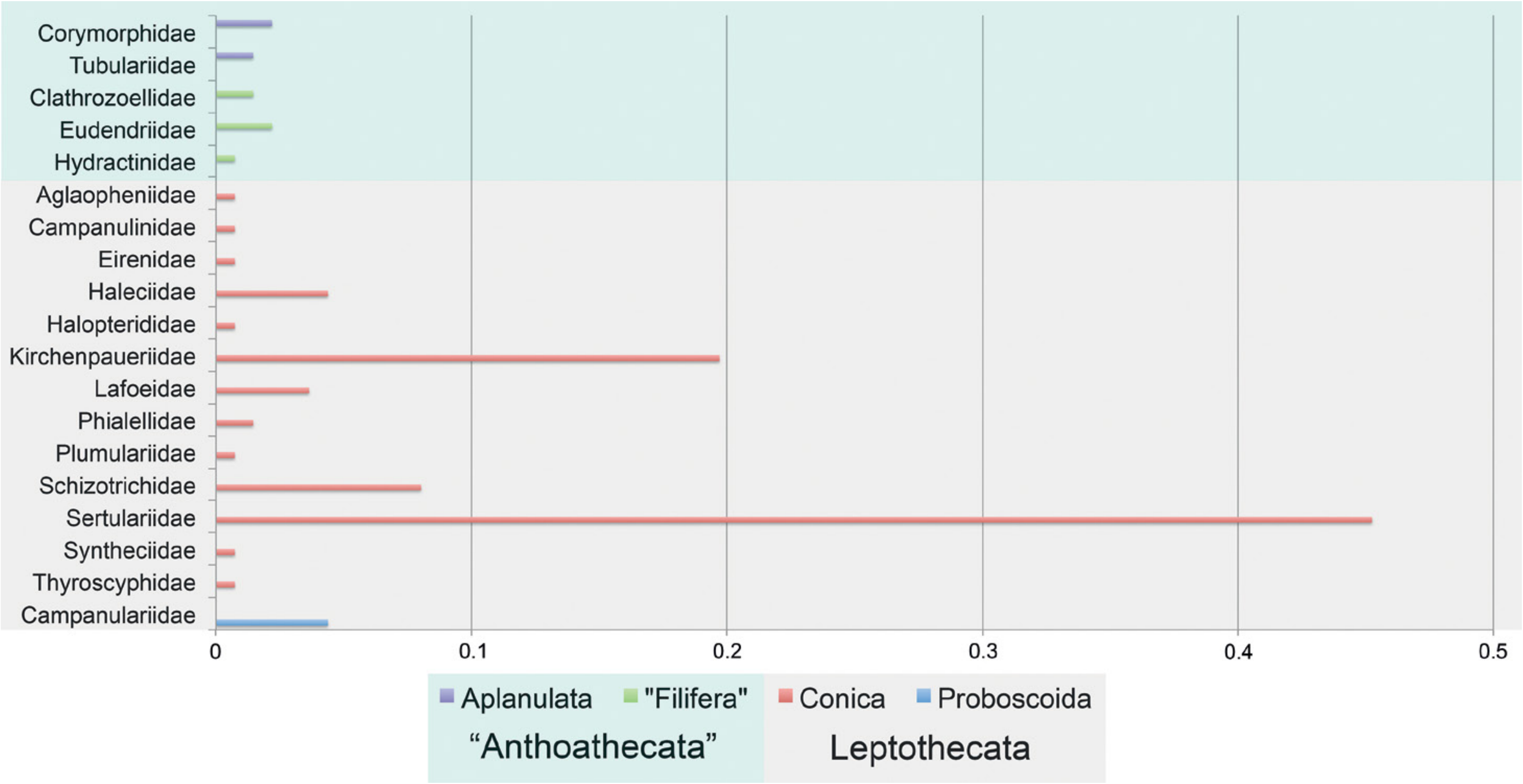

Figure 2. Proportion of endemism relative to the total number of endemic species of benthic hydroids (N=137) recorded for the southern South America (SSA) coast and the Southern Ocean (SO).

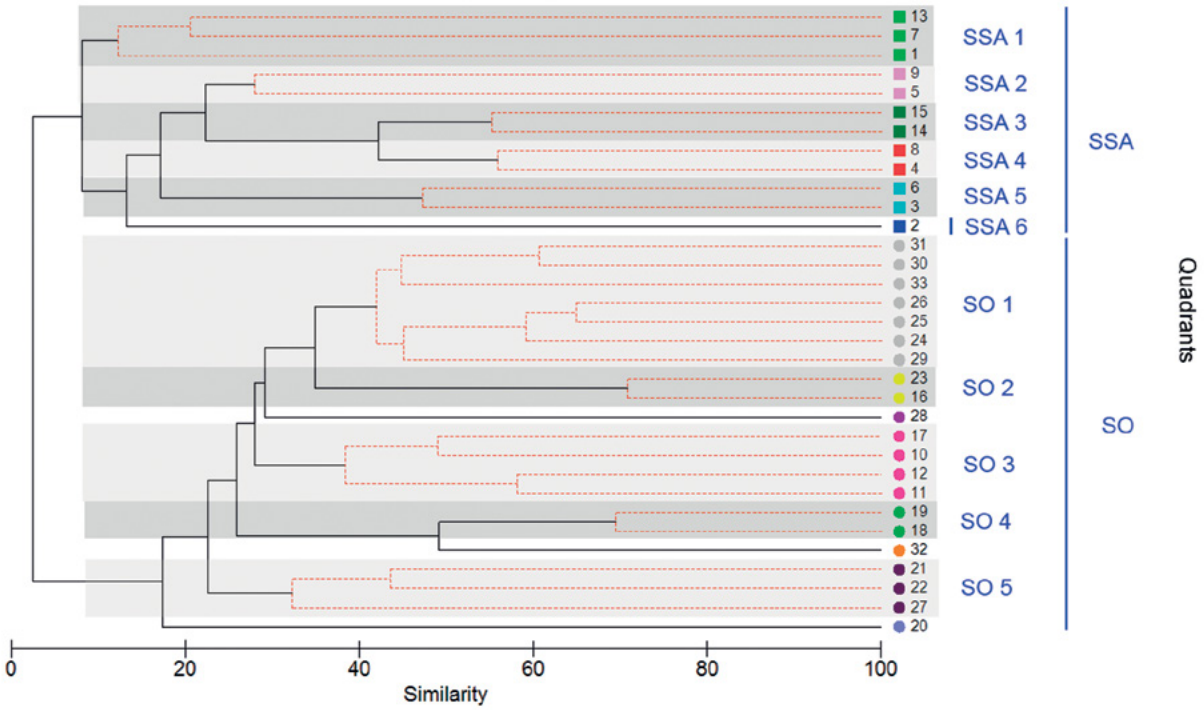

Figure 3. Hierarchical cluster based on Bray-Curtis similarity analysis resulted in 13 assemblages of benthic hydroid species for the Austral coast of South America (ACSA) and Southern Ocean (SO). Numbers 1 to 33 refer to the quadrants in Figure 6.

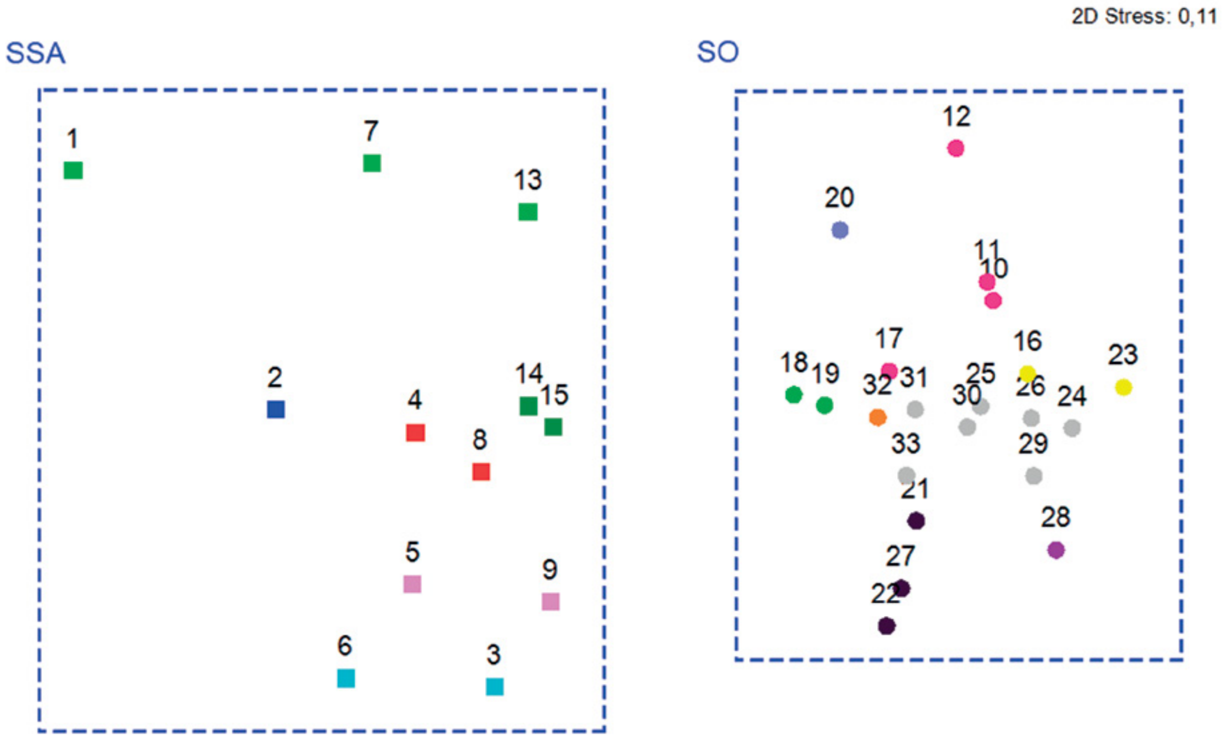

Figure 4. Non-metric multidimensional scaling (nMDS) diagram showing 13 assemblages of benthic hydroids species found for the southern South America (SSA) and the Southern Ocean (SO). Numbers 1 to 33 refer to the quadrants in Figure 6.

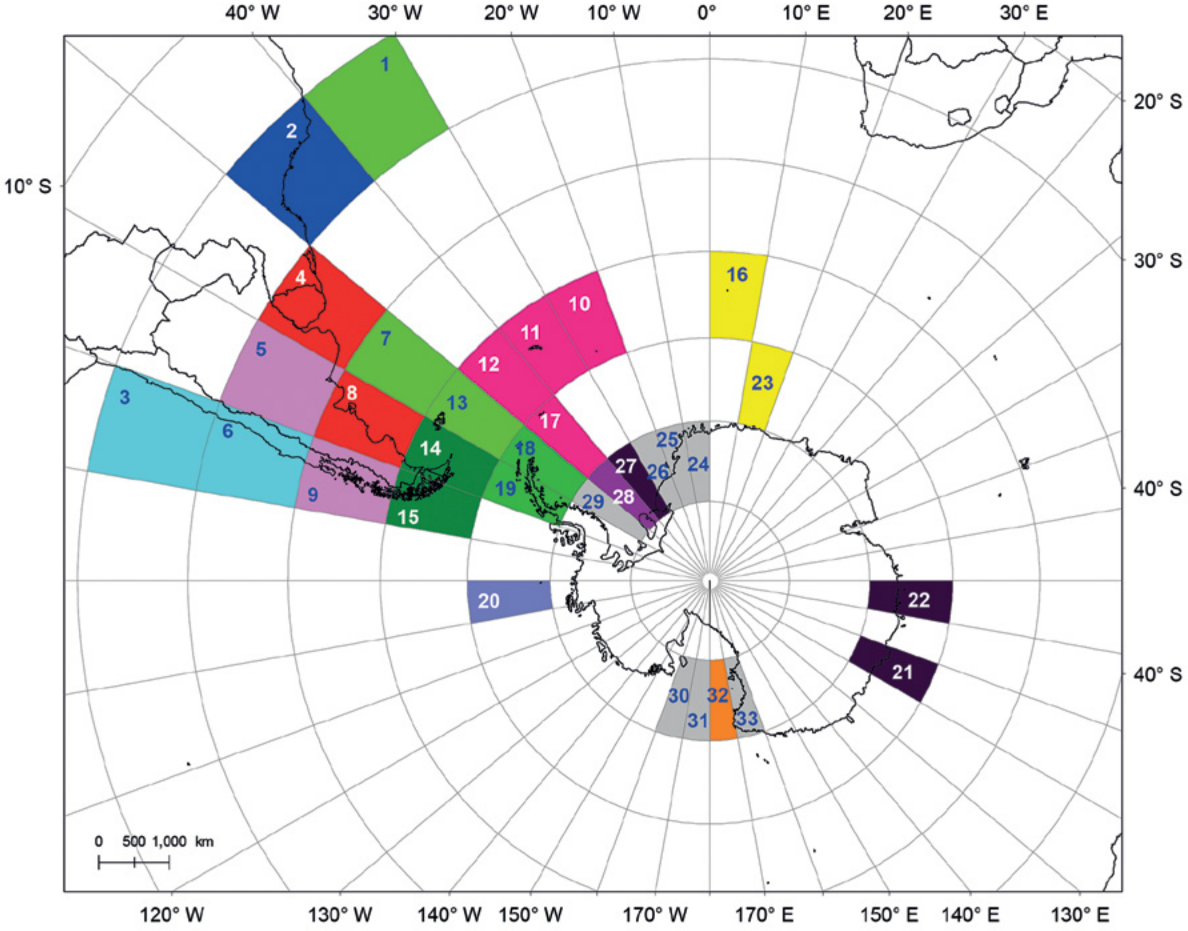

Figure 5. Geographic distribution of the 13 assemblages of benthic hydroid species derived from Bray-Curtis similarity analysis for the southern South America (SSA) coast and the Southern Ocean (SO). Numbers 1 to 33 refer to the quadrants used in the similarity analysis.

Table 1. Morphospecies of benthic hydroids analyzed, their substrates, occurrence, depth, collection method and provenance of the material. Endemic species are marked in grey. [1]SA: South Atlantic Ocean; SI: South Indian Ocean; SP: South Pacific Ocean; S: Southern Ocean; [2]DZOO-UFPR: Departamento de Zoologia-Universidade Federal do Paraná; FCNyM-UNLP: Facultad de Ciéncias Naturales y Museo-Universidad Nacional de La Plata; MCN-FZB: Museu de Ciências Naturais-Fundação Zoobotânica do Rio Grande do Sul; MNHNU: Museo Nacional de Historia Natural del Uruguay; MHNG: Muséum d'Histoire Naturelle de la Ville Genève; MNRJ: Museu Nacional, Universidade Federal do Rio de Janeiro; MZUSP: Museu de Zoologia, Universidade de São Paulo; UNMdP: Universidad Nacional Mar del Plata; USNM: National Museum of Natural History, Smithsonian Institution; UV: Universidad de Valencia; ZMH: Zoologisches Museum Hamburg.

Species	**Substrate**	**Locality**	**Ocean1**	**Depth (m)**	**Collection method**	**Provenance2**
CLASS HYDROZOA OWEN, 1843						
Hydrozoan not-identified	Sponges	22°S to 77°S	SA, SP, S	4–280	Not-recorded	MNHNU, MNRJ, USNM
ORDER "ANTHOATHECATA" CORNELIUS, 1992						
"Anthoathecata" not-identified	Algae, hydroids, rock, sponges	20°S to 64°S	SA, SP, S	1–75	Dredge, manual, snorkeling, SCUBA	MCN-FZB, MNRJ, MZUSP, USNM
SUBORDER APLANULATA COLLINS, WINKELMANN, HADRYS & SCHIERWATER, 2005						
Family Corymorphidae Allman, 1872						
Corymorpha januarii Steenstrup, 1854	Sandy soft-bottom	39°S to 43°S	SA	7–11	SCUBA	UNMdP
Monocaulus microrhiza (Hickson & Gravely, 1907)	Not-recorded	64°S to 78°S	S	237–970	Trawl	USNM; Svoboda & Stepanjants, 2001
Monocaulus parvula (Hickson & Gravely, 1907)	Rock, shingle	63°S to 79°S	S	3–440	Not-recorded	USNM; Svoboda & Stepanjants, 2001
Family Tubulariidae Fleming, 1828						
Bouillonia denhartogi Svoboda, Stepanjants & Ljubenkov, 2006	Not-recorded	66°S to 67°S	S	3421	Not-recorded	USNM
Ectopleura crocea (L. Agassiz, 1862)	Algae, boat, egg mass, hydroids, net tank, rock, sand shell	22°S to 53°S	SA	0–12	Manual, snorkeling, SCUBA, trawling	DZOO-UFPR, UNMdP, MZUSP
Ectopleura obypa Migotto & Marques, 1999	Algae	23°S to 24°S	SA	1	Manual	MZUSP
Ectopleura sp.	Not-recorded	22°S to 23°S	SA	Not-recorded	Not-recorded	MZUSP

Hybocodon chilensis Hartlaub, 1905	Rock	53°S to 55°S	SA	0–5	Manual	MZUSP, UNMdP, UV
?*Hybocodon chilensis* Hartlaub, 1905	Not-recorded	54°S to 55°S	SA	Not-recorded	Not-recorded	UV
Zyzzyzus warreni Calder, 1988	Algae, ascidian, hydroid, sponge	23°S to 28°S	SA	0–5	Manual	MZUSP
SUBORDER CAPITATA KÜHN, 1913						
Family Cladocorynidae Allman, 1872						
Cladocoryne floccosa Rotch, 1871	Algae	23°S to 28°S	SA	0–4	Manual, snorkeling	DZOO-UFPR, MZUSP
Family Cladonematidae Gegenbaur, 1857						
Cladonema radiatum Dujardin, 1843	Algae	23°S to 24°S	SA	1	Manual	MZUSP
Family Corynidae Johnston, 1836						
Coryne eximia Allman, 1859	Hydroid, sponge	28°S to 54°S	SA, SP	0–24	Manual	MNRJ, MZUSP, UNMdP
Staurodiosarsia reesi (Vannucci, 1956)	Not-recorded	40°S to 41°S	SA	0–5	Manual	UNMdP
Family Pennariidae McCrady, 1859						
Pennaria disticha Goldfuss, 1820	Algae, buoy, long line, rock	23°S to 28°S	SA	0–16	Manual, SCUBA, trawl	DZOO-UFPR, MZUSP
Family Sphaerocorynidae Prévot, 1959						
Sphaerocoryne sp.	Sponge	27°S to 28°S	SA	0–5	Manual	MZUSP
"FILIFERA" KÜHN, 1913						
Filifera not-identified	Algae, sand, sponges	22°S to 54°S	SA, SP	0–158	Dredge, manual	MCN-FZB, MNRJ, MZUSP
Family Bougainvilliidae Lütken, 1850						
Bougainvilliidae not-identified	Sponge	48°S to 49°S	SP	12	Not-recorded	MNRJ, MZUSP
Bimeria sp.	Rock	23°S to 26°S	SA	0–5	Manual	MZUSP
Bimeria vestita Wright, 1859	Algae, hydroid, sponge	23°S to 43°S	SA	0–70	Manual, SCUBA	DZOO-UFPR, MNRJ, MZUSP, UNMdP
Bougainvillia rugosa Clarke, 1882	Mussel, polyethylene plate	26°S to 27°S	SA	0–3	Snorkeling	DZOO-UFPR, MZUSP
Bougainvillia sp.	Algae, bryozoan, hydroid, mussel, polychaete tube, rock, rope, shell, sponge	22° to 73°S	SA, SP, S	0–264	Dredge, manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MCN-FZB, MNRJ, MZUSP, UNMdP, USNM

Bougainvilliidae not-identified	Sponge	22°S to 53°S	SA, SP	4–20	Snorkeling	MNRJ
Parawrightia robusta Warren, 1908	Algae, ascidian	26°S to 30°S	SA	0–5	Manual	DZOO-UFPR, MZUSP
Family Clathrozoellidae Peña Cantero, Vervoort & Watson, 2003						
Clathrozoella abyssalis Peña Cantero, Vervoort & Watson, 2003	Not-recorded	58°S to 59°S	S	3074–3093	Not-recorded	USNM
Clathrozoella medeae Peña Cantero, Vervoort & Watson, 2003	Not-recorded	60°S to 64°S	S	128–641	Not-recorded	USNM
Family Eudendriidae L. Agassiz, 1862						
Eudendriidae not-identified	Sponge	32°S to 63°S	SA, S	13–411	Trawl	MCN-FZB, USNM, UV
Eudendrium capillare Alder, 1856	Algae	23°S to 24°S	SA	0–1	Not-recorded	MZUSP
Eudendrium caraiuru Marques & Oliveira, 2003	Bryozoan, metallic structure, recruitment plate, rock, rope	22°S to 39°S	SA	0–1	Manual, SCUBA	DZOO-UFPR, MZUSP, UNMdP
Eudendrium carneum Clarke, 1882	Algae, boat, bryozoan, buoy, mud, rock, shell	23°S to 29°S	SA	0–26	Manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MZUSP
Eudendrium merulum Watson, 1985	Not-recorded	27°S to 28°S	SA	Not-recorded	Not-recorded	MZUSP
Eudendrium pocaruquarum Marques, 1995	Algae, rock	23°S to 24°S	SA	0–1	Not-recorded	MZUSP
Eudendrium ramosum (Linnaeus, 1758)	Rock, sponge	22°S to 42°S	SA, SP	2–48	Dredge, snorkeling	MCN-FZB, MNRJ, MZUSP, UNMdP
Eudendirum sp.	Algae, ascidians, hydroids, rocks, sponges	22°S to 68°S	SA, SP, S	0–355	Dredge, manual, SCUBA, snorkeling	DZOO-UFPR, MCN-FZB, MNRJ, MZUSP, USNM
Eudendrium tottoni Stechow, 1932	Not-recorded	64°S to 65°S	S	Not-recorded	Not-recorded	USNM
Family Hydractinidae L. Agassiz, 1862						
Hydractinidae not-identified	Not-recorded	52°S to 55°S	SA	70–329	Not-recorded	UV
Hydractinia sp.	Polyethylene plate, shell	25°S to 26°S	SA	8–329	Manual, trawl	DZOO-UFPR, MZUSP
Hydractinia uniformis Stampar, Tronolone & Morandini, 2006	Coral debries	23°S to 24°S	SA	Not-recorded	Not-recorded	MZUSP
Family Oceaniidae Eschscholtz, 1829						
Cordylophora caspia (Pallas, 1771)	Not-recorded	34°S to 35°S	SA	Not-recorded	Not-recorded	MZUSP
Corydendrium parasiticum (Linnaeus, 1767)	Shell	Not-recorded	SA	Not-recorded	Not-recorded	MZUSP

Rhizogeton nudus Broch, 1910	Not-recorded	38°S to 39°S	SA	0–5	Manual	UNMdP
Turritopsis nutricula McCrady, 1857	Hydroid, mussel, rock, rope, sponge	22°S to 28°S	SA	0–2	Manual, SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP
Turritopsis sp.	Algae	26°S to 27°S	SA	0–2	Manual, snorkeling	MZUSP
ORDER LEPTOTHECATA CORNELIUS, 1992						
Leptothecata not-identified	Sponge	53°S to 73°S	SP, S	51–59	Not-recorded	USNM
SUBORDER CONICA BROCH, 1910						
Family Aglaopheniidae Marktanner-Turneretscher, 1890						
Aglaophenia acacia Allman, 1883	Sponges	34°S to 43°S	SA	47–53	Dredge	MCN-FZB, MNHNU, MNRJ, UNMdP
Aglaophenia latecarinata Allman, 1877	Algae, hydroids, rock, sponges	22°S to 29°S	SA	0–15	Manual, SCUBA, snorkeling	DZOO-UFPR, MZUSP
Aglaophenia rhynchocarpa Allman, 1877	Submarine floating device	26°S to 27°S	SA	Not-recorded	Not-recorded	DZOO-UFPR, MZUSP
Aglaophenia trifida L. Agassiz, 1862	Algae, hydroid, rock, sponge	22°S to 24°S	SA	60	Dredge, SCUBA, Van Veen	DZOO-UFPR, MNRJ, MZUSP
Gymnangium allmani (Marktanner-Turneretscher, 1890)	Rock	22°S to 23°S	SA	Not-recorded	Not-recorded	DZOO-UFPR, MZUSP
Lytocarpia canepa Blanco & Bellusci de Miralles, 1971	Soft-bottom	38°S to 57°S	SA	100–800	Not-recorded	UNMdP, UV
Lytocarpia ?canepa Blanco & Bellusci de Miralles, 1971	Not-recorded	53°S to 55°S	SA	512–641	Not-recorded	UV
Lytocarpia tridentata (Versluys, 1899)	Algae, rock	23°S to 29°S	SA	0–9	SCUBA	MZUSP
Macrorhynchia grandis (Clarke, 1879)	Rock	22°S to 23°S	SA	Not-recorded	Not-recorded	DZOO-UFPR, MZUSP
Macrorhynchia philippina KIrchenpauer, 1872	Algae, hydroid, rock	23°S to 28°S	SA	0–8	Manual, SCUBA, snorkeling	DZOO-UFPR, MZUSP
Family Campanulinidae Hincks, 1868						
Campanulinidae not-identified	Algae, hydroid, sponges	23°S to 64°S	SA, S	0–400	Dredge, manual, net	DZOO-UFPR, MCN-FZB, MZUSP
Cuspidella sp.	Algae, hydroid	22°S to 28°S	SA	0–7	Manual, SCUBA, snorkeling	MNRJ, MZUSP
Lafoeina amirantensis (Millard & Bouillon, 1973)	Algae, hydroids, sponges	22°S to 28°S	SA	0–8	Manual, SCUBA, snorkeling	MNRJ, MZUSP
Stegella lobata (Vanhöffen, 1910)	Sponges	61°S to 78°S	S	0–490	Dredge	MCN-FZB, MZUSP, USNM
Family Eirenidae Haeckel, 1879						
Eutima sapinhoa Narchi & Hebling, 1975	Mussel	23°S to 24°S	SA	0	Manual	MZUSP

Family Haleciidae Hincks, 1868						
Haleciidae not-identified	Algae, bryozoan, sponge	22°S to 28°S	SA	9–103	Dredge, SCUBA, snorkeling	MNRJ, MZUSP
Halecium antarcticum Vanhöffen, 1910	Sponge	62°S to 63°S	S	280	Dredge	MCN-FZB, MZUSP
Halecium ?antarcticum Vanhöffen, 1910	Polychaete tube	54°S to 55°S	SA	Not-recorded	SCUBA	MZUSP
Halecium beanii (Johnston, 1838)	Sponge	35°S to 54°S	SA, SP	20–110	SCUBA, trawl	MNRJ, MZUSP, UNMdP, USNM, UV
Halecium bermudense Congdon, 1907	Rock, sponge	22°S to 28°S	SA	10–60	Dredge, SCUBA	MNRJ, MZUSP
Halecium delicatulum Coughtrey, 1876	Algae, hydroid, polychaete tube, shell, sponge	23°S to 78°S	SA, SP, S	82–411	Trawl	MCN-FZB, MZUSP, UNMdP, USNM, UV
Halecium dichotomum Allman, 1888	Algae, sponge	23°S to 36°S	SA	9–94	Dredge, SCUBA, Van Veen	MCN-FZB, MZUSP
Halecium dyssymetrum Billard, 1929	Algae, hydroid, rock, shell, sponge	23°S to 28°S	SA	0–15	Manual, SCUBA, snorkeling	DZOO- UFPR, MZUSP
Halecium ?dyssymetrum Billard, 1929	Hydroid, sponge	22°S to 34°S	SA	14–65	Dredge, SCUBA	MCN-FZB, MNRJ, MZUSP
Halecium jaederholmi Vervoort, 1972	Sponge	60°S to 78°S	S	73–1674	Net, trawl	MCN-FZB, MZUSP, USNM
?*Halecium jaederholmi* Vervoort, 1972	Sponge	62°S to 64°S	S	82–264	Dredge	MCN-FZB, MZUSP
Halecium lightbourni Calder, 1991	Algae, hydroid, sponge	23°S to 28°S	SA	9	SCUBA, snorkeling	MNRJ, MZUSP
Halecium ovatum Totton, 1930	Sponge	29°S to 77°S	SA, SP, S	7–1890	Net, trawl	MNRJ, MZUSP, USNM
Halecium pallens Jäderholm, 1904	Not-recorded	60°S to 78°S	S	100–640	Trawl	USNM
Halecium secundum Jäderholm, 1904	Not-recorded	Not-recorded	S	Not-recorded	Trawl	USNM
Halecium sp.	Algae, hydroid, sponge	27°S to 75°S	SA, SP, S	0–2306	Dredge, SCUBA, snorkeling, trawl	MCN-FZB, MNRJ, MZUSP, USNM, UV
Halecium tenellum Hincks, 1861	Algae, hydroid, rock, shell, sponge	23°S to 53°S	SA, SP	1–101	Manual, SCUBA, trawl	MZUSP, USNM
Hydrodendron arboreum (Allman, 1888)	Not-recorded	60°S to 63°S	S	94–229	Trawl	USNM
Nemalecium lighti (Hargitt, 1924)	Mussel, rope, sponge	22°S to 24°S	SA	0–2	Manual, snorkeling	MNRJ, MZUSP
Ophiodissa sp.	Sponge	23°S to 24°S	SA	Not-recorded	Not-recorded	MNRJ, MZUSP
Family Halopterididae Millard, 1962						
Halopterididae not-identified	Sponge	23°S to 63°S	SA, S	210–220	SCUBA, trawl	MZUSP, USNM

Antennella secundaria (Gmelin, 1791)	Sponge	27°S to 28°S	SA	13	SCUBA	MZUSP
Antennella sp.	Not-recorded	53°S to 54°S	SA	512–586	Not-recorded	UV
Halopteris alternata (Nutting, 1900)	Sponge	23°S to 24°S	SA	1	Not-recorded	MNRJ, MZUSP
Halopteris carinata Allman, 1877	Submarine floating device	26°S to 27°S	SA	Not-recorded	Not-recorded	DZOO-UFPR, MZUSP
Halopteris ?catharina (Johnston, 1833)	Not-recorded	53°S to 54°S	SA	256–269	Not-recorded	UV
Halopteris constricta Totton, 1930	Not-recorded	41°S to 43°S	SA	70–90	Not-recorded	UNMdP
Halopteris diaphana (Heller, 1868)	Algae, hydroid, rock, sponge	23°S to 27°S	SA	0–8	Manual, SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP
Halopteris plumosa Galea & Schories, 2012	Not-recorded	52°S to 54°S	SA	0–90	Not-recorded	UV
Halopteris polymorpha (Billard, 1913)	Algae, rock, sponge	22°S to 54°S	SA	0–14	SCUBA, Van Veen	DZOO-UFPR, MZUSP, UV
Halopteris sp.	Sponge	53°S to 54°S	SA, SP	51–110	Trawl	USNM, UV
Halopteris tenella (Verrill, 1874)	Sponge	52°S to 53°S	SP	188–247	Trawl	USNM
Monostaechas quadridens (McCrady, 1859)	Algae, hydroid, polychaete tube, rock, shell, sponge	22°S to 39°S	SA	6–103	Dredge, SCUBA, snorkeling	MNRJ, MZUSP, UNMdP
Family Hebellidae Fraser, 1912						
Hebellidae not-identified	Not-recorded	54°S to 55°S	SA	84	Not-recorded	UV
Halisiphonia sp.	Hydroid	53°S to 54°S	SA	567–578	Not-recorded	UV
Hebella scandens (Bale, 1888)	Hydroid	23°S to 38°S	SA	0–7	Manual, SCUBA	DZOO-UFPR, MZUSP, UNMdP
Hebella sp.	Hydroid	53°S to 57°S	SA, SP, S	18–494	Trawl	USNM, UV
Hebella striata Allman, 1888	Hydroid	52°S to 55°S	SA, SP	0–307	Not-recorded	UV
Hebella ?striata Allman, 1888	Hydroid	54°S to 55°S	SA	84	Not-recorded	UV
Scandia mutabilis (Ritchie, 1907)	Hydroid	23°S to 28°S	SA	0–2	Manual	DZOO-UFPR, MZUSP
Family Kirchenpaueriidae Stechow, 1921						
Oswaldella antarctica (Jäderholm, 1904)	Sponge	60°S to 78°S	S	22–1674	Trawl	USNM
Oswaldella bifurca (Hartlaub, 1904)	Not-recorded	67°S to 77°S	S	342–1610	Grab, trawl	USNM
Oswaldella billardi Briggs, 1938	Sponge	65°S to 76°S	S	0–500	Dredge	USNM
Oswaldella blanconae El Beshbeeshy, 2011	Not-recorded	63°S to 73°S	S	90–352	Trawl	USNM
Oswaldella crassa Peña Cantero & Vervoort, 1998	Not-recorded	62°S to 63°S	S	662–1120	Trawl	USNM
Oswaldella curiosa Peña Cantero & Vervoort, 1998	Not-recorded	62°S to 63°S	S	662–1120	Trawl	USNM
Oswaldella delicata Peña Cantero, Svoboda & Vervoort, 1997	Hydroid	62°S to 79°S	S	126–562	Trawl	USNM

Oswaldella elongata Peña Cantero, García Carrascosa & Vervoort, 1995	Not-recorded	54°S to 55°S	SA	86–250	Not-recorded	UV
Oswaldella encarnae Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	76°S to 78°S	S	252–440	Dredge	USNM
Oswaldella erratum Peña Cantero & Vervoort, 1997	Not-recorded	54°S to 78°S	SA, S	15–696	Grab, net, trawl	USNM
Oswaldella frigida Peña Cantero & Vervoort, 2004	Not-recorded	62°S to 64°S	S	44–124	Trawl	USNM
Oswaldella garciacarrascosai Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	76°S to 77°S	S	330–340	Not-recorded	UV
Oswaldella gracilis Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	75°S to 76°S	S	440	Not-recorded	UV
Oswaldella grandis Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	61°S to 77°S	S	20–922	Trawl	USNM
Oswaldella ?grandis Peña Cantero, Svoboda & Vervoort, 1997	Sponge	62°S to 63°S	S	210–220	Trawl	USNM
Oswaldella herwigi El Beshbeeshy, 2011	Not-recorded	52°S to 54°S	SA	44–586	Trawl	USNM
Oswaldella incognita Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	58°S to 67°S	SA, S	20–952	Grab, net, trawl	USNM
Oswaldella laertesi Peña Cantero, 2007	Not-recorded	71°S to 72°S	S	343–736	Not-recorded	UV
Oswaldella medeae Peña Cantero & Vervoort, 2004	Not-recorded	62°S to 75°S	S	210–503	Trawl	USNM
Oswaldella monomammillata Peña Cantero & Vervoort, 2004	Not-recorded	62°S to 63°S	S	265	Trawl	USNM
Oswaldella niobae Peña Cantero & Ramil, 2006	Not-recorded	62°S to 63°S	S	699–922	Not-recorded	UV
Oswaldella obscura Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	70°S to 77°S	S	260–830	Not-recorded	UV
Oswaldella rigida Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	70°S to 77°S	S	196–830	Not-recorded	UV
Oswaldella shetlandica Stepanjants, 1979	Not-recorded	58°S to 66°S	SA, S	20–952	Grab, net, trawl	USNM
Oswaldella ?shetlandica Stepanjants, 1979	Sponge	62°S to 63°S	S	95	Dredge	MCN-FZB, MZUSP
Oswaldella sp.	Sponge	54°S to 78°S	SA, S	70–384	Trawl	MCN-FZB, MZUSP, USNM
Oswaldella sp. 1	Not-recorded	62°S to 67°S	S	85–1120	Not-recorded	USNM
Oswaldella sp. 2	Not-recorded	66°S to 67°S	S	18–146	Not-recorded	USNM
Oswaldella stepanjantsae El Beshbeeshy, 2011	Not-recorded	62°S to 77°S	S	36–1890	Dredge, trawl	USNM
Oswaldella terranovae Peña Cantero & Vervoort, 1996	Not-recorded	71°S to 72°S	S	82–92	Not-recorded	USNM
Oswaldella tottoni Peña Cantero & Vervoort, 1996	Sponge	61°S to 77°S	S	210–400	Trawl	USNM
Oswaldella vervoorti Peña Cantero & García Carrascosa, 1998	Not-recorded	54°S to 55°S	SA, S	33–952	Dredge, grab, net, trawl	USNM
Pycnotheca mirabilis (Allman, 1888)	Algae, hydroid, rock	23°S to 29°S	SA	0–9	Manual, SCUBA, snorkeling	DZOO-UFPR, MZUSP
Ventromma halecioides (Alder, 1859)	Algae, rock, sponge	22°S to 54°S	SA, SP	0–80	Manual, SCUBA	DZOO-UFPR, MNRJ, MZUSP, UV
Family Lafoeidae A. Agassiz, 1865						
Lafoeidae not-identified	Sponge	31°S to 32°S	SA	170	Dredge	MCN-FZB, MZUSP
Abietinella operculata (Jäderholm, 1903)	Sponge	52°S to 74°S	SA, S	0–1674	Trawl	USNM, UV

?*Abietinella operculata* (Jäderholm, 1903)	Not-recorded	53°S to 54°S	SA	119–124	Not-recorded	UV
Acryptolaria conferta (Allman, 1877)	Sponge	22°S to 57°S	SA	124–586	Dredge	MCN-FZB, MNRJ, MZUSP, UNMdP, USNM, UV
Acryptolaria crassicaulis (Allman, 1888)	Not-recorded	Not-recorded	S	Not-recorded	Not-recorded	USNM
Acryptolaria ?encarnae Peña Cantero & Vervoort, 2010	Hydroid	53°S to 54°S	SA	567–578	Not-recorded	UV
Acryptolaria ?flabellum (Allman, 1888)	Not-recorded	54°S to 55°S	SA	1244–1771	Not-recorded	UV
Acryptolaria longitheca (Allman, 1877)	Not-recorded	48°S to 49°S	SP	821	Not-recorded	USNM
Acryptolaria minuta Watson, 2003	Sponge	57°S to 58°S	SA	2727–2754	Dredge	USNM
Acryptolaria operculata Stepanjants, 1979	Not-recorded	53°S to 57°S	SA	124–2044	Not-recorded	UV
Acryptolaria sp.	Sponge	54°S to 65°S	SA, S	0–300	Not-recorded	MNRJ, MZUSP, USNM, UV
Cryptolarella abyssicola (Allman, 1888)	Sponge	Not-recorded	SA	Not-recorded	Not-recorded	MNRJ, MZUSP
?*Filellum annulatum* (Watson, 1973)	Sponge	72°S to 73°S	S	348–352	Trawl	USNM
Filellum antarcticum (Hartlaub, 1904)	Not-recorded	52°S to 53°S	SA	119–329	Not-recorded	UV
Filellum contortum (Nutting, 1905)	Algae	Not-recorded	SA	Not-recorded	Not-recorded	UNMdP
Filellum sp.	Algae, bryozoan, hydroid, polychaete tube, sponge	22°S to 78°S	SA, SP, S	0–2044	Dredge, manual, net, SCUBA, snorkeling, trawl	DZOO-UFPR, MCN-FZB, MNRJ, MZUSP, UNMdP, USNM, UV
Grammaria abietina (M. Sars, 1851)	Not-recorded	36°S to 55°S	SA	124–128	Not-recorded	UNMdP, UV
Grammaria sp.	Hydroid	38°S to 56°S	SA	0–641	Dredge, manual	MCN-FZB, MZUSP, UV
Lafoea coalescens Allman, 1877	Sponge	22°S to 23°S	SA	103–250	Dredge	MNRJ, MZUSP
Lafoea dumosa (Fleming, 1820)	Polychaete tube, sponge	31°S to 73°S	SA, SP, S	0–641	Dredge, net, SCUBA, trawl	MCN-FZB, MNRJ, MZUSP, UNMdP, USNM, UV
Lafoea gaussica Vanhöffen, 1910	Not-recorded	77°S to 78°S	S	411	Not-recorded	USNM
Lafoea sp.	Hydroid, sponge	22°S to 63°S	SA, S	25–641	Dredge, net	MCN-FZB, MNRJ, MZUSP, USNM, UV

Zygophylax infundibulum Millard, 1958	Sponge	Not-recorded	SA	Not-recorded	Not-recorded	MNRJ, MZUSP
Zygophylax sibogae Billard, 1918	Sponge	22°S to 23°S	SA	Not-recorded	Not-recorded	MZUSP
Zygophylax sp.	Sponge	Not-recorded	SA	Not-recorded	Not-recorded	MNRJ, MZUSP
Family Lovenellidae Russell, 1953						
Lovenellidae not-identified	Sponge	22°S to 23°S	SA	60	Dredge	MNRJ, MZUSP
Lovenella gracilis Clarke, 1882	Algae, rock	27°S to 28°S	SA	0–2	Manual	MZUSP
Family Phialellidae Russell, 1953						
Phialella belgicae (Hartlaub, 1904)	Algae, hydroid, polychaete tube, sponge	38°S to 78°S	SA, SP, S	0–48	Manual, SCUBA	MNRJ, MZUSP, UNMdP, UV
Phialella chilensis (Hartlaub, 1905)	Algae, hydroid	35°S to 54°S	SA	38–99		MZUSP, UNMdP, UV
?*Phialella chilensis* (Hartlaub, 1905)	Not-recorded	52°S to 55°S	SA	0–90	Not-recorded	UV
Family Plumulariidae McCrady, 1859						
Plumulariidae not-identified	Algae	27°S to 54°S	SA	0–586	Manual	MZUSP, UV
Dentitheca bidentata (Jäderholm, 1920)	Algae	25°S to 27°S	SA	0–2	Manual, snorkeling	DZOO-UFPR, MZUSP
Monotheca margaretta Nutting, 1900	Algae, hydroid, shell, sponge	23°S to 28°S	SA	0–15	Manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MZUSP
Monotheca pulchella (Bale, 1882)	Algae, shell, sponge	38°S to 43°S	SA	Not-recorded	SCUBA	UNMdP
Nemertesia antennina (Linnaeus, 1758)	Mussel, polychaete tube	33°S to 35°S	SA	9–15	Not-recorded	MNHNU, MZUSP
?*Nemertesia ciliata* Bale, 1914	Not-recorded	23°S to 24°S	SA	Not-recorded	Trawl	DZOO-UFPR, MZUSP
Nemertesia cymodocea (Busk, 1851)	Not-recorded	52°S to 54°S	SA	Not-recorded	Not-recorded	UV
Nemertesia ramosa (Lamarck, 1816)	Submarine floating	26°S to 43°S	SA	800	Not-recorded	DZOO-UFPR, MZUSP, UNMdP
Nemertesia sp.	Sponge	43°S to 54°S	SA	0–578	Not-recorded	MNRJ, MZUSP, UV
Nemertesia vervoorti El Beshbeeshy, 2011	Not-recorded	53°S to 55°S	SA	0–578	Not-recorded	UV
Plumularia floridana Nutting, 1900	Sponge	23°S to 26°S	SA	0–6	SCUBA	MNRJ, MZUSP
Plumularia insignis Allman, 1883	Soft-bottom	35°S to 44°S	SA	360	Not-recorded	UNMdP
Plumularia setacea (Linnaeus, 1758)	Algae, polychaete tube, rock, shell, sponge	23°S to 55°S	SA, SP	0–511	Dredge, SCUBA, snorkeling	MCN-FZB, MNRJ, MZUSP, UNMdP, USNM, UV

Plumularia strictocarpa Pictet, 1893	Algae, rope, sponge	23°S to 47°S	SA	0–57	Dredge, manual, SCUBA	DZOO-UFPR, MCN-FZB, MNRJ, MZUSP
Family Schizotrichidae Peña Cantero, Sentandreu & Latorre, 2010						
Schizotricha anderssoni Jäderholm, 1904	Not-recorded	53°S to 73°S	SA, S	68–346	Trawl	USNM
Schizotricha crassa Peña Cantero & Vervoort, 2004	Not-recorded	56°S to 63°S	SA, S	93–485	Dredge, trawl	USNM
Schizotricha ?*crassa* Peña Cantero & Vervoort, 2004	Not-recorded	Not-recorded	S	Not-recorded	Not-recorded	MZUSP
Schizotricha falcata Peña Cantero, 1998	Not-recorded	63°S to 65°S	S	73–150	Trawl	USNM
Schizotricha jaederholmi Peña Cantero & Vervoort, 1996	Not-recorded	54°S to 55°S	SA	261–267	Trawl	USNM
Schizotricha multifurcata Allman, 1883	Not-recorded	57°S to 60°S	SA	97–121	Dredge, trawl	USNM
Schizotricha nana Peña Cantero, Svoboda & Vervoort, 1996	Sponge	56°S to 78°S	SA, S	91–1890	Grab, dredge, trawl	MCN-FZB, MZUSP, USNM
Schizotricha ?*nana* Peña Cantero, Svoboda & Vervoort, 1996	Sponge	71°S to 72°S	S	1565–1674	Trawl	USNM
Schizotricha southgeorgiae Peña Cantero & Vervoort, 2004	Not-recorded	66°S to 67°S	S	101	Trawl	USNM
Schizotricha sp.	Sponge	61°S to 64°S	S	108–135	Net, trawl	MCN-FZB, MZUSP
Schizotricha trinematotheca Peña Cantero & Vervoort, 2005	Not-recorded	66°S to 67°S	S	150–157	Trawl	USNM
Schizotricha turqueti Billard, 1906	Not-recorded	57°S to 78°S	SA, S	40–1890	Grab, dredge, trawl	USNM
Schizotricha unifurcata Allman, 1883	Not-recorded	53°S to 63°S	SA, S	142–417	Trawl	USNM
Schizotricha vervoorti Peña Cantero, 1998	Not-recorded	54°S to 69*S	SA, S	55–1153	Net, Trawl	USNM
Schizotricha ?*vervoorti* Peña Cantero, 1998	Sponge	62°S to 63°S	S	95	Dredge	MCN-FZB, MZUSP
Family Sertulariidae Lamouroux, 1812						
Sertulariidae not-identified	Sponge	22°S to 63°S	SA, S	103–412	Dredge	MCN-FZB, MNRJ, MZUSP
Amphisbetia operculata (Linnaeus, 1758)	Algae, rock, shell, sponge	27°S to 58°S	SA, SP	0–472	SCUBA, trawl	MNHNU, MNRJ, MZUSP, UNMdP, USNM, UV
Amphisbetia sp.	Not-recorded	Not-recorded	S	Not-recorded	Not-recorded	USNM
Antarctoscyphus admirabilis Peña Cantero, Svoboda & Vervoort, 1999	Not-recorded	70°S to 71°S	S	80	Not-recorded	UV
Antarctoscyphus asymmetricus Peña Cantero, García Carrascosa & Vervoort, 1997	Sponge	53°S to 73°S	SA, S	18–429	Dredge, net	MCN-FZB, MZUSP, USNM, UV
Antarctoscyphus ?*asymmetricus* Peña Cantero, García Carrascosa & Vervoort, 1997	Sponge	56°S to 63°S	S	194–759	Dredge	MCN-FZB, MZUSP, UV
Antarctoscyphus elongatus (Jäderholm, 1904)	Sponge	49°S to 79°S	SA, S	18–710	Dredge, trawl	MCN-FZB, MZUSP, USNM, UV

?*Antarctoscyphus elongatus* (Jäderholm, 1904)	Sponge	62°S to 63°S	S	210–220	Trawl	USNM
Antarctoscyphus ?*elongatus* (Jäderholm, 1904)	Not-recorded	56°S to 63°S	SA, S	55–759	Not-recorded	UV
Antarctoscyphus encarnae Peña Cantero, García Carrascosa & Vervoort, 1997	Not-recorded	61°S to 63°S	S	100–220	Not-recorded	UV
Antarctoscyphus fragilis Peña Cantero, Svoboda & Vervoort, 1999	Not-recorded	74°S to 75°S	S	460–470	Not-recorded	UV
Antarctoscyphus grandis (Blanco, 1977)	Not-recorded	54°S to 78°S	SA, S	15–600	Trawl	FCNyM-UNLP, USNM, UV
Antarctoscyphus ?*grandis* (Blanco, 1977)	Not-recorded	56°S to 74°S	SA, S	93–343	Not-recorded	UV
Antarctoscyphus gruzovi (Stepanjants, 1979)	Not-recorded	60°S to 62°S	S	350–414	Not-recorded	UV
Antarctoscyphus ?*gruzovi* (Stepanjants, 1979)	Sponge	62°S to 63°S	S	311–426	Trawl	USNM
Antarctoscyphus mawsoni (Briggs, 1938)	Not-recorded	56°S to 74°S	SA, S	70–759	Not-recorded	UV
Antarctoscyphus sp.	Sponge	62°S to 63°S	S	265–280	Dredge	MCN-FZB, MZUSP, UV
Antarctoscyphus spiralis (Hickson & Gravely, 1907)	Sponge	54°S to 78°S	SA, S	0–1890	Dredge, net, trawl	FCNyM-UNLP, MCN-FZB, MZUSP, USNM, UV
?*Antarctoscyphus spiralis* (Hickson & Gravely, 1907)	Algae, sponge	39°S to 40°S	SP	Not-recorded	Not-recorded	MNRJ, MZUSP
?*Diphasia crassa* Fraser, 1940	Not-recorded	51°S to 52°S	SP	472	Not-recorded	USNM
Diphasia digitalis (Busk, 1852)	Rock	23°S to 24°S	SA	Not-recorded	SCUBA	MZUSP
Diphasia tropica Nutting, 1904	Algae, hydroid, sponge	23°S to 28°S	SA	13	SCUBA	MZUSP
Dynamena crisioides Lamouroux, 1824	Algae, rock	23°S to 28°S	SA	0–2	Manual	DZOO-UFPR, MZUSP
?*Dynamena crisioides* Lamouroux, 1824	Algae	27°S to 28°S	SA	0–2	Manual	MZUSP
Dynamena dalmasi (Versluys, 1899)	Algae, hydroid, mussel, polychaete tube, rock, shell, sponge	22°S to 28°S	SA	8–103	SCUBA	DZOO-UFPR, MNRJ, MZUSP
Dynamena disticha (Bosc, 1802)	Algae, bryozoan, hydroid, net, rock, shell, sponge	22°S to 39°S	SA	0–250	Dredge, manual, SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP, UNMdP
Dynamena ?*disticha* (Bosc, 1802)	Algae	27°S to 28°S	SA	1–3	Snorkeling	DZOO-UFPR, MZUSP
Dynamena quadridentata (Ellis & Solander, 1786)	Algae	23°S to 28°S	SA	0–7	Manual, SCUBA, snorkeling	DZOO-UFPR, MZUSP

Idiellana pristis (Lamouroux, 1816)	Not-recorded	23°S to 26°S	SA	0–4	Manual, snorkeling	DZOO-UFPR, MZUSP
Mixoscyphus antarcticus Peña Cantero & Vervoort, 2005	Not-recorded	62°S to 64°S	S	154–429	Not-recorded	USNM, UV
Salacia desmoides (Thorrey, 1902)	Algae, rock, sponge	27°S to 28°S	SA	9–15	SCUBA	MZUSP
Sertularella antarctica Hartlaub, 1900	Algae, sponge	43°S to 64°S	SA, SP, S	0–135	Net, trawl	FCNyM-UNLP, MCN-FZB, MHNG, MNRJ, MZUSP, USNM, UV, ZMH
Sertularella areyi Nutting, 1904	Algae, gravel, hydroid, shell, sponge	23°S to 28°S	SA	9–15	SCUBA	MZUSP
Sertularella argentinica El Beshbeeshy, 2011	Not-recorded	43°S to 55°S	SA	380–680	Not-recorded	FCNyM-UNLP, ZMH
Sertularella conica Allman, 1877	Algae, hydroid, rock, sponge	22°S to 57°S	SA, SP	3–511	SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP, UNMdP, USNM, UV
Sertularella cruzensis El Beshbeeshy, 2011	Not-recorded	39°S to 54°S	SA, SP	40–95	Not-recorded	MHNG, ZMH
Sertularella fuegonensis El Beshbeeshy, 2011	Sponge	29°S to 55°S	SA, SP	15–586	Not-recorded	MHNG, MNRJ, MZUSP, USNM, UV, ZMH
Sertularella gaudichaudi (Lamouroux, 1824)	Algae, rock, sponge	29°S to 63°S	SA, SP, S	0–544	Manual, net, trawl	FCNyM-UNLP, MCN-FZB, MZUSP, UNMdP, USNM, UV, ZMH
Sertularella gayi (Lamouroux, 1821)	Sponge	41°S to 64°S	SA, SP, S	0–1200	Trawl	FCNyM-UNLP, MHNG, MNRJ, MZUSP, USNM, UV, ZMH
Sertularella ?implexa (Allman, 1888)	Not-recorded	53°S to 54°S	SP	40	Not-recorded	MHNG
Sertularella jorgensis El Beshbeeshy, 2011	Not-recorded	48°S to 57°S	SA, SP	32–990	Not-recorded	FCNyM-UNLP, MHNG, UV
Sertularella leiocarpa (Allman, 1888)	Sponge	29°S to 30°S	SA	388	Dredge	MCN-FZB, MZUSP
Sertularella mixta Galea & Schories, 2012	Not-recorded	29°S to 30°S	SP	15–17	Not-recorded	MHNG
Sertularella polyzonias (Linnaeus, 1758)	Sponge	29°S to 65°S	SA, SP, S	0–511	Dredge, trawl	FCNyM-UNLP, MCN-FZB, MNRJ, MZUSP, USNM, UV
Sertularella ?polyzonias (Linnaeus, 1758)	Sponge	22°S to 23°S	SA	60	Dredge	MNRJ, MZUSP

Sertularella robusta Coughtrey, 1876	Hydroid, sponge	29°S to 56°S	SA, SP	0–307	Not-recorded	FCNyM-UNLP, MHNG, MNRJ, MZUSP, UV
Sertularella sanmatiasensis El Beshbeeshy, 2011	Sponge	42°S to 64°S	SA, S	82–500	Dredge, net	MCN-FZB, MZUSP, ZMH
Sertularella ?sanmatiasensis El Beshbeeshy, 2011	Sponge	61°S to 62°S	S	362	Net	MCN-FZB, MZUSP
Sertularella sp.	Sponge	29°S to 64°S	SP, S	15–264	Dredge, net	MCN-FZB, MHNG, MZUSP, UV
Sertularella sp. 9	Sponge	29°S to 55°S	SA, SP	10–261	Not-recorded	MNRJ, MZUSP, UV
Sertularella sp. 12	Not-recorded	51°S to 53°S	SA	46–329	Not-recorded	UV
Sertularella sp. 13	Sponge	29°S to 55°S	SA, SP	0–17	Not-recorded	MNRJ, MZUSP, UV
Sertularella striata Stechow, 1923	Algae, hydroid, shell, sponge	34°S to 43°S	SA, SP	8–45	SCUBA, trawl	MZUSP, UNMdP
Sertularella tenella (Alder, 1856)	Algae, bryozoan, hydroid, rock, sponge	22°S to 54°S	SA, SP	0–360	Dredge, manual, SCUBA, trawl	FCNyM-UNLP, MCN-FZB, MNRJ, MZUSP, USNM
Sertularella uruguayensis Mañé-Garzón & Milstein, 1973	Not-recorded	Not-recorded	SA	Not-recorded	Not-recorded	MNHNU
Sertularella vervoorti Migotto & Calder, 1998	Not-recorded	41°S to 42°S	SA	550	Not-recorded	ZMH
Sertularia distans (Lamouroux, 1816)	Algae, bryozoan, hydroid, rock, sponge	22°S to 28°S	SA	0–103	Dredge, manual, SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP
Sertularia loculosa Busk, 1852	Algae, rock, sponge	23°S to 28°S	SA	0–15	Manual, SCUBA	DZOO-UFPR, MZUSP
Sertularia marginata (Kirchenpauer, 1864)	Algae, ascidian, buoy, hydroid, rock, sponge	23°S to 28°S	SA	0–12	Manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MNRJ, MZUSP
?*Sertularia marginata* (Kirchenpauer, 1864)	Algae	27°S to 28°S	SA	0–2	Manual	MZUSP
Sertularia rugosissima Thornely, 1904	Algae	23°S to 27°S	SA	0–5	Manual	DZOO-UFPR, MZUSP
Sertularia sp.	Algae, rock	27°S to 28°S	SA	0–7	Manual, SCUBA	MZUSP
Sertularia tumida Allman, 1877	Algae, rock	25°S to 28°S	SA	5–7	Manual, SCUBA	DZOO-UFPR, MZUSP
Sertularia turbinata (Lamouroux, 1816)	Algae, hydroid, rock, sponge	23°S to 28°S	SA	0–3	Manual, SCUBA, snorkeling	DZOO-UFPR, MNRJ, MZUSP
Staurotheca abyssalis Peña Cantero & Vervoort, 2003	Not-recorded	55°S to 57°S	SA	2599–4026	Trawl	USNM

Staurotheca affinis (Jäderholm, 1904)	Not-recorded	54°S to 55°S	SA	198–202	Not-recorded	UV
Staurotheca amphorophora Naumov & Stepanjants, 1962	Not-recorded	53°S to 55°S	SA	111–686	Trawl	USNM
Staurotheca antarctica Hartlaub, 1904	Sponge	52°S to 78°S	SA, SP, S	55–661	Dredge, grab, net, trawl	USNM
Staurotheca australis Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	69°S to 70°S	S	432–813	Not-recorded	UV
Staurotheca compressa Briggs, 1938	Sponge	56°S to 75°S	SA, S	49–1042	Dredge, grab, net, trawl	FCNyM-UNLP, MCN-FZB, MZUSP, USNM
Staurotheca cornuta Peña Cantero, García Carrascosa & Vervoort, 1999	Not-recorded	60°S to 62°S	S	111–407	Trawl	USNM
Staurotheca densa Peña Cantero & Vervoort, 2003	Not-recorded	61°S to 74°S	S	73–570	Grab, net, trawl	USNM
Staurotheca dichotoma Allman, 1888	Sponge	53°S to 77°S	SA, S	63–799	Trawl	USNM
Staurotheca echinocarpa (Allman, 1888)	Not-recorded	49°S to 50°S	SI	53–113	Not-recorded	UV
Staurotheca frigida Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	53°S to 77°S	SA, S	57–550	Dredge, trawl	USNM
Staurotheca glomulosa Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	54°S to 78°S	SA, S	55–870	Dredge, net, trawl	USNM
Staurotheca jaederholmi Stechow, 1920	Not-recorded	50°S to 62°S	SA, SP, S	50–62	Trawl	USNM
Staurotheca multifurcata Peña Cantero, García Carrascosa & Vervoort, 1999	Not-recorded	53°S to 59°S	SA	57–338	Dredge, trawl	MZUSP, USNM
Staurotheca nonscripta Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	53°S to 79°S	SA, S	15–640	Trawl	USNM
Staurotheca pachyclada (Jäderholm, 1904)	Not-recorded	56°S to 77°S	SA, S	56–3660	Grab, trawl	USNM
Staurotheca plana Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	70°S to 72°S	S	672–830	Not-recorded	UV
Staurotheca polarsterni Peña Cantero, Svoboda & Vervoort, 1997	Not-recorded	63°S to 77°S	S	181–1030	Not-recorded	UV
Staurotheca profunda Peña Cantero & Vervoort, 2003	Not-recorded	54°S to 55°S	SA	1647–2044	Not-recorded	UV
Staurotheca sp.	Sponge	62°S to 70°S	S	80–432	Trawl	USNM
Staurotheca stolonifera (Hartlaub, 1904)	Not-recorded	70°S to 71°S	S	262	Not-recorded	UV
Staurotheca tubifera Blanco, 1971	Sponge	63°S to 64°S	S	135–240	Dredge	MCN-FZB, MZUSP
Staurotheca undosiparietina (Stepanjants, 1979)	Not-recorded	53°S to 63°S	SA, S	74–922	Trawl	USNM
Staurotheca vanhoeffeni (Peña Cantero & García Carrascosa, 1994)	Not-recorded	53°S to 73°S	SI, S	92–426	Dredge, trawl	USNM
Staurotheca vervoorti (El Beshbeeshy, 2011)	Not-recorded	53°S to 55°S	SA	1647–2727	Dredge, trawl	USNM

Symplectoscyphus anae Peña Cantero, Svoboda & Vervoort, 2002	Sponge	62°S to 77°S	S	108–448	Trawl	MCN-FZB, MZUSP, USNM
Symplectoscyphus bathyalis Vervoort, 1972	Not-recorded	54°S to 55°S	SA	419–641	Not-recorded	UV
Symplectoscyphus curvatus (Jäderholm, 1917)	Sponge	61°S to 64°S	S	135–293	Net, trawl	MCN-FZB, MZUSP, USNM
Symplectoscyphus exochus Blanco, 1982	Sponge	52°S to 64°S	SA, S	82–165	Dredge	MCN-FZB, MZUSP, USNM, UV
Symplectoscyphus flexilis (Hartlaub, 1901)	Not-recorded	45°S to 46°S	SA	70	Not-recorded	UNMdP
Symplectoscyphus frigidus Peña Cantero, Svoboda & Vervoort, 2002	Not-recorded	52°S to 55°S	SA	99–119	Not-recorded	UV
Symplectoscyphus glacialis (Jäderholm, 1904)	Sponge	42°S to 78°S	SA, SP, S	0–2350	Dredge, grab, long line, net, trawl	MCN-FZB, MNRJ, MZUSP, USNM, UV
Symplectoscyphus ?*hero* Blanco, 1977	Not-recorded	60°S to 61°S	S	146–165	Not-recorded	USNM
Symplectoscyphus interruptus (Pfeffer, 1889)	Not-recorded	53°S to 54°S	SP	20	Not-recorded	MHNG
Symplectoscyphus leloupi El Beshbeeshy, 2011	Not-recorded	43°S to 55°S	SA, SP	20–128	Not-recorded	MHNG, UV
Symplectoscyphus liouvillei (Billard, 1914)	Sponge	72°S to 73°S	S	548–565	Trawl	USNM
Symplectoscyphus ?*liouvillei* (Billard, 1914)	Sponge	63°S to 65°S	S	32–264	Dredge, net	MCN-FZB, MZUSP, USNM
?*Symplectoscyphus liouvillei* (Billard, 1914)	Not-recorded	66°S to 69°S	S	27–274	Not-recorded	USNM
Symplectoscyphus magellanicus (Marktanner-Turneretscher, 1890)	Sponge	36°S to 55°S	SA, SP	0–329	Dredge	MCN-FZB, MNRJ, MZUSP, UV
Symplectoscyphus ?*magellanicus* (Marktanner-Turneretscher, 1890)	Not-recorded	53°S to 54°S	SP	40	Not-recorded	MHNG
Symplectoscyphus milneanus (d'Orbigny, 1842)	Not-recorded	41°S to 55°S	SA, SP	0–641	Manual, SCUBA, trawl	MZUSP, UNMdP, USNM, UV
Symplectoscyphus naumovi Blanco, 1969	Not-recorded	62°S to 78°S	S	46–411	Dredge, trawl	MZUSP, USNM
Symplectoscyphus nesioticus Blanco, 1987	Sponge	62°S to 73°S	S	73–565	Net, trawl	MCN-FZB, MZUSP, USNM
Symplectoscyphus paraglacialis El Beshbeeshy, 2011	Not-recorded	53°S to 55°S	SA	35–261	Not-recorded	UV
Symplectoscyphus ?*paraglacialis* El Beshbeeshy, 2011	Not-recorded	53°S to 54°S	SP	40	Not-recorded	MHNG
Symplectoscyphus paulensis Stechow, 1923	Not-recorded	77°S to 78°S	S	384	Not-recorded	USNM
Symplectoscyphus plectilis (Hickson & Gravely, 1907)	Hydroid, sponge	62°S to 78°S	S	11–2306	Dredge, net, trawl	MCN-FZB, MZUSP, USNM
Symplectoscyphus sofiae Peña Cantero, Svoboda & Vervoort, 2002	Not-recorded	61°S to 78°S	S	64–549	Trawl	USNM
Symplectoscyphus sp.	Algae, hydroid, sponge	49°S to 72°S	SA, SP, S	22–1674	Dredge, net, SCUBA, trawl	MCN-FZB, MNRJ, MZUSP, USNM, UV

Symplectoscyphus subdichotomus (Kirchenpauer, 1884)	Algae, gravel, sponge	29°S to 73°S	SA, SP, S	0–675	Dredge, manual, SCUBA	MCN-FZB, MZUSP, UNMdP, USNM, UV
Symplectoscyphus vanhoeffeni (Totton, 1930)	Not-recorded	62°S to 67°S	S	80–183	Trawl	USNM
Symplectoscyphus vervoorti El Beshbeeshy, 2011	Not-recorded	53°S to 54°S	SA	512–586	Not-recorded	UV
Thuiaria polycarpa Kirchenpauer, 1884	Sponge	29°S to 34°S	SP	12–30	Not-recorded	MNRJ, MZUSP
Family Syntheciidae Marktanner-Turneretscher, 1890						
Syntheciidae not-identified	Sponge	22°S to 23°S	SA	103	Dredge	MNRJ, MZUSP
Hincksella cylindrica (Bale, 1888)	Hydroid, sponge	22°S to 28°S	SA	13–250	Dredge, SCUBA, snorkeling	MNRJ, MZUSP
Synthecium protectum Jäderholm, 1903	Not-recorded	35°S to 55°S	SA, SP	38–675	Not-recorded	UNMdP, USNM, UV
Synthecium sp.	Sponge	22°S to 55°S	SA	84–103	Not-recorded	MNRJ, MZUSP, UV
Synthecium tubithecum (Allman, 1877)	Sponge	22°S to 23°S	SA	103–240	Dredge	MNRJ, MZUSP
Family Thyroscyphidae Stechow, 1920						
Thyroscyphidae not-identified	Sponge	23°S to 54°S	SA	1–124	Not-recorded	MNRJ, MZUSP, UV
Parascyphus repens (Jäderholm, 1904)	Not-recorded	42°S to 55°S	SA	0–119	Manual	MZUSP, UNMdP, UV
Thyroscyphus marginatus (Allman, 1877)	Rock, shell	23°S to 24°S	SA	0–15	SCUBA	MZUSP
Thyroscyphus ramosus Allman, 1877	Rock	23°S to 24°S	SA	0–5	Manual	MZUSP
Thyroscyphus sp.	Sponge	35°S to 36°S	SA	94	Dredge	MCN-FZB, MZUSP
Family Tiarannidae Russell, 1940						
Stegolaria irregularis Totton, 1930	Sponge	29°S to 74°S	SA, SP, S	10–864	SCUBA, trawl	MNRJ, MZUSP, UNMdP, USNM
SUBORDER PROBOSCOIDA BROCH, 1910						
Family Campanulariidae Johnston, 1836						
Campanualriidae not-identified	Algae, hydroid, polychaete tube, sponge	22°S to 64°S	SA, SP, S	1–240	Dredge, SCUBA	MCN-FZB, MNRJ, MZUSP
Billardia subrufa (Jäderholm, 1904)	Sponge	62°S to 78°S	S	55–640	Dredge, trawl	MCN-FZB, MZUSP, USNM, UV
Billardia sp.	Sponge	61°S to 65°S	S	110–280	Dredge	MCN-FZB, MZUSP
Campanularia agas Cornelius, 1982	Algae, coral	37°S to 55°S	SA	0–106	SCUBA	UNMdP, UV
Campanularia hincksii Alder, 1856	Algae	27°S to 39°S	SA	15	SCUBA	MZUSP, UNMdP
Campanularia ?hincksii Alder, 1856	Sponge	71°S to 72°S	S	1565–1674	Trawl	USNM

Campanularia hincksoni Totton, 1930	Not-recorded	66°S to 67°S	S	80	Trawl	USNM
Campanularia sp.	Algae, hydroid, sponge	22°S to 78°S	SA, SP, S	0–675	Manual, trawl	MNRJ, MZUSP, UNMdP, USNM, UV
Campanularia subantarctica Millard, 1971	Alga, hydroid	41°S to 55°S	SA	0–307	Manual, SCUBA, trawl	MZUSP, UNMdP, UV
Campanularia ?*subantarctica* Millard, 1971	Not-recorded	51°S to 52°S	SA	0–5	Manual	UV
Campanularia tincta Hincks, 1861	Not-recorded	52°S to 53°S	SA	38	Not-recorded	USNM
Clytia gracilis (M. Sars, 1851)	Algae, barnacle, bryozoan, egg mass, hydroid, mussel, polychaete tube, rubber band, rock, rope, shell, sponge, wood	22°S to 55°S	SA, SP	0–136	Dredge, manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MNRJ, MZUSP, UNMdP, USNM
Clytia ?*gracilis* (M. Sars, 1851)	Hydroid, sponge	23°S to 43°S	SA, SP	4	Snorkeling	MNRJ, MZUSP
Clytia hemisphaerica (Linnaeus, 1767)	Sponge	53°S to 54°S	SP	80–84	Trawl	USNM
Clytia hummelincki (Leloup, 1935)	Algae	23°S to 26°S	SA	1–2	Trawl	DZOO-UFPR, MZUSP
Clytia linearis (Thornely, 1900)	Algae, hydroid, metallic structure, mussel, rope, shell	23°S to 35°S	SA	0–53	Manual, SCUBA, snorkeling	DZOO-UFPR, MNHNU, MZUSP
Clytia noliformis (McCrady, 1859)	Algae	23°S to 28°S	SA	0–5	Manual, SCUBA	DZOO-UFPR, MZUSP
Clytia ?*reloncavia* Galea & Schories, 2012	Sponge	42°S to 43°S	SP	8–10	Not-recorded	MNRJ, MZUSP
Clytia sp.	Algae, hydroid, rock, shell, sponge	23°S to 64°S	SA, SP, S	0–280	Dredge, manual, net, SCUBA	MCN-FZB, MNRJ, MZUSP, USNM, UV
Gonothyraea loveni (Allman, 1859)	Recruitment plate	38°S to 39°S	SA	Not-recorded	Not-recorded	UNMdP
Hartlaubella gelatinosa (Pallas, 1766)	Not-recorded	39°S to 52°S	SA	0–70	Not-recorded	MZUSP, UNMdP
Obelia bidentata Clark, 1875	Algae, hydroid, metallic structure, sponge	22°S to 61°S	SA, S	0–165	Manual, snorkeling	DZOO-UFPR, MNRJ, MZUSP, UNMdP, USNM
Obelia dichotoma (Linnaeus, 1758)	Algae, bryozoan, egg mass, hydroid, mussel, rock, shell, sponge	22°S to 50°S	SA, SP	0–48	Dredge, manual, SCUBA, snorkeling	DZOO-UFPR, MCN-FZB, MNHNU, MNRJ, MZUSP, UAC
Obelia ?*dichotoma* (Linnaeus, 1758)	Scallop	35°S to 36°S	SA	Not-recorded	Not-recorded	MZUSP

?*Obelia dichotoma* (Linnaeus, 1758)	Sponge, hydroid	23°S to 44°S	SA, SP	3	SCUBA	MNRJ, MZUSP
Obelia geniculata (Linnaeus, 1758)	Algae, recruitment plate	23°S to 55°S	SA, SP	0–12	Manual, SCUBA, snorkeling, trawl	DZOO-UFPR, MZUSP, UAC, UNMdP
Obelia ?*geniculata* (Linnaeus, 1758)	Not-recorded	49°S to 50°S	SA	Not-recorded	Not-recorded	UNMdP, MZUSP
Obelia longissima (Pallas, 1766)	Hydroid, rock, sand tube, shell, wood	34°S to 69°S	SA, S	55	Manual, snorkeling	MNHNU, MZUSP, UNMdP, USNM
Obelia sp.	Sponge	43°S to 45°S	SP	31	Not-recorded	MNRJ, MZUSP
Orthopyxis caliculata (Hincks, 1853)	Algae, hydroid	25°S to 50°S	SA	0–2	Manual, snorkeling	DZOO-UFPR, MNHNU, MZUSP, UNMdP
Orthopyxis crenata (Hartlaub, 1901)	Algae, hydroid	27°S to 29°S	SA	0–2	Manual	MZUSP
Orthopyxis hartlaubi El Beshbeeshy, 2011	Not-recorded	54°S to 55°S	SA	76	Not-recorded	UV
Orthopyxis sargassicola (Nutting, 1915)	Algae	27°S to 28°S	SA	0–10	Manual, SCUBA	MZUSP
Orthopyxis ?*sargassicola* (Nutting, 1915)	Algae, rock	23°S to 27°S	SA	0–3	Snorkeling	DZOO-UFPR, MZUSP
Orthopyxis sp.	Algae, hydroid, net, sponge	23°S to 55°S	SA	0–137	Dredge, manual, SCUBA, snorkeling	DZOO-UFPR, MCN-FZB, MZUSP, UV
Silicularia rosea Meyen, 1834	Algae	47°S to 54°S	SA	73–79	Manual	MZUSP, UNMdP, UV
Tulpa tulipifera (Allman, 1888)	Not-recorded	41°S to 55°S	SA	70–586	Not-recorded	UNMdP, UV

Table 2. Richness of benthic hydroid species for each ocean surveyed on the studied area, their respective percentages in relation to the total number of species (N=256), richness of endemic species, percentage of endemic species in relation to the total number of species found for each ocean surveyed on the studied area. SWAO: Southwestern Atlantic Ocean; SEPO: Southeastern Pacific Ocean; SO: Southern Ocean.

Ocean	Richness	Percentage of richness	Richness of endemic species	Percentage of endemic species
SWAO	187	73%	73	39%
SEPO	41	16%	16	39%
SO	101	39%	89	88%
Total	**256**	–	**137**	**54%**

Table 3. Assemblages delimited by similarity percentages (SIMPER) analysis for the Austral coast of South America (ACSA) and Southern Ocean (SO).

Assemblages	Internal similarity	Number of species	Species composition	Observations
SSA 1	15%	4	*Acryptolaria conferta* (45%), *Lytocarpia canepa* (11%), *Sertularella tenella* (21%), *Symplectoscyphus subdichotomus* (11%)	Assemblage composed by species from deep and cold water areas (~200 to 800m depth).
SSA 2	28%	3	*Clytia gracilis* (33.4%), *Phialella belgicae* (33.4%), *Plumularia setacea* (33.4%)	Disjunct assemblage concentrated at the coast of Bahía Blanca and at the sub-Magellanic Chilean coast, grouping species from two different oceans, the Southwestern Atlantic Ocean (SWAO) and the Southeastern Pacific Ocean (SEPO).
SSA 3	55%	22	*Abietinella operculata* (3.7%), *Amphisbetia operculata* (3.7%), *Campanularia agas* (3.7%), *C. subantarctica* (3.7%), *Clytia gracilis* (3.7%), *Halecium beanii* (3.7%), *H. delicatulum* (3.7%), *Halopteris plumosa* (3.7%), *Hebella striata* (3.7%), *Lafoea dumosa* (3.7%), *Parascyphus repens* (3.7%), *Plumularia setacea* (3.7%), *Sertularella antarctica* (3.7%), *S. conica* (3.7%), *S. fuegonensis* (3.7%), *S. gaudichaudi* (3.7%), *S. gayi* (3.7%), *S. jorgensis* (3.7%), *S. polyzonias* (3.7%), *S. robusta* (3.7%), *S. tenella* (3.7%), *Staurotheca jaederholmi* (3.7%)	Assemblage concentrated at the Magellanic region, dominated by species of *Sertularella* (9/22 species) and including 9 endemic species for the SSA and SO: *Abietinella operculata, Campanularia agas*, *C. subantarctica, Halopteris plumosa, Parascyphus repens, Sertularella antarctica, S. fuegonensis, S. jorgensis, Staurotheca jaederholmi*.
SSA 4	56%	20	*Aglaophenia acacia* (4%), *Amphisbetia operculata* (4%), *Bimeria vestita* (4%), *Campanularia agas* (4%), *Clytia gracilis* (4%), *Coryne eximia* (4%), *Ectopleura crocea* (4%), *Eudendrium ramosum* (4%), *Halecium beanii* (4%), *H. delicatulum* (4%), *Monotheca pulchella* (4%), *Obelia bidentata* (4%), *O. dichotoma* (4%), *O. longissima* (4%), *Orthopyxis caliculata* (4%), *Phialella belgicae* (4%), *P. chilensis* (4%), *Plumularia setacea* (4%), *P. strictocarpa* (4%), *Sertularella gaudichaudi* (4%)	Assemblage concentrated along the Southern Brazil-Buenos Aires coast and the Argentinean Patagonia coast, with most part of its richness composed by campanulariid species (6/20 species), though all species contribute equally to the similarity among the quadrants.
SSA 5	47%	4	*Coryne eximia* (20%), *Plumularia setacea* (20%), *Sertularella gaudichaudi* (20%), *Stegolaria irregularis* (20%)	Assemblage gathering quadrants from North and central coast of Chile, in which the species *Coryne eximia*, *Plumularia setacea*, *Sertularella gaudichaudi* and *Stegolaria irregularis* have been constantly found associated to many different marine organisms (Galea, 2007; Galea et al., 2007b, 2007c, 2009a, 2009b; Galea & Schories, 2012a).
SO 1	46%	11	*Antarctoscyphus elongatus* (10%), *A. grandis* (9.5%), *A. spiralis* (9%), *Billardia subrufa* (4%), *Monocaulus microrhiza* (4%), *Oswaldella erratum* (4%), *O. stepanjantsae* (4%), *Staurotheca antarctica* (13%), *S. glomulosa* (13%), *S. nonscripta* (6%), *S. pachyclada* (6%)	Disjunct ssemblage gathering the Weddell and the Ross Seas, being dominated by species of Sertulariidae (7/11 species).
SO 2	71%	6	*Oswaldella erratum* (14%), *Staurotheca antarctica* (14%), *S. australis* (14%), *S. dichotoma* (14%), *S. glomulosa* (14%), *S. nonscripta* (14%)	Assemblage concentrated at the Bouvet Island region, dominated by species of *Staurotheca* (5/6 species).

SO 3	43%	9	*Antarctoscyphus asymmetricus* (13%), *A. elongatus* (13%), *A. grandis* (6%), *A. spiralis* (6%), *Schizotricha turqueti* (6%), *Staurotheca dichotoma* (13%), *S. frigida* (13%), *S. glomulosa* (6%), *S. multifurcata* (7%)	Assemblage concentrated at the Scotia Arc, dominated by species of Sertulariidae (8/9 species).
SO 4	70%	37	*Abietinella operculata* (2.3%), *Antarctoscyphus asymmetricus* (2.3%), *A. elongatus* (2.3%), *A. grandis* (2.3%), *A. mawsoni* (2.3%), *A. spiralis* (2.3%), *Billardia subrufa* (2.3%), *Clathrozoella medeae* (2.3%), *Halecium delicatulum* (2.3%), *H. jaederholmi* (2.3%), *H. ovatum* (2.3%), *H. pallens* (2.3%), *Lafoea dumosa* (2.3%), *Mixoscyphus antarcticus* (2.3%), *Oswaldella antarctica* (2.3%), *O. delicata* (2.3%), *O. errata* (2.3%), *O. frigida* (2.3%), *O. grandis* (2.3%), *O. incognita* (2.3%), *O. shetlandica* (2.3%), *O. stepanjantsae* (2.3%), *O. vervoorti* (2.3%), *Schizotricha falcata* (2.3%), *S. turqueti* (2.3%), *S. vervoorti* (2.3%), *Sertularella gayi* (2.3%), *S. sanmatiasensis* (2.3%), *Staurotheca antarctica* (2.3%), *S. compressa* (2.3%), *S. densa* (2.3%), *S. dichotoma* (2.3%), *S. glomulosa* (2.3%), *S. pachyclada* (2.3%), *S. vanhoeffeni* (2.3%), *Stegella lobata* (2.3%)	This is the richest assemblage (37 species), concentrated at the Antarctic Peninsula, and dominated by species of Sertulariidae (15 species) and Kirchenpaueriidae (9 species).
SO 5	36%	5	*Antarctoscyphus spiralis* (8%), *Halecium ovatum* (8%), *Oswaldella antarctica* (21%), *O. billardi* (21%), *Staurotheca antarctica* (21%)	Disjunct assemblage gathering the Weddell Sea and the East coast of Antarctica.

Appendix 1. Data set with the presence and absence of the 249 species of benthic hydroids for each quadrant of 10° latitude X 10° longitude used in the Bray-Curtis similarity analysis for the southern South America (SSA) coast and Southern Ocean (SO). Each block with “0” and “1” represent the list of the species used in the analysis ordered from 1 to 249. The correspondence of the numbers and the species is as follows: 1. *Abietinella operculata*; 2. *Acryptolaria conferta*; 3. *A. longitheca*; 4. *A. minuta*; 5. *A. operculata*; 6. *Aglaophenia acacia*; 7. *A. latecarinata*; 8. *A. rhynchocarpa*; 9. *A. trifida*; 10. *Amphisbetia operculata*; 11. *Antarctoscyphus admirabilis*; 12. *A. asymmetricus*; 13. *A. elongatus*; 14. *A. encarnae*; 15. *A. fragilis*; 16. *A. grandis*; 17. *A. gruzovi*; 18. *A. mawsoni*; 19. *A. spiralis*; 20. *Antennella secundaria*; 21. *Billardia subrufa*; 22. *Bimeria vestita*; 23. *Bougainvillia rugosa*; 24. *Bouillonia denhartogi*; 25. *Campanularia agas*; 26. *C. hincksii*; 27. *C. hincksoni*; 28. *C. subantarctica*; 29. *C. tincta*; 30. *Cladocoryne floccosa*; 31. *Cladonema radiatum*; 32. *Clathrozoella abyssalis*; 33. *C. medeae*; 34. *Clytia hemisphaerica*; 35. *C. gracilis*; 36. *C. hummelincki*; 37. *C. linearis*; 38. *C. noliformis*; 39. *Cordylophora caspia*; 40. *Corymorpha januarii*; 41. *Coryne eximia*; 42. *Dentitheca bidentata*; 43. *Diphasia digitalis*; 44. *D. tropica*; 45. *Dynamena crisioides*; 46. *D. dalmasi*; 47. *D. disticha*; 48. *D. quadridentata*; 49. *Ectopleura crocea*; 50. *E. obypa*; 51. *Eudendrium capillare*; 52. *E. caraiuru*; 53. *E. carneum*; 54. *E. merulum*; 55. *E. pocaruquarum*; 56. *E. ramosum*; 57. *E. tottoni*; 58. *Eutima sapinhoa*; 59. *Filellum antarcticum*; 60. *Gonothyraea loveni*; 61. *Grammaria abietina*; 62. *Gymnangium allmani*; 63. *Halecium antarcticum*; 64. *H. beanii*; 65. *H. bermudense*; 66. *H. delicatulum*; 67. *H. dichotomum*; 68. *H. dyssymetrum*; 69. *H. jaederholmi*; 70. *H. lightbourni;* 71. *H. ovatum*; 72. *H. pallens*; 73. *H. tenellum*; 74. *Halopteris alternata*; 75. *H. carinata*; 76. *H. constricta*; 77. *H. diaphana*; 78. *H. plumosa*; 79. *H. polymorpha*; 80. *H. tenella*; 81. *Hartlaubella gelatinosa*; 82. *Hebella scandens*; 83. *H. striata*; 84. *Hincksella cylindrica*; 85. *Hybocodon chilensis*; 86. *Hydractinia uniformis*; 87. *Hydrodendron arboreum*; 88. *Idiellana pristis*; 89. *Lafoea coalescens*; 90. *L. dumosa*; 91. *L. gaussica*; 92. *Lafoeina amirantensis*; 93. *Lovenella gracilis*; 94. *Lytocarpia canepa*; 95. *L. tridentata*; 96. *Macrorhynchia grandis*; 97. *M. philippina*; 98. *Mixoscyphus antarcticus*; 99. *Monocaulus microrhiza*; 100. *M. parvula*; 101. *Monostaechas quadridens*; 102. *Monotheca margaretta*; 103. *M. pulchella*; 104. *Nemalecium lighti*; 105. *Nemertesia antennina*; 106. *N. cymodocea*; 107. *N. ramosa*; 108. *N. vervoorti*; 109. *Obelia bidentata*; 110. *O. dichotoma*; 111. *O. geniculata*; 112. *O. longissima*; 113. *Orthopyxis caliculata*; 114. *O. crenata*; 115. *O. hartlaubi*; 116. *O. sargassicola*; 117. *Oswaldella antarctica*; 118. *O. bifurca*; 119. *O. billardi*; 120. *O. blanconae*; 121. *O. crassa*; 122. *O. curiosa*; 123. *O. delicata*; 124. *O. elongata*; 125. *O. encarnae*; 126. *O. erratum*; 127. *O. frigida*; 128. *O. garciacarrascosai*; 129. *O. gracilis*; 130. *O. grandis*; 131. *O. herwigi*; 132. *O. incognita*; 133. *O. laertesi*; 134. *O. medeae*; 135. *O. monomammilata*; 136. *O. niobae*; 137. *O. obscura*; 138. *O. rigida*; 139. *O. shetlandica*; 140. *O. stepanjantsae*; 141. *O. terranovae*; 142. *O. tottoni*; 143. *O. vervoorti*; 144. *Parascyphus repens*; 145. *Parawrightia robusta*; 146. *Pennaria disticha*; 147. *Phialella belgicae*; 148. *P. chilensis*; 149. *Plumularia floridana*; 150. *P. insignis*; 151. *P. setacea*; 152. *P. strictocarpa*; 153. *Pycnotheca mirabilis*; 154. *Rhizogeton nudus*; 155. *Salacia desmoides*; 156. *Scandia mutabilis*; 157. *Schizotricha anderssoni*; 158. *S. crassa*; 159. *S. falcata*; 160. *S. jaederholmi*; 161. *S. multifurcata*; 162. *S. nana*; 163. *S. southgeorgiae*; 164. *S. trinematotheca*; 165. *S. turqueti*; 166. *S. unifurcata*; 167. *S. vervoorti*; 168. *Sertularella antarctica*; 169. *S. areyi*; 170. *S. argentinica*; 171. *S. conica*; 172. *S. cruzensis*; 173. *S. fuegonensis*; 174. *S. gaudichaudi*; 175. *S. gayi*; 176. *S. jorgensis*; 177. *S. leiocarpa*; 178. *S. mixta*; 179. *S. polyzonias*; 180. *S. robusta*; 181. *S. sanmatiasensis*; 182. *S. striata*; 183. *S. tenella*; 184. *S. vervoorti*; 185. *Sertularia distans*; 186. *S. loculosa*; 187. *S. marginata*; 188. *S. rugosissima*; 189. *S. tumida*; 190. *S. turbinata*; 191. *Silicularia rosea*; 192. *Staurodisarsia reesi*; 193. *Staurotheca abyssalis*; 194. *S. affinis*; 195. *S. amphorophora*; 196. *S. antarctica*; 197. *S. australis*; 198. *S. compressa*; 199. *S. cornuta*; 200. *S. densa*; 201. *S. dichotoma*; 202. *S. echinocarpa*; 203. *S. frigida*; 204. *S. glomulosa*; 205. *S. jaederholmi*; 206. *S. multifurcata*; 207. *S. nonscripta*; 208. *S. pachyclada*; 209. *S. plana*; 210. *S. polarsterni*; 211. *S. profunda*; 212. *S. stolonifera*; 213. *S. tubifera*; 214. *S. undosiparietina*; 215. *S. vanhoeffeni*; 216. *S. vervoorti*; 217. *Stegella lobata*; 218. *Stegolaria irregularis*; 219. *Symplectoscyphus anae*; 220. *S. bathyalis*; 221. *S. curvatus*; 222. *S. exochus*; 223. *S. flexilis*; 224. *S. frigidus*; 225. *S. glacialis*; 226. *S. interruptus*; 227. *S. leoupi*; 228. *S. liouvillei*; 229. *S. magellanicus*; 230. *S. milneanus*; 231. *S. naumovi*; 232. *S. nesioticus*; 233. *S. paraglacialis*; 234. *S. paulensis*; 235. *S. plectilis*; 236. *S. sofiae*; 237. *S. subdichotomus*; 238. *S. vanhoeffeni*; 239. *S. vervoorti*; 240. *Synthecium protectum*; 241. *S. tubithecum*; 242. *Thuiaria polycarpa*; 243. *Thyroscyphus marginatus*; 244. *T. ramosus*; 245. *Tulpa tulipifera*; 246. *Turritopsis nutricula*; 247. *Ventromma halecioides*; 248. *Zygophylax sibogae*; 249. *Zyzzyzus warreni*.

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ROOT
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0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  0000000000  000000000
20 30S 30 40W
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0000000000  0000000000  0000000000  0000000000  0000000000  0010100000  0000000000  0000000000  0000000000  0000000000  0000000000  100000000
20 30S 40 50W
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20 30S 70 80W
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30 40S 50 60W
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30 40S 70 80W
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40 50S 50 60W
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40 50S 60 70W
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40 50S 70 80W
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50 60S 0 10W
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50 60S 40 50W
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50 60S 50 60W
1100100000   0000000000   0000000000   0000000000   0000000000   0000000000   1000000000   0000000000   0000000001   0001000000   0000000100   0000000000   0001000000
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50 60S 70 80W
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60 70S 0 10W
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60 70S 50 60W
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0101110011   0110001000   0000000110   0100111000   0001100000   1000000000   0000010111   1001001100   0011101110   1100100000   1100111000   000000000
60 70S 60 70W
1000000000   0110010110   1000000000   0010000000   0000000000   0000001000   0000010010   1100000000   0000000001   0000000110   0000000000   0000001011   0010011001
0100000011   0010000000   0000000010   0000101100   0000100010   1000000000   0000010101   1011000101   0000101010   1100100000   1100110100   000000000
60 70S 70 80W
0000000000   0000000000   0001000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000010000   0001000000   0000000000   0000000000   0000000000   000000000
60 70S 90 100W
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60 70S 110 120W
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0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   000000000
60 70S 140 150W
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000100   0000000000   0000000000   0000000000   0000000000   000000000
60 70S 160 170W
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0100000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000100   0000000100   0000000000   0000000000   0000000000   000000000
70 80S 0 10W
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Capítulo 3. Areas of endemism for the southern South America coast and Southern Ocean: a hypothesis based on benthic hydroids

ABSTRACT

The southern South America (SSA) coast and the Southern Ocean (SO) have a high differentiation of habitats and have been historically connected since the opening of the Drake Passage. The benthic marine fauna of both regions are connected and highly diverse, highlighting the need for more biogeographic investigations. Here, we studied the geographic distribution of benthic hydroids from the SSA coast and SO to hypothesize the areas of endemism for the region through the widely used Endemicity Analysis (EA). The geographic distribution of 249 species of benthic hydroids on a 10° latitude X 10° longitude grid were used together with the optimization algorithm of the NDM-VNDM software, and the "loose consensus rule" implemented in the software. We obtained 9 (F=0.5) and 10 (F=1.0) consensus areas of endemism historically related to the isolation of Antarctica. Our analyses combined a strong taxonomic basis with a high spatial resolution of the method, in addition to robustness in delimiting the areas of endemism. The patterns were compared with previous historical and ecological areas delimited for the SSA coast and SO and discussed in the context of vicariance/dispersal processes together with the particularities of hydrozoan biology involving polyps and medusae. The actual degree of endemicity presented by marine areas of endemism and to what extent they can be considered pure historical units is evaluated under a biogeographical context involving both ecology and history.

INTRODUCTION

Hydroid is the name given to cnidarians of the orders 'Anthoathecata' (non-monophyletic, see Cartwright et al., 2008; Van Iten et al., 2014) and Leptothecata (class Hydrozoa). They are among the most widely distributed marine organisms, occurring in all oceans and depths from the poles to the Equator and are represented by both planktonic and benthic stages during their complex life cycle (Millard, 1975; Cornelius, 1992a; Bouillon et al., 2006; Calder & Cairns, 2009). The asexual reproduction of hydroids allows them to grow quickly both on natural (including epibiosis) and artificial substrates, but they also have a high diversity of sexual reproductive strategies (Gili & Hughes, 1995; Genzano & Rodriguez, 1998; Migotto et al., 2001; Genzano, 2001, 2002; Genzano & San Martín, 2002; Dougherty & Russell, 2005; Gili et al., 2006; Oliveira & Marques, 2007). All these aspects qualify benthic hydroid species as a good model for marine biogeographic studies.

There are few biogeographic studies on benthic hydroids, and most of them are restricted to ecological analyses and discussions of distributional scenarios (*e.g.*, Millard, 1978; Calder, 1992; Peña Cantero & García Carrascosa, 1999; Galea et al., 2007; Gibbons et al., 2010a, 2010b). A few recent studies have focused on primary biogeographic homologies (*cf.* Morrone, 2001), proposing hypotheses of areas of endemism for the marine realm based on data of benthic hydroids (*e.g.*, Marques & Peña Cantero, 2010; Miranda et al., 2013). Despite the recent increase in the number of studies on marine areas of endemism (Garraffoni et al., 2006; Moreno et al., 2006, 2014; Winfield et al., 2006; Myers & Lowry, 2009), they are still concentrated in only a few taxa, and the understanding of marine primary biogeographic homologies is far less advanced than terrestrial homologies (Miranda & Marques, 2011). As a consequence, marine conservation policies are often compromised (Marques & Carranza, 2013).

In addition to the few formal biogeographical analyses for benthic hydroids (or cnidarians in general), there are also questions related to the approaches used in these analyses. Biogeographic methods are diverse, and there is some dispute about their efficiency, mainly concerning areas of endemism; several alternative methods can be used, including null models (Mast & Nyffeler, 2003; Giokas & Sfenthourakis, 2008), area groups (Harold & Mooi, 1994; Deo & DeSalle, 2006), parsimony analyses of endemicity (PAE; Rosen, 1988; Morrone, 1994; Morrone & Escalante, 2002), and optimization algorithms (Szumik et al., 2002; Szumik & Goloboff, 2004).

Among this portfolio of methods, Szumik et al. (2002) and Szumik & Goloboff (2004) proposed an optimization method to search for areas of endemism that has been widely used since its implementation (Domínguez et al., 2006; Díaz Gómez, 2007; Aagesen et al., 2009, 2012; Casagranda et al., 2009, 2012; Escalante et al., 2009a, 2009b; Navarro et al., 2009; Ferrari et al., 2010; Szumik et al., 2012; Aagesen et al., 2013). This method, Endemicity Analysis (EA), is different from other approaches because it reflects ecological and historical assumptions, in addition to considering the exact geographic point inside the analyzed quadrant (Szumik & Goloboff, 2004). The method is based on an endemicity score based on the number of taxa and their distribution constrained to a given area (Szumik et al., 2006). Analyses are carried out by NDM, following a heuristic search for the areas, and by VNDM, which allows for the visualization of the areas of endemism and the contribution of each species to each score (Goloboff, 2004). Different search strategies can be performed using EA, such as assumed and inferred presences, as well as the use of niche modeling algorithms as a previous treatment for the dataset to be analyzed (Casagranda et al., 2009; Escalante et al., 2009a, 2009b). Recently, a consensus algorithm for EA was proposed, helping to summarize results with large numbers of hypotheses of endemism (Aagesen et al., 2013). The various types of methods yield an interesting analysis that can be used in the complex marine environment (Miranda & Marques, 2011).

The southern South America (SSA) coast and the Southern Ocean (SO) are composed of several different habitats with various oceanographic characteristics, such as channels, estuaries, rocky shores and sandy beaches, deep-sea areas with soft and hard bottoms, ridges, seamounts, hydrothermal vents, fjords, ice shelves and icebergs (Boltovskoy, 1981; Silva & Palma, 2006; Silva, 2008; Genzano et al., 2009; Waller et al., 2011; Chown, 2012; Grange & Smith, 2013). Despite this diversity of habitats, the SSA and the SO were historically connected until the opening of the Drake Passage and the separation of the Antarctic Peninsula from the South America *ca.* 30 Mya (Barker & Burrell, 1977; Beu et al., 1997; Lawver & Gahagan, 2003; Clarke et al., 2005). This event initiated an oceanographic system of currents leading to the thermic and biogeographically isolation of the SO, followed by Antarctica glaciation and, as a by-product, the development of endemic marine fauna for the region (Barker & Burrell, 1977; Clarke & Crame, 1989; Beu et al., 1997; Lawver & Gahagan, 2003; Barker & Thomas, 2004; Clarke et al., 2004). The long isolation of the SO makes this area an interesting laboratory to study the factors that have influenced the evolutionary history of its biota (Clarke et al., 2004).

The SSA is an interesting case because its diversity is driven by the Antarctic and South American marine faunas (Cañete et al., 1999; Peña Cantero & García Carrascosa, 1999; Clarke & Johnston, 2003; Clarke et al., 2005; Yasuhara et al., 2007; Marques & Peña Cantero, 2010; Kaiser et al., 2011; Miranda et al., 2013). The SSA is influenced by a complex interaction between the Pacific and Atlantic waters. The Pacific side is oceanographically dominated by the cold Humboldt Current regime, and it is characterized by its strong heterogeneity and seasonality (Daneri et al., 2000). Wind-driven upwellings and variations caused by El Niño events are among the main characteristics of the Humboldt Current system, frequently regulating the dynamics of several marine communities/populations (Escribano, 1998; Daneri et al., 2000). The Atlantic side, on the other hand, is characterized by the convergence of the warm Brazil Current and the cold Falklands/Malvinas Current, which is responsible for the generation of intense thermoclines on the Southwestern region of the Atlantic Ocean and for events of coastal upwelling that contribute to the development of a diverse marine fauna in the region (Matsuura, 1986; Acha et al., 2004; Acha & Mianzan, 2006).

The high benthic diversity of the marine fauna of the SSA coast and SO (Clarke & Crame, 1992; De Broyer & Rauschert, 1999; Peña Cantero & García Carrascosa, 1999; Clarke et al., 2004; Giberto et al., 2004; Peña Cantero, 2004; Gappa et al., 2006; Brandt et al., 2007; Galea et al., 2007; Schejter & Bremec, 2007; Yasuhara et al., 2007; Clarke, 2008; Genzano et al., 2011; Kaiser et al., 2013; Marques et al., 2013; Oliveira et al., in press), which is associated with their unique geologic/oceanographic history and a large variety of habitats, raises questions about its basic biogeographic composition. To date, EA has not been applied for marine regions, and the efficacy of its use remains untested in marine settings. Thus, we suggest that this gap should be filled in studies of marine biogeography. We carry out an EA (Szumik et al., 2002; Szumik & Goloboff, 2004) using benthic hydroid species, which are a successful and well-represented taxonomic group, with the aim to infer the areas of endemism for the SSA coast and SO (with the exception of hydrocorals), as well as their geographic distribution in the area.

MATERIAL AND METHODS

Taxa

Our data matrix includes information of 249 species of benthic hydroids, involving 78 genera and 28 families, based on a survey of 4,837 geographic sampling sites distributed around an interval of 0–4,000 m in depth of the SSA coast and SO (Appendix 1). We reviewed the taxonomic identification of all materials and checked all geographic coordinates of their occurrence prior to the inclusion of any point in the dataset. To the best of our knowledge, this dataset is unique in marine biogeographical studies because it corresponds to an extensive amount of primary data and not a composite of literature records. This procedure increases the quality and reliability of the data, diminishing noise due to incorrect or problematic identifications. The taxonomic classifications of many species have previously been checked and published in other studies (*viz.*, Oliveira et al., in press).

Search methods

The search for areas of endemism was carried out using the optimization algorithm of the software NDM-VNDM ver. 3 (Goloboff, 2004). The analyses were performed with 249 species of benthic hydroids (Appendix 1) on a grid of quadrants of 10° latitude X 10° longitude along the entire area of the SSA coast and SO, with an origin at 17°S and 195°W. We used the heuristic search option “swap one cell at a time” and values of F=0.5 and 1.0 for inferred presences. The groups of quadrants resulting in a score above three were considered. Consensus areas were calculated using the “loose consensus rule” and a cut-off value of 75%. The “loose consensus rule” selects one area to be part of the consensus if it shares a percentage of the species with at least one other area in the consensus (Aagesen et al., 2009, 2013). This rule is more relaxed and allows us to depict a high number of candidate areas of endemism in the consensus, which is better for large-scale studies when it is not necessary to have a high level of detail on the area dataset (Aagesen et al., 2012, 2013).

RESULTS

The analysis with F=0.5 resulted in 19 areas of endemism summarized in 9 consensus areas with a total of 107 endemic species (Figure 1; Tables 1–3). The consensus areas depicted six main patterns of areas of endemism: (1) Southwestern Atlantic (areas 4, 9; Figure 1; Table 2), (2) South America (area 6; Figure 1; Table 2), (3) South America and Antarctic Peninsula (area 5, Figure 1, Table 2), (4) Patagonia and Antarctic Peninsula (area 3, Figure 1, Table 2), (5) Scotia Arc and Antarctic Peninsula (areas 1, 2; Figure 1; Table 2), and (6) Magellanic and Antarctic Peninsula (areas 7, 8, Figure 1, Table 2).

The analysis with F=1.0 resulted in 18 areas of endemism summarized in 10 consensus areas with a total of 112 endemic species (Figure 2, Tables 1–3). The consensus areas depicted seven main patterns of areas of endemism: (1) Southwestern Atlantic (areas 3, 10, Figure 2, Table 3), (2) South America (area 7, Figure 2, Table 3), (3) South America and Antarctic Peninsula (area 5; Figure 2; Table 3), (4) Patagonia and Antarctic Peninsula (area 2, Figure 2; Table 3), (5) Scotia Arc and Antarctic Peninsula (areas 1, 4; Figure 2; Table 3), (6) Magellanic and Antarctic Peninsula (areas 8, 9, Figure 2, Table 3), and (7) Magellanic, Antarctic Peninsula and Ross Sea (area 6, Figure 2, Table 3).

DISCUSSION

Ecological and historical aspects of hydroids areas of endemism

The identified areas of endemism (Figures 1, 2) may be compared to several coastal and pelagic marine realms, provinces and ecoregions. Overall, the areas of endemism delimited in this study were inserted into the two main coastal realms (Temperate South America and Southern Ocean) and six provinces (Warm Temperate Southeastern Pacific, Juan Fernández and Desventuradas, Warm Temperate Southwestern Atlantic, Magellanic, Scotia Sea, and Continental High Antarctic) of those proposed by Spalding et al. (2007). Concerning the pelagic realms, our areas of endemism overlapped with five of the realms: the South Central Atlantic, Malvinas Current, Subantarctic, Antarctic Polar Front, and Antarctic, which are influenced by several oceanographic processes related to different water masses, current systems and productivity rates (Spalding et al., 2012). For example, the continuous areas of endemism along the Antarctic Peninsula, Scotia Arc and Magellanic zone (areas 1–3, 5, 7, 8, Figure 1; areas 1, 2, 4–6, 8, 9, Figure 2) are mainly dominated by a branch of the Antarctic Circumpolar Current (ACC) that flows northwards along the Argentinean coast and is responsible for the existence of the Malvinas Current realm (Spalding et al., 2012).

Other marine areas of endemism, provinces and ecoregions have already been proposed for several marine taxa, such as bryozoans, crustaceans, echinoderms, mollusks, polychaetes, pycnogonids, sponges, and tunicates (Darlington, 1960; Knox, 1960; Hedgpeth, 1969; Briggs, 1974; Palacio, 1982; Van Soest, 1994, 1998; Van Soest & Hajdu, 1997; Glasby, 1999; Glasby & Alvarez, 1999; Garraffoni et al., 2006). Among these patterns, the Southwestern Atlantic, Magellanic, and Antarctic areas of endemism, which were first hypothesized by Van Soest (1994) and followed by many other studies (Van Soest, 1994, 1998; Van Soest & Hajdu, 1997; Glasby, 1999; Glasby & Alvarez, 1999; Garraffoni et al., 2006), are the areas that best fit the areas of endemism delimited herein, although some fragmentation and better cohesion was found in our patterns (Figures 1, 2). All these previous areas of endemism, however, are based on comparisons of distributional data from the literature and gather all the accumulated knowledge on traditional studies in marine biogeography from the last fifty years (Darlington, 1960; Knox, 1960; Hedgpeth, 1969; Briggs, 1974; Palacio, 1982). The problem is that this knowledge may contain misleading taxonomical information on the taxa used as a basis for the construction of the biogeographic area hypotheses, which will clearly be reflected in the patterns. In addition, these areas are not supported by formal biogeographical search methods of the areas of endemism (*e.g.*, area groups, null models, PAE, EA), and therefore, they might carry a high degree of subjectivity employed during the comparisons and delimitations of areas. Therefore, we do not consider the areas of endemism delimited only through the literature distributional data comparisons to represent robust and strong hypotheses of primary biogeographic homology (Morrone, 2001) for the SSA coast and SO.

The recent ecological hypotheses for global marine biogeographic patterns for coastal and pelagic waters (Spalding et al., 2007, 2012) are based on extensive literature distribution data and have high spatial resolution and several different parameters (abiotic and biotic factors, geomorphological and oceanographic features). They correspond to the paradigm used by the research community. Their taxonomic robustness, however, is not completely guaranteed. Our hypotheses of areas of endemism combine a well-grounded taxonomy of the key group of benthic hydroids with an inference method that provides a high spatial resolution and robustness to the proposed areas. The areas of endemism we hypothesized overlap with at least two provinces and several realms and ecoregions of Spalding et al. (2007, 2012). In some cases, it is possible that they are ruled by different oceanographic dynamics and distinct abiotic and biotic variables. Ultimately, this indicates that the environmental variables defining Spalding's et al. (2012, 2014) provinces, realms and ecoregions, which potentially act as ecological barriers to the distribution of marine species, do not necessarily represent a barrier for the distribution of benthic hydroids.

Hydroids and the dispersive events related to their distribution have a relationship with the diverse reproductive strategies involving the medusa and polyp stages. Their success in colonizing different habitats is related to their indeterminate growth, high rate of regeneration and the presence of resting stages that survive for long periods of time (Gili & Hughes, 1995). Hydroid colonies live attached to several types of natural or artificial substrates and may develop free hydranths, buds, frustules and clones from small portions of tissue (Calder & Brehmer, 1967; Gili & Hughes, 1995; Genzano, 1998, 2001, 2002; Genzano & Rodriguez, 1998; Migotto et al., 2001; Genzano & San Martín, 2002; Genzano & Zamponi, 2003; Genzano et al., 2011; Marques et al., 2013; Fernandez et al., 2014a). The substrates may serve as rafts, representing one of the main dispersal mechanisms recorded for hydroid species (Cornelius, 1992a, 1992b; Choong & Calder, 2013). The recent records of 15 Japanese benthic hydroid species on the west coast of the United States that drifted from the 2011 tsunami prove their potential for transoceanic dispersal (Choong & Calder, 2013; Calder et al., 2014). Transition zones, particularly the transition between South America and the Antarctic (*e.g.*, areas 1–3, 5, 7, 8, Figure 1; areas 1, 2, 4–6, 8, 9, Figure 2), are certainly influenced by this high dispersal potential. Many studies have also discussed transition hypotheses based on other benthic marine invertebrates and their strategies of dispersal (Beu et al., 1997; Cañete et al., 1999; Montiel et al., 2005; Linse et al., 2006; Rodríguez et al., 2007; Yasuhara et al., 2007; González-Wevar et al., 2010; Díaz et al., 2011; Kaiser et al., 2011). Undoubtedly, marine benthic organisms have more dispersive pathways than previously thought.

In addition to the ecological component of the areas of endemism of the SSA coast and SO, our results from the EA are also historically related to the opening of the Drake Passage and consequently the isolation of the Antarctic continent during the Cenozoic (Lawver & Gahagan, 2003; Clarke et al., 2005). The areas delimited by this study are supported by the unique compositions of hydroid species (Tables 2, 3), thus supporting the historical causes for their diversification. For example, species supporting the South American and Southwestern Atlantic patterns (areas 4–6, 9; Figure 1; Table 2; areas 3, 5, 7, 10; Figure 2; Table 3) occur mainly between 20°S and 50°S; although they are widespread along this entire area, they are rare in cold regions (Blanco, 1994; Migotto, 1996; Marques, 2001; Grohmann et al., 2003, 2011; Genzano et al., 2009; Cunha & Jacobucci, 2010; Miranda et al., 2011; Rodriguez et al., 2012; Marques et al., 2013; Fernandez et al., 2014a, 2014b), indicating the isolation of this fauna from the SO fauna.

Concerning the transition zones (areas 1–3, 5, 7, 8, Figure 1; Table 2; areas 1, 2, 4–6, 8, 9, Figure 2; Table 3), their species complement is frequently found along the region between South America and Antarctica, therefore characterizing a transitional benthic fauna as well (*e.g.*, species of *Antarctoscyphus*, *Clathrozoella* and *Oswaldella*; Tables 2, 3). Many of these "transition species" belong to genera strongly represented in the SO (Peña Cantero et al., 1997; 2003; Peña Cantero & Vervoort, 2004; Marques & Peña Cantero, 2010), most likely with their northern range limited by historical barriers; they therefore represent key taxa in the correspondence between the Antarctic and South American benthic fauna. Based on this southern distribution, the areas of endemism using endemic species of benthic hydroids from the Antarctic and subantarctic regions (above the 40°S) were already hypothesized for the Southwestern Atlantic Ocean (SWAO) and SO (Marques & Peña Cantero, 2010; Miranda et al., 2013; Miranda et al., unpublished). Miranda et al. (unpublished) proposed three areas of endemism for the SWAO: (1) Brazilian, (2) Uruguayan-Argentinean, and (3) disjunct areas along Brazil, Uruguay, and Argentina; all these locations coincide with several of our consensus areas (areas 3–6, 9, Figure 1; areas 2, 3, 5, 7, 10, Figure 2). The Magellanic Zone and the three SO areas (*viz.*, Antarctic Peninsula Zone, Western High Antarctica Zone and Eastern High Antarctica Zone) have previously been proposed (Marques & Peña Cantero, 2010: 618–619; Miranda et al., 2013) (Table 4).

Miranda et al. (2013) contrasted their areas of endemism with previous hypotheses of faunal evolution of the SO, *viz.* (H1) evolution *in situ*, (H2) derivation from adjacent deep-water basins, (H3) dispersal from South America through the Scotia Arc, and (H4) dispersal from Antarctica through the Scotia Arc (cf. Knox & Lowry, 1977). Our consensus can also be contrasted with these explanatory hypotheses. Hypotheses H1 and H2 support the vicariant isolation between the SSA coast and SO or a possible derivation from the adjacent deep-water basin (areas 4, 6, 9, Figure 1; areas 3, 7, 10, Figure 2). On the other hand, hypotheses H3 and H4 support the continuous patterns of some areas along the SSA coast and SO (areas 1–3, 5, 7, 8, Figure 1; areas 1, 2, 4, 5, 8, 9, Figure 2), in which dispersive events would be responsible for the widespread occurrence of the species in both the Patagonian-Magellanic and Antarctic Peninsula areas.

The processes related to the areas of endemism of the SSA coast and SO concern the ecological and historical causes that interact with the particularities of the biology of benthic hydroids. The historical sense of areas of endemism traditionally considers valid areas those with overlapping distributional ranges of two or more endemic species (Platnick, 1991; Morrone, 1994; Crisci et al., 2003; Szumik & Goloboff, 2004). Crother & Murray (2011) alternatively defined areas of endemism as geographic hierarchical areas with at least one unique species, or a unique combination of species, that are spatially and temporally bounded to constitute a single unit. The authors argue that areas of endemism are not 'classes' but 'individuals', and therefore they are real and natural entities that do not depend on human recognition. Thus, areas of endemism must be diagnosed by a unique combination of characters and not intentionally defined by a list of specific characters – they also evolve and interact with biological, geological and oceanographic dynamics and evolutionary changes on Earth (Crother & Murray, 2011).

The relaxed and integrative definition of areas of endemism by Crother & Murray (2011) considers the fact that both ecological and historical events are actually involved in their establishment and maintenance. This is particularly worrying when the SO is facing climatic changes – ancient/present areas of endemism may become extinct and/or seriously transformed, and the historical evidence that initiated their existence may be erased. Thus, considering that areas of endemism are transitory historical units and that the marine system is extremely dynamic and has been highly impacted, the challenge is to determine to what extent the SSA coast and SO areas of endemism herein (or elsewhere) delimited can be considered as actual historical units. After all, these assemblages could be the result of ecological/adaptive processes.

The disjunct areas of endemism, such as consensus area 6 (Figure 2), are good examples to illustrate this question. The interpretation of disjunct areas of endemism is complex because it involves the composition of disjunct quadrants that together have no clear evidence for a historical hypothesis of origin. A variety of hypotheses could explain the concatenated disjunct distribution of sets of species in different sub-areas. The first hypothesis is that EA is insensitive to some types of distribution, and therefore the disjunct pattern would be an algorithmic artifact. A second hypothesis is that the identity of each sub-area is derived from spurious processes, such as bioinvasions (*e.g.*, human mediated – see examples in Bardi & Marques, 2009; Rocha et al., 2013). If so, these sets of sub-areas would not be historical areas per se. A third hypothesis is that disjunct area 6 (Figure 2) is a result of a patchy distribution of rare species (*Oswaldella blanconae*, *Phialella belgicae*, *Symplectoscyphus anae* and *S. nesioticus*; see Blanco et al., 2000; Peña Cantero et al., 2002; Peña Cantero & Vervoort, 2004; El Beshbeeshy & Jarms, 2011; and Table 3, Appendix 1), possibly driven by specific selective pressures. A fourth hypothesis suggests that discontinuity reflects incipient vicariance, and a recent barrier is separating the biota. Finally, a fifth hypothesis suggests dispersal over a barrier (hypotheses H3 and H4 above), although barriers are seldom hypothesized or tested in marine scenarios, which makes them difficult to understand and characterize (Miranda & Marques, 2011). Whatever the hypothesis chosen, ecological and historical processes can be considered as good explanations for this scenario, even though there are contrasting hypotheses.

Another integrative view that addresses both ecological and historical processes is observed in the transition zones. Such zones (areas 1–3, 5, 7, 8, Figure 1; areas 1, 2, 4–6, 8, 9, Figure 2) may be related by the differential dispersive capacity among benthic hydroids due to their several-stage life cycle, contributing to the formation of species assemblages that are ecologically driven and maintained. The breaking between South America and Antarctica ca. 30 Mya generated oceanographic barriers to some species of benthic hydroids at the SSA, and this isolation might have led to the historical areas of endemism (areas 4, 6, 9, Figure 1; areas 3, 7, 10; Figure 2). These barriers, however, could not have affected all hydroid species, and some continue to disperse either from the SO to SSA or from the SSA to SO, resulting in a transition zone between both continents (see Tables 2, 3 and Appendix 1, for the species of areas 1–3, 5, 7, 8, Figure 1, and areas 1, 2, 4–6, 8, 9, Figure 2). Considering the definition of areas of endemism by Crother & Murray (2011), one may argue about the actual role of the ecological factors and barriers delimiting these biogeographic units. Most likely, the present distribution of the species is an interactive result of both ecological and historical processes. Indeed, the lack of historical understanding in biogeography to explain patterns of species distribution, which is often interpreted as a result of ecological processes, was criticized (Warren et al., 2014). The authors used three examples (community phylogenetics, environmental niche modeling, and analysis of beta diversity) in which it would be possible to integrate history with ecology in biogeographic-interpretative scenarios.

Dispersal, vicariance and barriers in the marine realm

Our hypotheses for the biogeographical patterns for the SSA coast and SO (Figures 1, 2) are related to dispersal and vicariance. Both evolutionary processes are frequently considered alternative (Heads, 2005; Cowie & Holland, 2006) and not complementary phenomena, and integrative approaches are rare. Studies emphasizing dispersalism and/or center of origin prevail (Briggs, 1974, 2003, 2005; Cornelius, 1992a, 1992b; Gravier-Bonnet, 1992; Parker & Tunnicliffe, 1994; Linse et al., 2006; Pearse et al., 2009; Castelin et al., 2010; Gibbons et al., 2010a, 2010b; Briggs & Bowen, 2012; 2013; Gillespie et al., 2012; Gittenberger, 2012; Longo et al., 2012; Marshall et al., 2012; Bowen et al., 2013; Choong & Calder, 2013; Gaither & Rocha, 2013; Macfarlane et al., 2013; Pierrat et al., 2013) in marine biogeography, but there are some counter examples of studies using vicariance hypotheses (Rosen, 1988; Myers, 1997; Anderson, 2000; Heads, 2005; Floeter et al., 2008; Ayre et al., 2009; Marques & Peña Cantero, 2010; Claremont et al., 2011; González-Wevar et al., 2012; Lind et al., 2012; Cowman & Bellwood, 2013; Pierrat et al., 2013). The studies listed above provided data corroborating both dispersal and vicariance to support distributional hypotheses, with variation on the nature of the biogeographic processes responsible for the past and present patterns of species distribution.

Geographic barriers and their relationship with dispersal and vicariance are rarely discussed in marine biogeographic studies. Most of the areas of endemism revealed by our EA appear to be related to “soft” barriers, which are formed from hydrological processes that disrupt the free movement of specimens (Cowman & Bullwood, 2013). This contrasts with “hard” barriers, which are formed from land bridges that physically split marine species (Cowman & Bullwood, 2013). The boundaries of the South America and Southwestern Atlantic Ocean areas (areas 4–6, 9, Figure 1; areas 3, 5, 7, 10, Figure 2) and their isolation in relation to the SO are examples of “soft” barriers. These areas integrate the historical, ecological and oceanographic processes of the SSA. Their boundaries are defined in the north and south by the upwelling zone of Cape Frio (~20°S) and the ACC (~60°S), respectively. The ACC separates the colder Antarctic waters from the northern warmer waters (Spalding et al., 2012). The fauna composing areas 4–6, 9 (Figure 1) and areas 3, 5, 7, 10 (Figure 2) is isolated from the SO at the distributional limit of 50°S (Tables 1, 2). Another example of biogeographic isolation generated by the ACC is the high endemicity rate in the SO (see chapter 2), which is represented by unique Antarctic genera (*Antarctoscyphus*, *Clathrozoella*, *Oswaldella* and *Mixoscyphus*). The ACC isolates the fauna into a zone where the water temperature decreases up to 3°C southwards, and the realm is characterized by sea-ice dynamics that drive the formation of cold and fresh bottom water (Spalding et al., 2012).

However, it is not a simple task to define biogeographic barriers, as what might represent a barrier for one taxa, is not a barrier for another taxa. The issue is also compromised due to the common view that the marine environment would be a large and continuous water mass without physical breaks acting on the distribution of species (Miranda & Marques, 2011). The transition areas along the Magellanic zone, Scotia Arc and Antarctic Peninsula (areas 1–3, 5, 7, 8, Figure 1; areas 1, 2, 4–6, 8, 9, Figure 2) are composed of species with different boundaries. For instance, widespread species such as *Amphisbetia operculata* and *Ectopleura crocea* are distributed along the entire region between ~20°S and 50°S (see Table 1, chapter 2), and their distribution appears to be related to a high tolerance to variations in environmental conditions, seasonality, and resting stages (Genzano et al., 2008; Di Camillo et al., 2013). Similar examples were already recorded for the marine benthos. Piovesan et al. (2012), in reviewing the marine ostracod *Majungaella*, emphasized that the distribution of the genus followed the break of Western Gondwana and the opening of the

Atlantic Ocean (*ca.* 115 Myr), which allowed the northward migration of marine taxa (Fairhead & Binks, 1991; Jacobs et al., 2009). The origin of the Atlantic Ocean affected the climate, geography and oceanography (Jacobs et al., 2009), establishing barriers to some taxa and facilitating dispersal for others. These barriers involve abiotic gradients (*e.g.*, temperature, salinity, oxygen concentration, nutrients), oceanographic regimes and geomorphological changes. Together or isolated, these changes may have constrained some taxa into an area or into different groups of areas (*i.e.*, disjunct areas).

Dispersal across biogeographic barriers depends on special biological traits that allow a given lineage to explore new habitats and establish new populations (Luiz et al., 2012). Hydroid species may have wide distributions due to the many different strategies of asexual and sexual reproduction, their complex life cycles including the polyp and medusa stages (Gili & Hughes, 1995), and large great capacity to colonize different substrates (Gili & Hughes, 1995; Genzano & Rodriguez, 1998; Migotto et al., 2001; Genzano, 2002; Oliveira & Marques, 2007, 2011). The seasonality and population dynamics of hydroid species (Gili & Hughes, 1995; Bavestrello et al., 2006; Rossi et al., 2012) are influenced by marine biogeographic factors that may represent geographic barriers for the biology of certain species.

Substrate availability can be an important "hard" barrier for benthic species. For example, the abundance, seasonality and reproductive periods of *Clytia gracilis* appear to modulate the seasonal cycles of regression and growth due to environmental conditions (Jaubet & Genzano, 2011). The polyp of this species has a wide distribution, differing from the limited geographical range of the medusae (Cornelius, 1995), and this difference may be caused by its successful asexual reproductive strategy. Asexual reproduction appears to be the main mechanism to maintain these populations because the reproductive cycle also depends on adequate substrates for the recruitment and growth of larvae (Jaubet & Genzano, 2011). Similar patterns occur in other hydroids, in which the geographical range of the polyp does not coincide with that of the medusae (*cf.* Mendoza-Becerril & Marques, 2013).

The knowledge of ecological, oceanographic and historical aspects, in addition to biological and genetic information, are required to determine how and which barriers affect the distribution of marine organisms (Luiz et al., 2012). We suggest that the areas of endemism outlined in this study and their respective barriers may be viewed as initial models to foster further investigation.

FINAL REMARKS

The EA showed a high degree of similarity among the consensus areas of both analyses with different values of F, and this supports the idea that the areas of endemism for the SSA coast and SO are not random. Area 6 (encompassing Magellanic, Antarctic Peninsula and Ross Sea areas; Figure 2; Table 3) is an exception because it resulted only from the analysis with F=1.0; as it is a disjunct area, it has several different biological explanations.

The resulting areas are driven by the ecological and historical aspects of the region in which they occur. Many biogeographic discussions have highlighted both these aspects (Ebach & Humphries, 2003; Morrone, 2004, 2007; Crother & Murray, 2011). However, in the marine realm, history and ecology appear to be far from a more integrative view. Dispersal and vicariance may be recognized in the formation of the areas in this study, as well the particular aspects of the biology of hydroids. In a historical sense, some areas of endemism may have an obscure "endemicity" nature, which may be caused by the high complexity of the marine realm.

Marine variables and systems naturally change over time, modulating population adaptive processes, and consequently, large-scale biogeographic patterns (Harley et al., 2006). The intense anthropogenic activities in recent centuries are considered to have influenced global climate change, causing phenomena such as global warming and chemical changes in marine systems (Harley et al., 2006; Barnes et al., 2014). Antarctic ecosystems are vulnerable to these changes, and some Antarctic marine areas are already suffering drastic changes in their biotic assemblages (Barnes et al., 2014). Scouring of seabeds is increasing due to the loss of ice shelves and winter sea ice, thus reducing the complexity of marine assemblages, increasing population mortality and downsizing benthic communities (Gutt et al., 1996; Barnes et al., 2014). Upwelling systems, which are fundamental for the maintenance of marine communities in the area (Acha et al., 2004), are also influenced by climate change (Doney et al., 2012; Salvatteci et al., 2014; Sydeman et al., 2014). All these changes certainly modify the biogeographical patterns by affecting the geographic ranges of species (Harley et al., 2006; Barnes et al., 2014) and consequently hampering our understanding of historical areas of endemism.

We discussed our hypotheses of the areas of endemism under the perspective that ecology and history interact, resulting in the present distribution. Considering our current scenario of climate change, the extent to which the historical aspects of marine areas of endemism are still evident and able to be discovered is an open question. We believe our hypotheses must be confronted with additional marine data from the SSA coast and SO and tested through different and integrative biogeographical tools to improve the understanding of their boundaries and composition.

References

Aagesen, L., Szumik, C.A., Zuloaga, F.O. & Morrone, O. 2009. Quantitative biogeography in the South America highlands–recognizing the Altoandina, Puna and Prepuna through the study of Poaceae. Cladistics, 25, 295–310.

Aagesen, L., Bena, M.J., Nomdedeu, S., Panizza, A., López, R.P. & Zuloaga, F.O. 2012. Areas of endemism in the Southern Central Andes. Darwiniana, 50, 218–251.

Aagesen, L., Szumik, C. & Goloboff, P. 2013. Consensus in the search for areas of endemism. Journal of Biogeography, 40, 2011–2016.

Acha, E.M. & Mianzan, H. 2006. Oasis en el océano: los frentes costeros del Mar Argentino. Ciencia Hoy, 16, 44–56.

Acha, M.E., Mianzan, H.W., Guerrero, R.A., Favero, M. & Bava, J. 2004. Marine fronts at the continental shelves of austral South America: physical and ecological processes. Journal of Marine Systems, 44, 83–105.

Anderson, F.E. 2000. Phylogeny and historical biogeography of the loliginid squids (Mollusca: Cephalopoda) based on mitochondrial DNA sequence data. Molecular Phylogenetics and Evolution, 15, 191–214.

Anker, A. & Baeza, J.A. 2012. Molecular and morphological phylogeny of hooded shrimps, genera *Betaeus* and *Bataeopsis* (Decapoda, Alpheidae): testing the center of origin biogeographic model and evolution of life history traits. Molecular Phylogenetics and Evolution, 64, 401–415.

Ayre, D.J., Minchinton, T.E. & Perrin, C. 2009. Does life history predict past and current connectivity for rocky intertidal invertebrates across a marine biogeographic barrier? Molecular Ecology, 18, 1887–1903.

Bardi, J., Marques, A.C. 2009. The invasive hydromedusa *Blackfordia virginica* (Cnidaria: Blackfordiidae) in southern Brazil, with comments on taxonomy and distribution of the genus *Blackfordia*. Zootaxa, 2198, 41–50.

Barker, P.F. & Burrell, J. 1977. The opening of Drake Passage. Marine Geology, 25, 15–34.

Barker, P.F. & Thomas, E. 2004. Origin, signature and palaeoclimatic influence of the Antarctic

Circumpolar Current. Earth-Science Reviews, 66, 143–162.

Barnes, D.K.A., Fenton, M. & Cordingley, A. 2014. Climate-linked iceberg activity massively reduces spatial competition in Antarctic shallow waters. Current Biology, 24, 553–554.

Bavestrello, G., Puce, S., Cerrano, C., Zocchi, E., Boero, N. 2006. The problem of seasonality of benthic hydroids. Chemistry and Ecology, 22, 197–205.

El Beshbeeshy, M. & Jarms, G. 2011. Thekate hydroiden vom Patagonischen Schelf (Cnidaria, Hydrozoa, Thecata). Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg, 46, 19–233.

Beu, A.G., Griffin, M. & Maxwell, P.A. 1997. Opening of Drake Passage gateway and Late Miocene to Pleistocene cooling reflected in Southern Ocean molluscan dispersal: evidence from New Zealand to Argentina. Tecnophysics, 281, 83–97.

Blanco, O. 1994. Enumeración sistemática y distribución geográfica preliminar de los Hydroida de la Republica Argentina. Suborden Athecatha (Gymnoblastea, Anthomedusae), Thecata (Calyptoblastea, Leptomedusae) y Limonomedusae. Revista del Museo de La Plata, 14, 181–216.

Blanco, O., Zamponi, M.O. & Genzano, G.N. 2000. Campanulinidae de la Argentina (Coelenterata, Hydrozoa, Hydroida). Revista del Museo de La Plata, 14, 267–278.

Boero, F. & Bouillon, J. 1987. Inconsistent evolution and paedomorphosis among the hydroids and medusae of the Athecatae/Anthomedusae and the Thecatae/Leptomedusae (Cnidaria, Hydrozoa). In: Bouillon, J., Boero, F., Cicogna, F. & Cornelius, P.F.S. (Eds) Modern trends in the Systematics, Ecology, and evolution of Hydroids and Hydromedusae. Oxford Science Publications, 354p.

Boltovskoy, D. 1981. Atlas del zooplankton del Atlántico Sudoccidental y métodos de trabajo con el zooplankton marino. Publicación Especial del INIDEP, 936p.

Bouillon, J. (1981) Origine et phylogenèse des cnidaires et des hydropolypes-hydroméduses. Annales de la Société Royale Zoologique de Belgique, 1-4, 45–56.

Bouillon, J., Gravili, C., Pagès, F., Gili, J.-M. & Boero, F. 2006. An introduction to Hydrozoa. Mémoires du Muséum National d'Histoire Naturelle, 194, 591p.

Bowen, B.W., Rocha, L.A., Toonen, R.J., Karl, S.A. & the ToBo Laboratory. 2013. The origins of tropical marine biodiversity. Trends in Ecology and Evolution, 28, 359–366.

Brandt, A., De Broyer, C., De Mesel, I., Ellingsen, K.E., Gooday, A.J., Hilbig, B., Linse, K., Thomson, M.R.A. & Tyler, P.A. 2007. The biodiversity of the deep Southern Ocean benthos. Philosophical Transactions of the Royal Society, 362, 39–66.

Briggs, J.C. 1974. Marine Zoogeography. McGraw-Hill Book Company, 475p.

Briggs, J.C. 2003. Marine centers of origin as evolutionary engines. Journal of Biogeography, 30, 1–18.

Briggs, J.C. 2005. The marine East Indies: diversity and speciation. Journal of Biogeography, 32, 1517–1522.

Briggs, J.C. & Bowen, B.W. 2012. A realignment of marine biogeographic provinces with particular reference to fish distributions. Journal of Biogeography, 39, 12–30.

Briggs, J.C. & Bowen, B.W. 2013. Marine shelf habitat: biogeography and evolution. Journal of Biogeography, 40, 1023–1035.

De Broyer, C. & Rauschert, M. 1999. Faunal diversity of the benthic amphipods (Crustacea) of the Magellan region as compared to the Antarctic (preliminary results). Scientia Marina, 63, 281–293.

Bueno Hernández, A. & Llorente Bousquets, J. 2001. Una visión de la biogeografía dispersionista con críticas a sus fundamentos. Caldasia, 22, 161–184.

Calder, D.R. 1992. Similarity analysis of hydroids assemblages along a latitudinal gradient in the western North Atlantic. Cannadian Journal of Zoology, 70, 1078–1085.

Calder, D.R. & Brehmer, M.L. 1967. Seasonal occurrence of epifauna on test panels in Hampton Roads, Virginia. International Journal of Oceanology and Limnology, 1, 149–164.

Calder, D.R. & Cairns, S. D. 2009. Hydroids (Cnidaria: Hydrozoa) of the Gulf of Mexico. In: Felder, D.L. & Camp, D.K. (Eds) Gulf of Mexico–origins, waters, and biota. Volume I. Texas A&M Press, 1312p.

Calder, D.R., Choong, H.H.C., Carlton, J.T., Chapman, J.W., Miller, J. & Geller, J. 2014. Hydroids (Cnidaria, Hydrozoa) from Japanese tsunami marine debris washing ashore in the northwestern United States. Aquatic Invasions, 9, in press.

Cañete, J.I., Leighton, G.L. & Aguilera, F.F. 1999. Polychaetes from Aysén Fjord, Chile: distribution, abundance and biogeographical comparison with the shallow soft-bottom polychaete fauna from Antarctica and the Magellan Province. Scientia Marina, 63, 243–252.

Cartwright, P., Evans, N.M., Dunn, C.W., Marques, A.C., Miglietta, M.P., Schuchert, P. & Collins, A.G. 2008. Phylogenetics of Hydroidolina (Hydrozoa: Cnidaria). Journal of the Marine Biological Association of the United Kingdom, 88, 1663–1672.

Casagranda, M.D., Arias, J.S., Goloboff, P.A., Szumik, C.A., Taher, L.M., Escalante, T. & Morrone, J.J. 2009. Proximity, interpretation, and sympatry networks: a reply to Dos Santos et al. Systematic Biology, 58, 271–276.

Casagranda, M.D., Taher, L. & Szumik, C.A. 2012. Endemicity analysis, parsimony and biotic elements: a formal comparison using hypothetical distributions. Cladistics, 1, 1–10.

Castelin, M., Lambourdiere, J., Boisselier, M.-C., Lozouet, P., Couloux, A., Cruaud, C. & Samadi, S. 2010. Hidden diversity and endemism on seamounts: focus on poorly dispersive neogastropods. Biological Journal of the Linnean Society, 100, 420–438.

Choong, H.H.C. & Calder, D.R. 2013. *Sertularella mutsuensis* Stechow, 1931 (Cnidaria: Hydrozoa: Sertulariidae) from Japanese tsunami debris: systematics and evidence for transoceanic dispersal. Bioinvasions Records, 2, 33–38.

Chown, S.L. 2012. Antarctic marine biodiversity and deep-sea hydrothermal vents. PLoS Biology, 10, e1001232.

Claremont, M., Williams, S.T., Barraclough, T.G. & Reid, D.G. 2011. The geographic scale of speciation in a marine snail with high dispersal potential. Journal of Biogeography, 38, 1016–1032.

Clarke, A. 2008. Antarctic marine benthic diversity: patterns and processes. Journal of Experimental Marine Biology and Ecology, 366, 48–55.

Clarke, A. & Crame, J.A. 1989. The origin of the Southern Ocean marine fauna. In: Crame, J.A. (Ed.). Origins and evolution of the Antarctic biota. Geological Society Special Publication, 47, 322p.

Clarke, A. & Crame, J.A. 1992. The Southern Ocean benthic fauna and climate change: a historical perspective. Philosophical Transactions of the Royal Society of London Series B Biological Sciences, 338, 299–309.

Clarke, A. & Johnston, N.M. 2003. Antarctic marine benthic diversity. In: Gibson, R.N. & Atkinson, R.J.A. (Eds) Oceanography and Marine Biology: an Annual Review. Taylor & Francis, 41, 468p.

Clarke, A., Aronson, R.B., Crame, J.A., Gili, J.-M. & Blake, D.B. 2004. Evolution and diversity of the benthic fauna of the Southern Ocean continental shelf. Antarctic Science, 16, 559–568.

Clarke, A., Barnes, D.K.A. & Hodgson, D.A. 2005. How isolated is Antarctica? Trends in Ecology and Evolution, 20, 1–3.

Cornelius, P.F.S. 1992a. Medusa loss in leptolid Hydrozoa (Cnidaria), hydroid rafting, and abbreviated life-cycles among their remote-island faunae: an interim review. Scientia Marina, 56, 245–261.

Cornelius, P.F.S. 1992b. The Azores hydroid fauna and its origin, with discussion of rafting and medusa suppression. Arquipélago, 10, 75–99.

Cornelius, P.F.S. 1995. North-West European thecate hydroids and their medusae. In: Barnes, R.S., Crothers, J.H. (Eds) Synopses of the British fauna. Part 2. Sertulariidae to Campanulariidae. London Field Studies Council for Linnean Society of London and Estuarine and Coastal Sciences Association, London, pp. 1–386.

Costello, M.J., Coll, M., Danovaro, R., Halpin, P., Ojaveer, H. & Miloslavich, P. 2010. A census of marine biodiversity knowledge, resources, and future challenges. PLoS ONE, 5, e12110.

Cowie, R.H. & Holland, B.S. 2006. Dispersal is fundamental to biogeography and the evolution of biodiversity on oceanic islands. Journal of Biogeography, 33, 193–198.

Cowman, P.F. & Bellwood, D.R. 2013. Vicariance across major marine biogeographic barriers: temporal concordance and the relative intensity of hard versus soft barriers. Proceedings of the Royal Society B Biological Sciences, 280, 20131541.

Crisci, J.V. 2001. The voice of historical biogeography. Journal of Biogeography, 28, 157–168.

Crisci, J.V., Katinas, L. & Posadas, P. 2003. Historical biogeography: an introduction. Harvard University Press, 250p.

Croizat, L., Nelson, G., Rosen, D.E. 1974. Centers of origin and related concepts. Systematic Zoologist, 23, 265–287.

Crother, B.I. & Murray, C.M. 2011. Ontology of areas of endemism. Journal of Biogeography, 38, 1009–1015.

Cunha, A.F. & Jacobucci, G.B. 2010. Seasonal variation of epiphytic hydroids (Cnidaria: Hydrozoa) associated to a subtropical *Sargassum cymosum* (Phaeophyta: Fucales) bed. Zoologia, 27, 945–955.

Daneri, G., Dellarossa, V., Quiñones, R., Jacob, B., Montero, P. & Ulloa, O. 2000. Primary production and community respiration in the Humboldt Current System off Chile and associated oceanic areas. Marine Ecology Progress Series, 197, 41–49.

Darlington, P.J. 1960. The zoogeography of the Southern Cold Temperate Zone. Proceedings of the Royal Society of London, 152, 659–668.

Deo, A.J. & DeSalle, R. 2006. Nested areas of endemism analysis. Journal of Biogeography, 33, 1511–1526.

Di Camillo, C.G., Giordano, G., Bo, M., Betti, F., Mori, M., Puce, S. & Bavestrello, G. 2013. Seasonal patterns in the abundance of *Ectopleura crocea* (Cnidaria: Hydrozoa) on a shipwreck in the Northern Adriatic. Marine Ecology, 34, 25–32.

Díaz, A., Féral, J.-P., David, B., Saucède, T. & Poulin, E. 2011. Evolutionary pathways among shallow and deep-sea echinoids of the genus Sterechinus in the Southern Ocean. Deep-Sea Research II, 58, 205–211.

Díaz Gómez, J.M. 2007. Endemism in *Liolaemus* (Iguania: Liolaemidae) from the Argentinian puna. South American Journal of Herpetology, 2, 59–68.

Domínguez, M.C., Roig-Juñent, S., Tassin, J.J., Ocampo, F.C. & Flores, G.E. 2006. Areas of endemism of the Patagonian steppe: an approach based on insect distributional patterns using endemicity analysis. Journal of Biogeography, 33, 1527–1537.

Doney, S.C., Ruckelshaus, M., Duffy, J.E., Barry, J.P., Chan, F., English, C.A., Galindo, H.M., Grebmeier, J.M., Hollowed, A.B., Knowlton, N., Polovina, J., Rabalais, N.N., Sydeman, W.J. & Talley, L.D. 2012. Climate change impacts on marine ecosystems. Annual Review of Marine Sciences, 4, 11–37.

Dougherty, J.R. & Russell, M.P. 2005. The association between the coquina clam *Donax fossor* Say and its epibiotic hydroid *Lovenella gracilis* Clarke. Journal of Shellfish Research, 24, 35–46.

Ebach, M.C. 1999. Paralogy and the centre of origin concept. Cladistics, 15, 387–391.

Ebach, M.C. & Humphries, C.J. 2001. Ontology of biogeography. Journal of Biogeography, 30, 959–962.

Escalante, T., Szumik, C. & Morrone, J.J. 2009a. Areas of endemism of Mexican mammals: reanalysis applying the optimality criterion. Biological Journal of the Linnean Society, 98, 468–478.

Escalante, T., Linaje, M., Illoldi-Rangel, P., Rivas, M., Estrada, P., Neira, F. & Morrone, J.J. 2009b. Ecological niche models and patterns of richness and endemism of the southern Andean genus *Eurymetopum* (Coleoptera, Cleridae). Revista Brasileira de Entomologia, 53, 379–385.

Escribano, R. 1998. Population dynamics of *Calanus chilensis* in the Chilean Eastern Boundary Humboldt Current. Fisheries Oceanography, 7, 245–251.

Fairhead, J.D., Binks, R.M. 1991. Differential opening of the Central and South Atlantic Oceans and the opening of the West African rift system. Tecnophysics, 187, 191–203.

Fauth, J.E., Bernardo, J., Camara, M., Resetarits Jr., W.J., Van Buskirk, J. & McCollum, S.A. 1996. Simplifying the jargon of community ecology: a conceptual approach. American Naturalist, 147, 282–286.

Fernandez, M.O., Navarrete, S. & Marques, A.C. 2014a. Temporal variation in richness and composition of recruits in a diverse cnidarian assemblage of subtropical Brazil. Journal of Experimental Marine Biology and Ecology, 460, 144–152.

Fernandez, M.O., Navarrete, S. & Marques, A.C. 2014b. A comparison of temporal turnover of species from benthic cnidarian assemblages in tropical and subtropical harbours. Marine Biology Research [in press].

Ferrari, A., Paladini, A., Schwertner, C.F. & Grazia, J. 2010. Endemism analysis of Neotropical Pentatomidae (Hemiptera, Heteroptera). Iheringia, 100, 449–462.

Forbes, E. 1859. The natural history of the European seas. John Van Voorst, Paternoster Row., 306p.

Floeter, S.R., Rocha, L.A., Robertson, D.R., Joyeux, J.C., Smith-Vaniz, W.F., Wirtz, P., Edwards, A.J., Barreiros, J.P., Ferreira, C.E.L., Gasparini, J.L., Brito, A., Falcón, J.M., Bowen, B.W. & Bernardi, G. 2008. Atlantic reef fish biogeography and evolution. Journal of Biogeography, 35, 22–47.

Garraffoni, A.R.S., Nihei, S.S., Lana, P.C. 2006. Distribution patterns of Terebellidae (Annelida: Polychaeta): an application of Parsimony Analysis of Endemicity (PAE). Scientia Marina, 70, 269–276.

Gaither, M.R. & Rocha, L.A. 2013. Origins of species richness in the Indo-Malay-Philippine biodiversity hotspot: evidence for the centre of overlap hypothesis. Journal of Biogeography, 40, 1638–1648.

Galea, H.R., Försterra, G. & Häussermann, V. 2007. Cnidaria, Hydrozoa: latitudinal distribution of hydroids along the fjords region of southern Chile, with notes on the world distribution of some species. Check List, 3, 308–320.

Gappa, J.L., Alonso, G.M. & Landoni, N.A. 2006. Biodiversity of benthic Amphipoda (Crustacea: Peracarida) in the Southwest Atlantic between 35°S and 56°S. Zootaxa, 1342, 1–66.

Genzano, G.N. 1998. Hydroid epizoites on hydroids *Tubularia crocea* and *Sertularella mediterranea* from the intertidal of Mar del Plata (Argentina). Russian Journal of Marine Biology, 24, 123–126.

Genzano, G.N. 2001. Associated fauna and sediment trapped by colonies of *Tubularia crocea* (Cnidaria, Hydrozoa) from the rocky intertidal of Mar del Plata, Argentina. Biociências, 9, 105–119.

Genzano, G.N. 2002. Associations between pycnogonids and hydroids from the Buenos Aires litoral zone, with observations on the semi-parasitic life cycle of *Tanystylum orbiculare* (Ammotheiidae). Scientia Marina, 66, 83–92.

Genzano, G.N. & Rodriguez, G.M. 1998. Association between hydroid species and their substrates from the intertidal zone of Mar del Plata (Argentine). Miscellània Zoològica, 21, 21–29.

Genzano, G.N. & San Martín, G. 2002. Association between the polychaete *Procerastea halleziana* (Polychaeta: Syllidae: Autolytinae) and the hydroid *Tubularia crocea* (Cnidaria: Hydrozoa) from the Mar del Plata intertidal zone, Argentina. Cahiers the Biologie Marine, 43, 165–170.

Genzano, G.N. & Zamponi, M.O. 2003. Hydroid assemblages from Mar del Plata, Argentina, at depths between 0 and 500m. Distribution and biological substrata. Oceanologica Acta, 25, 303–313.

Genzano, G., Mianzan, H., Diaz-Briz, L. & Rodriguez, C. 2008. On the occurrence of *Obelia* medusa blooms and empirical evidence of unusual massive accumulations of *Obelia* and *Amphisbetia* hydroids on the Argentina shoreline. Latin America Journal of Aquatic Research, 36, 301–307.

Genzano, G.N., Giberto, D., Schejter, L., Bremec, C. & Meretta, P. 2009. Hydroid assemblages from the Souhwestern Atlantic Ocean (34–42°S). Marine Ecology, 30, 33–46.

Genzano, G., Giberto, D. & Bremec, C. 2011. Benthic survey of natural and artificial reefs off Mar del Plata, Argentina, southwestern Atlantic. Latin American Journal of Aquatic Research, 39, 553–566.

Gibbons, M.J., Janson, L.A., Ismail, A. & Samaai, T. 2010a. Life cycle strategy, species richness and distribution in marine Hydrozoa (Cnidaria: Medusozoa). Journal of Biogeography, 37, 441–448.

Gibbons, M.J., Buecher, E., Thibault-Botha, D. & Helm, R.R. 2010b. Patterns in marine hydrozoan richness and biogeography around southern Africa: implications of life cycle strategy. Journal of Biogeography, 37, 606–616.

Giberto, D.A., Bremec, C.S., Acha, E.M. & Mianzan, H. 2004. Large-scale spatial patterns of benthic assemblages in the SW Atlantic: the Río de La Plata estuary and adjacent shelf waters. Estuarine Coastal and Shelf Science, 61, 1–13.

Gili, J.-M. & Hughes, R.G. 1995. The ecology of marine benthic hydroids. Oceanography and Marine Biology, an annual review, 33, 351–426.

Gili, J.-M., López-González, P.J. & Bouillon, J. 2006. A new Antarctic association: the case of the hydroid *Sarsia medelae* (new sp.) associated with gorgonians. Polar Biology, 29, 624–631.

Gillespie, R.G., Baldwin, B.G., Waters, J.M., Fraser, C.I., Nikula, R. & Roderick, G.K. 2012. Long-distance dispersal: a framework for hypothesis testing. Trends in Ecology and Evolution, 27, 47–56.

Gittenberger, E. 2012. Long-distance dispersal of molluscs: 'Their distribution at first perplexed me much'. Journal of Biogeography, 39, 10–11.

Giokas, S. & Sfenthourakis, S. 2008. An improved method for the identification of areas of endemism using species co-ocurrences. Journal of Biogeography, 35, 893–902.

Glasby, C.J. 1999. The Namanereidinae (Polychaeta: Nereididae). Part 2, Cladistic Biogeography.

Records of the Australian Museum, 25, 131–146.

Glasby, C.J. & Alvarez, B. 1999. Distribution patterns and biogeographic analysis of austral Polychaeta (Annelida). Journal of Biogegraphy, 26, 507–533.

Goloboff, P. 2004. NDM/VNDM version 3. Programs for identification of areas of endemism. Program and documentation, available at www.zmuc.dk/public/phylogeny/endemism.

González-Wevar, C.A., Nakano, T., Cañete, J.I. & Poulin, E. 2010. Molecular phylogeny and historical biogeography of *Nacella* (Patellogastropoda: Nacellidae) in the Southern Ocean. Molecular Phylogenetics and Evolution, 56, 115–124.

Grange, L.J. & Smith, C.R. 2013. Magafaunal communities in rapidly warming fjords along the West Antarctic Peninsula: hotspots of abundance and beta diversity. PLoS ONE, 8, e77917.

Grantham, B.A., Eckert, G.L. & Shanks, A.L. 2003. Dispersal potential of marine invertebrates in diverse habitats. Ecological Applications, 13, 108–116.

Gravier-Bonnet, N. 1992. Cloning and dispersal by buoyant autotomized hydranths of a Thecate hydroid (Cnidaria; Hydrozoa). In: Bouillon, J., Boero, F., Cicogna, F., Gili, J.-M. & Hughes, R.G. (Eds) Aspects of hydrozoan biology. Scientia Marina, 56, 229–236.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A. 2003. Hydroids (Cnidaria, Hydrozoa) collected on the continental shelf of Brazil during the Geomar X Oceanographic Operation. Zootaxa, 299, 1–19.

Grohmann, P.A., Nogueira, C.C. & Silva, V.M.A.P. 2011. Hydroids (Cnidaria, Hydrozoa) collected on the inner continental shelf of the state of Rio de Janeiro, Brazil, during the Oceanographic Operations GEOCOSTA RIO I and II. Biota Neotropica, 11, 193–201.

Gutt, J., Starmans, A. & Dieckmann, G. 1996. Impact of iceberg scouring on polar benthic habitats. Marine Ecology Progress Series, 137, 311–316.

Harley, C.D.G., Hughes, A.R., Hultgren, K.M., Miner, B.G., Sorte, C.J.B., Thornber, C.S., Rodriguez, L.F., Tomanek, L. & Williams, S.L. 2006. The impacts of climate change in coastal marine systems. Ecology Letters, 9, 228–241.

Harold, A.S. & Mooi, R.D. 1994. Areas of endemism: definition and recognition criteria. Systematic Biology, 43, 261–266.

Heads, M. 2005. Towards a panbiogeography of the seas. Biological Journal of the Linnean Society, 84, 675–723.

Hedgpeth, J.W. 1969. Distribution of selected groups of marine invertebrates in waters south of 35°S latitude. Antarctic Map Folio Series, 11, 1–9.

Humphries, C.J. & Parenti, L.R. 1999. Cladistic Biogeography: interpreting patterns of plant and animal distributions, 2nd edn, reprinted. Oxford University Press, 187p.

Jacobs, L.L., Mateus, O., Polcyn, M.J., Schulp, A.S., Scotese, C.R., Goswami, A., Ferguson, K.M., Robbins, J.A., Vineyard, D.P., Buto Neto, A. 2009. Cretaceous paleogeography, paleoclimatology, and amniote biogeography of the low and mid-latitude South Atlantic Ocean. Bulletin de la Société Géologique de France, 180, 333–341.

Jaubet, M.L. & Genzano, G.N. 2011. Seasonality and reproductive periods of the hydroid *Clytia gracilis* in temperate littoral ecosystems. Is asexual reproduction the prime mechanism in maintaining populations? Marine Biology Research, 7, 804–811.

Kaiser, S., Griffiths, H.J., Barnes, D.K.A., Brandão, S.N., Brandt, A. & O'Brien, P.E. 2011. Is there a distinct continental slope fauna in the Antarctic? Deep-Sea Research II, 58, 91–104.

Kaiser, S., Brandão, S.N., Brix, S., Branes, D.K.A., Bowden, D.A., Ingels, J., Leese, F., Schiaparelli, S., Arango, C.P., Badhe, R., Bax, N., Blazewicz-Paszkowycz, M., Brandt, A., Brenke, N., Catarino, A.I., David, B., De Ridder, C., Dubois, P., Ellingsen, K.E., Glover, A.G., Griffiths, H.J., Gutt, J., Halanych, K.M., Havermans, C., Held, C., Janussen, D., Lörz, A.-N., Pearce, D.A., Pierrat, B., Riehl, T., Rose, A., Sands, C.J., Soler-Membrives, A., Schüller, M., Strugnell, J.M., Vanheusel, A., Veit-Köhler, G., Wilson, N.G. & Yasuhara, M. 2013. Patterns, processes and vulnerability of Southern Ocean benthos: a decadal leap in knowledge and understanding. Marine Biology, 160, 2295–2317.

Knox, G.A. 1960. Littoral ecology and biogeography of the Southern Oceans. Proceedings of the Royal Society of London, 152, 577–624.

Knox, G.A. & J.K. Lowry. 1977. A comparison between the benthos of the Southern Ocean and the North Polar Ocean with special reference to the Amphipoda and the Polychaeta. In: M.J. Dunbar (ed.). Polar Oceans. Proceedings of the Polar Ocean Conference, Calgary, pp. 432–462.

Lawver, L.A. & Gahagan, L.M. 2003. Evolution of Cenozoic seaways in the circum-Antarctic region. Palaeogeography, Palaeoclimatology, Palaeoecology, 198, 11–37.

Leclère, L., Schuchert, P., Cruaud, C., Couloux, A. & Manuel, M. 2009. Molecular phylogenetics of Thecata (Hydrozoa, Cnidaria) reveals long-term maintenance of life history traits despite high frequency of recent character changes. Systematic Biology, 58, 509 – 526.

Leese, F., Agrawal, S. & Held, C. 2010. Long-distance island hopping without dispersal stages: transportation across major zoogeographic barriers in a Southern Ocean isopod. Naturwissenschaften, 97, 583–594.

Lind, C.E., Evans, B.S., Elphinstone, M.S., Taylor, J.J.U. & Jerry, D.R. 2012. Phylogeography of a pearl oyster (*Pinctada maxima*) across the Indo-Australian Archipelago: evidence of strong regional structure and population expansions but no phylogenetic breaks. Biological Journal of the Linnean Society, 107, 632–646.

Linse, K., Griffiths, H.J., Barnes, D.K.A. & Clarke, A. 2006. Biodiversity and biogeography of Antarctic and sub-Antarctic mollusca. Deep Sea Research II, 53, 985–1008.

Longo, C., Pontasuglia, C., Corriero, G. & Gaino, E. 2012. Life-cycle traits of *Peraleucilla magna*, a calcareous sponge invasive in a coastal Mediterranean basin. PLoS ONE, 7, e42392.

Macfarlane, C.B.A., Drolet, D., Barbeau, M.A., Hamilton, D.J. & Ollerhead, J. 2013. Dispersal of marine benthic invertebrates through ice rafting. Ecology, 94, 250–256.

Marques, A.C. 2001. O gênero *Eudendrium* (Hydrozoa, Anthomedusae, Eudendriidae) no Brasil. Papéis Avulsos de Zoologia, 41, 329–405.

Marques, A.C. & Peña Cantero, A.L. 2010. Areas of endemism in the Antarctic – a case study of the benthic hydrozoan genus *Oswaldella* (Cnidaria, Kirchenpaueriidae). Journal of Biogeography, 37, 617–623.

Marques, A.C. & Carranza, A. 2013. Politics should walk with science towards protection of the oceans. Marine Pollution Bulletin, 75, 1–3.

Marques, A.C., Klôh, A.S., Migotto, A.E., Cabral, A.C., Rigo, A.P.R., Bettim, A.L., Razzolini, E.L., Cascon, H.M., Bardi, J., Kremer, L.P., Vieira, L.M., Bezerra, L.E.A., Haddad, M.A., Oliveira Filho, R.R., Gutierre, S.M.M., Miranda, T.P., Franklin Jr., W. & Rocha, R.M. 2013. Rapid assessment survey for exotic benthic species in the São Sebastião Channel, Brazil. Latin American Journal of Aquatic Research, 41, 265–285.

Marshall, D.J., Krug, P.J., Kupriyanova, E.K., Byrne, M. & Emlet, R.B. 2012. The biogeography of marine invertebrate life histories. Annual Review of Ecology, Evolution, and Systematics, 43, 97–114.

Mast, A.R. & Nyffeler, R. 2003. Using a null model to recognize significant co-ocurrence prior to identifying candidate areas of endemism. Systematic Biology, 52, 271–280.

Matsuura, Y. 1986. Contribuição ao estudo da estrutura oceanográfica da região sudeste entre Cabo

Frio (RJ) e Cabo de Santa Marta Grande (SC). Ciência & Cultura, 38, 1439–1450.

Migotto, A.E. 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. Zoologische Verhandelingen, 306, 1–125.

Migotto, A.E., Marques, A.C. & Flynn, M.N. 2001. Seasonal recruitment of hydroids (Cnidaria) on experimental panels in the São Sebastião Channel, Southeastern Brazil. Bulletin of Marine Science, 68, 287–298.

Millard, N.A.H. 1975. Monograph on the Hydroida of Southern Africa. Annals of the South African Museum, 68, 1–513.

Millard, N.A.H. 1978. The geographical distribution of Southern African hydroids. Annals of the South African Museum, 74, 159–200.

Miranda, T.P. & Marques, A.C. 2011. Abordagens atuais em biogeografia marinha. Revista da Biologia, 7, 41–48.

Miranda, T.P., Haddad, M.A., Shimabukuro, V., Dubiaski-Silva, J. & Marques, A.C. 2011. Fauna de hidroides (Cnidaria, Hydrozoa) da região de Bombinhas, Santa Catarina, Brasil. Biota Neotropica, 11, 331–353.

Miranda, T.P., Peña Cantero, A.L. & Marques, A.C. 2013. Southern Ocean areas of endemism: a reanalysis using benthic hydroids (Cnidaria, Hydrozoa). Latin American Journal of Aquatic Research, 41, 1003–1009.

Miranda, T.P., Genzano, G.N. & Marques, A.C. Endemicity in benthic hydroids (Cnidaria, Hydrozoa) in the Southwestern Atlantic ocean: an NDM-VNDM hypothesis [unpublished].

Montiel, A.S.M., Gerdes, D. & Arntz, W.E. 2005. Distributional patterns of shallow-water polychaetes in the Magellan region: a zoogeographical and ecological synopsis. Scientia Marina, 69, 123–133.

Morrone, J.J. 1994. On the identification of areas of endemism. Systematic Biology, 43, 438–441.

Morrone, J.J. 2001. Homology, biogeography and areas of endemism. Diversity and Distributions, 7, 297–300.

Morrone, J.J. 2002. El espectro del dispersalismo: de los centros de origen a las áreas ancestrales. Revista de la Sociedad Entomológica Argentina, 61, 1–14.

Morrone, J.J. 2004. La zona de transición sudamericana: caracterización y relevancia evolutiva. Acta Entomológica Chilena, 28, 41–50.

Morrone, J.J. 2007. Hacia una biogegrafía evolutiva. Revista Chilena de História Natural, 80, 509–520.

Myers, A.A. 1997. Biogeographic barriers and the development of marine biodiversity. Estuarine, Coastal and Shelf Science, 44, 241–248.

Myers, A.A. & Lowry, J.K. 2009. The biogeography of Indo-West Pacific tropical amphipods with particular reference to Australia. Zootaxa, 2260, 109–127.

Moreno, R.A., Hernández, C.E., Rivadeneira, M.M., Vidal, M.A., Rozbaczylo, N. 2006. Patterns of endemism in south-eastern Pacific benthic polychaetes of the Chilean coast. Journal of Biogeography, 33, 750–759.

Moreno, T.R., Faria, S.B. & Rocha, R.M. 2014. Biogeography of Atlantic and Mediterranean ascidians. Marine Biology, 161, 2023–2033.

Morrone, J.J. & Escalante, T. 2002. Parsimony analysis of endemicity (PAE) of Mexican terrestrial mammals at different area units: when size matters. Journal of Biogeography, 29, 1095–1104.

Navarro, F., Cuezzo, F., Goloboff, P.A., Szumik, C., Lizarralde de Grosso, M. & Quintana, M.G. 2009. Can insect data be used to infer areas of endemism? An example from the Yungas

Argentina. Revista Chilena de História Natural, 82, 507–522.

Nelson, G. & Platnick, N.I. 1980. A vicariance approach to historical biogeography. BioScience, 30, 339–343.

Nelson, G. & Platnick, N.I. 1981. Systematics and biogeography: cladistics and vicariance. Columbia University Press, 567p.

Nelson, G. & Rosen, D.E. 1981. Vicariance biogeography: a critique. Columbia University Press, 593p.

Okolodkov, Y.B. 2010. Biogeografía marina. Universidad Autónoma de Campeche, Campeche, Mexico.

Oliveira, O.M.P. & Marques, A.C. 2007. Epiphytic hydroids (Hydrozoa: Anthoathecata and Leptothecata) of the world. Check List, 3, 21–38.

Oliveira, O.M.P. & Marques, A.C. 2011. Global and local patterns in the use of macrophytes as susbtrata by hydroids (Hydrozoa: Anthoathecata and Leptothecata). Marine Biology, 7, 786–795.

Oliveira, O.M.P., Araújo, E.M., Ayón, P., Cedeño-Posso, C.M., Cepeda, A.A., Córdova, P., Cunha, A.F., Galea, H., Genzano, G.N., Haddad, M.A., Mianzan, H.W., Migotto, A.E., Miranda, L.S., Miranda, T.P., Morandini, A.C., Nagata, R.M., Nascimento, K., Nogueira Jr., M., Palma, S., Quiñones, J.A.D., Rodriguez, C., Scarabino, F., Schiariti, A., Tronolone, V. & Marques, A.C. Census of the Cnidaria (Medusozoa) and Ctenophora from South American marine waters. Zootaxa [in press].

Palacio, F.J. 1982. Revisión zoogeográfica marina del sur del Brasil. Boletim do Instituto Oceanográfico, 31, 69–92.

Papavero, N., Teixeira, D.M. & Prado, L.R. 2013. História da biogeografia: do Gênesis à primeira metade do século XIX. Technical Book Editora, 443p.

Parker, T. & Tunnicliffe, V. 1994. Dispersal strategies of the biota on an oceanic seamount: implications for ecology and biogeography. Biological Bulletin, 187, 336–345.

Pearse, J.S., Mooi, R., Lockhart, S.J. & Brandt, A. 2009. Brooding and species diversity in the Southern Ocean: selection for brooders or speciation within brooding clades? In: Krupnik, I., Lang, M.A. & Miller, S.E. (Eds) Smithsonian at the Poles: contributions to international polar year science. Smithsonian Institution Press, 196p.

Peña Cantero, A.L. 2004. How rich is the deep-sea Antarctic benthic hydroid fauna? Polar Biology, 27, 767–774.

Peña Cantero, A.L. & García Carrascosa, A.M. 1999. Biogeographical distribution of the benthic thecate hydroids collected during the Spanish "Antártida 8611" expedition and comparison between Antarctic and Magellan benthic hydroid faunas. Scientia Marina, 63, 209–218.

Peña Cantero, A.L. & Vervoort, W. 2004. Species of *Oswaldella* Stechow, 1919 (Cnidaria: Hydrozoa: Kirchenpaueriidae) from US Antrarctic expeditions, with the description of three new species. Journal of Natural History, 38, 805–861.

Peña Cantero, A.L., García Carrascosa, A.M. & Vervoort, W. 1997. On *Antarctoscyphus* (Cnidaria, Hydrozoa), a new genus of Antarctic hydroids and the description of two new species. Polar Biology, 18, 23–32.

Peña Cantero, A.L., Svoboda, A. & Vervoort, W. 2002. Species of *Symplectoscyphus* Marktanner-Turneretscher, 1890 (Cnidaria: Hydrozoa, Sertulariidae) from recent Antarctic expeditions with R.V. Polarstern, with the description of four new species. Journal of Natural History, 36, 1509–1568.

Peña Cantero, A.L., Vervoort, W. & Watson, J.E. 2003. On Clathrozoellidae (Cnidaria, Hydrozoa, Anthoathecatae), a new family of rare deep-water leptolids, with the description of three new species. Zoologische Verhandelingen, 345, 281–296.

Pierrat, B., Saucède, T., Brayard, A. & David, B. 2013. Comparative biogeography of echinoids, bivalves and gastropods from the Southern Ocean. Journal of Biogeography, 40, 137–1385.

Piovesan, E.K., Ballent, S., Fauth, G. 2012. Cretaceous paleogeography of southern Gondwana from the distribution of the marine ostracod *Majungaella* Grekoff: new data and review. Cretaceous Research, 37, 127–147.

Platnick, N.I. On areas of endemism. Australian Systematic Botany, 4, 11–12.

Rocha, R.M., Vieira, L.M., Migotto, A.E., Amaral, A.C.Z., Ventura, C.R.R., Serejo, C.S., Pitombo, F.B., Santos, K.C., Simone, L.R.L., Tavares, M., Lopes, R.M., Pinheiro, U. & Marques, A.C. 2013. The need of more rigorous assessments of marine species introductions: a counter example from the Brazilian coast. Marine Pollution Bulletin, 67, 241–243.

Rodríguez, E., López-González, P.J. & Gili, J.M. 2007. Biogeography of Antarctic sea anemones (Anthozoa, Actinaria): what do they tell us about the origin of the Antarctic benthic fauna? Deep-Sea Research II, 54, 1876–1904.

Rodriguez, C.S., Miranda, T.P., Marques, A.C., Mianzan, H. & Genzano, G. 2012. The genus *Hybocodon* (Cnidaria, Hydrozoa) in the southwestern Atlantic Ocean, with a revision of the species recorded from the area. Zootaxa, 3523, 39–48.

Rosen, B.R. 1988. From fossils to earth history: applied historical biogeography. In: Myers, A.A. & Gillers, P.S. (Eds) Analytical Biogeography. Chapman & Hall, 578p.

Rossi, S., Bramanti, L., Broglio, E., Gili, J.M. 2012. Trophic impact of long-lived species indicated by population dynamics in the short-lived hydrozoan *Eudendrium racemosum*. Marine Ecology, 467, 97–111.

Salvatteci, R., Gutiérrez, D., Field, D., Sifeddine, A., Ortlieb, L., Bouloubassi, I., Boussafir, M., Boucher, H. & Cetin, F. 2014. The response of the Peruvian Upwelling Ecosystem to centennial-scale global change during the last two millennia. Climate of the Past, 10, 715–731.

Schejter, L. & Bremec, C. 2007. Benthic richness in the Argentine continental shelf: the role of *Zygochlamys patagonica* (Mollusca: Bivalvia: Pectinidae) as settlement substrate. Journal of Marine Biological Association of the United Kingdom, 87, 917–925.

Silva, N. 2008. Dissolved oxygen, pH, and nutrients in the austral Chilean channels and fjords. In: Silva, N. & Palma, S. (Eds) Progress in the oceanographic knowledge of Chilean interior waters, from Puerto Montt to Cape Horn. Comité Oceanográfico Nacional, Pontificia Universidad Católica de Valparaíso, 161p.

Silva, N. & Palma, S. 2006. El Programa CIMAR en los canals y fiordos australes. In: Silva, N. & Palma, S. (Eds) Avances en el conocimiento oceanográfico de las aguas interiors chilenas, Puerto Montt a cabo de Hornos. Comité Oceanográfico Nacional, Pontificia Universidad Católica de Valparaíso, 161p.

Spalding, M.D., Fox, H., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A. & Robertson, J. 2007. Marine ecoregions of the world: a bioregionalization of coastal and shelf areas. BioScience, 57, 573–583.

Spalding, M.D., Agostini, V.N., Rice, J. & Grant, S.M. 2012. Pelagic provinces of the world: a biogeographic classification of the world's surface pelagic waters. Ocean Coast Manage 60, 19–30.

Sydeman, W.J., García-Reyes, M., Schoeman, D.S., Rykaczewski, R.R., Thompson, S.A., Black, B.A. & Bograd, S.J. 2014. Climate change and wind intensification in coastal upwelling ecosystems. Science, 345, 77–80.

Szumik, C.A. & Goloboff, P.A. 2004. Areas of endemism: an improved optimality criterion. Systematic Biology, 53, 968–977.

Szumik, C.A., Cuezzo, F., Goloboff, P.A. & Chalup, A.E. 2002. An optimality criterion to determine areas of endemism. Systematic Biology, 51, 806–816.

Szumik, C., Casagranda, D. & Juñent, S.R. 2006. Manual de NDM/VNDM: programas para la identificación de áreas de endemismo. Instituto Argentino de Estudios Filogenéticos, Buenos Aires, Argentina.

Szumik, C., Aagesen, L., Casagranda, D., Arzamendia, V., Baldo, D., Claps, L.E., Cuezzo, F., Díaz Gómez, J.M., Di Giacomo, A., Giraudo, A., Goloboff, P., Gramajo, C., Kopuchian, C., Kretzschmar, S., Lizarralde, M., Molina, A., Mollerach, M., Navarro, F., Nomdedeu, S., Panizza, A., Pereyra, V.V., Sandoval, M., Scrocchi, G. & Zuloaga, F.O. 2012. Detecting areas of endemism with a taxonomically diverse data set: plants, mammals, reptiles, amphibians, birds, and insects from Argentina. Cladistics, 28, 317–329.

Van Iten, H., Marques, A.C., Leme, J.M., Pacheco, M.L.A.F. & Simões, M.G. 2014. Origin and early diversification of the Phylum Cnidaria Verrill: major developments in the analysis of the taxon's Proterozoic-Cambrian history. Paleontology, 57, 677–690.

Van Soest, R.W.M. 1994. Demosponge distribution patterns. In: Van Soest, R.W.M., van Kempen, T.M.G. & Braekman, J.C. (Eds) Sponges in time and space. Balkema, 515p.

Van Soest, R.W.M. 1998. The cladistic biogeography of salps and pyrosomas. In: Bone Q. (Ed.). The biology of pelagic tunicates. Oxford University Press, 340p.

Van Soest, R.W.M. & Hajdu, E. 1997. Marine area relationships from twenty sponge phylogenies. A comparison of methods and coding strategies. Cladistics, 13, 1–20.

Waller, R.G., Scanlon, K.M. & Robinson, L.F. 2011. Cold-water coral distributions in the Drake Passage Area from towed camera observations – initial interpretations. PLoS ONE, 6, e16153.

Warren, D.L., Cardillo, M., Rosauer, D.F. & Bolnick, D.I. 2014. Mistanking geography for biology: inferring processes from species distributions. Trends in Ecology and Evolution [http://dx.doi.org/10.1016/j.tree.2014.08.003].

Winfield, I., Escobar-Briones, E. & Morrone, J.J. 2006. Updated checklist and identification of areas of endemism of benthic amphipods (Caprellidea and Gammaridea) from offshore habitats in the SW Gulf of Mexico. Scientia Marina, 70, 99–108.

Yasuhara, M., Kato, M., Ikeya, N. & Seto, K. 2007. Modern benthic ostracodes from Lützow-Holm Bay, East Antarctica: paleoceanographic, paleobiogeographic, and evolutionary significance. Micropaleontology, 53, 469–496.

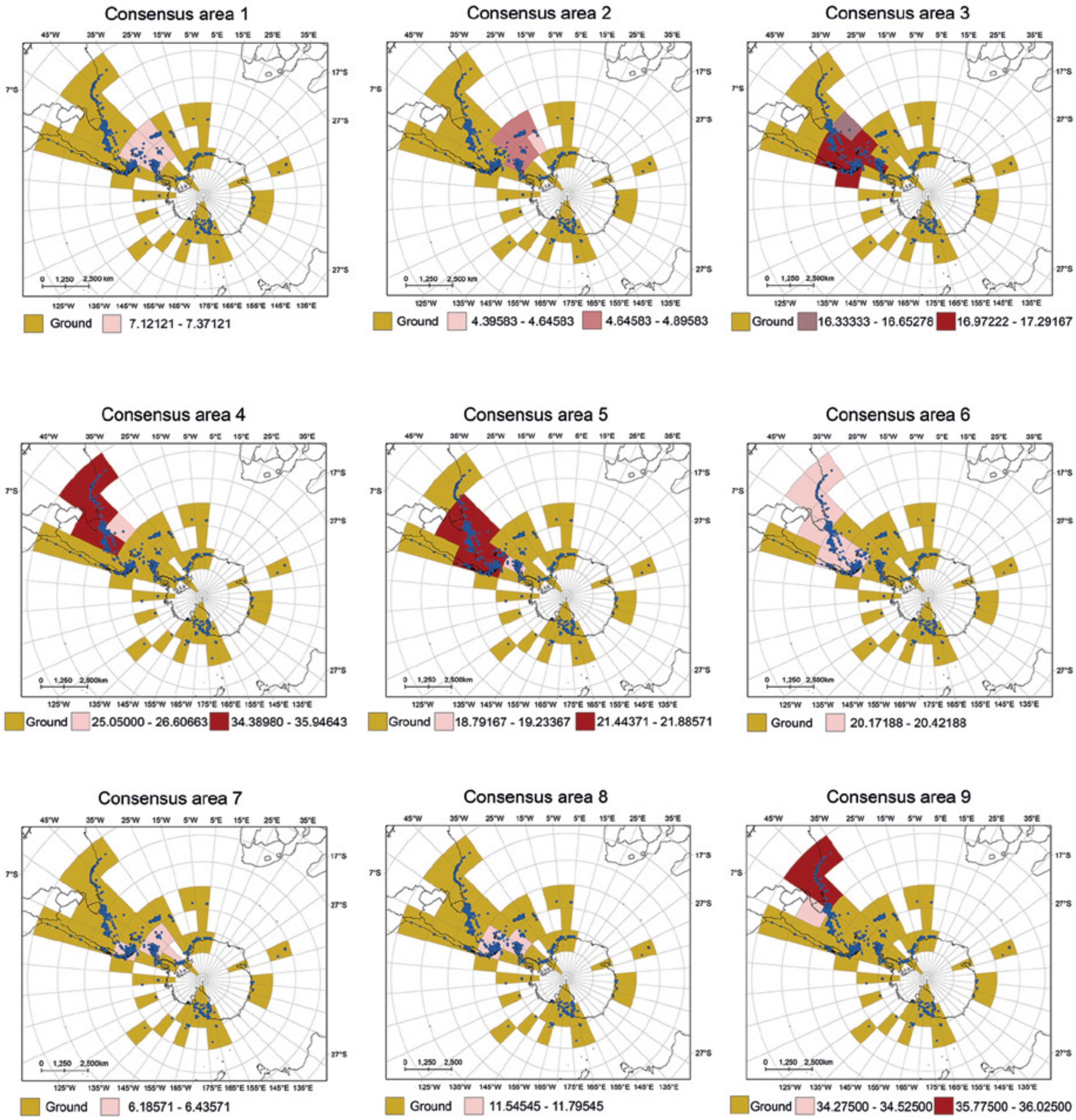
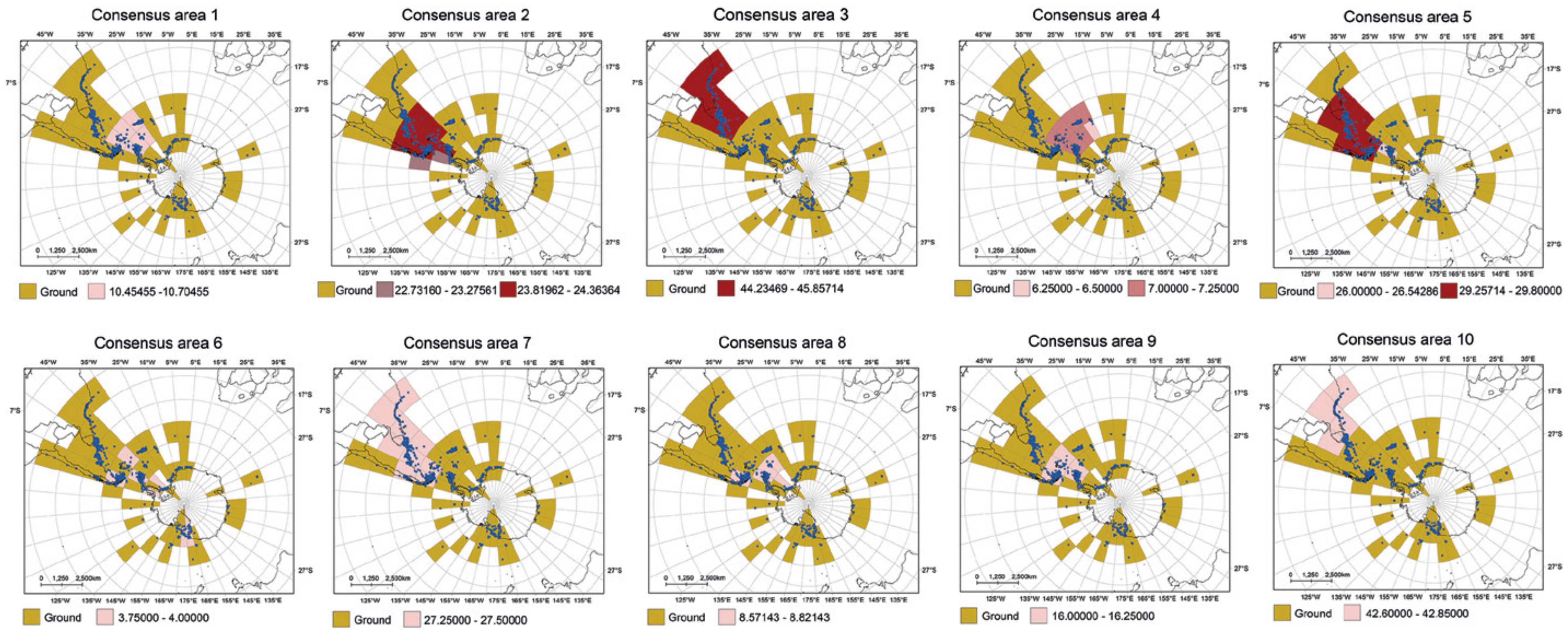


Figure 1. Consensus areas 1 to 9 resulting from the EA (F=0.5) carried out for 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO).


Consensus area 1

Consensus area 2

Consensus area 3

Consensus area 4

Consensus area 5

Consensus area 6

Consensus area 7

Consensus area 8

Consensus area 9

Consensus area 10

Figure 2. Consensus areas 1 to 10 resulting from the EA (F=1.0) carried out for 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO).

Table 1. Summary of the results of the EA with the 10°X10° grid carried out for 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO).

Inferred presences	Number of areas	Number of consensus areas	Number of endemic species	Patterns of the consensus areas of endemism
F=0.5	19	9	107	Southwestern Atlantic, South America, South America and Antarctic Peninsula, Patagonia and Antarctic Peninsula, Scotia Arc and Antarctic Peninsula, Magellanic and Antarctic Peninsula.
F=1.0	18	10	112	Southwestern Atlantic, South America, South America and Antarctic Peninsula, Patagonia and Antarctic Peninsula, Scotia Arc and Antarctic Peninsula, Magellanic and Antarctic Peninsula, Magellanic, Antarctic Peninsula and Ross Sea.

Table 2. Consensus areas 1 to 9, number of quadrants, approximate minimum and maximum values of the index of endemicity (IE), and endemic species for the EA with F=0.5 and grid 10°X10° carried out for 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO).

Area	Number of quadrants	IE (min–max)	Number of endemic species	Endemic species
1	6	7.12–7.37	11	*Antarctoscyphus gruzovi, Clathrozoella medeae, Hydrodendron arboreum, Oswaldella elongata, O. shetlandica, Schizotricha unifurcata, Staurotheca cornuta, S. undosiparietina, S. vervoorti, Symplectoscyphus bathyalis, S. curvatus*
2	7	4.39–4.89	8	*Clathrozoella medeae, Oswaldella elongata, O. shetlandica, Schizotricha crassa, S. unifurcata, Staurotheca multifurcata, S. undosiparietina, S. vervoorti*
3	8	16.34–17.29	33	*Acryptolaria operculata, Aglaophenia acacia, Amphisbetia operculata, Campanularia agas, C. subantarctica, Coryne eximia, Grammaria abietina, Halecium beanii, Halopteris plumosa, Hartlaubella gelatinosa, Hebella striata, Lytocarpia canepa, Oswaldella herwigi, Parascyphus repens, Phialella chilensis, Sertularella antarctica, S. argentinica, S. cruzensis, S. fuegonensis, S. gaudichaudi, S. gayi, S. jorgensis, S. polyzonias, S. robusta, S. sanmatiasensis, Staurotheca jaederholmi, Symplectoscyphus bathyalis, S. exochus, S. frigidus, S. leloupi, S. milneanus, Synthecium protectum, Tulpa tulipifera*
4	6	25.05–35.95	54	*Acryptolaria conferta, Aglaophenia acacia, A. latecarinata, Bimeria vestita, Campanularia hincksii, Cladocoryne floccosa, Clytia gracilis, C. linearis, C. noliformis, Coryne eximia, Diphasia tropica, Dynamena crisioides, D. dalmasi, D. disticha, D. quadridentata, Ectopleura crocea, Eudendrium caraiuru, E. carneum, E. ramosum, Grammaria abietina, Halecium beanii, H. bermudense, H. dichotomum, H. dyssymetrum, H. lightbourni, Halopteris polymorpha, Hebella scandens, Hincksella cylindrica, Lafoeina amirantensis, Lytocarpia tridentata, Macrorhynchia philippina, Monostaechas quadridens, Monotheca margaretta, Nemertesia ramosa, Obelia geniculata, Orthopyxis caliculata, Parawrightia robusta, Pennaria disticha, Plumularia insignis, P. strictocarpa, Pycnotheca mirabilis, Scandia mutabilis, Sertularella areyi, S. striata, S. tenella, Sertularia distans, S. loculosa, S. marginata, S. tumida, S. turbinata, Synthecium protectum, Turritopsis nutricula, Ventromma halecioides, Zyzzyzus warreni*
5	8	18.79–21.89	42	*Acryptolaria conferta, Aglaophenia acacia, Amphisbetia operculata, Bimeria vestita, Campanularia agas, C. hincksii, C. subantarctica, Clytia gracilis, Coryne eximia, Dynamena disticha, Ectopleura crocea, Eudendrium ramosum, Grammaria abietina, Halecium beanii, H. tenellum, Halopteris polymorpha, Hartlaubella gelatinosa, Hebella scandens, Lytocarpia canepa, Monostaechas quadridens, Obelia bidentata, O. dichotoma, O. geniculata, Orthopyxis caliculata, Parascyphus repens, Phialella chilensis, Plumularia setacea, P. strictocarpa, Sertularella argentinica, S. conica, S. cruzensis, S. gaudichaudi, S. gayi, S. polyzonias, S. robusta, S. sanmatiasensis, S. striata, S. tenella, Symplectoscyphus milneanus, Synthecium protectum, Tulpa tulipifera, Ventromma halecioides*
6	8	20.17–20.42	32	*Acryptolaria conferta, Aglaophenia acacia, Amphisbetia operculata, Bimeria vestita, Campanularia hincksii, Clytia gracilis, Coryne eximia, Dynamena disticha, Ectopleura crocea, Eudendrium caraiuru, E. ramosum, Grammaria abietina, Halecium beanii, H. tenellum, Halopteris polymorpha, Hebella scandens, Monostaechas quadridens, Nemertesia ramosa, Obelia bidentata, O. dichotoma, O. geniculata, Orthopyxis caliculata, Phialella chilensis, Plumularia setecea, P. strictocarpa, Sertularella conica, S. gaudichaudi, S. polyzonias, S. striata, S. tenella, Synthecium protectum, Ventromma halecioides*
7	5	6.19–6.44	9	*Antarctoscyphus gruzovi, Clathrozoella medeae, Hydrodendron arboreum, Oswaldella grandis, O. shetlandica, Staurotheca cornuta, S. undosiparietina, Symplectoscyphus curvatus, S. exochus*
8	4	11.54–11.79	19	*Acryptolaria operculata, Antarctoscyphus gruzovi, Campanularia agas, C. subantarctica, Halopteris plumosa, Hebella striata, Hydrodendron arboreum, Lytocarpia canepa, Oswaldella herwigi, O. shetlandica, Parascyphus repens, Sertularella antarctica, S. gayi, S. jorgensis, Staurotheca cornuta, Symplectoscyphus curvatus, Symplectoscyphus exochus, S. frigidus, S. milneanus*
9	4	34.27–36.02	47	*Aglaophenia acacia, Aglaophenia latecarinata, A. trifida, Bimeria vestita, Cladocoryne floccosa, Clytia linearis, C. noliformis, Diphasia tropica, Dynamena crisioides, D. dalmasi, D. disticha, D. quadridentata, Eudendrium capillare, E. caraiuru, E. carneum, E. pocaruquarum, E. ramosum, Halecium bermudense, H. dichotomum, H. dyssymetrum, H. lightbourni, Halopteris alternata, H. diaphana, Hebella scandens, Hincksella cylindrica, Lafoeina amirantensis, Lytocarpia tridentata, Macrorhynchia philippina, Monostaechas quadridens, Monotheca margaretta, Nemalecium lighti, Parawrightia robusta, Pennaria disticha, Plumularia floridana, P. strictocarpa, Pycnotheca mirabilis, Scandia mutabilis, Sertularella areyi, S. striata, Sertularia distans, S. loculosa, S. marginata, S. tumida, S. turbinata, Thyroscyphus ramosus, Turritopsis nutricula, Zyzzyzus warreni*

Table 3. Consensus areas 1 to 10, number of quadrants, approximate minimum and maximum values of the index of endemicity (IE), and endemic species for the EA with F=1.0 and grid 10°X10° carried out for 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO).

Area	Number of quadrants	IE (min–max)	Number of endemic species	Endemic species
1	6	10.46–10.71	11	*Antarctoscyphus gruzovi, Clathrozoella medeae, Hydrodendron arboreum, Oswaldella elongata, O. shetlandica, Schizotricha unifurcata, Staurotheca cornuta, S. undosiparietina, S. vervoorti, Symplectoscyphus bathyalis, S. curvatus*
2	9	22.73–24.36	33	*Acryptolaria operculata, Aglaophenia acacia, Amphisbetia operculata, Campanularia agas, C. subantarctica, Coryne eximia, Grammaria abietina, Halecium beanii, Halopteris plumosa, Hartlaubella gelatinosa, Hebella striata, Lytocarpia canepa, Oswaldella herwigi, Parascyphus repens, Phialella chilensis, Sertularella antarctica, S. argentinica, S. cruzensis, S. fuegonensis, S. gaudichaudi, S. gayi, S. jorgensis, S. polyzonias, S. robusta, S. sanmatiasensis, Staurotheca jaederholmi, S. bathyalis, S. exochus, S. frigidus, S. leloupi, S. milneanus, Synthecium protectum, Tulpa tulipifera*
3	6	44.23–45.86	54	*Acryptolaria conferta, Aglaophenia acacia, A. latecarinata, Bimeria vestita, Campanularia hincksii, Cladocoryne floccosa, Clytia gracilis, C. linearis, C, noliformis, Coryne eximia, Diphasia tropica, Dynamena crisioides, D. dalmasi, D. disticha, D. quadridentata, Ectopleura crocea, Eudendrium caraiuru, E. carneum, E. ramosum, Grammaria abietina, Halecium beanii, H. bermudense, H. dichotomum, H. dyssymetrum, H. lightbourni, Halopteris polymorpha, Hebella scandens, Hincksella cylindrica, Lafoeina amirantensis, Lytocarpia tridentata, Macrorhynchia philippina, Monostaechas quadridens, Monotaecha margaretta, Nemertesia ramosa, Obelia geniculata, Orhtopyxis caliculata, Parawrightia robusta, Pennaria diticha, Plumularia insignis, P. strictocarpa, Pycnotheca mirabilis, Scandia mutabilis, Sertularella areyi, S. striata, S. tenella, Sertularia distans, S. loculosa, S. marginata, S. tumida, S. turbinata, Synthecium protectum, Turritopsis nutricula, Ventromma halecioides, Zyzzyzus warreni*
4	8	6.25–7.25	8	*Clathrozoella medeae, Oswaldella elongata, O. shetlandica, Schizotricha crassa, S. unifurcata, Staurotheca multifurcata, S. undosiparietina, S. vervoorti*
5	8	26.00–29.80	42	*Acryptolaria conferta, Aglaophenia acacia, Amphisbetia operculata, Bimeria vestita, Campanularia agas, C. hincksii, C. subantarctica, Clytia gracilis, Coryne eximia, Dynamena disticha, Ectopleura crocea, Eudendrium ramosum, Grammaria abietina, Halecium beanii, H. tenellum, Halopteris polymorpha, Hartlaubella gelatinosa, Hebella scandens, Lytocarpia canepa, Monostaechas quadridens, Obelia bidentata, O. dichotoma, O. geniculata, Orthopyxis caliculata, Parascyphus repens, Phialella chilensis, Plumularia setacea, P. strictocarpa, Sertularella argentinica, S. conica, S. cruzensis, S. gaudichaudi, S. gayi, S. polyzonias, S. robusta, S. sanmatiasensis, S. striata, S. tenella, Symplectoscyphus milneanus, Synthecium protectum, Tulpa tulipifera, Ventromma halecioides*
6	5	3.75–4.00	4	*Oswaldella blanconae, Phialella belgicae, Symplectoscyphus anae, S. nesioticus*
7	9	27.25–27.50	32	*Acryptolaria conferta, Aglaophenia acacia, Amphisbetia operculata, Bimeria vestita, Campanularia hincksii, Clytia gracilis, Coryne eximia, Dynamena disticha, Ectopleura crocea, Eudendrium caraiuru, E. ramosum, Grammaria abietina, Halecium beanii, H. tenellum, Halopteris polymorpha, Hebella scandens, Monostaechas quadridens, Nemertesia ramosa, Obelia bidentata, O. dichotoma, O. geniculata, Orthopyxis caliculata, Phialella chilensis, Plumularia setecea, P. strictocarpa, Sertularella conica, S. gaudichaudi, S. polyzonias, S. striata, S. tenella, Synthecium protectum, Ventromma halecioides*
8	5	8.57–8.82	9	*Antarctoscyphus gruzovi, Clathrozoella medeae, Hydrodendron arboreum, Oswaldella grandis, O. shetlandica, Staurotheca cornuta, S. undosiparietina, Symplectoscyphus curvatus, S. exochus*
9	5	16.00–16.25	20	*Acryptolaria operculata, Antarctoscyphus gruzovi, Campanularia agas, Campanularia subantarctica, Halopteris plumosa, Hebella striata, Hydrodendron arboreum, Lytocarpia canepa, Oswaldella herwigi, O. shetlandica, Parascyphus repens, Sertularella antarctica, S. gayi, S. jorgensis, Staurotheca cornuta, Symplectoscyphus bathyalis, Symplectoscyphus curvatus, S. exochus, S. frigidus, S. milneanus*
10	4	42.60–42.85	47	*Aglaophenia acacia, A. latecarinata, A. trifida, Bimeria vestita, Cladocoryne floccosa, Clytia linearis, C. noliformis, Diphasia tropica, Dynamena crisioides, D. dalmasi, D. disticha, D. quadridentata, Eudendrium capillare, E. caraiuru, E. carneum, E. pocaruquarum, E. ramosum, Halecium bermudense, H. dichotomum, H. dyssymetrum, H. lightbourni, Halpteris alternata, H. diaphana, Hebella scandens, Hincksella cylindrica, Lafoeina amirantensis, Lytocarpia tridentata, Macrorhynchia philippina, Monostaechas quadridens, Monotheca margaretta, Nemalecium lighti, Parawrightia robusta, Pennaria disticha, Plumularia floridana, P. strictocarpa, Pycnotheca mirabilis, Scandia mutabilis, Sertularella areyi, S. striata, Sertularia distans, S. loculosa, S. marginata, S. tumida, S. turbinata, Thyroscyphus ramosus, Turritopsis nutricula, Zyzzyzus warreni*

Table 4. Comparison between the consensus areas of endemism hypothesized by the EA (F=0.5 and F=1.0) of benthic hydroid species from the southern South America (SSA) coast and Southern Ocean (SO) and the previous hypotheses of areas of endemism for the Southwestern Atlantic Ocean (SWAO) and SO proposed by Marques & Peña Cantero (2010), Miranda et al., 2013, and Miranda et al., unpublished. The consensus areas of endemism proposed in this study for the SSA coast and SO are shown in Figures 1 and 2, and their respective species compositions are shown in Tables 2 and 3.

Consensus areas of endemism hypothesized for the SSA coast and SO	Areas of endemism previously delimited for the SSA coast and SO		
	Miranda et al. unpublished	Marques & Peña Cantero (2010)	Miranda et al., 2013
Scotia Arc and Antarctic Peninsula (areas 1, 2, F=0.5; 1, 4, F=1.0)	–	Magellanic Zone, Antarctic Peninsula Zone	Areas I–III, V, VI
Patagonia and Antarctic Peninsula (area 3, F=0.5; 2, F=1.0)	Uruguayan-Argentinean (set 4, 10–12, 15, F=0.5; set 4, 10–12, F=1.0), disjunct areas along Brazil, Uruguay, and Argentina (set 6, 13, F=0.5)	Magellanic Zone, Antarctic Peninsula Zone	Areas I–III, V, VI
Southwestern Atlantic (areas 4, 9, F=0.5; 3, 10, F=1.0)	Brazilian (set 0–3, 5, 7–9, 14, F=0.5; set 0–3, 5–9, F=1.0), Uruguayan-Argentinean (set 4, 10–12, 15, F=0.5; set 4, 10–12, F=1.0), disjunct areas along Brazil, Uruguay, and Argentina (set 6, 13, F=0.5)	–	–
South America and Antarctic Peninsula (area 5, F=0.5 and F=1.0)	Brazilian (set 0–3, 5, 7–9, 14, F=0.5; set 0–3, 5–9, F=1.0), Uruguayan-Argentinean (set 4, 10–12, 15, F=0.5; set 4, 10–12, F=1.0), disjunct areas along Brazil, Uruguay, and Argentina (set 6, 13, F=0.5)	Magellanic Zone, Antarctic Peninsula Zone	Areas I–III, V, VI
South America (area 6, F=0.5; 7, F=1.0)	Brazilian (set 0–3, 5, 7–9, 14, F=0.5; set 0–3, 5–9, F=1.0), Uruguayan-Argentinean (set 4, 10–12, 15, F=0.5; set 4, 10–12, F=1.0), disjunct areas along Brazil, Uruguay, and Argentina (set 6, 13, F=0.5)	–	–
Magellanic and Antarctic Peninsula (areas 7, 8, F=0.5; 8, 9, F=1.0)	–	Magellanic Zone, Antarctic Peninsula Zone	Areas I–III, V, VI
Magellanic, Antarctic Peninsula and Ross Sea (area 6, F=1.0)	–	Magellanic Zone, Antarctic Peninsula Zone, Western High Antarctica Zone	Areas I–III, V, VI–VIII

Appendix 1. List of the species used in the endemicity analysis (EA) for a grid 10°X10° with 249 species of benthic hydroids from the southern South America (SSA) coast and Southern Ocean (SO). The geographical coordinates of the species occurrence are ordinated as “longitude latitude”.

1. *Abietinella operculata*: 170.5700 -72.3000; 93.0150 -66.5489; 171.6670 -71.2670; -56.1580 -61.3170; -62.6080 -63.8420; 171.6670 -71.2670; 170.4250 -72.3080; 171.4580 -73.5330; 171.6670 -71.2670; -63.8330 -54.6500; -63.5830 -53.9000; -66.2830 -55.7830; -58.7000 -54.0330; -59.5170 -53.0830; -75.0000 -52.9330; -75.3000 -52.8670; -56.9830 -54.6830; -56.1670 -62.6500; -57.0830 -54.6670; -64.0670 -54.7820; -64.1530 -54.9200; -65.8330 -54.5670; -64.7000 -54.3670; -64.8830 -54.9830; **2. *Acryptolaria conferta*:** -49.5250 -31.1280; -48.6660 -31.3330; -37.5880 -22.3820; -50.5100 -43.5500; -66.3170 -56.1000; -59.5170 -53.0830; -66.3170 -56.1000; -64.1530 -54.9200; -57.0830 -54.6670; **3. *Acryptolaria longitheca*:** -74.6000 -48.1500; **4. *Acryptolaria minuta*:** -67.9830 -57.1420; **5. *Acryptolaria operculata*:** -66.3170 -56.1000; -57.0830 -54.6670; -64.8830 -54.9830; -64.1530 -54.9200; -59.5170 -53.0830; -55.5000 -54.7170; **6. *Aglaophenia acacia*:** -53.0830 -35.0000; -53.1000 -35.0000; -57.2270 -38.0880; -53.2500 -34.7500; -54.7500 -35.7500; -54.7500 -36.2500; -55.7500 -36.7500; -54.7500 -36.7500; -56.2500 -37.2500; -56.7500 -37.7500; -57.2500 -38.2500; -57.5000 -38.1500; -58.5800 -38.4800; -60.2500 -40.2500; -61.7500 -41.2500; -64.0000 -42.2000; -64.7500 -41.2700; -65.0000 -41.2300; -64.0000 -42.0000; -54.1410 -34.6620; -53.7940 -34.4040; -64.3300 -42.3280; **7. *Aglaophenia latecarinata*:** -48.4790 -27.1342; -48.4800 -27.1526; -48.4770 -27.1411; -48.5100 -27.2159; -48.5140 -27.1312; -48.5890 -26.9967; -48.4810 -27.1466; -48.4920 -27.1290; -48.5100 -27.2162; -48.6010 -26.7748; -48.5220 -27.1340; -48.5220 -27.1530; -48.5220 -27.1420; -48.5220 -27.9970; -48.3740 -28.0130; -48.3740 -27.1620; -48.3740 -27.1990; -48.4330 -27.2280; -48.4330 -27.1430; -41.9470 -22.8700; -44.4090 -23.0960; -44.3990 -23.0970; -45.3030 -23.9100; -48.3160 -25.5722; -48.3170 -25.5735; -48.3630 -25.7350; -45.3970 -23.7280; -45.4310 -23.8310; -45.3970 -23.7280; -45.3490 -23.7460; -45.4310 -23.8310; -45.3490 -23.7460; -45.1500 -23.5160; -44.8330 -23.3830; -44.8160 -23.4160; -45.6660 -23.7660; -45.4000 -23.6330; -45.6660 -23.7660; **8. *Aglaophenia rhynchocarpa*:** -46.7840 -26.7673; **9. *Aglaophenia trifida*:** -41.9470 -22.8700; -40.8260 -22.3350; -44.3990 -23.0970; -45.1730 -23.7680; **10. *Amphisbetia operculata*:** -69.9250 -52.6833; -70.1750 -52.6333; -69.3667 -52.3750; -70.6300 -53.1750; -70.1750 -52.6333; -74.2250 -51.2000; -67.2330 -52.5080; -48.5220 -27.9970; -57.4990 -38.0990; -55.7500 -34.7500; -55.2500 -35.2500; -54.7500 -35.7500; -54.7500 -36.2500; -55.7500 -36.7500; -56.2500 -37.7500; -57.5000 -38.1500; -57.7500 -38.2500; -57.2500 -38.2500; -58.5800 -38.4800; -61.1500 -38.5900; -61.5000 -39.0700; -61.7500 -39.7500; -61.2500 -39.7500; -64.5000 -40.6500; -61.7500 -40.2500; -60.7500 -40.2500; -62.3000 -40.5000; -61.7500 -40.7500; -61.2500 -40.7500; -62.2500 -41.2500; -61.7500 -41.2500; -64.0000 -41.2500; -62.2500 -41.7500; -64.0000 -42.0000; -58.6000 -42.4700; -63.2830 -42.4680; -69.3100 -51.5200; -63.1160 -42.5890; -62.8210 -42.7860; -62.7320 -42.8410; -67.6330 -49.1560; -67.8440 -53.6880; -65.8760 -47.7620; -67.4430 -45.8600; -67.6330 -49.1560; -56.7330 -37.8000; -67.0670 -53.1000; -67.0000 -51.5830; -66.3330 -53.6670; -66.2000 -54.4500; -74.9670 -52.6670; -68.5830 -52.4330; -75.0000 -52.9330; -64.6330 -54.7670; -69.3330 -57.5830; -68.4670 -52.5330; -68.2500 -53.3000; -68.2170 -53.2830; -67.0000 -51.5830; -64.3670 -54.6500; -67.7000 -52.7330; -67.0670 -53.1000; -67.3000 -53.9000; -54.1410 -34.6620; -67.5740 -49.3140; -68.3330 -50.1460; -68.8690 -51.6070; -54.1506 -34.6620; -54.1436 -34.6295; **11. *Antarctoscyphus admirabilis*:** -8.8000 -70.6300; **12. *Antarctoscyphus asymmetricus*:** -55.3000 -63.3800; -58.8767 -63.2300; -55.2500 -63.5000; -45.8883 -60.4417; -59.7433 -63.2783; 170.3217 -72.2867; -58.7830 -63.2250; 170.4250 -72.3080; -62.0830 -63.4160; -55.0830 -61.2660; -46.4700 -60.4420; -60.8170 -62.9350; -41.2500 -53.8500; -27.4100 -56.3970; -64.1110 -64.7880; 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**16. *Antarctoscyphus grandis*:** -55.3000 -63.3800; -45.9450 -60.4483; -55.3000 -63.3800; -54.7500 -61.2700; -61.8633 -62.7250; -170.7170 -71.3670; -62.0320 -64.8230; -35.8300 -54.9320; -58.7500 -63.2330; -60.7940 -62.9310; -26.7270 -57.1130; -37.6070 -54.1980; -54.7500 -62.6670; -170.4330 -72.3000; -37.6680 -54.2070; -36.8120 -54.5320; -54.7500 -62.6670; -176.8330 -77.6670; -62.0000 -63.3667; -62.0000 -63.3670; 170.7790 -71.2760; -52.6300 -76.5200; -11.1900 -70.9600; -52.1500 -76.5000; -21.7400 -73.6900; -8.0800 -70.6300; -54.8840 -61.2840; -56.4500 -62.8833; -59.5333 -63.4333; -60.6074 -62.9169; -60.5303 -62.6948; -60.6492 -62.6756; -60.6667 -62.6369; -60.5950 -62.7633; -60.5244 -62.7289; -60.6573 -63.0572; -60.3279 -62.3403; -90.3542 -68.8350; -62.0000 -63.3670; **17. *Antarctoscyphus gruzovi*:** -54.9230 -61.8200; -55.6480 -60.8340; **18. *Antarctoscyphus mawsoni*:** -66.7830 -66.3620; -27.2500 -56.2330; -26.9950 -56.7130; -27.4100 -56.3970; -54.7500 -62.6670; -54.7170 -62.6830; -178.2170 -73.8170; -172.4670 -72.0000; -56.1670 -62.6500; -63.4420 -64.7740; **19. *Antarctoscyphus spiralis*:** 93.0150 -66.5489; -68.2720 -68.3910; -55.3000 -63.3800; -54.4000 -62.2000; -44.5000 -77.3500; -54.7170 -62.6830; -64.1217 -64.7903; -56.1500 -62.6580; 177.1330 -72.4420; -173.1330 -75.8420; 168.1670 -76.1420; 170.4250 -72.3080; 178.9750 -74.0000; 168.2830 -76.1670; 110.6917 -66.1778; -55.8660 -61.1330; -56.3330 -62.9500; -54.3330 -62.8000; -55.2660 -62.9160; -56.8330 -62.9500; -62.0830 -63.4160; -55.0830 -61.2660; -64.1220 -64.7900; -60.7610 -62.9740; -64.3230 -64.7920; -64.0330 -64.8000; -60.8350 -62.9480; -110.5130 -66.2770; -27.4100 -56.3970; -163.3170 -66.8830; -27.3780 -56.3780; -26.9950 -56.7130;

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-56.2500 -37.2500; -55.7500 -37.2500; -57.7500 -38.2500; -57.2500 -38.2500; -56.7500 -38.2500; -61.7500 -39.7500; -60.7500 -39.7500; -60.2500 -40.2500; -62.2500 -41.2500; -64.0000 -54.5500; -65.2330 -54.6670; -75.0000 -52.9330; -65.0920 -54.8270; **26. *Campanularia hincksii*:** -48.5220 -27.1340; -57.4990 -38.0990; -57.4330 -38.0880; **27. *Campanularia hincksoni*:** 93.0150 -66.5489; **28. *Campanularia subantarctica*:** -62.2500 -41.7500; -67.7200 -49.2990; -67.7200 -49.2980; -69.7670 -53.4220; -70.2430 -53.6750; -69.6530 -53.4130; -64.6330 -54.7670; -70.9220 -53.6520; -70.9180 -53.6570; -70.9230 -53.6550; **29. *Campanularia tincta*:** -69.9250 -52.6833; **30. *Cladocoryne floccosa*:** -48.4790 -27.1342; -48.4810 -27.1466; -45.3490 -23.7460; -45.4310 -23.8310; **31. *Cladonema radiatum*:** -45.3970 -23.7280; **32. *Clathrozoella abyssalis*:** -60.6330 -58.4660; **33. *Clathrozoella medeae*:** -62.6080 -63.8420; -56.5170 -61.4170; -40.7330 -60.5750; **34. *Clytia hemisphaerica*:** -69.9617 -53.5383; **35. *Clytia gracilis*:** -43.1590 -22.9430; -42.0180 -22.9710; -44.6230 -23.0570; -45.4000 -23.7330; -45.4160 -23.8160; -45.3970 -23.7280; -45.4310 -23.8310; -45.3490 -23.7460; -44.8330 -23.3830; -45.1330 -23.5000; -45.1000 -23.5000; -45.2160 -23.5330; -45.1500 -23.5160; -46.3690 -23.9790; -45.2330 -23.8830; -45.3830 -23.7830; -45.4330 -23.8160; -45.0200 -23.7340; -44.8160 -23.4160; -44.8390 -23.3790; -48.4790 -27.1342; -48.4800 -27.1526; -48.4770 -27.1411; -48.5100 -27.2159; -48.5890 -26.9967; -48.4810 -27.1466; -48.4920 -27.1290; -48.5100 -27.2162; -48.5140 -27.1312; -48.6030 -26.7772; -48.6010 -26.7748; -48.6160 -26.1169; -48.5220 -27.2160; -48.5220 -27.1530; -48.5220 -27.9970; -48.3740 -28.0130; -48.3740 -27.1390; -48.3740 -27.1990; -48.4330 -27.2280; -48.5220 -27.1320; -48.8150 -28.7730; -48.7860 -28.5630; -49.7300 -29.3500; -49.7340 -29.3580; -49.7320 -29.3580; -44.6060 -23.2520; -41.8390 -22.7220; -41.8680 -22.7460; -43.9060 -22.9360; -44.1680 -23.1320; -43.2000 -23.0200; -44.4090 -23.0960; 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-44.8390 -23.3790; -53.7940 -34.4040; **38. *Clytia noliformis*:** -48.4810 -27.1466; -48.6030 -26.7772; -48.6010 -26.7748; -45.3030 -23.9100; -48.5380 -25.8435; -45.3490 -23.7460; -45.3970 -23.7280; **39. *Cordylophora caspia*:** -56.4466 -34.7920; **40. *Corymorpha januarii*:** -61.5000 -39.0700; -64.3200 -42.5200; -64.7100 -42.6400; **41. *Coryne eximia*:** -48.8150 -28.7730; -48.7860 -28.5630; -72.4150 -42.3800; -57.2500 -37.7500; -57.7500 -38.2400; -57.2500 -38.2500; -57.7500 -38.2500; -59.2500 -38.7500; -67.6330 -49.1560; -67.8440 -53.6880; -67.7200 -49.2990; -67.5740 -49.3140; -71.4920 -29.2070; -73.4040 -39.8280; **42. *Dentitheca bidentata*:** -48.5890 -26.9967; -48.3630 -25.7350; **43. *Diphasia digitalis*:** -44.3460 -23.1360; -44.3990 -23.0970; **44. *Diphasia tropica*:** -48.5220 -27.1420; -44.4090 -23.0960; -44.3460 -23.1360; **45. *Dynamena crisioides*:** -48.4920 -27.1290; -48.5140 -27.1312; -48.5220 -27.1956; -47.9100 -25.0650; -48.3110 -25.5735; -48.5910 -25.9776; -48.5360 -25.8511; -46.3880 -23.9750; -46.7500 -24.1660; -45.1000 -23.5000; -45.1500 -23.5160; -47.0000 -24.3830; -44.8820 -23.3510; -45.4000 -23.6330; **46. *Dynamena dalmasi*:** -48.5220 -27.1340; -48.4330 -27.2280; -41.9470 -22.8700; -44.4090 -23.0960; -44.3460 -23.1360; -44.3990 -23.0970; -40.8260 -22.3350; -37.5880 -22.3820; **47. *Dynamena disticha*:** -48.4790 -27.1342; -48.4770 -27.1411; -48.5140 -27.1312; -48.5890 -26.9967; -48.4810 -27.1466; -48.4920 -27.1290; -48.5100 -27.2162; -48.6130 -26.7738; -48.6030 -26.7772; -48.6010 -26.7748; -48.4640 -27.1400; -48.5220 -27.1340; -48.5220 -27.1530; -48.5220 -27.1320; -48.5220 -27.9970; -48.3740 -28.0130; -48.3740 -27.1620; -48.3740 -27.1990; -48.4640 -27.1900; -48.4640 -27.2230; -48.5220 -27.2160; -48.4330 -27.2280; -48.4330 -27.1430; -48.4640 -27.1390; -48.4340 -27.1450; -43.2000 -23.0200; -37.5880 -22.3820; -44.4090 -23.0960; -45.3030 -23.9100; -48.3110 -25.5735; -48.3630 -25.7350; -44.6410 -23.2290; -45.3970 -23.7280; -45.3490 -23.7460; -45.4310 -23.8310; -46.1160 -23.8500; -45.2160 -23.5330; -44.7830 -23.3660; -44.8160 -23.4160; -45.6660 -23.7660; -45.4000 -23.6330; -44.8390 -23.3790; -57.5120 -37.9720; -57.4990 -38.0990; -57.7500 -38.2500; **48. *Dynamena quadridentata*:** -48.4790 -27.1342; -48.5100 -27.2162; -48.5220 -27.9970; -44.4090 -23.0960; -48.3630 -25.7350; -45.3490 -23.7460; -44.8160 -23.4160; -45.6660 -23.7660; -45.4000 -23.6330; **49. *Ectopleura crocea*:** -48.5100 -27.2160; -48.5140 -27.1310; -48.6130 -26.7740; -48.6160 -26.1170; -48.7860 -28.7730; -48.8150 -28.7730; -49.7300 -29.3500; -49.7340 -29.3580; -49.7320 -29.3580; -48.3110 -25.5735; -48.5600 -25.8616; -48.5610 -25.8894; -48.4730 -25.7021; -48.5380 -25.8435; -43.1500 -22.9340; -46.7500 -24.1660; -46.7830 -24.1830; -46.3880 -23.9750; -46.3690 -23.9790; -46.9660 -24.3160; -47.0000 -24.3830; -47.9500 -25.0000; -47.9000 -25.0330; -47.1160 -24.4660; -55.7500 -34.7500; -57.2500 -37.7500; -57.7500 -38.2500; -59.2500 -38.7500; -68.7200 -50.2200; -67.6800 -52.2800; -67.6330 -49.1560; -67.7200 -49.2990; -67.5740 -49.3140; -68.3330 -50.1460; -54.1435 -34.6541; **50. *Ectopleura obypa*:** -45.3490 -23.7460; **51. *Eudendrium capillare*:** -45.3970 -23.7280; -45.000 -23.7500; -45.6660 -23.7660; **52. *Eudendrium caraiuru*:** -57.3900 -38.0200; -48.3220 -25.5837;

-47.9100 -25.0650; -47.9000 -25.0330; -45.4300 -23.8330; -45.4220 -23.8270; -45.4180 -23.8240; -45.4000 -23.8160; -45.4000 -23.6330; -45.3970 -23.7280; -45.3830 -23.7830; -45.2160 -23.5330; -45.1330 -23.5000; -44.8880 -23.3650; -44.3460 -23.1360; -44.2830 -23.1170; -43.1500 -22.9340; **53. *Eudendrium carneum*:** -48.7860 -28.1310; -48.7860 -28.1950; -48.7860 -28.5630; -48.5890 -26.9967; -48.5670 -27.6000; -48.5670 -27.4167; -48.5630 -25.8925; -48.5610 -25.8894; -48.5610 -25.8900; -48.5600 -25.8616; -48.5500 -27.1333; -48.5380 -27.4916; -48.5300 -25.8425; -48.5220 -27.1340; -48.5220 -27.1420; -48.5140 -27.1312; -48.5100 -27.2159; -48.5100 -27.2162; -48.4920 -27.1290; -48.4870 -25.5172; -48.4810 -27.1466; -48.4800 -27.1526; -48.4770 -27.1411; -48.4730 -25.7021; -48.4670 -27.4000; -48.3740 -27.1620; -48.3740 -27.1990; -48.3670 -27.4500; -48.3220 -25.5837; -48.3110 -25.5735; -47.0000 -24.3830; -46.3880 -23.9750; -46.3690 -23.9790; -46.1160 -23.8500; -45.4180 -23.8240; -45.4070 -23.8120; -45.4000 -23.8160; -45.3970 -23.7280; -45.3830 -23.8000; -45.3030 -23.9100; -45.1500 -23.5160; -45.1330 -23.5000; -45.1000 -23.5000; -44.8330 -23.3830; -44.4090 -23.0960; -44.3000 -23.0160; -44.1670 -23.1340; -41.9910 -23.0060; **54. *Eudendrium merulum*:** -48.5000 -27.7333; **55. *Eudendrium pocaruquarum*:** -45.3970 -23.7280; -45.4000 -23.7500; -45.0500 -23.4160; -44.8820 -23.3510; **56. *Eudendrium ramosum*:** -41.8390 -22.7220; -41.8680 -22.7460; -53.0830 -35.0000; -45.4180 -23.8240; -45.4000 -23.8160; -44.8330 -23.3830; -57.4330 -38.0800; -54.2500 -34.7500; -56.2500 -37.7500; -56.7500 -37.7500; -57.2500 -38.2500; -57.7500 -38.2500; -54.7500 -38.7500; -62.2500 -41.2500; **57. *Eudendrium tottoni*:** -64.1300 -64.8200; **58. *Eutima sapinhoa*:** -45.4260 -23.6540; -45.4310 -23.6820; -45.4120 -23.6270; **59. *Filellum antarcticum*:** -75.3000 -52.8670; **60. *Gonothyraea loveni*:** -57.5140 -38.0430; -57.7500 -38.2500; -58.5800 -38.4800; **61. *Grammaria abietina*:** -57.0830 -54.6670; -54.2500 -36.7500; -56.2500 -38.2500; -55.2500 -38.7500; **62. *Gymnangium allmani*:** -41.9470 -22.8700; **63. *Halecium antarcticum*:** -54.3330 -62.8000; **64. *Halecium beanii*:** -73.4040 -39.8280; -72.9230 -53.6550; -70.4000 -53.6580; -69.9800 -53.5650; -62.7320 -43.8410; -61.7500 -39.2500; -60.2500 -39.2500; -60.2500 -39.7500; -59.7500 -39.7500; -59.2500 -38.7500; -58.5800 -38.4800; -57.7500 -38.2500; -57.7500 -38.7500; -57.4990 -38.0990; -57.4330 -38.0800; -57.2500 -38.2500; -57.2500 -39.2500; -56.7500 -37.7500; -56.7500 -38.2500; -56.2500 -37.2500; -56.2500 -37.7500; -56.2500 -38.2500; -55.7500 -36.2500; -55.7500 -37.2500; -55.7500 -37.7500; -55.7500 -38.7500; -55.2500 -36.2500; -55.2500 -36.7500; -55.2500 -38.7500; -54.7500 -36.7500; -54.7500 -38.7500; -53.7500 -35.7500; -53.7500 -36.2500; -53.2500 -35.7500; **65. *Halecium bermudense*:** -48.4330 -27.1430; -40.8260 -22.3350; **66. *Halecium delicatulum*:** -57.8200 -62.1450; -54.7500 -61.2700; 170.3217 -72.2867; -35.5000 -77.6700; -55.3000 -63.3800; -64.0581 -64.7767; -70.4000 -53.6580; -44.4090 -23.0960; -45.0810 -23.5200; -57.0650 -38.1070; -55.2660 -62.9160; -59.9160 -63.2660; -54.1800 -36.6600; -57.7500 -38.2500; -68.3500 -54.6600; -67.6330 -49.1560; -68.2450 -54.8680; -67.7200 -49.2990; -75.3000 -52.8670; -67.0670 -53.1000; **67. *Halecium dichotomum*:** -48.3740 -27.1620; -52.7660 -35.1660; -45.0810 -23.5200; **68. *Halecium dyssymetrum*:** -48.4790 -27.1342; -48.4810 -27.1466; -48.5100 -27.2162; -48.6030 -26.7772; -48.4640 -27.1400; -48.5220 -27.1340; -48.5220 -27.1530; -48.5220 -27.1320; -48.5220 -27.9970; -48.4640 -27.1900; -48.4640 -27.2230; -48.5220 -27.2160; -48.4330 -27.2280; -44.4090 -23.0960; -45.3970 -23.7280; -45.1500 -23.5160; **69. *Halecium jaederholmi*:** -45.8883 -60.4417; 166.5667 -77.8467; -44.7500 -77.5300; 169.5000 -77.4500; 160.2500 -73.3200; 165.4420 -77.6880; -57.8200 -62.1300; -165.1170 -76.1500; -64.1200 -64.7917; 171.6670 -71.2670; 180.0000 -73.0830; -59.5330 -63.4330; **70. *Halecium lightbourni*:** -48.3740 -27.1620; -43.2000 -23.0200; **71. *Halecium ovatum*:** 3.0150 -66.5489; -61.8633 -62.7250; -64.0581 -64.7767; -64.1833 -65.2267; 171.5170 -71.2750; -61.7975 -63.7750; 176.8670 -73.0330; 177.1330 -72.4420; 170.4250 -72.3080; -173.1330 -75.8420; 171.6670 -71.2670; 110.4528 -66.3481; 172.1420 -72.0830; 174.9330 -76.5250; -66.7970 -54.9680; -58.8600 -62.2210; -71.5260 -29.2350; -71.4680 -29.2460; **72. *Halecium pallens*:** -163.0000 -77.6300; -60.8500 -63.3800; -54.4000 -62.2000; -44.7500 -77.5300; 166.0700 -77.5000; -35.5000 -77.6700; 170.3139 -72.2778; 160.2500 -73.3200; 170.5700 -72.3000; 170.3000 -72.2778; -44.6367 -60.5867; **73. *Halecium tenellum*:** -75.0000 -52.9330; -48.4800 -27.1526; -48.5100 -27.2159; -45.3030 -23.9100; -45.4310 -23.8310; **74. *Halopteris alternata***: -44.6230 -23.0570; -45.4000 -23.6330; -45.6660 -23.7660; **75. *Halopteris carinata*:** -46.7840 -26.7673; **76. *Halopteris constricta*:** -64.0100 -41.1300; -64.0100 -42.0300; **77. *Halopteris diaphana*:** -48.5890 -26.9967; -48.6010 -26.7748; -48.6010 -26.7748; -44.6320 -23.2330; -43.2010 -23.0360; -45.3970 -23.7280; -45.3970 -23.7280; -45.3970 -23.7280; -45.3970 -23.7280; -45.3970 -23.7280; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3970 -23.7280; -45.3970 -23.7280; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.4310 -23.8310; -45.4310 -23.8310; -45.3490 -23.7460; -45.3490 -23.7460; -45.3970 -23.7280; -45.3970 -23.7280; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -45.3490 -23.7460; -46.1160 -23.8500; -45.2160 -23.5330; **78. *Halopteris plumosa*:** -75.0000 -52.9330; -64.0670 -54.7820; -74.9670 -52.6670; **79. *Halopteris polymorpha*:** -48.5220 -27.1340; -48.4330 -27.2280; -48.4340 -27.1430; -41.9470 -22.8700; -44.4090 -23.0960; -44.3460 -23.1360; -48.3630 -25.7350; -45.0810 -23.5200; -68.2430 -53.1530; **80. *Halopteris tenella*:** -74.5250 -52.7150; **81. *Hartlaubella gelatinosa*:** -60.2500 -39.2500; -61.7500 -40.2500; -60.7500 -40.2500; -61.7500 -40.7500; -61.7500 -41.2500; -61.2500 -41.2500; -68.8690 -51.6070; **82. *Hebella scandens*:** -48.5140 -27.1312; -48.4920 -27.1290; -48.5100 -27.2162; -48.6160 -26.1169; -44.4090 -23.0960; -44.3990 -23.0970; -57.5120 -37.9720; -57.7500 -38.2500; **83. *Hebella striata*:** -70.9230 -53.6550; -69.8000 -53.5000; -64.0000 -54.5500; -66.5670 -52.7500; -65.0530 -54.9170; -70.2430 -53.6750; -69.7500 -53.5830; -69.7670 -53.4220; -69.6530 -53.4130; -64.0670 -54.7820; -68.5830 -52.4330; -70.9220 -53.6520; -70.9180 -53.6570; **84. *Hincksella cylindrica*:** -48.5220 -27.1340; -48.5220 -27.1960; -48.5220 -27.9970; -41.8680 -22.7460; -37.5880 -22.3820; **85. *Hybocodon chilensis*:** -67.8440 -53.6880; **86. *Hydractinia uniformis*:** -45.4120 -23.8510; **87. *Hydrodendron arboreum*:** -45.8883 -60.4417; -57.8483 -62.1442; **88. *Idiellana pristis*:** -48.3630 -25.7350; -48.3590 -25.5473; -47.9000 -25.0330; -45.0810 -23.5200; **89. *Lafoea coalescens*:** -37.5880 -22.3820; **90. *Lafoea dumosa*:** -69.1750 -67.8800; -45.8883 -60.4417; -54.7500 -61.2700; -61.8633 -62.7250; 170.3217 -72.2867; 170.3139 -72.2778; 170.3000 -72.2778; 93.0150 -66.5489; -61.8667 -62.7225; -64.0581 -64.7767; -74.5250 -52.7170; -69.9800 -53.5650; -70.9233 -53.6550; -62.2170 -63.4000; -64.1117 -64.7883; -56.1580 -61.3170; -64.1200 -64.7917; -62.6330 -63.4330; -49.4000 -31.0830; -53.3660 -36.0830; -55.6160 -38.3660; -56.5167 -51.3167; -59.9160 -63.2660; -62.0830 -63.4160; -59.5330 -63.4330; -62.3160 -63.4160; -53.7500 -35.7500; -54.2500 -36.7500; -57.2500 -38.2500; -56.2500 -38.2500; -55.7500 -38.7500; -55.2500 -38.7500; -54.7500 -38.7500; -68.2860 -54.8660; -68.2380 -54.8770; -68.2450 -54.8680; -68.2550 -54.8460; -64.0000 -54.6500; -64.8830 -54.9830; -57.0830 -54.6670; -63.8830 -52.5330; -58.7670 -54.0670; -58.7000 -54.0330; -66.8500 -53.2500; -64.0670 -54.7820; -70.9250 -53.6500; -70.9230 -53.6550; -70.9230 -53.6570; -64.0000 -54.5500; -75.3000 -52.8670; -63.8330 -54.8330; -63.5830 -53.9000; -75.0000 -52.9330; -63.8330 -54.6500; -75.0000 -52.9170; -64.1670 -54.8340; -65.8330 -54.5670; -66.7970 -54.9680; -72.1900 -52.5540; **91. *Lafoea gaussica*:** -35.5000 -77.6700;

92. *Lafoeina amirantensis*: -48.5890 -26.9967; -48.5100 -27.2162; -48.3740 -27.1990; -41.8680 -22.7460; -43.9060 -22.9360; -44.8160 -23.4160; -45.4120 -23.8270; -45.6660 -23.7660; **93. *Lovenella gracilis*:** -48.5140 -27.1312; **94. *Lytocarpia canepa*:** -54.7500 -38.7500; -55.7500 -39.2500; -55.5000 -39.4600; -55.7500 -40.2500; -57.2500 -41.2500; -54.1000 -41.2000; -66.3170 -56.1000; -59.6170 -53.1500; **95. *Lytocarpia tridentata*:** -48.3740 -28.0130; -48.3740 -27.1990; -45.3030 -23.9100; -46.3690 -23.9790; -45.0810 -23.5200; -44.8160 -23.4160; **96. *Macrorhynchia grandis*:** -41.9470 -22.8700; **97. *Macrorhynchia philippina*:** -48.4770 -27.1411; -48.5100 -27.2159; -48.5890 -26.9967; -48.4880 -26.1800; -48.3740 -27.1990; -48.4740 -27.2320; -48.3590 -25.5473; -48.3630 -25.7350; -45.3970 -23.7280; -45.3660 -23.6330; **98. *Mixoscyphus antarcticus*:** -61.8633 -62.7250; -60.8517 -62.9483; -60.8350 -62.9483; -60.6492 -62.6756; -60.5517 -62.7519; -60.5303 -62.6948; -60.4313 -62.0860; -60.4032 -62.6408; -60.3229 -62.4420; -60.3229 -62.4419; -55.3000 -63.3800; **99. *Monocaulus microrhiza*:** 166.5900 -77.8890; -11.6960 -71.0760; -26.3380 -74.7200; -55.9980 -75.2910; -22.6500 -73.7010; -62.0500 -64.4183; **100. *Monocaulus parvula*:** -55.2500 -63.5000; 166.1370 -78.0200; 92.9660 -66.5500; 92.9830 -66.0533; 93.0160 -66.5500; 93.0160 -66.0533; 72.1610 -68.4170; -52.6130 -76.5210; -27.7610 -75.2260; -49.4560 -76.8560; -53.0460 -76.4700; -52.1110 -76.5150; **101. *Monostaechas quadridens*:** -48.5220 -27.2160; -48.5220 -27.9970; -48.3740 -27.1990; -48.4330 -27.2280; -41.8390 -22.7220; -43.2000 -23.0200; -37.5880 -22.3820; -40.8260 -22.3350; -44.4090 -23.0960; -44.3990 -23.0970; -57.2500 -38.2500; **102. *Monotheca margaretta*:** -48.4790 -27.1342; -48.4800 -27.1526; -48.5100 -27.2159; -48.4810 -27.1466; -48.4920 -27.1290; -48.6030 -26.7772; -48.6010 -26.7748; -48.5220 -27.2160; -48.5220 -27.1420; -48.5220 -27.9970; -48.3740 -27.1620; -48.4640 -27.2230; -48.4330 -27.2280; -48.4330 -27.1430; -48.4640 -27.1390; -44.4090 -23.0960; -45.3030 -23.9100; -48.3160 -25.5722; -48.5610 -25.8894; -48.5360 -25.8511; -45.3490 -23.7460; -45.3970 -23.7280; -45.4310 -23.8310; -45.6660 -23.7660; **103. *Monotheca pulchella*:** -57.2850 -38.1000; -57.1520 -38.0780; -57.4330 -38.0800; -57.0650 -38.1070; -57.2500 -38.2500; -64.0000 -42.2000; **104. *Nemalecium lighti*:** -41.8680 -22.7460; -45.0320 -23.4580; -44.8880 -23.3650; -45.2180 -23.8240; -45.4180 -23.8240; **105. *Nemertesia antennina*:** -54.8500 -34.9210; -53.4660 -33.9330; -53.7830 -34.3330; -53.7500 -34.3330; -53.5320 -34.0440; -54.9570 -34.9700; **106. *Nemertesia cymodocea*:** -74.2170 -52.8500; -71.6000 -53.8500; **107. *Nemertesia ramosa*:** -46.7840 -26.7673; -55.5600 -40.0200; -63.1160 -42.5890; **108. *Nemertesia vervoorti*:** -64.1530 -54.9200; -59.3830 -53.1330; -64.0670 -54.7820; **109. *Obelia bidentata*:** -69.3100 -51.5200; -68.3330 -50.1460; -64.0000 -41.4000; -64.0000 -42.0000; -62.6200 -41.1500; -61.2500 -39.2500; -57.7500 -38.2500; -48.6030 -26.7772; -48.5750 -25.9294; -47.9100 -25.0650; -45.8883 -60.4417; -45.4000 -23.6330; -45.3970 -23.7280; -45.3490 -23.7460; -43.9060 -22.9360; **110. *Obelia dichotoma*:** -48.4790 -27.1342; -48.4800 -27.1526; -48.5100 -27.2159; -48.5140 -27.1312; -48.5890 -26.9967; -48.4810 -27.1466; -48.5100 -27.2162; -48.6030 -26.7772; -48.6010 -26.7748; -48.4990 -27.7486; -48.5340 -27.5710; -48.5220 -27.1340; -48.3740 -27.1620; -48.3740 -27.1990; -48.5220 -27.2160; -48.7860 -28.7730; -48.8150 -28.7730; -48.7860 -28.5630; -49.7300 -29.3500; -49.7320 -29.3580; -41.8380 -22.7220; -43.9060 -22.9360; -43.2000 -23.0200; -44.4090 -23.0960; -44.2830 -23.1170; -44.3460 -23.1360; -44.3990 -23.0970; -45.0320 -23.4580; -44.8880 -23.3650; -45.0520 -23.4270; -47.9100 -25.0650; -45.3030 -23.9100; -48.3110 -25.5735; -48.3170 -25.5735; -48.3160 -25.5711; -48.5600 -25.8616; -48.3630 -25.7350; -48.3220 -25.5837; -53.0830 -35.0000; -53.1000 -35.0000; -41.8670 -22.7460; -43.1580 -22.9430; -42.0180 -22.9710; -45.3490 -23.7460; -45.4310 -23.8310; -45.3970 -23.7280; -46.7500 -24.1660; -45.1000 -23.5000; -46.3780 -23.9690; -46.9660 -24.3160; -46.3760 -23.9690; -47.9000 -25.0330; -45.4000 -23.6330; -44.8650 -23.3560; -44.8160 -23.4160; -45.3660 -23.6330; -72.4150 -42.3800; -67.4430 -45.8600; -67.7200 -49.2990; -67.5290 -45.9000; -65.0000 -42.7670; -65.0090 -42.7720; -54.8500 -34.9210; -54.1660 -34.6760; -55.3540 -34.8070; -67.5740 -49.3140; -72.8230 -43.7030; -73.7490 -43.9010; -74.2070 -48.4880; -72.4460 -42.3740; -72.4450 -42.1630; -72.5870 -42.1550; -71.5260 -29.2550; -72.5920 -42.5320; -72.4300 -42.4670; -70.1780 -20.3450; -64.2650 -42.6190; -72.8950 -43.7640; -72.6050 -42.5380; -73.0440 -43.7710; -72.6300 -42.5130; -72.4500 -42.3340; -72.4340 -42.1650; -54.1416 -34.6523; **111. *Obelia geniculata*:** -48.4790 -27.1342; -48.5140 -27.1312; -48.4810 -27.1466; -48.5100 -27.2162; -48.6030 -26.7772; -48.6010 -26.7748; -48.6160 -26.1169; -48.8150 -28.7730; -48.3110 -25.5735; -48.5610 -25.8894; -48.5380 -25.8435; -45.3970 -23.7280; -45.4000 -23.6330; -71.6850 -33.0870; -65.0000 -42.6600; -68.7200 -50.2200; -67.6800 -52.2800; -67.5190 -46.4250; -68.2380 -54.8770; -67.4430 -45.8600; -68.2450 -54.8680; -68.3170 -54.8160; -67.7200 -49.2980; -67.5290 -45.9000; -67.5740 -49.3140; -65.8550 -47.7690; -66.7970 -54.9680; **112. *Obelia longissima*:** -90.5800 -68.7800; -55.0032 -61.2124; -60.2860 -38.9190; -57.4500 -38.1000; -57.4990 -38.0990; -57.0650 -38.1070; -57.4330 -38.0800; -57.3240 -38.0500; -60.0670 -38.8800; -55.7500 -36.2500; -55.2500 -36.2500; -54.7500 -36.2500; -54.7500 -36.7500; -57.7500 -38.2500; -57.2500 -38.2500; -56.7500 -38.2500; -61.1500 -38.5900; -59.2500 -38.7500; -57.7500 -38.7500; -61.2500 -39.2500; -60.7500 -39.2500; -61.7500 -39.7500; -61.2500 -39.7500; -60.7500 -39.7500; -61.7500 -40.2500; -64.0000 -42.0000; -54.1660 -34.6760; -68.4910 -50.0290; -68.8690 -51.6070; **113. *Orthopyxis caliculata*:** -67.7200 -49.2990; -67.6330 -49.1560; -67.5740 -49.3140; -67.4430 -45.8600; -53.5040 -33.8970; -48.6160 -26.1169; -48.6030 -26.7772; -48.5890 -26.9967; -48.5140 -27.1312; -48.4920 -27.1290; -48.4800 -27.1526; -48.4790 -27.1342; -48.3110 -25.5735; **114. *Orthopyxis crenata*:** -48.5140 -27.1312; -48.8150 -28.7730; **sp 115. *Orthopyxis hartlaubi*:** -64.1670 -54.8340; **116. *Orthopyxis sargassicola*:** -48.4810 -27.1466; -48.4640 -27.1390; **117. *Oswaldella antarctica*:** -56.5870 -64.2220; 110.4778 -66.2567; -69.1750 -67.8800; -45.8883 -60.4417; 110.5531 -66.2658; -35.5000 -77.6700; 93.0150 -66.5489; -90.5833 -68.7800; -56.9000 -64.2900; -58.5717 -62.2850; 171.6670 -71.2670; -56.6333 -64.3333; -55.7170 -61.3220; **118. *Oswaldella bifurca*:** -176.1670 -75.1750; 163.5500 -67.0170; 172.3670 -71.0580; 172.1420 -72.0830; 178.2250 -73.8250; -164.8080 -76.0750; 171.4000 -71.2000; -56.2520 -75.8200; -61.1300 -74.7400; -176.2167 -75.1667; 163.5500 -67.0333; 172.6333 -72.0500; 172.1500 -72.0833; -178.2167 -73.8167; -164.7667 -76.0667; 171.4000 -71.2000; **119. *Oswaldella billardi*:** 110.4692 -66.3540; 110.4989 -66.3660; -30.1383 -75.5250; -68.2720 -68.3910; 110.6917 -66.1778; 92.1667 -65.7000; 110.4678 -66.3536; -110.4972 -66.3650; -30.1333 -75.5167; **120. *Oswaldella blanconae*:** 172.1420 -72.0830; 172.1333 -72.0833; -61.9070 -63.3670; **121. *Oswaldella crassa*:** -57.8080 -62.6670; -57.8500 -62.6833; **122. *Oswaldella curiosa*:** -57.8080 -62.6670; -57.8500 -62.6833; **123. *Oswaldella delicata*:** -54.9300 -74.0000; -168.9920 -78.4000; -56.6167 -64.0500; -53.0600 -76.4600; -55.9800 -75.2800; -54.9333 -74.0000; -168.9833 -78.4000; -60.4032 -62.6408; -60.3864 -62.2022; **124. *Oswaldella elongata*:** -54.9100 -54.88970; -35.8040 -54.5600; -34.8270 -54.8970; -35.8040 -54.5600; **125. *Oswaldella encarnae*:** -45.2217 -77.9033; -53.0300 -76.4600; -55.9800 -76.5000; -45.2217 -77.9033; **126. *Oswaldella erratum*:** -54.9300 -74.0000; -54.7670 -62.6500; -54.7420 -62.6670; -54.7170 -62.6830; -27.0067 -56.7050; -64.1233 -64.7950; -56.0292 -62.6917; -59.2683 -63.5233; -44.2250 -60.8000; -35.5000 -77.6700; -63.4850 -64.8217; -67.3580 -65.6000; -63.4883 -64.7800; -64.1142 -64.7883; -64.1119 -64.7871; -64.1167 -64.8069; -64.1000 -64.7800; -8.6633 -70.4483; -8.0667 -70.5050; -30.5683 -76.6100; -13.0700 -71.2633; -26.9900 -75.2367; -29.5933 -74.6050; -29.2783 -74.6700; -19.8233 -72.7450;

-20.9900 -73.2833; -21.0650 -73.5800; -11.7700 -71.0800; -19.3000 -72.8600; -27.0200 -75.4600; -27.5600 -74.8400; -26.3600 -74.7400; -8.0800 -70.6300; -28.3800 -76.2170; 10.7450 -69.7280; -28.3800 -76.1267; 10.7450 -69.7283; -54.9333 -74.0000; -54.7667 -62.6500; -54.7500 -62.6667; -54.7167 -62.6833; -63.9260 -64.2650; -67.3167 -65.5833; -64.1233 -64.7883; -64.1217 -64.7900; -64.1167 -64.8070; -64.1000 -64.7833; 3.2350 -54.5010; 3.2250 -54.5260; -60.9682 -63.9541; -60.8665 -63.9745; -61.9170 -63.3670; **127. *Oswaldella frigida*:** -59.1900 -62.3167; -62.2420 -63.4250; -62.2500 -63.3833; -59.1900 -62.3167; **128. *Oswaldella garciacarrascosai*:** -52.6300 -76.5200; -52.1500 -76.5000; **129. *Oswaldella gracilis*:** -55.9800 -75.2800; **130. *Oswaldella grandis*:** -60.8350 -62.9733; -60.8517 -62.9483; -60.8217 -62.9400; -55.3000 -63.3800; -50.6733 -76.8750; -50.6733 -76.8667; -52.3017 -76.6200; -49.8100 -76.9400; -49.4300 -76.8500; -53.0600 -76.4600; -60.8350 -62.9483; -60.8167 -62.9350; -59.9853 -62.8778; -58.3917 -62.0833; -60.6573 -63.0572; -60.4323 -62.0860; -60.4378 -62.0236; -55.5670 -61.0170; 131. Oswaldella herwigi: -75.0000 -52.9330; -59.4580 -53.1080; -59.3670 -53.1250; -59.1420 -53.7750; -75.0000 -52.9340; -59.5167 -53.0830; -59.3833 -53.1340; -59.1500 -53.6830; **132. *Oswaldella incognita*:** -62.2170 -63.4000; -60.8217 -62.9400; -62.6630 -64.1950; -61.0417 -62.7200; -55.6480 -60.8340; -55.7170 -61.3220; -62.6600 -64.2017; -62.2333 -63.4000; -44.6000 -58.7333; -60.8167 -62.9350; -61.0417 -62.7167; -57.1667 -62.9667; -58.3917 -62.0833; -60.2839 -62.3903; -60.4007 -62.4031; -60.4032 -62.6408; -60.4493 -62.7264; -60.6437 -62.6594; -60.6492 -62.6756; -60.6557 -62.9477; -60.5517 -62.7529; -163.2347 -66.9214; -162.7617 -66.6808; -163.0044 -66.5517; **133. *Oswaldella laertesi*:** 170.9747 -71.2067; 171.3086 -71.5414; **134. *Oswaldella medeae*:** 178.9750 -74.0000; 178.2250 -73.8250; -54.7150 -62.6830; -54.7167 -62.6833; 178.8833 -74.0167; -178.2167 -73.8167; **135. *Oswaldella monomammilata*:** -54.7420 -62.6670; -54.7500 -62.6667; **136. *Oswaldella niobae*:** -59.9853 -62.8778; **137. *Oswaldella obscura*:** -21.7500 -73.6900; -49.4300 -76.8500; -22.2340 -74.1500; -7.0517 -70.3100; **138. *Oswaldella rigida*:** -13.9717 -71.3983; -12.1567 -71.6467; -19.3000 -72.8600; -19.5000 -73.4340; -27.0200 -75.4600; -21.7500 -73.6900; -8.8000 -70.6300; -28.3800 -76.1270; -7.0517 -70.3100; **139. *Oswaldella shetlandica*:** -59.1900 -62.3167; -58.5767 -62.2950; -58.7717 -62.3433; -59.1080 -62.0170; -62.6630 -64.1950; -62.6750 -64.1580; -62.2170 -63.4000; -61.0417 -62.7200; -63.4258 -64.7776; -64.2000 -65.2333; -62.5600 -64.2358; -64.1167 -64.8069; -61.8842 -63.3142; -62.1500 -63.2800; -58.6000 -61.8480; -58.9950 -61.9050; -58.6350 -61.7900; -58.9350 -62.3260; -59.0833 -62.0333; -62.6600 -64.2017; -63.0000 -64.1500; -62.2333 -63.4000; -44.6000 -58.7333; -58.5767 -62.2917; -61.0417 -62.7167; -58.7567 -62.3417; -63.4417 -64.7750; -63.5383 -64.2350; -64.1167 -64.8070; -61.8917 -63.3083; -62.1500 -63.2833; -58.3917 -62.0833; -54.2667 -62.5000; -62.3167 -63.4167; -60.6437 -62.6594; -60.6557 -62.9477; -60.3279 -62.3403; -60.3881 -62.2022; -60.7008 -62.6650; -61.9170 -63.3670; -62.0000 -63.3670; **140. *Oswaldella stepanjantsae*:** 177.1330 -72.4420; 170.6830 -71.3670; 110.4778 -66.2567; 110.5396 -66.2964; 110.5244 -66.2657; 110.4372 -66.3360; 110.4988 -66.2646; -54.7170 -62.6830; 168.2830 -76.1670; -173.1330 -75.8500; -173.1330 -75.8420; -56.1500 -62.6580; -62.2420 -63.4250; 163.3200 -66.8800; -56.0292 -62.6917; -11.6900 -71.0800; -8.0800 -70.6300; 110.5342 -66.2950; 110.5192 -66.2656; 110.4333 -66.3375; 110.4989 -66.2631; -54.7167 -62.6833; 168.2833 -76.1667; -173.1333 -75.8333; 177.0667 -72.4500; 170.7167 -71.3667; -56.1667 -62.6500; -62.2500 -63.4333; 163.3167 -66.8833; **141. *Oswaldella terranovae*:** 170.7790 -71.2760; **142. *Oswaldella tottoni*:** -54.7500 -61.2700; -55.3000 -63.3800; -54.7170 -62.6830; 164.2000 -76.9340; -12.2033 -71.1467; **143. *Oswaldella vervoorti*:** -63.7800 -64.8300; -58.7717 -62.3433; -56.1830 -62.6920; -59.1080 -62.0170; -62.6630 -64.1950; -62.6750 -64.1580; -59.1900 -62.3167; -57.9733 -62.1067; -64.1000 -64.7800; -56.6167 -64.0500; -56.1667 -62.7000; -59.0833 -62.0333; -63.7833 -64.8333; -62.6600 -64.2017; -63.0000 -64.1500; -44.6000 -58.7333; -58.5767 -62.2917; -58.7567 -62.3417; -64.1000 -64.7833; -60.6950 -62.6433; 3.9230 -54.3750; -60.2839 -62.3903; -60.6952 -62.6438; -60.3864 -62.2022; **144. *Parascyphus repens*:** -64.0100 -42.0300; -67.6330 -49.1560; -67.7200 -49.2990; -64.0000 -54.5500; -69.6530 -53.4130; -75.0000 -52.9330; -64.1670 -54.8340; -66.3330 -53.6670; -64.0000 -54.6500; -70.9180 -53.6470; **145. *Parawrightia robusta*:** -48.6160 -26.1169; -49.7300 -29.3500; **146. *Pennaria disticha*:** -48.5620 -27.1229; -48.6130 -26.7738; -48.6030 -26.7772; -44.2830 -23.1170; -48.3110 -25.5735; -48.5610 -25.8894; -48.4730 -25.7021; -48.5910 -25.9776; -48.3630 -25.7350; -44.3000 -23.0160; -45.4180 -23.8240; -46.1160 -23.8500; -46.3690 -23.9790; -45.1330 -23.5000; -47.0000 -24.3830; -47.9000 -25.0330; -47.0000 -24.4000; -44.8590 -23.4160; -44.8390 -23.3790; -45.1160 -23.7230; -45.6660 -23.7660; **147. Phialella belgicae:** -74.2070 -48.4880; -73.7490 -43.9010; -72.6290 -42.0750; -69.6530 -53.4130; -68.2450 -54.8680; -68.2430 -53.1530; -67.8440 -53.6880; -67.5740 -49.3140; -67.4430 -53.9220; -65.0000 -42.7670; -60.2500 -39.2500; -60.2500 -39.7500; -57.7500 -38.2500; -55.3000 -63.3800; 166.5667 -77.8467; 169.5000 -77.4500; **148. *Phialella chilensis*:** -56.7500 -35.2500; -53.7500 -35.7500; -56.2500 -38.2500; -65.0000 -42.7670; -65.0090 -42.7720; -75.0000 -52.9170; -70.9230 -53.6550; **149. *Plumularia floridana*:** -43.2000 -23.0200; -47.9000 -25.0330; **150. *Plumularia insignis*:** -55.2500 -35.2500; -55.7500 -35.7500; -54.7500 -38.7500; -50.5100 -43.5500; -54.1000 -41.2000; **151. *Plumularia setacea*:** -69.9800 -53.5650; -70.9233 -53.6550; -48.5100 -27.2162; -48.5220 -27.1320; -48.5220 -27.9970; -47.9500 -29.3810; -51.7000 -33.2660; -43.2000 -23.0200; -55.2340 -34.9030; -52.7660 -35.1660; -57.2850 -38.1000; -57.3240 -38.0500; -57.5350 -38.0800; -57.5140 -38.0430; -64.4420 -42.9300; -55.7500 -34.7500; -52.7500 -35.2500; -53.7500 -35.7500; -53.2500 -35.7500; -55.0000 -36.4500; -55.7500 -36.2500; -55.2500 -36.2500; -57.0000 -37.0000; -56.2500 -37.2500; -57.2500 -37.7500; -56.7500 -37.7500; -56.2500 -37.7500; -57.5000 -38.1500; -57.7500 -38.2500; -57.2500 -38.2500; -56.7500 -38.2500; -59.2500 -38.7500; -57.7500 -38.7500; -61.1500 -38.5900; -61.7500 -39.2500; -61.2500 -39.2500; -60.2500 -39.2500; -61.7500 -39.7500; -60.7500 -39.7500; -62.6000 -41.1000; -64.0000 -41.5000; -64.0000 -42.2000; -68.7200 -50.2200; -62.7320 -42.8410; -67.5190 -46.4250; -65.8760 -47.7620; -70.9230 -53.6550; -75.0000 -52.9170; -75.0000 -52.9330; -64.1530 -54.9200; -70.9180 -53.6570; -74.9670 -52.6670; -67.5740 -49.3140; -68.3330 -50.1460; -68.8690 -51.6070; -67.4430 -53.9220; -72.4340 -42.1650; -71.5260 -29.2550; -71.6140 -33.0350; -64.2650 -42.6190; -70.4090 -23.6420; -71.6000 -33.0250; -71.5260 -29.2350; -73.7470 -44.0140; -72.6560 -41.6720; -71.5540 -29.1890; -73.8950 -48.6070; -71.5350 -29.2500; -71.4680 -29.2460; **152. *Plumularia strictocarpa*:** -48.4810 -27.1466; -48.6010 -26.7748; -44.8880 -23.3650; -47.9100 -25.0650; -45.3030 -23.9100; -53.1000 -35.0000; -65.5170 -46.7840; -44.2850 -23.0250; -45.4310 -23.8310; **153. *Pycnotheca mirabilis*:** -48.4790 -27.1342; -48.5100 -27.2159; -48.4810 -27.1466; -48.6010 -26.7748; -48.3740 -28.0130; -48.3740 -27.1620; -48.3740 -27.1990; -45.3030 -23.9100; **154. *Rhizogeton nudus*:** -57.7500 -38.2400; **155. *Salacia desmoides*:** -48.4640 -27.1400; -48.5220 -27.1340; -48.5220 -27.2160; -48.5220 -27.1530; -48.5220 -27.1420; -48.5220 -27.1320; -48.5220 -27.9970; -48.4640 -27.1900; -48.4330 -27.2280; -48.4330 -27.1430; **156. *Scandia mutabilis*:** -48.5140 -27.1312; -44.8880 -23.3650; -48.3110 -25.5735; **157. *Schizotricha anderssoni*:** -35.9783 -54.3600; -35.5983 -54.5117; -35.8300 -54.9317; -37.7167 -54.1967; -37.6850 -54.1967; -42.0500 -53.4500; -41.2500 -53.8500; -35.9200 -55.1200; -34.8000 -55.1700; -35.0500 -54.8500; -34.9500 -54.7800; 170.3217 -72.2867; **158. *Schizotricha crassa*:** -54.7170 -62.6830; -27.0067 -56.7050; -27.3983 -56.2000; -45.1500 -62.1000; **159.**

Schizotricha falcata: -58.7830 -63.2250; -63.4258 -64.7776; **160. *Schizotricha jaederholmi***: -35.5983 -54.5117; **161. *Schizotricha multifurcata***: -26.7383 -57.0200; -26.6830 -59.0670; **162. *Schizotricha nana***: -54.7670 -62.6500; -54.7170 -62.6830; 171.6670 -71.2670; 179.0500 -73.0700; 177.1330 -72.4420; -27.0067 -56.7050; -27.0450 -56.7433; -27.4100 -56.3967; -27.3783 -56.3783; -27.5000 -56.2667; 170.3217 -72.2867; 170.3000 -72.2778; 110.4372 -66.3360; -54.7420 -62.6670; 172.1420 -72.0830; 165.8000 -77.1500; -56.8330 -62.9500; **163. *Schizotricha southgeorgiae***: 110.5396 -66.2964; **164. *Schizotricha trinematotheca***: 162.8000 -66.6580; **165. *Schizotricha turqueti***: -56.5170 -61.4170; 171.6670 -71.2670; 168.2830 -76.1670; 179.1800 -74.1000; 177.1330 -72.4420; 171.4000 -71.2000; -26.4450 -57.6567; -56.1580 -61.3170; -59.1080 -62.0170; -44.5580 -58.8170; -60.8350 -62.9733; -60.8517 -62.9483; -58.5767 -62.2950; -64.1233 -64.7617; -60.8083 -62.9283; -60.8217 -62.9400; -60.8233 -62.9517; -60.8150 -62.9633; -63.4258 -64.7776; -26.6830 -59.0670; -54.8000 -61.2467; -55.3000 -63.3800; -45.9200 -60.4800; -61.8633 -62.7250; 165.8000 -77.1500; -57.8080 -62.6670; -58.7717 -62.3433; **166. *Schizotricha unifurcata***: -42.1000 -53.6000; -54.4000 -62.2000; **167. *Schizotricha vervoorti***: -129.7830 -54.8420; -62.2170 -63.4000; -62.1330 -63.4330; -60.5575 -63.0539; -58.5767 -62.2950; -90.5800 -68.7800; **168. *Sertularella antarctica***: -74.9420 -52.6330; -74.0835 -43.4096; -71.4920 -52.6370; -69.9250 -52.6833; -68.4330 -52.3990; -68.2550 -54.8460; -68.2160 -52.7660; -67.8440 -53.6880; -67.7200 -49.2990; -66.8400 -55.3480; -66.6950 -55.0240; -66.6950 -55.0246; -66.3430 -55.0000; -66.3330 -53.6670; -65.2300 -54.6670; -65.0920 -54.8270; -64.6330 -54.7670; -64.4870 -54.8470; -64.4630 -54.8200; -64.4470 -54.8330; -64.2330 -74.7220; -64.1590 -54.7580; -64.0670 -54.7820; **169. *Sertularella areyi***: -48.5220 -27.1340; -48.5220 -27.2160; -48.5220 -27.1530; -48.5220 -27.1320; -48.5220 -27.9970; -48.4330 -27.1430; -44.3460 -23.1360; -44.3990 -23.0970; **170. *Sertularella argentinica***: -59.5800 -43.8783; -62.9500 -54.2000; **171. *Sertularella conica***: -70.9250 -53.6567; -48.4790 -27.1342; -48.5100 -27.2162; -41.9470 -22.8700; -57.7500 -38.2500; -57.2500 -38.2500; -56.2500 -38.2500; -75.3000 -52.8670; -66.3170 -56.1000; -64.1530 -54.9200; -74.9670 -52.6670; -71.6990 -33.3480; **172. *Sertularella cruzensis***: -70.9739 -53.7817; -57.1834 -39.9334;

173. *Sertularella fuegonensis*: -70.9183 -53.6567; -73.2760 -52.1620; -68.5830 -52.4330; -64.1670 -54.8340; -59.5170 -53.0830; -71.5540 -29.1890; -65.6050 -63.4550; **174. *Sertularella gaudichaudi***: -74.1250 -52.8580; -64.7000 -54.3670; -59.4170 -58.1000; -67.0000 -51.5830; -57.1500 -54.6500; -63.8830 -52.5330; -66.3170 -56.1000; -70.9180 -53.6570; -68.4670 -52.5330; -66.2830 -55.7830; -56.9830 -54.6830; -57.0830 -54.6670; -71.5260 -29.2350; -71.6990 -33.3480; -58.8600 -62.2210; -57.5047 -38.0268; -64.9743 -42.7545; -66.6950 -55.0246; -67.3567 -54.9100; -66.3434 -55.0000; -64.7140 -54.8730; -66.8400 -55.3480; -65.6050 -53.4550; -66.5160 -51.3160; -53.7500 -35.7500; -57.7500 -38.2500; -57.2500 -38.2500; -56.2500 -38.2500; -55.7500 -38.7500; -55.2500 -38.7500; -62.2500 -41.7500; -67.6330 -49.1560; -68.4100 -50.1170; -67.6330 -49.1560; **175. *Sertularella gayi***: -74.1580 -52.8830; -74.5250 -52.7170; -74.1250 -52.8580; -75.3420 -52.9000; -62.6080 -63.8420; -56.1580 -61.3170; -56.1500 -62.6580; -73.7160 -43.8830; -72.6565 -41.6726; -72.4680 -42.3910; -72.4520 -42.1720; -75.0510 -48.8250; -75.3840 -49.1900; -74.8980 -48.6070; -75.0000 -52.9170; -70.9230 -53.6550; -64.0000 -54.5500; -71.6000 -53.8500; -64.7000 -54.3670; -65.0530 -54.9170; -66.3330 -53.6670; -66.2000 -54.4500; -64.0670 -54.7820; -63.8830 -52.5330; -63.9880 -54.8330; -68.4670 -52.5330; -70.2430 -53.6750; -69.7500 -53.5830; -63.8330 -54.6500; -57.0830 -54.6670; -75.0000 -52.9330; -64.3400 -54.9170; -63.8330 -54.8330; -75.3000 -52.8670; -72.5910 -42.1620; -64.3300 -42.3280; -55.0334 -52.0334; -58.1670 -50.9000; -63.7500 -44.9667; -58.1667 -50.9000; -67.3334 -54.6834; -66.6667 -54.1667; -63.8500 -53.9334; **176. *Sertularella jorgensis***: -74.2070 -48.4880; -52.1330 -54.1500; -56.6170 -54.7170; -66.3170 -56.1000; -63.8830 -52.5330; -57.0830 -54.6670; -63.8330 -54.8330; -74.9670 -52.6670; -75.3000 -52.8670; -64.4000 -54.9650; **177. *Sertularella leiocarpa***: -47.9500 -29.3880; **178. *Sertularella mixta***: -71.5265 -29.2551; **179. *Sertularella polyzonias***: -70.4167 -53.8217; -53.3660 -35.7160; -65.8330 -54.5670; -66.3330 -53.6670; -64.0670 -54.7820; -64.6780 -54.7930; -66.5670 -52.7500; -64.1530 -54.9200; -71.4920 -52.6370; -72.1900 -52.5540; -71.5540 -29.1890; -71.4680 -29.2460; -62.6667 -64.1667; -66.6950 -55.0246; -61.9167 -63.3667; **180. *Sertularella robusta***: -75.1280 -50.4630; -67.0670 -53.1000; -69.6530 -53.4130; -70.9250 -53.6500; -70.9230 -53.6550; -64.0000 -54.5500; -69.8000 -53.5000; -66.5670 -52.7500; -63.5830 -53.9000; -68.5830 -52.4330; -66.3330 -53.6670; -64.1670 -54.8340; -64.0000 -54.6500; -70.2430 -53.6750; -65.0920 -54.8270; -66.2000 -54.4500; -70.9180 -53.6470; -69.7670 -53.4220; -70.9180 -53.6570; -64.7390 -54.7380; -68.4670 -52.5330; -69.7500 -53.5830; -66.2830 -55.7830; -63.8330 -54.6500; -70.9220 -53.6520; -74.9670 -52.6670; -68.2500 -53.3000; -65.2330 -54.6670; -71.5260 -29.2550; -66.6950 -55.0246; -64.4000 -55.1160; -67.3340 -54.6830; -64.1500 -42.0500; -64.7140 -54.8730; -65.8330 -47.7570; **181. *Sertularella sanmatiasensis***: -62.5000 -63.2830; -55.2660 -62.9160; -58.1000 -42.2167; **182. *Sertularella striata***: -57.3900 -38.0200; -57.4990 -38.0990; -57.3240 -38.0500; -57.2270 -38.0880; -57.0650 -38.1070; -57.5120 -37.9720; -53.7500 -35.7500; -55.7500 -36.2500; -55.2500 -36.2500; -53.7500 -36.2500; -55.7500 -36.7500; -55.2500 -36.7500; -56.2500 -37.2500; -57.7500 -38.2500; -57.2500 -38.2500; -57.7500 -38.7500; -62.2500 -41.2500; -61.7500 -41.2500; -62.2500 -41.7500; -63.1160 -42.5890; -54.1436 -34.6295; **183. *Sertularella tenella***: -70.9183 -53.6567; -48.4640 -27.1400; -48.5220 -27.2160; -48.4330 -27.2280; -48.4340 -27.1450; -48.5220 -27.1320; -48.5220 -27.9970; -49.5250 -31.1280; -48.6660 -31.3330; -37.5880 -22.3820; -44.4090 -23.0960; -55.2340 -34.9030; -53.1000 -35.0000; -53.3660 -36.0830; -55.6160 -38.3660; -51.7620 -32.2500; -67.6330 -49.1560; -67.8440 -53.6880; -67.7200 -49.2990; -67.5190 -46.4250; -59.5500 -43.5830; -57.5686 -38.1672; -64.5179 -41.6240; **184. *Sertularella vervoorti***: -57.3000 -41.3834; **185. *Sertularia distans***: -48.4790 -27.1342; -48.4810 -27.1466; -48.5100 -27.2162; -48.6010 -26.7748; -48.6160 -26.1169; -48.5220 -27.1340; -48.5220 -27.1530; -48.5220 -27.2160; -48.5220 -27.9970; -48.5220 -27.1320; -37.5880 -22.3820; -45.0320 -23.4580; -45.3030 -23.9100; -48.3110 -25.5735; -48.5380 -25.8435; -45.3970 -23.7280; -45.4310 -23.8310; -45.3490 -23.7460; -46.3880 -23.9750; -45.2160 -23.5330; -46.9660 -24.3160; -47.0000 -24.3830; **186. *Sertularia loculosa***: -48.5220 -27.1340; -48.5220 -27.9970; -44.4090 -23.0960; -48.3110 -25.5735; -45.3970 -23.7280; -45.4310 -23.8310; -45.3490 -23.7460; -45.6660 -23.7660; -45.4000 -23.6330; -44.8160 -23.4160; **187. *Sertularia marginata***: -48.4800 -27.1526; -48.4770 -27.1411; -48.5100 -27.2159; -48.5140 -27.1312; -48.5890 -26.9967; -48.4810 -27.1466; -48.4920 -27.1290; -48.5100 -27.2162; -48.6030 -26.7772; -48.6160 -26.1169; -48.4640 -27.1900; -43.2000 -23.0200; -44.4090 -23.0960; -44.3990 -23.0970; -45.0320 -23.4580; -45.3030 -23.9100; -48.3110 -25.5735; -48.5610 -25.8894; -48.5360 -25.8511; -48.4730 -25.7021; -48.3630 -25.7350; -44.6230 -23.0570; -45.3970 -23.7280; -45.3970 -23.7460; -46.3880 -23.9750; -46.7830 -24.1830; -46.3690 -23.9790; -45.1000 -23.5000; -45.2160 -23.5330; -46.9660 -24.3160; -47.0000 -24.3830; -47.0000 -24.4000; -47.1160 -24.4660; -44.8330 -23.3830; -44.8820 -23.3510; -44.8160 -23.4160; -44.8650 -23.3500; -45.6660 -23.7660; -44.8650 -23.3560; -44.8390 -23.3790; **188. *Sertularia rugosissima***: -48.6010 -26.7748; -48.3110 -25.5735; -45.6660 -23.7660; **189. *Sertularia tumida***: -48.5100 -27.2162; -48.3630 -25.7350; **190. *Sertularia turbinata***: -48.4790 -27.1342; -48.4800 -27.1526; -48.5220 -27.1956; -48.4770 -27.1411; -48.5140 -27.1312; -48.5890 -26.9967; -48.4810 -27.1466; -48.4920 -27.1290; -48.6010

-26.7748; -44.4090 -23.0960; -44.2830 -23.1170; -44.3460 -23.1360; -44.3990 -23.0970; -48.3630 -25.7350; -44.6410 -23.2290; -45.3970 -23.7280; -45.3490 -23.7460; -45.4310 -23.8310; -45.1000 -23.5000; -44.8390 -23.3790; -45.5160 -23.8330; -44.8160 -23.4160; -45.4000 -23.6330; -45.6660 -23.7660; -45.5080 -23.8600; **191. *Silicularia rosea*:** -67.8440 -53.6880; -68.5830 -52.4330; -67.5740 -49.3140; -65.8550 -47.7690; **192. *Staurodisarsia reesi*:** -64.9500 -40.7400; **193. *Staurotheca abyssalis*:** -58.8670 -55.9080; -56.4170 -56.9333; -59.0000 -55.9000; **194. *Staurotheca affinis*:** -35.8540 -54.7070; **195. *Staurotheca amphorophora*:** -42.1000 -53.6000; -41.5700 -53.7200; -39.3700 -53.9000; -38.1800 -54.5200; -39.3670 -54.4840; -42.1000 -53.6000; -41.5670 -53.8000; -39.3670 -53.9000; -38.1840 -54.5170; **196. *Staurotheca antarctica*:** -179.9500 -76.0350; -178.2167 -73.8167; -173.1333 -75.8333; -173.1330 -75.8500; -173.1330 -75.8420; -164.8080 -76.0750; -164.7667 -76.0667; -163.4667 -76.3833; -163.4580 -76.3830; -73.4500 -52.8330; -70.3333 -67.2333; -70.3300 -67.2300; -66.7833 -66.3617; -66.7725 -66.3567; -64.1233 -64.7883; -64.1200 -64.7917; -64.1192 -64.7917; -64.1167 -64.8069; -64.1167 -64.8070; -64.1142 -64.7883; -64.1000 -64.7800; -64.1000 -64.7833; -62.8811 -64.8811; -62.6330 -63.4330; -62.6080 -63.8420; -60.8500 -63.3800; -57.1120 -64.4620; -53.1000 -76.7667; -53.0500 -76.8667; -52.3000 -76.6167; -52.2500 -76.8333; -50.6500 -76.8667; -50.3500 -77.5667; -49.7167 -77.4167; -44.3933 -61.3067; -36.6420 -54.2320; -35.5790 -54.9080; -35.5000 -77.6700; -27.0333 -75.7667; -26.6000 -75.2333; -19.8167 -72.7333; -19.5000 -73.4333; -13.2333 -71.2000; -12.5667 -71.0833; -12.3500 -71.6500; -12.2833 -71.1333; -12.2000 -71.1333; -11.3167 -71.6000; -4.9333 -70.4000; 5.1333 -69.9667; 6.3167 -69.9500; 10.7333 -69.7167; 93.0150 -66.5489; 110.4597 -66.3490; 110.4667 -66.3480; 166.5833 -77.8370; 166.5847 -77.8372; 168.2830 -76.1670; 168.2833 -76.1667; 170.1830 -74.5170; 170.3300 -72.2000; -170.4250 -72.3080; 172.3670 -72.0580; 172.6333 -72.0500; 178.2250 -73.8250; 178.2330 -75.9750; 178.3670 -76.0330; **197. *Staurotheca australis*:** 5.7667 -69.9667; 10.7333 -69.7167; **198. *Staurotheca compressa*:** -54.7420 -62.6670; -54.7170 -62.6830; -27.2750 -56.2170; 162.9580 -66.6170; -27.3167 -56.3950; -27.5000 -56.2667; -56.1500 -62.6580; -62.6330 -63.4330; -62.6630 -64.1950; -62.1330 -63.4330; -60.5575 -63.0539; -61.7975 -63.7750; -62.6300 -64.7000; 165.8700 -74.6500; -26.9950 -56.7133; -27.5833 -56.2600; -62.2420 -63.4250; -62.2170 -63.4000; 163.3200 -66.8800; -58.8767 -63.2300; -62.6080 -63.8420; -54.3330 -62.8000; -55.0830 -61.2660; -54.7500 -62.6667; -54.7167 -62.6833; -27.2500 -56.2333; 162.9333 -66.6333; -56.1667 -62.6500; -62.6167 -63.4500; -62.6600 -64.2017; -62.2500 -63.4333; -62.2333 -63.4000; -62.1667 -63.4333; -60.5500 -63.0667; -61.8083 -63.7550; -62.6333 -64.7000; 163.3167 -66.8833; 165.8667 -74.6500; -54.8167 -63.0167; -59.5333 -63.4333; -62.0833 -63.4167; -62.3167 -63.4167; -60.2709 -62.4354; -60.3913 -62.4102; -60.4493 -62.7264; -60.6334 -62.9613; -60.6573 -63.0572; -60.9956 -63.9523; -60.8665 -63.9745; -60.6544 -62.6870; -164.5256 -67.2764; -54.8180 -61.2000; -55.2780 -61.5020; -56.0350 -61.1380; -55.9480 -61.0840; -54.7010 -61.0570; -55.7170 -61.3220; -57.9670 -61.8500; -58.7470 -61.8320; -58.6000 -61.8480; -58.9950 -61.9050; -58.8970 -62.0150; -59.3200 -61.8600; -61.1350 -62.8050; -141.8930 -66.5710; -57.0000 -60.0000; **199. *Staurotheca cornuta*:** -56.4580 -61.3330; -56.5170 -61.4170; -45.0933 -60.5933; -55.7170 -61.3220; -57.3870 -61.6600; -56.4670 -61.3170; -56.5000 -61.4170; -45.0930 -60.5930; **200. *Staurotheca densa*:** -54.7420 -62.6670; -54.7170 -62.6830; 179.0500 -73.0700; -56.1500 -62.6580; -60.7972 -62.9393; -63.4258 -64.7776; 170.4250 -72.3080; -54.7500 -62.6667; -54.7167 -62.6833; 170.4333 -72.3000; -56.1667 -62.6500; -60.7833 -62.9310; -63.4417 -64.7750; -60.9682 -63.9541; -163.9431 -67.4231; -58.9950 -61.9050; **201. *Staurotheca dichotoma*:** -37.6170 -53.8580; 178.2250 -73.8250; -173.1330 -75.8500; -36.5133 -54.0933; -26.4450 -57.6567; -27.4100 -56.3967; -42.1000 -53.6000; -41.2500 -53.8500; -34.8000 -55.1700; -63.6625 -64.8650; -63.2500 -64.8417; -54.7500 -61.2700; -61.8633 -62.7250; -64.1833 -65.2267; -56.1500 -62.6580; -63.6667 -64.8667; -56.1580 -61.3170; 178.3670 -76.0330; -8.1167 -70.4833; -29.6833 -74.6000; 10.7333 -69.7167; 9.8667 -69.7667; 6.3167 -69.9500; -37.6340 -53.8500; -178.2167 -73.8170; -173.1333 -75.8340; -36.5140 -54.0940; -26.4450 -57.6570; -27.4100 -56.3970; -34.8000 -55.1670; -63.6667 -64.8670; 3.2350 -54.5010; 3.2250 -54.5260; -90.5972 -68.9436; -90.5994 -68.9458; -90.8264 -68.8361; -90.6936 -68.7033; -90.3542 -68.8347; -90.3514 -68.8364; -42.1230 -53.3890; -35.2820 -54.9440; -34.8270 -54.8970; -35.4570 -54.5200; -59.7970 -62.2470; -60.6970 -63.0170; -59.3770 -61.9750; -59.6250 -62.1680; -46.7670 -60.8830; -36.8120 -54.5300; **202. *Staurotheca echinocarpa*:** 69.9670 -49.1240;

203. *Staurotheca frigida*: 110.4989 -66.3660; -37.6170 -53.8580; 172.3670 -72.0580; 172.1420 -72.0830; 172.5080 -72.0080; -164.8080 -76.0750; -36.5133 -54.0933; -35.9783 -54.3600; -35.5983 -54.5117; -26.7383 -57.0200; -27.0067 -56.7050; -27.4100 -56.3967; -27.3783 -56.3783; -35.7567 -55.1467; -35.8300 -54.9317; -36.8117 -54.5317; -37.3967 -54.8433; -37.7167 -54.1967; -37.6850 -54.1967; -37.6683 -54.2067; -37.6067 -54.1983; -37.9033 -54.2350; -42.1000 -53.6000; -41.5700 -53.7200; -41.6800 -53.8000; -41.7000 -53.9200; -41.2500 -53.8500; -39.4700 -53.8800; -38.6800 -54.1000; -38.1800 -54.5200; -37.4000 -54.4700; -34.6300 -55.1800; -34.8000 -55.1700; -35.2200 -54.7200; -35.8200 -54.6500; -35.6500 -54.4700; -38.0500 -53.9200; -38.7000 -53.9700; -46.4217 -60.4267; -46.3850 -60.4633; -44.4350 -61.3283; -44.3933 -61.3067; -44.3900 -61.3017; -8.6500 -70.4333; -22.2500 -74.1500; -12.1500 -71.1333; 8.0000 -69.9833; -6.1167 -70.4000; 110.4972 -66.3650; -37.6340 -53.8500; 172.6333 -72.0500; 172.1333 -72.0833; 172.5500 -72.0167; -164.7667 -76.0667; -36.5140 -54.0940; -35.9780 -54.3600; -35.5980 -54.5000; -26.7380 -57.0200; -36.8120 -54.5320; -37.3970 -54.8440; -37.7170 -54.1970; -37.6850 -54.1970; -37.6680 -54.2070; -37.6070 -54.1980; -37.9030 -54.2350; -41.5670 -53.8000; -41.6830 -53.8000; -41.7000 -53.9170; -39.4670 -53.8830; -38.6840 -54.1000; -38.1840 -54.5170; -37.4000 -54.4670; -34.6340 -55.1840; -34.8000 -55.1670; -35.2170 -54.7170; -35.8170 -54.6500; -35.6500 -54.4670; -38.0500 -53.9170; -67.3170 -65.5840; -46.4210 -60.4270; -46.3850 -60.4630; -44.4350 -61.3280; -44.3940 -61.3070; -44.3900 -61.3020; -60.9682 -63.9541; -35.5800 -54.9940; -36.0180 -55.1400; -34.6920 -55.0680; -34.9720 -55.1700; -34.8270 -54.8970; -34.9870 -54.1770; -35.8040 -54.5600; -35.6450 -54.5400; -44.4000 -60.8180; **204. *Staurotheca glomulosa*:** 110.5396 -66.2964; 110.4989 -66.3660; 162.8000 -66.6580; 172.3670 -72.0580; 176.8670 -73.0330; -176.8250 -77.6670; -164.8080 -76.0750; -70.0830 -66.0000; -37.6767 -54.0017; -36.5133 -54.0933; -35.5983 -54.5117; -27.0067 -56.7050; -35.8300 -54.9317; -37.7167 -54.1967; -37.6683 -54.2067; -37.9033 -54.2350; -56.1580 -61.3170; -62.6330 -63.4330; -37.4000 -54.4700; -64.1792 -65.2217; -64.1142 -64.7883; 163.3200 -66.8800; -64.2000 -65.2333; -44.4350 -61.3283; -44.3933 -61.3067; -20.9167 -73.6833; -24.3667 -74.0333; -55.6333 -60.8333; -20.7500 -73.3500; -13.4500 -71.2000; -53.0500 -76.8667; -22.2500 -74.1500; -12.1500 -71.1333; -12.0167 -71.4167; -11.3167 -71.6000; -22.2333 -74.1500; -4.9333 -70.4000; 10.7333 -69.7167; 11.8000 -69.9500; 5.1333 -69.9667; 3.9333 -70.0000; 110.5342 -66.2950; 110.4972 -66.3650; 162.8000 -66.6667; 172.6333 -72.0500; 176.9000 -73.0333; -176.8333 -77.6667; -164.7667 -76.0667; -70.0833 -65.9667; -37.6770 -54.0010; -36.5140 -54.0940; -35.5980 -54.5120; -27.0060 -56.7050; -35.8300 -54.9320; -37.7170 -54.1970; -37.6680 -54.2070; -37.9030 -54.2350; -56.1500 -61.3000; -62.6170 -63.4500; -37.4000 -54.4670; -64.1833 -65.2267; -64.1233 -64.7883; 163.3167 -66.8833; -44.4350 -61.3280; -44.3940 -61.3070; -60.2512 -62.3937; -60.4032 -62.6408; -60.4323 -62.0860; **205. *Staurotheca jaederholmi*:** -75.0000 -52.9330; -66.6750 -53.3250;

-75.3420 -52.9000; -94.6670 -61.4500; -64.7330 -53.9080; -64.0050 -54.5670; -64.1667 -54.8342; -75.0000 -52.9340; -75.3000 -52.8670; -94.9670 -61.4500; -66.8500 -53.2500; -63.5830 -53.9000; -64.0000 -54.5500; -64.1670 -54.8340; -58.0670 -50.6670; **206. *Staurotheca multifurcata*:** -37.6767 -54.0017; -35.9783 -54.3600; -35.7567 -55.1467; -37.7167 -54.1967; -37.6850 -54.1967; -37.6683 -54.2067; -37.6067 -54.1983; -41.5700 -53.7200; -37.8800 -54.1800; -34.5000 -54.9000; -34.9500 -54.7800; -35.2200 -54.7200; -34.9720 -55.1700; -37.6770 -54.0010; -35.9780 -54.3600; -35.7570 -55.1470; -37.7170 -54.1970; -37.6850 -54.1970; -37.6680 -54.2070; -37.6070 -54.1980; -41.5670 -53.8000; -37.8840 -54.1840; -34.9500 -54.7840; -35.2170 -54.7170; -35.8540 -54.7070; -35.2820 -54.9940; -35.0380 -55.1270; -35.6450 -54.5400; -35.4570 -54.5200; -26.8200 -59.0000; -26.6350 -58.9650; **207. *Staurotheca nonscripta*:** 170.4250 -72.3080; 170.1830 -74.5170; -168.9920 -78.4000; -173.1330 -75.8500; 170.6830 -71.3670; -67.3000 -53.9000; 166.3250 -77.7017; 164.6200 -74.6917; 165.8700 -74.6500; -35.5000 -77.6700; -8.6500 -70.4333; -55.6333 -60.8333; -12.5667 -71.0833; -12.2833 -71.1333; -61.2167 -75.2333; -3.2667 -70.3167; 10.7333 -69.7167; 6.3167 -69.9500; 3.9333 -70.0000; 170.4333 -72.3000; 170.1667 -74.5000; -169.0000 -78.4000; -173.1333 -75.8333; 170.7167 -71.3667; 164.6167 -75.6917; 165.8667 -74.6500; **208. *Staurotheca pachyclada*:** -56.5870 -64.2220; -54.7420 -62.6670; -54.7170 -62.6830; -175.9080 -75.1330; 172.3670 -72.0580; 172.1420 -72.0830; 170.7170 -60.1330; -164.8080 -76.0750; 170.6830 -71.3670; 171.4000 -71.2000; -27.3167 -56.3950; -62.2420 -63.4250; -8.1167 -70.4833; -12.2833 -71.1333; -27.9333 -75.4000; -22.2500 -74.1500; -12.1500 -71.1333; -12.0167 -71.4167; -54.7500 -62.6667; -54.7167 -62.6833; -175.9667 -75.1500; 172.6333 -72.0500; 172.1333 -72.0833; 172.4667 -72.0000; -164.7667 -76.0667; 170.7167 -71.3667; -27.3170 -56.3950; -62.2500 -63.4340; -60.2709 -62.4354; -60.4617 -62.7353; -60.9682 -63.9541; -160.8917 -67.4139; -160.8931 -65.4211; -54.8580 -61.0570; -55.7170 -61.3220; -58.7470 -61.8320; **209. *Staurotheca plana*:** -13.4500 -71.2000; -7.0500 -70.3000; **210. *Staurotheca polarsterni*:** -24.3667 -74.0333; -12.3500 -71.6500; -13.2333 -71.2000; -13.4500 -71.2000; -12.5667 -71.0833; -12.2833 -71.1333; -19.5000 -73.4333; -34.2000 -74.4833; -28.3667 -76.1167; 2.1000 -69.9667; 10.7333 -69.7167; 8.0000 -69.9833; 11.8000 -69.9500; 3.9333 -70.0000; -60.6591 -63.0593; **211. *Staurotheca profunda*:** -55.5000 -54.7170;

212. *Staurotheca stolonifera*: -8.0667 -70.5000; **213. *Staurotheca tubifera*:** -59.5330 -63.4330; -58.2500 -63.5500; **214. *Staurotheca undosiparietina*:** -37.6170 -53.8580; -39.3420 -54.5000; -35.8300 -54.9317; -42.1000 -53.6000; -41.6800 -53.8000; -39.2500 -54.1500; -38.6800 -54.1000; -34.9500 -54.7800; -35.8200 -54.6500; -36.8500 -53.7300; -34.5500 -54.9300; -38.5750 -54.6580; -36.8750 -53.6000; -55.6333 -60.8333; -37.6340 -53.8500; -39.3670 -54.4840; -35.8300 -54.9320; -38.6840 -54.1000; -34.9500 -54.7840; -35.8170 -54.6500; -36.8500 -53.7340; -34.5500 -54.9340; -38.6340 -54.6840; -36.8500 -53.6000; -59.9853 -62.8778; -41.9700 -53.4030; -41.7530 -53.7280; -41.0010 -53.6380; -41.1120 -53.6700; -38.3280 -54.1450; -37.7200 -54.3750; -36.5920 -53.7850; -35.2820 -54.9440; -55.9480 -61.0840; -54.6120 -61.0740; -55.8640 -61.0880; -58.0120 -61.7880; -59.6250 -62.1680; -57.9820 -61.7750; -36.8120 -54.5300; **215. *Staurotheca vanhoeffeni*:** -54.7420 -62.6670; -54.7170 -62.6830; 172.3670 -72.0580; -56.1500 -62.6580; 72.9580 -53.0830; -8.0667 -70.5000; -12.1500 -71.6333; -12.2833 -71.1333; -3.2667 -70.3167; 8.0000 -69.9833; -54.7500 -62.6667; -54.7167 -62.6833; 172.6333 -72.0500; 72.9670 -53.0670; -56.1670 -62.6500; -60.5244 -62.7289; -60.9956 -63.9523; -60.9682 -63.9541; -54.6120 -61.0740; -58.0120 -61.7880; -58.9950 -61.9050; **216. *Staurotheca vervoorti*:** -55.8830 -53.9580; -48.9500 -53.0500; -55.5000 -54.7170; -55.9000 -53.9500; -58.9670 -53.0670; -33.7170 -54.0840; **217. *Stegella lobata*:** -67.2833 -67.8778; -68.2720 -68.3910; -60.8500 -63.3800; 160.2500 -73.3200; -35.5000 -77.6700; 93.0150 -66.5489; -64.0581 -64.7767; -62.7409 -64.7494; -64.0867 -64.7767; 178.3670 -76.0330; -55.0830 -61.2660; **218. *Stegolaria irregularis*:** -54.9000 -61.2700; 176.8670 -73.0330; -57.1520 -38.0780; -55.7500 -40.2500; -71.6140 -33.0350; -71.5430 -29.2340; -71.5340 -29.2590; **219. *Symplectoscyphus anae*:** 174.9330 -76.5250; -56.4500 -62.8830; -60.4160 -63.7330; **220. *Symplectoscyphus bathyalis*:** -52.1330 -54.1500; -64.8830 -54.9830; **221. *Symplectoscyphus curvatus*:** -54.7500 -61.2700; -56.4500 -62.8830; -62.3160 -63.4160;

222. *Symplectoscyphus exochus*: -45.8883 -60.4417; -62.3160 -63.4160; -55.2660 -62.9160; -75.0000 -52.9330; **223. *Symplectoscyphus flexilis*:** -62.2500 -45.7500; **224. *Symplectoscyphus frigidus*:** -75.0000 -52.9170; -58.7670 -54.0670; **225. *Symplectoscyphus glacialis*:** -68.2720 -68.3910; 101.2200 -65.4200; -163.0000 -77.6300; 110.4778 -66.2567; -59.2683 -63.5233; -44.9633 -61.0100; -60.2567 -63.5567; -57.8200 -62.1450; -54.7500 -61.2700; -61.8633 -62.7250; 170.3217 -72.2867; -68.5000 -68.5000; 166.5667 -77.8467; 169.5000 -77.4500; 170.3300 -72.2000; -35.5000 -77.6700; 166.4300 -77.7700; 160.2500 -73.3200; -13.5300 -71.3000; 170.3000 -72.2778; 93.0150 -66.5489; 95.3300 -66.2500; -62.6080 -63.8420; -64.0581 -64.7767; -56.5870 -64.2220; -64.0500 -64.7760; -64.0581 -64.7750; -69.7500 -53.5800; -70.4000 -53.6580; -69.9800 -53.5650; -74.5250 -52.7170; -70.9183 -53.6567; -70.4167 -53.8217; -75.0000 -52.9330; -70.9233 -53.6550; -70.9250 -53.6567; -70.9217 -53.6517; -175.4500 -74.6420; 172.0000 -71.6330; -58.7830 -63.2250; 171.6670 -71.2670; 175.4500 -72.4500; 174.9330 -76.5250; -61.7975 -63.7750; -60.7950 -62.9717; -64.1100 -64.7867; -56.1500 -62.6580; 177.1330 -72.4420; -62.8811 -64.8811; -58.5717 -62.2850; 170.4250 -72.3080; -56.1580 -61.3170; -58.5617 -62.2850; -46.3933 -60.4317; -62.6330 -63.4330; -175.0250 -74.1000; -173.1330 -75.8420; 110.4972 -66.3650; 177.6500 -73.3670; 177.6000 -77.8670; 168.2830 -76.1670; 178.9750 -74.0000; 172.3670 -72.0580; 168.2800 -74.5300; 178.3670 -76.0330; 172.1420 -72.0830; 110.6917 -66.1778; -54.9160 -61.0330; -56.4500 -62.8830; -55.8660 -61.1330; -58.3830 -62.0830; -62.5000 -63.2830; -59.5330 -63.4330; -56.3330 -62.9500; -54.3330 -62.8000; -55.2660 -62.9160; -62.3160 -63.4160; -54.2670 -62.5000; -54.8160 -63.0160; -59.9160 -63.2660; -59.9160 -61.0330; -176.1830 -73.9670; -72.5870 -42.1550; -72.1900 -52.5540; -58.8600 -62.2210; -72.8330 -43.0170; -72.4430 -42.1620; -72.6050 -42.5380; -68.9890 -51.6050; -72.6610 -42.5360; -71.4920 -52.6370; **226. *Symplectoscyphus interruptus*:** -70.9739 -53.7817; **227. *Symplectoscyphus leloupi*:** -74.0809 -43.4175; -57.0830 -54.6670; **228. *Symplectoscyphus liouvillei*:** 175.4500 -72.4500; **229. *Symplectoscyphus magellanicus*:** -53.3660 -36.0830; -65.2330 -54.6670; -75.0000 -52.9330; -7.3000 -53.9000; -75.3000 -52.8670; -63.8330 -54.6500; -64.0000 -54.5500; -65.0530 -54.9170; -68.4670 -52.5330; -70.2430 -53.6750; -63.8830 -52.5330; -65.8330 -54.5670; -63.5830 -53.9000; -74.9670 -52.6670; -68.8690 -51.6070; **230. *Symplectoscyphus milneanus*:** -70.1750 -52.6333; -69.9250 -52.6833; -64.0100 -41.1300; -67.8440 -53.6880; -67.7200 -49.2990; -67.6330 -49.1560; -68.4100 -50.1170; -65.0530 -54.9170; -75.3000 -52.8670; -64.8830 -54.9830; -64.7000 -54.3670; -66.3330 -53.6670; -68.5830 -52.4330; -74.9670 -52.6670; -67.5740 -49.3140; -68.8690 -51.6070; -74.1417 -51.0417; **231. *Symplectoscyphus naumovi*:** 110.4778 -66.2567; -60.8500 -63.3800; -57.8200 -62.1450; 170.3217 -72.2867; -35.5000 -77.6700; **232. *Symplectoscyphus nesioticus*:** -69.1750 -67.8880; -60.7972 -62.9393; 175.4500 -72.4500; -56.1500 -62.6580; -62.6080 -63.8420; -62.3160 -63.4160; **233. *Symplectoscyphus paraglacialis*:** -68.2170 -53.2830; -65.0530 -54.9170; **234. *Symplectoscyphus paulensis*:** -35.5000 -77.6700; **235. *Symplectoscyphus plectilis*:** -63.2500 -64.8417; 166.5667 -77.8467; 169.5000 -77.4500; 160.2500 -73.3200; -64.0581 -64.7767; -175.4500 -74.6420; 171.6670

-71.2670; -64.1833 -65.2267; -64.1100 -64.7867; 177.1330 -72.4420; -62.6330 -63.4330; -62.8811 -64.8811; -173.1330 -75.8420; 168.2830 -76.1670; 177.6500 -73.3670; -59.9160 -63.2660; -55.2660 -62.9160; -62.8240 -64.2440; **236. *Symplectoscyphus sofiae*:** -44.9633 -61.0100; -54.4000 -62.2000; -53.1700 -63.9700; -35.5000 -77.6700; 101.2200 -65.4200; -68.2720 -68.3910; -60.1700 -63.0800; **237. *Symplectoscyphus subdichotomus*:** -73.7083 -53.0167; -69.9250 -52.6833; -47.9500 -29.3810; -56.1160 -38.0660; -53.7500 -35.7500; -53.2500 -35.7500; -52.7500 -35.7500; -53.7500 -36.2500; -54.7500 -36.7500; -54.2500 -36.7500; -56.0000 -37.5500; -55.7500 -37.7500; -57.7500 -38.2500; -57.2500 -38.2500; -56.7500 -38.2500; -56.2500 -38.2500; -55.2500 -38.7500; -60.7500 -40.2500; -58.7000 -42.7000; -68.7200 -50.2200; -63.1160 -42.5890; -62.8210 -42.7860; -67.6330 -49.1560; -68.2380 -54.8770; -67.8440 -53.6880; -68.2450 -54.8680; -59.5500 -43.5830; -69.6530 -53.4130; -69.8000 -53.5000; -65.2330 -54.6670; -75.0000 -52.9330; -7.3000 -53.9000; -75.3000 -52.8670; -63.8330 -54.6500; -64.0000 -54.5500; -65.0530 -54.9170; -70.9180 -53.6570; -70.9220 -53.6520; -68.4670 -52.5330; -64.0000 -54.6500; -56.9830 -54.6830; -70.9230 -53.6550; -66.3330 -53.6670; -70.2430 -53.6750; -69.7670 -53.4220; -69.7500 -53.5830; -70.9180 -53.6470; -172.6330 -72.0500; -57.0830 -54.6670; -67.0670 -53.1000; -59.5170 -53.0830; -70.4000 -53.6830; -70.9250 -53.6500; -59.3830 -53.1330; -64.3050 -54.7880; -64.1670 -54.8340; -66.3170 -56.1000; -63.8830 -52.5330; -64.0670 -54.7820; -64.1530 -54.9200; -65.8330 -54.5670; -63.5830 -53.9000; -65.0920 -54.8270; -68.2500 -53.3000; -66.2830 -55.7830; -64.0000 -54.6170; -70.9230 -53.6570; -66.2000 -54.4500; -56.1830 -61.2670; -68.2170 -53.2830; -64.9500 -53.5330; -65.2580 -54.7970; -57.1500 -54.6500; -68.5830 -52.4330; -74.9670 -52.6670; -67.5740 -49.3140; -68.3330 -50.1460; -66.7970 -54.9680; **238. *Symplectoscyphus vanhoeffeni*:** 93.0150 -66.5489; -61.8633 -62.7250; **239. *Symplectoscyphus vervoorti*:** -59.5170 -53.0830; **240. *Synthecium protectum*:** -73.7083 -53.0167; -69.9250 -52.6833; -63.5830 -53.9000; -65.0920 -54.8270; -55.7500 -35.7500; -53.7500 -36.2500; -54.7500 -36.7500; -54.2500 -36.7500; -57.7500 -38.2500; -57.2500 -38.2500; -56.7500 -38.2500; -56.2500 -38.2500; -63.2830 -42.4680; -63.1160 -42.5890; -62.7320 -42.8410; -62.4430 -43.0350; **241. *Synthecium tubithecum*:** -37.5880 -22.3820; **242. *Thuiaria polycarpa*:** -71.5260 -29.2350; -71.6140 -33.0350; -71.5540 -29.1890; **243. *Thyroscyphus marginatus*:** -44.4090 -23.0960; -44.3990 -23.0970; **244. *Thyroscyphus ramosus*:** -44.8880 -23.3650; -45.4330 -23.6160; -45.3660 -23.8330; -45.4070 -23.8120; -45.1000 -23.5000; -45.1330 -23.5000; -45.0810 -23.5200; -45.1220 -23.5250; **245. *Tulpa tulipifera*:** -59.5170 -53.0830; -64.1530 -54.9200; -56.6170 -54.7170; -56.9830 -54.6830; -63.8830 -52.5330; -50.5100 -43.5500; -54.1000 -41.2000; **246. *Turritopsis nutricula*:** -48.5890 -26.9967; -48.5140 -27.1312; -48.6030 -26.7772; -43.9060 -22.9360; -43.2000 -23.0200; -44.8880 -23.3650; -45.0320 -23.4580; -42.0180 -22.9710; -44.6230 -23.0570; -45.4310 -23.8310; -45.3490 -23.7460; -47.9000 -25.0330; -47.0000 -24.4000; **247. *Ventromma halecioides*:** -48.4810 -27.1466; -48.5140 -27.1312; -48.6030 -26.7772; -48.4990 -27.7486; -48.3740 -27.1620; -48.4330 -27.1430; -44.6060 -23.2520; -43.1590 -22.9430; -45.3970 -23.7280; -45.3490 -23.7460; -47.9500 -25.0000; -47.9000 -25.0330; -66.8500 -53.2500; -71.5540 -29.2230; **248. *Zygophylax sibogae*:** -40.0000 -22.5000; **249. *Zyzzyzus warreni*:** -48.5100 -27.2159 -45.4210 -23.8230 -45.4330 -23.8270 -45.4230 -23.8230 -45.4400 -23.8270 -45.4120 -23.8230 -45.4260 -23.8370

Capítulo 4. Southern Ocean areas of endemism: a reanalysis using benthic hydroids (Cnidaria, Hydrozoa)

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ABSTRACT

The biogeographic history of the Southern Ocean (SO) fauna is complex and poorly studied, especially the areas of endemism. We reanalyzed the data of Marques & Peña Cantero (2010), along with other geographical records of endemic benthic hydroids below 45ºS. A Parsimony Analysis of Endemicity (PAE) based on 5º latitude by 5º longitude matrix with 61 species resulted in eight areas of endemism. We discuss these results in the context of different hypotheses of the evolution of the SO fauna and previously proposed biogeography patterns.

SHORT COMMUNICATION

Marine polar regions are often considered to have low biodiversity, a pattern generally thought to be associated with extreme abiotic factors (Clarke & Crame, 1992). However, several studies on biodiversity, biogeography and paleontology of polar regions (*e.g.*, Beu et al., 1997; Clarke & Johnston, 2003; Adey et al., 2008) revealed greater than expected biodiversity, particularly for the Southern Ocean (SO; *viz.*, Clarke & Johnston, 2003).

The SO is a unique oceanographic system in which the Antarctic Circumpolar Current (ACC) dominates (Barker & Thomas, 2004) and moves around the southern seas with no continental barriers. The ACC originated with the opening of the Drake Passage (*ca.* 30 Ma), thereby causing biogeographically and thermal isolation of the SO (Lawver & Gahagan, 2003). This, in turn, contributed to the isolation and development of endemic marine fauna (Clarke & Crame, 1989; Beu et al., 1997; Barker & Thomas, 2004; Clarke et al., 2004).

On the other hand, there are historical similarities of the Antarctic fauna to those from northern regions (Cañete et al., 1999; Yasuhara et al., 2007; Kaiser et al., 2011), mainly in the Antarctic Peninsula and the subantarctic region of South America (Clarke & Johnston, 2003; Clarke et al., 2005). The connection between both continents is through the Scotia Arc, and since it will have influenced dispersal of their marine fauna, we may question exactly how isolated was the SO (Clarke et al., 2005).

Thus, several hypotheses have been proposed to explain the origin of the SO fauna: (H1) evolution *in situ*, (H2) derivation from adjacent deep-water basins, (H3) dispersal from South America through the Scotia Arc, and (H4) dispersal from Antarctica through the Scotia Arc (*cf.*, Knox & Lowry, 1977). These not mutually-independent hypotheses are partially supported by fauna and geography and have been contrasted with abiotic factors of the SO (*viz.*, Beu et al., 1997; Cañete et al., 1999; Yasuhara et al., 2007; Kaiser et al., 2011).

Theoretical and practical frameworks concerning areas of endemism (*cf.* Harold & Mooi, 1994; Morrone, 1994; Szumik et al., 2002) are complicated in marine biogeography. The tridimensional nature of the marine realm, the dynamics of currents and

oceanic fronts, the difficulties to establish thresholds in ecophysiological continuums and the amazingly diverse strategies of dispersal, all make for a unique definition of areas, or "volumes," of endemism (see Miranda & Marques, 2011). Clearly, this will also be an issue in the SO, and in which few studies examine the origin and evolution of all marine organisms, not just endemics (*e.g.*, Clayton, 1994; Brandt, 1999; Clarke et al., 2004).

The hydroids – benthic hydrozoans of the orders Anthoathecata and Leptothecata (*cf.* Marques & Collins, 2004; Collins et al., 2006) – provide an example with many endemics in the SO (Peña Cantero, 2012). For example, a Parsimony Analysis of Endemicity (PAE) for the endemic SO genus *Oswaldella* (a single study using strict endemicity analysis) suggested four areas of endemism: (1) Magellanic Zone, (2) Antarctic Peninsula Zone, (3) Western High Antarctica Zone and (4) Eastern High Antarctica Zone (Marques & Peña Cantero, 2010). In another PAE for the SO, we used additional geographic data of endemic benthic hydroids to test previous hypotheses and to better understand the biogeography of the SO. We used a matrix of 5° latitude by 5° longitude and geographic records of 61 species of the genera *Antarctoscyphus*, *Mixoscyphus*, *Oswaldella* and *Staurotheca* (Table 1). PAE was carried out following Marques & Peña Cantero (2010), but using semistrict consensus trees. Eight areas of endemism were found for the SO, concentrated in the Magellan region, the Antarctic Peninsula, the subantarctic islands, the Ross Sea, the Weddell Sea and Wilkes Land (Figures 1, 2).

Areas I, II and V (Figures 1, 2) are similar to the previously mentioned Magellanic and Antarctic Peninsula zones (Marques & Peña Cantero, 2010). These areas began with the ACC as a system of deep eastward currents connecting the Magellan region and Scotia Arc to the Weddell Sea, Queen Maud Land and Wilkes Land (Beu et al., 1997; Lawver & Gahagan, 2003; Marques & Peña Cantero, 2010). These currents caused dispersal towards Queen Maud Land (Marques & Peña Cantero, 2010), thereby supporting the third hypothesis of a South American origin for the SO fauna (Knox & Lowry, 1977). Areas of endemism I, III, V and VI (Figures 1, 2) coincide with the Scotia Arc of Marques & Peña Cantero (2010), and may be a transitional region for dispersal events of species distributed both in the Antarctic Peninsula and in the Magellan region (Peña Cantero et al., 1997; Peña Cantero & Vervoort, 2003, 2004 – except the monotypic genus *Mixoscyphus*, which is exclusively in Antarctica (*cf.* Peña Cantero & Vervoort, 2005). These areas support the previously mentioned third and fourth hypotheses (Knox & Lowry, 1977). Nonetheless, this does not refute the hypothesis that vicariance influenced the isolation of the Magellanic (*e.g.*, area V, Figures 1, 2) from the Antarctic Peninsula (areas I and II, Figures 1, 2). Thus, evolution *in situ* (hypothesis H1) may have also occurred with a fauna derived from the adjacent deepwater basin (hypothesis H2; *cf.* Knox & Lowry, 1977). Other areas of endemism (I, IV, VI to VIII; Figures 1, 2) coincide with the Western High Antarctica Zone and Eastern High Antarctica Zone (Marques & Peña Cantero, 2010), and may be due to variations in depth, present oceanic currents and paleocurrents of the SO (Marques & Peña Cantero, 2010).

These results are coherent in part with ecological areas based on earlier informal biogeographic analyses (Hedgpeth, 1969; Briggs, 1974; Spalding et al., 2007). But, these results agree completely with previously hypothesized areas of endemism (Marques & Peña Cantero, 2010, *cf.* their Figure 2), but now with more detail and defined subregions of those areas. These subregions suggest specific microhabitats for the benthic hydroid fauna of the SO that may be derived from dispersal or vicariant events.

If dispersal, then this suggests the formation of microhabitats, as a consequence of different strategies of larvae transportation, such as rafting of incrusting biota (*e.g.*, on algae, wood) and oceanographic mechanisms (*e.g.*, vortices and oceanic fronts). Both of these mechanisms are important for transportation of subantarctic/Antarctic plankton and benthos (including larvae of benthic or epipelagic organisms) along the southern polar region. If vicariance, historical and ecological barriers may have involved continental drift and climatic changes over time. Nevertheless, vicariance does not imply the absence of dispersal in the formation of the SO benthic hydroid fauna.

Considering the evolutionary history of the SO, an important question to be answered is how important were the intensity and periodicity of changes in sea level and ice (both in extent and quantity) in causing the depth and occupation of habitats along the Antarctic continental shelf (Clarke & Crame, 1989; Clarke et al., 2004). These phenomena influence marine areas of endemism because they contribute to the formation of new habitats and the availability of ecological niches, which in turn may alter the geographic distribution of the species. The SO biota has a complex evolutionary history associated with dispersal, vicariance and subsequent processes of oceanic restructuring. The use of different data sets and multiple evolutionary hypotheses will increase the explanatory power for understanding the peculiar processes leading to endemism and biogeographic patterns in the SO realm.

References

Adey, W.H., Lindstrom, S.C., Hommersand, M.H. & Müller, K.M. 2008. The biogeographic origin of Arctic endemic seaweeds: a thermogeographic view. Journal of Phycology, 44, 1384–1394.

Barker, P.F. & Thomas, E. 2004. Origin, signature and palaeoclimatic influence of the Antarctic Circumpolar Current. Earth-Science Reviews, 66, 143–162.

Beu, A.G., Griffin, M. & Maxwell, P.A. 1997. Opening of Drake Passage gateway and Late Miocene to Pleistocene cooling reflected in Southern Ocean molluscan dispersal: evidence from New Zealand and Argentina. Tectonophysics, 281, 83–97.

Brandt, A. 1999. On the origin and evolution of Antarctic Peracarida (Crustacea, Malacostraca). Scientia Marina, 63, 261–274.

Briggs, J.C. 1974. Marine zoogeography. McGraw-Hill Book Company, 475 p.

Cañete, J.I., Leighton, G.L. & Aguilera, F.F. 1999. Polychaetes from Aysén Fjord, Chile: distribution, abundance and biogeographical comparison with the shallow soft-bottom polychaete fauna from Antarctica and the Magellan Province. Sciencia Marina, 63, 243–252.

Clarke, A. & Crame, J.A. 1989. The origin of the Southern Ocean marine fauna. In: Crame, J.A. (Ed). Origins and evolution of the Antarctic biota, 47. Geological Society Special Publications, 322p.

Clarke, A. & Crame, J.A. 1992. The Southern Ocean benthic fauna and climate change: a historical perspective. Philosophical Transactions of the Royal Society B, 338, 299–309.

Clarke, A. & Johnston, N.M. 2003. Antarctic marine benthic diversity. In: Gibson, R.N. & Atkinson, R.J.A. (Eds) Oceanography and marine biology: an annual review. Taylor & Francis, 435p.

Clarke, A., Aronson, R.B., Crame, J.A., Gili, J.-M. & Blake, D.B. 2004. Evolution and diversity of the benthic fauna of the Southern Ocean continental shelf. Antarctic Science, 16, 559–568.

Clarke, A., Barnes, D.K.A. & Hodgson, D.A. 2005. How isolated is Antarctic? Trends in Ecology and Evolution, 20, 1–3.

Clayton, M.N. 1994. Evolution of the Antarctic marine benthic algal flora. Journal of Phycology, 30, 897–904.

Collins, A.G., Schuchert, P., Marques, A.C., Jankowski, T., Medina, M. & Schierwater, B. 2006. Medusozoan phylogeny and character evolution clarified by new large and small subunit rDNA data and an assessment of the utility of phylogenetic mixture models. Systematic Biology, 55, 97–115.

Harold, A.S. & Mooi, R.D. 1994. Areas of endemism: definition and recognition criteria. Systematic Biology, 43, 261–266.

Hedgpeth, J.W. 1969. Distribution of selected groups of marine invertebrates in waters south of 35ºS latitude. Antarctic Map folio Series, 11, 1–9.

Kaiser, S., Griffiths, H.J., Barnes, D.K.A., Brandão, S.N., Brandt, A. & O'Brien, P.E. 2011. Is there a distinct continental slope fauna in the Antarctic? Deep-Sea Research II, 58, 91–104.

Knox, G.A. & Lowry, J.K. 1977. A comparison between the benthos of the Southern Ocean and the North Polar Ocean with special reference to the Amphipoda and the Polychaeta. In: Dunbar, M.J. (Ed.) Polar oceans. Proceedings of the Polar Ocean Conference, 681p.

Lawver, L.A. & Gahagan, L.M. 2003. Evolution of Cenozoic seaways in the circum-Antarctic region. Palaeogeography, Palaeoclimatology, Palaeoecology, 198, 11–37.

Marques, A.C. & Collins, A.G. 2004. Cladistic analysis of Medusozoa and cnidarian evolution. Invertebrate Biology, 123, 23–42.

Marques, A.C. & Peña Cantero, A.L. 2010. Areas of endemism in the Antarctica case study of the benthic hydrozoan genus *Oswaldella* (Cnidaria, Kirchenpaueriidae). Journal of Biogeography, 37, 1–7.

Miranda, T.P. & Marques, A.C. 2011. Abordagens atuais em biogeografia marinha. Revista da Biologia, 7, 41–48.

Morrone, J.J. 1994. On the identification of areas of endemism. Systematic Biology, 43, 438–441.

Peña Cantero, A.L. 2012. Filling biodiversity gaps: benthic hydroids from the Bellingshausen Sea (Antarctica). Polar Biology, 35, 851–865.

Peña Cantero, A.L. & Vervoort, W. 2003. Species of *Staurotheca* Allman, 1888 (Cnidaria: Hydrozoa: Sertulariidae) from US Antarctic expeditions, with the description of three new species. Journal of Natural History, 37, 2653–2722.

Peña Cantero, A.L. & Vervoort, W. 2004. Species of *Oswaldella* Stechow, 1919 (Cnidaria: Hydrozoa: Kirchenpaueriidae) from US Antarctic expeditions, with the description of three new species. Journal of Natural History, 38, 805–861.

Peña Cantero, A.L. & Vervoort, W. 2005. *Mixoscyphus antarcticus* gen. nov., sp. nov. (Cnidaria, Hydrozoa, Sertulariidae), the first truly endemic genus of Antarctic benthic hydroids. Polar Biology, 28, 956–963.

Peña Cantero, A.L., García Carrascosa, A.M. & Vervoort, W. 1997. On *Antarctoscyphus* (Cnidaria, Hydrozoa), a new genus of antarctic hydroids and the description of two new species. Polar Biology, 18, 23–32.

Spalding, M.D., Fox, H.E., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A. & Robertson, J. 2007. Marine ecoregions of the world: a bioregionalization of coastal and shelf areas. Bioscience, 57, 573–583.

Szumik, C.A., Cuezzo, F., Goloboff, P.A. & Chalup, A.E. 2002. An optimality criterion to determine areas of endemism. Systematic Biology, 51, 806–816.

Yasuhara, M., Kato, M., Ikeya, N. & Seto, K. 2007. Modern benthic ostracodes from Lützow-Holm Bay, East Antarctica: paleoceanographic, paleobiogeographic, and evolutionary significance. Micropaleontology, 53, 469–496.

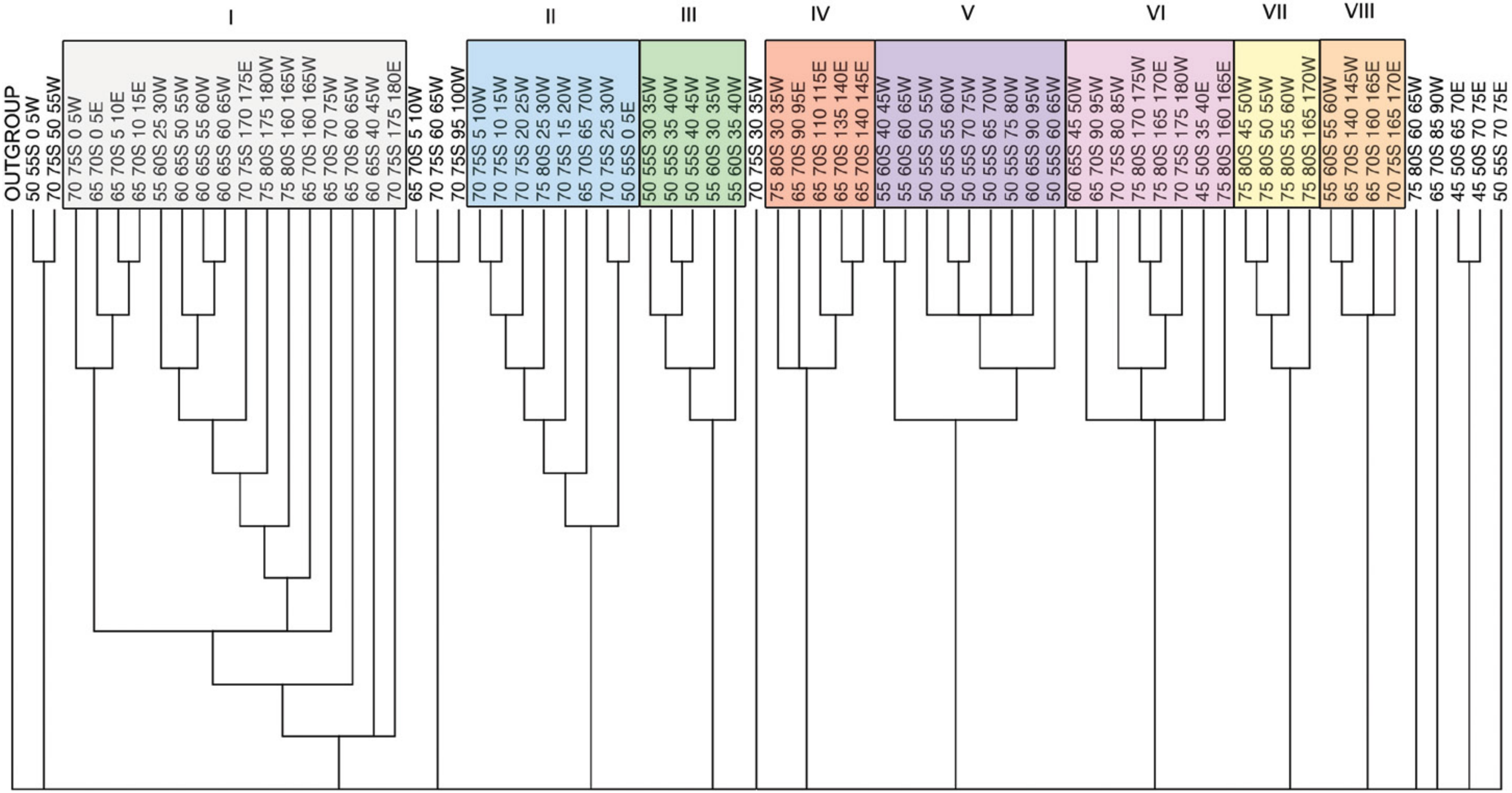

Figure 1. Semistrict consensus of the PAE in the 5°X5° matrix grid. Codes I to VIII indicate the resultant areas of endemism. Colors are as in Figure 2.

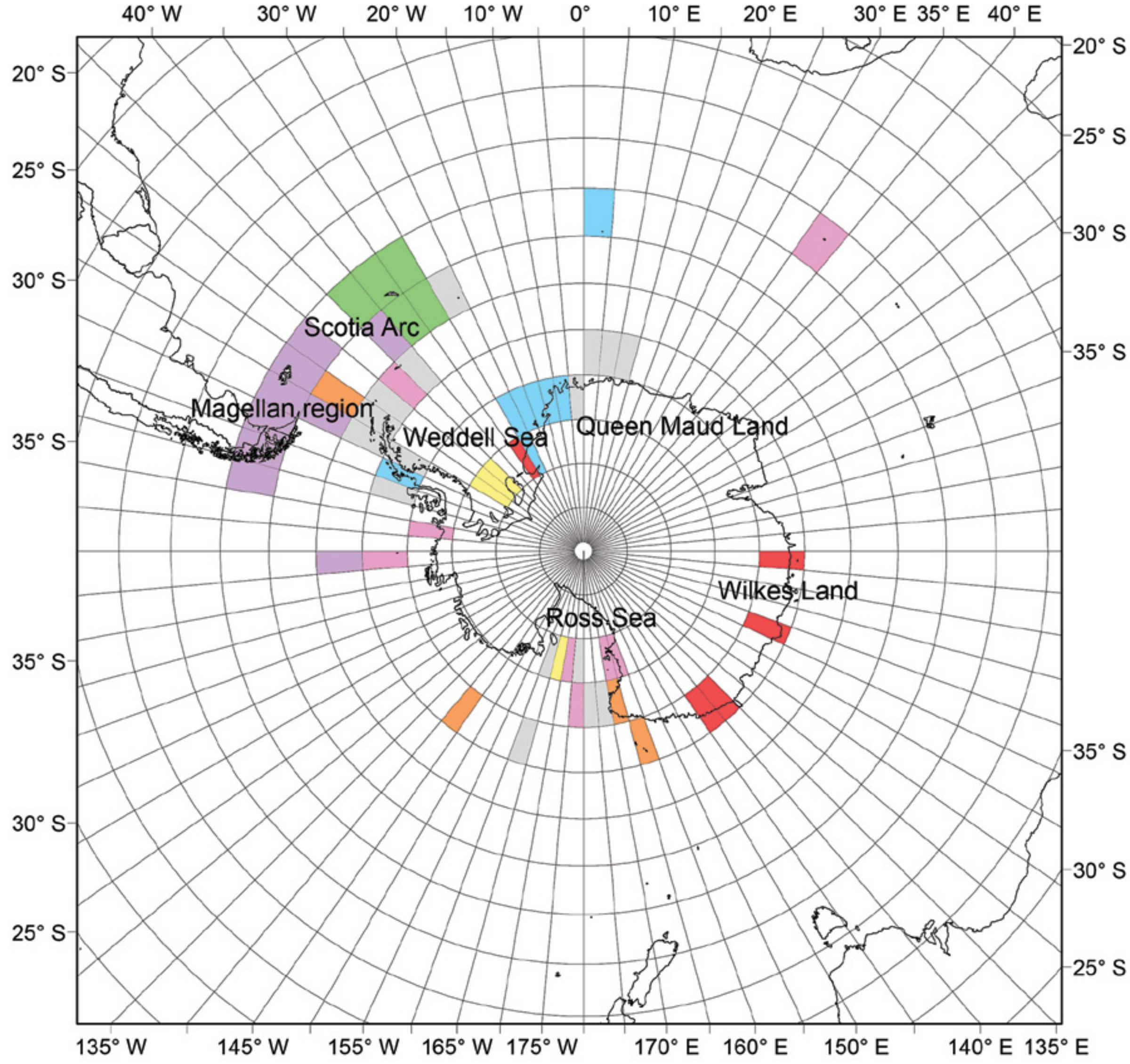

Figure 2. Areas of endemism from PAE for the 5°X5° matrix grid. Colors indicate monophyletic groups delimited in the semistrict consensus from Figure 1 and the same for the clades in Figure 1.

Table 1. List of the 61 species of benthic hydroids used in PAE and quadrants in which they are present.

Species	Quadrant
Antarctoscyphus admirabilis	70-75°S, 5-10°W
Antarctoscyphus asymmetricus	55-60°S, 25-30°W; 50-55°S, 35-40°W; 50-55°S, 40-45°W; 60-65°S, 45-50°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 90-95°W
Antarctoscyphus elongatus	65-70°S, 5-10°W; 70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 70-75°S, 25-30°W; 75-80°S, 25-30°W; 50-55°S, 35-40°W; 55-60°S, 35-40°W; 50-55°S, 40-45°W; 75-80°S, 45-50°W; 60-65°S, 50-55°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 60-65°W; 70-75°S, 60-65°W; 65-70°S, 65-70°W; 70-75°S, 95-100°W; 75-80°S, 165-170°W; 50-55°S, 0-5°E; 45-50°S, 65-70°E; 65-70°S, 110-115°E; 65-70°S, 135-140°E; 65-70°S, 140-145°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E
Antarctoscyphus encarnae	60-65°S, 55-60°W
Antarctoscyphus fragilis	70-75°S, 25-30°W
Antarctoscyphus grandis	70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 50-55°S, 35-40°W; 60-65°S, 50-55°W; 70-75°S, 50-55°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 90-95°W; 75-80°S, 175-180°W; 65-70°S, 135-140°E; 65-70°S, 140-145°E; 70-75°S, 170-175°E
Antarctoscyphus gruzovi	60-65°S, 50-55°W; 60-65°S, 55-60°W
Antarctoscyphus mawsoni	55-60°S, 25-30°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 65-70°W; 70-75°S, 175-180°W; 65-70°S, 140-145°E; 70-75°S, 170-175°E
Antarctoscyphus spiralis	65-70°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 75-80°S, 25-30°W; 50-55°S, 35-40°W; 60-65°S, 40-45°W; 75-80°S, 45-50°W; 60-65°S, 50-55°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 60-65°W; 70-75°S, 60-65°W; 65-70°S, 85-90°W; 65-70°S, 90-95°W; 70-75°S, 95-100°W; 75-80°S, 170-175°W; 70-75°S, 175-180°W; 75-80°S, 175-180°W; 50-55°S, 0-5°E; 65-70°S, 135-140°E; 65-70°S, 140-145°E; 65-70°S, 160-165°E; 70-75°S, 165-170°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E; 70-75°S, 175-180°E
Mixoscyphus antarcticus	60-65°S, 60-65°W
Oswaldella antarctica	50-55°S, 55-60°W; 60-65°S, 55-60°W; 65-70°S, 90-95°W; 65-70°S, 135-140°E; 65-70°S, 140-145°E
Oswaldella bifurca	75-80°S, 55-60°W; 70-75°S, 60-65°W; 75-80°S, 160-165°W; 70-75°S, 175-180°W; 75-80°S, 175-180°W; 65-70°S, 160-165°E; 70-75°S, 170-175°E
Oswaldella billardi	75-80°S, 30-35°W; 65-70°S, 90-95°E; 65-70°S, 110-115°E; 65-70°S, 135-140°E; 65-70°S, 140-145°E
Oswaldella blanconae	60-65°S, 60-65°W; 70-75°S, 170-175°E
Oswaldella crassa	60-65°S, 55-60°W
Oswaldella curiosa	60-65°S, 55-60°W
Oswaldella delicata	60-65°S, 50-55°W; 70-75°S, 50-55°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 75-80°S, 55-60°W; 60-65°S, 60-65°W; 75-80°S, 165-170°W
Oswaldella elongata	50-55°S, 30-35°W; 50-55°S, 35-40°W; 50-55°S, 50-55°W
Oswaldella encarnae	75-80°S, 45-50°W; 75-80°S, 50-55°W; 75-80°S, 55-60°W
Oswaldella erratum	50-55°S, 0-5°W; 70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 15-20°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 70-75°S, 25-30°W; 75-80°S, 25-30°W; 75-80°S, 30-35°W; 60-65°S, 50-55°W; 70-75°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 65-70°W; 50-55°S, 0-5°E; 65-70°S, 10-15°E
Oswaldella frigida	60-65°S, 55-60°W; 60-65°S, 60-65°W

Oswaldella garciacarrascosai	75-80°S, 50-55°W
Oswaldella gracilis	75-80°S, 55-60°W
Oswaldella grandis	75-80°S, 45-50°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W
Oswaldella herwigi	50-55°S, 55-60°W; 50-55°S, 70-75°W
Oswaldella incognita	55-60°S, 40-45°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 160-165°W
Oswaldella laertesi	70-75°S, 170-175°E
Oswaldella medeae	60-65°S, 50-55°W; 70-75°S, 175-180°W; 70-75°S, 175-180°E
Oswaldella monomammillata	60-65°S, 50-55°W
Oswaldella niobae	60-65°S, 55-60°W
Oswaldella obscura	70-75°S, 5-10°W; 70-75°S, 20-25°W; 75-80°S, 45-50°W
Oswaldella rigida	70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 15-20°W; 70-75°S, 20-25°W; 75-80°S, 25-30°W
Oswaldella shetlandica	55-60°S, 40-45°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 50-55°S, 60-65°W; 55-60°S, 60-65°W; 60-65°S, 60-65°W; 65-70°S, 60-65°W
Oswaldella stepanjantsae	70-75°S, 5-10°W; 70-75°S, 10-15°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 75-80°S, 170-175°W; 65-70°S, 110-115°E; 65-70°S, 160-165°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E; 70-75°S, 175-180°E
Oswaldella terranovae	70-75°S, 170-175°E
Oswaldella tottoni	70-75°S, 10-15°W; 75-80°S, 160-165°E
Oswaldella vervoorti	55-60°S, 40-45°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 50-55°S, 0-5°E
Staurotheca abyssalis	55-60°S, 55-60°W
Staurotheca affinis	50-55°S, 35-40°W
Staurotheca amphorophora	50-55°S, 35-40°W; 50-55°S, 40-45°W
Staurotheca antarctica	70-75°S, 0-5°W; 70-75°S, 10-15°W; 70-75°S, 15-20°W; 75-80°S, 25-30°W; 50-55°S, 35-40°W; 75-80°S, 45-50°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 60-65°W; 65-70°S, 65-70°W; 50-55°S, 70-75°W; 65-70°S, 70-75°W; 70-75°S, 80-85°W; 75-80°S, 160-165°W; 75-80°S, 170-175°W; 70-75°S, 175-180°W; 75-80°S, 175-180°W; 65-70°S, 5-10°E; 65-70°S, 10-15°E; 65-70°S, 110-115°E; 65-70°S, 135-140°E; 65-70°S, 140-145°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E
Staurotheca australis	65-70°S, 5-10°E; 65-70°S, 10-15°E
Staurotheca compressa	55-60°S, 25-30°W; 60-65°S, 50-55°W; 55-60°S, 55-60°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 140-145°W; 65-70°S, 160-165°W; 65-70°S, 140-145°E; 65-70°S, 160-165°E; 70-75°S 165-170°E
Staurotheca cornuta	60-65°S, 45-50°W; 60-65°S, 55-60°W
Staurotheca densa	60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 160-165°W; 70-75°S, 170-175°E; 70-75°S, 175-180°E
Staurotheca dichotoma	70-75°S, 5-10°W; 55-60°S, 25-30°W; 70-75°S, 25-30°W; 50-55°S, 30-35°W; 55-60°S, 30-35°W; 50-55°S, 35-40°W; 50-55°S, 40-45°W; 60-65°S, 45-50°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 70-75°S, 80-85°W; 65-70°S, 90-95°W; 75-80°S, 170-175°W; 70-75°S, 175-180°W; 50-55°S, 0-5°E; 65-70°S, 5-10°E; 65-70°S, 10-15°E; 45-50°S, 35-40°E; 65-70°S, 160-165°E; 75-80°S, 160-165°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E
Staurotheca echinocarpa	45-50°S, 65-70°E; 45-50°S, 70-75°E

Staurotheca frigida	70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 20-15°W; 55-60°S, 25-30°W; 50-55°S, 30-35°W; 55-60°S, 30-35°W; 50-55°S, 35-40°W; 55-60°S, 35-40°W; 50-55°S, 40-45°W; 60-65°S, 40-45°W; 60-65°S, 45-50°W; 60-65°S, 60-65°W; 65-70°S, 65-70°W; 75-80°S, 160-165°W; 65-70°S, 5-10°E; 65-70°S, 110-115°E; 70-75°S, 170-175°E
Staurotheca glomulosa	70-75°S, 0-5°W; 70-75°S, 10-15°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 50-55°S, 35-40°W; 60-65°S, 40-45°W; 75-80°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 60-65°W; 65-70°S, 70-75°W; 65-70°S, 160-165°W; 75-80°S, 160-165°W; 75-80°S, 175-180°W; 65-70°S, 0-5°E; 65-70°S, 5-10°E; 65-70°S, 10-15°E; 65-70°S, 110-115°E; 65-70°S, 160-165°E; 70-75°S, 170-175°E; 70-75°S, 175-180°E
Staurotheca jaderholmi	50-55°S, 50-55°W; 50-55°S, 55-60°W; 50-55°S, 60-65°W; 50-55°S, 65-70°W; 50-55°S, 70-75°W; 50-55°S, 75-80°W; 60-65°S, 90-95°W; 65-70°S, 135-140°E; 65-70°S, 140-145°E
Staurotheca juncea	70-75°S, 95-100°W
Staurotheca multifurcata	55-60°S, 25-30°W; 50-55°S, 30-35°W; 55-60°S, 30-35°W; 50-55°S, 35-40°W; 55-60°S, 35-40W; 50-55°S, 40-45°W
Staurotheca nonscripta	70-75°S, 0-5°W; 70-75°S, 5-10°W; 70-75°S, 10-15°W; 60-65°S, 55-60°W; 75-80°S, 60-65°W; 75-80°S, 165-170°W; 75-80°S, 170-175°W; 65-70°S, 0-5°E; 65-70°S, 5-10°E; 65-70°S, 10-15°E; 75-80°S, 160-165°E; 70-75°S, 165-170°E; 75-80°S, 165-170°E; 70-75°S, 170-175°E
Staurotheca pachyclada	70-75°S, 5-10°W; 70-75°S, 10-15°W; 70-75°S, 20-25°W; 55-60°S, 25-30°W; 75-80°S, 25-30°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 160-165°W; 75-80°S, 160-165°W; 75-80°S, 175-180°W; 70-75°S, 170-175°E
Staurotheca plana	70-75°S, 5-10°W; 70-75°S, 10-15°W
Staurotheca polarsteni	70-75°S, 10-15°W; 70-75°S, 15-20°W; 70-75°S, 20-25°W; 75-80°S, 25-30°W; 70-75°S, 30-35°W; 60-65°S, 60-65°W; 65-70°S, 0-5°E; 65-70°S, 5-10°E; 65-70°S, 10-15°E
Staurotheca profunda	50-55S 55-60W
Staurotheca stolonifera	70-75°S, 5-10°W; 70-75°S, 80-85°W
Staurotheca undosiparietina	50-55°S, 30-35°W; 50-55°S, 35-40°W; 50-55°S, 40-45°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W
Staurotheca vanhoeffeni	70-75°S, 0-5°W; 70-75°S, 5-10°W; 70-75°S, 10-15°W; 60-65°S, 50-55°W; 60-65°S, 55-60°W; 60-65°S, 60-65°W; 65-70°S, 5-10°E; 50-55°S, 70-75°E; 70-75°S, 170-175°E
Staurotheca vervoorti	50-55°S, 30-35°W; 50-55°S, 55-60°W

Capítulo 5. Considerações finais

A costa austral da América do Sul (CAAS) e o oceano Austral (OA) possuem enorme diversidade de habitats com diferentes características abióticas (Boltovskoy, 1981; Silva & Palma, 2006; Silva, 2008; Genzano et al., 2009; Waller et al., 2011; Chown, 2012; Grange & Smith, 2013). Ambas as áreas eram historicamente conectadas até que a passagem de Drake abriu-se há *ca.* 30 milhões de anos, separando a península antártica e a América do Sul (Barker & Burrell, 1977; Beu et al., 1997; Lawver & Gahagan, 2003; Clarke et al., 2005). Essa separação criou um sistema oceanográfico de correntes que isolou térmica e biogeograficamente o continente antártico, proporcionando o desenvolvimento de uma fauna altamente endêmica na região (Barker & Burrell, 1977; Clarke & Crame, 1989; Beu et al., 1997; Lawver & Gahagan, 2003; Barker & Thomas, 2004; Clarke et al., 2004).

Similaridades e correspondências entre as faunas marinhas de CAAS e OA têm sido melhor documentadas (*e.g.*, Cañete et al., 1999; Peña Cantero & García Carrascosa, 1999; Clarke & Johnston, 2003; Clarke et al., 2005; Yasuhara et al., 2007; Marques & Peña Cantero, 2010; Kaiser et al., 2011; Miranda et al., 2013), tornando essa região geográfica um modelo interessante com relação aos fatores que influenciaram sua história evolutiva (Clarke et al., 2004). A alta diversidade bentônica de CAAS e OA (Clarke & Crame, 1992; De Broyer & Rauschert, 1999; Peña Cantero & García Carrascosa, 1999; Clarke et al., 2004; Giberto et al., 2004; Peña Cantero, 2004; Gappa et al., 2006; Brandt et al., 2007; Galea et al., 2007; Schejter & Bremec, 2007; Yasuhara et al., 2007; Clarke, 2008; Genzano et al., 2011; Kaiser et al., 2013; Marques et al., 2013; Oliveira et al., in press), associada à sua história geológica e oceanográfica e a alta diversidade de habitats, a torna uma modelo para o desenvolvimento de estudos básicos em biogeografia, tais como a delimitação de áreas de endemismo.

Neste estudo, os hidroides bentônicos (exceto hidrocorais), um grupo com boa representatividade e sucesso de sobrevivência no bentos marinho, foi usado para estudar os padrões de endemismo da CAAS e OA. No total, 359 morfoespécies de hidroides bentônicos foram levantadas para a área de estudo, sendo 3 delas (?*Nemertesia ciliata*, *Sertularella leiocarpa*, *Zygophylax sibogae*) novos registros para o sudoeste do Atlântico. Dessas espécies, 256 foram identificadas até o nível específico, 40 até gênero, 44 têm o status taxonômico duvidoso e 19 não puderam ser identificadas devido a sua condição morfológica precária. Das 256 espécies, 54% são endêmicas para a CAAS e SO, sendo a maioria Leptothecata (92%).

A maior riqueza de espécies foi registrada para o sudoeste do Atlântico (73% do total de espécies). Com relação à distribuição horizontal e vertical, as espécies estão relativamente bem distribuídas ao longo da CAAS e SO, sendo a maior parte das espécies encontradas até 200m de profundidade. Exceções são as espécies de “Anthoathecata”, as quais concentraram-se mais nas áreas tropicais e as espécies de Sertulariidae, Kirchenpaueriidae, Schizotrichidae, Lafoeidae e Plumulariidae, que foram mais frequentes em zonas mais profundas (>200m). Com relação ao substrato, os hidroides bentônicos caracterizaram-se pela predominância de espécies generalistas, sendo a maior parte encontrada em substratos naturais.

As análises de similaridade de fauna por “clusters” e nMDS resultaram em 13 assembleias de hidroides bentônicos, sendo clara a separação entre a CAAS e OA. A Análise de Endemicidade (AE) feita pelo software NDM-VNDM encontrou 9 (F=0,5) e 10 (F=1,0) áreas consensuais de endemismo, com 107 e 112 espécies endêmicas no total, respectivamente. Os padrões de endemismo incluem composições únicas de hidroides bentônicos, concentrando-se principalmente em oito regiões: (1) sudoeste do Atlântico, (2) América do Sul, (3) América do Sul e Península

Antártica, (4) Patagônia e Península Antártica, (5) Arco de Scotia e Península Antártica, (6) região Magalhânica e Península Antártica, (7) região Magalhânica e (8) Península Antártica e Mar de Ross. Esses padrões de endemismo podem ser explicados tanto por processos dispersivos quanto vicariantes. Algumas "áreas de endemismo" tiveram seu conceito de endemicidade questionado e discutido em relação a aspectos de biogeografia ecológica.

As assembleias e as áreas de endemismo de CAAS e OA resultantes tiveram seus padrões comparados a aspectos oceanográficos e outros padrões biogeográficos (ecológicos e históricos) previamente delimitados para a região (Spalding et al., 2007; Marques & Peña Cantero, 2010; Miranda et al., 2013; Miranda et al., não publicado). Por outro lado, a Análise de Parcimônia de Endemicidade (PAE) foi realizadas com 61 hidroides bentônicos endêmicos da região acima dos 45°S dos oceanos Atlântico e Austral. Essa análise resultou em oito áreas de endemismo para a região subantártica e antártica, corroborando padrões gerais previamente encontrados por Marques & Peña Cantero (2010), mas definindo as subregiões com maior grau de acurácia (*viz.*, Miranda et al., 2013).

O conhecimento sobre a diversidade e biogeografia de hidroides bentônicos reunidos e trabalhados neste estudo permite que mudanças na biodiversidade possam ser melhor avaliadas, em especial face aos constantes e crescentes impactos ambientais acumulados no ambiente marinho. Os padrões biogeográficos ecológicos e históricos que descrevemos são uma tentativa de entender melhor o ambiente marinho e os fatores ambientais responsáveis por sua manutenção e evolução. Espera-se que a ampla base de dados aqui reunida colabore para elucidar outros padrões biogeográficos e macroecológicos de comunidades marinhas bentônicas, integrando diferentes abordagens biogeográficas e contribuindo para criação de estratégias e programas futuros em conservação da biodiversidade marinha.

Referências

Barker, P.F. & Burrell, J. 1977. The opening of Drake Passage. Marine Geology, 25, 15–34.

Barker, P.F. & Thomas, E. 2004. Origin, signature and palaeoclimatic influence of the Antarctic Circumpolar Current. Earth-Science Reviews, 66, 143–162.

Beu, A.G., Griffin, M. & Maxwell, P.A. 1997. Opening of Drake Passage gateway and Late Miocene to Pleistocene cooling reflected in Southern Ocean molluscan dispersal: evidence from New Zealand to Argentina. Tecnophysics, 281, 83–97.

Boltovskoy, D. 1981. Atlas del zooplankton del Atlántico Sudoccidental y métodos de trabajo con el zooplankton marino. Publicación Especial del INIDEP, 936p.

Brandt, A., De Broyer, C., De Mesel, I., Ellingsen, K.E., Gooday, A.J., Hilbig, B., Linse, K., Thomson, M.R.A. & Tyler, P.A. 2007. The biodiversity of the deep Southern Ocean benthos. Philosophical Transactions of the Royal Society, 362, 39–66.

De Broyer, C. & Rauschert, M. 1999. Faunal diversity of the benthic amphipods (Crustacea) of the Magellan region as compared to the Antarctic (preliminary results). Scientia Marina, 63, 281–293.

Cañete, J.I., Leighton, G.L. & Aguilera, F.F. 1999. Polychaetes from Aysén Fjord, Chile: distribution, abundance and biogeographical comparison with the shallow soft-bottom polychaete fauna from Antarctica and the Magellan Province. Scientia Marina, 63, 243–252.

Chown, S.L. 2012. Antarctic marine biodiversity and deep-sea hydrothermal vents. PLoS Biology, 10, e1001232.

Clarke, A. 2008. Antarctic marine benthic diversity: patterns and processes. Journal of Experimental Marine Biology and Ecology, 366, 48–55.

Clarke, A. & Crame, J.A. 1989. The origin of the Southern Ocean marine fauna. In: Crame, J.A. (Ed.) Origins and evolution of the Antarctic biota. Geological Society Special Publication, 47, 322p.

Clarke, A. & Crame, J.A. 1992. The Southern Ocean benthic fauna and climate change: a historical perspective. Philosophical Transactions of the Royal Society of London Series B Biological Sciences, 338, 299–309.

Clarke, A. & Johnston, N.M. 2003. Antarctic marine benthic diversity. In: Gibson, R.N. & Atkinson, R.J.A. (Eds) Oceanography and Marine Biology: an Annual Review. Taylor & Francis, 41, 468p.

Clarke, A., Aronson, R.B., Crame, J.A., Gili, J.-M. & Blake, D.B. 2004. Evolution and diversity of the benthic fauna of the Southern Ocean continental shelf. Antarctic Science, 16, 559–568.

Clarke, A., Barnes, D.K.A. & Hodgson, D.A. 2005. How isolated is Antarctica? Trends in Ecology and Evolution, 20, 1–3.

Galea, H.R., Försterra, G. & Häussermann, V. 2007. Cnidaria, Hydrozoa: latitudinal distribution of hydroids along the fjords region of southern Chile, with notes on the world distribution of some species. Check List, 3, 308–320.

Gappa, J.L., Alonso, G.M. & Landoni, N.A. 2006. Biodiversity of benthic Amphipoda (Crustacea: Peracarida) in the Southwest Atlantic between 35°S and 56°S. Zootaxa, 1342, 1–66.

Genzano, G.N., Giberto, D., Schejter, L., Bremec, C. & Meretta, P. 2009. Hydroid assemblages from the Souhwestern Atlantic Ocean (34–42°S). Marine Ecology, 30, 33–46.

Genzano, G., Giberto, D. & Bremec, C. 2011. Benthic survey of natural and artificial reefs off Mar del Plata, Argentina, southwestern Atlantic. Latin American Journal of Aquatic Research, 39, 553–566.

Giberto, D.A., Bremec, C.S., Acha, E.M. & Mianzan, H. 2004. Large-scale spatial patterns of benthic assemblages in the SW Atlantic: the Río de La Plata estuary and adjacent shelf waters. Estuarine Coastal and Shelf Science, 61, 1–13.

Grange, L.J. & Smith, C.R. 2013. Magafaunal communities in rapidly warming fjords along the West Antarctic Peninsula: hotspots of abundance and beta diversity. PLoS ONE, 8, e77917.

Kaiser, S., Griffiths, H.J., Barnes, D.K.A., Brandão, S.N., Brandt, A. & O'Brien, P.E. 2011. Is there a distinct continental slope fauna in the Antarctic? Deep-Sea Research II, 58, 91–104.

Kaiser, S., Brandão, S.N., Brix, S., Branes, D.K.A., Bowden, D.A., Ingels, J., Leese, F., Schiaparelli, S., Arango, C.P., Badhe, R., Bax, N., Blazewicz-Paszkowycz, M., Brandt, A., Brenke, N., Catarino, A.I., David, B., De Ridder, C., Dubois, P., Ellingsen, K.E., Glover, A.G., Griffiths, H.J., Gutt, J., Halanych, K.M., Havermans, C., Held, C., Janussen, D., Lörz, A.-N., Pearce, D.A., Pierrat, B., Riehl, T., Rose, A., Sands, C.J., Soler-Membrives, A., Schüller, M., Strugnell, J.M., Vanheusel, A., Veit-Köhler, G., Wilson, N.G. & Yasuhara, M. 2013. Patterns, processes and vulnerability of Southern Ocean benthos: a decadal leap in knowledge and understanding. Marine Biology, 160, 2295–2317.

Lawver, L.A. & Gahagan, L.M. 2003. Evolution of Cenozoic seaways in the circum-Antarctic region. Palaeogeography, Palaeoclimatology, Palaeoecology, 198, 11–37.

Marques, A.C. & Peña Cantero, A.L. 2010. Areas of endemism in the Antarctic – a case study of the benthic hydrozoan genus *Oswaldella* (Cnidaria, Kirchenpaueriidae). Journal of Biogeography, 37, 617–623.

Marques, A.C., Klôh, A.S., Migotto, A.E., Cabral, A.C., Rigo, A.P.R., Bettim, A.L., Razzolini, E.L., Cascon, H.M., Bardi, J., Kremer, L.P., Vieira, L.M., Bezerra, L.E.A., Haddad, M.A., Oliveira Filho, R.R., Gutierre, S.M.M., Miranda, T.P., Franklin Jr., W. & Rocha, R.M. 2013.

Rapid assessment survey for exotic benthic species in the São Sebastião Channel, Brazil. Latin American Journal of Aquatic Research, 41, 265–285.

Miranda, T.P., Peña Cantero, A.L. & Marques, A.C. 2013. Southern Ocean areas of endemism: a reanalysis using benthic hydroids (Cnidaria, Hydrozoa). Latin American Journal of Aquatic Research, 41, 1003–1009.

Miranda, T.P., Genzano, G.N. & Marques, A.C. Endemicity in benthic hydroids (Cnidaria, Hydrozoa) in the Southwestern Atlantic ocean: an NDM-VNDM hypothesis [não publicado].

Oliveira, O.M.P., Araújo, E.M., Ayón, P., Cedeño-Posso, C.M., Cepeda, A.A., Córdova, P., Cunha, A.F., Galea, H., Genzano, G.N., Haddad, M.A., Mianzan, H.W., Migotto, A.E., Miranda, L.S., Miranda, T.P., Morandini, A.C., Nagata, R.M., Nascimento, K., Nogueira Jr., M., Palma, S., Quiñones, J.A.D., Rodriguez, C., Scarabino, F., Schiariti, A., Tronolone, V. & Marques, A.C. Census of the Cnidaria (Medusozoa) and Ctenophora from South American marine waters. Zootaxa [in press].

Peña Cantero, A.L. 2004. How rich is the deep-sea Antarctic benthic hydroid fauna? Polar Biology, 27, 767–774.

Peña Cantero, A.L. & García Carrascosa, A.M. 1999. Biogeographical distribution of the benthic thecate hydroids collected during the Spanish "Antártida 8611" expedition and comparison between Antarctic and Magellan benthic hydroid faunas. Scientia Marina, 63, 209–218.

Schejter, L. & Bremec, C. 2007. Benthic richness in the Argentine continental shelf: the role of *Zygochlamys patagonica* (Mollusca: Bivalvia: Pectinidae) as settlement substrate. Journal of Marine Biological Association of the United Kingdom, 87, 917–925.

Silva, N. 2008. Dissolved oxygen, pH, and nutrients in the austral Chilean channels and fjords. In: Silva, N. & Palma, S. (Eds) Progress in the oceanographic knowledge of Chilean interior waters, from Puerto Montt to Cape Horn. Comité Oceanográfico Nacional, Pontificia Universidad Católica de Valparaíso, 161p.

Silva, N. & Palma, S. 2006. El Programa CIMAR en los canals y fiordos australes. In: Silva, N. & Palma, S. (Eds) Avances en el conocimiento oceanográfico de las aguas interiors chilenas, Puerto Montt a cabo de Hornos. Comité Oceanográfico Nacional, Pontificia Universidad Católica de Valparaíso, 161p.

Spalding, M.D., Fox, H., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., McManus, E., Molnar, J., Recchia, C.A. & Robertson, J. 2007. Marine ecoregions of the world: a bioregionalization of coastal and shelf areas. BioScience, 57, 573–583.

Waller, R.G., Scanlon, K.M. & Robinson, L.F. 2011. Cold-water coral distributions in the Drake Passage Area from towed camera observations – initial interpretations. PLoS ONE, 6, e16153.

Yasuhara, M., Kato, M., Ikeya, N. & Seto, K. 2007. Modern benthic ostracodes from Lützow-Holm Bay, East Antarctica: paleoceanographic, paleobiogeographic, and evolutionary significance. Micropaleontology, 53, 469–496.

Resumo

A costa austral da América do Sul (CAAS) e o oceano Austral (OA) possuem grande variedade de habitats e estão historicamente conectados desde a abertura da passagem de Drake. A fauna marinha de ambas as regiões é altamente diversa e muitas espécies possuem distribuições geográficas contraditórias, como é o caso dos hidroides bentônicos (Cnidaria, Hydrozoa). Toda essa heterogeneidade faunística atrai estudos adicionais em biogeografia, envolvendo a busca por áreas de endemismo e outros padrões de distribuição geográfica. Uma atualização do status taxonômico das espécies de hidroides bentônicos da CAAS e OA foi feito, reunindo informações sobre sua riqueza, grau de endemismo, substrato biológico e distribuição geográfica. Um total de 5.621 amostras e 359 morfoespécies de hidroides bentônicos foram levantadas para a área de estudo e checadas taxonomicamente, sendo 256 identificadas até o nível específico. Os registros de presença e ausência ao longo da área foram usados em uma análise de similaridade pelo índice de Bray-Curtis, sendo os resultados sintetizados em "clusters" hierárquicos e nMDS. A taxa de endemismo para ambos a CAAS e OA foi de 54%, sendo o OA responsável por 88% dos registros de espécies endêmicas. As espécies de leptotecados foram as que apresentaram maior amplitude de distribuição horizontal e vertical. A maior parte das espécies de hidroides bentônicos levantadas são substrato-generalistas. Treze assembleias ecológicas de hidroides bentônicos foram encontradas ao longo da CAAS e OA, as quais foram relacionadas com a dinâmica oceanográfica da área e comparadas com ecorregiões, realms, assembleias e áreas de endemismo previamente delimitadas para a região. As áreas de endemismo para a CAAS e OA foram hipotetizadas por meio da Análise de Endemicidade (AE) em uma otimização pelo software NDM-VNDM, com uma grade de 10° latitude X 10° longitude. Nove (F=0.5) e 10 (F=1.0) áreas consensuais de endemismo foram historicamente relacionadas com o isolamento da Antártica e comparadas com hipóteses já existentes para a CAAS e OA. Todas as áreas foram discutidas considerando-se os processos de vicariância e dispersão, e com relação ao real grau de endemicidade que elas representam. Uma PAE também foi realizada mas apenas com 61 espécies de hidroides bentônicos endêmicos da região acima de 45°S. Essa análise foi feita com o objetivo de reanalisar os dados previamente publicados por Marques & Peña Cantero (2010), inserindo um conjunto de dados complementar para a obtenção de uma melhor definição e acurácia nas áreas de endemismo delimitadas para a região. Oito áreas de endemismo foram definidas como subregiões dos padrões previamente encontrados. O uso de diferentes técnicas e conjuntos de dados biogeográficos são meios alternativos para clarear padrões gerais de áreas de endemismo e também outros padrões relacionados à comunidades ecológicas e estudos em conservação da biodiversidade.

Abstract

The southern South America (SSA) coast and the Southern Ocean (SO) have a high differentiation of habitats and are historically connected since the opening of the Drake Passage. The marine fauna of both regions are connected, highly diverse and many species are contradictory distributed, such as the benthic hydroids (Cnidaria, Hydrozoa). All this faunistic heterogeneity calls attention for additional biogeographic investigations, involving the search for areas of endemism and other geographic distribution patterns. An update of the taxonomic status of the species of benthic hydroids from SSA and SO was carried out, gathering information about their richness, endemicity level, biological substrates and geographic distribution. A total of 5.621 samples and 359 morphospecies of benthic hydroids were surveyed for the studied area and taxonomically checked, being 256 identified up to the specific level. The records of presence-absence along the SSA and SO were used in a Bray-Curtis similarity analysis and the results were synthesized in hierarchical clusters and nMDS. The level of endemism at both the SSA and the SO is 54%, being the SO responsible for 88% of the records of endemic species. Leptothecate species had the widest horizontal and vertical distribution and most part of the benthic hydroids surveyed were considered substrate-generalists. Thirteen ecological assemblages of benthic hydroids were found along the SSA and SO and compared with the oceanographic dynamics of the area, as well as with earlier ecoregions, realms, assemblages, and areas of endemism delimited for the region. Areas of endemism were hypothesized for the SSA and SO using the Endemicity Analysis (EA) through an optimization performed by the software NDM-VNDM, with a 10° latitude X 10° longitude grid. Nine (F=0.5) and 10 (F=1.0) consensus areas of endemism were historically related with the isolation of Antarctica, and compared with previous hypotheses for the SSA and SO. All areas were discussed in the context of vicariance/dispersal processes, and concerning the real degree of endemicity that they represent. PAE was also performed but only with 61 endemic species of benthic hydroids for the region above the 45°S. This analysis was carried out with the aim to reanalyze previous data already published by Marques & Peña Cantero (2010), inserting a complementary dataset in order to obtain a better definition and accuracy in the areas of endemism delimited for the region. Eight areas of endemism were defined as subregions of the patterns previously found. The use of different techniques and biogeographic datasets are alternative strategies to clarify general patterns of areas of endemism, as well as other patterns related with ecological communities and studies in conservation biology.