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Faunistic survey of Hydromedusae (Cnidaria, Medusozoa) from the coast of Paraná State, Southern Brazil

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Abstract

This study is the first faunistic inventory of hydromedusae from the inner continental shelf of Paraná State. We describe the composition of hydromedusae species, collected with bottom-trawl and Hensen nets, in campaigns carried out from 1997 to 2006. We analyzed 17,797 specimens from 578 samples, and provide descriptions, photographs, and information about the biology of the 22 species found. All species had previous records from the Brazilian coast; however, this is the first record of *Bougainvillia frondosa*, *Ectopleura dumortieri*, *Cirrholovenia tetranema*, *Eucheilota maculata*, *Gossea brachymera*, *Solmaris corona*, and *Amphogona apsteini* for the coast of Paraná. Most species are typical of tropical and subtropical coastal waters from the South Brazilian Bight. However, *Turritopsis nutricula*, *Niobia dendrotentaculata*, *Solmaris corona*, and *Aglaura hemistoma* are abundant in oceanic waters, and *Olindias sambaquiensis* and *Solmaris corona* are associated with colder waters (<20°C). The current number of species known for the state is 26. Additional collection effort is needed in regions not sampled in this work, such as bays and offshore waters.

Key words: Hydrozoa, taxonomy, gelatinous zooplankton, jellyfish, faunistic composition

Introduction

Hydromedusae are the solitary, vagile and sexual life-cycle stages of Hydrozoa, and are among the most diverse animals in the pelagic environment, with 892 species known by the beginning of this century (Bouillon & Boero 2000). In the South Atlantic, hydromedusae are only less diverse than copepods (Boltovskoy 1999). They are also very common and can reach high biomass (e.g., Mianzan & Guerrero 2000). Although some species are omnivorous (e.g., Boero *et al.* 2007), most hydromedusae are predators of zooplankton and/or ichthyoplankton. They are, therefore, potential consumers of the early stages of commercial species, and also competitors with zooplanktivorous fishes (Mills 1995, 2001; Purcell *et al.* 2007). In addition, some species can seriously sting swimmers and/or fishermen, for example *Olindias sambaquiensis* Müller, in northern Argentina and southern and southeastern Brazil (Mianzan & Ramirez 1996; Mianzan *et al.* 2001; Haddad *et al.* 2002). Therefore, hydromedusae can be considered extremely important for the dynamics of marine plankton, and for many human activities in the oceans.

In Brazil, 131 species of hydromedusae have been documented (Migotto *et al.* 2002 and references). This number is likely less than the true species richness, since most of the 8500 km of the Brazilian coastline has scarcely or never been studied, including the coast of Paraná State (Marques *et al.* 2003). Faunistic knowledge of this region is based on isolated studies, from oceanographic campaigns that revealed overall mesoscale patterns of spatial distributions and correlations of species with the main water masses on the South Brazilian Bight (SBB) (Vannucci 1957; Correia 1983; Tronolone 2007). However, extensive sampling (e.g., standardized continuous sampling) has not been carried out along the shelf off Paraná, and consequently the regional diversity and its dynamics are insufficiently known.

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References

- Altwater, L. (2009) *Composição e sazonalidade de cnidários em substrato artificial, na foz do rio Itiberê, Baía de Paranaguá, Paraná*. Master Thesis, Universidade Federal do Paraná, Curitiba, 167 pp.
- Ballard, L. & Myers, A. (2000) Observations on the seasonal occurrence and abundance of gelatinous zooplankton in Lough Hyne, Co. Cork, South–West Ireland. *Biology and Environment: Proceedings of The Royal Irish Academy*, 100 (2), 75–83.
- Bardi, J. & Marques, A.C. (2009) The invasive hydromedusae *Blackfordia virginica* Mayer, 1910 (Cnidaria: Blackfordiidae) in southern Brazil, with comments on taxonomy and distribution of the genus *Blackfordia*. *Zootaxa*, 2198, 41–50.
- Bavestrello, G., Sommer, C. & Sarà, M. (1992) Bi-directional conversion in *Turritopsis nutricula* (Hydrozoa). *Scientia Marina*, 56, 137–140.
- Baxter, J.E., Rodger, H.D., McAllen, R. & Doyle, T.K. (2011) Gill disorders in marine–farmed salmon: investigating the role of hydrozoan jellyfish. *Aquaculture Environment Interactions*, 1, 245–257.
<http://dx.doi.org/10.3354/aei00024>
- Benovic, A. & Bender, A. (1987) Seasonal distribution of medusae in the Adriatic Sea. In: Bouillon, J., Boero, F., Cicogna F. & Cornelius, P.F.S. (Eds.), *Modern Trends in the Systematics, Ecology and Evolution of Hydroids and Hydromedusae*. Clarendon Press, Oxford, pp. 117–131.
- Bettim, A.L. (2010) *Caracterização de uma espécie de Podocoryna M. Sars, 1846 (Cnidaria, Hydrozoa, Hydractiniidae), abundante em substrato artificial na região portuária de Paranaguá, incluindo uma sinopse da taxonomia da família*. Undergraduate Thesis, Universidade Federal do Paraná, Curitiba, 52 pp.
- Boero, F., Bucci, C., Colucci, A.M.R., Gravili, C. & Stabili, L. (2007) *Obelia* (Cnidaria, Hydrozoa, Campanulariidae): a microphagous, filter–feeding medusa. *Marine Ecology*, 28 (1), 178–183.
<http://dx.doi.org/10.1111/j.1439-0485.2007.00164.x>
- Boltovskoy, D. (1999) *South Atlantic Zooplankton*. Backhuys Publishers, Leiden, 997 pp.
- Bouillon, J. (1978) Hydroméduses de l'Archipel des Séchelles et du Mozambique. *Revue de Zoologie Africaine*, 92 (1), 117–173.
- Bouillon, J. (1999) Hydromedusae. In: Boltovskoy, D. (Ed.), *South Atlantic Zooplankton*. Backhuys Publishers, Leiden, pp. 385–465.
- Bouillon, J. & Boero, F. (2000) Synopsis of the families and genera of Hydromedusae of the world, with a list of the worldwide species. *Thalassia Salentina*, 24, 47–296.
- Bouillon, J., Medel, M.D., Pagès, F., Gili, J.M., Boero, F. & Gravili, C. (2004) Fauna of the Mediterranean Hydrozoa. *Scientia Marina*, 68 (2), 5–438.
<http://dx.doi.org/10.3989/scimar.2004.68s25>
- Brandini, F.P., Lopes, R.M., Gutseit, K.S., Spach, H.L. & Sassi, R. (1997) *Planctonologia na Plataforma Continental do Brasil. Diagnose e Revisão Bibliográfica*. Ministério do Meio Ambiente e da Amazônia Legal—IBAMA, Brasília, 196 pp.
- Brandini, F.P., da Silva, A.S., Teixeira da Silva, E. & Kolm, H. (2007) Sources of Nutrients and Seasonal Dynamics of Chlorophyll in the Inner Shelf off Paraná State—South Brazil Bight. *Journal of Coastal Research*, 23 (5), 1131–1140.
<http://dx.doi.org/10.2112/04-0360.1>
- Brinckmann, A. & Vannucci, M. (1965) On the life–cycle of *Proboscidactyla ornata* (Hydromedusae, Proboscidactylidae). *Pubblicazioni della Stazione Zoologica di Napoli*, 34, 357–365.
- Buecher, E. & Gibbons, M. (1999) Temporal persistence in the vertical structure of the assemblage of planktonic medusae in the NW Mediterranean Sea. *Marine Ecology Progress Series*, 189, 105–115.
<http://dx.doi.org/10.3354/meps189105>
- Carré, D. & Carré, C. (1990) Complex reproductive cycle in *Eucheilota paradoxa* (Hydrozoa: Leptomedusae): medusae, polyps and frustules produced from medusa stage. *Marine Biology*, 104, 303–310.
<http://dx.doi.org/10.1007/bf01313272>

- Castro, B.M., Lorenzetti, J.A., Silveira, I.C.A. & Miranda, L.B. (2006) Estrutura termohalina e circulação na região entre o Cabo de São Tomé (RJ) e o Chuí (RS). In: Rossi-Wongtshowski, C.L.B & Madureira, L.S.P. (Eds.), *Ambiente Oceanográfico da Plataforma Continental e do Talude na Região Sudeste-sul do Brasil*. EDUSP, São Paulo, pp. 11–120.
- Chaves, P.T., Cova-Grando, G. & Calluf, C. (2003) Demersal ichthyofauna in a continental shelf region on the south coast of Brazil exposed to shrimp trawl fisheries. *Acta Biologica Paranaense*, 32 (1, 2, 3, 4), 69–82.
- Chiaverano, L., Mianzan, H. & Ramirez, F. (2004) Gonad development and somatic growth patterns of *Olindias sambaquiensis* (Limnomedusae, Olindiidae). *Hydrobiologia*, 530/531, 373–381.
<http://dx.doi.org/10.1007/s10750-004-2666-4>
- Colin, S.P., Costello, J.H., Graham, W.H. & Higgins, J. (2005) Omnivory by the small cosmopolitan hydromedusa *Aglaura hemistoma*. *Limnology and Oceanography*, 50, 1264–1268.
<http://dx.doi.org/10.4319/lo.2005.50.4.1264>
- Collins, A.G., Bentlage, B. Lindner, A., Lindsay, D., Haddock, S.H.D., Jarms, G., Norenburg, J., Jankowski T., & Cartwright, P. (2008) Phylogenetics of Trachylina (Cnidaria: Hydrozoa) with new insights on the evolution of some problematical taxa. *Journal of the Marine Biological Association of the United Kingdom*, 88, 1–13.
<http://dx.doi.org/10.1017/s0025315408001732>
- Cornelius, P.F.S. (1975) The hydroid species of *Obelia* (Coelenterata, Hydrozoa: Campanulariidae), notes on the medusa stage *The Bulletin of the British Museum, Natural History, Zoology*, 28, 249–293.
<http://dx.doi.org/10.1080/00222939000770381>
- Cornelius, P.F.S. (1990) European *Obelia* (Cnidaria, Hydroida): systematics and identification. *Journal of Natural History*, 24, 535–578.
- Cornelius, P.F.S. (1995) *North-west European Thecate Hydroids and Their Medusae (Cnidaria, Leptolida, Leptothecatae)*. Synopses of the British Fauna, n.s., 50 (1), 1–347; 50 (2), 1–386.
- Correia, K.V. (1983) *As medusas das regiões da plataforma e oceânica dos estados do Paraná e Santa Catarina (Operação Conversus III) sistemática e distribuição*. Master Thesis, Universidade Federal do Paraná, Curitiba, 222 pp.
- 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. (2007) The phylum Cnidaria: A review of phylogenetic patterns and diversity 300 years after Linnaeus. *Zootaxa*, 1668, 127–182.
- Daly Yahia, M.N., Goy, J. & Daly Yahia-Kéfi, O. (2003) Distribution et écologie des Méduses (Cnidaria) du golfe de Tunis (Méditerranée sud occidentale). *Oceanologica Acta*, 26, 645–655.
<http://dx.doi.org/10.1016/j.oceact.2003.05.002>
- Dawson, M.N. (2004) Some implications of molecular phylogenetics for understanding biodiversity in jellyfishes, with emphasis on Scyphozoa. *Hydrobiologia*, 530/531, 249–260.
<http://dx.doi.org/10.1007/s10750-004-2659-3>
- Ennes, R.A.L. (2000) *Aspectos populacionais e da pesca do camarão sete barbas Xiphopenaeus kroyeri (Heller, 1862) (Crustacea, Decapoda, Penaeidae) obtidos na pesca artesanal do Balneário de Shangri-lá, Paraná*. Master Thesis, Universidade Federal do Paraná, Curitiba, 55 pp.
- Fernandes, L.F., Zehnder-Alves, L. & Bassfeld, J. (2001) The recently established diatom *Coscinodiscus wailiesii* (Coscinodiscales, Bacillariophyta) in Brazilian waters. I: remarks on morphology and distribution. *Phycology Research*, 49, 89–96.
- Genzano, G., Mianzan, H. & Bouillon, J. (2008) Hydromedusae (Cnidaria: Hydrozoa) from the temperate southwestern Atlantic Ocean: a review. *Zootaxa*, 1750, 1–18.
- Gili, J.M., Pagès, F., Sabatés, A & Ros, J.D. (1988) Small-scale distribution of a cnidarian population in the western Mediterranean. *Journal of Plankton Research*, 10 (3), 385–401.
<http://dx.doi.org/10.1093/plankt/10.3.385>
- Gomes, I.D. (2004) *A Estrutura da Ictiofauna da Região Demersal do Paraná e dieta das espécies mais abundantes*. PhD Thesis, Universidade Federal do Paraná, Curitiba, 104 pp.
- Goy, J. (1979) Méduses. Campagne de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961–1962). *Résultats Scientifiques de la Campagne de la Calypso*, 11, 263–296.
- Goy, J., Lakkis, S. & Zeidane, R. (1990) Les méduses de la Méditerranée orientale. *Bulletin de l'Institut Océanographique*, 7, 79–88.
- Goy, J., Lakkis, S. & Zeidane, R. (1991) Les Méduses (Cnidaria) des eaux libanaises. *Annales de l'Institut Océanographique*, 67, 99–128.
- Haddad, M.A. (2006) Cnidaria. In: Ribeiro-Costa, C.S. & Rocha, R.M. (Eds.), *Invertebrados, Manual de Aulas Práticas 2ª Edição*. Holos, Ribeirão Preto, pp. 34–47.
- Haddad Jr., V., Silveira, F.L., Cardoso, J.L.C. & Morandini, A.C. (2002) A report of 49 cases of cnidarian envenoming from southeastern Brazilian coastal Waters. *Toxicon*, 40, 1445–1450.
[http://dx.doi.org/10.1016/s0041-0101\(02\)00162-9](http://dx.doi.org/10.1016/s0041-0101(02)00162-9)
- Houliston, E., Momose, T. & Michael, M. (2011) *Clytia hemisphaerica*: a jellyfish cousin joins the laboratory. *Trends in Genetics*, 26 (4), 159–167.
<http://dx.doi.org/10.1016/j.tig.2010.01.008>

- Kawamura, M. & Kubota, S. (2008) Influences of temperature and salinity on asexual budding by hydromedusa *Proboscoidactyla ornata* (Cnidaria: Hydrozoa: Proboscoidactylidae). *Journal of the Marine Biological Association of the United Kingdom*, 88 (8), 1601–1606.
<http://dx.doi.org/10.1017/s0025315408002944>
- Kokelj, F., Stinco, G., Avian, M., Mianzan, H. & Burnett, J.W. (1995) Cell-mediated sensitization to jellyfish antigens confirmed by positive patch test to *Olindias sambaquiensis* preparations. *Journal of the American Academy of Dermatology*, 33 (2 Pt 1), 307–309.
[http://dx.doi.org/10.1016/0190-9622\(95\)90267-8](http://dx.doi.org/10.1016/0190-9622(95)90267-8)
- Kramp, P.L. (1955) The Medusae of the tropical west coast of Africa. *Atlantide [report 3]*. Copenhagen: University of Copenhagen and British Museum (Natural History), 239–328.
- Kramp, P.L. (1957) Hydromedusae from the Discovery collections. *Discovery Report*, 29, 1–128.
- Kramp, P.L. (1959a) The Hydromedusae of the Atlantic Ocean and adjacent waters. *Dana-Report*, 46, 1–283.
- Kramp, P.L. (1959b) Some new and little-known Indo-Pacific medusae. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening*, 121, 223–259.
- Kramp, P.L. (1961) Synopsis of the Medusae of the world. *Journal of the Marine Biological Association of the United Kingdom*, 40, 7–382.
<http://dx.doi.org/10.1017/s0025315400007347>
- Kramp, P.L. (1962) Medusa of Vietnam. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening*, 124, 305–366.
- Kramp, P.L. (1965) The Hydromedusae of the Pacific and Indian Oceans. *Dana-Reports*, 63, 1–162.
- Kramp, P.L. (1966) A collection of Medusae from the coast of Chile. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening*, 129, 1–38.
- Kramp, P.L. (1968) The Hydromedusae of the Pacific and Indian Oceans. Sect. II and III. *Dana-Reports*, 72, 1–200.
- Kubota, S. (1995) Cnidome and growth of a Medusa of *Cirrholovenia tetranema* (Leptomedusae, Cirrholoveniidae) in Japan. *Publications of the Seto Marine Biological Laboratory*, 6, 365–378.
- Larson, R.J. (1982) Medusae (Cnidaria) from Carrie Bow Cay, Belize. In: Reutzler, K. & Macintyre, I.G. (Eds.), *The Atlantic Barrier Reef Ecosystem at Carrie Bow Cay, Belize, I. Structure and Communities*. Smithsonian Institution Press, Washington, D.C., pp. 252–258.
- Lin, P.-C. (2010) *Spatiotemporal distribution of hydromedusae in the water off southern and northern Taiwan*. Master Thesis, University of Zhongshan, China, 114 pp.
- Lindner, A., Govindarajan, A.F. & Migotto, A.E. (2011) Cryptic species, life cycles, and the phylogeny of *Clytia* (Cnidaria: Hydrozoa: Campanulariidae). *Zootaxa*, 2980, 23–36.
- Lindner, A. & Migotto, A.E. (2002) The life cycle of *Clytia linearis* and *Clytia noliformis*: metagenic campanulariids (Cnidaria: Hydrozoa) with contrasting polyp and medusa stages. *Journal of the Marine Biological Association of the United Kingdom*, 82, 541–553.
<http://dx.doi.org/10.1017/s0025315402005866>
- Loman-Ramos, L., Ordóñez-López, U. & Segura-Puertas, L. (2007) Variación espacial de la comunidad de medusas (Cnidaria) del sur del Golfo de México, durante el otoño de 1999. *Hidrobiológica*, 17 (1), 203–212.
- Lopes, R.M. (2009) *Informe sobre as Espécies Exóticas Invasoras Marinhas no Brasil*. Brasília, Ministério do Meio Ambiente, Série Biodiversidade, 33, 439 pp.
- Lopes, R.M., Katsuragawa, M., Dias, J.F., Montú, M.A., Muelbert, J.H., Gorri, C. & Brandini, F.P. (2006a) Zooplankton and ichthyoplankton distribution in the southern Brazilian shelf: an overview. *Scientia Marina*, 70 (2), 189–202.
- Lucas, C.H. & Reed, A.J. (2009) Observations on the life histories of the narcomedusae *Aeginura grimaldii*, *Cunina peregrina* and *Solmissus incisa* from the western North Atlantic. *Marine Biology*, 156, 373–379.
<http://dx.doi.org/10.1007/s00227-008-1089-6>
- Lucić, D., Benović, A., Onofri, I., Batistić, M., Gangai, B., Miloslavić, M., Onofri, V., Njiri, J., Brautović, I., Bojanić Varezić, D., Morović, M. & Kogovšek, T. (2009) Planktonic cnidarians in the open Southern Adriatic Sea: a comparison of historical and recent data. *Annals for Istrian and Mediterranean Studies, Series Historia Naturalis*, 19 (2), 27–38.
- Marques, A.C., Morandini, A.C. & Migotto, A.E. (2003) Synopsis of Knowledge on Cnidaria Medusozoa from Brazil. *Biota Neotropica*, 3 (2), 1–18.
<http://dx.doi.org/10.1590/s1676-06032003000200007>
- Mayer, A.G. (1910) *Medusae of the World. Hydromedusae. Vol. I, II*. Carnegie Institution, Washington, D.C., 735 pp.
- Mesquita, S.S.A., Costa, R.M., Pereira, L.C.C. & Magalhães, A. (2006) Composição, ocorrência e distribuição das hidromedusas no estuário do rio Caeté, litoral do estado do Pará. *Boletim do Museu Paraense Emílio Goeldi em Ciências Naturais*, 1 (3), 113–119.
- Mianzan, H.W. (1989) Distribución de *Olindias sambaquiensis* Müller, 1861 (Hydrozoa, Limnomedusae) en el Atlántico Sudoccidental. *Iheringia Série Zoologia*, 69, 155–157.
- Mianzan, H.W., Fenner, P.J., Cornelius, P.F.S. & Ramirez, F.C. (2001) Vinegar as a disarming agent to prevent further discharge of the nematocysts of the stinging hydromedusa *Olindias sambaquiensis*. *Cutis*, 68, 45–49.
- Mianzan, H.W. & Guerrero, R.A. (2000) Environmental patterns and biomass distribution of gelatinous macrozooplankton. Three study cases in the South-western Atlantic Ocean. *Scientia Marina*, 64 (1), 215–224.
<http://dx.doi.org/10.3989/scimar.2000.64s1215>

- Mianzan, H.W. & Ramirez, F.C. (1996) *Olindias sambaquiensis* stings in the South West Atlantic. In: Williamson, J.A.H., Fenner, P.J., Burnett, J.W. & Rifkin, J.F. (Eds.), *Venomous and Poisonous Marine Animals: A Medical and Biological Handbook*. University of New South Wales Press, Brisbane, pp. 206–208.
- Mianzan, H.W., Sorarrain, D., Burnett, J.W. & Lutz, L.L. (2000) Mucocutaneous junctional and flexural paresthesias caused by the holoplanktonic trachymedusa *Liriope tetraphylla*. *Dermatology*, 201, 46–48.
<http://dx.doi.org/10.1159/000018429>
- Miglietta, M.P., Piraino, S., Kubota, S. & Schuchert, P. (2007) Species in the genus *Turritopsis* (Cnidaria, Hydrozoa): a molecular evaluation. *Journal of Zoological Systematics and Evolutionary Research*, 45 (1), 11–19.
<http://dx.doi.org/10.1111/j.1439-0469.2006.00379.x>
- Miglietta, M.P., Rossi, M. & Collin, R. (2008) Hydromedusa blooms and upwelling events in the Bay of Panama, Tropical East Pacific. *Journal of Plankton Research*, 30 (7), 783–793.
<http://dx.doi.org/10.1093/plankt/fbn038>
- Migotto, A.E. (1996) Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastião, Brazil, including a checklist of Brazilian hydroids. *Zoologische Verhandlungen, Leiden*, 306, 1–125.
- Migotto, A.E. & Marques, A.C. (1999) Hydroid and medusa stages of the new species *Ectopleura obypa* (Cnidaria: Hydrozoa: Tubulariidae) from Brazil. *Proceedings of the Biological Society of Washington*, 112 (2), 303–312.
- Migotto, A.E., Marques, A.C., Morandini, A.C. & Silveira, F.L. (2002) Checklist of the Cnidaria Medusozoa of Brazil. *Biota Neotropica*, 2 (1), 1–30.
<http://dx.doi.org/10.1590/s1676-06032002000100010>
- Mills, C.E. (1995) Medusae, siphonophores and ctenophores as planktivorous predators in changing global ecosystems. *ICES Journal of Marine Sciences*, 52, 575–581.
[http://dx.doi.org/10.1016/1054-3139\(95\)80072-7](http://dx.doi.org/10.1016/1054-3139(95)80072-7)
- Mills, C.E. (2001) Jellyfish blooms: are populations increasing globally in response to changing ocean conditions? *Hydrobiologia*, 451, 55–68.
http://dx.doi.org/10.1007/978-94-010-0722-1_6
- Miranda, L.S., Collins, A.G. & Marques, A.C. (2010) Molecules clarify a cnidarian life cycle—The “hydrozoan” *Microhydrula limopscicola* is an early life stage of the staurozoan *Haliclystus antarcticus*. *PLoS ONE*, 5 (4), e10182.
<http://dx.doi.org/10.1371/journal.pone.0010182>
- MMA, Ministry of Environment (2007) Áreas Prioritárias para a Conservação, Uso Sustentável e Repartição de Benefícios da Biodiversidade Brasileira: Atualização—Portaria No. 09, 23 janeiro 2007. *Diário Oficial da União*, 17, 55.
- Montú, M. & Cordeiro, T.A. (1988) Zooplankton del complejo estuarial de la Bahía de Paranaguá. I. Composición, dinámica de las especies, ritmos reproductivos y acción de los factores ambientales sobre la comunidad. *Nerítica*, 3 (1), 61–83.
- Morandini, A.C., Stampar, S.N., Migotto, A.E. & Marques, A.C. (2009) *Hydrocoryne iemanja* (Cnidaria), a new species of Hydrozoa with unusual mode of asexual reproduction. *Journal of the Marine Biological Association of the United Kingdom*, 89 (1), 67–76.
<http://dx.doi.org/10.1017/s0025315408002968>
- Moreira, G.S. (1973) On the diurnal vertical migration of hydromedusae off Santos, Brazil. *Publications of the Seto Marine Biology Laboratory*, 20, 537–566.
- Moreira, G.S. (1975) Sobre duas Leptomedusae do litoral do estado de São Paulo. *Ciência e Cultura*, 27 (5), 556–558.
- Moreira, G.S. (1978) A preliminary laboratory study on the salinity and temperature tolerances of some medusae from the São Paulo coast, Brazil. *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 27 (2), 45–55.
- Nagata, R.M. (2006) *Impacto das macromedusas na pesca de arrastos no litoral paranaense*. Undergraduate Thesis, Universidade Federal do Paraná, Curitiba, 49 pp.
- Navas-Pereira, D. (1980) Hydromedusae of the Bay of Sepetiba (Rio de Janeiro, Brazil). *Revista Brasileira de Biologia*, 40 (4), 817–824.
- Navas-Pereira, D. (1981) Distribuição das hidromedusas (Cnidaria, Hydrozoa) na região da plataforma continental do Rio Grande do Sul. In: Lunetta, J.E. (Ed.), *Seminários de Biologia Marinha*, Anais da Academia Brasileira de Ciências, São Paulo, pp. 221–276.
- Navas-Pereira, D. & Vannucci, M. (1991) The Hydromedusae and water masses of the Indian Ocean. *Boletim do Instituto Oceanográfico*, 39 (1), 25–60.
<http://dx.doi.org/10.1590/s0373-55241991000100003>
- Neumann-Leitão, S., Eskinazi-Sant’anna, E.M., Gusmão, L.M.O., Nascimento-Vieira, D.A., Paranaguá, M.N. & Schwaborn, R. (2008) Diversity and distribution of the mesozooplankton in the tropical, Southwestern Atlantic. *Journal of Plankton Research*, 30 (7), 795–805.
<http://dx.doi.org/10.1093/plankt/fbn040>
- Nogueira, M. (2006) *Macrozooplâncton gelatinoso do litoral do Paraná: composição, abundância e aspectos ecológicos*. Master Thesis, Universidade Federal do Paraná, Curitiba, 156 pp.
- Nogueira, M. (2011) *Composição, migração vertical e distribuição espaço-temporal do zooplâncton gelatinoso (Cnidaria, Ctenophora e Thaliacea) da Plataforma Sudeste do Brasil*. PhD Thesis, Universidade Federal do Paraná, Curitiba, 237 pp.

- Nogueira, M. (2012) Gelatinous zooplankton fauna (Cnidaria, Ctenophora and Thaliacea) from Baía da Babitonga (southern Brazil). *Zootaxa*, 3398, 1–21.
- Nogueira, M. & Haddad, M.A. (2006a) Variações morfológicas de *Olindias sambaquiensis* (Cnidaria, Hydrozoa, Limnomedusae) no litoral de Guaratuba, Paraná. *Revista Brasileira de Zoologia*, 23 (3), 879–882.
<http://dx.doi.org/10.1590/s0101-81752006000300036>
- Nogueira, M. & Haddad, M.A. (2006b) Macromedusae (Cnidaria) from the Paraná coast, Southern Brazil. *Journal of Coastal Research*, 39, 1161–1164.
- Nogueira, M., Nagata, R.M. & Haddad, M.A. (2010) Seasonal variation of macromedusae (Cnidaria) at North Bay, Florianópolis, southern Brazil. *Zoologia*, 27 (3), 377–386.
<http://dx.doi.org/10.1590/s1984-46702010000300009>
- Nogueira, M. & Oliveira, J.S. (2006) *Moerisia inkermanica* Paltschikowa–Ostroumova (Hydrozoa; Moerisiidae) e *Blackfordia virginica* Mayer (Hydrozoa; Blackfordiidae) na Baía de Antonina, Paraná, Brasil. *Pan-American Journal of Aquatic Sciences*, 1 (1), 35–42.
- Nogueira, M., Robert, M.C. & Haddad, M.A. (2006) *Calliactis tricolor* (Anthozoa, Acontaria) epibionte em *Brachyura* (Crustacea, Decapoda) no litoral sul do Paraná e Norte de Santa Catarina. *Acta Biologica Paranaense*, 35 (3–4), 233–248.
- Nogueira, M., Rodriguez, C., Mianzan, H., Haddad, M., Genzano, G. (2013) Description of a new hydromedusa from the Southwestern Atlantic Ocean, *Bougainvillia pagesi* sp. nov. (Cnidaria, Hydrozoa, Anthoathecata). *Marine Ecology*, 34 (suppl. 1), 1–10.
<http://dx.doi.org/10.1111/maec.12030>
- Palma, S., Apablaza, P. & Silva, N. (2007) Hydromedusae (Cnidaria) of the Chilean southern channels (from the Corcovado Gulf to the Pulluche–Chacabuco Channels). *Scientia Marina*, 71 (1), 65–74.
<http://dx.doi.org/10.3989/scimar.2007.71n165>
- Pagès, F., Gili, J.-M. & Bouillon, J. (1992) Medusae (Hydrozoa, Scyphozoa, Cubozoa) of the Benguela Current (southeastern Atlantic). *Scientia Marina*, 56 (1), 1–64.
- Petersen, K.W. (1990) Evolution and Taxonomy in Capitata Hydroids and Medusae. *Zoological Journal of the Linnean Society*, 100, 101–231.
<http://dx.doi.org/10.1111/j.1096-3642.1990.tb01862.x>
- Piraino, S., Boero, F., Aeschbach, B. & Schmid, V. (1996) Reversing the life cycle: medusae transforming into polyps and cell transdifferentiation in *Turritopsis nutricula* (Cnidaria, Hydrozoa). *Biological Bulletin*, 190, 302–312.
<http://dx.doi.org/10.2307/1543022>
- Piraino, S., De Vito, D., Schmich, J., Bouillon, J. & Boero, F. (2004) Reverse development in Cnidaria. *Canadian Journal of Zoology*, 82, 1748–1754.
<http://dx.doi.org/10.1139/z04-174>
- Purcell, J.E., Uye, S.-I. & Lo, W. (2007) Anthropogenic causes of jellyfish blooms and their direct consequences for humans: a review. *Marine Ecology Progress Series*, 350, 153–174.
<http://dx.doi.org/10.3354/meps07093>
- Ramírez, F.C. & Zamponi, M.O. (1981) Hydromedusae. In: Boltovskoy, D. (Ed.), *Atlas del Zooplancton del Atlántico Sudoccidental y Metodos de Trabajo con el Zooplancton Marino*. INIDEP, Mar del Plata, pp. 443–469.
- Robert, M.C., Souza, M.A.M. & CHAVES, P.T.C. (2007) Biologia de *Paralorchurus brasiliensis* (Steindachner) (Teleostei Sciaenidae) no litoral sul do Estado do Paraná, Brasil. *Revista Brasileira de Zoologia*, 24, 191–198.
<http://dx.doi.org/10.1590/s0101-81752007000100024>
- Russell, F.S. (1939) On the Medusa *Gossea brachymera* Bigelow. *Proceedings of the Zoological Society of London*, B108 (4), 707–710.
<http://dx.doi.org/10.1111/j.1469-7998.1939.tb08093.x>
- Russell, F.S. (1953) *The Medusae of the British Isles. Anthomedusae, Leptomedusae, Limnomedusae, Trachymedusae and Narcomedusae*. Cambridge University Press, London, 530 pp.
- Santhakumari, V. (1993) A study of medusae from Andaman and Nicobar waters. *Journal of the Zoological Society of Kerala*, 3 (1), 37–43.
- Santhakumari, V. & Nair, R.V. (1997) Ecology of hydromedusae from Bombay Harbour—Thana and Bassein Creek Estuarine Complex. *Indian Journal of Marine Sciences*, 26, 162–168.
- Santhakumari, V., Tiwari, L.R. & Nair, V.R. (1999) Species composition, abundance and distribution of hydromedusae from Dharamtar estuarine system, adjoining Bombay harbor. *Indian Journal of Marine Science*, 28, 158–162.
- Sartori, L.P. & Lopes, R.M. (2000) Seasonal variability of pelagic copepod assemblages on the inner continental shelf off Paraná, Brazil. *Nauplius*, 8, 79–88.
- Schuchert, P. (2004) Revision of the European athecate hydroids and their medusae (Hydrozoa, Cnidaria): families Oceanidae and Pachycordylidae. *Revue Suisse de Zoologie*, 11, 315–369.
- Schuchert, P. (2013) *World Hydrozoa Database*. Available from: <http://www.marinespecies.org/hydrozoa> (accessed 16 June 2013)
- Segura-Puertas, L. (1992) Medusae (Cnidaria) from Yucatan Shelf and Mexican Caribbean. *Bulletin of Marine Science*, 51 (3), 353–359.

- Segura-Puertas, L., Suárez-Morales, E. & Celis, L. (2003) Checklist of the Medusae (Hydrozoa, Scyphozoa and Cubozoa) of Mexico. *Zootaxa*, 194, 1–15.
- 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 (4), 81–89.
- Suárez-Morales, E., Segura-Puertas, L. & Gasca, R. (1995) Medusas (Cnidaria Hydrozoa) de la Bahía de Chetumal, Quintana Roo, Mexico (1990–1991). *Caribbean Journal of Science*, 31 (3–4), 243–251.
- Suárez-Morales, E., Segura-Puertas, L. & Gasca, R. (1999) A survey of the reef-related medusa (Cnidaria) community in the western Caribbean Sea. *Gulf Research Reports*, 11, 23–31.
- Suárez-Morales, E., Gasca, R., Segura-Puertas, L. & Biggs, D.C. (2002) Planktonic cnidarians in a cold-core ring in the Gulf of Mexico. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México, Serie Zoología*, 73 (1), 19–36.
- Thiel, M.E. (1936) Systematische Studien an den Trachylinae der Meteor Expedition, zugleich ein Beitrag zu einer Revision der Trachylinae. *Zoologische Jahrbücher, Systematik*, 69, 1–92.
- Thiel, M.E. (1938) Die Leptolinae der "Meteor" Expedition in systematischer Betrachtung (I. Anthomedusae). *Zoologischer Anzeiger*, 121, 289–303.
- Tronolone, V.B. (2001) *Hidromedusas (Cnidaria, Hydrozoa) do canal de São Sebastião, SP*. Master Thesis, Universidade de São Paulo, São Paulo, 184 pp.
- Tronolone, V.B. (2007) *Estudo faunístico e da distribuição das hidromedusas (Cnidaria, Hydrozoa) da região compreendida entre Cabo Frio (RJ) e Cabo de Santa Marta Grande (SC), Brasil*. PhD Thesis, Universidade de São Paulo, São Paulo, 217 pp.
- Uchida, T. & Sugiura, Y. (1975) On the formation of medusa buds in *Proboscicactyla ornata*. *Publications of the Seto Marine Biological Laboratory*, 22, 347–354.
- Vannucci, M. (1951a) Hydrozoa e Scyphozoa existentes no Instituto Paulista de Oceanografia I. *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 2 (1), 67–98.
<http://dx.doi.org/10.1590/s0100-42391951000100003>
- Vannucci, M. (1951b) Distribuição dos Hydrozoa até agora conhecidos nas costas do Brasil. *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 2 (1), 105–124.
<http://dx.doi.org/10.1590/s0100-42391951000100004>
- Vannucci, M. (1955) On the newly liberated medusa of *Obelia hyaline* Clarke 1879. *Dusenía*, 6 (1–2), 55–60.
- Vannucci, M. (1957) On Brazilian Hydromedusae and their distribution in relation to different water masses. *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 8 (1–2), 23–109.
<http://dx.doi.org/10.1590/s0373-55241957000100002>
- Vannucci, M. (1960) On the young stage of *Eucheilota duodecimalis* (Leptomedusae). *Anais da Academia Brasileira de Ciências*, 32 (3–4), 395–397.
- Vannucci, M. (1963) On the ecology of Brazilian medusae at 25° lat. S. *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 13 (1), 143–184.
<http://dx.doi.org/10.1590/s0373-55241963000100002>
- Vannucci, M. & Rees, W.J. (1961) A revision of the genus *Bougainvillia* (Anthomedusae). *Boletim do Instituto Oceanográfico da Universidade de São Paulo*, 11 (2), 57–100.
<http://dx.doi.org/10.1590/s0373-55241961000100003>
- Vannucci, M. & Ribeiro, L.C. (1955) O ciclo de vida de *Clytia cylindrica* L. Agass. 1862 (Hydrozoa: Campanulariidae). *Dusenía*, 6 (3–4), 69–81.
- Vannucci, M. & Tundisi, J. (1962) Las medusas existentes en los museos de La Plata y Buenos Aires. *Comunicaciones del Museo Natural de Ciencias Naturales "Bernardino Rivadavia"*, 3 (8), 203–215.
- Xu, Z.-Z. & Huang, J.-Q. (2004) On New Species and Record of Laingiomedusae and Leptomedusae (Cnidaria, Hydrozoa, Hydroidomedusae) in the Taiwan Strait. *Journal of Xiamen University (Natural Science)*, 43 (1), 107–114.
- Zamponi, M.O. & Facal, O.N. (1987) Estudio bioecológico de *Olindias sambaquiensis* Müller 1861, en la area de Monte Hermoso. I Ciclo de vida (Limnomedusae, Olindiidae). *Neotropica*, 33 (90), 119–126.
- Zamponi, M.O. & Genzano, G.N. (1989a) Variaciones de algunas estructuras de valor taxonómico en la Familia Geryonidae (Cnidaria; Trachymedusae) y su relación con la temperatura y salinidad. *Iheringia Série Zoologia*, 69, 31–47.
- Zamponi, M.O. & Genzano, G.N. (1989b) Nuevas adiciones a la medusofauna de la region subantártica. II. Trachymedusae (Coelenterata: Hydrozoa). *Neotropica*, 34 (91), 33–39.