



<http://dx.doi.org/10.11646/zootaxa.3919.1.7>

<http://zoobank.org/urn:lsid:zoobank.org:pub:FCC72B2D-BA06-4B46-89B1-6D2D0388189D>

## Redescription of *Alitta succinea* (Leuckart, 1847) and reinstatement of *A. acutifolia* (Ehlers, 1901) n. comb. based upon morphological and molecular data (Polychaeta: Nereididae)

TULIO F. VILLALOBOS-GUERRERO<sup>1</sup> & LUIS F. CARRERA-PARRA

*El Colegio de la Frontera Sur, Unidad Chetumal, Estructura y Función del Bentos, Departamento de Sistemática y Ecología Acuática, Av. Centenario, Chetumal, Quintana Roo, 77014, México*

<sup>1</sup>Corresponding author. E-mail: [tulio1786@msn.com](mailto:tulio1786@msn.com), [tvillalobos@ecosur.edu.mx](mailto:tvillalobos@ecosur.edu.mx)

### Abstract

The nereidid worm *Alitta succinea* (Leuckart, 1847), described from Western Germany, has been considered by some authors as a widespread and alien invasive species, or else as a group of morphologically indistinguishable species. Neither idea has yet been supported by critical taxonomic revisions of relevant material. Most characterizations of *A. succinea* were based upon a mixture of morphological features from specimens from the type locality and from other regions. Moreover, four species described from America are considered junior synonyms of *A. succinea*, including *Nereis acutifolia* Ehlers, 1901, described from the eastern tropical Pacific. The type material of the latter species has not been reviewed since its description. We re-examined type and topotype materials of *A. succinea* and *N. acutifolia* including atokous and epitokous specimens. In addition, newly collected specimens were used to evaluate genetic divergence between both species using the mitochondrial gene COI. *Alitta succinea* is redescribed from type material and specimens from Germany. We rejected the recent placement of the species in *Neanthes* and we transferred it to *Alitta*. Further, we refuse the synonymy of *N. acutifolia* with *A. succinea* due to morphological and molecular differences. Consequently, we regard *Alitta acutifolia* n. comb. as a valid species, and the supposed introduction and the alien status of *A. succinea* along the Mexican and Central American Pacific shores are rejected.

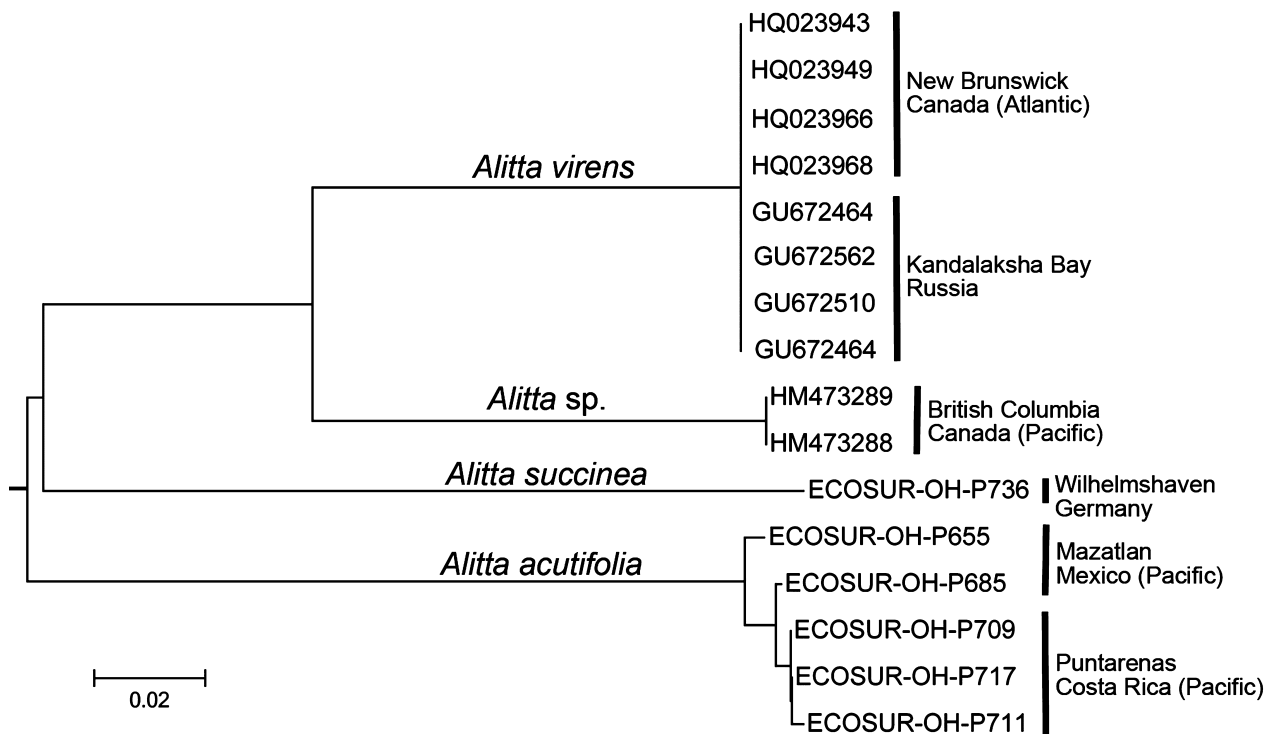
**Key words:** Annelida, COI, DNA Barcoding, Mexican Pacific, morphology, paragnaths, re-establishment, species complex, taxonomy

### Introduction

*Alitta succinea* (Leuckart, 1847), commonly known as the pileworm, ragworm, or clamworm, is a nereidid polychaete described from Helgoland (Germany) and is now regarded as having worldwide distribution. Many maritime anthropogenic activities (Carlton 1979; Wilson 1984; Bakken & Wilson 2005; Glasby *et al.* 2009; Gillet *et al.* 2011; Villalobos-Guerrero 2012; Sato 2013; Ghasemi *et al.* 2013) and high tolerance to fluctuations of some environmental parameters (Wolff 1973; Kuhl & Oglesby 1979; Neuhoff 1979; Kristensen 1983; Fong 1991) are proposed as factors explaining a global widespread distribution. These ideas led the designation of *A. succinea* as an invasive species with almost world-wide distribution (Global Invasive Species Database 2007). In contrast, other authors consider the species as a morphologically indistinguishable species complex (Wilson 1988; Steiner & Santos 2004; Dean *et al.* 2012); this conclusion has been also reached for some nereidid complexes that show dissimilar reproductive patterns, such as *Platynereis dumerilii* (Audouin & Milne-Edwards, 1833) and related species (Read 2007) or *Neanthes japonica* (Izuka, 1912) (Wilson 1988). However, neither status of *A. succinea* (cosmopolitanism or cryptic species) is supported by taxonomic studies based on delineation of species morphology using only specimens from Western Germany; the most recent revisions included a mixture of specimens from worldwide localities (see below).

Generic and species delineation of what we know as “*Alitta succinea*” has a complex and problematic taxonomic history. The species has been variously placed in three genera or subgenera: *Nereis* Linnaeus, 1758

and Central American Pacific are likely *A. acutifolia* **n. comb.** (e.g., Monro 1933; Rioja 1947, 1962; de León-González & Solís-Weiss 2000; Villalobos-Guerrero 2012; Villalobos-Guerrero & Tovar-Hernández 2014). The description of *N. succinea* from various depths and substrates from the Pacific of Costa Rica (Dean 2001) is similar to *A. acutifolia* **n. comb.**; however, the size of Dean's specimen (length: 259 mm, width: 19 mm, 91 chaetigers) exceeds by far the size range of the species (length: 7–44 mm, width: 0.5–6 mm, 122 chaetigers). Re-examination of the largest specimen reported by Dean (2001) is required to assess some diagnostic features and corroborate the identification.



**FIGURE 4.** Neighbor-joining tree of COI sequences of *Alitta* species using T92+G.

## Acknowledgments

Angelika Brandt (ZMH), Birger Neuhaus (ZMB), Karen Osborn and Linda Ward (USNM) made kindly available the type and some topotype materials of involved species. Alexandra Market (Senckenberg) and Patricia Salazar Silva (ITBB) generously send us materials fixed in alcohol for molecular analysis. We are also indebted to María Ana Tovar Hernández (Geomare) for providing us specimens from the Gulf of California through the grant INE/ADE-013/2011. We thank Linda Ward and Karen Osborn (USNM) who kindly provided space and careful support to one of us (TFVG) in the Smithsonian Museum. Arely Martínez Arce (ECOSUR) kindly help us with the process of DNA Barcoding, as part of the Mexican Barcode of Life (MEXBOL). Special thanks are given to Sergio I. Salazar-Vallejo (ECOSUR) and J. Ángel de León-González (UANL) who provided valuable ideas and suggestions. We are grateful to Robin S. Wilson, Torkild Bakken and Jason D. Williams who contributed greatly with their recommendations to improve this contribution. During this research, TFVG was supported by a scholarship from ECOSUR and CONACyT (513943).

## References

- Abbiati, M. & Maltagliati, F. (1992) Genetic population structure of *Neanthes succinea* (Polychaeta, Nereididae). *Journal of the Marine Biological Association of the United Kingdom*, 72, 511–517.  
<http://dx.doi.org/10.1017/S0025315400059300>

- Annenkova, N.P. (1929) Polychaeten aus dem Reliktsee Palaostom (West Kaukasus) und den mit ihm verbundenen Flüssen. *Doklady Akademii Nauk SSSR*, 21, 138–140.
- Augener, H. (1933) Polychaeten aus den Zoologischen Museen von Leiden und Amsterdam. *Zoologische Mededeelingen uitgegeven door het Rijksmuseum van Natuurlijke Historie te Leiden*, 15, 177–260.
- Audouin, J.V. & Milne-Edwards, H. (1833) Classification des Annélides et description de celles qui habitent les côtes de la France. *Annales des sciences naturelles*, Série 1, 29, 195–269. [Paris]
- Bakken, T. & Wilson, R.S. (2005) Phylogeny of nereidids (Polychaeta, Nereididae) with paragnaths. *Zoologica Scripta*, 34, 507–547.  
<http://dx.doi.org/10.1111/j.1463-6409.2005.00200.x>
- Bakken, T., Glasby, C.J. & Wilson, R.S. (2009) A review of paragnath morphology in Nereididae (Polychaeta). *Zoosymposia*, 2, 305–316.
- Banse, K. (1954) Über Morphologie und Larvalentwicklung von *Nereis (Neanthes) succinea* (Leuckart) 1847. *Zoologische Jahrbücher. Abteilung für Anatomie und Ontogenie der Tiere*, 74, 160–171.
- Barroso, R., Klautau, M., Solé-Cava, A.M. & Paiva, P.C. (2010) *Eurythoe complanata* (Polychaeta: Amphinomidae), the ‘cosmopolitan’ fireworm, consists of at least three cryptic species. *Marine Biology*, 157, 69–80.  
<http://dx.doi.org/10.1007/s00227-009-1296-9>
- Berkeley, E. & Berkeley, C. (1953) Swarming of *Nereis succinea* (Leuckart) off the East Coast of Canada. *Nature*, 171, 847.  
<http://dx.doi.org/10.1038/171847a0>
- Carlton, J.T. (1979) Introduced invertebrates of San Francisco Bay. In: Conomos, T.J. (Ed.), *San Francisco Bay: the urbanized estuary - Investigations into the natural history of San Francisco Bay and Delta with reference to the influence of man*. Pacific Division, American Association for the Advancement of Science, pp. 427–444.
- Carr, M.C., Hardy, S.M., Brown, T.M., Macdonald, T.A. & Hebert, P.D.N. (2011) A Tri-Oceanic Perspective: DNA Barcoding reveals geographic structure and cryptic diversity in Canadian polychaetes. *PLoS ONE*, 6, e22232.  
<http://dx.doi.org/10.1371/journal.pone.0022232>
- Carrera-Parra, L.F. & Salazar-Vallejo, S.I. (2011) Redescriptions of *Eunice filamentosa* and *E. denticulata* and description of *E. tovarae* n. sp. (Polychaeta: Eunicidae), highlighted with morphological and molecular data. *Zootaxa*, 2880, 51–64.
- Chambers, S. & Garwood, P. (1992) *Polychaetes from Scottish waters. A guide to identification: Part 3 Family Nereididae*. National Museums of Scotland, Edinburgh, 64 pp. [Scotland]
- Claparède, E. (1870) Les annélides chétopodes du Golfe de Naples. Supplément. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève*, 20, 365–542.
- Dales, R.P. (1962) The polychaete stomodeum and the inter-relationships of the families of Polychaeta. *Proceedings of the Zoological Society of London*, 139 (3), 389–428.
- de Blainville, H. (1818) Mémoire sur la classe des Sétipodes partie des Vers à sang rouge de M. Cuvier, et des Annélides de M. de Lamarck. *Bulletin des Sciences par la Société Philomatique de Paris*, 1818, 78–85.
- de León-González, J.A. & Solís-Weiss, V. (2000) A review of the polychaete family Nereididae from western Mexico. *Bulletin of Marine Science*, 67, 549–569.
- de León-González, J.A., Solís-Weiss, V. & Ochoa-Rivera, V. (1999) Nereidids (Polychaeta) from the Caribbean Sea and adjacent Coral Islands of the southern Gulf of Mexico. *Proceedings of the Biological Society of Washington*, 112, 667–681.
- de Quatrefages, A. (1866) *Histoire Naturelle des Annelés Marins et d'Eau Douce: Annélides et Géphyriens*. Tome Premier. Librairie Encyclopédique de Roret, Paris, 588 pp.
- de Saint-Joseph, A.A. (1898) Les Annélides Polychètes des côtes de France (Manche et Océan). *Annales des Sciences Naturelles, Zoologie*, Série 8, 5, 209–464.
- Dean, H.K. (2001) Some Nereididae (Annelida: Polychaeta) from the Pacific Coast of Costa Rica. *Revista de Biología Tropical*, 49, 37–67.
- Dean, H.K., Sibaja-Cordero, J.A. & Cortés, J. (2012) Polychaetes (Annelida: Polychaeta) of Cocos Island National Park, Pacific Costa Rica. *Pacific Science*, 66, 347–386.  
<http://dx.doi.org/10.2984/66.3.8>
- Ehlers, E. (1868) *Die Borstenwürmer (Annelida Chaetopoda) nach Systematischen und Anatomischen Untersuchungen*. Verlag von Wilhelm Engelmann, Leipzig, xx + 269, 269–748, 24 taf.
- Ehlers, E. (1901) *Die Polychaeten des magellanischen und chilenischen Strandes: Ein faunistischer Versuch. Festschrift zur Feier des 150jährigen Bestehens der Königlichen Gesellschaft der Wissenschaften zu Göttingen*. Weidmannsche, Berlin, 232 pp.
- Ehlers, E. (1908) Die bodensässigen Anneliden aus den Sammlungen der deutschen Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der deutschen Tiefsee- Expedition au dem Dampfer "Valdivia"*, 16, 1–167.  
<http://dx.doi.org/10.1038/078267a0>
- Ehlers, E. (1920) Polychaeten von Java und Amboina. Ein Beitrag zur Kenntnis der malaiischen Strandfauna. *Abhandlungen der königlichen Gesellschaft der Wissenschaften zu Göttingen, Mathematisch-Physikalische Klasse*, 10, 1–73, pls 1–3.
- Fauvel, P. (1912) Sur quelques néréidiens (*Perinereis marionii* Aud. Edw. - *P. macropus* Clap. - *Neanthes succinea* Leuck.). *Comptes rendu de l'Association Française pour l'avancement des sciences*, 40, 559–566.
- Fauvel, P. (1919) Annélides Polychètes de la Guyane Française. *Bulletin du Muséum d'Histoire Naturelle*, 25, 472–479. [Paris]

- Fauvel, P. (1923a) Annélides Polychètes des îles Gambiers et de la Guyane française. *Memorie della Pontificia Accademia Romana dei Nuovi Lincei*, Series 2, 6, 1–59.
- Fauvel, P. (1923b) Polychètes errantes. *Faune de France*, 5, 1–488.
- Fauvel, P. (1936) Remarques sur les Néréidiens *Nereis succinea* Leuckart et *Nereis lamellosa* Ehlers. *Bulletin de la Société Zoologique de France*, 61, 307–314.
- Fauvel, P. & Rullier, F. (1959) Contribution à la faune des annélides polychètes du Sénégal et de Mauritanie. Première Partie. *Bulletin de l'Institut français d'Afrique noire*, Séries A, 21, 477–533.
- Ferrando, A. & Méndez, N. (2010) Checklist of soft-bottom polychaetes (Annelida: Polychaeta) of the coastal lagoon Estero de Urías (Sinaloa, Mexico). *Marine Biodiversity Records*, 3, 1–6.  
<http://dx.doi.org/10.1017/S1755267210000710>
- Fong, P.P. (1991) The effects of salinity, temperature, and photoperiod on epitokal metamorphosis in *Neanthes succinea* (Frey et Leuckart) from San Francisco Bay. *Journal of Experimental Marine Biology and Ecology*, 149, 177–190. [http://dx.doi.org/10.1016/0022-0981\(91\)90044-W](http://dx.doi.org/10.1016/0022-0981(91)90044-W)
- Ghasemi, A.F., Taheri, M. & Jam, A. (2013) Does the introduced polychaete *Alitta succinea* establish in the Caspian Sea? *Helgolander Marine Research*, 67, 715–720.  
<http://dx.doi.org/10.1007/s10152-013-0356-1>
- Gillandt, L. (1979a) Zur Systematik, Autökologie und Biologie der Polychaeten des Helgoländer Felslitorals. *Mitteilungen aus dem Hamburgischen zoologischen Museum und Institut*, 76, 19–73.
- Gillandt, L. (1979b) Zur ökologie der polychaeten des Helgoländer Felslitorals. *Helgoländer wissenschaftliche Meeresuntersuchungen*, 32, 1–35.  
<http://dx.doi.org/10.1007/BF02189890>
- Gillet, P., Surugiu, V., Metais, I., Mouloud, M. & Simo, P. (2011) Preliminary data on population dynamics and genetics of *Alitta succinea* (Polychaeta: Nereididae) from the Romanian coast of the Black Sea. *Italian Journal of Zoology*, 78, 1–13.  
<http://dx.doi.org/10.1080/11250003.2011.593347>
- Global Invasive Species Database (2007). *Alitta succinea*. Available from: <http://www.issg.org/database/species/ecology.asp?si=1068&fr=1&sts=sss&lang=EN> (accessed 25 August 2014)
- Glasby, C.J. (1993) Family revision and cladistic analysis of the Nereidoidea (Polychaeta: Phyllococida). *Invertebrate Taxonomy*, 7, 1551–1573.  
<http://dx.doi.org/10.1071/IT9931551>
- Glasby, C.J., Timm, T., Muir, A.I. & Gil, J. (2009) Catalogue of non-marine Polychaeta (Annelida) of the World. *Zootaxa*, 2070, 1–52.
- Glasby, C.J., Wilson, R.S. & Bakken, T. (2011) Redescription of the Indo-Pacific polychaete *Neanthes pachychaeta* (Fauvel, 1918) n. comb. (Annelida, Phyllococida, Nereididae) and its synonyms. *Zoosystema*, 33, 361–375.  
<http://dx.doi.org/10.5252/z2011n3a5>
- Glasby, C.J., Nu-Wei, V.W. & Gibb, K.S. (2013) Cryptic species of Nereididae (Annelida: Polychaeta) on Australian coral reefs. *Invertebrate Systematics*, 27, 245–264.  
<http://dx.doi.org/10.1071/IS12031>
- Gravier, C. (1909) Annelides polychetes recueillis a Payta (Perou). Mission du service géographique de l'armée pour la mesure d'un arc de meridien equatorial en Amerique du Sud. Sous le controle scientifique de l'Academie des Sciences, 1899-1906. *Zoologie*, 9, 93–126.
- Grube, A.E. (1850) Die Familien der Anneliden. *Archiv für Naturgeschichte*, Berlin, 16, 249–364.
- Hartman, O. (1936) New species of polychaetous annelids of the family Nereidae from California. *Proceedings of the United States National Museum*, 83, 467–480.
- Hartman, O. (1938) Brackish and fresh-water Nereidae from the northeast Pacific, with the description of a new species from central California. *University of California Publications in Zoology*, 43, 79–82.
- Hartman, O. (1940) Polychaetous annelids. Part II. Chrysopetalidae to Goniadidae. *Allan Hancock Pacific Expeditions*, 7, 173–287.
- Hartman, O. (1945) The marine annelids of North Carolina. *Bulletin of the Duke University Marine Station*, 2, 1–51.
- Hartman, O. (1954) The marine annelids of San Francisco Bay and its environs, California. *Occasional Papers of the Allan Hancock Foundation*, 15, 1–20.
- Hartman, O. (1959) Catalogue of the polychaetous annelids of the world. Part 1. *Occasional Papers of the Allan Hancock Foundation*, 23, 1–353.
- Hartmann-Schröder, G. (1959) Zur Ökologie der Polychaeten des Mangrove-Estero-Gebietes von El Salvador. *Beiträge zur neotropischen Fauna*, 1, 69–183.
- Hartmann-Schröder, G. (1996) *Annelida, Borstenwürmer, Polychaeta*. Gustav Fischer, Jena, 648 pp. [Germany]
- Hartwich, G. (1993) Die Polychaeten-Typen des Zoologischen Museums in Berlin. *Mitteilungen aus dem zoologisches Museum*, Berlin, 69 (1), 73–154.
- Heinen, A. (1911) Die Nephthydeen und Lycorideen der Nord- und Ostsee, einschliesslich der verbindenden Meeresteile. *Wissenschaftliche Meeresuntersuchungen*, Kiel, Series neue folge, 13, 1–87.
- Horst, R. (1909) On the supposed identity of *Nereis* (*Neanthes*) *succinea* Leuck. and *N. perrieri* St. Jos. *Notes from the Leyden Museum*, 30, 215–218.

- Horst, R. (1910) De anneliden der Zuiderzee. Mededelingen betreffende de uitkomsten der Zuiderzee-Expeditie. *Tijdschrift der Nederlandsche Dierkundige Vereeniging, Leiden*, Series 2, 11, 138–152.
- Horst, R. (1924) Polychaeta errantia of the Siboga Expedition. Pt. 3. Nereidae and Hesionidae. *Siboga-Expeditie*, 24, 144–198, 7 pls.
- Hutchings, P.A. & Turvey, S.P. (1982) The Nereididae of South Australia. *Transactions of the Royal Society of South Australia*, 106, 93–144.
- Hylleberg, J., Nateewathana, A. & Bussarawit, S. (1986) Polychaetes of Thailand, Nereidae (Part 1), *Perinereis* and *Pseudonereis*, with notes on species of commercial value. *Phuket Marine Biological Center Research Bulletin*, 43, 1–22.
- Iannotta, M.A., Gambi, M.C. & Patti, F.C. (2009) Molecular evidence of intraspecific variability in *Lysidice ninetta* (Polychaeta: Eunicidae) in the Mediterranean Sea. *Aquatic Biology*, 6, 121–132.
- Imajima, M. (1972) Review of the annelid worms of the family Nereidae of Japan, with descriptions of five new species or subspecies. *Bulletin of the National Science Museum*, 15, 37–153. [Tokyo]
- Izuka, A. (1912) The errantiate polychaeta of Japan. *Journal of the College of Science, Imperial University*, 30, 1–262. [Tokyo]
- Jones, W.J., Johnson, S.B., Rouse, G.W. & Vrijenhoek, R.C. (2008) Marine worms (genus *Osedax*) colonize cow bones. *Proceedings of the Royal Society B: Biological Sciences*, 275, 387–391.  
<http://dx.doi.org/10.1098/rspb.2007.1437>
- Kesäniemi, J.E., Rawson, P.D., Lindsay, S.M. & Knott, K.E. (2012) Phylogenetic analysis of cryptic speciation in the polychaete *Pygospio elegans*. *Ecology and Evolution*, 2, 994–1007.  
<http://dx.doi.org/10.1002/ece3.226>
- Khlebovich, V.V. (1996) *Fauna of Russia and neighbouring countries. Polychaetous annelids. 3. Polychaetes of the family Nereididae of the Russian Seas and the adjacent waters. New Series 140. Russian Academy of Sciences, Zoological Institute, St Petersburg*. Nauka Publishing House, Moscow, 222 pp. [in Russian]
- Khlebovich, V.V. & Jirkov, I.A. (2001) Nereidae Lamarck, 1818. In: Jirkov, I.A. (Ed.), *Polychaeta of the Arctic Ocean*. Yanus-K, pp. 222–235. [in Russian]
- Khlebovich, V.V., Komendantov, A.Y. & Shklyarevich, G.A. (1980) Validity of *Nereis virens*, *N. grandis* and *N. brandti* (Annelida, Polychaeta) and variations in the number of their paragnaths. *Zoologicheskii zhurnal*, 59, 1617–1624.
- Kinberg, J.G.H. (1865) Annulata nova. Nereidum dispositio nova. *Öfversigt af Kongelige Vetenskaps-Akademiens Förhandlingar*, 22, 167–179.
- Kristensen, E. (1983) Ventilation and oxygen uptake by three species of *Nereis* (Annelida: Polychaeta). II. Effects of temperature and salinity changes. *Marine Ecology Progress Series*, 12, 299–306.
- Kuhl, D.L. & Oglesby, L.C. (1979) Reproduction and survival of the pileworm *Nereis succinea* in higher Salton Sea salinities. *Biological Bulletin*, 157, 153–165.
- Leuckart, R.S. (1847) Verzeichnis der zur Fauna Helgoland's gehörenden wirbellosen Seethiere. In: Frey, H. & Leuckart, R.S. (Eds.), *Beiträge zur Kenntnis Wirbelloser Thiere mit Besonderer Berücksichtigung der Fauna des Norddeutschen Meeres*. Friedrich Vieweg und sohn, Braunschweig, pp. 136–168.
- Linnaeus, C. (1758) *Systema Naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Editio decima, reformata. Laurentius Salvius, Holmiae, ii + 824 pp.
- Luttikhuisen, P.C. & Dekker, R. (2010) Pseudo-cryptic species *Arenicola defodiens* and *Arenicola marina* (Polychaeta: Arenicolidae) in Wadden Sea, North Sea and Skagerrak: Morphological and molecular variation. *Journal of Sea Research*, 63, 17–23.
- Malmgren, A.J. (1865) Nordiska Hafs-Annulater. *Öfversigt af Kongliga Vetenskaps-Akademiens förhandlingar*, Stockholm, 22, 51–110.
- Malmgren, A.J. (1867) Annulater polychaeta Spetsbergiae, Gronlandiae, Islandiae et Scandinaviae hactenus cognita. *Öfversigt af Kongliga Vetenskaps-Akademiens förhandlingar*, Stockholm, 24, 127–235.
- Maturana, C.S., Moreno, R.A., Labra, F.A., González-Wevar, C.A., Rozbaczylo, N., Carrasco, F.D. & Poulin, E. (2011) DNA barcoding of marine polychaetes species of southern Patagonian fjords. *Revista de Biología Marina y Oceanografía*, 46, 35–42.
- McIntosh, W.C. (1910) *A Monograph of the British Annelids, 2. Polychaeta. Syllidae to Ariciidae. Vol. 2*. Ray Society of London, London, 291 pp. [pp. 233–524]
- Mearns, A.J. & Reish, D.J. (1969) A comparison of the free amino acids in two populations of the polychaetous annelid *Neanthes succinea*. *Bulletin of the Southern California Academy of Sciences*, 68, 43–53.
- Monro, C.C.A. (1933) The polychaeta errantia collected by Dr. C. Crossland at Colon, in the Panama region, and the Galapagos Islands during the expedition of the S.Y. St. George. *Proceedings of the Zoological Society of London*, 1933, 1–96.
- Monro, C.C.A. (1938) On a small collection of polychaeta from Uruguay. *Annals and Magazine of Natural History*, 2, 311–314.
- Neuhoff, H.G. (1979) Effects of seasonally varying factors on a *Nereis succinea* population (Polychaeta, Annelida). *Marine Ecology Progress Series*, 1, 263–268.
- Nygren, A. & Pleijel, F. (2011) From one to ten in a single stroke – resolving the European *Eumida sanguinea* (Phyllodocidae, Annelida) species complex. *Molecular Phylogenetics and Evolution*, 58, 132–141.  
<http://dx.doi.org/10.1016/j.ympev.2010.10.010>
- Nygren, A., Sundkvist, T., Mikac, B. & Pleijel, F. (2010) Two new and two poorly known autolytines (Polychaeta: Syllidae)

- from Madeira and the Mediterranean Sea. *Zootaxa*, 2640, 35–52.
- Pettibone, M.H. (1956) Some polychaete worms of the families Hesionidae, Syllidae and Nereidae from the east coast of North America, West Indies, and Gulf of Mexico. *Journal of the Washington Academy of Sciences*, 46, 281–294.
- Pettibone, M.H. (1963) Marine polychaete worms of the New England region. 1. Aphroditidae through Trochochaetidae. *Bulletin of the United States National Museum*, 227, 1–356.
- Pflugfelder, O. (1933) Landpolychaeten aus Niederländisch-Indien. *Zoologischer Anzeiger*, 105, 65–76.
- Ratnasingham, S. & Hebert, P.D.N. (2007) BOLD: The Barcode of Life Data System ([www.barcodinglife.org](http://www.barcodinglife.org)). *Molecular Ecology Notes*, 7, 355–364.  
<http://dx.doi.org/10.1111/j.1471-8286.2006.01678.x>
- Read, G.B. (2007) Taxonomy of sympatric species of New Zealand *Platynereis*, with description of three new species additional to *P. australis* (Schmarda) (Annelida: Polychaeta: Nereididae). *Zootaxa*, 1558, 1–28.
- Rioja, E. (1918) Datos para el conocimiento de la fauna de anélidos poliquetos del Cantábrico. *Trabajos del Museo Nacional de Ciencias Naturales de Madrid, Serie Zoológica*, 37, 1–99.
- Rioja, E. (1946) Estudios anelidológicos. XV. Nereidos de agua salobre de los esteros del litoral del Golfo de México. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 17, 205–214.
- Rioja, E. (1947) Estudios anelidológicos, XVII. Contribución al conocimiento de los anélidos poliquetos de Baja California y Mar de Cortés. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 18, 197–224.
- Rioja, E. (1962) Estudios anelidológicos. XXVI. Algunos anélidos poliquetos de las costas del Pacífico de México. *Anales del Instituto de Biología, Universidad Nacional Autónoma de México*, 33, 131–229.
- Salazar-Silva, P. & Carrera-Parra, L.F. (2014) Revision of *Lepidonopsis humilis* (Augener, 1922) and description of *L. barnichae* sp. nov. (Annelida: Polychaeta: Polynoidae) based upon morphological and molecular characters. *Zootaxa*, 3790 (4), 555–566.  
<http://dx.doi.org/10.11646/zootaxa.3790.4.4>
- Sampértegui, S., Rozbaczylo, N., Canales-Aguirre, C.B., Carrasco, F., Hernández, C.E. & Rodríguez-Serrano, E. (2013) Morphological and molecular characterization of *Perinereis gualpensis* (Polychaeta: Nereididae) and its phylogenetic relationships with other species of the genus off the Chilean coast, Southeast Pacific. *Cahiers de Biologie Marine*, 54, 27–40.
- Santos, C.S.G., Pleijel, F., Lana, P. & Rouse, G.W. (2005) Phylogenetic relationships within Nereididae (Annelida: Phyllococida). *Invertebrate Systematics*, 19, 557–576.
- Sars, M. (1835) *Beskrivelser og lagttagelser over nogle moerkelige eller nye i Havet ved den Bergenske Kyst levende Dyr af Polypernes, Acalephernes, Radiaternes, Annelidernes og Molluskernes classer, med en kort Oversigt over de hidtil af Forfatter. Bergen. Trykt paa Thorstein Hallagers Forlag hos Chr. Dahl, R. S. xii + 81 pp., 15 pls.*
- Sato, M. (2013) Resurrection of the genus *Nectoneanthes* Imajima, 1972 (Nereididae: Polychaeta), with redescription of *Nectoneanthes oxypoda* (Marenzeller, 1879) and description of a new species, comparing them to *Neanthes succinea* (Leuckart, 1847). *Journal of Natural History*, 47, 1–50.
- Sato, M. & Nakashima, A. (2003) A review of Asian *Hediste* species complex (Nereididae, Polychaeta) with descriptions of two new species and a redescription of *Hediste japonica* (Izuka, 1908). *Zoological Journal of the Linnean Society*, 137, 403–445.  
<http://dx.doi.org/10.1046/j.1096-3642.2003.00059.x>
- Smith, R.I. (1963) On the occurrence of *Nereis* (*Neanthes*) *succinea* at the Kristineberg Zoological Station, Sweden, and its recent northward spread. *Arkiv för Zoologi*, 15, 437–441.
- StatSoft, Inc. (2007) STATISTICA (data analysis software system) (8.0). Available from: <http://www.statsoft.com> (accessed 5 January 2015)
- Stainer, T.M. & Santos, C.S.G. (2004) A new species of *Neanthes* (Annelida, Polychaeta, Nereididae) from Brazil, and some remarks on *Neanthes bruaca* Lana & Sovierzoski, 1987. *Beaufortia*, 54, 39–57.
- Stimpson, W. (1853) Synopsis of the marine Invertebrata of Grand Manan: or the region about the mouth of the Bay of Fundy, New Brunswick. *Smithsonian Contributions to Knowledge*, 6, 1–66, 3 pls.
- Sun, Y., Kupriyanova, E.K. & Qiu, J.W. (2012) COI barcoding of *Hydroïdes*: a road from impossible to difficult. *Invertebrate Systematics*, 26, 539–547.  
<http://dx.doi.org/10.1071/IS12024>
- Tamura, K., Peterson, D., Peterson, N., Stecher, G., Nei, M. & Kumar, S. (2011) MEGA5: Molecular evolutionary genetics analysis using likelihood, distance, and parsimony methods. *Molecular Biology and Evolution*, 28, 2731–2739.
- Tebble, N. (1955) The polychaete fauna of the Gold Coast. *Bulletin of the British Museum (Natural History), Series Zoology*, 3, 59–148.
- Tovar-Hernández, M.A. & Carrera-Parra, L.F. (2011) *Megalomma* Johansson, 1925 (Polychaeta: Sabellidae) from America and other world-wide localities, and phylogenetic relationships within the genus. *Zootaxa*, 2861, 1–71.
- Tovar-Hernández, M.A., Villalobos-Guerrero, T.F., Yáñez-Rivera, B., Aguilar-Camacho, J.M. & Ramírez-Santana, I.D. (2012) *Guía de invertebrados acuáticos exóticos en Sinaloa. Geomare, A. C., USFWS, INESEMARNAT. Mazatlán, México. 41 pp.*
- Treadwell, A.L. (1923) The heteronereis phase of a new species of a polychaetous annelid from Uruguay. *Proceedings of the United States National Museum*, 64, 1–3.

- Villalobos-Guerrero, T.F. (2012) Ficha técnica y análisis de riesgo de *Alitta succinea* (Leuckart in Frey & Leuckart, 1847) (Polychaeta: Nereididae). In: Low-Pfeng, A.M. & Peters-Recagno, E.M. (Ed.), *Invertebrados marinos exóticos en el Pacífico mexicano*. Geomare, A.C., INE-Semarnat, México, D.F., pp. 131–165.
- Villalobos-Guerrero, T.F. & Tovar-Hernández, M.A. (2014) Poliquetos errantes (Polychaeta: Errantia) esclerobiontes del puerto de Mazatlán, Sinaloa (México). *Boletín de Investigaciones Marinas y Costeras*, 43, 43–87.
- Vrijenhoek, R.C., Johnson, S.B. & Rouse, G.W. (2009) A remarkable diversity of bone-eating worms (*Osedax*; Siboglinidae; Annelida). *BMC Biology*, 7, 1–13.  
<http://dx.doi.org/10.1186/1741-7007-7-74>
- von Marenzeller, E. (1879) Südjapanische Anneliden, 1 Amphinomea, Aphroditea, Lycoridea, Phyllodocea, Hesionea, Syllidea, Eunicea, Glycera, Sternaspidea, Chaetoptera, Cirratulea, Amphictenea. *Denkschriften der Kaiserlichen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Classe der Kaiserlichen Akademie der Wissenschaften*, 41, 109–154.
- Wesenberg-Lund, E. (1949) Polychaetes of the Iranian Gulf. *Danish Scientific Investigations in Iran*, 4, 247–400.
- Wilson, R.S. (1984) *Neanthes* (Polychaeta: Nereididae) from Victoria with descriptions of two new species. *Proceedings of the Royal Society of Victoria*, 96, 209–226.
- Wilson, R.S. (1988) Synonymy of the genus *Nectoneanthes* Imajima, 1972, with *Neanthes* Kinberg, 1866 (Polychaeta: Nereididae). *Proceedings of the Biological Society of Washington*, 101, 4–10.
- Wolff, W.J. (1973) The estuary as a habitat. An analysis of data on the soft-bottom macrofauna of the estuarine area of the rivers Rhine, Meuse, and Scheldt. *Zoologische Verhandelingen, Leiden*, 126, 1–242.
- Wu, B.L., Sun, R. & Yang, D. (1981) *The Nereidae (Polychaetous Annelids) of the Chinese Coast*. Institute of Oceanology, Academia Sinica, Qingdao (Tsingtao), vi + 234 pp. [English translation published by China Ocean Press, Beijing and Springer-Verlag, Berlin, vi + 234 pp., 1985]
- Yáñez-Rivera, B. & Carrera-Parra, L.F. (2012) Reestablishment of *Notopygos megalops* McIntosh, description of *N. caribea* sp. n. from the Greater Caribbean and barcoding of “amphiamerican” *Notopygos* species (Annelida, Amphinomididae). *ZooKeys*, 223, 69–84.  
<http://dx.doi.org/10.3897/zookeys.223.3561>