First insights into marine invasions along the Namibian coast

Cathleen Deelie[1,2,3], Carol A Simon[1,] Tamara B Robinson[2]

[1]Department of Botany and Zoology, Stellenbosch University, Matieland, 7609, South Africa

[2]Centre for Invasion Biology, Stellenbosch University, Matieland, 7609, South Africa

[3] Department of Environmental Science, University of Namibia, Windhoek, 10005, Namibia

Supplementary Material

Details of the taxa reported as alien and cryptogenic from Namibia

Porifera

The cryptogenic sponge, *Hymeniacidon perlevis* Montagu, 1814, was recorded at Lüderitz in 1969 (Penrith & Kensley 1970a), Möwe Bay in the Kunene region in 2014 (Kreiner 2014) and at Swakopmund in 2019 (Kreiner et al. 2019a). It is a common sponge that occupies a wide variety of coastal habitats across most ocean basins (Turner 2020). Hull fouling has been suggested as a likely mechanism of introduction of this species (Schwindt et al. 2020). The sea orange, *Suberites ficus* Johnston, 1842 (alien) was collected at Black rock, Lüderitz in 1998 (Samaai & Gibbons 2005). It is native to the northeast Atlantic and the Mediterranean Sea, and alien on the west coast of South Africa (Samaai & Gibbons 2005). The bread sponge, *Halichondria panicea* Pallas, 1766 (alien) was recorded in Lüderitz in the Ikaras region (Samaai & Gibbons 2005). Its persistence was confirmed in 2024 when it was noted in the intertidal zone of Shear water Bay in Lüderitz (Kelp Blue 2024). This sponge is native to the North Atlantic and has a wide alien distribution from Iceland to the Mediterranean, northern Canada to New England and North Pacific (Erpenbeck & Van Soest 2002). The suggested mechanism of introduction for this species is hull fouling. (Schwindt et al. 2020).

Cnidaria

The wiry hydroid *Amphisbetia operculata* Linnaeus, 1758 (cryptogenic) was collected during an intertidal fauna survey at Diaz Point in Lüderitz (Penrith & Kensley 1970a). This hydroid is cryptogenic along the southwestern Atlantic (Schwindt et al. 2020) as well as along the Chilean southern Pacific coast (Leclerc et al. 2020) but is recognized as alien in Australia (Ruiz

et al. 2000). The suggested mechanisms of introduction are shipping related, i.e. hull fouling and ballast water (Schwindt et al. 2020). The pink hydroid, *Coryne eximia* Allman, 1859 (alien) was reported as *Sarsia eximia* Allman, 1859 from Lüderitz (Millard 1975). While this species has a circum-global distribution (Schuchert 2005), the suggested origin is either the North Atlantic or the North Pacific (Mead et al. 2011b). This hydroid is considered alien in the Tunisian part of the Mediterranean Sea (Amor et al. 2016), along the South African coast (Robinson et al. 2016) and the Chilean part of south Pacific Ocean (Leclerc et al. 2020). The plumed hydroid, *Plumularia setacea* Linnaeus, 1758 (cryptogenic), was reported in Namibia from the Kunene River mouth south to Möwe Bay, Henties Bay, Swakopmund, Walvis Bay and Lüderitz (Penrith & Kensley 1970a, Penrith & Kensley 1970b; Gili et al. 1989). This represents a range of more than 812km. This species is thought to have been introduced by hull fouling (Schwindt et al. 2020). The sea thread hydroid, *Obelia dichotoma* Linnaeus, 1758 (cryptogenic) was recorded in the Kunene, Erongo and Ikaras regions (Penrith & Kensley 1970b; Millard 1975; Kensley & Penrith 1980; Gili et al. 1989) while the congener *Obelia geniculata* Linnaeus, 1758 (alien) is known only from Lüderitz (Millard 1975; Gili et al.1989) in the Ikaras region. Both species are common on kelps and ships hulls but can be distinguished by the presence of a thickened stem below the hydrotheca of *O. geniculata* (Schuchert 2001). The cross-jelly hydroid, *Ptychogena crocea* Kramp & Damas, 1925 (alien) was recorded as *Stegopoma plicatile* Sars, 1863 in Lüderitz (Gili et al. 1989). This hydroid is native to the North Atlantic Ocean (Van der Land et al. 2001) and has been reported from east and west Pacific (Schuchert 2001, Schuchert et al. 2017).

Annelida

The only alien polychaete known from Namibia, *Polydora websteri* Hartman in Loosanoff & Engle, 1943 has been recorded on cultured oysters in Swakopmund (Williams 2015; Rodewald et al. 2021). As the oysters are grown directly in the coastal environment the polychaete is accepted as introduced. Namibian individuals of this species share haplotypes with populations from South Africa (Rodewald et al. 2021). *Polydora websteri* is the second most wide-spread polydorid pest of mollusc culture in the world (Rodewald et al. 2021). To date impacts on the Namibian oyster culture industry have not been quantified but elsewhere polydorid pests have had detrimental impacts on aquaculture production (Martinelli et al. 2020) that have led to significant economic losses (Shinn et al. 2015).

Crustacea

Crustaceans known from Namibia include barnacles, tanaids, isopods and amphipods. Of the three species of barnacles that have been reported, only the Pacific barnacle *Balanus glandula* Darwin, 1854 (alien) occurs intertidally. This species is native to the Pacific coast of North America from Baja in California to Alaska (Newman & Abbott 1980) and has invaded other cold temperate regions including Argentina (Schwindt et al. 2020), Japan (Kado 2003), South Africa (Simon-Blecher et al. 2008; Laird & Griffiths 2008) and Atlantic coast of Europe (Kerckhof et al. 2018). The recognition of *B. glandula* in South Africa was delayed as it was confused with the superficially similar native barnacle *Chthamalus dentatus* Krauss, 1848 (Simon-Blecher et al. 2008). There is, however, evidence that it has been in South Africa since at least 1992 (Laird & Griffith 2008). It has recently been recorded in Namibia for the first time (Spencer Bay, Lüderitz (Kreiner et al. 2019b) and the Kunene region (Bezeng & Van der Bank 2019)). Two mechanisms of introduction are possible for this species; ship aided dispersal or natural spread from South Africa (Mead et al. 2011b). The triangle barnacle, *Balanus trigonus* Darwin, 1854 (alien) has a native distribution in the Pacific Ocean and is widely distributed in the Atlantic Ocean (Carlton et al. 2011). It is considered introduced to West Africa (Guinea (Weltner 1897); Congo (Gruvel (1905); Mauritania (Gruvel 1912) and Angola (Gruvel 1912, Pestana et al. 2020)). This barnacle was introduced to South Africa via vessel traffic (Millard 1952). Only one record of *B. trigonus* is known from Great Fish Bay which borders Angola (Stubbings 1967). Follow-up surveys would help to establish if this species has spread from this location.

The cryptogenic tanaidacean *Chondrochelia savignyi* Krøyer, 1842, was reported as *Leptochelia savignyi* Krøyer, 1842 in Lüderitz, by Penrith & Kensley (1970a). It has been found on the British Columbian coast (Gartner et al. 2016) as well as in the Mediterranean Sea (Koulouri et al. 2020). The most likely mechanism of introduction is hull fouling (Bamber 1977).

The alien amphipod *Ischyrocerus anguipes* Krøyer, 1838 has been recorded at Lüderitz in the south (Penrith & Kensley 1970a) and at Rocky Point, in the north (Kensley & Penrith 1980). It is suggested to be native to the North Atlantic (Mead et al. 2011b) and has been introduced to the north western Atlantic (King & Holmes 2004) as well as South Africa (Griffiths 1974). This amphipod is tube dwelling and attaches to algae, bryozoans, sponges, hydroids (Lippert

et al. 2001), and artificial substrata (Mead et al. 2011b). This species is thought to have been moved around via ballast water and hull fouling (Mead et al. 2011a). The fat feeler amphipod *Monocorophium acherusicum* A. Costa, 1853 (alien) was recorded in Lüderitz as *Corophium acherusicum* A. Costa, 1853 (Penrith & Kensley1970a). The suggested native range of this species is the North Atlantic (Mead et al. 2011b) while it is considered alien in Argentina (Albano et al. 2013; Schwindt et al. 2014), British Columbia (Gartner et al. 2016) and South Africa (Barnard 1916). In other counties, however, it's regarded as cryptogenic. These include Brazil (Neves & da Rocha 2008), Chile (Pérez-Schultheiss 2009), Hawaii (Carlton & Eldredge 2009), Australia (Hewitt et al. 2004) and New Zealand (Cranfield et al. 1998). Considering its global distribution (Griffiths et al. 2009; Ruiz et al. 2011), this species has most probably been introduced through hull fouling (Albano & Obenat 2019) and ballast water (Gollasch et al. 2000).

The isopods *Synidotea hirtipes* Milne Edwards, 1840 and *Synidotea variegata* Collinge, 1917 are both considered cryptogenic in Namibia and have been reported from the Robert Harbour in Lüderitz (Kensley 1978; Chapman 1999). These isopods are thought to have been dispersed on the hulls of ships (Chapman & Carlton 1994). The isopod *Ligia exotica* Roux, 1828 (alien), commonly known as the sea roach, is a semi-terrestrial isopod that has been reported from Robert Harbour in Lüderitz (Panning 1924). It represents one of the oldest documented introductions of a marine organism (Hurtado et al. 2018). It has a wide tropical and subtropical distribution where it is frequently found in harbours, and ports, and on other man-made structures (Yin et al. 2013). It is considered introduced in South Africa where it is believed to been introduced by wooden ships and solid ballast (Griffiths et al. 2011). The mangrove boring isopod *Sphaeroma terebrans* Spence Bate, 1866 (alien) was collected from Lüderitz (1911) and was identified much later by Loyola e Silva (1960). Its native region is the Indo-Pacific (Chapman & Carlton 1994) and it was likely introduced to the Atlantic on the hulls of wooden ships before 1850 (Carlton & Ruckelshaus 1997).

Bryozoa

Bryozoans grow on hard surfaces such as rocks, seaweed, oysters, ship hulls, maritime structures, power plant intake pipes, and aquaculture equipment (Xavier et al. 2021). The brown bryozoan, *Bugula neritina* Linnaeus, 1758 (cryptogenic) was collected at Lüderitz (Lim 2004) and is recognized as a species complex (Fehlauer-Ale et al. 2014), but work has not been

completed on the morphological distinction and renaming of taxa in the complex. The *Bugula neritina* complex has been introduced to the southwest Atlantic, the northeast and southwest Pacific (Carlton 1979; Wonham & Carlton 2005), the coast of northern Europe (Ryland 1960) and Hawaii (Carlton & Eldredge 2009). Presently, three species are recognized within the complex. Type S is considered to have a worldwide distribution, while Type D is geographically restricted to California and Type N is restricted to the north-western Atlantic. The identity of the Namibian specimens has not been confirmed. The hairy sea mat *Electra verticillata* Ellis & Solander, 1786 (alien) has a native range in the northeastern Atlantic, the Mediterranean Sea, the Atlantic coast of the Iberian Peninsula and North Africa (Nikulina et al. 2013). In 1969 this bryozoan was recorded at Rocky Point in the Kunene region (Penrith & Kensley 1970b).

Mollusca

Thee South African abalone *Haliotis midae* Linnaeus, 1758, was introduced to Penguin and Seal Islands in Lüderitz in 2002 for mariculture purposes (Britz et al. 2019). The cultivation of this abalone requires continual stock imports as the species cannot reproduce naturally under Namibian conditions (Faul et al. 2020). As such this abalone is not expected to become established, although how this may be affected by climate change remains unknown. Another gastropod, the periwinkle *Littorina saxatilis* Olivi, 1792 (alien) was recorded. It is an intertidal snail that that was first noted by Reid et al. (1996) in Lüderitz. This record identified the fourth African population of this species. Native to the North Atlantic, introduced populations of this species are known from California (Carlton & Cohen 1998), Italy (Reid et al. 1996), and southern Africa (Mead et al. 2011b).

The South American mussel *Semimytilus patagonicus* (alien) was the first alien bivalve known from Namibia and was recorded in Walvis Bay in the period 1928 – 1931 (Lamy 1931) and later further north at Cape Cross in 1957 (Kensley & Penrith 1970). In 1968 it was reported for the first time in the Kunene region (Kensley & Penrith 1970). It is native to the Pacific coast of South America and has spread to the Atlantic coast of South America (Bigatti et al. 2014) and the western coast of southern Africa (Kensley & Penrith 1980; Mead et al. 2011b; de Greef et al. 2013). This species has thus been in the coastal waters of Namibia for more than 94 years. The Mediterranean mussel *Mytilus galloprovincialis* (alien) was first reported from Lüderitz in 1988, 18 years after it was first noted in South Africa (Hockey & Van Erkom 1992). In 2002,

it was eventually observed much further north at Portuguese Lorry and False Cape Fria, in the Kunene region (Kreiner et al. 2019c). This species is native to the Mediterranean (Gosling 1992) and is widely introduced to all continents, except in Antarctica (Hillbisch et al. 2000). The most rapid invasion by *M. galloprovincialis* took place in southern Africa (Grant & Cherry 1985; Branch and Steffani 2004), where it spread along more than 3,860 km (1,510 km in Namibia and 2,350 km in South Africa) in just 47 years (Ma et al. 2021). It displays an antitropical distribution which is the result of trans-equatorial migration from the northern to the southern hemisphere (Hilbish et al. 2000). Moreover, it has been reported mostly in ports and harbours so the likely introduction mechanisms are ballast water and hull fouling (Sylvester et al. 2011). *Mytilus galloprovincialis* is known to have negative impacts in its introduced range. It is a dominant space occupier that outcompetes native species (Robinson et al. 2007; Gardner et al. 2012). Other known impacts include hybridisation with congeners, *Mytilus edulis* Linnaeus, 1758 and *Mytilus trossulus* A. Gould, 1850 (Branch & Steffani 2004: Assis et al. 2015) and alteration of community structure of rocky shores (Sadchatheeswaran et al. 2015). Impacts in Namibia have not yet been assessed but likely reflect those documented elsewhere. The Pacific oyster, *Magallana gigas* Thunberg, 1793 is native to Japan and the Pacific coasts of Asia (Herbert et al. 2016) and was first introduced to Namibia for mariculture purposes in the early 1990s (Mann et al. 1991). This species is now farmed in Swakopmund, Walvis Bay and Lüderitz. In 2023 it was documented in the Namibian Islands marine protected area by a citizen scientist (Hooft 2023). While this record was of dead shells, it does highlight the need for field surveys to confirm the extent of the invasion outside of culture facilities. The presence of the naval shipworm *Teredo navalis* Linnaeus, 1758 (alien) in Namibia was noted during the replacement of the wooden jetty in Swakopmund in 1911 (Kalb 2022). Additionally, this mollusc was detected during the excavation of an old shipwreck in Oranjemund in 2008 (Werz 2009; Alves 2011). It is a pest that damages and destroys wooden structures (Treneman et al. 2018). This boring bivalve was one of the earliest introductions in South Africa (Mead et al. 2011b).

Ascidiacea

Despite limited natural dispersal ability, they are easily spread at both regional and global scales, through various mechanisms like shipping and as contaminants associated with mariculture (Aldred & Clare 2014). The ascidians reported for Namibia include five alien and one cryptogenic species. The ascidian, *Corella eumyota* Traustedt, 1882 (cryptogenic) also

known as the orange-tipped sea squirt, was recorded in Lüderitz (Michealson 1914). This species is considered cryptogenic due to its circumpolar distribution within the temperate and sub-polar regions (Chile, Antarctic Peninsula, South Africa, Australia, New Zealand (Turon 1988; Lambert 2004)). *Ascidia sydneiensis* Stimpson, 1855, *Asterocarpa humilis* Heller, 1878, the *Diplosoma listerianum* complex Milne Edwards, 1841, and *Ciona robusta* Hoshino & Tokioka, 1967 are alien in Namibia. Except for the sea vase *C. robusta* which is known from the Ikaras, Kunene and Erongo regions, these species have been reported only from Lüderitz. *Ciona robusta,* previously known as *Ciona intestinalis* Linnaeus, 1767 (Brunetti et al. 2015; Pestana et al. 2020), is a solitary ascidian native to the Mediterranean Sea (Ruiz et al. 2011) and is a widespread fouling organism found in harbours and on man-made structures such as docks, pilings, boats, and aquaculture gear (Fitridge et al. 2012). The solitary tunicate, *A. sydneiensis* (alien), was first reported at Agate Beach in Lüderitz (Penrith & Kensley 1970a). It is native to the Indo-Pacific and has been introduced via shipping (Carlton & Eldredge 2009) to the Southwestern Atlantic, Southeast Pacific (Kott 1985) and South Africa (Monniot et al. 2001; Peters et al. 2017).The compass sea squirt *A. humilis* Heller, 1878 (alien), previously known as *Styela asymmetra* Hartmeyer, 1912, was first reported from Lüderitz by Michaelsen (1914). It has a wide distribution in the Southern Hemisphere (southeast Pacific (Chile: Kott 1985; Pinochet et al. 2017), southeast Atlantic (South Africa: (Monniot et al. 2001; Mead et al. 2011b; Peters et al. 2017) and southwest Atlantic (Argentina: (Schwindt et al. 2020)). Introduction of this ascidian is associated with hull fouling and mariculture (Bishop et al. 2013; Leclerc et al. 2020). The jelly crust colonial tunicate, *D. listerianum* Milne Edwards, 1841 is a recognised species complex (Rocha et al. 2021) and is native to the northeast Atlantic (Milne-Edwards 1841), but has a widespread alien distribution in Canada (Ma et al. 2018), the Caribbean (Rocha & Costa 2005), the Mediterranean (Brunetti et al. 1988), Southwestern Atlantic (Schwindt et al. 2014; 2020) and South Africa (Monniot et al. 2001; Mead et al. 2011b). In Namibia it was first reported from Lüderitz by Michaelsen (1914) and was probably introduced via fouling as in its other invaded ranges (Lambert & Lambert 1998; Mead et al. 2011b). The yellow didemnid, *Polysyncraton bilobatum* Lafargue, 1968 (cryptogenic) was reported from Namibia by Turon (1988) and as with most ascidians, its likely mechanism of introduction is hull fouling. It was noted by Turon (1988) that this species might be a group of morphologically similar species, so further research is needed to clarify the status of this record. The absence of this species in South Africa and Angola could be attributed to lack of research effort.

Chlorophyta

The fine green algae, *Cladophora prolifera* (Roth) Kützing, 1843 (alien) is widespread and has been introduced from the Mediterranean to the southern hemisphere (Hewitt et al. 2004). It is reported by Branch et al. (2022) as widely distributed along the entirety of the Namibian coast.

Ochrophyta

The giant kelp *Macrocystis pyrifera* (Linnaeus) C. Agardh, 1820, is the largest of the brown algae and is native to the Pacific coasts of North and South America (Fleischman et al. 2020). This kelp was intentionally introduced to Lüderitz in 2022 for mariculture purposes, with no record of the species in the country before then. It is grown from spores on land, and seedlings are then transplanted into the ocean in Shearwater Bay (Hooft 2023).

Rhodophyta

The red turf algae *Caulacanthus ustulatus* **(**Turner) Kützing, 1843 (alien) has been reported from Terrace Bay, Möwe Bay, Rocky Point, Torra Bay, Swakopmund and Lüderitz, (Kreiner 2014; 2019) resulting in a range of 280 km. This alga is native to the Pacific Ocean and has been reported from Japan, Indonesia, South Africa, Spain and New Zealand (Zuccoarello et al. 2002).

References

Albano, M.J., da Cunha Lana, P., Bremec, C., Elías, R., Martins, C.C., Venturini, N., Muniz, P., Rivero, S., Vallarino, E.A. & Obenat, S., 2013, "Macrobenthos and multi-molecular markers as indicators of environmental contamination in a South American port (Mar del Plata, Southwest Atlantic)", *Marine pollution bulletin*, *73*(1), 102-114, https://doi.org/10.1016/j.marpolbul.2013.05.032

Albano, M. J., & Obenat, S.M., 2019, "Fouling assemblages of native, non-indigenous and cryptogenic species on artificial structures, depths and temporal variation", *Journal of Sea Research* 144, 1–15, https://doi.org/10.1016/j.seares.2018.10.002

Aldred, N., & Clare, A.S., 2014, "Mini review: Impact and dynamics of surface fouling by solitary and compound ascidians", *Biofouling* 30, 259–270, https://doi.org/10.1080/08927014.2013.866653.

Alves, F.J.S., 2011, "The 16th century Portuguese Shipwreck of Oranjemund, Namibia. Report on the Missions carried out by the Portuguese team in 2008 and 2009", *Trabalhos da DANS* 45, 1–78.

Amor, K.O., Ben Rifi, M., Ghanem, R., Draief, I., Zaouali, J., & Ben Souissi, J., 2016, "Update of alien fauna and new records from Tunisian marine waters", *Mediterranean Marine Science* 17, 124–143, https://doi.org/10.12681/mms.1371.

Assis, J., Zupan, M., Nicastro, K.R., Zardi, G.I., McQuaid, C.D., & Serrão, E.A., 2015, "Oceanographic conditions limit the spread of a marine invader along southern African shores", *PLoS ONE* 10, 1–17, e0128124 doi: 10.1371/journal.pone.0128124.

Bamber, R.N., 1977, "On mobile littoral environments", *Porcupine Newsletter* 1, 62–63.

Barnard, K.H., 1916, "Contributions to the crustacean fauna of South Africa", *Annals of the South African Museum* 15, 105–302.

Bezeng, B.S., & van der Bank, H.F., 2019, "DNA barcoding of southern African crustaceans reveals a mix of invasive species and potential cryptic diversity", *PLoS ONE* 14, https://doi.org/10.1371/journal.pone.0222047.

Bigatti, G., Signorelli, J.H., & Schwindt, E., 2014, "Potential invasion of the Atlantic coast of South America by *Semimytilus algosus* (Gould, 1850)", *BioInvasions Records* 3, 241–246, https://doi.org/10.3391/bir.2014. 3.4.05.

Bishop, J., Roby, C., Yunnie, A., Wood, C., Lévêque L., Turon X., & Viard, F., 2013, "The Southern Hemisphere ascidian *Asterocarpa humilis* is unrecognised but widely established in NW France and Great Britain", *Biological Invasions* 15, 253–260, DOI 10.1007/s10530-012-0286-x.

Branch, G.M., Griffiths, C.L., Branch, M.L., & Beckley, L.E., 2022, "*Two Oceans: a Guide to the Marine Life of Southern Africa* ", (4th ed.), Cape Town, Struik Nature.

Branch, G.M., & Steffani, C.N., 2004, "Can we predict the effects of alien species? A case-history of the invasion of South Africa by *Mytilus galloprovincialis* (Lamarck)", *Journal of Experimental Marine Biology Ecology* 300, 189–215, https:// doi.org/10.1016/j.jembe.2003.12.007.

Britz, P., Iitembu, J.A., Cochrane, K.L., Ortega-Cisneros K., & Sauer, W.H.H., 2019, "Enhancing climate change resilience in the current Benguela series systems*", Report Namibia mariculture sector* 37.

Brunetti, R., Bressan, M., Marin, M., & Libralato, M., 1988, "On the ecology and biology of *Diplosoma listerianum* (Milne Edwards, 1841) (Ascidiacea, Didemnidae)", *Life and Environment* 123–131.

Brunetti, R., Gissi, C., Pennati, R., Caicci, F., Gasparini, F., & Manni, L., 2015, "Morphological evidence that the molecularly determined *Ciona intestinalis* type A and type B are different species: *Ciona robusta* and *Ciona intestinalis*", *Journal of Zoological Systematics and Evolutionary Research* 53, 186–193, doi: 10.1111/jzs.12101.

Carlton, J.T., 1979, "Introduced intertidal invertebrates of San Francisco Bay", In Conomos TJ (ED), *The urbanized estuary. American Association for the Advancement of Science, Pacific Division*. San Francisco, 427–444.

Carlton, J.T., & Ruckelshaus, MH., 1997, "Nonindigenous marine invertebrates and algae of Florida", In: Simberloff D, Schmitz DC, Brown TC (eds), *Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida*, Washington, DC, 187–201.

Carlton, J.T., & Cohen, A.N.,1998, "Periwinkle's progress: the Atlantic snail *Littorina saxatilis* (Mollusca: Gastropoda) establishes a colony on a Pacific shore", *Veliger* 41, 333–338.

Carlton, J.T., & Eldredge, L.G., 2009, "*Marine bioinvasions of Hawaii. The introduced and cryptogenic marine and estuarine animals and plants of the Hawaiian Archipelago*", Bishop

Museum Bulletins in Cultural and Environmental Studies 4, Bishop Museum Press, Honolulu, 202.

Carlton, J.T., Newman, W.A., & Pitombo, F.B., 2011, "The global dispersal of marine and estuarine crustaceans", In Galil BS, Clark PF, Carlton JT (eds), *In the wrong place: alien marine crustaceans*, Distribution, Biology and Impacts, 3–23. Dordrecht, Springer

Chapman, A.S., 1999, "From introduced species to invader: what determines variation in the success of *Codium fragile* spp. *tomentosoides* (Chlorophyta) in the north Atlantic Ocean", *Helgoland Marine Research* 52, 277–289.

Chapman, J.W., & Carlton, J.T., 1994, "Predicted Discoveries of the Introduced Isopod *Synidotea laevidorsalis* (Miers, 1881)", *Journal of Crustacean Biology* 14, 700–714.

Cranfield, H., Gordon, D.P., Willan, R., Marshall, B., Battershill, C., Frances, M., Glasby, G., & Read G., 1998, "Adventive marine species in New Zealand", *Wellington Technical Report* 34–48.

De Greef, K., Griffiths, C.L., & Zeeman, Z., 2013, "Deja vu? A second mytilid mussel, *Semimytilus algosus* invades South Africa's west coast", *African Journal of Marine Science* 35, 307–313, https://doi.org/10.2989/1814232X.2013.829789.

Erpenbeck, D., & Van Soest, R.W., 2002," Family Halichondriidae Gray, 1867" In: Hooper, J.N.A., Van Soest, R.W.M., & Willenz, P.,(eds), *Systema Porifera Springer Boston*, MA, https://doi.org/10.1007/978-1-4615-0747-5_84.

Faul, A., Botha, P., & Pelser, E., 2020, "Development and operations of proposed abalone and mussel mariculture activities and seaweed collection at Lüderitz", *Environmental Assessment Scoping Report* 100.

Fehlauer-Ale, K.H., Mackie, J.A., Lim-Fong, G.E., Ale, E., Pie, M.R., & Waeschenbach, A., 2014, "Cryptic species in the cosmopolitan *Bugula neritina* complex (Bryozoa, Cheilostomata)", *Zoologica Scripta* 43, 193–205, https://doi.org/10.1111/zsc.12042.

Fleischman, M.J., Bolton, J.J., & Rothman, MD., 2020, "Macrocystis (Laminariales, Phaeophyceae) in South Africa: distribution, morphology, and potential susceptibility to warming events", *Journal of Applied Phycology* 32, 2447–2457, https://doi.org/10.1007/s10811-019-01980-w.

Fitridge, I., Dempster, T., Guenther, J., & de Nys, R., 2012, "The impact and control of biofouling in marine aquaculture: A review", *Biofouling* 28, 649–669, https://doi.org/10.1080/08927014.2012.700478.

Gardner, J.P.A., & Westfall, K.M., 2012," Geographic distribution and molecular identification of a metapopulation of blue mussels (Genus Mytilus) in Northeastern New Zealand", *Journal of Molecular Studies* 78, 66–73.

Gartner, H.N., Murray, C.C., Frey, M.A., Nelson. J.C., Larson, K.J., Ruiz, G.M., & Therriault, T.W., 2016, "Non-indigenous invertebrate species in the marine fouling communities of British Columbia, Canada", *Bio Invasions Records* 5, 205–212, https://doi.org/10.3391/bir.2016.5.4.03.

Gili, J.M., Vervoort, W., & Pagès, F., 1989, "Hydroids from the west African coast: Guinea Bissau, Namibia and South Africa*", Scientia Marina* 53, 67–112.

Gollasch, S., Lenz, J., Dammer, M., & Andres, H.-G., 2000, "Survival of tropical ballast water organisms during a cruise from the Indian Ocean to the North Sea", *Journal of Plankton Research* 22, 923–937, https://academic.oup.com/plankt/article/22/5/923/1475703.

Griffiths, C.L., 1974, "The Amphipoda of Southern Africa. Part 4. The Gammaridea and Caprellidea of the Cape Province East of Cape Agulhas", *Annals of the South African Museum* 65, 251–336.

Griffiths, C.L., Robinson, T.B., & Mead, A., 2009, "The status and distribution of marine alien species in South Africa", In: Rilov, G., & Crooks. JA., (eds), *Biological invasions in marine ecosystems*, Springer-Verlag, Berlin, 393–408.

Griffiths, C.L., Robinson, T.B., Mead, A., 2011, "The Alien and Cryptogenic Marine Crustaceans of South Africa", In: Galil, B.S., Clark, P.F., & Carlton, J.T., (eds), *In the wrong place: Alien marine crustacea – Distribution, biology and impacts.* Invading Nature - Springer Series in Invasion Biology 6, Springer-Verlag, Berlin, Heidelberg, 269–282.

Gruvel, A.,1905, "Monograph of Cirrhipedes or Thecostraces" Masson et Cie, Paris, 120.

Gruvel, A., 1912, "Mission to the West Coast of Africa (1909–1910) and the collection of the Natural History Museum Les Cirrhipede", *Bulletin du Musee d'Histoire Naturelle de Paris* 18, 344–350.

Gosling, E.M., 1992, "Systematics and geographic distribution of Mytilus", Gosling, E.M., (ED), *The Mussel Mytilus; Ecology, Physiology, Genetic and Culture. Developments in Aquaculture and Fisheries Science* 25, Elsevier Science, Amsterdam, Netherlands.

Herbert, R.J.H., Humphreys, J., Davies, C.J., Roberts, C., Fletcher, S., & Crowe, TP., 2016, "Ecological impacts of non-native Pacific oysters (Crassostrea gigas) and management measures for protected areas in Europe", *Biodiversity and Conservation* 25, 2835–2865, https://doi.org/10.1007/s10531-016-1209-4.

Hewitt, C.L., Campbell. M.L., Thresher, R.E., Martin, R.B., Boyd, S., Cohen, B.F., Currie, D.R., Gomon, M.F., Keough, M.J., Lewis, J.A., Lockett, M.M., Mays, N., McArthur, M.A., O'Hara, T.D., Poore, G.C.B., Ross, D.J., Storey, M.J., Watson, J.E., & Wilson, RS., 2004, "Introduced and cryptogenic species in Port Phillip Bay, Victoria, Australia", *Marine Biology* 144, 183–202, https://doi.org/10.1007/s00227-003-1173-x.

Hilbish, T.J., Mullinax, A., Dolven, SI., Meyer, A., Koehn, R.K., Rawson, P.D., 2000, "Origin of the antitropical distribution pattern in marine mussels (Mytilus spp.): Routes and timing of transequatorial migration", *Marine Biology* 136, 69–77, https://doi.org/10.1007/s002270050010.

Hockey, P.A.R., & van Erkom Schurink, C., 1992, "The invasive biology of the mussel *Mytilus galloprovincialis* on the southern African coast", *Transactions of the Royal Society of South Africa* 48, 123–139, https://doi.org/10.1080/00359199209520258.

Hooft, D., 2023, *Magallana gigas*, https://www.inaturalist.org/observations/183645876. Accessed 2025-02-17

Hurtado, L.A., Mateos, M., Wang, C., Santamaria, C.A., Jung, J., Khalaji-Pirbalouty, V., & Kim, W., 2018, "Out of Asia: Mitochondrial evolutionary history of the globally introduced supralittoral isopod *Ligia exotica", PeerJ* 6, e4337, https://doi.org/ 10.7717/peerj.4337.

Kado, R., 2003, "Invasion of Japanese shores by the NE Pacific barnacle *Balanus glandula* and its ecological and biogeographical impact", *Marine Ecology Progress Series* 249, 99–206.

Kalb, M., 2022, "Environing Empire: Nature, Infrastructure and the Making of German Southwest Africa" Berghahn Books, New York 23.

Kelp Blue, 2024, "Kelp Blue marine ecology - Luderitz, Namibia", (2021-09 to 2024-09). Version 1.0. Kelp Blue. Sampling event dataset. Available: Ocean Biodiversity Information System. Intergovernmental Oceanographic Commission of UNESCO. obis.org. (https://ipt.iobis.org/afrobis/resource?r=kelp_blue_marine_ecology_luderitz&v=1.0). Accessed: 2025-02-17

Kensley, B.F., 1978, "Bathynataliidae, a new marine isopod family from the Southwestern Indian Ocean", *Annals of the South African Museum* 75, 41–5.

Kensley, B., & Penrith M-L.,1970, "New records of Mytilidae from the northern Southwest African coast", *Annals of the South African Museum* 57, 15–24.

Kensley, B., & Penrith M-L., 1980, "The constitution of the fauna of rocky intertidal shores of Southwest Africa, Part 3. The north coast from False Cape Frio to the Kunene River ", *Cimbebasia* 5, 201–214.

Kerckhof, F., de Mesel, I., Degraer, S., 2018, "First European record of the invasive barnacle *Balanus glandula* Darwin, 1854", *Bio Invasions Records* 7, 21–31, https://doi.org/10.3391/bir.2018.7.1.04.

King, R.A., & Holmes, M.C., 2004," A new species of Ischyrocerus (Crustacea: Amphipoda) from Ireland, with a review of *Ischyrocerus anguipes* and *Ischyrocerus minutus* from the North-East Atlantic", *Journal of Natural History* 38, 1757–1772.

Koulouri, P., Gerovasileiou, V., Bailly, N., & Dounas, C., 2020, "Tanaidacea of Greece: a preliminary checklist", *Biodiversity Data Journal* 8, e47184, https://doi.org/10.3897/BDJ.8.e47184.

Kott, P., 1985, "The Australian Ascidiacea Part 1, Phlebobranchia and Stolidobranchia", *Memoirs of the Queensland Museum* 23, 1–440.

Kreiner, A., 2014, "*Intertidal Sampling Trip Student's Bay– Kunene River Mouth*", Report by the Subdivision Environment, National Marine Information and Research Centre, Ministry of Fisheries and Marine Resources, 20.

Kreiner, A., Bolton, J., Branch, G., Lima, F., Reddy, M., & Serrão, E., 2019a, *"Coastal Biodiversity Surveys",* Survey 1, Namibia: Subdivision Environment, National Marine Information and Research Centre, Ministry of Fisheries and Marine Resources, 52.

Kreiner, A., Reddy, M., Seabra, R., & Thomas, M., 2019b, "Coastal Biodiversity Surveys", Survey 2, Namibia: Subdivision Environment, National Marine Information and Research Centre, Ministry of Fisheries and Marine Resources, 62.

Kreiner, A., Branch, G., Ferreira, L., Reddy, M., Serrão E., & Thomas. M., 2019c, *"Coastal Biodiversity Surveys",* Survey 3, Namibia: Subdivision Environment, National Marine Information and Research Centre, Ministry of Fisheries and Marine Resource, 87.

Laird, M., & Griffiths C., 2008, "Present distribution and abundance of the introduced barnacle *Balanus glandula* Darwin in South Africa", *African Journal of Marine Science* 30, 93–100, doi:10.2989/AJMS.2008.30.1.9.459.

Lambert, C.C., & Lambert G., 1998, "Non-indigenous ascidians in southern California harbours and marinas", *Marine Biology* 130, 675–688.

Lambert, G., 2004, “The south temperate and Antarctic ascidian *Corella eumyota* reported in two harbours in north-western France”, *Journal of the Marine Biological Association of the United Kingdom* 84, 239–241.

Lamy, M.E., 1931, “Mollusques marins”, *Bulletin du Muséum national d'histoire naturelle* 23, 304–307.

Leclerc, J.C., Viard, F., & Brante A., 2020, “Experimental and survey-based evidence for effective biotic resistance by predators in ports”, *Biological Invasions* 22, 339–352, https://doi.org/10.1007/s10530-019-02092-9.

Lim, G.E., 2004,” *Bugula (Bryozoa) and their bacterial symbionts: a study in symbiosis, molecular phylogenetics and secondary metabolism”*, PhD Thesis, University of California (San Diego), CA, 188.

Lippert, H., Iken, K., Rachor, E., & Wienke, C., 2001, “Macrofauna associated with macroalgae in the Kongsfjord (Spitsbergen)”, *Polar Biology* 24, 512–522.

Loyola e Silva, J de.,1960,“Sphaeromatidae do litoral Brasileiro (Isopoda– Crustacea). Bol University Parana”, *Zoology* 4, 1–182.

Ma, K.C.K., Goodwin, C., & Cooper, J.A., 2018, “Second record of *Diplosoma listerianum* (Milne-Edwards, 1841) five years after and 280 kilometres from the site of the first record in Nova Scotia”, *BioInvasions Records* 7, 159–163, https://doi.org/10.3391/bir.2018.7.2.07.

Ma, K.C.K., Gusha, M.N.C., Zardi, G. I., Nicastro, K.R., Monsinjon, J.R., & McQuaid, C. D., 2021, “Biogeographic drivers of distribution and abundance in an alien ecosystem engineer: Transboundary range expansion, barriers to spread, and spatial structure”, *Journal of Biogeography*, *48*, 1941–1959, https://doi.org/10.1111/jbi.14124.

Mann, R.L., Burreson, E.M., & Baker, P.K., 1991, “The Decline of The Virginia Oyster Fishery in Chesapeake Bay. Consideration for Introduction of a Non-Endemic Species*, Crassostrea gigas* (Thunberg, 1793)”, *Journal of Shellfish Research* 10, 37–388.

Martinelli, J.C., Lopes, H.M., Hauser, L., Jimenez-Hidalgo, I., King, T.L., Padilla-Gamiño, J.L., Rawson, P., Spencer, L.H., Williams, JD., & Wood, C.L., 2020, "Confirmation of the shell-boring oyster parasite *Polydora websteri* (Polychaeta: Spionidae)", *Scientific Reports* 10, 39–61, //doi.org/10.1038/s41598-020-60805-w.

Mead A, Carlton JT, Griffiths CL, & Rius, M., 2011a, "Revealing the scale of marine bio invasions in developing regions: A South African re-assessment" *Biological Invasions* 13, 991–2008, https://doi.org/10.1007/s10530-011-0016-9.

Mead, A., Carlton, J.T., Griffiths, C.L., Rius, M., 2011b, "Introduced and cryptogenic marine and estuarine species of South Africa", *Journal of Natural History* 45, 2463–2524, https://doi.org/10.1080/00222933.2011.595836.

Michaelsen, V.W., 1914,"Ueber einigke westafrikanische ascidien" *Zoologischer Anzeiger* 43, 423–432.

Millard, N., 1952, "Observations and experiments on fouling organisms in Table Bay Harbour, South Africa", *Transactions of the Royal Society of South Africa* 33, 415–445.

Millard, N., 1975, "Monographs on the Hydroida of southern Africa", *Annals South African Museum* 68, 1–513.

Milne-Edwards, H.,1841, "Observation on Ascidians composed of the coasts of the English Channel", *Memoirs Academy of Sciences of the Institute of France* 18, 217–326.

Monniot, C., Monniot, F., Griffiths, C.L & Schleyer, M., 2001 "South African Ascidians", *Annals of South African Museum* 108, 1–141.

Neves, C.S., & da Rocha, R.M., 2008, "Introduced and cryptogenic species and their management in Paranaguá Bay, Brazil", *Brazilian Archives of Biology and Technology* 51, 623–633, https://doi.org/10.1590/S1516-89132008000300025.

Newman, W.A., & Abbott, D.P., 1980, "*Cirripeda: the barnacles' intertidal invertebrates of California Stanford*", Stanford University Press, 50, pp. 4–535.

Nikulina, E.A., de Blauwe, H., & Reverter-Gil, O., 2013, ”Molecular phylogenetic analysis confirms the species status of *Electra verticillata* (Ellis and Solander, 1786): Species status of *Electra verticillate*”, *Lecture Notes in Earth System Sciences* 143, 217–236, https://doi.org/10.1007/978-3-642-16411-8_15.

Panning, A., 1924, “Beitrage zur Kenntnis der Land- und Suesswasserfauna Deutsch Suedwestafrika (Zur Zeit Mandat Suedwest-Afrika), Ergebnisse der Hamburger Deutsch südwestafrikanischen Studienrese 1911, herausgegeben Hamburg“, *Isopoda* 2, 167–201.

Penrith, M-L., & Kensley, B.F., 1970a, “The constitution of the intertidal fauna of rocky shores of Southwest Africa Part. 1. Luderitzbucht”, *Cimbebasia* 1, 191–239.

Penrith, M-L., & Kensley, B.F.,1970b, “The constitution of the fauna of rocky intertidal shores of Southwest Africa. Part 2 Rocky Point” *Cimbebasia* 1, 243–268.

Pérez-Schultheiss, J., 2009,” New records of chorofidean amphipods (Crustacea: Amphipoda: Corophiidea) in southern Chile, with comments on the invasion of exotic marine species”, *Boletín de Biodiversidad de Chile* 1, 24–30.

Pestana, L. B., Dias, G. M., & Marques, A. C.,2020, “Spatial and temporal diversity of non-native biofouling species associated with marinas in two Angolan bays”, *African Journal of Marine Science 42*(4), 413–422. https://doi.org/10.2989/1814232X.2020.1831954

Peters, K., Sink, K., & Robinson, T.B., 2017,” Raising the flag on marine alien fouling species”, *Management of Biological Invasions* 8, 1–11, https://doi.org/10.3391/mbi.2017.8.1.01.

Pinochet, J., Leclerc, J-C., Brante, A., Daguin-Thiébaut, C., Díaz, C., Tellier, F., & Viard F., 2017, “Presence of the tunicate *Asterocarpa humilis* on ship hulls and aquaculture facilities in the coast of the Biobío Region, south central Chile”, *PeerJ* 5, e3672, https://doi.org/10.7717/peerj.3672.

Reid, D.G., Rumbak, E., & Thomas, R.H., 1996, “DNA, Morphology and fossils: phylogeny and evolutionary rates of the gastropod genus. Philosophical Transactions*”, Biological Sciences* 351, 877–895.

Robinson, T.B., Griffiths, C.L., Branch, G.M., & Govender, A., 2007, “The invasion and subsequent die-off of *Mytilus galloprovincialis* in Langebaan Lagoon, South Africa: Effects on natural communities” *Marine Biology* 152, 225–232.

Robinson, T.B., Alexander, M.E., Simon, C.A., Griffiths, C.L., Peters, K., & Sibanda, S., 2016, “Lost in translation? Standardising the terminology used in marine invasion biology and updating South African alien species lists”, *African Journal of Marine Science* 38, 129–140.

Rocha, R.M., & Costa, L.V.G., 2005,“Ascidians (Urochordata: Ascidiacea) from Arraial do Cabo, Rio de Janeiro, Brazil. Iheringia”, *Serie zoologia 95*, 57–64.

Rocha, R.M., Teixeira, J.A., & Barros, R.C.D., 2021. “Genetic diversity in the Diplosoma listerianum complex (Ascidiacea: Didemnidae) from the Western Atlantic”, *Systematics and Biodiversity*, *19*(8), 1149-1163, https://doi.org/10.1080/14772000.2021.1988003.

Rodewald, N., Snyman, R.G., & Simon, CA., 2021, “Worming its way in – *Polydora websteri* (Annelida: Spionidae) increases the number of non-indigenous shell-boring polydorin pests of cultured molluscs in South Africa”, *Zootaxa* 4969, 255–279, https://doi.org/10.11646/zootaxa.4969.2.2.

Ruiz, G.M., Fofonoff, P.W., Carlton, J.T., Wonham, M.J., & Hines, A.H., 2000, “Invasion of coastal marine communities in North America: Apparent patterns, processes, and biases*”, Annual Review of Ecology and Systematics* 31, 481–531, doi.org/10.1146/annurev.ecolsys.31.1.481.

Ruiz, G.M., Fofonoff, P.W., Steves, B., & Dahlstrom, A., 2011,“Marine Crustacean Invasions in North America: A Synthesis of Historical Records and Documented Impacts”, In Galil, BS., Clark, P.F., & Carlton, J.T., (eds), *In the Wrong Place - Alien Marine Crustaceans: Distribution, Biology and Impacts, Invading Nature*, Springer Series in Invasion Ecology 6, DOI 10.1007/978-94-007-0591-3_6.

Ryland, J.S., 1960, “The British species of Bugula (Polyzoa)”, *Proceedings of the Zoological Society of London* 134, 65–105, doi:10.1111/j.1469-7998. 1960.tb05919. x.

Sadchatheeswaran, S., Branch, G.M., & Robinson T.B., 2015, “Changes in habitat complexity resulting from sequential invasions of a rocky shore: implications for community structure”, *Biological Invasions* 17, 1799–1816, https://doi.org/10.1007/s10530-014-0837-4.

Samaai T, &., Gibbons, M., 2005, “Demospongiae taxonomy and biodiversity of the Benguela region on the west coast of South Africa”, *African Natural History* 1, 1–96.

Schuchert, P., 2001, “Hydroids of Greenland and Iceland (Cnidaria, Hydrozoa)”, *Bioscience* 53, 1–185.

Schuchert, P., 2005, “Species boundaries in the hydrozoan genus Coryne”, *Molecular Phylogenetics and Evolution* 36, 194–199, https://doi.org/10.1016/j.ympev.2005.03.021.

Schuchert, P., Hosia, A., & Leclère, L., 2017, “Identification of the polyp stage of three leptomedusa species using DNA barcoding”, *Revue suisse de Zoologie* 124, 167–182.

Schwindt, E., Carlton, J.T., Orensanz, J.M., Scarabino, F., & Bortolus, A., 2020, “Past and future of the marine bio invasions along the Southwestern”, Atlantic. *Aquatic Invasions* 15, 11–29, https://doi.org/10.3391/AI.2020.15.1.02.

Shinn. A.P., Pratoomyot, J., Bron, J.E., Paladini, G., Brooker, E.E., & Brooker, AJ., 2015,” Economic costs of protistan and metazoan parasites to global mariculture”, *Parasitology* 142, 196–270, doi:10.1017/S0031182014001437.

Simon-Blecher, N., Granevitze, Z., & Achituv, Y., 2008, “*Balanus glandula*: from North-West America to the west coast of South Africa”, *African Journal of Marine Science* 30, 85–92, https://doi.org/10.2989/A.

Stubbings, H.G., 1967, “The cirriped fauna of tropical West Africa. Bulletin of the British museum”, *Natural Zoology History* 15, 227–239, https://doi.org/10.5962/bhl.part.27518.

Sylvester, F., Kalaci, O., Leung, B., Lacoursière-Roussel,A., Murray, C.C., Choi, F.M., Bravo, M.A., Therriault, T.W., & Macisaac, H.J., 2011, "Hull fouling as an invasion vector: Can simple models explain a complex problem", *Journal of Applied Ecology* 48, 415–423, https://doi.org/10.1111/j.1365-2664.2011.01957.x.

Treneman, N.C., Carlton, J.T., Borges, L.M.S., Shipway, J.R., Raupach, M.J., & Altermark, B., 2018, "Species diversity and abundance of shipworms (Mollusca: Bivalvia: Teredinidae) in woody marine debris generated by the great east Japan earthquake and tsunami of 2011", *Aquatic Invasions* 13, 87–100, https://doi.org/10.3391/ai.2018.13.1.07.

Turner, T.L., 2020, "The marine sponge *Hymeniacidon perlevis* is a globally distributed exotic species", *Aquatic Invasions* 15, 542–561, https://doi.org/10.3391/ai.2020.15.4.01.

Turon, X., 1988, "Some ascidians from Namibia (SW Africa)", *Monografi´a de Zoologı´a Marina* 3, 267–291.

Van der Land, J., Vervoort, W., Cairns, S.D., & Schuchert, P., 2001, "Hydrozoa", Costello, W.J., Emblow, C, & White R (eds), *European register of marine species: a checklist of the marine species in Europe and a bibliography of guides to their identification*, Collection Patrimoines Nature 50, pp, 112–120.

Weltner, W., 1897, "List of recent Cirripedia species described so far Archives", *Naturgesh* 1, 227–280.

Werz, B.E.J., 2009, "The Oranjemund shipwreck, Namibia. The excavation of sub-Saharan Africa's oldest discovered wreck" *Journal of Namibian Studies* 6, 81–106.

Williams, L-G., 2015, "*Genetic structure of pest polydorids (Annelida: Spionidae) infesting Crassostrea gigas in southern Africa: Are pests being moved with oysters*?", MSc Thesis, University Stellenbosch, South Africa, https://scholar.sun.ac.za.

Wonham, M.J., & Carlton, JT., 2005, “Trends in marine biological invasions at local and regional scales: the Northeast Pacific Ocean as a model system”, *Biological Invasions* 7, 369–392.

Xavier, E.A., Almeida, A.C.S., & Vieira, L.M., 2021, “The role of artificial habitats fouling bryozoan fauna in the southwestern Atlantic”, *Marine Pollution Bulletin* 167, https://doi.org/10.1016/j.marpolbul.2021.112310.

Yin, J., Pan, D., He, C., Wang, A., Yan, J., & Sun, H., 2013, “Morphological and molecular data confirm species assignment and dispersal of the genus Ligia (Crustacea: Isopoda: Ligiidae) along northeastern coastal China and East Asia”, *Zoological Journal of the Linnean Society* 169, 362–376, https://doi.org/10.1111/zoj.12068.

Zuccoarello, G.C, West, J.A., & Rueness, J., 2002, “Phylogeography of the cosmopolitan red alga *Caulacanthus˙ ustulatus* (Caulacanthaceae, Gigartinales)”, *Phycological Research* 50, 163–172.