See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/337426914

Gnathia bermudensis (Crustacea, Isopoda, Gnathiidae), a new species from the mesophotic reefs of Bermuda, with a key to Gnathia from the Greater Caribbean biogeographic region



#### Some of the authors of this publication are also working on these related projects:

Study of Diplostomum (Digenea: Diplostomoidea) in South Africa: Diversity and effect of metacercariae on fish behaviour View project

Novel approaches to assess toxicity of platinum-group elements in aquatic environments View project

RESEARCH ARTICLE



# Gnathia bermudensis (Crustacea, Isopoda, Gnathiidae), a new species from the mesophotic reefs of Bermuda, with a key to Gnathia from the Greater Caribbean biogeographic region

Kerry A. Hadfield<sup>1</sup>, Nikolaos V. Schizas<sup>2</sup>, Tapas Chatterjee<sup>3</sup>, Nico J. Smit<sup>1</sup>

I Water Research Group, Unit for Environmental Sciences and Management, North-West University, Private Bag X6001, Potchefstroom, 2520, South Africa 2 University of Puerto Rico at Mayagüez, Department of Marine Sciences, PO Box 9000, Mayagüez, Puerto Rico, 00681, USA 3 Crescent International School, Bario, Govindpur, Dhanbad 828109, Jharkhand, India

Corresponding author: Kerry A. Hadfield (kerry.malherbe@nwu.ac.za)

Academic editor: T. Horton   Received 30 August 2019   Accepted 21 October 2019   Published 21 November 201	9
http://zoobank.org/82F35276-BF62-47A2-BCF6-5045351EB6F3	

**Citation:** Hadfield KA, Schizas NV, Chatterjee T, Smit NJ (2019) *Gnathia bermudensis* (Crustacea, Isopoda, Gnathiidae), a new species from the mesophotic reefs of Bermuda, with a key to *Gnathia* from the Greater Caribbean biogeographic region. ZooKeys 891: 1–16. https://doi.org/10.3897/zooKeys.891.39564

## Abstract

*Gnathia bermudensis* **sp. nov.** is described from mesophotic coral ecosystems in Bermuda; it is distinguished by pronounced and pointed supraocular lobes, two superior frontolateral processes and a weak bifid mediofrontal process, pereonite 1 not fused dorsally with the cephalosome, and large eyes. This is the first record of a species of *Gnathia* from Bermuda. A synopsis and key to the other *Gnathia* species from the Greater Caribbean biogeographic region is provided.

## Keywords

Atlantic Ocean, benthic, ectoparasite, Nekton Mission, taxonomy

## Introduction

Gnathiid isopods are temporary ectoparasites that occur in a variety of habitats ranging in depth, water currents, temperature, climate and salinity (Smit and Davies 2004). The parasitic juveniles feed on the blood and lymph of their fish hosts, while the nonfeeding free-living adults are usually hidden in cavities, corals, or sponges (Hadfield et al. 2009). The taxonomic classification of these isopods is based almost exclusively on the morphology of the adult males, and this makes studies reliant on accurate species identification problematic as males can be difficult to obtain. Currently, there are 12 genera in the family Gnathiidae Leach, 1814 (Smit et al. 2019). Of these, the most speciose genus is Gnathia Leach, 1814, with 126 valid species (Boyko et al. 2008 onwards). To date, there are 14 known species of Gnathia from the Greater Caribbean biogeographic region (see Table 1 for a summary of known information on these species). In 1993, Müller (1993) proposed Gnathia puertoricensis Menzies & Glynn, 1968 as a junior synonym for G. virginalis Monod, 1926 based on the variation in the characters that separated these two species (granulation and tubercles on the anterior pereonites and cephalon). Although not recognised in subsequent publications on gnathiids from this region (George 2003; Farquharson et al. 2012), this synonymisation appears to still be valid and the information regarding both species is combined in Table 1.

Recently, there has been a growing interest in gnathiids from this region specifically regarding their role in cleaner interactions (Artim et al. 2017), food web ecology (Demopoulos and Sikkel 2015), and their role as potential vectors of blood parasites (Cook et al. 2015). However, all of this work has focused on a single species, *G. marleyi* Farquharson, Smit & Sikkel, 2012, and therefore it is also the only species from this region with known hosts for the parasitic larval stage. These host fishes include *Acanthurus bahianus* Castelnau, 1855; *Chaetodon capistratus* Linnaeus, 1758; *Epinephelus guttatus* (Linnaeus, 1758); *Haemulon flaviolineatum* (Desmarest, 1823); *H. plumieri* (Lacepede, 1801); *H. sciurus* (Shaw, 1803); *Holocentrus rufus* (Walbaum, 1792); *Lutjanus apodus* (Walbaum, 1792); *L. griseus* (Linnaeus, 1758); *Scarus taeniopterus* Desmarest, 1831; *Sparisoma aurofrenatum* (Valenciennes, 1840); *Stegastes diencaeus* (Jordan & Rutter, 1897); and *S. planifrons* (Cuvier, 1830) (see Farquharson et al. 2012).

Bermuda forms part of this Greater Caribbean biogeographic region in the North Atlantic Ocean (Robertson and Cramer 2014). It is situated on the western side of the Sargasso Sea (high salinity, high temperatures and high biodiversity), and has the most northern coral reef system in the world. As part of the Nekton Foundation/XL-Catlin Deep-Ocean Survey – Mission 1 (www.nektonmission.org), fish (Stefanoudis et al. 2019a), zooplankton (Stefanoudis et al. 2019b), black corals (Wagner and Shuler 2017), macroalgae (Schneider et al. 2018, 2019) and other benthic communities (NVS pers. obs.) were studied. Macrofaunal collections from mesophotic reef ecosystems of Bermuda (MCEs) contained several specimens of a gnathiid isopod that did not correspond to currently described species. This isopod is here described as a new species of *Gnathia* and is the first gnathiid isopod to be recorded from Bermuda.

**Table 1.** Summary of the location, depth, size and references of 15 *Gnathia* species from the Greater Caribbean biogeographic region, including the 14 previously known species and the new species, *Gnathia bermudensis* sp. nov.

G. keedwaver Paul & Menzies, 1971     Venezuela     95     3     managroor roose modely and andy bortoms; algues, sexweed, tunicars; sequess coral rubble     Paul and Menzies 177; assert of tunicars; sequess for and andy bortoms; algues coral rubble     Miller 1988.4       Menzies, 1971     Calombia (Santa Marta)     13-30     I     18.8     Coral rubble     Miller 1988.4       Menzies, 1970     Mesico (Puerro Moreloo)     3-12     1.8     Coral rubble     Miller 1988.4       G. bermudemis sp. nov.     Bermuda     56-90     1.7-2.2     loose greel and sedime mage algues pronges; rodolith     Present study       G. bernei George, 2003     USA (North Carolina)     1000-1020     2.8     George 2003       G. adui Müller, 1988     Marrinique, French     0-2     1.9     dead corals     Miller 1988.4       G. genzadezi Müller, 1988     Caba (Cojimar Bay)     2     3     wood pile     Miller 1988.4       G. genzadezi Müller, 1988     Caba (Cojimar Bay)     2     3     wood pile     Minder 1926; Miller 1988.4       G. homingroopi Orizk     Caba (Cojimar Bay)     2     3     wood pile     Miller 1988.4       G. homingroopi Orizk     Caba (Cojimar Bay)     2     3     wood pile     Miller 1988.4       Miller, 1988     Marcinglue, French     3-2     2-3.1     wood pile     Wonel 1926; Miller 1984	Species	Location	Depth (m)	Size (mm)	Substratum	References
Menzies, 1971     and sindy bottoms, sliges, sequence: nutraters sequences: nutraters near 2016, Mailler 1988a     Miller 1988a <ul> <li>Colombia (Santa Marta)</li> <li>S-20</li> <li>S-20</li> <li>S-20</li> <li>S-20</li> <li>Iosoe rared and sediment (Santa Marta)</li> <li>S-20</li> <li>S-20</li> <li>Color and sediment (Santa Marta)</li> <li>S-20</li> <li>S-20</li></ul>	G. beethoveni Paul &	Venezuela	95	3	mangrove roots; muddy	Paul and Menzies 1971;
karved: unicates segmes Tobago Tobago Tobag Tobago Tobago Tobago Tobago Tobago Tobago Tobago Tobago Tobag Tobag Tobago Tobag Tobag Tobago Tobag Tobag Tobag Tobago Tobag Tobag Tobago Tobag Tobag Tobag Tobag Tobag Tobag Tobag Tobago Tobag Tobago Tobag Tobag Tobag Tobag Tobag Tobago Tobago Tobag Tobag Tobag Tobago Tobag Tob	Menzies, 1971				and sandy bottoms; algae;	Dias et al. 2013
Colombia (Santa Maria) 13–30 (colar lubble Miller 1988, Kendy and Schoter 1994 Mexico (Puerto Morelos) 3–12 1.8 (coral rubble Monov-Velizquez and Alvarez 2016, Monov- Velizquez et al. 2017 <i>Familer 1995</i> (array 2016) (array 2016) <i>G. bracel George</i> , 2003 (USA (North Carolina) 1000–1020 2.8–3.2 (cose gravel and scilment) <i>G. drake Miller</i> , 1993 (USA (North Carolina) 1000–1020 2.8–3.2 (cose gravel and scilment) <i>G. drake Miller</i> , 1993 (USA (North Carolina) 1000–1020 2.8–3.2 (cose gravel and scilment) <i>G. drake Miller</i> , 1993 (USA (North Carolina) 12–30 (cose gravel and scilment) <i>G. drake Miller</i> , 1993 (Cose and Martinique, French 0–2 1.9) (cose gravel and scilment) <i>G. drake Miller</i> , 1998 (Colombia (Santa Marta) 12–30 (cose and rubble) (Miller 1988a) <i>G. drake Miller</i> , 1998 (Colombia (Santa Marta) 12–30 (cose and rubble) (Miller 1988a) <i>G. drake Miller</i> , 1997 (cose and table) (Colombia (Santa Marta) 12–30 (cose and rubble) (Cose and Science 1990) <i>John</i> (cose and Science 1990) <i>John</i> (cose and table) (Cose and table) (Cose and Science 1990) <i>John</i> (cose and Science 1990) <i>John</i> (cose and Science 1992) <i>John</i> (Cose and Science 1994) <i>Miller</i> , 1988 (Colombia (Santa Marta) 6–30 2.8 (coal arubble) (Miller 1988a) <i>Miller</i> , 1988 (Colombia (Santa Marta) 3–52 2.6–37 (coal arubble) (Monrov-Velizquez et al. 2017) <i>G. marleyi</i> Harquharson, St. John, US Virgin 13–30 (coal arubble) (Monrov-Velizquez et al. 2017) <i>G. mirleyi</i> Ortiz, Minfiel (Custo Kosta) (cose and table) (Cose and table) (Miller 1988a) <i>G. mirleyi</i> Miller, 1988 (Cose Martia) (cose and table) (coal arubble) (Miller 1988a) <i>G. mirleyi</i> Mirleyi (Custo Morta) (cose and table) (coal arubble) (Miller 1988a) <i>G. mirleyi</i> Miller, 1988 (Cose Martia) (cose and table) (coal arubble) (Cose and table) (coal arubble) (coal arubble) (Miller 1988a) <i>G. mirleyi</i> Miller, 1988 (Coal (Caro Martia) (cose and table) (coal arubble) (coal a					seaweed; tunicates; seagrass	
TobagoKender 1994Kender 1994Mexico (Puerto Morelos)3-121.8coral rubbleMonray-Velázquez and Alvarez 2016 Monray-G. bernudenuis işp. nov.Bernuda56-901.7-2.2loose gravel and schindre const); algare sponges; rodolithsTesen studyG. bracei George, 2003USA (North Carolina)1000–10202.8-3.2George 2003George 2003G. adu Müller, 1988Calombia (Sann Marta)12-301.5coral rubbleMüller 1988.G. berninguayi Oriz & G. berninguayi Oriz & Lainan, 1997Cubai (Cojimar Bay)23wood pileOriz and Lalana 1997G. johanna Monol, 1926US Virgin Islands (St. Venezuela29-462-2.16Monod 1926; Müller 1988.G. indideenemisColombia Colombia5-302.8coral rubbleMiller 1988.Müller, 1988BelizeKensley and Schorte 1990Diaz et al. 2013Diaz et al. 2013G. indidemenisColombia (Sana Marta)6-302.8coral rubbleMonroy-Velázquez et al. 2017G. indideformisSt. John, US Virgin3-522.6-37several host fishKensley and Schorte 1980Müller, 1988BelizeKensley Cipace Kensley and Schorte 1980Kensley and Schorte 1980Kensley and Schorte 1980Müller, 1988Guarde (Puerto Morelos)3-12coral rubbleKensley and Schorte 1980Müller, 1988BelizeKensley 1984Kensley 1984Kensley 1984G. individe Orriz, WinfieldCuba (Cayre Maria)2.02.6-3.7sever		Colombia (Santa Marta)	13-30		coral rubble	Müller 1988a
Mexico (Puerto Morelos)     3–12     1.8     coral rubble     Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez et al. 2017       G. bermudeniis sp. nov.     Bermuda     56–90     1.7–2.2     loose gravel and sediment (algaes sponges) rodoliths     Present study       G. brneei George, 2003     USA (North Carolina)     1000–102     2.8–3.2     George 2003     George 2003       G. addi Müller, 1998     Colombia (Sama Marra)     12–30     1.5     coral rubble     Müller 1998a       G. bornigneosi? Ortiz & Laba (Cojimar Bay)     2     3     wood pile     Ortiz and Lalana 1997       Ialana, 1997     Colombia     2     3     wood pile     Ortiz and Lalana 1997       G. johanna Monod, 1926     US Virgin Islands (St. 29–46     2–2.16     Monod 1926; Müller 1988a       John)     Colombia     Seagras beds; muddy     Diar et al. 2013       Venezuela     seagras beds; muddy     Diar et al. 2013     Diar et al. 2013       Müller, 1988     Belize     coral rubble     Müller 1988a       Müller, 1988     Keisco (Puerto Morelos)     3–12     coral rubble     Müller 1988a       Müller, 1988     Keisco (Puerto Morelos)     3–12     coral rubble     Müller 1988a       G. indeklorensis     Sighandy, Startish     several host fish     Faresly and Schotret 1990       G. indeklorensis		Tobago				Kensley and Schotte 1994
G. bermudensis sp. nov.     Bermuda     56-90     1.7-2.2     loose gravel and sediment (associated with corals); ages sponges; nodoliths     Present study       G. brane George, 2003     USA (North Carolina)     1000–1020     2.8-3.2     ages sponges; nodoliths       G. aclai Müller, 1993     Martinique, French     0-2     1.9     dead corals     Müller 1993       G. genzalezi Müller, 1988     Colombia (Sama Marra)     12-30     1.5     coral rubble     Müller 1988       G. berninguogi Ortiz & G. berninguogi Ortiz & G. johanna Monod, 1926     US Vingin Islands (St.     29-46     2-2.16     Monod 1926; Müller 1988       G. ibdamina Monod, 1926     US Vingin Islands (St.     29-46     2-2.16     Kensley and Schotte 1990       John     John     John     John     John     Jize et al. 2013       G. indedienentis     Colombia (Santa Marta)     6-30     2.8     coral rubble     Muller 1988       Meller, 1988     Belize     Kensley and Schotte 1990     Jize et al. 2017     Monory-Veläzquez et al. 2017       Smite & Sikkel, 2012     Islandy, Ishamas British     Virgin Islands (Ganan     Scaras     Jize et al. 2017       Smite & Sikkel, 2012     Islandy, Ishamas British     Virgin Islands (Ganan     Scaras     Jize et al. 2012       G. michel Ortiz, Winfield     Cuba (Cayo Matias)     30     1.7 <t< td=""><td></td><td>Mexico (Puerto Morelos)</td><td>3-12</td><td>1.8</td><td>coral rubble</td><td>Monroy-Velázquez and</td></t<>		Mexico (Puerto Morelos)	3-12	1.8	coral rubble	Monroy-Velázquez and
G. bermudenzis sp. nov.         Bermuda         56-90         1.7-2.2         loose gravel and sediment (associated with conals); algaes sponges; rodoliths         Present study           G. bracei George, 2003         USA (North Carolina)         1000–102         2.8-3.2         George 2003           G. addi Müller, 1993         Martinique, French         0-2         1.9         dead corals         Müller 1993           G. gonzalezi Müller, 1998         Colombia (Santa Marta)         12–30         1.5         coral rubble         Müller 1988a           G. johanna Monod, 1926         US Virgin Islands (St.         29–46         2–2.16         Monod 1926; Müller 1988b           John)         Calombia         Seagrass beds; muldy         Diaz et al. 2013         Diaz et al. 2013           G. johanna Monod, 1926         US Virgin Islands (St.         29–46         2–8.1         Kensley and Schorte 1980           G. johanna Monod, 1926         US Virgin Stand Marta)         6–30         2.8         coral rubble         Müller 1988a           Müller, 1988         Beize         seegrass beds; muldy         Miaroy Virgin Stand Marta)         1.12         Georal rubble         Müller 1988a           G. indriv Farugharson         St. John, US Virgin         3–5         2.6–3.7         several host fish         Farugharson et al. 2012						Alvarez 2016; Monroy-
G. bermudensis sp. nov.       Bermuda       56-90       1.7-2.2       loose gravel and sediment (associated with corals); (associated						Velázquez et al. 2017
G. braver George, 2003 USA (North Carolina) 1000–1020 2.8–3.2. G. caki Miller, 1993 Martinique, French 0–2 1.9 dead corals Miller 1993 Antilles Antilles - G. gonzalezi Miller, 1988 Colombia (Santa Marta) 12–30 1.5 coral rubble Miller 1988a G. heminguogri Ortiz & Cuba (Cojimar Bay) 2 3 wood pile Ortiz and Lalana 1997 Lalana, 1997 G. johanna Monod, 1226 US Virgin Islands (St. 29–46 2–2.16 Monord 1926; Miller 1988b G. olombia Seagnas beds; muddy Dizz et al. 2013 bottom Kensley and Schotte 1990 Mexico (Puerto Morelos) 3–12 coral rubble Miller 1988a Miller, 1988 Belize Colombia Seagnas beds; muddy Dizz et al. 2013 Miller, 1988 Mexico (Puerto Morelos) 3–12 coral rubble Miller 1988a Miller, 1988 Belize tal. 2012 Islands (Guana Harta) 6–30 2.8 coral rubble Miller 1988a Miller, 1988 Belize tal. 2012 Islands (Guana Harta) 6–30 2.6–3.7 several host fish Farquharson et al. 2012 Smit & Sikkel, 2012 Islands (Guana Harta) 3–5 2.6–3.7 several host fish Farquharson et al. 2012 G. markeyi Farquharson, St. John, US Virgin 3–5 2.6–3.7 several host fish Farquharson et al. 2012 Montor (Leser Antilles) - G. michel Ortiz, Winfield G. michel Ortiz, Miller 1988a Belize (	G. bermudensis sp. nov.	Bermuda	56–90	1.7–2.2	loose gravel and sediment	Present study
G. brucei George, 2003 USA (North Carolina) 1000–1020 2.8–3.2 George 2003 G. addi Müller, 1993 Martinique, French 0–2 1.9 dead corals Müller 1993 Antilles G. beninguogi Ortiz & Cuba (Cojimar Bay) 2 3 wood pile Ortiz and Lalana 1997 Lalana, 1997 G. johanna Monod, 1926 US Virgin Islands (St. 29–46 2–2.16 Monod 1926; Müller 1988b Golombia (Santa Marta) 6–30 2.8 cagrass beds; muddy Diaz et al. 2013 bottom Gamaphice (Colombia (Santa Marta) 6–30 2.8 cagrass beds; muddy Diaz et al. 2013 Belize Gamaphice (Colombia (Santa Marta) 6–30 2.8 coral rubble Müller 1988a Kensley and Schotte 1990 Mexico (Puerto Morelos) 3–12 coral rubble Monov, Velázquez et al. 2017 Sinit & Sikkel, 2012 Islands; Bahamas; British Virgin Islands (Guana Island; Pareno Rico; Saba (Lesser Antilles) (Lesser Antilles) (Lesser Antilles) G. antahi Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 (Gama Marta) 20 2.6–3.3 algae Ortiz et al. 2012 G. antahi Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 G. antahi (Santa Marta) 20 2.6–3.3 algae Ortiz et al. 2012 G. antahi Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 (G. antahi Kanta) 20 8.8 Boone 1918 Boone, 1918 G. anta Marta) 20 2.6–3.3 algae Ortiz et al. 2012 G. antahi Kensley, 1984 (Colombia (Santa Marta) 20 8.8 Boone 1918 Boone, 1918 G. antahi Kanta) 200 8.8 Boone 1918 Boone, 1918 G. antahi Kanta) 25–30 1.5 sponges and hydroids seagrass beds; mangrove roots; algae (Carrie Bow Cay) 6–612 2.7 Coral rubble Müller 1988a (Danta Marta) 25–30 1.5 sponges and hydroids Müller 1988a (Danta Marta) 25–30 (Carl Irubble) Monol 1926 Mitalier 1988 (Danta Marta) 25–30 (Carl Irubble) (Marta 2016 Monory-Velázquez at al. 2013 roots; algae (Carlei Bow Cay) 6–612 2.7 (Coral rubble (Mitalier 1988a (Danta Marta) 25–30 (Carlei Tubble) (Marta 2016 (Mitalier 1988a (Danta Marta) 25–30 (Carlei Tubble)					(associated with corals);	
G. <i>microt</i> George 2005 G. <i>adii</i> Miller, 1988 G. <i>cadii</i> Miller, 1988 G. <i>colis</i> Miller, 1988 Miller, 1988 Miller, 1988 G. <i>colis</i> Miller, 1988 G. <i>colis</i> Miller, 1988 G. <i>colis</i> Miller, 1988 Miller, 1988 G. <i>colis</i> Miller, 1983 G. <i>colis</i> Miller, 1988 G. <i>colis</i> Mille	C 1 : C 2002		1000 1020	20.22	algae; sponges; rodoliths	C 2002
G. chart Muller, 1995 Natrunque, Freich 0-2 1.9 dead coras Muller 1995 Antilles G. genzelezi Müller, 1988 Colombia (Sana Marta) 12–30 1.5 coral rubble Müller 1988a G. heminguagi Ortiz & Cuba (Cojimar Bay) 2 3 wood pile Ortiz and Lalana 1997 G. johanna Monod, 1926 US Virgin Islands (Sr. 29–46 2–2.16 Monod 1926; Müller 1988b John) Colombia Venezuela seagras beds; muddy Diaz et al. 2013 bottom G. magdalenensis Colombia (Santa Marta) 6–30 2.8 coral rubble Müller 1988a Kensley and Schotte 1990 Venezuela seagras beds; muddy Diaz et al. 2013 Muller, 1988 Belize Kensley and Schotte 1980 Mexico (Puerto Morelos) 3–12 coral rubble Miller 1988a Kensley and Schotte 1980 Monoy-Velázquez et al. 2017 G. marleyi Farquharson, St. John, US Virgin 3–5 2.6–3.7 several host fish Farquharson et al. 2012 Smit & Sikkel, 2012 Islands; (Guana Island); Puerto Rico; Saba (Lesser Antilles) G. micheli Ortiz, Winfield Cuba (Cayo Matias) 20 2.6–3.3 algae Ortiz et al. 2012 & Varela, 2012 G. mich Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 G. strangathiona USA (Florida) 200 8.8 Boone 1918 G. reidout Müller, 1988 C. olombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 G. reidout Müller, 1988 Colombia (Santa Marta) 20 2.8 sponges and hydroids seagrass beds; mangrove Dias et al. 2013 Venezuela Venezuela USA (Florida) 200 8.8 Boone 1918 Boone, 1918 G. vellosa Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Menzies and Glym, 1968 Menzies and Glym, 1968 Menzies & Glym, 1968 Cuba Belize (Carrie Bow Cay) Coral rubble Monroy-Velázquez at al. 2013 Venezuela USA (Florida) 200 R.8 Boone 1918 Boone, 1918 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monod 1926 Menzies and Glym, 1968 Menzies and Glym, 1968 Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antille 1988a Martinique, French 0.5–2 margrove rotos; segarass Dias et al. 2013	G. orucei George, 2005	Marcini and Erroral	0.2	2.8-3.2	deed evenly	George 2005
Commercial GeneraleziNumber Colombia (Santa Marta)12–301.5coral rubbleMüller 1988aG. johanna Monod, 1926US Virgin Islands (St. John)29–462–2.16Monod 1926; Müller 1988bG. johanna Monod, 1926US Virgin Islands (St. John)29–462–2.16Monod 1926; Müller 1988bG. johanna Monod, 1926US Virgin Islands (St. John)29–462–2.16Kensley and Schotte 1990Colombia (Santa Marta)6–302.8coral rubbleMüller 1988aMüller, 1988BelizeKensley and Schotte 1980Muller 1988aMüller, 1988Seagrass beds; muldy bottomMüller 1988aMüller 1988aMüller, 1988St. John, US Virgin3–52.6–3.7several host fishFarquharson, Isk Sikkel, 2012St. John, US Virgin3–52.6–3.7several host fishKander, SabarUsero Rice; SabarVirgin Islands (Guana Islands); Putero Rice; Sabar1.6–1.9rubbleKensley 1984G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldColombia (Santa Marta)301.7coral rubbleMüller 1988aG. stamariensi Müller, 1988Colombia (Santa Marta)301.7coral rubbleMüller 1988aG. stringuthismaUSA (Florida)2008.8Boone 1918Boone, 1918Golombia (Santa Marta)25–301.5sponges and hydroidsMüller 1988aG. virginalis Monod, 1926Virgin Is	G. calst Muller, 1995	Martinique, French	0-2	1.9	dead corais	Muller 1993
G. genzelized Muller, 1988 Colombia (Santa Marta) 2 3 wood pile Ortiz and Lalana 1997 Lalana, 1997 G. johanna Monod, 1926 US Virgin Islands (St. 29–46 2–2.16 Monod 1926; Müller 1988b John) Colombia (Santa Marta) 6–30 2.8 coral rubble Müller 1988a Mexico (Puerto Morelos) 3–12 coral rubble Müller 1988a Mexico (Puerto Morelos) 3–12 coral rubble Monory-Velázquez et al. 2017 G. markeyi Farquharson, St. John, US Virgin 3–5 2.6–3.7 several host fish Virgin Islands (Guana Island): Puerto Rico; Saba (Lesser Antilles) G. mickeli Ortiz, Winfield G. mickeli Ortiz, Ortiz Ortiz, Ortiz, Ortiz Ortiz, Ortiz, Ortiz Ortiz, O	C	Antilies	12 20	15		M#II 1099.
G. permittiguing Ortiz & Cluba (Cajimar Bay) 2 3 5 wood pile Ortiz and Liana 1997 G. johanna Monod, 1926 US Virgin Islands (St. 29–46 2–2.16 Monod 1926; Müller 1988b John Colombia Kensley and Schorte 1990 Venezuela Seagrass beds; muddy Díaz et al. 2013 bottom Kensley and Schorte 1989 Mexico (Puerto Morelos) 3–12 coral rubble Monroy-Velázquez et al. 2017 G. marleyi Farquharson, St. John, US Virgin 3–5 2.6–3.7 several host fish Farquharson et al. 2012 Smit & Sikkel, 2012 Islands; Bahamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles) G. micheli Ortiz, Winfield G. marleyi Explore, 102 (Carie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 G. samariensis Müller, Colombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 G. triappathinan USA (Florida) 200 8.8 Boone 1918 Boone, 1918 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monroy-Velázquez et al. 2017 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monroy-Velázquez et al. 2017 Menzies & Glynn 1968 Cuba (Cayo Martas) 20 8.8 Boone 1918 Boone, 1918 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monroy-Velázquez et al. 2017 Menzies & Glynn, 1968 Cuba Caba (Santa Marta) 29 2.2 Monroy-Velázquez et al. 2017 Menzies & Glynn, 1968 Cuba Marta) 0–30 2 coral rubble Kensley 1984 Menzies & Glynn, 1968 Cuba Marta) 0–30 2 coral rubble Kensley 1984 Menzies & Glynn, 1968 Cuba Marta) 0–30 2 coral rubble Kensley 1984 Menzies & Glynn, 1968 Cuba Marta) 0–30 2 coral rubble Kensley 1984 Menzies & Glynn, 1968 Cuba Marta Marta) 0–30 2 coral rubble Kensley 1984 Menzies & Glynn, 1968 Cuba Marta Marta) 0–30 2 coral rubble Kensley 1984 Miller 1988a Miller 1988a Marter 2016; Monroy-Velázquez at al. 2017 Menzies & Glynn, 1968 Cuba Marta Marta) 0–30 2 coral rubble Kensley 1984 Miller 1988a Miller 1988a Marter 2016; Martingue, French 0.5–2 seagrass beds; dead corals; Müller 1988a Marter 1993 Marter 1993 Marter 1993 Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Marter 1993 Marter 1993 marter 1.2013	G. gonzalezi Muller, 1988	Colombia (Santa Marta)	12-50	1.5	coral rubble	Muller 1988a
Lalana, 1997 G. johanna Monod, 1926 US Virgin Islands (St. 29–46 John) Colombia C	G. nemingwayı Ortiz &	Cuba (Cojimar Day)	2	3	wood pile	Offiz and Lalana 1997
G. Johanim Mundel, 1920 Color Might Sainta Get. 2,2–40 2–410 Feature 1920, Mundel 1	C inhamma Monod 1926	US Virgin Islands (St	20 /6	2 2 16		Manad 1926, Müller 1988b
Colombia VenezuelaKensley and Schotte 1990 Díaz et al. 2013 bottomG. magdalenemis Müller, 1988Colombia (Santa Marta) Belize6–30 Seagrass beds; muddy bottomMüller 1988 Kensley and Schotte 1989 Monroy-Velázquez et al. 2017G. marleyi Farquharson, St. John, US Virgin Sinit & Sikkel, 2012Colombia (Guana Islands; Bahamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Artilles)cond rubble several host fishMonroy-Velázquez et al. 2017 Farquharson et al. 2012G. micheli Ortiz, Winfield G. sumarienisis Müller, 1988Belize (Carrie Bow Cay) Venezuela0.5–128 2.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, Winfield G. sumarienisis (Lesser Artilles)200 2.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, Winfield G. sumarienisis Müller, 1988Belize (Carrie Bow Cay) 0.5–1280.5–128 2.6–3.3algaeOrtiz et al. 2012G. ringpathioma Boone, 1918USA (Florida)200 2.008.8Boone 1918 3.0Boone 1918G. virginalis Mone, 1918Colombia (Santa Marta) Venezuela25–301.5sponges and hydroids seagrass beds; mangrove roots; algaeMuiller 1988a Alvarez 2016; Monroy- Velázquez and Alvarez 2016; Monroy- Velázquez and Alvarez 2016; Monroy- Velázquez and Alvarez and Glynn 1968 Ortiz 1983; Müller 1988aG. virginalis Menzies & Glynn, 196829 Cuba2.2Monroy-Velázquez and Alvarez and Glynn 1968 Ortiz 1983; Müller 1988a GualsG. virginalis Menzies & Glynn, 196829 Cuba2.2	G. jonanna Wollod, 1920	John)	29-40	2-2.10		Wonod 1920; Wuller 19880
Venezuelaseagrass beds; muddy bottomDíaz et al. 2013 bottomG. magdalenensisColombia (Santa Marta)6–302.8coral rubbleMüller, 1988Müller, 1988BelizeKensley and Schotte 1989Mexico (Puerto Morelos)3–12coral rubbleMonroy-Velázquez et al. 2017G. marleyi Farquharson, St. John, US VirginS. John, US Virgin3–52.6–3.7several host fishFarquharson et al. 2012Smit & Sikkel, 2012Islands; Bhamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfeldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfeldGuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012& Varela, 2012Guba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012& Varela, 2012Belize (Carrie Bow Cay)0.5–1281.6–1.9rubbleKensley 1984G. samariensis Müller, Olombia (Santa Marta)2008.8Boone 1918Boone, 1918USA (Florida)2008.8Boone 1918G. virginalii Monod, 1926US Virgin Islands292.2Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez at al. 2017G. virginalii Monod, 1926US Virgin Islands292.2Monod 1926 Monod 1926Syn: G. puertoricensis Menzies & Glynn, 1968Cuba292.2Monod 1926 Morroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2		Colombia				Kenslev and Schotte 1990
G. magdalemensi:Colombia (Santa Marta)6-302.8coral rubbleMüller 1988aMüller, 1988BelizeKensley and Schotte 1989Monroy-Velázquez et al. 2017G. marleyi Farquharson,St. John, US Virgin3-52.6-3.7several host fishFarquharson et al. 2012Smit & Sikkel, 2012Islands; Bahamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles)202.6-3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6-3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6-3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldColombia (Santa Marta)301.7coral rubbleMüller 1988a1988G. rathri Kensley, 1984Belize (Carrie Bow Cay)0.5-1281.6-1.9rubbleMüller 1988a1988G. reiospathionaUSA (Florida)2008.8Boone 1918Boone, 1918Golombia (Santa Marta)25-301.5sponges and hydroidsMüller 1988aG. vieginadli Monod, 1926US Virgin Islands292.2Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017G. virginadli Monod, 1926US Virgin Islands292.2Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017G. virginadli Monod, 1926US Virgin Islands292.2Monroy-Velázquez et al. 2017G. virginadli Monod, 1926US Virgin Islands292.2Monroy-Velázquez et al. 2017 </td <td></td> <td>Venezuela</td> <td></td> <td></td> <td>seagrass beds; muddy</td> <td>Díaz et al. 2013</td>		Venezuela			seagrass beds; muddy	Díaz et al. 2013
G. magdalenemisColombia (Santa Marta)6–302.8coral rubbleMüller 1988aMüller, 1988BelizeKensley and Schotte 1989Müller, 1988Mexico (Puerto Morelos)3–12coral rubbleMonroy-Velázquez et al. 2017Smit & Sikkel, 2012Islands; Bahama; BritishFarquharson et al. 2012Sandards; Bahama; BritishFarquharson et al. 2012Smit & Sikkel, 2012Islands; GuanaVirgin Islands (GuanaFarquharson et al. 2012Farquharson et al. 2012G. micheli Ortiz, WinfeldCuba (Gayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfeldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfeldBelize (Carrie Bow Cay)0.5–1281.6–1.9rubbleKensley 1984G. samariensis Müller,Oolombia (Santa Marta)301.7coral rubbleMüller 1988a1988USA (Florida)2008.8Boone 1918Boone, 1918Müller, 1988Venezuelaroots; algaeDias et al. 2013G. virginalis Monod, 1926US Virgin Islands292.2Monoroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Schurte, 1988Guriz, G. virginalis Monod, 1926US Virgin Islands292.2Monord 1926Syn: G. puertoricensisPuerto Rico0–33Menzies and Glynn 1968Menzies & Glynn, 1968CubaCubaCoral rubbleMenzies and Glynn 1968Menzies & Glynn, 1968CubaCubaCubaKensley 1984<					bottom	
Müller, 1988BelizeKensley and Schotte 1989Müsico (Puerto Morelos)3–12coral rubbleMonroy-Velázquez et al. 2017G. marleyi Farquharson, St. John, US Virgin3–52.6–3.7several host fishFarquharson et al. 2012Smit & Sikkel, 2012Islands; Bahamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Mensley, 1984Belize (Carrie Bow Cay)0.5–1281.6–1.9rubbleKensley 1984G. starbi Kensley, 1984Belize (Carrie Bow Cay)0.5–1281.6–1.9rubbleMüller 1988a1988Colombia (Santa Marta)301.7coral rubbleMüller 1988aBoone, 1918G. segarass beds; mangroveDias et al. 2013roots; algaeDias et al. 2013G. virginalis Monod, 1926US Virgin Islands292.2Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázq	G. magdalenensis	Colombia (Santa Marta)	6-30	2.8	coral rubble	Müller 1988a
Mexico (Puerto Morelos)3–12coral rubbleMonroy-Velázquez et al. 2017G. marleyi Farquharson, Smit & Sikkel, 2012St. John, US Virgin Islands; Bahamas; British3–52.6–3.7several host fishFarquharson et al. 2012Smit & Sikkel, 2012Islanda; Bahamas; BritishVirgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles)algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012G. micheli Ortiz, WinfieldBelize (Carrie Bow Cay)0.5–1281.6–1.9rubbleKensley 1984G. sumariensis Müller, 1988Colombia (Santa Marta)301.7coral rubbleMüller 1988a1988G. sumariensis Müller, 1988Colombia (Santa Marta)25–301.5sponges and hydroids seagrass beds; mangrove roots; algaeMüller 1988aG. virginalis Monod, 1918Colombia (Santa Marta)25–301.5sponges and hydroids seagrass beds; mangrove roots; algaeMonroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Beize (Carrie Bow Cay)6–122.7coral rubble coral rubbleMenzies and Glynn 1968G. virginalis Monod, 1926US Virgin Islands292.2Monod 1926Miler 1983aSyn: G. puertoricensisPuerto Rico33Ortiz 1983; MüllerMenzies & Glynn, 1968CubaCubaOrtiz 1983; Müller 1988aG. virginalis Monod, 1926Kensley 1984Ortiz 1	Müller, 1988	Belize				Kensley and Schotte 1989
G. marleyi Farquharson,       St. John, US Virgin       3-5       2.6-3.7       several host fish       Farquharson et al. 2012         Smit & Sikkel, 2012       Islands; Bahamas; British       Virgin Islands (Guana       Island; Puerto Rico; Saba       0         G. micheli Ortiz, Winfield       Cuba (Cayo Matias)       20       2.6-3.3       algae       Ortiz et al. 2012         G. micheli Ortiz, Winfield       Cuba (Cayo Matias)       20       2.6-3.3       algae       Ortiz et al. 2012         G. micheli Ortiz, Winfield       Cuba (Cayo Matias)       20       2.6-3.3       algae       Ortiz et al. 2012         G. micheli Mensley, 1984       Belize (Carrie Bow Cay)       0.5-128       1.6-1.9       rubble       Kensley 1984         G. strinspathiona       USA (Florida)       200       8.8       Boone 1918       Boone, 1918         G. vellosa Müller, 1988       Colombia (Santa Marta)       25-30       1.5       sponges and hydroids seagrass beds; mangrove       Müller 1988a         G. vellosa Müller, 1988       Colombia (Santa Marta)       25-30       1.5       sponges and hydroids seagrass beds; Magrave       Müller 1988a         G. vellosa Müller, 1988       Colombia (Santa Marta)       25-30       2.7       coral rubble       Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and		Mexico (Puerto Morelos)	3-12		coral rubble	Monroy-Velázquez et al. 2017
Smit & Šikkel, 2012 Islands; Bahamas; British Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles) <i>G. micheli</i> Ortiz, Winfield & Varela, 2012 <i>G. rathi</i> Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 <i>G. samariensis</i> Müller, 1988 Colombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 <i>G. trispathiona</i> USA (Florida) 200 8.8 Boone 1918 Boone, 1918 <i>G. vellosa</i> Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela Venezuela Seagrass beds; mangrove Dias et al. 2013 <i>Mexico</i> (Puerto Morelos) 6–12 2.7 coral rubble Monoy-Velázquez and Alvarez 2016; Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez et al. 2017 <i>G. virginalis</i> Monod, 1926 Syn: <i>G. puertoricensis</i> Puerto Rico 0–3 3 Menzies & Glynn, 1968 Belize (Carrie Bow Cay) vulta 0–30 2 coral rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble Kensley 1984 Menzies and Glynn 1968 Menzies and Glynn 1968 Menzies de Glynn, 1968 Cuba Oriz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble Miller 1988a fouling on harbour pilings <i>Martinique</i> , French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones	G. marleyi Farquharson,	St. John, US Virgin	3–5	2.6-3.7	several host fish	Farquharson et al. 2012
Virgin Islands (Guana Island); Puerto Rico; Saba (Lesser Antilles)G. micheli Ortiz, WinfieldCuba (Cayo Matias)202.6–3.3algaeOrtiz et al. 2012& Varela, 2012G. rathi Kensley, 1984Belize (Carrie Bow Cay)0.5–1281.6–1.9rubbleKensley 1984G. rathi Kensley, 1984Belize (Carrie Bow Cay)0.5–1281.6–1.9rubbleMüller 1988a1988Colombia (Santa Marta)301.7coral rubbleMüller 1988a1988USA (Florida)2008.8Boone 1918G. ritoispathionaUSA (Florida)25–301.5sponges and hydroidsMüller 1988aBoone, 1918Venezuela25–301.5sponges and hydroidsMüller 1988aVenezuelaVenezuelarotors; algaeDias et al. 2013rotors; algaeG. virginalis Monod, 1926US Virgin Islands292.2Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017G. virginalis Monod, 1926US Virgin Islands292.2Monroy 1926Menzies & Glynn, 1968CubaOrtiz 1983; Müller 1988a fouling on harbour pillingsMüller 1988a fouling on harbour pillingsBelize (Carrie Bow Cay)co-32coral rubble; under stones; fouling on harbour pillingsHartinique, French0.5–2seagrass beds; dead corals; mangrove roots; seagrassMüller 1993a Müller 1993Antillesunder stonesunder stonesStiller 1993Hartinique, French0.5–2seagrass beds; dead corals; mangrove	Smit & Sikkel, 2012	Islands; Bahamas; British				*
Island, Puerto Rico; Saba (Lesser Antilles)		Virgin Islands (Guana				
(Lesser Antilles)202.6-3.3algaeOrtiz et al. 2012& Varela, 2012		Island); Puerto Rico; Saba				
G. micheli Ortiz, Winfield       Cuba (Cayo Matias)       20       2.6–3.3       algae       Ortiz et al. 2012         & Varela, 2012		(Lesser Antilles)				
& Varela, 2012 G. nthi Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 (Golombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 (Colombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 (Colombia (Santa Marta) 200 8.8 Boone 1918 Boone, 1918 (Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela Venezuela Venezuela Dias et al. 2013 roots; algae (Monroy-Velázquez and Alvarez 2016; Monroy-Velázquez and Corres, algae (Carrie Bow Cay) Cuba (Cuba (Carrie Bow Cay) (Cuba (Carrie Bow Cay)) (Coral rubble; under stones; Müller 1988a Belize (Carrie Bow Cay) (Cuba (Cuba (Carrie Bow Cay)) (Cuba (Carrie Bow Cay)) (Coral rubble; under stones; Müller 1988a fouling on harbour pilings (Carrie Bow Cay) (Cuba (Carrie Bow Cay)) (Coral rubble; under stones; Müller 1988a (Colombia (Santa Marta) 0–30 2 (Coral rubble; under stones; Müller 1988a (Colombia (Santa Marta) 0–50) (Cuba (Cuba (Carrie Bow Cay)) (Cuba (Carrie Bow Cay)) (Cuba (Cuba (Cuba (Carrie Bow Cay)) (Cuba (Cuba (Cuba (Cuba (Carrie Bow Cay)) (Cuba (Cuba (Cuba (Carrie Bow Cay)) (Cuba (Cuba (Cuba (Carrie Bow Cay)) (Cuba (C	G. micheli Ortiz, Winfield	Cuba (Cayo Matias)	20	2.6–3.3	algae	Ortiz et al. 2012
G. rathi Kensley, 1984 Belize (Carrie Bow Cay) 0.5–128 1.6–1.9 rubble Kensley 1984 G. samariensis Müller, Colombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 G. triospathiona USA (Florida) 200 8.8 Boone 1918 Boone, 1918 G. vellosa Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela venezuela seagrass beds; mangrove Dias et al. 2013 roots; algae Mexico (Puerto Morelos) 6–12 2.7 coral rubble Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monod 1926 Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies and Glynn 1968 Menzies & Glynn, 1968 Cuba Ortiz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones	& Varela, 2012					/
G. samariensis Müller, Colombia (Santa Marta) 30 1.7 coral rubble Müller 1988a 1988 G. triospathiona USA (Florida) 200 8.8 Boone 1918 Boone, 1918 G. vellosa Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela venezuela seagrass beds; mangrove Dias et al. 2013 roots; algae Mexico (Puerto Morelos) 6–12 2.7 coral rubble Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monod 1926 Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies & Glynn, 1968 Cuba Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela Marta 2013	G. rathi Kensley, 1984	Belize (Carrie Bow Cay)	0.5–128	1.6–1.9	rubble	Kensley 1984
1988 G. triagnathiona USA (Florida) 200 8.8 Boone 1918 Boone, 1918 G. vellosa Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela Dias et al. 2013 roots; algae Mexico (Puerto Morelos) 6–12 2.7 coral rubble Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monord Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies & Glynn, 1968 Cuba Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1988a Antilles under stones Venezuela Marta 1203	G. samariensis Müller,	Colombia (Santa Marta)	30	1.7	coral rubble	Müller 1988a
G. triginalis Monod, 1926 USA (Fiorida) 200 8.8 Boone, 1918 Boone, 1918 G. vellosa Müller, 1988 Colombia (Santa Marta) 25–30 1.5 sponges and hydroids Müller 1988a Venezuela Dias et al. 2013 roots; algae Mexico (Puerto Morelos) 6–12 2.7 coral rubble Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017 G. virginalis Monod, 1926 US Virgin Islands 29 2.2 Monod 1926 Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies and Glynn 1968 Menzies & Glynn, 1968 Cuba Ortiz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones	1988	LICA (EL: L.)	200	0.0		D 1010
G. vellosa Müller, 1988 G. vellosa Müller, 1988 Colombia (Santa Marta) Venezuela Mexico (Puerto Morelos) G. virginalis Monod, 1926 Syn: G. puertoricensis Menzies & Glynn, 1968 Menzies & Cuba Belize (Carrie Bow Cay) Colombia (Santa Marta) 0–30 Martinique, French 0.5–2 Martinique, French 0.5–2 Martinique french Venezuela Martinique french Venezuela Martinique french Venezuela Martinique french Martinique french	G. triospatmona	USA (FIORIda)	200	0.0		Doone 1918
Of beause infinite (solute visite)       23-30       1.5       sponges and infutious       Finite 1988a         Venezuela       seagrass beds; mangrove       Dias et al. 2013       roots; algae         Mexico (Puerto Morelos)       6-12       2.7       coral rubble       Monroy-Velázquez and         Alvarez 2016; Monroy-       Velázquez et al. 2017       Velázquez et al. 2017       Velázquez et al. 2017         G. virginalis Monod,1926       US Virgin Islands       29       2.2       Monod 1926         Syn: G. puertoricensis       Puerto Rico       0-3       3       Menzies and Glynn 1968         Menzies & Glynn, 1968       Cuba       Ortiz 1983; Müller 1988a       Ortiz 1983; Müller 1988a         Belize (Carrie Bow Cay)       rubble       Kensley 1984         Colombia (Santa Marta)       0-30       2       coral rubble; under stones;         Martinique, French       0.5-2       seagrass beds; dead corals;       Müller 1993         Antilles       under stones       Venezuela       mangrove roots; seagrass       Dias et al. 2013	C unllar Müller 1088	Colombia (Santa Manta)	25 20	15	anon and huduaida	Müller 1089a
Venezuela     stagras beds, nangrove     Dia et al. 2013       roots; algae       nots; algae       Mexico (Puerto Morelos)     6–12     2.7     coral rubble     Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017       G. virginalis Monod,1926     US Virgin Islands     29     2.2     Monod 1926       Syn: G. puertoricensis     Puerto Rico     0–3     3     Menzies and Glynn 1968       Menzies & Glynn, 1968     Cuba     Ortiz 1983; Müller 1988a     Ortiz 1983; Müller 1988a       Belize (Carrie Bow Cay)     rubble     Kensley 1984       Colombia (Santa Marta)     0–30     2     coral rubble; under stones;       Martinique, French     0.5–2     seagrass beds; dead corals;     Müller 1993       Antilles     under stones     Venezuela     mangrove roots; seagrass     Dias et al. 2013	G. veuosa iviullei, 1988	Veneruele	23-30	1.)	sponges and nydroids	Disc et al. 2013
Mexico (Puerto Morelos) 6–12 2.7 coral rubble Monroy-Velázquez and Alvarez 2016; Monroy- Velázquez et al. 2017 G. virginalis Monod,1926 US Virgin Islands 29 2.2 Monod 1926 Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies and Glynn 1968 Menzies & Glynn, 1968 Cuba Ortiz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones		venezueia			seagrass beus, mangrove	Dias et al. 2015
G. virginalis Monod,1926       US Virgin Islands       29       2.2       Monod 1926         Syn: G. puertoricensis       Puerto Rico       0–3       3       Menzies and Glynn 1968         Menzies & Glynn, 1968       Cuba       Ortiz 1983; Müller 1988a       Ortiz 1983; Müller 1988a         Belize (Carrie Bow Cay)       rubble       Kensley 1984         Colombia (Santa Marta)       0–30       2       coral rubble; under stones;         Martinique, French       0.5–2       seagrass beds; dead corals;       Müller 1993         Antilles       under stones       Venezuela       mangrove roots; seagrass       Dias et al. 2013		Marrico (Puarto Moralos)	6 12	27	correl rubble	Monroy Velázquez and
G. virginalis Monod,1926       US Virgin Islands       29       2.2       Velázquez et al. 2017         Syn: G. puertoricensis       Puerto Rico       0–3       3       Menzies and Glynn 1968         Menzies & Glynn, 1968       Cuba       Ortiz 1983; Müller 1988a       Ortiz 1983; Müller 1988a         Belize (Carrie Bow Cay)       rubble       Kensley 1984         Colombia (Santa Marta)       0–30       2       coral rubble; under stones; Müller 1988a         Martinique, French       0.5–2       seagrass beds; dead corals; Müller 1993         Antilles       under stones       Venezuela		Wexico (1 dei to Worelos)	0-12	2./	corai rubbie	Alwarez 2016: Monroy
G. virginalis Monod,1926 US Virgin Islands 29 2.2 Monod 1926 Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies and Glynn 1968 Menzies & Glynn, 1968 Cuba Ortiz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013						Velázquez et al. 2017
Syn: G. puertoricensis Puerto Rico 0–3 3 Menzies and Glynn 1968 Menzies & Glynn, 1968 Cuba Ortiz 1983; Müller 1988a Belize (Carrie Bow Cay) rubble Kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013	Catinginglic Monod 1926	US Virgin Islands	20	2.2		Monod 1926
Menzies & Glynn, 1968 Cuba O-30 2 Coral rubble; under stones; Müller 1988a Belize (Carrie Bow Cay) rubble kensley 1984 Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013	Sum C puertonicancic	Duerto Dico	0.3	2.2		Monoid 1920
Melizes & Celula (Carrie Bow Cay) Belize (Carrie Bow Cay) Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013	Manziac & Clypp 1968	Cuba	0–5	5		Ortiz 1983: Müller 1988
Colombia (Santa Marta) 0–30 2 coral rubble; under stones; Müller 1988a fouling on harbour pilings Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013	Menzies & Giynn, 1968	Belize (Carrie Bow Cav)			rubble	Kensley 1984
Colorina (canta France)     6 50     2     fouling on harbour pilings       fouling on harbour pilings     fouling on harbour pilings       Martinique, French     0.5–2     seagrass beds; dead corals;       Miller     under stones       Venezuela     mangrove roots; seagrass     Dias et al. 2013		Colombia (Santa Marta)	0-30	2	coral rubble: under stones:	Müller 1988a
Martinique, French 0.5–2 seagrass beds; dead corals; Müller 1993 Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013		Colombia (Santa Warta)	0-50	2	fouling on barbour pilings	Wither 1900a
Antilles under stones Venezuela mangrove roots; seagrass Dias et al. 2013		Martinique French	0.5-2		seagrass beds: dead corals:	Müller 1993
Venezuela mangrove roots; seagrass Dias et al. 2013		Antilles	0.9 2		under stones	Wither 1999
interfacture interfacture interfactor inte		Venezuela			mangrove roots: seagrass	Dias et al. 2013
beds: muddy bottom; algae		, enclueia			beds: muddy bottom: aloae	20 may 64 min 2013
Mexico (Puerto Morelos) 6–12 2.2 coral rubble Monrov-Velázouez and		Mexico (Puerto Morelos)	6-12	2.2	coral rubble	Monrov-Velázquez and
Abarez 2016 Monroy			0.12	2.2	conta rabbie	Alvarez 2016: Monrov-
Velázouez et al. 2017						Velázquez et al. 2017

#### Materials and methods

All benthic samples were collected from 17 July to 14 August 2016 aboard the R/V "Baseline Explorer". Mesophotic benthic surveys and sampling were conducted using Trimix rebreathing divers from the Global Underwater Explorers (GUE) down to 94 m around the edge of the Bermuda platform. The sampling sites North Northeast (NNE), Plantagenet Bank, Spittal, and Tiger, were selected along the northeast, southeast and southern slopes of the Bermuda platform, respectively (Figure 1). During the same mission, two two-person Triton Class Submersibles (Nomad and Nemo; Vero Beach, FL, United States) equipped with an arm manipulator assisted in sample collection down to 300 m. Divers collected macroalgae, loose gravel, bottom sediment, rhodoliths, sponges, and hard and soft corals to characterise the biodiversity of the Bermudian mesophotic reefs. The depth range for each sample was noted. Once the substrata were brought onto the research vessel, they were placed on a 0.063 µm sieve and washed thoroughly with filtered water. Meiofauna and macrofauna associated with the substrata were captured on the 0.063  $\mu$ m sieve and preserved in > 95 % ethanol. The preserved samples were sorted, placed in 95 % ethanol, and stored at -20 °C until further processing. Research permits for Bermuda were issued by the Department of Environment and Natural Resources, Bermuda (No. 2016070751).

From these samples, several gnathiids were cleaned and prepared for scanning electron microscopy (SEM; PhenomWorld). Gnathiids were also observed and drawn using an Olympus BX41 compound microscope and an Olympus SZX7 dissecting microscope with a camera lucida. Appendages were removed with the aid of dissecting needles and forceps and stained using lignin pink.

The species description was prepared in DELTA (DEscriptive Language for TAxonomy) using a general Gnathiidae character set (as used in Svavarsson and Bruce 2012). The description is based on the adult male gnathiid. Terminology follows Monod (1926), Cohen and Poore (1994) and Svavarsson and Bruce (2012, 2019). Isopod classification follows that of Brandt and Poore (2003).

Material is deposited in the Natural History Museum of Bermuda.

#### Taxonomy

Suborder Cymothoida Wägele, 1989 Superfamily Cymothooidea Leach, 1814 Family Gnathiidae Leach, 1814

## Genus Gnathia Leach, 1814, restricted syn.

*Gnathia* Leach, 1814: 386–402; Monod 1926: 326–329 (part); Cohen and Poore 1994: 343–346. *Anceus* Risso, 1816: 8.



**Figure 1.** Map of collection sites around Bermuda. Data overlay GEBCO\_2014 Grid which provides 30 arc-second global grid of elevations. Depth contours in meters.

Praniza Latreille, 1817: 54. Zuphea Risso, 1826: 104. Gnathia (Gnathia) s.s.: Monod 1926: 329 (part). Gnathia (Perignathia): Monod 1926: 554–555 (not Perignathia Monod, 1922).

Type species. Gnathia termitoides Leach, 1814, by monotypy (see Cohen and Poore 1994).

**Diagnosis.** Frontal margin of cephalosome generally straight (not deeply excavated), with frontal processes. Mandibles not elongate, usually with mandibular incisor and dentate mandibular blade. Paraocular ornamentation and/or a dorsal sulcus may

be present on cephalosome. Pereonite 1 possibly immersed in cephalosome. Pylopod broad and distinct, with two or three articles, operculate; article 1 enlarged, generally with dense external margin of plumose setae; article 3 reduced or absent.

**Remarks.** *Gnathia* can be identified by the presence of frontal processes, a straight frontal border, a broad 2 or 3 articled pylopod, and non-extended mandibles with a dentate blade.

It is the most speciose genus in the family Gnathiidae (currently with 126 valid species). *Gnathia* is a cosmopolitan genus, commonly found in coral-reef habitats, and its parasitic larvae have been reported from both teleost and elasmobranch hosts (Smit and Davies 2004). The most recent revision of this genus was by Cohen and Poore (1994).

#### Gnathia bermudensis sp. nov.

http://zoobank.org/5FD1EC92-2EE5-40E8-8BB8-0C47255A73A2 Figures 2–4

**Material examined.** *Holotype.* BERMUDA • 1 ♂ (2.2 mm TL); Plantagenet Bank (31°56.55'N, 65°09.29'W); 56 m; 12 Aug 2016; Diver 2, from sediment; Sample ID BEX 2016-449 (BAMZ 2016-338-147).

*Paratypes.* BERMUDA • 3 ♂♂ (1.9–2.1 mm TL) (one dissected), 1 ♂ used for SEM (1.8 mm TL), 1 ♀ (1.6 mm TL); same info as holotype (BAMZ 2016-338-148).

Other material. BERMUDA • 4 33 (1.8–1.9 mm TL) (one dissected); Spittal (32°19.119'N, 64°39.437'W); 45 m; 3 Aug 2016; sediment from Montastraea cavernosa (Linnaeus, 1767) corals, Divers 39; Sample ID BEX 2016-227, Parent BEX2016-225 (sediment from several Montastraea cavernosa colonies) (BAMZ 2016-338-149) • 1 🗟 (2.0 mm TL); NNE (32°28.59'N, 64°34.46'W); 90 m; 4 Aug 2016; Event Divers; Sample ID BEX 2016-250, Parent BEX2016-248 (BAMZ 2016-338-150) • 1 zuphea (Z1) (0.45 mm TL); NNE (32°28.59'N, 64°34.46'W); 4 Aug 2016; algae substrate; Sample ID BEX 2016-251 • 1 ♂ used for SEM (1.7 mm TL); Spittal (32°19.119'N, 64°39.437'W); from rhodolith collected between 82-152 m; 7 Aug 2016; Dive 22, Nomad 1 (a Triton Submersible); Sample ID BEX 2016-299, Parent BEX2016-0265 • 1  $\bigcirc$  (2.0 mm TL), 1  $\bigcirc$  (1.9 mm TL), 1 zuphea (0.8 mm TL); Tiger 4 (32°11.17'N, 64°58.36'W); 7 Aug 2016; Divers 12, from sediment; Sample ID BEX 2016-304, Parent BEX2016-0282 (rhodolith with red encrusting sponge, > 40 m) (BAMZ 2016-338-151) • 2 🖧 (1.9–2.0 mm TL); Spittal (32°19.119'N, 64°39.437'W); 77 m; 11 Aug 2016; wash from rhodolith; Sample ID BEX 2016-428 • 1 👌 (2.0 mm TL), 1 praniza (P3) (2.3 mm TL), 1 zuphea (Z1) (0.5 mm TL); Spittal (32°19.119'N, 64°39.437'W); 77 m; 11 Aug 2016; Diver 30; Sample ID BEX 2016-430 • 4 zuphea (Z1) (0.5 mm TL); Plantagenet Bank (31°56.55'N, 65°09.29'W); 56 m; 12 Aug 2016; Divers 2; Sample ID BEX 2016-450 • 2 dd (1.7-1.9 mm TL) (one used for SEM); Plantagenet Bank (31°56.55'N, 65°09.29'W); 56 m; 12 Aug 2016; Divers 6; Sample ID BEX 2016-451. All samples were collected by GUE technical divers except Sample ID BEX 2016-299, Parent BEX2016-0265, which was collected by a Triton Submersible.



**Figure 2.** *Gnathia bermudensis* sp. nov. (BAMZ 2016-338-147), male holotype (2.2 mm TL) **A** dorsal view **B** dorsal view of cephalosome **C** dorsal view of pleotelson and uropods **D** dorsal view of mandible **E** antenna **F** antennula **G** pylopod **H** maxilliped. Scale bars: 100 μm.

**Description of male.** Body 2.3 times as long as greatest width, widest at pereonite 3; dorsal surfaces sparsely punctate, sparsely setose. Cephalosome quadrate, 0.7 as long as wide, lateral margins sub-parallel; dorsal surface with sparse granules; dorsal sulcus narrow, shallow, short; translucent region absent; paraocular ornamentation strongly developed, posteromedian tubercle present. Frontolateral processes present. Frontal margin slightly produced. External scissura present, wide, shallow. Mediofrontal process present, weak, bifid, without fine setae. Supraocular lobe pronounced, pointed; accessory supraocular lobe not pronounced. Superior frontolateral process absent. Mesioventral margin concave. Eyes present, elongate, 0.3 times as long as cephalosome length, bulbous, standing out from head surface, ommatidia arranged in rows, eye colour black.

*Pereon* lateral margins subparallel, with few setae; anteriorly with sparse fine granules. *Pereonite 1* not fused dorsally with cephalosome; dorsolateral margins fully obscured by cephalosome. *Pereonite 2* wider than pereonite 1. *Areae laterales* present on pereonite 5. *Pereonite 6* without lobi laterales; lobuii weak, globular. *Pleon* covered in pectinate scales, epimera not dorsally visible on all pleonites. *Pleonite 1* lateral margins with one pair of simple setae, with one pair of simple setae medially. *Pleotelson* as long as anterior width, covered in pectinate scales. Pleotelson lateral margins finely serrate, anterolateral margins weakly convex, with two submarginal setae; posterolateral margin distally weakly concave, with two submarginal setae; apex with two setae.

*Antennula* peduncle article 2 0.8 times as long as article 1; article 3 1.9 times as long as article 2, 2.7 times as long as wide; flagellum 1.1 times as long as article 3, with five articles; article 3 with one aesthetasc seta and one simple seta; article 4 with one aesthetasc seta and one simple seta; article 5 terminating with one aesthetasc seta and three simple setae. *Antenna* peduncle article 4 2.5 times as long as wide, twice as long as article 3, and four simple setae; article 5 1.3 times as long as article 4, 2.8 times as long as wide, inferior margin with three penicillate setae, with six simple setae; flagellum 1.5 times as long as article 5, with seven articles.

*Mandible* 0.4 as long as width of cephalosome, triangular, weakly curved, evenly; apex 42% total length; mandibular seta present. *Incisor* dentate. *Blade* present, dentate, weakly convex, dentate along 100% of margin. *Pseudoblade* absent; internal lobe absent; dorsal lobe absent; basal neck short; erisma present.

*Maxilliped* 5-articled; article 1 lateral margin with continuous marginal scale-setae; article 2 lateral margin with four plumose setae; article 3 lateral margin with six plumose setae; article 4 lateral margin with four plumose setae; article 5 with eight plumose setae; endite extending to mid-margin of article 3; without coupling setae.

*Pylopod* first article 1.5 as long as wide, without distolateral lobe; posterior and lateral margins forming rounded curve; lateral margin with 23 large plumose setae; mesial margin with continuous scale-setae; distal margin with three simple setae; second article 1.1 as long as wide.

*Pereopods 2–6* with long simple setae and randomly covered in pectinate scales; pereopod 2 with tubercles on carpus and basis to ischium. *Pereopod 2 basis* 2.8 times as long as greatest width, superior margin with five setae, inferior margin with two setae; ischium 0.6 times as long as basis, 2.6 as long as wide, superior margin with one seta,



**Figure 3.** *Gnathia bermudensis* sp. nov. (BAMZ 2016-338-147), male holotype (2.2 mm TL) **A** pleopod 2 **B–F** pereopods 2–6, respectively. Scale bar: 100 μm.

inferior margin with three setae; merus 0.5 as long as ischium, 1.5 as long as wide, superior margin with two setae, inferior margin with four setae; carpus 0.6 as long as ischium, 1.9 as long as wide, superior margin without setae, inferior margin with two setae; propodus 0.8 times as long as ischium, 2.8 times as long as wide, superior and inferior margins without setae, and two robust setae; dactylus 0.7 as long as propodus. *Pereopods 3 and 4* similar to pereopod 2. *Pereopod 5* similar to pereopod 6. *Pereopod 6* with tubercles on merus and carpus; basis 3.1 times as long as greatest width, superior margin with two setae; ischium 0.7 as long as basis, 2.7 as long as greatest width, superior margin with three setae, inferior margin with four setae; merus 0.6 as long as ischium, 2.1 times as long as wide, superior margin with three setae, inferior margin with two setae; carpus 0.6 as long as ischium, 1.7 times as

long as wide, superior margin and inferior margin with one seta; propodus 0.9 as long as ischium, 3.8 times as long as wide, superior margin with three setae, inferior margin with one seta, and two robust setae; dactylus 0.6 as long as propodus.

Penes opening flush with surface of sternite 7.

*Pleopod 2 exopod* 1.9 as long as wide, distally broadly rounded, with eight plumose setae; endopod 1.9 as long as wide, distally broadly rounded, with eight plumose setae; appendix masculina absent; peduncle 1.5 times as wide as long, mesial margin with two coupling setae, lateral margin with one simple seta.

Uropod rami extending beyond pleotelson, apices narrowly rounded. Uropod endopod 2.4 as long as greatest width, dorsally with five setae; lateral margin straight; proximomesial margin weakly convex, with seven long plumose setae. Uropod exopod not extending to end of endopod, 2.9 times as long as greatest width; lateral margin straight, with two simple setae; proximomesial margin straight, distally convex, mesiodistal margin with seven long plumose setae.

**Etymology.** The epithet *bermudensis* is for the country Bermuda, being the first *Gnathia* record from this island nation.

Distribution. Bermuda.

Hosts. Not known.

**Remarks.** *Gnathia bermudensis* sp. nov. may be identified by the produced frontal margin; presence of two superior frontolateral processes; a weak and bifid mediofrontal process; and pronounced and pointed supraocular lobes. The uropod rami extend past the posterior point of the pleotelson; pereonite 1 is not dorsally fused with the cephalosome; large eyes (0.3 as long as cephalosome length); and a weakly curved, dentate mandible.

This species is from a moderate depth of 56–90 m and was collected from several habitat types (algae, loose gravel, rhodoliths, sediment associated with scleractinian corals, muddy sand, and sponges) encompassing the mesophotic reef ecosystems of Bermuda. The Mesophotic Coral Ecosystems (MCEs) of Bermuda represent the most northern coral reef systems of the Atlantic; they are visually dominated by scleractinian corals at the upper depth limits, which are replaced gradually at greater depths by rhodoliths, macroalgae beds and fossilised reefs (Goodbody-Gringley et al. 2019). The new gnathiid species has been found on the mesophotic slopes of the main seamount (i.e., the main island of Bermuda) and the smaller seamount Plantagenet (Figure 1); therefore, it is expected to be found throughout the deeper reefs of Bermuda. Only four other species of *Gnathia* have been collected from greater depths in this region.

Gnathia bermudensis sp. nov. is most similar to G. beethoveni Paul & Menzies, 1971, G. calsi Müller, 1993, G. johanna Monod, 1926, G. magdalenensis Müller, 1988, and G. virginalis Monod, 1926 from the region. The frontal margin of G. beethoveni differs from Gnathia bermudensis in having less pronounced supraocular lobes, four frontolateral processes, a shallow median notch, and the cephalosome is lacking dorsal tubercles. Gnathia calsi also has a deeply notched mediofrontal process with two lobes (and setae), and well developed but angular supraocular lobes, not seen in Gnathia bermudensis sp. nov. Gnathia johanna is narrower than Gnathia bermudensis sp. nov., with less pronounced supraocular lobes and a single convex mediofrontal process (with setae) between the supe-



**Figure 4.** *Gnathia bermudensis* sp. nov. (BAMZ 2016-338-148), male paratype (1.8 mm TL) Scanning Electron Microscope (SEM) images. **A** dorsal view **B** frontal margin and mandibles **C** ventral view of cephalosome **D** maxilliped **E** dorsal view of pleotelson and uropods. Scale bars: 100 μm.

rior frontolateral processes. *Gnathia magdalenensis* and *G. virginalis* differ from *Gnathia bermudensis* sp. nov. in having slightly pointed supraocular lobes, a single pointed medio-frontal process with setae, and a longer cephalosome that is fused with pereonite 1.

Although adult females and zuphea juveniles were collected with the males, they cannot be confidently linked to this species without molecular or ecological data. More collections and rearing of the gnathiid isopods would need to be made in the future for more information and validation of these different life stages, as well as to determine the hosts of the juvenile stages.

## Key to members of the genus *Gnathia* known from the Greater Caribbean biogeographic region

This key is based on the morphological characters of the adult male:

1	Pereonite 5 elongate (quadrate); located in deeper waters ( $\geq 200$ m); cephalon frontal horder ways (with 3 bifd frontal lobes or 3 tooth like projections)
_	Pereonite 5 similar in shape and size to pereonites 2–4: located in shallower
	waters ( $\leq 200$ m); cephalon frontal border with regular frontal processes 3
2	Frontal border produced with large quadrate projection; deep sea (> 1000 m);
	total body length measuring approximately 2.8–3.2 mm
-	Frontal border with deep V-shaped grove; depths below 1000 m (approx.
	200 m); total body length measuring approximately 8.8 mm
	G. triospathiona
3	Mediofrontal processes absent
_	Mediofrontal processes present10
4	Anterior margin of cephalon medially concave; robust body; cephalon wider
	than long and without granules or tubercles
_	Anterior margin of cephalon not medially concave; slender body; cephalon
	quadrate
5	Ônly superior frontolateral processes present
_	Both superior and inferior frontolateral processes present
6	Frontal margin slightly convex or straight; cephalon granular (tubercles)
	G. ratbi
_	Frontal margin convex with 4 medial setae; cephalon without tubercles
	G. johanna
7	Pylopod 2-articled; inferior frontolateral processes smaller in size than supe-
	rior frontolateral processes G. micheli
_	Pylopod 3-articled; superior and inferior frontolateral processes similar in
	size
8	Cephalon and body without granules or tubercles; sparsely setose
	G. beethoveni
_	Cephalon with granules or tubercles; few to many slender setae over the
	body

9	Supraocular lobes not well developed; narrow pleon and pleotelson longer
	than wide; pereonites 5 and 6 not clearly defined G. hemingwayi
_	Supraocular lobes well developed; pleon with short setae and wider than long;
	pereonites 5 and 6 clearly defined
10	Mediofrontal process bifid
_	Mediofrontal process not bifid
11	Frontal margin medially concave; superior frontolateral processes weak with
	3 or 4 simple setae on each process; supraocular lobe not pronounced
	G. marleyi
_	Frontal margin produced; superior frontolateral processes strong with 2 sim-
	ple setae on each process; supraocular lobe pronounced and pointed
	G. bermudensis sp. nov.
12	Cephalon with few or no granules or tubercles
_	Cephalon with many small tubercles (finely granular)
13	Mediofrontal process with 2–4 simple setae; mandible with inner lobe
	G. magdalenensis
_	Mediofrontal process without any setae; mandible without inner lobe
	G. samariensis
14	Cephalon approximately 1.7 times as wide as long; mandibular carina distally
	notched <i>G. vellosa</i>
_	Cephalon approximately 1.2 times as wide as long; mandibular carina distally
	rounded
	8

# Acknowledgments

The authors and the Nekton Mission would like to thank SR Smith, J Pitt, T Trotts, and C Flook from the Bermudian Government for their assistance, advice and participation in the XL-Catlin Deep-Ocean Survey Bermuda Mission. We would also like to thank the crew and technicians of the Baseline Explorer, Brownies Global Logistics, and Triton Submersibles. This is contribution number 14 for Nekton and contribution number 355 for the NWU Water Research Group.

## References

- Artim JM, Hook A, Grippo RS, Sikkel PC (2017) Predation on parasitic gnathiid isopods on coral reefs: a comparison of Caribbean cleaning gobies with non-cleaning microcarnivores. Coral Reefs 36: 1213–1223. https://doi.org/10.1007/s00338-017-1613-6
- Boone PL (1918) Description of ten new isopods. Proceedings of the United States National Museum 54: 591–604.
- Brandt A, Poore GCB (2003) Higher classification of the flabelliferan and related Isopoda based on a reappraisal of relationships. Invertebrate Systematics 17: 893–923. https://doi. org/10.1071/IS02032

- Boyko CB, Bruce NL, Hadfield KA, Merrin KL, Ota Y, Poore GCB, Taiti S, Schotte M, Wilson GDF (Eds) (2008 onwards) World Marine, Freshwater and Terrestrial Isopod Crustaceans database. *Gnathia* Leach, 1814. Accessed through: World Register of Marine Species. http://www.marinespecies.org/aphia.php?p=taxdetails&id=118437 [on 2019-07-10]
- Cohen BF, Poore GCB (1994) Phylogeny and biogeography of the Gnathiidae (Crustacea: Isopoda) with descriptions of new genera and species, most from South-Eastern Australia. Memoirs of the Museum of Victoria 54: 271–397. https://doi.org/10.24199/j.mmv.1994.54.13
- Cook CA, Sikkel PC, Renoux LP, Smit NJ (2015) Blood parasite biodiversity of reef-associated fishes of the eastern Caribbean. Marine Ecology Progress Series 533: 1–13. https://doi.org/10.3354/meps11430
- Demopoulos AWJ, Sikkel PC (2015) Enhanced understanding of ectoparasite-host trophic linkages on coral reefs through stable isotope analysis. International Journal for Parasitology: Parasites and Wildlife 4: 125–134. https://doi.org/10.1016/j.jjppaw.2015.01.002
- Díaz YJ, Martín A, Herrera J (2013) Diversidad de isópodos (Crustacea: Isopoda) del Parque Nacional Morrocoy, Venezuela, y clave de identificación. Boletín del Instituto Oceanográfico de Venezuela 52: 33–60.
- Farquharson C, Smit NJ, Sikkel PC (2012) Gnathia marleyi sp. nov. (Crustacea, Isopoda, Gnathiidae) from the Eastern Caribbean. Zootaxa 3381: 47–61. https://doi.org/10.11646/ zootaxa.3381.1.3
- George RY (2003) Two new species of gnathiid isopod Crustacea from the North Carolina coast. Journal of the North Carolina Academy of Science 119: 33–40.
- Goodbody-Gringley G, Noyes T, Smith SR (2019) Mesophotic Coral Ecosystems of Bermuda. In: Loya Y, Puglise KA, Bridge TCL (Eds) Mesophotic Coral Ecosystems (MCEs). Springer International Publishing, 31–45. https://doi.org/10.1007/978-3-319-92735-0
- Hadfield KA, Smit NJ, Avenant-Oldewage (2009) Life cycle of the temporary fish parasite, *Gnathia pilosus* (Crustacea: Isopoda: Gnathiidae) from the east coast of South Africa. Journal of the Marine Biological Association of the United Kingdom 89: 1331–1339. https:// doi.org/10.1017/S0025315409000587
- Kensley B (1984) The Atlantic Barrier Reef Ecosystem at Carrie Bow Cay, Belize, III: New marine Isopoda. Smithsonian Institution Press, Washington, DC, 81 pp. https://doi. org/10.5479/si.01960768.24.1
- Kensley B, Schotte M (1989) Guide to the marine isopod crustaceans of the Caribbean. Smithsonian Institution Press, Washington D.C., 308 pp. https://doi.org/10.5962/bhl.title.10375
- Kensley B, Schotte M (1994) Marine isopods from the Lesser Antilles and Colombia (Crustacea: Peracarida). Proceedings of the Biological Society of Washington 107: 482–510.
- Latreille PA (1817) Les Crustacés, les Arachnides, et les Insectes. In: Cuvier G (Ed.) Le Règne Animal, distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée. Vol. 3. D'Eterville, Paris, 653 pp. https:// doi.org/10.5962/bhl.title.41460
- Leach WE (1814) Crustaceology. In: Brewster's Edinburgh Encyclopedia. 7: 383–437. https:// doi.org/10.5962/bhl.title.30911
- Menzies RJ, Glynn PW (1968) The common marine isopod Crustacea of Puerto Rico: A handbook for marine biologists. Martinus Nijhoff, The Hague, Netherlands, 133 pp.

- Monod T (1926) Les Gnathiidæ. Essai monographique (morphologie, biologie, systématique). Mémoires de la Société des Sciences Naturelles du Maroc 13: 1–668.
- Monroy-Velázquez V, Alvarez F (2016) New records of isopods (Crustacea: Peracarida: Isopoda) from the Mesoamerican Reef at Puerto Morelos, Quintana Roo, Mexico. Check List 12: 1938. https://doi.org/10.15560/12.4.1938
- Monroy-Velázquez V, Rodríguez-Martínez RE, Alvarez F (2017) Taxonomic richness and abundance of cryptic peracarid crustaceans in the Puerto Morelos Reef National Park, Mexico. PeerJ 5: e3411. https://doi.org/10.7717/peerj.3411
- Müller H-G (1988a) The genus *Gnathia* Leach (Isopoda) from the Santa Marta area, northern Colombia, with a review of Gnathiidea from the Caribbean Sea and Gulf of Mexico. Bijdragen tot de Dierkunde 58: 88–104. https://doi.org/10.1163/26660644-05801008
- Müller H-G (1988b) Redescription of *Gnathia johanna* Monod, 1926 (Isopoda) from St. John, Virgin Islands. Bulletin Zoölogisch Museum Universiteit van Amsterdam 11(15): 129–135.
- Müller H-G (1993) Marine Isopoda from Martinique, French Antilles: Cirolanidae and Gnathiidae (Crustacea: Cymothoidea). Cahiers de Biologie Marine 34: 29–42.
- Ortiz M (1983) Guía para la identificación de los isópodos y tanaidáceos (Crustacea: Peracarida), asociados a los pilotes de las aguas Cubanas. Revista de Investigaciones Marinas 4: 3–20.
- Ortiz M, Lalana R (1997) *Gnathia hemingwayi* especie nueva (Isopoda, Gnathiidea) de la costa noroccidental de Cuba. Revista de Investigaciones Marinas 18: 21–26.
- Ortiz M, Winfield I, Varela C (2012) First records of peracarid crustaceans from the Cayo Matias Ocean Blue Hole, SW Cuba, with the description of two new species. Zootaxa 3505: 53–66. https://doi.org/10.11646/zootaxa.3505.1.4
- Paul AZ, Menzies RJ (1971) Sub-tidal isopods of the Fosa de Cariaco, Venezuela, with descriptions of two new genera and twelve new species. Boletin de Instituto Universidade Oriente 10: 29–48.
- Risso A (1816) Histoire naturelle des Crustacés des environs de Nice. Paris: Librairie Grecque-Latine-Allemande. 175 pp. https://doi.org/10.5962/bhl.title.8992
- Risso A (1826) Histoire naturelle des principales productions de l'Europe méridionale et particulièrement de celles des environs de Nice et des Alpes Maritimes, vol. 5. FG Levrault, Paris, 403 pp. https://doi.org/10.5962/bhl.title.58984
- Robertson DR, Cramer KL (2014) Defining and dividing the Greater Caribbean: Insights from the biogeography of shorefishes. PLoS ONE 9(7): e102918. https://doi.org/10.1371/ journal.pone.0102918
- Schneider CW, Lane CE, Saunders GW (2018) A revision of the genus *Cryptonemia* (Halymeniaceae, Rhodophyta) in Bermuda, western Atlantic Ocean, including five new species and *C. bermudensis* (Collins & M. Howe) comb. nov. European Journal of Phycology 53: 350–368. https://doi.org/10.1080/09670262.2018.1452297
- Schneider CW, Popolizio TR, Saunders GW (2019) Collections from the mesophotic zone off Bermuda reveal three species of Kallymeniaceae (Gigartinales, Rhodophyta) in genera with transoceanic distributions. Journal of Phycology 55: 414–424. https://doi.org/10.1111/ jpy.12828
- Smit NJ, Davies AJ (2004) The curious life-style of the parasitic stages of gnathiid isopods. Advances in Parasitology 58: 289–391. https://doi.org/10.1016/S0065-308X(04)58005-3

- Smit NJ, Bruce NL, Hadfield KA (2019) Parasitic Crustacea: State of knowledge and future trends. Springer International Publishing, 481 pp. https://doi.org/10.1007/978-3-030-17385-2
- Stefanoudis PV, Gress E, Pitt JM, Smith SR, Kincaid T, Rivers M, Andradi-Brown DA, Rowlands G, Woodall LC, Rogers AD (2019a) Depth-dependent structuring of reef fish assemblages from the shallows to the rariphotic zone. Frontiers in Marine Science 6 p. 357. https://doi.org/10.3389/fmars.2019.00307
- Stefanoudis PV, Rivers M, Ford H, Yashayaev IM, Rogers AD, Woodall LC (2019b) Changes in zooplankton communities from epipelagic to lower mesopelagic waters. Marine Environmental Research 146: 1–11. https://doi.org/10.1016/j.marenvres.2019.02.014
- Svavarsson J, Bruce NL (2012) New and little-known gnathiid isopod crustaceans (Cymothoida) from the northern Great Barrier Reef and the Coral Sea. Zootaxa 3380: 1–33. https:// doi.org/10.11646/zootaxa.3380.1.1
- Svavarsson J, Bruce NL (2019) New gnathiid isopod crustaceans (Cymothoida) from Heron Island and Wistari Reef, southern Great Barrier Reef. Zootaxa 4609: 31–67. https://doi. org/10.11646/zootaxa.4609.1.2
- Wagner D, Shuler A (2017) The black coral fauna (Cnidaria: Antipatharia) of Bermuda with new records. Zootaxa 4344: 367–379. https://doi.org/10.11646/zootaxa.4344.2.11