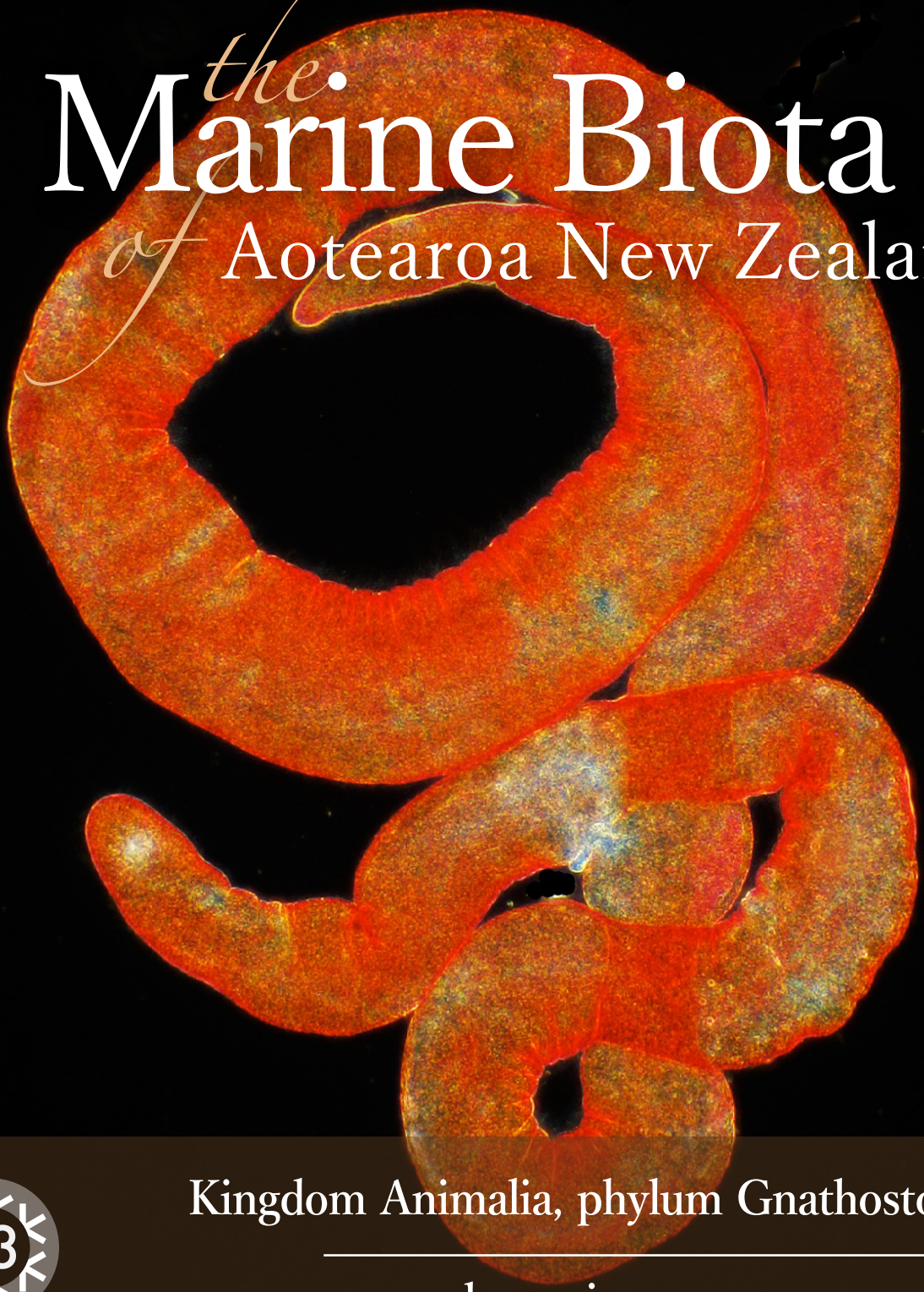
the Marine Biota of Aotearoa New Zealand



13

Kingdom Animalia, phylum Gnathostomulida

lesser jaw worms

Wolfgang Sterrer

CHAPTER 13

NIWA Biodiversity Memoir 136 2023

NIWA Taihoro Nukurangi

To cite this article: Sterrer, W. (2023) Chapter 13. Kingdom Animalia, phylum Gnathostomulida (lesser jaw worms). Pp. 210–212 *in*: Kelly, M., Mills, S., Terezow, M., Sim-Smith, C., Nelson, W. (Eds) The Marine Biota of Aotearoa New Zealand. Updating our marine biodiversity inventory. *NIWA Biodiversity Memoir* 136, 494 pp. https://docs.niwa.co.nz/library/public/NIWAbm136-ch13.zip

13 Kingdom Animalia, phylum Gnathostomulida (lesser jaw worms)

Wolfgang Sterrer

Bermuda Natural History Museum, Flatts FLBX, Bermuda; westerrer@gov.bm

Summary

Aotearoa New Zealand's gnathostomulid diversity is only partially known. In 2009, Sterrer in Shiel *et al.* (2009) recorded two endemic species, *Austrognathia novaezelandiae* Sterrer, 1991 and *Gnathostomula maorica* Sterrer, 1991, and ten *species indeterminatae* (four each of *Haplognathia* and *Pterognathia*, and one each of *Austrognatharia* and *Gnathostomula*) (Table 13.1; Fig. 13.1). These *species indeterminatae* were described fully by Sterrer (1991) and Sterrer (2006). Of the more than 100 species in 26 genera described globally, 12 species in five genera are currently known from New Zealand from two collecting events (Sterrer 1991, 2006). A checklist of New Zealand Gnathostomulida is provided.

Introduction

Phylum Gnathostomulida are exclusively marine and meiobenthic, free-living, cylindrical, acoelomate microscopic worms (0.23–3.5 mm body length, 40–100 µm diameter) (Fig. 13.1). They live predominantly in detritus-rich, low-energy coastal sand, and are uniquely characterised by a one-layered epidermis in which each cell carries only a single, long cilium. They feed by ingesting sulphur bacteria by means of their jaws, whilst gliding slowly through interstitial spaces propelled by their cilia.

Since the description of the first two species from coasts in Germany and southern France (Ax 1956), gnathostomulids have been reported from around the world, with many morpho-species having a global distribution (Sørensen & Sterrer 2020). Body shape differs between the two orders (Filospermoidea, Bursovaginoidea), with Filospermoidea being quite elongated (to 3.6 mm), with a pointed anterior and rounded posterior, whereas the stockier Bursovaginoidea have a well-rounded anterior (rostrum) set with paired sensory bristles, and the posterior end often thinning to an adhesive tail. Located subterminally, the mouth contains a muscular pharynx equipped with cuticular mouth parts (paired jaws and an unpaired basal plate) which opens into an anus-less gut. All species are hermaphrodites, with an unpaired ovary located in the anterior-dorsal region and paired or unpaired testes occupying the posterior-dorsal or dorso-lateral region (Fig. 13.1). Copulation is by subdermal impregnation in Filospermoidea (which lack a vagina, bursa, and penis stylet), or injection into a dorsal bursa by means of a penis stylet (in suborder Scleroperalia). Filospermoidea have elongated, filiform sperm with a single, 9+2 cilium, while Scleroperalia have aciliate dwarf sperm, and suborder Conophoralia are distinguished by aciliate, cone-shaped 'giant' sperm (conuli). Development is direct (Sterrer & Sørensen 2015).

By comparison with the coast of Belize, one of the globally best sampled gnathostomulid sites, with 26 species recorded (Sterrer 1998), it seems that New Zealand's gnathostomulid diversity is only partially known (Table 13.1). The main reason for the late discovery of the phylum is their preference for sandy bottoms rich in organic detritus, such as near mangroves, in the lee of coral reefs, and especially in and among seagrass rhizomes. They can be fairly easily extracted live by scooping the surface of collected sand that has sat in a bucket for a few days into a flask with a magnesium chloride solution, shaking the flask, then pouring the stirred-up liquid through a 63 µm sieve, rinsing it with seawater, and setting the sieve into a petri dish. Much of the meiofauna then crawls through the meshes to the bottom of the dish, from where it is easily collected.

Specimens squeezed under a cover slip are readily identified by their cuticular mouth parts, at least as morpho-species, under a high-power microscope (preferably with phase contrast). However, the global distribution of many such morpho-species suggests there may be a larger number of cryptic species, as shown for Nemertodermatida (Meyer-Wachsmuth *et al.* 2014).

The phylum has recently been summarised in two book chapters (Sterrer & Sørensen 2015, Sørensen & Sterrer 2020), the latter emphasising collecting procedures and identification criteria for all known species, which can also be found in World Register of Marine Species (WoRMS) (https://www.marinespecies.org/). A correction to Sterrer (2006) is noted here: Table 6 (page 9) should read 'Morphometric data for *Pterognathia tuatara*', and Table 5 (page 13) should read 'Morphometric data for *Pterognathia ugera* n. sp.'

Table 13.1. Summary of extant gnathostomulid diversity in the Aotearoa New Zealand region expressed as total numbers and percentage change. Data for 2009 are derived from Shiel *et al.* (2009: p. 138). OTU = Operational Taxonomic Unit.

	Filospermoidea		Bursovaginoidea		Total		% change
	2009	2023	2009	2023	2009	2023	
Total species diversity	8	8	4	4	12	12	0
Described extant species		8	2	4	2	12	500
Undescribed extant species (OTU)	8		2		10	0	–100
Described endemic extant species		2		3		5	n/a

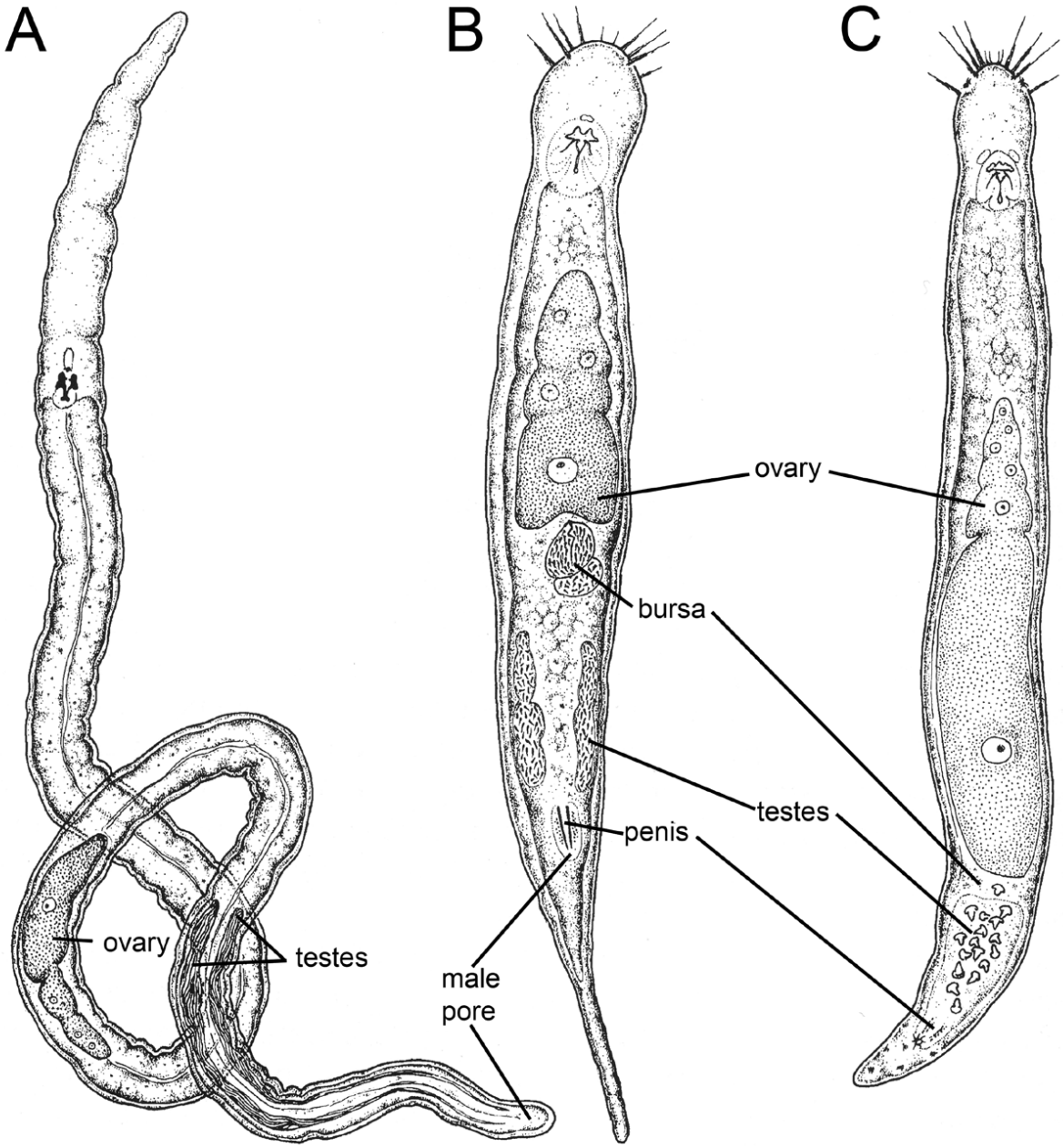


Figure 13.1. Gnathostomulid species similar to taxa recorded from New Zealand to date: **A.** *Haplognathia* sp. (Order Filospermoidea, family Haplognathiidae); **B.** *Gnathostomula* sp. (Order Bursovaginoidea, suborder Scleroperalia, family Gnathostomulidae); **C.** *Austrognathia* sp. (Order Bursovaginoidea, suborder Conophoralia, family Austrognathiidae). Modified from figure *The major groups of Gnathostomulida* in Shiel *et al.* (2009: 139) and reproduced with permission by Canterbury University Press, Christchurch, New Zealand.

Knowledge gaps, research progress and future priorities

While species descriptions have increased substantially since 1956 – from two to 102 species globally – New Zealand has only 12 species in five genera, (of which five are endemic, two regional, and five global) – about half of the actual diversity expected. Globally, the majority come from shallow sediments and are documented as morphotypes, with only 23 having been sequenced. This still leaves the question open regarding evolution, in time and space, of what may well be the most primitive of all bilaterian phyla.

Acknowledgements

I am grateful to the late John Wells (Victoria University of Wellington) and Bev Dickson (Portobello Marine Laboratory) for their hospitality and support, and Martin Sørensen for his kind review.

References

References to the taxonomic authorities and dates for Gnathostomulida taxa in this chapter and in the associated checklist can be located in Sterrer & Sørensen (2015) and Sørensen & Sterrer (2020), and in the World Register of Marine Species (WoRMS https://www.marinespecies.org/).

Ax, P. (1956) Die Gnathostomulida, eine rätselhafte Wurmgruppe aus dem Meeressand. *Abhandlungen der Akademie für Wissenschaft und Literatur Mainz, mathematisch-naturwissenschaftliche* Klasse 8: 1–32.

Meyer-Wachsmuth, I., Curini Galletti, M., Jondelius, U. (2014) Hypercryptic marine meiofauna: species complexes in Nemertodermatida. *PLoS One* 9 (9): e107688. https://doi:10.1371/journal.pone.0107688

Shiel, R.J., Smales, L., Sterrer, W., Duggan, I.C., Pichelin, S., Green, J.D. (2009) Chapter 8. Phylum Gnathifera – lesser jaw worms, rotifers, thorny-headed worms. Pp. 137–158 *in*: Gordon, D.P. (Ed.) *New Zealand Inventory of Biodiversity Volume 1, Kingdom Animalia: Radiata, Lophotrochozoa, and Deuterostomia*, Canterbury University Press, Christchurch, 566 pp.

Sørensen, M.V., Sterrer, W. (2020) Gnathostomulida. Pp. 199–226 *in:* Schmidt-Rhaesa, A. (Ed.) *Guide to the Identification of Marine Meiofauna.* F. Pfeil, München, 608 pp.

Sterrer, W. (1991) Gnathostomulida from Fiji, Tonga and New Zealand. *Zoologica Scripta* 20 (2): 107–128. https://doi.org/10.1111/j.1463-6409.1991.tb00278.x

Sterrer, W. (1998) Gnathostomulida from the (sub)tropical northwestern Atlantic. *Studies on the Natural History of the Caribbean Region* 74: 1–178.

Sterrer, W. (2006) Gnathostomulida from the Otago Peninsula, southern New Zealand. *Zootaxa* 1172: 1–19. https://doi.org/10.11646/zootaxa.1172.1.1

Sterrer, W., Sørensen, M.V. (2015) Phylum Gnathostomulida. Pp. 135–196 *in:* Schmidt-Rhaesa, A. (Ed.) *Handbook of Zoology, Volume 3.* De Gruyter, GmbH, Berlin, 354 pp. https://doi.org/10.1515/9783110274271.135

Checklist of extant Gnathostomulida known from the New Zealand EEZ

The checklist of Aotearoa New Zealand Gnathostomulida is arranged according to the currently accepted systematics and classificatory scheme employed by the World Register of Marine Species, Gnathostomulida (https://www.marinespecies.org/aphia.php?p=taxdetails&id=14262). Endemic taxa are indicated by 'E'. All other taxa are considered native by default, i.e., naturally occurring in New Zealand and elsewhere.

Phylum GNATHOSTOMULIDA
Order FILOSPERMOIDEA
Family HAPLOGNATHIIDAE
Haplognathia asymmetrica Sterrer, 1991
Haplognathia gubbarnorum (Sterrer, 1969)
Haplognathia rosea (Sterrer, 1969)
Haplognathia ruberrima (Sterrer, 1966)

Family PTEROGNATHIIDAE
Pterognathia portobello Sterrer, 2006 E
Pterognathia sica Sterrer, 2001
Pterognathia tuatara Sterrer, 2006 E
Pterognathia ugera Sterrer, 1991

Order BURSOVAGINOIDEA
Suborder CONOPHORALIA
Family AUSTROGNATHIIDAE
Austrognathia novaezelandiae Sterrer, 1991 E
Austrognatharia australis Sterrer, 2006 E
Suborder SCLEROPERALIA
Family GNATHOSTOMULIDAE
Gnathostomula maorica Sterrer, 1991 E
Gnathostomula cf. *salotae* Sterrer, 1991

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License.
To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-nd/3.0/.

All photographic images remain the copyright of the original credited photographers.

ISSN 1174-0043; 136
ISBN 978–1–99–117447–5 (digital edition)
Copyright NIWA 2023