The Marine Worms of the Southern Islands of Singapore

Rachel Y.Y. Mark, Geoffrey W.H. Davison, Bryan P.I. Leong, R.Y. Nicholas Seng, Y.H. Jonathan Tan

National Parks Board, 1 Cluny Road, 259569 Singapore

ABSTRACT. The Southern Islands Biodiversity Survey (SIBS) in 2000–2022 provided an opportunity to compile information on a disparate range of worm-like intertidal and marine animals. Of necessity, there was greater reliance on published literature than on findings during fieldwork. Nevertheless, compilation into a faunal database, listed by island, yielded useful totals for Annelida: Polychaeta and the beginnings of a more structured approach to the remaining phyla.

Keywords. Annelida, Chaetognatha, Nemertea, Platyhelminthes, Polychaeta

Introduction

Marine worms are a polyphyletic group of organisms included within the phyla Annelida (segmented worms), Platyhelminthes (flatworms), Chaetognatha (arrow worms), Nemertea (ribbon worms) and Xenacoelomorpha (a small phylum only split off from Platyhelminthes in 2011). Some members of these phyla are widespread in terrestrial, freshwater and marine environments (Rouse & Pleijel, 2001), though others are exclusively found in marine environments. Marine worms are typically benthic dwellers that are closely associated with their preferred habitat type. Some groups are sessile such as tube worms that burrow into or attach to the substrate while others are free-living.

Amongst the marine worms, polychaetes (Annelida: Polychaeta) are the most abundant and diverse in marine environments. They are soft-bodied, segmented worms with bundles of short bristles known as setae at each segment, the segments often lobed or frilled. Two main life strategies are dominant, the free moving predatory or deposit feeding polychaetes and the sessile, tube-dwelling filter feeders (Weigert & Bleidorn, 2016). They are hermaphrodites with a range of reproductive strategies. Based on genomics, the phylum now includes peanut worms (Annelida: Sipunculida), despite their lack of segmentation and setae. The phylum also includes the small group of unsegmented worms previously recognised as a phylum Echiura.

Platyhelminthes are dorso-ventrally flattened, simple animals with no anus: the pharyngeal opening ingests food and expels waste. The free-living flatworms in shallow marine environments are mostly from the Order Polycladida and are hermaphrodite, reproducing either sexually or asexually. Some are colourful and can be mistaken for nudibranchs (Ng et al., 2011). Chaetognatha have elongated, streamline bodies with paired lateral fins and a single-finned tail, swimming freely in open sea and migrating vertically through the water column in a diurnal cycle to feed. A minority of species are benthic. They are hermaphroditic, reproducing either sexually or asexually. Nemertea are widely distributed but often inconspicuous, although most are free-swimming, benthic marine worms, flattened and unsegmented. They have a simple circulatory system, a mouth and anus. Most have separate sexes and form a mating mass in which external fertilization occurs. Xenacoelomorpha are found in marine and brackish water, and they are typically benthic and inhabit soft sediments. They have a simple body plan without an anus and a basic nervous system.

Although these groups are widespread in Singapore's marine environment, they are mostly inconspicuous and may require special techniques or great labour (such as sifting and washing large quantities of mud) to obtain them whole and undamaged. Few surveys have concentrated on these phyla locally or in the region, so their diversity is poorly known and their ecological functions are poorly understood. Glasby et al. (2016) have compiled records of marine Annelida from the entire South China Sea including Singapore, and there are various publications on smaller groups of species and specific localities. Bolaños et al. (2016) have reported on some Platyhelminthes from Singapore while Ong & Tong (2018) have published a preliminary checklist of polyclad Platyhelminthes known locally.

This chapter summarises the information available on a range of worm-like forms in waters off the Southern Islands, based on data compiled from published and unpublished literature, and SIBS intertidal field surveys. A comprehensive survey would require specialised techniques adapted to the particular habits of a highly varied group, so greater reliance was placed on published records. Site-specific distribution can provide a basis for conservation and management as well as comparison for the future monitoring of populations, but specialist knowledge is necessary for these difficult phyla. Hence the information on worm-like forms is not as thorough as that for other taxa treated by the Southern Islands Biodiversity Survey (SIBS).

Methods and Materials

Intertidal surveys were conducted at 16 sites at Pulau Biola, Pulau Berkas, Sentosa (formerly Pulau Blakang Mati), Pulau Hantu, Pulau Jong, Pulau Salu, Pulau Satumu (Raffles Lighthouse), Pulau Sakijang Bendera (Saint John's Island), Pulau Sakijang Pelepah (Lazarus Island), Pulau Semakau, Pulau Seringat (now merged with Lazarus Island), Pulau Subar Darat (Small Sister's Island), Pulau Tembakul (Kusu Island), Pulau Tekukor, and Terumbu Pandan (Cyrene Reef). The surveys were conducted between August 2020 and March 2022 during low spring tides, typically during early morning hours (6:00am to 10:00am) or during the evening (4:00pm to 8:00pm). Intertidal surveys were not conducted at Keppel Island and Pulau Subar Laut (Big Sister's Island), although other aspects of biodiversity at those islands were included in the SIBS study (Tan et al., 2025).

A reconnaissance trip was organised for each site to identify suitable areas for laying out transects that would encompass a wide diversity of intertidal habitat types and maximise species encounters. During the actual survey, a 30m line perpendicular to the shoreline was laid across the intertidal zone, and three sets of 25 m line transects were placed parallel to the shore. There was one set each within the zones 0–10m, 10–20m and 20–30m from the shoreline, so as to ensure sampling covered the upper, middle, and lower shore. Each transect set/shore level was surveyed by a team of 3-5 surveyors, and for each transect five quadrats (50cm by 50cm) were placed along either side of the transect tape at intervals determined via a random number generator. Tan et al. (2025) provides an illustration of the layout of transects and quadrats. All living morphospecies in the quadrat were photographed for record keeping and identification to the lowest possible taxonomic level. Another team of 5-10 surveyors separately patrolled the intertidal zone beyond the vicinity of the transects to take photographs of as many morphospecies as possible for later identification.

Records were compiled from published literature and NParks internal records. The earliest publication included in the literature review was published in 2007, although there

may be earlier unpublished records drawn from the internal database, with the latest literature included published in 2020. Scientific names were standardised according to the Singapore Red Data Book (Davison et al., 2024).

Results

There were 229 morphospecies documented from the Southern Islands Biodiversity surveys and compiled literature from seven phyla, with 112 (49%) identified to species level (Appendix 1–5). Due to the nature of the survey method, most were documented from past published records rather than from SIBS fieldwork. The most species-rich phylum was Platyhelminthes with 116 morphospecies, of which 37 (32%) were identified to species level. The least species-rich phylum was Xenacoelomorpha with one identified species, *Amphiscolops bermudensis*. The remaining phyla had between five and 99 morphospecies reported. Pulau Semakau had the highest diversity of worms with 112 morphospecies, followed by Sisters' Islands (77) and Pulau Hantu (63). Low diversity of worms was recorded at Pulau Brani and Keppel Island with one (terrestrial flatworm) and eight morphospecies respectively.

Within the phylum Platyhelminthes, Pseudocerotidae was the most well represented family with 60 recorded morphospecies (54%). SIBS fieldwork added 15 new locality records of platyhelminth species. *Pseudobiceros hancockanus* and *Pseudoceros concinnus* were the most widespread, each found at 15 survey sites. The highest diversity of platyhelminths was at Pulau Semakau (43), followed by Pulau Hantu (42 species), Sisters' Islands (40), and St John's Island (37). Few were found at Pulau Brani and Keppel Island, with one and four morphospecies respectively. The species *Polycelis coronata* (Planariidae) has been reported from Sisters' Islands and Pulau Tekukor, but this is a freshwater planarian and the record may be doubtful.

Phylum Annelida was the second most diverse phylum of marine worms, with 99 recorded morphospecies, of which 65 were identified to species level. Only three new locality records were obtained. Eunicidae was the most well represented family with 20 species. Most annelid species were restricted to only one or two sites each. Notable exceptions were *Eurythoe complanata* and *Eunice* sp. 'giant reef' that were found at 12 sites each. Among sites, the highest diversity of annelids was at Pulau Semakau with 67 morphospecies, and seven out of 16 sites had fewer than ten recorded morphospecies of annelids (Table 1, Appendix 1).

Solely from literature compiled by (Hsueh & Tan, 2016) eight species of sipunculids (Annelida: Sipunculida) have been listed from named localities in the Southern Islands (Table 2). This is half of the total listed for Singapore as a whole. A further taxon, *Aspidosiphon gracilis*, may be known from the waters south of Singapore without precise locality.

Five species of Chaetognatha have been recorded from specific localities in the Southern Islands, four of them at Sisters' Islands (Pulau Subar Laut and Pulau Subar Darat) and three at Pulau Tekukor, all of the family Sagittidae (Appendix 2). One species of Echiuroidea appears to have been identified in the Southern Islands, that is *Ochetostoma erythrogrammon* (Echiuridae) at St John's Island.

The remaining phyla of marine worms generally had low diversity and distribution among the southern islands. Most species had records of presence at only one or two sites, predominantly at Sisters' Islands, except for the Nemertean species *Basodiscus delineatus* that was recorded at 11 sites, with three new recorded localities at Pulau Berkas, Lazarus Island and Pulau Salu. Nemertea (Appendix 3) only showed a handful of morphospecies, but

Platyhelminthes: Rhabditophora (Appendix 4) were diverse and suggested large differences in diversity between the different islands (Fig. 1).

The only species of Xenacoelomorpha recorded from a specific locality in the Southern Islands is *Amphiscolops bermudensis* (Convolutidae), noted from Sisters' Islands in 2019.

Two taxa of acorn worms (Hemichordata: Enteropneusta) have been recorded in Singapore waters, *Balanoglossus* sp. (Ptychoderidae) and *Tornaria* sp. (family incertae sedis). None was identified to species or genus level during SIBS, but acorn worms have been recorded (often without even generic identification) at nearly all the Southern Islands. Because of their uncertain identification they are not included in the totals here, but occurrences are included in the associated faunal database.

Most of the recorded marine worms were not evaluated or not listed in the Singapore Red Data Book third edition. Only seven species of flatworms were classified as Vulnerable (Tan et al., 2024), with the species typically recorded at multiple sites across the southern islands during SIBS.

Table 1. Summary statistics for polychaetes (Annelida: Polychaeta) species richness of the Southern Islands, Singapore, listed by site. Data are summarised from Appendix 1. BIO = Pulau Biola; BRK = Pulau Berkas; CYR = Cyrene Reef; HNT = Pulau Hantu; JNG = Pulau Jong; KEP = Keppel Island; KUS = Pulau Tembakul (Kusu Island); Laz = Pulau Sekijang Pelepah (Lazarus Island); RAL = Pulau Satumu (Raffles Lighthouse); SAL = Pulau Salu; SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), SJI = Pulau Sekijang Bendera (St John's Island), SMK = Pulau Semakau; SNT = Pulau Blakang Mati (Sentosa Island); TKR = Pulau Tekukor; TPS =Terumbu Pempang reefs.

Family	**BIO**	**BRK**	**CYR**	**HNT**	**JNG**	**KEP**	**KUS**	**LAZ**	**RAL**	**SAL**	**SIS**	**SJI**	**SMK**	**SNT**	**TKR**	**TPS**	**Total**
Eunicidae	4	1	1	6	4		7	5	6		3	4	16	4	7	3	**20**
Polynoidae							4		3		1	2	2			1	**10**
Sabellidae		1	5	5	2	3	2	2	1		5	3	9	4	4	3	**10**
Nereididae											2		6				**8**
Chaetopteridae				2	1		1	1			1	1	1	1		1	**6**
Phyllodocidae											1		4				**5**
Spionidae											4	1	1		3		**5**
Syllidae											3	2	1				**4**
Terebellidae											1	1	3				**4**
Amphinomidae		1	2	1	1	1	2	1		1	2	2	2	2	1		**3**
Oenonidae													3				**3**
Orbiniidae													3				**3**
Lumbrineridae													3				**3**
Onuphidae	1												1				**2**
Hesionidae			1										1				**2**
Hesiondae				1				1	1		1						**1**
Flabelligeridae													1				**1**
Glyceridae													1				**1**
Aphroditidae													1				**1**
Curratulidae													1				**1**
Trichobranchidae													1				**1**
Maldanidae													1				**1**
Nephtyidae													1				**1**
Total	**5**	**3**	**9**	**15**	**8**	**4**	**16**	**10**	**11**	**1**	**28**	**16**	**67**	**11**	**15**	**8**	**99**

Table 2. Annelida: Sipunculida (acorn worms) from named localities in the Southern Islands of Singapore, summarised from Hsueh & Tan (2016).

Species	Location	Most recent publication
Sipunculus nudus	RAL (Raffles Lighthouse)	1961
Siphonosoma cumanense	RAL	1961
Phascolion convestitum	SMK (Pulau Semakau)	2016
Phascolion hibridum	Pulau Sebarok	2016
Golfingia vulgaris	RAL	1905
Phascolosoma nigrescens	LAZ (Lazarus Island)	2016
Phascolosoma scolops	RAL	1905
Aspidosiphon steenstrupii	SMK	2016

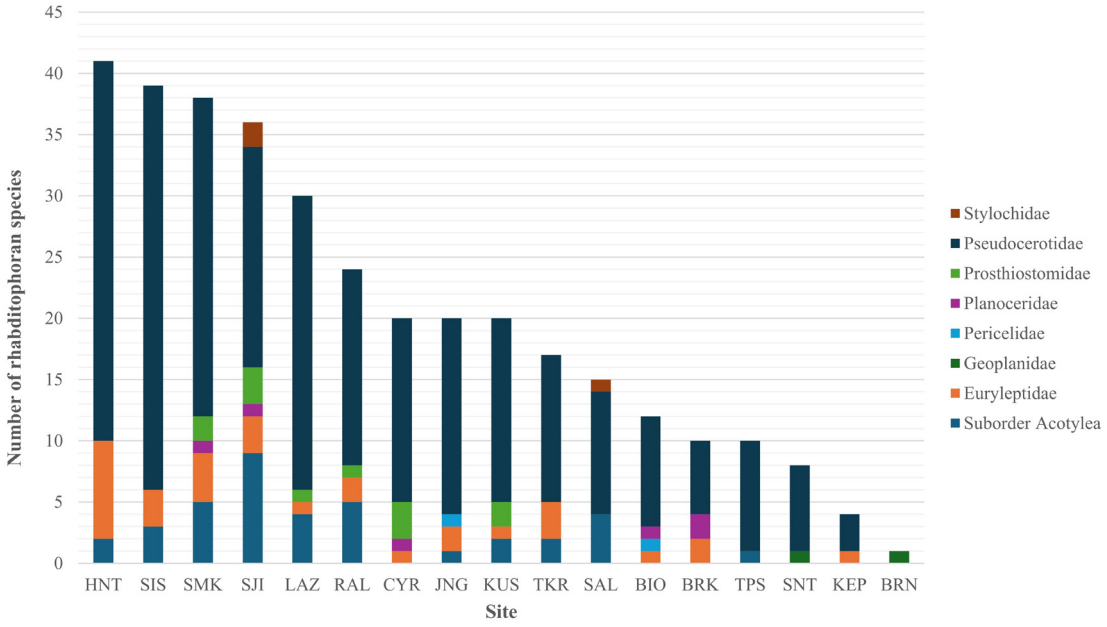


Figure 1. Recorded rhabditophoran (Platyhelminthes:Rhabditophora) species richness of the Southern Islands, Singapore by site. HNT = Pulau Hantu, SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), SMK = Pulau Semakau, SJI = Pulau Sekijang Benderah (St John's Island), LAZ = Pulau Sekijang Pelepah (Lazarus Island), RAL = Pulau Satumu (Raffles' Lighthouse), JNG = Pulau Jong, KUS = Pulau Tembakul (Kusu Island), CYR = Cyrene Reef, TKR = Pulau Tekukor, SAL = Pulau Salu, BIO = Pulau Biola, BRK = Pulau Berkas, TPS = Terumbu Pempang group, SNT = Pulau Blakang Mati (Sentosa Island), KEP = Keppel Island.

Discussion

Marine worms in these disparate phyla are poorly understood in Singapore and more broadly because of the taxonomic impediment. The impediment is manifested in four ways. First, the identification and taxonomy of whole families and orders is unsettled, and even at the level of phyla there have been major changes within the past two decades. Second, there are few specialists working on these groups. Third, the scientific literature is scanty and much of it is outdated. Fourth, museum material is sparse and well curated and securely identified reference specimens are still more scarce.

The compilation of records permitted by SIBS therefore sets the scene for future research. The checklist of polycladid Platyhelminthes by Ong & Tong (2018) lists 81 taxa of Cotylea and 38 taxa of Acotylea, while the checklist of Annelida: Polychaeta by Jaafar et al. (2018) lists 90 taxa in Singapore. These totals will certainly change, and there may be substantial specimen holdings at the Lee Kong Chian Museum of Natural History, Singapore, resulting from the Comprehensive Marine Biodiversity Survey (Tan & Goh, 2015, 2016) that are yet to be identified. Several recent papers have described new species and there are a fair number of morphotypes that are yet to be described as species, demonstrating how little we know at the moment. A major knowledge gap also exits concerning the ecology of the many species. Marine worms can be important indicators of the health of the marine ecosystem, for example as indicators of general and specific pollutants. Platyhelminthes are embedded within food chains related to ascidians, gastropods, bivalves, corals and other marine invertebrates, and use coral reefs, rocky shores, mudflats and seagrass patches. Polychaetes include various predators with important but still poorly defined ecological roles. Notable species include the herbivorous Giant Reef Worm (*Eunice* sp.), the largest marine worm found locally. It acts as an ecosystem engineer by accumulating rubble to form structures that provide habitat for other marine organisms to colonise (Jaafar et al., 2018).

Despite these broad areas of ignorance, the present listing of marine worms emphasises Pulau Semakau and the Sisters' Islands as two outstandingly diverse locations in Singapore waters. Pulau Semakau is surrounded by a range of marine habitats providing diverse niches for a variety of benthic invertebrates. These habitats support most of the flatworms that have been listed as Vulnerable (Tan et al., 2024). Sisters' Islands are surrounded mostly by coral reefs and sandy substrates and have been identified as an important conservation priority helping to re-seed other areas. The regulations to protect the area from fishing, collection and other destructive practices are currently helping to maintain diversity there with beneficial effects on nearby locations too. Cyrene Reef is a third area of high interest, because of its extensive seagrasses and algae, providing habitat for a moderate diversity but probably high population size of various marine worms.

ACKNOWLEDGEMENTS. A full list of personnel involved in the surveys is given by Tan et al. (2025).

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Appendix 1. Locations of recorded polychaete species (Annelida: Polychaeta) from published, unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates species was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record. BIO = Pulau Biola, BRK = Pulau Berkas, CYR = Cyrene Reef, HNT = Pulau Hantu, JNG = Pulau Jong, KEP = Keppel Island, KUS = Pulau Tembakul (Kusu Island), LAZ = Pulau Sekijang Pelepah (Lazarus Island), RAL = Pulau Satumu (Raffles' Lighthouse), SAL = Pulau Salu, SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), SJI = Pulau Sekijang Benderah (St John's Island), SMK = Pulau Semakau, SNT = Pulau Blakang Mati (Sentosa Island), TKR = Pulau Tekukor, TPS = Terumbu Pempang group. For all species below, RDB3 status and IUCN Red List status are either Not Listed or Not Evaluated.

Family	Scientific Name	BIO	BRK	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SIS	SJI	SMK	SNT	TKR	TPS
Amphinomidae	*Chloeia flava*						2015					2013	2012			
Amphinomidae	*Chloeia* sp "beautiful"							2020						2020		
Amphinomidae	*Eurythoe complanate*		SIBS	SIBS 2020	2020	SIBS 2020		2020	SIBS 2020		2020	2020	2020	SIBS 2018; 2020	SIBS	
Amphinomidae	Family Amphinomidae sp. "fireworm"			2013							2013					
Aphroditidae	*Pontogenia indica*												2013			
Capitellidae	*Heteromastus* sp "YL1"												2013			
Chaetopteridae	*Chaetopterus* sp "A"					2013										
Chaetopteridae	*Chaetopterus* sp "B"				2013											
Chaetopteridae	*Chaetopterus* sp "C"								2013			2013				
Chaetopteridae	*Chaetopterus* sp "D"															2013
Chaetopteridae	*Chaetopterus variopedatus*												2013			
Chaetopteridae	Family Chaetopteridae sp "gregarious tubeworm"			SIBS; 2020				2020	2020				2020	2020		
Cirratulidae	*Cirratulus cirratus*												2013			
Eunicidae	*Eunice aphroditois*		SIBS	2020		SIBS 2020		2020	2020	SIBS 2020	2020	2020	2020	2020	2020	2020
Eunicidae	*Eunice coccinioides*												2013			
Eunicidae	*Eunice grubei*												2013			
Eunicidae	*Eunice hirschi*												2013			

Appendix 1. Continuation.

Family	Scientific Name	BIO	BRK	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SIS	SJI	SMK	SNT	TKR	TPS
Eunicidae	*Eunice nesiotes*												2013			
Eunicidae	*Eunice* sp "4W"				2013	2013		2013		2013			2013		2013	
Eunicidae	*Eunice* sp "bead"	2013			2013	2013		2013	2013	2013		2013	2013	2015	2013	2013
Eunicidae	*Eunice* sp "blind"	2013			2013									2015		
Eunicidae	*Eunice* sp "smooth"	2013			2013	2013		2013	2013	2013	2013		2013		2013	
Eunicidae	Euniphysa aculeata												2013			
Eunicidae	*Leodice antennata*												2013			
Eunicidae	*Leodice lucei*												2013			
Eunicidae	*Lysidice* sp "YL2"													2015		
Eunicidae	*Marphysa fauchaldi*											2013				
Eunicidae	*Marphysa macintoshi*												2013			
Eunicidae	*Marphysa mossambica*												2013			
Eunicidae	*Nicidion* sp "patch"	2013			2013			2013	2013	2013			2013		2013	2013
Eunicidae	*Nicidion* sp "regular"				2013			2013	2013	2013	2013	2013	2013		2013	
Eunicidae	*Nicidion* sp "smooth"							2013							2013	
Eunicidae	*Paucibranchia disjuncta*												2013			
Flabelligeridae	*Pherusa monroi*												2013			
Glyceridae	*Glycera tridactyla*												2013			
Hesiondae	*Hesione intertexta*				2015				2015	2015	2019					
Hesionidae	*Oxydromus angustifrons*			2020												
Hesionidae	*Oxydromus latifrons*												2013			
Lumbrineridae	*Lumbrineris hartmani*												2013			
Lumbrineridae	Lumbrineris latreilli												2013			
Lumbrineridae	*Scoletoma* sp "YL2"												2013			

Appendix 1. Continuation.

Family	Scientific Name	BIO	BRK	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SIS	SJI	SMK	SNT	TKR	TPS
Maldanidae	*Euclymene lombricoides*												2013			
Nephtyidae	*Aglaophamus dibranchis*												2013			
Nereididae	*Ceratonereis mirabilis*												2013			
Nereididae	*Neanthes glandicincta*												2013			
Nereididae	*Perinereis barbara*												2013			
Nereididae	*Perinereis camiguinoides*										2019					
Nereididae	*Perinereis cultrifera var perspicillata*												2007			
Nereididae	*Perinereis cultrifera var striolata*												2013			
Nereididae	*Perinereis vancaurica*												2013			
Nereididae	*Pseudonereis variegata*										2019					
Oenonidae	*Arabella iricolor*												2013			
Oenonidae	*Oenone fulgida*												2013			
Oenonidae	*Owenia fusiformis*												2013			
Onuphidae	*Diopatra neapolitana*												2013			
Onuphidae	*Onuphis* sp “YL2”	2013														
Orbiniidae	*Leitoscoloplos* sp “YL1”												2013			
Orbiniidae	*Ophelina acuminata*												2013			
Orbiniidae	*Scoloplos* sp “YL1”												2013			
Phyllodocidae	*Eulalia magalaensis*												2013			
Phyllodocidae	*Mysta siphodonta*												2013			
Phyllodocidae	*Naiades cantrainii*												2013			
Phyllodocidae	*Phyllodoce madeirensis*												2013			
Phyllodocidae	*Pterocirrus burtoni*										2019					

Appendix 1. Continuation.

Family	Scientific Name	BIO	BRK	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SIS	SJI	SMK	SNT	TKR	TPS
Poecilochaetidae	*Poecilochaetus serpens*												2013			
Polynoidae	Family Polynoidae sp “2 colours”							2013								
Polynoidae	Family Polynoidae sp “FS5”									2013						
Polynoidae	Family Polynoidae sp “INT1”							2013		2013						2013
Polynoidae	Family Polynoidae sp “SEA4”							2013								
Polynoidae	Family Polynoidae sp “freckles”							2013				2013				
Polynoidae	Family Polynoidae sp “grey patch”									2013						
Polynoidae	Family Polynoidae sp “pixel dot”											2013				
Polynoidae	*Lepidonotus* sp “geographic”												2013			
Polynoidae	*Paradyte crinoidicola*										2019					
Polynoidae	*Paralepidonotus ampulliferus*												2013			
Sabellidae	*Notaulax phaeotaenia*												2013			
Sabellidae	*Potamilla leptochaeta*												2013			
Sabellidae	*Pseudopotamilla reniformis*												2013			
Sabellidae	*Sabellastarte spectabilis*				2013		2015				2019		2013	2015		
Sabellidae	Family Sabellidae sp “banded”		SIBS	SIBS 2020	SIBS 2020	SIBS 2020	2020	SIBS 2020	SIBS 2020	2020	2020	SIBS 2020	SIBS 2020	SIBS 2020	2020	2020
Sabellidae	Family Sabellidae sp “blue”			2020												
Sabellidae	Family Sabellidae sp “olive”												2020			
Sabellidae	Family Sabellidae sp “orange”			SIBS 2020	SIBS 2020	SIBS 2020	2020		SIBS 2020		2020	SIBS 2020	SIBS 2020	SIBS	SIBS 2020	2020
Sabellidae	Family Sabellidae sp “tiny sand”			2020	2020			2020			2020		2020		2020	

Appendix 1. Continuation.

Family	Scientific Name	BIO	BRK	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SIS	SJI	SMK	SNT	TKR	TPS
Sabellidae	Family Sabellidae sp "white spiral"			SIBS 2020	2020						2020	2020	SIBS 2020	SIBS 2020	2020	2020
Spionidae	*Boccardiella hamata*										2019				2019	
Spionidae	*Polydora aura*										2019				2019	
Spionidae	*Polydora websteri*										2019				2019	
Spionidae	*Prionospio komaeti*												2013			
Spionidae	*Pseudopolydora paucibranchiata*										2019	2019				
Syllidae	*Haplosyllis spongicola*												2013			
Syllidae	*Opisthosyllis leslieharrisae*										2019	2019				
Syllidae	*Syllis gracilis*										2019	2019				
Syllidae	*Xenosyllis moloch*										2019					
Terebellidae	*Nicolea gracilibranchis*												2013			
Terebellidae	*Thelepus cincinnatus*										2019	2019				
Terebellidae	*Thelepus gracilis*												2013			
Terebellidae	*Thelepus setosus*												2013			
Trichobranchidae	*Terebellides stroemii*												2013			

Appendix 2. Locations of recorded arrow-worms (Chaetognatha) from published and unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates species was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record. RDB3 = Singapore Red Data Book 3 Status, IUCN = International Union for Conservation of Nature Status, SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), TKR = Pulau Tekukor. Acronyms for RDB3/IUCN: NE = Not Evaluated, NL = Not Listed.

Family	**Scientific Name**	**RDB3**	**IUCN**	**SIS**	**TKR**
Sagittidae	*Aidanosagitta neglecta*	NL	NE	2019	
Sagittidae	*Falccisagitta enflata*	NL	NE	2019	
Sagittidae	*Ferosagitta robusta*	NL	NE	2019	2019
Sagittidae	*Flaccisagitta enflata*	NL	NE		2019
Sagittidae	*Zonosagitta bedoti*	NL	NE	2019	2019

Appendix 3. Locations of recorded ribbon worms (Phylum Nemertea) from published and unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates species was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publication or NParks internal record. BRK = Pulau Berkas, CYR = Cyrene Reef, HNT = Pulau Hantu, JNG = Pulau Jong, LAZ = Pulau Sekijang Pelepah (Lazarus Island), SAL = Pulau Salu, SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), SJI = Pulau Sakijang Bendera (St John's Island), SMK = Pulau Semakau, SNT = Pulau Blakang Mati (Sentosa Island), TPS = Terumbu Pempang group.

Family	**Scientific Name**	**BRK**	**CYR**	**HNT**	**JNG**	**KUS**	**LAZ**	**SAL**	**SIS**	**SJI**	**SMK**	**SNT**	**TKR**	**TPS**
-	Phylum Nemertea sp "pink"			2020						2020				
-	Phylum Nemertea sp "red reef"			SIBS 2020	SIBS	2020	SIBS 2020	SIBS			2020	2020	SIBS	
-	Phylum Nemertea sp "short"			2020			SIBS 2020		2020	2020		2020	SIBS	2020
-	Phylum Nemertea sp "two toned"			SIBS										
Emplectonematidae	Emplectonema mitsuii								2019	2019				
Emplectonematidae	Nemertopsis tetraclitophila								2019					
Lineidae	*Cerebratulus leucopsis*								2019					
Valenciniidae	*Baseodiscus delineatus*	SIBS	SIBS; 2020	SIBS; 2020	2020		SIBS	SIBS	2020	2020	2020	2020		2020
Valenciniidae	*Baseodiscus quinquelineatus*								2019					

Appendix 4. Locations of recorded rhabditophorans (Phylum Platyhelminthes: subphylum Rhabditophora) from published and unpublished literature and Southern Islands Biodiversity Survey (SIBS) data. SIBS indicates species was observed during Southern Islands Biodiversity Survey 2019-2022. Year corresponds to most recent publications or NParks internal record. RDB3 = Singapore Red Data Book 3 Status, IUCN = International Union for Conservation of Nature Status, BIO = Pulau Biola, BRK = Pulau Berkas, BRN = Pulau Brani, CYR = Cyrene Reef, HNT = Pulau Hantu, JNG = Pulau Jong, KEP = Keppel Island, KUS = Pulau Tembakul (Kusu Island), LAZ = Pulau Sekijang Pelepah (Lazarus Island), RAL = Pulau Satumu (Raffles' Lighthouse), SAL = Pulau Salu, SIS = Pulau Subar Laut and Pulau Subar Darat (Sisters' Islands), SJI = Pulau Sekijang Benderah (St John's Island), SMK = Pulau Semakau, SNT = Pulau Blakang Mati (Sentosa Island), TKR = Pulau Tekukor, TPS = Terumbu Pempang group. Acronyms for RDB3/IUCN: EX = Globally Extinct, NE = Presumed Nationally Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated, NA = Not Applicable, NL = Not Listed.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Euryleptidae	*Cycloporus* sp "1"	NL	NE		2018															
Euryleptidae	*Cycloporus venetus*	DD	NE					2018							2018	2018			2018	
Euryleptidae	*Eurylepta aurantiaca*	DD	NE										2018				2018			
Euryleptidae	*Eurylepta* sp "1"	NL	NE									2018								
Euryleptidae	*Eurylepta* sp "2"	NL	NE													2018				
Euryleptidae	*Eurylepta* sp "3"	NL	NE					2018			2018						2018		2018	
Euryleptidae	*Eurylepta* sp "4"	NL	NE		2018			2018												
Euryleptidae	*Eurylepta* sp "5"	NL	NE	2018				2018												
Euryleptidae	*Eurylepta* sp "6"	NL	NE					2018												
Euryleptidae	*Eurylepta* sp "7"	NL	NE					2018												
Euryleptidae	*Maritigrella eschara*	NA	NE												2019					
Euryleptidae	*Maritigrella fuscopunctata*	DD	NE				2018	2018	2020				2018				2018			
Euryleptidae	*Maritigrella virgulata*	DD	NE					2018	2020	2020					2020	2020	2020		2018	
Geoplanidae	*Platydemus manokwari*	NL	NE			SIBS												SIBS		
Pericelidae	*Pericelis byerleyana*	DD	NE	SIBS					2018											

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Planoceridae	Family Planoceridae sp "1"	NL	NE													2018				
Planoceridae	Family Planoceridae sp "2"	NL	NE	2018																
Planoceridae	Family Planoceridae sp "3"	NL	NE		2018															
Planoceridae	Family Planoceridae sp "4"	NL	NE		2018															
Planoceridae	Family Planoceridae sp "6"	NL	NE														2018			
Planoceridae	Family Planoceridae sp "7"	NL	NE				2018													
Prosthiostomidae	Family Prosthiostomidae sp "1"	NL	NE				2018					2018				2018	2018			
Prosthiostomidae	Family Prosthiostomidae sp "2"	NL	NE				2018						2018				2018			
Prosthiostomidae	Family Prosthiostomidae sp "3"	NL	NE													2018				
Prosthiostomidae	Family Prosthiostomidae sp "4"	NL	NE				2013				2018					2018				

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Prosthiostomidae	Family Prosthiostomidae sp "5"	NL	NE								2013									
Pseudocerotidae	*Acanthozoon* sp "1"	VU	NE		SIBS		2018	2018			SIBS; 2018	2018	SIBS; 2018	SIBS	2018	SIBS; 2018	2018	SIBS; 2018	SIBS; 2018	2018
Pseudocerotidae	*Acanthozoon/ Thysanozoon* sp "1"	VU	NL												2018					
Pseudocerotidae	*Acanthozoon/ Thysanozoon* sp "2"	NL	NE					2018												
Pseudocerotidae	Family Pseudocerotidae sp "1"	NL	NE										2018			2018				
Pseudocerotidae	Family Pseudocerotidae sp "3"	NL	NE						2018											
Pseudocerotidae	Family Pseudocerotidae sp "4"	NL	NE														2018			
Pseudocerotidae	Family Pseudocerotidae sp "5"	NL	NE												2018					
Pseudocerotidae	Family Pseudocerotidae sp "7"	NL	NE					2020												
Pseudocerotidae	*Maiazoon orsaki*	NL	NE												2019					
Pseudocerotidae	*Nymphozoon bayeri*	DD	NE	SIBS	SIBS			2020	2018		2018	2018	SIBS; 2018	2018	2018		2020			
Pseudocerotidae	*Nymphozoon orsaki*	DD	NE					2018				2020								

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Pseudocerotidae	*Phrikoceros* sp "1"	NL	NE					2018							2018					
Pseudocerotidae	*Phrikoceros* sp "2"	NL	NE					2018												
Pseudocerotidae	*Pseudobiceros bajae*	DD	NE		2018		SIBS					2018		SIBS			2018			
Pseudocerotidae	*Pseudobiceros bedfordi*	DD	NE	SIBS			2020	2018; 2020			2020	2020	2020		2020	2020	2020		SIBS	2020
Pseudocerotidae	*Pseudobiceros damawan*	DD	NE					2018			2020				2020	2019			2019	
Pseudocerotidae	*Pseudobiceros flowersi*	DD	NE									2015					2018			
Pseudocerotidae	*Pseudobiceros fulgor*	DD	NE		SIBS			2018	2018		2020	2020	2018	2018	2019	SIBS; 2018	2020			2020
Pseudocerotidae	*Pseudobiceros fulvogriseus*	NL	NE														2013			
Pseudocerotidae	*Pseudobiceros gratus*	NL	NE					2020				2020			2020	2020	2020			
Pseudocerotidae	*Pseudobiceros hancockanus*	VU	NE	SIBS; 2018	SIBS		SIBS; 2020	2020	SIBS		2020	SIBS; 2020	SIBS; 2020	SIBS; 2016	2020	2020	2020	SIBS; 2020	2020	2020
Pseudocerotidae	*Pseudobiceros hymanae*	DD	NE	2016			2020	2018	2018			2018	2018	2018	2018					
Pseudocerotidae	*Pseudobiceros* sp "1"	NL	NE					2018			2018	2018	2018		2018		2018		2018	
Pseudocerotidae	*Pseudobiceros* sp "2"	NL	NE					2018			2018	2018	SIBS		2018					
Pseudocerotidae	*Pseudobiceros* sp "3"	NL	NE									2018	2018			2018				

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Pseudocerotidae	*Pseudobiceros* sp "4"	NL	NE											2018						
Pseudocerotidae	*Pseudobiceros* sp "5"	NL	NE					2020	SIBS; 2018					SIBS; 2018	2020	2020	2020			2020
Pseudocerotidae	*Pseudobiceros* sp "6"	NL	NE					2020												
Pseudocerotidae	*Pseudobiceros stellae*	VU	NE				2020	2020			2020	2020			2019	2020	2020			
Pseudocerotidae	*Pseudobiceros uniarborensis*	NL	NE				2013					2013	2013		2013		2013			
Pseudocerotidae	*Pseudoceros bifurcus*	DD	NE				2020			2020	2020	SIBS; 2018			2020	2020	2020	2020	2020	
Pseudocerotidae	*Pseudoceros caeruleocinctus*	DD	NE				2018	2018				SIBS; 2018			2018		2018			
Pseudocerotidae	*Pseudoceros concinnus*	VU	NE	SIBS; 2016			SIBS; 2020	SIBS; 2020	SIBS; 2020	2020	SIBS; 2020	2020	2020	SIBS; 2018	2020	SIBS; 2020	2020	2020	2020	2020
Pseudocerotidae	*Pseudoceros* cf *cruentus*	DD	NE												2018					
Pseudocerotidae	*Pseudoceros duplicinctus*	DD	NE		2018			2018												
Pseudocerotidae	*Pseudoceros* cf *gamblei*	DD	NE												2018					
Pseudocerotidae	*Pseudoceros indicus*	VU	NE	2016			2020	2020	2018	2020	2016	2020	2018		2020	2020	2020	2015	2020	2020
Pseudocerotidae	*Pseudoceros laingensis*	VU	NE												2019	2019	2020	2018		
Pseudocerotidae	*Pseudoceros meenae*	DD	NE				2018		SIBS; 2020											
Pseudocerotidae	*Pseudoceros microcelis*	DD	NE	2018				2018	2018						2018				2018	
Pseudocerotidae	*Pseudoceros paralaticlavus*	DD	NE												2018					2018

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Pseudocerotidae	*Pseudoceros* cf *prudhoei*	DD	NE				SIBS; 2018	2018	2018						2020	2020		2020		
Pseudocerotidae	*Pseudoceros scintillatus*	DD	NE					2018	2020											
Pseudocerotidae	*Pseudoceros* cf *stimpsoni*	DD	NE										2018			2018				
Pseudocerotidae	*Pseudoceros rubrotentatculatus*	DD	NE					2020	2020				2020		2020	2020	2020		SIBS; 2020	
Pseudocerotidae	*Pseudoceros* sp “10”	NL	NE	2018																
Pseudocerotidae	*Pseudoceros* sp “11”	NL	NE						2018											
Pseudocerotidae	*Pseudoceros* sp “12”	NL	NE					2018									2018			
Pseudocerotidae	*Pseudoceros* sp “13”	NL	NE												2020					
Pseudocerotidae	*Pseudoceros* sp “14”	NL	NE												2020					
Pseudocerotidae	*Pseudoceros* sp “2”	NL	NE									2018								
Pseudocerotidae	*Pseudoceros* sp “3”	NL	NE									2020				2020	2020	2020	2020	
Pseudocerotidae	*Pseudoceros* sp “4”	NL	NE				2020				2020				2020	2020	2020		SIBS; 2020	
Pseudocerotidae	*Pseudoceros* sp “5”	NL	NE					2018	2018				2018		2018		2013			
Pseudocerotidae	*Pseudoceros* sp “6”	NL	NE	2018				2018	2018				2013		2018					
Pseudocerotidae	*Pseudoceros* sp “7”	NL	NE						2013						2018					
Pseudocerotidae	*Pseudoceros* sp “8”	NL	NE				2013	2018			2018				2018					

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
Pseudocerotidae	*Pseudoceros susanae*	DD	NE					2020												
Pseudocerotidae	*Thysanozoon brocchii*	NL	NE										2018							
Pseudocerotidae	*Thysanozoon nigropapillosum*	DD	NE					2018	2018			2018			2019		2018		2018	2018
Pseudocerotidae	*Thysanozoon nigrum*	DD	NE											2018			2018			
Pseudocerotidae	*Thysanozoon* sp “1”	NL	NE									2018			2018		2018			
Pseudocerotidae	*Tytthosoceros lizardensis*	VU	NE				2020				2020	2020				2020				
Pseudocerotidae	*Tytthosoceros* sp “1”	NL	NE													2018				
Pseudocerotidae	*Tytthosoceros* sp “2”	NL	NE					2018												
Stylochidae	Family Stylochidae sp “1”	NL	NE											2018		2018				
Stylochidae	Family Stylochidae sp “6”	NL	NE													2018				
NA	Order Polycladida sp “beige”																2012			
NA	Order Polycladida sp “black”																2012			
NA	Order Polycladida sp “olive”																2012			
NA	Suborder Acotylea sp “1”	NL	NE													2018				
NA	Suborder Acotylea sp “10”	NL	NE										2018	2018			2018		2013	

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
NA	Suborder Acotylea sp "11"	NL	NE											2018						
NA	Suborder Acotylea sp "12"	NL	NE								2018									
NA	Suborder Acotylea sp "13"	NL	NE													2018				
NA	Suborder Acotylea sp "14"	NL	NE								2018	2018				2018				
NA	Suborder Acotylea sp "15"	NL	NE														2018			
NA	Suborder Acotylea sp "16"	NL	NE												2018					
NA	Suborder Acotylea sp "19"	NL	NE													2018				
NA	Suborder Acotylea sp "2"	NL	NE					2013					2013	2018	2018	2013	2018			
NA	Suborder Acotylea sp "26"	NL	NE										2013			2013				
NA	Suborder Acotylea sp "3"	NL	NE									2018				2018				
NA	Suborder Acotylea sp "4"	NL	NE					2018								2018			2018	
NA	Suborder Acotylea sp "5"	NL	NE																	2018
NA	Suborder Acotylea sp "6"	NL	NE														2018			
NA	Suborder Acotylea sp "7"	NL	NE									2018								
NA	Suborder Acotylea sp "8"	NL	NE										2018	2018						

Appendix 4. Continuation.

Family	Scientific Name	RDB3	IUCN	BIO	BRK	BRN	CYR	HNT	JNG	KEP	KUS	LAZ	RAL	SAL	SIS	SJI	SMK	SNT	TKR	TPS
NA	Suborder Acotylea sp “9”	NL	NE						2018			2018	2018		2013	2018	2018			
NA	Suborder Acotylea sp “phlegm”	NL	NE				2020	2020				2020	2020			2020	2020	2020		
NA	Suborder Acotylea sp “silt”	NL	NE				2020					2020					2020			



Appendix 6 (**A**) Bayer's Flatworm (*Nymphozoon bayeri*) at Pulau Biola, credits: Loh Kok Sheng. (**B**) Giant Reef Worm (*Eunice* sp.), credits: Kiew Won Lee. (**C**) Persian Carpet Flatworm (*Pseudobiceros bedfordi*) at Pulau Biola, credits: Liu Jianlin. **(D)** Giant Reef Worm (*Eunice* sp.) dragging a piece of coral rubble, reef off Pulau Semakau, credits: Jonathan Tan. **(E)** Very Long Ribbon Worm (*Nemertea*), Big Sister's Island, credits: Jonathan Tan.