Biodiversity and Biogeography of Polychaetes (Annelida): Globally and in Indonesia

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A thesis submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy in Marine Science,
University of Auckland
October 2020

Abstract

This thesis presents a review of the biodiversity of polychaete worms (Annelida) and their distribution across the globe. It also provides an evaluation of polychaete biodiversity studies in Indonesia and a description of a new polychaete species collected from Ambon Island, Province of Maluku, Indonesia.

I reviewed polychaete data from the World Register of Marine Species (WoRMS), and found that 11,456 accepted polychaete species (1417 genera, 85 families) have been formally described by 835 first authors since the middle of the 18th century. A further 5200 more polychaete species are predicted to be discovered by the year 2100. The total number of polychaete species in the world by the end of the 21st century is thus anticipated to be about 16,700 species. While the number of both species and authors increased, the average number of polychaete species described per author decreased. This suggested increased difficulty in finding new polychaete species today as most conspicuous species may have been discovered.

I analysed polychaete datasets from the Global Biodiversity Information Facility (GBIF), the Ocean Biogeographic Information System (OBIS), and my recently published checklist of Indonesian polychaete species, and identified 11 major biogeographic regions of polychaetes. They were: (1) North Atlantic & eastern and western parts of the Mediterranean, (2) Australia, (3) Indonesia, (4) New Zealand, (5) the Atlantic coasts of Spain and France, (6) Antarctica and the southern coast of Argentina, (7) Central Mediterranean Sea, (8) the western coast of the USA, (9) the eastern part of the Pacific Ocean, (10) Caribbean Sea and (11) Atlantic Ocean. Further, the latitudinal species richness gradient pattern of the animals was found to be asymmetrically bimodal, with similar peaks of richness in the northern (60°N) and southern (30°S) hemispheres, and a pronounced dip north of the Equator (15°N). The pattern is unlikely to be due to sampling bias, but rather a natural phenomenon most significantly correlated with sea temperature.

I garnered all Indonesian polychaete species names from taxonomic and ecological literature, as well as from GBIF and OBIS, and found that since the middle of the 18th century, 713 polychaete species (55 families) have been identified from the Indonesian waters. Of these, 301 species (40 families) were described from the geographic region. Through time, most polychaete samples were collected during the *Siboga Expedition* at the turn of the 19th century, most of which were identified by European taxonomists and deposited in museums in the Netherlands, but now centralised at the Naturalis Biodiversity Center, Leiden. Marine benthic studies conducted by local scientists have yielded polychaete specimens, yet most were not identified to species level and not vouchered in a recognised institution. I discovered that the polychaete collections at the three largest polychaete repositories in Indonesia were mostly unidentified, unpublished, and not databased, suggesting that the taxonomic study of the polychaete fauna, at least locally, has been largely overlooked.

I collected polychaete specimens from the Wallacea region and its surrounding waters, and discovered a new capitellid species formally named *Capitella ambonensis* Pamungkas, 2017. The species, which was discovered from a mangrove habitat on Ambon Island, differs from other *Capitella* species in the form of hooded hooks and the methylene blue staining pattern. Indeed, the polychaete material obtained from this fieldwork may contain more new species and may give a clue as to whether or not the Wallace's Line is a real boundary for polychaete fauna.

Acknowledgement

I would like to thank all the people who helped me during my doctoral study at the University of Auckland in New Zealand. First of all, I would like to express my gratitude and appreciation to my principal supervisor, Prof. Dr. Mark J. Costello, and to my co-supervisor, Dr. Christopher J. Glasby, without whom I would not have been able to undertake and complete my study. Constructive critical comments by Dr. Shane Lavery also improved the quality of this thesis.

Further, I would also like to thank my fellow Ph.D students who supported me a lot during my studies. They were: Chhaya Chaudhary, Dinusha Jayathilake, Han-Yang Lin, Irawan Assad, Rakhshan Roohi, Tamlin Jefferson, Thomas Morris, Tri Arfianti and Qianshuo Zhao. This study would not have been possible without the technical assistance of my colleagues at the Museum Zoologicum Bogoriense, i.e., Alfiah, Nur R. Isnaningsih, Riena Prihandini and Ristiyanti M. Marwoto, and without the financial support from the New Zealand ASEAN Scholarship (NZAS) and Postgraduate Research Student Support (PReSS) funding by the University of Auckland. During my fieldwork in Indonesia, a number of people helped me a lot in collecting polychaete samples. I, therefore, would like to thank them: Achmad Husein Nyompa, Asriadin, Boby Otoluwa, E. Moniharapon, Habel Dimara, Hermes Sirlay, La Pay, Mochtar Djabar, Muhammad Bahri, Rikardo Huwae and Tendri Karey. Technical help by Natalia Abrego during my lab work at the University of Auckland is also highly appreciated.

Lastly, special thanks to my beloved wife, Sri Murni Asih, who has accompanied me through this challenging process, and to my lovely children, i.e., Bintang Cahaya Langit, Annisa Zhafira and Felicity Queen (the latest one was “gifted” here), who have made my ‘learning journey’ in New Zealand more colourful.

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Chapter 2: Progress and perspectives in the discovery of polychaete worms (Annelida) of the world

Nature of contribution by PhD candidate	Cleaning and analysing the dataset, creating the figures and tables, and writing the manuscript.
Extent of contribution by PhD candidate (%)	75

CO-AUTHORS

Name	Nature of Contribution
Prof. Dr. Mark J. Costello	Conceiving the research idea, providing advice and guidance in the study design, and reviewing the manuscript for scientific rigor and readability.
Dr. Christopher J. Glasby	Reviewing the manuscript for scientific rigor and readability.
Dr. Geoffrey B. Read	Rechecking the dataset cleaning and Reviewing the manuscript for scientific rigor and readability.
Dr. Simon P. Wilson	Performing the non-homogeneous renewal process model and the least squares piecewise regression analysis

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
- that the candidate wrote all or the majority of the text.

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Dr. Christopher J. Glasby		9 February 2020
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Last updated: 28 November 2017

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Chapter 3: Biogeography of polychaete worms (Annelida) of the world

Nature of contribution by PhD candidate	Extracting, cleaning and analysing the dataset, generating all the figures, tables and maps, writing the manuscript.
Extent of contribution by PhD candidate (%)	85

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Prof. Dr. Mark J. Costello	Conceiving the research idea, providing advice and guidance in the study design, and reviewing the manuscript for scientific rigor and readability.
Dr. Christopher J. Glasby	Providing advice and guidance in the study design, and reviewing the manuscript for scientific rigor and readability.

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Chapter 4: Status of polychaete (Annelida) taxonomy in Indonesia, including a checklist of Indonesian species

Nature of contribution by PhD candidate	Conceiving the research ideas, garnering and analysing the data, visiting Museum Zoologicum Bogoriense and Research Center for Deep Sea to see the polychaete collections, writing the manuscript.
Extent of contribution by PhD candidate (%)	85

CO-AUTHORS

Name	**Nature of Contribution**
Dr. Christopher J. Glasby	Providing advice and guidance in the study design, reviewing the manuscript for scientific rigor and readability.

Certification by Co-Authors

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- ❖ that the candidate wrote all or the majority of the text.

Name	**Signature**	**Date**
Dr. Christopher J. Glasby		9 February 2020

Chapter 1

Thesis overview

1.1 General introduction

1.1.1 Polychaete worms: a brief review

Systematics

Polychaetes are segmented marine worms belonging to the phylum Annelida. They are a disparate group of annelids encompassing several taxa that were once considered separate classes or phyla, including clitellates (oligochaetes and hirudinids), siboglinids, echiurans, sipunculans and myzostomids (Struck et al., 2007, 2011; Weigert et al., 2014). However, in the present study, the taxon is defined as a class as currently portrayed in the World Register of Marine Species (WoRMS) (Read & Fauchald, 2016). The major reason for restricting the concept of polychaetes is because the existing literature on the biodiversity and biogeography of the group also excludes these other taxa.

Morphology

The body plan of a polychaete basically consists of three distinct regions, i.e., head, trunk and pygidium. The head comprises two distinct parts, i.e., the prostomium, followed by the peristomium, which is usually visible externally as a more-or-less complete ring. The prostomium typically bears appendages such as palps, antennae and pharynx, and some cirri (also called tentacles) may be present on the peristomium. The trunk, which is situated between the head and the pygidium, is composed of repeated body segments bearing parapodia. Parapodia are lateral projections of the fauna which bear chaetae, or bristles. Both parapodia and chaetae play a vital role in polychaetes' body movement. The pygidium is the posterior end of the animals. It is non-segmental – usually conical or broadly rounded – and is the organ where the anus is located (e.g., Fauchald, 1977; Fitzhugh et al., 1997) (Figure 1.1).

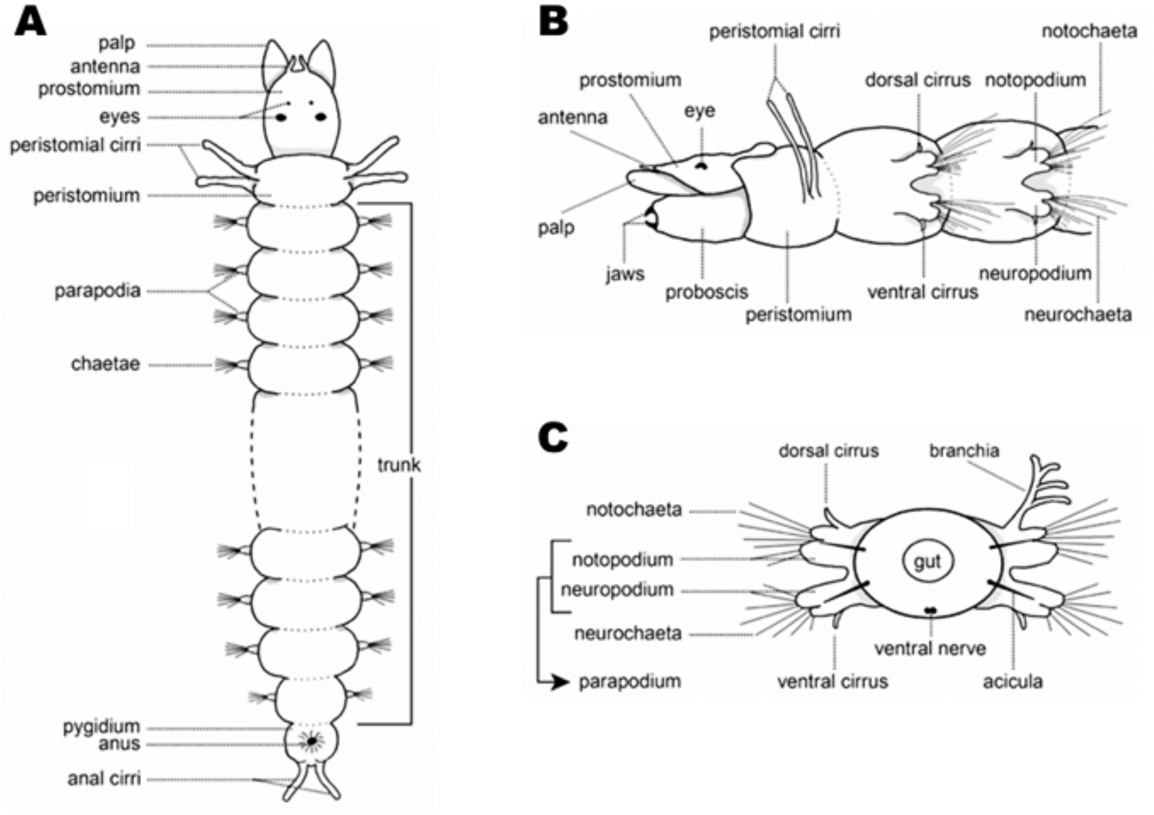


Figure 1.1 Schematic body plan of a polychaete: (A) entire worm (dorsal view). (B) anterior end (lateral view). (C) cross section through a segment. Modified after Fitzhugh et al. (1997).

Habitat and life habits

Polychaetes are predominantly marine (Fauchald, 1977). However, they also live in brackish water (e.g., ten Hove & Weerdenburg, 1978) and freshwater habitats (e.g., Glasby & Timm, 2008). Some polychaete species inhabit the abyssal plain (e.g., Alalykina, 2015), and some species can be found near hydrothermal vents with high temperatures (e.g., McHugh & Tunnicliffe, 1994).

Adult polychaetes generally live as benthic fauna, yet some species are planktonic (e.g., Marquez-Rojas et al., 2013). Based on the types of body regions, development of anterior appendages and life habits, polychaetes are separated into two main groups, i.e., Errantia and Sedentaria (de Quatrefages, 1866; Rouse & Fauchald, 1997). Errant polychaetes are free-moving (mostly crawlers or active swimmers), whereas sedentary ones are mostly sessile (burrowers or tube dwellers). Polychaetes may also live in symbiosis with other marine creatures. For instance, syllids live in symbiosis with ascidians, cnidarians, crustaceans, echinoderms and sponges (e.g., Martin & Britayev, 1998; López et al., 2001), whereas polynoids are symbiotic with anthozoans, echinoderms, molluscs and other polychaetes (e.g., Britayev, 1991; Britayev & Zamyshliak, 1996; Britayev et al., 2007).

Feeding modes

Polychaetes show a number of modes for acquiring food. Some of them are deposit feeders, i.e., those that ingest organic matter from the substrate around them. Examples of deposit feeders include arenicolids, capitellids and lumbrinerids, which have either pointed or rounded prostomiums and an eversible proboscis to burrow and consume sediment directly. Another example is spaghetti or medusa worms (Terebellidae), which have elongated tentacles to collect selected particles from the sea floor's surface (e.g., Fauchald & Jumars, 1979; Jumars et al., 2015).

Some polychaetes are suspension feeders, i.e., those that feed on particles in the water column. Fan worms (Sabellidae and Fabriciidae) and feather duster worms (Serpulidae) are examples of this; they have a highly modified head region called a 'branchial crown' to filter the food. Polychaetes can also be predatory. Some species feed on other polychaetes, and others consume small crustaceans (e.g., Fauchald & Jumars, 1979; Jumars et al., 2015). The giant eunicid bobbit worm (*Eunice aphroditois*) is even capable of consuming small fish and octopuses. Some polychaete species are also parasitic. Polychaetes, in turn, are usually eaten by other benthic organisms such as molluscs and crustaceans, as well as by fish (see a review by Hutchings, 1998).

Reproductive strategies

Polychaetes display a wide range of reproductive strategies, yet in principal they reproduce either asexually (e.g., Oliver, 1984) and sexually (e.g., Wilson, 1991). In asexual reproduction, polychaetes reproduce through binary fission: the body separates into anterior and posterior halves, then the anterior half regenerates by forming posterior segments and a pygidium, whereas the posterior half regenerates by forming anterior segments and the head region. Polychaetes also reproduce asexually by budding. That is, clones bud off the posterior end of adult, detach and crawl away. The same individual, interestingly, is often able to reproduce sexually.

The most common sexual reproduction in polychaetes is simultaneous spawning by males and females as they are generally dioecious (Fauchald, 1977) – some species are hermaphrodites and others may be males at particular times of their life then become females later. During spawning, polychaetes release eggs and sperm into the water column. The fertilised eggs (zygote) develop into trochophores, i.e., planktonic ciliated polychaete larvae. Depending on the species, trochophores can spend from hours to weeks in the water column before they metamorphose into juveniles. Juveniles then settle to the sea floor where they continue to grow to maturity as benthic organisms. In some species, eggs, embryos and trochophores are brooded by adults (Wilson, 1991).

A remarkable sexual reproduction mode of polychaetes is called 'epitoky'. In this mode, the animals modify their body into a swimming body called 'epitoke' (e.g., Caspers, 1984; Chatelain et al., 2008; Pamungkas & Glasby, 2015). Triggered by a particular lunar phase and cycle, epitokes swarm in the water column and perform the so-called 'mating dance' to shed gametes (Bentley et al., 2001). Afterwards, they die. Depending on the species, two main strategies of epitoky are employed: either the whole animal or only the posterior part of the animal metamorphoses into an epitoke. The former case (also called 'epigamy') is common for Nereididae (e.g., Chatelain et al., 2008; Pamungkas & Glasby, 2015) and some Syllidae (e.g., Fischer & Fischer, 1995), whereas the latter case (also called 'schizogamy') is common for some members of Eunicidae like *palolo* (Caspers, 1984) and *wawo* worms (Pamungkas, 2015a) as well as Syllidae.

Ecological and economic importance

Polychaetes are often among the most abundant taxon in benthic samples, both in terms of the number of species and individuals (e.g., Grassle & Maciolek, 1992). The group, as a result, has been used extensively as an indicator of the general health of benthic communities in response to marine pollution (Dean, 2008). Particular polychaete species have also been used as indicator species of marine pollution. The once-considered cosmopolitan species *Capitella capitata* (Capitellidae), for example, has been linked to a habitat with high organic substance (Pearson & Rosenberg, 1978); nowadays this species is known to be restricted to the Arctic-subarctic, and other records from boreal and temperate localities represent different species (Blake 2009; Blake et al., 2009). Polychaetes are typically utilized by humans as fishing bait, feed in mariculture (e.g., Olive, 1999; Narciso & da Fonseca, 2000) and aquarium decoration. In certain Indo-Pacific tropical and subtropical regions, *wawo* and *palolo* worms are consumed by locals (e.g., Caspers, 1984; Martens et al., 1995; Pamungkas, 2011).

1.1.2 The importance of species discovery

Knowing what species exist on Earth is the fundamental starting point for all biodiversity-based research. Here, taxonomy plays a vital role, mainly in the 19th century where numerous species new to science were described by prominent naturalists – the heyday of natural history. Both morphological and molecular data are used to describe species today and, when used together, offer the most comprehensive approach. However, the vast majority of species known today have been described based on morphology.

Because of its importance, scientists are always curious about how many species that may exist on this planet. Costello & Wilson (2011) identified four approaches to estimating the total number of species, i.e., based on: (1) expert opinions, (2) species-habitat relationships using the island biogeographic theory, (3) body size-species richness relationships and (4) past species discovery rates. While expert estimates are subjective, the relationship between species and habitats may be weak, and body size is poorly related to species richness, past species discovery rates seems to be the best method presently available. This method has been used by Appeltans et al. (2012) and Costello et al. (2012) to predict the numbers of marine and global species, respectively, that will be discovered by the end of the 21st century. Both studies come up with a similar notable conclusion that most species of the world may have been described and that it is now getting harder to discover new species.

To date, reviews of the discovery rate of various terrestrial and marine taxa have been conducted. However, a comprehensive review of polychaete species discovery has never been done. Research on this particular area will thus improve our knowledge on marine species discovery progress (see Chapter 2).

1.1.3 Global species distribution: why does it matter?

On Earth, species are not evenly distributed: they tend to clump into particular habitats and geographic regions. Investigating the spatial distribution of species is thus critical to identifying areas with high species richness and endemicity – so that we can protect them from extinction due to (typically) anthropogenic activities. Here, the establishment of Marine Protected Areas (MPAs) by policy makers is often the implementation of marine biogeographical studies.

Initial attempts to classify terrestrial biogeographic regions based on the species distribution of vertebrates were conducted by Sclater (1858) and Wallace (1876). Wallace's Line is also recognized to date as one of the oldest boundaries in biogeography which divides the Asian from the Australian fauna (Wallace 1860). For a long time, evidence for biogeographic boundaries in the ocean was considered unclear, and some groups, including polychaetes, were considered to have wide, sometimes cosmopolitan, distributions (e.g., Ekman 1953, Briggs 1974). In recent decades this view has changed, with Spalding et al. (2007) outlining 12 coastal realms of the world, and Costello et al. (2017) proposing 18 and 12 coastal and offshore realms. Biogeographic regions are basically defined based on the presence of endemic species, i.e., species whose existence are unique to a particular region. A region that contains endemic species has usually been isolated over a long period of time and has developed a particular set of environmental characteristics to which endemic species have adapted.

While the world's species are distributed in geographic regions, latitudinally, their distribution is believed to show a unimodal pattern (Figure 1.2A). That is, species richness increases from the polar to tropical regions, with a peak around the Equator (e.g., Kaufman, 1995; Gaston, 2000). However, Chaudhary et al. (2016) discovered the latitudinal distribution of marine species to be bimodal with a dip in species richness near the Equator (Figure 1.2B). This was considered as an artefact from sampling bias (Fernandez & Marques, 2017; Menegotto & Rangel, 2018), yet using the rarefaction method, which accounts for sampling bias, Chaudhary et al. (2017)

confirmed that the pattern to be a natural phenomenon. In addition, the latitudinal species richness gradient is generally accepted to be taxon-specific, which means that each taxon may have a distinct pattern. Studies on species distribution on a global scale have been conducted for various marine taxa, but not for polychaetes. Investigating the biogeographic regions of polychaetes, as well as their latitudinal distribution, will thus fill in a gap in the knowledge of a major marine taxonomic group (see Chapter 3).

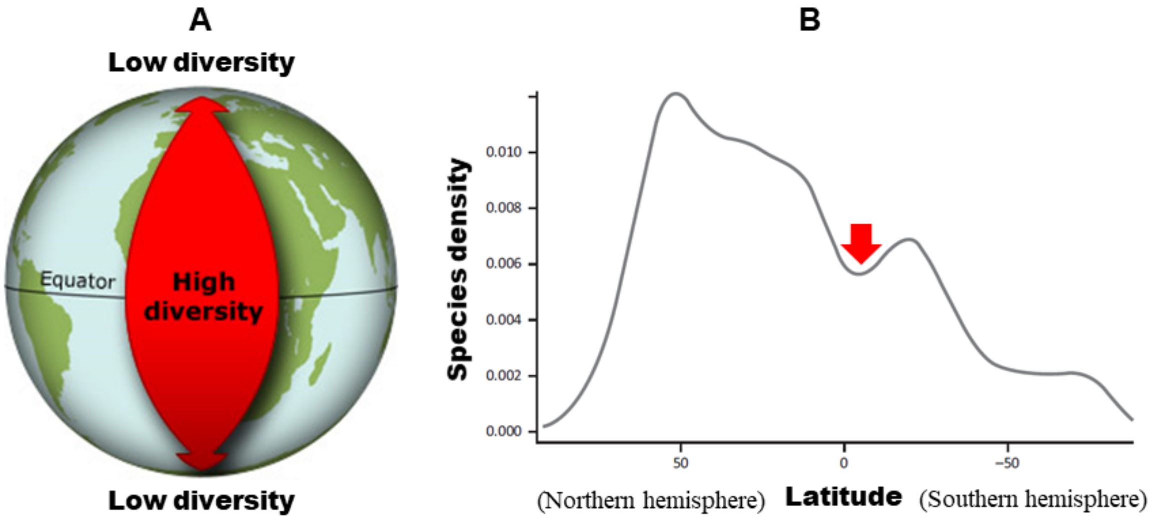


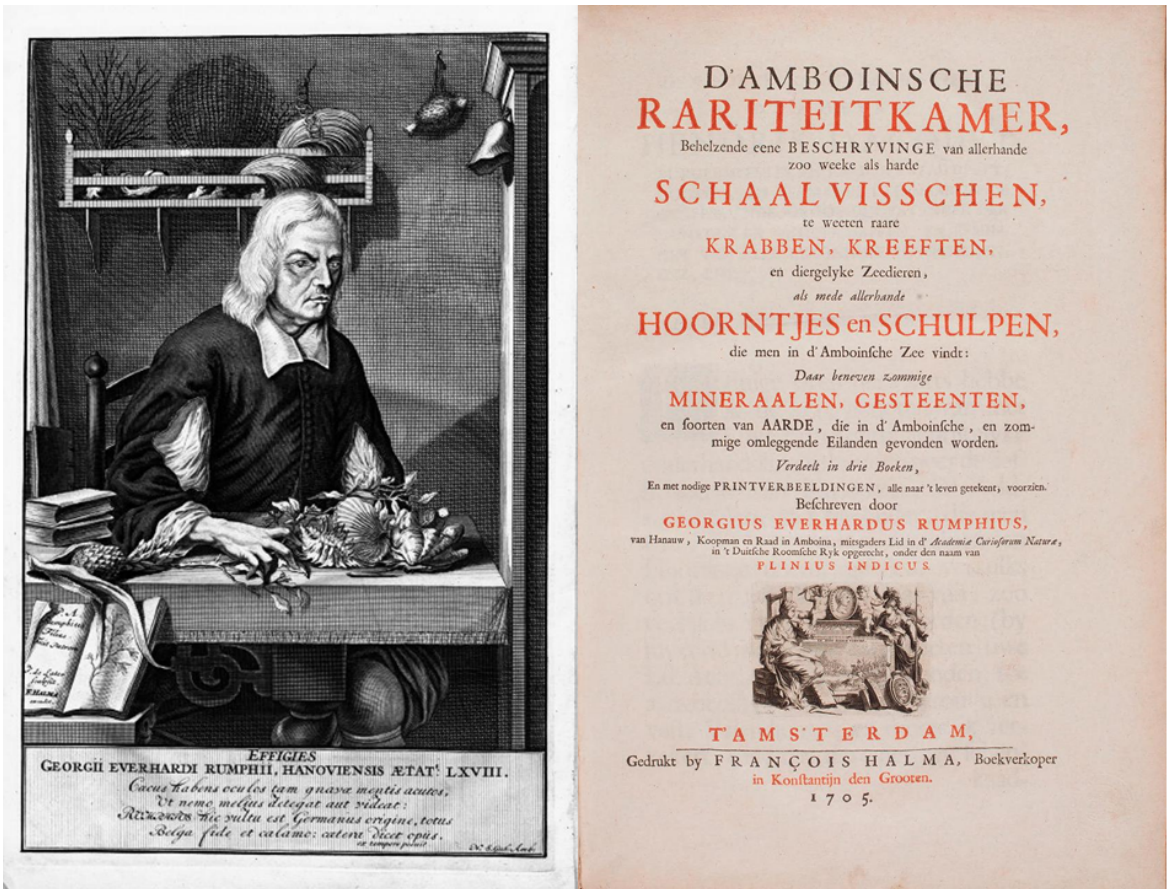
Figure 1.2 (A) The classical unimodal pattern. The figure is adapted from an original illustration at http://www.flickr.com/photos/ontdesign/ by the University of California, Museum of Paleontology (2017). (B) The alternate bimodal pattern. The figure is modified after Chaudhary et al. (2016). The red arrow shows the dip in species richness near the Equator.

1.1.4 Indonesian polychaetes: what is known?

With its diversity of marine habitats including the Coral Triangle (CT), i.e., a marine area located in the western Pacific Ocean including the waters of Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste and Solomon Islands, Indonesia is exceptionally rich in marine species (e.g., Asaad et al., 2018), including polychaetes. However, there has not been a study reviewing how many polychaete species have been reported and formally described from the geographic region to date.

The very first study on Indonesian polychaetes was probably by Georg Eberhard Rumphius (1627-1702) when he observed the swarming *wawo* worms on Ambon Island (Figure 1.3). Thereafter, the Dutch Siboga Expedition (1899-1900) is widely thought to be the most important marine expedition yielding the most Indonesian polychaete specimens. Many benthic studies have been conducted by local researchers, yet their contribution to the polychaete species description, as well as where they deposited the specimens obtained for their studies is unclear despite the availability of a few local research institutions housing polychaete collections. A review of polychaete taxonomic studies in the geographic region is thus necessary (see Chapter 4).

Moreover, Indonesian waters, particularly the CT, is likely to harbour many polychaete species new to science (see Chapter 5).



D'AMBOINSCHE
RARITEITKAMER,
Behelzende eene BESCHRYVINGE van allerhande
zoo weeke als harde
SCHAALVISSCHEN,
te weeten raare
KRABBEN, KREEFTEN,
en diergelyke Zeedieren,
als mede allerhande
HOORNTJES en SCHULPEN,
die men in d'Amboinſche Zee vindt:
Daar beneven zommige
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en ſoorten van AARDE, die in d'Amboinſche, en zommige omleggende Eilanden gevonden worden.
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PLINIUS INDICUS.

T'AMSTERDAM,
Gedrukt by FRANÇOIS HALMA, Boekverkoper
in Konſtantijn den Grooten.
1705.

Figure 1.3 G. E. Rumphius (left) and his book '*D'Amboinsche Rariteitkamer*' (right) containing the first study on Indonesian polychaetes.

1.2 Research questions

Research questions that will be addressed in the present work are divided into four topics which reflect the global to regional scopes of the study, i.e., 'Polychaete Discovery' (Chapter 2), 'Polychaete Biogeography' (Chapter 3), 'Indonesian Polychaete Biodiversity' (Chapter 4) and 'A New Capitellid Species from Ambon' (Chapter 5). The questions are:

1. How many polychaete species have been formally described over the past 250 years and how many taxonomists were involved? Is there any evidence that most polychaete species have been discovered? Based on the past discovery rate, how many more polychaete species are predicted to be described by the end of the 21st century and how many taxonomists are needed to complete this work? Is the trend in polychaete discovery following that of global and marine species discovery?
2. How are polychaete species distributed globally? Which hemisphere and geographic regions have more polychaete data and species? How many biogeographic regions can be

identified based on the present online polychaete data? Does the latitudinal polychaete species richness show a uni- or bimodal gradient and what are the possible reasons for it?

3. How many Indonesian polychaete species have been identified to date and how many of them were formally described from this geographic region? Who has described the most Indonesian polychaete species? What was the most prominent marine expedition yielding the most Indonesian polychaete materials and which part of Indonesia was studied? Which museum in the world houses the biggest collection of Indonesian polychaete species? Have benthic studies conducted by local scientists yielded many polychaete specimens and where were they deposited? What local institutions house Indonesian polychaete collections? How does this knowledge inform what actions could be performed to improve the polychaete taxonomic knowledge of the country?
4. Are the capitellid specimens collected on Ambon – an island in the CT identified as having extraordinarily high marine species richness by Asaad et al. (2018) – new species? To what genus do they belong? What are the features that distinguish them from other species? What is the habitat and distribution of the species?

1.3 Thesis objectives and structure

This thesis has four objectives, and the chapters are structured corresponding to them. The objectives are:

1. To review progress in polychaete species discovery as well as predict its future discovery (Chapter 2). This work has been published in *Helgoland Marine Research* (https://doi.org/10.1186/s10152-019-0524-z).
2. To identify global biogeographic regions and latitudinal species richness gradient pattern of polychaetes (Chapter 3). This work has been submitted for publication to *Marine Ecology Progress Series*.
3. To review the current status of polychaete taxonomy in Indonesia and create a checklist of Indonesian polychaete species (Chapter 4). This work has been published in *Raffles Bulletin of Zoology* (https://lkcnhm.nus.edu.sg/rbz/volume-67/).
4. To describe a new polychaete species collected from Ambon Island (Chapter 5). This work has been published in *Zootaxa* (https://doi.org/10.11646/zootaxa.4227.4.7).

Chapter 2

Progress and perspectives in the discovery of polychaete worms (Annelida) of the world

Abstract

Despite the availability of well-documented data, a comprehensive review of the discovery progress of polychaete worms (Annelida) has never been done. In the present study, I reviewed available data in the World Register of Marine Species, and found that 11,456 valid species of Recent polychaetes (1417 genera, 85 families) have been named by 835 first authors since 1758. Over this period, three discovery phases of the fauna were identified. That is, the initial phase (from 1758 to mid-19th century) where nearly 500 species were described by few taxonomists, the second phase (from the 1850's to mid-20th century) where almost 5000 species were largely described by some very productive taxonomists, and the third phase (from the 1950's to modern times) in which about 6000 species were described by the most taxonomists ever. Six polychaete families with the most species were Syllidae (993 species), Polynoidae (876 species), Nereididae (687 species), Spionidae (612 species), Terebellidae (607 species) and Serpulidae (576 species). The increase in the number of first authors through time indicated greater taxonomic effort. By contrast, there was a decline in the number of polychaete species described in proportion to the number of first authors since around mid-19th century. This suggested that it has been getting more difficult to find new polychaete species. About 5200 more species are predicted to be discovered between now and the year 2100. The total number of polychaete species of the world by the end of this century is thus anticipated to be about 16,700 species.

2.1 Introduction

The taxonomic work underlying species discoveries lays the foundations for all subsequent biodiversity-based research. To know how many species exist provides valuable information about progress in the rate of discovery of life on Earth (Costello et al., 2013a). Moreover, species richness – the number of different species in an area – is one of the key metrics for estimating species diversity, which is the basis for many comparative ecological, biogeographic and conservation studies.

One useful method to estimate total species richness – or the number of species that will be discovered by a particular time – is by looking at species discovery rates (Costello & Wilson, 2011). Using this approach, Costello et al. (2012) have predicted global species richness to be around 1.8 to 2.0 million species. Appeltans et al. (2012), using a statistical model of past rates of species description, field observations of undescribed species, and over one hundred expert's assessments, estimated the number of marine species to be 0.5 ± 0.2 million. Their model could not be used for polychaetes alone, but their expert-opinion estimate was that some 6320 polychaete species remained to be described, and they speculated that "a total of 25,000 to 30,000 species would not be surprising."

Polychaete naming began before the formal start of taxonomy (arbitrarily deemed to be 1758, matching the 10th edition of Linnaeus's Systema Naturae). The historic developments of polychaete taxonomy, and the seminal works on each family, were reviewed by Fauchald & Rouse (1997) and Rouse & Pleijel (2001). All the thousands of Polychaeta names created up to the 1960's was subsequently captured by the Olga Hartman catalogues (Hartman, 1959a,b; Hartman, 1965a).

Those early names, along with all the names published since, were digitized by Kristian Fauchald, and the data have been made publicly available in 2007 as part of the World Register of Marine Species (WoRMS) online database.

Despite the availability of those well-documented data, a comprehensive review of the discovery rate of polychaetes has never been done. In the present study, I review progress in the discovery of polychaete species and estimate the number of species that will be discovered by the end of the 21st century.

2.2 Materials and Methods

The present study was based on data from the World Polychaeta Database, which is part of WoRMS (Read & Fauchald, 2018), downloaded on 10 October 2016. It included all the taxa traditionally referred to as polychaetes (assigned class rank in WoRMS) within the Annelida, plus the more recently added Pogonophora and Vestimentifera (now the siboglinids) and the echiurans, but not aeolosomatids and myzostomids (both of them are Annelida *incertae sedis*), and not the clitellates and sipunculans. Sipunculans appear to be basal annelids (Weigert et al., 2014), not 'polychaetes' per se; and the clitellates, while now molecularly aligned within Sedentaria polychaetes, have been outside the scope of WoRMS to date because they are largely terrestrial, so complete data on clitellates was unavailable. WoRMS and this study do not include polychaete species that are informally named, even when these names are connected to vouchered and registered museum specimens as they are not accepted species names.

During initial analyses, I noticed issues that merited correction. These were corrected prior to data analysis to maximize the accuracy of the data used (Appendix 2.1). I included only Recent species-rank names whose WoRMS-status was 'accepted'. Consequently, 499 species of fossils, 204 names not checked by a taxonomist, 424 currently accepted subspecies, and some taxonomically uncertain name categories were excluded (Appendix 2.2). Only family names currently valid in WoRMS (Terebellidae subfamilies here treated at family level) were included. Although many other family names have been proposed, they are now synonyms or subfamilies, either for nomenclatural reasons such as priority, or more fundamental reasons such as re-classification following insights from molecular analyses (e.g., Pisionidae as part of Sigalionidae (Norlinder et al., 2012).

The discovery rate of polychaetes was studied in the following ways. First, the cumulative number of species described from 1758 to 2016 – for both errant and sedentary species – was plotted to see if the curve reached an asymptote. The non-homogeneous renewal process model of

Wilson & Costello (2005) was then run to forecast the number of species that would be described by the years 2050 and 2100 with 95% confidence limits. The equation used was:

$$\boldsymbol{t} = \frac{\boldsymbol{N}}{\mathbf{1} + \mathbf{exp}\,(-\boldsymbol{N\beta}(\boldsymbol{t} - \boldsymbol{\alpha}))}$$

where $\boldsymbol{t}$ is the number of polychaete species discovered by a particular year; $\boldsymbol{N}$ is the total number of polychaete species to be discovered; $\boldsymbol{\alpha}$ is the year of the maximum rate of discovery; and $\boldsymbol{\beta}$ is the overall rate of discovery (a larger $\boldsymbol{\beta}$ implying a faster rate). In addition, the annual number of species described was plotted to see the general trend of species discovery.

As an indicator of taxonomic effort through time, the number of first authors describing polychaete species was plotted yearly. Here, I only considered unique surnames of first authors so that the presence of additional authors did not inflate the apparent effort. Thus, for example, the well-known 19th century pairing of Audouin & Milne Edwards was counted once. In cases where different authors have the same surname, I attempted to find the original source of descriptions to distinguish them based on their given names (e.g., F. Müller, O. F. Müller, M. Müller and M. C. Müller). When this was not possible, a surname for 50 years from its first occurrence was counted, with an assumption that any effects of different authors with the same surname within a year were negligible and/ or random over time.

Next, the average number of polychaete species described per first authors per year was plotted. A least squares piecewise regression analysis was additionally performed to identify the period from where the number of species described per author began to decrease. Bouchet et al. (2016) suggested that the decline in the number of species described per author in Mollusca may be caused by many citizen-scientist authors describing just one or two species, and thereby does not necessarily indicate a difficulty in finding new species. To ascertain whether any increase in first authors of new species descriptions was due to an increasing proportion of authors who only described one species, I looked at their contribution to species descriptions over decades (decades were used to minimize the occurrence of zero values). In addition, I used Pearson's skewness coefficient to compare the relative number of species described by all first authors over the decades. A change in skewness could indicate a changing proportion of highly productive authors.

Finally, the number of non-polychaete species described by the top 25 most prolific first authors was counted using the 'advanced search' feature in WoRMS to see if polychaete taxonomists are now more specialized than they were in the 19th century (note that some of these authors may have named non-marine species that are not in WoRMS). I counted surnames from different authors as previously explained, and only counted non-polychaete names that were accepted species.

2.3 Results

2.3.1 Species richness

WoRMS is constantly being updated and corrected. At the time of the data download in 2016, as many as 11,456 polychaete species (1417 genera, 85 families) had been described (Table 2.1) – these are the valid names remaining from the 21,104 names actually created, which include as well all of the unaccepted names (Appendix 2.2). Of these species, 6033 species belong to the subclass Errantia, whereas 5085 and 158 species belong to the subclasses Sedentaria and Echiura, respectively. Additionally, 180 species were from families currently outside of, or as yet unassigned to, subclass groupings in WoRMS, and referred to as Polychaeta *incertae sedis*.

Six polychaete families were identified to be the most species-rich. That is, in order, Syllidae (993 species), Polynoidae (876 species), Nereididae (687 species), Spionidae (612 species), Terebellidae (607 species) and Serpulidae (576 species) (Table 2.1). About 38% of known polychaete species belonged to these families. By contrast, four polychaete families, i.e., Ichthyotomidae, Ikedidae, Laetmonectidae and Pontodoridae, were monotypic (having only one species) (Table 2.1). These four family names are hierarchy place-holders for morphologically distinctive species with as yet no obvious affinities to other families. Rouse & Pleijel (2001) regarded such monotypic family group names as being redundant as they represented an ‘empty taxon’.

Table 2.1 The list of valid polychaete families and their author(s), species and genera (ranked by species number per family), as well as years of first and last species descriptions and cumulative percentages of species described per half century.

Family	Author(s)	Species	Genus	First species described in	% of species described by				Last species described in
					1850	1900	1950	2000	
Syllidae	Grube, 1850	993	103	1776	2	20	34	79	2016
Polynoidae	Kinberg, 1856	876	174	1758	3	31	60	95	2016
Nereididae	Blainville, 1818	687	50	1758	10	35	61	94	2016
Spionidae	Grube, 1850	612	54	1767	3	12	27	83	2016
Terebellidae	Johnston, 1846	607	73	1766	4	28	55	85	2016
Serpulidae	Rafinesque, 1815	576	77	1758	8	29	47	90	2016
Sabellidae	Latreille, 1825	493	42	1767	10	39	61	86	2016
Phyllodocidae	Örsted, 1843	448	34	1767	7	36	58	93	2015
Eunicidae	Berthold, 1827	419	14	1767	6	46	70	94	2014
Onuphidae	Kinberg, 1865	340	24	1776	2	20	40	90	2016
Ampharetidae	Malmgren, 1866	306	66	1835	1	20	46	81	2016
Lumbrineridae	Schmarda, 1861	302	22	1776	3	27	56	91	2014
Cirratulidae	Carus, 1863	291	21	1776	3	22	41	75	2016
Maldanidae	Malmgren, 1867	272	45	1780	2	33	64	96	2016
Sigalionidae	Malmgren, 1867	219	28	1830	3	29	53	91	2016
Hesionidae	Grube, 1850	214	37	1780	3	19	36	83	2015
Dorvilleidae	Chamberlin, 1919	201	37	1828	1	13	23	83	2015
Capitellidae	Grube, 1862	193	46	1780	1	13	35	83	2016
Orbiniidae	Hartman, 1942	184	25	1758	3	16	32	90	2016
Flabelligeridae	de Saint-Joseph, 1894	182	27	1776	6	30	59	80	2016
Siboglinidae	Caullery, 1914	178	32	1933	0	0	2	86	2015
Paraonidae	Cerruti, 1909	169	10	1879	0	2	10	83	2013
Opheliidae	Malmgren, 1867	155	10	1818	4	22	49	85	2015
Amphinomidae	Lamarck, 1818	152	22	1766	8	44	81	95	2012
Nephtyidae	Grube, 1850	144	6	1780	4	27	52	94	2016
Sabellariidae	Johnston, 1865	130	13	1767	5	20	46	91	2015

Family	Author(s)	Species	Genus	First species described in	% of species described by				Last species described in
					1850	1900	1950	2000	
Aphroditidae	Malmgren, 1867	123	12	1758	9	43	77	94	2013
Sphaerodoridae	Malmgren, 1867	112	11	1843	1	5	15	80	2016
Pilargidae	de Saint-Joseph, 1899	105	13	1758	1	9	25	76	2013
Fabriciidae	Rioja, 1923	91	21	1774	1	10	22	89	2014
Oenonidae	Kinberg, 1865	90	19	1804	8	35	65	97	2015
Goniadidae	Kinberg, 1866	90	12	1833	4	27	59	94	2004
Chrysopetalidae	Ehlers, 1864	87	27	1855	0	13	23	74	2015
Glyceridae	Grube, 1850	87	3	1776	9	46	67	83	2012
Echiuridae	Quatrefages, 1847	79	7	1766	5	25	76	99	2013
Trichobranchidae	Malmgren, 1866	78	6	1758	3	21	33	77	2016
Bonelliidae	Lacaze-Duthiers, 1858	74	31	1821	1	12	34	97	2015
Chaetopteridae	Audouin & Edwards, 1833	73	5	1804	3	26	52	69	2015
Magelonidae	Cunningham & Ramage, 1888	67	2	1858	0	5	19	81	2013
Scalibregmatidae	Malmgren, 1867	66	16	1843	3	12	26	83	2015
Acoetidae	Kinberg, 1856	60	10	1817	5	30	65	97	2008
Euphrosinidae	Williams, 1852	59	4	1818	7	29	70	92	2009
Pectinariidae	Quatrefages, 1866	57	5	1766	14	40	79	88	2015
Oweniidae	Rioja, 1917	55	6	1844	2	18	29	67	2015
Tomopteridae	Grube, 1850	52	3	1825	6	34	87	100	1992
Nerillidae	Levinsen, 1883	49	14	1848	2	4	20	90	2009
Alciopidae	Ehlers, 1864	47	10	1828	10	60	79	100	1991
Acrocirridae	Banse, 1969	44	10	1835	2	11	25	84	2012
Protodrilidae	Hatschek, 1888	39	4	1868	0	10	33	85	2015
Travisiidae	Hartmann-Schröder, 1971	34	1	1840	3	29	65	88	2006
Poecilochaetidae	Hannerz, 1956	31	1	1875	0	3	13	90	2009
Sternaspidae	Carus, 1863	29	3	1817	7	28	41	45	2015
Cossuridae	Day, 1963	26	1	1887	0	4	0	85	2015
Pholoidae	Kinberg, 1858	25	5	1776	20	24	0	88	2016

Family	Author(s)	Species	Genus	First species described in	% of species described by				Last species described in
					1850	1900	1950	2000	
Arenicolidae	Johnston, 1835	22	5	1758	14	55	68	96	2001
Eulepethidae	Chamberlin, 1919	22	7	1875	0	18	41	86	2011
Fauveliopsidae	Hartman, 1971	22	2	1922	0	0	9	86	2014
Saccocirridae	Czerniavsky, 1881	22	1	1872	0	5	36	82	2007
Lopadorrhynchidae	Claparède, 1870	19	5	1855	0	53	84	100	1978
Typhloscolecidae	Uljanin, 1878	17	3	1851	0	53	100	0	1950
Dinophilidae	Remane, 1925	15	3	1848	7	60	80	100	1999
Polygordiidae	Czerniavsky, 1881	15	1	1868	0	40	87	100	1999
Trochochaetidae	Pettibone, 1963	15	2	1844	13	33	60	87	2013
Histriobdellidae	Claus & Moquin-Tandon, 1884	13	3	1858	0	15	39	85	2005
Iphionidae	Kinberg, 1856	13	4	1818	8	23	0	92	2014
Lacydoniidae	Bergström, 1914	13	1	1875	0	8	15	69	2016
Spintheridae	Augener, 1913	12	1	1845	17	33	67	92	2003
Alvinellidae	Desbruyères & Laubier, 1986	11	2	1980	0	0	0	100	1993
Longosomatidae	Hartman, 1944	7	1	1874	0	14	29	86	2016
Apistobranchidae	Mesnil & Caullery, 1898	6	1	1879	0	33	0	100	1978
Psammodrilidae	Swedmark, 1952	6	1	1952	0	0	0	50	2015
Aberrantidae	Wolf, 1987	4	1	1965	0	0	0	50	2005
Iospilidae	Bergström, 1914	4	3	1879	0	75	100	0	1911
Urechidae	Monro, 1927	4	1	1852	0	75	100	0	1928
Antonbruunidae	Fauchald, 1977	3	1	1965	0	0	0	33	2015
Hartmaniellidae	Imajima, 1977	3	1	1977	0	0	0	100	1986
Uncispionidae	Green, 1982	3	2	1982	0	0	0	67	2011
Yndolaciidae	Støp-Bowitz, 1987	3	3	1987	0	0	0	33	2004
Paralacydoniidae	Pettibone, 1963	2	1	1913	0	0	100	0	1923
Parergodrilidae	Reisinger, 1925	2	2	1925	0	0	100	0	1934
Protodriloididae	Purschke & Jouin, 1988	2	1	1904	0	0	100	0	1926
Ichthyotomidae	Eisig, 1906	1	1	1906	0	0	100	0	1906

Family	**Author(s)**	**Species**	**Genus**	**First species described in**	**% of species described by**				**Last species described in**
					1850	**1900**	**1950**	**2000**	
Ikedidae	Bock, 1942	1	1	1904	0	0	100	0	1904
Laetmonectidae	Buzhinskaya, 1986	1	1	1986	0	0	0	100	1986
Pontodoridae	Bergström, 1914	1	1	1879	0	100	0	0	1879
Total		**11,456**	**1,417**						

2.3.2 Species discovery and authors

In the present study, I identified three phases of polychaete species discovery. The initial phase, where few polychaete species had been described by few taxonomists, occurred from 1758 to the middle of the 19th century (Figure 2.2). During this period, the cumulative number of species described increased slowly (Figure 2.1), and nearly 500 species, or about 4% of the known species, had been described.

The second phase of the discovery started from about the 1850's to the middle of 20th century, indicated by many species being described mostly by some very productive authors. For example, McIntosh (1885) recorded 308 species from the Challenger (1872-76) expedition, of which 220 (71%) were new. The 1860's stand out as an unusually productive and dynamic time for polychaete taxonomy (Figure 2.2C) due to major monographs or series by Claparède, Ehlers, Grube, Kinberg, Malmgren, Quatrefages, and Schmarda. Despite a low period of activity in the late 19th century (Figure 2.2A) and a dip in active authors during the Second World War (Figure 2.2B), almost 5000 species, or about 43% of the known species, had been named by the end of this phase.

The third phase of the discovery started after the Second World War. At this point, the annual number of species described rose significantly and reached a peak in the 1960's (Figure 2.2A). It then plateaued until 1990, declined to around the turn of the century, and increased again from 2010 (Figure 2.2A). Over this period, approximately 6000 species, or about 52% of the known species, had been described by the most authors ever (Figure 2.2B). The trend in the cumulative number of polychaete species described was similar for both errant and sedentary polychaetes (Appendix 2.3).

Based on earlier species discoveries and at 95% probability, I forecast medians of 2600 (± 300) and 5200 (± 600) more polychaete species will be discovered by the years 2050 and 2100, respectively (Figure 2.1). The cumulative numbers of polychaete species described are thus estimated to be about 14,100 and 16,700 species by the years 2050 and 2100, respectively (Figure 2.1).

From 1758 to 2016, 835 taxonomists were first authors of the descriptions of the 11,456 valid polychaete species. Among them, Hartmann-Schröder, Hartman, and Grube were the top three most prolific authors describing about 1400 species or about 12% of the known species (Table 2.2). Thus, 25 authors have described over 5200 species, or 45% of the known species (Table 2.2). One-third (278) of authors have described 90% of the known species.

The number of first authors describing polychaete species per year increased slowly from 1758 to mid-19th century (Figure 2.2B). It then increased moderately and dropped most noticeably during the Second World War (Figure 2.2B). Afterwards, many more authors described species, and the past two decades were the period with the most first authors ever (Figure 2.2B). In contrast to this, the number of polychaete species described per first author per year began to decrease since around the middle of the 19th century (Figure 2.2C & Appendix 2.4).

The majority of the 25 most prolific authors had polychaete publication lifetimes of around 30-60 years. There is no indication these are decreasing (Appendix 2.5), and three of these prolific authors are still active (Table 2.2). Among the 25 most prolific authors, 14 individuals also described non-polychaete species (Table 2.2), which were mostly published between the 1840's and 1960's (Appendix 2.6), indicating that past polychaete taxonomists were more generalistic than recent ones. There was no clear trend in the proportion of non-career first-author polychaete taxonomists over the past centuries (Figure 2.3A). This indicates that the increase in the number of authors was not due to more incidental authors. Rather, it suggests that there has been increased taxonomic effort since the 1950's, as already shown in Figure 2.2B. Moreover, the positive skewness values show that over all decades most authors described few species (Figure 2.3B).

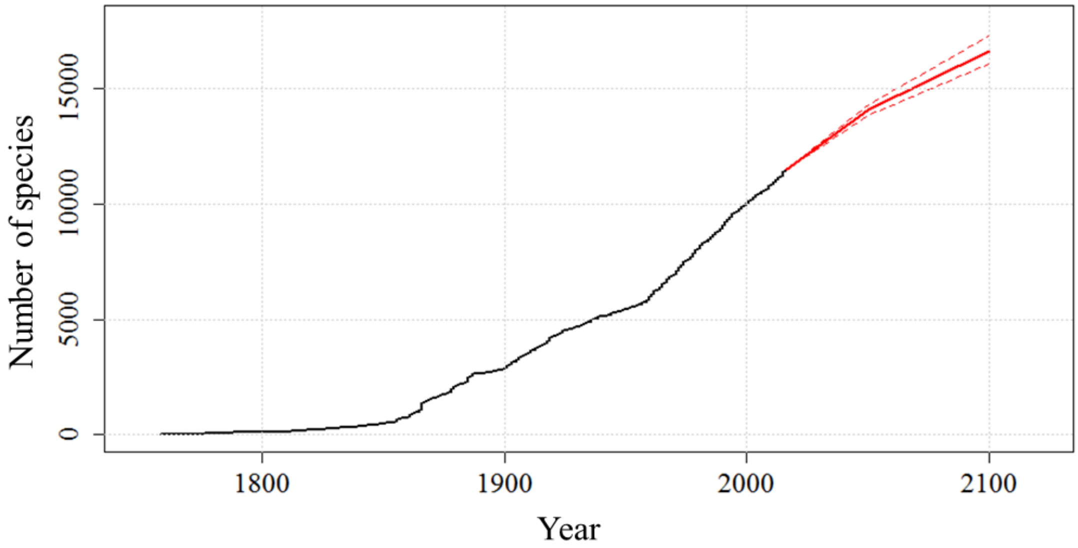

Figure 2.1 Cumulative (black line) and median predicted (red line with 95% confidence limit) numbers of species described to 2100 using the model of Wilson & Costello (2005).

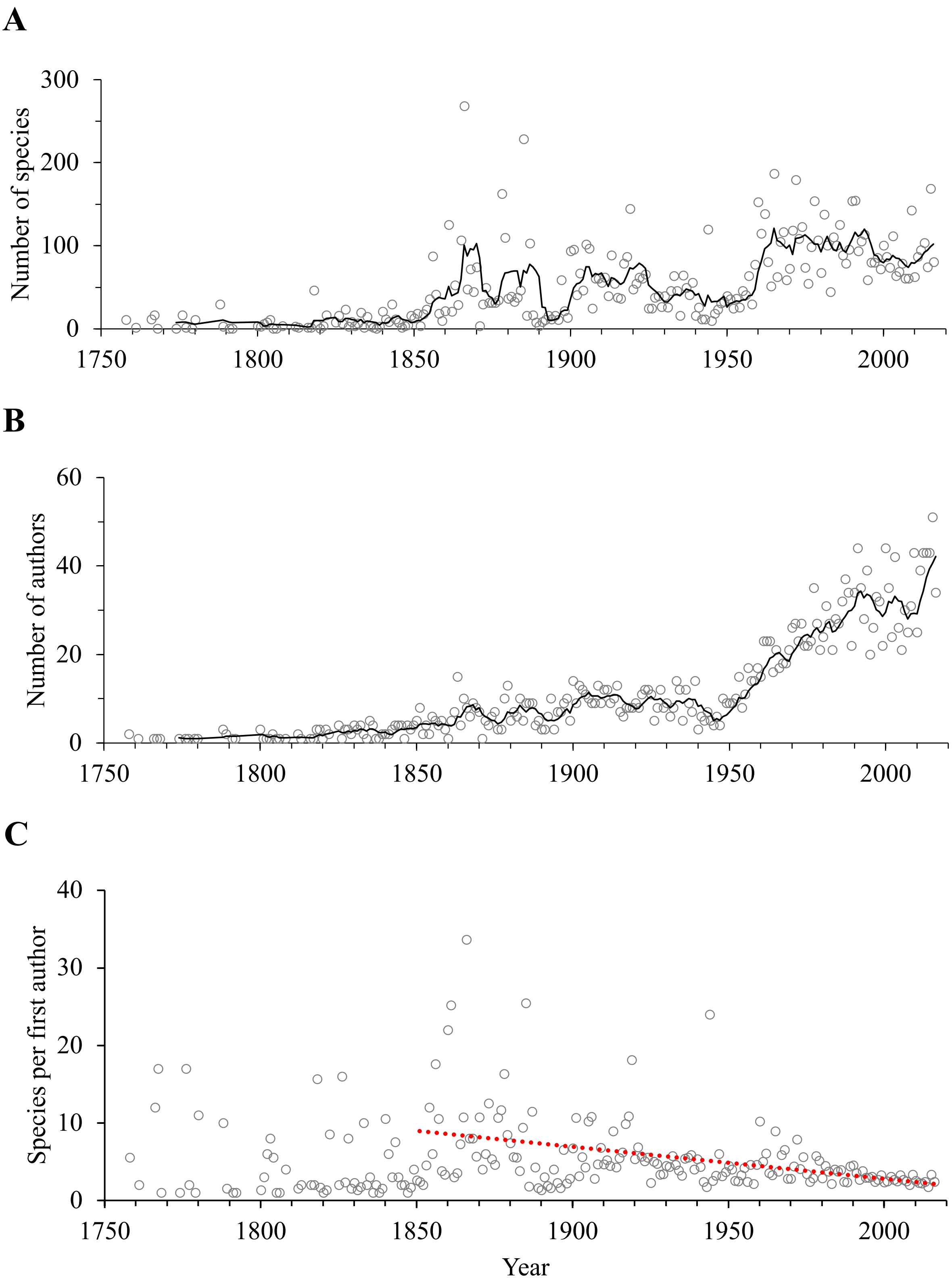

Figure 2.2 (A) The number of species described per year. (B) The number of first authors per year. (C) The number of species described per first author per year. The black lines are six-year moving average. The red linear correlation line represents the best fit based on the piecewise regression analysis (Appendix 2.4), showing that there is a statistically significant trend of decreasing number of species per author since around mid-19th century (prior to that, there is not enough evidence to identify a trend).

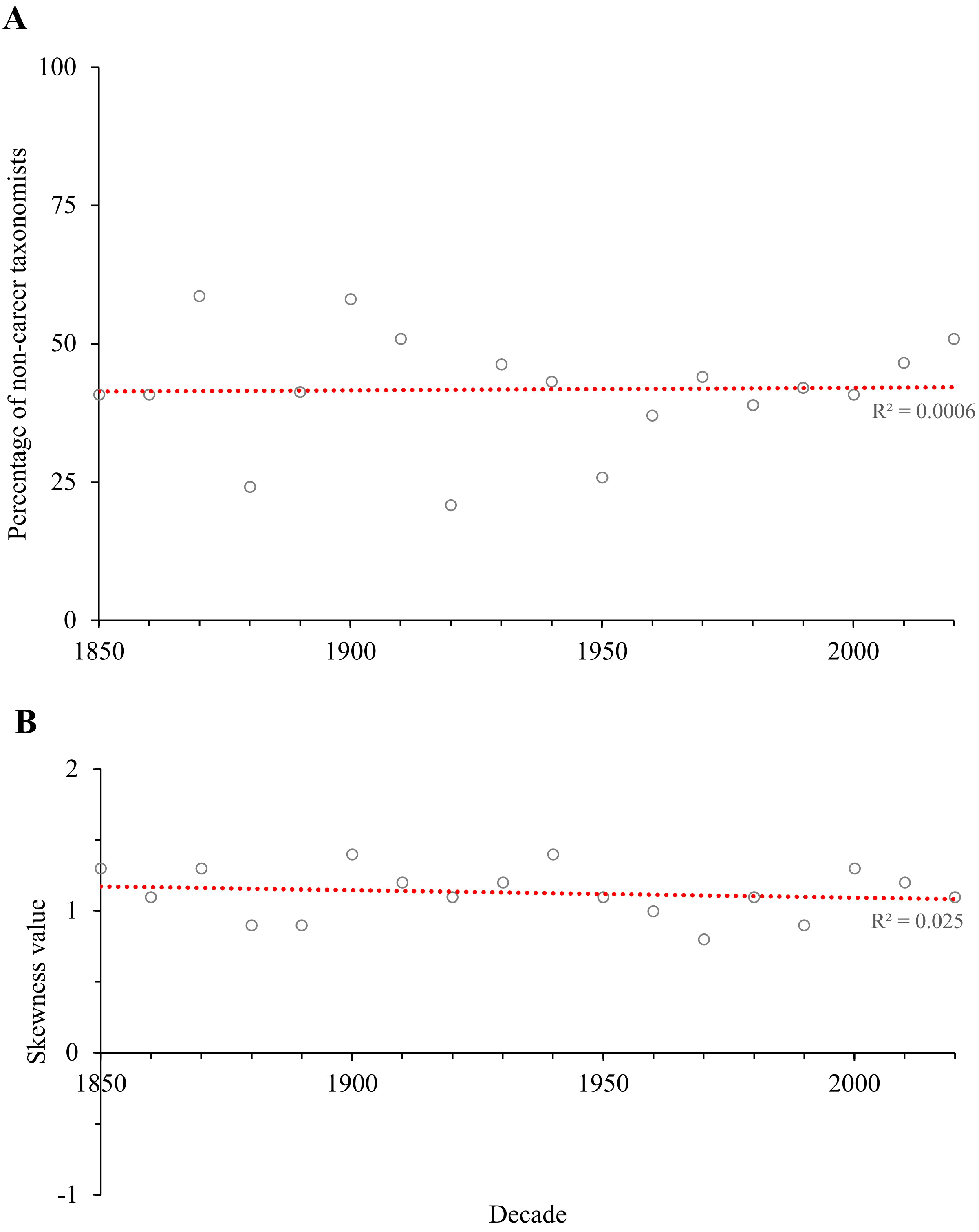

Figure 2.3 (A) The proportion of authors describing one species only per decade (i.e., non-career taxonomists). (B) The Pearson's Skewness coefficient per decade. The red dashed lines are the linear trends.

Table 2.2 The top 25 most prolific first authors along with their numbers of polychaete species described, first and last discoveries, cumulative proportion of the number of polychaete species described, publication lifetime and the number of non-polychaete species described. Authors in bold indicate those who are still active until now.

First author	Polychaete species described	First discovery	Cumulative % of species described by				Last discovery	Publication lifetime	Non-polychaete species described
			1850	1900	1950	2000			
G. Hartmann-Schröder	517	1956	0	0	0	100	1998	43	4
O. Hartman	473	1936	0	0	26	100	1971	36	1
A. E. Grube	468	1840	5	100	100	0	1881	42	78
W. C. McIntosh	297	1868	0	82	100	0	1924	57	14
E. Ehlers	262	1864	0	53	100	0	1920	57	6
M. Imajima	239	1959	0	0	0	**78**	2013	55	0
J. P. Moore	223	1894	0	2	100	0	1923	30	7
H. Augener	217	1906	0	0	98	100	[1]1970	65	2
J. G. H. Kinberg	212	1855	0	100	100	0	[2]1910	56	0
J. A. Blake	206	1969	0	0	0	**85**	2016	48	0
P. A. Hutchings	197	1974	0	0	0	**89**	2015	42	0
J. H. Day	192	1934	0	0	6	100	1977	44	0
K. Fauchald	188	1965	0	0	0	100	2012	48	0
A. L. Treadwell	168	1900	0	1	100	0	1945	46	0
M. H. Pettibone	158	1948	0	0	1	100	1997	50	0
P. Fauvel	142	1900	0	1	95	100	1959	60	0
A. de Quatrefages	141	1843	9	100	0	0	1870	28	22
R. V. Chamberlin[3]	131	1918	0	0	100	0	1920	3	[3]1652
A. E. Verrill	123	1873	0	99	100	0	1901	29	730
C. C. A. Monro	121	1924	0	0	100	0	1939	16	0
R. Horst	116	1889	0	3	100	0	1924	36	1
G. San Martín	112	1982	0	0	0	**45**	2014	33	0
L. K. Schmarda	111	1861	0	100	0	0	1861	1	92
C. Gravier	107	1896	0	24	100	0	1936	41	47
M. Caullery	103	1896	0	11	100	0	1944	49	28
Total	**5,224**								

Note:

[1] Posthumous, deceased 1938.

[2] Posthumous, last article in 1867.

[3] Arthropod taxonomist with brief career in annelids.

2.4 Discussion

I found that there were 11,456 validly named polychaete species at the time of the data download in 2016 (Table 2.1). This number is rather lower than that used by Appeltans et al. (2012), i.e., 12,632 species, and coincidentally close to that used by Costello et al. (2012), viz., 11,548 species. The decrease, despite well over one hundred new taxa added every year, is due to recognition of synonyms as a consequence of data revisions.

The model based on current rates of species descriptions showed that about 5200 more polychaete species will be discovered by 2100 (Figure 2.1); this number is around one-third of the total predicted number of species by then (16,700 species). In other words, as shown in Figure 2.1, approximately two-thirds of the total predicted number of polychaete species by 2100 have already been described; a proportion regarded as typical for progress in marine and other taxa by some analysts (Costello et al., 2012; Costello & Chaudhary, 2017).

The high current rate of polychaete species discovery is being supported by an increasing number of people describing the animals since the 1960's (Figure 2.2B). A similar trend of an all-time peak in authors in recent decades was also observed for various taxa such as fossil mammals (Alroy, 2002), amphibians, birds, cone snails, flowering plants, mammals and spiders (Joppa et al., 2010; Joppa et al., 2011), fish (Eschmeyer et al., 2010; Costello et al., 2015), Brazilian flowering plants and land vertebrates (Pimm et al., 2010), parasites (Costello, 2016), and amphipod crustaceans (Arfianti et al., 2018). The increase in the number of authors was also the case for all taxa on Earth (Costello et al., 2012). My findings on the increase in first author numbers for polychaete taxonomy were thus inconsistent with the common belief that the science of taxonomy is in crisis (Godfrey, 2002), and that the number of people specializing in taxonomy is in decline (Gaston & May, 1992; Hopkins & Freckleton, 2002). Recent analyses confirm earlier indications that the increase in taxonomic authors has been particularly high in South America and Asia (Costello et al., 2013a; Costello et al., 2013b; Deng et al., 2018).

In contrast to the increasing number of first authors, the number of polychaete species described per first author in a year has declined since around mid-19th century and shows a continued decline since the 1960's, with noticeably reduced variation in the data since the 1990's (Figure 2.2C). This is different from the accepted phenomenon of author-inflation per article. As to the latter, in the case of taxonomy one possible reason for there being more authors per individual species is likely to be partly due to there being higher-quality species descriptions (especially those including molecular data) that require a wider range of expertise (Sangster & Luksenburg, 2015), as well as possible changing authorship practices.

The gradual decrease in the number of species described per first author per year may be a sign of an increasing difficulty in finding new polychaete species as the more widespread and conspicuous taxa have been discovered (the remaining species may require more careful taxonomic review and scrutiny to distinguish). Yet, the greater number of first authors, new sampling methods (e.g., scuba, ROVs), more advanced technology (e.g., better microscopes, digital drawing and photography tools, molecular methods), the rapid increase in the number of scientific journals publishing taxonomic works and easier access to publications since the era of the Internet (Costello et al., 2013a; Zhang, 2010) should at least balance the greater effort needed to describe species more comprehensively in recent decades (Poulin & Presswell, 2016). If this is the case, such a pool of taxonomic workers, at some point, will no longer maintain the description rate, and a reduction in the number of species described per year will occur. This phenomenon has already occurred for various taxa such as some insects (Gaston, 1991), scleractinian corals (Cairns, 1999), fossil mammals (Alroy, 2002), marine fishes (Eschmeyer et al., 2010), amphibians, birds, flowering plants, mammals, spiders (Joppa et al., 2010; Joppa et al., 2011), algae (De Clerck et al., 2013), flowering plants (Bebber et al., 2014), beetles (Costello et al., 2014), parasites (Costello, 2016) and amphipod crustaceans (Arfianti et al., 2018).

If the drop in the number of polychaete species described per first author was due to a bigger proportion of non-career taxonomists nowadays, then the increase in the number of authors since the 1960's would not reflect increased taxonomic effort. In this study, how long recent authors (i.e., people who described species since the 1950's) will continue to publish species descriptions is unknown. Therefore, whether the working lifetime of recent authors will be similar to that of previous decades remains to be seen. Nonetheless, my analysis found no trend in the proportion of non-career polychaete taxonomists over time (Figure 2.3A), which is consistent with the observation on the proportion of non-career taxonomists through time globally (Costello et al., 2013b). Thus, the considerable increase in the number of first authors since the 1960's (Figure 2.2B) appears to reflect greater scientific effort, and the drop in the number of species described per first authors (Figure 2.2C) – despite the greater effort – indicates difficulty in finding new species. However, reasons for the increased difficulty in finding new polychaete species may be more complex than having discovered most of them. Perhaps, an equally likely reason is that small-sized and cryptic species are being under-sampled by commonly-employed survey sampling methods and the greater focus on more obvious collectable invertebrate species (Glasby & Al-Hakim, 2017). Certainly Annelida, whose members show a four orders of magnitude size variation (including meiofaunal-sizes) and an apparent abundance of cryptic species, provide a bigger challenge than many other phyla in estimating species diversity.

Chapter 3

Biogeography of polychaete worms (Annelida) of the world

Abstract

The global biogeography of polychaete worms has never been assessed previously. In the present study, I studied the world distribution patterns of polychaetes based on datasets obtained from the Global Biodiversity Information Facility, the Ocean Biogeographic Information System, and my recently published checklist of Indonesian polychaete species. Polychaete biogeographic regions were visualized using 'Infomap Bioregions', and the latitudinal species richness gradient was examined using three metrics: alpha, gamma and estimated species richness (the last metric was adjusted for sampling bias). I identified 11 major polychaete biogeographic regions. The North Atlantic, Australia and Indonesia were the top three species-rich biogeographic regions in the world. The total polychaete species was higher in the southern hemisphere (about 2100 species, 67 families) than in the northern hemisphere (about 1800 species, 75 families) despite significantly more data in the latter (over 500,000 records compared to over 26,000 records). Contrary to the classical idea of a unimodal distribution pattern, the latitudinal gradient of polychaetes was generally bimodal with similar peaks of species richness in the northern (60°N) and southern (30°S) hemispheres, and a pronounced dip north of the Equator (15°N). This pattern is unlikely to be due to sampling bias but rather a natural phenomenon, and I found it most significantly correlated with sea temperature.

3.1 Introduction

Understanding of the world's biodiversity requires biogeographic knowledge, i.e., why species occur where they do. Identifying biogeographic regions, i.e., areas of endemism, is thus the first step in protecting areas with high biodiversity and endemicity.

Historically, the first biogeographic schema focused on terrestrial fauna (mainly vertebrate species) such as those of Sclater (1858) and Wallace (1876). Wallace's Line is one of the oldest boundaries in biogeography and divides the Asian from the Australian fauna (Wallace, 1860). In the marine realm, the evidence for biogeographic boundaries was first considered unclear (e.g., Ekman, 1953; Briggs, 1974). However, Spalding et al. (2007) proposed 12 coastal realms based on expert opinions, and more recently Costello et al. (2017) published a map of 18 and 12 coastal and offshore realms of the world based on species distribution data analysis.

The latitudinal distribution of the world's species was generally believed to show a unimodal pattern, whereby species richness increases from the polar to tropical regions with a peak around the Equator (e.g., Kaufman, 1995; Gaston, 2000). As latitude is strongly correlated with temperature, some temperature-driven hypotheses have been proposed to explain the underlying mechanisms behind these patterns, including *the species-energy hypothesis*, which asserts that faster metabolic and speciation rates in warmer temperatures have contributed to higher species numbers in the tropics (e.g., Kaspari et al., 2004), and *the species-productivity hypothesis*, which states that greater primary productivity has supported more individuals in the tropics (e.g., Rosenzweig, 1995; Chase & Leibold, 2002).

Contrary to the classical unimodal paradigm, Chaudhary et al. (2016) found the latitudinal gradient of marine species richness to be bimodal with a dip around the Equator. The pattern was considered due to sampling bias by Fernandez & Marques (2017) and Menegotto & Rangel (2018). However, Chaudhary et al. (2017) used a rarefied species richness estimator to show that the pattern was unlikely to be due to sampling bias. The latitudinal diversity gradient pattern, in fact, can vary between taxa. Razor clams (Mollusca), for example, shows a strong bimodal pattern (Saeedi et al., 2017), whereas the pattern for planktonic radiolarians appears to be unimodal (Boltovskoy & Correa, 2016, 2017).

Polychaete worms (Annelida) are ubiquitous in virtually all marine and estuarine habitats, at all latitudes, and from the supra-littoral to abyssal waters. They typically dominate macrofaunal assemblages in sedimentary environments, representing 25-63% of all species and 39-73% of all individuals (Hutchings, 1998). The group also has a high tolerance towards extremes of temperature, salinity and oxygen availability. Some species occur near hydrothermal vents with extremely high temperatures and low available oxygen (McHugh & Tunnicliffe, 1994), and others occur in fresh or near-fresh waters (Glasby & Timm, 2008).

Since the middle of the 18th century, about 11,500 polychaete species (about 1400 genera, 85 families) have been described and accepted (Pamungkas et al., 2019). Over this period, numerous marine expeditions and investigations have been carried out at regional scales. Many polychaete datasets generated from these studies are pooled in the Global Biodiversity Information Facility (GBIF) and Ocean Biogeographic Information System (OBIS). Despite the availability of these datasets, the global biogeography of polychaetes has never been assessed. In this study, I investigate the geographic world distribution of polychaetes, including regions of endemicity and latitudinal diversity gradient patterns, identify gaps in the distributional data, and compare my findings with those of other marine groups. I thus test whether or not the geographic world distribution of the taxon is similar to that of all marine taxa together as studied by Costello et al. (2017). Also, I ask whether polychaetes, like many other marine organisms, show the classical unimodal diversity gradient pattern with peak species richness at the Equator, as suggested by the taxon-limited study of Giangrande & Licciano (2004). In addition, I determine the primary environmental variables responsible for shaping polychaete distributional patterns and species richness.

3.2 Materials and Methods

3.2.1 Dataset collection and quality control

The datasets used in the present study were primarily obtained from GBIF and OBIS, downloaded on 10 June 2018 (Appendix 3.1). In addition to these, I added Indonesian polychaete records published in Pamungkas & Glasby (2019) as most records in that geographic region were not in GBIF and OBIS. Each dataset from GBIF and OBIS was first prepared by removing records without a species name or geocoordinates. To ensure the use of data with high coordinate accuracy, I omitted records without coordinate uncertainty or with coordinate uncertainty of more than 10 km. This 10 km figure is a compromise between retaining existing record accuracy – most records have less than 1 km of coordinate uncertainty – recognising small islands, and keeping each record within one degree of latitude, i.e., about 111 km. Duplicated records with the same species name, latitude and longitude, depth and collection date, were also removed (Appendix 3.2 & 3.3). Both datasets were then merged, and duplicates between the two datasets were removed (Appendix 3.4). To reconcile synonyms and misspellings, the nomenclature of polychaete species names was verified using 'Taxon match' in the World Register of Marine Species (WoRMS). The final dataset used for analyses in this study is available at https://auckland.figshare.com/articles/dataset/Global_polychaete_data_csv/12401993.

3.2.2 Polychaete biogeographic regions and indicator species

All polychaete occurrence records were mapped using ArcGIS version 10.4.1. Records that were mapped inland were either corrected (based on the locality information given in the dataset) or removed (if no locality information was given). The interactive web application 'Infomap Bioregions' (http://bioregions.mapequation.org) was then used to objectively identify polychaete biogeographic regions based on latitude-longitude coordinates for all species records (Edler et al., 2016). For the spatial resolution, I used grid cells of 4^{o} to reflect spatial differences in data density. The maximum and the minimum cell capacities were set to 100 and 50 occurrence records, respectively. For the clustering algorithm, I set the numbers of trials and cluster cost to 1 and 1.5, respectively, to identify major polychaete biogeographic regions. 'Infomap Bioregions' uses neural network theory to map the similarity of cells based on their species composition. In doing so, it identified the most common and indicative polychaete species in each biogeographic region. In addition to this, I calculated the percentage of endemic polychaete species in each region.

3.2.3 Analyses

Following the methods of Chaudhary et al. (2017), the latitudinal gradient was examined using three metrics, i.e., alpha, gamma and estimated species richness. As alpha and gamma species richness were biased by uneven numbers of records between latitudinal bands, I performed the rarefaction method of Hurlbert (1971) in R using the 'vegan' package (Appendix 3.5). The analysis calculated the expected number of species in each 5^{o} latitudinal band per repeatedly sampled 50 occurrence records, i.e., the so-called E(S50). The basic equation used was:

$$\mathbf{E(S_n) = {}^{\Sigma}{}_{i}\ [1—({}^{N—N}{}_{in})/({}^{N}{}_{n})]}$$

where **E(Sn)** is defined as the expected number of species in a sample of **(n)** records, selected randomly from a sample containing **(N)** records and **(S)** species. E(S50) was much less biased by sampling effort. I then ran a Generalised Additive Model (GAM) using R (Appendix 3.6) to define the best non-linear model fitting the latitudinal gradients in species richness (Hastie & Tibshirani, 1990), i.e., whether it shows a uni-, bi- or multimodal pattern.

Using the non-parametric Spearman rank correlation analysis, I correlated E(S50) and E(S30) with a number of environmental variables per 5^{o} latitudinal band and 5^{o} cell, respectively. All environmental datasets, i.e., sea surface and bottom temperatures, salinity, primary productivity, particulate organic carbon, depth, slope, distance from land and sea-to-land ratio, were retrieved from the Global Marine Environment Datasets (GMED) (Basher et al., 2018) and were analysed using MATLAB R2018.

3.3 Results

3.3.1 Geographical distribution

Most polychaete records and species, i.e., over 75%, were coastal (Figure 3.1) and within 2.5 km of land (Figure 3.4). Consequently, fewer species were found in latitudinal bands with more sea than land, which reflect less coastal area (Appendix 3.7). The number of species tended to decline with depth (Figure 3.4). The coasts of some temperate and subtropical regions, i.e., Europe, Australia and New Zealand, had the most records and species. In the tropics, most records and species were centred in Indonesia, and in polar waters more occurred in the Antarctic than Arctic (Figure 3.1). Of all polychaete families, spionids had the most records (over 62,000 records), followed by serpulids and terebellids with over 28,000 records each (Appendix 3.8).

I identified 11 major polychaete biogeographic regions (Figure 3.1). Regions with the most polychaete species were, in order, North Atlantic (including eastern and western parts of Mediterranean Sea), Australia and Indonesia, whereas regions with the least species were the eastern Pacific Ocean, Caribbean Sea and Atlantic Ocean (Table 3.1). Despite being the region with the most polychaete species, the North Atlantic had the lowest indicative species score (1), whereas Indonesia had the highest indicative species score (291) (Table 3.1). These scores mean that the indicative species of the North Atlantic have the same frequency of occurrence there as in the other regions, whereas those of Indonesia are 291 times more frequent in this biogeographic region than the other regions (the indicative species of Indonesia are thus far more distinctive than those of the North Atlantic). Of the 11 biogeographic regions, seven regions had more than 50% endemicity of polychaete species (Table 3.1). The eastern part of the Pacific Ocean and the Central Mediterranean Sea had the highest (100%) and the lowest (5%) percentage of endemic polychaete species, respectively (Table 3.1) (here, I define ‘endemic species’ as species unique to a biogeographic region as defined in this study).

Table 3.1 The major polychaete biogeographic regions mapped (sorted on species richness) in comparison with marine regions outlined by Spalding et al. (2007) and Costello et al. (2017). A cell represents an area with 4^{o} grid-cell resolution.

Region	Location(s)	Records	Species	Cells	Most common species (record)	Most indicative species (score)	% endemic species	Spalding et al. (2007)	Costello et al. (2017)
1	North Atlantic & eastern and western parts of Mediterranean	494766	1144	41	*Lanice conchilega* (11004)	*Pygospio elegans, Nephtys cirrosa, Pholoe baltica, Pseudopolydora pulchra, Scalibregma celticum, Ophelia borealis, Polycirrus norvegicus, Dipolydora caulleryi, Ampharete falcata, Paranaitis kosteriensis* (1)	62.4	Temperate Northern Atlantic	Northeast Atlantic, Norwegian Sea & Mediterranean
2	Australia	13292	1111	24	*Aglaophamus australiensis* (295)	*Longicarpus modestus, Pista australis, Spio blakei, Armandia intermedia, Nephtys inornata, Micronephthys oculifera, Galeolaria gemineoa, Prionospio tridentata, Mediomastus australiensis* (37)	65.9	Central Indo-Pacific & Temperate Australasia	Coral Sea & South Australia
3	Indonesia	1571	513	11	*Leodice antennata* (38)	*Ceratonereis tentaculata, Tomopteris nationalis, Leanira coeca, Glycera longipinnis, Opisthosyllis australis, Phyllochaetopterus claparedii, Polyodontes atromarginatus, Lumbrineris latereilli, Loimia nigrifilis, Lysidice oele* (291)	62.3	Central Indo-Pacific	Indo-Pacific Seas & Indian Ocean
4	New Zealand	5659	381	10	*Hyalinoecia tubicola* (193)	*Armandia maculata, Asychis trifilosus, Scolecolepides benhami, Boccardia syrtis, Sthenelais chathamensis, Lepidonotus polychromus, Pomatoceros caeruleus, Phylo novaezealandiae, Neosabellaria kaiparaensis, Paradiopatra minuta* (57)	35.5	Temperate Australasia	New Zealand

Region	Location(s)	Records	Species	Cells	Most common species (record)	Most indicative species (score)	% endemic species	Spalding et al. (2007)	Costello et al. (2017)
5	The Atlantic coasts of Spain & France	928	216	3	*Glycera papillosa* (46)	*Lumbrinerides laubieri, Poecilochaetus fulgoris, Paradoneis abranchiata, Exogone furcigera, Sclerobregma branchiata, Microrbinia linea, Paraonides rubriceps, Lumbrineriopsis gasconiensis, Diplobrachia capillaris, Bonellia plumosa* (240)	20.7	Temperate Northern Atlantic	Northwest North Atlantic
6	Antarctica & the southern coast of Argentina	1983	207	17	*Pelagobia longicirrata* (103)	*Spiophanes tcherniai, Amythas membranifera, Polycirrus kerguelensis, Lanicides vayssierei, Genetyllis polyphylla, Epigamia charcoti, Ophryotrocha notialis, Capitella perarmata, Thelepides koehleri, Terebellides* spp. (107)	50.8	Southern Ocean & Temperate South America	Southern Ocean & Argentina
7	Central Mediterranean Sea	5066	197	6	*Sabella spallanzanii* (631)	*Perinereis macropus, Protobonellia brevirhynchus, Spirobranchus lima, Adercodon pleijeli* (18)	5.1	Temperate Northern Atlantic	Mediterranean
8	The western coast of the USA	419	87	3	*Phragmatopoma californica* (156)	*Phyllodoce medipapillata, Dorvillea moniloceras, Pareurythoe californica, Pista pacifica, Spirobranchus spinosus, Megasyllis nipponica, Glycera robusta, Odontosyllis phosphorea, Lepidonotus spiculus, Hermadionella truncata* (71)	77.4	Temperate Northern Pacific	North Pacific

Region	Location(s)	Records	Species	Cells	Most common species (record)	Most indicative species (score)	% endemic species	Spalding et al. (2007)	Costello et al. (2017)
9	The eastern part of the Pacific Ocean	574	31	3	*Paralvinella grasslei* (52)	*Branchinotogluma sandersi, Branchiplicatus cupreus, Branchipolynoe symmytilida, Paralvinella pandorae, Thermiphione risensis, Protis hydrothermica, Lepidonotopodium riftense, Nicomache arwidssoni, Sirsoe hessleri, Malacoceros samurai* (213)	100	Tropical Eastern Pacific & Eastern Indo-Pacific	Southeast Pacific & Gulf of California
10	Caribbean Sea	243	16	3	*Spirobranchus giganteus* (67)	*Notaulax nudicollis, Eupolymnia crassicornis, Notopygos caribea, Hydroides mongeslopezi* (165)	44.4	Tropical Atlantic	Carribean & Gulf of Mexico
11	Atlantic Ocean	254	15	2	*Branchipolynoe seepensis* (80)	*Lepidonotopodium jouinae, Prionospio unilamellata, Laonice asaccata, Ophryotrocha fabriae, Neomicrorbis azoricus* (138)	62.5	Temperate Northern Atlantic	Offshore & Northwest North Atlantic

Biogeographic regions for which our study lacked data are: Arctic, Western Indo-Pacific and Temperate Southern Africa (in Spalding et al. 2007), as well as Arctic Seas, Gulf of Aqaba, Aden, Suez & Red Sea, South Africa, Black Sea, Chile, Inner Baltic Sea, North American Boreal, Northwest Pacific, Offshore Indian Ocean, Offshore middleeast Pacific, Offshore South Atlantic, Offshore West Pacific, Tasman Sea and Tropical East Atlantic (in Costello et al. 2017). Biogeographic regions that were relatively data-poor in the study of Glasby (2005) included Southwest Atlantic, Red Sea, Greater New Zeland, Peruvian, Magellan, and West Atlantic and South Georgia, which all had fewer than 2% of the total number of species records in the study.

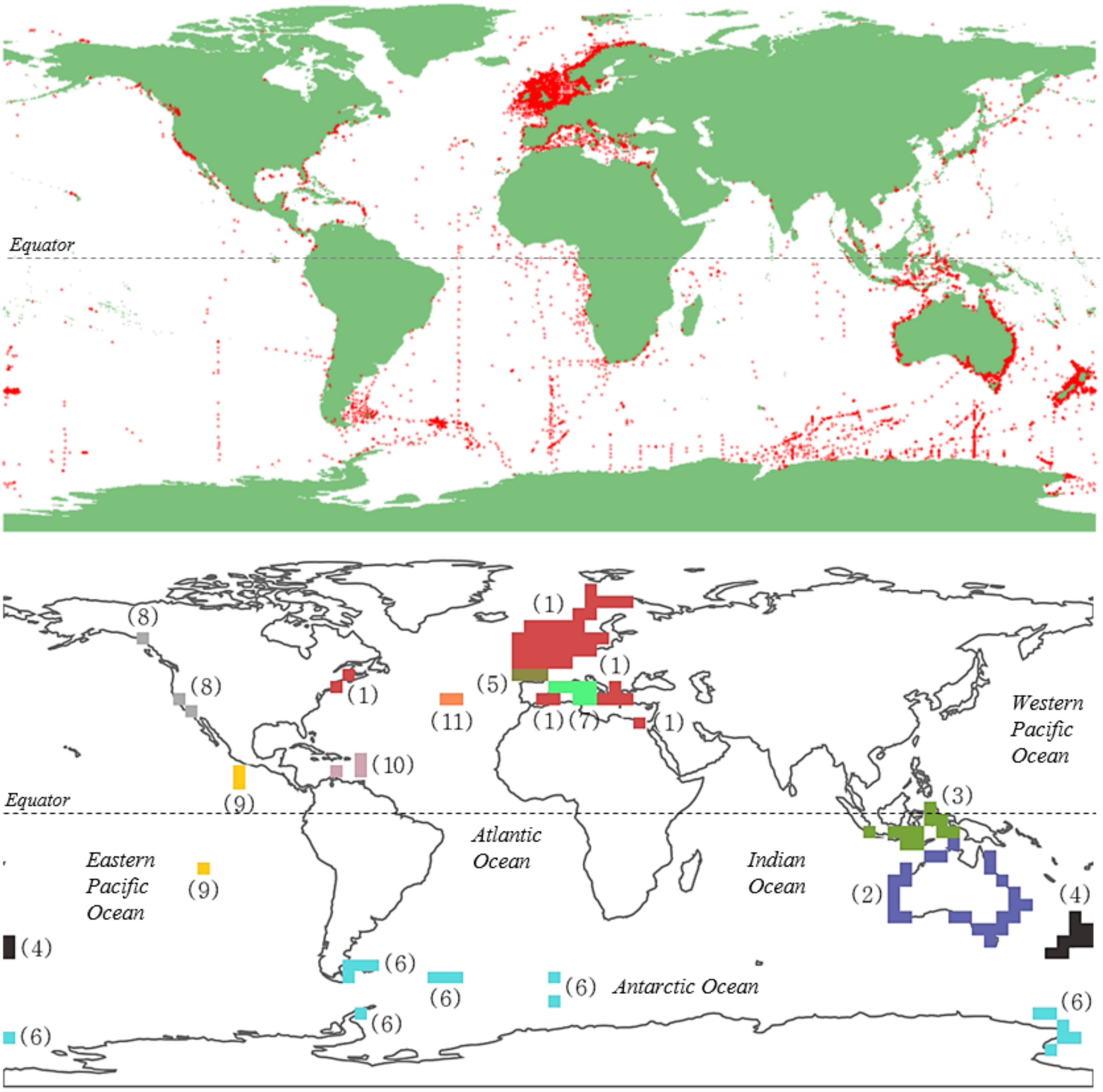

Figure 3.1 Map of polychaete occurrence records (above) and biogeographic regions (below – see Table 3.1 for the details).

3.3.2 Latitudinal distribution

The analysis of over 550,000 cleaned polychaete occurrence records (3415 species, 77 families) (Appendix 3.4 & 3.8) showed significantly more records in the northern (over 500,000 records) than the southern hemisphere (over 26,000 records) (Figure 3.2A). Similarly, the average number of polychaete species, including the data variance, was generally higher in the northern than the southern hemisphere (Figure 3.2A). However, the total number of species was higher in the southern (about 2100 species, 67 families) than the northern (about 1800 species, 75 families) hemisphere (Figure 3.2B). A similar pattern of slightly higher species numbers in the southern hemisphere was also observed for each of the two major clades (i.e., Errantia and Sedentaria), although Sedentaria appeared to be relatively less speciose than Errantia between 5ºN and 10ºS (Figure 3.2C).

The latitudinal gradient of alpha species richness (average per latitudinal band) was bimodal and much higher in the northern than southern hemisphere (Figures 3.2A & 3.3A). Gamma (total) species richness for all errant and sedentary species was more symmetrically bimodal with peak at around 55ºN and slightly higher one at 35ºS, and a dip north of the Equator between 15ºN and 30ºN (Figures 3.2B, C & 3.3B). I found that both alpha and gamma species richness were highly correlated with the number of occurrence records (Appendix 3.9), suggesting that the pattern was driven by uneven sampling effort. Nevertheless, my rarefaction analysis, which adjusted for the uneven sampling effort across latitudinal bands, found that the latitudinal species richness gradient of polychaetes, i.e., the E(S50) remained bimodal with the peaks at around 60ºN and 30ºS, and a dip at around 15ºN (Figure 3.2D). Supporting this, my GAM also showed the pattern to be bimodal (Figure 3.3C). This further indicates that the bimodality is unlikely to be due to sampling bias, and that the southern hemisphere has higher species richness than northern.

There were significant correlations between the E(S30) and all environmental variables in each 5º cell, except particulate organic carbon and slope (Figure 3.4). All correlation coefficients were positive except the coefficients for depth and distance from land (Figure 3.4). For latitudinal bands, there was a moderate, positive correlation between the E(S50) and the sea surface temperature and salinity, and negative with the sea-to-land ratio (Appendix 3.7).

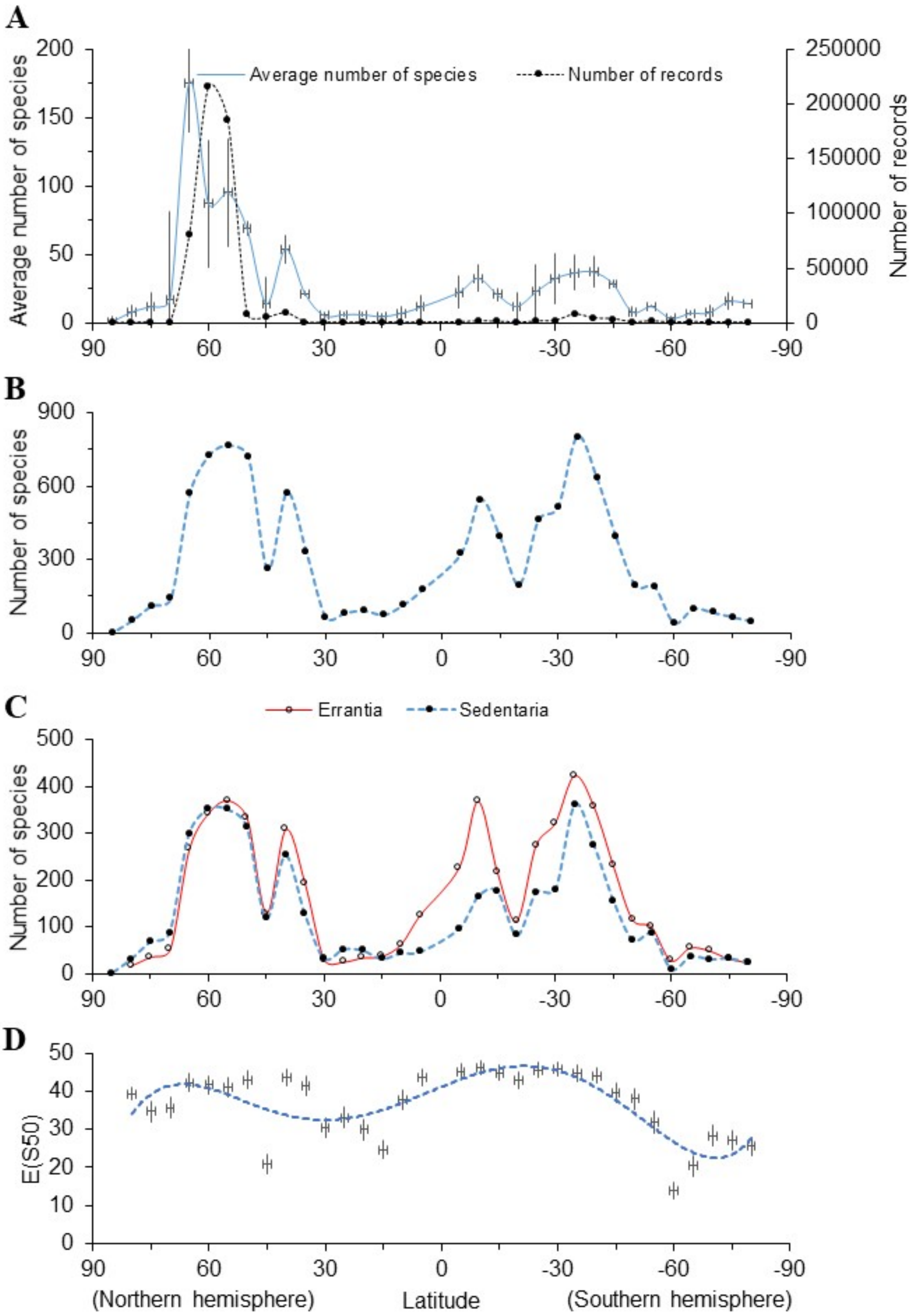

Figure 3.2 (A) Alpha species richness (calculated as means of species number ± standard erors with two-point moving average trend line) and record numbers. (B) Gamma species richness (all species). (C) Gamma species richness (errant and sedentary species). (D) E(S50).

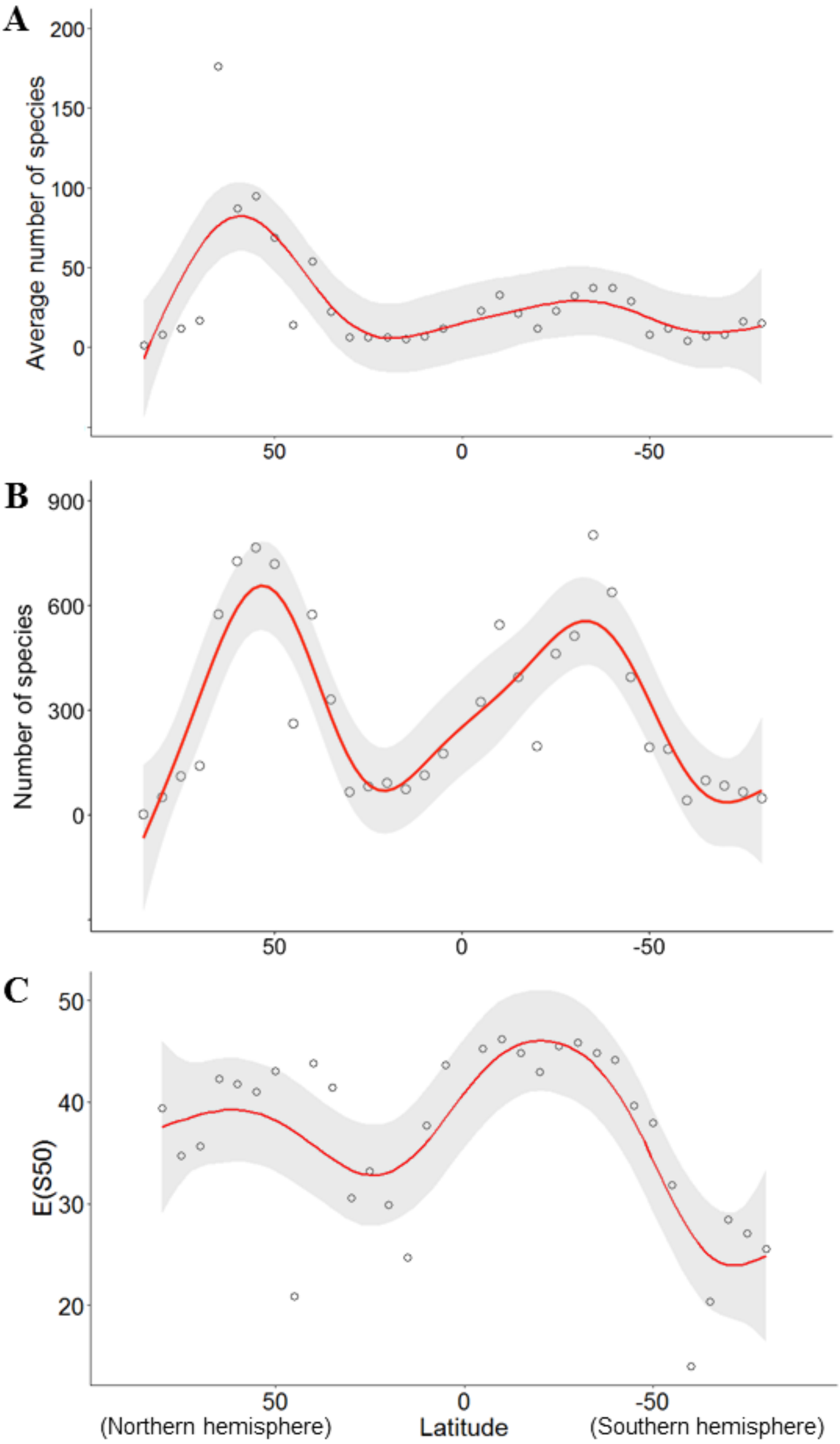

Figure 3.3 GAMs of the (A) alpha species richness, (B) gamma species richness and (C) E(S50). The solid red lines are the best non-linear models, smoothed using the Restricted Maximum Likelihood (REML) method (see Appendix 3.6). Grey shadings are the standard errors, whereas empty circles are the data points.

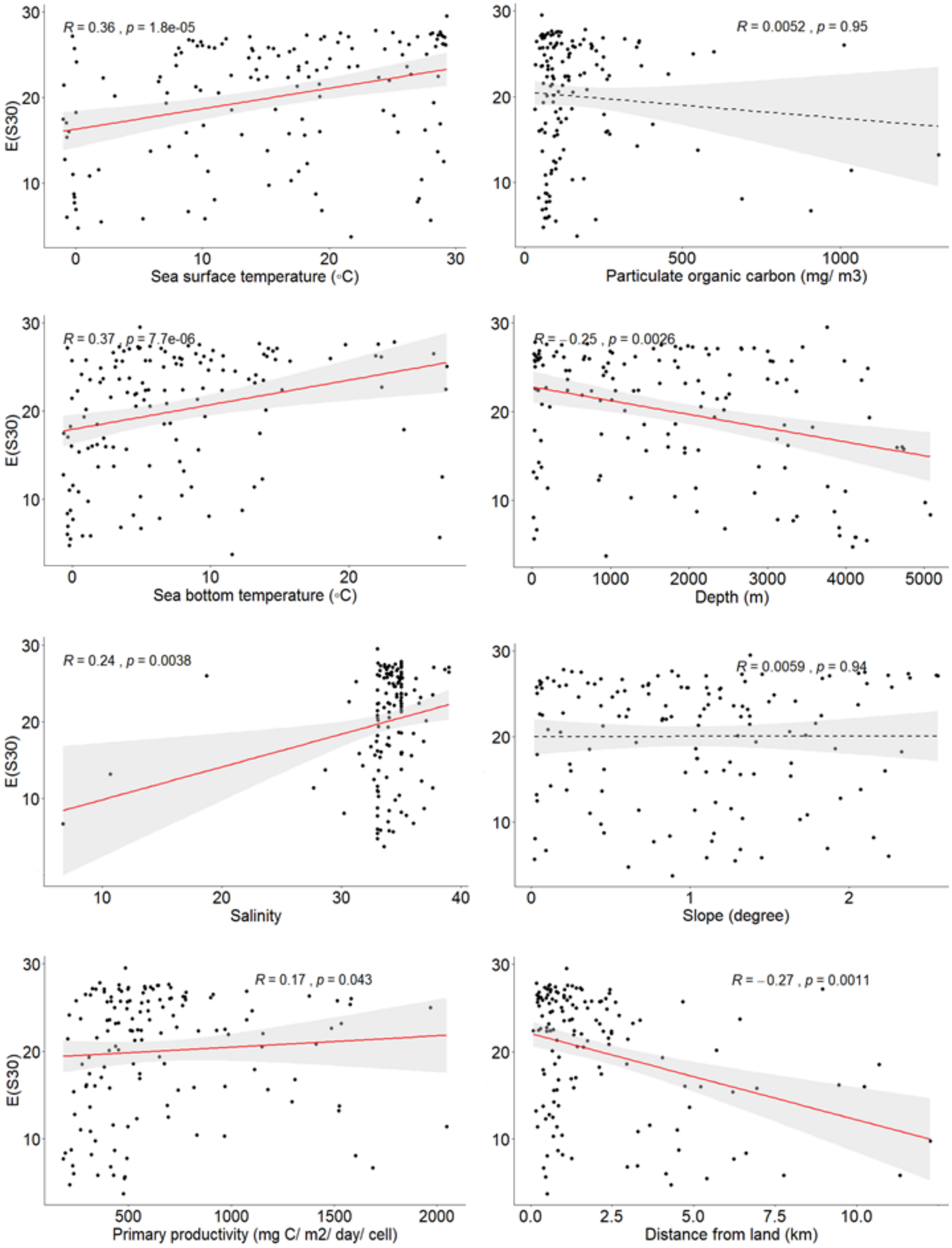

Figure 3.4 Spearman correlation analyses between the E(S30) and various environmental variables in each 5° grid-cell resolution. *R* is the Spearman's correlation coefficient. The analysis is significant and very significant when *p* value < 0.05 and < 0.01 or < 0.001, respectively. Visually, red-solid and black-dashed linear regression lines also indicate significant and non-significant analysis results, respectively. Grey shadings are the standard errors.

3.4 Discussion

3.4.1 Geographical distribution

I found that Europe and its surroundings had the most records – and therefore have published the most polychaete data – followed by Australia and New Zealand. More records were also found in Antarctic than Arctic waters, and in Indonesia than other tropical regions (Figure 3.1). That most polychaete records were coastal is in line with the general pattern for marine species (Costello et al., 2017; Costello & Chaudhary, 2017).

The 11 polychaete biogeographic regions identified in this study largely coincide with the marine biogeographic regions proposed by Spalding et al. (2007) and determined from data analysis by Costello et al. (2017). They also closely coincide with the 24 biogeographic regions outlined by Glasby (2005), which were based on sponge and polychaete distributions, albeit some adjacent regions of Glasby (2005) were combined in the present study (e.g., temperate and tropical Australia). However, due to insufficient data particularly for Africa, South America and the deep sea in general, the present study did not recover previously defined biogeographic regions such as the Arctic Seas, Black Sea (studies by Arvanitidis et al. (2002, 2009), Surugiu et al. (2010) and Costello et al. (2017) found this area as a distinct marine biogeographic region from the Mediterranean Sea), Chile, Inner Baltic Sea, North American Boreal, Northwest Pacific, offshore Indian Ocean, middle east Pacific, South Atlantic and West Pacific Oceans, South Africa, Tasman Sea, Tropical East Atlantic as well as the Western Indo-Pacific (Table 3.1). Further, some biogeographic regions recognized in this study were subdivided into smaller units in other studies For example, biogeographic region 6, i.e., Antarctica and the southern coast of Argentina, which here includes the entire Southern Ocean, comprised several distinct regions including East Antarctic, West Antarctic – South Georgia and Magellan in the polychaete biogeography study of Glasby & Alvarez (1999) and Glasby (2005). My recognition of region 6, nevertheless, agrees with several all-taxa studies considering the Antarctic and Southern Ocean to be one biogeographic region (Ekman, 1953; Spalding et al., 2007; Costello et al., 2017). Reasons for the recognition of a combined Antarctic plus Southern Ocean area seem to reflect the larger amount of data available (Glasby & Alvarez (1999) and Glasby (2005) only analysed six families and ten clades of polychaetes, respectively); it may also reflect spatial biases where particular geographic areas may have been sampled differently (e.g., sediments or epifauna). Obtaining polychaete data from poorly-known areas and utilizing all available data using a standard biogeographic methodology are thus a priority for further research.

Biogeographic region 1, i.e., the North Atlantic excluding the coast of Spain and France facing Biscay Bay, was found to be the region with the most polychaete species reflecting its large area and survey effort. Yet, the score of the indicative species of this region was the lowest among all biogeographic regions (Table 3.1) as polychaete species from the North Atlantic occurred in many geographic cells. By contrast, Indonesia (region 3) had the highest score and was the third most species-rich biogeographic region in the world despite a relatively low number of records (Table 3.1). The high polychaete species richness and endemicity in this area is not surprising as the region is part of the Coral Triangle (CT), so named because it is a globally rich region for corals (Veron et al., 2009) fish and other species (e.g., Asaad et al., 2018).

Despite located near region 1, the Bay of Biscay coast of Spain and France (region 5) and the central part of the Mediterranean Sea (region 7) were identified as distinct biogeographic regions. However, I caution regarding the indicative species of these regions as endemic because the data were taken from 42 locations only. To the best of my knowledge, almost all of the indicative species of both regions have not been reported elsewhere since their first descriptions. Rarely, these seemingly endemic species have been reported a considerable distance outside the study area – for example, one of the indicative species of region 5, i.e., *Microrbinia linea*, was also reported in the China Sea (Liu & Liu, 2008). This outlier, and others, may however represent a misidentification; taxonomic revisions are the basis to improving the accuracy of species name in global datasets. Thus, regions 5 and 7 may be part of region 1, following the warm-temperate Lusitania Province proposed by Briggs & Bowen (2012), which includes largely coastal areas of southern Britain and Ireland, extending south to southern Morocco, and eastwards through the Mediterranean Sea. Similarly, Spalding et al. (2007) considered coastal Europe (including Bay of Biscay) and Mediterranean Sea as one marine biogeographic realm (i.e., Temperate Northern Atlantic), albeit comprising six provinces. Also, the species distribution data analyses by Costello et al. (2017) defined North East Atlantic and Mediterranean as one biogeographic realm.

Further, I found that most of the polychaete biogeographic regions were coastal, but some were offshore, such as those situated in the offshore northern Atlantic, Antarctic and eastern Pacific Oceans (regions 11, 6 and 9, respectively) (Figure 3.1). These biogeographic regions were dominated by deep-sea polychaete species associated with hydrothermal vent habitat. In fact, all indicative species of region 11 were described from the deep-sea environment of the area, and four of the five species were obtained from hydrothermal vents (Zibrowius, 1972; Desbruyères & Hourdez, 2000; Sigvaldadóttir & Desbruyères, 2003; Paxton & Morineaux, 2009). Similarly, all indicative species of region 9 were originally described from a similar hydrothermal vent habitat (Pettibone, 1984a,b, 1985a,b, 1986; Blake, 1985, 1991; Desbruyères & Laubier, 1986; ten Hove & Zibrowius, 1986; Hourdez et al., 2006), all of whose species were not recorded elsewhere (Table 3.1). Whether these regions are really biogeographic regions or reflect rare sampling of unique deep-sea habitats merits more research using more data from vents around the world and non-vent habitats in the geographic regions.

3.4.2 Latitudinal distribution

The total number of polychaete species was slightly higher in the southern hemisphere despite about twenty times more samples in the northern than southern hemispheres (Figure 3.2 A, B, C). These findings contradict the pattern of most marine taxa where species richness generally peaked in the northern hemisphere (Chaudhary et al., 2016, 2017; Chaudhary, 2019), but are similar to the pattern of a few taxa such as fish, shark and rays, stony corals (Chaudhary, 2019) and amphipods (Arfianti & Costello, 2020) when sampling bias is accounted for (Appendix 3.10). In my study, the elevated polychaete species richness in the southern hemisphere may be driven by high endemicity as species richness and endemicity have been found to be positively correlated (Costello et al., 2017). Moreover, when the brackish Black and Baltic Seas are excluded, an all-taxon study suggested that endemicity may be higher in the southern than northern hemisphere regions (47% vs 40%) (Costello et al., 2017). Indeed, a comparison of the number of endemic species (per biogeographic region) shows about 1300 endemic species occur in the southern hemisphere and about 870 endemic species occur in the northern one (62% vs 48%).

A less likely explanation for the greater number of polychaete species in the southern than northern hemisphere is the adoption of northern hemisphere species names by polychaete workers of the southern hemisphere (see a review by Hutchings & Kupriyanova, 2018). This may have, in small part, artificially inflated the number of species in the southern hemisphere, and at the same time hidden the distinctive, largely endemic fauna in the southern hemisphere which was first revealed in revisionary morphological taxonomic studies (Hutchings & Glasby, 1991), and more recently by molecular studies. However, my analysis of species occurring in both hemispheres indicated that less than 1% (5 of about 500) of species occurring in both hemispheres may be the result of suspected misidentification (Appendix 3.11), so taxonomic bias would appear to have little influence on the patterns observed in this study. Also, the number of polychaete species documented in the present study (i.e., about 3400 species) is much less than the total named species (i.e., nearly 11,500). Therefore, the use of a larger sample of polychaete species, underpinned by improved taxonomy, will undoubtedly provide additional insights into the large scale biogeography of polychaetes.

The bimodal latitudinal gradient in alpha, gamma and E(S50) species richness for polychaetes (Figures 3.2 & 3.3) supports the findings of Chaudhary et al. (2016, 2017) of bimodality of overall marine species. My results are thus in line with the latitudinal species richness gradient of various marine groups such as amphipods (Arfianti & Costello, 2020), bivalves (Crame, 2000, 2001, 2002), brachiopods (Shen & Shi, 2004), planktonic organisms (Brayard et al., 2005), razor clams (Saeedi et al., 2017), sea anemones (Fautin et al., 2013), seaweeds (Bolton, 1994; Kerswell, 2006) and zooplankton (Rutherford et al., 1999), as well as with the latitudinal species richness gradient of some terrestrial groups like amphibians, reptiles, birds and mammals (McCoy & Connor, 1980; Currie, 1991; Sax, 2001). However, most of the authors of these studies did not explicitly state the pattern to be bimodal, either because the pattern was not noticed, or the drop in species richness near the Equator was considered to be due to a lack of data. The pattern was first noticed and reinterpreted to be bimodal by Chaudhary et al. (2016).

The results of the present study thus strongly contradict the findings of other studies suggesting that the latitudinal gradient in polychaete species richness either does not exist (Gobin & Warwick, 2006) or is unimodal (Giangrande & Licciano, 2004). The former study had only 14-77 polychaete species from 15 sampling sites at four geographic locations, whereas the latter study was limited to 428 species of the family Sabellidae. Our study advances these by including about 3400 species in 85 families sampled across 10,000 sampling sites around the globe, resulting in the bimodal pattern in polychaete species richness. I show that alpha and gamma species richness-based latitudinal gradients are biased by uneven sampling effort across the globe. However, our rarefaction index E(S50) and GAM, which corrected for sampling effort, demonstrated that the pattern remains bimodal (Figure 3.3C). This indicates that the bimodal pattern in polychaete species richness is not an artefact, but rather a natural phenomenon.

Chaudhary et al. (2016) proposed that sea surface temperature was the primary factor causing the dip in marine species richness in the tropics. That is, the equatorial region may already be too hot from climate warming; some marine species may have moved to higher latitudes as has been observed for marine fish (e.g., Perry et al., 2005; Nye et al., 2009; Last et al., 2011). Polychaete species composition in an area is generally influenced by a range of abiotic factors such as food availability (e.g., Snelgrove & Butman, 1994; Haedrich et al., 2008), sediment type (Etter & Grassle, 1992), habitat complexity (Serrano & Preciado, 2007), salinity (Stephenson et al., 1979) and environmental disturbances (Gray, 1997). However, these factors influence distributions of marine species at local habitat scales rather than biogeographic scales. Sea temperature, in contrast, influences both local and global distributions of marine species due to its pervading effects on individual growth, reproduction and physiology, as well as the limits of species geographic distributions. Of all the potential environmental variables, sea surface temperature is also the only one that is relatively symmetrical with latitude, and is possibly the primary factor shaping the bimodal pattern in polychaete species richness.

Further, that polychaete species number tends to decrease with depth support the findings of studies by Carvalho et al. (2013) and Gunton et al. (2015) for polychaetes, and Costello & Chaudhary (2017) for marine species in general. Poor food supply in the deep-sea environment (I define ‘deep-sea environment’ as the pelagic and benthic zones below 200 m), which results in low environmental disturbance, growth and competitive displacement rates, may be an explanation (Cosson-Sarradin et al., 1998). Habitat homogeneity and lower temperatures have also been linked to lower species richness in the deep sea compared to continental shelves (Costello & Chaudhary, 2017). I also note that deep-sea species are in general poorly-documented (Smith et al., 2006). In many parts of the world’s oceans, as my data indicated, no deep-sea species have even been reported. Information gaps in Earth’s polychaete diversity can, therefore, be filled by further targeting collecting of this data-poor habitat, as well as other habitats with high marine species richness such as coral reef ecosystems. More researchers and research institutions also need to make their datasets publicly available – this ideally includes data of published literature – so that other scientists can make use of them to better study the distribution of marine species (e.g., Costello, 2009; Costello et al., 2013). More detailed morphological and molecular studies are also likely to reveal a large increase in polychaete diversity not only in poorly-studied areas, but also in well-studied areas (for example, Lavesque et al. (2017) identified a large intertidal polychaete as a new *Marphysa* species from *M. sanguinea* complex collected from a well-studied area, i.e., Bay of Biscay, Northeast Atlantic). Indeed, when the data gaps from poorly-sampled geographic areas are filled, and datasets are made fully available as I found by compiling data for Indonesia, and more detailed taxonomic studies are conducted, it may provide new insights into the latitudinal gradients and biogeographic regions recognised here.

Chapter 4

Status of polychaete (Annelida) taxonomy in Indonesia, including a checklist of Indonesian species

Abstracts

Despite some past remarkable marine expeditions in the seas surrounding the Indo-Malay Archipelago, a checklist of Indonesian polychaete species has never been published to date. In this paper, an inventory of species was created based mainly on existing published literature. All records of Indonesian polychaetes were mapped, and this indicated a preponderance of deep-sea records in the Wallacea region, which were primarily collected by the Dutch Siboga Expedition at the turn of the 19th century. Most biodiversity studies on the fauna by local scientists have been ecological in nature and conducted in shallow water. Many specimens were not identified to species level and not vouchered in a recognised institution. Since the mid 1700s, 580 valid polychaete species (51 families) have been identified by 37 first authors in 90 taxonomic publications. Of these species, 301 species (40 families) were new to science and mostly described by R. Horst and M. Caullery. An additional 133 polychaete species and four polychaete families are also known from the species records of the Global Biodiversity Information Facility and the Ocean Biogeographic Information System. Altogether, there have been 713 polychaete species (55 families) identified from Indonesian waters. The three largest polychaete repositories in Indonesia, i.e., the Museum Zoologicum Bogoriense in Bogor, Research Center for Deep Sea in Ambon, and Research Center for Oceanography in Jakarta, were examined, and I found that the collections at each institution were mostly unidentified, unpublished, and not databased, suggesting that the taxonomic study of the polychaete fauna, at least locally, has been largely overlooked. Despite some challenges, international collaborative research may be the solution to improve the knowledge of the polychaete fauna of this species-rich, yet poorly known geographic region.

4.1 Introduction

In some parts of the world, the ubiquitous, largely marine polychaetes (Annelida) remain poorly studied. The Indo-Malay Archipelago, and especially its most populous nation, Indonesia, is one of them. Despite its exceptional marine biodiversity – the country is part of the Coral Triangle, has about 17,500 islands and coastline in excess of over 80,000 km (Tomascik et al., 1997) straddling two continental shelves (Sunda and Sahul) including Wallacea – little attention has been paid to this ecologically important group of invertebrates in Indonesia (Glasby & Al-Hakim, 2017).

The initial study on Indonesian polychaetes probably dates back to Rumphius (1627–1702), a prominent German naturalist who was based in Ambon, Province of Maluku, as an agent for the Dutch United East Indian Company. During his stay on the island, Rumphius (1705) observed *wawo* worms, i.e., the local name for the annually swarming *palolo* polychaetes (Pamungkas, 2011). One *wawo* species was described by Horst (1902) as *Lysidice oele* (Eunicidae). More than three centuries after Rumphius' initial observations, a more complete estimate of the species composition of the swarming animals was provided by Martens et al. (1995), Pamungkas (2015a), and Pamungkas & Glasby (2015).

Historically, the Siboga Expedition (1899–1900) was the most remarkable marine expedition in Indonesian waters conducted to date. The expedition yielded most of the total number of Indonesian polychaete specimens archived in museums today. Subsequent taxonomic publications on the material indicate that none of the specimens can be found at the Museum

Zoologicum Bogoriense (MZB), i.e., the only internationally accredited zoological museum of the country established in 1894, five years prior to the start of the Expedition. Bleeker & van der Spoel (1992) did not indicate any Indonesian repository in their catalogue of Siboga polychaetes. Rather, it appears that all of the specimens were returned to the Netherlands and deposited in museums in Amsterdam and Leiden. Now they mostly reside at the Naturalis Biodiversity Center (NBC), Leiden, after the Zoological Museum Amsterdam collections were subsumed into the NBC.

The polychaete specimens collected during the Siboga Expedition have been studied by a number of polychaete workers across the globe, past and present (Glasby & Al-Hakim, 2017). The Errantia groups, for instance, were studied by Horst (1902, 1903, 1910, 1911, 1912, 1913, 1915, 1916a, b, c, 1917, 1918b, 1919b, 1921, 1924), Pettibone (1970, 1971), Hutchings & McRae (1993), and Aguado et al. (2008), whereas the Sedentaria groups were investigated by Caullery (1914c, 1915a, b, c, d, 1944a, b), Mesnil & Fauvel (1939) and Southward (1961). Further, Glasby & Al-Hakim (2017) listed all marine expeditions and fieldwork that collected polychaete materials from the Indo-Malay-Philippines Archipelago and surrounding seas. They found that most of the polychaete material were subsequently scattered across many different natural history museums of the world, and that most are still undetermined. It is thus not surprising that the Indonesian polychaete fauna remains poorly known. In the present study, I provide the first step toward an improved knowledge of the fauna: an inventory of Indonesian polychaete species, accompanied by biodiversity statistics, and identification of repositories as well as a list of relevant literature and associated datasets.

4.2 Material and Methods

4.2.1 Taxonomic and geographic scope

The primary taxonomic units used in the present study were valid species, genera and families as currently indicated in the World Register of Marine Species (WoRMS). Subspecies were elevated to species level. The traditional concept of polychaetes was used as currently adopted in WoRMS, i.e., a non-monophyletic taxon within the phylum Annelida, excluding aphanoneurans (Aeolosomatidae and Potamodrilidae), clitellates, sipunculans, and myzostomids, but including echiurans and siboglinids (previously known as Pogonophora and Vestimentifera). Freshwater polychaetes are also included in this study, although only a few species are known from the Indonesian region (Glasby & Timm, 2008). The geographic scope of this study was Indonesia, including all coastal and offshore waters in its jurisdiction. The country is situated between 6°N and 11°S, and between 95°E and 141°E. It includes the biogeographical entity, Wallacea, lying between the Sunda Shelf to the west and the Sahul Shelf to the east.

4.2.2 Data collection

Polychaete data were mainly garnered from the published literature, including both taxonomic and ecological publications, containing lists of polychaete species collected from Indonesian waters up until December 2018 known to both authors. In addition, polychaete data in the Global Biodiversity Information Facility (GBIF) and the Ocean Biogeographic Information System (OBIS), downloaded on 26 December 2018, were also included after selection in R version 3.5.3 (Appendix 4.1, 4.2 & 4.3). In order to standardise taxonomic accuracy, species names listed in ecological publications were only taken into account if they were associated with voucher specimens and/or a polychaete taxonomist was known to be involved. Species identified to morphospecies (e.g., *Nereis* sp. A) were not included, unless they represented the only current record of the genus in which case their inclusion was considered useful for the added information at the genus level without unduly inflating species numbers. In order to visualise the areas where biodiversity studies on the fauna have been conducted, all polychaete records with coordinates were mapped using ArcGIS version 10.6.1 (records without coordinates were given approximate coordinates based on their detailed localities provided).

4.2.3 Repository visits

In order to properly assess the Indonesian polychaete collections, visits to each repository was necessary as their collection data are not currently online. The Research Center for Deep Sea (RCDS) in Ambon and MZB in Cibinong – the latter one is managed by the Research Center for Biology (RCB) – were visited by the author JP in November 2017 and February 2018, respectively, whereas a visit to the Research Center for Oceanography (RCO) in Jakarta was carried out by the author CG in 2005. An information update about the polychaete collection at the RCO was given by Hadiyanto through personal communication on 16 January 2019. Acronyms of institutional repositories housing Indonesian polychaete collections are listed in Table 4.1.

Table 4.1 Acronym of institutional repositories housing Indonesian polychaete collections. Institutions in Indonesia in bold.

Acronym	Institution	City	Country
AMS	Australian Museum	Sydney	Australia
BMNH	British Museum of Natural History	London	England
MNHM	Muséum National d'Histoire Naturelle	Paris	France
MZB	**Museum Zoologicum Bogoriense**	**Bogor**	**Indonesia**
NBC	Naturalis Biodiversity Center	Leiden	Netherlands
NRS	Naturhistoriska Riskmuseet Stockholm	Stockholm	Sweden
NTM	Northern Territory Museum	Darwin	Australia
RCB	**Research Center for Biology**	**Bogor**	**Indonesia**
RCDS	**Research Center for Deep Sea**	**Ambon**	**Indonesia**
RCO	**Research Center for Oceanography**	**Jakarta**	**Indonesia**
SMF	Naturmuseum und Forschunginstitut, Senckenberg	Frankfurt am Main	Germany
UCLA	University of California, Los Angeles	Los Angeles	USA
UPMSI	University of the Philippines Marine Science Institute	Quezon	Philippines
USNM	United States National Museum	Washington, D.C.	USA
WAM	Western Australian Museum	Perth	Australia
ZMB	Museum für Naturkunde	Berlin	Germany
ZMH	Zoological Museum Hamburg	Hamburg	Germany
ZMUC	Zoological Museum, University of Copenhagen	Copenhagen	Denmark
ZRC	Zoological Reference Collection	Singapore	Singapore

4.3 Results

4.3.1 Biodiversity studies

Most of Indonesian polychaete species were collected from offshore and deep-sea (more than 200 m deep) environments around Wallacea (Figure 4.1) by overseas voyages, notably the Siboga Expedition (Table 4.2). The polychaete materials obtained from these studies were deposited at overseas museums, largely at the NBC (Table 4.2). Over the last ~ 2.5 centuries, there have been 90 taxonomic publications on Indonesian polychaetes by 37 first authors. The first taxonomic publication on an Indonesian polychaete was probably the description of *Amphinome rostrata* (Amphinomidae) by Pallas (1766), although the pre-Linnaean publication of Seba (1734: plate 81) shows another amphinomid (unidentifiable) from Ambon (see Read, 2019). Pallas' specimen upon which the description was based was thought to have been also collected in Ambon by a Dutch physician and naturalist Dr. van Hoey, but now appears to have been lost (Glasby & Al-Hakim, 2017). Thereafter, there were no publications until the mid 1800s. The number of publications on Indonesian polychaetes then generally increased from 1 to 20 publications annually between the 1850s and 1910s, dropped to two publication in the 1980s despite some fluctuations, then increased again to 7–9 publications per annum in the last three decades. Until the end of the 1900s, the publications were solely made by overseas scientists (mostly European taxonomists) without the involvement of local scientists. The contribution of local scientists to polychaete identification of the country was relatively minor (i.e., about 70 species identified, two of which were new to science) and did not occur until early this century (Figure 4.2).

Studies on Indonesian polychaete fauna by local scientists were mostly ecological in nature and have yielded numerous specimens. The fauna was typically collected from various shallow water habitats such as estuaries (e.g., Nurmaulidiyah, 2005; Irmawan et al., 2010; Jauhara, 2012), mangroves (e.g., Indarjo et al., 2005; Junardi & Wardoyo, 2008; Romadhoni & Aunurohim, 2013; Priyandayani et al., 2018), seagrass beds (e.g., Hadiyanto, 2012; Wulansari et al., 2012; Rahman et al., 2013), coral reefs (e.g., Yusron, 1989) and subtidal habitats (e.g., Lumingas et al., 2011). Additionally, deep-sea polychaetes in East Nusa Tenggara were studied by Widianwari & Widianingsih (2011). Unfortunately, the polychaete materials obtained from these studies were usually not identified beyond family, rarely to species level, since the availability of regional keys is very limited. In most cases, local ecologists distinguished species by morphospecies names (e.g., *Nereis* sp. A) for statistical analysis purposes, or perhaps used old taxonomic literature such as Fauvel (1923, 1927) and Day (1967) to identify their specimens to species level, which resulted in polychaete species from temperate regions being reported in Indonesian waters (e.g., Hadiyanto, 2013, 2018) – this practice has been identified by Hutchings & Kupriyanova (2018) as one of the major causes of the emergence of the concept of cosmopolitan polychaete species. Typically, the materials were not registered in an accredited repository as most institutions in the country did not possess suitable storage facilities to archive biological specimens. The studies were also either unpublished (e.g., in the form of theses or reports) or published locally in Indonesian, which might limit their wider usage.

A limited number of polychaete taxonomic studies have been conducted by the RCO and RCDS, with two new species formally described by an Indonesian scientist up until 2018, i.e., *Polymastigos javaensis* (Pamungkas, 2015b) and *Capitella ambonensis* (Pamungkas, 2017) (Tables 4.2 & 4.4). However, accounts of informally described and vouchered polychaetes (in MZB, among others) in the publication of Al-Hakim & Glasby (2004) included a first record of the family Hartmaniellidae (*Hartmaniella* sp.) in Indonesian waters.

4.3.2 Species richness

From the years 1766 to 2018, 580 valid polychaete species in 51 families have been identified from Indonesian waters. Of these species, 301 species in 40 families were new to science (Table 4.2), which were mainly described by Horst and Caullery, who between them have described 198 species or about 35% of the known Indonesian polychaete species (Table 4.4). Most polychaetes were formally identified between the 1910's and 1940's, although a significant number of published names have appeared during the last decade of the 1900s (Figure 4.2).

Nereididae, Polynoidae, and Terebellidae respectively were the top three families with the most species, which are also among the top five most speciose families worldwide (Table 4.3). At the other end of the scale, 11 families (i.e., Cirratulidae, Cossuridae, Dorvilleidae, Eulepethidae, Iphionidae, Hartmaniellidae, Oenonidae, Poecilochaetidae Scalibregmatidae, Travisiidae, and Trichobranchidae) in Indonesian waters are only known from one or two species; surprisingly, two of these families (i.e., Cirratulidae, Dorvilleidae) are actually quite diverse worldwide with 291 and 201 species, respectively (Pamungkas et al., 2019). Compared to the numbers of known polychaete species of the world, the numbers of known Indonesian polychaete species are very low (Table 4.3).

The GBIF and OBIS datasets yielded 300 species names, of which almost half (133 species, 36 families) were additional to the species names from the literature; there were four additional families (i.e., Alciopidae, Arenicolidae, Lopadorrhynchidae, and Poecilochaetidae) (Table 4.2). Most of the species data in the GBIF and OBIS datasets are linked to voucher specimens, but the specimens have not been described in taxonomic publications (Table 4.2), so their species identifications need verification. Family level identifications are, however, likely to be reliable. In this case, the top three families in the GBIF and OBIS datasets were Nereididae, Serpulidae, and Eunicidae.

4.3.3 Specimen repositories

I identified three national research institutions in Indonesia housing polychaete collections, i.e., the MZB, RCO, and RCDS (Table 4.5). Most polychaete specimens collected from the geographic region were housed at the RCO, yet the specimens were stored in an unsuitable office and the collection data not databased (Table 4.5). Only specimens associated with taxonomic publications were deposited at the MZB, and I confirm that it does not include any of the Siboga material. The RCO collection is in need of curation because of its size, i.e., estimated in 2005 at about 45,000 specimen lots, and importance: it represents collections carried out over more than 30 years from at least 37 shallow water and offshore locations in Indonesia. A collection of Indonesian polychaetes can also be found at the RCDS. The collection dates from 2014 and comprises 191 specimen lots from Ambonese waters and surrounding areas (Table 4.5).

At the MZB, the first polychaete specimen lots were added between the 1900’s and 1930’s by European scientists (Figure 4.3); the specimens were identified by Augener (1933c). Thereafter, there was no addition until the early 2000s when a few local scientists started to deposit polychaete specimens at the museum, including the material described by Al-Hakim & Glasby (2004), Pamungkas (2015a, b, 2017) and Pamungkas & Glasby (2015) (Figure 4.3). Thus, only six published papers relate to the polychaete collection at the MZB (Table 4.5; Figure 4.3). In general, the polychaete collection at this institution is well curated, but relatively small (Figure 4.4).

Table 4.2 List of Indonesian polychaete species garnered from both taxonomic literature and GBIF/ OBIS datasets. The symbol '*' indicates that the species was originally described from Indonesian waters. Capital and small letters in Expedition/ collector column indicate expedition and collector names, respectively. The symbol '-' indicates either no information provided, or difficulty to obtain the information as the literature is not in English. The question mark indicates the likely institution based on the author's workplace and/ or the institution where the author usually deposited other specimens obtained from the same expedition.

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Acoetidae	*Acoetes melanonota*	(Grube, 1876)	LIMNOLOGISCHE SUNDA & Merton	ZMB?	Ehlers (1918); Pflugfelder (1932)
Acoetidae	*Eupolyodontes amboinensis* *	Malaquin & Dehorne, 1907	SIBOGA & SWISS	NBC	Horst (1917); Malaquin & Dehorne (1907)
Acoetidae	*Panthalis nigromaculata*	Grube, 1878	SIBOGA	NBC	Horst (1917)
Acoetidae	*Polyodontes atromarginatus* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Acoetidae	*Polyodontes sibogae* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Acoetidae	*Polyodontes tidemani* *	Pflugfelder, 1932	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1932)
Acoetidae	*Polyodontes jolli* *	Pettibone, 1989	L. M. Joll	WAM	Pettibone (1989)
Alciopidae	*Plotohelmis sumatransis*	Peter, 1973	-	Centre for Marine Living Resources and Ecology?	GBIF/ OBIS datasets
Ampharetidae	*Amage auricula sibogae* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Amage madurensis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Ampharete macrobranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Amphicteis gunneri*	(M. Sars, 1835)	-	-	GBIF/ OBIS datasets
Ampharetidae	*Amphicteis malayensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Amphicteis quadridentata* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Amphicteis sibogae* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Amphicteis theeli* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Auchenoplax crinita*	Ehlers, 1887	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Ampharetidae	*Eclysippe* sp.	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Ampharetidae	*Isolda pulchella*	Müller in Grube, 1858	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Lysippe caeca*	(Holthe, 2000)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Ampharetidae	*Melinna malmgreni* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Paramphicteis angustifolia*	(Grube, 1878)	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Paramphicteis weberi* *	(Caullery, 1944)	ANAMBAS & SIBOGA	MZB, NBC, NTM & ZRC	Al-Hakim & Glasby (2004); Caullery (1944a);

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Ampharetidae	*Pavelius* sp.	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Ampharetidae	*Phyllocomus balinensis*	Holthe, 2000	GALATHEA	ZMUC	GBIF/ OBIS datasets
Ampharetidae	*Samytha hesslei* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Samytha heterobranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Sosane fauveli* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Sosane malayensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Ampharetidae	*Sosane wireni*	(Hessle, 1917)	SIBOGA	NBC	Caullery (1944a)
Amphinomidae	*Amphinome jukesi*	Baird, 1868	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Amphinome nigrobranchiata* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Amphinome rostrata* *	(Pallas, 1766)	P. A. Ouwens & van Hoey	MZB	Augener (1933c); Pallas (1766)
Amphinomidae	*Bathychloeia sibogae* *	Horst, 1910	SIBOGA	NBC	Horst (1910, 1912)
Amphinomidae	*Benthoscolex coecus* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Chloeia amphora* *	Horst, 1910	SIBOGA	NBC	Horst (1910, 1912)
Amphinomidae	*Chloeia conspicua* *	Horst, 1910	SIBOGA	NBC	Horst (1910, 1912)
Amphinomidae	*Chloeia flava*	(Pallas, 1766)	Merton, SIBOGA, S. M. S. GAZELLE & T. van Patot	MZB, NBC & ZMB?	Augener (1933c); Ehlers (1918); Grube (1877); Horst (1912)
Amphinomidae	*Chloeia flava pulchella*	Baird, 1868	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Chloeia fusca* *	McIntosh, 1885	H. M. S. CHALLENGER & SIBOGA	BMNH & NBC	Horst (1912); McIntosh (1885)
Amphinomidae	*Chloeia nuda* *	Quatrefages, 1866	-	MNHM?	Quatrefages (1866b)
Amphinomidae	*Chloeia parva*	Baird, 1868	SIBOGA	MZB & NBC	Augener (1933c); Horst (1912)
Amphinomidae	*Chloeia violacea* *	Horst, 1910	ANAMBAS & SIBOGA	MZB, NTM & ZRC	Al-Hakim & Glasby (2004); Horst (1910, 1912)
Amphinomidae	*Cryptonome parvecarunculata* *	(Horst, 1912)	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Eurythoe complanata*	(Pallas, 1766)	J. Verwey, P. A. Ouwens & SIBOGA	MZB & NBC	Augener (1933c); Horst (1912)
Amphinomidae	*Eurythoe dubia* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Hermodice carunculata*	(Pallas, 1766)	B. Glavic	-	GBIF/ OBIS datasets
Amphinomidae	*Linopherus acarunculatus*	(Monro, 1937)	GALATHEA	ZMUC	GBIF/ OBIS datasets

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Amphinomidae	*Linopherus oculifera*	(Augener, 1913)	L. Colinvaux	USNM	GBIF/ OBIS datasets
Amphinomidae	*Linopherus oligobranchia*	(Wu, Shen & Chen, 1975)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Amphinomidae	*Notopygos* cf. *rayneri*	(Baird, 1868)	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Notopygos cirratus* *	Horst, 1911	SIBOGA	NBC	Horst (1911, 1912)
Amphinomidae	*Notopygos crinita*	Grube, 1855	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Notopygos gigas* *	Horst, 1911	SIBOGA	NBC	Horst (1911, 1912)
Amphinomidae	*Notopygos variabilis*	Potts, 1909	J. M. Martens et al.	ZMH	Martens et al. (1995)
Amphinomidae	*Parachloeia marmorata* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Paramphinome indica*	Fauvel, 1932	GALATHEA	ZMUC	GBIF/ OBIS datasets
Amphinomidae	*Pareurythoe* cf. *chilensis*	(Kinberg, 1867)	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Pherecardia striata*	(Kinberg, 1857)	J. Verwey, SIBOGA, SWISS & W. Kükenthal	NBC	Augener (1933c); Fischli (1903); Horst (1912); Malaquin & Dehorne (1907)
Amphinomidae	*Pherecardites parva* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Amphinomidae	*Sangiria hystrix* *	Horst, 1911	SIBOGA	NBC	Horst (1911, 1912)
Aphroditidae	*Aphrodita aphroditoides*	(McIntosh, 1885)	SIBOGA	NBC	Horst (1917)
Aphroditidae	*Aphrodita decipiens* *	Horst, 1916	SIBOGA	NBC	Horst (1916c, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrodita floresiana* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrodita limosa* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrodita malayana* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrodita sibogae* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrodita sondaica*	Grube, 1875	A. Grube	USNM	GBIF/ OBIS datasets

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Aphroditidae	*Aphrogenia nigropunctata* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Aphrogenia villosa* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Hermonia* cf. *malleata*	(Grube, 1875)	SIBOGA	NBC	Horst (1917)
Aphroditidae	*Laetmonice arenifera* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice batheia* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice brachyceras*	(Haswell, 1883)	SIBOGA	NBC	Horst (1916a, 1917)
Aphroditidae	*Laetmonice brevihastata* *	(Ehlers, 1918)	Merton	-	Ehlers (1918)
Aphroditidae	*Laetmonice conchifera* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice dubiosa* *	Horst, 1916	SIBOGA	NBC	Horst (1916a, 1917)
Aphroditidae	*Laetmonice malayana* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice moluccana* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice parva* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice rugosa* *	Horst, 1916	SIBOGA	NBC	Horst (1916b, 1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice viridescens* *	Horst, 1917	SIBOGA	NBC	Horst (1917); Hutchings & McRae (1993)
Aphroditidae	*Pontogenia macleari*	(Haswell, 1883)	SIBOGA	NBC	Horst (1917); Hutchings & McRae (1993)

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Aphroditidae	*Pontogenia spinosa* *	Horst, 1917	SIBOGA	NBC	Horst (1917); Hutchings & McRae (1993)
Aphroditidae	*Pontogenia villosa* *	Horst, 1917	SIBOGA	NBC	Horst (1917); Hutchings & McRae (1993)
Aphroditidae	*Laetmonice producta*	Grube, 1877	SIBOGA	NBC	Horst (1916b)
Arenicolidae	*Branchiomaldane vincenti*	Langerhans, 1881	L. Colinvaux	USNM	GBIF/ OBIS datasets
Bonelliidae	*Bonellia pumicea* *	Sluiter, 1891	SIBOGA	NBC?	Sluiter (1891, 1902)
Bonelliidae	*Bruunellia bandae*	Zenkevitch, 1966	GALATHEA	ZMUC	GBIF/ OBIS datasets
Bonelliidae	*Ikedella bogorovi*	Zenkevitch, 1964	-	-	GBIF/ OBIS datasets
Bonelliidae	*Sluiterina sibogae* *	(Sluiter, 1902)	SIBOGA	NBC?	Sluiter (1902)
Capitellidae	*Capitella ambonensis* *	Pamungkas, 2017	J. Pamungkas	MZB & RCDS	Pamungkas (2017)
Capitellidae	*Capitella singularis*	(Fauvel, 1932)	T. G. Pillai	BMNH?	Pillai (1965)
Capitellidae	*Dasybranchus caducus*	(Grube, 1846)	Merton & SIBOGA	NBC	Ehlers (1918); Mesnil & Fauvel (1939)
Capitellidae	*Leiochrus alutaceus* *	Ehlers, 1908	DEUTSCHE TIEFSEE	SMF?	Ehlers (1908)
Capitellidae	*Mediomastus warrenae*	Green, 2002	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Capitellidae	*Notomastus* cf. *latericeus*	M. Sars, 1851	ANAMBAS & SIBOGA	MZB, NBC, NTM & ZRC	Al-Hakim & Glasby (2004); Mesnil & Fauvel (1939)
Capitellidae	*Notomastus hemipodus*	Hartman, 1945	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Capitellidae	*Polymastigos javaensis* *	Pamungkas, 2015b	J. Pamungkas	MZB	Pamungkas (2015b)
Capitellidae	*Promastobranchus orbiculatus*	Green, 2002	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Chaetopteridae	*Chaetopterus variopedatus*	(Renier, 1804)	SIBOGA	NBC	Caullery (1944a)
Chaetopteridae	*Mesochaetopterus malayensis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Chaetopteridae	*Phyllochaetopterus claparedii*	McIntosh, 1885	SIBOGA	NBC	Caullery (1944a)
Chaetopteridae	*Phyllochaetopterus sibogae* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Chaetopteridae	*Chaetopterus cautus*	Marenzeller, 1879	SIBOGA	NBC	Caullery (1944a)
Chrysopetalidae	*Arichlidon hanneloreae*	Watson Russell, 1998	-	MAGNT	GBIF/ OBIS datasets

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Chrysopetalidae	*Bhawania amboinensis* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Chrysopetalidae	*Bhawania cryptocephala*	Gravier, 1901	SIBOGA	NBC	Horst (1917)
Chrysopetalidae	*Bhawania goodei*	Webster, 1884	-	-	GBIF/ OBIS datasets
Chrysopetalidae	*Bhawania pottsiana* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Chrysopetalidae	*Bhawania riveti*	(Gravier, 1908)	-	-	GBIF/ OBIS datasets
Chrysopetalidae	*Treptopale paromolos*	Watson, 2010	-	MAGNT	GBIF/ OBIS datasets
Cirratulidae	*Aphelochaeta multifilis*	(Moore, 1909)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Cirratulidae	*Chaetozone* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Cirratulidae	*Cirratulus annamensis*	Gallardo, 1968	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Cirratulidae	*Cirriformia afer*	(Ehlers, 1908)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Cirratulidae	*Dodecaceria fistulicola*	Ehlers, 1901	SIBOGA	NBC	Mesnil & Fauvel (1939)
Cirratulidae	*Dodecaceria joubini*	Gravier, 1905	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Cirratulidae	*Monticellina* sp.1	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Cirratulidae	*Monticellina* sp.2	-	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Cirratulidae	*Protocirrineris chrysoderma*	(Claparède, 1868)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Cirratulidae	*Tharyx* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Cirratulidae	*Timarete anchylochaeta*	(Schmarda, 1861)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Cossuridae	*Cossura dimorpha*	(Hartman, 1976)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Dorvilleidae	*Dorvillea bioculata*	(Grube, 1856)	Merton	-	Ehlers (1918)
Dorvilleidae	*Protodorvillea biarticulata*	Day, 1963	-	-	GBIF/ OBIS datasets
Eulepethidae	*Pareulepis malayana* *	(Horst, 1913)	ANAMBAS & SIBOGA	NBC & NTM	Al-Hakim & Glasby (2004); Horst (1913, 1917)

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Eunicidae	*Eunice afra*	Peters, 1854	H. Singou & J. Rosewater	USNM	GBIF/ OBIS datasets
Eunicidae	*Eunice aphroditois*	(Pallas, 1788)	Vorster	MZB	Augener (1933c)
Eunicidae	*Eunice australis*	Quatrefages, 1866	-	MZB	Augener (1933c)
Eunicidae	*Eunice coccinea*	Grube, 1878	Vorster	MZB	Augener (1933c)
Eunicidae	*Eunice complanata* *	Grube, 1877	S. M. S. GAZELLE	ZMB?	Grube (1877)
Eunicidae	*Eunice dilatata* *	Grube, 1877	S. M. S. GAZELLE	ZMB?	Grube (1877)
Eunicidae	*Eunice filamentosa*	Grube & Örsted in Grube, 1856	J. Rosewater	USNM	GBIF/ OBIS datasets
Eunicidae	*Eunice indica* *	Kinberg, 1865	ANAMBAS & EUGENIE	MZB, NRS & NTM	Al-Hakim & Glasby (2004); Kinberg (1865a)
Eunicidae	*Eunice laticeps*	Ehlers, 1868	Verngren	NRM	GBIF/ OBIS datasets
Eunicidae	*Eunice margariticacea*	Fischli, 1900	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Eunicidae	*Eunice marianae*	Hartmann-Schröder in Hartmann-Schröder & Zibrowius, 1998	U. S. FISH COMMISSION	USNM	GBIF/ OBIS datasets
Eunicidae	*Eunice metatropos*	Hanley, 1986	-	MAGNT	GBIF/ OBIS datasets
Eunicidae	*Eunice microprion*	Marenzeller, 1879	U. S. FISH COMMISSION	USNM	GBIF/ OBIS datasets
Eunicidae	*Eunice pennata*	(Müller, 1776)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Eunicidae	*Eunice schemacephala*	Schmarda, 1861	A. Humes	USNM	GBIF/ OBIS datasets
Eunicidae	*Eunice vittata*	(Delle Chiaje, 1828)	GALATHEA	MAGNT & ZMUC	GBIF/ OBIS datasets
Eunicidae	*Euniphysa aculeata*	Wesenberg-Lund, 1949	SIBOGA	NBC	Pettibone (1970)
Eunicidae	*Leodice antennata*	Savigny in Lamarck, 1818	Merton, S. M. S. GAZELLE & Vorster	MZB & ZMB?	Augener (1933c); Ehlers (1918); Grube (1877)
Eunicidae	*Lysidice collaris*	Grube, 1870	-	USNM	GBIF/ OBIS datasets

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Eunicidae	*Lysidice kuekenthali*	Fischli, 1900	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Eunicidae	*Lysidice oele* *	Horst, 1902	J. M. Martens et al., J. Pamungkas et al. & SIBOGA	MZB, RCDS & ZMH	Horst (1902); Martens et al. (1995); Pamungkas (2015a)
Eunicidae	*Lysidice unicornis*	(Grube, 1840)	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Eunicidae	*Marphysa mossambica*	(Peters, 1854)	-	AM	GBIF/ OBIS datasets
Eunicidae	*Marphysa soembaensis* *	Augener, 1933	van de Sande	MZB	Augener (1933c)
Eunicidae	*Nicidion cariboea*	(Grube, 1856)	L. Colinvaux	USNM	GBIF/ OBIS datasets
Eunicidae	*Palola siciliensis*	Grube, 1840	Merton	-	Ehlers (1918)
Eunicidae	*Palola viridis*	Gray in Stair, 1847	J. M. Martens et al.	ZMH	Martens et al. (1995)
Euphrosinidae	*Euphrosine affinis* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine globosa* *	Horst, 1912	SIBOGA	NBC	Horst (1912)
Euphrosinidae	*Euphrosine hystrix* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine laureata*	Savigny in Lamarck, 1818	SIBOGA	NBC	Horst (1912)
Euphrosinidae	*Euphrosine longesetosa* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine maculata* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine mucosa* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine obiensis* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine pelagica* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine pilosa* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine sibogae* *	Horst, 1903	SIBOGA	NBC	Horst (1903, 1912)
Euphrosinidae	*Euphrosine superba*	Marenzeller, 1879	SIBOGA	NBC	Horst (1912)
Flabelligeridae	*Brada talehsapensis*	Fauvel, 1932	GALATHEA	ZMUC	Kirkegaard (1995/ 1996)
Flabelligeridae	*Diplocirrus erythroporus*	Gallardo, 1968	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Flabelligeridae	*Pherusa coronata*	(Ehlers, 1908)	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Pherusa curvisetis* *	(Caullery, 1944)	GALATHEA & SIBOGA	NBC & ZMUC	Caullery (1944a); Kirkegaard (1995/ 1996)

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Flabelligeridae	*Pherusa indica*	(Fauvel, 1928)	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Flabelligeridae	*Pherusa sibogae* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Piromis eruca*	(Claparède, 1869)	-	-	GBIF/ OBIS datasets
Flabelligeridae	*Piromis nuda* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Trophoniella avicularia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Trophoniella intoshi* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Trophoniella rigida* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Flabelligeridae	*Daylithos parmatus*	(Grube, 1877)	P. A. Ouwens	MZB	Augener (1933c)
Glyceridae	*Glycera africana*	Arwidsson, 1899	Merton	-	Ehlers (1918)
Glyceridae	*Glycera amboinensis* *	McIntosh, 1885	H. M. S. CHALLENGER	BMNH	McIntosh (1885)
Glyceridae	*Glycera brevicirris*	Grube, 1870	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Glyceridae	*Glycera lapidum*	Quatrefages, 1866	GALATHEA	ZMUC	GBIF/ OBIS datasets
Glyceridae	*Glycera longipinnis*	Grube, 1878	-	-	GBIF/ OBIS datasets
Glyceridae	*Glycera macintoshi*	Grube, 1877	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Glyceridae	*Glycera madagascariensis*	Böggemann & Fiege, 2001	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Glyceridae	*Glycera onomichiensis*	Izuka, 1912	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Glyceridae	*Glycera sagittariae* *	McIntosh, 1885	H. M. S. CHALLENGER	BMNH	McIntosh (1885)
Glyceridae	*Glycera tesselata*	Grube, 1840	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Glyceridae	*Glycera unicornis*	Lamarck, 1818	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Goniadidae	*Bathyglycinde sibogana* *	(Augener & Pettibone in Pettibone, 1970)	SIBOGA	NBC	Pettibone (1970)
Goniadidae	*Glycinde* cf. *oligodon*	Southern, 1921	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Goniadidae	*Goniada clavata* *	Kirkegaard, 1995	GALATHEA	ZMUC	Kirkegaard (1995)
Hartmaniellidae	*Hartmaniella* sp.	-	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)

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Hesionidae	*Gyptis* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Hesionidae	*Hesione eugeniae* *	Kinberg, 1866	EUGENIE	NRS	Kinberg (1866)
Hesionidae	*Hesione splendida*	Lamarck, 1818	J. Verwey & Merton	MZB	Augener (1933c); Ehlers (1918)
Hesionidae	*Leocrates djangkarensis* *	Augener & Pettibone in Pettibone, 1970	SIBOGA	NBC	Pettibone (1970)
Hesionidae	*Leocrates indicus* *	Horst, 1921	SIBOGA	NBC	Horst (1921)
Hesionidae	*Leocrates wesenberglundae*	Pettibone, 1970	-	-	GBIF/ OBIS datasets
Hesionidae	*Leocratides ehlersi* *	(Horst, 1921)	SIBOGA	NBC	Horst (1921, 1924)
Hesionidae	*Leocratides filamentosus*	Ehlers, 1908	-	ZMB	GBIF/ OBIS datasets
Hesionidae	*Ophiodromus* sp.	-	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Hesionidae	*Podarkeopsis capensis*	(Day, 1963)	-	-	GBIF/ OBIS datasets
Hesionidae	*Psamathe* sp.	-	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Hesionidae	*Hesione intertexta*	Grube, 1878	SIBOGA	NBC	Horst (1924)
Hesionidae	*Leocrates chinensis*	Kinberg, 1866	SIBOGA	NBC	Horst (1924); Pettibone (1970)
Hesionidae	*Oxydromus angustifrons*	(Grube, 1878)	SIBOGA	NBC	Horst (1924)
Iphionidae	*Iphione muricata*	(Lamarck, 1818)	SIBOGA	NBC	Horst (1917)
Iphionidae	*Iphionella philippinensis*	Pettibone, 1986	SIBOGA	NBC	Horst (1917)
Lopadorrhynchidae	*Lopadorrhynchus indica*	Peter, 1974	-	CMLRE	GBIF/ OBIS datasets
Lumbrineridae	*Abyssoninoe* sp.	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Lumbrineridae	*Lumbinerides* sp.	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Lumbrineridae	*Lumbrineris albidentata*	Ehlers, 1908	-	-	GBIF/ OBIS datasets
Lumbrineridae	*Lumbrineris amboinensis* *	Grube, 1877	S. M. S. GAZELLE	ZMB?	Grube (1877)
Lumbrineridae	*Lumbrineris impatiens*	Claparède, 1868	-	-	GBIF/ OBIS datasets
Lumbrineridae	*Lumbrineris indica* *	Kinberg, 1865	EUGENIE	NRS	Kinberg (1865a)
Lumbrineridae	*Lumbrineris maxillosa* *	Ehlers, 1918	Merton	-	Ehlers (1918)

Family	**Species**	**Author(s)**	**Expedition/ collector**	**Repository**	**Reference(s)**
Lumbrineridae	*Lumbrineris pseudobifilaris*	Fauvel, 1932	-	-	GBIF/ OBIS datasets
Lumbrineridae	*Ninoe bruuni*	Gallardo, 1968	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Lumbrineridae	*Ninoe nigripes*	Verrill, 1873	GALATHEA	ZMUC	GBIF/ OBIS datasets
Magelonidae	*Magelona cincta*	Ehlers, 1908	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Magelonidae	*Magelona crenulifrons*	Gallardo, 1968	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Magelonidae	*Magelona gemmata*	Mortimer & Mackie, 2003	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Maldanidae	*Isocirrus tropicus*	(Monro, 1928)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Lumbriclymene interstricta*	(Ehlers, 1908)	-	ZMB	GBIF/ OBIS datasets
Maldanidae	*Maldane sarsi*	Malmgren, 1865	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Notoproctus sibogae* *	(Mesnil & Fauvel, 1939)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Petaloproctus cirratus*	Monro, 1937	GALATHEA	ZMUC	GBIF/ OBIS datasets
Maldanidae	*Petaloproctus terricolus*	Quatrefages, 1866	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Praxillella affinis*	(M. Sars in G. O. Sars, 1872)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Praxillella gracilis*	(M. Sars, 1861)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Maldanella grossa*	(Baird, 1873)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Metasychis gotoi*	(Izuka, 1902)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Rhodine loveni*	Malmgren, 1865	SIBOGA	NBC	Mesnil & Fauvel (1939)
Maldanidae	*Sabaco javanicus* *	(Augener, 1934)	C. Ph. Sluiter	NBC	Augener (1934)
Maldanidae	*Sabaco maculatus* *	Kinberg, 1866	-	NRS?	Kinberg (1866)
Nephtyidae	*Aglaophamus* cf. *vietnamensis*	Fauchald, 1968	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)

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Nephtyidae	*Aglaophamus dibranchis*	(Grube, 1877)	-	-	GBIF/ OBIS datasets
Nephtyidae	*Aglaophamus lyratus* *	Kinberg, 1866	EUGENIE	NRS	Kinberg (1866)
Nephtyidae	*Aglaophamus tepens*	Fauchald, 1968	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Nephtyidae	*Micronephthys oligobranchia*	(Southern, 1921)	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Nephtyidae	*Micronephthys sphaerocirrata*	(Wesenberg-Lund, 1949)	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Nephtyidae	*Nephtys* cf. *punctata*	Hartman, 1938	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Nephtyidae	*Nephtys palatii*	Gravier, 1904	Merton	-	Ehlers (1918)
Nephtyidae	*Nephtys spiribranchis* *	Ehlers, 1918	Merton	-	Ehlers (1918)
Nephtyidae	*Nephtys squamosa*	Ehlers, 1887	GALATHEA	ZMUC	GBIF/ OBIS datasets
Nereididae	*Alitta succinea*	(Leuckart, 1847)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Ceratocephale* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Nereididae	*Ceratonereis (Composetia) hyalognatha* *	(Ehlers, 1920)	-	SMF?	Ehlers (1920)
Nereididae	*Ceratonereis australis*	Hartmann-Schröder, 1985	J. Pamungkas et al.	MZB, NTM & RCDS	Pamungkas (2015a); Pamungkas & Glasby (2015)
Nereididae	*Ceratonereis* cf. *perkinsi*	Hartmann-Schröder, 1985	J. M. Martens et al.	ZMH	Martens et al. (1995)
Nereididae	*Ceratonereis dorsolineata* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Ceratonereis hircinicola*	(Eisig, 1870)	Kinberg	Newcastle Regional Museum?	GBIF/ OBIS datasets
Nereididae	*Ceratonereis ternatensis*	(Fischli, 1900)	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Nereididae	*Ceratonereis tripartita* *	Horst, 1918	SIBOGA	NBC	Horst (1918b)
Nereididae	*Composetia marmorata* *	(Horst, 1924)	J. Pamungkas et al. & SIBOGA	MAGNT & NBC	Horst (1924); Pamungkas & Glasby (2015)
Nereididae	*Dendronereis pinnaticirris*	Grube, 1878	T. G. Pillai	BMNH?	Pillai (1965)
Nereididae	*Gnatholycastis brocki* *	Ehlers, 1920	-	ZMB	Ehlers (1920)

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Nereididae	*Gymnonereis fauveli*	(Hartmann-Schröder, 1962)	SIBOGA	NBC	Pettibone (1970)
Nereididae	*Gymnonereis phuketensis*	Hylleberg & Nateewathana, 1988	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Nereididae	*Gymnonereis sibogae* *	(Horst, 1918)	SIBOGA	NBC	Horst (1918b)
Nereididae	*Hediste diversicolor*	(O. F. Müller, 1776)	-	ZMB	GBIF/ OBIS datasets
Nereididae	*Leonnates indicus*	Kinberg, 1865	SIBOGA	NBC	Horst (1924)
Nereididae	*Leonnates nierstraszi* *	Horst, 1924	SIBOGA	NBC	Horst (1924)
Nereididae	*Leonnates persicus*	Wesenberg-Lund, 1949	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Nereididae	*Namalycastis hawaiiensis*	(Johnson, 1903)	LIMNOLOGISCHE SUNDA	ZMB?	Feuerborn, (1931); Horst (1909)
Nereididae	*Namalycastis meraukensis* *	(Horst, 1918)	J. W. R. Koch	NBC	Horst (1918b)
Nereididae	*Namalycastis nipae* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Namalycastis rhodochorde* *	Glasby, Miura, Nishi & Junardi, 2007	Junardi	NTM	Glasby et al. (2007)
Nereididae	*Namalycastis terrestris* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Namalycastis vivax* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Namanereis amboinensis* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Namanereis catarractarum* *	(Feuerborn, 1931)	LIMNOLOGISCHE SUNDA	ZMB?	Feuerborn (1931); Glasby et al. (1990)
Nereididae	*Neanthes cricognatha*	(Ehlers, 1904)	-	MAGNT	GBIF/ OBIS datasets
Nereididae	*Neanthes kerguelensis*	(McIntosh, 1885)	-	-	GBIF/ OBIS datasets
Nereididae	*Neanthes larentukana* *	(Grube, 1881)	Martens	ZMB	Grube (1881)
Nereididae	*Neanthes negomboensis*	Silva, 1965	T. G. Pillai	BMNH?	Pillai (1965)
Nereididae	*Neanthes pachychaeta*	(Fauvel, 1918)	SIBOGA	NBC	Horst (1919, 1924); Pamungkas & Glasby (2015)
Nereididae	*Neanthes rubicunda*	(Ehlers, 1868)	SIBOGA	NBC	Horst (1924)
Nereididae	*Neanthes trifasciata*	(Ehlers, 1901)	J. Rosewater	USNM	GBIF/ OBIS datasets

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Nereididae	*Neanthes unifasciata*	(Willey, 1905)	J. M. Martens, J. Pamungkas et al., Merton & SIBOGA	MZB, NBC, NTM, RCDS & ZMH	Ehlers (1918); Horst (1924); Martens et al. (1995); Pamungkas (2015a); Pamungkas & Glasby (2015)
Nereididae	*Neanthes vitabunda* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Nectoneanthes* sp.	-	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Nereididae	*Nereis abyssicola* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis baliensis* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis batjanensis* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis buitendijki* *	(Horst, 1924)	SIBOGA	NBC	Horst (1919, 1924)
Nereididae	*Nereis heteromorpha* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis jacksoni*	Kinberg, 1865	L. van Lummel	MZB	Augener (1933c)
Nereididae	*Nereis macropis* *	Ehlers, 1919	-	SMF?	Ehlers (1920)
Nereididae	*Nereis nigripes*	Ehlers, 1868	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis nouhuysi* *	Horst, 1918	J. W. van Nouhuys & SIBOGA	NBC	Horst (1918a, 1924)
Nereididae	*Nereis onychophora* *	Horst, 1918	SIBOGA	NBC	Horst (1918b, 1924)
Nereididae	*Nereis persica*	Fauvel, 1911	J. Rosewater	USNM	GBIF/ OBIS datasets
Nereididae	*Nereis profundi* *	Kirkegaard, 1956	GALATHEA	ZMUC	Kirkegaard (1956)
Nereididae	*Nereis quoyii* *	Quatrefages, 1866	-	MNHM?	Quatrefages (1866a)
Nereididae	*Nereis sumbawaensis* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis thysanota* *	Ehlers, 1920	-	SMF?	Ehlers (1920)
Nereididae	*Nereis tydemani* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Nereis vandersandi* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Paraleonnates tenuipalpa* *	(Pflugfelder, 1933)	LIMNOLOGISCHE SUNDA	ZMB?	Pflugfelder (1933)
Nereididae	*Perinereis aibuhitensis*	(Grube, 1878)	-	MAGNT	GBIF/ OBIS datasets
Nereididae	*Perinereis binongkae* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Perinereis caeruleis* *	(Hoagland, 1920)	ALBATROSS	USNM	Hoagland (1920)
Nereididae	*Perinereis camiguina*	(Grube, 1878)	Merton & SIBOGA	NBC	Ehlers (1918); Horst (1924)
Nereididae	*Perinereis cavifrons* *	(Ehlers, 1920)	-	ZMB	Ehlers (1920)
Nereididae	*Perinereis cultrifera*	(Grube, 1840)	J. M. Martens et al.	ZMH	Martens et al. (1995)
Nereididae	*Perinereis dongalae* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)

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Nereididae	*Perinereis floridana*	(Ehlers, 1868)	SIBOGA	NBC	Horst (1924)
Nereididae	*Perinereis helleri*	(Grube, 1878)	J. Pamungkas et al. & SIBOGA	MZB, NBC, NTM & RCDS	Horst (1924); Pamungkas (2015a); Pamungkas & Glasby (2015)
Nereididae	*Perinereis nigropunctata*	(Horst, 1889)	J. M. Martens et al., J. Pamungkas et al. & SIBOGA	MZB, NBC, NTM, RCDS & ZMH	Horst (1924); Martens et al. (1995); Pamungkas (2015a); Pamungkas & Glasby (2015),
Nereididae	*Perinereis nuntia*	Lamarck, 1818	I. Al-Hakim	NTM	Glasby & Hsieh (2006)
Nereididae	*Perinereis obfuscata*	(Grube, 1878)	SIBOGA	NBC	Horst (1924)
Nereididae	*Perinereis perspicillata*	(Grube, 1878)	L. van Lummel	MZB	Augener (1933c)
Nereididae	*Perinereis rumphii* *	(Horst, 1919)	SIBOGA	NBC	Horst (1919b)
Nereididae	*Perinereis singaporiensis*	(Grube, 1878)	SIBOGA	NBC	Horst (1924)
Nereididae	*Perinereis suluana* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Perinereis tobeloana* *	(Augener, 1933)		NBC	Augener (1933b)
Nereididae	*Perinereis variodentata*	(Augener, 1913)	-	MAGNT	GBIF/ OBIS datasets
Nereididae	*Platynereis abnormis* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Platynereis cristatus* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Platynereis dumerilii*	(Audouin & Milne Edwards, 1833)	K. W. Dammerman, L. van Lummel & SIBOGA	NBC	Augener (1933c); Horst (1924)
Nereididae	*Pseudonereis anomala*	Gravier, 1899	SIBOGA	NBC	Horst (1924)
Nereididae	*Pseudonereis trimaculata* *	(Horst, 1924)	SIBOGA	NBC	Horst (1924)
Nereididae	*Rullierinereis gallardoi*	Pettibone, 1971	GALATHEA	ZMUC	GBIF/ OBIS datasets
Nereididae	*Simplisetia erythraeensis*	(Fauvel, 1918)	-	MAGNT	GBIF/ OBIS datasets
Nereididae	*Solomononereis merauensis*	Gibbs, 1971	J. Pamungkas et al.	MZB & NTM	Pamungkas (2015a), Pamungkas & Glasby (2015)
Nereididae	*Tylorrhynchus heterochetus* *	(Quatrefages, 1866)	-	MNHM?	Quatrefages (1866a)
Nereididae	*Websterinereis foli*	(Fauvel, 1930)	J. M. Martens et al.	ZMH	Martens et al. (1995), Pamungkas & Glasby (2015)
Nereididae	*Neanthes indica* *	(Kinberg, 1865)	-	NRS?	Kinberg (1865b)

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Nereididae	*Platynereis bengalensis*	(Willey, 1905)	SIBOGA	NBC	Horst (1924)
Oenonidae	*Arabella (Notopsilus)* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Oenonidae	*Drilonereis logani*	Crossland, 1924	GALATHEA	ZMUC	GBIF/ OBIS datasets
Oenonidae	*Oenone fulgida*	(Savigny in Lamarck, 1818)	S. M. S. GAZELLE & W. Kükenthal	ZMB?	Fischli (1903); Grube (1877)
Oenonidae	*Arabella iricolor*	(Montagu, 1804)	T. van Benthem Jutting	MZB	Augener (1933c)
Oenonidae	*Drilonereis parasiticus* *	(Caullery, 1914)	-	MNHM?	Caullery (1914a)
Onuphidae	*Anchinothria hiatidentata*	(Moore, 1911)	SIBOGA	NBC	Pettibone (1970)
Onuphidae	*Diopatra amboinensis* *	Audouin & Milne Edwards, 1833	-	MNHM?	Audouin & Milne Edwards (1833)
Onuphidae	*Diopatra claparedii*	Grube, 1878	-	-	GBIF/ OBIS datasets
Onuphidae	*Diopatra maculata*	Paxton, 1993	-	-	GBIF/ OBIS datasets
Onuphidae	*Diopatra uncinifera* *	Quatrefages, 1866	-	MNHM?	Quatrefages (1866a)
Onuphidae	*Hyalinoecia robusta*	Southward, 1977	GALATHEA	ZMUC	GBIF/ OBIS datasets
Onuphidae	*Hyalinoecia tubicola*	(O. F. Müller, 1776)	-	ZMB	GBIF/ OBIS datasets
Onuphidae	*Kinbergonuphis abyssalis*	(Fauchald, 1968)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Onuphidae	*Kinbergonuphis investigatoris*	(Fauvel, 1932)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Onuphidae	*Kinbergonuphis proalopus*	(Chamberlin, 1919)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Onuphidae	*Kinbergonuphis pseudodibranchiata*	(Gallardo, 1968)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Onuphidae	*Longibrachium arariensis*	Nishi & Kato, 2009	M. Rosenstein	NBC	GBIF/ OBIS datasets
Onuphidae	*Nothria hawaiiensis* *	Pettibone, 1970	SIBOGA	NBC	Pettibone (1970)
Onuphidae	*Onuphis eremita*	Audouin & Milne Edwards, 1833	-	-	GBIF/ OBIS datasets
Onuphidae	*Onuphis holobranchiata*	Marenzeller, 1879	-	-	GBIF/ OBIS datasets
Onuphidae	*Onuphis opalina*	(Verrill, 1873)	GALATHEA	ZMUC	GBIF/ OBIS datasets

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Onuphidae	*Paradiopatra quadricuspis*	(M. Sars in G. O. Sars, 1872)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Onuphidae	*Protodiopatra willemoesii* *	(McIntosh, 1885)	H. M. S. CHALLENGER	BMNH	McIntosh (1885)
Onuphidae	*Rhamphobrachium chuni* *	Ehlers, 1908	DEUTSCHE TIEFSEE	SMF?	Ehlers (1908)
Onuphidae	*Rhamphobrachium pacifica*	Hoagland, 1920	U. S. FISH COMMISSION	USNM	GBIF/ OBIS datasets
Opheliidae	*Ammotrypane galatheae* *	Kirkegaard, 1956	GALATHEA	ZMUC	Kirkegaard (1956)
Opheliidae	*Armandia bipapillata*	Hartmann-Schröder, 1974	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Opheliidae	*Armandia longicaudata* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina bimensis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina brevibranchiata* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina cordiformis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina dubia* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina fauveli* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina profunda* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina remigera* *	(Ehlers, 1918)	Merton	SMF?	Ehlers (1918)
Opheliidae	*Ophelina sibogae* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Opheliidae	*Ophelina buitendijki* *	(Horst, 1919)	P. Buitendijk	NBC	Horst (1919a)
Opheliidae	*Ophelina ehlersi* *	(Horst, 1919)	P. N. van Kampen	NBC	Horst (1919a)
Opheliidae	*Ophelina kampeni* *	(Horst, 1919)	P. N. van Kampen	NBC	Horst (1919a)
Opheliidae	*Ophelina pygocirrata* *	(Ehlers, 1920)	-	SMF?	Ehlers (1920)
Orbiniidae	*Leitoscoloplos* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Orbiniidae	*Leodamas marginatus*	(Ehlers, 1897)	GALATHEA	ZMUC	Kirkegaard (1995/ 1996)
Orbiniidae	*Scoloplos (Leodamas) gracilis*	Pillai, 1961	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Orbiniidae	*Scoloplos (Leodamas) orientalis*	Gallardo, 1968	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Orbiniidae	*Scoloplos (Leodamas) rubra*	(Webster, 1879)	-	-	GBIF/ OBIS datasets
Oweniidae	*Galathowenia lobopygidiata*	(Uschakov, 1950)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Oweniidae	*Myriochele eurystoma* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Oweniidae	*Myriochele minor* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)

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Oweniidae	*Myriochele picta*	Southern, 1921	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Oweniidae	*Owenia assimilator* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Oweniidae	*Owenia collaris*	Hartman, 1955	SIBOGA	NBC	Caullery (1944a)
Paralacydoniidae	*Paralacydonia paradoxa*	Fauvel, 1913	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Paralacydoniidae	*Paralacydonia weberi* *	Horst, 1923	SIBOGA	NBC	Horst (1923)
Paraonidae	*Aricidea (Acmira) lopezi*	Berkeley & Berkeley, 1956	-	-	GBIF/ OBIS datasets
Paraonidae	*Cirrophorus* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Paraonidae	*Levinsenia* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Paraonidae	*Paradoneis* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Paraonidae	*Paraonis* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Pectinariidae	*Pectinaria brevispinis*	Grube, 1878	SIBOGA	NBC	Caullery (1944a)
Pectinariidae	*Pectinaria leioscapha* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Pectinariidae	*Pectinaria papillosa* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Pectinariidae	*Pectinaria profunda* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Pectinariidae	*Petta tenuis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Pectinariidae	*Amphictene leioscapha* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Phyllodocidae	*Genetyllis gracilis*	(Kinberg, 1866)	-	-	GBIF/ OBIS datasets
Phyllodocidae	*Paranaitis* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Phyllodocidae	*Phyllodoce lamelligera*	(Gmelin in Linnaeus, 1788)	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Phyllodocidae	*Phyllodoce madeirensis*	Langerhans, 1880	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Phyllodocidae	*Phyllodoce quadraticeps*	Grube, 1878	Zadelhoff	MZB	Augener (1933c)
Pilargidae	*Hermundura gladstonensis*	(Marks & Hocknull, 2006)	-	MAGNT	GBIF/ OBIS datasets
Pilargidae	*Litocorsa annamita*	(Gallardo, 1968)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)

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Pilargidae	*Pilargis* sp.	-	ANAMBAS	MZB & NTM	Al-Hakim & Glasby (2004)
Pilargidae	*Sigambra bassi*	(Hartman, 1945)	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Pilargidae	*Sigambra constricta*	(Southern, 1921)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Pilargidae	*Sigambra hanaokai*	(Kitamori, 1960)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Pilargidae	*Sigambra parva*	(Day, 1963)	-	-	GBIF/ OBIS datasets
Pilargidae	*Synelmis rigida*	(Fauvel, 1919)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Pilargidae	*Synelmis sergi*	Glasby & Marks, 2013	-	MAGNT	GBIF/ OBIS datasets
Poecilochaetidae	*Poecilochaetus serpens*	Allen, 1904	-	-	GBIF/ OBIS datasets
Polygordiidae	*Polygordius epitocus* *	Dawydoff, 1905	-	-	Dawydoff (1905)
Polynoidae	*Admetella longipedata*	(McIntosh, 1885)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Allmaniella arafurensis* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Australaugeneria pottsi*	Pettibone, 1969	SIBOGA	NBC	Horst (1917)
Polynoidae	*Bathyeliasona abyssicola*	(Fauvel, 1913)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Polynoidae	*Bathynoe pustulata* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Benhamipolynoe antipathicola*	(Benham, 1927)	SIBOGA	NBC	Pettibone (1970)
Polynoidae	*Drieschella maculata* *	Augener & Pettibone, 1970	SIBOGA	NBC	Pettibone (1970)
Polynoidae	*Eunoe pallida* *	(Ehlers, 1908)	DEUTSCHE TIEFSEE	SMF?	Ehlers (1908)
Polynoidae	*Gastrolepidia clavigera*	Schmarda, 1861	SIBOGA	NBC	Horst (1917)
Polynoidae	*Halosydna batheia* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Polynoidae	*Halosydnopsis pilosa* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Harmothoe atra* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Harmothoe* cf. *benthaliana*	McIntosh, 1885	SIBOGA	NBC	Horst (1917)
Polynoidae	*Harmothoe* cf. *imbricata*	(Linnaeus, 1767)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Harmothoe cornuta*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Harmothoe dictyophora*	(Grube, 1878)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Harmothoe flaccida*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Hemilepidia versluysi* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)

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Polynoidae	*Heteralentia ptycholepis*	(Grube, 1878)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Hololepidella nigropunctata* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Lagisca elytrophora* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Lagisca malayana* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Lepidasthenia elegans*	(Grube, 1840)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidasthenia microlepis*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus albopustulatus* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Lepidonotus carinulatus*	(Grube, 1870)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus* cf. *adspersus*	(Grube, 1878)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus* cf. *squamatus*	(Linnaeus, 1758)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus cristatus*	(Grube, 1876)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus echinatus*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus glaucus*	(Peters, 1854)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus javanicus* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus malayanus* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Lepidonotus onisciformis* *	Ehlers, 1918	Merton	-	Ehlers (1918)
Polynoidae	*Lepidonotus ornatus*	Potts, 1910	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus ruber* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus suluensis* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Polynoidae	*Lepidonotus vandersandei* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Polynoidae	*Medioantenna variopinta* *	Di Camillo, Martin & Britayev, 2011	Di Camillo et al.	MNCN	Di Camillo et al. (2011)
Polynoidae	*Ophthalmonoe pettiboneae* *	Petersen & Britayev, 1997	SNELLIUS II	NBC	Petersen & Britayev (1997)
Polynoidae	*Paradyte crinoidicola*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Paradyte tentaculata* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Parahalosydna sibogae* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Paralepidonotus ampulliferus*	(Grube, 1878)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Paralepidonotus* cf. *indica*	(Potts, 1910)	SIBOGA	NBC	Horst (1917)
Polynoidae	*Paralepidonotus indicus* *	(Kinberg, 1856)	EUGENIE & SIBOGA	NBC & NRS	Horst (1915, 1917); Kinberg (1856)
Polynoidae	*Perolepis regularis*	Ehlers, 1908	SIBOGA	NBC	Horst (1913, 1917)
Polynoidae	*Polynoe cornuta* *	Fischli, 1903	SIBOGA & W. Kükenthal	NBC	Fischli (1903); Horst (1917)
Polynoidae	*Polynoe kampeni* *	Horst, 1915	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Scalisetosus acutipinnis* *	Ehlers, 1920	-	ZMB	Ehlers (1920)

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Polynoidae	*Scalisetosus ceramensis* *	McIntosh, 1885	H. M. S. CHALLENGER & SIBOGA	NBC	Horst (1917); McIntosh (1885)
Polynoidae	*Subadyte papillifera* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Telolepidasthenia lobetobiensis* *	Augener & Pettibone, 1970	SIBOGA	NBC	Pettibone (1970)
Polynoidae	*Thormora jukesii*	Baird, 1865	SIBOGA & Vorster	MZB & NBC	Augener (1933c); Horst (1917)
Polynoidae	*Verrucapelma nigricans* *	(Horst, 1915)	SIBOGA	NBC	Horst (1915, 1917)
Polynoidae	*Eunoe kerguelensis*	(McIntosh, 1885)	SIBOGA	NBC	Horst (1915)
Polynoidae	*Lepidonotus adspersus*	(Grube, 1878)	SIBOGA	NBC	Horst (1915, 1917)
Sabellariidae	*Idanthyrsus bihamatus* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Sabellariidae	*Idanthyrsus willora*	Hutchings, Capa & Peart, 2012	-	MAGNT	GBIF/ OBIS datasets
Sabellariidae	*Lygdamis ehlersi* *	(Caullery, 1913)	SIBOGA	NBC	Caullery (1944a)
Sabellariidae	*Lygdamis indicus* *	Kinberg, 1866	EUGENIE & GALATHEA	NRS & ZMUC	Kinberg (1866); Kirkegaard (1995/ 1996)
Sabellariidae	*Phalacrostemma abyssalis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Sabellariidae	*Sabellaria javanica* *	Augener, 1934	C. Ph. Sluiter & P. Buitendijk	NBC	Augener (1934); Nishi et al. (2010)
Sabellariidae	*Tetreres philippinensis*	(Treadwell, 1926)	GALATHEA	ZMUC	Kirkegaard (1995/ 1996)
Sabellariidae	*Tetreres porrectus* *	(Ehlers, 1908)	DEUTSCHE TIEFSEE	SMF?	Ehlers (1908)
Sabellariidae	*Tetreres superbus* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Sabellidae	*Acromegalomma interruptum*	(Capa & Murray, 2009)	-	MAGNT	GBIF/ OBIS datasets
Sabellidae	*Amphiglena mediterranea*	(Leydig, 1851)	Merton	-	Ehlers (1918)
Sabellidae	*Bispira melanostigma*	(Schmarda, 1861)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Bispira porifera*	(Grube, 1878)	P. Taylor	USNM	GBIF/ OBIS datasets
Sabellidae	*Bispira tricyclia*	(Schmarda, 1861)	ANAMBAS & P. A. Ouwens	MZB & NTM	Al-Hakim & Glasby (2004); Augener (1933c)

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Sabellidae	*Branchiomma cingulatum*	(Grube, 1870)	SIBOGA & W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin? & NBC	Augener (1933c); Fischli (1903); Mesnil & Fauvel (1939)
Sabellidae	*Caobangia morrisoni* *	Jones, 1974	A. Dewilde, O. Bryant, W. Palmer	BMNH & USNM	Jones (1974)
Sabellidae	*Chone infundibuliformis*	Krøyer, 1856	-	-	GBIF/ OBIS datasets
Sabellidae	*Chone letterstedti*	(Kinberg, 1866)	-	-	GBIF/ OBIS datasets
Sabellidae	*Euchone* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Sabellidae	*Laonome andamanensis*	Fitzhugh, 2002	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Sabellidae	*Notaulax phaeotaenia*	(Schmarda, 1861)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Paradialychone ecaudata*	(Moore, 1903)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Perkinsiana* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Sabellidae	*Potamilla leptochaeta*	Southern, 1921	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Pseudobranchiomma zebuensis*	(McIntosh, 1885)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Pseudopotamilla* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Sabellidae	*Sabella pavonina*	Savigny, 1822	SIBOGA	NBC	Mesnil & Fauvel (1939)
Sabellidae	*Sabellastarte magnifica*	(Shaw, 1800)	Vorster	MZB	Augener (1933c)
Sabellidae	*Sabellastarte spectabilis*	(Grube, 1878)	SIBOGA & S. M. S. GAZELLE	NBC & ZMB?	Ehlers (1918); Mesnil & Fauvel (1939)
Sabellidae	*Stylomma palmatum*	(Quatrefages, 1866)	-	ZMB	GBIF/ OBIS datasets
Sabellidae	*Acromegalomma vesiculosum*	(Montagu, 1813)	-	MZB	Augener (1933c)
Sabellidae	*Sabella spallanzanii*	(Gmelin, 1791)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Scalibregmatidae	*Hyboscolex verrucosa*	Hartmann-Schröder, 1979	J. M. Martens et al. & J. Pamungkas et al.	MZB & ZMH	Martens et al. (1995), Pamungkas (2015a)

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Serpulidae	*Ditrupa gracillima*	Grube, 1878	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Ficopomatus uschakovi*	(Pillai, 1960)	T. G. Pillai	BMNH?	Pillai (1965)
Serpulidae	*Filograna implexa*	Berkeley, 1835	-	MAGNT	GBIF/ OBIS datasets
Serpulidae	*Hydroides albiceps*	(Grube, 1870)	SIBOGA & W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin? & NBC	Fischli (1903); Mesnil & Fauvel (1939)
Serpulidae	*Hydroides bandaensis* *	Zibrowius, 1972	-	-	Zibrowius (1972)
Serpulidae	*Hydroides exaltata*	(Marenzeller, 1885)	P. Taylor	USNM	GBIF/ OBIS datasets
Serpulidae	*Hydroides externispina*	Straughan, 1967	E. Wong	AM	GBIF/ OBIS datasets
Serpulidae	*Hydroides minax*	(Grube, 1878)	E. Wong	AM & SMF	GBIF/ OBIS datasets
Serpulidae	*Hydroides multispinosa*	Marenzeller, 1885	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Serpulidae	*Hydroides novaepommeraniae*	Augener, 1925	P. Taylor	USNM	GBIF/ OBIS datasets
Serpulidae	*Hydroides recta*	Straughan, 1967	E. Wong	AM & MAGNT	GBIF/ OBIS datasets
Serpulidae	*Hydroides tambalagamensis*	Pillai, 1961	-	AM	GBIF/ OBIS datasets
Serpulidae	*Hydroides tuberculata*	Imajima, 1976	-	AM, SMF & USNM	GBIF/ OBIS datasets
Serpulidae	*Pomatostegus stellatus*	(Abildgaard, 1789)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Protula tubularia*	(Montagu, 1803)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Salmacina dysteri*	(Huxley, 1855)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Spiraserpula deltoides*	Pillai & Ten Hove, 1994	-	BMNH	GBIF/ OBIS datasets
Serpulidae	*Spiraserpula ingoconvexa*	Pillai & Ten Hove, 1994	-	BMNH	GBIF/ OBIS datasets
Serpulidae	*Spiraserpula snellii*	Pillai & Ten Hove, 1994	H. ten Hove	BMNH & USNM	GBIF/ OBIS datasets

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Serpulidae	*Spiraserpula sumbensis*	Pillai & Ten Hove, 1994	-	BMNH	GBIF/ OBIS datasets
Serpulidae	*Spirobranchus corniculatus* *	(Grube, 1862)	D. A. Willette & SIBOGA	AMSS, NBC, UCLA & UPMSI	Grube (1862); Mesnil & Fauvel (1939); Willette et al. (2015)
Serpulidae	*Spirobranchus corrugatus*	Straughan, 1967	H. ten Hove	AM, BMNH, MAGNT & SMF	GBIF/ OBIS datasets
Serpulidae	*Spirobranchus decoratus*	Imajima, 1982	-	ZMB	GBIF/ OBIS datasets
Serpulidae	*Spirobranchus giganteus*	(Pallas, 1766)	C. Johnsen, P. Taylor & R. Fadli	USNM	GBIF/ OBIS datasets
Serpulidae	*Spirobranchus latiscapus*	(Marenzeller, 1885)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Spirobranchus nigranucha* *	(Fischli, 1903)	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Serpulidae	*Spirobranchus tetraceros*	(Schmarda, 1861)	SIBOGA & SWISS	MNHM? & NBC	Malaquin & Dehorne (1907); Mesnil & Fauvel (1939)
Serpulidae	*Vermiliopsis infundibulum*	(Philippi, 1844)	-	AM & SMF	GBIF/ OBIS datasets
Serpulidae	*Vermiliopsis labiata*	(O. G. Costa, 1861)	-	SMF	GBIF/ OBIS datasets
Serpulidae	*Neodexiospira foraminosa*	(Bush in Moore & Bush, 1904)	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Serpula jukesii*	Baird, 1865	SIBOGA	NBC	Mesnil & Fauvel (1939)
Serpulidae	*Vermiliopsis glandigera*	Gravier, 1906	SIBOGA	NBC	Mesnil & Fauvel (1939)
Siboglinidae	*Euthalenessa festiva*	(Grube, 1875)	Merton	-	Ehlers (1918)
Siboglinidae	*Galathealinum bruuni*	Kirkegaard, 1956	GALATHEA	ZMUC	GBIF/ OBIS datasets
Siboglinidae	*Lamellisabella pallida*	Southward, 1975	-	-	GBIF/ OBIS datasets
Siboglinidae	*Paraescarpia echinospica*	Southward, Schulze & Tunnicliffe, 2002	-	Centre for Marine Living Resources and Ecology?	GBIF/ OBIS datasets

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Siboglinidae	*Siboglinum polystichum*	Southward, 1975	-	-	GBIF/ OBIS datasets
Siboglinidae	*Siboglinum sumatrense*	Ivanov, 1963	Ivanov A. V.	-	GBIF/ OBIS datasets
Siboglinidae	*Siboglinum weberi* *	Caullery, 1944	SIBOGA	NBC	Caullery (1914c, 1944b)
Siboglinidae	*Unibrachium tenuifrenum*	Southward, 1975	-	-	GBIF/ OBIS datasets
Sigalionidae	*Ehlersileanira incisa*	(Grube, 1877)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Sigalionidae	*Euthalenessa* cf. *oculata*	(Peters, 1854)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Fimbriosthenelais gracilis* *	(Fischli, 1903)	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Sigalionidae	*Fimbriosthenelais longipinnis*	(Grube, 1870)	SIBOGA	NBC	Horst (1917); Pettibone (1971)
Sigalionidae	*Horstileanira vanderspoeli* *	Pettibone, 1970	ANAMBAS & SIBOGA	MZB, NBC, NTM & ZRC	Al-Hakim & Glasby (2004); Horst (1917); Pettibone (1970)
Sigalionidae	*Labioleanira tentaculata* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Labiosthenolepis sibogae* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Leanira coeca* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Leanira quatrefagesi*	Kinberg, 1856	GALATHEA	ZMUC	GBIF/ OBIS datasets
Sigalionidae	*Pelogenia zeylanica*	(Willey, 1905)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Pottsipelogenia malayana* *	(Horst, 1913)	SIBOGA	NBC	Horst (1913, 1917)
Sigalionidae	*Psammolyce flava*	Kinberg, 1856	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Psammolyce horsti* *	Pettibone, 1997	SIBOGA	NBC	Pettibone (1997)
Sigalionidae	*Sigalion amboinensis* *	Grube, 1877	SIBOGA & S. M. S. GAZELLE	NBC & ZMB?	Grube (1877); Horst (1917)
Sigalionidae	*Sthenelais boa*	(Johnston, 1833)	-	-	GBIF/ OBIS datasets
Sigalionidae	*Sthenelais malayana* *	Horst, 1917	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Sthenelais orientalis*	Potts, 1910	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Sthenelanella ehlersi* *	(Horst, 1916)	SIBOGA	NBC	Horst (1916a, 1917)
Sigalionidae	*Sthenolepis incisa*	(Grube, 1877)	GALATHEA	ZMUC	GBIF/ OBIS datasets

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Sigalionidae	*Sthenolepis japonica*	(McIntosh, 1885)	GALATHEA	ZMUC	GBIF/ OBIS datasets
Sigalionidae	*Sthenolepis javanica* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Sthenolepis melanocephala* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Sthenolepis vulturis* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917)
Sigalionidae	*Willeysthenelais bandaensis* *	Pettibone, 1971	SIBOGA	NBC	Pettibone (1971)
Sigalionidae	*Willeysthenelais heterochela* *	(Horst, 1917)	SIBOGA	NBC	Horst (1917); Pettibone (1971)
Sigalionidae	*Willeysthenelais horsti* *	Pettibone, 1971	ANAMBAS & SIBOGA	NBC & NTM	Al-Hakim & Glasby (2004); Pettibone (1971)
Sigalionidae	*Willeysthenelais suluensis* *	Pettibone, 1971	SIBOGA	NBC	Pettibone (1971)
Sphaerodoridae	*Sphaerodoropsis malayana* *	(Augener, 1933)	van de Velde	NBC	Augener (1933a)
Spionidae	*Dipolydora armata*	(Langerhans, 1880)	J. D. Williams	USNM	Williams (2001)
Spionidae	*Laonice* cf. *cirrata*	(M. Sars, 1851)	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Spionidae	*Paraprionospio inaequibranchia* *	(Caullery, 1914)	SIBOGA	NBC	Caullery (1914b, 1944a)
Spionidae	*Paraprionospio pinnata*	(Ehlers, 1901)	SIBOGA	NBC	Caullery (1944a)
Spionidae	*Polydora robi* *	Williams, 2000	J. D. Williams	USNM	Williams (2000)
Spionidae	*Polydora umangivora* *	Williams, 2001	J. D. Williams	USNM	Williams (2001)
Spionidae	*Prionospio delta*	Hartman, 1965	-	-	GBIF/ OBIS datasets
Spionidae	*Prionospio ehlersi*	Fauvel, 1928	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Spionidae	*Prionospio komaeti*	Hylleberg & Nateewathana, 1991	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Spionidae	*Prionospio malayensis* *	(Caullery, 1914)	ANAMBAS & SIBOGA	MZB, NBC, NTM & ZRC	Al-Hakim & Glasby (2004); Caullery (1914b)
Spionidae	*Prionospio multibranchiata*	Berkeley, 1927	ANAMBAS	MZB & ZRC	Al-Hakim & Glasby (2004)
Spionidae	*Pseudopolydora reishi*	Woodwick, 1964	L. Colinvaux	USNM	GBIF/ OBIS datasets
Spionidae	*Spio* cf. *pettiboneae*	Foster, 1971	ANAMBAS	MZB	Al-Hakim & Glasby (2004)
Spionidae	*Spiophanes kroyeri*	Grube, 1860	ANAMBAS	MZB	Al-Hakim & Glasby (2004)

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Spionidae	*Spiophanes malayensis* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915d)
Spionidae	*Spiophanes longicirris* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915d)
Sternaspidae	*Caulleryaspis laevis* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a); Sendall & Salazar-Vallejo (2013)
Sternaspidae	*Sternaspis costata*	Marenzeller, 1879	SIBOGA?	NBC?	Sluiter (1891)
Sternaspidae	*Sternaspis minor* *	Caullery, 1944	ANAMBAS & SIBOGA	MZB, NBC, NTM & ZRC	Al-Hakim & Glasby (2004); Caullery (1944a)
Sternaspidae	*Sternaspis rietschi* *	Caullery, 1944	SIBOGA	NBC	Caullery (1994a); Sendall & Salazar-Vallejo (2013)
Sternaspidae	*Sternaspis spinosa* *	Sluiter, 1882	SIBOGA	NBC	Sendall & Salazar-Vallejo (2013); Sluiter (1882)
Syllidae	*Alcyonosyllis xeniaecola* *	(Hartmann-Schröder, 1993)	W. Kükenthal	ZMH?	Hartmann-Schröder (1993)
Syllidae	*Branchiosyllis exilis*	(Gravier, 1900)	K. W. Dammerman & SIBOGA	MZB & NBC	Aguado et al. (2008); Augener (1933c)
Syllidae	*Branchiosyllis maculata*	(Imajima, 1966)	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Branchiosyllis verruculosa*	(Augener, 1913)	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Eusyllis assimilis*	Marenzeller, 1875	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Eusyllis lamelligera*	Marion & Bobretzky, 1875	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Exogone normalis*	Day, 1963	-	-	GBIF/ OBIS datasets
Syllidae	*Exogone verugera*	(Claparède, 1868)	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Haplosyllis aciculata* *	Lattig, Martin & Aguado, 2010	SNELLIUS II	NBC	Lattig et al. (2010)
Syllidae	*Haplosyllis ingensicola* *	Lattig, Martin & Aguado, 2010	A. Janssen, B. W. Hoeksema & N. J. de Voogd	NBC	Lattig et al. (2010)
Syllidae	*Haplosyllis nicoleae* *	Lattig, Martin & Aguado, 2010	A. Janssen, B. W. Hoeksema & N. J. de Voogd	NBC	Lattig et al. (2010)
Syllidae	*Haplosyllis spongicola*	(Grube, 1855)	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Syllidae	*Haplosyllis tenhovei* *	Lattig, Martin & Aguado, 2010	SNELLIUS II	NBC	Lattig et al. (2010)
Syllidae	*Odontosyllis arenicolor*	Grube, 1878	L. van Lummel & Steinfurth	MZB	Augener (1933c)
Syllidae	*Odontosyllis freycinetensis*	Augener, 1913	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Odontosyllis gibba*	Claparède, 1863	L. van Lummel	MZB	Augener (1933c)
Syllidae	*Opisthosyllis flaccida*	(Grube, 1878)	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Opisthosyllis mariae* *	Aguado, San Martín & ten Hove, 2008	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Paraehlersia cf. ehlersiaeformis*	(Augener, 1913)	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Paraehlersia ferrugina*	(Langerhans, 1881)	L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Paraopisthosyllis fusigera*	(Augener, 1913)	Merton	-	Ehlers (1918)
Syllidae	*Proceraea picta*	Ehlers, 1864	L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Salvatoria rhopalophora*	(Ehlers, 1897)	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Sphaerosyllis georgeharrisoni*	San Martín, 2005	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis alternata*	Moore, 1908	SIBOGA & SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Syllis armillaris*	(O. F. Müller, 1776)	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis augeneri*	Haswell, 1920	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis* cf. *cruzi*	Núñez & San Martín, 1991	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Syllis* cf. *parapari*	San Martín & López, 2000	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis cornuta*	Rathke, 1843	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Syllis gracilis*	Grube, 1840	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Syllis komodoensis* *	Aguado, San Martín & ten Hove, 2008	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Syllis krohnii*	Ehlers, 1864	L. van Lummel	MZB	Augener (1933c)
Syllidae	*Syllis prolifera*	Krohn, 1852	J. Rosewater & L. Colinvaux	USNM	GBIF/ OBIS datasets
Syllidae	*Syllis quadrifasciata*	Fischli, 1900	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Syllidae	*Syllis setoensis*	(Imajima, 1966)	SIBOGA	NBC	Aguado et al. (2008)

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Syllidae	*Syllis variegata*	Grube, 1860	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis villenai* *	Aguado, San Martín & ten Hove, 2008	SIBOGA	NBC	Aguado et al. (2008)
Syllidae	*Syllis ypsiloides* *	Aguado, San Martín & ten Hove, 2008	SIBOGA & SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Trypanosyllis taeniaformis*	(Haswell, 1886)	-	BMNH	GBIF/ OBIS datasets
Syllidae	*Trypanosyllis zebra*	(Grube, 1860)	SNELLIUS II	NBC	Aguado et al. (2008)
Syllidae	*Pionosyllis* sp.	-	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Syllidae	*Opisthosyllis australis*	Augener, 1913	L. van Lummel	MZB	Augener (1933c)
Syllidae	*Syllis onkylochaeta* *	Hartmann-Schröder, 1991	-	ZMH	Hartmann-Schröder (1991)
Terebellidae	*Amaeana apheles*	(Hutchings, 1974)	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Terebellidae	*Amaeana* cf. *yirrarn*	Hutchings, 1997	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Terebellidae	*Amphitrite cirrata*	Müller, 1776	J. H. Schaay & W. C. Klein	-	GBIF/ OBIS datasets
Terebellidae	*Amphitrite leptobranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Amphitrite malayensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Axionice (Parascione) abyssorum* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Axionice albomaculata* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Axionice moorei* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupistella dibranchiata*	(Fauvel, 1909)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupistella digitibranchia* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupolymnia caulleryi*	Buzhinskaja, 2013	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupolymnia dubia* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupolymnia intoshi* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupolymnia marenzelleri* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Eupolymnia triloba*	(Fischli, 1900)	W. Kükenthal	Gesellschaft Naturforschender Freunde zu Berlin?	Fischli (1903)
Terebellidae	*Lanice fauveli*	Day, 1934	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Lanice wollebaeki* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Leprea ceratobranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Leprea verrucosa* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Terebellidae	*Loimia annulifilis*	(Grube, 1872)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Loimia crassifilis*	(Grube, 1878)	Merton & SIBOGA	NBC	Caullery (1944a); Ehlers (1918)
Terebellidae	*Loimia ingens*	(Grube, 1878)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Loimia nigrifilis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Loimia ochracea*	(Grube, 1877)	-	MAGNT	GBIF/ OBIS datasets
Terebellidae	*Loimia verrucosa* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Lysilla albomaculata* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Lysilla pacifica*	Hessle, 1917	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Neoamphitrite sibogae* *	(Caullery, 1944)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Nicolea angustiscutis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Nicolea incerta* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Nicolea koehleri* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Nicolea longibranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Nicolea willeyi* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Opisthopista sibogae* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Paralanice timorensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Pista aequibranchia* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Pista brevibranchia*	Caullery, 1915	-	-	GBIF/ OBIS datasets
Terebellidae	*Pista crassa* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915a, 1944a)
Terebellidae	*Pista curtiuncata*	Hartmann-Schröder, 1981	-	AM	GBIF/ OBIS datasets
Terebellidae	*Pista fasciata*	(Grube, 1870)	-	-	GBIF/ OBIS datasets
Terebellidae	*Pista foliigera* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915a)
Terebellidae	*Pista robustiseta* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915c, 1944a)
Terebellidae	*Pista typha*	Grube, 1878	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Polycirrus aquila* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Streblosoma amboinense* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Streblosoma gracile* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Streblosoma prora*	Hutchings & Glasby, 1987	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Terebellidae	*Streblosoma quadridentatum* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)

Family	Species	Author(s)	Expedition/ collector	Repository	Reference(s)
Terebellidae	*Terebella annulifilis*	Grube, 1872	Merton	-	Ehlers (1918)
Terebellidae	*Terebella plagiostoma*	Schmarda, 1861	Merton	-	Ehlers (1918)
Terebellidae	*Thelepides malayensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus abyssorum* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus angustitoris* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus dubius* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus malayensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus microbranchiatus* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus robustus*	(Grube, 1878)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus taamensis* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Thelepus thoracicus*	(Grube, 1870)	SIBOGA	NBC	Caullery (1944a)
Terebellidae	*Pista obesiseta* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915c)
Terebellidae	*Streblosoma longiremis* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915a)
Thalassematidae	*Anelassorhynchus moebii*	(Greeff, 1879)	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Anelassorhynchus semoni*	(Fischer, 1896)	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Ochetostoma baronii*	(Greeff, 1872)	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Ochetostoma erythrogrammon*	Rüppell & Leuckart, 1828	SIBOGA?	NBC?	Sluiter (1891)
Thalassematidae	*Ochetostoma formosulum*	(Lampert, 1883)	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Ochetostoma kokotoniense*	(Fischer, 1892)	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Thalassema diaphanes* *	Sluiter, 1889	SIBOGA	NBC?	Sluiter (1889, 1891, 1902)
Thalassematidae	*Thalassema leptodermon*	Not in WoRMS?	SIBOGA	NBC?	Sluiter (1902)
Thalassematidae	*Thalassema ovatum* *	Sluiter, 1902	SIBOGA	NBC?	Sluiter (1902)
Travisiidae	*Travisia horsti* *	Caullery, 1944	SIBOGA	NBC	Caullery (1944a)
Travisiidae	*Travisia profundi*	Chamberlin, 1919	GALATHEA	ZMUC	GBIF/ OBIS datasets
Trichobranchidae	*Artacamella* sp.	-	ANAMBAS	NTM	Al-Hakim & Glasby (2004)
Trichobranchidae	*Terebellides ehlersi*	McIntosh, 1885	SIBOGA	NBC	Caullery (1944a)
Trichobranchidae	*Terebellides intoshi* *	Caullery, 1915	SIBOGA	NBC	Caullery (1915b)
Trichobranchidae	*Terebellides jorgeni* *	Hutchings, 2007	-	-	Hutchings (2007)
Trichobranchidae	*Terebellides narribri*	Hutchings & Peart, 2000	ANAMBAS	MZB, NTM & ZRC	Al-Hakim & Glasby (2004)
Trichobranchidae	*Terebellides sieboldi* *	Kinberg, 1866	-	NRS?	Kinberg (1866)
Trichobranchidae	*Terebellides stroemii*	Sars, 1835	SIBOGA	NBC	Caullery (1944a)

Table 4.3 List of Indonesian polychaete families with species numbers in comparison with the world's species numbers (Pamungkas et al. 2019). Text in bold and highlighted in yellow indicates the top-three families with the most species. The family Poecilochaetidae is also known from Indonesia (see Al-Hakim & Glasby, 2004) but is not included in the Table as species numbers are not known with any accuracy.

Family	Author(s)	Species number	World's species number	In %
Acoetidae	Kinberg, 1856	7	60	11.7
Ampharetidae	Malmgren, 1866	19	306	6.2
Amphinomidae	Lamarck, 1818	27	152	17.8
Aphroditidae	Malmgren, 1867	24	123	19.5
Bonelliidae	Lacaze-Duthiers, 1858	2	74	2.7
Capitellidae	Grube, 1862	9	193	4.7
Chaetopteridae	Audouin & Edwards, 1833	5	73	6.8
Chrysopetalidae	Ehlers, 1864	3	87	3.4
Cirratulidae	Carus, 1863	9	291	3.1
Cossuridae	Day, 1963	1	26	3.8
Dorvilleidae	Chamberlin, 1919	1	201	0.5
Eulepethidae	Chamberlin, 1919	1	22	4.5
Eunicidae	Berthold, 1827	14	419	3.3
Euphrosinidae	Williams, 1852	12	59	20.3
Flabelligeridae	de Saint-Joseph, 1894	11	182	6.0
Glyceridae	Grube, 1850	9	87	10.3
Goniadidae	Kinberg, 1866	3	90	3.3
Hartmaniellidae	Imajima, 1977	1	3	33.3
Hesionidae	Grube, 1850	11	214	5.1
Iphionidae	Kinberg, 1856	2	13	15.4
Lumbrineridae	Schmarda, 1861	6	302	2.0
Magelonidae	Cunningham & Ramage, 1888	3	67	4.5
Maldanidae	Malmgren, 1867	11	272	4.0
Nephtyidae	Grube, 1850	8	144	5.6
Nereididae	**Blainville, 1818**	**75**	687	10.9
Oenonidae	Kinberg, 1865	4	90	4.4
Onuphidae	Kinberg, 1865	7	340	2.1
Opheliidae	Malmgren, 1867	15	155	9.7
Orbiniidae	Hartman, 1942	4	184	2.2
Oweniidae	Rioja, 1917	5	55	9.1
Paralacydoniidae	Pettibone, 1963	2	2	100.0
Paraonidae	Cerruti, 1909	4	169	2.4
Pectinariidae	Quatrefages, 1866	6	57	10.5
Phyllodocidae	Örsted, 1843	4	448	0.9
Pilargidae	de Saint-Joseph, 1899	5	105	4.8
Polygordiidae	Czerniavsky, 1881	1	15	6.7
Polynoidae	**Kinberg, 1856**	**56**	876	6.4
Sabellariidae	Johnston, 1865	8	130	6.2
Sabellidae	Latreille, 1825	18	493	3.7
Scalibregmatidae	Malmgren, 1867	1	66	1.5
Serpulidae	Rafinesque, 1815	15	576	2.6
Siboglinidae	Caullery, 1914	2	178	1.1
Sigalionidae	Malmgren, 1867	22	219	10.0
Sphaerodoridae	Malmgren, 1867	1	112	0.9
Spionidae	Grube, 1850	14	612	2.3
Sternaspidae	Carus, 1863	5	29	17.2
Syllidae	Grube, 1850	34	993	3.4
Terebellidae	**Johnston, 1846**	**56**	607	9.2
Thalassematidae	Forbes & Goodsir, 1841	9	75	12.0
Travisiidae	Hartmann-Schröder, 1971	1	34	2.9

Family	Author(s)	Species number	World's species number	In %
Trichobranchidae	Malmgren, 1866	7	78	9.0

*In Pamungkas et al. (2019), members of family Thalassematidae were merged with members of family Echiuridae.

Table 4.4 First authors who have formally described new Indonesian polychaete species along with their country and the number of species described. Authors who described the most species in bold and highlighted in yellow.

First author	Country	Number of species described
A. E. Grube	Germany	6
A. Malaquin	France	1
A. Quatrefages	France	4
C. Dawydoff	Russia	1
C. G. Di Camillo	Italy	1
C. J. Glasby	Australia	1
C. Ph. Sluiter	Germany	5
E. Ehlers	Germany	16
F. Mesnil	France	1
G. Hartmann-Schröder	Germany	2
H. Augener	Germany	9
H. Fischli	Germany	3
H. J. Feuerborn	Germany	1
H. Zibrowius	France	1
J. B. Kirkegaard	Denmark	3
J. G. H. Kinberg	Sweden	9
J. Pamungkas	Indonesia	2
J. V. Audouin	France	1
J. D. Williams	USA	2
M. Caullery	**France**	**92**
M. E. Petersen	Denmark	1
M. H. Pettibone	USA	7
M. L. Jones	USA	1
M. T. Aguado	Spain	4
O. Pflugfelder	Germany	7
P. Hutchings	Australia	1
P. Lattig	Spain	4
P. S. Pallas	The Netherlands	1
R. A. Hoagland	USA	1
R. Horst	**The Netherlands**	**106**
W. C. McIntosh	The United Kingdom	5
Total		**299**

Table 4.5 Collection information for polychaete collections at the Museum Zoologicum Bogoriense (MZB), Research Center for Deep Sea (RCDS) and Research Center for Oceanography (RCO).

Remarks	MZB	RCDS	RCO
The institution is accredited as a zoological specimens repository	Yes	No	No
The collection is registered and housed in a reference collection room	Yes	Yes	No
The reference collection room's space is sufficient to house marine specimens	No	Yes	No
First year of specimen addition	1907	2014	1985
Number of specimen lots	204	191	45,000
Number of families	31	17	>45
Number of species identified to species level	81	10	Unknown
Number of publications associated with the collection	6	3	Unknown
Number of polychaete scientists	0	1	2

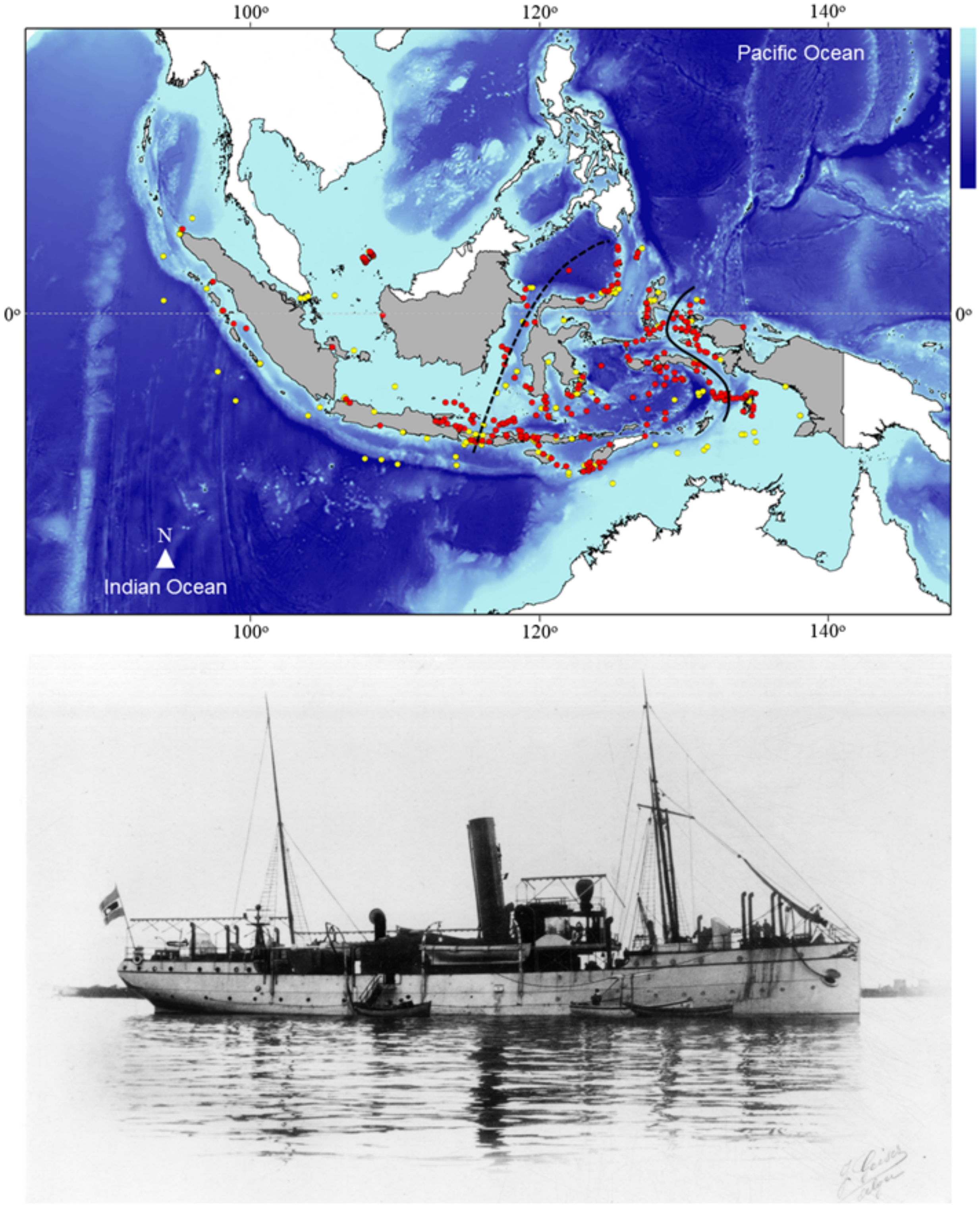

Figure 4.1 Above: map of Indonesian polychaete records (scale 1:30,000,000). Red circles represent records from taxonomic publications, whereas yellow circles represent records from both GBIF/ OBIS and ecological publications. Black dash and solid lines are Wallace's and Lydekker's Lines, respectively. The upper (light blue) and bottom (dark blue) bathymetric scales represent depths < 100m and >8000 m, respectively. Below: the research vessel used during Siboga Expedition.

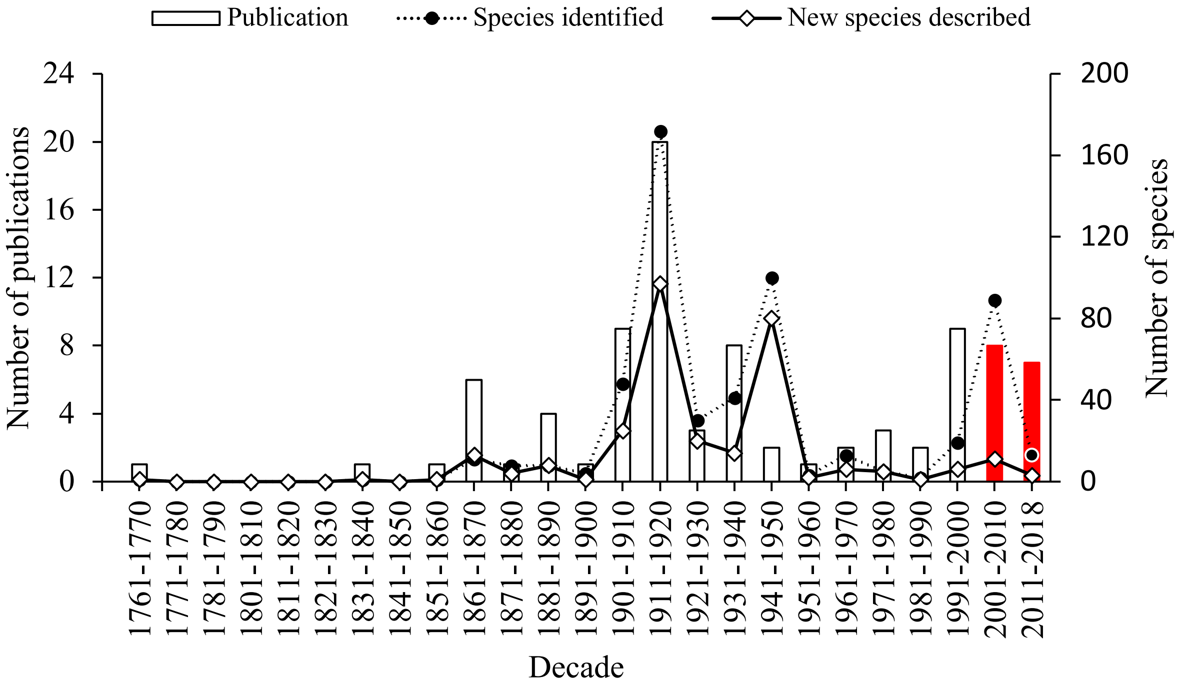

Figure 4.2 Number of taxonomic publications and species identified. White bars indicate publications by overseas scientists; red bars indicate publications by both overseas and local scientists.

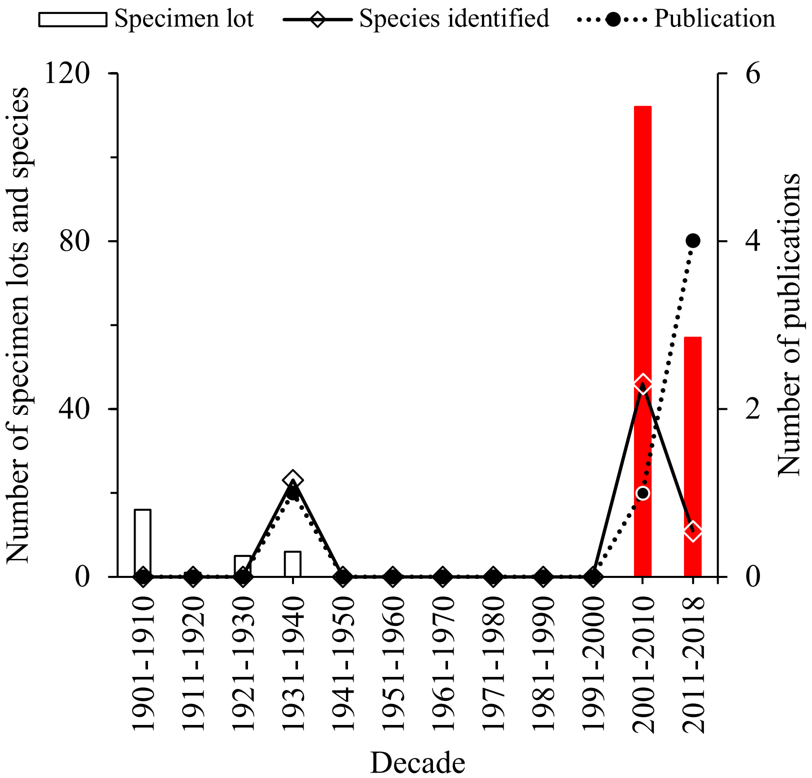

Figure 4.3 Rate of specimen lot addition at the MZB as the only internationally-accredited zoological museum of the country. White and red bars indicate specimen lots added by European and local scientists, respectively; white diamonds indicate the number of species identified and published.

Figure 4.4 The Museum Zoologicum Bogoriense (left) and the entire polychaete collection housed (right).

4.4 Discussion

4.4.1 Biodiversity studies

Since around the mid 1700s, Indonesian polychaetes were mostly sampled and identified by European taxonomists, and the contribution of local scientists was minor and recent. This is mainly due to the fact that up until the mid 1900s biodiversity research in the geographic region was lacking. Up until the 1970's, no marine expedition was carried out by national research institutions. The first marine expeditions by a national research institution were conducted by the RCO through a series of cruises in the 1970s (Rumphius I-IV), and some collaborative voyages in the 1980s (Snellius II) and early 1990s (Karubar and MNINGA) (Glasby & Al-Hakim, 2017). Despite specimens from these expeditions being housed at the RCO and NBC (Glasby & Al-Hakim, 2017), no taxonomic publication on the fauna was produced, and no specimens were deposited at the MZB.

Taxonomic investigations on polychaete species conducted by local scientists began early this century. However, the number of studies, as well as the number of new species described, was extremely low. The major reason for this is that marine taxonomy is not yet of great concern to policy makers in the country. Although conservation and rehabilitation of coastal and marine ecosystems has been identified as a priority research topic (the Ministry of Research, Technology and Higher Education of the Republic of Indonesia, 2017) species description is still an under-valued pursuit. This state of affairs has led to few people specialising in marine taxonomy. To the best of our knowledge, there are currently no more than three senior Indonesian marine taxonomists, and there has never been a full-time polychaete taxonomist in the country (the author (JP) is the only early-career researcher specialising in the study of polychaetes). This current situation in Indonesia is in sharp contrast to the global pattern where the number of people describing polychaete species has generally increased since the 1960's. Although we now live in an age of having the most polychaete taxonomists ever globally (Pamungkas et al., 2019), taxonomists are still an “endangered species” (Buyck, 1999; Wägele et al., 2011) in Indonesia.

Indonesia’s neighbours (e.g., Malaysia and Singapore) also seem to share the lack of funding for taxonomic investigations. Funds are rarely provided by the government unless the taxonomic studies are attached to other studies with a more economic or ecological focus (I. Idris, 2019 & Y-l. Lee, 2019 – pers. comm.). This practice could be one way to overcome the similar problem in Indonesia, considering that local researchers have conducted marine benthic studies yielding numerous polychaete specimens. The involvement of a polychaete taxonomist in an ecological benthic study would also address the crucial issues of correct species identification and specimen vouchering.

Further, international research collaborations may be another way to increase the marine taxonomic effort in the country. However, the fact that many Indonesian biological materials obtained from international expeditions have been exclusively housed in overseas museums, many of which have been described by overseas taxonomists without the involvement of local scientists, may have contributed to the current strict permitting requirements for international biodiversity research collaborations today (see the Ministry of Research, Technology and Higher Education of the Republic of Indonesia, 2019). To conduct biodiversity studies, foreign researchers, in principle, must obtain an official research permit in advance, and research permits are only issued if there is at least one Indonesian counterpart (this typically also implies a Memorandum of Understanding between the two collaborating research institutions). Sharing biological specimens is possible, but research permits may stipulate that holotypes are to be deposited at the MZB, and any resulting publications should be either authored or co-authored by a local scientist.

4.4.2 Species richness

I found 580 valid polychaete species in 51 families reported from Indonesian waters. This is much higher than in neighboring countries: 64 species in 31 families were reported from Malaysia (Idris & Arshad, 2013), 64 species in 28 families from Singapore (Tan & Chou, 1993), but comparable to the Philippines with 443 species in 43 families (Palpal-latoc, 2001). However, the number of documented Indonesian polychaetes is only about 5% of known polychaete species of the world (i.e., nearly 11,500 species belonging to 85 families) investigated by Pamungkas et al. (2019). Our findings suggest that the polychaete fauna of Indonesia is still poorly studied, especially considering that the region encompassing the Coral Triangle is known for its high biodiversity in other groups of marine invertebrates such as molluscs and crustaceans (e.g., Valentine, 1971; Hutomo & Moosa, 2005).

The high proportion of offshore and deep-sea polychaete records in the region is notable and is probably quite different from depth range records of countries such as Australia and the United States, where deep-sea surveys tend to be outnumbered by coastal monitoring surveys. The majority of the known Indonesian polychaete species were collected from the Wallacea region and its surrounding waters by the Siboga Expedition, which is geographically situated in the central and eastern part of Indonesia, including Java (eastern part), Bali, Flores, Savu, Timor, Arafura, Banda, Ceram, Halmahera, Molucca, Celebes Seas, and Makassar Strait. The western part of Indonesia, including Java (western part) and South China Seas, Malacca Strait, and Indian Ocean has, in contrast, been relatively under sampled. Many intertidal habitats have been sampled recently by local scientists, but polychaete specimens were rarely identified to species level and vouchered.

To rectify the current bias in the geographic sampling pattern and fill the current gap in the knowledge of Indonesian polychaete diversity, I recommend conducting future taxonomic studies in the populous western part of Indonesia, as well as in intertidal habitats. Such a strategy will serve to identify species that may be useful for monitoring areas of high human impact related to both urbanisation and mining. Not only is it cost-efficient and more easily accessible, but collecting polychaete fauna in intertidal habitats will also better reveal the true species richness of a number of common, under-represented polychaete families, such as Dorvilleidae, Lumbrineridae, Phyllodocidae and Scalibregmatidae (all with an Indonesian representation of two percent or less of the total global number of species). It will enable faunistic comparison with similar habitats in neighbouring areas, e.g., mangrove habitat of northern Australia (e.g., Metcalfe & Glasby, 2008), the coral reef habitat of north-eastern Australia (e.g., Hutchings, 2019), and other tropical habitats, e.g., the seagrass habitat of Brazil (e.g., Omena & Creed, 2004).

Special taxonomic attention may also be paid to polychaetes of direct significance to humans, e.g., the annually swarming palolo polychaetes consumed by natives of a number of Indonesian islands, most famously Lombok during February or March (Bachtiar & Bachtiar, 2019). Although the festival of bau nyale (English: catching nyale, i.e., the local name of the worms) has attracted many tourists to Lombok to witness various traditional performances linked to the local nyale myth (see the Ministry of Tourism, Republic of Indonesia, 2019), the species richness of nyale remains unknown to date. Presuming that nyale are similar to the wawo worms of Ambon, which comprise multiple species of eunicids and nereidids, taxonomic investigation of this fauna will certainly improve our knowledge of Indonesian reef-dwelling species. Further, taxonomic studies focusing on mangrove habitats may also lead to the discovery of indicator species useful for monitoring these threatened habitats, particularly those near industrial areas (e.g., Pamungkas, 2015b, 2017); species with the potential to be cultured for use as growth-stimulating feed for shrimps (e.g., Rahmad & Yuwono, 2000; Yuwono, 2005) are also common in mangrove habitats.

4.4.3 Specimen repositories

The present study clearly indicates that the small polychaete collection at the MZB, as well as those at the RCO and RCDS, do not represent well Indonesia's polychaete diversity. Resolving the issue of the lack of in-country storage of voucher collections is thus the first step to the safe-keeping of Indonesia's biodiversity heritage. Second, international collaborations could be encouraged by specifying an intention for eventual repatriation of polychaete collections back to accredited museums in Indonesia, particularly those collections that remain unidentified and type specimens. However, because the MZB is currently the only accredited institution, an agreement for future repatriation may serve to encourage collaboration and facilitate construction of other accredited institutions in Indonesia. Such positive action may be a good start to initiate collaboration between scientists and collection managers as well as to stimulate the taxonomic study of the polychaete fauna in the country.

Chapter 5

Capitella ambonensis: a new polychaete species (Annelida: Capitellidae) collected from a mangrove habitat on Ambon Island, Indonesia

Abstract

A new species *Capitella ambonensis* sp. nov., formally described by Pamungkas (2017), was discovered from loamy sand sediment of a mangrove habitat on Ambon Island, Indonesia. The species was described primarily based on the distribution of capillary chaetae and hooks. Methylene blue staining pattern was also used to examine the similarity between the material of this study and other species of *Capitella*. *Capitella ambonensis* sp. nov. differs from other *Capitella* species in the form of hooded hooks and the methylene blue staining pattern. A table that lists all *Capitella* species with their thoracic chaetal formulas is also provided.

5.1 Introduction

The genus *Capitella* was originally erected by Blainville (1828) for *Lumbricus capitatus* Fabricius, 1780. The genus, as pointed out by Hartman (1947), is characterized as having 9 thoracic chaetigers, of which the first 7 chaetigers bear capillary chaetae in both rami. Subsequently, hooded hooks are present in posterior thoracic chaetigers as well as in the abdomen, but the hooks in the 8th and 9th notopodia of males are replaced by genital hooks. In addition to this, Warren (1976) reported the presence of genital hooks in some female *Capitella*.

Based on the data garnered by World Register of Marine Species (WoRMS), the genus *Capitella* to date includes 17 species. Neglecting subspecies, these include: *Capitella aberranta*, *C. aciculata*, *C. capitata*, *C. caribaeorum*, *C. dizonata*, *C. giardi*, *C. gracilis*, *C. hermaphrodita*, C. *iatapiuna*, *C. intermedia*, *C. jonesi*, *C. minima*, *C. ovincola*, *C. perarmata*, *C. singularis*, *C. teleta* and *C. teres*. Among these, *C. capitata* is the species with the most subspecies (i.e., 7 subspecies; ignoring the unreviewed *C. capitata capitata*).

Due to similar morphology, specimens of the type species, *Capitella capitata* (Fabricius, 1780), originally described from Greenland, have been referred to this species from worldwide locations and the species has been considered cosmopolitan and an indicator of marine pollution (Reish, 1957; Warren, 1977; Tsutsumi, 1987; Dean, 2008). However, Grassle & Grassle (1976) identified a number of sibling species of this genus in the northeastern United States. These were very similar morphologically, but differed in life history, reproduction and genetics. These discoveries complicated subsequent efforts to identify *Capitella* spp.

To date, there is no taxonomic information about species of *Capitella* from Indonesian waters. In this paper, a description of a new species *C. ambonensis* sp. nov. is given. This represents the first taxonomic study on Indonesian *Capitella* species.

5.2 Materials and Methods

Five mangrove stations were sampled on Ambon Island, Province of Maluku (Figure 5.1). The new species, *Capitella ambonensis* sp. nov., interestingly, was only found at station 2, which is a mangrove habitat adjacent to a diesel-powered electricity generator (PLTD) at the Poka Village.

To collect these worms, mangrove sediments were first shoveled to about 50 cm depth and directly screened in the field using a 0.5 mm mesh sieve. All materials retained on the sieve, including *C. ambonensis* sp. nov. with other macrobenthic fauna and mangrove litter, were first fixed in 4% formalin sea-water solution for more than 24 hours, then rinsed with tap water to remove the fixative. Afterwards, the materials were sorted and preserved in 70% ethanol.

The *Capitella ambonensis* sp. nov. specimens were examined using an Olympus SZX7 stereo microscope and a NIKON OPTIPHOT-2 compound microscope. Photomicrographs of the preserved specimens were taken with an Olympus E-330 digital single lens reflector (DSLR) mounted on the stereo microscope. The drawing of the hooded hook was made with a camera lucida fitted to a compound microscope. SEM observations to observe hooded hooks of the selected specimen (MZB. Pol. 00187) were carried out using a JEOL JSM 5310 LV. All laboratory work in this study was done at the Research Center for Biology (RCB), Indonesian Institute of Sciences (LIPI).

Due to postal restrictions (pers.obs.), no comparative material was examined. The material in this study was identified and compared to other *Capitella* species based solely on the taxonomic publications – mostly original ones – on *Capitella* spp. by Blake (2009), Blake et al. (2009), Fabricius (1780), Fauvel (1932), Gravier (1911), Hartman (1947; 1959), Hartman & Fauchald (1971), Langerhans (1880), Shimabukuro et al. (2016), Treadwell (1939), Verrill (1880), Warren (1976; 1991) and Warren & George (1986). The material in this study was identified to the generic level based mainly on the distribution of capillary chaetae and hooded hooks, whereas to the species level a detailed morphology of hooded hooks was observed with the compound microscope using high magnification (1000x). Methylene blue staining pattern (MBSP), was also used to examine the similarity between the material of this study and other *Capitella* species. Modifying the protocol of Warren et al. (1994), the specimens were first immersed for approximately one minute in a solution of methylene blue in 70% alcohol. After that, they were rinsed in clean alcohol for about one minute to eliminate excess stain. During the examination, the specimens were put in a petri dish filled with tap water to restrain the leaching.

The holotype and almost all of paratype specimens of *C. ambonensis* sp. nov., including the one on the SEM stub, were deposited at the Museum Zoologicum Bogoriense (MZB), Cibinong, Bogor, Indonesia. Some paratype specimens were also deposited at the Reference Collection LIPI Ambon (RCLA) at the Research Center for Deep Sea (RCDS), Indonesian Institute of Sciences (LIPI), Ambon, Indonesia.

Figure 5.1 Map of the sampling stations. Red circles from the lower left clockwise: stations 1, 2, 3, 4 and 5. The map is taken and modified from Google Earth (data providers: TerraMetrics & DigitalGlobe).

5.3 Results

5.3.1 Systematics

Order Capitellida Fauchald, 1977

Family Capitellidae Grube, 1862

Genus *Capitella* Blainville, 1828

Species *Capitella ambonensis* sp. nov.

5.3.2 Material examined

Holotype: 1 male (MZB. Pol 00182), Poka Village, Ambon Island, 03˚38′45.3″S, 128˚11′31.6″E, coll. J. Pamungkas, August 28th, 2015. Paratypes: 5 males (MZB. Pol. 00183), 1 male (MZB. Pol. 00184), 10 females (?) (MZB. Pol. 00185), 2 females (?) (MZB. Pol. 00186), 1 female (?) (MZB. Pol. 00187), 1 female (?) (MZB. Pol. 00188), 3 males (RCLA. Ann. 176), 2 females (?) (RCLA. Ann. 196), all from Poka Village, Ambon Island, 03˚38′45.3″S, 128˚11′31.6″E, coll. J. Pamungkas, August 28th, 2015.

5.3.3 Description

Holotype complete but with broken pygidium, with about 179 chaetigers, 54 mm long, 0.9 mm wide in anterior abdomen. Paratypes complete or anterior fragments (mostly), ranging from 17 mm long by 0.7 mm wide (49 chaetigers) to 57 mm long, 1.0 mm wide (about 208 chaetigers). Color in alcohol whitish, except abdominal dorsum pigmented dark brown. Prostomium conical, somewhat flattened dorsoventrally, eyes absent. Peristomium distinct, a single achaetous ring.

Thorax with 9 segments, all chaetigerous. Chaetigers 1–7 with capillary chaetae only in both rami (Figures 5.2A & B; 5.5A). Chaetigers 8 and 9 with neurohooks only; notopodia achaetous, but with genital spines in male (i.e., on chaetigers 8 and 9) and some female (?) specimens (i.e., on chaetiger 9 only); thoracic chaetal formula = $^{c}/_{c}$ (1–7), $^{gs}/_{h}$ (8–9) for males, and $^{c}/_{c}$ (1–7), $^{a}/_{h}$ (8–9) or $^{c}/_{c}$ (1–7), $^{a}/_{h}$ (8), $^{gs}/_{h}$ (9)[1] for females (?). Thoracic region with two distinct parts, i.e. (1) striated uni-annulate segments (starting from peristomium to chaetiger 7), and (2) smoother multi-annulate segments (chaetigers 8 and 9). First six chaetigers gradually increasing in size with chaetiger 6 largest. From chaetigers 7–9, size gradually decreasing (Figure 5.2A & B). Shallow lateral line from chaetigers 5 or 6 continuing to posterior end (Figures 5.2A & 5.5A). Ventral groove present from chaetiger 7 to posterior end (Figure 5.4C & D). Genital pore, when seen, between chaetigers 7 and 8 (Figure 5.5A).

In males, genital spines of each chaetiger in two bundles. Spines of both chaetigers pointed toward each other with larger spines of chaetiger 9 directed anteriorly and smaller, less conspicous spines of chaetiger 8 directed posteriorly. Color of genital spines of chaetiger 8 light brown with those of chaetiger 9 blackish brown (Figure 5.2C). In most females (?), genital spines not seen (Figure 5.2D), often hidden in intersegmental groove between chaetigers 8 and 9. Some female specimens with minute genital spines in chaetiger 9 only (size of spines much smaller than those of males). Dorsal region around genital spines of chaetiger 9 of male specimens inflated (Figure 5.2A, B & C), perhaps due to the presence of copulatory organ; chaetiger 9 of females not inflated. Holotype male with three obvious pairs of genital spines in chaetiger 9, but hidden spines in intra-annular groove of chaetiger 8. Paratype MZB Pol. 00184 male with six and three pairs of obvious genital spines in chaetigers 8 and 9, respectively (Figure 5.2C). Most male paratypes with spines not visible, or with slightly visible spines in chaetiger 8 and obvious spines in chaetiger 9.

Transition between thorax and abdomen clearly marked by: (1) deep inter-segmental groove between chaetigers 9 and 10, (2) dark brown-pigmented abdominal dorsum, and (3) presence of abdominal hooded hooks in noto- and neuropodia (Figure 5.2A, B & C). Abdominal segments multi-annulate (Figure 5.2A & B), not narrowing posteriorly, except far posterior region slightly narrowing. Branchiae absent. Pygidium mostly broken; MZB. Pol. 00188 complete; pygidium simple and without any appendages (Figure 5.2E).

Hooded hooks with two rows of teeth above main fang, covered with short hood to shoulder. Hooks with narrow neck, relatively long anterior shaft between shoulder and node, obvious constriction and inflated node (Figure 5.5C, D & E). In anterior abdomen, number of notohooks within fascicle slightly fewer than neurohooks, i.e., about 13 and 18 hooks,

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[1] The notations used for thoracic chaetal formulas can be seen below Table 5.1.

respectively. Hooks within fascicles decrease in number posteriorly with about 7 and 10 hooks in noto- and neuropodia of posterior chaetigers, respectively.

5.3.4 Methylene blue staining pattern (MBSP)

Thorax fully stained, including intersegmental and ventral grooves. Dorsal region of thorax stained blue with medium intensity, except in areas around notopodia and genital spines stained light blue (Figure 5.4A & B). Ventral regions of prostomium and peristomium stained light blue; more weakly stained areas around neuropodia and ventral line. Ventrum of chaetigers 1, 2 and 4 stained blue with medium intensity; chaetiger 3 brighter. In subsequent chaetigers, ventral areas of chaetigers 5, 6 and 7 stained deeper on prechaetal annuli and darker on postchaetal annuli, whereas those of chaetigers 8 and 9 stained blue with medium intensity (Figure 5.4C). Dorsum of anterior abdominal segments stained dark blue with slightly brighter areas around noto- and neuropodia (Figure 5.4A & B), whereas that of mid to posterior abdominal segments stained brighter. Abdominal venter stained light greenish blue with dark blue oval patterns (ring-like) surrounding neuropodia (Figure 5.4C & D).

5.3.5 Variation

Some variation was noted in the paratype MZB. Pol. 00186. Whereas abdominal dorsum of other type specimens dark brown, those of two specimens of MZB Pol. 00186 pale. Also, in contrast to other type specimens, posterior region of these two specimens slightly inflated.

5.3.6 Distribution

Capitella ambonensis sp. nov. was first discovered in a mangrove habitat adjacent to a diesel-powered electricity generator (PLTD) at the Poka Village, Ambon Island, Province of Maluku, Indonesia. To the best of the author's knowledge, this species has not been found in any other mangrove habitats on the island, or elsewhere in Indonesia. *Capitella ambonensis* sp. nov. inhabits a mangrove area with loamy sand sediment, and seems to be tolerant of salinity. This species lives in an area where earthworms were also found.

5.3.7 Etymology

The species is named based on its locality, i.e., Ambon Island.

5.3.8 Remarks

The new species *C. ambonensis* sp. nov. most resembles five known *Capitella* species: *C. dizonata* Johnson, 1901, *C. capitata* (Fabricius, 1780), *C. perarmata* (Gravier, 1911), *C. singularis* (Fauvel, 1932), and *C. teleta* Blake, Grassle & Eckelbarger, 2009. They all have the first seven thoracic chaetigers with capillary chaetae in both rami (Table 5.1). *Capitella ambonensis* sp. nov. differs from these other *Capitella* species in the following features.

When compared to *C. dizonata*, the first abdominal segment of *C. ambonensis* sp. nov. has hooded hooks in both rami, whereas *C. dizonata* has capillary chaetae in notopodia and hooded hooks in neuropodia. This is unfortunately the only obvious difference between the two species as *C. dizonata* was in fact described from a single, incomplete and presumably immature female specimen and the type specimen of this species is not known to exist (Hartman, 1947).

When compared with *C. capitata* (Figure 5.3A), the number of chaetigers of *C. ambonensis* sp. nov. is much higher than that of *C. capitata*. The largest specimen of *C. ambonensis* sp. nov. has about 208 chaetigers, whereas that of *C. capitata*, as described by Blake (2009), has around 60 chaetigers. *Capitella ambonensis* sp. nov. also has a striated thoracic epithelium with chaetiger 6 being the largest, whereas the epithelium of *C. capitata* is smooth with chaetiger 4 being the largest. In terms of visibility, genital spines of chaetiger 8 of *C. ambonensis* sp. nov. are often hidden in the intra-annular groove, whereas those of *C. capitata* are normally visible. In reverse, genital spines of chaetiger 9 of *C. ambonensis* sp. nov. are very obvious particularly in adult male specimens, whereas those of *C. capitata* are usually not visible (dissection is thus necessary to see the spines). The body color of *C. ambonensis* sp. nov. in alcohol is whitish with dark brown pigment on the abdominal dorsum, whereas *C. capitata* might have different color. The staining pattern between the two species, as well as the morphology of the hooded hooks, is also different.

In *Capitella perarmata*, the neuropodia of chaetigers 8 and 9 of males bear mixed capillaries and hooks, whereas *C. ambonensis* sp. nov. has hooded hooks only. This, unfortunately, is the only distinguishing character known between the two species as the original publication on *C. perarmata* by Gravier (1911) is relatively short and without figures.

In comparison with *Capitella singularis*, the genital spines of chaetiger 8 of *C. ambonensis* sp. nov. are much smaller than those of chaetiger 9, whereas in *C. singularis* spines of chaetiger 8 are more or less of the same size as those of chaetiger 9. Another clear difference between the two species is that branchiae are absent in *C. ambonensis* sp. nov., whereas branchiae are present in *C. singularis*.

When compared to *C. teleta*, the prostomium of *C. ambonensis* sp. nov. lacks eyes, a nuchal organ is not apparent, and the peristomium is distinct; whereas the prostomium of *C. teleta* has both eyes and nuchal organs, followed posteriorly with an indistinct peristomium. The thoracic chaetal formula of chaetigers 8 and 9 of females of the two species is also slightly different (Table 5.1), but the most obvious difference between the two species might be the color of their abdominal dorsum: dark brown in *C. ambonensis* sp. nov. and light tan in *C. teleta*. In addition, the morphology of the hooded hooks and the staining patterns between the two species are also different.

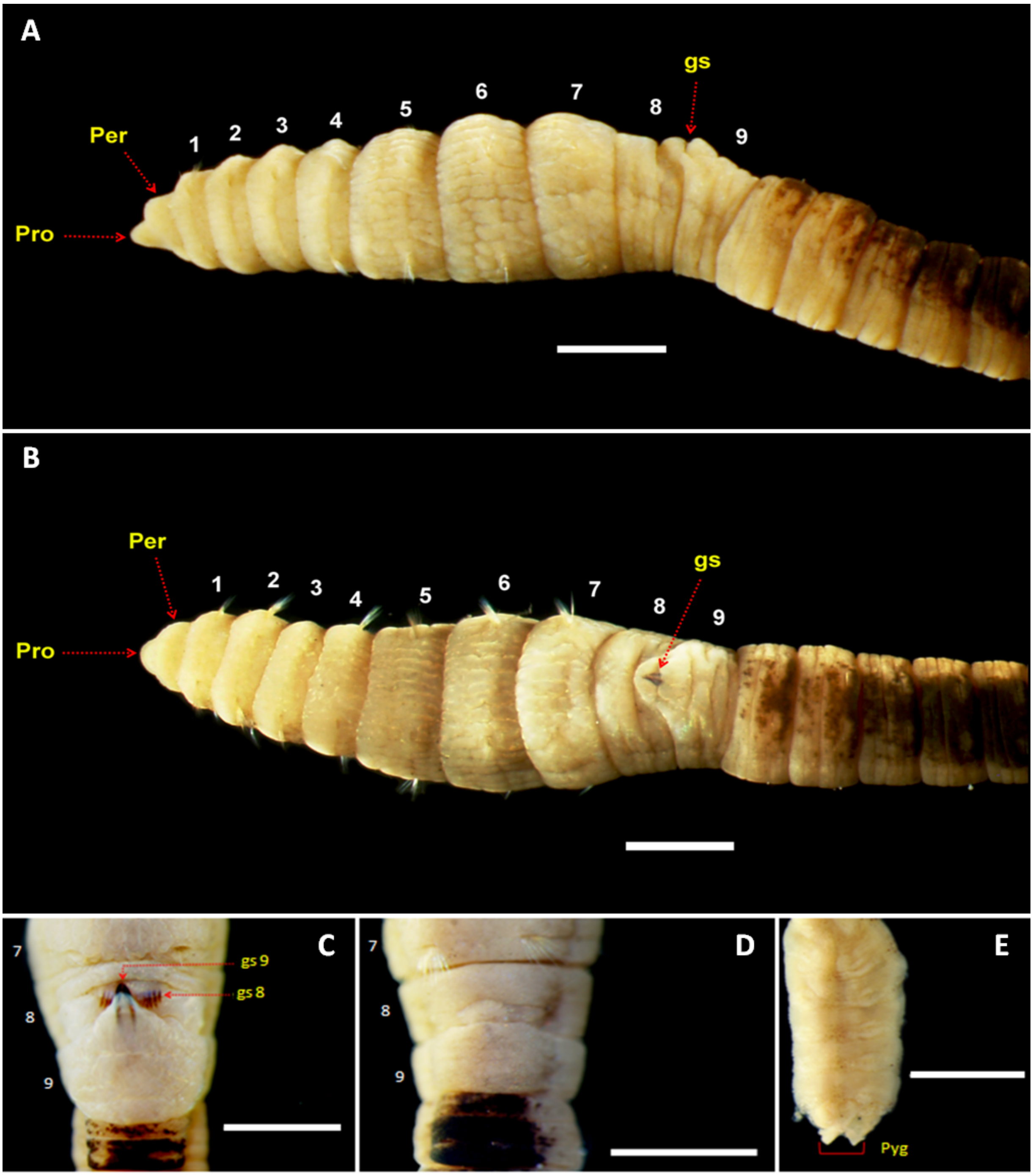

Figure 5.2 (A) lateral view from prostomium to 5th abdominal segment (holotype). (B) dorsal view from prostomium to 5th abdominal segment (holotype). (C) genital spines of the paratype MZB. Pol. 00184. (D) dorsal appearance of chaetigers 7, 8 and 9 of a female (?) specimen. (E) posterior end with pygidium of the paratype MZB. Pol. 00188. Pro, Prostomium; Per, Peristomium; gs, genital spines; Pyg. Pygidium; numbers indicate chaetigers. Scale bars: A–E = 1.0 mm.

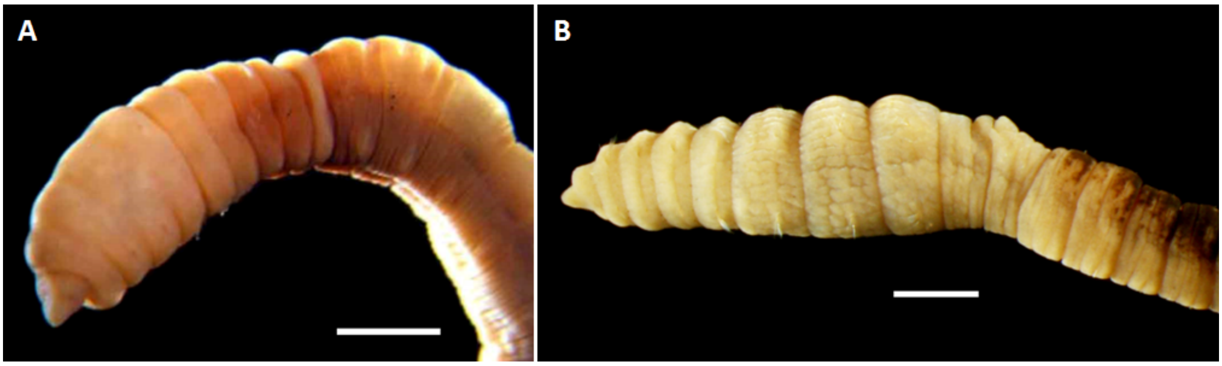

Figure 5.3 Morphological comparison between (A) *C. capitata* – the figure is modified after Blake (2009) – and (B) *C. ambonensis* sp. nov. Scale bars: A = 0.5 mm, B = 1.0 mm.

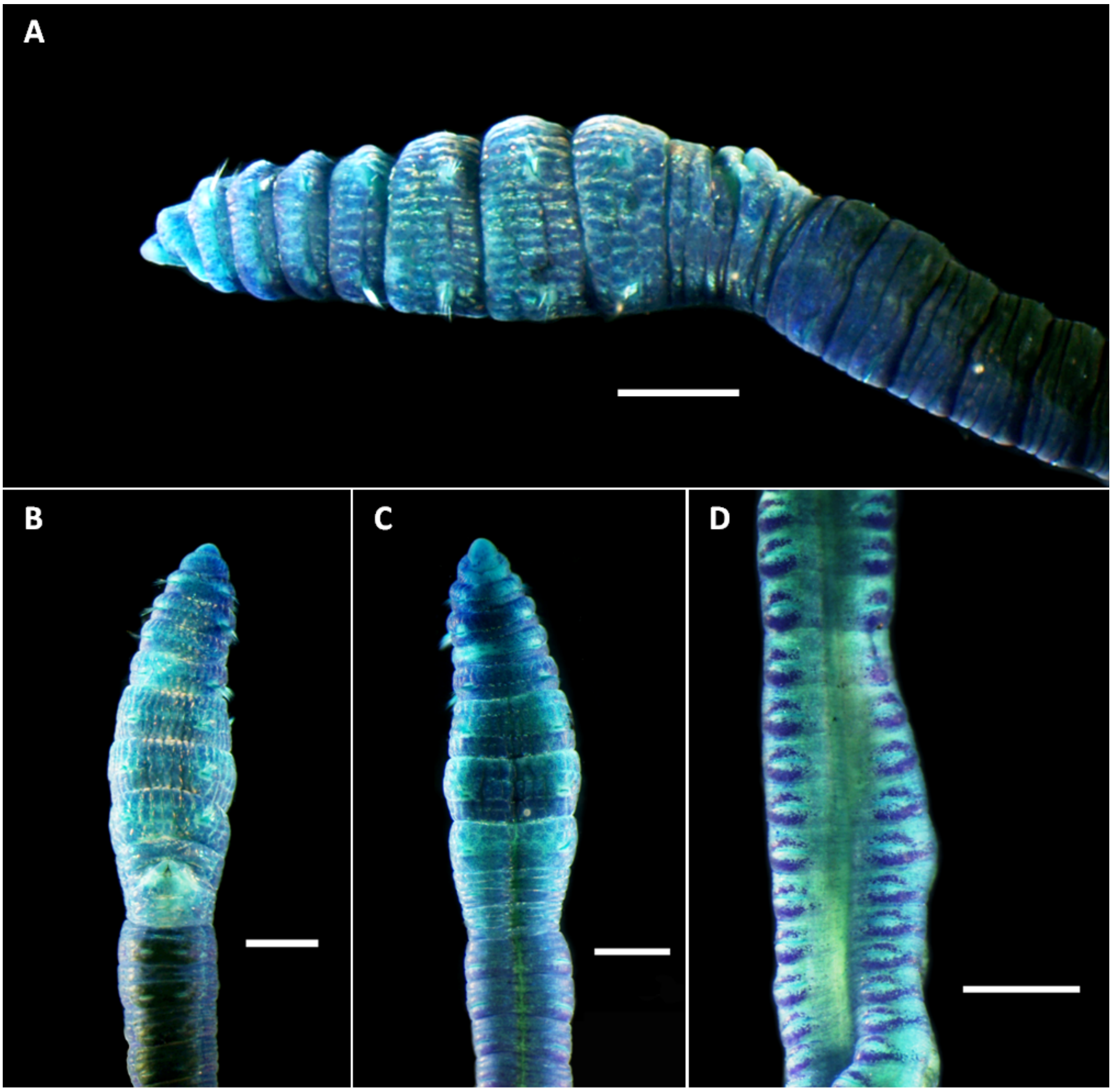

Figure 5.4 Methylene blue staining pattern of the holotype: (A) lateral view, prostomium to 5th abdominal segment. (B) dorsal view, prostomium to 4th abdominal segment. (C) ventral view, prostomium to 4th abdominal segment. (D) mid-ventral abdomen. Scale bars: A–D = 1.0 mm.

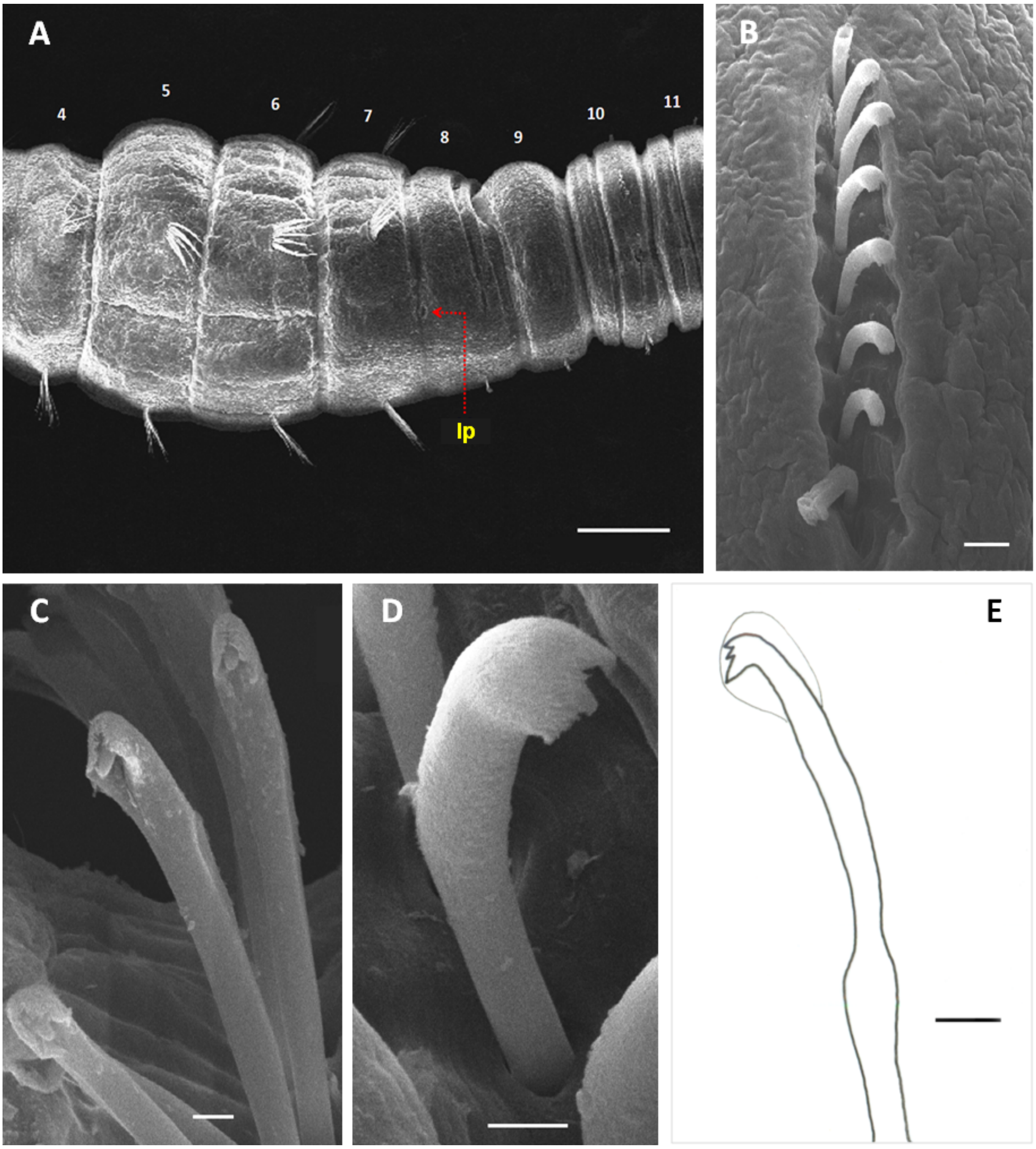

Figure 5.5 Scanning electron micrographs of *C. ambonensis* sp. nov (A–D). (A) lateral view, chaetigers 4 to 11. (B) hooks of the second abdominal notopodia in one fascicle. (C–D) hooded hooks of the anterior abdominal neuropodia. (E) line drawing of the hooded hook. Scale bars: A = 0.5 mm, B = 15 µm, C–D = 5.0 µm, E = 10 µm. lp, lateral pore.

5.4 Discussion

Identifying capitellids, especially *Capitella* spp., is difficult. The number of thoracic segments and more importantly the thoracic chaetal formula are important diagnostic characters to identify *Capitella* species. Even so, the number of thoracic segments can be confusing if an achaetous first segment, along with indistinct peristomium, is present.

For instance, in this study *C. ambonensis* sp. nov. was initially misidentified as a new species of the genus *Leiocapitellides*. After a closer look, the genus apparently needs to be re-examined due to some confusion over the number of thoracic segments. In her original publication, Hartmann-Schröder (1960) indicated the thorax of *Leiocapitellides* consisted of one achaetigerous segment followed posteriorly by eight chaetigerous segments bearing capillary chaetae only, and one transitional segment with noto-capillaries and neurohooks. Although Hartmann-Schröder did not explicitly mention the exact number of thoracic segments for *Leiocapitellides*, but based on her description and illustration, the genus has ten thoracic segments, excluding the peristomium. However, Fauchald (1977) mistakenly reported the genus as having eight thoracic segments which consist of one achaetigerous segments and seven chaetigerous segments with capillary chaetae. Considering this confusion, the number of thoracic chaetigers (or the thoracic chaetal formula in more detail) is more reliable than that of thoracic segments to identify *Capitella*.

The thoracic chaetal formula, however, works best if specimens are mature. If not, then immature specimens can show the characters of other capitellid genera. This is because in immature specimens (often indicated by the presence of mixed chaetae, either both capillaries and hooks in one fascicle, *or* notocapillaries and neurohooks in one segment), the number of segments bearing capillaries gradually increases with age. The author personally believes that the difficult taxonomy of Capitellidae is due in part to the use of mixed chaetae as a diagnostic character. Therefore, obtaining mature intact capitellid specimens, preferably in excellent condition is the first step to identify these worms correctly.

The use of the thoracic chaetal formula to identify mature *Capitella* specimens, however, can still be problematic as capitellids can become sexually mature before they acquire their full complement of capillaries. To deal with this problem, it is essential that the identification of capitellids is based on a sufficient number of specimens, and that we use other complementary diagnostic features. A sufficient number of specimens will allow us to identify variability and ensure mature specimens are available.

The most reliable character to determine capitellid species is perhaps the morphological shape of hooded hooks, especially their detailed dentition. Dentition may differ from species to species, but details are difficult to observe due to their small size manner in which the hooks are oriented. Additionally, MGSP is also widely used to differentiate among capitellid species. In this study methyl green is replaced with methylene blue due to availability; however, both chemicals are apparently interchangeable.

In Indonesia, capitellids often become a dominant group of mangrove macrobenthic fauna (e.g., Nordhaus et al., 2009; Pamungkas, 2013), but taxonomic details are rare. The only taxonomic study on this polychaete group is perhaps the description of *Polymastigos javaensis* by Pamungkas (2015). This species might have the potential to be used as a local indicator species of polluted coastal water as the species was discovered dominantly in a mangrove habitat near an industrial area. Similar to this, *Capitella ambonensis* sp. nov. might also be an indicator species as the worms were discovered abundantly in a mangrove habitat where oily sediments can be found. However, this requires further ecological investigations.

Table 5.1 All *Capitella* species (neglecting the sub-species) arranged in order of the increasing number of thoracic chaetigers bearing capillary chaetae. *Capitella ambonensis* sp. nov. highlighted in yellow.

No.	Species	Thoracic chaetal formula	Genital spines/ other comments	References
1	*C. jonesi* (Hartman, 1959)	$^{c/c}$ (1–3), $^{h/h}$ (4–7), $^{gs/h}$ (8–9)	In males and females.	Hartman (1959); Warren (1976)
2	*C. minima* (Langerhans, 1880)*	$^{c/c}$ (1–3/4), $^{h/h}$ (4/5–7), $^{gs/h}$ (8–9)	In males and females.	Langerhans (1880); Warren (1991)
3	*C. hermaphroditica* Boletzky & Dohle, 1967*	$^{c/c}$ (1–4), $^{h/h}$ (5–7), $^{gs/h}$ (8–9)	Probably in males and females.	Warren (1991)
4	*C. ovincola* Hartman, 1947	$^{c/c}$ (1–4/5), ^{m} (5/6–7), $^{gs/h}$ (8–9) in males, $^{c/c}$ (1–4/5), ^{m} (5/6–7), $^{h/h}$ (8–9) in females	In males only.	Hartman (1947); Warren (1991)
5	*C. aberranta* Hartman & Fauchald, 1971	$^{c/c}$ (1–5), $^{h/h}$ (6–9)	Absent.	Hartman & Fauchald (1971); Warren (1991)
6	*C. giardi* (Mesnil, 1897)	$^{c/c}$ (1–6), $^{h/h}$ (7), $^{gs/h}$ (8–9)	In males and females.	Warren (1991)
7	*C. gracilis* (Verrill, 1880)*	$^{c/c}$ (1–6), $^{h/m}$ (7)	Absent.	Verrill (1880)
8	*C. caribaeorum* Warren & George, 1986	$^{c/c}$ (1–6), $^{c/h}$ (7), $^{gs/h}$ (8–9)	In males and females.	Warren & George (1986)
9	*C. iatapiuna* Shimabukuro, Alfaro-Lucas, Fujiwara, Sumida & Amaral, 2016	$^{c/c}$ (1–6), $^{c/h}$ (7), $^{gs/h}$ (8–9)	Probably in males only.	Shimabukuro et al. (2016)
10	*C. capitata* (Fabricius, 1780)	$^{c/c}$ (1–6), ^{m} (7), $^{gs/h}$ (8–9), or $^{c/c}$ (1–7), $^{gs/h}$ (8–9)	In males only.	Fabricius (1780); Blake (2009)
11	*C. dizonata* Johnson, 1901*	$^{c/c}$ (1–7), $^{a/h}$ (8–9), $^{c/h}$ (10)	The species was described from a single, incomplete and presumably immature female specimen, and the type specimen of this species is not known to exist according to Hartman (1947).	Hartman (1947)
12	*C. ambonensis* sp. nov.	$^{c/c}$ (1–7), $^{gs/h}$ (8–9) in males, $^{c/c}$ (1–7), $^{a/h}$ (8–9) in females (?), or $^{c/c}$ (1–7), $^{a/h}$ (8), $^{gs/h}$ (9) in females (?)	In males and (probably) females (?); the dark brown-pigmented abdominal dorsum is the most striking feature of the species.	This publication

No.	Species	Thoracic chaetal formula	Genital spines/ other comments	References
13	*C. singularis* (Fauvel, 1932)	$^{c/c}$ (1–7), $^{gs/h}$ (8–9)	Probably in males only; posterior abdominal region with finger-shaped branchiae.	Fauvel (1932)
14	*C. teleta* Blake, Grassle & Eckelbarger, 2009	$^{c/c}$ (1–7), $^{gs/h}$ (8–9) in males, or $^{c/c}$ (1–7), $^{h/h}$ (8–9) in females	In males only.	Blake et al. (2009)
15	*C. perarmata* (Gravier, 1911)*	$^{c/c}$ (1–7), $^{gs/m}$ (8–9)	In males only.	Gravier (1911); Warren (1991)
16	*C. aciculata* (Hartman, 1959)	$^{as/as}$ (1–2), $^{c/c}$ (3–7), $^{gs/c}$ (8), $^{gs/m}$ (9) in males, or $^{as/c}$ (1–2), $^{c/c}$ (3–7), $^{m/m}$ (8), $^{gs/h}$ (9) in females	In males and females; the first two thoracic chaetigers with blunt acicular spines as the unique feature of the species.	Hartman (1959)
17	*C. teres* (Treadwell, 1939)*	$^{c/c}$ (1–8), $^{gs/h}$ (9)	The species was described from a single incomplete female specimen.	Treadwell (1939); Warren (1991)
18	*C. intermedia* Czerniavsky, 1881*	Not clear	Fauvel (1927) synonymized the species under *C. capitata*, thus the status of *C. intermedia* on the WoRMS as an accepted species might be a mistake.	Czerniavsky (1881)

- The following notations are used for thoracic chaetal formulas. **a** = absence of chaetae; **as** = acicular spines; **c** = capillary chaetae; **h** = hooded hooks; **m** = mixed chaetae (capillaries and hooks); **gs** = genital spines. Numbers in **( )** indicate the chaetiger number.
- The symbol '*' indicates that redescription of the species can be suggested for one or more of the following reasons, i.e. the description is too short and/ or lacks clear illustrations and/ or not written in English without English abstract.

Chapter 6

General discussion

6.1 Discussion

Historically, the naming of polychaete species began before Linnaeus's classification system in the middle of the 18th century. During the time, un-standardised Latin names were given to species based typically on their distinguishing features. Rumphius (1705), for example, named *wawo* worms (the annually swarming polychaetes consumed by Ambonese people in Indonesia) *Vermiculi Marini*, which means 'sea larva'. The use of an un-standardised species naming system in former times probably resulted in multiple names given to a single species. Contrary to this, a local name was often given for multiple species of polychaetes. For instance, the same name *wawo* was given to a group of polychaete species belonging to several different families that occurred together in the annual mass spawning in Ambon (Pamungkas & Glasby, 2015). The better-known name *palolo* (and several similar sounding variations) was also applied to mass swarming eunicid polychaetes in the SW Pacific, although whether it represents multiple species (and families) is unknown.

The benchmark of modern taxonomy was established in 1758 when the Swedish scientist Carolus Linnaeus published his 10th revision of *Systema Naturae*, proposing the binomial nomenclature system for naming species (Linnaeus 1758). By reviewing polychaete data in WoRMS, I found that since that year, 11,456 accepted polychaete species (1417 genera, 85 families) have been formally described by over 835 first authors. The number of species was slightly different from that reported by Appeltans et al. (2012) and Costello et al. (2012) due to continuous data revisions in WoRMS since 2012. The taxon Polychaeta thus contributed about 5% to the overall number of marine species that have been described in the world today, i.e., about 226,000 accepted species (Appeltans et al., 2012).

Of the 85 accepted polychaete families, six, i.e., Syllidae, Polynoidae, Nereididae, Spionidae, Terebellidae and Serpulidae, were found to be exceptionally species-rich. Whereas four families, i.e., Ichthyotomidae, Ikedidae, Laetmonectidae and Pontodoridae, were monotypic (having only one species). Species rich families tend to show a greater range of morphological and physiological adaptions and are therefore able to colonise a wider range of ecological niches. Syllids, for instance, live in symbiosis with many other marine organisms such as ascidians, cnidarians, crustaceans, echinoderms and sponges (e.g., Martin & Britayev, 1998; López et al., 2001). Similarly, some polynoids form symbiotic associations with anthozoans, echinoderms, molluscs and other polychaetes (e.g., Britayev, 1991; Britayev & Zamyshliak, 1996; Britayev et al., 2007). Using different strategies, nereidids have particularly good osmoregulatory abilities, can resist dehydration and have adaptable feeding methods and mechanisms to colonise estuarine, freshwater and semi-terrestrial niches. Polychaete families with fewer species (less diversity), by contrast, are usually less adaptable and often occupy very specific niches. For example, the only member of family Ichthyotomidae *Ichthyotomus sanguinarius* Eisig, 1906 has a highly modified body form capable only of living as a parasite in eels.

In the present study, I found that the discovery rate of polychaete species was similar to that of marine (Appeltans et al., 2012) and global species (Costello et al., 2012) in general. It basically consisted of three main phases:

1. **the initial phase (1750s – 1850s)**, where morphological characters to distinguish polychaete species were being developed by few taxonomists pioneering the work,
2. **the second phase (1850s – 1950s)**, where most conspicuous polychaete species were described by some prolific taxonomists despite some interruption during the World Wars, and
3. **the third phase (1950s – modern times)**, where many more polychaete species were described by the most authors ever, contradicting the common belief that the number of people specialising in taxonomy is in decline (e.g., Gaston & May, 1992; Hopkins & Freckleton, 2002).

Note that fewer polychaete species were described by taxonomists today despite more advanced sampling and identification equipment as well as a more rapid publication rate since the era of the Internet. This phenomenon, in part, reflects the difficulty in finding new polychaete species as most conspicuous ones may have been discovered. Despite this, 5200 more polychaete species were projected to be discovered by the end of the 21st century.

Marine species, including polychaetes, are not evenly distributed on Earth: they tend to clump into particular geographic regions. By analysing global polychaete datasets, I found that Europe, Australia and New Zealand were the geographic regions with the most polychaete data. This reflects a high number of marine benthic surveys conducted in these geographic regions, as well as the valuable contribution of research institutions in making their polychaete datasets available online (for instance, more than 90% of polychaete records from Australia and New Zealand were provided by the Australian Museum and National Institute of Water and Atmospheric Research, respectively).

I further identified 11 major polychaete biogeographic regions across the globe, which suggested that polychaetes are generally worldwide in their distribution at family and genus levels, reflecting the very old age of the group (e.g., Glasby et al., 2000). In order of species richness, the regions were: (1) North Atlantic & eastern and western parts of Mediterranean, (2) Australia, (3) Indonesia, (4) New Zealand, (5) the Atlantic coasts of Spain & France, (6) Antarctica & the southern coast of Argentina, (7) Central Mediterranean Sea, (8) the western coast of the USA, (9) the eastern part of the Pacific Ocean, (10) Caribbean Sea and (11) Atlantic Ocean. These biogeographic regions largely coincide with the marine biogeographic realms outlined by Spalding et al. (2007) and Costello et al. (2017). The present study thus strengthens the paradigm that boundaries in the ocean exist.

Further, it turned out that the total number of polychaete species was found to be higher in the southern hemisphere (about 2100 species, 67 families) than in the northern one (about 1800 species, 75 families) despite significantly more data in the latter hemisphere. This contradicts the pattern of most marine taxa where species richness generally peaked in the northern hemisphere (Chaudhary et al. 2016, 2017; Chaudhary 2019), but are similar to the pattern of a few taxa such as fish, shark and rays, stony corals (Chaudhary 2019) and amphipods (Arfianti & Costello, 2020) when sampling bias is taken into account. In the present study, high species richness in the southern hemisphere may be due to high endemicity as species richness and endemicity have been found to have a positive correlation (e.g., Costello et al. 2017). Additionally, the adoption of northern hemisphere species names by polychaete workers of the southern hemisphere (Hutchings & Kupriyanova 2018) may have, in small part, artificially inflated the number of species in the southern hemisphere.

Contrary to the classical paradigm of a unimodal pattern, the latitudinal species richness gradient of polychaetes was found to be asymmetrically bimodal, with similar peaks of richness in the northern (60°N) and southern (30°S) hemispheres, and a pronounced dip north of the Equator (15°N). The pattern is unlikely to be due to sampling bias, but rather a natural phenomenon: it was most significantly correlated with sea surface temperature. The results of this study thus support the bimodal pattern in marine species richness in general outlined by Chaudhary et al. (2016, 2017).

On Earth, some geographic regions have exceptionally high marine biological diversity. The Indo-West Pacific (IWP), which extends from the Red Sea and East Africa to the Central Pacific, is recognised as the center of marine biodiversity due to the occurrence of coral reefs which provide favourable habitats for marine life (e.g., Ekman, 1934; Briggs, 1974; Paulay, 1997). In this region, the area with the highest high marine biodiversity is centered at the Coral Triangle (CT), which includes parts of Indonesia, along with the other five neighbouring countries.

I reviewed polychaete biodiversity studies that have been done in Indonesia since the mid 1700s, and found that 713 polychaete species (55 families) have been identified, comprising 580 and 133 species names reported in taxonomic publications and GBIF-OBIS datasets, respectively. Of the 713 species, 301 species (40 families) were described from the geographic region. Indonesia thus contributed only less than 3% to the total polychaete species that have been described in the world today (about 11,500 species).

Generally, central and eastern parts of Indonesia (mainly offshore and deep-sea habitats of the Wallacea region) have been surveyed much more intensively than the western part of the country. In the majority, Indonesian polychaete specimens were collected during the Siboga Expedition at the turn of the 19th century, and most were identified by European taxonomists and were deposited in museums in the Netherlands (now all centralised at the Naturalis Biodiversity Center (NBC), Leiden). Marine benthic studies conducted by local scientists seem to have yielded many polychaete specimens, yet I found that most of them were not identified to species level due limited local taxonomic information on the taxon.

To date, the Museum Zoologicum Bogoriense (MZB) is still the only accredited zoological museum of the country. The marine collections housed at this institution are thus a direct reflection of marine taxonomic studies in Indonesia. During my visit to the museum, I found only a few marine collections (i.e., crustaceans, polychaetes and zooplankton), reflecting the few local scientists who work actively in marine taxonomy. Large collections of various marine taxa from ecological surveys, including polychaetes, were housed at the Research Center for Oceanography in Jakarta. However, the collections are generally not linked to taxonomic publications, making it difficult to review progress in Indonesian marine species discovery. The polychaete collection of this institution, in particular, was also not databased, creating a challenge for those who want to do taxonomic studies based on the existing collection.

Since the mid 1700s, there was only one polychaete species described by a local scientist, i.e., *Polymastigos javaensis* Pamungkas, 2015 (Capitellidae). The new species *Capitella ambonensis* Pamungkas, 2017 (Capitellidae) described in this thesis is thus the second one. The very low rate of polychaete species discovery in Indonesia is mainly due to a limited number of local polychaete taxonomists.

Capitella ambonensis is the first *Capitella* species described from Indonesian waters. The species differs from other *Capitella* species in the form of hooded hooks and the methylene blue staining pattern. That *Capitella ambonensis* was exclusively obtained from a mangrove area subjected to oil discharge suggests that the species has potential to be used as bioindicator of organic pollution, similar to other species in the well-known *Capitella capitata* species complex (e.g., Dean, 2008; Blake, 2009; Blake et al., 2009).

6.2 Future directions

In the present study, I found significant gaps in both taxonomic and numbers of records across the globe. The estimate of polychaete species richness, as well as the number of biogeographic regions and the latitudinal distribution of the animals may, therefore, change in the future as these gaps are filled. Refinements in taxonomic data will result from the naming of new polychaete species resulting from: (1) the recognition that specimens in many parts of the world have probably been misidentified and (2) the discovery of complexes of cryptic polychaete species. Further, additional species records will result from increased sampling, and these will include new species, and refinement in the information on species distributions.

To accelerate the discovery rate of polychaete species, future marine biodiversity studies should be concentrated on poorly-studied geographic regions with high marine species richness and endemicity. Indonesian waters, particularly in the coastal area of the CT, may be the best place as the region has relatively high polychaete species richness and endemicity. I found, however, that the marine species discovery in this country has been hindered by an inadequate number of trained marine taxonomists as well as lack of funds allocated to taxonomic work. International collaborative research, as well as partnerships with benthic ecologists, may be the quick solution to improve the knowledge of polychaete fauna of this geographic region, yet training new Indonesian taxonomists will be the long-term solution.

Future research in the deep-sea habitats, as well as in the data-poor coastal areas, will also fill in the gaps in world's polychaete diversity data. In addition to this, making polychaete data publicly available (so that other scientists can make use of them to better study the spatial distribution of the animals across the globe with more complete data) is strongly encouraged. When the data gaps are filled, and datasets made fully available, it may provide new insights into the biogeographic regions and latitudinal gradients recognised here. Uneven sampling effort across the globe is inevitable. Studies on the latitudinal diversity gradient of world's species should, therefore, use approaches that account for sampling bias to generate reliable patterns.

During my fieldwork in the Wallacea region and its surroundings, I collected many polychaete samples from rocky shores. The polychaete specimens have been identified to family level and are now deposited at the MZB. The continuation of this work is of importance as it may reveal the biodiversity of reef-dwelling polychaetes of the region. Additionally, as samples were taken on both sides of Wallace's Line using the same methods, it may give a clue as to whether or not the Wallace's Line is a real boundary for polychaetes.

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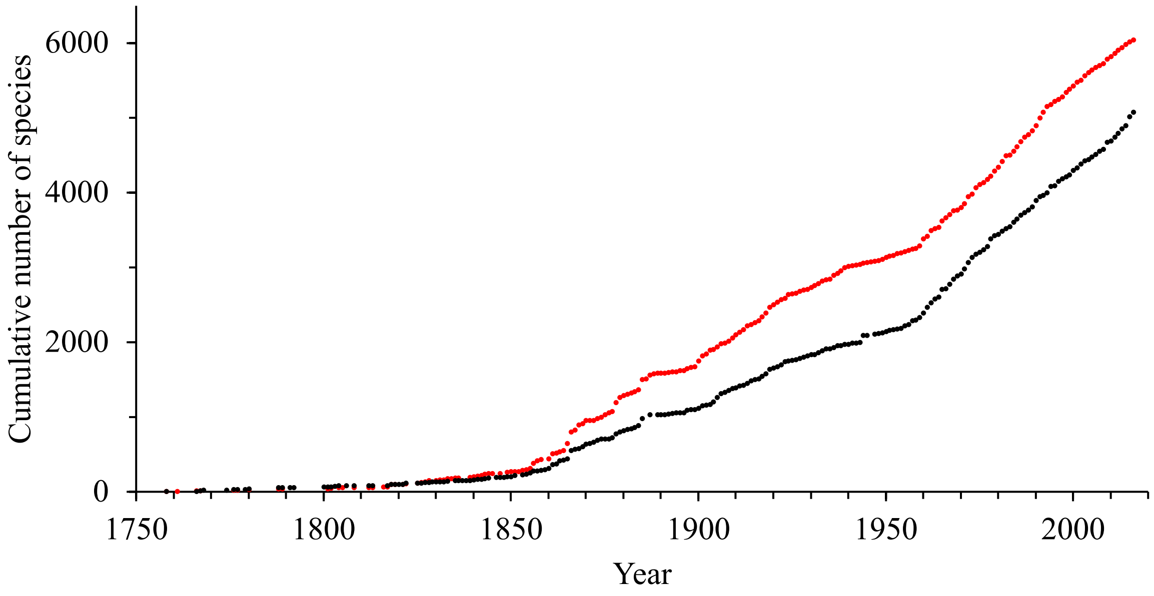
Appendices

Appendix 2.1 The details of data selection conducted before analyses.

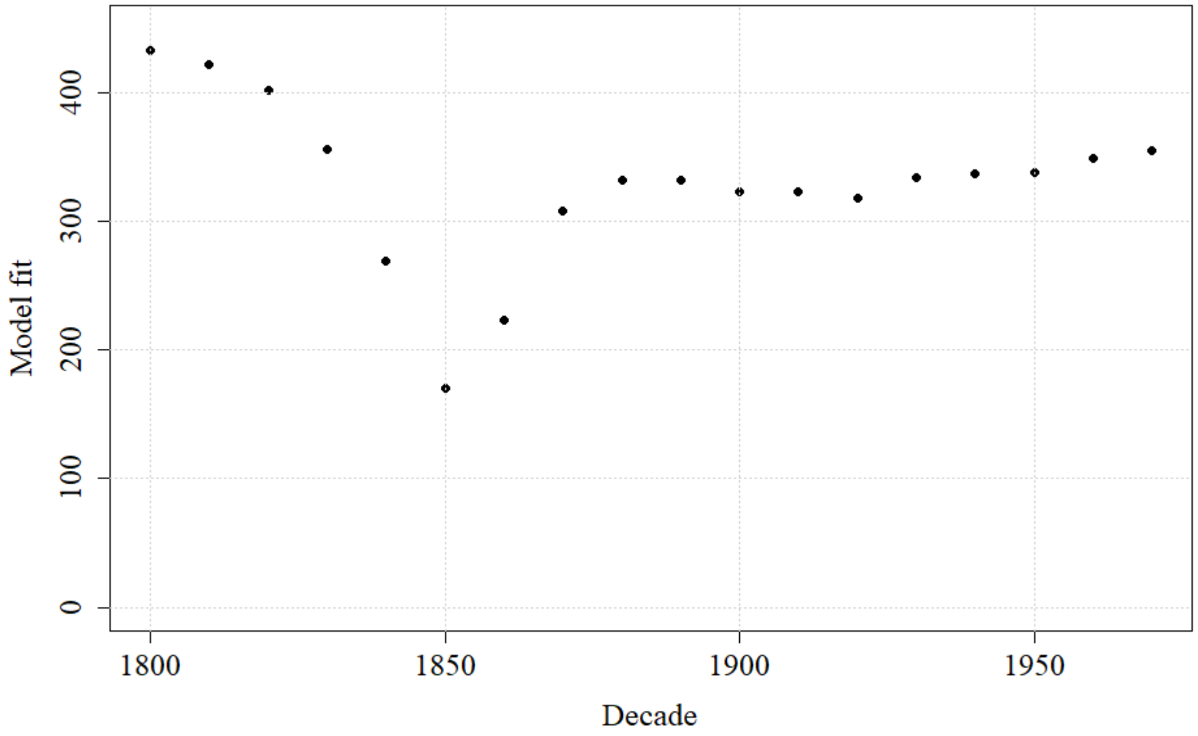
No.	Mistakes or data deficient	Treatment	Data included
1	Some species names were mistakenly categorized as 'accepted' instead of 'unaccepted'.	Their taxonomic name status was altered to 'unaccepted'.	No
2	Some species were mistakenly categorized as 'recent only' instead of 'fossil only'.	Their status was altered to 'fossil only'.	No
3	Some species were without information about status because the species names had not been verified by taxonomic editors.	The records were removed from the list.	No
4	Some species without information about stratigraphic status, but they were assessed as unlikely to be fossil only.	Their status was altered to 'stratigraphic status lacking.	Yes
5	Some species not assigned to family. After a further investigation, their taxonomic name status was not determinable (larval or enigmatic), *or* their existing status was 'fossil only'.	The records were removed from the listing, *or* their status was altered to 'fossil only' (fossils often have no family).	No
6	Family Ctenodrilidae was reassigned at WoRMS to be a *taxon inquirendum* subsequent to the data download.	Valid members of this family were moved to the family Cirratulidae.	Yes
7	Typographical errors or spelling variants were found in author names.	The name of those authors was corrected or standardised as far as possible.	Yes
8	Different contemporaneous authors were found to have the same surname.	Different authors with the same surname were distinguished.	Yes
9	Some species names without information about author(s), but they fulfill the categories of 'accepted', 'verified by taxonomic editors' and 'not fossil only'.	We attempted to find the author name(s) of those species. Yet, a number of species were left anonymous (without author information).	Yes

Appendix 2.2. Data selection from WoRMS for the present analyses.

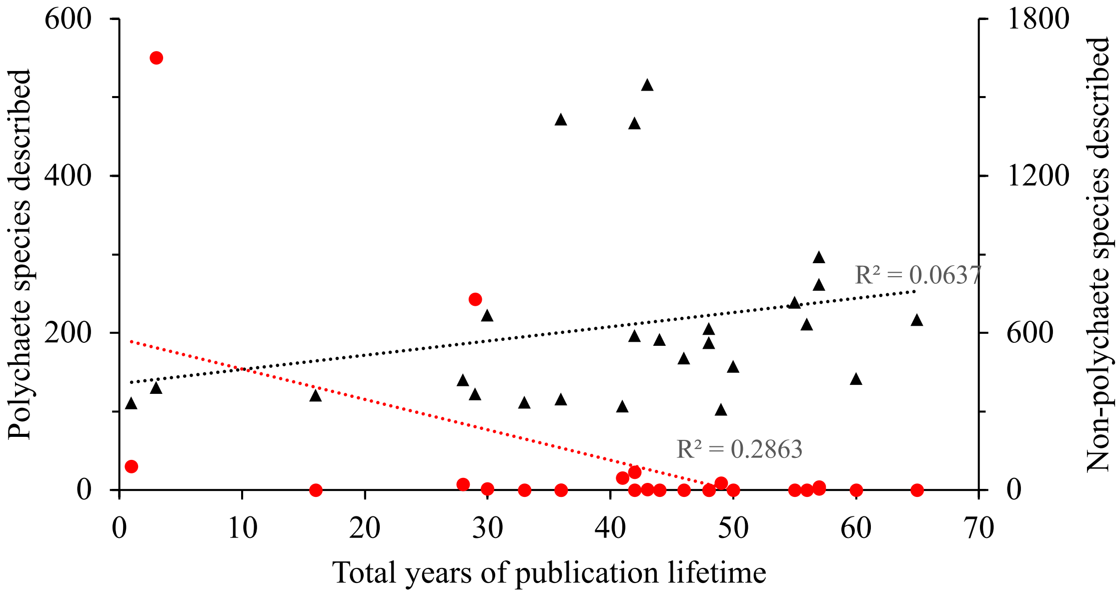
Row	Status	Category	Species number	Percent
1	Accepted	Accepted, but not verified	204	1
2	Accepted	Accepted, verified, recent	10,347	49
3	Accepted	Accepted, verified, but fossil only	498	2
4	Accepted	Accepted, verified, recent but also fossil record	9	0
5	Accepted	Accepted, verified, stratigraphic status lacking	1,137	5
6	Unaccepted	Synonyms and errors	8,072	38
7	Unaccepted	Alternative names representation	295	1
8	Unaccepted	Interim unpublished	12	0
9	Unaccepted	*Nomen dubium*	253	1
10	Unaccepted	*Nomen nudum*	62	0
11	Unaccepted	*Taxon inquirendum*	214	1
12	Unaccepted	Temporary	1	0
		Total number of names	21,104	100
		Total relevant for analysis (rows 2, 4, 5)	11,493	
		Total excluded	9,611	



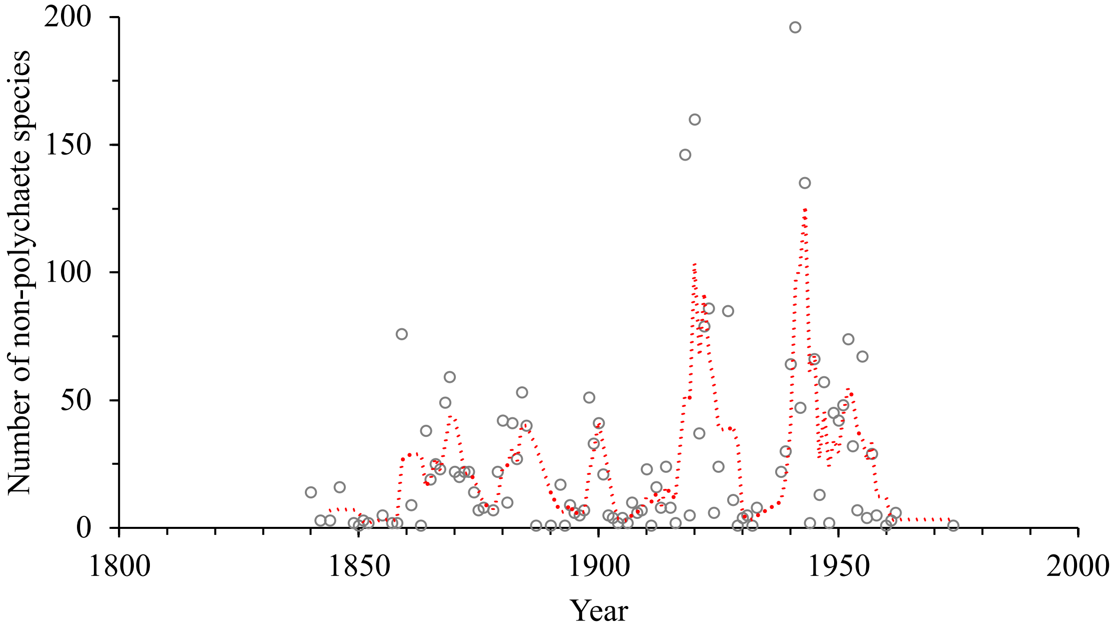
Appendix 2.3 Cumulative number of errant (red dots) and sedentary (black dots) polychaete species described over time.



Appendix 2.4 The least squares piecewise regression analysis. From the point of view of minimising the squared error between the correlation line and data (Figure 2.2C), the middle of the 19th century was identified as the period from where the number of species described per author began to decrease. Prior to that period, there is not enough evidence to identify a trend.



Appendix 2.5 The number of polychaete (black triangles and line) and non-polychaete (red dots and line) species described by the 25 most prolific first authors during their publication lifetime.



Appendix 2.6 The number of non-polychaete species described by the 14 most prolific polychaete first authors over time. The red line is a three-year moving average.

Appendix 3.1 GBIF and OBIS datasets references

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Appendix 3.2 Process of selection of datasets from GBIF.

Step	Omitted record	Remaining record
Initial number of records	-	1,570,934
Removing records without species names	442,376	1,128,558
Removing records without latitudes	164,397	964,161
Removing records without longitudes	0	964,161
Removing records without coordinate uncertainty	353,522	610,639
Removing records with coordinate uncertainty more than 10 km	3741	606,898
Removing duplicates	246,852	360,046
	Remaining records	360,046

Appendix 3.3 Process of selection of datasets from OBIS.

Step	Omitted record	Remaining record
Initial number of records	-	2,212,260
Removing records without species names	565,661	1,646,599
Removing records without latitudes	0	1,646,599
Removing records without longitudes	0	1,646,599
Removing records without coordinate uncertainty	1,235,084	411,515
Removing records with coordinate uncertainty more than 10 km	1356	410,159
Removing duplicates	176,512	233,647
	Remaining records	233,647

Appendix 3.4 The process of merging and selection of datasets from GBIF and OBIS and the addition of Indonesian polychaete records (Pamungkas & Glasby, 2019).

Step	Added record	Omitted record	Remaining record
Merging of GBIF and OBIS datasets	593,693	-	593,693
Removing duplicates	-	9610	584,083
Removing records with coordinate uncertainty containing characters 'NA'	-	51,339	532,744
Removing inland records	-	602	532,142
Adding Indonesian polychaete records	1687	-	533,829
Removing non-polychaete records	-	327	553,502
		Selected records	553,502
		Number of species	3415
		Number of families	77

Appendix 3.5 R scripts for the rarefaction analyses.

Step	Script
Installing the necessary package	install.packages ("vegan")
Loading the necessary package	library (vegan)
Checking the minimum value allowed *	minimumvalue <- min (rowSums (E(S50)_Analysis_in_R))
Performing rarefaction analysis **	E(S50) <- rarefy (E(S50)_Analysis_in_R, 50 , se = TRUE)
Creating a csv file	write.csv (E(S50), "E(S50) Result from R.csv")

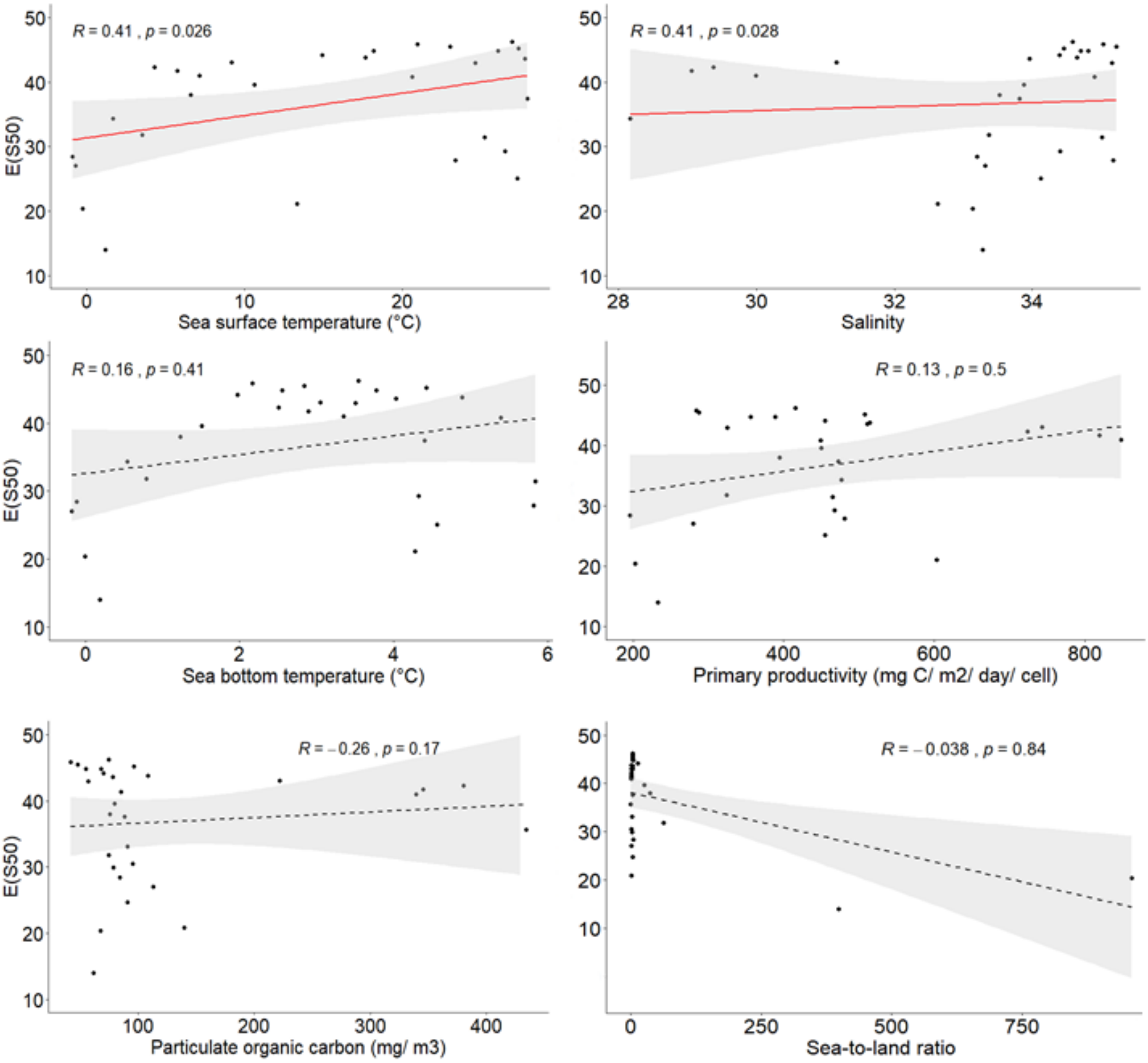
* To calculate E(S50) and E(S30), the minimum values allowed should be at least 50 and 30, respectively.

** To calculate E(S30), the number ‘50’ must be changed with ‘30’.

Appendix 3.6 R scripts for the GAMs.

Step	Script
Installing the necessary package	install.packages("mgcv")
Loading the necessary package	library(mgcv)
GAM analysis for the alpha species richness [1]	Alpha.GAM <- gam(Alpha ~ s(Latitude), data = GAM, method = "REML")
Summary of the analysis	summary(Alpha.GAM)
Plotting the model line	plot(Alpha.GAM, se = TRUE, residuals = TRUE, shade = TRUE, shift = coef(Alpha.GAM)[1], pch = 1, xlim = rev(c(-80,85)), cex.axis = 1.5, cex.lab = 1.5, ylab = "Average number of species")
GAM analysis for the gamma species richness [2]	Gamma.GAM <- gam(Gamma ~ s(Latitude), data = GAM, method = "REML")
Summary of the analysis	summary(Gamma.GAM)
Plotting the model line	plot(Gamma.GAM, se = TRUE, residuals = TRUE, shade = TRUE, shift = coef(Gamma.GAM)[1], pch = 1, xlim = rev(c(-80,85)), cex.axis = 1.5, cex.lab = 1.5, ylab = "Number of species")
GAM analysis for the E(S50) [3]	E(S50).GAM <- gam(E(S50) ~ s(Latitude), data = GAM, method = "REML")
Summary of the analysis	summary(E(S50).GAM)
Plotting the model line	plot(E(S50).GAM, se = TRUE, residuals = TRUE, shade = TRUE, shift = coef(E(S50).GAM)[1], pch = 1,xlim = rev(c(-80,80)), cex.axis = 1.5, cex.lab = 1.5, ylab = "E(S50)")

[1, 2, 3] These are to find the best non-linear model fitting the scatter plots of alpha and gamma species richness as well as E(S50) based on the polychaete data file named ‘GAM’, which consists of four columns: ‘Latitude’, ‘Alpha’, ‘Gamma’ and ‘E(S50)’.

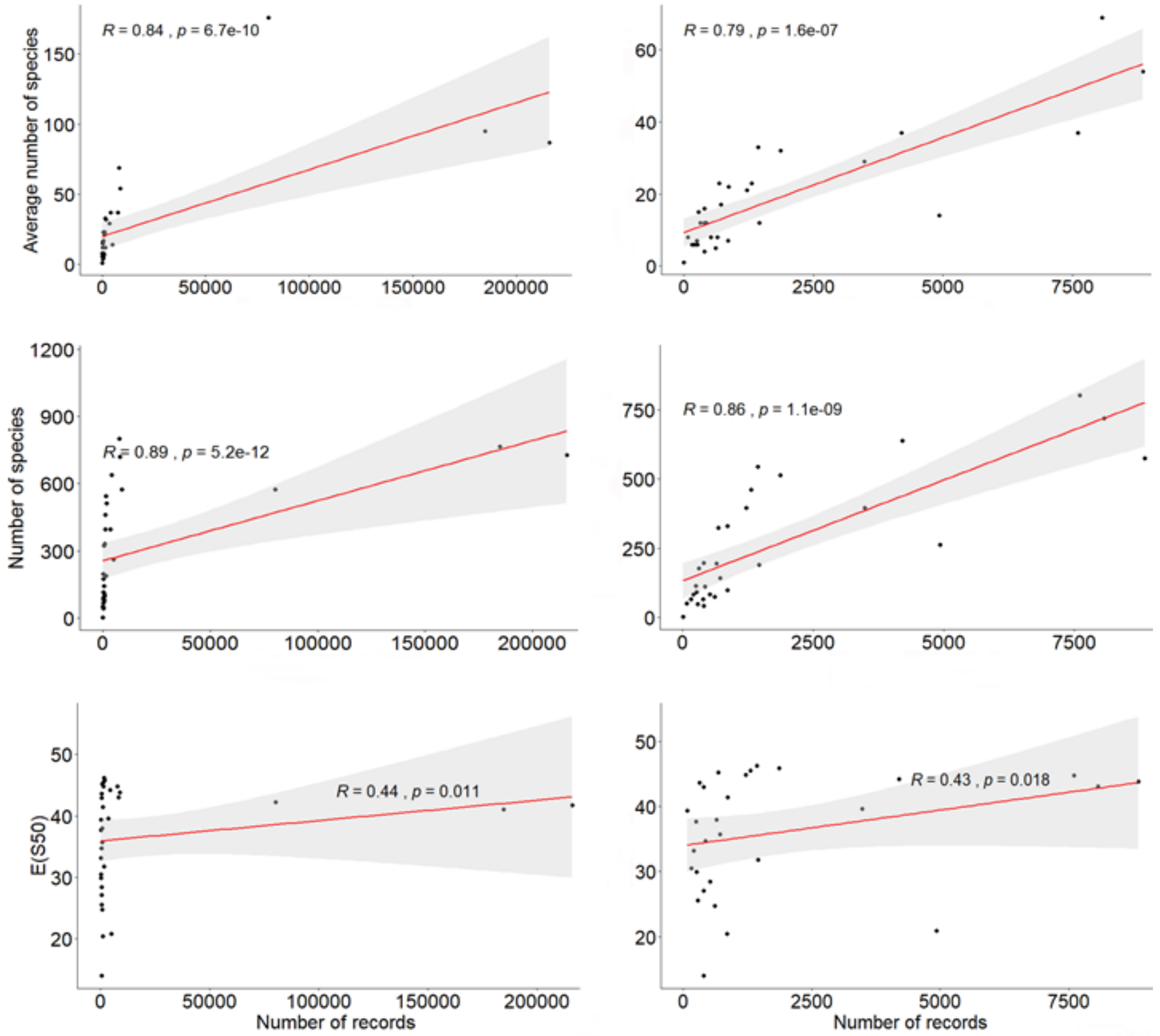


Appendix 3.7 Spearman correlation analyses between the E(S50) and several environmental variables per 5° latitudinal band. *R* is the Spearman's rank correlation coefficient. Visually, red-solid and black-dashed linear regression lines indicate significance at $p < 0.05$ and non-significant correlations, respectively. Grey shadings are the standard errors.

Appendix 3.8 List of polychaete families along with their occurrence record and species numbers.

Family	Authority	Record number	Species number
Acoetidae	Kinberg, 1856	255	16
Acrocirridae	Banse, 1969	1040	10
Alciopidae	Ehlers, 1864	1766	20
Alvinellidae	Desbruyères & Laubier, 1986	165	6
Ampharetidae	Malmgren, 1866	21,049	79
Amphinomidae	Lamarck, 1818	2941	40
Aphroditidae	Malmgren, 1867	4094	49
Apistobranchidae	Mesnil & Caullery, 1898	1574	2
Arenicolidae	Johnston, 1835	7485	14
Bonelliidae	Lacaze-Duthiers, 1858	1203	56
Capitellidae	Grube, 1862	23,642	46
Chaetopteridae	Audouin & Milne Edwards, 1833	3198	19
Chrysopetalidae	Ehlers, 1864	162	27
Cirratulidae	Ryckholt, 1851	23,979	52
Cossuridae	Day, 1963	460	10
Dinophilidae	Macalister, 1876	18	4
Dorvilleidae	Chamberlin, 1919	5927	50
Echiuridae	Quatrefages, 1847	219	5
Eulepethidae	Chamberlin, 1919	3	1
Eunicidae	Berthold, 1827	3851	83
Euphrosinidae	Williams, 1852	179	22
Fabriciidae	Rioja, 1923	1402	11
Fauveliopsidae	Hartman, 1971	35	4
Flabelligeridae	de Saint-Joseph, 1894	7431	45
Glyceridae	Grube, 1850	15,268	39
Goniadidae	Kinberg, 1866	9364	40
Hesionidae	Grube, 1850	9658	55
Histriobdellidae	Claus & Moquin-Tandon, 1884	3	2
Iospilidae	Bergström, 1914	75	1
Iphionidae	Kinberg, 1856	32	4
Lacydoniidae	Bergström, 1914	171	3
Longosomatidae	Hartman, 1944	23	2
Lopadorrhynchidae	Claparède, 1870	930	10
Lumbrineridae	Schmarda, 1861	13,447	74
Magelonidae	Cunningham & Ramage, 1888	7795	18
Maldanidae	Malmgren, 1867	10,217	76
Nephtyidae	Grube, 1850	23,335	64
Nereididae	Blainville, 1818	12,834	190
Nerillidae	Levinsen, 1883	25	12
Oenonidae	Kinberg, 1865	909	16
Onuphidae	Kinberg, 1865	4491	90
Opheliidae	Malmgren, 1867	6562	58
Orbiniidae	Hartman, 1942	10,526	49
Oweniidae	Rioja, 1917	14,198	20
Paralacydoniidae	Pettibone, 1963	74	2

Family	Authority	Record number	Species number
Paraonidae	Cerruti, 1909	13,649	48
Parergodrilidae	Reisinger, 1925	1	1
Pectinariidae	Quatrefages, 1866	9007	22
Pholoidae	Kinberg, 1858	10,897	5
Phyllodocidae	Örsted, 1843	27,360	120
Pilargidae	Saint-Joseph, 1899	891	17
Poecilochaetidae	Hannerz, 1956	2518	9
Polygordiidae	Czerniavsky, 1881	237	4
Polynoidae	Kinberg, 1856	13,289	238
Protodrilidae	Hatschek, 1888	20	13
Protodriloididae	Purschke & Jouin, 1988	186	2
Psammodrilidae	Swedmark, 1952	151	2
Sabellariidae	Johnston, 1865	6039	40
Sabellidae	Latreille, 1825	22,007	134
Saccocirridae	Bobretzky, 1872	51	5
Scalibregmatidae	Malmgren, 1867	9661	17
Serpulidae	Rafinesque, 1815	28,819	228
Siboglinidae	Caullery, 1914	265	32
Sigalionidae	Kinberg, 1856	6254	52
Sphaerodoridae	Malmgren, 1867	2946	23
Spintheridae	Augener, 1913	44	4
Spionidae	Grube, 1850	62,820	194
Sternaspidae	Carus, 1863	221	9
Syllidae	Grube, 1850	24,811	366
Terebellidae	Johnston, 1846	28,354	268
Thalassematidae	Forbes & Goodsir, 1841	28	11
Tomopteridae	Grube, 1850	911	14
Travisiidae	Hartmann-Schröder, 1971	700	8
Trichobranchidae	Malmgren, 1866	8845	21
Trochochaetidae	Pettibone, 1963	56	2
Typhloscolecidae	Uljanin, 1878	425	6
Urechidae	Monro, 1927	24	4
		533,502	3415



Appendix 3.9 Spearman correlation analyses between polychaete species richness – i.e., alpha (first row), gamma (second row), E(S50) (third row) – and the number of records per latitudinal band. Left and right graphs are the analyses including and excluding outliers, respectively. *R* is the Spearman's correlation coefficient. The analysis is highly significant with *p* value < 0.0001 for alpha and gamma species richness, and *p* value < 0.05 for E(S50). Red-solid line is the linear regression line. Grey shadings are the standard errors.

Appendix 3.10 List of a number of taxa along with their species richness peak. The symbols * and ** indicate that the study was northern biased and took sampling bias into account, respectively.

Marine taxon	**Peak of species richness**	**Reference**
Amphipods	Southern hemisphere	Arfianti & Costello (2020)
Benthic algae	Northern hemisphere	Kerswell (2006)
Bivalves	Northern hemisphere	Crame (2000)
Brachiopods	Northern hemisphere	Shen & Shi (2004)
Bryozoans	Northern hemisphere*	Clarke & Lidgard (2000)
Fish**	Southern hemisphere	Chaudhary (2019)
Marine species	Northern hemisphere	Chaudhary et al. (2016, 2017)
Planktonic organisms	Symmetrical	Brayard et al. (2005)
Polychaetes	Southern hemisphere	This study
Prosobranch gastropods	Northern hemisphere*	Roy et al. (1998)
Razor clams	Northern hemisphere	Saeedi et al. (2017)
Sea anemones	Northern hemisphere	Fautin et al. (2013)
Shark & rays	Southern hemisphere	Chaudhary (2019)
Stony corals	Southern hemisphere	Chaudhary (2019)
Zooplankton	Symmetrical	Rutherford et al. (1999)

Appendix 3.11 List of over 500 polychaete species that can be found in both hemispheres. Species listed below with an asterisk are confirmed in Hutchings & Kupriyanova (2018) as unlikely to occur in both hemispheres. For the others, an amphi-hemisphere natural distribution hypothesis is accepted pending species revisions on a global scale using a combination of morphological and molecular data. A few species indicated with a double asterisk occur in both hemispheres as a result of human translocation (Hutchings & Kupriyanova, 2018).

Family	Species	Author(s)
Acoetidae	*Eupanthalis kinbergi*	McIntosh, 1876
Acoetidae	*Panthalis novaezealandiae*	Knox, 1960
Acoetidae	*Panthalis oerstedi*	Kinberg, 1856
Alciopidae	*Alciopa reynaudii*	Audouin & Milne Edwards, 1833
Alciopidae	*Alciopina parasitica*	Claparède & Panceri, 1867
Alciopidae	*Krohnia lepidota*	(Krohn, 1845)
Alciopidae	*Naiades cantrainii*	Delle Chiaje, 1830
Alciopidae	*Rhynchonereella angelini*	(Kinberg, 1866)
Alciopidae	*Rhynchonereella fulgens*	Greeff, 1885
Alciopidae	*Rhynchonereella gracilis*	Costa, 1864
Alciopidae	*Rhynchonereella petersii*	(Langerhans, 1880)
Alciopidae	*Torrea candida*	(Delle Chiaje, 1841)
Alciopidae	*Vanadis antarctica*	(McIntosh, 1885)
Alciopidae	*Vanadis crystallina*	Greeff, 1876
Alciopidae	*Vanadis formosa*	Claparède, 1870
Alciopidae	*Vanadis longissima*	(Levinsen, 1885)
Alvinellidae	*Alvinella caudata*	Desbruyères & Laubier, 1986
Alvinellidae	*Alvinella pompejana*	Desbruyères & Laubier, 1980
Alvinellidae	*Paralvinella grasslei*	Desbruyères & Laubier, 1982
Alvinellidae	*Paralvinella pandorae*	Desbruyères & Laubier, 1986
Ampharetidae	*Amage auricula*	Malmgren, 1866
Ampharetidae	*Amphicteis gunneri*	(M. Sars, 1835)
Ampharetidae	*Amphicteis posterobranchiata*	Fauvel, 1932
Ampharetidae	*Amphisamytha galapagensis*	Zottoli, 1983
Ampharetidae	*Isolda pulchella*	Müller in Grube, 1858
Ampharetidae	*Melinna cristata*	(M. Sars, 1851)
Ampharetidae	*Paramphicteis weberi*	(Caullery, 1944)
Amphinomidae	*Amphinome rostrata*	(Pallas, 1766)
Amphinomidae	*Archinome rosacea*	(Blake, 1985)
Amphinomidae	*Chloeia amphora*	Horst, 1910
Amphinomidae	*Chloeia flava*	(Pallas, 1766)
Amphinomidae	*Chloeia fusca*	McIntosh, 1885
Amphinomidae	*Chloeia viridis*	Schmarda, 1861
Amphinomidae	*Eurythoe complanata*	(Pallas, 1766)
Amphinomidae	*Eurythoe dubia*	Horst, 1912
Amphinomidae	*Hermodice carunculata*	(Pallas, 1766)
Amphinomidae	*Linopherus minuta*	(Knox, 1960)
Amphinomidae	*Notopygos crinita*	Grube, 1855
Amphinomidae	*Pherecardia striata*	(Kinberg, 1857)
Amphinomidae	*Pherecardites parva*	Horst, 1912
Aphroditidae	*Aphrodita aculeata*	Linnaeus, 1758
Aphroditidae	*Aphrodita floresiana*	(Horst, 1916)
Aphroditidae	*Aphrodita talpa*	Quatrefages, 1866
Aphroditidae	*Laetmonice benthaliana*	McIntosh, 1885
Aphroditidae	*Laetmonice filicornis*	Kinberg, 1856
Aphroditidae	*Laetmonice moluccana*	(Horst, 1916)
Aphroditidae	*Laetmonice producta*	Grube, 1877
Arenicolidae	*Arenicola cristata*	Stimpson, 1856
Bonelliidae	*Alomasoma belyaevi*	Zenkevitch, 1964

Family	Species	Author(s)
Bonelliidae	*Alomasoma chaetiferum*	Zenkevitch, 1958
Bonelliidae	*Alomasoma nordpacificum*	Zenkevitch, 1958
Bonelliidae	*Bonellia thomensis*	Fischer, 1922
Bonelliidae	*Bruunellia bandae*	Zenkevitch, 1966
Bonelliidae	*Charcotus clavatum*	DattaGupta, 1981
Bonelliidae	*Choanostomellia bruuni*	(Zenkevitch, 1964)
Bonelliidae	*Hamingia arctica*	Danielssen & Koren, 1880
Bonelliidae	*Jakobia birsteini*	Zenkevitch, 1958
Bonelliidae	*Maxmuelleria faex*	(Selenka, 1885)
Bonelliidae	*Maxmuelleria lankesteri*	(Herdman, 1897)
Bonelliidae	*Prometor benthophila*	Fisher, 1948
Bonelliidae	*Prometor grandis*	(Zenkevitch, 1957)
Bonelliidae	*Protobonellia mitsukurii*	Ikeda, 1908
Bonelliidae	*Pseudoikedella achaeta*	(Zenkevitch, 1958)
Bonelliidae	*Sluiterina flabellorhynchum*	Murina, 1976
Bonelliidae	*Torbenwolffia galatheae*	Zenkevitch, 1966
Bonelliidae	*Vitjazema ultraabyssalis*	Zenkevitch, 1958
Capitellidae	*Capitella capitata*	(Fabricius, 1780)
Capitellidae	*Capitella jonesi*	(Hartman, 1959)
Capitellidae	*Dasybranchus caducus*	(Grube, 1846)
Capitellidae	*Heteromastus filiformis*	(Claparède, 1864)
Capitellidae	*Notomastus aberans*	Day, 1957
Capitellidae	*Notomastus latericeus*	Sars, 1851
Capitellidae	*Notomastus lineatus*	Claparède, 1869
Chaetopteridae	*Chaetopterus variopedatus*	(Renier, 1804)
Chaetopteridae	*Phyllochaetopterus claparedii*	McIntosh, 1885
Chaetopteridae	*Phyllochaetopterus socialis*	Claparède, 1869
Chaetopteridae	*Spiochaetopterus costarum*	(Claparède, 1869)
Chrysopetalidae	*Arichlidon reyssi*	(Katzmann, Laubier & Ramos, 1974)
Chrysopetalidae	*Bhawania cryptocephala*	Gravier, 1901
Chrysopetalidae	*Bhawania goodei*	Webster, 1884
Chrysopetalidae	*Chrysopetalum debile*	(Grube, 1855)
Cirratulidae	*Aphelochaeta filiformis*	(Keferstein, 1862)
Cirratulidae	*Aphelochaeta marioni*	(Saint-Joseph, 1894)
Cirratulidae	*Caulleriella alata*	(Southern, 1914)
Cirratulidae	*Caulleriella bioculata*	(Keferstein, 1862)
Cirratulidae	*Chaetozone setosa*	Malmgren, 1867
Cirratulidae	*Cirratulus cirratus*	(O. F. Müller, 1776)
Cirratulidae	*Cirriformia filigera*	(Delle Chiaje, 1828)
Cirratulidae	*Cirriformia tentaculata*	(Montagu, 1808)
Cirratulidae	*Dodecaceria concharum*	Örsted, 1843
Cirratulidae	*Kirkegaardia dorsobranchialis*	(Kirkegaard, 1959)
Cirratulidae	*Protocirrineris chrysoderma*	(Claparède, 1868)
Cossuridae	*Cossura longocirrata*	Webster & Benedict, 1887
Cossuridae	*Cossura pygodactylata*	Jones, 1956
Dorvilleidae	*Dorvillea rubrovittata*	(Grube, 1855)
Dorvilleidae	*Ophryotrocha akessoni*	Blake, 1985
Dorvilleidae	*Protodorvillea biarticulata*	Day, 1963
Dorvilleidae	*Schistomeringos neglecta*	(Fauvel, 1923)
Eunicidae	*Eunice aphroditois*	(Pallas, 1788)
Eunicidae	*Eunice australis*	Quatrefages, 1866
Eunicidae	*Eunice coccinea*	Grube, 1878
Eunicidae	*Eunice filamentosa*	Grube & Örsted in Grube, 1856
Eunicidae	*Eunice floridana*	(Pourtalès, 1867)

Family	Species	Author(s)
Eunicidae	*Eunice laticeps*	Ehlers, 1868
Eunicidae	*Eunice leptocirrus*	Grube, 1870
Eunicidae	*Eunice pennata*	(Müller, 1776)
Eunicidae	*Eunice tibiana*	(Pourtalès, 1867)
Eunicidae	*Eunice vittata*	(Delle Chiaje, 1828)
Eunicidae	*Leodice antennata*	Savigny in Lamarck, 1818
Eunicidae	*Lysidice collaris*	Grube, 1870
Eunicidae	*Lysidice ninetta*	Audouin & Milne Edwards, 1833
Eunicidae	*Lysidice unicornis*	(Grube, 1840)
Eunicidae	*Marphysa aenea*	(Blanchard in Gay, 1849)
Eunicidae	**Marphysa sanguinea*	(Montagu, 1813)
Eunicidae	*Palola siciliensis*	(Grube, 1840)
Euphrosinidae	*Euphrosine longesetosa*	Horst, 1903
Euphrosinidae	*Euphrosine superba*	Marenzeller, 1879
Euphrosonidae	*Euphrosine laureata*	Savigny in Lamarck, 1818
Fabriciidae	*Fabricia stellaris*	(Müller, 1774)
Fabriciidae	*Fabriciola baltica*	Friedrich, 1939
Fabriciidae	*Fabriciola berkeleyi*	Banse, 1956
Fabriciidae	*Manayunkia aestuarina*	(Bourne, 1883)
Fabriciidae	*Pseudofabriciola filamentosa*	(Day, 1963)
Fauveliopsidae	*Fauveliopsis adriatica*	Katzmann & Laubier, 1974
Fauveliopsidae	*Laubieriopsis brevis*	(Hartman, 1967)
Flabelligeridae	*Bradabyssa villosa*	(Rathke, 1843)
Flabelligeridae	*Flabelligera affinis*	M. Sars, 1829
Glyceridae	*Glycera alba*	(O. F. Müller, 1776)
Glyceridae	*Glycera americana*	Leidy, 1855
Glyceridae	*Glycera brevicirris*	Grube, 1870
Glyceridae	*Glycera capitata*	Örsted, 1843
Glyceridae	*Glycera lancadivae*	Schmarda, 1861
Glyceridae	*Glycera fallax*	Quatrefages, 1850
Glyceridae	*Glycera lapidum*	Quatrefages, 1866
Glyceridae	*Glycera oxycephala*	Ehlers, 1887
Glyceridae	*Glycera papillosa*	Grube, 1857
Glyceridae	*Glycera tesselata*	Grube, 1863
Glyceridae	*Glycera tridactyla*	Schmarda, 1861
Glyceridae	*Glycera unicornis*	Lamarck, 1818
Glyceridae	*Glycerella magellanica*	(McIntosh, 1885)
Goniadidae	*Glycinde bonhourei*	Gravier, 1904
Goniadidae	*Glycinde oligodon*	Southern, 1921
Goniadidae	*Goniada emerita*	Audouin & Milne Edwards, 1833
Goniadidae	*Goniada maculata*	Örsted, 1843
Goniadidae	*Goniada multidentata*	Arwidsson, 1899
Goniadidae	*Goniada pallida*	Arwidsson, 1898
Goniadidae	*Goniada paucidens*	Grube, 1878
Goniadidae	*Progoniada regularis*	Hartman, 1965
Hesionidae	*Amphiduros fuscescens*	(Marenzeller, 1875)
Hesionidae	*Hesiolyra bergi*	Blake, 1985
Hesionidae	*Hesione intertexta*	Grube, 1878
Hesionidae	*Hesione splendida*	Lamarck, 1818
Hesionidae	*Hesiospina vestimentifera*	Blake, 1985
Hesionidae	*Psamathe fusca*	Johnston, 1836
Hesionidae	*Leocrates chinensis*	Kinberg, 1866
Hesionidae	*Oxydromus angustifrons*	(Grube, 1878)
Hesionidae	*Podarkeopsis arenicolus*	(La Greca, 1946)

Family	Species	Author(s)
Hesionidae	*Podarkeopsis capensis*	(Day, 1963)
Hesionidae	*Psamathe fusca*	Johnston, 1836
Iphionidae	*Iphione muricata*	(Lamarck, 1818)
Iphionidae	*Iphione ovata*	Kinberg, 1855
Iphionidae	*Thermiphione risensis*	(Pettibone, 1986)
Lacydoniidae	*Lacydonia miranda*	Marion, 1874
Lopadorrhynchidae	*Lopadorrhynchus brevis*	Grube, 1855
Lopadorrhynchidae	*Lopadorrhynchus krohnii*	(Claparède, 1870)
Lopadorrhynchidae	*Lopadorrhynchus uncinatus*	Fauvel, 1915
Lopadorrhynchidae	*Maupasia coeca*	Viguier, 1886
Lopadorrhynchidae	*Pelagobia longicirrata*	Greeff, 1879
Lumbrineridae	*Abyssoninoe scopa*	(Fauchald, 1974)
Lumbrineridae	*Augeneria tentaculata*	Monro, 1930
Lumbrineridae	*Eranno bifrons*	Kinberg, 1865
Lumbrineridae	*Hilbigneris gracilis*	(Ehlers, 1868)
Lumbrineridae	*Augeneria albidentata*	(Ehlers, 1908)
Lumbrineridae	*Lumbrineris cingulata*	Ehlers, 1897
Lumbrineridae	*Lumbrineris coccinea*	(Renier, 1804)
Lumbrineridae	*Lumbrineris inflata*	Moore, 1911
Lumbrineridae	*Lumbrineris latreilli*	Audouin & Milne Edwards, 1833
Lumbrineridae	*Lumbrineris tetraura*	(Schmarda, 1861)
Lumbrineridae	*Paraninoe brevipes*	(McIntosh, 1903)
Lumbrineridae	*Paraninoe fusca*	(Moore, 1911)
Lumbrineridae	*Paraninoe minuta*	(Théel, 1879)
Lumbrineridae	*Scoletoma brevicirra*	(Schmarda, 1861)
Lumbrineridae	*Scoletoma fragilis*	(O. F. Müller, 1776)
Lumbrineridae	*Scoletoma impatiens*	(Claparède, 1868)
Magelonidae	*Magelona capensis*	Day, 1961
Magelonidae	*Magelona papillicornis*	F. Müller, 1858
Magelonidae	*Magelona pitelkai*	Hartman, 1944
Magelonidae	*Magelona rosea*	Moore, 1907
Maldanidae	*Euclymene palermitana*	(Grube, 1840)
Maldanidae	*Maldane sarsi*	Malmgren, 1865
Maldanidae	*Maldanella harai*	(Izuka, 1902)
Maldanidae	*Nicomache arwidssoni*	Blake, 1985
Maldanidae	*Notoproctus oculatus*	Arwidsson, 1906
Maldanidae	*Petaloproctus terricolus*	Quatrefages, 1866
Maldanidae	*Praxillella affinis*	(M. Sars in G. O. Sars, 1872)
Maldanidae	*Praxillella gracilis*	(M. Sars, 1861)
Maldanidae	*Rhodine loveni*	Malmgren, 1865
Nephtyidae	*Aglaophamus dibranchis*	(Grube, 1877)
Nephtyidae	*Aglaophamus elamellatus*	(Eliason, 1951)
Nephtyidae	*Inermonephtys inermis*	(Ehlers, 1887)
Nephtyidae	*Micronephthys longicornis*	(Perejaslavtseva, 1891)
Nephtyidae	*Micronephthys sphaerocirrata*	(Wesenberg-Lund, 1949)
Nephtyidae	*Nephtys paradoxa*	Malm, 1874
Nereididae	*Alitta succinea*	(Leuckart, 1847)
Nereididae	*Ceratonereis tentaculata*	Kinberg, 1865
Nereididae	*Namalycastis abiuma*	(Grube, 1872)
Nereididae	*Namalycastis rhodochorde*	Glasby, Miura, Nishi & Junardi, 2007
Nereididae	*Namanereis quadraticeps*	(Blanchard in Gay, 1849)
Nereididae	*Neanthes acuminata*	(Ehlers, 1868)
Nereididae	*Neanthes kerguelensis*	(McIntosh, 1885)
Nereididae	*Neanthes pachychaeta*	(Fauvel, 1918)

Family	Species	Author(s)
Nereididae	*Nereis jacksoni*	Kinberg, 1865
Nereididae	*Nereis onychophora*	Horst, 1918
Nereididae	*Nereis pelagica*	Linnaeus, 1758
Nereididae	*Nereis sandersi*	Blake, 1985
Nereididae	*Nicon moniloceras*	(Hartman, 1940)
Nereididae	*Perinereis cultrifera*	(Grube, 1840)
Nereididae	*Perinereis helleri*	(Grube, 1878)
Nereididae	*Perinereis singaporiensis*	(Grube, 1878)
Nereididae	*Perinereis vallata*	(Grube, 1857)
Nereididae	*Platynereis bicanaliculata*	(Baird, 1863)
Nereididae	*Platynereis dumerilii*	(Audouin & Milne Edwards, 1833)
Nereididae	*Pseudonereis anomala*	Gravier, 1899
Nereididae	*Websterinereis glauca*	(Claparède, 1870)
Oenonidae	*Arabella iricolor*	(Montagu, 1804)
Oenonidae	*Arabella mutans*	(Chamberlin, 1919)
Oenonidae	*Drilonereis filum*	(Claparède, 1868)
Oenonidae	*Drilonereis logani*	Crossland, 1924
Oenonidae	*Halla okudai*	Imajima, 1967
Oenonidae	*Oenone fulgida*	(Savigny in Lamarck, 1818)
Onuphidae	*Diopatra cuprea*	(Bosc, 1802)
Onuphidae	*Diopatra gallardoi*	Paxton, 2016
Onuphidae	*Diopatra neapolitana*	Delle Chiaje, 1841
Onuphidae	*Hyalinoecia robusta*	Southward, 1977
Onuphidae	*Hyalinoecia tubicola*	(O. F. Müller, 1776)
Onuphidae	*Kinbergonuphis investigatoris*	(Fauvel, 1932)
Onuphidae	*Nothria conchylega*	(Sars, 1835)
Onuphidae	*Nothria otsuchiensis*	Imajima, 1986
Onuphidae	*Onuphis eremita*	Audouin & Milne Edwards, 1833
Onuphidae	*Onuphis holobranchiata*	Marenzeller, 1879
Onuphidae	*Onuphis rullieriana*	(Amoureux, 1977)
Onuphidae	*Paradiopatra antarctica*	(Monro, 1930)
Onuphidae	*Paradiopatra quadricuspis*	(M. Sars in G. O. Sars, 1872)
Onuphidae	*Rhamphobrachium brevibrachiatum*	(Ehlers, 1874)
Onuphidae	*Rhamphobrachium chuni*	Ehlers, 1908
Opheliidae	*Polyophthalmus pictus*	(Dujardin, 1839)
Orbiniidae	*Phylo norvegicus*	(M. Sars in G. O. Sars, 1872)
Orbiniidae	*Leodamas rubrus*	(Webster, 1879)
Orbiniidae	*Scoloplos armiger*	(Müller, 1776)
Oweniidae	*Myriochele eurystoma*	Caullery, 1944
Oweniidae	*Myriochele heeri*	Malmgren, 1867
Oweniidae	**Owenia fusiformis*	Delle Chiaje, 1844
Paralacydoniidae	*Paralacydonia paradoxa*	Fauvel, 1913
Paralacydoniidae	*Paralacydonia weberi*	Horst, 1923
Paraonidae	*Aricidea (Acmira) catherinae*	Laubier, 1967
Paraonidae	*Aricidea (Acmira) lopezi*	Berkeley & Berkeley, 1956
Paraonidae	*Aricidea (Acmira) simplex*	Day, 1963
Paraonidae	*Aricidea (Strelzovia) ramosa*	Annenkova, 1934
Paraonidae	*Aricidea (Aricidea) albatrossae*	Pettibone, 1957
Paraonidae	*Aricidea (Strelzovia) suecica*	Eliason, 1920
Paraonidae	*Aricidea longobranchiata*	Day, 1961
Paraonidae	*Levinsenia gracilis*	(Tauber, 1879)
Paraonidae	*Paradoneis lyra*	(Southern, 1914)
Pectinariidae	*Pectinaria antipoda*	Schmarda, 1861
Phyllodocidae	*Eulalia bilineata*	(Johnston, 1840)

Family	**Species**	**Author(s)**
Phyllodocidae	*Eulalia viridis*	(Linnaeus, 1767)
Phyllodocidae	*Eumida sanguinea*	(Örsted, 1843)
Phyllodocidae	*Galapagomystides aristata*	Blake, 1985
Phyllodocidae	*Notophyllum imbricatum*	Moore, 1906
Phyllodocidae	*Phyllodoce lamelligera*	(Gmelin in Linnaeus, 1788)
Phyllodocidae	*Phyllodoce longipes*	Kinberg, 1866
Phyllodocidae	*Phyllodoce madeirensis*	Langerhans, 1880
Phyllodocidae	*Phyllodoce quadraticeps*	Grube, 1878
Phyllodocidae	*Phyllodoce sanctijosephi*	Gravier, 1900
Phyllodocidae	*Pterocirrus macroceros*	(Grube, 1860)
Pilargidae	*Ancistrosyllis groenlandica*	McIntosh, 1878
Pilargidae	*Sigambra parva*	(Day, 1963)
Pilargidae	*Sigambra tentaculata*	(Treadwell, 1941)
Pilargidae	*Synelmis rigida*	(Fauvel, 1919)
Poecilochaetidae	*Poecilochaetus serpens*	Allen, 1904
Poecilochaetidae	*Poecilochaetus trachyderma*	Read, 1986
Polynoidae	*Bathyeliasona nigra*	(Hartman, 1967)
Polynoidae	*Bathykermadeca hadalis*	(Kirkegaard, 1956)
Polynoidae	*Branchinotogluma hessleri*	Pettibone, 1985
Polynoidae	*Branchinotogluma sandersi*	Pettibone, 1985
Polynoidae	*Branchipolynoe pettiboneae*	Miura & Hashimoto, 1991
Polynoidae	*Branchipolynoe seepensis*	Pettibone, 1986
Polynoidae	*Branchipolynoe symmytilida*	Pettibone, 1984
Polynoidae	*Drieschella maculata*	Augener & Pettibone, 1970
Polynoidae	*Drieschia pelagica*	Michaelsen, 1892
Polynoidae	*Eunoe hubrechti*	(McIntosh, 1900)
Polynoidae	*Euphione tenuisetosa*	Gravier, 1901
Polynoidae	*Gorgoniapolynoe caeciliae*	(Fauvel, 1913)
Polynoidae	*Harmothoe impar*	(Johnston, 1839)
Polynoidae	*Lepidasthenia grimaldii*	(Marenzeller, 1892)
Polynoidae	*Lepidasthenia maculata*	Potts, 1910
Polynoidae	*Lepidonotopodium atalantae*	Desbruyères & Hourdez, 2000
Polynoidae	*Lepidonotopodium fimbriatum*	Pettibone, 1983
Polynoidae	*Lepidonotopodium williamsae*	Pettibone, 1984
Polynoidae	*Lepidonotus clava*	(Montagu, 1808)
Polynoidae	*Lepidonotus cristatus*	(Grube, 1876)
Polynoidae	*Lepidonotus tenuisetosus*	(Gravier, 1902)
Polynoidae	*Levensteiniella kincaidi*	Pettibone, 1985
Polynoidae	*Levensteiniella plicata*	Hourdez & Desbruyères, 2000
Polynoidae	*Paralepidonotus indicus*	(Kinberg, 1856)
Polynoidae	*Polynoe cornuta*	Fischli, 1903
Polynoidae	*Subadyte pellucida*	(Ehlers, 1864)
Polynoidea	*Gastrolepidia clavigera*	Schmarda, 1861
Sabellariidae	*Idanthyrsus macropaleus*	(Schmarda, 1861)
Sabellariidae	*Idanthyrsus pennatus*	(Peters, 1854)
Sabellariidae	*Lygdamis ehlersi*	(Caullery, 1913)
Sabellariidae	*Sabellaria alveolata*	(Linnaeus, 1767)
Sabellariidae	*Tetreres philippinensis*	(Treadwell, 1926)
Sabellariidae	*Tetreres varians*	(Treadwell, 1901)
Sabellidae	*Amphiglena mediterranea*	(Leydig, 1851)
Sabellidae	*Bispira manicata*	(Grube, 1878)
Sabellidae	*Bispira melanostigma*	(Schmarda, 1861)
Sabellidae	*Branchiomma bairdi*	(McIntosh, 1885)
Sabellidae	*Branchiomma cingulatum*	(Grube, 1870)

Family	Species	Author(s)
Sabellidae	*Branchiomma nigromaculatum*	(Baird, 1865)
Sabellidae	*Chone duneri*	Malmgren, 1867
Sabellidae	*Desdemona ornata*	Banse, 1957
Sabellidae	*Jasmineira elegans*	Saint-Joseph, 1894
Sabellidae	*Laonome calida*	Capa, 2007
Sabellidae	*Myxicola infundibulum*	(Montagu, 1808)
Sabellidae	*Notaulax phaeotaenia*	(Schmarda, 1861)
Sabellidae	*Parasabella aulaconota*	(Marenzeller, 1884)
Sabellidae	*Pseudopotamilla reniformis*	(Bruguière, 1789)
Sabellidae	*Sabella pavonina*	Savigny, 1822
Sabellidae	***Sabella spallanzanii*	(Gmelin, 1791)
Sabellidae	*Sabellastarte magnifica*	(Shaw, 1800)
Sabellidae	*Sabellastarte spectabilis*	(Grube, 1878)
Scalibregmatidae	*Scalibregma inflatum*	Rathke, 1843
Serpulidae	*Ditrupa gracillima*	Grube, 1878
Serpulidae	***Ficopomatus enigmaticus*	(Fauvel, 1923)
Serpulidae	*Ficopomatus uschakovi*	(Pillai, 1960)
Serpulidae	*Filograna implexa*	Berkeley, 1835
Serpulidae	*Hydroides albiceps*	(Grube, 1870)
Serpulidae	***Hydroides brachyacantha*	Rioja, 1941
Serpulidae	*Hydroides dirampha*	Mörch, 1863
Serpulidae	***Hydroides elegans*	(Haswell, 1883)
Serpulidae	***Hydroides ezoensis*	Okuda, 1934
Serpulidae	*Hydroides multispinosa*	Marenzeller, 1885
Serpulidae	**Hydroides norvegica*	Gunnerus, 1768
Serpulidae	*Hydroides sanctaecrucis*	Krøyer in Mörch, 1863
Serpulidae	*Hydroides tuberculata*	Imajima, 1976
Serpulidae	*Josephella marenzelleri*	Caullery & Mesnil, 1896
Serpulidae	*Laminatubus alvini*	ten Hove & Zibrowius, 1986
Serpulidae	*Neodexiospira pseudocorrugata*	(Bush, 1905)
Serpulidae	*Neodexiospira steueri*	(Sterzinger, 1909)
Serpulidae	*Pomatostegus actinoceras*	Mörch, 1863
Serpulidae	*Pomatostegus stellatus*	(Abildgaard, 1789)
Serpulidae	*Protula tubularia*	(Montagu, 1803)
Serpulidae	*Salmacina dysteri*	(Huxley, 1855)
Serpulidae	*Serpula concharum*	Langerhans, 1880
Serpulidae	**Serpula vermicularis*	Linnaeus, 1767
Serpulidae	*Simplaria pseudomilitaris*	(Thiriot-Quievreux, 1965)
Serpulidae	*Spirobranchus corniculatus*	(Grube, 1862)
Serpulidae	*Spirobranchus giganteus*	(Pallas, 1766)
Serpulidae	*Spirobranchus kraussii*	(Baird, 1864)
Serpulidae	*Spirobranchus maldivensis*	Pixell, 1913
Serpulidae	*Spirobranchus polytrema*	(Philippi, 1844)
Serpulidae	*Spirobranchus tetraceros*	(Schmarda, 1861)
Serpulidae	*Spirorbis (Spirorbis) spirorbis*	(Linnaeus, 1758)
Serpulidae	*Vermiliopsis glandigera*	Gravier, 1906
Serpulidae	*Vermiliopsis infundibulum*	(Philippi, 1844)
Serpulidae	*Vitreotubus digeronimoi*	Zibrowius, 1979
Siboglinidae	*Diplobrachia similis*	Southward & Brattegard, 1968
Siboglinidae	*Oasisia alvinae*	Jones, 1985
Siboglinidae	*Riftia pachyptila*	Jones, 1981
Siboglinidae	*Siboglinum angustum*	Southward & Brattegard, 1968
Siboglinidae	*Siboglinum pholidotum*	Southward & Brattegard, 1968
Siboglinidae	*Tevnia jerichonana*	Jones, 1985

Family	Species	Author(s)
Sigalionidae	*Euthalenessa digitata*	(McIntosh, 1885)
Sigalionidae	*Euthalenessa festiva*	(Grube, 1875)
Sigalionidae	*Euthalenessa oculata*	(Peters, 1854)
Sigalionidae	*Fimbriosthenelais longipinnis*	(Grube, 1870)
Sigalionidae	*Leanira quatrefagesi*	Kinberg, 1856
Sigalionidae	*Neoleanira tetragona*	(Örsted, 1845)
Sigalionidae	*Pelogenia zeylanica*	(Willey, 1905)
Sigalionidae	*Pottsipelogenia malayana*	(Horst, 1913)
Sigalionidae	*Sigalion lewisii*	Berkeley & Berkeley, 1939
Sigalionidae	*Sigalion mathildae*	Audouin & Milne Edwards in Cuvier, 1830
Sigalionidae	*Sigalion squamosus*	Delle Chiaje, 1830
Sigalionidae	*Sthenelais boa*	(Johnston, 1833)
Sigalionidae	*Sthenelais limicola*	(Ehlers, 1864)
Sigalionidae	*Sthenelais malayana*	Horst, 1917
Sigalionidae	*Sthenelanella ehlersi*	(Horst, 1916)
Sigalionidae	*Willeysthenelais horsti*	Pettibone, 1971
Sphaerodoridae	*Sphaerodoropsis chardyi*	Desbruyères, 1980
Sphaerodoridae	*Sphaerodoropsis parva*	(Ehlers, 1913)
Spionidae	*Aonides oxycephala*	(Sars, 1862)
Spionidae	*Boccardia proboscidea*	Hartman, 1940
Spionidae	*Dipolydora armata*	(Langerhans, 1880)
Spionidae	*Dipolydora flava*	(Claparède, 1870)
Spionidae	*Dipolydora giardi*	(Mesnil, 1893)
Spionidae	*Dipolydora socialis*	(Schmarda, 1861)
Spionidae	*Dispio uncinata*	Hartman, 1951
Spionidae	*Paraprionospio pinnata*	(Ehlers, 1901)
Spionidae	*Polydora calcarea*	(Templeton, 1836)
Spionidae	*Polydora ciliata*	(Johnston, 1838)
Spionidae	*Polydora cornuta*	Bosc, 1802
Spionidae	*Polydora hoplura*	Claparède, 1868
Spionidae	*Prionospio aucklandica*	Augener, 1923
Spionidae	*Prionospio cirrifera*	Wirén, 1883
Spionidae	*Prionospio dubia*	Day, 1961
Spionidae	*Prionospio ehlersi*	Fauvel, 1928
Spionidae	*Prionospio malmgreni*	Claparède, 1869
Spionidae	*Prionospio multibranchiata*	Berkeley, 1927
Spionidae	*Prionospio paucipinnulata*	Blake & Kudenov, 1978
Spionidae	*Prionospio pygmaeus*	Hartman, 1961
Spionidae	*Prionospio steenstrupi*	Malmgren, 1867
Spionidae	*Pseudopolydora antennata*	(Claparède, 1869)
Spionidae	*Pseudopolydora paucibranchiata*	(Okuda, 1937)
Spionidae	*Scolelepis carunculata*	Blake & Kudenov, 1978
Spionidae	*Spio filicornis*	(Müller, 1776)
Spionidae	*Spiophanes bombyx*	(Claparède, 1870)
Spionidae	*Spiophanes kroyeri*	Grube, 1860
Spionidae	*Spiophanes wigleyi*	Pettibone, 1962
Sternaspidae	*Sternaspis scutata*	(Ranzani, 1817)
Syllidae	*Autolytus (Polybostrichus) triangulifer*	Grube, 1878
Syllidae	*Branchiosyllis exilis*	(Gravier, 1900)
Syllidae	*Brania pusilla*	(Dujardin, 1851)
Syllidae	*Epigamia alexandri*	(Malmgren, 1867)
Syllidae	*Eurysyllis tuberculata*	Ehlers, 1864
Syllidae	*Eusyllis assimilis*	Marenzeller, 1875
Syllidae	*Eusyllis lamelligera*	Marion & Bobretzky, 1875

Family	Species	Author(s)
Syllidae	*Exogone (Parexogone) gambiae*	Lanera, Sordino & San Martín, 1994
Syllidae	*Exogone africana*	Hartmann-Schröder, 1974
Syllidae	*Exogone dispar*	(Webster, 1879)
Syllidae	*Exogone naidina*	Örsted, 1845
Syllidae	*Exogone normalis*	Day, 1963
Syllidae	*Haplosyllis spongicola*	(Grube, 1855)
Syllidae	*Myrianida pachycera*	(Augener, 1913)
Syllidae	*Odontosyllis gibba*	Claparède, 1863
Syllidae	*Opisthosyllis brunnea*	Langerhans, 1879
Syllidae	*Paraehlersia ferrugina*	(Langerhans, 1881)
Syllidae	*Paraehlersia weissmannioides*	(Augener, 1913)
Syllidae	*Plakosyllis brevipes*	Hartmann-Schröder, 1956
Syllidae	*Prosphaerosyllis xarifae*	(Hartmann-Schröder, 1960)
Syllidae	*Salvatoria clavata*	(Claparède, 1863)
Syllidae	*Salvatoria euritmica*	(Sardá, 1984)
Syllidae	*Sphaerosyllis georgeharrisoni*	San Martín, 2005
Syllidae	*Streptodonta pterochaeta*	(Southern, 1914)
Syllidae	*Syllides japonicus*	Imajima, 1966
Syllidae	*Syllides longocirratus*	(Örsted, 1845)
Syllidae	*Syllis alternata*	Moore, 1908
Syllidae	*Syllis amica*	Quatrefages, 1866
Syllidae	*Syllis armillaris*	(O. F. Müller, 1776)
Syllidae	*Syllis cerina*	Grube, 1878
Syllidae	*Syllis cornuta*	Rathke, 1843
Syllidae	*Syllis cruzi*	Núñez & San Martín, 1991
Syllidae	*Syllis garciai*	(Campoy, 1982)
Syllidae	*Syllis gracilis*	Grube, 1840
Syllidae	*Syllis hyalina*	Grube, 1863
Syllidae	*Syllis lutea*	(Hartmann-Schröder, 1960)
Syllidae	*Syllis parapari*	San Martín & López, 2000
Syllidae	*Syllis prolifera*	Krohn, 1852
Syllidae	*Syllis rosea*	(Langerhans, 1879)
Syllidae	*Syllis variegata*	Grube, 1860
Syllidae	*Syllis villenai*	Aguado, San Martín & ten Hove, 2008
Syllidae	*Trypanosyllis (Trypanosyllis) coeliaca*	Claparède, 1868
Syllidae	*Trypanosyllis aeolis*	Langerhans, 1879
Syllidae	*Trypanosyllis zebra*	(Grube, 1860)
Syllidae	*Typosyllis anops*	(Ehlers, 1897)
Terebellidae	**Amaeana trilobata*	(Sars, 1863)
Terebellidae	*Amphitrite rubra*	(Risso, 1826)
Terebellidae	*Amphitritides gracilis*	(Grube, 1860)
Terebellidae	*Artacama proboscidea*	Malmgren, 1866
Terebellidae	*Eupolymnia intoshi*	(Caullery, 1944)
Terebellidae	*Eupolymnia marenzelleri*	(Caullery, 1944)
Terebellidae	*Eupolymnia nebulosa*	(Montagu, 1819)
Terebellidae	*Hauchiella tribullata*	(McIntosh, 1869)
Terebellidae	*Lanice conchilega*	(Pallas, 1766)
Terebellidae	*Loimia crassifilis*	(Grube, 1878)
Terebellidae	*Loimia ingens*	(Grube, 1878)
Terebellidae	*Loimia medusa*	(Savigny, 1822)
Terebellidae	*Loimia nigrifilis*	Caullery, 1944
Terebellidae	*Lysilla loveni*	Malmgren, 1866
Terebellidae	*Lysilla pacifica*	Hessle, 1917
Terebellidae	*Neoamphitrite affinis*	(Malmgren, 1866)

Family	Species	Author(s)
Terebellidae	*Neoamphitrite edwardsi*	(Quatrefages, 1865)
Terebellidae	*Neoamphitrite robusta*	(Johnson, 1901)
Terebellidae	*Nicolea longibranchia*	Caullery, 1944
Terebellidae	*Nicolea venustula*	(Montagu, 1819)
Terebellidae	*Pista cristata*	(Müller, 1776)
Terebellidae	*Pista maculata*	(Dalyell, 1853)
Terebellidae	*Pista mirabilis*	McIntosh, 1885
Terebellidae	*Pista violacea*	Hartmann-Schröder, 1984
Terebellidae	*Streblosoma bairdi*	(Malmgren, 1866)
Terebellidae	*Terebella ehrenbergi*	Gravier, 1906
Terebellidae	*Thelepus cincinnatus*	(Fabricius, 1780)
Terebellidae	*Thelepus microbranchiatus*	Caullery, 1944
Terebellidae	*Thelepus robustus*	(Grube, 1878)
Terebellidae	*Thelepus setosus*	(Quatrefages, 1866)
Terebellidae	*Thelepus thoracicus*	(Grube, 1870)
Thalassematidae	*Thalassema ovatum*	Sluiter, 1902
Tomopteridae	*Tomopteris (Johnstonella) apsteini*	(Rosa, 1908)
Tomopteridae	*Tomopteris (Johnstonella) helgolandica*	(Greeff, 1879)
Tomopteridae	*Tomopteris (Johnstonella) pacifica*	(Izuka, 1914)
Tomopteridae	*Tomopteris cavallii*	Rosa, 1908
Tomopteridae	*Tomopteris krampi*	Wesenberg-Lund, 1936
Tomopteridae	*Tomopteris ligulata*	Rosa, 1908
Tomopteridae	*Tomopteris nationalis*	Apstein, 1900
Tomopteridae	*Tomopteris nisseni*	Rosa, 1908
Tomopteridae	*Tomopteris planktonis*	Apstein, 1900
Tomopteridae	*Tomopteris rolasi*	Greeff, 1885
Tomopteridae	*Tomopteris septentrionalis*	Steenstrup, 1849
Travisiidae	*Travisia forbesii*	Johnston, 1840
Travisiidae	*Travisia gravieri*	McIntosh, 1908
Travisiidae	*Travisia kerguelensis*	McIntosh, 1885
Travisiidae	*Travisia profundi*	Chamberlin, 1919
Trichobranchidae	*Terebellides kerguelensis*	McIntosh, 1885
Typhloscolecidae	*Sagitella kowalewskii*	Wagner, 1872
Typhloscolecidae	*Travisiopsis lanceolata*	Southern, 1910
Typhloscolecidae	*Travisiopsis levinseni*	Southern, 1910
Typhloscolecidae	*Travisiopsis lobifera*	Levinsen, 1885
Typhloscolecidae	*Typhloscolex muelleri*	Busch, 1851

Appendix 4.1 GBIF record selection.

Task	Removed record	Remaining record
Initial download	0	1183
Removing records without species name *	719	464
Removing duplicates **	68	396
	Clean records	396

Appendix 4.2 OBIS record selection.

Task	Removed record	Remaining record
Initial download	0	1523
Removing records without species name *	999	524
Removing duplicates **	91	433
	Clean records	433

Appendix 4.3 GBIF and OBIS records merger

Task	Removed record	Remaining record
Merging GBIF and OBIS records ***	0	829
Removing duplicates **	34	795
Removing non-polychaete records (Myzostomatidae)	11	784
	Clean records	784
	Species number	**** 300

* Using the ‘complete.cases’ function in R.
** Using ‘!duplicated’ function in R.
*** Using ‘rbind’ function in R.
**** Of this number, 133 species are different from the 580 valid polychaete species obtained from taxonomic publications.