The evolutionary history and biogeography of South African nudibranch molluscs (Euthyneura: Nudibranchia)

by
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ABSTRACT

South Africa lies at the interface of two opposing oceanographical systems boasting incredibly biodiverse and unique marine environments, however it is estimated that a large amount of the biodiversity still remains undiscovered and undescribed.

The SeaKeys collaborative project led by SANBI aims to tackle the paucity of marine biodiversity knowledge in South Africa, and this Masters project functions to update the knowledge on the unique marine taxon Nudibranchia (Euthyneura: Nudipleura) in South Africa. Nudibranchs are a charismatic species and popular subjects for diving photographers and citizen scientists and as a result there are many unpublished records in grey literature, identification guides and online forums which have not yet been incorporated into science. This project therefore worked closely with citizen scientists with excellent knowledge on their local nudibranch fauna and called for the public to contribute their nudibranch observations to iSpotnature and SANBI's Sea Slug Atlas. Using this approach, distributional information for 382 putative South African species was accumulated and is herein documented with references to published photographs (in literature and online).

Nudibranchs make ideal study species to elucidate information not only on the present biodiversity patterns and processes governing them along the South African coastline, but the large distributions of genera and families across the globe allows for the testing of historical biogeographical processes, providing insight into the manner in which the South African coastal marine biodiversity was shaped over evolutionary timescales. Using molecular methods, genetic sequence data of three genes (mtDNA: COI, 16S, nDNA: H3) for146 putative South African morpho-species were amplified. Analyses revealed these to constitute 163 distinct genetic lineages, hereby bringing to light at least 16 cryptic lineage complexes along the coastline and exposing several species that are currently misclassified. Additionally, through the comparisons of sequences of South African morpho-species to their conspecifics that reside in the Northern Atlantic and in the Indo-Pacific, significant (species-level) sequence divergence was found for over 40% of species examined in this study, indicating the extent of isolation and endemicity along the entire coastline is much higher than previously anticipated.

This thesis has demonstrated 1) the value of involving citizen science into species assessments and specimen collection, 2) the necessity of using molecular data in the species identification process, and 3) the value of molecular methods in the exploration of evolutionary and historical biogeographical patterns to enable us to understand the patterns we find our unique marine realm today.

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CHAPTER ONE: BACKGROUND AND INTRODUCTION

1.1 South Africa's oceanographical setting

The South African coastline, bounded by two sharply contrasting oceanographical systems, boasts an extraordinary rich marine realm hosting a large proportion of endemic species as well as more widespread species from the Atlantic, Southern and Indo-Pacific Oceans (Griffiths et al. 2010).

South Africa's Exclusive Economic Zone (EEZ) spans ~1 million km^2 (excluding Prince Edwards Island territory; Griffiths et al. 2010). The coastline along the continent is relatively short and linear, measuring ±3500km and is placed at the confluence of two ocean basins and current systems 1) the Southeast Atlantic Ocean, dominated by the cold northward flowing Benguela Current which brings nutrient rich waters to the south and southwest coasts (Shillington et al. 2006) and 2) the Southwest Indian Ocean which comprises the warm, nutrient poor southward flowing Agulhas Current on the east coast (Lutjeharms 2006; Fig. 1.1). The coastal dynamics surrounding South Africa are exceedingly complex and variable, which in combination with the coastline's remarkable geological and paleo-history (Ramsay & Cooper 2002, Compton 2011, Beal et al. 2011, Toms et al. 2014) have set the stage for, and continue to shape, the highly diverse and unique marine biodiversity at the southern tip of the African continent.

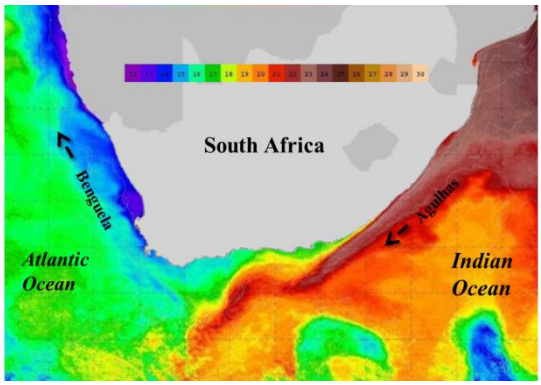

Figure 1.1 Map of South Africa demarcating the two major current systems and SST data (°C). Source of base map: MRSU (www.afro-sea.org.za).

There are four recognized coastal marine ecoregions, namely: 1) Southern Benguela, 2) Agulhas, 3) Natal and 4) Delagoa, and two offshore ecoregions: 1) Southeast Atlantic and 2) Southwest Indian (Sink et al. 2012). Each ecoregion is broadly classified by its unique species composition and environmental components (Sink et al. 2012). These six ecoregions are further subdivided into 22 ecozones, each containing a subset of unique species assemblages (Fig. 1.2; Sink et al. 2012). Many marine species have demonstrated reduced gene-flow between populations (genetic breaks) across at least one of these bioregions (von der Heyden 2009, Teske et al. 2011) and most range restricted species are found inhabiting the unique areas of ecoregion transitions (though it is argued that this may be due to sampling biases; Scott et al. 2012). Further, sister species have also been recovered across biogeographic breaks, further highlighting their importance in shaping marine biodiversity in the southern Africa (von der Heyden et al. 2011).

South Africa harbours around 15% of the world's marine species, with over 12 900 species having thus far been described, of which around 33% are endemic (Griffiths et al. 2010). It is anticipated that

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much of the total marine biodiversity remains undiscovered and many of the species documented or housed in musea have yet to be described. For example, it is estimated that around 25% of the endemic southern African fish fauna is still unsampled and unknown (von der Heyden 2009). For taxa that are less well recorded such as the benthic invertebrate fauna, these estimates are expected to be much higher (Griffiths et al. 2010). Gaps in our knowledge of basic biodiversity hampers our understanding of marine ecosystems and their functioning; rendering their future stability, along with the marine species biodiversity within these ecosystems, uncertain (Worm et al. 2010). This is particularly problematic in the light of unprecedented global anthropogenic changes which are currently taking place, which is resulting in population extinctions and demographic changes (Halpern et al. 2007, Sink et al. 2012, Mead et al. 2013); a challenge that is being faced globally (May 2002, Mora et al. 2011, Appletans et al. 2012, Costello et al. 2013, Pimm et al. 2014).

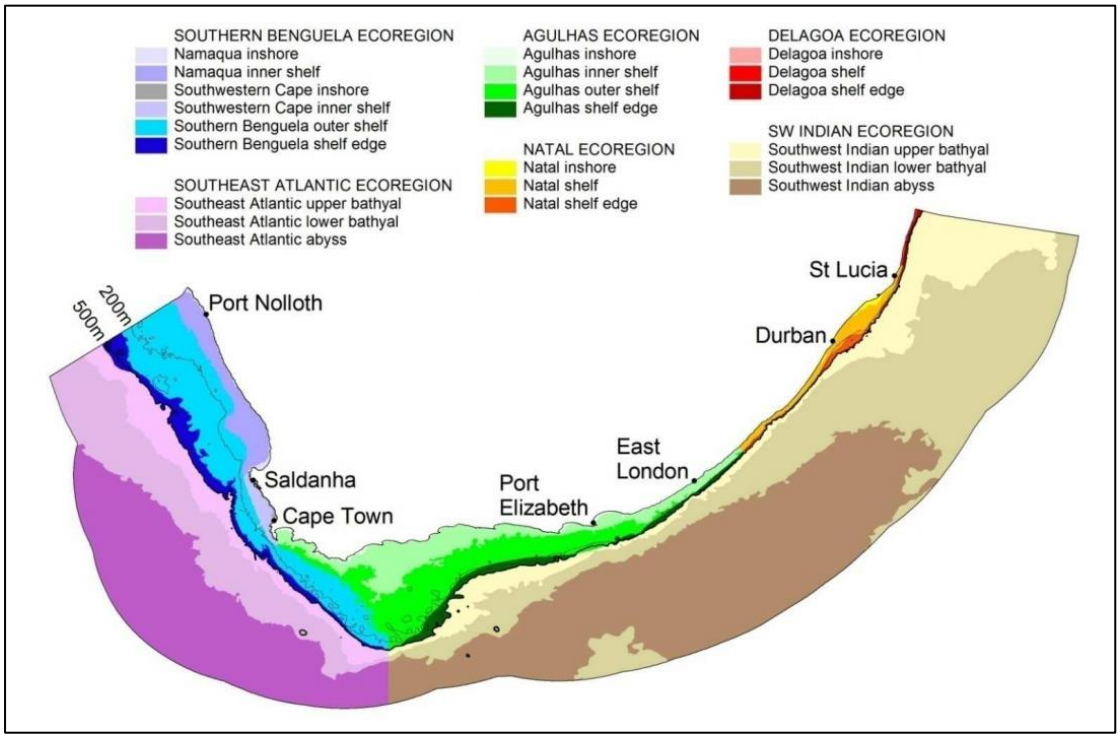

Figure 1.2 South African Marine Ecoregions and Ecozones (from: Sink et al. 2012). Each ecoregion is broadly classified by its unique species compositional and environmental components; each ecozone contains a subset of unique species assemblages.

1.2 Marine biodiversity planning in South Africa

Fishery industries, coastal developments, exploitation of marine resources and other anthropogenic impacts have been putting increasing pressures on marine biodiversity globally (Halpern et al. 2007, Hoegh-Guldberg & Bruno 2010), including South Africa (Sink et al. 2012, Mead et al. 2013). The need for more efficient protection of biodiversity has received attention internationally, which is particularly highlighted by the UN Convention on Biological Diversity (CBD). In 2002, parties of the CBD set targets to reduce rates of global declines in biodiversity at the World Summit for Sustainable Development. These target were not realised and as a result, at the tenth meeting of the CBD parties

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in 2010, a new strategic plan which includes the '20 Aichi Biodiversity Targets' to be met by 2020, was set in place and signed by 193 countries, including South Africa (see: https://www.cbd.int/sp/targets/). Strategic goal C (targets 11-13) aims to "to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity", target 11 requires that by 2020: "at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes".

South Africa is currently behind target in terms of the coverage of representative ecosystems and habitats within its current Marine Protected Area (MPA) network. While 21.5% of the coastline lies within MPAs, only 9% of South Africa's coastal habitat types and 4% of the offshore habitat types are fully protected no-take zones (Sink et al. 2012). By taking South Africa's EEZ into account, the percentage of protected areas is further reduced to 0.4%, with less than 0.2% being no-take zones. Additionally, 47% of coastal habitats types are currently threatened (>70% of the coastline) and 40% of coastal and offshore habitat types are not represented in the MPA network at all (Sink et al. 2012).

The Operation Phakisa Initiative launched in 2014 aims to advance marine spatial plans for the development of South African Ocean Economy (http://www.operationphakisa.gov.za/). Recent outcomes of this project include draft notices and regulations published by the South African Minister of Environmental Affairs, declaring a network of an additional 22 proposed MPAs (MIN Molewa, DEA 2016*: Government Gazette* no. 39646). This network will increase South Africa's MPA coverage to over 5% of the EEZ, incorporating offshore ecosystems, threatened species, charismatic features and many habitat types which are currently underrepresented in order to safeguard ecologically (feeding areas), biologically (spawning grounds, nesting areas) and structurally (reefs, mangroves, coastal wetlands) important areas.

Although the MPA coverage of the EEZ is currently being expanded, it is important to note that biodiversity planning in South Africa has thus far failed to integrate the genetic aspects of biodiversity, thereby not yet meeting the Aichi target to "safeguard ecosystems, species and genetic diversity" (von der Heyden in: Sink et al. 2012, Wright et al. 2015). This has been a trend globally, mostly due to (1) the increasingly complex nature of studies based on genetic data, (2) the deficiency of such studies being 'translated' into understandable terms for the public and policy makers to understand and (3) the lack of frameworks provided to policy and decision makers to follow (von der Heyden et al. 2016). However, several studies have grappled with a more integrated approach, thus paving the way for a more directly applied conservation/genetic interface (von der Heyden 2009, von der Heyden et al. 2014, Beger et al. 2014, Lewison et al. 2015, Nielsen et al. 2016).

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1.3 Genetic tools for improved understanding of biodiversity

Genetic data hold information on the inheritance of genetic traits of all living organisms, and can be applied to elucidate a vast amount of information in a large variety of ways. Simple genetic tools have defined and clarified many patterns in biodiversity and relationships that have long puzzled evolutionary biologists and taxonomists. It can be argued that it is essential for genetic data to be incorporated into biodiversity planning practices for several reasons: they provide increased accuracy when delineating species, revealing divergent lineages, cryptic species as well as hybrids in species complexes, and importantly they bring to light the evolutionary relationships, assess population structure and connectivity as well as historical demographics of species (reviewed in: von der Heyden et al. 2014, Beger et al. 2014). By failing to understand and incorporate such data, the processes that maintain and generate biodiversity could potentially be disrupted, leading to losses in genetic diversity and ultimately evolutionary (and thus adaptive-) potential of species (Rocha et al. 2007, von der Heyden et al. 2014).

Genetic tools and their applications are rapidly advancing, specifically with the onset of high throughput or "Next Generation Sequencing" methods, which are becoming more user-friendly and affordable (Puritz et al. 2012, Hemmer-Hansen et al. 2014). However the more traditional molecular methods that use few molecular markers remain invaluable, as they are relatively inexpensive and powerful tools as first assessments to gain understanding of the population structure and demographic history of species as well as to identify interesting genetic patterns, prior to subsequent investigations using the more advanced genomic methods, ultimately increasing their efficiency (Bowen et al. 2014).

In South Africa, marine phylogeographic studies performed on multiple species with different life histories, have so far demonstrated that MPAs are on average spaced farther apart than required for effective gene-flow connectivity (von der Heyden 2009, Teske et al. 2011, Wright et al. 2015). Although phylogeographic studies have revealed many important things about the patterns of species' genetic diversity and evolutionary and demographic histories, they are very specific and typically only assess intra-specific variation. However, studies covering larger taxonomic groups with marine distributions in South Africa are lacking. Molecular phylogenies provide important molecular tools for gaining understanding of such larger groups, and provide a broader perspective on the evolutionary history and demographics of thereof.

1.3.1 The use of molecular phylogenetic trees for studying biodiversity

Phylogenetic trees display the evolutionary relationships of taxonomic groups based on DNA sequences (although newer phylogenomic approaches are based on Single Nucleotide Polymorphism data), and they can reveal important information on the evolutionary history of their constituent taxa, adding new knowledge on taxonomic relationships and uncovering cryptic species. In South Africa

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for example, von der Heyden et al. (2011) discovered four novel genetic lineages within two clinid species, which led to the description of two additional clinid species (Holleman et al. 2012). Such a phylogenetic approach is therefore an important tool in delineating the genetic diversity of species and has been shown to be invaluable both in terrestrial and marine settings.

Trees that reconstruct the phylogenetic history of species additionally have important applications in marine biodiversity planning. Research conducted for the prioritization of areas for conservation, traditionally examined species richness and endemicity data within a certain geographic region. For example, several studies along the South African coastline have been conducted which included large taxonomic groups to identify concordant biogeographic patterns in species richness and endemicity (Turpie et al. 2000, Awad et al. 2002, Scott et al. 2012). Although such studies are of great significance, they are missing a key component of biological diversity, namely: phylogenetic or evolutionary diversity. Phylogenetic diversity (PD) is a biodiversity measure of the 'genetic uniqueness' of taxa within a specific area, which is inferred from phylogenetic trees by calculating branch-lengths of these taxa, hereby incorporating their evolutionary history (Pio et al. 2011, Winter et al. 2012). This brings a new dimension into spatial biodiversity planning, through revealing areas of high phylogenetic diversity; areas with evolutionarily unique lineages (Winter et al. 2013). In South Africa, a study mapping the phylogenetic diversity and species richness of chitons (the first marine study of its kind in South Africa) has indicated that areas of high species richness do not always coincide with areas of high phylogenetic diversity (Volkman 2014, unpublished honours thesis). Areas of high PD warrant consideration for protection, because if the evolutionary unique lineages are also rare, the loss of these by means of extinction will result in a larger proportion of genetic information (and hence evolutionary information) being lost from the tree in comparison to the extinction of lineages from younger more taxonomically rich clades (Rodrigues & Gaston 2002, Isaac et al. 2007, Brooks et al. 2015). These examples authenticate the benefits of such genetic information to be taken into account in South Africa's marine spatial planning priorities.

Globally, phylogenetic studies have greatly enhanced our understanding of biodiversity patterns as well as the evolutionary processes involved in shaping these patterns (von der Heyden et al. 2014). In addition, molecular chronograms (dated phylogenetic trees) can test hypotheses on patterns of origination, dispersal, colonization and diversification of taxa through time. Studies such as these have revealed the historical biogeographic patterns over a wide range of marine taxa globally (e.g. reef fishes: Floeter et al. 2008, Cowman & Bellwood 2013, Gaither et al. 2014; marine molluscs: Frey & Vermij 2008, Medina et al. 2011, Hallas & Gosliner 2016, Williams et al. 2013; and corals: Wirshing & Baker 2014). Therefore a phylogenetic approach can add multiple dimensions to understanding biodiversity.

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1.4 The SeaKeys Project

In order to tackle the current paucity of marine biodiversity knowledge in South Africa, the South African National Biodiversity Institute (SANBI) marine group set up a three year project launched in February 2014, named the SeaKeys Project. This is a large collaboration involving multiple government departments, research institutes, universities and industries as well as citizen scientists working together to "*unlock foundational marine biodiversity information and disseminate this knowledge to improve decision-making, service delivery and create new economic opportunities for South Africa*". It is funded by the National Research Foundation (NRF) and the Department of Science and Technology (DST) through the Foundational Biodiversity Information Programme (FBIP). A brief description follows below.

<u>Main Goals of the SeaKeys project include:</u>

1) Creating comprehensive species lists

- Digitization of Museum inventories
- Adding new species records
- Contribute barcodes to the Barcode of Life Database (BOLD) that underpin species description and uncover cryptic species and identifying invasive or non-indigenous species (NIS)
- Contribute Encyclopaedia of Life (EOL) pages on South Africa's marine species

2) Mapping projects involving taxonomic experts, students, citizen scientists and the public

- Involving the public in mapping projects through online platforms such as iSpotnature's Marine Atlas Projects
- Reaching out to local citizen scientists, as well as fisherman and underwater photographers to gather information on species distributions
- Photographic competitions and BioBlitzes in attempts to record as many species as possible from a certain area in a certain time-frame
- The 'Dive South Africa' project serves to encourage people to get to know, appreciate and take ownership of their unique regional marine life along our dynamic coastline

3) Shedding light on historical perspectives to better understand and predict of the impact of current and future changes

- Comparisons to past surveys and documenting and range extensions or contractions of indigenous species' (as well as NIS) distributions
- Increase our understanding of processes involved in shaping species distributions through phylogenetic and population genetic studies

4) Strengthening our understanding ecosystem dynamics

- All this information combined provides an integrated approach to improve our understanding of ecological and environmental aspects involved in the complex ecosystems surrounding South Africa's coastline. This will ultimately support science based management and policy advice, and will for the first time incorporate genetic information into biodiversity planning in South Africa.

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1.5 Genetic study of an enigmatic South African marine taxonomic group

This Masters project form part of the SeaKeys initiative and examines a unique marine invertebrate taxon: the nudibranch molluscs (Mollusca: Gastropoda: Heterobranchia: Euthyneura: Nudipleura: Nudibranchia). Members of the clade Euthyneura are among the most ecologically and morphologically diverse of all gastropods. Nudibranchia forms its largest and most enigmatic suborder comprising well over 3000 species globally, exhibiting an extensive array of fascinating morphological, anatomical and physiological adaptations indicative of their extremely complex evolutionary history (Wägele & Willan 2000, Wägele et al. 2014). The order Nudibranchia can be sub-divided in multiple categories. Following the diagram in Fig. 2.3 Nudibranchia comprises: two Suborders, three Infraorders, four Parvorders 11 Superfamilies, 53 Families, 16 Subfamilies, 256 genera and 2268 described species, globally (according to WoRMS: www.marinespecies.org). South African waters hold representatives of 37 families, and 101 genera (Fig. 1.3).

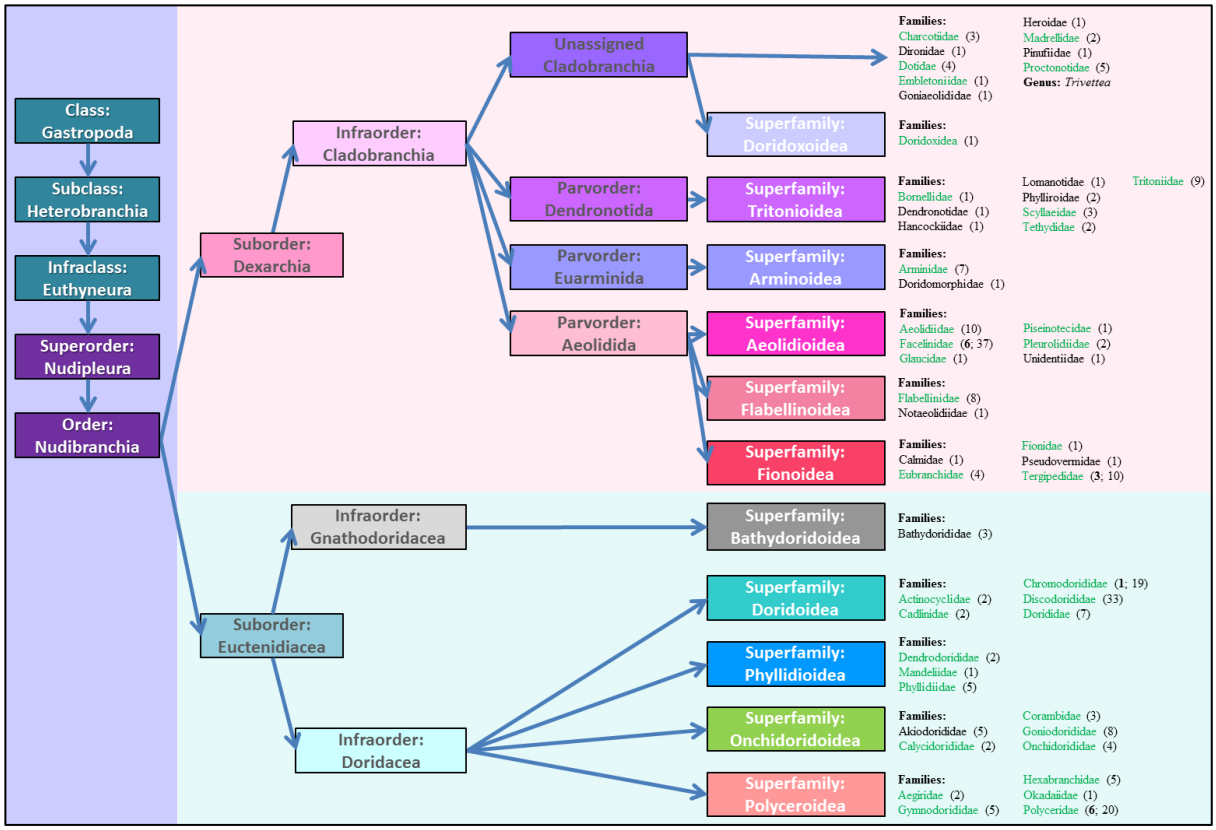

Figure 1.3 Taxonomical groupings of Nudibranchia according to World Registry of Marine Species. The number of subfamilies and genera contained in each family are depicted in parentheses behind the family names as follows: (**number of subfamilies**; number of genera). Families printed in a green colour indicate their presence in South Africa.

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1.5.1 Brief summary on the biology, ecology and life-history of nudibranchs

Nudibranchs are found from the tropics to the poles, occupying niches from deep oceanic habitats to shallow reefs and intertidal rockpools. Although their adult sizes range from 2 to over 500mm, most are around 10-30mm in length (Wägele & Willan 2000, this study). All nudibranchs are carnivorous and feed on a wide variety of organisms, yet most species mostly rely on only one specific food type (genus/species), making the majority habitat specialists (Gosliner 1987a, Todd 1981, McDonald & Nybakken 1997). Specialized feeding structures such as the jaws and radular teeth (present in most species) and the buccal mass are highly variable among species, indicative of their specialized feeding modes (Todd 1981, Wägele and Willan 2000). Dietary preferences can be broadly allocated to different taxonomical groups within Nudibranchia, for example the Doridacea feed mainly on species or genera within the Porifera or Bryozoa, and Aeolidida feed mainly on species or genera within the Cnidaria such as Hydrozoa and Anthozoa (Todd 1981, McDonald & Nybakken 1997).

By far the most striking aspects of the Nudibranchia are their remarkable coloration patterns and external morphological features (Fig. 1.4). Some are incredibly well camouflaged, having adapted a similar appearance to their food sources (e.g. *Corambe* sp., *Tritonia nilsodhneri*), whereas others exhibit highly conspicuous coloration patterns (e.g. *Cratena capensis*, *Bornella valdae*), often warning potential predators of their toxicity or merely mimicking the aposematic coloration patterns of other toxic species (Todd 1981, Rudman 1991, Valdés 2001).

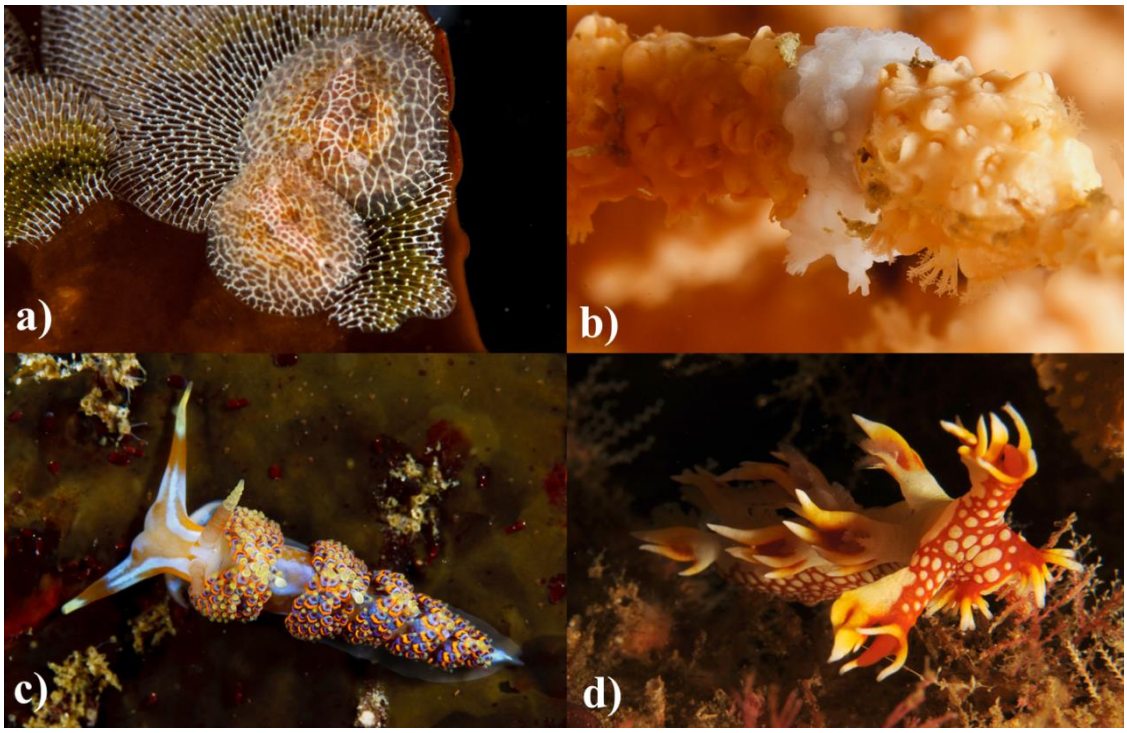

Figure 1.4 Camouflaged and conspicuous nudibranch species. a) *Corambe* sp. on the bryozoan *Membranipora rustica*; b) *Tritonia nilsodhneri* on the gorgonian *Eunicella papillosa*; c) *Godiva quadricolor*; d) *Bornella valdae* (photo credits: a-c: Guido Zsilavecz, d: Valda Fraser).

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To compensate for the absence of hard shells for defence, nudibranchs have acquired alternative methods to prevent predation. Many species have acquired toxins and secondary metabolites (Avila & Paul, 1997) and their mantles often possess calcareous spicules, rendering them unpalatable to most marine predators (Long & Hay 2006, Cheney et al. 2016). The chemical defences are often localized in selected parts of the body (Avila & Paul 1997, Carbone et al. 2013) and are usually derived from their diets (Cimino & Ghiselin 2009, Da Cruz et al. 2012), although many also synthesize toxins and secondary metabolites *de novo* (Cimino et al. 1983, Cimino & Sodano 1993). Their chemical defence mechanisms make nudibranchs interesting study subjects for bioprospecting, as the toxins and secondary metabolites (isocyanides, diterpenes and sesquiterpenes) they produce demonstrate potential pharmaceutical value (Leal et al. 2012). Nudibranchs also rely on chemical cues throughout their life cycles. They use highly developed sensory structures, or rhinophores which are located on top of the head. They can sense pheromones emitted by suitable mates and other chemical cues in order to locate their specific food sources (Todd 1981, Croll 1983).

Nudibranchs are simultaneously hermaphroditic, with fertilization sometimes being delayed where sperm from another individual is stored in the 'seminal receptacle' after copulation, often for several months, until eggs are mature (Todd 1981, Gosliner 1987a). The egg ribbons laid by nudibranchs are highly variable among species and in some cases can be used to distinguish species with the same external appearances (e.g. *Janolus longidentatus* which has a flat spiral shaped ribbon with 5-7 eggs per capsule, and *Janolus capensis* whose eggs form a spherical mass with 30-40 eggs per capsule see Fig. 1.5). The dispersal to other favourable environments depends mainly on the veliger larval stage, with most nudibranchs having planktotrophic or lecithotrophic larval stages and few are direct developers (Gosliner 1987ab, Goddard 2004). Planktotrophic veliger larvae can remain in the water column for extended periods (a few days to several months) until chemical signals from food sources trigger metamorphosis (Todd 1981, Kempf & Hadfield 1985, Todd et al. 1998, Koehl et al. 2007). Adult nudibranchs live a predominantly benthic lifestyle, crawling along substrates using a muscular foot which runs along the length of the body (Zsilavecz 2007). Nudibranchs have short life-spans of a few months to two years (Wägele & Willan, 2000).

Figure 1.5 *Janolus longidentatus* (left) and *J. capensis* (right). These species can be distinguished by their differently shaped egg ribbons displayed in the pictures above (iSpotnature observations by: Peter Southwood (left); Georgina Jones (right)).

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1.5.2 Nudibranchia as model organisms

Nudibranchs make ideal study subjects to contribute valuable information to the SeaKeys project, and to test biogeographical hypotheses in South Africa for several reasons, outlined below:

1) Nudibranchs have widespread geographical distributions; as such South Africa shares many species, genera and families of nudibranchs with regions all over the world. Many taxonomical and biogeographical publications incorporating molecular data from elsewhere in the world, involve families and genera that are also present in South Africa, of which data is available online to researchers (e.g. Goodheart & Valdes 2013, Johnson & Gosliner 2012, Churchill et al. 2014, Palomar et al. 2014, Carmona et al. 2014b, Pola & Gosliner 2015, Shipman & Gosliner 2015, Hallas & Gosliner 2015). This provides a platform to test biogeographical patterns and affinities of South African species using molecular data.

2) The taxonomy of Nudibranchia has been revised numerous times (mainly since the advent molecular techniques). Although Heterobranchia is still unresolved (Wagele et al. 2014), Nudibranchia is confirmed a well-supported monophyletic group in most studies (Wagele & Willan 2000, Wollscheid-lengeling et al. 2001, Grande et al. 2004, Medina et al. 2011). Evolutionary relationships among lower taxonomic levels are being more frequently explored using molecular data, forming more resolved phylogenies which are revealing more detailed information of the evolution of the constituent species and provide a platform to test hypotheses on the ecological and historical processes involved (e.g. Johnson & Gosliner 2012, Hallas et al. 2016).

3) Barcoding, phylogenetic and phylogeographic studies have revealed many cryptic morphospecies and species complexes (e.g. Pola et al. 2012, Churchill et al. 2014, Layton et al. 2014, Wilson & Burghardt 2015). This was predominantly found in species with widespread geographical distributions, where different morphological characteristics were thought exhibit morphological plasticity (e.g. Wilson & Burghardt 2015). Cryptic lineages have often been revealed to be geographically restricted lineages with specific ecological preferences (e.g. Pola et al. 2012, Shipman & Gosliner 2015). Such studies are greatly increasing our understanding on the evolution of nudibranch species and their historical biogeography, their life history traits and other ecological aspects.

4) Nudibranchs and other heterobranch sea slugs make excellent indicator species for changing environments, (e.g. temperature and current changes: Goddard et al. 2011, 2016, Nimbs et al. 2016; pollution: Goddard et al., 2013). For example, a study on the Californian coastline revealed climate related northward range extension and increased abundance of *Phidiana hiltoni*, associated with warming events and associated current patterns (shift in cool to warm phases of the Pacific Decadal Oscillation) (Goddard et al. 2011). This study indicated that water temperature affected the recruitment and changed patterns of larval dispersal of this generalist feeder causing a northward range shift of this species, resulting in a considerable decline in the abundance of other nudibranch

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species vulnerable to predation and competition in these areas (Goddard et al. 2011).
During another warm anomaly in 2014-2015, the northward range shifts of 30 nudibranch and other heterobranch species was documented along the northeast Pacific coastline of the USA (Goddard et al. 2016). Nine species extended to new northernmost localities, and several species were observed spawning in these northern ranges. *Okenia rosacea*, a conspicuously brightly coloured pink nudibranch, reached its highest recorded densities to date within its native range of California as well as in Oregon, where it was previously only recorded as a single specimen during the 1998 El Nino event (Goddard et al. 2016). Similarly, in Port Stephens (New South Wales, Australia), a southward range extension of an increasing number of heterobranch sea slugs (including nudibranchs) and other marine life is being recorded in association with the southward extent of the Eastern Australian Current (EAC) (Nimbs et al. 2015, 2016). Another example is the regional extinction of the once abundant nudibranch *Felimare californensis* in California in 1984, which left researchers puzzled as populations of the same species in Mexico, as well as congeneric species and those with similar life-history strategies had persisted throughout the years (Goddard et al. 2013). *Felimare californensis* has since only reappeared in Santa Catalina Island since 2003, as well as Santa Cruz Island and Mission Bay. It did not appear to be associated with temperature anomalies over the last four decades, but rather was attributed to coastal development and more importantly coastal water pollution, which seems to have negatively affected the abundance of its sponge prey (Goddard et al. 2013) and is known to have also affected other marine species (Puritz and Toonen 2011).
5) Another reason they make interesting and ideal study subjects, is that nudibranchs are popular subjects among the diving community and are gaining more popularity among the non-diving community too. Photographs taken by divers and documented globally onto online databases can greatly aid researchers' understanding of the ecology and range distribution of species (Silvertown 2009, Nimbs et al. 2016). This is specifically important in marine habitats in which scientists usually do not get to spend as much time underwater as recreational divers. This also brings together scientific researchers, citizen scientists and the public, bridging the communication gap and increasing the awareness and understanding of the public of the research projects taking place.

These examples demonstrate that these conspicuous and brightly coloured shallow-water species with planktonic larval stages and short life cycles make ideal indicators to detect changes in seawater properties that may potentially be affecting other species in the area in a similar manner and importantly, can signify early warnings for the effects of global changes on coastal habitats (Goddard et al. 2016). However, nudibranchs could only be positively utilised for monitoring if species can accurately be identified. Without a sound understanding of the biodiversity of this group, many of the positive benefits for biodiversity monitoring or marine prospecting will not be realised.

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1.6 Research Objectives

In summary this project aims to:

1) Work closely with citizen scientists and the public for data collection, to provide baseline biodiversity information on nudibranchs in South Africa for the SeaKeys Project;
2) Collect known information from various sources (published and 'grey' literature, museum records and online data bases) in order to update knowledge on species distribution patterns.
3) Delineate South African species (and lineages) using molecular tools and investigate the evolutionary history of South African nudibranch molluscs using a phylogenetic approach. This project will make use of published nudibranch sequences globally and extends this work by including genetic data on South African species. This will enable more accurate inferences to be made about the historical biogeography and evolutionary history of taxa, for example past colonization patterns and diversification patterns;
4) Contribute to global data of nudibranchs, by adding COI barcodes of South African species to the online Barcode of Life database. Furthermore, histone H3 and 16S rRNA sequence data will be made publically available and added to GenBank upon completion of the project.

1.7 Chapter overviews

In order to address the research aims listed above, this thesis is divided into four chapters (inclusive of this introductory chapter). I have outlined the structure of the remaining chapters below:

Chapter two will cover most of the methodology, data collection and capturing. This chapter used genetic data of 146 morphospecies (336 specimens) collected in South Africa from 2014-2015 in order to examine their evolutionary relationships using a phylogenetic approach. Further, South African species records are collected from literature, online databases, musea and the present study to create an updated national species list including references to photographic and distributional records.

Chapter three builds on the tree in chapter two, by focussing on some of the more interesting evolutionary relationships of only a few groups. For example, clades of South African taxa that indicate potential cryptic species complexes, that also have many geographically widespread conspecific, congeneric and confamilial species sequences available on GenBank. This will allow exploration of biogeographical patterns to see whether species diversified within South Africa or are the result of the (repeated) colonizations from other regions globally. This chapter provides novel insights into the present and historical biogeographical relationships of South African nudibranchs and explores historical and contemporary influences on their distribution patterns.

Chapter four provides a summary of the findings of this project, as well as suggestions for future research.

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CHAPTER TWO: EVOLUTIONARY RELATIONSHIPS AMONG SOUTH AFRICAN NUDIBRANCH TAXA

Being at the interface of two vastly contrasting current regimes, South Africa forms an important area from a biogeographical perspective (Spalding et al. 2007, Floeter et al. 2008, Briggs and Bowen 2013), with many unique lineages of Nudibranchia and close affiliations to fauna from both the Atlantic and Indian Ocean basins (Gosliner 1987b). Within South Africa, species richness appears to increase in most marine taxonomic groups from a westerly to easterly direction, with a reduction in endemicity, i.e. many more marine species are shared with the wider Indian and Indo-Pacific Ocean faunas (Awad et al. 2002). A large proportion of endemic species are found along the south (and -west) coast and this is undoubtedly a result of the unique and highly dynamic marine habits found along this part of the coastline, with most range restricted species occupying regions where biogeographic boundaries meet (Scott et al. 2012). Additionally, the influences of the coastline's recent paleo-history, illuminated though molecular studies, have further contributed to South Africa's unique ocean biodiversity (Henriques et al. 2014, 2016, Toms et al. 2014, Phair et al. 2015).

2.1 Nudibranchia in South Africa

The biogeographical patterns of Opisthobranchia in South Africa are currently thought to follow similar patterns as other marine taxa (Gosliner 1987b, Awad et al. 2002; see Fig. 2.1). Several new recordings and taxonomical updates have taken place since Gosliner (1987a), although a comprehensive record on the updated findings and distributions of nudibranchs recorded and examined along the South African coastline is currently lacking. South Africa's nudibranch sighting records, specifically those captured online, have not always been captured and incorporated into science and national species list. This thesis will therefore attempt to update the list of species recorded in South Africa to date with (references to) photographs and distributional data mined from literature, online forums and websites, and delineate species using

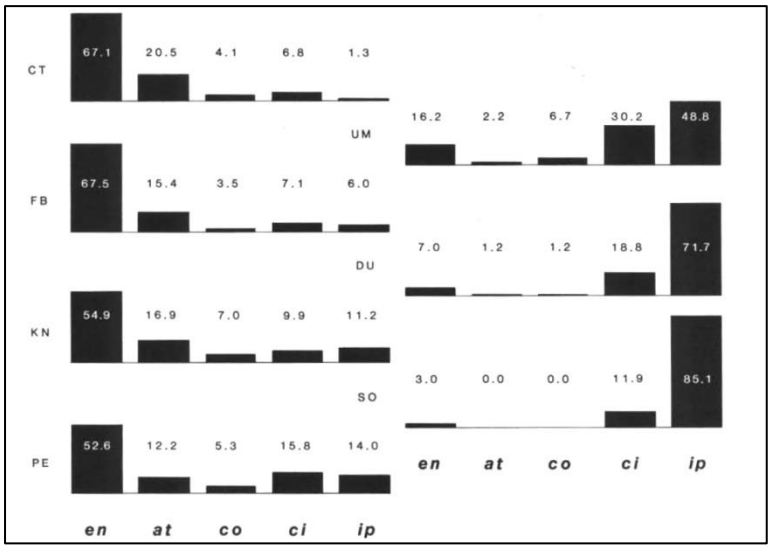

Figure 2.1 Biogeographical patterns of Opisthobranchia in South Africa, in Gosliner (1987b). Abbreviations to the left of each graph indicate regions: CT= Lamberts Bay-Cape Point, FB= Buffels Bay-Rooi Els, KN= Still Bay-Storm's River Mouth, PE= Jeffreys Bay to Port Alfred, UM= Gonubie to Port St. Johns, DU= Park Rynie to Salt Rock, SO= Adlam's Reed to Kosi Bay. Abbreviations below the table indicate biogeographic status: en= endemic, at= Atlantic, co= cosmopolitan, ci= circumtropical and ip= Indo-Pacific; numbers in boxes indicate the percentages of opisthobranch species in each portion for each region.

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genetic information where available, providing a suitable baseline for testing whether morphology and genes resolve the same or different patterns. Below is a brief summary on the history of the status of knowledge of Nudibranchia in South Africa.

2.*1.1* ***Status of knowledge***

Identification guides

The most comprehensive study on South African nudibranch species (as well as other heterobranch gastropods) to date was performed in the 1980s and published in the book "Nudibranchs of Southern Africa: A Guide to Opisthobranch Molluscs of Southern Africa" by Gosliner (1987). This bookwork listed 241 nudibranch species and laid the groundwork for nudibranch knowledge in South Africa, and remains the 'go-to' publication for researchers, citizen scientists and divers to identify their photographic dive-treasures. Specifically since the onset and increasing ease and popularity of underwater photography, nudibranchs became a sought after and popular subject for diving photographers.

Valda Fraser, an underwater naturalist diving photographer residing on the KZN south coast, presented another 37 new species records from the KwaZulu-Natal coast in her books "More Reef Fishes and Nudibranchs" (King & Fraser 2002) and "The Reef Guide" (King & Fraser 2014).

Guido Zsilavecz and Georgina Jones of the Southern Underwater Research Group (SURG; www.surg.co.za) presented an additional seven new species records in their books "Nudibranchs of the Cape Peninsula and False Bay" (Zsilavecz 2007) and "Marine Animals of the Cape Peninsula" (Jones 2008).

Online forums and other websites

Many more South African records have been documented through the years on online forums, such as Bill Rudman's Sea Slug Forum (www.seaslugforum.net), and more recently on iSpotnature (www.ispotnature.org). Bill Rudman is a Senior Fellow and Malacologist at the Australian Museum. The Sea Slug Forum was the first of its kind and hugely popular among nudibranch enthusiast globally. Non-scientists could directly interact with experts and present their photographic findings for identification, hereby bringing to light a massive amount of data on nudibranch distributions and ecology globally, which has since been captured in several books and other publications (e.g. Debelius & Kuiter 2007, Gosliner et al. 2008, 2015). Unfortunately, the Australian Museum's funding for the Sea Slug Forum ceased in 2010, and it has not been active since.

iSpotnature is another interactive online platform where the public can interact with scientists and citizen scientists for species identification. SANBI's Sea Slug Atlas on iSpotnature, aimed mainly at

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collating southern African photographic records of marine heterobranch mollusc distributions, has gained much popularity since the onset of the SeaKeys project, and attracted many enthusiasts and citizen scientists to post their observations.

SURG keeps their website (www.surg.co.za) updated with any new and rare species sightings in the Cape Town area and the Eastern Cape Scuba Diving website (www.easterncapescubadiving.co.za) has also kept photographic records of nudibranch sightings in the region over the years.

2.1.2 Molecular Studies

Species were traditionally classified based on the synapomorphy of certain phenotypical (morphological, anatomical) features (e.g. Wägele & Willan 2000), however, these do not always uncover the true evolutionary history, and can be hampered by homoplasy, as well as the artefacts of taxonomic 'lumping' (Carmona et al. 2013, 2014, Johnson 2011, Johnson & Gosliner 2012). Incorporating molecular data mostly reduces this uncertainty and thus forms a powerful tool in combination with species' phenotypical traits, giving researchers more insight into the trajectory of the evolutionary history of species. Several South African species have been described since the publication of Gosliner (1987a), with more recent studies incorporating genetic data to underpin these descriptions. However, only 32 South African species have been incorporated into molecular studies thus far. A major reason as to why so few are genetically examined, is that specimens traditionally were fixed in formalin, which preserved the morphological features better. Unfortunately as a result of this, DNA extraction is greatly hindered, i.e. fresh specimens have to be collected and stored in substances that will not damage DNA in order to successfully extract and amplify genetic material. Some of the outcomes of genetic studies incorporating South African species are briefly summarized below.

Taxonomical revisions involving South African species

Many taxonomical groupings based on morphological traits have been challenged, revised, reclassified and resurrected primarily as a result of the outcome of molecular studies.
Examples include:
1) The monophyly of the Phanerobranchia, Polyceridae, *Tambja* and *Roboastra* within the Nembrothinae was rejected by Pola et al. (2007, 2014).
2) The monophyly of *Armina* and *Dermatobranchus* within the Arminidae was rejected by Pola & Gosliner (2010).
3) Cadlinidae was revealed to be sister to a clade containing the Chromodorididae, Actinocyclididae, Discodorididae, Dorididae and Phyllidiidae, and was therefore resurrected by Johnson (2011).
4) Genera within Chromodorididae previously formed poly- and paraphyletic groupings; hence many taxa were reclassified to different genera in order to form well-supported clades that accurately reflect

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the evolutionary and biogeographic history of species by Johnson & Gosliner (2012).
5) Members of the family Gymnodorididae were shown to cluster with strong support within the Polycerinae subfamily of the family Polyceridae, rendering the latter polyphyletic by Palomar et al. (2014).

Molecular tools resolve cryptic speciation

Several South African species were shown to form part of cryptic species complexes, where southern African species originally classified on morphological traits alone were revealed to be genetically distinct from their conspecifics globally. In most cases these findings were backed by rigorous re-descriptions and species reclassified. Importantly, these studies highlight that the true biodiversity of South African nudibranch species may well be very much higher than currently thought.

Examples include:
1) *Limacia* sp. 1 and sp. 2 which previously both were thought to be *Limacia clavigera*, were revealed to be genetically distinct (but were not further discussed) by Pola & Gosliner (2010).
2) *Notobryon thompsoni* which previously was thought to be conspecific to *N. wardii* was redescribed and reclassified by Pola et al. (2012).
3) *Anteolidiella saldanhensis* previously thought to be conspecific to *Aeolidiella indica* was redescribed and reclassified by Carmona et al. (2013, 2014).
4) *Doto africoronata* previously thought to be conspecific to northern Atlantic *D. coronata* is re-described and reclassified by Shipman & Gosliner (2015).
5) *Thecacera* cf. *pennigera* was revealed to be distinct from a European specimen of *T. pennigera* (but was not further discussed) by Palomar et al. (2014).
6) In a phylogeographical study by Goodheart & Valdes (2013), species of *Doriopsilla miniata* were expected to be genetically distinct from *Doriopsilla areolata* from the European Atlantic, however this was not the case and as such they suggested *D. miniata* from South Africa be reclassified as *D. areolata.*

Molecular tools for testing biogeographical affinities

When species show sister relationships in combination with high support values, this usually indicates shared (recent) ancestry. Molecular approaches have uncovered interesting historical biogeographic affinities between South Africa and other regions in the world. Some examples are given below:

Examples of sister-relations with the eastern Pacific:
1) *Doto splendidissima* (Agulhas) was revealed to be more closely related to two eastern Pacific taxa: *Doto* sp. H (Mexico) and *Doto columbiana* (Washington State, USA), than to its South African congenerics by Pola & Gosliner (2015).

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Examples of sister-relations with the western Atlantic:
1) *Bornella valdae* (Natal - Delagoa) was revealed to be more closely related to the western Atlantic *B. calcarata* (Brazil, Barra Grande de Camamu, Bahía Marou) than to other Indo-Pacific (including those present in South Africa) congeneric species by Pola & Gosliner (2010).
2) A dated phylogeny by Hallas et al. (2016) revealed that the temperate South African *Acanthodoris planca*, and South American *A. falklandica* together form a South Atlantic clade, deeply split from the clade containing all Northern Hemisphere congeneric species.
3) The closest sister-species to *Antaeolidiella saldanhensis* (Agulhas) was revealed to be the amphi-Atlantic *A. lurana* (Brazil, Mexico, Bermuda, Italy as well as Australia) by Carmona et al (2013).

Examples of sister-relations with the northeastern (NE) Atlantic:
1) *Doto africoronata* (Southwestern Cape) is thought to have diverged from *D. coronata* (NE Atlantic), following vicariance between the North and South Atlantic, in Shipman & Gosliner (2015).
2) Palomar et al. (2014) confirmed that there are two sympatric genetic lineages of the genus *Polycera* in present in South Africa, that present two separate colonization events to South Africa. *Polycera* sp. 1 (Agulhas) was sister to *P. faeroensis* (Aveiro, Portugal), and *P. capensis* (Southwestern Cape – Agulhas) was sister to *P. aurantiomarginata* (Aghroud, Morocco and Cádiz, Spain). Furthermore, *P. capensis* from South Africa and Australia (thought to be introduced to New South Wales) were confirmed to be conspecifics.

Examples of sister-relations with the Indo-Pacific:
1) *Melibe rosea* (Namaqua - Agulhas) grouped closely with Indo-Pacific *M. engeli* (Philippines), however a morphological phylogeny did not support this relationship (Gosliner & Pola, 2012).
2) *Notobryon thompsoni* (Namaqua - Agulhas) formed a sister-relationship with *N. wardi* from the Indo-Pacific in Pola et al. (2012).
3) The study by Johnson & Gosliner (2012) (mentioned above) revealed that the majority of genera in Chromodorididae belong strictly to the Indo-Pacific, with only three genera with Atlantic/Eastern Pacific relationships and two genera with Indo-Pacific/Eastern Pacific relationships. All South African taxa used in their study (which included species present in the Southwestern Cape and Agulhas Ecoregions) belong to the Indo-Pacific clades only, forming sister-relations with Indo-Pacific species only, thus forming the southwestern range limits for all these clades.

As is evident from the above mentioned studies, much information can be extracted from genetic data, especially when explored in combination with distributional, morphological and ecological information. We still know relatively little about the phylogenetic and phylogeographical patterns of nudibranch species present in South Africa and their relationships to other species globally. Currently there is only genetic data available for 32 South African nudibranch species; eight (1/4) of which were reclassified (and some re-described) following molecular investigations; and five were previously

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thought to be geographically wide-spread globally, but subsequently were shown to be unique lineages endemic to southern Africa (Pola & Gosliner 2010, Pola et al. 2012, Carmona et al. 2013, Palomar et al. 2014, Shipman & Gosliner 2015). It is thus very likely that much of our unique South African nudibranch biodiversity is currently still unrecognized and greatly underestimated.

2.1.3 Chapter aims

In this chapter new and updated South African species list with distributional data is collected from this study and collated from literature and reliable online forums and websites. I attempted to collect fresh tissue of as many South African nudibranch species as possible during a two year study period (2014-2015), using assistance from citizen scientist and accessing museum collections which were appropriately preserved. Sequences of three gene regions (two mitochondrial (COI, 16S) genes and one nuclear (H3) gene) are utilized to: 1) construct molecular phylogenies in order to gain greater insight into the evolutionary relationships of nudibranch species found in South Africa; 2) assess the presence and proportion of cryptic lineages and taxonomically misplaced species; and 3) identify groupings within South Africa that warrant further investigation (i.e. possible radiations that occurred within South Africa). Additionally COI barcodes generated in this chapter will be submitted to the Barcode of Life Database (BOLD; Ratnasingham & Hebert, 2007).

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2.2 Methodology

2.2.1 Species list compilation

Throughout the duration of the project, data on South African species records and their (global) distributions were collected from literature (Gosliner 1987ab, King & Fraser 2002, 2014, Zsilavecz 2007, Jones 2008, Gosliner et al. 2008, 2015) as well as from publically available online data: Sea Slug Forum (www.seaslugforum.net, Rudman) and SANBI's iSpotnature page (www.ispotnature.org). Further, photographic records by the Southern Underwater Research group (www.surg.co.za) as well as Eastern Cape Scuba Diving (www.easterncapescubadiving.co.za) were closely examined and documented. Museum collections of iZiko (South African Museum: SAM) and Natal (KwaZulu-Natal Museum: NMSA) were additionally inspected for any missing species. Corrected and updated nomenclature and taxomonical groupings were researched using the World Registry of Marine Species (WoRMS) (WoRMS Editorial Board 2017; www.marinespecies.org) as well as recent publications, and applied here in order to give all the species the correct genus and species names, up to date with current knowledge.

2.2.2 Specimen and data collection

Nudibranchs were collected from 20 relatively evenly spaced collection localities in South Africa (consisting of several dive sites/shore collection sites within these localities) at depths ranging from 0-40 meters (see Fig. 2.2). Localities were chosen based on the field-guides by Gosliner (1987a), Zsilavecz (2007) and King & Fraser (2014). In addition, a few specimens from Namibia were obtained from Lüderitz (K. Grobbler, Lüderitz Marine Research Station) and Walvis Bay (D. Herbert, KwaZulu-Natal Museum).

Specimens were collected either from shore, while snorkelling or while SCUBA/Rebreather diving. Citizen scientists with professional commercial diving qualifications and excellent knowledge of their local nudibranch fauna were asked to assist with sample collection: Guido Zsilavecz in Cape Town, Louw Claassens in Knysna, Evania Snyman in Port Elizabeth and East London, as well as Valda Fraser, Allan Connell in KwaZulu-Natal (each was supplied with collection materials and standard operating procedures (see Appendix 2.1)). Four large field-work trips were conducted (±21 days each), mainly focussing on the areas where assistance from local experts was not available or possible: Sodwana Bay (Cape Vidal to Nine Mile Reef), south coast (Mossel Bay to East London), southeast coast (Port Alfred to Durban South Coast) and west coast (West Coast Peninsula to Port Nolloth). In Sodwana Bay all dives were organized by Triton Dive Charters and the SeaKeys dive team, in Cape St Francis by African Waters Scuba and in Port Alfred by Outdoor Focus. Dives were carefully planned by the dive supervisor in the remaining localities: local dive professionals in these areas were sought out to learn about the local shore/ boat dive sites (i.e. best points of entry and exit

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and possible hazards to be aware of). Local authorities, the NSRI as well as DANSA were informed of dives taking place and emergency equipment was on stand-by. Other local sampling trips were conducted in more familiar waters throughout the duration of the project (Cape Peninsula, False Bay and Walker Bay). Samples were not collected without the appropriate sampling and diving permits for the respective localities (DAFF, iSimangaliso Wetland Park, Knysna Lagoon, Table Mountain National Park, De Hoop Nature Reserve (see Appendix 2.2)). Bad weather conditions throughout the duration of the project unfortunately did not allow for diving in the De Hoop Marine Reserve to take place. Additional samples were obtained from the Iziko SAM and the NMSA musea, and connections were set up with researchers in Namibia and Mozambique for additional samples and information.

Where possible, each specimen was photographed in its natural environment and subsequently collected into a plastic tube filled with seawater. The following field notes were taken: GPS coordinates of collection locality, water depths and the substrates (sponge, hydroid, etc.) the specimens were found on, water temperature at the time of collection, date and collector. Specimens were later measured and photographed while alive in seawater, using a digital camera and when available the SU Botany and Zoology Department's 3D microscope (Marine Research Group: Dr Carol Simon). Specimens were subsequently sedated by refrigeration or addition of $MgCl_2$ before being preserved in 96% ethanol in individual, labelled containers. Specimens were then stored at 4°C in the Evolutionary Genomics Group (EGG) laboratory's refrigerators at Stellenbosch University. Following the completion of the MSc project, all collected specimens that remain after these laboratory procedures will be deposited in the Iziko South African Museum and in the Natal Museum.

2.2.3 Laboratory Procedures

Specimens were measured and photographed while preserved and cross-referenced (labelled with unique identifiers) to enable submission to the BOLD (Ratnasingham & Hebert 2007). A small piece of tissue was cut from the posterior end of the foot of each specimen, and in the case of small specimens ($\leq 3mm^2$ preserved) the whole specimen was digested. Total genomic DNA was extracted using CTAB extraction methods (Winnepenninckx et al. 1993), and where this method did not work, the DNeasy Blood & Tissue extraction kit (QIAGEN) or the NucleoSpin® Tissue kit (Machery-Nagel) were used to extract DNA following manufacturer's guidelines.

2.2.4 Gene Marker Selection

Three gene regions were selected for gene amplification using Polymerase Chain Reaction (PCR) techniques.

Firstly, a partial sequence of the cytochrome oxidase subunit I (COI) gene was selected. This gene is widely utilized for species identification as it is typically conserved within members of the same

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species, yet variable enough to be able to distinguish closely related sister species and other congenerics across a broad range of taxa (Remigio & Hebert 2003, Hebert et al. 2003a,b; Hajibabaei et al. 2007). The COI gene is the most commonly used gene in evolutionary studies of taxa within Nudibranchia (GenBank: 1959 sequences; Wägele & Willan 2000, Wollscheid-Lengeling et al. 2001, Wägele et al. 2003, Grande et al. 2004, Pola et al. 2006, 2007, 2008, 2010, 2012, 2014, Turner & Wilson 2008, Wilson et al. 2009, Wilson & Burghardt 2015, Valdés et al. 2011, Moore & Gosliner 2011, Johnson 2011, Stout et al. 2011, Johnson & Gosliner 2012, Carmona et al. 2011, 2013, 2014ab, 2015, Camara et al. 2014, Palomar et al. 2014, Shipman & Gosliner 2015, Pola & Gosliner 2015, Hallas et al. 2016, among others). This COI-barcodes obtained in this study will contribute to the global Barcode of Life Database initiative (Ratnasingham & Hebert 2007).

Secondly, a partial sequence of the 16S ribosomal RNA was selected. Although 16S rRNA is not always as powerful as the COI protein coding gene in its ability to detect divergence between closely related taxa, its somewhat more conserved nature allows for increased resolution of evolutionary relationships at slightly deeper nodes (Brown & Simpson 1981, Thollesson 1999). This gene has also been extensively applied to phylogenetic studies concerning species belonging to the order Nudibranchia (GenBank: 1748 sequences; Thollesson 1999, 2000, Wollscheid-Lengeling et al. 2001, Valdés 2003, Wägele et al. 2003, Wilson & Lee 2005, Turner & Wilson 2008, Shields 2009, Wilson et al. 2009, Wilson & Burghardt 2015, Harris 2011, Moore & Gosliner 2011, Johnson 2011, Stout et al. 2011, Johnson & Gosliner 2012, Carmona et al. 2011, 2013, 2014abcd, 2015, Gonzalez et al. 2013, Valdés et al. 2011, 2013, Goodheart & Valdés 2013, Santander & Valdés 2014, Camara et al. 2014, Palomar et al. 2014, Hulett et al. 2015, Shipman & Gosliner 2015, Pola & Gosliner 2015, Hallas et al. 2016, among others).

Thirdly, a nuclear gene was included in the analyses. Due to the potential drawbacks of relying solely on mtDNA (e.g. homoplasy, selection, recombination, maternal lineage sampling bias, heteroplasmy and paternal leakage; see Avise 1987, White et al. 2008), nuclear DNA (nDNA) markers are often incorporated in phylogenetic studies to corroborate the findings of mtDNA data (Hare, 2001).The nuclear gene regions histone H3, 28S (28Sa & 28Sb (Whiting et al, 1997)) as well as 18S (18A1 & 1800 (Wollscheid-Lengeling et al, 2001)) were experimented with, however limited time and money did not allow for the incorporation of all three of the gene regions. Histone H3 was selected for this study, mainly for its ease of amplification and because it has been repeatedly and successfully applied in nudibranch phylogenetic research (GenBank: 1008 sequences; Moore & Gosliner, 2011, Stout et al. 2011, Carmona et al. 2011, 2013, 2014abc, 2015, Gonzalez et al. 2013, Valdés et al. 2011, 2013, Goodheart & Valdés 2013, Santander & Valdés 2014, Camara et al. 2014, Palomar et al. 2014, Hulett et al. 2015, Shipman & Gosliner 2015, Pola & Gosliner 2015, Hallas et al. 2016, among others). Histone H3 has a relatively slow mutation rates and has been previously used to clarify evolutionary

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relationships among taxa belonging to the Gastropoda (Colgan et al. 2003), as well as Arthropoda, Polychaeta, Polyplacophora, Cephalopoda and Hexapoda (Colgan et al. 1998, Brown et al. 1999, Okusu et al. 2003, Lindgren et al. 2004, Kjer et al. 2006). The histone H3 marker has been shown to demonstrate a partially obscured phylogenetic signal, due to selection and homoplasy and often shows poor phylogenetic resolution at deeper nodes, although this marker has performed well on the genus level (tested and reviewed in Dinapoli et al. 2006).

Each gene independently provides a hypothesis testing of the evolutionary relationships and together can provide a more robust representation of the true species tree relationships (Gadagkar et al. 2005). Importantly, all three genes were selected for their comparability to sequences of other nudibranch taxa globally (GenBank COI: 1959 sequences; GenBank 16S: 1748 sequences; GenBank H3: 1008 sequences). This data will be incorporated in the next chapter when examining global evolutionary and biogeographical patterns. Their short, but highly informative amplicons and their ease of amplification across all nudibranch species was an additional advantage, considering expenditure and time constraints.

2.2.5 Gene Amplification and Sequencing

A Labnet MultiGene® Gradient PCR Thermal Cycler was used to amplify each of the three gene regions. Reaction conditions for each gene region are displayed in Table 2.1.

Gene Region	**COI**			**16S**			**H3**		
Primers	Geller et al. 2013 jgLCO 1490: 5'-TIT CIA CIA YCA YAA RGA YAT TGG-3' jgHCO 2198: 5'-TAI ACY TCI GGR TGI CCR AAR AAY CA-3'			Xiong & Kocher, 1991 16Sa: 5'-CGC CTG TTT ATC AAA AAC AT-3' 16Sb: 5'-CTC CGG TTT GAA CTC AGA TCA-3'			Colgan et al. 1998 H3F: 5'-ATG GCT CGT ACC AAG CAG ACV GC-3' H3R: 5'-ATA TCC TTR GGC ATR ATR GTG AC-3'		
Initial Denaturation	94°C	3 minutes		94°C	3 minutes		94°C	3 minutes	
Denaturation Step	94°C	30 seconds	39 cylces	94°C	30 seconds	39 cylces	94°C	30 seconds	39 cylces
Annealing Step	46-50°C	30 seconds		50-52°C	30 seconds		53-55°C	30 seconds	
Elongation Step	72°C	1 minute		72°C	1 minute		72°C	1 minute	
Final Elongation	72°C	7 minutes		72°C	7 minutes		72°C	5 minutes	

Table 2.1: Primer sequences and Polymerase Chain Reaction (PCR) amplification protocols for each of the three gene regions.

For extracts of which DNA concentrations were sufficient (analysed with NanoDrop Spectrophotometer) but did not produce amplified products, a method by Dr S.Miller described in Palumbi et al. (2002) was utilized to remove mucopolysaccharides inhibiting the PCR reactions. Genomic DNA extracts were heated to 60°C for one hour, after which 8M $LiCl_2$ was added at a volume of 1:1 to make up a 4M solution. Then the solution was left for an hour and centrifuged on 8000 rpm for several minutes in order for the DNA to form a pellet. Dissolved mucopolysaccharides were discarded and the pellet re-suspended in the original starting volume of dH_2O.

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Gel electrophoresis was performed on a gel of 1% agarose in TBE buffer, stained with ethidium bromide (0.05µL/mL), products were loaded and run along with a 1kB DNA ladder molecular weight marker (Promega®) at 100V for at least 1hr to visually ensure appropriate amplification of PCR products. COI products often revealed multiple bands, and correctly sized fragments were carefully extracted from the gel using Biospin Gel Extraction Kits (BioFlux, Bioer Technology Co., Ltd.) following the manufacturer's guidelines. PCR products for which gel extraction was not required (most of the 16S and H3 products) were cleaned at the Central Analytical Facility (CAF) at Stellenbosch University (http://academic.sun.ac.za/saf/services/services3.html). Cleaned PCR products were sequenced at the CAF using dye terminator methods prior to capillary electrophoresis of fragments in order to obtain the sequence chromatograms.

2.2.6 Sequence Editing:

Sequences were grouped by genera and subsequently aligned using ClustalW (Larkin et al. 2007) implemented in Geneious v7.1.9 (http://www.geneious.com, Kearse et al. 2012). Additional sequences were obtained from GenBank (http://www.ncbi.nlm.nih.gov/genbank) of nudibranch species collected in South Africa, that had not been collected as part of my study or that were genetically distinct from those found in this project, and added to the dataset (see Table 2.2). Thereafter, primer ends were trimmed and sequence ambiguities edited by hand in Geneious v7.1.9. Following editing, sequences were run through the Blastn function (https://blast.ncbi.nlm.nih.gov; Altshul et al. 1990) to ensure sequences corresponded to the correct species or genera (for novel/non-previously submitted sequences). In the instances where discrepancies were found between collected specimens' sequences and those of supposed conspecifics (within South Africa or globally), PCR and sequencing was usually performed a second time or more individuals were examined (if available) to ensure the sequences were correct. Finally, protein coding sequences (COI and H3) were translated into amino acid sequences in Geneious v7.1.9 to detect stop codons and ensure sequences were in the correct reading frame.

Extra South African specimens added to dataset	Locality	Sample ID used in this project	GenBank Accession Numbers			Reference
			COI	16S	H3	
Doto africoronata	Cape Peninsula West	ASBDOA01	HM162734	HM162657	HM162566	Shipman & Gosliner, 2015
Doto splendidissima	Western False Bay	WFBDOS01	HM162741	HM162664	HM162573	Pola & Gosliner, 2015
Mandelia mirocornata	Cape Peninsula West	ASBMM01	KP871646	KP871694	KP871670	Maghuib & Valdes, 2015

Table 2.2 Published sequences of specimens collected in South Africa that were downloaded and utilized in phylogenetic analyses in this chapter. GenBank accession numbers and references to the journal articles in which they were published are included.

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2.2.7 Alignment and Preparation for Phylogenetic Analyses:

Sequences of the protein coding gene regions, COI and H3, were aligned by translation using the alignment plugin MAFFT v7.017 (Katoh & Standley 2013) (G-INS-i algorithm (Katoh et al. 2005)) implemented in Geneious v7.1.9. The alignment for 16S rRNA proved more challenging due to the presence of many gaps and thus was constructed on the MAFFT v7 online server (http://mafft.cbrc.jp/alignment/software, Kuraku et al. 2013) implementing the Q-INS-i algorithm (Katoh & Toh 2008), which takes into account the secondary structure of rRNA sequences. Subsequently variable regions were removed using GBlocks (Castresana 2000) using both relaxed and stringent settings (Appendix 2.3). The removal of these variable regions however, did not improve the phylogenetic inference and hence the edited Q-INS-i alignment was used for subsequent phylogenetic reconstruction. Sequences in each alignment were additionally checked by eye and trimmed down to the same lengths.

The substitution saturation test (Xia et al. 2003, Xia and Lemey 2009) was used to inspect the degree of substitution saturation for each gene, and additionally plots of transition and transversion frequencies vs. uncorrected p-distances were constructed using the program DAMBE (Table 2.3, Appendix 2.4 (Xia 2013)). Third codon position of COI showed significant substitution saturation (Iss>Iss.cSym (0,721>0,691; P= 0,0000)), and so the COI tree was constructed with and without third codon position to test if changes in tree topology and support would occur by removing the third position. Most of the phylogenetic structure is typically contained in the third codon position (Kälersjö et al. 1999) and indeed, trees generated using this reduced dataset for COI lost phylogenetic signal resulting in lower branch support values at a majority of its nodes (Appendix 2.5). Therefore, all characters were included in subsequent phylogenetic analyses involving the COI gene region. Protein coding regions were partitioned by codon. Akaike's Information Criterion (AIC) implemented in MrModeltest v2.3 (Nylander 2004) was used to select the best-fit model of nucleotide substitution for each gene partition (Table 2.3). Genes were analysed individually, producing largely identical groupings at most of the shallow nodes, with some rearrangements among the deeper poorly-supported nodes. H3 unfortunately did not necessarily provide much more support to deeper nodes, although it did mirror support for many of the more recent divergences that were recovered in the COI and 16S gene trees. Hence, genes were concatenated for further analyses in order to enhance the phylogenetic signal. Long branches in mtDNA trees, and duplicate sequences from the same collection localities were identified and deleted prior to concatenation of datasets for use in the combined analyses. For analyses that included all three gene regions, only taxa with sequence data for no less than two genes regions were utilised. For combined data sets, sequences were partitioned by gene and protein coding genes were further partitioned by codon (see Table 2.3).

Dataset	Number of Taxa	Alignment Length (bp)	Sites: Conserved (C) Parsimony Informative (PI)	Substitution Saturation DAMBE	Best-fit Evolutionary Model (AIC) MrModeltest	MrBayes parameters: Partitioning scheme; # Generations; Sample frequency (Nruns=2; Nchains=4)	RAxML parameters: Partititoning scheme; Inference method; # Bootstrap replicates
COI	222	599	C: 297; PI: 289	Pos 1: $I_{ss}<I_{ss.cSym}$(0,125<0,691) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,030<0,691) *P= 0,0000* Pos 3: $I_{ss}>I_{ss.cSym}$(0,721>0,691) *P= 0,0000*	Pos 1: GTR + I + Γ P_{inv}= *0,5736;* γ= *1,1573* Pos 2: GTR + I + Γ P_{inv}= *0,7481;* γ= 0,7089 Pos 3: GTR + Γ P_{inv}=*0,0000;* γ= 1,0669	-	-
16S	224	444	C: 156; PI: 263	$I_{ss}<I_{ss.cSym}$(0,647<0,696) *P= 0.0005*	GTR + I + Γ P_{inv}= *0,3093;* γ= *0,5107*	-	-
COI + 16S	226	1043	C: 645; PI: 656	-	-	Partitioned by gene (COI by codon); Ngen= 50 000 000; Samplefreq= 1000	Partitioned by gene (COI by codon); GTRGAMMAI; Bootstrap replicates (thorough) = 1000
H3	192	305	C: 192; PI: 104	Pos 1: $I_{ss}<I_{ss.cSym}$(0,054<0,799) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,148<0,683) *P= 0,0000* Pos 3: $I_{ss}<I_{ss.cSym}$(0,419<0,802) *P= 0,0011*	Pos 1: GTR + Γ P_{inv}= *0,0000;* γ= *0,0576* Pos 2: K80 P_{inv}= *0,0000; Equal rates* Pos 3: GTR + I + Γ P_{inv}= *0,0623;* γ= *1,9711*	Partitioned by codon; Ngen= 20 000 000; Samplefreq= 1000	Partitioned by codon; GTRMIX; Bootstrap replicates (thorough) = 1000
COI + 16S + H3	226	1348	C: 453; PI: 552	-	-	Partitioned by gene (COI+H3 by codon); Ngen= 150 000 000; Samplefreq= 1000	Partitioned by gene (COI+H3 by codon); GTRMIX; Bootstrap replicates (thorough) = 1000

Table 2.3: Properties of datasets and parameters used in Bayesian and ML phylogenetic inference. The second and third columns display the alignment properties: number of genetically unique taxa and nucleotide alignment lengths for each dataset. The fourth column displays the number of conserved and parsimony informative sites for each datadet. The fifth column shows the results of substitution saturation tests (Xia et al. 2003; Xia & Lemey, 2009) implemented in the programme DAMBE; where $I_{ss}<I_{ss.cSym}$ indicates little saturation and $I_{ss}<I_{ss.cSym}$ indicates substantial saturation. The sixth column displays the best-fit evolutionary models estimated for use in MrBayes, using the Akaike information criterion in MrModeltest (Nylander, 2004), implemented in PAUP*v4.0b10 (Swofford, 2002). The seventh and eighth columns show the parameters used for phylogenetic tree reconstruction in MrBayes v3.2.6 (Huelsenbeck & Ronquist, 2001) and RAxML v8.2.4 (Stamatakis, 2014).

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2.2.8 Species tree reconstruction of South African nudibranchs:

Bayesian inference was performed in MrBayes v3.2.6 (Huelsenbeck & Ronquist 2001). For individual gene trees and concatenated datasets, Metropolis-coupled Markov chain Monte Carlo analyses were run for 50 000 000 – 200 000 000 generations (see Table 2.3), sampling every 1000 generations, with two independent runs and four chains (1 cold and 3 heated). BEAGLE (Ayres et al. 2011) was employed to speed up the convergence time of the runs. The first 25% of trees were discarded as 'burnin'. Convergence was visually examined in MrBayes using the 'sump function, ensuring an average standard deviation of split frequencies below 0.01, "white noise" 'in the plot of generations vs. log likelihood values and the convergence diagnostic (potential scale reduction factor (PSRF) (Gelman and Rubin 1992)) approaching 1.0. Convergence was further examined in Tracer v1.6 (Rambaut et al. 2014): ensuring adequate effective sample sizes (ESSs >200 indicate good mixing of the mcmc) and that the μ-estimates frequency plot of samples showed a good representation of posterior distribution. The trace plots (of sampled values vs. mcmc-steps) revealed 25% burnin was adequate with no obvious trends visible, and the posterior density plot for the substitution rate (of two runs separately and combined) showed clean bell-shaped curves (Rambaut et al. 2014). Trees were constructed in MrBayes using the 'sumt' function, posterior probabilities (PP) greater than 0.95 were considered well supported.

Maximum likelihood tree inference was performed with RAxML v8.2.4 (Stamatakis 2014) in Windows 8 command prompt. The tree search parameters for each dataset were determined following the manual's guidelines in search for the highest likelihood scores of the best trees obtained from ten independent ML searches conducted using six different inference methods (GTRGAMMA, GTRGAMMAI, GTRCAT, GTRCATI, slow ML search and random starting trees (Stamatakis 2015)). Selected models are displayed in Table 2.3. A total of 1000 non-parametric bootstrap-iterations were employed to infer extended majority rule consensus trees. Bootstrap support (BS) values greater than 75 were considered well supported.

Trees were visualised, combined and edited in the programme FigTree v1.4.2 (Rambaut 2012).

2.2.9 Estimation of uncorrected p-distances and species delimitation:

In order to place genetically dissimilar individuals identified as the same species into context (i.e. population or species level divergences), estimates of uncorrected pairwise genetic distances were performed in MEGA v7.0.14 (Kumar et al. 2016). Comparing sequence divergence between known species (usually within the same genus where possible), allowed me to examine and identify cryptic morphospecies that warrant further investigation and description.

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2.3 Results

2.3.1 Species list

A species list including photographic and distributional records of 382 putative South African nudibranch species was compiled using literature, data from the present study and publically available online websites and databases (see Appendix 2.6), bringing the total number of recorded nudibranch species in South Africa to 423. Thirty-five species in the previous list printed in Gosliner 1987a (pp. 16-20), included in the latter total number, have not been seen since their original (mostly poor) descriptions or sighting-records in the 1800s and early 1900s, and therefore may have been misidentified or mistakenly recorded twice (Gosliner 1987a). Nudibranchia recorded in South Africa belong to a total of 37 families (20 of the Infraorder Cladobranchia and 17 of the Infraorder Doridacea) and 101 genera (see Fig. 1.3, Appendix 2.6).

New South African species records (i.e. range extensions into South Africa and potential new species to science) obtained from online databases and from collections in this study that have not previously been recorded in literature, are highlighted in pink and have an asterisk behind their species name in sheet 2 of Appendix 2.6. It should be noted that although each of the photographic observations have been carefully examined, most of them must still be verified by taxonomical experts. Because material has not been collected for all these species, accurate identification incorporating genetic and anatomical data is not yet possible, however photographic evidence is a first step in establishing the records of these species (or close relatives thereof) in South African waters.

2.3.2 Specimen collection, gene amplification and sequencing

A total of 455 fresh specimens were collected for this project during the two year study period (2014-2015) from the 21 collection localities (Fig. 2.2, Appendix 2.7), thought to belong to 143 currently recognized species of Nudibranchia recorded in South Africa. At least six species had not been previously recorded (in South Africa or elsewhere) and are therefore new to science; an additional seven species have not previously been recorded from South Africa, but are recorded in literature (further discussed and listed in § 2.4.1.3).

A total of 346 specimens were successfully amplified for at least one of the three gene regions, with each of the 143 nudibranch species being represented at least once (see Appendix 2.7). Including the sequences of three South African species downloaded from GenBank (Table 2.2), the number of putative species included in the analyses was 146. These belonged to 30 of 37 (~81%) families present in South Africa, and 71 of 101 (~70%) of genera present in South African. These 146 putative species consisted of 162 distinct genetic lineages, which are included in the final species list, and therefore this genetic study represents around ~40% of the species recorded in South Africa to date.

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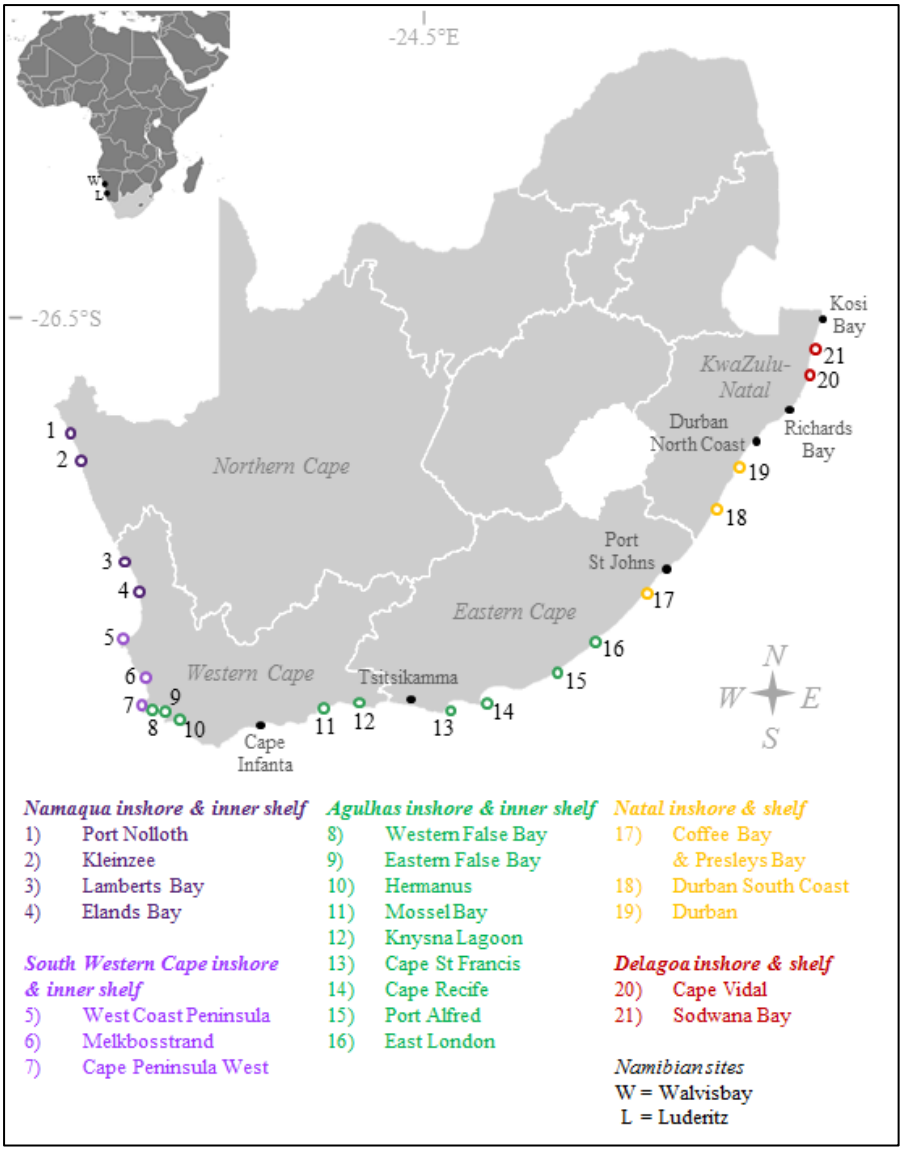

Figure 2.2 Sampling localities. Twenty-one localities were selected, within which several sites were dived or sampled from shore. Colours depict the inshore coastal marine ecozones (according to the NBA Sink et al. 2012) that the sites fall within. Additional samples were obtained from Walvisbay and Luderitz in Namibia and offshore of Cape Agulhas see text for more details.

2.3.3 Phylogenetic analyses

The number of taxa used for each analysis, alignment lengths, the number of conserved and parsimony-informative sites, the best fit evolutionary models and the parameters used for the MrBayes and RAxML analyses are displayed in Table 2.3.

Bayesian Inference (BI) and Maximum Likelihood (ML) trees revealed largely congruent tree topologies for each of the analyses. In Fig. 2.3.1-2.3.3 the BI majority rule consensus trees (MRCT) are presented with the ML bootstrap support values included on congruent nodes (support values displayed as: “PP / BS”) for the following datasets:

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1) Concatenated mitochondrial DNA (COI-16S) datasets (Fig. 2.3.1)

2) Nuclear DNA (H3) dataset (Fig. 2.3.2)

3) Concatenated mitochondrial and nuclear DNA (COI-16S-H3) datasets (Fig. 2.3.3)

Trees of the mithochondrial DNA (mtDNA) and nuclear DNA (nDNA) genes showed a high level of congruence at shallow nodes, with many of the deeper nodes being poorly supported resulting in the rearrangements of some clades. Bayesian inferences tended to inflate support values, whereas ML inferences displayed significant support values less frequently. The mtDNA genes were more variable than the nDNA gene, revealing more recent divergences, with COI being the most variable and 16S the more conserved. The nuclear gene reflected its more gradual rates of accumulating evolutionary change. General support mainly increased with concatenation, with the tree including all three genes revealing greatest support values at both shallow and deeper nodes.

The tree of separate mitochondrial and nuclear data wherein long-branches were detected is displayed in Appendix 2.9. Taxa of *Melibe sp.*, *M. rosea*, *Dendrodoris sp.*, *D. nigra*, *D. caesia* as well as *Vaysierrea felis* and *Pteraeolidia* cf. *semperi* all suffered from Long Branch Attraction (LBA, Felsenstein 1978; see § 2.4.2.2), and were removed from the final analyses.

2.3.3.1 Separate mtDNA and nDNA trees

Trees largely showed congruence among most of the shallow nodes, with deeper nodes being poorly supported and often forming polytomies, which in most cases can be attributed to incomplete taxon sampling and the inability of the markers to resolve deeper nodes. There were some inconsistencies between individual trees, for example the larger grouping of Cladobranchia was recovered in the mtDNA tree with strong support for both methods, although Doridacea was recovered with strong support only for the Bayesian (BI) analysis (Fig. 2.3.2). Further, the mtDNA tree was most similar to the combined mtDNA-nDNA tree, which is to be expected as the mtDNA fragments contributed a larger portion to the combined alignment (Table 2.3).

The tree based only on the nuclear gene Histone H3 did not clearly resolve many of the deeper clades and the only major grouping that was recovered with significant support was the Euctenidiacea for the BI analysis. The majority of the genera and family groupings were however similar to the other trees, with few clear inconsistencies, for example *Mandelia mirocornata*, which grouped incorrectly among the *Halgerda* in the nDNA tree (Fig. 2.3.2).

For these reasons and because it contains the most information (i.e. has the longest alignment length; Table 2.3) only the concatenated three gene tree will be further discussed in more detail.

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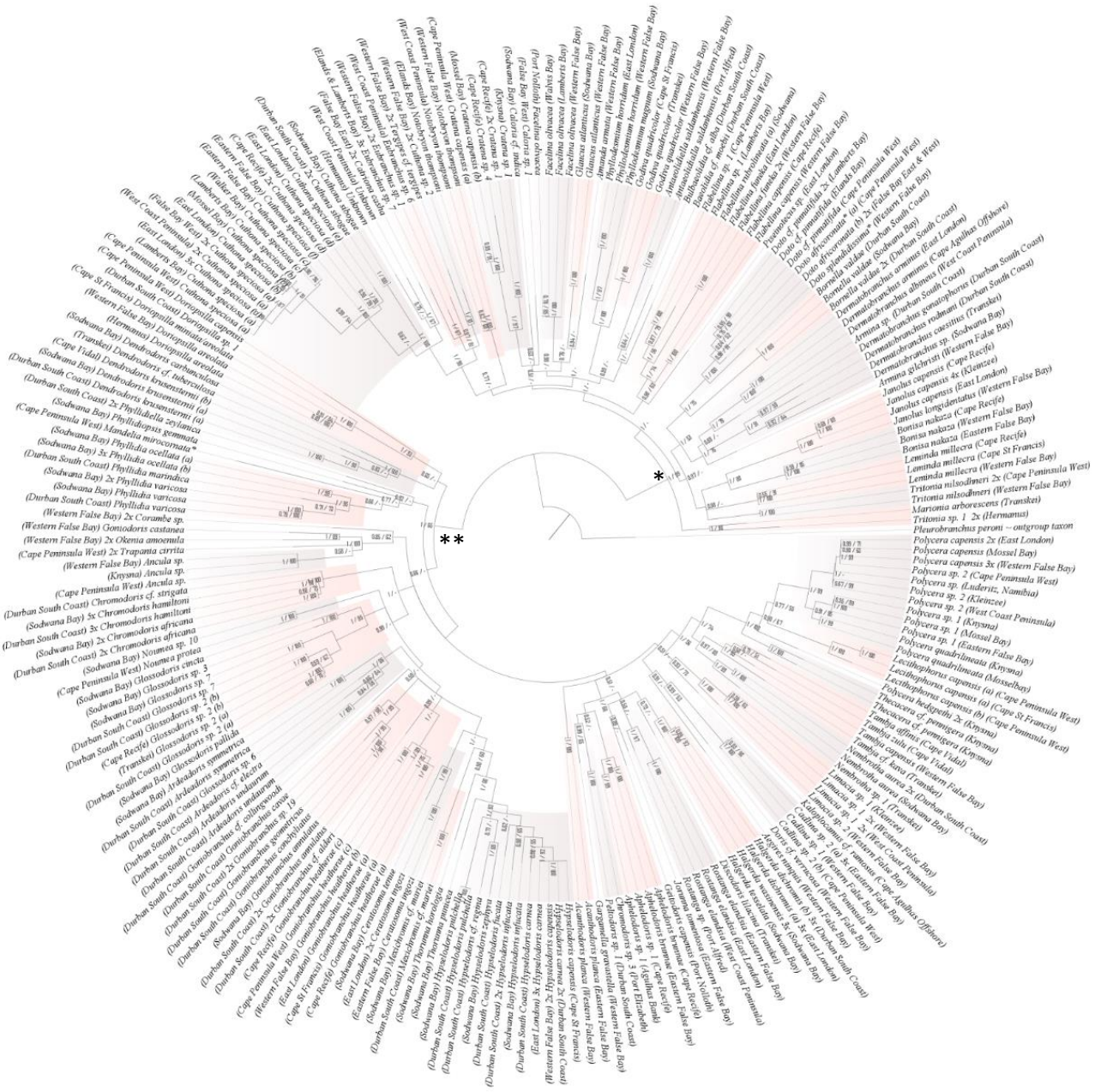

Figure 2.3.1 Bayesian Inference tree of combined mitochondrial COI and 16S gene data, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". Colours highlight the genera to facilitate reading this mtDNA tree. * demarcates the clade of Cladobranchia and ** demarcates Doridacea.

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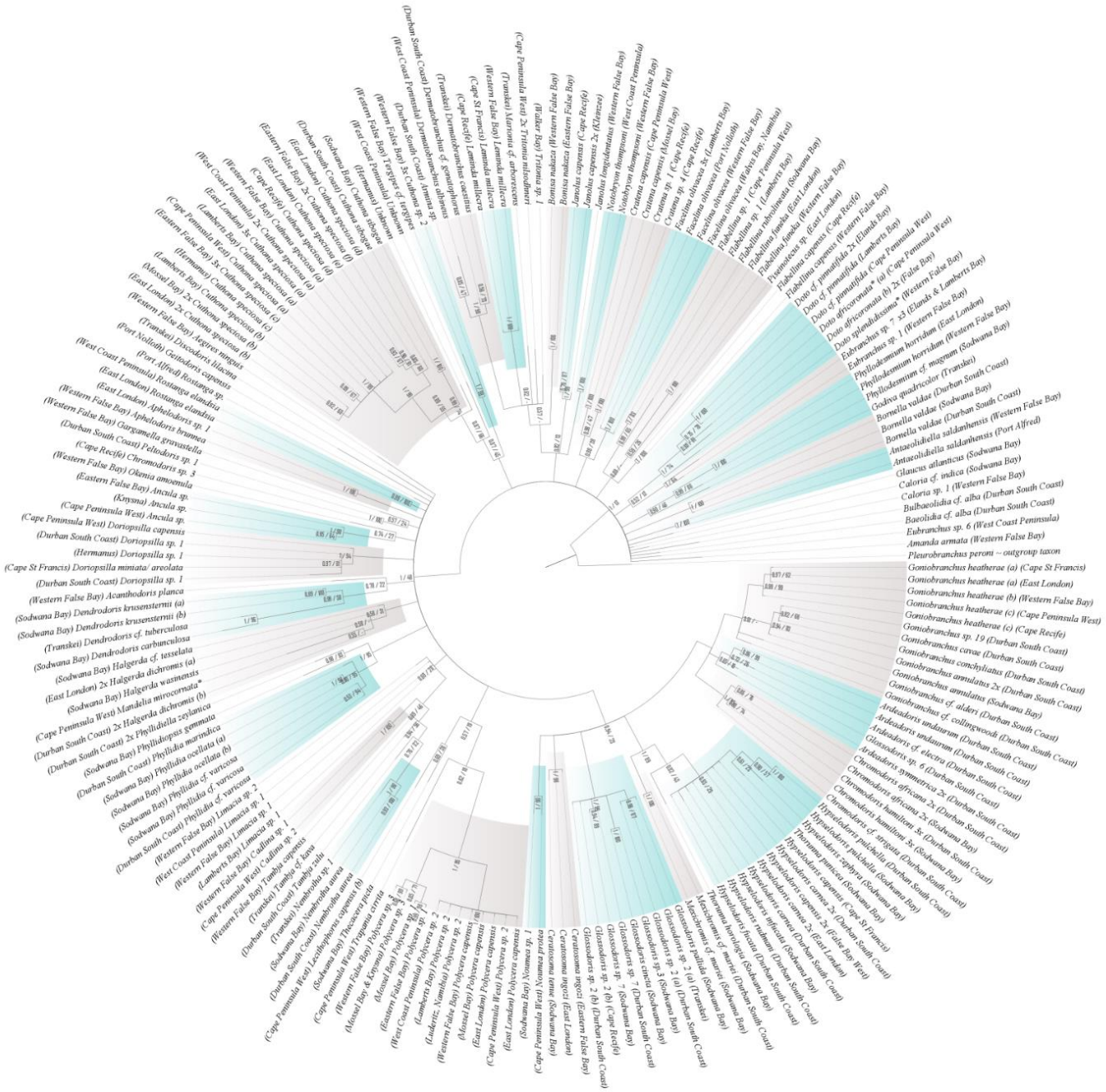

Figure 2.3.2 Bayesian Inference tree of nuclear histone H3 gene data, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". Colours highlight the genera for ease of reading of this nDNA tree.

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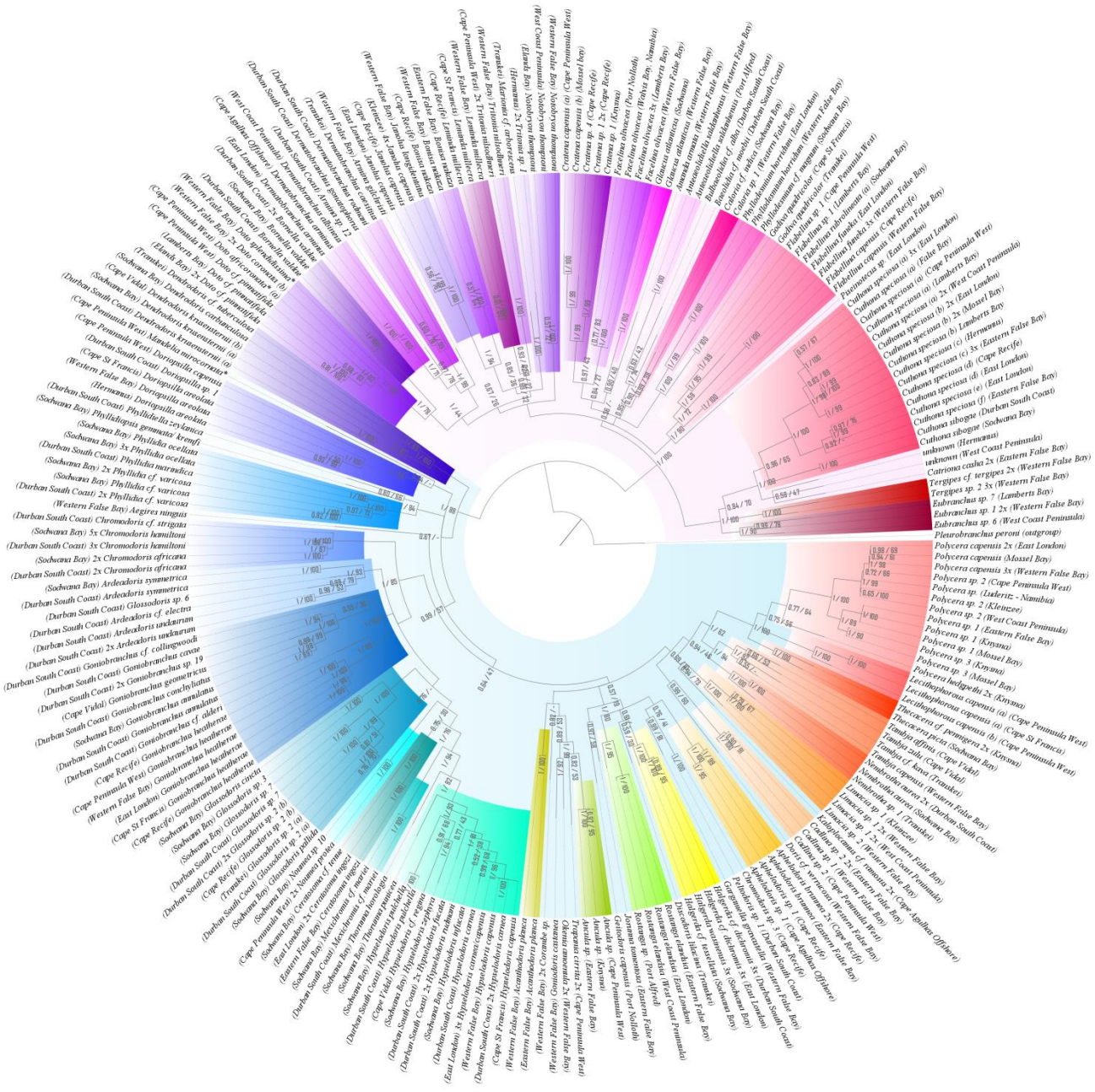

Figure 2.3.3 Bayesian Inference tree of combined mitochondrial (COI and 16S) and nuclear (H3) gene data, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". Faded pink and blue background colours demaracate the large groupings of Cladobranchia and Doridacea, respectively. Darker rainbow colours highlight the genera for ease of reading of this mtDNA/nDNA tree, these colours are consistent with the figures in Appendix 2.8.

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2.3.3.2 Concatenated mtDNA-nDNA tree

Major groupings Cladobranchia and Doridacea are well supported by both BI and ML methods. Shallow nodes are largely congruent and group most genera and families together, although there are a few rearrangements at weakly supported deeper nodes between the tree topologies resulting from RAxML (Appendix 2.11C) and MrBayes (Fig. 2.3.3) inference methods of the concatenated mtDNA and nDNA data.

2.3.3.3 Superfamilial, familial and subfamilial groupings

Reconstruction of phylogenetic relationships revealed an overarching theme: classical taxonomy of the familial groupings within Nudibranchia needs to be reviewed incorporating genetic data, i.e. there is much discordance between classifications based on morphological characteristics and evolutionary relationships as they are found using genetic information. Only two (Flabellinoidea and Fionoidea) of the ten superfamilies included here reveal monophyletic and well-supported clades, with remainder being poly- or paraphyletic, containing taxa from different superfamilial groupings. This can be attributable to the fact that there are many missing taxa in each of the groupings represented, although many reveal strongly supported clades contradicting current taxonomy. Resulting phylogenies of each superfamily are briefly discussed below and refers to figures in Appendix 2.8. In the figures, coloured clades display the different genera and family groupings belonging to each of the superfamilies (those tinted grey do not belong to the displayed superfamilies).

Infraorder: Doridacea

1) Superfamily Polyceroidea (Fig 2.4, Appendix 2.8, p.1)

Polyceroidea examined in this study should include the families Aegiridae, Gymnodorididae and Polyceridae, however these do not form a monophyletic group, as *Aegires ninguis* does not group with the other Polyceroids. The remaining groups form a monophyletic group although support for this group is not high (PP: 0.94 / BS: 46). The three families are briefly discussed below.

Family Gymnodorididae:*Lecithophorous capensis* specimens used in this study were sampled from Cape Peninsula West and Cape St Francis, and reveal the presence of two lineages, (a) and (b), on the western coast of the Cape Peninsula. These members of Gymnodorididae, form a monophyletic clade that groups within subfamily Polycerinae with strong support for both analyses (PP: 1 / BS: 100), rendering the Polycerinae (and family Polyceridae) paraphyletic.

Family Polyceridae: Subfamily Polycerinae as presented here is paraphyletic, as explained above. All the *Polycera* species currently documented in South Africa are represented in this study, and reveal several genetically divergent clades. At least three well-supported monophyletic clades of closely

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related lineages with overlapping distributions are recovered. These range from Lüderitz to East London (*Polycera* sp. 2 and *P. capensis*), and from Cape Peninsula West to Algoa bay (*Polycera* sp. 3) and from Cape Peninsula WEST to Durban (*Polycera* sp. 1). Specimens of *Polycera* sp. 2 found along the west coast additionally form a less divergent clade, sister to *P. capensis*, with strong BS support and weak PP support. One specimen externally classified as *Polycera* sp. 2, clustered within the *P. capensis* lineage with strong support. The position of the Namibian *Polycera* sp. is unresolved within this clade.

Subfamily Nembrothinae is well-supported with *Nembrotha* and *Tambja* each forming monophyletic clades. Very few Nembrothinae species present in South Africa were sampled in this study.

Subfamily Triophinae here shows weak support. *Limacia* is well-supported and reveals two sympatric lineages). The South African *Kaloplocamus* cf. *ramosus*, reveals significant sequence divergence from *Kaloplocamus ramosus* examplars on GenBank (see Appendix 2.10b). Again, very few Triophinae species present in South Africa are included here.

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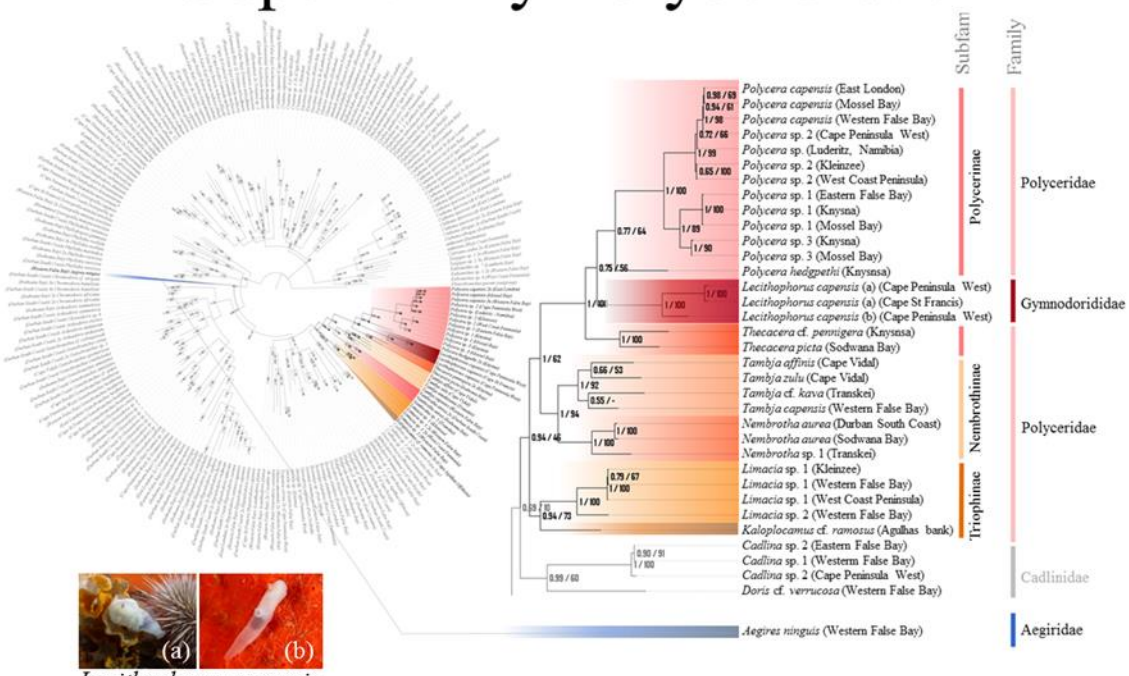
Superfamily Polyceroidae



COI		1	2	3	4	5
Polycera capensis	1	0,004				
Polycera sp. 2	2	0,022	0,005			
Polycera sp. 1	3	0,107	0,106	0,001		
Polycera sp. 3	4	0,094	0,093	0,085	0,007	
Polycera hedgpethi	5	0,132	0,137	0,156	0,146	n/c
16S		**1**	**2**	**3**	**4**	**5**
Polycera sp. 1	1	0,002				
Polycera sp. 3	2	0,021	0,000			
Polycera sp. 2	3	0,041	0,041	0,002		
Polycera capensis	4	0,042	0,042	0,007	0,001	
Polycera hedgpethi	5	0,064	0,062	0,060	0,062	n/c
H3		**1**	**2**	**3**	**4**	
Polycera capensis	1	0,000				
Polycera sp. 2	2	0,000	0,000			
Polycera sp. 1	3	0,053	0,053	0,000		
Polycera sp. 3	4	0,053	0,053	0,013	0,000	

COI		1	2
Limacia sp. 1	1	0,002	
Limacia sp. 2	2	0,119	n/c
16S		**1**	**2**
Limacia sp. 1	1	0,002	
Limacia sp. 2	2	0,036	n/c
H3		**1**	**2**
Limacia sp. 1	1	0,000	
Limacia sp. 2	2	0,010	n/c
COI		**1**	**2**
Lecithophorus capensis (a)	1	0,000	
Lecithophorus capensis (b)	2	0,076	n/c
16S		**1**	**2**
Lecithophorus capensis (a)	1	0,013	
Lecithophorus capensis (b)	2	0,092	n/c

Figure 2.4 Phylogenetic relationships of the South African representatives of the superfamily Polyceroidae examined in the present study. Divergent lineages discussed in the text are dipicted and labelled accordingly in the figures above. Matrices of uncorrected p-distances between lineages (black) and within lineages (green) for each gene region, obtained in MEGA, are displayed. (photo credits: *L. capensis* (b), *P. capensis* and *P.* sp. 2: Guido Zsilavecz; *P.* sp. (Lüderitz): Kolette Grobler *P.*sp. 1: Louw Claassens; *Limacia* sp. 2: Jelly Gelletich).

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2) Superfamily Doridoidea (Fig 2.5; Appendix 2.8, p. 2)

Family groupings within this superfamily fail to form a larger monophyletic grouping. Deeper nodes are unresolved, with families Cadlinidae and Dorididae grouping with Polyceroidae and members of the family Discodorididae clustering with Onchidoridoidea and Polyceroidea, rather than with the Chromodorididae. The families belonging to this superfamily are briefly discussed below.

The South African members of the family Chromodorididae represented here form a well-supported monophyletic clade (PP: 1 / BS: 85), apart from one individual labelled '*Chromodoris* sp. 3' which clusters among discodorids. This individual is clearly misclassified given its close genetic relatedness to *Peltodoris* sp. 1, and will be further discussed below. Deeper nodes within Chromodorididae, are unresolved with weak support and differing arrangements of many genera in both the ML and BI trees. To the contrary, shallow nodes of separate genera form identical clades in both analyses with similar support values.

The members of subfamily Miamirinae are well-supported in both trees. The genus *Thorunna* is however paraphyletic within this subfamily, as *Thorunna* cf. *punicea* appears basal to *Hypselodoris* with strong support (PP: 1 / BS: 92), excluding *Thorunna horologia* from this clade association, suggesting with strong support that this individual is misidentified.

Specimens classified as *Hypselodoris carnea* based on external appearance from East London and the Durban South Coast, showed no sequence divergence with *H. capensis* from False Bay and Cape St. Francis. One specimen, however, from the Durban South Coast (Fig. 2.9; found in intertidal rockpools) did reveal significant divergence.

Glossodoris sp. 2 is revealed to be polyphyletic, with one clade includes *Glossodoris pallida* while another clade is sister to this grouping. These lineages appear to have a partially overlapping, i.e. parapatric distribution.

Goniobranchus heatherae seems to consist of at least three cryptic, para-/sympatrically distributed genetic lineages, depicted as (a), (b) and (c), with significant support on both trees (see Fig. 2.5).

Ardeadoris is paraphyletic due to the presence of *Glossodoris* sp. 6. Given this taxon's significant relationship to other *Ardeadoris* species, I suggest this should be classified as an *Ardeadoris*, until further descriptions are performed. In this case *Adreadoris* will form a well-supported monophyletic grouping.

Cadlina species sampled here form a strongly supported clade. The placement of this clade, which is weakly supported, suggests that this group does not cluster with other members of Doridoidea, but appears instead to group with the Polyceroidea. *Cadlina* sp. 1 and sp. 2 from False Bay (identified based on external appearance) seem to be the same species, with no detectable sequence divergence between them. The *Cadlina* sp. 2 specimen from the Cape Peninsula West however, is genetically divergent from both of these individuals (see Fig. 2.9).

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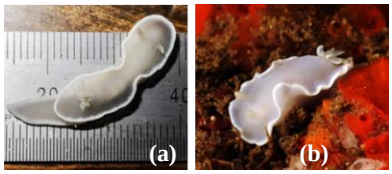
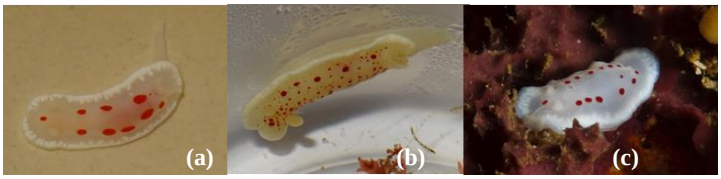
Doris cf. *verrucosa* of the family Dorididae forms a sister relationship to Cadlinidae specimens, with strong support only recovered in the BI tree. South African *Aphelodoris* species appear to not belong to this family grouping.

South African representatives of Discodorididae sampled in this study are paraphyletic, and only together with the genus *Aphelodoris* (of family: Dorididae) do they form a well-supported clade. The relationships among genera within this grouping are largely unresolved.
Chromodoris sp. 3, forms a strong sister relationship to *Peltodoris* sp. 1 (PP: 1 / ML 100) and may even belong to the same species (uncorrected p-distance COI: 3.34%; 16S: 1.04%; H3: 0%). Although both species are undescribed, *Peltodoris* sp. 1, was classified as such by taxonomical experts (Gosliner et al. 2008, 2015). It is unclear how *Chromodoris* sp. 3 was classified, though it is labelled as such on the Eastern Cape Scuba Diving website (www.easterncapescubadiving.co.za). Given the strongly supported position of *Chromodoris* sp. 3 sister to *Peltodoris* sp. 1, I suggest the *Chromodoris* sp. 3 becomes *Peltodoris* sp. 2 until further descriptions of these species are performed. *Peltodoris* here group sister to *Gargamella gravastella* with strong support (PP: 0.99 / ML 81).
Very little sequence divergence was observed between specimens of *Halgerda wasinensis* (all collected from Sodwana Bay) and *Halgerda* cf. *dichromis* specimens (from Durban South Coast and East London) (uncorrected p-distance COI: 2.48%; 16S: 0.90%; H3: 0.35%). Further, specimens of *H.* cf. *dichromis* from East London and from the Durban South Coast show some level of population genetic structuring, and are hence labelled (a) and (b), respectively (uncorrected p-distance COI: 1.84%; 16S: 0.77%; H3: 0.44%).
Lastly, a specimen of *Rostanga*, collected from Port Alfred is here clearly shown to be genetically distinct at the species level from *Rostanga elandsia* from the south and southwest coasts (uncorrected p-distance COI: 14.6%; 16S: 4.98%; H3: 3.61%).



Glossodoris sp. 2



Goniobranchus heatherae

A)

Ardeadoris sp. (previously: *Glossodoris* sp. 6)

Hypselodoris cf. *bullocki* (previously: *Thronuna punicea*)

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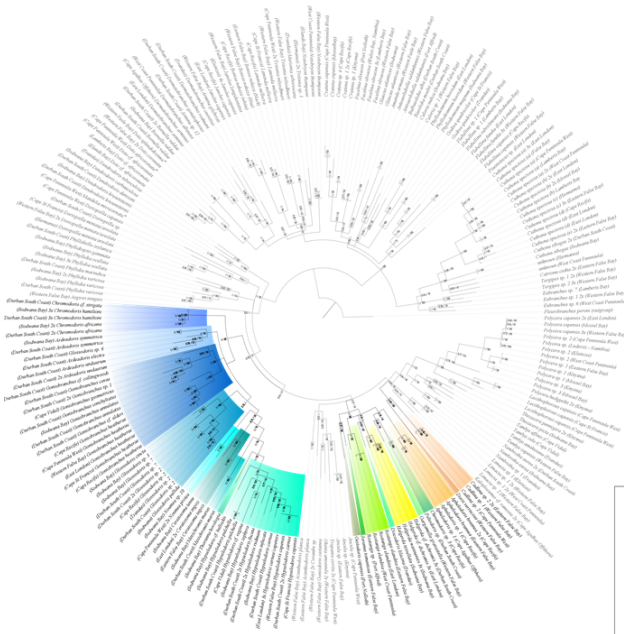
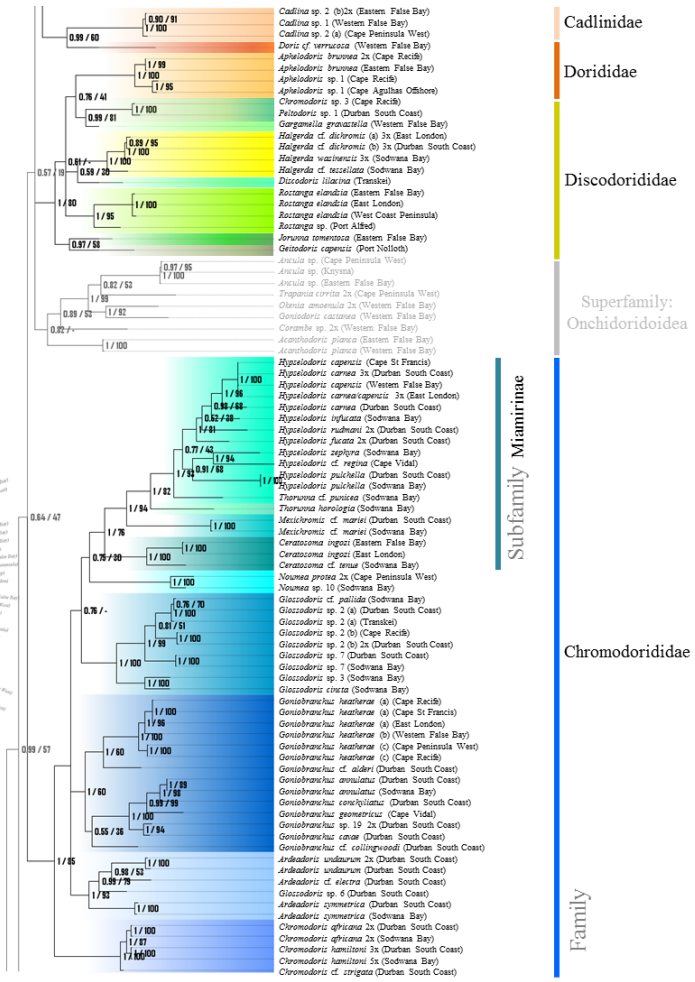
Superfamily Doridoidea





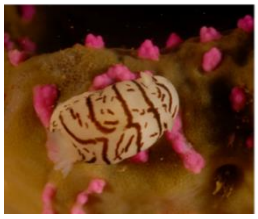
Rostanga sp.

Rostanga elandsia

B)

Halgerda cf. *dichromis*

Halgerda wasinensis



Peltodoris sp. 1

Peltodoris sp. 2
(previously: *Chromodoris* sp. 3)

Figure 2.5 Phylogenetic relationships of the South African representatives of the superfamily Doridoidea examined in the present study. Examples of individuals with divergent lineages recovered within morphospecies are displayed as well as the misclassified species in A) Chromodorididae (p.37) and in B) Discodorididae. For uncorrected p-distances with and between lineages see text and Appendix 2.10a. (photo credits *Glossodoris* sp. 2 (b), *Ardeadoris* sp., *Halgerda* cf. *dichromis* (b) and *Peltodoris* sp. 1: Valda Fraser; *Goniobranchus heatherae* (c) and *Rostanga elandsia*: Guido Zsilavecz; *H.* cf. *dichromis* (a): Evania Snyman; *Halgerda wasinensis*: Allan Connell).

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3) Superfamily Onchidoridoidea (Appendix 2.8, p. 3)

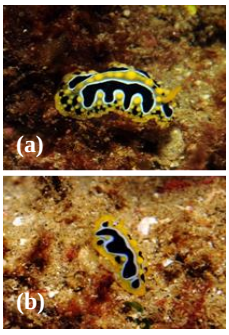
Very few taxa of this family are included in this study resulting in poor support values at deeper nodes. South African members of Goniodorididae presented here formed a well-supported clade, although the position of *Trapania cirrita* within this clade is unresolved. The positions of *Acanthodoris planca* (Onchidorididae) and *Corambe* sp. (Corambidae) are also unresolved. It is evident that too few species of these families are represented to draw any accurate conclusions about the evolutionary relationships among them.

4) Superfamily Phyllidioidea (Appendix 2.8, p. 4)

This superfamily does not form a monophyletic clade on the ML nor the BI trees. Constituent families presented here are briefly expanded on below.

The family Phyllididae forms a monophyletic clade, with some genetic diversity apparent within *Phyllidia varicosa* and specifically in *Phyllidia ocellata*, of which the latter has subsequently been depicted as *Phyllidia ocellata* (a) and (b) (Fig. 2.6; uncorrected p-distance COI: 7.18, 16S: 2.78, H3: 0%).

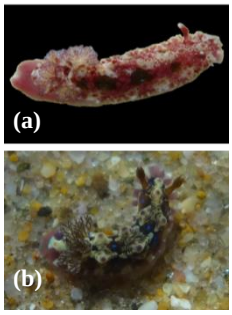
Doriopsilla and *Dendrodoris* fail to form the family grouping Dendrodorididae in the MrBayes tree. This clade is recovered in the RAxML tree, although unresolved (Appendix 2.11). As mentioned above, some of the *Dendrodoris* taxa resulted in the formation of long branches on the mtDNA trees, and were not included in the concatenated dataset due to an amino acid insertion at COI pos. 418-420. Nuclear genes however more accurately reflected the evolutionary relationships among *Dendrodoris* taxa, and are therefore displayed on the bottom half of p. 4 of Appendix 2.8.
There appear to be two overlapping divergent lineages of *Dendrodoris krusensterni* north of Durban, depicted on the tree as (a) and (b) (Fig. 2.6; uncorrected p-distances: COI: 14.90%; 16S: 6.67%). *Doriopsilla areolata* shows some geographical genetic variation between the individual from Cape St Francis and those from False Bay and Hermanus. Molecular data shows that *Doriopsilla* sp. 1 from KwaZulu-Natal is divergent from *D. areolata* (Fig. 2.6; uncorrected p-distances: COI: 8.60%; 16S: 2.94%), confirming the divergent lineages from the Agulhas and Natal Ecoregions (Gosliner et al. 2015). The placement of the unique endemic *Mandelia mirocornata* within this grouping is unresolved.



Phyllidia ocellata

Doriopsilla areolata *Doriopsilla* sp. 1

Figure 2.6 Divergent lineages within Phyllidioidea. Distances between lineages are presented in the text. (photo credits: *Phyllidia ocellata* (a-b), *Dendrodoris krusensterni* (a): Allan Connell; *Doriopsilla areolata*: Guido Zsilavecz; *Doriopsilla* sp. 1: Dai Herbert).



Dendrodoris krusensterni

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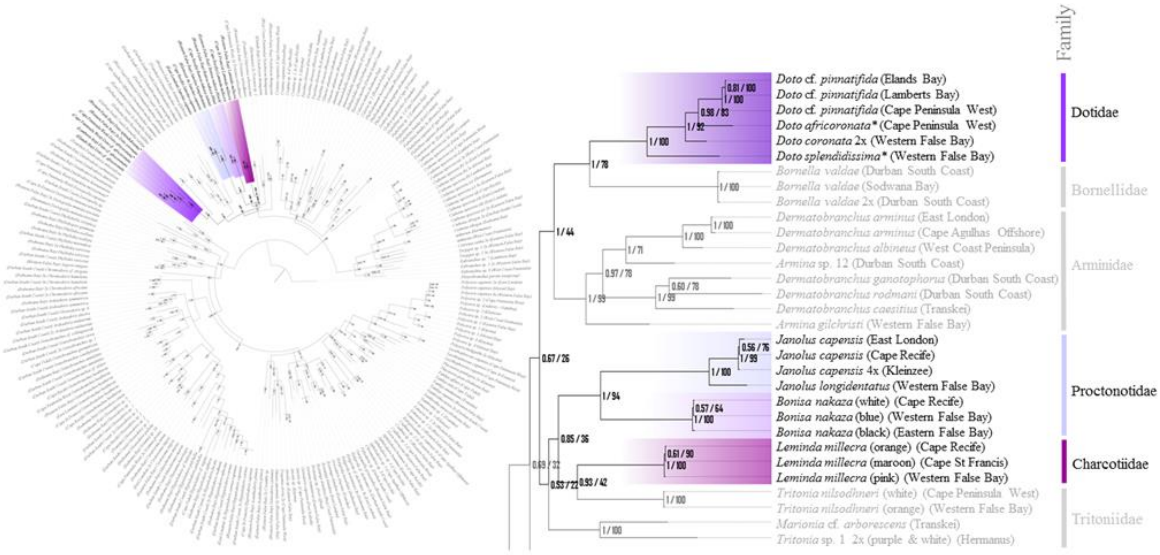
Infraorder Cladobranchia

5) Unassigned Cladobranchia (Fig. 2.7; Appendix 2.8, p. 5)

Family Dotidae forms a monophyletic grouping. Interestingly there is some clear genetic divergence within *Doto*, with two distinct lineages recovered here (p-distances: COI: 10.1%, 16S: 0.52%, H3: 6.00%). One Blastn results revealed a close relation of two of the specimens (here depicted as *Doto coronata* collected from either side of False Bay; Fig. 2.7) to European specimens of *D. coronata* (see § 2.3.9).

Another lineage previously identified as *D. pinnatifida* in Gosliner (1987a) appears to be closely related, but distinct from *D. africoronata* (p-distances: COI: 9.18%, 16S: 0.59%, H3: 4.12%). Additionally Blastn results reveal this is not a close relative of European *D. pinnatifida* specimens (see § 2.3.9), as such it is here depicted as *Doto* cf. *pinnatifida* (Fig. 2.7).

Unassigned Cladobranchia



COI		1	2	3
Doto africoronata	1	*n/c*		
Doto coronata	2	0,101	*0,002*	
Doto cf. *pinnatifida*	3	0,092	0,096	*0,000*

16S		1	2	3
Doto coronata	1	*0,000*		
Doto africoronata	2	0,005	*n/c*	
Doto cf. *pinnatifida*	3	0,006	0,006	*0,001*

H3		1	2	3
Doto africoronata	1	*n/c*		
Doto coronata	2	0,06	*0,00*	
Doto cf. *pinnatifida*	3	0,04	0,04	*0,00*

Figure 2.7 Phylogenetic relationships of the South African representatives of the Unassigned Cladobranchia. Examples of individuals with divergent lineages recovered within *Dotidae* in the Western Cape; (a) *Doto* cf. *pinnatifida*; (b) *Doto africoronata* (taken from Shipman & Gosliner, 2015); and (c) *Doto coronata*.Uncorrected p-distances showing the variation within (green) and between (black) these lineages for each gene region, calculated in MEGA are displayed above the photographs.

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Family Proctonotidae forms a well-supported monophyletic clade, containing two monophyletic groupings of the genera *Janolus* and *Bonisa.*

Leminda millecra is the only member of family Charcotiidae (synonym: Lemindidae, Griffiths 1985) present in South Africa, showing little sequence divergence between the three specimens collected from western False Bay to Cape Recife. Interesting to note is that this species is found mainly on deep reefs (below 20m) in the Western Cape, however is also found in fairly shallow waters in the Eastern Cape (~10m).

6) Superfamily Tritonioidea (Appendix 2.8, p. 6)

This superfamily as represented here is polyphyletic; in addition members of the genus *Melibe* formed long branches in mtDNA datasets and were therefore not included in the combined mtDNA and nDNA trees. Families are briefly discussed below.

Bornella valdae does not group with other tritonoidids in this study, but instead forms a well-supported sister relationship with Dotidae. Bornellidae previously was found not to group among other tritonoidids, however the sister relationship to Dotidae has not been recovered in other molecular studies that have included both genera (Pola et al. 2012, Pola & Gosliner 2010, Pola & Gosliner 2015, Shipman & Gosliner 2015) and is therefore likely an artefact of missing data.

Tritonia nilsodhneri is not well-supported and doesn't group with other Tritoniids on either ML or BI trees. *Tritonia* sp. 1 and *Marionia* cf. *arborescens* form a well-supported clade, indicating *Tritonia* sp. 1 belongs instead to *Marionia*, which was also concluded in Pola & Gosliner (2010), and so this species should be reclassified as such. More species would need to be added to examine and understand the relationships among these taxa better.

Notobryon thompsoni was the only member of the Scyllaeidae included in this study, and its position is unresolved.

Long branch lengths in the mtDNA trees including all taxa (see Appendix 2.6), were the result of five amino acid deletions in COI gene regions of *Melibe* (further expanded on in the discussion of this chapter). Relationships of the mtDNA tree which included *Melibe* revealed a cryptic lineage from Cape Point, here presented as *Melibe rosea* (b) on the bottom half of p.6 in Appendix 2.8 (uncorrected p-distances: COI: 8.40%; 16S: 3.62%). There is a possibility this could be *M. liltvedi* (Gosliner & Smith, 2003), and requires further morphological examination.

7) Superfamily Arminoidea (Appendix 2.8, p. 7)

Family Arminidae forms a well-supported clade on both trees, however the genera within Arminidae do not form monophyletic groupings. *Armina* sp. 12 clusters within a clade containing species of the

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genus *Dermatobranchus*. Similar results were recovered in Pola and Gosliner (2010) using different species, confirming this clade needs further examination and taxonomical revision.

8) Superfamily Aeolidioidea (Appendix 2.8, p. 8)

This superfamily is polyphyletic, with Piseinotecidae (superfamily Aeolidoidea) and Flabellinidae (superfamily Flabellinoidea) forming a well-supported clade, sister to the remaining Aeolidoidea sampled here. Further, the clade containing the remaining Aeolidoidea taxa is well-supported in the BI analysis only, where it forms a polytomy.

Members of family Aeolidiidae form a well-supported clade for BI analysis (PP: 1 / BS: 74).

Representatives of the family Facelinidae included in this study are polyphyletic as illustrated in the figure: the families Aeolidiidae and Glaucidae group together in the same polytomy and their positions are unresolved. Relationships among the Aeolidiidae resulted in a better resolved phylogeny, more clearly displaying the evolutionary relationships among genera and families in Carmona et al. (2013), which included many more taxa. Their study also found Facelinidae as well as Piseinotecidae and Flabellinidae to be para-/polyphyletic (Carmona et al. 2013).
Two lineages of *Cratena capensis* were recovered: one from Cape Peninsula West and another from Mossel Bay (uncorrected p-distance COI: 7.01%; 16S: 3.41%). These are labelled (a) and (b) on p.8 of Appendix 2.8.
Interesting to note is that the three colour forms of *Facelina olivacea* (olive, blue, white, brown and red) showed little or no sequence divergence. The blue, white and red and brown forms were only found on the west coast from Lamberts Bay to Walvis Bay (Namibia) whereas the olive form was found from Port Elizabeth to Lamberts Bay.

9) Superfamily Flabellinoidea (Appendix 2.8, p. 9)

Currently only Flabellinidae and the Antarctic family Notaeolidiidae belong to this superfamily. The only genus of Flabellinidae present in South Africa is *Flabellina*.

Piseinotecus (Family: Aeolidiidae) clusters with strong support sister to *Flabellina*. Further, the monophyly of *Flabellina* is only well-supported in the BI tree. Specimens *Flabellina rubrolineata* from Sodwana Bay belong to different COI lineages (uncorrected p-distance COI: 16.78%) and were subsequently marked as (a) and (b). Unfortunately, 16S and H3 gene region amplification for *F. rubrolineata* (b) were unsuccessful, and therefore was only represented in the mtDNA tree (bottom of p. 9 in Appendix 2.8).

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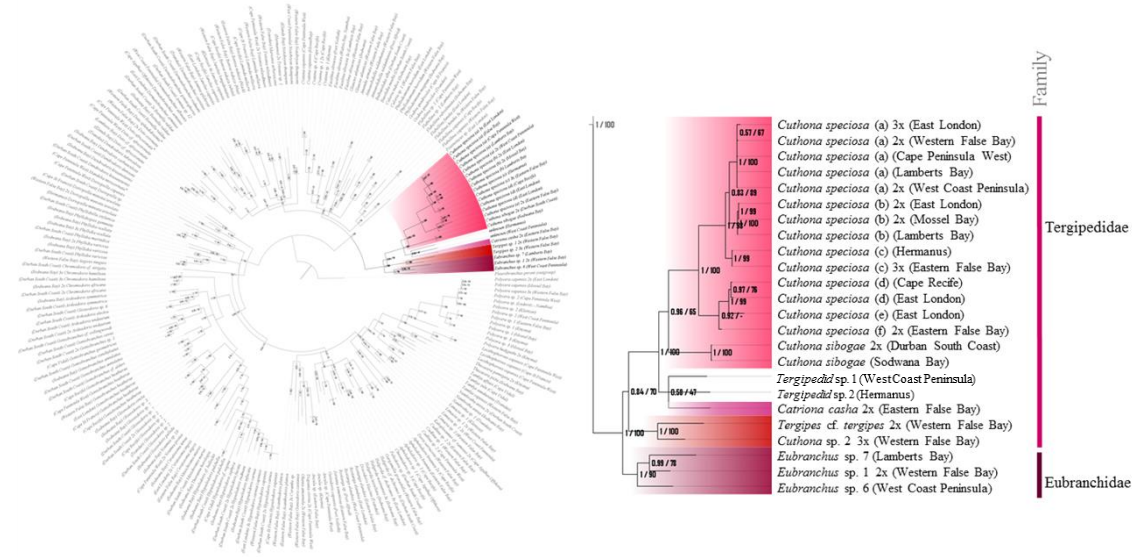
10) Superfamily Fionoidea (Fig. 2.7; Appendix 2.8, p. 9)

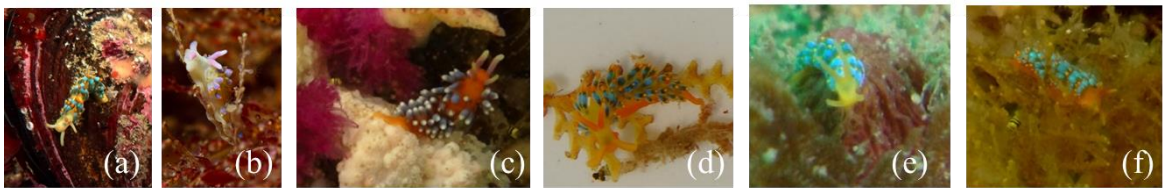
Taxa included in this study belonging to this superfamily form a well-supported monophyletic clade for both analyses.

Family Eubranchidae represented by three species here form a well-supported monophyletic clade.

Tergipedidae also forms a monophyletic clade on both the BI and ML trees, however it is not well-supported in either analysis. A strongly supported clade is formed including *Cuthona* specimens, *Catriona casha* and the tergepedid spp., although most relationships among them are unresolved. *Cuthona speciosa* appears to be a large complex of two larger clades and six cryptic lineages, labelled (a) to (f) on p. 9 of Appendix 2.8 (uncorrected p-distance: COI: 5.53-17.18%; 16S: 2.52-12.33%; H3: 0.62-5.33%). Distributions range from Lamberts Bay on the west coast to East London on the southeast coast and most of these lineages do not appear to be geographically restricted, and have overlapping distributions (see § 2.3.9).
Tergipes cf. *tergipes* and *Cuthona* sp. 2 formed a well-supported clade, indicating *Cuthona* sp. 2 most likely belongs to the genus *Tergipes*. Blastn results revealed *Tergipes* cf. *tergipes* from South Africa to be divergent from the amphi-Atlantic species *T. tergipes* (uncorrected p-distance: COI: 14.66%; 16S: 11.21%; H3: 10.48%).

Superfamily Fionoidea





Cuthona speciosa

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Tergipes cf. *tergipes*

Tergipes sp. 2
(previously: *Cuthona* sp. 2)

Eubranchus sp. 1

COI		1	2	3	4	5	6
Cuthona speciosa (a)	1	*0,011*					
Cuthona speciosa (b)	2	0,067	*0,005*				
Cuthona speciosa (c)	3	0,057	0,055	*0,003*			
Cuthona speciosa (e)	4	0,154	0,157	0,148	*n/c*		
Cuthona speciosa (d)	5	0,168	0,164	0,158	0,067	*0,003*	
Cuthona speciosa (f)	6	0,172	0,164	0,157	0,064	0,012	*0,007*

16S		1	2	3	4	5	6
Cuthona speciosa (a)	1	*0,003*					
Cuthona speciosa (b)	2	0,017	*0,002*				
Cuthona speciosa (c)	3	0,028	0,033	*0,002*			
Cuthona speciosa (e)	4	0,090	0,092	0,092	*n/c*		
Cuthona speciosa (d)	5	0,088	0,092	0,088	0,037	*0,011*	
Cuthona speciosa (f)	6	0,026	0,031	0,002	0,090	0,086	*0,000*

H3		1	2	3	4	5	6
Cuthona speciosa (a)	1	*0,006*					
Cuthona speciosa (f)	2	0,044	*0,007*				
Cuthona speciosa (c)	3	0,006	0,046	*0,000*			
Cuthona speciosa (b)	4	0,007	0,047	0,007	*0,002*		
Cuthona speciosa (e)	5	0,051	0,010	0,053	0,053	*n/c*	
Cuthona speciosa (d)	6	0,041	0,010	0,043	0,043	0,015	*0,016*

Eubranchus sp. 6
(top right: egg spiral)

Eubranchus sp. 7
(right: juvenile;
above: adult)

Unknown Tergipedid sp. 1

Unknown Tergipedid sp. 2

Figure 2.8 (pp. 43-44) Phylogenetic relationships of the South African representatives of the superfamily Fionoidea examined in the present study. Examples of individuals with divergent lineages recovered within *Cuthona speciosa* (p. 43) with their uncorrected p-distance matrices within (green) and between lineages (black) calculated in MEGA (p. 44) are presented. Species of *Tergipes*, *Eubranchus* and the unkown tergipedid sp. 1 and sp. 2 are also displayed. (photo credits: *C. speciosa* (b); and both *Tergipes* species: Guido Zsilavecz; *C. speciosa* (e): Evania Snyman).

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2.3.3 Estimation of uncorrected p-distances

For 73 of 146 species collected in this study, I collected multiple individuals from several localities (Table 2.10) and where possible sequenced individuals from different locations to work out the uncorrected pairwise distances Appendix 2.10a. Distances between recognized species vary among genera and also among gene regions. Notably, 16 currently recognized morphospecies examined were revealed to contain at least two distinct lineages within South Africa. Genetic distances of within these morphospecies ranged from 4.56% (*Goniobranchus heatherae*) to 17.18% (*Cuthona speciosa*) for the COI gene, from 0.52% (*Doto africoronata*) to 12.33% (*Cuthona speciosa*) for the 16S gene, and ranged from 0% (*Cratena capensis, Doriopsilla areolata, Goniobranchus heatherae, Hypselodoris carnea, Melibe rosea,* and *Phyllidia ocellata*) to 5.50% (*Doto africoronata*) for the H3 nuclear gene. When comparing these distances to those currently recognized sister species in the respective genus (or family), it becomes clear that these taxa are most probably currently unrecognized new species, that warrant further investigation and description.

On the basis of my results that 16 of 73 recognised species contain multiple lineages displaying inter-specific levels of divergence, one can estimate that around >20% of nudibranch species could form part of larger cryptic species complexes within South Africa that are currently still unrecognized.

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2.4 Discussion

This chapter aimed to examine the phylogenetic relationships of 146 nudibranch species collected in South Africa. As was made clear from the superfamily groupings in the results section, more complete taxon sampling for each these families is necessary to gain greater insight into evolutionary relationships among these complex clades. In addition, a major finding is that the South African nudibranch fauna is vastly understudied and likely includes numerous unidentified species.

2.4.1 Unrecognized biodiversity and the importance of genetic data

2.4.1.1 Misclassified South African nudibranch species

There were two types of taxonomic inconsistencies that were recovered by this study:
Firstly, some taxa grouped into clades that were not supported by their current classification and taxonomy. For example, of the sampled taxa, five were clearly misclassified and in the wrong genera with strong support in all trees. Reclassification of these taxa (presented in Table 2.4) is required; suggested reclassifications according to genetic data are displayed in the second column of Table 2.4. Some species, such as *Thorunna punicea* appears to be present in South Africa (see: http://www.ispotnature.org/node/599435), but the specimen identified as *T. punicea* in this study showed the sequences not matching those of the individual on GenBank (see chapter 3), and it groups strongly with other *Hypselodoris* taxa in this study, rather than with *Thorunna*.

Current classification	**Revised classification**
Glossodoris sp. 6	*Ardeadoris* sp.
Chromodoris sp. 3	*Peltodoris* sp. 2
Cuthona sp. 2	*Tegipes* sp. 2
Tritonia sp. 1	*Marionia* sp.
Thorunna cf. *punicea*	*Hypselodoris* sp.

Table 2.4 Suggested reclassification of taxa, according to phylogenetic inference of two mitochondrial and one nuclear marker. These taxa require further description to corroborate findings of these genetically unique lineages.

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A second finding is that taxa that are currently classified as two species based on morphological differences actually belong to one species. For example, individuals currently classified as *Hypselodoris carnea* and *H. capensis* clearly belong to one and the same species (Fig. 2.9; Appendix 2.8, p. 2) based on identical sequences. However, one specimen, collected intertidally (the others were collected at 35 metres depth), showed to be unrelated to the other *H. carnea/capensis* and could possibly represent the true *H. carnea*, which requires further studies to unravel their identification and relationships. Further, specimens of *Cadlina* sp. 1 and sp. 2, were thought to be distinguished by the "lack of brown pigment across the mid-dorsal region" in *Cadlina* sp. 2 (Gosliner, 1987a). The specimens collected from eastern False Bay in this study lacked the brown pigment on the mid-dorsal region, yet formed a strongly supported grouping with *Cadlina* sp. 1, which was sister to *Cadlina* sp. 2 (from Cape Peninsula West) (Fig. 2.9; Appendix 2.8, p. 2). Laboratory analyses were repeated to ensure this finding was correct. It is challenging to distinguish these species based on external appearances alone.

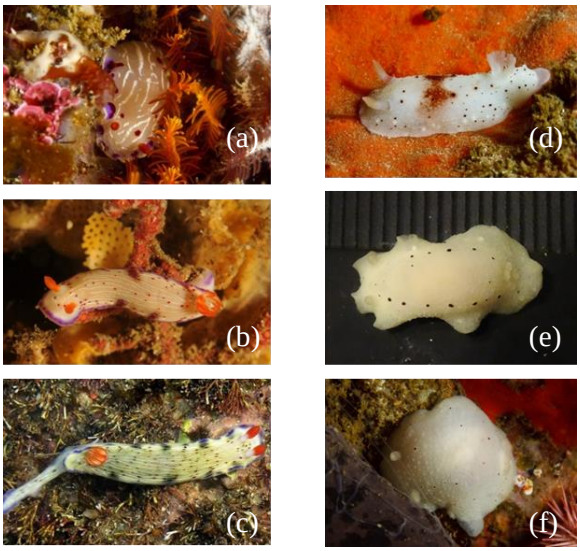

Figure 2.9 Species currently classified as different species; that were not found to be genetically divergent. (a) *Hypselodoris capensis* from False Bay and (b) *H. carnea* from Durban; (c) is the true *H. carnea* also from Durban which is divergent from the two above. (d) *Cadlina* sp. 1 from False Bay and (e) *C.* sp. 2 from False Bay; (f) is the true *Cadlina* sp. 2 from the Cape Peninsula west, which is divergent from (a) and (e). (photo credits: (a), (d) and (f): Guido Zsilavecz; (b): Valda Fraser; (c) Dai Herbert).

2.4.1.2 Patterns of cryptic speciation of nudibranchs in South African waters

There were numerous instances of cryptic lineages distributed throughout the tree; reconstruction of phylogenetic relationships revealed two patterns: 1) 16 groups of individuals currently assigned to one morphospecies in South Africa were found to hold more than one distinct genetic lineage within them (for example, six divergent lineages were recovered within *Cuthona speciosa*), and 2) many taxa supposedly geographically widespread were revealed to be mostly southern (or South-) African endemics, cryptic to their global relatives (for example, an individual identified as *Baeolidia moebi* is divergent from Indo-West Pacific species of *B. moebii*) and these will be further expanded on in the next chapter.

Genetic distances can differ within a family as a result of different genera having varying evolutionary rates (Hebert et al. 2003). In this study, we found that even within a genus (*Dendrodoris*) evolutionary rates in the mtDNA can differ dramatically, resulting in different branch lengths between sister-taxa (Appendix 2.9a). Minimum sequence divergence between nudibranch sister-taxa mainly differ

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between genera, and for this reason estimated uncorrected p-distances were compared to distances of currently described sister-taxa within the same genus (where possible, otherwise another genus within the same family was used). This provides an estimate for whether divergence is more likely representative of population or species-level differences. For example, cryptic lineages within *Anteaeolidiella indica* were brought to light in Carmona et al. (2013), and subsequently described in Carmona et al. (2014); reclassified sister-species had a distance of ~8.4% between *A. saldanhenesis* and *A. lurana*. In contrast, Palomar et al. (2014) showed that for COI in *Polycera*, intra-specific genetic distances measured between 0 and 4%. In Shipman and Gosliner (2015) close sister species of *Doto* showed a distance of 5.7% (see Table in Appendix 2.10a for more examples). Distances for many divergent lineages recovered within South African morphospecies in this study exceeded such distances (see Appendix 2.10ab), supporting the hypothesis of cryptic speciation. These therefore call for further morphological description to corroborate the genetic information in order to re-classify these species.

Marine Ecozones	**a) Species for which multiple specimens were collected**	**b) Species that form part of cryptic lineage complexes**	**c) Species with multiple lineages present within the ecozone**
Namaqua inshore	9	4	**1** (*Cuthona speciosa* (a+b))
Southwestern Cape inshore	17	11	**3** (*Melibe rosea* (a+b); *Lecithophorus capensis* (a+b); *Doto africoronata*, *D.* cf. *pinnatifida* + *D. coronata*)
Agulhas inshore / shelf	45	13	**4** (*C. speciosa* (a,b,c,d+e); *Polycera capensis*, *P.* sp. 1+3; *Goniobranchus heatherae* (a,b+c); *Limacia* sp. 1+2)
Natal inshore / shelf	27	7	**3** (*Dendrodoris* sp. + *D. caesia*; *Glossodoris* sp. 2 (a+b); *Hypselodoris carnea* + *H. capensis*)
Delagoa inshore	19	5	**3** (*Flabellina rubrolineata* (a+b); *Phyllidia ocellata* (a+b); *Dendrodoris krusensterni* (a+b)

Table 2.5 Proportion of species belonging to cryptic lineage complexes, per marine ecozone. Depicted are: a) the number of species for which multiple specimens were collected at the respective South African Ecozones (according to Sink et al. 2012); b) the number of these species that formed part of cryptic lineage complexes within South Africa; c) the number species (in b) for which multiple lineages were recovered in one region.

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The number of cryptic lineages recovered per ecozone is displayed in Table 2.5, and the proportion of duplicate species collected that contain cryptic lineages is estimated. One can deduce that duplicate specimens were not sampled evenly throughout the coastline, yet cryptic lineages were recovered at each of the regions and are therefore not confined to one region. Most cryptic lineages were here found in the most heavily sampled Agulhas region.

2.4.1.3 New species and new South African nudibranch records

In total, at least eight species, not before recorded in literature and new to science, were found in this study (Table 2.6). In addition to this, ten new records of nudibranchs that have not previously been documented from South Africa were genetically examined in this chapter. Four hereof were found in the Atlantic waters of the Western Cape, three in the Eastern Cape (along the transition zone between the Agulhas and Natal Ecoregions) and one was along the Natal Ecoregion coastline. Interestingly, all range extensions into South Africa were all recorded along the KwaZulu-Natal and Transkei coastlines. Figures of photographs of specimens can be found in § 2.3.3.3 and in Appendix 2.7.

Species records obtained in this study not yet documented in literature	**Collected from**	**Collected by**	**New to South Africa / Science**	**Global distribution**
Ardeadoris cf. *electra*	*Durban South Coast*	V. Fraser	South Africa	Indian and Western Pacific Ocean
Baeolidia cf. *moebii*	*Durban South Coast*	Prof. D. Herbert & L. Davis	South Africa	Hawaii
Chromodoris cf. *strigata*	*Durban South Coast*	V. Fraser	Science	Endemic
Eubranchus sp. 6	*West Coast Peninsula*	J. Toms & F. Gelletich	Science	Endemic
Eubranchus sp. 7	*Lamberts Bay*	J. Toms & F. Gelletich	Science	Endemic
Glossodoris sp. 7	*Durban South Coast – Sodwana*	V. Fraser & Dr A. Connell	South Africa	Japan
Goniobranchus cavae	*Durban South Coast*	Prof. D. Herbert & L. Davis	South Africa	Western Indian Ocean
Hypselodoris cf. *bullocki*	*Sodwana Bay*	J. Toms	Science	Western and central Pacific
Nembrotha sp. 1	*Transkei*	J. Toms & F. Gelletich	South Africa	Indo-Pacific
Noumea sp. 10	*Sodwana Bay*	Prof. C. Griffiths & M. Franken	South Africa	Madagascar
Peltodoris sp. 2	*Cape Recife*	E. Snyman & J. Swanepoel	Science	Endemic
Piseinotecus sp.	*East London*	J. Toms & F. Gelletich	Science	Endemic
Phyllidiopsis gemmata	*Sodwana Bay*	Dr K. Sink	South Africa	Indonesia
Rostanga sp.	*Transkei*	J. Toms & F. Gelletich	Science	Endemic
Tambja cf. *kava / amakusana*	*Transkei*	J. Toms & F. Gelletich	South Africa	Western and central Pacific

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Thecacera picta	*Sodwana Bay*	Dr A. Connell	South Africa	Indian and Western Pacific Oceans
Unknown tergipedid sp.	*Hermanus*	J. Toms & F. Gelletich	Science	Endemic
Unknown tergipedid sp.	*West Coast Peninsula*	J. Toms & F. Gelletich	Science	Endemic

Table 2.6 Species records of specimens that were collected in the present study only, that are not yet recorded in literature. Species collected in this study that represent new records for South Africa, together with the collection locality and collector. Species are either new to science (i.e. not previously recorded in literature in or outside of South Africa) or represent range extensions from other regions into South Africa.

Many more new records were mined from online databases, and documented in the species list in the present study (Appendix 2.6). Fifty of these species from online databases (Sea Slug Forum, iSpotnature, SURG and Eastern Cape Scuba Diving) were not previously recorded in literature as being present in South Africa and a further 21 are likely new to science (highlighted in pink on the Table in Appendix 2.6)). Photographic evidence, as well as distributional data of these sightings was collected in order to get a comprehensive list of species recorded thus far in South Africa. These findings brought number of putative species recorded in South Africa up to 382 (not including historical records, see: §2.3.1).

In summary, the results from this chapter revealed that the phylogenetic relationships of nudibranch taxa in South Africa are very complex and it will require numerous additional attempts to clarify the findings based on the phylogenetic trees presented in this chapter.

2.4.2 Problems encountered in phylogenetic inference

A few problems were encountered while performing the reconstruction of the phylogenetic trees. These are briefly explained below.

2.4.2.1 Polytomies

Polytomies are defined as nodes with more than two branches stemming from them, i.e. they are multifurcating as opposed to bifurcating (Walsch et al. 1999). Polytomies can be described as “soft” or “hard” (Maddison 1989) depending on their underlying evolutionary patterns. Soft polytomies, result from a deficiency of information utilized in phylogenetic inference, which can usually be resolved into chronological bifurcations by including a greater amount of taxa or character data with adequate variation (Whitfield & Lockhart 2007). In contrast, hard polytomies, reflect true concurrent radiation events of one lineage being split into several daughter lineages at once (through for example vicariance, see: Hoelzer & Meinick, 1994, Durand et al. 2003, Bauza-Ribot et al. 2012), and are incapable of being resolved into dichotomous branches, regardless of the amount of character data that is included (Maddison 1989).

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The polytomies observed here are typical examples of soft polytomies, which can be attributed to the fact that there is insufficient (variable) genetic data, resulting in certain nodes in the tree being unresolved (Maddison 1989). This can readily be observed in the nDNA tree, which contains many more polytomies than the mtDNA tree (Fig. 2.3.2). For shallow nodes this is likely due to the faster mutation rates of mtDNA (Brown et al. 1979), where not enough time has passed for genetic changes to become established in order to create variation in the nDNA dataset of some of the closely related taxa tested here. Another reason for the observed deeper polytomies is that species used in these analyses are distantly related, and most of their closer relatives are missing from the dataset, i.e. they either were not collected, have gone extinct or are simply not present in South Africa. See for example the Chromodorididae and Aeolidiidae, which were sampled in great detail throughout their distribution ranges globally by Johnson and Gosliner (2012) and Carmona et al. (2013). As a result of the inclusion of more taxa, their trees uncover far greater insight into the evolutionary history of these groups than the trees presented here. However, given the scope and time constraints of this MSc it was not possible to include the same level of taxonomic depth for all South African nudibranchs as in other studies that focussed on specific families or genera.

2.4.2.2 Long Branch Attraction

In the mtDNA phylogenies, *Melibe sp.*, *M. rosea*, *Dendrodoris sp.*, *D. nigra*, *D. caesia* as well as *Vaysierrea felis* and *Pteraeolidia* cf. *semperi* appeared to suffer from long-branch attraction (trees displayed in Appendix 2.9). Long-branch attraction (LBA; Felsenstein 1978) is an erroneous systematic artefact of phylogenetic inference whereby taxa with long branch lengths are mistakenly grouped together (Felsenstein 1978). This phenomenon can result from distinctive underlying mechanisms in the way phylogenetic programs interpret 1) sequences of lineages with differing evolutionary rates (of lineages or of specific sites within a lineage: "heterotachy") (Felsenstein 1978, Lockhart & Steel 2005) or 2) disproportionate sampling of taxa (Hendy & Penny 1989). Long branches tend to group together when the amount of change accumulated in both lineages (falsely counted as shared characters) exceeds the number of synapmorphies a lineage shares with its true relatives, resulting in convergence of the distantly-related lineages (see: Bergsten 2005). LBA can be avoided by excluding variable regions, adding more sequence data and by sampling more broadly (Crawford et al. 2012, Prum et al. 2015, Thomas 2015).

Melibe and *Dendrodoris* are far from being closely related, each belonging to different suborders, as are *Vaysierrea* and *Ptereaolidia*. When observing the alignments of mtDNA genes the reasons behind these long branches and subsequent grouping of taxa become clearer: see Fig. 2.10. There is considerable sequence variation and an insertion in COI gene regions of *Dendrodoris sp.*, *D. nigra* and *D. caesia*, including five amino-acid deletions in COI gene regions of *Melibe sp.* and *M. rosea* (*V. felis* and *P. semperi* were not included in the COI-dataset). Dendrodoris was previously shown to be

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saturated by multiple substitutions, having a faster evolutionary rate in the COI and 16S mitochondrial genes by Wollscheid-Lengeling et al. (2001) and Wägele et al. (2003). Similarly, the deletions in *Melibe* were also encountered by Pola & Gosliner (2012) and in Sevigny et al. (2015).

Further, the 16S gene region suffered from large gaps in sequences of all seven species, likely contributing to the long branches observed in the individual and combined mtDNA trees (not shown). It is likely that the *Dendrodoris* taxa forming long branches have higher mutation rates (of the partial COI and 16S gene regions) than their congenerics sampled here, and that the long branches of *Melibe*, *Vaysierrea* and *Pteraeolidia* could also be the result of incomplete taxon sampling. This was not further explored in this MSc thesis as long branches can obscure the phylogenetic inference of evolutionary relationships; hence, these taxa were removed from further analyses.

The slower evolving nuclear H3 gene interestingly did not reveal any LBA for the above mentioned taxa, clustering the *Dendrodoris* together with its congenerics, and placing *Melibe* in a more appropriate position in the tree within Cladobranchia (Fig. 2.3.2). There are however many instances of taxa grouping together incorrectly, which is likely an artefact of incomplete taxon sampling or homoplasy, except for *Amanda armata* which may indicate elevated evolutionary rates in H3 as it is clustering near to the outgroup rather than it's close relatives in Facelinidae.

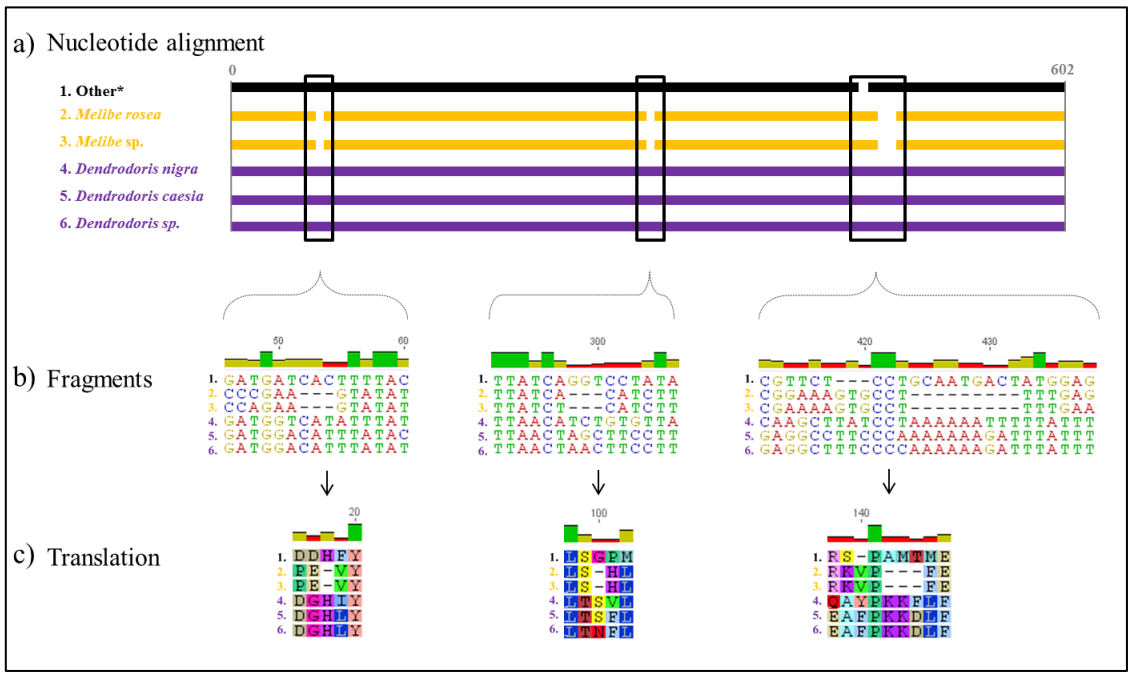

Figure 2.10 COI sequence Insertions and deletions. a) COI sequence alignments zoomed out, * represents all other members of Nudibranchia and the outgroup taxon in the alignment used for the tree in Appendix 2.8. b) Fragments of the DNA with gaps/insertions are enlarged. c) The translated protein alignments of fragments in b). Note: in b & c "1" displays fragments of the specific nucleotide and protein sequences for *Dendrodoris krusensterni* as a representative of the * taxa in the alignment.

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CHAPTER THREE: TESTING BIOGEOGRAPHICAL AFFINITIES OF SOUTH AFRICAN NUDIBRANCHS TAXA USING SPECIES DISTRIBUTIONS AND MOLECULAR DATA

3.1 Biogeographical patterns of South African nudibranchs

The efficacy of biodiversity assessments for decision making and biodiversity planning relies on accurate species lists and distributional data, as well as an understanding what has influenced distributional patterns historically and how they are shaped today (i.e. the contemporary factors influencing them), in order to preserve them for the future (von der Heyden 2009, von der Heyden in: Sink et al. 2012). For these reasons it is of great importance and value to incorporate genetic data into such assessments as was seen in the previous chapter, where it was demonstrated that of the morphospecies tested along the South African coastline, many (>20%) held distinct lineages within them (i.e. separate units of biodiversity and likely distinct species), that are currently unrecognized and unaccounted for. The fields of biogeography (spatial patterns of species based on taxonomy) and phylogeography (spatial patterns of distinct genetic lineages) add additional value through for example comparing evolutionary patterns of many species (comparative phylogeography). This brings to light the localities of barriers and other drivers affecting the divergence and speciation of large groups, and can reveal evolutionary (such as endemism and biodiversity-) hotspots that produce and may export novel biodiversity (Bowen et al. 2016). The dynamic coastline of South Africa which displays high levels of endemicity across taxa (Griffiths et al. 2010), provides an exciting natural laboratory to explore drivers of lineage divergence and speciation in the sea (Teske et al. 2011). Together with the distributional and molecular data obtained in the previous chapter, this chapter will look into the patterns of South African nudibranch lineages, past and present, and seek to better explain the physical (oceanography, climate) and ecological (life history, diet) factors that contribute to shaping nudibranch biodiversity.

3.1.1 Status of knowledge

The most comprehensive study on the biogeography of Ophisthobranchia in South Africa is documented in the publications of Gosliner (1987a&b). These works suggested that the South African Opisthobranch fauna is phylogenetically and biogeographically linked to three regions: the Southern Ocean, Indian Ocean, and the Atlantic Ocean. The eldest relations were suggested to be with the sub-Antarctic, dating back to the late Pliocene when the Southern Ocean fauna are thought to have shared many species with Southern Africa. Periodic warming events during the Pleistocene would have severed faunal connections with the Southern Oceans, resulting in divergence and speciation. The more recent Atlantic and Indo-Pacific relations were attributed to Pleistocene climatic oscillations (Gosliner, 1987a). Within South Africa, biogeographical patterns revealed endemicity to peak along the southwest coast and reduced moving further east, while species richness increased, reaching its

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peak along the KwaZulu-Natal coastline (Gosliner 1987a&b, Fig. 2.1). Being performed in the 1980s the identifications of species and assessments of relationships did not include any molecular data, and were based solely on the identifications of species through morphological synapmorphies.

More recent studies strategizing conservation prioritization areas along the coastline, as well as those on South Africa's introduced/cryptogenic marine species, incorporated information on the South African opisthobranch biogeography which were based mainly on the above mentioned 1987 study. Examples include: studies examining species richness and endemicity (Emmanuel et al. 1992, Awad et al. 2002) as well as patterns of marine endemicity and range restriction (Scott et al. 2012). The largest proportions of range-restricted endemic opisthobranchs is currently considered to be around False Bay, Port Elizabeth, Durban and St Lucia; regions that coincide with recognized biogeographic breaks, as well as high shipping activity and research bias (Scott et al. 2012). Other studies on introduced and cryptogenic species include Mead et al. (2011ab) and Robinson et al. (2016). In Mead et al. (2011ab), introduced nudibranch species include: *Catriona columbiana* (O'Donoghue, 1922) and *Polycera hedgpethi* (Marcus, 1964), while cryptogenic species included *Thecacera pennigera* (Montagu, 1815) and *Aeolidiella indica* (Bergh, 1888) (the latter was recently revealed to be an endemic South African species, genetically distinct from global relatives and now classified as: *Antaeolidiella saldanhensis* (Barnard, 1927) in Carmona et al. 2013). In the latest list of alien and invasive species for South Africa published in Robinson et al. (2016), only *Catriona columbiana* is categorized as 'alien' with medium confidence, while the other two species were not included. Their status remains undetermined.

3.1.2 Supporting biogeographical relationships using molecular data

Molecular data provides a relatively cheap, effective and fast way to identify and delineate species, and detect lineages of cryptic morphospecies. Biogeographical patterns of species have been difficult to test until the incorporation of molecular systematics into evolutionary biology. Genetic data has not been incorporated for most of the species identification and classification processes in South Africa, and thus their evolutionary affinities to other populations of a species (within South Africa and globally) have never been tested. Indeed, the perception that species belong to populations with widespread distributions within as well as outside of southern Africa have been refuted in many of these recent studies incorporating genetic data: e.g. Pola & Gosliner 2010, Pola et al. 2012, Carmona et al. 2013ab, Palomar et al. 2014. Globally, cryptic nudibranch lineages and morphospecies are being discovered more frequently, with molecular techniques being key to their discovery, revealing that certain regions of the world hold a much higher proportion of endemic species and divergent lineages than previously thought (e.g. (north) eastern Pacific: Santander & Valdés 2013, Hoover et al. 2015; Southern Ocean: Wilson et al. 2009; Australia and the Indo-Pacific: Wilson & Burghardt 2015; Carmona et al. 2013). Additionally, interesting sister-relationships of South African nudibranchs to

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regions all over the world indicating historical links to the northwestern/eastern Atlantic, the southwest Atlantic, the northeastern Pacific, as well as the wider Indo-Pacific region have been recovered using molecular data (reviewed in § 2.1.2). These patterns will be further explored and compared to the findings in the present study.

3.1.3 Marine phylogeography and biogeography in South Africa

Speciation in the sea is complex as marine species generally have large geographical distributions, pelagic larval durations of a few days up to several months, and essentially live in environments with few obvious barriers separating them, contradicting the notion that complete isolation is the main driver of species differentiations (Palumbi 1994, Miglietta et al. 2011). These processes are poorly understood for widespread species rich taxa such as nudibranchs, and are particularly challenging to understand in groups that have diverse habitat and diet preferences, as many different factors could be involved in their divergence (Krug 2011). Phylogeography and molecular phylogenetics are useful in that they provides a window into the primary isolating mechanisms of the speciation process influencing intraspecific divergence (Avise et al. 1987, Gaither et al. 2015, Bowen et al. 2016).

Phylogeographical studies of other South African marine fauna were last reviewed in Teske et al. 2011. Taxa have indicated three concordant regions where breaks in gene flow occur, that match marine ecoregion boundaries (see Fig. 1 in von der Heyden 2009, Teske 2011): a) the transition zone of Southwestern Cape and Agulhas (Cape Point – Cape Agulhas); b) the transition zone between the Agulhas and the Natal (Algoa Bay – Transkei); and c) the transition zone between the Natal and Delagoa (St Lucia). Not all species revealed breaks at each biogeographical boundary and the exact localities of boundaries differ among them (von der Heyden et al. 2013, Teske et al. 2006); other species carry genetic signatures of historical perturbations, that don't correspond to contemporary biogeographical boundaries, but have persisted due to limited gene flow between populations in species with limited dispersal capabilities (Teske et al. 2007, von der Heyden et al. 2008, Toms et al. 2014, Wright et al. 2015) or those that seem to have adapted to a specialized habitats for example (von der Heyden et al. 2015, Phair et al. 2015). Relationships in widely distributed taxa that are present in temperate regions of South Africa have revealed divergent lineages to species in temperate regions in the Northern hemisphere (northern Atlantic). Similarly, in the Indian and Pacific Ocean, taxa previously thought to occur throughout the region were revealed to be lineages confined to western Indian Ocean (reviewed in Teske et al. 2011).

In this chapter, I will attempt to explain divergent lineages (sister-species relationships) recovered using phylogenetic methods (historical divergences between sister-taxa within South Africa and well-supported phylogenetic sister-taxa between South African taxa and species found globally), though

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comparative phylogeography, i.e. comparisons to previous studies performed using other species that revealed similar genetic patterns.

3.1.4 Chapter aims

This chapter more closely examines the relationships of South African nudibranchs between localities within South Africa and with other marine regions globally. This chapter will first look at South Africa's local biogeographical patterns, i.e. how species are distributed within South Africa. This is based on the newly acquired distributional data as well as molecular data visualised on the phylogeny obtained in chapter two.

Then, by including genetic data obtained from published research, I compared DNA sequences of South African species to their global relatives to identify discrepancies and unrecognized relationships with conspecifics found globally to estimate the proportion of cryptic morphospecies, and update our understanding on the composition of South African nudibranchs along the coastline. Thirdly, again using molecular data, phylogenetic trees were constructed in order to gain greater insight into the evolutionary and biogeographical history, focussing only on certain genera and families present in South Africa.

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3.2 Methods

3.2.1 Local Biogeography

3.2.1.1 Regions of species similarity within South Africa

In order to visualize the biogeographical regions of nudibranchs in South Africa, cluster analyses were performed on species distribution data collected as described. Using data obtained of South African species distributions (Appendix 2.6), a ".csv" file marking the presence (1) or absence (0) of each nudibranch species at each locality was created (Appendix 3.1). This was then used to create matrices using the Jaccard index of dissimilarity applied in R-studio using Package 'vegan' Community Ecology Package v.2.3-4 (Oksanen et al. 2007); see Appendix 3.2 for scripts. A cluster dendrogram was constructed and then exported as a '.newick' tree using Package 'APE' (Paradis et al. 2004) and further edited in FigTree v1.4.2 (Rambaut 2014) to visualize the percentage similarity of nudibranch fauna between sites within South Africa.

3.2.1.2 Regions of genetic similarity within South Africa

On the combined tree in chapter two, taxon names were highlighted according to their respective ecozones (see Fig. 1.2 for ecoregions and ecozones in South Africa). It must be noted that this study did not examine entire marine ecoregions, but rather areas along the shore down to 30-40m. Therefore ecozones that cover just these depths were rather selected, namely: Namaqua (inshore & inner shelf), Southwestern Cape (inshore & inner shelf), Agulhas (inshore & inner shelf), Natal (inshore), Delagoa (inshore). This was then compared to see if the phylogenetic relatedness of taxa reflects the Jaccard dendrogram, i.e. whether phylogeographic patterns reflect the biogeographical patterns found.

3.2.2 Global distributional patterns and visual analytics

In order to better understand the biogeographic associations of South African nudibranch species, global distributional data of conspecific species were collected from literature and online sources such as the Global Biodiversity Information Facility (www.GBIF.org) and the Sea Slug Forum (Rudman, 2004). The visual analytics program Tableau Desktop® (Chabot et al. 2003) was used to assess these biogeographic affinities. Locations were grouped by their respective Marine Ecoregions of the World (MEOW; Spalding et al. 2007). Point coordinates along coastlines were captured for each marine ecoregion in the list using the MEOW shape file (Spalding et al. 2007; available at: http://www.worldwildlife.org/publications/marine-ecoregions-of-the-world-a-bioregionalization-of-coastal-and-shelf-areas) in using Q-GIS v.2.2 Valmiera (Q-GIS Development Team, 2014) and a map was generated in Tableau Desktop using sized pie-charts to visualise the number of similar species within each MEOW to the respective South African Ecozone.

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3.2.3 Testing global biogeographical affinities using molecular data

For each of the families for which genetic data was obtained in chapter two, all available online sequences were downloaded for the three gene region (mtDNA: COI, 16S and nDNA: H3) from the Entrez Nucleotide Database (NCBI: Geer et al. 2009) using the search function in Geneious v7.1.9 (http://www.geneious.com, Kearse et al. 2012).

3.2.3.1 Alignment and preparation for phylogenetic analyses

Sequences were first grouped by Suborder in separate folders in Geneious v7.1.9 (Kearse et al. 2012), and subsequently by Superfamily, Family, Subfamily and Genus. Depending on the available sequence data available per grouping, alignments were constructed for genera or (sub-/super-) family. Alignments with more than 50 taxa were aligned using MAFFT v7.017 (Katoh & Standley, 2013) as in chapter two (see §2.2.7). If there were fewer sequences to be aligned, ClustalW (Larkin et al. 2007) was utilised (with protein coding sequences aligned by translation) implemented in Geneious v7.1.9 (Kearse et al. 2012). Aligned sequences were trimmed to the same length; shorter sequences they were either deleted or missing data was replaced with "N" and alignments were concatenated in Geneious v7.1.9 (Kearse et al. 2012).

3.2.3.2 Phylogenetic reconstruction using RAxML GUI v1.5.b1

Phylogenetic trees were generated using RAxML GUI v1.5.b1 (Silvestro & Michalak 2012) as a more rapid assessment of evolutionary relationships within each of the groupings. The model GTR-CAT was applied for larger alignments and GTR-GAMMA was implemented for alignments containing less than 50 taxa. Where alignments were concatenated, sequences were partitioned by gene and mitochondrial genes further by codon. Outgroup taxa were selected based on published studies where available or according to the tree in chapter two. The autoMRE bootstrap convergence criterion was implemented (Pattengale et al. 2010), which determines the number of bootstrap replicates required automatically; whereby the addition of more replicates will not alter the bootstrap support values substantially (Stamatakis 2015). Several interesting biogeographical patterns emerged (expanded on in the Results section, § 3.3.3.1) and only four examples that displayed each of these patterns were selected for more thorough investigation, as to demonstrate evolutionary relationships and global affinities of South African species and lineages collected from different regions within South Africa. Criteria used to select groupings were:

a) Whether there was a good coverage of taxa distributed throughout geographical ranges of genera;

b) Whether phylogenies added new information and recovered notable differences to recently published molecular studies, specifically concerning the biogeographical affinities of South African taxa;

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c) Whether they demonstrated at least one of the different biogeographical patterns in recovered phylogenies (§ 3.3.3.1) with clades showing significant support (BS≥75).

3.2.3.3 Groupings selected for further phylogenetic analysis

Groupings selected for further analysis were:

1) Family Dotidae (available sequences on GenBank: COI: 41; 16S: 39; H3: 39).
The phylogeny of Dotidae was recently examined using molecular data, which included the description of two South African species: *D. africoronata* in Shipman & Gosliner (2015), and *D. splendidissima* in Pola & Gosliner (2015). Additional lineages were recovered in this study from Namaqua, Southwestern Cape and the Agulhas Ecoregions (Appendix 2.8, p5), that were not included in the above mentioned studies.

2) Superfamily Fionoidea (available sequences on GenBank: COI: 118; 16S: 83; H3: 30).
The Fionoidea superfamily has not previously been examined, the phylogenetic relationships within certain genera and species has been explored, for example: the genus *Cuthona* by Medrano et al. (2016), *Phestilla* from the Indo-West Pacific were examined by Faucci et al. (2007), *Calma* by Prkic et al. (2014) and *Tergipes* examined by Cámara et al. (2014). Several species belonging to the Fionoidea were recovered in the present study, including a large radiation of *Cuthona speciosa* that may have taken place within South Africa, several *Eubranchus* species, two *Tergipes* species and two species whose identity remains unknown (Appendix 2.8, p. 10).

3) Subfamily Miamirinae (available sequences on GenBank: COI: 74; 16S: 93).
Subfamily Miamirinae (Bergh, 1981) was verified and reclassified to include the genera: *Hypselodoris, Thorunna, Mexichromis, Felimare, Ceratosoma* and *Miamira*, using molecular data in Johnson & Gosliner (2012). Relationships among genera within this subfamily were relatively well resolved compared to the remaining genera of Chromodorididae in Johnson & Gosliner (2012) and again in the present study, although with only few South African representatives (see Fig. 2.5 or Appendix 2.8 p.2), and therefor this group was selected to test biogeographical affinities further.

4) Subfamily Polycerinae (available sequences on GenBank: COI: 50; 16S: 47).
The phylogenetic relationships of species within Polycerinae, was recently explored by Palomar et al. (2014), where two lineages of *Polycera* were confirmed in South Africa, overlapping in distribution, and both having a sister-species in the northern Atlantic rather than being sister to one another (See Ch. 2 § 2.3.3.3(1)). This study included all (an additional three) morphospecies of *Polycera* found in South Africa to date as well as species of *Lecithophorus* and *Thecacera* (Appendix 2.8, p. 1).

Sequences downloaded from GenBank (including accession numbers) which were used in the reconstruction of the phylogenies for the groups above, are listed in Appendix 3.5.

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For each dataset substitution saturation tests and best-fit evolutionary models were estimated as in chapter two (§ 2.2.7). Genes were analysed as concatenated datasets (see Appendix 3.6 for details on number of taxa used, alignment lengths, partitions, model selection and other parameters).

Bayesian inference was performed in MrBayes v3.2.6 (Huelsenbeck & Ronquist 2001). For concatenated datasets, Metropolis-coupled Markov chain Monte Carlo analyses were run for 20 000 000 – 150 000 000 generations (see Appendix 3.5), sampling every 1000 generations, with two independent runs and four chains (1 cold and 3 heated). BEAGLE (Ayers et al. 2012) was employed to speed up the convergence time of the runs. The first 25% of trees were discarded as 'burnin'. Convergence was visually examined in MrBayes v3.2.6 (Huelsenbeck & Ronquist 2001) and in Tracer v1.6 (Rambaut et al. 2014) as in chapter two (§ 2.2.8). Trees were constructed in MrBayes using the 'sumt' function, posterior probabilities greater than 0,95 were considered well supported.

Maximum likelihood tree inference was performed with RAxML v8.2.4 (Stamatakis 2015) in Windows 8 command prompt, as in chapter two (§ 2.2.8). Selected tree search parameters are displayed in Appendix 3.5. A total of 1000 non-parametric bootstrap-iterations were employed to infer extended majority rule consensus trees. Bootstrap values greater than 75 were considered well supported.

Trees were visualised and edited in the programme FigTree v1.4.2 (Rambaut 2014).

3.2.3.4 Estimation of uncorrected p-distances

If conspecific species with widespread geographical distributions were available on GenBank, these were downloaded and compared to sequences of South African taxa to examine the level of genetic divergence, specifically to test whether nudibranchs from South Africa would be genetically identical, show population-level of species-level divergences to individuals of the same species sampled elsewhere. Estimates of uncorrected pairwise genetic distances were performed in MEGA v7.0.14 (Kumar et al. 2016).

3.2.3.5 Visual analytics

Phylogenetic sister-species relationships to South African taxa, were inferred from the constructed trees and listed in Appendix 3.7. Data on the localities of sister-taxa individuals were collected from the corresponding publications or as listed on GenBank. The locations were grouped by the respective marine ecoregions (MEOW; Spalding et al. 2007) and coordinates were captured as in section § 3.2.2. A map was generated in Tableau Desktop® using sized pie-charts to visualise the number and proportion of genetic sister-species relationships with South African taxa (grouped by South African Ecozone) found per MEOW.

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3.3 Results

3.3.1 Local Biogeography

3.3.1.1 Clustering of localities based on Jaccard index results

The Jaccard similarity index clustering dendrogram reveals clear clustering of certain localities based on the presence/absence of nudibranch species recorded (see Fig. 3.1). On the dendrogram, eight clusters with greater than 50% faunal similarity are demarcated with numbers: 1) Kosi Bay – Sodwana Bay, 2) Richards Bay – Durban South Coast, 3) Port St Johns – Coffee Bay, 4) East London – Port Alfred, 5) Cape Recife – Cape Infanta, 6) Walker Bay –Cape Peninsula West, 7) Melkbosstrand – West Coast Peninsula, and 8) Elands Bay – Port Nolloth. These analyses reveal that the nudibranch fauna of Coffee Bay/Port St Johns and East London/Port Alfred regions is more similar to the southeast and south coast rather than to the Natal coastline. Additionally, it shows the nudibranch fauna of Cape Peninsula West is more similar to western False Bay – Walker Bay than to the rest of the localities within the Southwestern Cape coastline.

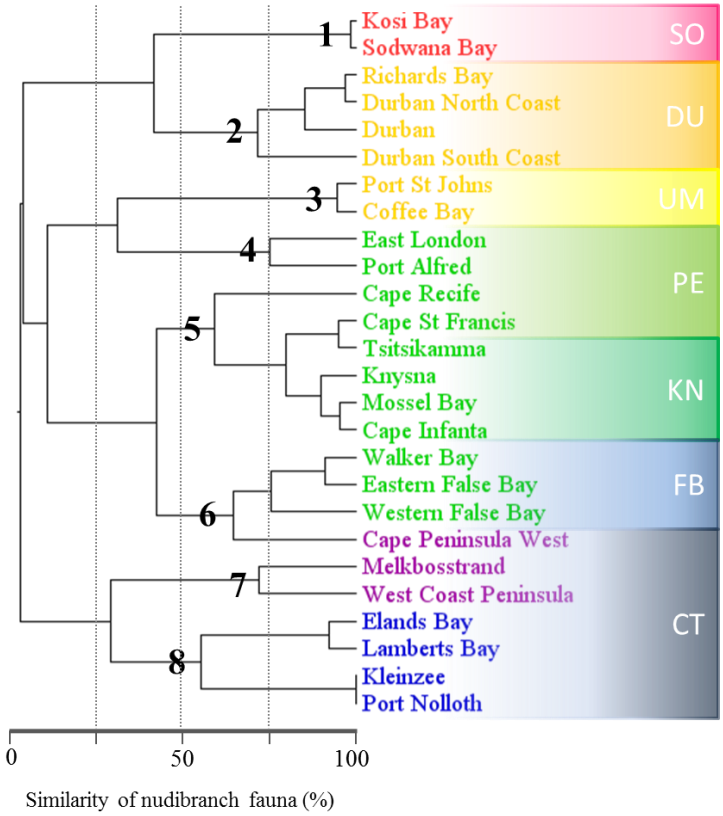

Figure 3.1 Jaccard dendrogram of the similarity of species among localities. Numbers 1-8 on the dendrogram demarcate clusters of localities with > 50% species similarity. Locality names are coloured according to the ecozones of the NBA they fall within (Sink et al. 2012, see Fig. 2.2). Coloured boxes with white letters delineate the regions used in the Gosliner (1987) biogeographical study of Opisthobranchs (see Fig. 2.1).

3.3.1.2 Clustering of localities based on phylogenetic results

When the taxa on the tree from chapter two are coloured according to their localities, one can visualize the local biogeographic affinities of genetically connected clades. I chose to use this approach given the dense sampling on the tree. Although many South African species were not sampled in this study and are missing from the dataset, some families are relatively well sampled (e.g. Chromodorididae, Polyceridae and Tergepedidae) and display noticeable patterns. The trees show that taxa labelled in greens, blues and purples mostly cluster closely together, as well as yellows and reds; i.e. the inshore/inner shelf Namaqua, Southwestern Cape and Agulhas Ecozones, and those of Natal and Delagoa (Fig. 3.2). In contrast, but not as frequent as the groupings per region, some clades

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include members of west, south and east coast taxa; however, these usually show some genetic discontinuities i.e. forming sister-relationships (e.g. *Ceratosoma ingozi*, *Doriopsilla* sp. 1, *Goniobranchus heatherae*) or providing evidence for possible population level phylogeographic structuring (e.g. *Halgerda dichromis* (a) from East London and *Halgerda dichromis* (b) from Durban (also see: Appendix 2.10a)). On this tree, three species appear to be genetically homogenous having both blue/green and yellow/red taxa: 1) *Hypselodoris capensis* (False Bay-Durban), 2) *Glossodoris* sp. 2 (a) (Cape Recife-Sodwana Bay), and 3) the pelagic *Glaucus atlanticus*.

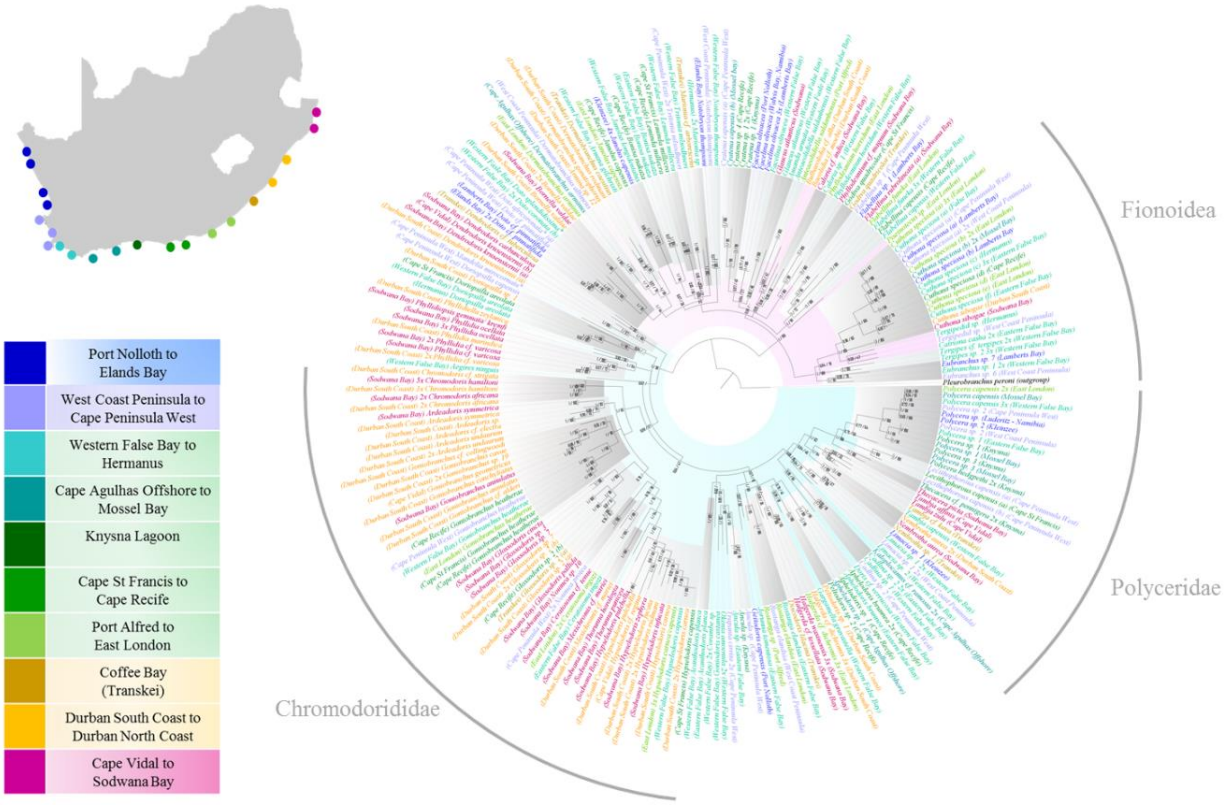

Figure 3.2 Clustering of localities based on phylogenetic data. Bayesian tree of Figure 2.3.3, with taxa coloured according to the marine ecozone they were collected in. Three families are demarcated as examples that are discussed in the text.

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3.3.2 Global distributional patterns and visual analytics in Tableau Desktop®

Distributional data for 162 non-endemic South African species were collected from literature and online databases and online forums (listed in Appendix 3.3). The map generated from this data is presented in Fig. 3.3. From this map it is clear the vast majority of shared species have widespread Indo-Pacific distributions that are linked mainly to the Natal and Delagoa regions. Far fewer species are linked with the Namaqua, Southwestern Cape and Agulhas Ecoregions which are mainly found in the northeastern Atlantic, with few single species occurrences are found in the western Atlantic, (north-) eastern Pacific Ecoregions and even the temperate regions of the western Pacific.

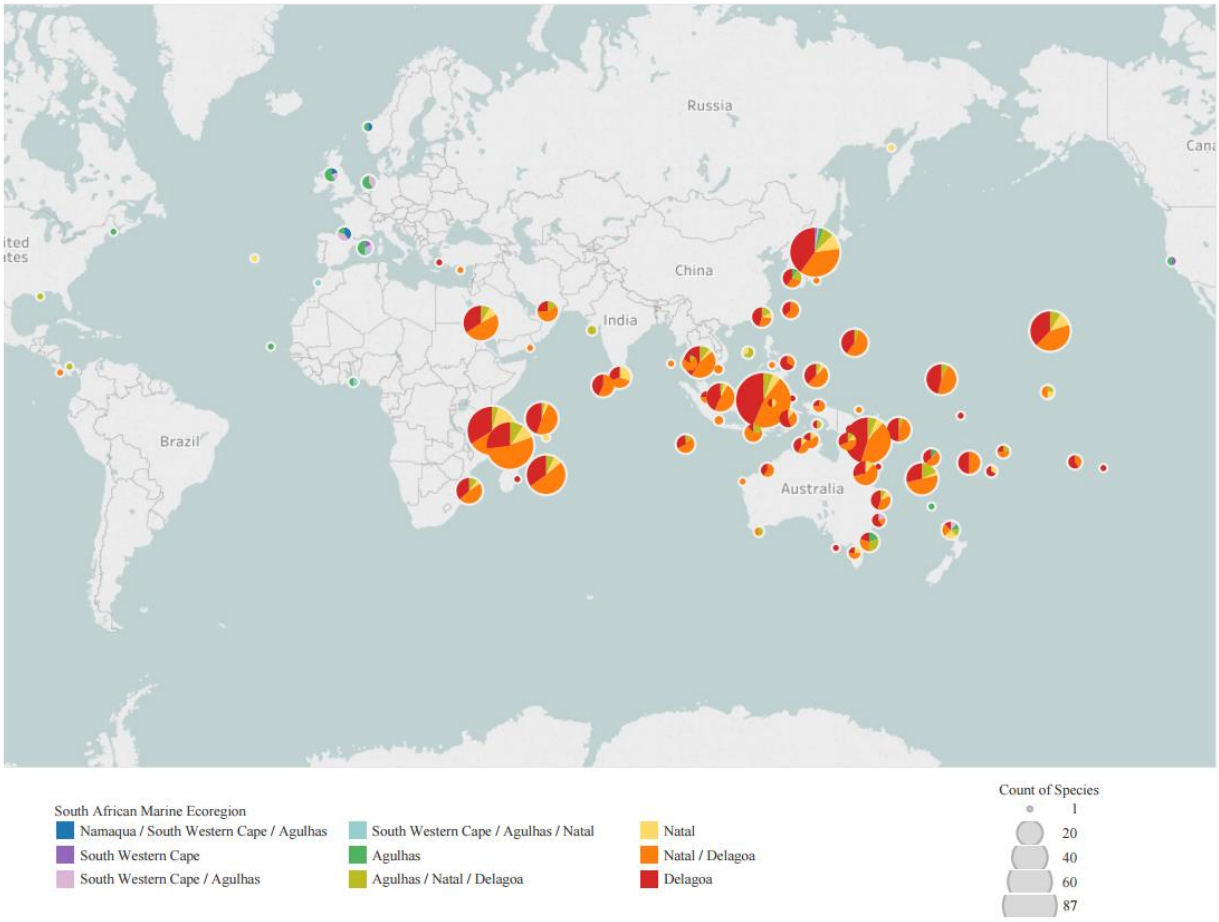

Figure 3.3 Map displaying the distribution of nudibranch species that are also found outside of South Africa. Global localities are grouped by marine ecoregion (as in Spalding et al. 2007). Pie-charts display the ecozone within South Africa that species are linked to. Sizes of circles increase with number of shared species with South Africa.

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3.3.3 Testing global biogeographical affinities using molecular data

3.3.3.1 RAxML GUI trees

Twenty-six alignments were generated, 12 hereof were on the genus level, 12 on the familial level, and two represented well supported clades within a family grouping. The 22 trees constructed in RAxML GUI are displayed in Appendix 3.4, localities and accession numbers are depicted next to the taxon-names. Sister relationships revealed close relations with many different regions globally. Four predominant patterns repeated themselves; 1) many endemic South African species of the west and south coasts of South Africa, including from East London and even the Transkei have close relatives in the Northern Atlantic Ocean; 2) the majority of species found along the Northeast coast of South Africa have close relations or are identical to many species found throughout the Indo-Pacific; 3) some taxa reveal clear patterns of species proliferation within South Africa; 4) some taxa show South African species within genera, and even closely related species in South Africa, have originated from multiple colonization events over evolutionary time.

These patterns are clearly demonstrated in the trees that follow and are expanded on below.

3.3.3.2 Dotidae

The inferred Dotidae tree recovered in this study is displayed in Fig. 3.4. The tree reveals a strong biogeographical pattern: Indo-Pacific and eastern Pacific taxa cluster together (with each region (I/E Pacific) forming its own clade), split from the northern and southern Atlantic clades, which group together (with each region (N/S Atlantic) not forming its own clade, indicating continued interchange between regions). One exception to this pattern however, is the South African species *Doto splendidissima*. *Doto splendidissima* is found in Western False Bay (southern Atlantic) and groups within a Pacific clade (PP: 1 / BS: 80), forming a weak sister-relationship with the undescribed *Doto* sp. H (Mexico). The distant relationship of this species to other South African *Doto* species, the scarcity of its sighting, and its well-supported position among Pacific taxa, could potentially point toward a recent introduction into South Africa.

The *Doto* cf. *pinnatifida* specimens recovered in this study form a cluster within the unresolved clade containing the Northeast Atlantic taxa and the South African *D. africoronata*. Interestingly, *Doto africoronata* here groups with *D. maculata* (from Wales, UK) with strong confidence (PP: 1 / BS: 98). *Doto* cf. *pinnatifida* forms its own monophyletic clade (PP: 1 / BS: 100). Additionally, the South African *Doto* cf. *pinnatifida* does not group in the same clade as the European *D. pinnatifida*.

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Two specimens of *D. coronata* collected in this study were found either side of False Bay and are here shown to group strongly for both ML and BI analyses, within a northern Atlantic clade together with true *D. coronata* species (PP: 0.97 / BS: 97), i.e. not closely related the clade containing *D. africoronata*. The position of the taxa within northern Atlantic clade is however unresolved.

3.3.3.3 Fionoidea

Fionoidae as examined here form a strongly supported clade, with species of the family Facelinidae grouping nearest to the Foinoidea with low support for both analyses. Relationships among clades within the Fionoidea however are less clear. *Calma* and *Catriona* are the only genera in this tree to form monophyletic clades. *Cuthona*, *Eubranchus*, *Phestilla* and *Tergipes* in this tree are all polyphyletic, forming large polytomies rather than monophyletic clades. As a result of this topology it is difficult to deduce the broader biogeographical patterns. Indo-Pacific taxa appear to cluster with some South African taxa from the subtropical as well as temperate regions, although the remainder of the tree shows a polytomy containing small clades of temperate southeastern and northern Atlantic, northeastern Pacific, as well as Southern Ocean taxa grouping together, although not all of these clades are well supported.

A group of *Phestilla* species from the Indo-West Pacific including the unknown tergipedid sp. 1 from Jacobsbaai on the Cape Peninsula West form a well-supported clade (PP: 0.99 / BS: 78), providing an example of an Atlantic-Indian Ocean association. Most other South African fionoidid nudibranchs appear to have sister relationships with nudibranchs distributed in the Atlantic Ocean. For example, *Catriona casha* forms a well-supported sister relationship with the Northwest Atlantic *Catriona columbiana* (PP: 1/ BS: 91). *Cuthona speciosa* clearly forms a radiation of lineages within South Africa, and forms a weak sister relation to the Nothern Atlantic *Cuthona caerulea* (Kattegat). *Cuthona sibogae* specimens (found in Natal and Delagoa) are here recovered sister to GenBank representatives (one from Queensland, Australia). Only 16S data were available on GenBank (16S uncorrected p-distances: 2.84-3.36%).

South African *Tergipes* species formed a weakly supported clade with the Northern Atlantic *T. tergipes*; relationships among these taxa are poorly supported. The position of the unknown tergipedid sp. 2 from Hermanus (Walker Bay) is unresolved.

Eubranchus sp. 1 from False Bay, forms a sister-relationship with Northeast Atlantic *Eubranchus farrani* (Sweden) with support only for ML (PP: 0.78 / BS: 89). *Eubranchus* sp. 6 from Cape Peninsula West, forms a strongly supported sister relationship (PP: 0.99 / BS: 78) to *E. rupium* from

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Northeast Atlantic and the Gulf of Alaska (Alaska and Helgoland). *Eubranchus* sp. 7 from the Namaqua Ecoregion forms a weak sister-relationship to *E. rustyus* from the Northeast Pacific.

3.3.3.4 Miamirinae

This subfamily was strongly supported for both analyses. For the purpose of the present study, the genus *Felimare* was collapsed on the tree, as it holds no South African representatives. The biogeographical pattern of the tree topology reflect those found in Johnson & Gosliner, 2012: most genera in this subfamily are restricted to the Indo-Pacific region, with few single species colonizations (and subsequent radiations) into the eastern Pacific and temperate regions of South Africa.

The only two cool-temperate South African species of the subfamily, *Hypselodoris capensis* and *Ceratosoma ingozi*, revealed interesting patterns:

a) The divergent individual of *Hypselodoris carnea* (likely the true *H. carnea* see Ch2) forms a sister-relationship to *H. bollandi* from Japan and the Philippines (PP: 0.98 / BS: 77); this clade is sister to the other South African *H. capensis/carnea* individuals.

b) *Ceratosoma ingozi* is sister to a clade of *Ceratosoma* species from the Indo-Pacific, and this Indo-Pacific/South African clade forms a well-supported sister-relationship with *Ceratosoma* species from Western Australia and Madagascar.

The relationships of South African taxa from Natal and Delagoa within the Miamirinae display the following patterns which are repeated in most Indo-Pacific clades (see Appendix 3.4):

a) There are some taxa that appear to show very little or no sequence divergence with localities widespread in the Indian -, Indo-Pacific -, and Pacific Ocean regions (see for example the clades including the South African taxa: *Hypselodoris infucata*, *H. fucata*, *H. zephyra*, *Thorunna horologia*, *Mexichromis sp.*).

b) There are several occurrences where South African taxa formed sister relations to clades with Indo-Pacific taxa (see for example: 1) *Hypselodoris carnea* and *H. bollandi* (Okinawa, Japan and Batangas, Philippines), 2) *Hypselodoris rudmani* (Natal / Delagoa) and *H. bertschi* (Maui, Hawaii), 3) *Hypselodoris pulchella* (Natal / Delagoa) and *H. imperialis* (Maui, Hawaii and Southeast India), 4) *Hypselodoris* cf. *bullocki* (Delagoa) and *H. bullocki/apolegma* (Okinawa, Japan and Batangas, Philippines), 5) *Hypselodoris* cf. *regina* basal to a clade with *H. jacksoni* (Queensland, Australia), *H. krakatoa (*Teipei, Taiwan and Palau Aur, Malaysia and Madagascar) and *H. reidi* (Batangas, Philippines) and 6) *Ceratosoma* cf. *tenue* (Delagoa) and *Ceratosoma tenue* (Queensland, Australia).

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3.3.3.5 Polycerinae

Polycerinae together with Gymnodorididae again form a monophyletic clade, well supported in both ML and BI analyses (PP: 1 / BS: 100), as previously discussed in §2.3.3.3 (p. 34).

The biogeographical patterns on the tree reveal relatively recent connections between the northeastern and southeastern Atlantic taxa for *Polycera* and *Thecacera*, a historical connection between *Lecithophorus* (temperate South Africa) and the Indo-Pacific *Gymnodoris*, and present day connections between the Indo-Pacific and Delagoa (*Thecacera picta*), as well as the northeastern Atlantic, northeastern Pacific and (warm temperate) Indian Ocean (*Polycera hedgpethi*). These relationships are explained in finer detail below.

Polycera sp. from Maui (Hawaii) is here revealed to occupy a basal position to a well-supported clade containing the remainder of *Polycera* species from the southern and the northern Atlantic (PP: 1 / BS: 86). This clade divides into two smaller clades. In the first, South African *Polycera* sp. 1 and *Polycera* sp. 3 both occupy well supported reciprocally monophyletic clades, and are here shown to be sister to *P. faeroensis* from Aveiro in Portugal (PP: 98 / BS: 75), although the relationships between these three species are unresolved. In the second clade, South African *Polycera capensis* and *Polycera* sp. 2 fall into two less divergent, but well supported clades (PP: 1 / BS: 100) and (PP: 0.98 / BS: 75). These lineages are sister to *P. aurantiomarginata*. Interestingly, *Polycera* sp. 2 is found to group with *Polycera* sp. from Lüderitz, with these lineages appearing to be geographically restricted to the western coastline of southern Africa.

Polycera hedgpethi does not fall within the same clade as other South African species of *Polycera*, but rather groups with strong support within a clade containing other P. hedgpethi specimens from California and Morocco (PP: 1 / BS: 48), wich is sister to *P. tricolor* from California (PP: 1 / BS: 84). The high sequence identity with Californian (uncorrected p-distance 16S: 0.0025) and Morrocan (uncorrected p-distance COI: 0.0034) specimens and the position of this species within a mainly eastern Pacific clade, distant from all other South African *Polycera* species, strongly supports the hypothesis that this species is introduced into South Africa (Willan 1984, Wilson 2006, Mead et al. 2011b).

Species of *Thecacera* form a monophyletic clade; *Thecacera picta* groups with the *T. picta* specimen (no locality given, but documented from the Indian and western Pacific Oceans in Gosliner et al. 2015). *Thecacera* cf. *pennigera* specimens from South Africa form a well-supported clade (PP: 1 / BS: 99), sister to a divergent individual from Spain.

The monophyly of Gymnodorididae is strongly supported in both analyses (PP: 1 / BS: 88), showing *Lecithophorus* species from South Africa to be sister to a clade with all the Indo-Pacific *Gymnodoris* species represented here.

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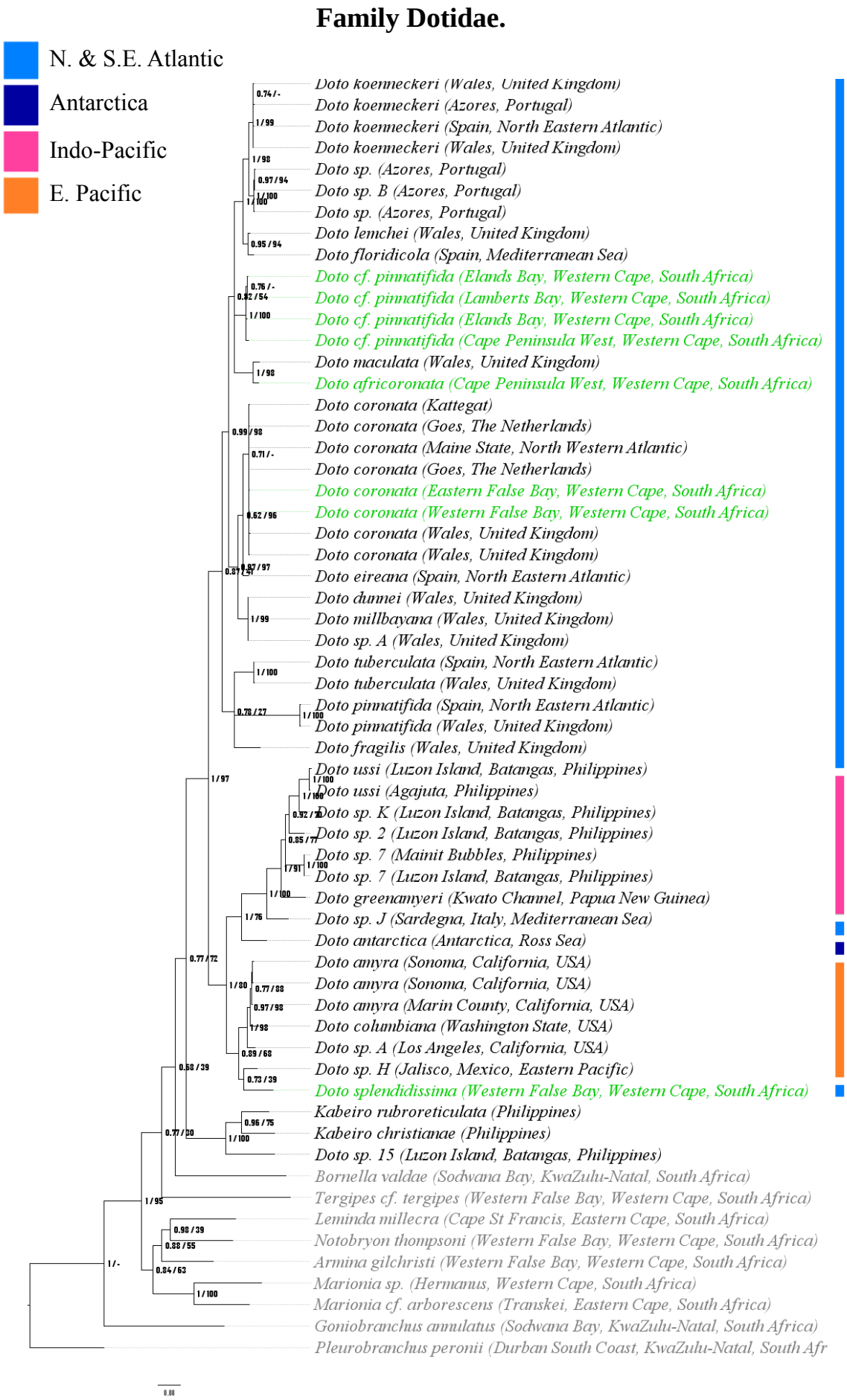

Figure 3.4 Bayesian tree of combined mitochondrial (COI+16S) and nuclear (H3) data of the Family Dotidae, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". South African taxa have a green colour and outgroup taxa a grey colour. Coloured bars indicate region specimens were obtained from.

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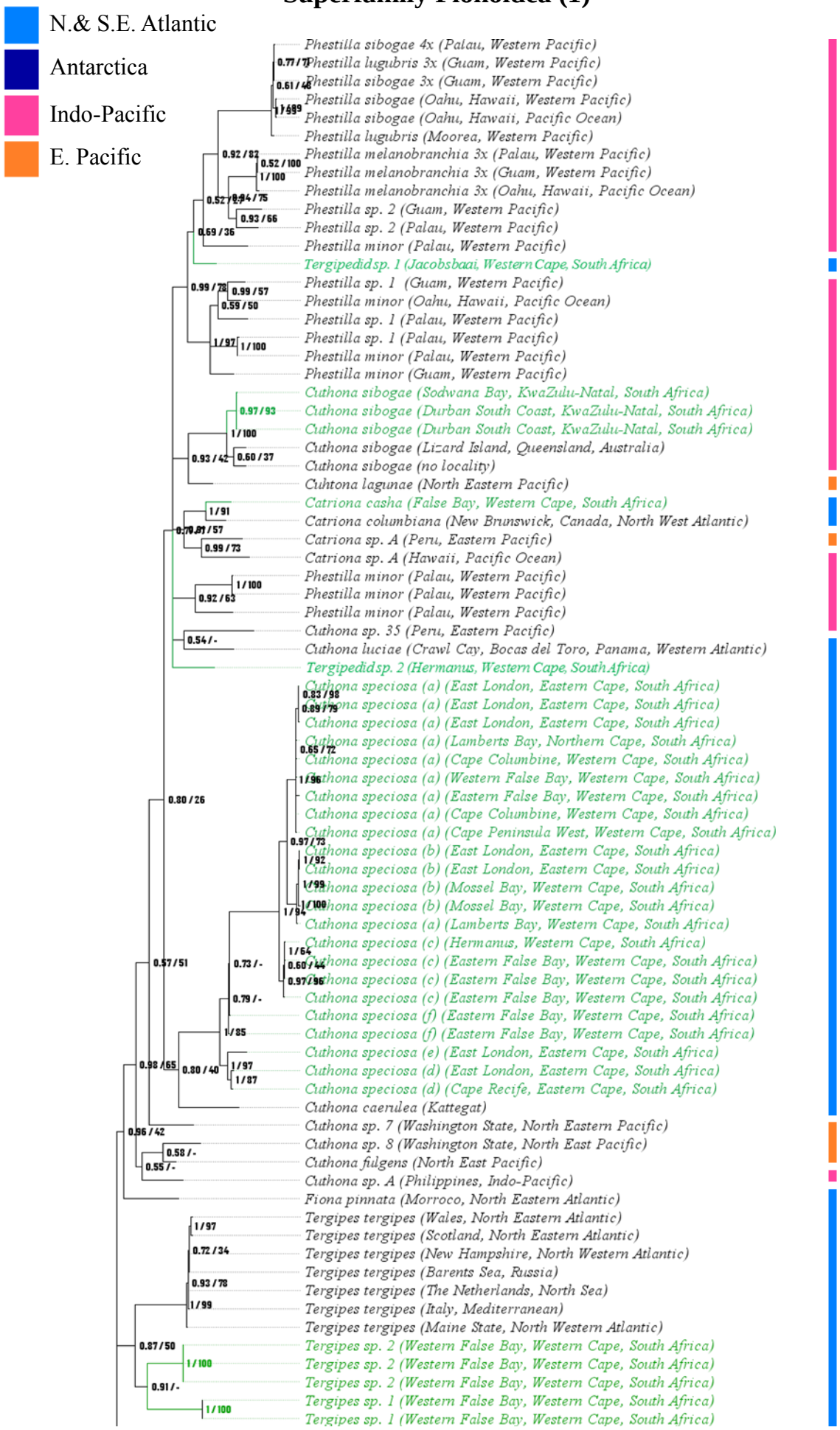
Superfamily Fionoidea (1)



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Superfamily Fionoidea (continued)

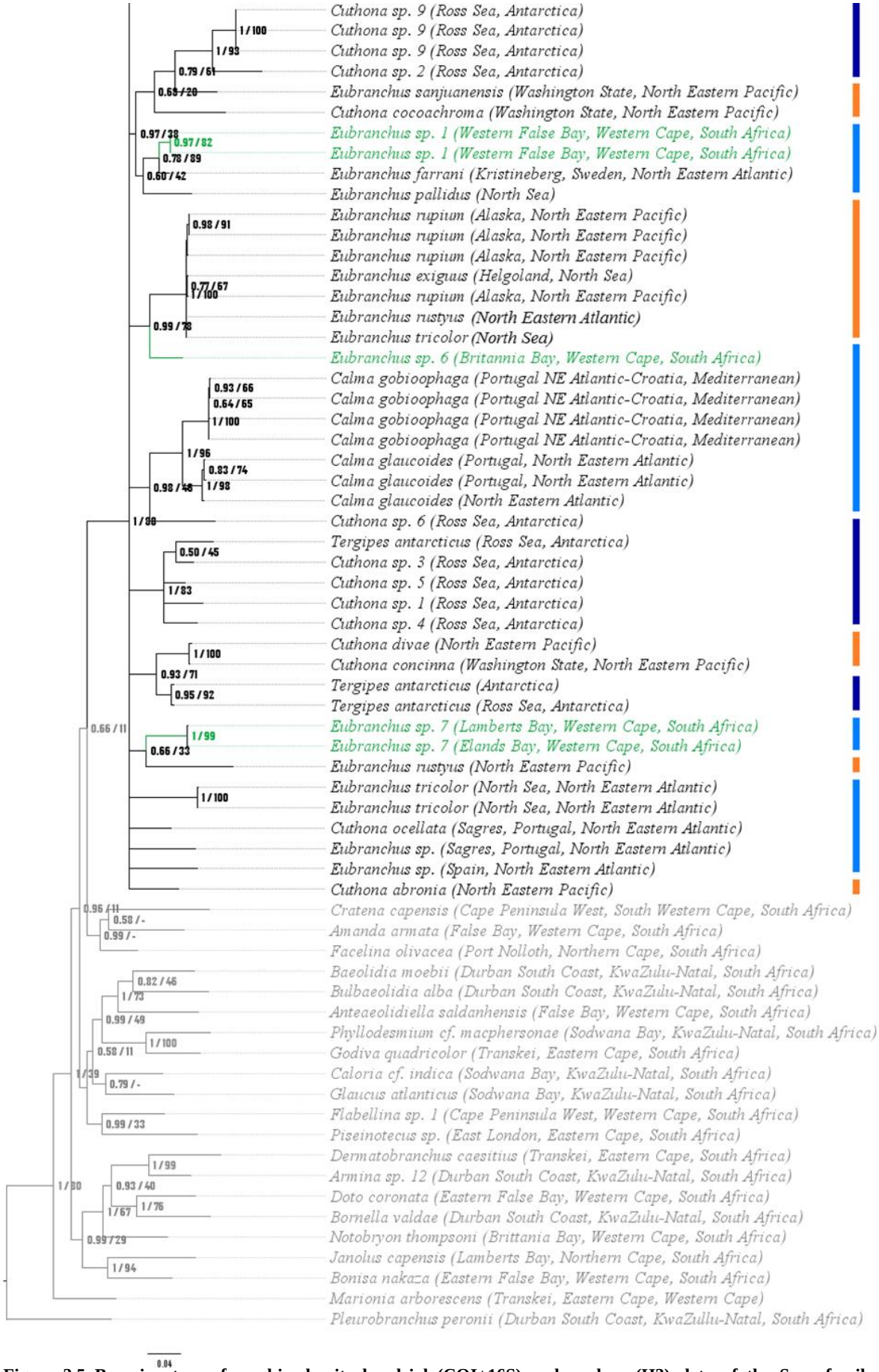

Figure 3.5 Bayesian tree of combined mitochondrial (COI+16S) and nuclear (H3) data of the Superfamily Fionoidea, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". South African taxa have a green colour and outgroup taxa a grey colour. Coloured bars indicate region specimes were obtained from.

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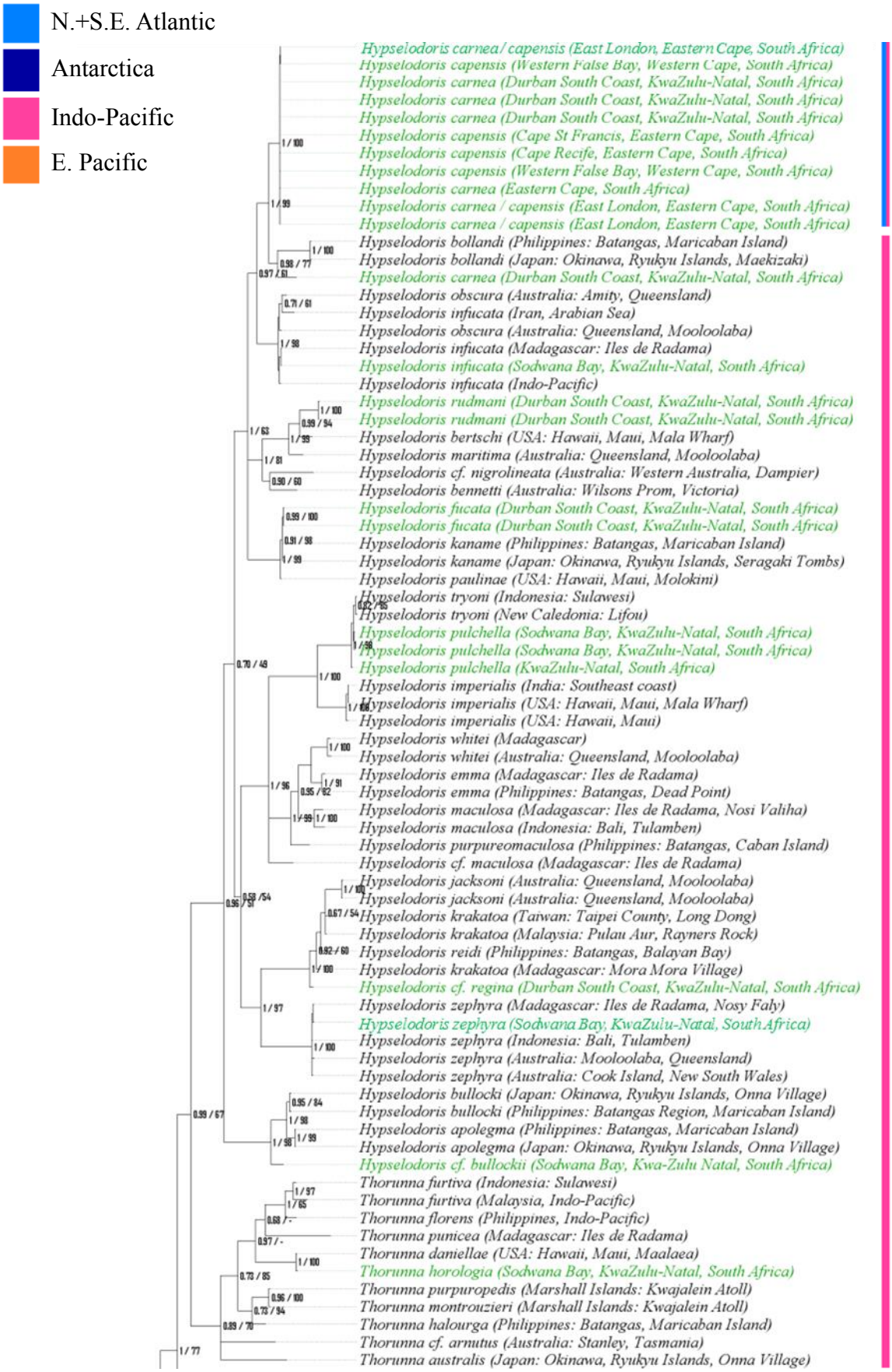
Subfamily Miamirinae (1)



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Subfamily Miamirinae (continued)

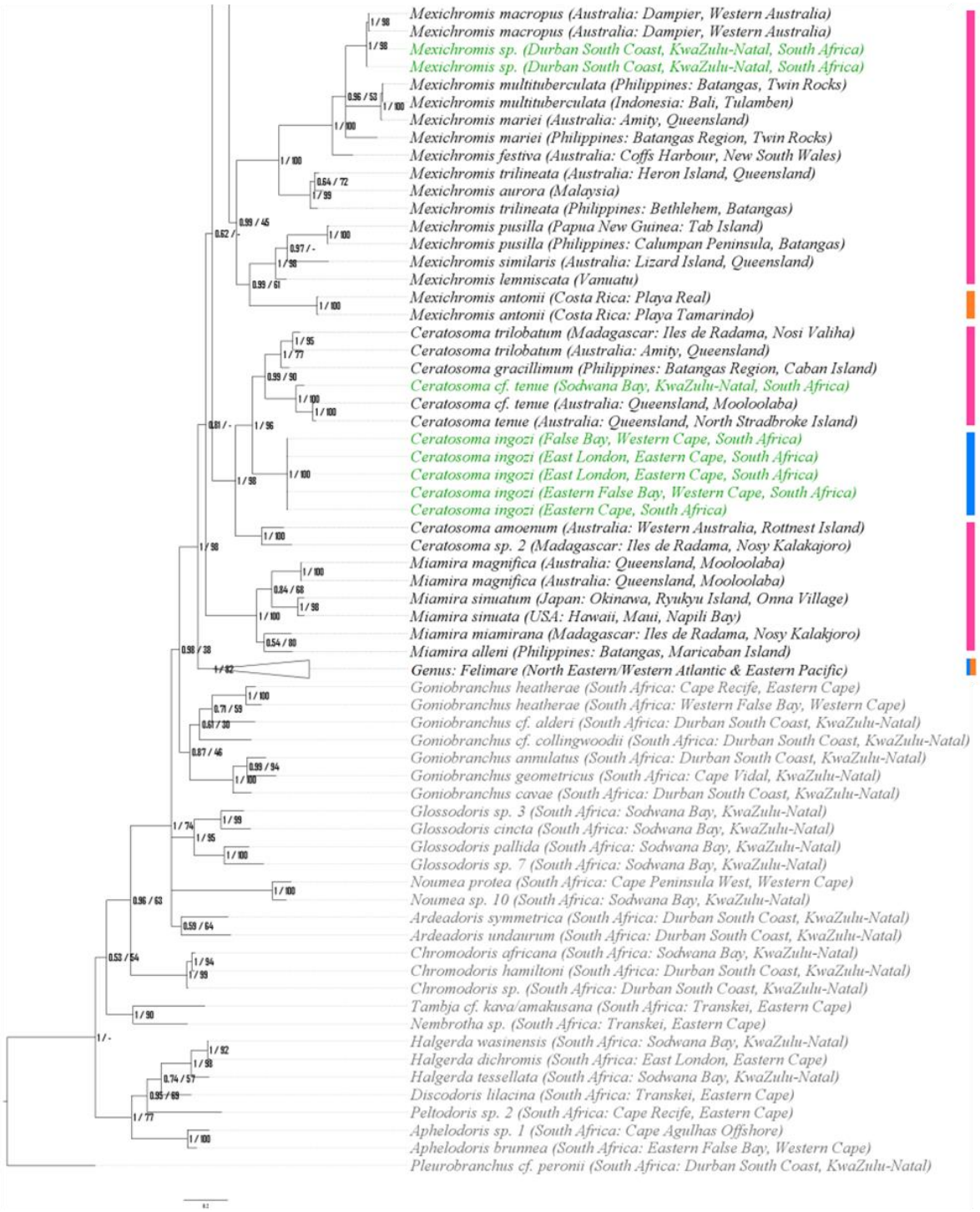

Figure 3.6 Bayesian tree of combined mitochondrial (COI+16S) of the Family Miamirinae, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". South African taxa have a green colour and outgroup taxa a grey colour. Coloured bars indicate region specimes were obtained from.

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Subfamily Polycerinae

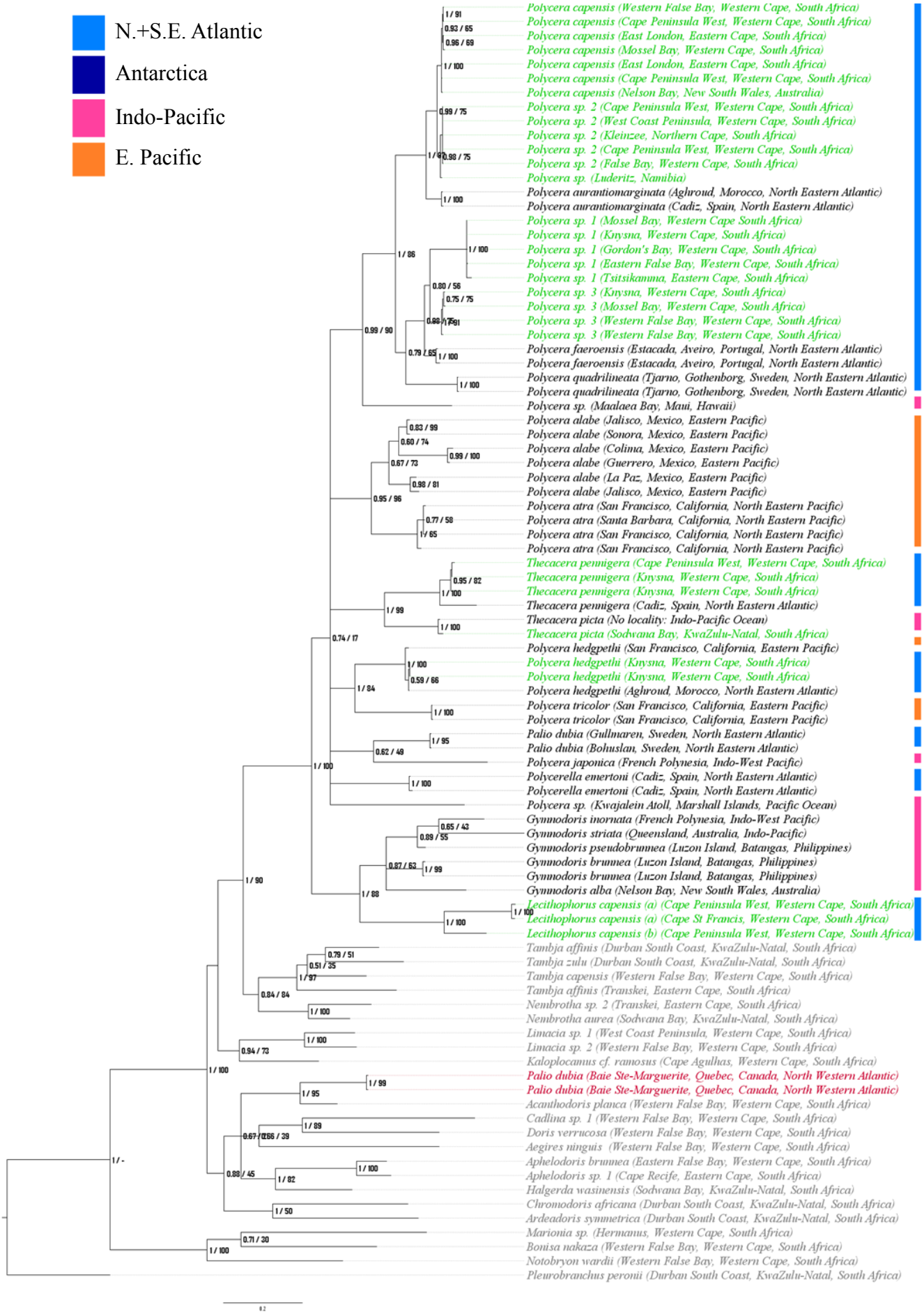

Figure 3.7 Bayesian tree of combined mitochondrial (COI+16S) of the Family Polycerinae, with posterior probabilities and maximum likelihood bootstrap support presented at each node as: "PP / BS". South African taxa have a green colour and outgroup taxa a grey colour, misidentified *Palio dubia* from Canada are coloured in red. Coloured bars indicate region specimes were obtained from.

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3.3.3.6 Discrepancies with published sequenced data on GenBank

A total of 82 species sampled in this study supposedly are not endemic and have wide geographical distributions, although only 64 of these have representatives on GenBank for which to compare sequence identity against. Of the 64 species with global representatives that have sequences available on GenBank, a total of 26 of the South African taxa were revealed to be cryptic genetic lineages unique to South Africa (with >5% COI divergences; although the majority had >10% COI divergence); and 27 revealed high sequence identity to their global conspecifics (and some to species identified under a different name) on GenBank (Table 3.1; Appendix 2.10b). Additionally, 11 of the 64 South African taxa when compared to conspecific taxa from different global localities on GenBank, revealed both cryptic genetic lineages as well as lineages with high sequence identity, indicating a geographical overlap in divergent lineages within species across certain regions (Table 3.1; Appendix 2.10b).

3.3.3.7 Patterns of historical biogeographical relationships

Genetically verified sister species relationships recovered from other publications and the trees constructed in this study counted 96 and are listed in Appendix 3.7. Maps generated in Tableau desktop plotting sister relationships with links to each of the ecozones on the South African coastline are displayed in Fig. 3.8.

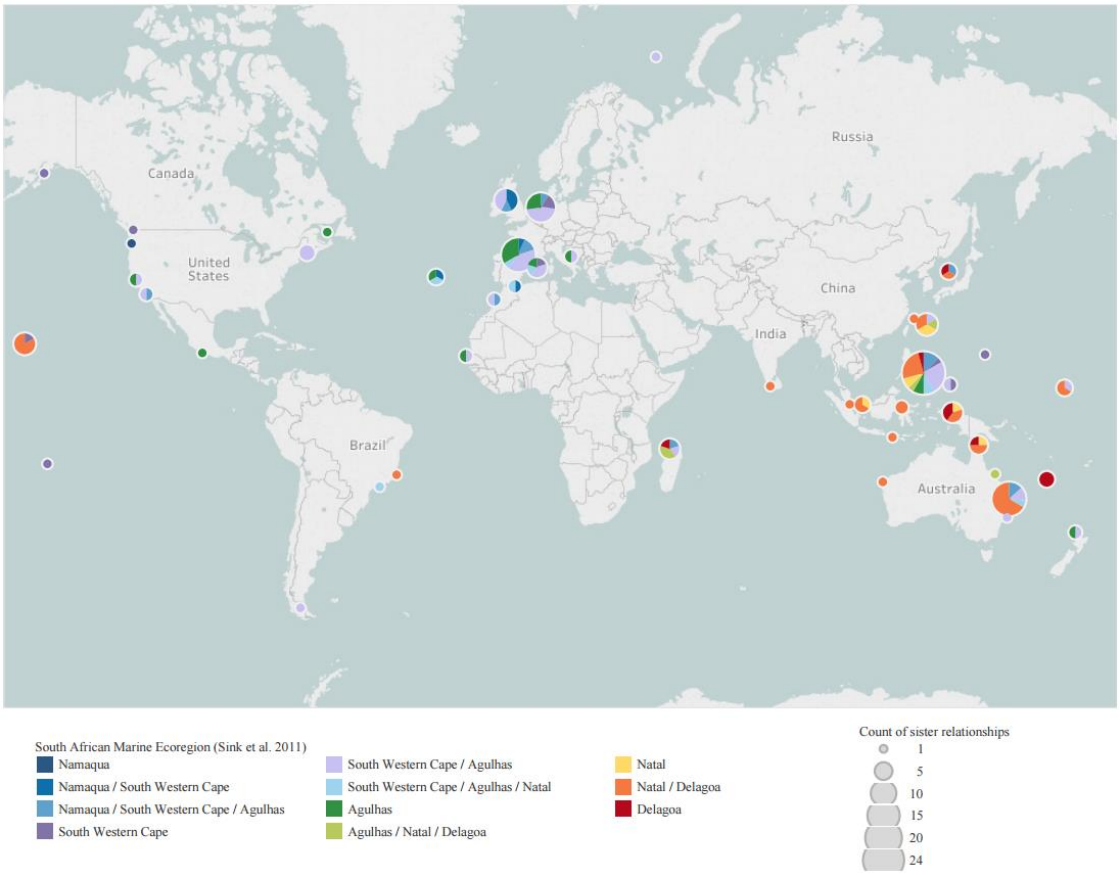

Figure 3.8 Map displaying the distribution of nudibranchs that are genetic sister-species to South African species tested. Global localities are grouped by marine ecoregion (as in Spalding et al. 2007). Pie-charts display the ecozone within South Africa that sister-species are linked to. Sizes of circles increase with the number of sister-species relationships a region has with South Africa.

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	Cryptic to global relatives	Genetically distant (cryptic) to conspecifics from	Genetically similar to conspecifics (or another species) from
1	*Ardeadoris undaurum*	-	Australia (WA)
2	*Baeolidia* cf. *moebii*	Philippines, Hawaii, Marshall Islands	-
3	*Bulbaeolidia* cf. *alba*	Malaysia, Philippines, Japan, Brazil	Hawaii (*Aeolidiidae* gen. sp. A)
4	*Caloria* cf. *indica*	Hawaii, No location	-
5	*Ceratosoma* cf. *tenue*	Australia (QLD), Hawaii	-
6	*Chromodoris africana*	-	Madagascar
7	*Chromodoris hamitoni*	Madagascar	-
8	*Chromodoris cf. strigata*	-	Madagascar, Australia, Philippines
9	*Cuthona sibogae*	No locality	-
10	*Dendrodoris krusensterni* (a)	Japan, New Caledonia, New Zealand	-
11	*Dendrodoris krusensterni* (b)	Japan	New Caledonia
12	*Dendrodoris nigra*	-	Australia (GBR), Japan
13	*Dendrodoris* cf. *tuberculosa*	Australia (QLD), New Caledonia	-
14	*Discodoris lilacina*	-	Spain (*D. confusa*)
15	*Doriopsilla areolata*	Spain, Portugal, Angola, Cape Verde, Japan	Cape Verde, Spain
16	*Doriopsilla sp. 1*	Spain, Portugal, Angola, Japan	Cape Verde, Spain
17	*Doris* cf. *verrucosa*	Italy	-
18	*Doto coronata*	-	All North Atlantic specimens (*D. coronata*)
19	*Doto cf. pinnatifida*	Wales, Spain	-
20	*Flabellina rubrolineata* (a)	-	Australia (QLD)
21	*Flabellina rubrolineata* (b)	Australia (QLD)	-
22	*Glaucus atlanticus*	-	Worldwide tropical Oceans
23	*Glaucus marginatus*	-	Indian and Indo-Pacific Oceans
24	*Glossodoris* cf. *pallida*	Australia (QLD), Philippines	-
25	*Glossodoris cincta*	Philippines	Madagascar, Australia (QLD)
26	*Glossodoris* sp. 3 (cf. *cincta*)	-	Madagascar
27	*Goniobranchus annulatus*	-	Iran
28	*Goniobranchus cavae*	-	Australia (QLD) (*G. leopardus*)
29	*Goniobranchus* cf. *alderi*	Australia (QLD), Philippines	-
30	*Goniobranchus* cf. *collingwoodi*	Australia (QLD)	Bali
31	*Goniobranchus conchyliatus*	Australia (QLD)	India (SW), Hawaii (*G. vibratus*)
32	*Goniobranchus geometricus*	-	Madagascar, Australia (QLD)
33	*Halgerda* cf. *tesselata*	Lifou, New Caledonia	-
34	*Goniodoris castanea*	-	Sweden
35	*Hypselodoris* cf. *bullocki*	Japan, Philippines	-
36	*Hypselodoris infucata*	Australia (NSW), Iran	Madagascar, Australia, Indo-Pacific
37	*Hypselodoris pulchella*	-	Australia (QLD), New Caledonia
38	*Hypselodoris zephyra*	-	Australia (QLD, NSW), Bali, Madagascar
39	*Jorunna funebris*	-	No locality
40	*Jorunna tomentosa*	-	Sweden
41	*Kaloplocamus* cf. *ramosus*	Azores, Australia (NSW)	-
42	*Limacia clavigera* (a)	Sweden	Spain
43	*Limacia clavigera* (b)	Spain, Sweden	-
44	*Marionia* cf. *arborescens*	Philippines	-
45	*Mexichromis mariei*	Philippines, Australia (QLD), Bali	Australia (WA) (*M. macropus*)
46	*Nembrotha aurea*	-	Comores
47	*Nembrotha sp.*	-	Philippines (*N. cristata*), Philippines (*N. gutatta*), Philippines (*N. livingstonei*), Philippines (*N. mullineri*), Philippines (*Nembrotha* sp.1, sp.2), Australia (NSW) (*Nembrotha* sp. 4)
48	*Phyllydia ocellata* (a)	Australia (QLD), No locality	Indonesia

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49	*Phyllydia ocellata* (b)	Australia (QLD), Indonesia, No locality	-
50	*Phyllidia* cf. *varicosa*	Malaysia, Indonesia, Australia (QLD)	-
51	*Phyllidiopsis gemmata/kremfi*	-	Indonesia
52	*Phyllodesmium magnum*	-	Eastern Malaysia, Philippines
53	*Phyllodesmium* cf. *macphersonae*	Eastern Malaysia	-
54	*Piseinotecus* sp.	Philippines	-
55	*Polycera capensis*	-	Australia (NSW, invaded from SA)
56	*Polycera hedgpethi*	-	Morocco, USA (California, SF)
57	*Polycea* cf. *quadrilineata*	Sweden	-
58	*Pteraeolidia* cf. *semperi*	Australia (QLD, NWS, WA), Indo-West Pacific, Philippines, Malaysia, Red Sea	-
59	*Tambja affinis*	-	Comores
60	*Tambja* cf. *kava*	Japan, Vanuatu	-
61	*Tergipes* cf. *tergipes*	All North Atlanic specimens	-
62	*Thecacera* cf. *pennigera*	Spain	-
63	*Thecacera picta*	-	No location
64	*Thorunna horologia*	-	Hawaii (*T. danielae*)

Table 3.1 Global cryptic diversity. Lineages from South Africa recovered in this study that appear to be cryptic to their (currently thought to be conspecific) global relatives as well as those are currently thought to be different species, that appear to have identical gene regions. See Appendix 2.10b for uncorrected p-distance comparisons.

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3.4 Discussion

This chapter used the distributions of the present day as well as historical relationships to better understand how the South African nudibranch fauna is structured along the coastline, how it was connected to worldwide coastal regions in the past and how it is linked today. With this information, we can start exploring the biogeographical history and how the unique fauna that exists in South Africa came about, explore what likely influenced distributional patterns in the past, and explore the drivers of contemporary patterns we find today.

3.4.1 Contemporary distributional patterns of South African nudibranchs

3.4.1.1 Distributional patterns within South Africa

Fig. 3.2 reveals eight clusters of localities with similar nudibranch fauna along the South African coastline. These are slightly different to the regions delineated based on opistobranch faunal distributions in Gosliner (1987ab) (outlined by colour-shaded boxes), specifically those areas west of East London (clusters 4-8); interestingly, they show the Transkei to be more similar in composition to East London/Port Alfred and the south coast (cluster 4, 5 and 6) rather than to the KwaZulu-Natal coastline (cluster 1 and 2). These discrepancies are likely due to the greater coverage of nudibranch recordings in South Africa that exists today than what was available in the 1980s when the previous analyses were performed. These findings also do not match the coastal marine ecoregions of the NBA (Sink et al. 2012). Firstly, Port St Johns and Coffee Bay (cluster 3), located in the Natal Ecoregion, group with East London and Port Alfred (cluster 4) of the Agulhas Ecoregion and secondly, Cape Peninsula West, located in the South Western Cape Ecozone of the Southern Benguela Ecoregion, here groups with western False Bay – Walker Bay (cluster 6) of the Agulhas Ecoregion.
Some of these findings can be attributed to sampling biases, for example, sightings from Melkbosstrand and the West Coast Peninsula are not recorded as extensively, nor are they dived as frequently by recreational divers compared to the dive sites of Cape Peninsula West. The region between Walker Bay and Cape Infanta is also very poorly sampled and could not be sampled in this study (see § 2.2.2). Additionally the regions from Port Alfred to East London and Coffee Bay to Port St Johns (cluster 3 and 4) appear to be two very unique faunistic areas, showing <50% faunal similarity to either of their neighbouring regions. Both of these areas are also still very poorly sampled for nudibranchs, mainly due to difficulty of diving conditions in the area throughout the year, and limited logistical access to coastal dive sites. Importantly, the dendrogram shows that more fine scale sampling along the coast can detect more detailed patterns of faunistic similarity along the coastline.

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3.4.1.2 Distributions patterns of conspecific species across global marine regions

Fig. 3.3 shows that South Africa currently shares the greatest proportions of its nudibranchs throughout the Indo-Pacific, however these nudibranchs only represent a small part of our eastern coastline, namely the Natal and Delagoa regions. Importantly species with distributions from the eastern extent of the Agulhas region to Delagoa share species in the widespread Indo-Pacific region, although these make up only a small proportion. Similar patterns were found for the opisthobranch fauna in Gosliner (1987b) and are comparable to findings of other marine fauna in South Africa, for example seaweeds: Bolton et al. (2004), other invertebrates: Sink et al. (2005), Awad et al. (2002), as well as fishes: Turpie et al. (2000). The fauna on the southern and western coastline of South Africa (Namaqua, Southwestern Cape and Agulhas regions) holds a high proportion of endemic species, is not as speciose as the Natal and Delagoa regions, and thus shares only a small proportion of its nudibranchs almost exclusively with the northern (/northeastern) Atlantic Ocean, with few species also found in the northeastern, northwestern and southwestern reaches of the Pacific Ocean. These patterns are again comparable to findings of opistobranchs in (Gosliner 1987b) and other marine faunal groups such as other invertebrates: Vermeij (1992), Awad et al. (2002) and reef fishes: Floeter et al. (2008). It must be taken into account that these connections have not all been confirmed through molecular data and may change as a result as more cryptic species are revealed. For example, of the 20 identified morphospecies that were once thought to be shared with the northern Atlantic before molecular data were available; genetic data for 12 of these have now been compared, of which at least seven (~58%) display species-level divergence (Table 3.1; Appendix 2.10b; and see Goodheart & Valdes 2013, Carmona et al. 2014b, Palomar et al. 2014, Shipman & Gosliner, 2015). Several other marine species have also revealed divergent genetic lineages between species found in the south eastern Atlantic and northeastern Atlantic (reviewed in Teske et al. 2011, Miller et al. 2012). Additionally of 64 Indo-Pacific morphospecies that were compared in this study, 19 (~30%) are revealed to be unique to southern Africa (Table 3.1; Appendix 2.10b). More studies are finding lineages that restricted to southern Africa or the South West Indian Ocean as opposed to widespread distributions across the Indian Ocean and Indo-Pacific (e.g. Zemlak et al. 2009, Hoareau et al. 2013). These patterns will be further discussed and explored in the next section.

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3.4.2 Inferred historical patterns and connections to global marine regions

A list of putative sister species of the South African opistobranch fauna was published by Gosliner (1987b), based on synapmorphies (Gosliner and Ghiselin 1984) with same the goal of understanding historical links of the South African opisthobranch fauna (see Table 3.2). When observing the table, it becomes clear that a major limitation of testing patterns using molecular data is the lack thereof; even though we have genetic data for almost all the South Africa species listed in the table, global data are only available for 11 of the 35 possible sister-species relationships. Of these, four are confirmed and seven are rejected (through published phylogenies and the phylogenies presented in this study) and when there were no sequences available to test the possible sister-species, but close relationships with other nudibranchs species were recovered, these were added. Interesting relationships to further explore would be the connections to southern Australia and New Zealand, of which only one (*Aphelodoris* sp. 1 and *A. luctuosa*) was able to be tested and is here confirmed. A large amount of sequence data on nudibranch taxa are being published or made available every year, as the data in this study will be, and in the near future these patterns and relationships will become clearer.

A total of 96 well-supported close sister-relationships were recovered: 84 with species from other regions globally, and 14 within South Africa (Fig. 3.8; Appendix 3.6). These relationships reveal a strong historical connection of the Namaqua and Agulhas regions to European waters in the past, and to fewer regions of the western and eastern Pacific. The Natal and Delagoa regions show historical connections to Indo-West Pacific primarily, with additional connections to the Red Sea, western Africa, and southern Brazil (Fig. 3.8).

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South African endemic	**Possible sister**	**From**	**Confirmed / Rejected**	**Phylogenetic sister recovered**	**From**
Geitodoris capensis	*G. planata*	N. Atlantic	Sequence not available	*G. heathi*	N.E. Pacific
Aphelodoris brunnea	*A. varia*	Australia NSW	x		
Aphelodoris sp. 1	*A. luctuosa*	New Zealand	Confirmed	*A. luctuosa*	New Zealand
Gargamella gravastella	*G. latior*	s. America	x		
Gargamella bovina	*G. latior*	s. America	x		
Rostanga elandsia	*R. setidens*	N. Atlantic	Sequence not available	*R. pulchra*	N.E. Pacific
Aldisa benguela	*A. banyulensis*	N. Atlantic	x		
Aldisa trimaculata	*A. zetlandica*	N. Atlantic	Sequence not available	*A. albatrossae*	Indo-Pacific
Ceratosoma ingozi	*C. brevicaudatum*	s. Australia	x		
Goniobranchus heatherae	*G. splendida*	s. Australia	Sister to clade with *G. splendida*, *G.* cf. *alderi*, and *G. tinctorius*		Australia (QLD & WA)
Hypselodoris capensis	*H. carnea*	Indo-Pacific	Sister to clade with *H. carnea and H. bollandi*		Durban & Indo-Pacifc
Dendrodoris caesia	*D. grandiflora*	N. Atlantic	Sequence not available	*D. arborescens*	Japan
Corambe sp.	*C. testudinaria*	N. Atlantic	Sequence not available	*Corambe steinbergae*	
Goniodoris mercurialis	*G. castanea*	N. Atlantic	x		N.E. Pacific
Trapania cirrita	*T. lineata*	N. Atlantic	x		
Polycera capensis	*P. quadrilineata*	N. Atlantic	Rejected	*P. aurantiomarginata* (in Palomar et al. 2014)	N.E. Atlantic
Lecitophorus capensis	*Paliolla cooki*	s. Australia	x		
Lecithophorus sp.	*P. cooki*	s. Australia	x		
Tambja capensis	*T. morosa*	Indo-Pacific	Rejected	*No close sister found*	
Acanthodoris planca	*A. molicella*	Auckland Is.	Sequence not available	*A. falklandica* (in Hallas & Gosliner, 2016)	S.E. Pacific/S.W. Atlantic
Melibe rosea	*M. australis*	s. Australia	Sequence not available	*M. engeli* (Gosliner & Pola, 2012)	Indo-Pacific
Melibe liltvedi	*M. australis*	s. Australia	x		
Leminda millecra	*Telarma antarctica*	Antarctica	x		
Dermatobranchus spp.	*Genus restricted to Indo-Pacific*	Indo-Pacific	x		
Bonisa nakaza	*Galeojanolus ionnae*	New Zealand	Sequence not available	*Janolus sp. 1, 2 & 7* (Pola & Gosliner, 2010)	Indo-Pacific
Janolus capensis	*J. novozealandicus*	New Zealand	Sequence not available	*Janolus barbarensis* (Pola & Gosliner, 2010)	Indo-Pacific

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Janolus longidentatus	*J. novozealandicus*	New Zealand	Sequence not available	*Janolus barbarensis* (Pola & Gosliner, 2010)	Indo-Pacific
Flabellina capensis	*F. lineata*	N. Atlantic	x		
Flabellina sp. 1	*F. albomarginata*	New Zealand	Sequence not available	*F. rubrolineata (low support)*	Sodwana Bay & Australia (QLD)
Flabellina funeka	*F. affinis*	Mediterranean	Rejected	*F. ischitana*	N.E. Atlantic
Cuthona speciosa	*C. caerulea*	N. Atlantic	Confirmed	*not strongly supported*	N.E. Pacific
Facelina olivacea	*F. bostoniensis*	N. Atlantic	Confirmed		
Caloria sp. 1	*C. elegans*	N. Atlantic	Confirmed		
Amanda armata	*Nanuca sebastiani*	N. Atlantic	Rejected	*No close sister found*	
Cratena capensis	*C. peregrina*	Mediterranean	Sister to a clade with *Cratena peregrina* and *Cratena* sp. 1		South Africa, E-N.E. Atlantic

Table 3.2 Phylogenetic sister species inferred based on morphological synapmorphies in Gosliner (1987b) which have been confirmed or rejected in published studies and in this study using genetic data.

3.4.3 Possible explanations of historical biogeographical patterns of South African nudibranchs

Although phylogenies in this study have not been dated, and the divergence times between sister species are not known, comparisons to phylogenies and findings in other published research can give us clues as to what caused the divergences between South African species and their global sister-species. A discussion on the historical biogeographical patterns and possible explanations for the sister species relationships recovered, with examples from other studies, follows below and refers to Fig. 3.8.

North eastern and south eastern Atlantic sister relationships

Species from the Namaqua, South Western Cape, Agulhas, Natal and Delagoa regions appear to have recent historical connections (i.e. sister-species/lineages) with the north eastern Atlantic. Sister relationships and population genetic divergences between north eastern Atlantic and southeastern Atlantic species have already been demonstrated in other nudibranchs (Palomar et al. 2014, Shipman & Gosliner 2015) and for many temperate species for example fishes: Grant & Leslie (2001), Silva et al. (2014), and other invertebrates: Vermeij (1992), Miller et al. (2012). Divergence is attributed to a phenomenon called ‘anti-tropical’ divergence (Hubbs 1952, Briggs 1987), where cold-adapted species are unable to penetrate the belt of elevated sea surface temperatures across the equatorial region. It is unclear when species traversed the region, as divergence times differ between species although they are mainly shown to be associated with (although not limited to) the start of Pleistocene glacial

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terminations (D'Amato et al. 2008, Silva et al. 2014). Interestingly these have mainly been recovered along the eastern continental margins (Bowen et al. 2016).

Southwestern Atlantic sister relationships

Connections between the southeastern and southwestern Atlantic are poorly understood. A connection with the Natal region (*Bornella valdae* see §2.1.2) was established in Pola & Gosliner (2010) and a few more connections were demonstrated in this study. The Agulhas region has been suggested as a colonization passage to Brazil for certain fishes and invertebrates from the Indian Ocean (Vermeij and Rosenberg 1993, Rocha et al. 2005, Floeter et al. 2008). These species are suggested to have traversed the Benguela upwelling system (Shannon 1985) barrier by means of warm eddies that splice off the Agulhas current when it meets the coastal shelf off southern Africa and retroflects (Lutjeharms & Cooper 1996, Beal et al. 2011) or during repeated interruptions in the cold water upwelling at the end of glacial maxima (Peeters et al. 2004).

North eastern Pacific sister relationships

The cool temperate regions of Namaqua, South Western Cape and Agulhas reveal recent historical connections to the north eastern Pacific and northern Atlantic. These most likely indicate recent introductions from the northern Pacfic/ Atlantic, i.e. human mediated or older anti-tropical connections via the northern Atlantic Ocean (see for example: *Eubranchus* sp. 6 which is sister to a clade containing species distributed across northeastern Pacific to the northern Atlantic in Fig. 3.5), however other mechanisms of connections between these distant regions have been explored. The North Pacific Ocean is suggested to have acted as an 'evolutionary engine' in the past in Briggs (2003) as it appears many taxa globally have originated in this region, due its high productivity, relative stability through glaciations and large expanse (Briggs & Bowen 2013). Species from the North Pacific could have been able to cross biogeographic boundaries, for example into the northern Atlantic via 'trans-Arctic-interchange' established c. 3.5 Mya, which is suggested to have been mainly unidirectional from northern Pacific into the northern Atlantic (Vermeij 1991, 2005, Briggs 1974). Further, northern Pacific species have been shown to even cross hemispheres by a number of hypothesized pathways which defy traditional oceanographic current patterns (reviewed in Briggs and Bowen, 2013), for example through isothermic submergence, whereby species moved beneath the tropics at great depth. Upwelling is also given as a possible explanation for the manner in which some species could have used upwelling cells as stepping stones to cross biogeographic boundaries (reviewed in Briggs and Bowen 2013). It is clear that a huge complexity exists in the manner in which species disperse across enormous distances between hemispheres and between ocean basins. The links between species in the Northeast Pacific and Southeast Atlantic could be explained by similar phenomena although a significant amount of extra research and observations would be needed to verify these hypotheses.

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Southern Ocean sister relationships

South African and South American species of *Acanthodoris* revealed deeply divergent sister taxa in Hallas et al. (2016), with a dated phylogeny tracing the split to the late Miocene (Hallas et al. 2016). Scenarios explored by Williams et al. (2013), showed that periods of climatic cooling of the Eocene Oligocene transition, which coincided with the onset of the Antarctic Circumpolar Current (AAC) and changes in oceanography, ocean geochemistry and tectonic events led to the opening of the Drake and Tasman passages. This subsequently mixed deep sea layers increasing nutrient availability and resulting in a cascade of diversifications and range expansions in solarid gastropods and many other species, and connected Southern Ocean fauna with the Atlantic-, Indian- and Pacific Oceans during the Meiocene (reviewed in Williams et al. 2013).

The shallower divergence observed between *Aphelodoris* species in South Africa and New Zealand, may have occured via sporadic dispersal events with the west wind drift during glacial maxima when the oceanic subtropical front shifted northwards (Berger & Wefer 1996, Beal et al. 2011). One of the *Aphelodoris* sp. 1 individuals tested here which indicated a close sister relation to *A. luctuosa* from New Zealand, was trawled from a depth of 95m, indicating its tolerance to colder temperatures and perhaps its temperate origins.

Indo-West Pacific sister relationship

It is well known that the Coral Triangle supports the largest amount of marine biodiversity in the world, which is believed to be the result of a relatively stable, persistent tropical marine habitats throughout geological history (Pellisier 2014), accumulating, innovating and exporting genetic diversity to the neighbouring and peripheral areas of the Indian and western Pacific Oceans (Cowman & Bellwood, 2013). Repeated glaciations lowered sea-levels by -120m and exposed the shallow Sunda and Sahul shelves (Indo-Pacific Barrier) and caused changes in oceanographical characteristics, reducing habitable areas and connectivity between Indian Ocean and West Pacific Ocean faunas, resulting in many phylogeographical breaks in species that spanned the region (reviewed in Ludt & Rocha 2016). Surprisingly few species went extinct during this time and the repeated glaciations (repeated isolation and overlap of lineages) are believed to have resulted in the high genetic and species diversity that exists in the region today (Ludt & Rocha 2016). Many nudibranchs from Natal to Delagoa (e.g. Miamirinae Fig. 3.7; and see Appendix 3.4), examined in this study revealed genetic breaks or sister-relationships that are located mainly at this boundary between the eastern Indian Ocean and the West Pacific Ocean, likely reflecting the effect on the connectivity between the Indian and the West Pacific Oceans and the divergent lineages that established as a result of this historical Indo-Pacific Barrier. The coastal regions of the Indian Ocean still remain very poorly sampled for nudibranchs, and as more genetic data are made available, connectivity of the South African fauna to the rest of the Indo-Pacific will become clearer.

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Some nudibranchs from the Namaqua, Agulhas and South Western Cape also have close sisters in the Indo-Pacific (Fig. 3.8), and these most likely reveal successful colonization and establishment of taxa from the Indo-Pacific into the temperate and cool-temperate waters of South Africa. The study by Johnson & Gosliner (2012) on the family Chromodorididae together with this study revealed at least five species within Indo-Pacifc clades/genera that colonized and adapted to the temperate and cool-temperate waters of South Africa (*Goniobranchus heatherae, Hypselodoris capensis, Noumea protea, Glossodoris* sp. 2). RAxML trees indicate that a further five species from other families (*Dermatobranchus arminus, D. albineus, Dendrodoris caesia, Marionia sp. 2, Phyllodesmium horridum*) colonized temperate waters of South Africa from the Indo-Pacific.

Sister relationships recovered within South Africa

From the trees a few South African taxa (14) had their nearest sister-taxa located within South Africa and these likely reveal patterns of diversifications that have occurred strictly within South Africa under the influence of the ecological, and environmental influences. The most speciose species complex found in this study is distributed from the Namaqua region to the eastern edge of the Agulhas region, and is aptly named: *Cuthona speciosa*. More patterns such as these were recovered for other nudibranch genera, of which some appear to have overlapping distibitions (e.g. three overlapping lineages of *Goniobranchus heatherae*; three closely related taxa of *Cratena* within South Africa; three closely related taxa of *Halgerda*) and can been found in: Appendix 2.10a and Appendix 3.4.

When divergent lineages such as these overlap in distribution it is difficult to explain the patterns observed. For example, for *C. speciosa*, lineages were recovered with many overlapping lineages stretching the region of Lamberts Bay (Namaqua) to East London (eastern part of the Agulhas) (see also Fig. 2.7). Lineages reveal a deeper split between clade (e,d) and (a,b,c), and shallower divergences between the (a) (b) and (c). More research will need to be done to explain these patterns, however other studies pattern of genetic divergences have been explained through glacial refuges along the coastline (von der Heyden et al. 2011, Teske et al. 2011, Toms et al. 2014). In Toms et al. (2014) the paleo-shoreline of the Southern Coastal Plain (Agulhas Bank) that was exposed during glaciations was revealed to consist of long swaths of sandy beaches along much of the coastline as sea-levels regressed and transgressed, with only few available refuges for obligate rocky shore and reef species, likely resulting in the extirpation of many populations. Along the south and southeast coast, only few pockets of small refugial areas were available, whereas the rocky shoreline along a significantly larger proportion of the southwest coast persisted throughout the glacial cycles. Concordantly, higher genetic diversity was found in species along whose populations persisted throughout glaciations, whereas low genetic diversity was found for the populations along the eastern coastline, where populations underwent severe bottlenecks (von der Heyden et al. 2008, 2011). Present day rocky habitats along the coastline were re-established c. 9000 ya, allowing for population

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expansions into new favourable habitat outside of the refugia, resulting in a contemporary overlap of lineages. As *Cuthona speciosa* relies on shallow rocky reef habitats where their hydroid-foods are found (*Sertularella* spp.), it is likely they were affected in a similar way as the clinids were during glacial low-stands. Many other temperate nudibranchs restricted to shallow rocky reef were likely also affected in this manner.

Further, temperature appears to separate divergent clades in within *P. capensis* (*P. capensis* and *Polycera* sp. 2). In this study, *Polycera capensis* was tested along the Atlantic coast of the Cape Peninsula to East London, whereas *Polycera* sp. 2 here was tested from the western coast of the Cape Peninsula up to Lüderitz in Namibia.

Other explanations of divergences could be ecological adaptations such as dietary preferences, which has been demonstrated in Dotidae (Shipman & Gosliner, 2015). *Doto* cf. *pinnatifida* recovered in this study is exclusively found on the hydroid *Corhiza scotiae*, whereas the distantly related *D. coronata* tested in this study was found to be a generalist feeder, as are its northern Atlantic conspecifics in Shipman & Gosliner (2015). A study by Faucci et al. (2007) explored ecological speciation of species of the genus *Phestilla* in the western Pacific Ocean, where a shift in dietary preferences of corals resulted in divergent clades.

Clearly these interesting patterns underlying the divergence of clades within South Africa need to be further explored in future studies, including finer ecological, distributional and oceanographical data to support such hypotheses.

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CHAPTER FOUR: SUMMARY OF FINDINGS AND CONCLUDING REMARKS

This Masters project as part of the greater SeaKeys project aimed to unlock and update knowledge on South African nudibranch diversity. Although this is one of the more popular and better studied invertebrate groups, it is clear that a huge lack of information exists in our present records. Only few South African nudibranchs were genetically tested prior to this study and distributional records have not been accurately monitored or updated over the last few decades. In this study, I aimed to tackle this problem, and have updated knowledge on nudibranch diversity and biogeographical patterns within South Africa significantly. Below follows a summary of the main findings, as well as a discussion of some limitations and recommendations for future research directions.

4.1 Summary of findings

1) A list including distribution records of 382 putative South African species was assembled, using published literature and identification guides, online data bases such as the Sea Slug Forum, iSpotnature and the Sea Slug Atlas, and the SURG and Eastern Cape Scuba Diving websites as well as data collected in the present study (list presented in Appendix 2.7, written in pink*). This data includes several new species records along South Africa's coastline (50 range extentions in to RSA), and several potentially new species to science (21). New records were more frequently encountered along the eastern parts of the South African coastline (Eastern Agulhas Region, Natal and Delagoa), indicating the influx from the Indian Ocean via the Agulhas Current. New species records recovered during sample collections for this study (18) are displayed in Table 2.6.

2) Genetic sequence data (mitochondrial and nuclear genes) of 162 genetically distinct lineages (putative species) were recovered in this study, of which 130 have not been previously published and for which currently no genetic information was available. This data was used to construct phylogenetic trees which allowed examining of evolutionary relationships, the delineation of lineages and their distributional patterns.

Several cryptic lineage complexes (at least 16) were recovered for species that are currently understood to constitute one morphospecies. Cryptic lineages were recovered along the entire coastline, with the highest proportion found in the Agulhas region (Table 2.5). From the data recovered in this study it is likely that more (~20%) of the species currently recorded in South African waters, could form part of larger cryptic species complexes, i.e. currently unrecognized biodiversity. This data would not have been recovered using morphological characteristics alone, and demonstrates the value of molecular methods in species assessments.

Further, at least five misclassifications and misidentifications were brought to light using molecular data in this study (Table 2.4).

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3) The largest faunal breaks in nudibranch species distributions along the coastline, appear to lie at the eastern boundary of the Transkei, and Cape Point (Fig. 3.1). These patterns are reflected in the clades recovered on the phylogenetic tree of South African species (Fig. 3.2).

4) South Africa currently appears to share many nudibranch species across the Indian and Indo-Pacific Ocean and only few in the northern Atlantic (see Fig 3.3). The amount of shared species differs strongly between bioregions, with the Namaqua – Agulhas regions sharing species almost exclusively with the northern Atlantic, whereas the Natal and Delagoa regions share the majority of the species across the Indian and Indo-Pacific Oceans. However, in many of these areas especially in the Indian Ocean, very little genetic data of the nudibranchs exists, as such undetected cryptic morphospecies will likely be recovered as more genetic studies are being performed, which will very likely change our understanding of these patterns.

5) Through comparisons of sequences of South African morphospecies to their conspecifics that reside in the northern Atlantic and in the Indo-Pacific, significant (species-level) sequence divergence was found for over 40% of species examined in this study. This indicates that the South African nudibranch fauna is more unique than previously thought, and is likely been isolated from close relatives in the Indo-Pacific and Atlantic Oceans for some time.

6) Close sister-relationships were recovered mainly with species outside of South Africa, for example in the northern Atlantic, the southwestern Atlantic, the western Pacific, northern Pacific and the Southern Ocean. Fewer sister species were found within South Africa.

4.2 Changes in our understanding of biogeographical patterns

4.2.1 Range extensions

Range extensions since previous assessments were detected in 32 species listed in Table 4.1. Most of these extensions are likely the result of increased (informal) recordings in previously under sampled areas, particularly in the Eastern Cape over the last years and in the Namaqua region in this study. Molecular data presented in this study (§ 3.3.3.5) strongly supports the hypothesis based on morphological data that *Polycera hedgepethi* is introduced in South Africa (Willan 1984, Wilson 2006, Mead et al. 2011b). *Polycera hedgpethi* is usually found in untroubled bays, lagoons and harbors in subtropical and warm temperate regions globally and is expanding in its range distribution, likely as a result of shipping activities (reviewed in Keppel et al. 2012). It is described from the eastern Pacific (California; Marcus 1964), which is currently its presumed origin (Keppel et al. 2012). In South Africa, it was originally discovered at Keurbooms River mouth (Gosliner, 1982) and it has since been found in the Knysna Lagoon and in Port Elizabeth, indicating a range extension to the east and to the west (Table 4.1, and Appendix 2.6).

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4.2.2 Biogeographical patterns along our coastline

To view the changes in understanding of the biogeographical patterns of Nudibranchia, current data was compared to data on nudibranchs recovered in Gosliner (1987b). As the Gosliner 1987 study encompassed all Opisthobranchia, and I only want to compare biogeographical patterns of taxa belonging to Nudibranchia; data on the Nudibranchia only was extracted from the supplementary material of this study, in order to recreate graphs of biogeographical affinities to global regions. To enable comparison to the patterns we find today, similar graphs were constructed for the updated nudibranch species list with distributional data from chapter two, using the same seven biogeographic regions and categories as Gosliner (1987b) to ensure consistency. Definitions of the categories species were placed in were as follows, and the resulting graphs are displayed in Fig. 4.1.

- Endemic: Restricted to Southern Africa
- Atlantic: Conspecifics found in another portion of the Atlantic
- Cosmopolitan: Conspecifics distributed globally, not limited to tropical or temperate regions
- Circumptropical: Conspecifics found in tropical regions of the Atlantic, Indian and Pacific Oceans
- Indo-Pacific: Conspecifics found throughout the tropical Indian and Pacific Oceans

When observing the patterns displayed in Fig. 4.1, both sets of graphs show clear patterns that were recovered in 1987 and still hold today: 1) there is a large endemic proportion which decreases sharply east of Port Alfred. East hereof the Indo-Pacific portion increases markedly and reaches a maximum at Kosi Bay in the Delagoa eco-region. 2) the largest proportion of Atlantic species is found in the South Western Cape, and these are completely absent from the regions to the east of Port Alfred. Then, there are a few major differences that immediately stand out when comparing the graphs generated using data from Gosliner (1987b) and the current data. Firstly, the presence of many more species in each region has been discovered over the years since the 1987 study, and as such the sample sizes are considerably larger, with the largest increases along the eastern parts of the coastline (> 250% increase from Cape St Francis – Kosi Bay). Numbers along the South Coast (Mossel Bay – Plettenberg Bay), the Transkei (Coffee Bay – Port St Johns) and a large part of the West Coast (north of Elands Bay) are still comparatively low when comparing them to their neighbouring regions, and are clearly still poorly sampled. Secondly, from these graphs we can deduce that the percentage of endemic species is much higher than originally understood, throughout the coastline. The once held notion that many South African nudibranch species were also found in wider regions globally (Atlantic, Indo-Pacific, circumtropical or cosmopolitan), has been challenged in recent years, specifically since the onset of molecular studies (e.g. Pola et al. 2012, Carmona et al. 2013, 2014b), including this study. As a result, the proportions in these categories have declined in most areas, whereas the proportion of endemics has greatly increased, and is likely to further increase as more molecular data becomes available.

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Species	Most Western Locality	Most Eastern Locality	Previous Range	Range Extension	
Acanthodoris planca	Vulcan Rock, Cape Town	Tsitsikamma	*False Bay*	West	East
Aldisa trimaculata	Bakhoven	Brazenhead, Transkei	*Oudekraal*	-	East
Amanda armata	Oudekraal	Hermanus	*Oudekraal*	-	East
Ancula sp.	Bloubergstrand	Knysna	*Bloubergstrand*	-	East
Aphelodoris sp. 1	Oudekraal	Port Elizabeth	*Llandudno - Danger Point*	-	East
Bonisa nakaza	West Coast Peninsula	Port Alfred	*West Coast - Port Elizabeth*	-	East
Cadlina sp. 3	Partridge Point	Algoa Bay	*Algoa Bay*	West	-
Ceratosoma ingozi	Western False Bay	East London	*Port Elizabeth*	-	East
Cuthona speciosa (a)	Lamberts Bay	East London	*Oudekraal - Port Elizabeth*	West	East
Cuthona sp. 6	Oudekraal	Port Elizabeth	*Oudekraal*	-	East
Dendrodoris caesia	Cape Point	Transkei	*Cape Point - Port Elizabeth*	-	East
Dermatobranchus albineus	West Coast Peninsula	Port Elizabeth	*Oudekraal - Port Elizabeth*	West	-
Facelina olivacea	Walvis Bay (Namibia)	Port Elizabeth	*Cape Town - Jeffery bay*	West	East
Flabellina capensis	Oudekraal	East London	*Cape Town - Port Elizabeth*	-	East
Flabellina funeka	Cape Point	East London	*Cape Point - Port Elizabeth*	-	East
Flabellina sp. 1	Lamberts Bay	Western False Bay	*Windmill Beach - Dassie Point*	West	-
Geitodoris capensis	Port Nolloth	Port Alfred	*Kommetjie - Port Alfred*	West	-
Glossdoris cf. *pallida/* sp. 2 (a)	Transkei	Sodwana Bay	*Northern KZN, TRG*	West	-
Goniobranchus heatherae	Cape St Francis	East London	*Cape Town - Port Elizabeth*	-	East
Hypselodoris capensis	Cape Peninsula West	Durban South Coast	*Cape Point - Transkei*	-	East
Janolus capensis	Kleinzee	East London	*Cape town - East London*	West	-
Lecithophorus capensis (a)	Oudekraal	East London	*Cape Province*	-	East
Leminda millecra	Cape Peninsula West	Durban (offshore)	*Cape - Natal coast*	-	East
Marionia sp. 2	Port Elizabeth	Brazenhead, Transkei	*Algoa Bay*	-	East
Noumea protea	Oudekraal	Port Elizabeth	*Oudekraal - False Bay*	-	East
Paradoris sp.	Oudekraal	Port Elizabeth	*Oudekraal - False Bay*	-	East
Polycera capensis	Lüderitz, Namibia	East London	*Lüderitz - Port Alfred*	-	East
Polycera hedgpethi	Knysna	Port Elizabeth	*Keurbrooms River mouth*	West	East
Rostanga elandsia	West Coast Peninsula	East London	*Oudekraal - Rooi Els*	West	East
Tambja capensis	Oudekraal	East London	*Oudekraal - Port Elizabeth*	-	East
Tritonia nilsodhneri	Oudekraal	Hermanus	*Oudekraal - Western False Bay*	-	East

Table 4.1 Range extensions of nudibranchs within South Africa. Species and their current eastern and western distributional ranges, which were noted when compiling the South African species list (Appendix 2.6). Previously recorded ranges and the direction of range extensions are displayed in the last three columns.

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Figure 4.1 Biogeographical affinities of South African nudibranchs, according to: a) data published in the Gosliner (1987b) study and b) current data, including findings of the present study. Graphs and map modified from Gosliner (1987b). Numbers in grey boxes depict the number of species used in the analysis of each region.

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4.3 Future research

As is evident from this study, much more work needs to be done to fully grasp the biodiversity and patterns that exist in South Africa, and some fascinating future projects can follow from the results and conclusions obtained in this study.

Sampling biases

In Fig. 4.2 it can be seen that the majority of the 336 sequences were obtained from specimens collected in the localities Sodwana Bay, Durban South Coast and False Bay. When observing the localities of nudibranch observations on iSpotnature (Fig. 4.3) a similar pattern emerges. Naturally, the most heavily dived areas will have the most species recordings.

It was attempted to sample the regions evenly, although time, costs and weather restraints limited sampling capability. Many of the more commonly found nudibranchs were not yet genetically examined, and so I had to sample the more heavily dived areas first in order to include as many species as possible to the project. Most of the more common nudibranchs from heavily dived areas are now included and so future research can focus more effort on sampling the rarer nudibranchs as well as the understudied and highly unique areas along the West Coast, the south coast and along the Transkei.

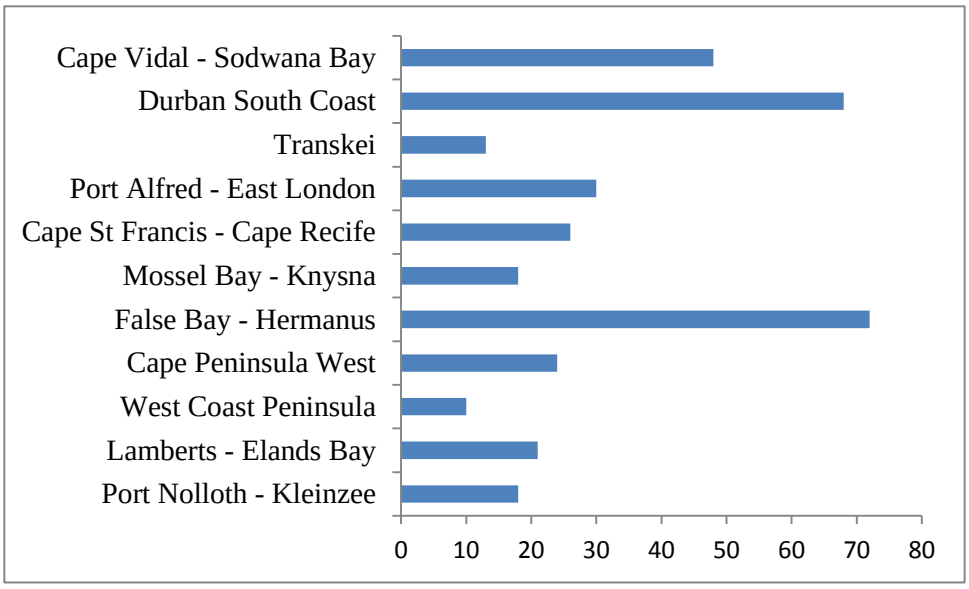

Figure 4.2 Number of specimens included in the phylogenetic analyses per collection locality.

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Genetic research

Many South African species have yet to be genetically barcoded and there are likely many more species complexes to be found. This study has highlighted the importance of collecting multiple individuals of a species from each locality. Genetic research can now focus on exploring the extent and the evolutionary drivers behind the species complexes further, using population genetics in combination with other disciplines, for example studying the ecological and physiological aspects of the divergent clades, in order to better understand when lineages diverged and what is driving lineage diversification, i.e. how species are currently adapting and evolving, in order to preserve genetic diversity in our uncertain future. Further, molecular dating of phylogenetic trees will help us better explain the historical biogeography of South African species.

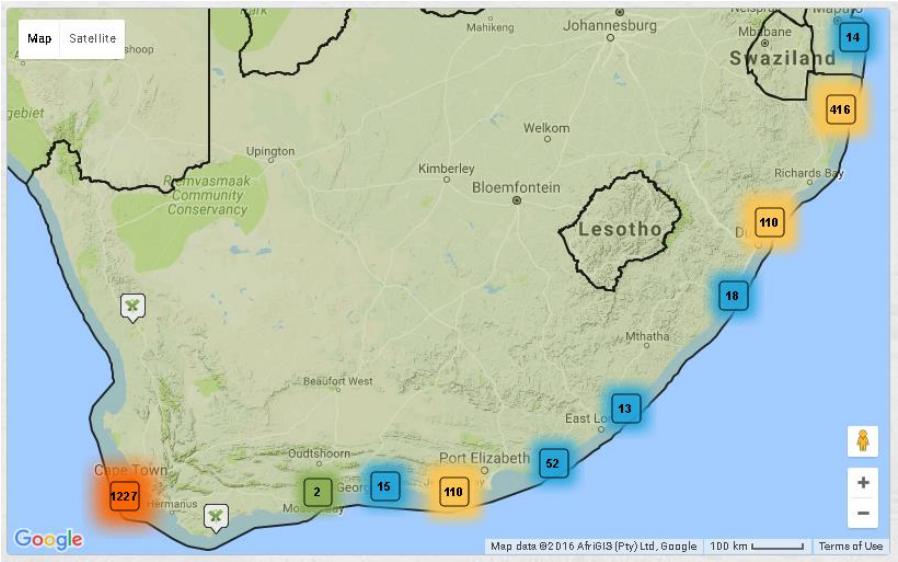

Figure 4.3 Localities of 2000 nudibranch observations uploaded onto iSpotnature.

Distribution ranges

Distributional data has herein been updated, including many range extensions of species within South Africa and those that have extended their ranges into South Africa from the Indo-Pacific. This enables us to more carefully track range extensions along the coastline in the future and helps us to better understand changes and the influence of other regions on the South African marine environment, highlighting the usefulness of nudibranchs as indicator species.

This enigmatic marine taxon is a fascinating study subject for a wide range of other disciplines (see § 1.5.2). Being a charismatic marine species they bridge the gap between scientists and the public, allowing everyone to marvel at and enjoy their mysteries and splendour. Through this study and the SeaKeys project, our knowledge has now been brought up to date and it will be interesting to see how these beautiful little colourful marine creatures will aid our understanding of the unique South African marine environment in the years to come.

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Appendix 2.1

Standard Operating Procedures for nudibranch collection

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Contact: Jessica Toms 0715167823 Stellenboch University Department of Botany and Zoology

Standard Operating Procedures for Nudibranch specimen collection and preservation:

NUDIBRANCHS:

- Photograph the specimen while in its natural environment (see figure 1.1), then carefully collect it in a tube.
- At the lab, put it in a petri-dish / shallow bowl with some sea water.
  Using a small ruler, take a photograph with it next to the nudibranch (or put it underneath the bowl if it's transparent), for me to estimate the size (see figure 1.2). Please make sure you get a good photo of the gills, their coloration and rhinophores.
- After taking the photographs you can just pop them straight into a 5 or 35 mL tube or a pot (depending on size of specimen) and fill the tube/pot up to ¾ full (specimen must be covered) with 100% ethanol.
- Cut out a piece of tracing paper (roughly 3x3cm), and write on it with a **pencil**:
  - the species name (specify colour morph if there are different morphs), or, if you don't know the name just write down the file name of the photograph,
  - dive site,
  - date, depth and water temperature (see figure 1.3).
- Put the piece of tracing paper into the tube (see figure 1.4).

Fig 1.1

Fig 1.2

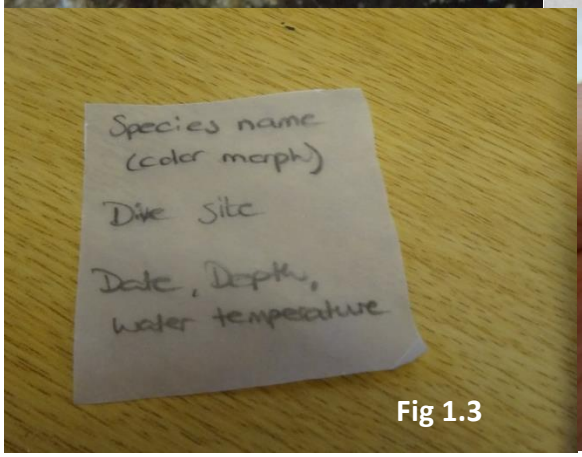

Fig 1.3

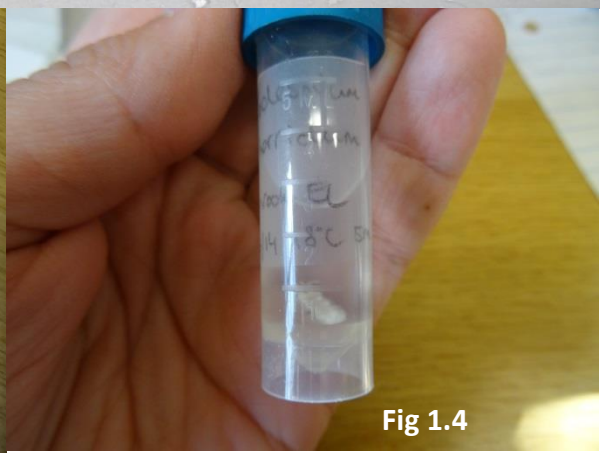
Fig 1.4

- If you can find more than one specimen of a species, please collect; 2-3 specimens would be ideal.
- If you get the chance, take a look at them under the microscope (in a petridish with some seawater), they are absolutely fascinating to observe, and it can help with the identification. You are welcome to note any strange features (e.g. rhinophore shape) or behaviours (e.g. gill/rhinophore retraction etc.).
- Thank you for your help with this project; it is very much appreciated!

Books to help you with identification:

1. Guido Zsilavecz; *Nudibranchs of the Cape Peninsula and False Bay;* SURG; 2007; ISBN 0-620-38054-3.
2. Dennis King & Valda Fraser; *The Reef Guide, fishes, corals, nudibranchs & other invertebrates, East & South Coasts of Southern Africa*; Struik Nature; 2014; ISBN 978-1-77584-018-3.
3. Terrence M. Gosliner; *Nudibranchs of Southern Africa: a guide to Opisthobranch Molluscs of Southern Africa*; 1987; ISBN 0-930118-13-8.
4. Terrence M. Gosliner, David W. Behrens, Ángel Valdés; *Indo-Pacific Nudibranchs and Sea Slugs: a field guide to the World's most diverse fauna*; 2008; ISBN 978-0-9700574-3-3.
5. Alternatively you could always email me a picture: jessica.toms@gmail.com

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Appendix 2.2

Collection Permits

South African NATIONAL PARKS

Permit No: CRC-2014-031

CAPE RESEARCH CENTRE

P.O. Box 216, STEENBERG, 7947
Tel: +27 (0)21 713 7511; Fax: +27 (0)21 712 0131

Research Permit: TABLE MOUNTAIN NATIONAL PARKS

10 September 2014

Jessica Toms – "Using a phylogenetic approach to uncover the evolutionary history and biogeographic patterns of South African nudibranch molluscs"
Co-workers: F. I. Gelletich & G. Zsilavecz
Department of Botany and Zoology
University of Stellenbosch
PO Box 7081
Stellenbosch
7599

Herewith the permit for your research project valid from **25 November 2014** until **30 November 2015**. Please familiarize yourself with the following. Please contact Park Management staff prior to entry into the park (see list of relevant staff members below). You are allowed access to the **MPA section of Table Mountain NP.**

Standard Conditions:

- Please note that you (your delegates, staff etc) are subject to the conditions set in terms of Section 86(1) of the National Environmental Management Act (107 of 1998) and the National Environmental Act: Protected Areas Act (Act 57 of 2003) for the duration of your stay in the National Park. Your attention is specifically drawn to sections 64(1) (a), (b) & (c) which refers to penalties in terms of the Act.
- The areas under the control of SANParks are used entirely at your own risk and SANParks shall not be liable for any claims, accidents, injuries or loss, etc. arising from such use.
- No damage shall be permitted to any natural vegetation, environment or property. Any damage done shall be made good at your expense. Strictly no fires, smoke machines or audible generators will be permitted. No braais or skottels allowed unless in dedicated braai areas. NO LITTERING. Please take all rubbish away with you. NO PETS ALLOWED.
- Your permit must be retained and kept on your person at all times, and produced on request.
- Please contact the park management staff if restricted areas need to be accessed.
- SANParks staff's instructions shall be complied with. Visitors to the area may not be hindered in any way. The research activity shall be restricted to the area applied for.

Special Conditions:

- Researchers may SCUBA dive in recreational dive areas.
- Dives may not take place in restricted areas without prior permission.
- Specimens will be photographed in their natural environments and collected into tubes filled with sea water, while SCUBA diving.
- No chemicals or foreign substances will be used to collect the samples and special care will be taken not to harm the reef environments in any way while collecting specimens.
- A minimum of two and a maximum of ten Nudibranch molluscs may be collected per species (10 collections in the case of 5 different colour morphs).
- Specimens will be deposited at the Iziko museum once research is complete.

addo elephant
agulhas
augrabies falls
bontebok
golden gate highlands
karoo
kgalagadi transfrontier
knysna lake area
kruger
mapungubwe
marakele
mountain zebra
namaqua
table mountain
tankwa-karoo
tsitsikamma
|ai-|ais/richtersveld
vaalbos
west coast
wilderness

Park - Area	Park Management Staff	Telephone Number:
TMNP - MPA	Ralph Kelly	021 786 5656

Yours faithfully,

Debbi Winterton, Science Liaison Officer; E-mail: deborah.winterton@sanparks.org

Permit No: CRC/2015/031--2014/V2

CAPE RESEARCH CENTRE

P.O. Box 216, STEENBERG, 7947
Tel: +27 (0)21 713 7511; Fax: +27 (0)21 712 0131

Research Permit: TABLE MOUNTAIN NATIONAL PARKS

09 February 2016

Jessica Toms – "Using a phylogenetic approach to uncover the evolutionary history and biogeographic patterns of South African nudibranch molluscs"

Co-workers: F. I. Gelletich & G. Zsilavecz
Department of Botany and Zoology
University of Stellenbosch
PO Box 7081
Stellenbosch
7599

Herewith the permit for your research project valid from **09 February 2016** until **30 November 2016**. Please familiarize yourself with the following. Please contact Park Management staff prior to entry into the park (see list of relevant staff members below). You are allowed access to the **MPA section of Table Mountain NP.**

Standard Conditions:

• The use of non-demarcated areas will lead to the disturbance of animals and eco-systems, trampling of vegetation and soil erosion and only the use of accepted pathways and areas is therefore permitted, UNLESS BY SPECIAL ARRANGEMENTS. PLEASE CONTACT THE PARK MANAGEMENT STAFF IF RESTRICTED AREAS NEED TO BE ACCESSED.
• No damage shall be permitted to any natural vegetation, environment or property.
• Animals may not be disturbed in any way.
• Uncontrolled vehicle access and parking could cause damage to vegetation and soil erosion and therefore only the use of approved vehicles routes and parking areas is allowed.
• Fires can cause loss of vegetation, soil erosion and life and therefore fires, and braai's are not permitted unless in dedicated braai areas.
• Remove all rubbish and waste as it has an effect on the health of visitors, animals and plants.
• Other visitors to the area and or neighbours may not be hindered in any way.
• Pollution affects the health and safety of animals, plants, visitors and neighbours and is not permitted.
• Excessive noise affects animals (e.g. birds nesting in the areas), visitors and or neighbours and is not permitted.
• Your permit must be retained and kept on your person at all times, and produced on request.
• The areas under the control of SANParks are used entirely at your own risk. South African National Parks, its Board, directors, employees and agents are not liable for any loss or damage to the property or possession of any guest or participant (or accompanying minor) whether such damage is caused by the negligent act or omission of South African National Parks; arising from death or any bodily injuries of whatsoever nature sustained by a guest or participant (or accompanying minor) whether such injuries are caused by the negligent act or omission by South African National Parks, and/or by the defective functioning of any apparatus. The guest or participant and/or his/her/their estate hereby indemnifies South African National Parks against any claim, action, judgment, costs and/or expenses which may be made against South African National Parks and as may in any way be related to the above. The onus lies with the company or applicant to ensure that they are adequately insured.
• Please note that you (your staff etc) are subject to the conditions of Section 86 of the National Environmental Management Act (107 of 1998) and the National Environmental Act: Protected Areas Act (Act 57 of 2003) and any other relevant legislation for the duration of your stay in the National Park (e.g. adherence to the Registrar's requirements for guides).

- SANParks staff's instructions, notices, regulations and signs must be complied with.
- The activity shall be restricted to the area applied for.
- Gate and operating times to be complied with.
- NO PETS ALLOWED

Special Conditions:

- Researchers may SCUBA dive in recreational dive areas.
- Dives may not take place in restricted areas without prior permission.
- Specimens will be photographed in their natural environments and collected into tubes filled with sea water, while SCUBA diving.
- No chemicals or foreign substances will be used to collect the samples and special care will be taken not to harm the reef environments in any way while collecting specimens.
- A minimum of two and a maximum of ten Nudibranch molluscs may be collected per species (10 collections in the case of 5 different colour morphs).
- Specimens will be deposited at the Iziko museum once research is complete.

Park - Area	Park Management Staff	Telephone Number:
TMNP - MPA	Ralph Kelly Ralph.Kelly@SANParks.org	021 786 5656

Yours faithfully,

Debbi Winterton, Science Liaison Officer; E-mail: deborah.winterton@sanparks.org

2015/08/19

Dear Madam,

APPLICATION TO DO RESEARCH IN THE GARDEN ROUTE NATIONAL PARK

PROJECT TITLE: Using a phylogenetic approach to uncover the evolutionary history and biogeographic patterns of South African nudibranch molluscs

It is my pleasure to confirm that your application to do research in the Garden Route National Park: Knysna Section has been successful. The attached front page of your application (approved by the Area Manager and General Managers) is your permit valid from 29 July 2015 - 31 December 2016. You must keep it handy at all times when in the park and it must be produced on request.

This approval grants you (Jessica Toms) and your co-workers (L. Claassens and Dr. S vd Heyden) free entrance to the Park. You are required to abide by the Parks' rules and regulations, which are available from the Area Manager.

This approval is subject to the standard conditions below. The Park Management staff must be contacted prior to entry into the park (see list of staff members below). Use may only be made of accepted roads and pathways, unless otherwise agreed with the Park Management staff. This permit gives access only to the Knysna Section of the Garden Route National Park.

Area	Park Management Staff	Telephone Number:
Knysna	**Johan de Klerk**	**044 382 2095**

Kind Regards

Jessica Hayes
Regional Ecologist
Garden Route: Scientific Services
PO Box 176
Sedgefield
6573
Tel: 044 343 1302
Fax: 044 343 2331
e-mail: jessica.hayes@sanparks.org

Standard Conditions:
No fires, littering and overnight camping shall be permitted;
No parking at entrances to fire fighting access roads;
No damage may be caused to indigenous flora and fauna or geological formations;
Any other instruction, issued in writing by any GRNP staff, to safe guard the environment or to protect persons against injury, will have to be adhered to.

Conservation Services: Rondevlei
P.O. Box 176 SEDGEFIELD 6573
Tel: 044 343 1302
Fax: 044 343 2331
E-Mail: jessica.hayes@s@sanparks.org
reservations@sanparks.org
Website: www.sanparks.org

Stellenbosch University https://scholar.sun.ac.za

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Enquiries: Dr Kim Prochazka
Tel: 021-402 3546
Fax : 021-402 3639
E-mail : researchpermits@daff.gov.za

Dr Sophie von der Heyden
Evolutionary Genomics Group
Department of Botany and Zoology
University of Stellenbosch
Private Bag X1
Matieland
7602

Attention: Dr Sophie von der Heyden

PERMIT FOR THE PURPOSES OF A SCIENTIFIC INVESTIGATION OR PRACTICAL EXPERIMENT IN TERMS OF SECTION 83 OF THE MARINE LIVING RESOURCES ACT, 1998 (ACT NO. 18 OF 1998).

I, the undersigned, Chief Director: Fisheries Research and Development, Branch: Fisheries Management, Department of Agriculture, Forestry and Fisheries (the Chief Director) acting in pursuance of the delegated authority conferred upon me by the Honourable Minister of Agriculture, Forestry and Fisheries as contemplated in terms of Section 79 of the Marine Living Resources Act of 1998 (Act No. 18 of 1998) ("the Act") hereby permit, in terms of Section 83 of the Act, the following person(s)/institution to engage in the scientific investigation or practical experiment referred to below:

PERMIT REFERENCE NUMBER: RES2014/37
PERSON(S)/ INSTITUTION: Dr Sophie von der Heyden, Evolutionary Genomics Group, Department of Botany and Zoology, University of Stellenbosch,
SCIENTIFIC INVESTIGATION OR PRACTICAL EXPERIMENT: Collection, possession and transportation of marine invertebrates and vertebrates for genetic research

subject to the following conditions:

1. GENERAL CONDITIONS

1.1. This permit is issued subject to the provisions and regulations of the following laws:
(a) The Marine Living Resources Act, 1998 (Act No. 18 of 1998) ("the Act"), and all regulations published in terms thereof;
(b) The National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"), and in particular, the regulations that control vehicle use in the coastal zone (as amended);
(c) The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);

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(d) The National Environmental Management Protected Areas Act, 2003 (Act No. 57 of 2003);
(e) The Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973); and
(f) The Prevention of Pollution from Ships Act (Act No. 2 of 1986).

1.2. This permit is intended to facilitate *bona fide* research, and should not be used for the purposes of financial gain by the Permit Holder.

1.3. If, in the opinion of the Chief Director there are sound reasons for doing so, the Chief Director may amend the conditions of the permit.

1.4. A breach of the provisions of the Act, regulations or these permit conditions by the Permit Holder may result in the initiation of legal proceedings (civil or criminal). A breach includes:

(a) furnishing information to which the Department of Agriculture, Forestry & Fisheries (the Department) is entitled, which is not true or complete;
(b) contravening or failing to comply with a permit condition or with the provisions of the Act;
(c) being convicted of an offence in terms of the Act; or

1.5. An application for a permit may be refused if the conditions of a previously issued permit had not been adhered to.

1.6. In terms of the Act, the permit holder is obliged to report to the Minister any contravention of the provisions of the Act by any other person.

1.7. This permit does not in any way absolve the holder from the obligations of and adhering to the remainder of the provisions and conditions of the Act.

1.8. Any individual utilizing this permit shall in addition to the above conditions have a certified copy of any other permit/exemption required in terms of other legislation including any permit or exemption in terms of the Marine Living Resources Act, 1998 (Act No. 18 of 1998).

1.9. Any reference to the Permit Holder in these permit **conditions includes the entity or person, his/her or its employees (whether permanent, full-time or part-time)**, registered students, contractors, agents or advisers, being cognisant of the course and scope of their contractual relationship.

1.10. If the permit is in the name of an institution/company/close corporation, the individual utilizing the permit shall in addition to a certified copy of this permit, be in possession of identification and/or a letter which identifies the individual as an authorized person or employee of the permit holder.

1.11. The Permit Holder shall store at their registered-place of business/residence the original permit issued. The Permit Holder shall at all times, have available a true certified copy of this permit which should be produced on demand by any Fishery Control Officer or any other law enforcement official.

1.12. The Permit Holder must safely store all inorganic waste material, garbage and pollutants on board the vessel or at the site of research activities. Should the Permit Holder discard any inorganic waste material, garbage or pollutants into the sea or coastal environment, this permit will be suspended for a period determined by the Department and the Permit Holder shall take those steps considered necessary in terms of NEMA to remedy any pollution caused.

1.13. Specimens collected in terms of this permit shall not be sold or offered for sale.

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1.14. No vehicle may be used in the coastal zone in terms of this permit, and an application for an exemption to use a vehicle in the coastal zone shall be made to the Minister in terms of regulation 6(1)(a) of GN Regulation 1399 of 21 December 2001: Control of Vehicles in the Coastal Zone, as amended.

1.15. Report(s), as stipulated in the Specific Conditions must be submitted to the Chief Director: Fisheries Research and Development, Department of Agriculture, Forestry and Fisheries, Branch: Fisheries Management (Attention: Dr Kim Prochazka), Private Bag X2, Roggebaai, 8012. This should be submitted within one month of the expiry date of this permit, or with the application for renewal of the permit, as required.

2. SPECIFIC CONDITIONS

2.1. This permit allows the collection, possession and transportation of marine invertebrates and vertebrates from the following locations (Port Nolloth, Hondeklip Bay, Lamberts bay, Jacobs Bay, Sea Point (Rocklands Beach), Kommetjie, Wooley's Pool (Kalk Bay), Rooiels, Bettys Bay, Gans Bay, Cape Infanta, Herolds Bay, Knysna, Jeffreys Bay, Port Elizabeth, Port Alfred, Haga Haga, Margate, Port St John's and Durban) for *bona fide* research projects of the Evolutionary Genomics Group at the Department of Botany and Zoology, University of Stellenbosch, as authorized by the Head of the Department.

2.2. A maximum of thirty (30) specimens per species may be collected, as detailed below:

Scientific name
Nudibranchs (Opisthobranchia)
Chitons (Polyplacophora)
Cyclograpsus punctatus
Tetraclita serrata
Octomeris angulosa
Parechinus angulosus
Bullia digitalis
Oxystele variegata
Oxystele sinensis
Oxystele tigrina
Turbo sarmaticus
Nodolittorina africana
Acanthochiton garnoti
Fissurella mutabilis
Scutellastra granularis
Haploblepharus edwardsii
Haploblepharus pictus
Poroderma africana
Caffrogobius sp.
Cancelloxus sp.
Clinus acuminatus
Clinus cottoides
Clinus heterodon
Clinus superciliosus
Muraenoclinus dorsalis

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Xenopoclinus sp.
Comanthus wahlbergi
Tropiometra carinata
Various other crinoids

2.3. No harmful chemicals are to be used when collecting marine species. Limited use of fish anaesthetics (including rotenone) is permitted if no other suitable technique is available to collect fishes, and should be kept to a minimum. Local authorities should be advised when anaesthetics are to be used to collect fish.

2.4. No collections may occur in Marine Protected Areas.

2.5. No Mammals or birds are to be collected.

2.6. No red listed or protected shark species may be collected.

2.7. The report, as required under Condition 1.15, must include a table giving the date, location, and number of specimens per species collected. The report must further provide a summary of the major research findings.

3. PERMIT VALIDITY PERIOD

This permit is valid from **1 January 2014** until **31 December 2014.**

DR JOHANN AUGUSTYN
CHIEF DIRECTOR: FISHERIES RESEARCH AND DEVELOPMENT
DATE: 27/11/2013

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18th June 2014

TO WHOM IT MAY CONCERN

This letter serves to confirm that Jessica Toms has my permission to collect species listed on DAFF research permit, number RES2014/37. She will be collecting nudibranch (Nudibranchia), crinoid (Crinoidea) and chiton (Polyplacophora) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
Department of Botany and Zoology
Stellenbosch University
Private Bag X1
Matieland
7602
South Africa

Tel: +27 (0)21 8089321
Fax: +27 (0)21 8082405
Cell: +27 (0)833890940
Web: http://academic.sun.ac.za/botzoo/heyden/index.htm

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14th July 2014

TO WHOM IT MAY CONCERN

This letter serves to confirm that Mrs Valda Fraser has my permission to collect species listed on DAFF research permit, number RES2014/37. She will be collecting nudibranchs (Nudibranchia) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
Department of Botany and Zoology
Stellenbosch University
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14th July 2014

TO WHOM IT MAY CONCERN

This letter serves to confirm that Prof Dai Herbert has my permission to collect species listed on DAFF research permit, number RES2014/37. He will be collecting nudibranchs (Nudibranchia) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
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10th September 2014

TO WHOM IT MAY CONCERN

This letter serves to confirm that Evania Lombard has my permission to collect species listed on DAFF research permit, number RES2014/37. She will be collecting nudibranch (Nudibranchia) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
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Stellenbosch University https://scholar.sun.ac.za

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Enquiries: Dr Kim Prochazka
Tel: 021-402 3546
Fax : 021-402 3639
E-mail : researchpermits@daff.gov.za

Dr Sophie von der Heyden
Evolutionary Genomics Group
Department of Botany and Zoology
University of Stellenbosch
Private Bag X1
Matieland
7602

Attention: Dr Sophie von der Heyden

PERMIT FOR THE PURPOSES OF A SCIENTIFIC INVESTIGATION OR PRACTICAL EXPERIMENT IN TERMS OF SECTION 83 OF THE MARINE LIVING RESOURCES ACT, 1998 (ACT NO. 18 OF 1998).

I, the undersigned, Chief Director: Fisheries Research and Development, Branch: Fisheries Management, Department of Agriculture, Forestry and Fisheries (the Chief Director) acting in pursuance of the delegated authority conferred upon me by the Honourable Minister of Agriculture, Forestry and Fisheries as contemplated in terms of Section 79 of the Marine Living Resources Act of 1998 (Act No. 18 of 1998) ("the Act") hereby permit, in terms of Section 83 of the Act, the following person(s)/institution to engage in the scientific investigation or practical experiment referred to below:

PERMIT REFERENCE NUMBER: RES2015/26
PERSON(S)/ INSTITUTION: Dr Sophie von der Heyden, Evolutionary Genomics Group, Department of Botany and Zoology, University of Stellenbosch,
SCIENTIFIC INVESTIGATION OR PRACTICAL EXPERIMENT: Collection, possession and transportation of marine invertebrates and vertebrates for genetic research

subject to the following conditions:

1. GENERAL CONDITIONS

1.1. This permit is issued subject to the provisions and regulations of the following laws:
(a) The Marine Living Resources Act, 1998 (Act No. 18 of 1998) ("the Act"), and all regulations published in terms thereof;
(b) The National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA"), and in particular, the regulations that control vehicle use in the coastal zone (as amended);
(c) The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004);

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(d) The National Environmental Management Protected Areas Act, 2003 (Act No. 57 of 2003);
(e) The Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973); and
(f) The Prevention of Pollution from Ships Act (Act No. 2 of 1986).

1.2. This permit is intended to facilitate *bona fide* research, and should not be used for the purposes of financial gain by the Permit Holder.

1.3. If, in the opinion of the Chief Director there are sound reasons for doing so, the Chief Director may amend the conditions of the permit.

1.4. A breach of the provisions of the Act, regulations or these permit conditions by the Permit Holder may result in the initiation of legal proceedings (civil or criminal). A breach includes:

(a) furnishing information to which the Department of Agriculture, Forestry & Fisheries (the Department) is entitled, which is not true or complete;
(b) contravening or failing to comply with a permit condition or with the provisions of the Act;
(c) being convicted of an offence in terms of the Act; or

1.5. An application for a permit may be refused if the conditions of a previously issued permit had not been adhered to.

1.6. In terms of the Act, the permit holder is obliged to report to the Minister any contravention of the provisions of the Act by any other person.

1.7. This permit does not in any way absolve the holder from the obligations of and adhering to the remainder of the provisions and conditions of the Act.

1.8. Any individual utilizing this permit shall in addition to the above conditions have a certified copy of any other permit/exemption required in terms of other legislation including any permit or exemption in terms of the Marine Living Resources Act, 1998 (Act No. 18 of 1998).

1.9. Any reference to the Permit Holder in these permit **conditions includes the entity or person, his/her or its employees (whether permanent, full-time or part-time**), registered students, contractors, agents or advisers, being cognisant of the course and scope of their contractual relationship.

1.10. If the permit is in the name of an institution/company/close corporation, the individual utilizing the permit shall in addition to a certified copy of this permit, be in possession of identification and/or a letter which identifies the individual as an authorized person or employee of the permit holder.

1.11. The Permit Holder shall store at their registered-place of business/residence the original permit issued. The Permit Holder shall at all times, have available a true certified copy of this permit which should be produced on demand by any Fishery Control Officer or any other law enforcement official.

1.12. The Permit Holder must safely store all inorganic waste material, garbage and pollutants on board the vessel or at the site of research activities. Should the Permit Holder discard any inorganic waste material, garbage or pollutants into the sea or coastal environment, this permit will be suspended for a period determined by the Department and the Permit Holder shall take those steps considered necessary in terms of NEMA to remedy any pollution caused.

1.13. Specimens collected in terms of this permit shall not be sold or offered for sale.

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1.14. No vehicle may be used in the coastal zone in terms of this permit, and an application for an exemption to use a vehicle in the coastal zone shall be made to the Minister in terms of regulation 6(1)(a) of GN Regulation 1399 of 21 December 2001: Control of Vehicles in the Coastal Zone, as amended.

1.15. Report(s), as stipulated in the Specific Conditions must be submitted to the Chief Director: Fisheries Research and Development, Department of Agriculture, Forestry and Fisheries, Branch: Fisheries Management (Attention: Dr Kim Prochazka), Private Bag X2, Roggebaai, 8012. This should be submitted within one month of the expiry date of this permit, or with the application for renewal of the permit, as required.

2. SPECIFIC CONDITIONS

2.1. This permit allows the collection, possession and transportation of marine invertebrates and vertebrates from the following locations (Port Nolloth, Hondeklip Bay, Lamberts bay, Jacobs Bay, Sea Point (Rocklands Beach), Kommetjie, Wooley's Pool (Kalk Bay), Rooiels, Bettys Bay, Gans Bay, Cape Infanta, Herolds Bay, Knysna, Jeffreys Bay, Port Elizabeth, Port Alfred, Haga Haga, Margate, Port St John's and Durban) for *bona fide* research projects of the Evolutionary Genomics Group at the Department of Botany and Zoology, University of Stellenbosch, as authorized by the Head of the Department.

2.2. A maximum of thirty (30) specimens per species may be collected, as detailed below:

Scientific name
Nudibranchs (Opisthobranchia)
Chitons (Polyplacophora)
Cyclograpsus punctatus
Tetraclita serrata
Octomeris angulosa
Parechinus angulosus
Bullia digitalis
Oxystele variegata
Oxystele sinensis
Oxystele tigrina
Turbo sarmaticus
Nodolittorina africana
Acanthochiton garnoti
Fissurella mutabilis
Scutellastra granularis
Haploblepharus edwardsii
Haploblepharus pictus
Poroderma africana
Caffrogobius sp.
Cancelloxus sp.
Clinus acuminatus
Clinus cottoides
Clinus heterodon
Clinus superciliosus
Muraenoclinus dorsalis
Xenopoclinus sp.

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Comanthus wahlbergi
Tropiometra carinata
Various other crinoids

2.3. No harmful chemicals are to be used when collecting marine species. Limited use of fish anaesthetics (including rotenone) is permitted if no other suitable technique is available to collect fishes, and should be kept to a minimum. Local authorities should be advised when anaesthetics are to be used to collect fish.

2.4. No collections may occur in Marine Protected Areas.

2.5. No Mammals or birds are to be collected.

2.6. No red listed or protected shark species may be collected.

2.7. The report, as required under Condition 1.15, must include a table giving the date, location, and number of specimens per species collected. The report must further provide a summary of the major research findings.

3. PERMIT VALIDITY PERIOD

This permit is valid from **1 January 2015** until **31 December 2015.**

MR JUSTICE MATSHILI
ACTING CHIEF DIRECTOR: FISHERIES RESEARCH AND DEVELOPMENT
DATE: 03.12.2014

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20th January 2015

TO WHOM IT MAY CONCERN

This letter serves to confirm that Jessica Toms has my permission to collect species listed on DAFF research permit, number RES2015/26. She will be collecting nudibranch (Nudibranchia), crinoid (Crinoidea) and chiton (Polyplacophora) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
Department of Botany and Zoology
Stellenbosch University
Private Bag X1
Matieland
7602
South Africa

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30th January 2015

TO WHOM IT MAY CONCERN

This letter serves to confirm that Valda Fraser has my permission to collect species listed on DAFF research permit, number RES2015/26. She will be collecting specimens of nudibranchs (Nudibranchia) specifically. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
Department of Botany and Zoology
Stellenbosch University
Private Bag X1
Matieland
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South Africa

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18th January 2015

TO WHOM IT MAY CONCERN

This letter serves to confirm that Evania Snyman has my permission to collect species listed on DAFF research permit, number RES2015/26. She will be collecting nudibranch (Nudibranchia) species in particular. I am not always able to accompany students, postdocs and collaborators into the field and as such give them use of the permit. Please do not hesitate to contact me to confirm their credentials.

Sincerely,

Dr Sophie von der Heyden

Evolutionary Genomics Group
Department of Botany and Zoology
Stellenbosch University
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7602
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Stellenbosch University https://scholar.sun.ac.za

Western Cape Province

Telephone No: (027) 021 483 0000
EMail: permits.fax@capenature.co.z
PGWC Shared Services Centre
cnr Bosduif and Volstruis Streets
Bridgetown
7764

CapeNature

Facsimile No: (027)0865567734
Internet: www.capenature.co.za
Private Bag X29
Gatesville
7766

PERMIT TO HUNT WITH
PROHIBITED HUNTING METHOD OF WILD ANIMALS - RESEARCH PURPOSES

(Issued in terms of the provisions of the Nature Conservation Ordinance 1974, (Ord 19 of 1974)Section29&33)

Not Transferable

Holder			
Full Name	Ms JA Toms	**Identity No.**	8609120126081
Trade Name	Stellenbosch University	**Registration No.**	AAA041-00443
Postal Address	Department of Botany and Zoology Stellenbosch University Private Bag X1	**Physical Address**	Sybrand Mankadan 42 147 Dorp Street
Suburb\Town	Matieland	**Suburb\Town**	Stellenbosch
Province\State	Western Cape	**Province\State**	Western Cape
Country	South Africa	**Country**	South Africa
Postal\Zip Code	7602	**Longitude**	.0000
		Latitude	.0000

In terms of and to the provisions of the abovementioned Ordinance and the Regulations framed thereunder, the holder of this permit is hereby authorised to Hunt (capture/disturb/stampede/kill) the protected wild animal(s) specified below on the property mentioned on this permit. See conditions on last page:

Details		
Permit/Licence No	**0056-AAA041-00103**	*Stamp:* CapeNature FAUNA • FLORA • HUNTING • CITES
Expiry Date	2016-04-10	
Date Issued	2015-04-13	
Amount Paid	R 0.00	
Reference	NO CHARGE	
File Code	1/2/1/6/5/F8	

Description	Property
Organization	Stellenbosch University
Person	Toms, JA Ms
ID	8609120126081
Properties	De Hoop Marine Protected Area
Physical Address	De Hoop Nature Reserve
District	Bredasdorp
Province/State	Western Cape
Country	South Africa
Longitude	.0000
Latitude	.0000

Species(Scientific Name)	Qty	Note
A) Note(NA)	0	Conditions apply, note special conditions.
Headshield slug(Cephalaspidea)	3	Per species (whole specimen).
Nudibranchia spp(Nudibranchia spp)	6	Per species (whole specimen).
Pleurobranchomorpha(Pleurobranchomorpha spp)	3	Per species (whole specimen).
Sap-sucking sea slug(Sacoglossa)	3	Per species (whole specimen).
Sea hare(Anaspidea)	3	Per species (whole specimen).

2015-04-13

Issued by:	Approved on Behalf CEO	Effective Date	Signature of Holder
Terrence Moses	Western Cape Nature Conservation Board		I acknowledge, accept and understand fully the permit conditions as described

Standard Conditions

1. When the holder of this permit *kills/captures/collect any wild animal in terms thereof, he shall, before leaving the above-mentioned property, or if he does not leave it, after each day's *hunt/capture/collection, record the particulars regarding the date, species and number of each sex of each species, or if it is impossible to distinguish the sex, the total number of each species of such wild animals which he had *killed/capture/collected.

2. The holder of this permit shall return it to the Chief Executive Officer: Western Cape Nature Conservation Board, Private Bag X29, Gatesville, 7766, within 14 days of the date of expiry thereof.

3. THIS PERMIT IS SUBJECT TO THE ADDITIONAL CONDITIONS AS SET OUT IN THE ADDENDUM HERETO.

Special Conditions

CapeNature
FAUNA • FLORA • HUNTING • CITES

Stellenbosch University https://scholar.sun.ac.za

SPECIAL CONDITIONS:
1) All divers must be registered and in date as scientific divers.
2) The permit holder must make use of their own vessel.
3) The permit holder must provide a research report at the end of the field season, including submission of data onto the SOB database.
4) The permit holder must present their findings to the CapeNature Quarterly Ecological Forum.
5) Copies of all papers emanating out of this project must be supplied to CapeNature.

AREA WHERE CAPTURE AND SAMPLING WILL TAKE PLACE:
* De Hoop Marine Protected Area

METHOD OF CAPTURE:
* Specimens will be collected by hand (large specimens) or using tweezers (small specimans) .

NUMBER OF PERSONS ENGAGED IN THIS PROJECT:
* Dr Kerry Sink: Project leader (SANBI Marine Programme).
* Dr Sophie von Der Heyden & Prof Cang Hui: Project Supervisors (Stellenbosch University).
* Jessica Toms: Permit Holder & research diver.
* Jean Tresfon: Skipper and Diving Photographer (ID: 7408115125088)
* Georgina Jennifer Jones: Research Diver, SURG member (Senior Naturalist), SeaKeys team member (ID: 6509020022087)
* Peter Brian Southwood: Research Diver, SURG co-founder (Surveyor General), SeaKeys team member (ID: 5409105014086)
* Francis Gelletich: Research Diver and Diving logistics coordinator(ID: 8911065596082)

CONDITIONS APPLICABLE TO RESEARCHERS UNDERTAKING RESEARCH OR OTHER COLLECTING WORKS ON PROVINCIAL CONSERVATION AREAS AND / OR PRIVATELY OWNED LAND IN THE PROVINCE OF WESTERN CAPE:

1. THE MANAGER OF THE RELEVANT CONSERVATION AREA(S) (IF ANY) MUST BE INFORMED TIMEOUSLY BEFORE ANY CONSERVATION AREA IS ENTERED FOR COLLECTING OR RESEARCH PURPOSES AND THE MANAGER'S WRITTEN PERMISSION TO ENTER SUCH RESERVE MUST BE ACQUIRED BEFOREHAND. THIS PERMIT DOES NOT GRANT THE PERMIT HOLDER AUTOMATIC ACCESS TO ANY NATURE RESERVE, CONSERVATION AREA, WILDERNESS AREA AND / OR STATE FOREST. ANY OTHER / FURTHER CONDITIONS OR RESTRICTIONS THAT THE MANAGER MAY STIPULATE AT HIS / HER DISCRETION MUST ALSO BE ADHERED TO. THIS PERMIT MUST BE AVAILABLE TO BE SHOWN ON DEMAND.
2. The owner of any other land concerned (be it privately or publicly owned land) must give WRITTEN consent allowing the permit holder to enter said property to collect flora / fauna. This written permission must reflect the full name and address of the property owner (or of the person authorised to grant such permission), the full name and address of the person to whom the permission is granted and the number and species of the flora / fauna, the date or dates on which such flora / fauna may be picked / collected and the land in respect of which permission is granted. Copies of this written permission must be made available to The Western Cape Nature Conservation Board upon request.
3. Type-specimens of any newly described / discovered species or other taxon collected must be lodged with a recognised South African scientific institution / museum / herbarium (preferably within the Province of Western Cape) where such material Nature Conservation Board Herbarium at Jonkershoek (c/o MJ Simpson, Private Bag X5014, Stellenbosch 7599).
4. A list of all collected specimens / material including the; species name, the number collected, the collection date and the precise locality of the collection must be submitted within 14 days from the date of expiry of your permit to The Chief Executive Officer: CapeNature, Private Bag X29, Rondebosch, 7701
5. The maximum number of specimens per species specified in the permit (if at all) may not be exceeded without the prior permission of The Chief Executive Officer: Western Cape Nature Conservation Board.
6. For projects of more than one year's duration a progress report must be submitted to The Chief Executive Officer: Western Cape Nature Conservation Board before 31 December of each year.
7. One copy of all completed reports, publications, or articles (including books, videos, CDs, DVDs etc.) resulting from the project/collection must be submitted to The Chief Executive Officer: Western Cape Nature Conservation Board free of charge.
8. Should a report, publication, article or thesis arise from this project/collection, an acknowledgement to Western Cape Nature Conservation Board must be included.
9. The Forest Act 1984 (Act 122 of 1984) and regulations, the Nature Conservation Ordinance, 1974 (Ordinance 19 of 1974) and all regulations in terms of the Ordinance must be adhered to.
10. Should it be envisaged to export any material / specimens across the boundaries of the Western Cape Province, an export permit will be required in respect of certain species and a further application form will have to be completed. The permit holder must confirm with the Western Cape Nature Conservation Board whether an export permit is required BEFORE exporting any material / specimens from the Western Cape Province.
11. No species that appear on the Red Data List or species listed as endangered in terms of the Nature Conservation Ordinance, 1974 (Ordinance 19 of 1974) may be collected, except for those mentioned on the permit.
12. Unless otherwise specifically indicated in writing, no material or specimens collected with this permit or material or specimens bred or propagated, from material or specimens collected with this permit, may be donated, sold or used for any commercial purpose by any party.
13. IF APPLICABLE, ETHICS CLEARANCE MUST BE ACQUIRED FROM YOUR RESEARCH INSTITUTE PRIOR TO COLLECTION.

P CHIEF EXECUTIVE OFFICER
CAPENATURE

CapeNature
FAUNA • FLORA • HUNTING • CITES

Stellenbosch University https://scholar.sun.ac.za

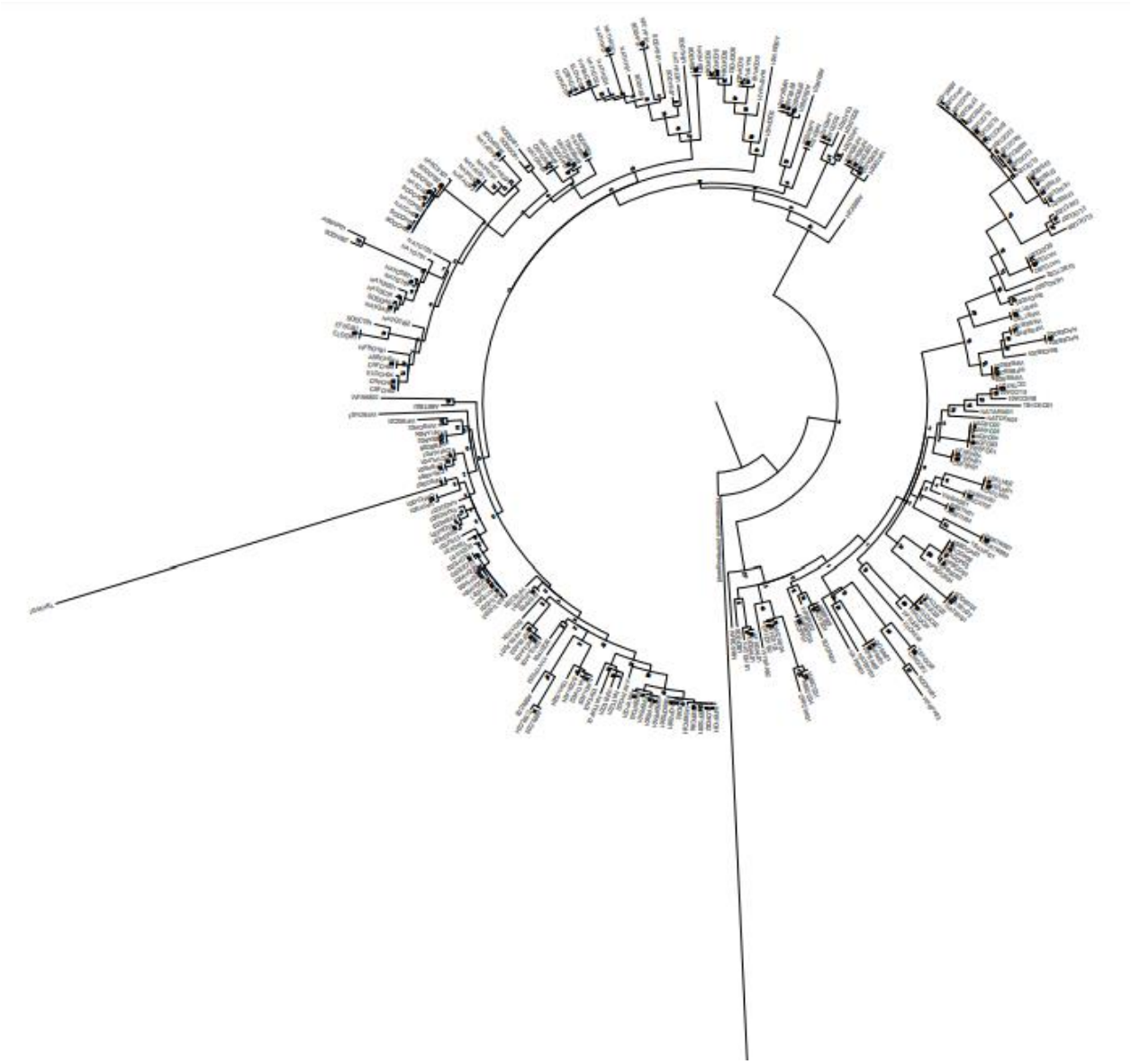
Appendix 2.3

GBlocks results

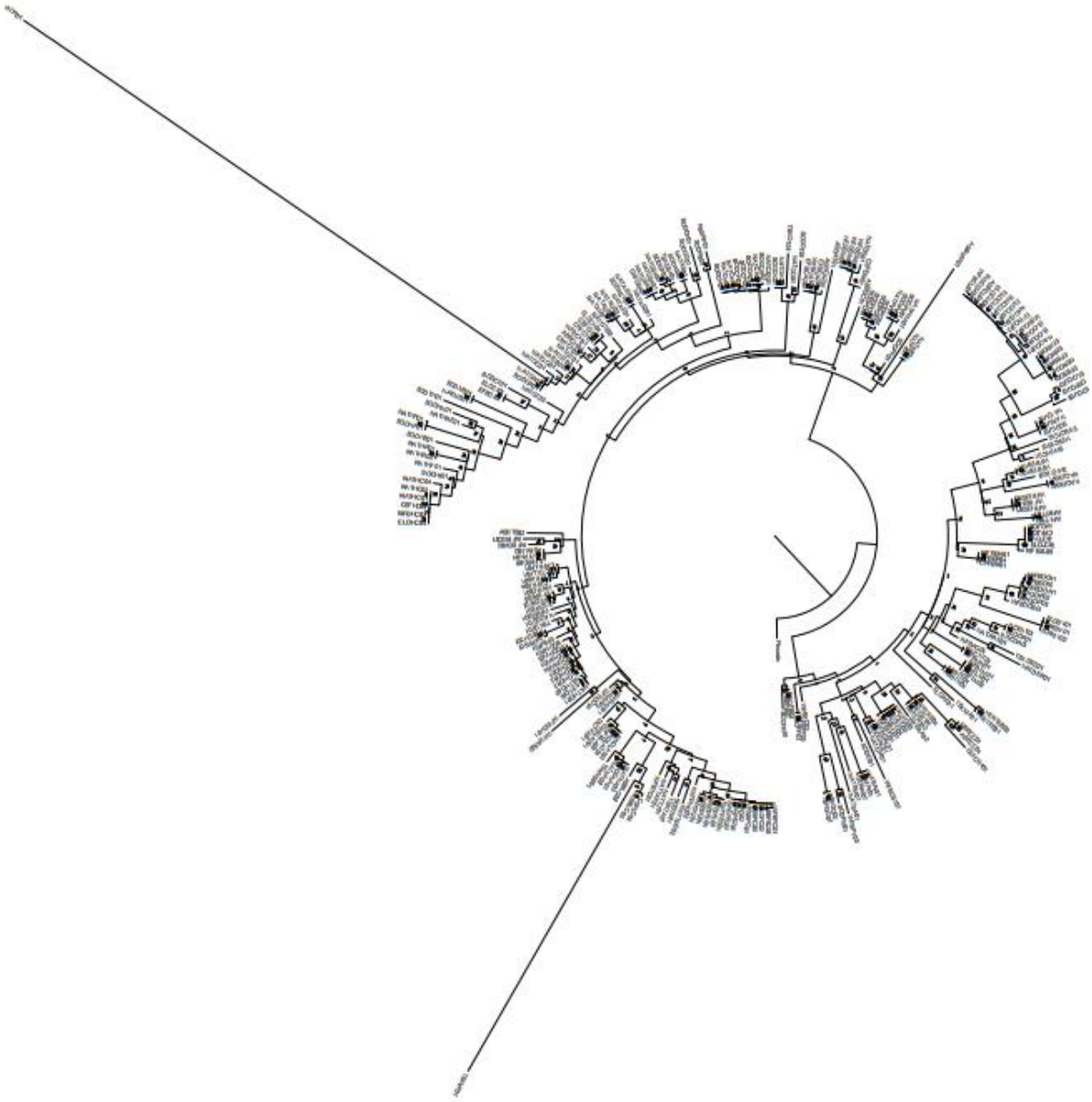
& trees for 16S gene

16S gene RAxML GUI tree
(1000 rapid bootstraps; GTRCAT)

16S GBLOCKS ‘stringent’:
RAxML GUI tree
(1000 rapid bootstraps; GTRCAT)



16S GBLOCKS 'relaxed':
RAxML GUI tree
(1000 rapid bootstraps; GTRCAT)



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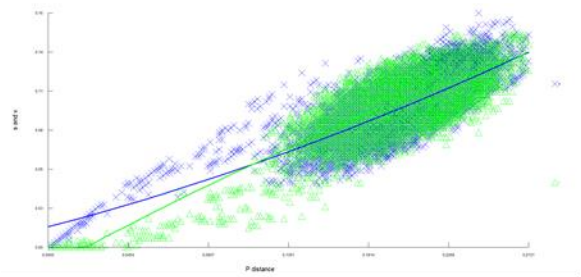
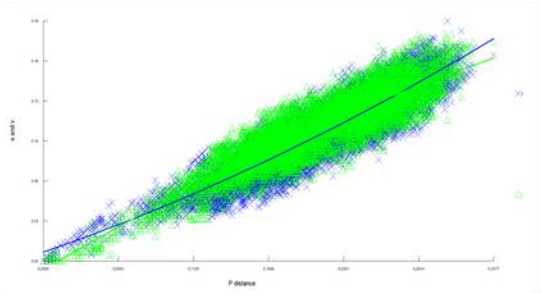
Appendix 2.4

DAMBE substitution-saturation plots

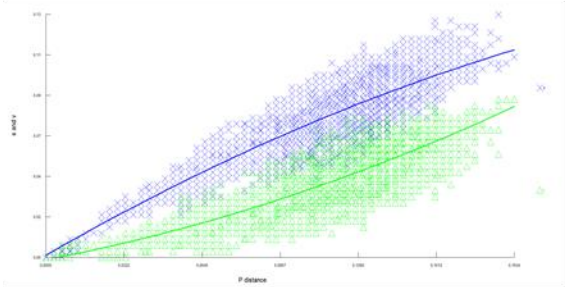
COI



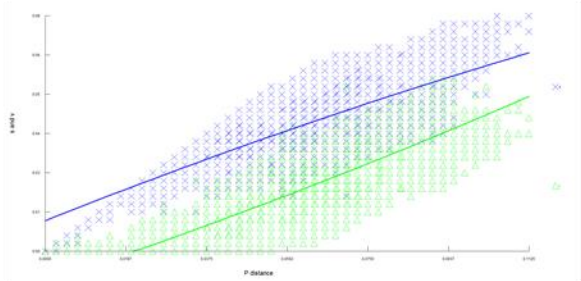
16S



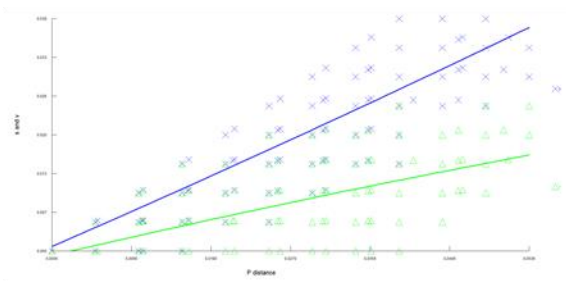
H3



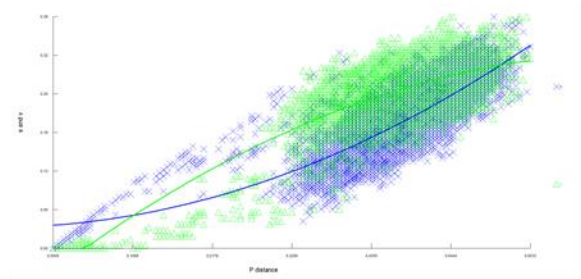
COI codon position 1&2



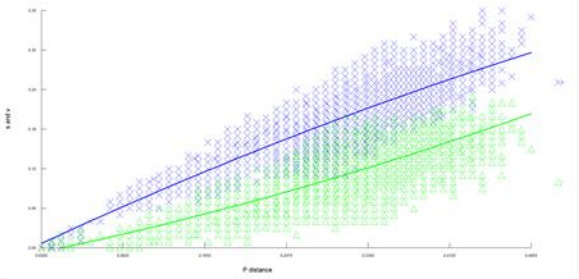
H3 codon position 1&2



COI codon position 3



H3 codon position 3



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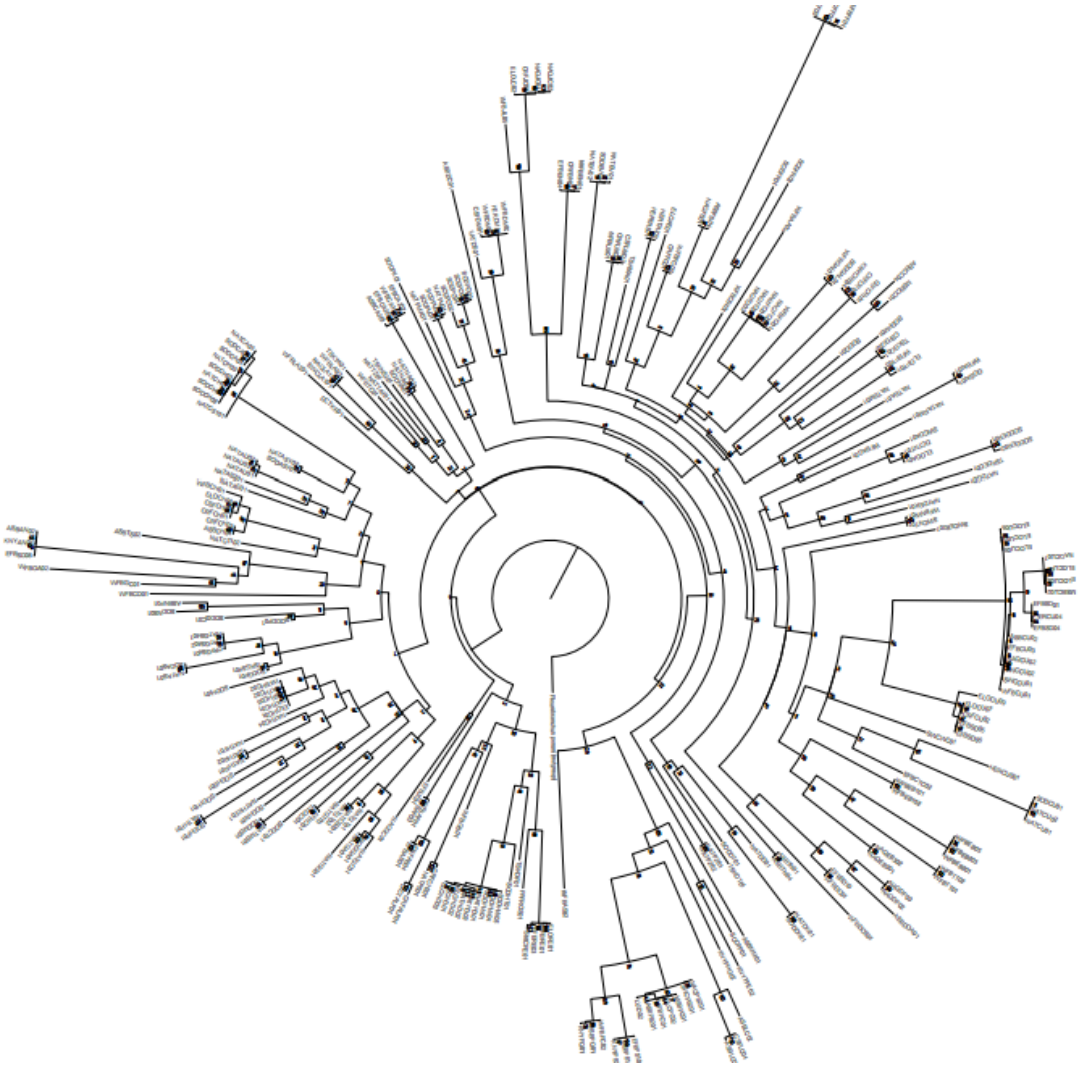
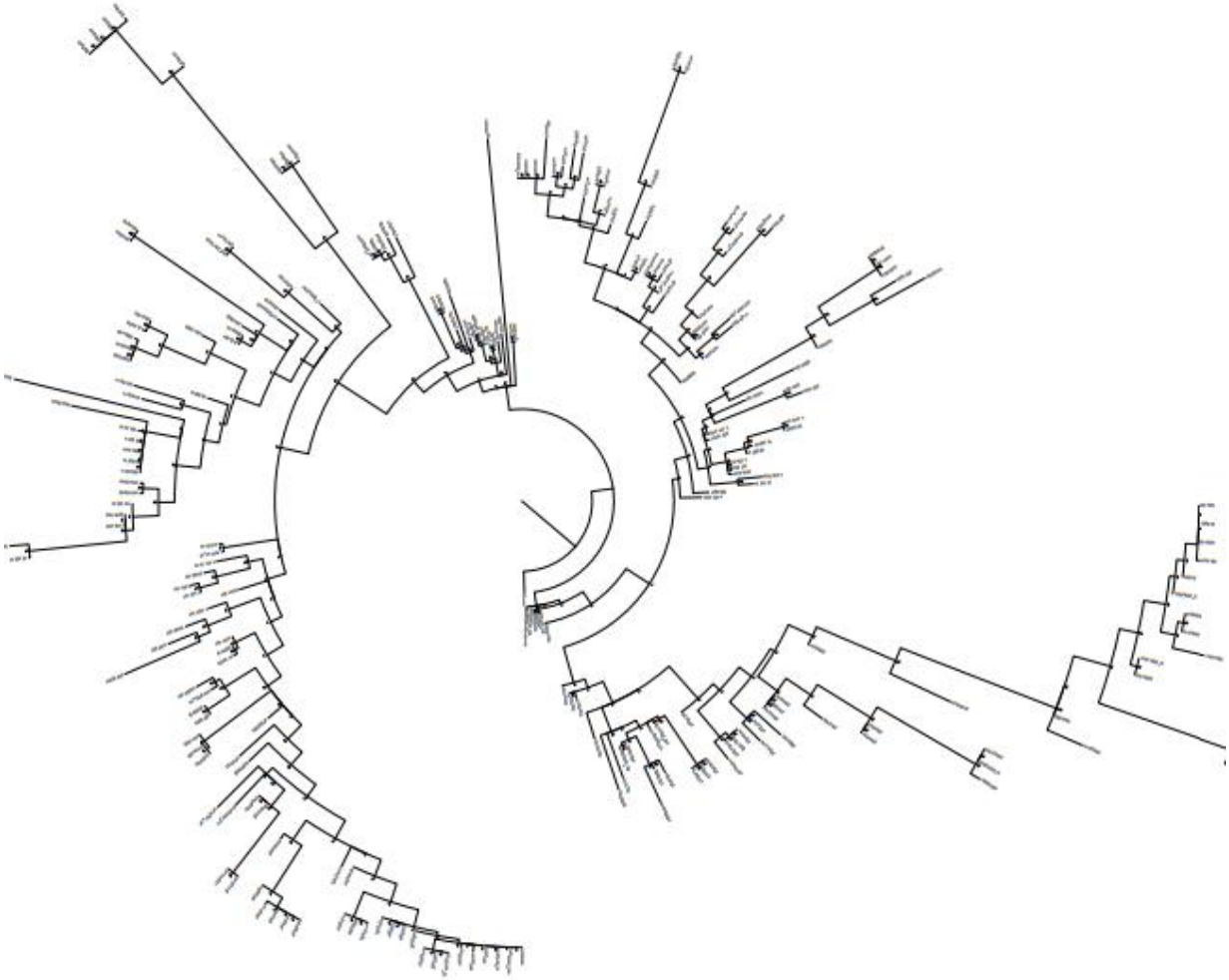
Appendix 2.5

Trees of COI gene with and without third codon positions

COI all characters



COI character positions 1&2 only



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Appendix 2.6

South African species list with references to photographic records

Species	Reference	Notes	Sighting in S.A. Recorded in Literature	Most Western Locality	Reference	Most Eastern Locality	Reference	Outside of S.A.
Acanthodoris planca	Fahey & Valdés, 2005		NOSA p. 91, s. 136	**Buffels Bay, Cape Town**	https://www.inpotnature.org/node/578205?nav=parent_ob	**Tsitsikamma**	Hallas & Gosliner, 2015	**Endemic**
Aegires lemoncello	Fahey & Gosliner, 2004		TRG p. 308	**Sodwana Bay**	TRG p. 308	**widespread Indo-Pacific**	NSB p. 148	**widespread Indo-Pacific**
Aegires ninguis	Fahey and Gosliner, 2004		NOSA p. 99, s. 178	**Cape Peninsula**	NOSA p. 99, s. 178	**Port Elizabeth**	NOSA p. 99, s. 178	**Endemic**
Aegires sp. *	http://www.inpotnature.org/node/595341		s.	**Sodwana Bay**	http://www.inpotnature.org/node/595341	s.		**Endemic**
Aegires sp. 4*	NSB p. 147	*Phcecera* on inpot: Cogden	s.	**Sodwana Bay**	http://www.inpotnature.org/node/641183	**Marshall Islands**	NSB p. 147	**Marshall Islands**
*Aegires villosus**	Farran, 1905		s.	**Sodwana Bay**	http://www.inpotnature.org/node/641223	**Indian and Western Pacific Oceans**	NSB p. 146	**Indian and Western Pacific Oceans**
Aldisa benguelae	Gosliner in Millen & Gosliner, 1985		NOSA p. 73, s. 101	**Oudekraal, Cape Town**	NOSA p. 73, s. 101	s.		**Endemic**
Aldisa sp. 7	sp. 7 in NSB		TRG p. 310	**Sodwana Bay**	TRG p. 310	s.		**Endemic**
Aldisa sp. 2*	NSB p. 168		s.	**Park Rynie**	http://www.seaslugforum.net/find/aldisp4	**Madagascar**	NSB p. 168	**Madagascar**
Aldisa trimaculata	Gosliner in Millen & Gosliner, 1985		NOSA p. 72, s. 100	**Bakhawu, Cape Town**	NOSA p. 72, s. 100	**Braeenbrad, Transkei**	http://www.seaslugforum.net/message/5026	**Endemic**
Amanda armata	Macnae, 1954		NOSA p. 125, s. 257	**Oudekraal, Cape Town**	NOSA p. 125, s. 257	**Rosi Ilo, Eastern False Bay**	https://www.inpotnature.org/node/574426	**Endemic**
Ancula sp.	NOSA p.94; s.165		NOSA p. 94, s. 165	**Bloubergstrand, Cape Town**	NOSA p. 94, s. 165	**Kaysna**	this study; https://www.inpotnature.org/node/644178?nav=parent_ob	**Endemic**
Anteaeolidiella saldanhensis	Barnard, 1927	previously: Aeolidiella alba	NOSA p. 128, s. 265	**Saldanha Bay**	NOSA p. 128, s. 265	**Ramsgate, KZN**	NOSA p. 128, s. 265 ; this study	**Endemic**
Apheloderis brunnea	Bergh, 1907		NOSA p. 66, s. 82	**Buffels Bay, Cape Town**	NOSA p. 66, s. 82	**East London**	NOSA p. 66, s. 82	**Endemic**
Apheloderis sp. 1	NOSA p. 67; s.83	same as: *Apheloderis* sp. 3 in Zolavecz, 2007	NOSA p. 67; s.83	**Oudekraal, Cape Town**	NOCP p. 35 (12.2)	**Port Elizabeth**	this study & http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=254	**Endemic**
*Ardeadoris cf. angustolutea**	Rudman, 1990		s.	**Sodwana Bay**	https://www.inpotnature.org/node/641250	**Western and Central Pacific Ocean**	NSB p. 243	**Western and Central Pacific Ocean**
*Ardeadoris cf. electra**	Rudman, 1990		this study	**Durban South Coast**	this study	**Indian and Western Pacific Oceans**	NSB p. 242	**Indian and Western Pacific Oceans**
*Ardeadoris cf. tommintbi**	Bertsch & Gosliner, 1989		s.	**Port Shepstone**	http://www.seaslugforum.net/find/glossp7	**Sodwana Bay**	https://www.inpotnature.org/node/641529	**Endemic**
Ardeadoris sp.*	https://www.inpotnature.org/node/641256		s.	**Sodwana Bay**	https://www.inpotnature.org/node/641256	s.		**Endemic**
Ardeadoris sp. 6	NSB p. 236; generic data this study	Glossodoris sp. 6 in NSB	NSB p. 236	**Durban South Coast**	NSB p. 236	**Réunion Island; Okinawa (Japan)**	http://seaslug.free.fr/traducbranchea_glossodoris_sp3.htm ; NSB p. 236	**Réunion Island; Okinawa (Japan)**
Ardeadoris symmetrica	Rudman, 1990		This study & TRG p. 322	**Transkei**	TRG p. 322	**widespread Indo-Pacific**	NSB p. 242	**widespread Indo-Pacific**
Ardeadoris undaurum	Rudman, 1985		NOSA p. 84, s. 134	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=141	**Indian Ocean**	NSB p. 241	**Indian Ocean**
Armina gilchristi	White, 1955		NOSA p. 109, s. 210	**Cape Point**	NOSA p. 109, s. 210	**Jeffrey's Bay**	NOSA p. 109, s. 210	**Endemic**
Armina sp.	NOCP p.76 (26.2)		NOCP p. 76 (26.2)	**Western False Bay**	NOCP p. 76 (26.2)	s.		**Endemic**
Armina sp. 12	NSB p. 295		NSB p. 295; this study	**Durban South Coast**	NSB p. 295; this study	s.		**Endemic**
Armina sp. 13	NSB p. 295		NSB p. 295	**Durban South Coast**	NSB p. 295	s.		**Endemic**
Atagema cf. gibba	NOSA p. 63; s.72		NOSA p. 63; s.72	**Algoa Bay**	NOSA p. 63; s.72	s.		**NE-Atlantic, Mediterranean (Gosliner, 1987)**
Atagema cf. rugosa	NOSA p. 63; s.73		NOSA p. 63; s.73	**Oudekraal, Cape Town**	NOSA p. 63; s.73	s.		**NE-Atlantic, Mediterranean (Gosliner, 1987)**
Atagema sp. 1*	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=96		s.	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=96	s.		**Endemic**
Baeolidia chaka	Gosliner, 1985		NOSA p. 128, s. 162	**Sodwana Bay**	NOSA p. 128, s. 162	s.		**Endemic**
*Baeolidia cf. moebii**	Bergh, 1888		s.	**Durban South Coast**	this study; http://www.inpotnature.org/node/601219	**widespread Indo-Pacific**	Carmona et al., 2014	**Endemic**
Baeolidia palythoae	Gosliner, 1985		NOSA p. 129, s. 268	**Umgazana**	NOSA p. 129, s. 268	**Sodwana bay**	NOSA p. 129, s. 268	**Endemic (Possily Japan NSSI p. 390)**
Bonisa nakaza	Gosliner, 1981		NOSA p. 112, s. 218	**West Coast Peninsula**	this study	**Port Alfred**	https://www.inpotnature.org/node/712702	**Endemic**
Bornella anguilla	Johnson, 1984		NOSA p. 105, s. 196	**Durban South Coast**	TRG p. 330	**widespread Indo-Pacific**	NSB p. 309	**widespread Indo-Pacific**
Bornella stellifer	A. Adams & Reeve [in A. Adams], 1848		NOSA p. 104, s. 195	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=60	**widespread Indo-Pacific**	NSB p. 309	**widespread Indo-Pacific**
Bornella valdae	Pola, Rudman & Gosliner, 2009		TRG p. 330	**Transkei, Eastern Cape**	TRG p. 330	**Mozambique**	TRG p. 330	**Mozambique**
Bulbaeolidia cf. alba	Risbec, 1928		NOSA p. 128, s. 266	**Durban South Coast**	this study	s.		**Hawaii: Bulbaeolidia sp. B (Carmona et al., 2014)**
Cadlina sp. 1	NOSA p. 85; s.139		NOSA p. 85, s. 139	**Buffelfs Bay, Cape Town**	NOSA p. 85, s. 139	**Rosi Ilo, Eastern False Bay**	NOSA p. 85, s. 139	**Endemic**
Cadlina sp. 2	NOSA p. 86; s.140	genetically identical to: *Cadlina* sp. 1	NOSA p. 86; s.140	**Oudekraal, Cape Town**	NOSA p. 86; s.140	**Rosi Ilo, Eastern False Bay**	NOCP p. 47 (16.6)	**Endemic**
Cadlina sp. 3	NOSA p. 86; s.141		NOSA p. 86; s.141	**Partridge Point**	https://www.inpotnature.org/node/749430	**Algoa Bay**	NOSA p. 86; s.141	**Endemic**
Cadlina sp. 4	NOSA p. 86; s.142		NOSA p. 86; s.142	**Algoa Bay**	NOSA p. 86; s.142	s.		**Endemic**
Cadlina sp. 5	NOCP p. 36 (12.3)	previously: *Aphelodoris* sp.. 2	NOCP p. 36 (12.3)	**Hout Bay & Moari Bay offshore**	NOCP p. 36 (12.3)	s.		**Endemic**
Cadlinella ornatissima	Risbec, 1928		TRG p. 314	**Sodwana Bay**	TRG p. 314	**Indian & Western Pacific Oceans**	NSB p. 207	**Indian & Western Pacific Oceans**
Caloria indica	Bergh, 1896		NOSA p. 122	**Durban South Coast**	http://www.seaslugforum.net/find/2814	**widespread Indo-Pacific**	NSB p. 361	**widespread Indo-Pacific**
Caloria sp. 1	NOSA p. 122; s.249		NOSA p. 122; s.249	**Oudekraal, Cape Town**	NOSA p. 122; s.249	**Rosi Ilo, Eastern False Bay**	NOCP p. 91 (32.2)	**Endemic**
Caloria sp. 2	NOSA p. 123; s. 250		NOSA p. 123; s. 250	**Oudekraal, Cape Town**	NOSA p. 123; s. 250	**Hout Bay Sentinel**	NOCP p. 92 (32.3)	**Endemic**
Caloria sp. 3	NOSA p. 123; s. 251		NOSA p. 123; s. 251	**Sodwana Bay**	NOSA p. 123; s. 251	**widespread Indo-Pacific**	NSB p. 362	**widespread Indo-Pacific**
Catriona casha	Gosliner & Griffiths, 1981		NOSA p. 119, s. 239	**Langebaan Lagoon**	NOSA p. 119, s. 239	**Kaysna**	NOSA p. 119, s. 239	**Endemic**
Catriona columbiana	O'Donoghue, 1922		NOSA p. 119, 240	**Table Bay Harbour**	NOSA p. 119, 240	**Introduced from: North East Pacific, Japan**	NOSA p. 119, 240	**Introduced from: North East Pacific, Japan**
Catriona sp.	NOSA p. 120, s. 241		NOSA p. 120, s. 241	**Sodwana Bay**	NOSA p. 120, s. 241	**widespread Indo-Pacific**	NSB p. 356	**widespread Indo-Pacific**
Ceratophyllidia africana	Eliot, 1903		NOSA p. 74, s. 155	**Sodwana Bay**	NOSA p. 74, s. 155	**Indian and Western Pacific Oceans**	NSB p. 291	**Indian and Western Pacific Oceans**
Ceratosoma inpaxi	Gosliner, 1996		NOSA p. 85; 138	**Western False Bay**	NOCP p. 45 (16.4)	**East London**	this study	**Endemic**
Ceratosoma sp. 1	NSB p. 266		NOSA p. 78, s. 116	**Sodwana Bay**	NOSA p. 78, s. 116	**widespread Indo-Pacific**	NSB p. 266	**widespread Indo-Pacific**
Ceratosoma sp. 5*	https://www.inpotnature.org/node/641257		s.	**Sodwana Bay**	https://www.inpotnature.org/node/641257	s.		**Endemic**
Ceratosoma sp. 4*	https://www.inpotnature.org/node/642602		s.	**Sodwana Bay**	https://www.inpotnature.org/node/642602	s.		**Endemic**
Ceratosoma cf. tenue	Abraham, 1876		TRG p. 322	**Transkei**	TRG p. 322	s.		**Endemic**
*Cerberilla affinis**	Bergh, 1888		s.	**Sodwana Bay**	http://www.seaslugforum.net/message/20692	**widespread Indo-Pacific**	NSB p. 392	**widespread Indo-Pacific**
Cerberilla africana	Eliot, 1903		NSB p. 392	**Aliwal Shoal**	https://www.facebook.com/DiveIntoCT/photos/a.929844230394737.1073741865.226332834079217/929844450394715/?type=3&theater	**Tanzania**	NSB p. 392	**Tanzania**
Cerberilla sp.*	http://www.narg.co.za/home/html/news/news_2014/cerberilla_sp.htm		s.	**Western False Bay**	http://www.narg.co.za/home/html/news/news_2014/cerberilla_sp.htm	s.		**Endemic**
Cerberilla sp. 2*	NSB p. 393		s.	**Port Shepstone**	http://www.seaslugforum.net/find/1527	**Philippines**	NSB p. 393	**Philippines**
Chromodoris africana	Eliot, 1904		NOSA p. 74, s. 105	**Durban South Coast**	this study	**Indian Ocean**	NSB p. 208	**Indian Ocean**
Chromodoris boucheti	Rudman, 1982		NOSA p. 314	**Durban South Coast**	http://www.seaslugforum.net/find/1540	**Western Indian Ocean**	NSB p. 210	**Western Indian Ocean**
*Chromodoris cf. colemani**	http://www.inpotnature.org/node/566392		s.	**Sodwana Bay**	http://www.inpotnature.org/node/566392	**Western and Central Pacific Ocean**	NSB p. 209	**Western and Central Pacific Ocean**
*Chromodoris cf. striguata**	this study		s.	**Durban South Coast**	this study	s.		**Endemic**
Chromodoris hamiltoni	Rudman, 1977		NOSA p. 74, s. 104	**Transkei**	TRG p. 314	**Western Indian Ocean**	NSB p. 210	**Western Indian Ocean**
Chromodoris strigata	Rudman, 1982		TRG p. 314	**Durban South Coast**	http://www.seaslugforum.net/find/1794	**widespread Indo-Pacific**	NSB p. 212	**widespread Indo-Pacific**
Corambe sp.	NOSA p. 95; s. 166		NOSA p. 95; s. 166	**Western False Bay**	NOSA p. 95, s. 166	s.		**Endemic**
Cratena capensis (a)	Barnard, 1927		NOSA p. 125, s. 258	**Saldanha Bay**	NOSA p. 125, s. 258	**Port Alfred**	NOSA p. 125, s. 258	**Endemic**
*Cratena capensis (b)**	Barnard, 1928		s.	**Mossel Bay**	this study			**Endemic**
Cratena simba	Edmunds, 1970		NOSA p. 126, s. 259	**Sodwana Bay**	NOSA p. 126, s. 259	**Indian and Western Pacific Oceans**	NSB p. 381	**Indian and Western Pacific Oceans**
Cratena sp. 1	NOSA p. 126;s. 260		NOSA p. 126;s. 260	**Western False Bay**	NOCP p. 97 (33.2)	**Durban South Coast**	http://www.seaslugforum.net/message/2020	**Endemic**
Cratena sp. 2	NOSA p. 126;s. 261		NOSA p. 126;s. 261	**Durban South Coast (Aliwal Shoal)**	NOSA p. 126;s. 261	s.		**Endemic**
Cratena sp. 3	NOSA p. 127; s. 262		NOSA p. 127; s. 262	**Sodwana Bay**	NOSA p. 127; s. 262	**widespread Indo-Pacific**	NSB Cratena sp. 5	**widespread Indo-Pacific**
Cratena sp. 4	NOSA p. 127; s. 263		NOSA p. 127; s. 263	**Algoa Bay**	NOSA p. 127; s. 263	s.		**Endemic**
Crimora lutea	Baba, 1949		NOSA p. 95, s. 167	**Durban (Chaka's Rock)**	https://www.inpotnature.org/node/762586?nav=parent_ob	**widespread Indo-Pacific**	NSB p. 121	**widespread Indo-Pacific**
Cuthona anulata	Baba, 1949		NOSA p. 117, s. 232	**Sodwana Bay**	NOSA p. 117, s. 232	**Japan**	http://www.seaslugforum.net/find/cuthanul	**Japan**
Cuthona cf. sp.1?	NSB p. 343		s.	**Durban (Chaka's Rock)**	https://www.inpotnature.org/node/763119?nav=parent_ob	**Indian and Western Pacific Oceans**	NSB p. 343	**Indian and Western Pacific Oceans**
Cuthona speciosa (a)	Macnae, 1954		NOSA p. 116, s. 229; NOCP p. 88, s. 31.1	**Lamberts Bay**	this study	**East London**	this study	**Endemic**
*Cuthona speciosa (b)**	this study		s.	**Lamberts Bay**	this study	**East London**	this study	**Endemic**
*Cuthona speciosa (c)**	this study		s.	**Western False Bay**	this study	**Walker Bay**	this study	**Endemic**
*Cuthona speciosa (d)**	this study		s.	**Cape Recife**	this study	**Durban South Coast**	this study	**Endemic**
*Cuthona speciosa (e)**	this study		s.	**East London**	this study	s.		**Endemic**
*Cuthona speciosa (f)**	this study		s.	**Eastern False Bay**	this study	s.		**Endemic**
*Cuthona cf. speciosa**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=445		s.	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=445	s.		**Endemic**
Cuthona kanga	Edmunds, 1970		NOSA p. 116, s. 231	**Sodwana Bay**	NOSA p. 116, s. 231	**Western Indian Ocean**	NSB p. 344	**Western Indian Ocean**
Cuthona ornata	Baba, 1937		NOSA p. 116 s. 230	**Durban (La Mercy)**	NOSA p. 116 s. 230	**Indian and Western Pacific Oceans**	NSB p. 343	**Indian and Western Pacific Oceans**
Cuthona sibogae	Bergh, 1905		TRG p. 332	**Durban South Coast**	http://www.seaslugforum.net/find/15064	**widespread Indo-Pacific**	NSB p. 342	**widespread Indo-Pacific**
Cuthona sp. 4	NOSA p. 118, s. 236		NOSA p. 118, s. 236	**Sodwana Bay**	NOSA p. 118, s. 236	s.		**Endemic**
Cuthona sp. 5 (sp. 23 IPNU; sp. 35 NSSI)	NOSA p. 118, s. 237		NOSA p. 118, s. 237	**Durban South Coast**	NOSA p. 118, s. 237 ; http://www.seaslugforum.net/message/1996	s.		**Endemic**
Cuthona sp. 6	NOCP p. 89 (31.2)		NOCP p. 89, s. 31.2	**Oudekraal, Cape Town**	NOCP p. 89 (31.2)	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=525	**Endemic**
Dendrodoris caesia	Bergh, 1907		NOSA p. 88, s. 145	**Cape Point**	NOSA p. 88, s. 145	**Transkei**	this study; http://www.seaslugforum.net/find/4859	**Endemic**
Dendrodoris carbunculosa	Kelaart, 1858		NOSA p. 89, s. 148	**Sodwana Bay**	NOSA p. 89, s. 148	**Indo-Pacific and Eastern-Pacific**	NSB p. 273	**Indo-Pacific and Eastern-Pacific**
Dendrodoris fumata	Rüppell & Leuckart, 1830		IPNU p. 283	**Durban (Salt Rock)**	http://www.inpotnature.org/node/630298	**widespread Indo-Pacific**	NSB p. 275	**widespread Indo-Pacific**
Dendrodoris guttata	Odhner, 1917		s.	**Kosi Bay**	http://www.inpotnature.org/node/598554	**western Pacific Ocean**	NSB p. 274	**western Pacific Ocean**
Dendrodoris krusensternii (a)	Gray, 1850		NOSA p. 88, s. 146	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=497	**widespread Indo-Pacific**	http://www.seaslugforum.net/showall/dendkrus	**widespread Indo-Pacific**
*Dendrodoris krusensternii (b)**	Angas, 1864		s.	**Cape Vidal**	this study	**widespread Indo-Pacific**	NSB p. 273	**widespread Indo-Pacific**
Dendrodoris nigra	Stimpson, 1855		NOSA p. 87, s. 144	**East London**	this study	**widespread Indo-Pacific**	NSB p. 274	**widespread Indo-Pacific**
Dendrodoris sp. 1	this study		s.	**Transkei**	this study	s.		**Endemic**
Dendrodoris sp. 2*	http://www.seaslugforum.net/message/3039		s.	**Durban South Coast**	http://www.seaslugforum.net/message/3039	s.		**Endemic**
Dendrodoris cf. tuberculosa	Quoy & Gaimard, 1832		s.	**Transkei**	this study	**widespread Indo-Pacific**	NSB p. 272	**widespread Indo-Pacific**
Dermatobranchus albireus	Gosliner & Fahey, 2011		s.	**West Coast Peninsula**	this study	**Port Elizabeth**	NOSA p. 110, s. 211	**Endemic**
Dermatobranchus albus	Eliot, 1904		Gosliner & Fahey, 2011	**Sodwana Bay**	Gosliner & Fahey 2011 (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3073124/)	**Indian and Western Pacific Oceans**	NSB p. 300	**Indian and Western Pacific Oceans**
Dermatobranchus arminus	Gosliner & Fahey, 2011		NOSA p. 110, s. 214	**Bakhawu, Cape Town**	NOSA p. 110, s. 212	**East London**	this study	**Endemic**
Dermatobranchus caesitius	Gosliner & Fahey, 2011		NOSA p. 110, s. 212	**Transkei**	NOSA p. 110, s. 212	s.		**Endemic**
Dermatobranchus sp.*	this study	*D. cf. semilinus*? (NSB p. 300)	this study	**Sodwana Bay**	this study	s.		**Endemic**
Dermatobranchus gonatophorus	van Hasselt, 1824		TRG p. 328	**Durban South Coast**	TRG p. 328	**Indian and Western Pacific Oceans**	NSB p. 297	**Indian and Western Pacific Oceans**
*Dermatobranchus ornatus**	Bergh, 1874		s.	**Sodwana Bay**	https://www.inpotnature.org/species-dictionaries/sandi/Dermatobranchus%20ornatus	**Indian and Western Pacific Oceans**	NSB p. 297	**Indian and Western Pacific Oceans**
Dermatobranchus pustulosus	van Hasselt, 1824		NSB p. 297	**South Africa**	NSB p. 297	**western Pacific Ocean**	NSB p. 297	**western Pacific Ocean**
Dermatobranchus rodmani	Gosliner & Fahey, 2011		NOSA p. 110, s. 213	**Durban South Coast**	this study	**Madagascar, Eastern Malaysia**	Gosliner & Fahey, 2011; NSB p. 302	**Madagascar, Eastern Malaysia**
*Dermatobranchus rubidus**	Gould, 1852		s.	**Durban (Sheffield Beach)**	http://www.inpotnature.org/node/594423	**Western and Central Pacific Ocean**	NSB p. 304	**Western and Central Pacific Ocean**
Diaphorodoris mitsuii	Baba, 1938		NOSA p. 92, s. 157	**Sodwana Bay**	NOSA p. 92, s. 157	**Indian and Western Pacific Oceans**	NSB p. 146	**Indian and Western Pacific Oceans**
Diaululu sp.	NOSA p.65; s.79	*Aeinodoris* sp. 2 in NOSA; possibly: *Dendrodoris* cf. *guttata*	NOSA p. 65, s. 79	**Algoa Bay**	NOSA p. 65, s. 79	s.		**Endemic**
Discodoris cebuensis	Bergh, 1877		NOSA p. 64, s. 76	**Sodwana Bay**	NOSA p. 64, s. 76	**widespread Indo-Pacific**	NSB p. 171	**widespread Indo-Pacific**
Discodoris lilacina	Gould, 1852		NOSA p. 64, s. 74	**Transkei**	NOSA p. 64, s. 74; this study	**Widespread Indo-Pacific**	NSB p. 170	**Widespread Indo-Pacific**
Discodoris sp. 6	NSB p. 171; NOSA p. 65, s. 78		NOSA p. 65, s. 78	**Transkei**	NOSA p. 65, s. 78	s.		**Endemic**
Diversidoris aurantionodulosa	Rudman, 1987		IPNU p. 276	**Durban South Coast**	http://www.seaslugforum.net/message/6315	**Indian and Western Pacific Oceans**	NSB p. 146	**Indian and Western Pacific Oceans**
*Diversidoris cf. crocea**	Rudman , 1986		s.	**Sodwana Bay**	http://www.seaslugforum.net/message/16068	**Western and Central Pacific Ocean**	NSB p. 248	**Western and Central Pacific Ocean**
Diversidoris sp.*	http://www.inpotnature.org/node/770499		s.	**Sodwana Bay**	http://www.inpotnature.org/node/770499	s.		**Endemic**
Doriopsilla areolata	Bergh, 1880	previously: *D. miniata*	NOSA p. 89 s. 149; Goodheart & Valdés, 2013	**Oudekraal, Cape Town**	NOCP p. 50 (17.3)	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=325	**NE-Atlantic, Indo-Pacific to Australia (Gosliner, 1987)**
Doriopsilla capensis	Bergh, 1907		NOSA p. 90, s. 151	**Oudekraal, Cape Town**	NOCP p. 49 (17.2)	**Eastern False Bay**	https://www.inpotnature.org/node/577490?nav=search	**Endemic**
Doriopsilla sp. 1	this study	previously: *D. miniata*	s.	**Jeffrey's Bay**	this study	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=325	**Endemic**
Doripromatica atromarginata	Cuvier, 1804		NOSA p. 83, s. 133	**Sodwana Bay**	NOSA p. 83, s. 133	**widespread Indo-Pacific**	NSB p. 238	**widespread Indo-Pacific**
*Doripromatica palademana**	Rudman, 1986		s.	**Sodwana Bay**	https://www.inpotnature.org/node/595374	**Western Pacific Ocean**	NSB p. 238	**Western Pacific Ocean**
Doris pecten	Collingwood, 1881		NOSA p. 63, s. 71	**Durban (Salt Rock)**	https://www.inpotnature.org/node/765940	**widespread Indo-Pacific**	NSB p. 166	**widespread Indo-Pacific**
Doris sp. 1	NOSA p. 62, s. 69		NOSA p. 62, s. 69	**Western False Bay**	this study	**Algoa Bay**	NOSA p. 62, s. 69	**Endemic**
Doris ananas	Lima, Tibiriça & Simone, 2016		NOSA p. 62, s. 70	**Transkei**	TRG p. 310	**Western Indian Ocean**	NSB p. 165	**Tanzania**
Doris cf. verrucosa	Linnaeus, 1758		NOSA p. 62, s. 68	**Luderitz**	NOSA p. 62, s. 68	**Port Elizabeth**	NOSA p. 62, s. 68; http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=531	**ENW-Atlantic (Gosliner, 1987)**
Doto africoronata	Stojenas & Gosliner, 2015		Stojenas & Gosliner, 2015; NOSA p. 106, s. 201	**Oudekraal, Cape Town**	Stojenas & Gosliner, 2015; NOSA p. 106, s. 201	**Kaysna**	NOSA p. 106, s. 201	**Endemic**
Doto cf. pinnatifida	this study		s.	**Lamberts Bay**	this study	**Cape Peninsula West**	this study	**Endemic**
*Doto coronata**	Gmelin, 1791		NOSA p. 106, s. 200	**Oudekraal, Cape Town**	NOSA p. 106, s. 200	**Kaysna**	NOSA p. 106, s. 200	**Endemic**
Doto rosea	Trinchese, 1881		NOSA p. 107, s. 202	**Western False Bay**	NOSA p. 107, s. 202	s.		**Endemic**
Doto splendidissima	Pola & Gosliner, 2015		Pola & Gosliner, 2015	**Western False Bay**	Pola & Gosliner, 2015 ; http://www.inpotnature.org/node/715157	s.		**Endemic**
Embletonia sp.	NOSA p. 115, s. 228		NOSA p. 115, s. 228	**Western False Bay**	NOSA p. 115, s. 228	s.		**Embletonia Gracilis: Hawaii (Gosliner, 1987)**
Eubranchus sp. 8	NOSA p. 117, s. 233; www.inpotnature.org/node/599310?nav=parent_ob	previously *Cuthona* sp. 1 in NOSA (p. 117, sl. 234)	NOSA p. 117, s. 234	**Hout Bay**	NOSA p. 117, s. 234	**St James, Cape Town**	NOSA p. 117, s. 234	**Endemic**
Eubranchus sp. 1	NOSA p. 114, s. 225		NOSA p. 114, s. 225	**Bloubergstrand, Cape Town**	NOSA p. 114, s. 225	**Western False Bay**	NOSA p. 114, s. 225	**Endemic**
Eubranchus sp. 2	NOSA p. 115, s. 226		NOSA p. 115, s. 226	**Western False Bay**	NOSA p. 115, s. 226	**Kaysna**	NOSA p. 115, s. 226	**Endemic**
Eubranchus sp. 3	NOSA p. 115, s. 227		NOSA p. 115, s. 227	**Kaysna Lagoon (mouth)**	NOSA p. 115, s. 227	s.		**Endemic**
Eubranchus sp. 4	NOCP p. 86 (30.1)		NOCP p. 86 (30.1)	**Hout Bay**	http://www.seaslugforum.net/message/19954	s.		**Endemic**
Eubranchus sp. 5	NOCP p. 87 (30.2)	jones, candelabra (*E. cf. dorise*)	MACP p. 152	**Partridge Point**	http://www.seaslugforum.net/message/19936	**Rosi Ilo, Eastern False Bay**	NOCP p. 87 (30.2)	**Endemic**
Eubranchus sp. 6*	this study		s.	**Lamberts Bay**	this study	**Elands Bay**	this study	**Endemic**
Eubranchus sp. 7*	this study		s.	**West Coast Peninsula**	this study	s.		**Endemic**
Eubranchus sp. 9	T.M. Gosliner: http://www.narg.co.za/home/html/news/news_2008/gosliner.htm		s.	**Millers Point**	http://www.narg.co.za/home/html/news/news_2008/gosliner.htm	s.		**Endemic**
Eubranchus sp. 10	T.M. Gosliner: http://www.narg.co.za/home/html/news/news_2008/gosliner.htm		s.	**Millers Point**	http://www.narg.co.za/home/html/news/news_2008/gosliner.htm	s.		**Endemic**
Facelina bouraillii	Risbec, 1928		NOSA p. 212, s. 245	**Durban (Salt Rock)**	http://www.inpotnature.org/node/747699	**Indian and Western Pacific Oceans**	NSB p. 358	**Indian and Western Pacific Oceans**
Facelina olivacea	Macnae, 1954		NOSA p. 212, s. 244	**Walvis Bay (Namibia)**	this study	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=species&specie_id=404	**Endemic**
Favorinus ghanensis	Edmunds, 1968		NOSA p. 124, s. 253	**Kaysna Lagoon (mouth)**	NOSA p. 124, s. 253	**only other locality: Tema (Ghana)**	NOSA p. 124, s. 253	**Tema (Ghana) Gosliner, 1987**
Favorinus japonicus	Baba, 1949		NOSA p. 123, s. 252	**Sodwana Bay**	NOSA p. 123, s. 252	**widespread Indo-Pacific**	NOSA p. 363	**widespread Indo-Pacific**
Favorinus sp.*	http://www.seaslugforum.net/find/1672		s.	**Durban South Coast**	http://www.seaslugforum.net/find/1672	s.		**Endemic**
*Favorinus tasuragianus**	Baba & Abe, 1964		s.	**Sodwana Bay**	http://www.seaslugforum.net/find/19965	**Indian and Western Pacific Oceaun**	NSB p. 363	**Indian and Western Pacific Oceaun**
Fiona pinnata	Eschscholtz, 1831		NOSA p. 120, s. 243	**Witsand**	NOSA p. 120, s. 243	**widespread in all Oceans**	NSB p. 358	**widespread in all Oceans**
Flabellina bicolor	Kelaart, 1858		NSB p. 334	**Durban South Coast**	http://www.seaslugforum.net/find/20686	**widespread Indo-Pacific**	NSB p. 334	**widespread Indo-Pacific**
Flabellina capensis	Thiele, 1925		NOSA p. 113, s. 220	**Oudekraal, Cape Town**	NOSA p. 113, s. 220	**East London**	this study	**Endemic**
Flabellina delicata	Gosliner & Willan, 1991		NOSA p. 114, s. 225	**Durban South Coast**	NOSA p. 114, s. 225	**Indian and Western Pacific Oceans**	NSB p. 332	**Indian and Western Pacific Oceans**
Flabellina exoptata	Gosliner & Willan, 1991		NSB p. 332	**Sodwana Bay**	http://www.seaslugforum.net/find/17408	**widespread Indo-Pacific**	NSB p. 332	**widespread Indo-Pacific**
Flabellina funeka	Gosliner & Griffiths, 1981		NOSA p. 112, s. 219	**Cape Point**	NOSA p. 112, s. 219	**East London**	this study	**Endemic**
Flabellina rubrolineata (a)	O'Donoghue, 1929		NSB p. 332	**Sodwana Bay**	http://www.seaslugforum.net/find/15621	**widespread Indo-Pacific**	NSB p. 332	**widespread Indo-Pacific**
*Flabellina rubrolineata (b)**	this study		s.	**Sodwana Bay**	this study	s.		**Endemic**
Flabellina rubropurpurata	Gosliner & Willan, 1991		NOSA p. 114, s. 223	**Sodwana Bay**	http://www.seaslugforum.net/find/15621	**widespread Indo-Pacific**	NSB p. 334	**widespread Indo-Pacific**
Flabellina sp. 1	NOSA p. 113, s. 221		NOSA p. 113, s. 222	**Oudekraal, Cape Town**	NOSA p. 113, s. 222	**Western False Bay**	NOSA p. 113, s. 222	**Endemic**
Flabellina sp. 2	NOSA p. 113, s. 222		NOSA p. 113, s. 223	**Lamberts Bay**	this study	**Western False Bay**	NOSA p. 113, s. 223	**Endemic**
Gargamella bovina	Garaevoy, Valdés & Gosliner, 1999		NOSA

Phyllidiella meandrina	Pruvot-Fol, 1957		NOSA p. 90 s. 153	**Durban South Coast**	https://www.inpotnature.org/node/602174	**Indian Ocean**	NSSI p. 285	**Indian Ocean**
Phyllidiella striata	Bergh, 1889		IPNU p. 296	**Sodwana Bay**	http://www.seaslugforum.net/find/2899	**western and central Pacific Oceans**	NSSI p. 287	**western and central Pacific Oceans**
Phyllidiella zeylanica	Kelaart, 1859		NOSA p. 91, s. 154	**Transkei**	TRG p. 328	**Indian and western Pacific Oceans**	NSSI p. 283	**Indian and western Pacific Oceans**
Phyllidiopsis cardinalis	Bergh, 1876		IPNU p. 296	**Durban South Coast**	http://www.seaslugforum.net/message/2326	Widespread Indo-Pacific	NSSI p. 289	**Widespread Indo-Pacific**
*Phyllidiopsis gremanica krempfi**	Pruvot-Fol, 1957		this study	**Sodwana Bay**	this study	**Indian and western Pacific Oceans**	NSSI p. 286	**Indian and western Pacific Oceans**
*Phyllodesmium cf. macphersonae**	Burn, 1962		x	**Durban (Garvies)**	https://www.inpotnature.org/node/613117	**Western Pacific Ocean**	NSSI p. 375	**Western Pacific Ocean**
*Phyllodesmium cf. poindimiri**	Risbec, 1928		x	**Sodwana Bay**	https://www.inpotnature.org/node/599421 (second picture)	**widespread Indo-Pacific**	NSSI p. 376	**widespread Indo-Pacific**
*Phyllodesmium cf. serratum**	Baba, 1949		x	**Durban South Coast**	https://www.inpotnature.org/node/617173; https://www.inpotnature.org/node/593749	**Australia, Japan**	NSSI p. 377	**Australia, Japan**
Phyllodesmium horridum	Macnae, 1954		NOSA p. 124, s. 255	**Western False Bay**	NOCP p. 94	**Durban**	https://www.inpotnature.org/node/593743	**Endemic**
Phyllodesmium hyalinum	Ehrenberg, 1831		NOSA p. 125, s. 256	**Sodwana Bay**	NOSA p. 125, s. 256	**Indian and western Pacific Oceans**	NSSI p. 371	**Indian and western Pacific Oceans**
Phyllodesmium cf. magnum	Rudman. 1991		TRG p. 332	Durban South Coast	this study	**widespread Indo-Pacific**	NSSI 372	**widespread Indo-Pacific**
*Phyllominiscus sp.**	this study; NSSI p. 336		x	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=specie&specie_id=444	**Western Pacific Ocean**	NSSI p. 336	**Western Pacific Ocean**
Platydoris cruenta	Quey & Gaimard, 1832		NOSA p. 73, s. 102	**Durban (harbour)**	NOSA p. 73, s. 102	**widespread Indo-Pacific**	NSSI p. 201	**widespread Indo-Pacific**
Platydoris sp.	NOSA p. 73, s. 103		NOSA p. 73, s. 103	**Transkei**	NOSA p. 73, s. 103	**x**		**Endemic**
*Plocamopherus sp.**	Angas, 1864	Emyrman ECSD	x	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=specie&specie_id=427	**Eastern Australia, Northern New Zealand**	NSSI p. 116	**Eastern Australia, Northern New Zealand**
*Plocamopherus cf. margaritae**	Valdés & Gosliner, 2006	Angas McDonald	x	**Sodwana Bay**	http://www.inpotnature.org/search/node/plocamopherus	**Indian and western Pacific Oceans**	NSSI p. 116	**Indian and western Pacific Oceans**
Plocamopherus maculatus	Pease, 1860		NOSA p. 98, s. 175	**Sodwana Bay**	NOSA p. 98, s. 175	**Widespread Indo-Pacific**	NSSI p. 117	**Widespread Indo-Pacific**
Plocamopherus sp. 3	NSSI p. 118		NOSA p. 98, s. 176	**Sodwana Bay**	NOSA p. 98, s. 176	**x**		**Endemic**
Polycera capensis / sp. 2 / luderitz	Quey & Gaimard, 1824; NOCP p. 60 (21.4); this study		NOSA p. 96, s. 171; NOCP p. 60 (21.4)	**Luderitz, Namibia**	this study	**East London**	this study	**introduced in Australia (Gosliner, 1987)**
Polycera sp. 3	NOSA p. 97, s. 172	*previously P. quadrolineata*	NOSA p. 97, s. 172	**Cape Peninsula West**	**MAC P p. 140**	**Algoa Bay**	NOSA p. 97, s. 172	**Endemic**
Polycera hedgpethi	Er. Marcus, 1964		NOSA p. 97, s. 173	**Knysna**	this study; http://www.inpotnature.org/node/572283	**Port Elizabeth**	http://www.easternscapescubadiving.co.za/index.php?page_name=specie&specie_id=235	**Australia, New Zealand, Pacific North America (Gosliner, 1987)**
Polycera sp. 1	NOSA p. 97, s. 174		NOSA p. 97, s. 174	**Western False Bay**	**NOCP p. 59 (21.3); MAC P p. 142**	**Durban**	NOSA p. 97, s. 174; TRG p. 308	**Endemic**
*Pruvotfolidiella cf. atra**	Baba, 1955		x	**Sodwana Bay**	http://www.inpotnature.org/en/node/599424?un=parent_ob	**x**		**Endemic**
Pruvotfolia pselliotes	Lobbe, 1923		NOSA p. 121, s. 246	**Saldanha Bay**	NOSA p. 121, s. 246	**Algoa Bay**	NOSA p. 121, s. 246; http://easternscapescubadiving.co.za/index.php?page_name=specie&specie_id=404 (last 8 photos)	**Mediterranean, Ghana (Gosliner 1987)**
Pteraeolidia cf. semperi	Bergh, 1870	Wilson & Burghardt, 2015	TRG p. 332 (mislabeled: *Pteraeolidia ianthina* ; see: Wilson & Burghardt, 2015)	**Transkei**	TRG p. 332	**Mozambique**	TRG p. 332	**Mozambique**
Roboastra gracilis	Bergh, 1877		NOSA p. 101, s. 185	**Sodwana Bay**	NOSA p. 101, s. 185	**widespread Indo-Pacific**	NSSI p. 129	**widespread Indo-Pacific**
Roboastra luteolineata	Baba, 1936		NOSA p. 101, s. 186	**Durban**	http://www.seaslugforum.net/find/4639	**Indian and western Pacific Oceans**	NSSI p. 129	**Indian and western Pacific Oceans**
Rostanga aureomala	Garovoy, Valdés & Gosliner, 2001		NOSA p. 72, s. 99	**Algoa Bay**	NOSA p. 72, s. 99	**x**		**Endemic**
Rostanga bifurcata	Rudman & Avern, 1989	*Rostanga muscula* in NOSA	NOSA p. 72, s. 96	**Durban South Coast**	NOSA p. 71, s. 96	**widespread Indo-Pacific**	NSSI p. 198	**widespread Indo-Pacific**
Rostanga elandsia	Garovoy, Valdés & Gosliner, 2001		NOSA p. 72, s. 98	**Oudekraal**	NOSA p. 72, s. 98	**East London**	this study	**Endemic**
Rostanga phepha	Garovoy, Valdés & Gosliner, 2001		NOSA p. 71, s. 97	**Cap Peninsula West**	NOSA p. 71, s. 97	**x**		**Endemic**
*Rostanga sp.**	this study		x	**Transkei**	this study	**x**		**Endemic**
Sclerodoris apiculata	Alder & Hancock, 1864		NOSA p. 67, s. 84	**Transkei**	NOSA p. 67, s. 84	**Indian and western Pacific Oceans**	NSSI p. 194	**Indian and western Pacific Oceans**
Scleroderis coriacea	Eliot, 1904		NOSA p. 67, s. 85	**Sodwana Bay**	NOSA p. 67, s. 85	**Indian Ocean**	NSSI p. 194	**Indian Ocean**
Scleroderis tuberculata	Eliot, 1904		IPNI p. 186	**Durban South Coast**	http://www.inpotnature.org/node/592050	**Indian and western Pacific Oceans**	NSSI p. 195	**Indian and western Pacific Oceans**
Tambja affinis	Eliot, 1904		IPNU p. 118	**Cape Vidal**	this study	**Red Sea and Indian Ocean**	NSSI p. 127	**Red Sea and Indian Ocean**
Tambja capensis	Bergh, 1907		NOSA p. 100, s. 182	**Oudekraal**	NOSA p. 100, s. 182	**East London**	this study	**Endemic**
*Tambja cf. kuroa**	this study		x	**Transkei**	this study	**western and central Pacific Ocean**	NSSI p. 128	**western and central Pacific Ocean**
Tambja morosa	Bergh, 1877		NOSA p. 100, s. 183	**Durban South Coast**	https://www.inpotnature.org/node/718870	**Widespread Indo-Pacific**	NSSI p. 126	**Widespread Indo-Pacific**
Tambja sp.	TOFG, p. 210 s. 94.4		TOFG, p. 210 s. 94.4	**Durban South Coast**	TOFG, p. 210 s. 94.4	**Mozambique**	TOFG, p. 210 s. 94.4	**Mozambique**
Tambja zulu	Pola, Cervera & Gosliner, 2005		NOSA p. 101, s. 184	**Durban South Coast**	http://www.seaslugforum.net/find/2271	**Mozambique**	TRG p. 306	**Mozambique**
Tergipes cf. tergipes	Forskål in Niebuhr, 1775		NOSA p. 119, s. 238	**Bloubergstrand**	NOSA p. 119, s. 238	**Western False Bay**	NOSA p. 119, s. 238	**(T. tergipes: E&W-Atlantic, Mediterranean)**
Tergipes sp.	This study	*Cuthona* sp. 2 in NOSA	NOSA p. 117, s. 234	**Bloubergstrand**	NOSA p. 117, s. 234	**Western False Bay**	NOSA p. 117, s. 234	**Endemic**
Thecacera cf. pennigera	Montagu, 1813		NOSA p. 95, s. 168	**Houtbay**	NOCP p. 57 (21.1)	**Natal (present study only found in Knysna)**	NOCP p. 57 (21.1)	**(T. pennigera: E&W-Atlantic, Mediterranean, Ghana, Pakistan, Australia, New Zealand, Japan)**
Thecacera pacifica	Bergh, 1884		NOSA p. 96, s. 169	**Knysna Lagoon**	NOSA p. 96, s. 169	**Widespread Indo-Pacific**	NSSI p. 118	**Widespread Indo-Pacific**
*Thecacera picta**	Baba, 1972		x	**Sodwana Bay**	this study	**Indian and western Pacific Oceans**	NSSI p. 119	**Indian and western Pacific Oceans**
Thecacera sp. 1	NSSI p. 119		NOSA p. 96, s. 170	**Transkei**	NOSA p. 96, s. 170	**Sodwana Bay**	NOSA p. 96, s. 170	**Endemic**
Thordisa luteola	Chan & Gosliner, 2007		NOSA p. 66, s. 81; NSSI p. 177	**Sodwana Bay**	NOSA p. 66, s. 81; NSSI p. 177	**x**		**Endemic**
Thordisa oliva	Chan & Gosliner, 2007		NOSA p. 66, s. 80; NSSI p. 178	**Sodwana Bay**	NOSA p. 66, s. 80	**Kerama Island (Japan)**	NSSI p. 178	**Kerama Island (Japan)**
Thordisa sp. 12	NSSI p. 180	*Thordisa* sp. 3 in IPNU	NOSA p. 68, s. 87	**Knysna Lagoon**	NOSA p. 68, s. 87	**x**		**Endemic**
Thorunna australis	Risbec, 1928		IPNU p. 251	**Sodwana Bay**	http://www.seaslugforum.net/find/14907	**Indo-Pacific**	NSSI p. 249	**Indo-Pacific**
*Thorunna cf. halmargo**	NSSI p. 252		x	**Sodwana Bay**	http://www.inpotnature.org/node/642592	**western Pacific Ocean**	NSSI p. 252	**western Pacific Ocean**
Thorunna horologia	Rudman, 1984		NOSA p. 80, s. 124	**Durban South Coast**	http://www.seaslugforum.net/find/22385	**Western Indian Ocean**	NSSI p. 250	**Western Indian Ocean**
*Thorunna punicea**	Rudman, 1995		x	**Sodwana Bay**	http://www.inpotnature.org/node/599435	**Indian and western Pacific Oceans**	NSSI p. 251	**Indian and western Pacific Oceans**
Trapania cirrita	Gosliner & Fahey, 2008		NOSA p. 94, s. 163	**Oudekraal**	NOCP p. 55 (20.3)	**Knysna**	NOSA p. 94, s. 163	**Endemic**
Trapania melainia	Gosliner & Fahey, 2008		NOSA p. 94, s. 164	**Sodwana Bay**	NOSA p. 94, s. 164	**x**		**Endemic**
Tritonia nibodhmeri	Marcus Ev., 1983		NOSA p. 108, s. 204	**Oudekraal**	NOSA p. 108, s. 204	**Hermanus**	this study	**European Atlantic (Gosliner, 1987)**
Marionia sp. 1	NOSA p. 108, s. 205	previously: *Tritonia* sp. 1	NOSA p. 108, s. 205	**Oudekraal**	NOCP p. 72 (25.2)	**Port Elizabeth**	NOSA p. 108, s. 205	**Endemic**
Tritonia sp. 13	NSSI p. 321		IPNU p. 344	**Durban South Coast**	http://www.seaslugforum.net/showall/tritsp1	**x**		**Endemic**
Tritonia sp. 2	NOSA p. 108, s. 206		NOSA p. 108, s. 206	**Oudekraal**	NOCP p. 73 (25.3)	**Jeffrey's Bay**	NOSA p. 108, s. 206	**Endemic**
Tritoniopsis elegans	Audouin, 1826		NOSA p. 108, s. 207	**Durban South Coast**	https://www.inpotnature.org/node/718933	**Indian and western Pacific Oceans**	NSSI p. 322	**Indian and western Pacific Oceans**
Voyssiorea felis	Colliguaiod, 1881		NOSA p. 104, s. 194	**Gonubie (East London)**	NOSA p. 104, s. 194	**Indo-Pacific and adjacent temperate seas**	NSSI p. 330	**Indo-Pacific and adjacent temperate seas**

** = South African records not yet recorded in published literature*

Historical records listed in Gosliner 1978		**Taxonomy updated to:**						
Doriodoxa benthalis	*Barnard, 1963*			**Cape Town**	Barnard, 1963	**Endemic**		
Archidoris capensis	*Bergh, 1907*	*Doris capensis (Bergh, 1907)*						
Archidoris scripta	*Bergh, 1907*	*Doris scripta (Bergh, 1907)*						
Alloiodoris inhacae	*O'Donoghue, 1929*							
Discodoris coerulescens	*Bergh, 1907*							
Thordisa burnupi	*Eliot, 1910*							
Thordisa punctilifera	*Bergh, 1907*							
Platydoris scarbra	*Cuvier, 1806 (recorded by Smith 1903)*			**Sodwana Bay**	Smith 1903	**Marshall Islands (Gosliner, 1987)**	Gosliner, 1987	
Chromodoris euelpis	*Bergh, 1907*							
Chromodoris albolimbata	*Bergh, 1907*							
Chromodoris porcata	*Bergh, 1888 (recorded by Eliot, 1910)*							
Ceratosoma cornigerum	*Macnae and Kalk, 1958*	*Ceratosoma trilobatum (J.E. Gray, 1827)*				**Indo-Pacific (Hawaii)**	Gosliner, 1987	
Dendrodoris calliosa	*Bergh, 1907*							
Dendrodoris sp.	*Bergh, 1907*							
Doris natalensis	*Krauss, 1848*	*Discodoris natalensis (Krauss, 1848)*						
Doris psudula	*Bergh, 1907*	*Discodoris pseudula (Bergh, 1907)*						
Doris perplexa	*Bergh, 1907*	*Discodoris perplexa (Bergh, 1907)*						
Doris glabella	*Bergh, 1907*	*Discodoris glabella (Bergh, 1907)*						
Goniodoris ovata	*Barnard, 1934*			**False Bay**	Barnard, 1934	**Endemic**		
Scyllaea pelagica	*Linnaeus, 1758*							
Melibe pilosa	*Odhner, 1936 (recorded by Macnae and Kalk, 1958)*	*Melibe viridis (Kelaart, 1858)*		**Sodwana Bay**	Macnae and Kalk, 1958	**Widespread Indo-Pacific**	NSSI, p. 317	
Tritonia aurantiacum	*Barnard, 1927*							
Tritonia pallida	*Stimpson, 1854*							
Tritonia indecora	*Bergh, 1907*							
Tritoniodoxa capensis	*Bergh, 1907*							
Armina bergh	*Thiele, 1925*							
Armina capensis	*Bergh, 1907*							
Armina euchroa	*Bergh, 1907*							
Armina grisea	*O'Donoghue, 1929*							
Armina microdonta	*Bergh, 1907*							
Armina natalensis	*Bergh, 1866*							
Armina serrata	*O'Donoghue, 1929*							
Armina simoniana	*Tiele, 1925*							
Facelina annulata	*Macnae, 1954a*							
Echinopsole fulvus	*Macnae, 1954a*							

References to books:

TOFG = Branch G, Griffiths CL, Branch ML, Beckley LE. 2008. *Two oceans: a guide to the marine life of southern Africa*. Struik. ISBN 978-1-77007-772-0

NOTW = Debelius H. & Kuiter RH. 2007. *Nudibranchs of the World*. Ikan-Unterwasserarchiv. ISBN 978-3-939767-06-0

NSSI = Gosliner TM, Valdés A, Behrens DW. 2015. *Nudibranchs and Sea Slugs of the Indopacific*. New World Publications, Inc. Jacksonville, Florida USA. ISBN 978-1-878348-59-3.

NOSA = Gosliner TM. 1987. *Nudibranchs of Southern Africa, A Guide to Opistobranch Molluscs of Southern Africa*. Sea Challengers & Jeff Hamann. ISBN 0-930118-12-8.

IPNU = Gosliner TM, Behrens DW, Valdés A. 2008. *Indo-Pacific nudibranchs and sea slugs: a field guide to the world's most diverse fauna*. Sea Challengers Natural History Books; California Academy of Sciences. ISBN 978-0-9700574-3-3

MACP = Jones G, 2008. *A field guide to the marine animals of the Cape Peninsula*. Southern Underwater Research Group. ISBN 9-780620-416399

TRG = King D, Fraser V. 2014. *The Reef Guide: Fishes, Corals, Nudibranchs & other Invertebrates. East & South Coasts of Southern Africa*. Struik Nature. ISBN 978-1-77584-018-3.

NOCP = Zsilavecz G. 2007. *Nudibranchs of the Cape Peninsula and False Bay*. Southern Underwater Research Group, Cape Town. ISBN 0-620-38654-3.

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Appendix 2.7
Collected & Sequenced Specimens of Nudibranchia

Figure names: "Species name", "Locality code"-"Collector's initials", "Sequence code"

See last pages of this appendix for more details on specimens and collection localities.

Locality codes:

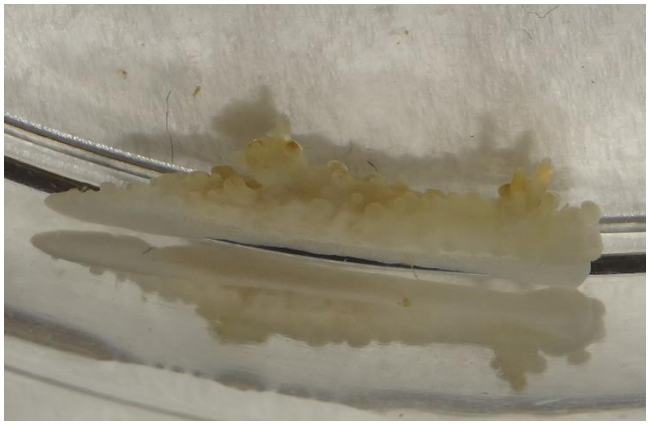
CPW	= Cape Peninsula West
WFB	= Western False Bay
EFB	= Eastern False Bay
HER	= Hermanus
KNY	= Knysna
WCP	= West Coast Peninsula
NAQ	= Elands Bay/ Lamberts Bay/ Port Nolloth
CSF	= Cape St Francis
CRF	= Cape Recife
PAF	= Port Alfred
TSK	= Transkei
ELO	= East London
DSC	= Durban South Coast
CVD	= Cape Vidal
SOD	= Sodwana Bay
LUD	= Luderitz, Namibia
NMSA	= KwaZulu-Natal Museum samples from Walvisbay, Namibia
IZSAM	= Iziko South African Museum samples from SAEON offshore trawls the of Agulhas Bank

Collector's initials:

VF = Valda Fraser
GZ = Guido Zsilavecz
AC = Allan Connell
ES = Evania Snyman
DH = Dai Herbert
CG = Charles Griffiths
FG = Francis Ian Gelletich
KG = Kolette Grobler
KE = Kerry-Lee Etsebeth
MF = Mari-Lise Franken
ADT = Alheit du Toit
JT = Jessica Toms

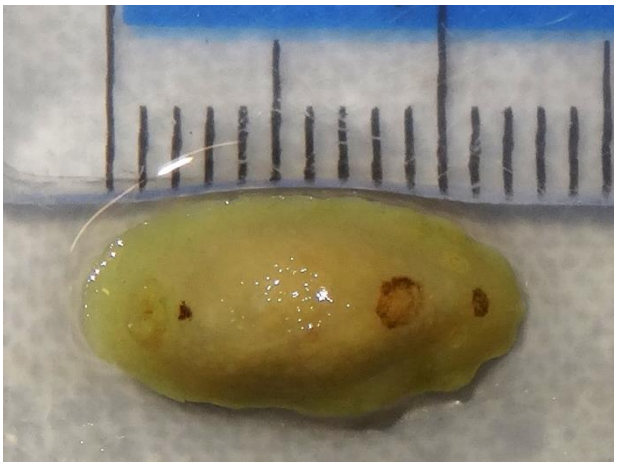
Acanthodoris planca, WFB-GZ, WFBAP01

Acanthodoris planca, EFB-JT, EFBAP03



Aegires ninguis, WFB-JT, WFBAS01

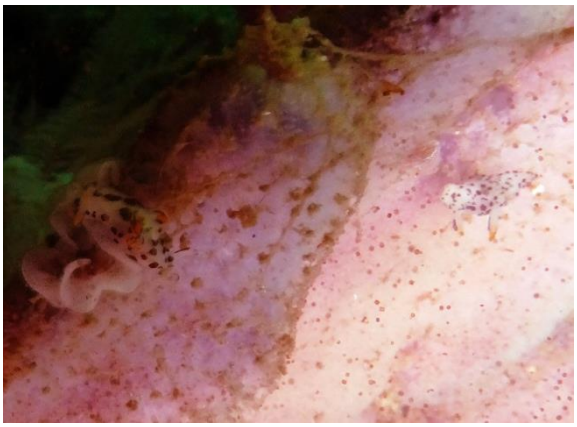
Aegires ninguis, WFB-JT, WFBAS02



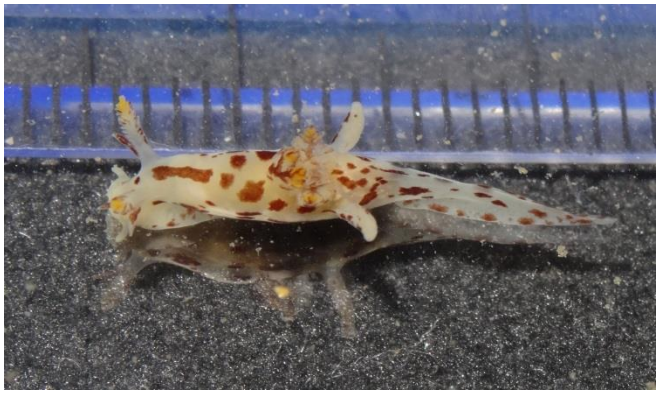
Aldisa trimaculata (preserved), IZSAM, DCTAT01

Amanda armata, WFB-JT, WFBAA02

Ancula sp.,
CPW-GZ, ASBAN02



Ancula sp.,
EFB-JT, EFBSD08



Ancula sp.,
KNY-FG, KNYAN04

Anteaeolidiella saldanhensis,
PAF-JT, PAFAI01

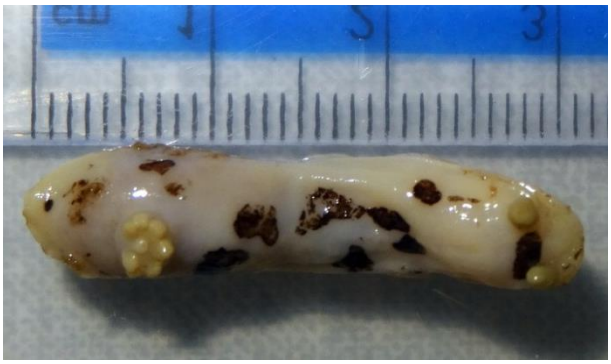
Aphelodoris brunnae,
EFB-JT, EFBAB01

Aphelodoris brunnea (preserved),
CRF-ES, CRFAB03

Aphelodoris brunnea (preserved),
CRF-ES, CRFAB04

Aphelodoris burnnea (preserved),
CRF-ES, CRFAB02

Aphelodoris sp. 1 (preserved),
CRF-ES, CRFAB01



Aphelodoris sp. 1, (preserved),
IZSAM, DCTALP01

Ardeadoris cf. *electra*,
DSC-VF, NATAE01

Ardeadoris sp.
(prev. *Glossodoris* sp. 6),
DSC-VF, NATAS201

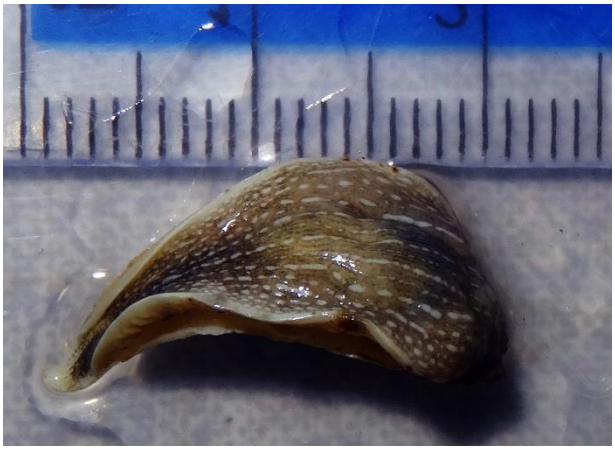
Ardeadoris symmetrica,
DSC-VF, NATASY02

Ardeadoris symmetrica,
SOD-VF, SODASY01

Ardeadoris undaurum,
DSC-VF, NATAU01

Ardeadoris undaurum,
DSC-VF, NATAU02

Ardeadoris undaurum,
DSC-VF, NATAU03

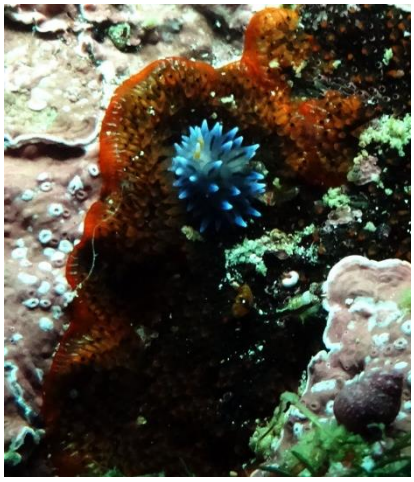


Armina gilchristi (preserved),
IZSAM, DCTAG01

Armina sp. 12,
DSC-VF, NATARM01

Baeolidia sp. (prev. *B. moebii*),
DSC-DH, NATBM01

Bonisa nakaza,
CRF-JT, CRFBN01



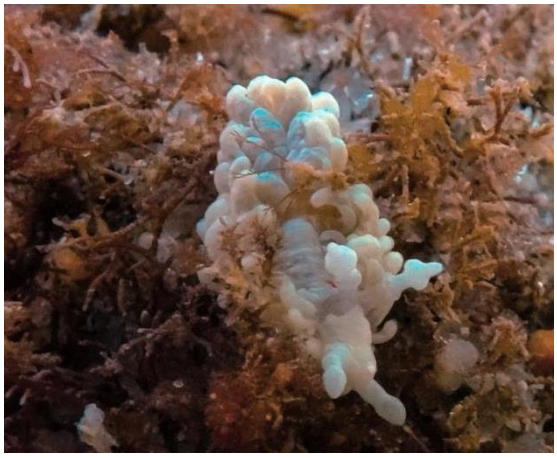
Bonisa nakaza,
EFB-BN, EFBBN04

Bonisa nakaza,
WFB-GZ, WBBN01

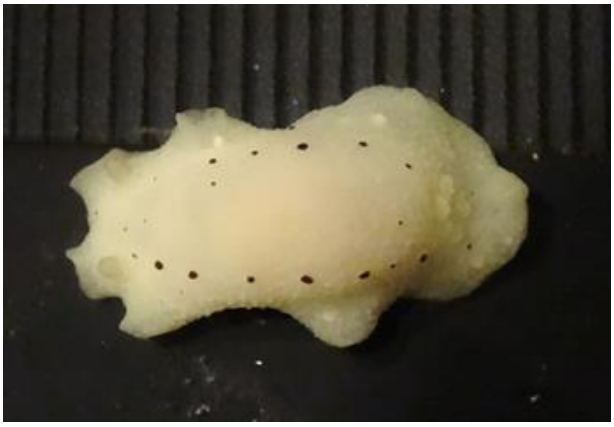
Bornella valdae,
DSC-VF, NATBV01

Bornella valdae, DSC-VF, NATBV02

Bornella valdae, SOD-JT, SODBV01



Bulbaeolidia sp. (prev. *B. alba*), DSC-JT, NATBA01



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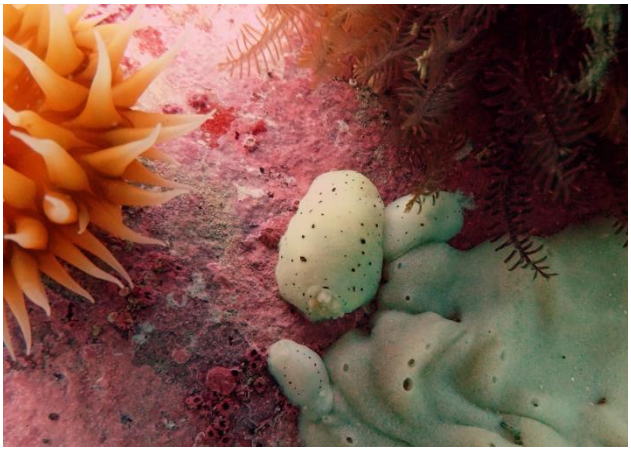


Cadlina sp. 1 (prev. *Cadlina* sp. 2), EFB-JT, EFBCA207

Cadlina sp. 1, WFB-GZ, WFBCA101

Cadlina sp. 2,
CPW-GZ, ASBCA201

Phidiana cf. *indica* (prev. *Caloria indica*),
SOD-JT, SODCI01

Caloria sp. 1,
WFB-GZ, WFBCS101

Catriona casha,
EFB-JT, EFBCTC01-02

Ceratosoma cf. *tenue*,
SOD-JT, SODCT01

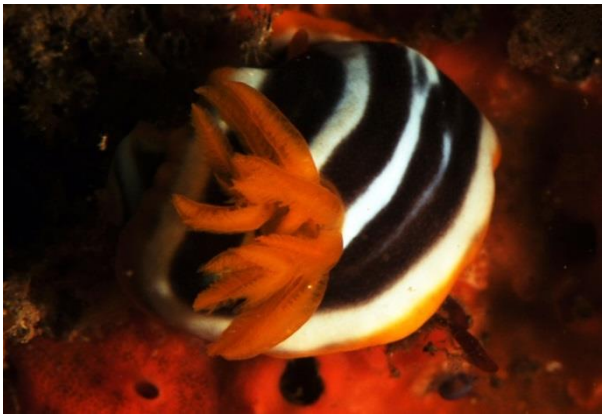
Ceratosoma ingozi,
EFB-JT, EFBCI01

Ceratosoma ingozi,
ELO-ES, ELOCI01

Ceratosoma ingozi,
ELO-ES, ELOCI02

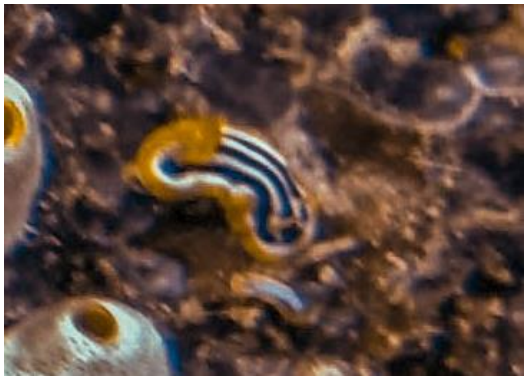
Ceratosoma sp.,
SOD-JT, SODGP02

Chromodoris africana,
DSC-VF, NATCA01



Chromodoris africana,
DSC-VF, NATCA02

Chromodoris africana,
SOD-JT, SODCA02



Chromodoris africana,
SOD-KE, SODCA01

Chromodoris hamiltoni,
DSC-VF, NATCH01

Chromodoris hamiltoni,
DSC-VF, NATCH02

Chromodoris hamiltoni,
DSC-VF, NATCH03

Chromodoris hamiltoni,
SOD-AC, SODCH05

Chromodoris hamiltoni,
SOD-AC, SODCH06

Chromodoris hamiltoni,
SOD-JT, SODCA04

Chromodoris hamiltoni,
SOD-JT, SODCH02

Chromodoris hamiltoni,
SOD-JT, SODCH03

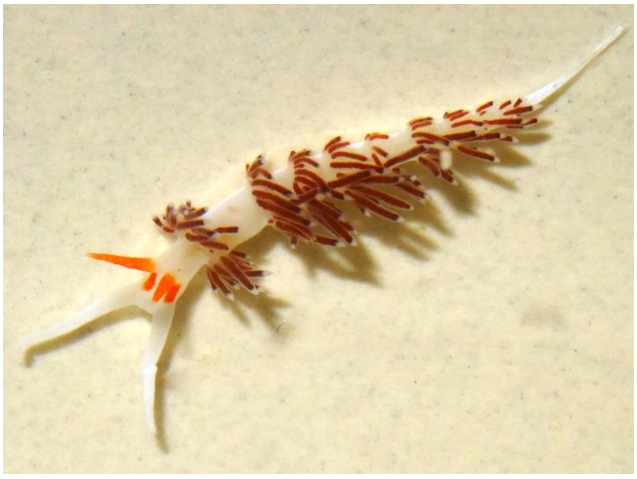
Chromodoris sp.,
DSC-VF, NATCS101

Corambe sp.,
WFB-GZ, WFBCO01,
WFBCO02

Cratena capensis (a),
CPW-JT, ASBCC04-05

Cratena capensis (b),
MSB-JT, MSBCC01

Cratena sp. 1,
CRF-JT, CRFCR101



Cratena sp. 1,
CRF-JT, CRFCR102

Cratena sp. 1,
KNY-LC, KNYCRS104

Cratena sp. 4,
CRF-ES, CRFCR401

Cuthona sibogae,
DSC-VF, NATCU01, NATCU02

Cuthona speciosa (a),
CPW-JT, ASBCU02

Cuthona speciosa (a),
EFB-JT, EFBCU03

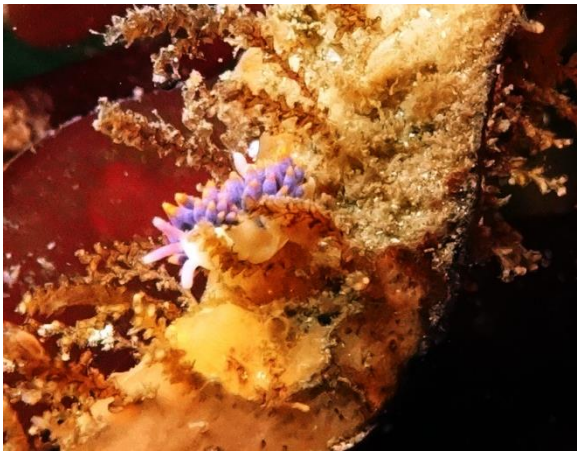
Cuthona speciosa (a),
ELO-JT, ELOCU03

Cuthona speciosa (a),
ELO-JT, ELOCU05

Cuthona speciosa (a),
ELO-JT, ELOCU06

Cuthona speciosa (a),
NAQ-JT, NAQCU02

Cuthona speciosa (a),
SWC-JT, SWCCU01



Cuthona speciosa (a),
SWC-JT, SWCCU02

Cuthona speciosa (a),
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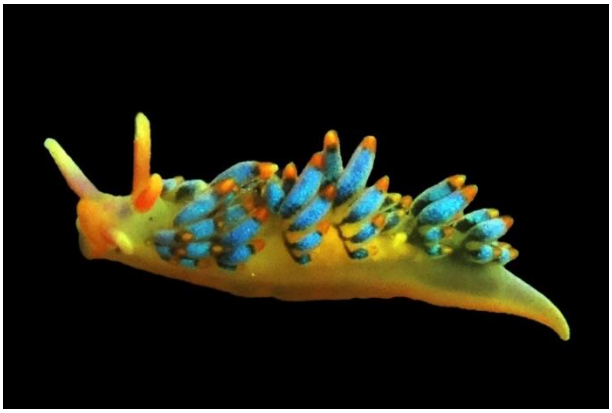
Cuthona speciosa (b),
ELO-JT, ELOCU04

Cuthona speciosa (b),
ELO-JT, ELOCU08



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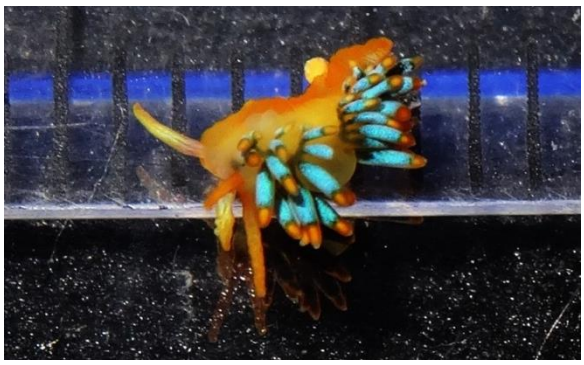
MSB-JT, MSBCU01



Cuthona speciosa (b),
MSB-JT, MSBCU02

Cuthona speciosa (b),
NAQ-JT, NAQCU01

Cuthona speciosa (c),
EFB-JT, EFBSD01

Cuthona speciosa (c),
EFB-JT, EFBSD02

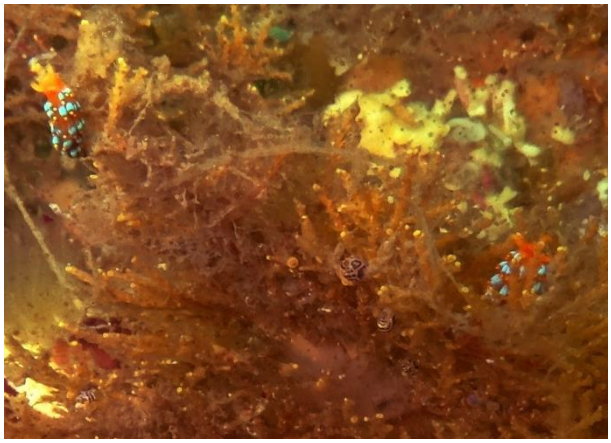
Cuthona speciosa (c),
EFB-JT, EFBSD04

Cuthona speciosa (c),
HER-JT, HERCU04

Cuthona speciosa (d),
CRF-JT, CRFCU01, CRFCU02

Cuthona speciosa (d),
ELO-JT, ELOCU07

Cuthona speciosa (e),
ELO-ES, ELOCU09



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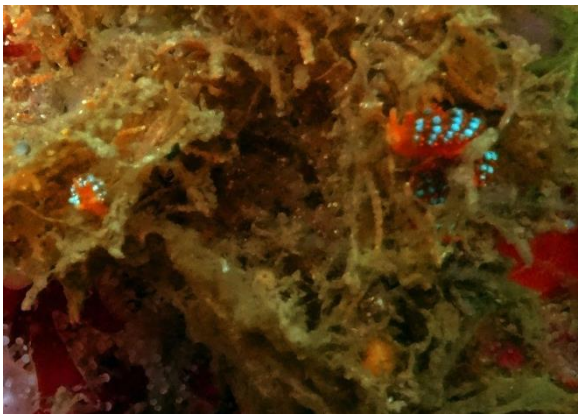
EFB-JT, EFBSD05



Cuthona speciosa (f),
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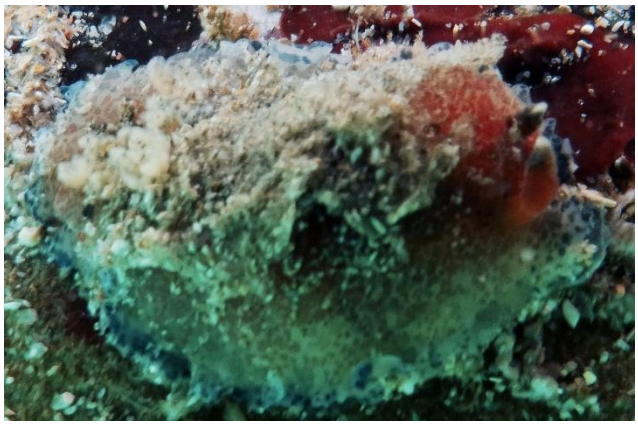
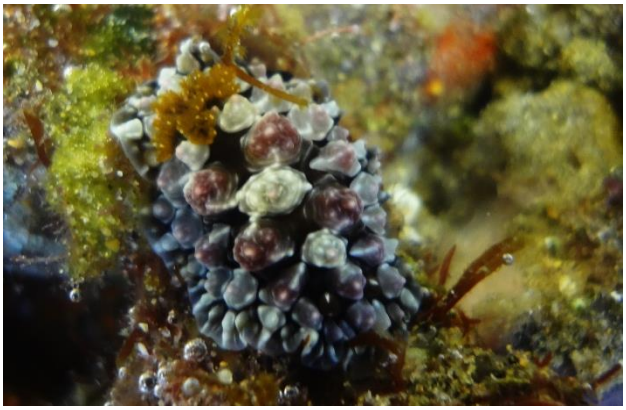
Dendrodoris caesia,
PAF-JT, PAFDCA01

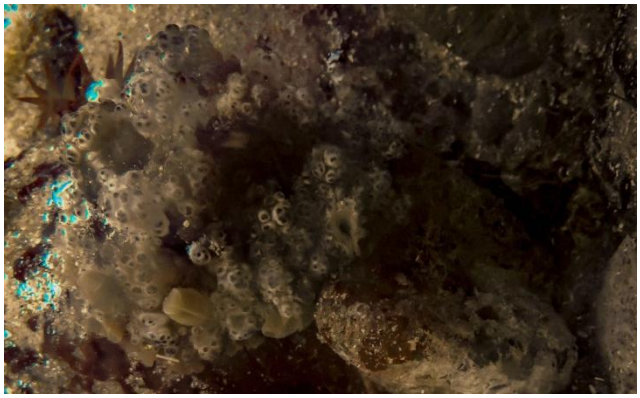


Dendrodoris caesia,
TSK-JT, TSKDCA01

Dendrodoris caesia,
WFB-GZ, WFBDCA01



Dendrodoris carbunculosa,
SOD-JT, SODDT01



Dendrodoris cf. *tuberculosa*,
TSK-JT, TSKDT01

Dendrodoris krusensternii (a),
DSC-FG, NATDK01

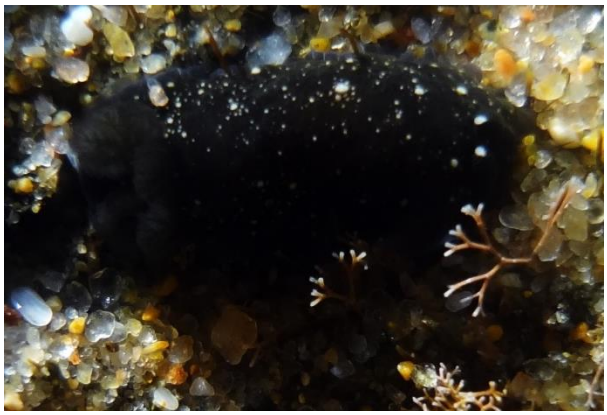
Dendrodoris krusensternii (a),
SOD-JT, SODDK01

Dendrodoris krusensternii (b),
CVD-VF, NATDD01

Dendrodoris nigra,
DSC-FG, NATDN01

Dendrodoris nigra,
DSC-JT, NATDN02

Dendrodoris nigra,
ELO-JT, ELODN01



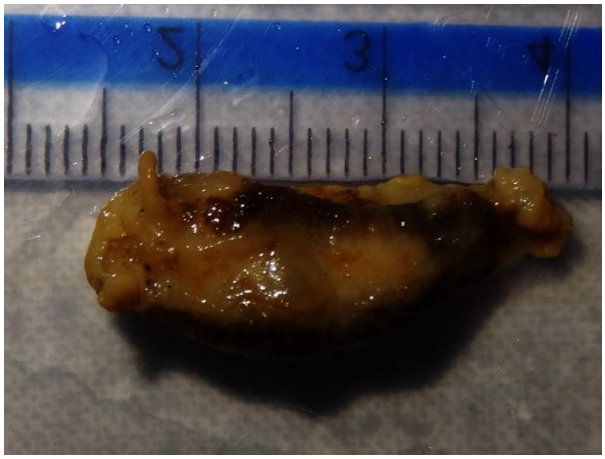
Dendrodoris nigra,
SOD-JT, SODDN01

Dendrodoris nigra,
TSK-JT, TSKDN01

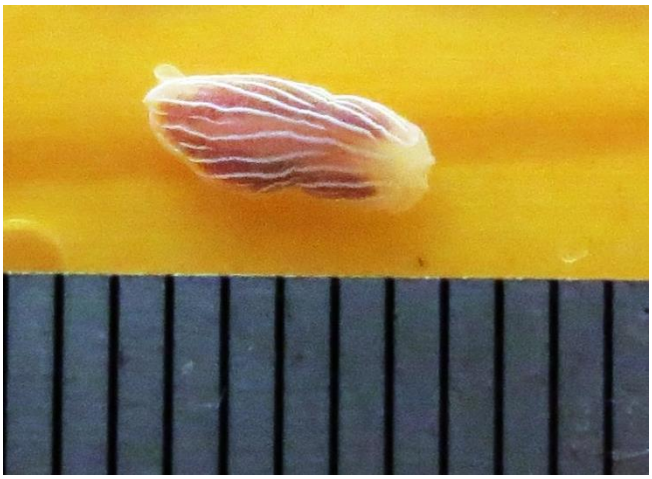
Dendrodoris nigra,
TSK-FG, TSKDN02

Dendrodoris sp.,
TSK-JT, TSKDS01

Dermatobranchus albineus,
SWC-JT, SWCDA01



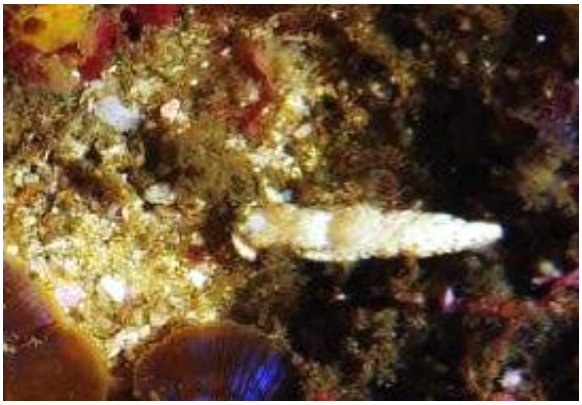
Dermatobranchus arminus,
(preserved), IZSAM, DCTNT01



Dermatobranchus arminus,
ELO-ES, ELODA01

Dermatobranchus caesitius,
TSK-FG, TSKDEC01

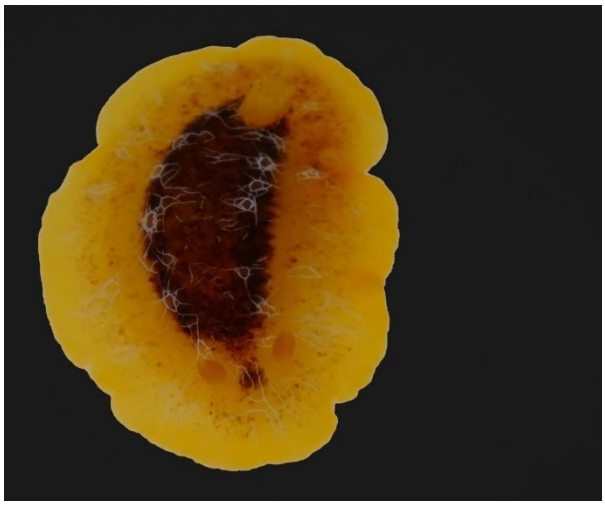
Dermatobranchus gonatophorus,
DSC-VF, NATDG01



Dermatobranchus rodmani,
DSC-VF, NATDER01

Dermatobranchus sp.,
SOD-JT, SODDER01

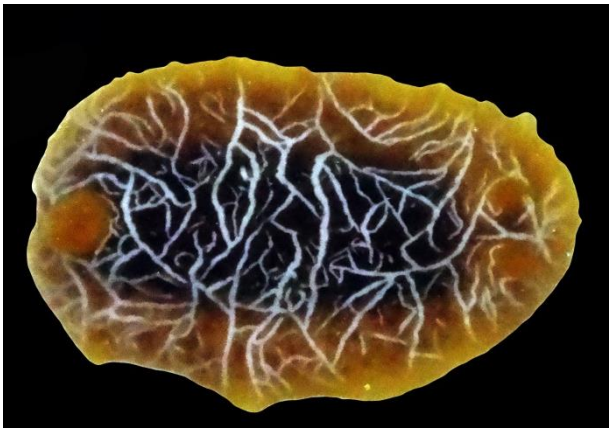
Dermatobranchus sp.,
SOD-JT, SODDER02



Doriopsilla areolata,
CSF-JT, CSFDM01

Doriopsilla areolata,
HER-JT, HERDM03

Doriopsilla areolata,
WFB-GZ, WFBDM02

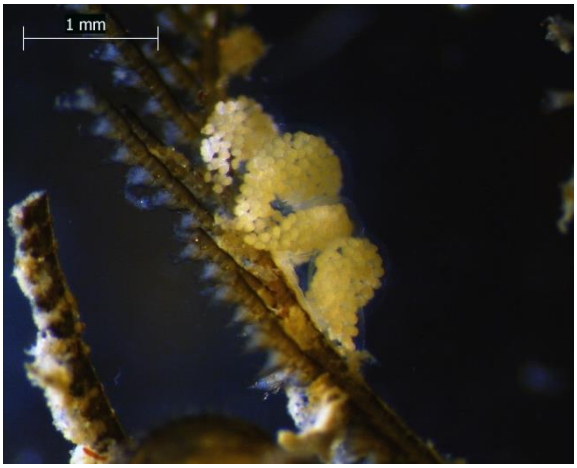


Doriopsilla areolata,
WFB-JT, WFBDM01

Doriopsilla capensis,
CPW-GZ, ASBDC01

Doriopsilla sp.,
DSC-DH, NATDS01

Doris cf. *verrucosa*,
WFB-GZ, WFBDV01



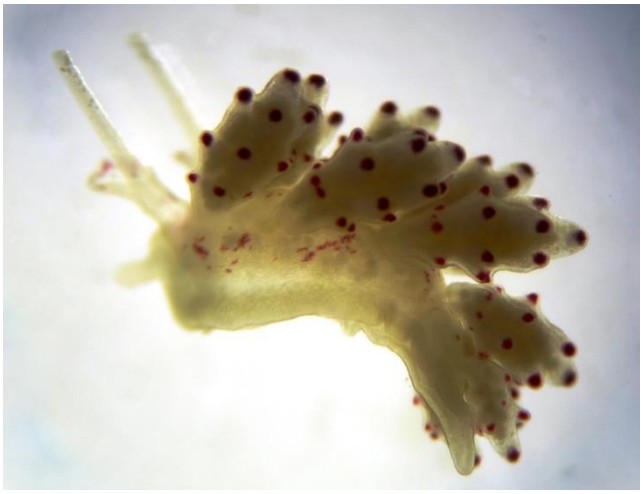
Doto cf. *pinnatifida* egg ribbon

Doto cf. *pinnatifida*, CPW-JT, ASBDP02

Doto cf. *pinnatifida*, NAQ-JT, NAQDP01

Doto cf. *pinnatifida*, NAQ-JT, NAQDP02

Doto cf. *pinnatifida*, NAQ-JT, NAQDP03



Doto coronata, EFB-JT, EFBSD10

Doto coronata, EFD-FG, EFBSD09 & EFBSD10

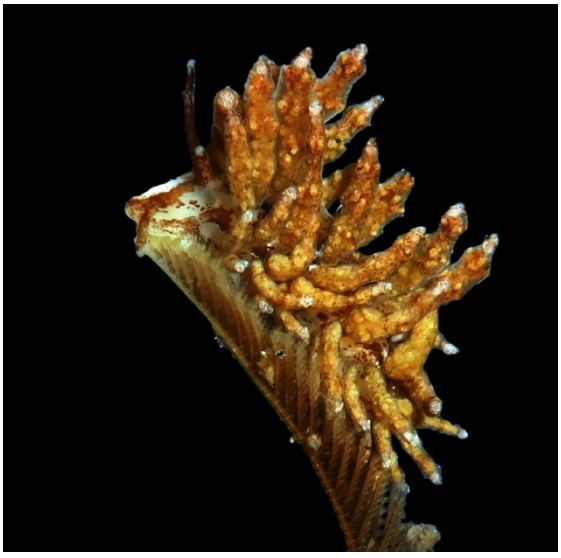
Doto coronata, WFB-FG, WFBDO01

Eubranchus sp. 1, EFB-JT, EFBEB102

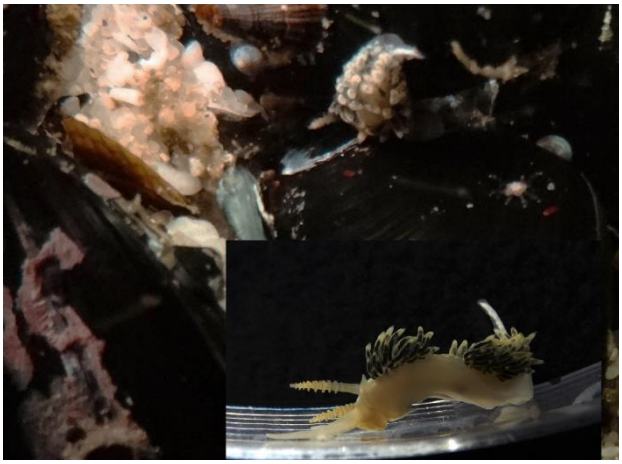
Eubranchus sp. 1, WFB-JT, WFBEB101

Eubranchus sp. 6, SWCEB201

Eubranchus sp. 7, NAQ-JT, NAQEB301



Eubranchus sp. 7, NAQ-JT, NAQEB302



Facelina olivacea (blue),
NAQ-JT, NAQF001

Facelina olivacea (olive),
NAQ-JT, NAQFO03

Facelina olivacea (red),
NAQ-JT, NAQFO04

Facelina olivacea (white),
NAQ-JT, NAQFO02

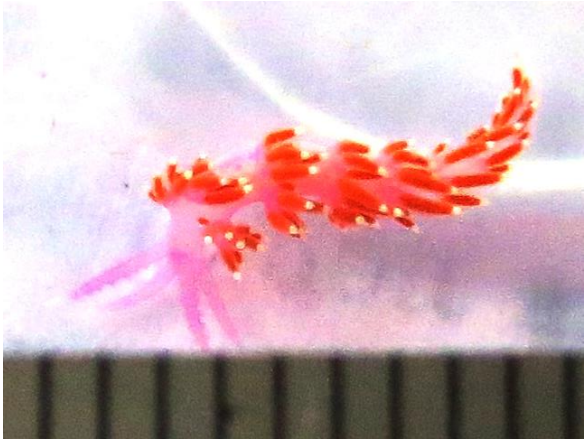
Facelina sp.,
NMSA, NAMFO01

Facelina sp.,
NMSA, NAMFO02

Facelina olivacea,
WFB-JT, WFBFO01

Flabellina capensis,
CPW-GZ, ASBFC02

Flabellina capensis,
CRF-JT, CRFFC01



Flabellina funeka,
ELO-ES, ELOFF03

Flabellina funeka,
WFB-GZ, WFBFF01

Flabellina funeka,
WFB-JT, WFBFF03

Flabellina rubrolineata (a)
SOD-JT, SODFR01

Flabellina rubrolineata (b),
SOD-JT, SODFR02

Flabellina sp. 1,
CPW-GZ, ASBFS01

Flabellina sp. 1,
NAQ-JT, NAQFS01

Gargamella gravastella,
WFB-GZ, WFBGS01

Geitodoris capensis,
NAQ-JT, NAQGC01 (2)

Glaucus atlanticus,
SOD-MF, SODGAL01

Glaucus atlanticus,
WFB-ADT, WFBGAL01

Glossodoris cincta,
SOD-AC, SODGC01

Glossodoris pallida sp. 2 (a),
SOD-JT, SODGP01

Glossodoris sp. 2 (a),
DSC-VF, NATGS403

Glossodoris sp. 2 (a),
TSK-JT, TSKGS401

Glossodoris sp. 2 (b),
CRF-JT, CRFGS401

Glossodoris sp. 2 (b),
DSC-VF, NATGS401

Glossodoris sp. 2 (b),
DSC-VF, NATGS402

Glossodoris sp. 3,
SOD-JT, SODDP01

Glossodoris sp. 7,
DSC-VF, NATAS01

Glossodoris sp. 7,
SOD-AC, SODAS01

Godiva quadricolor, CSF-JT, CSFGQ02

Godiva quadricolor, ELO-JT, ELOGQ01

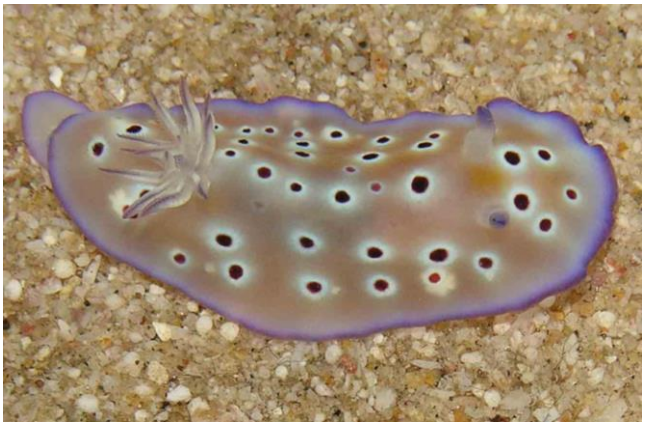
Godiva quadricolor, TSK-JT, TSKGQ01

Godiva quadricolor, WFB_GZ, WFBGQ01

Gonibranchus annulatus, DSC-DH, NATGA01

Goniobranchus annulatus, DSC-VF, NATGA02

Goniobranchus annulatus,
SOD-JT, SODGA01



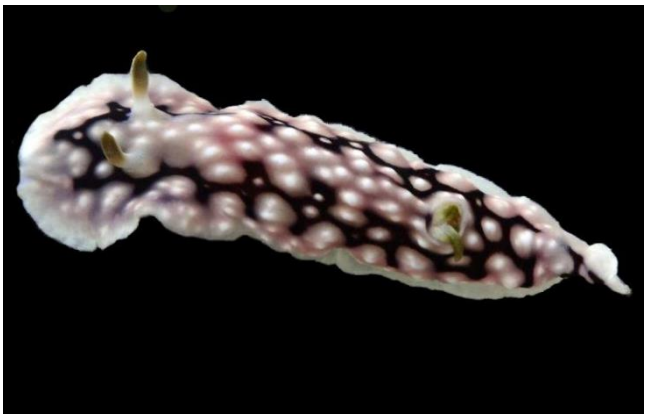
Goniobranchus cavae,
DSC-DH, NATGT01

Goniobranchus cf. alderi,
DSC-VF, NATGTI01

Goniobranchus cf. alderi,
DSC-VF, NATGTI02

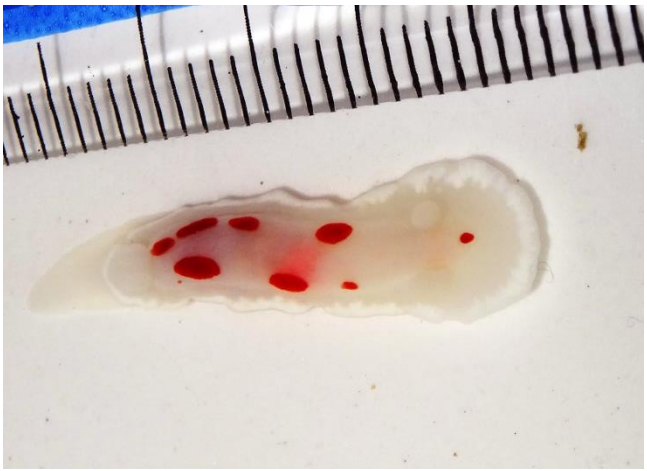
Goniobranchus cf. collingwoodi,
DSC-VF, NATGT03

Goniobranchus conchyliatus,
DSC-DH, NATGC01

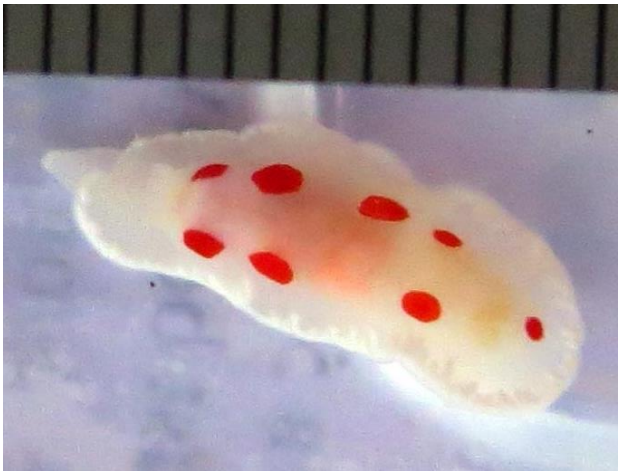


Goniobranchus geometricus, CVD-AC, NATGG01

Goniobranchus heatherae (a), CRFCH01



Goniobranchus heatherae (a), CSF-JT, CSFCH02



Goniobranchus heatherae (a), ELO-ES, ELOCH04

Goniobranchus heatherae (c), CPW-GZ, ASBCH03-04

Goniobranchus heatherae (c), CRF-ES, CRFCH03

Goniobranchus sp. 19, DSC-VF, NATCS201

Goniobranchus sp. 19, DSC-VF, NATGT02

Goniodoris castanea, WFB-GZ, WFBGC01

Halgerda dichromis (a), ELO-ES, ELOHD01

Halgerda dichromis (a), ELO-ES, ELOHD02

Halgerda dichromis (a), ELO-ES, ELOHD03

Halgerda dichromis (b), DSC-VF, NATHD01

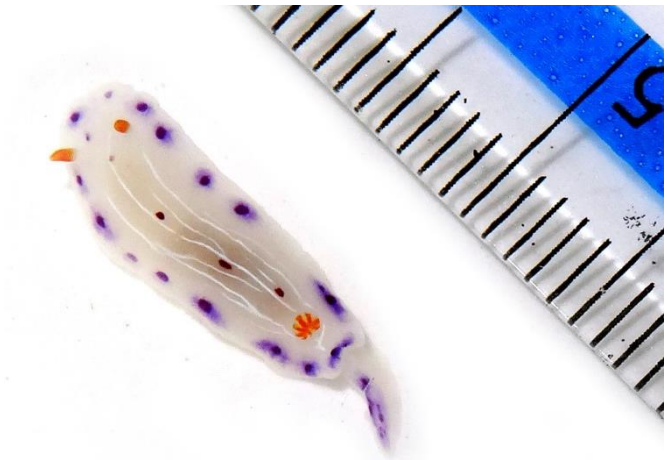
Halgerda dichromis (b), DSC-VF, NATHD02

Halgerda dichromis, DSC-VF, NATHD03

Halgerda wasinensis, SOD-AC, SODHW05

Halgerda wasinensis, SOD-JT, SODHW01

Hypselodoris capensis, CRF-JT, CRFHC01



Hypselodoris capensis, CSF-JT, CSFHC05

Hypselodoris capensis, DSC-VF, NATHC01

Hypselodoris capensis, DSC-VF, NATHC03

Hypselodoris capensis, DSV-VF, NATHC02

Hypselodoris capensis, ELOHC03

Hypselodoris capensis, ELOHC02

Hypselodoris capensis, ELOHC04

Hypselodoris capensis, WFB-GZ, WFBHC01, WFBHC02

Hypselodoris carnea, DSC-DH, NATHC04

Hypselodoris cf. bullocki, SOD-JT, SODHB01

Hypselodoris cf. regina, CVD-VF, NATHRE01

Hypselodoris fucata, DSC-VF, NATHF01

Hypselodoris fucata, DSC-VF, NATHF02

Hypselodoris infucata, SOD-JT, SODHI01

Hypselodoris pulchella, DSC-VF, NATHP01

Hypselodoris pulchella, SOD-JT, SODHP01

Hypselodoris rudmani, DSC-VF, NATHR01

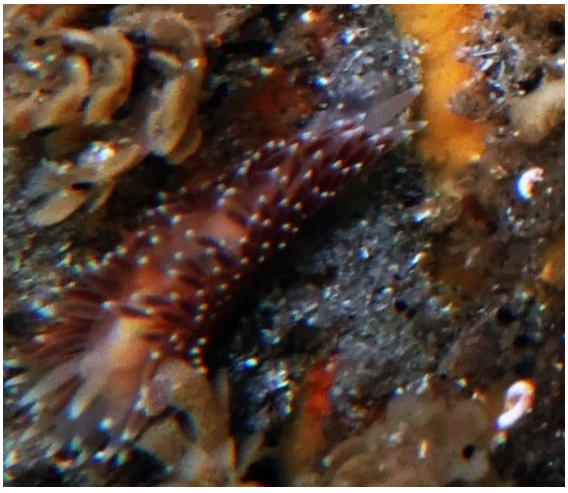
Hypselodoris rudmani, DSC-VF, NATHR02

Hypselodoris zephyra, SOD-JT, SODHN01

Janolus capensis, CRF-JT, CRFJC01

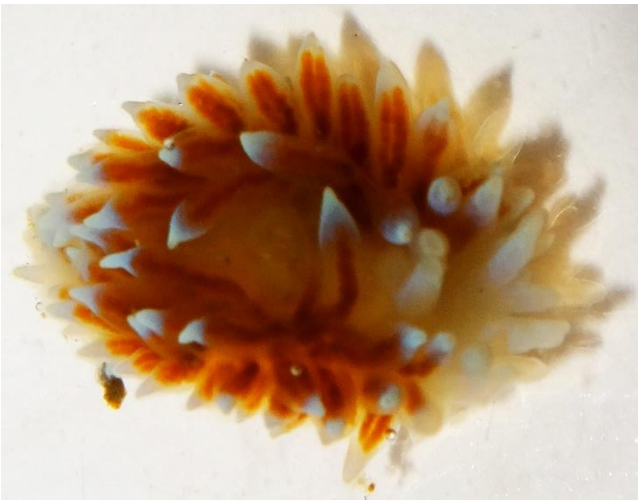
Janolus capensis, ELOJC02

Janolus capensis, NAQ-JT, NAQJC01



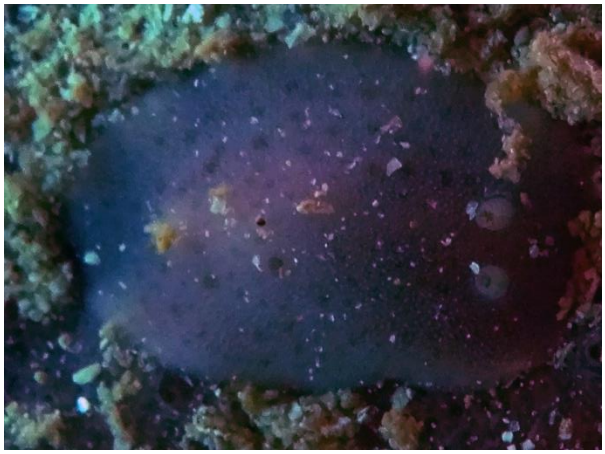
Janolus capensis, NAQ-JT, NAQJC02

Janolus capensis, NAQ-JT, NAQJC03

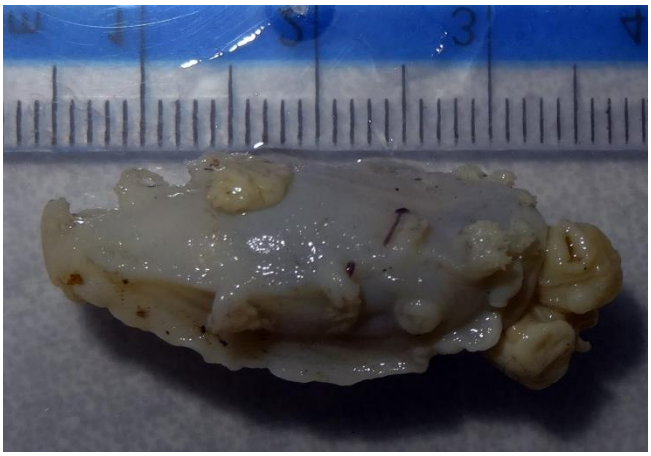


Janolus longidentatus, WFBJCL05

Jorunna funebris, DSC, DH, NATJF01



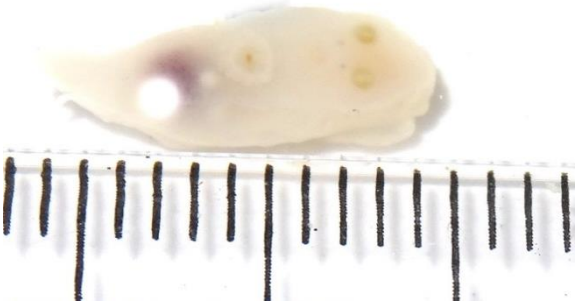
Jorunna tomentosa, EFBJT01



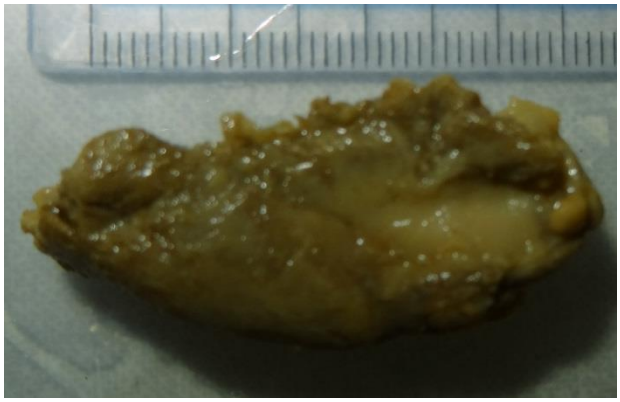
Kaloplocamus cf. *ramosus* (preserved), DCTKR01

Lecithophorous capensis (a), CPW-JT, ASBLC03

Lecithophorus capensis (b), CPW-GZ, ASBLC02



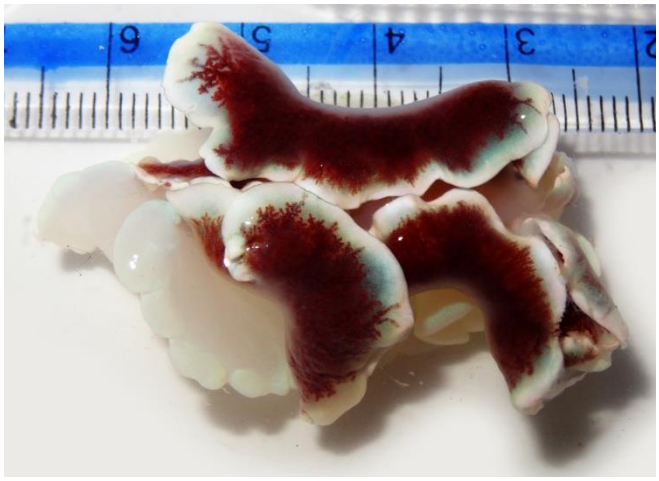
Lecithophorus capensis, CSFLC04



Leminda millecra, (preserved), IZSAM, DCTUN01

Leminda millecra, CRF-ES, CRFLM03

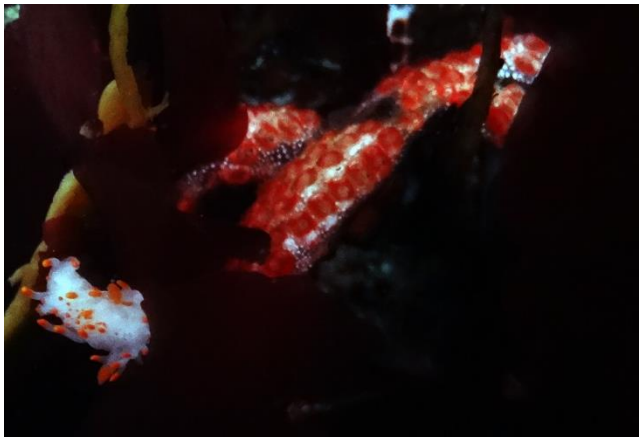
Leminda millecra, CRFLM01



Leminda millecra, CSFLM02

Leminda millecra, WFB-JT, WFBLM01

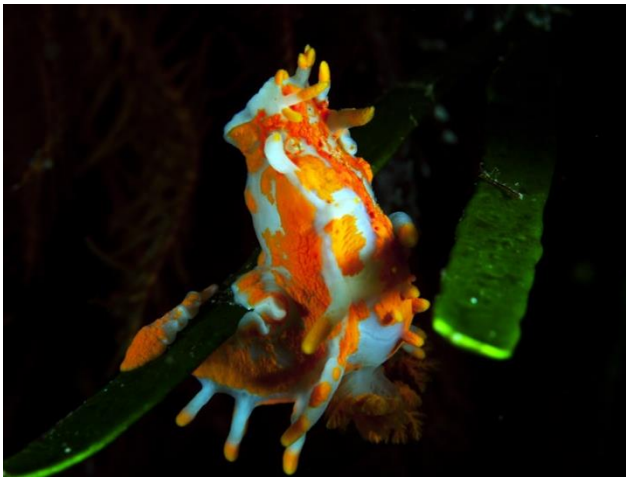
Limacia sp. 1, NAQ-JT, NAQLA101



Limacia sp. 1, NAQ-JT, NAQLA102

Limacia sp. 1, SWCLA101

Limacia sp. 1, SWCLA102



Limacia sp. 1, WFB-GZ, WFBLA03

Limacia sp. 1, WFB-JT, WFBLAC01

Limacia sp. 2, WFB-JT, WFBLA201

Marionia cf. *arborescens*, TSK-JT, TSKMA01

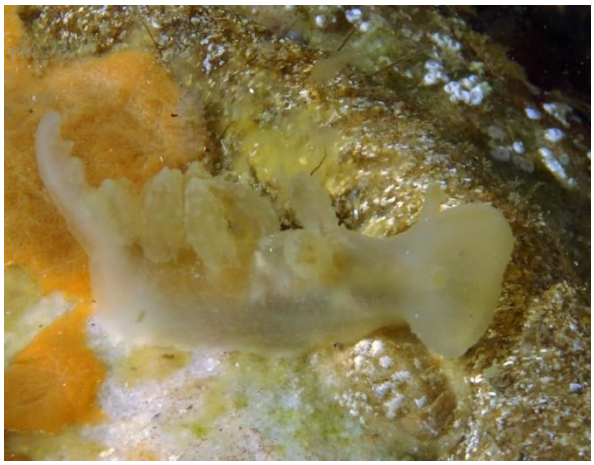
Marionia sp. 1, HER-JT, HERTRS01

Marionia sp., HER-JT, HERTRS103

Melibe rosea (a), CPW-FG, ASBMR01

Melibe rosea (a), CPW-FG, ASBMR03

Melibe rosea (a), NAQ-JT, NAQMR01



Melibe rosea (b), CPW-JT, ASBMR02

Mexichomis cf. *mariei*, DSC-VF, NATMM01

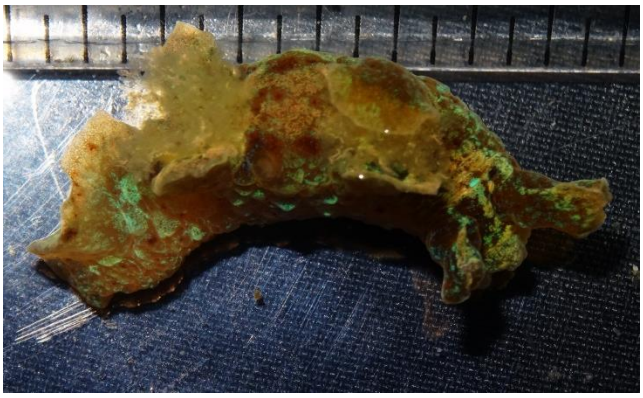
Mexichromis cf. *mareie*, SOD-JT, SODMS01

Nembrotha aurea, DSC-VF, NATNA02

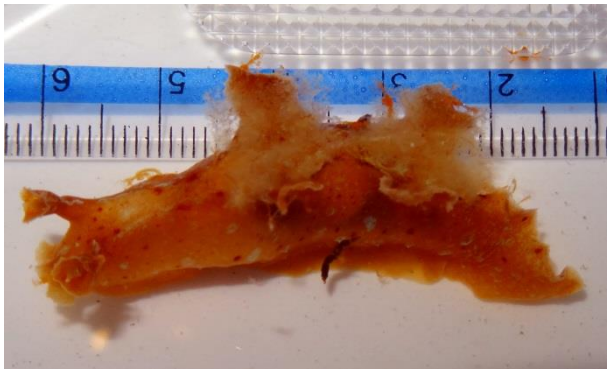
Nembrotha aurea, DSC-VF, NATNA03

Nembrotha aurea, SOD-AC, SODNA01

Nembrotha sp. 1, TSK-JT, TSKNS201



Notobryon thompsoni, NAQ-JT, NAQNT01



Notobryon thompsoni, SWC-JT, SWCNT01

Notobryon thompsoni, WFB-GZ, WFBNW01

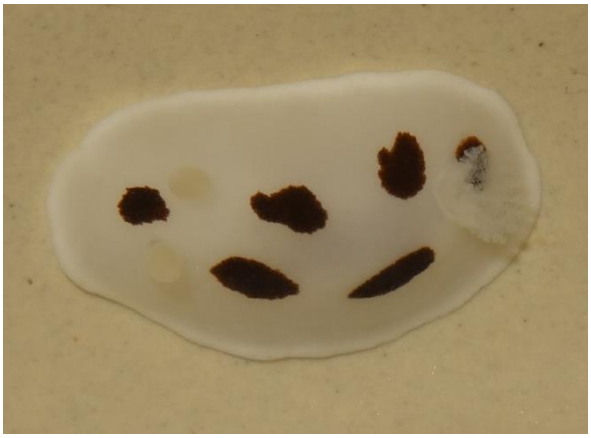
Noumea protea, CPW-GZ, ASBNP01-02

Noumea sp. 10,
SOD-CG, SODNS01

Okenia amoenula,
CPQ-GZ, ASBOA01

Okenia amoenula,
WFB-JT, WFBOA02

Peltodoris sp. 1,
DSC-VF, NATPS01



Peltodoris sp. 2 (prev. *Chromodoris* sp. 3),
CRF-JT, CRFCH301

Phyllidia cf. *varicosa*,
DSC-VF, NATPV01

Phyllidia cf. *varicosa*,
SOD-AC, SODPV04

Phyllidia cf. *varicosa*,
SOD-KE, SODPV01

Phyllidia marindica,
DSC-VF, NATPMA02

Phyllidia ocellata (b),
SOD-JT, SODPO01

Phyllidia ocellata (a),
SOD-AC, SODPO04

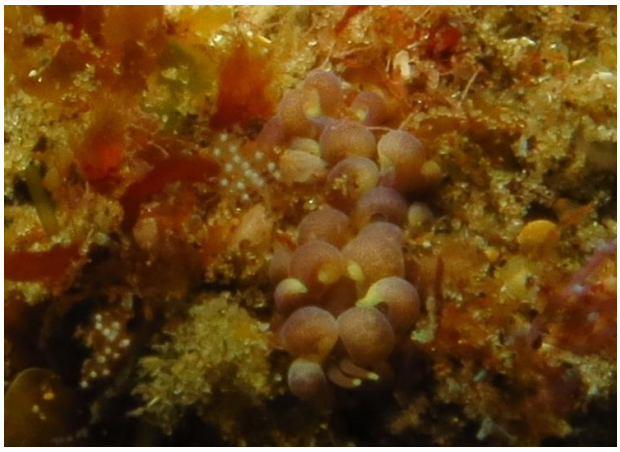
Phyllidia ocellata (b),
SOD-AC, SODPO03

Phyllidia ocellata (b), SOD-AC, SODPO04

Phyllidiella zeylanica, DSC-VF, NATPZ01

Phyllidiella zeylanica, DSC-VF, NATPZ02

Phyllidiopsis krempfi / gemmata, SOD-JT, SODPK01

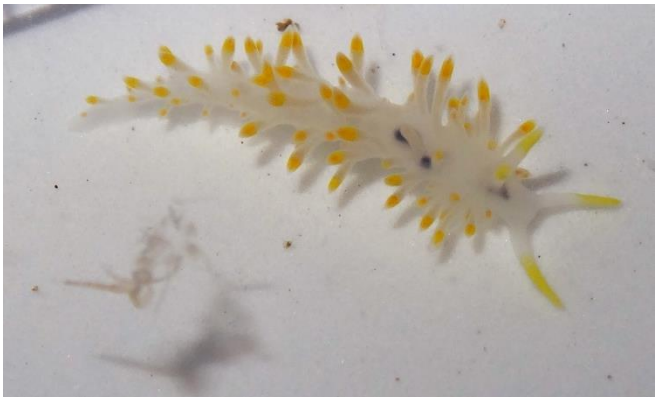


Phyllodesium cf. *macphersonnae*, SOD-JT, SODPM01

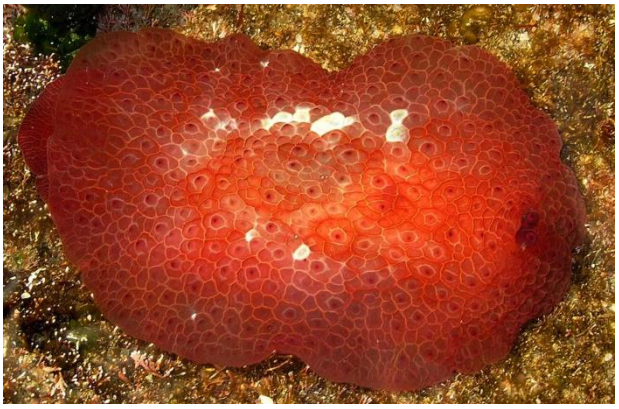
Phyllodesmium cf. *magnum*, DSC-VF, NATPM01

Phyllodesmium horridum, ELO-JT, ELOPY01

Phyllodesmium horridum, WFB-GZ, WFBPY03

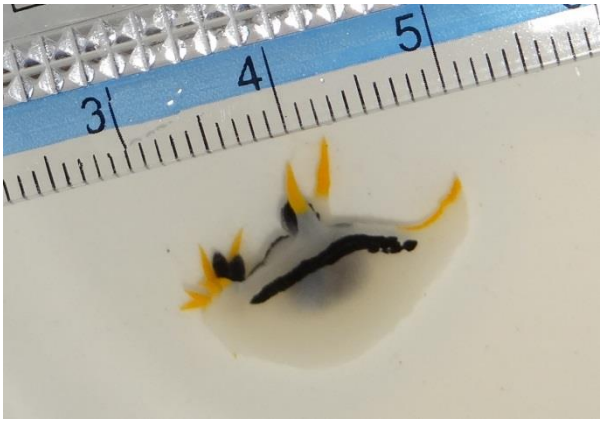


Piseinotecus sp., ELO-JT, ELOAE01

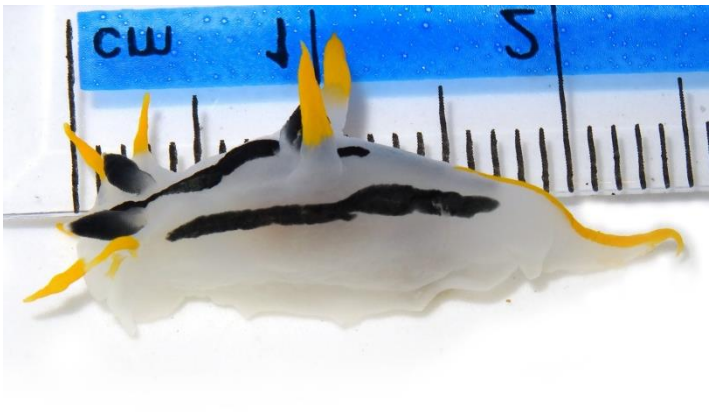


Pleurobranchus peroni, DSC-DH, OUTGROUP

Polycera capensis, CPW-GZ, ASBPC06



Polycera capensis, ELOPC01



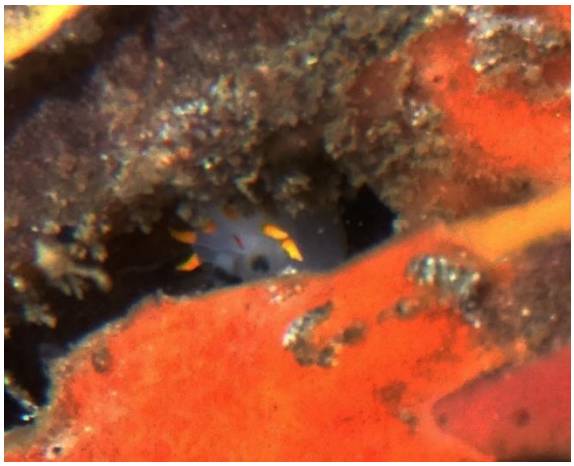
Polycera capensis, ELO-JT, ELOPC02

Polycera capensis, MSB-JT, MSBPC01

Polycera capensis, WFB-JT, WFBPC01

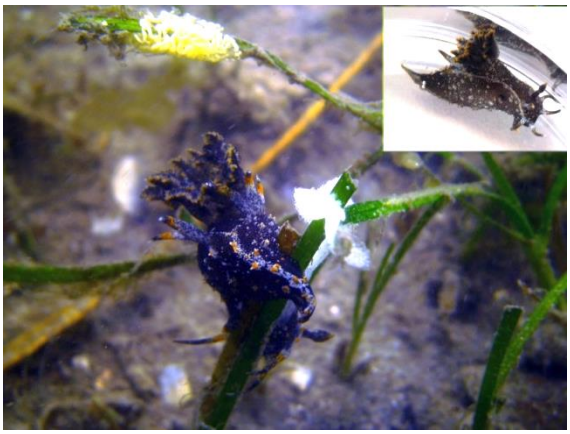
Polycera capensis (luderitz), LUD-KG, LUD02

Polycera capensis_sp. 2, CPW-GZ, ASBPS201



Polycera capensis_sp. 2, NAQ-JT, NAQPS201

*Polycera capensis*_sp. 2, WCP-JT, SWCPS201



Polycera hedgpethi, KNY-LC, KNYPHG01

Polycera sp. 1, KNY-LC, KNYPS301

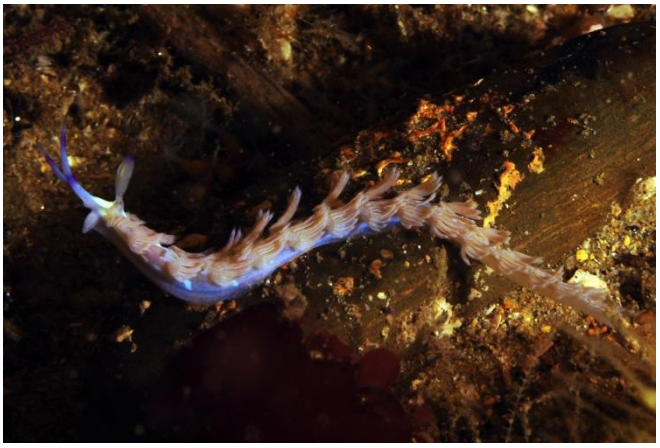
Polycera sp. 1, MSB-JT, MSBPS101

Polycera sp. 3, KNY-JT, KNYPQ01

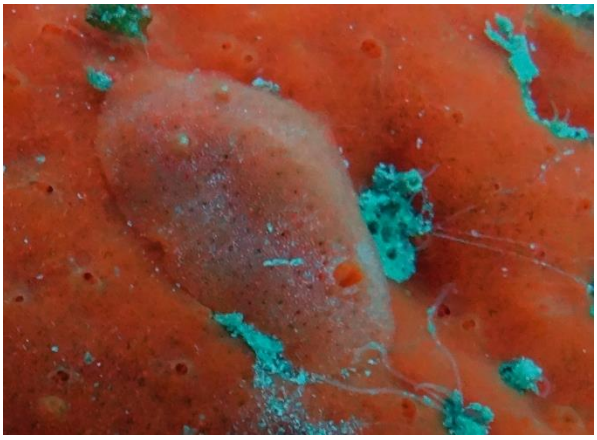
Polycera sp. 3, WFB-JT, WFBPC02

Polycera sp. 3, WFB-JT, WFBPC03

Pteraeolidia ianthina, DSC-VF, NATPI01



Ptereaeolidia cf. *ianthina*, DSC-VF, NATPI02



Rostanga elandsia, EFB-JT, EFBRE03

Rostanga elandsia, ELO-JT, ELORE01

Rostanga elandsia, SWC-JT, SWCRE01

Rostanga elandsia,
WFB-GZ, WFBRE01

Rostanga sp.,
PAF-JT, PAFROS01

Tambja affinis,
CVD-VF, NATTAF01

Tambja capensis,
CRF-JT, CRFTC01

Tambja capensis,
ELO-JT, ELOTC02

Tambja capensis, WFB-GZ,
WFBTC01

Tambja cf. *kava*, TSK-JT, TSKTA01

Tambja zulu, VCD-VF, NATTZ01

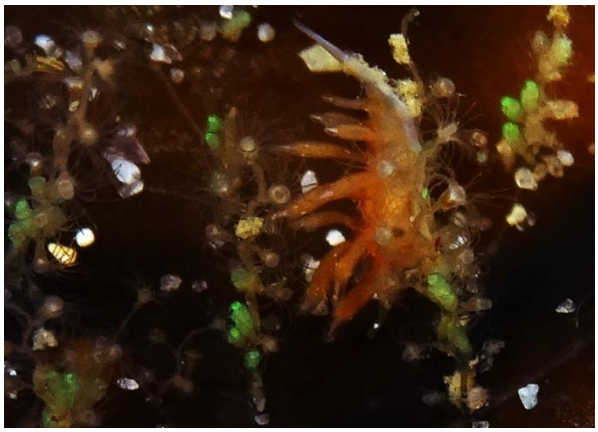
Tayuva lilacina, TSK-JT, TSKTDF01

Tergipes cf. *tergipes*, WFB-GZ, WFBTT01

Tergipes cf. *tergipes* / sp. 1, WFB-GZ, WFBTT02

Tergipes sp. 2, WFB-GZ, WFBEB203

Tergipes sp. 2, WFB-JT,
WFBEB05



Tergipes sp. 2, WFB-JT,
WFBEB201

Tergipedid sp. 1,
SWC-JT, SWCWC01

Tergipedid sp. 2,
HER-JT, HERCUS01

Thecacera cf. *pennigera*,
KNY-LC, KNYTPE01

Thecacera cf. *pennigera*,
KNY-LC, KNYTPE02

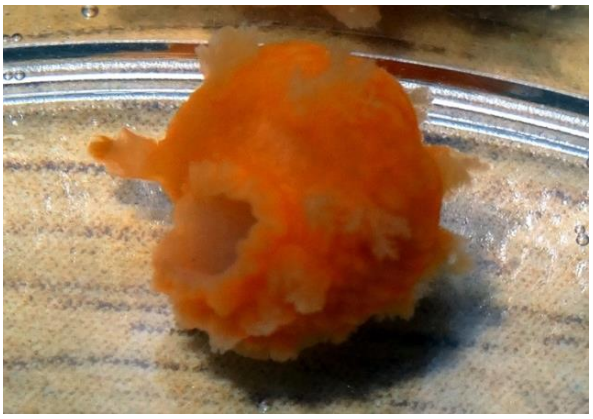
Thecacera picta,
SOD-AC, SODTP01

Thorunna horologia,
SOD-AC, SODTH01

Trapania cirrita,
CPW-GZ, ASBTS01-02

Tritonia nilsodhneri,
CPW-GZ, ASBTN01

Tritonia nilsodhneri, CPW-GZ,
ASBTN04



Tritonia nilsodhneri,
WFB-JT, WFBTN05

Vaysierrea felis,
TSK-JT, TSKVF01

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Appendix 2.8

Superfamily groupings enlarged

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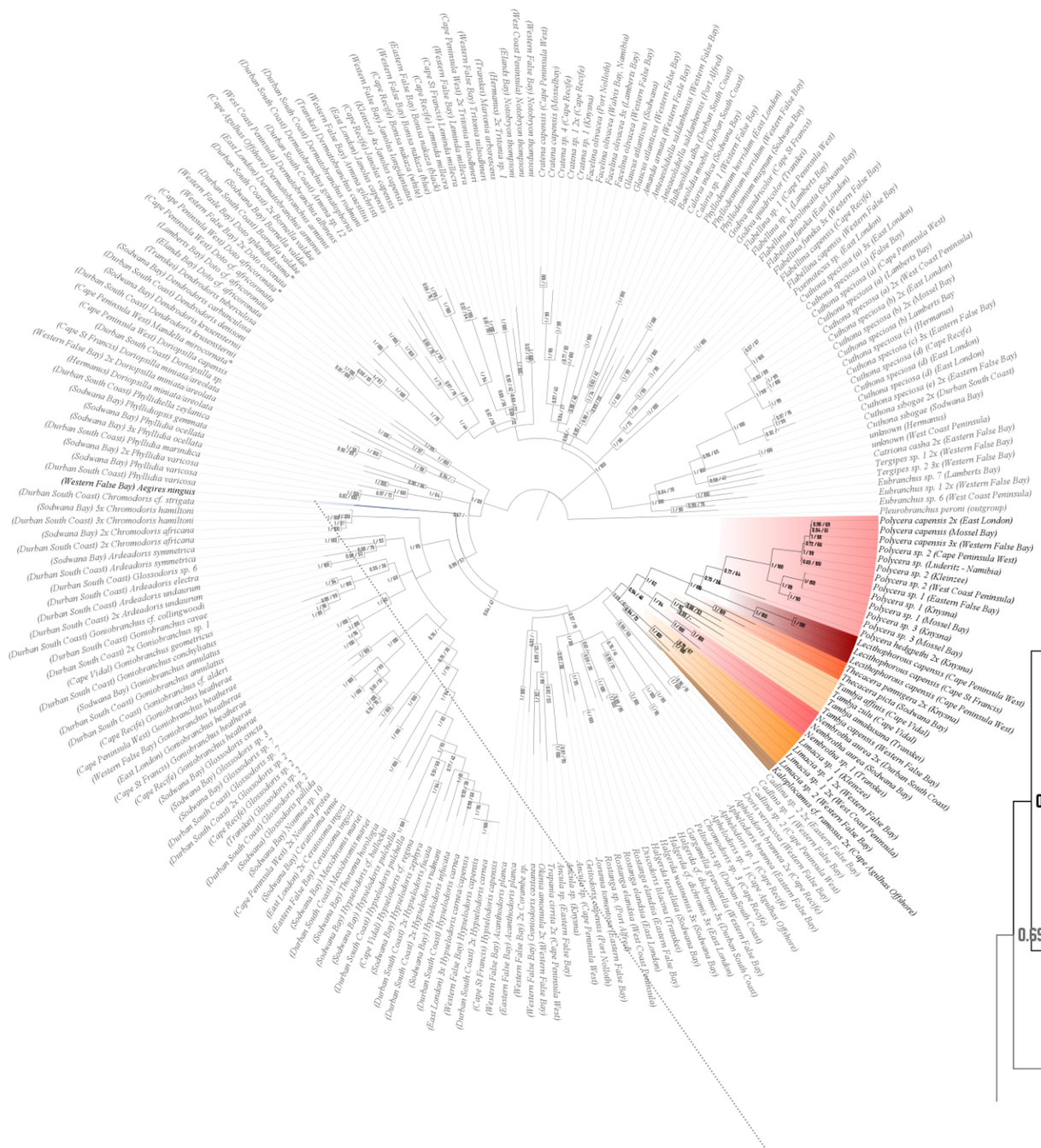
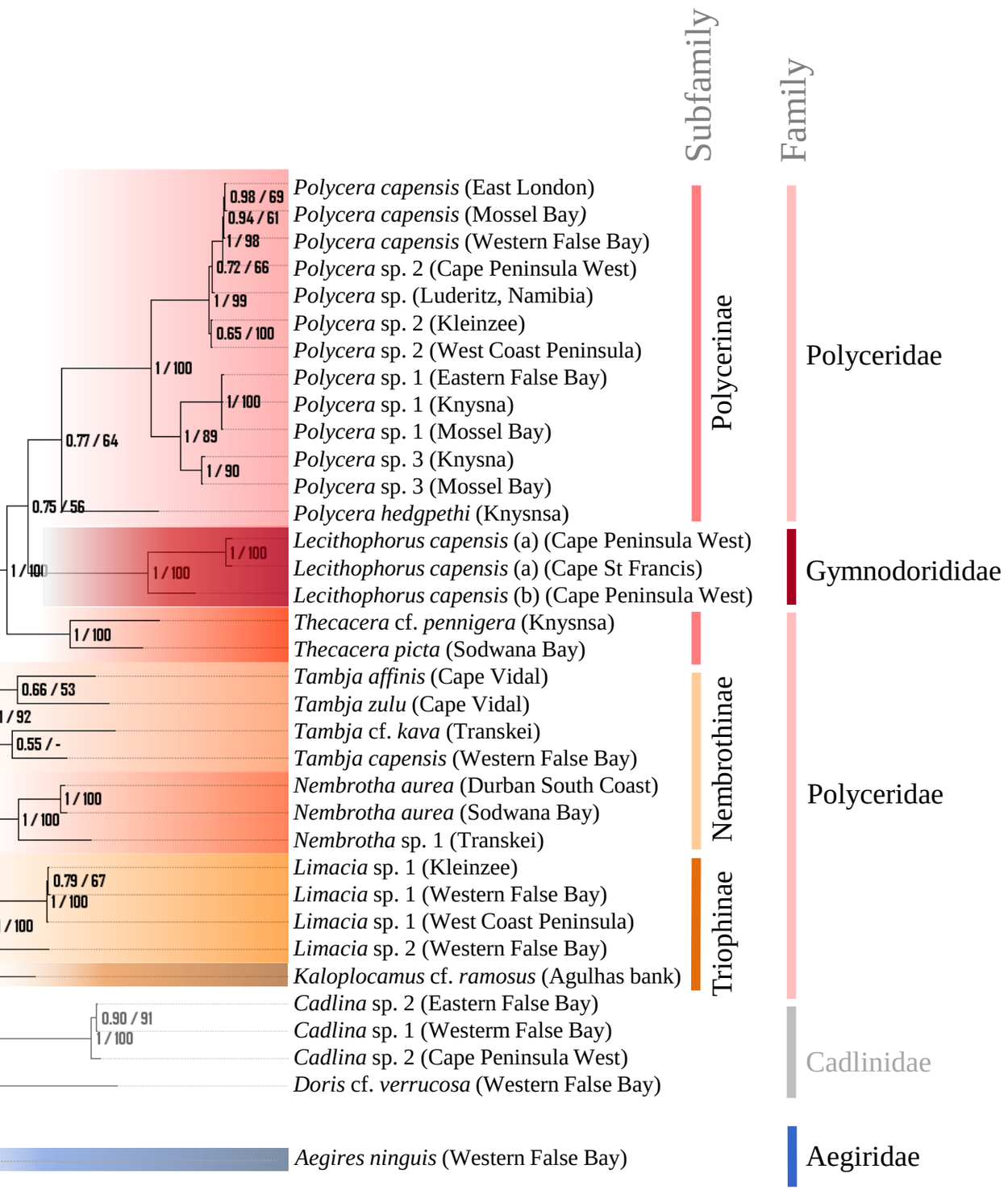
Superfamily Polyceroidae





Superfamily Doridoidea

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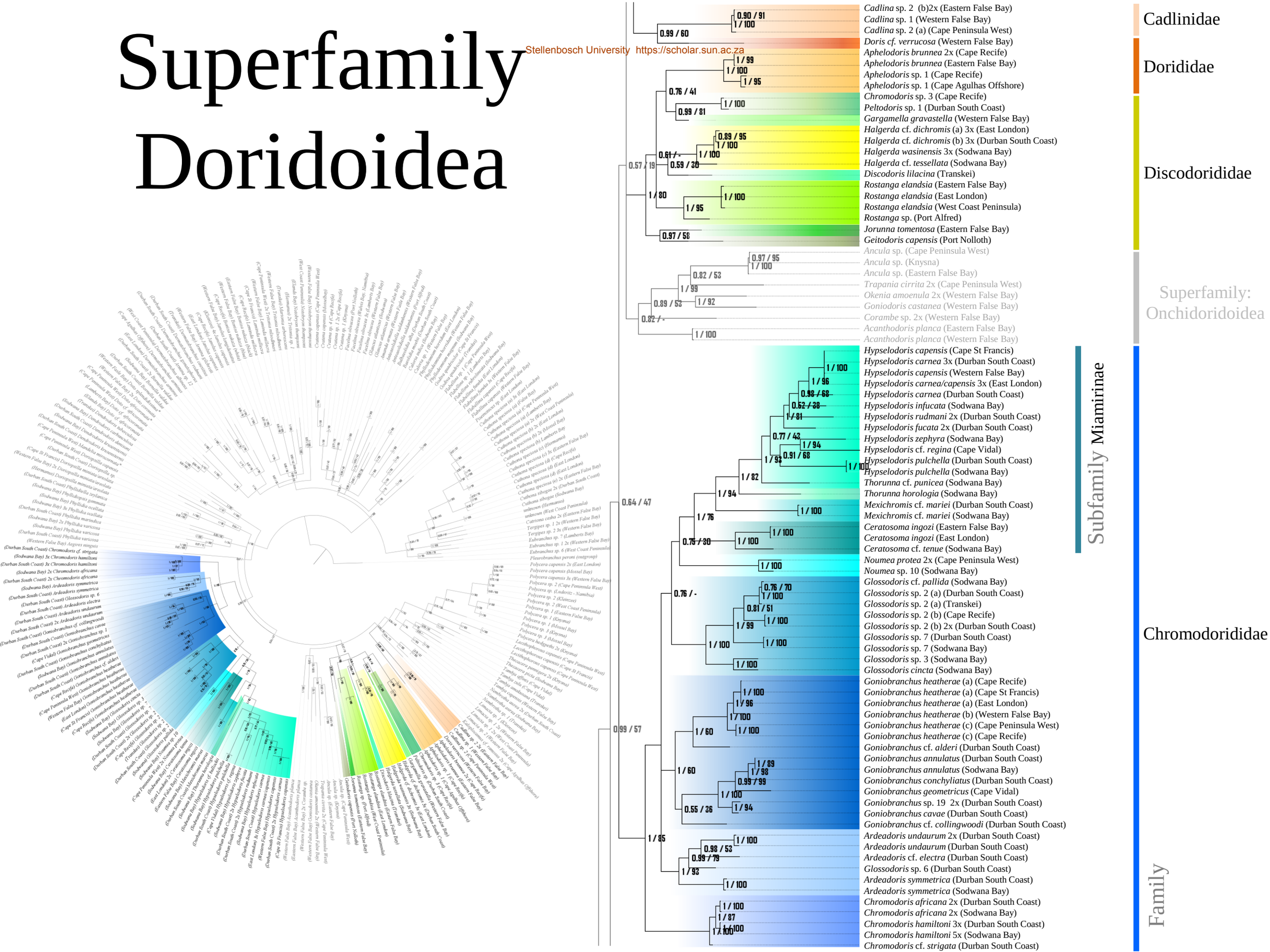

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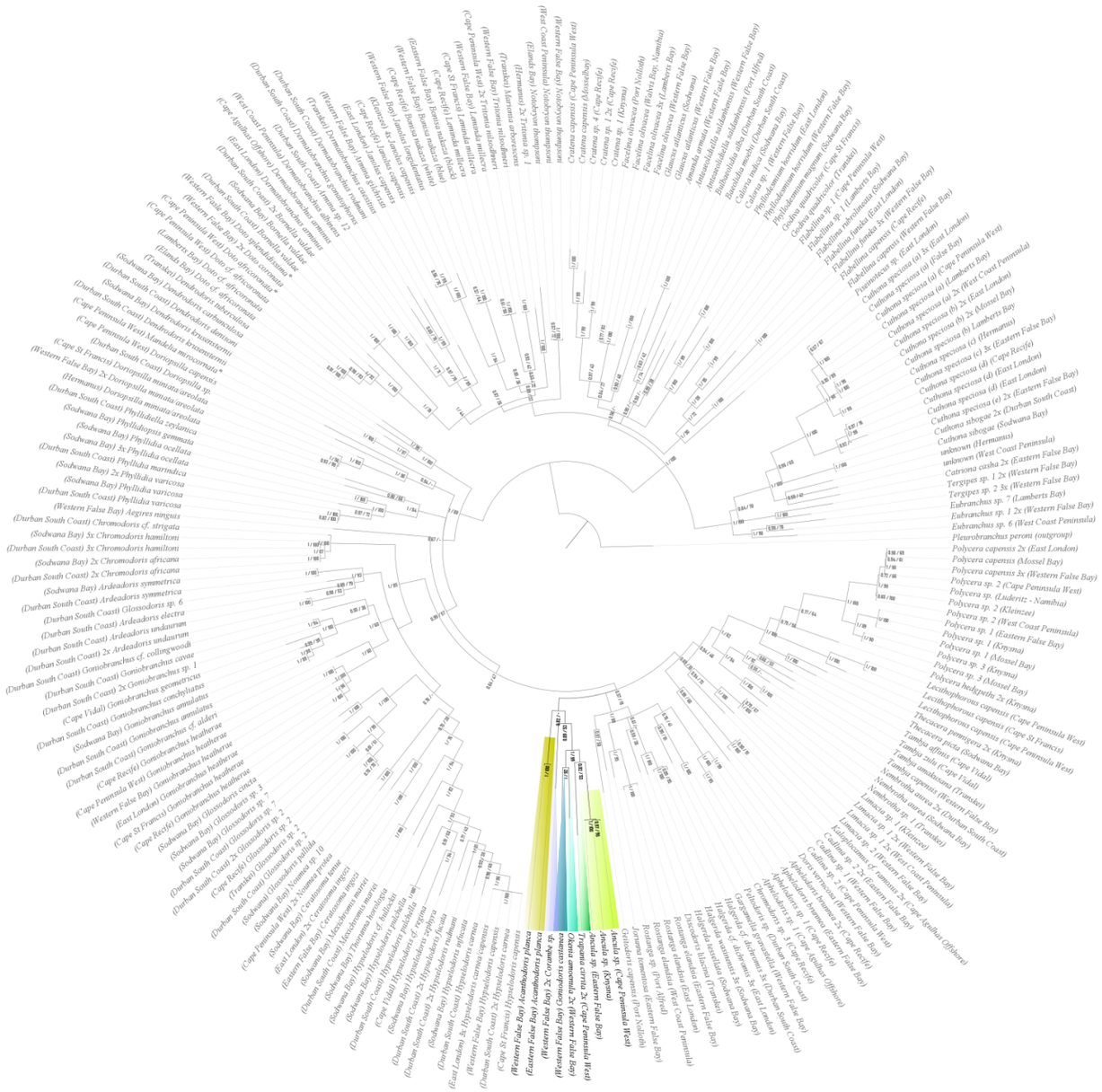
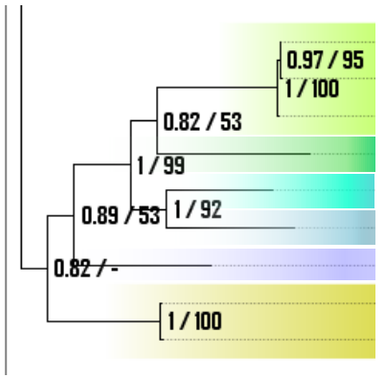
Superfamily Onchidoridoidea





Family

Ancula sp. (Cape Peninsula West)
Ancula sp. (Knysna)
Ancula sp. (Eastern False Bay)
Trapania cirrita 2x (Cape Peninsula West)
Okenia amoenula 2x (Western False Bay)
Goniodoris castanea (Western False Bay)
Corambe sp. 2x (Western False Bay)
Acanthodoris planca (Eastern False Bay)
Acanthodoris planca (Western False Bay)

Goniodorididae
Corambidae
Onchidorididae

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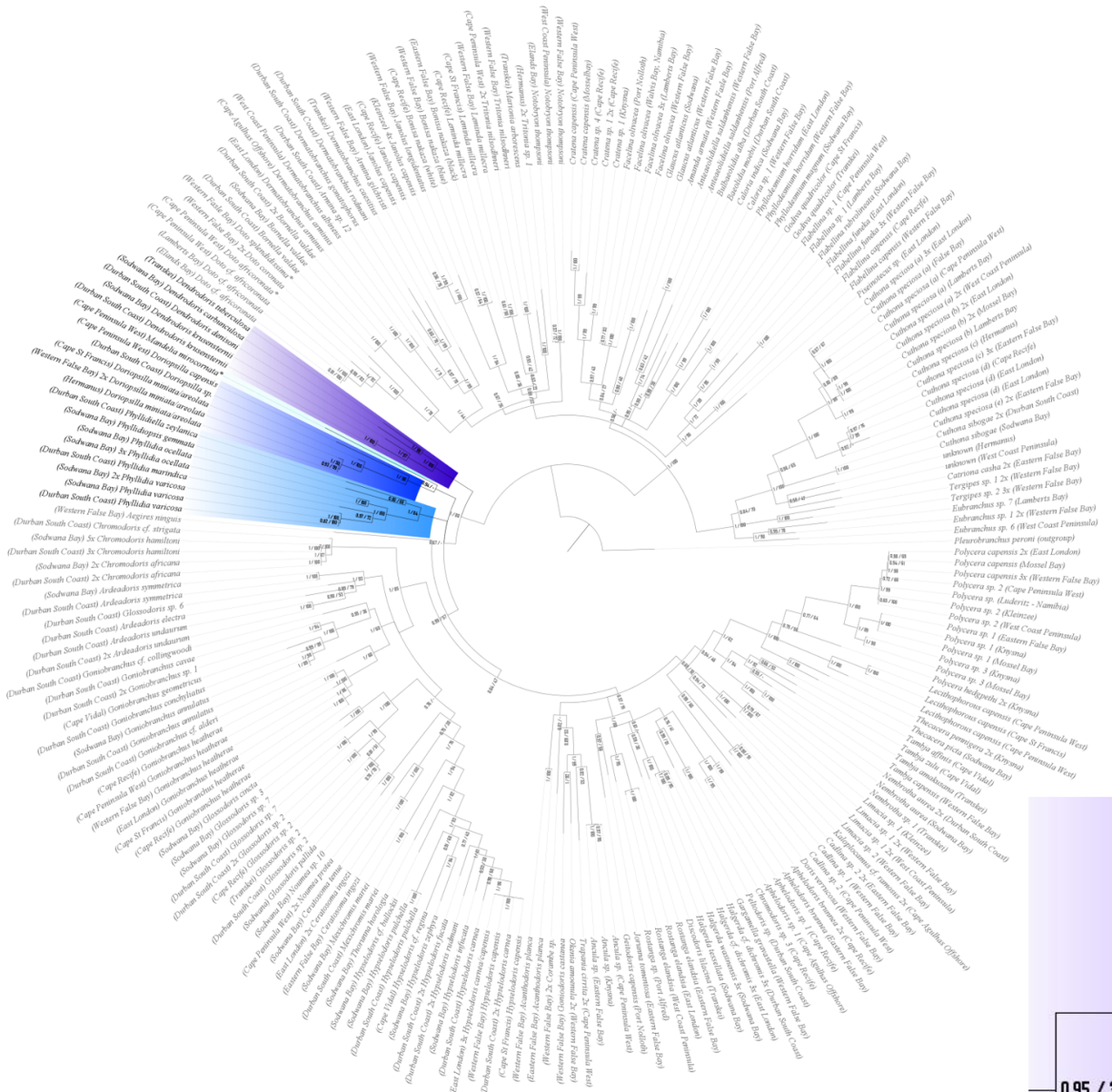
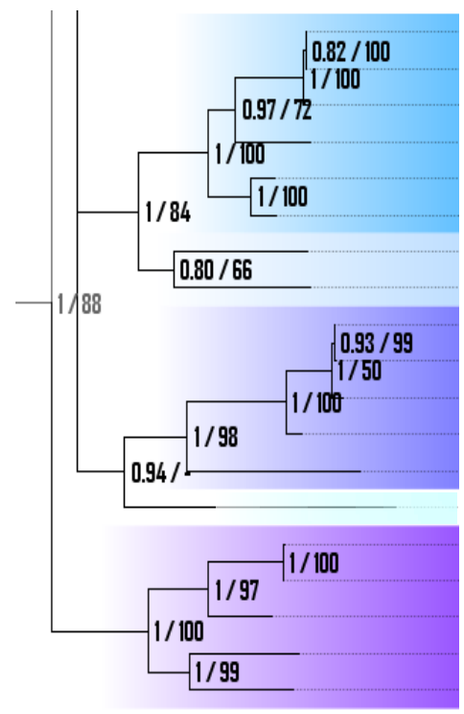
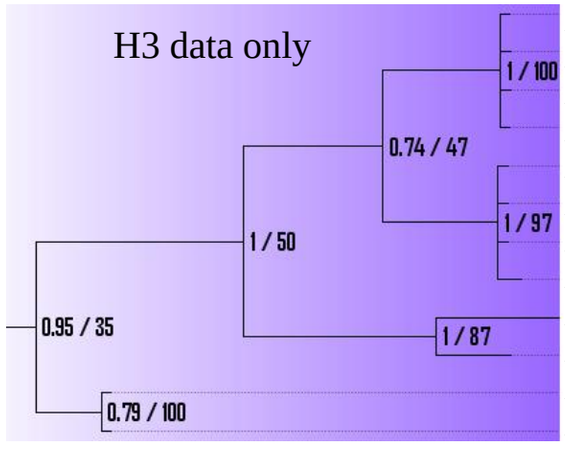
Superfamily Phyllidioidea





Phyllidia cf. *varicosa* (Durban South Coast)
Phyllidia cf. *varicosa* (Sodwana Bay)
Phyllidia cf. *varicosa* 2x (Sodwana Bay)
Phyllidia marindica (Durban South Coast)
Phyllidia ocellata (a) (Sodwana Bay)
Phyllidia ocellata (b) 3x (Sodwana Bay)
Phyllidiopsis cf. *gemmata* (Sodwana Bay)
Phyllidiella zeylanica (Durban South Coast)
Doriopsilla areolata (Hermanus)
Doriopsilla areolata 2x (Western False Bay)
Doriopsilla areolata (Cape St Francis)
Doriopsilla sp. (Durban South Coast)
Doriopsilla capensis (Cape Peninsula West)
*Mandelia mirocornata** (Cape Peninsula West)
Dendrodoris krusensterni (a) (Durban S. Coast)
Dendrodoris krusensterni (a) (Sodwana Bay)
Dendrodoris krusensterni (b) (Cape Vidal)
Dendrodoris carbunculosa (Sodwana Bay)
Dendrodoris cf. *tuberculosa* (Transkei)



Dendrodoris nigra (East London)
Dendrodoris nigra (Transkei)
Dendrodoris nigra (Durban South Coast)
Dendrodoris nigra (Sodwana Bay)
Dendrodoris caesia (Port Alfred)
Dendrodoris caesia (Transkei)
Dendrodoris caesia (Western False Bay)
Dendrodoris sp. (Transkei)
Dendrodoris carbunculosa (Sodwana Bay)
Dendrodoris cf. *tuberculosa* (Transkei)
Dendrodoris krusensterni (a) (Durban S. Coast)
Dendrodoris krusensterni (a) (Sodwana Bay)

Family
Phyllidiidae
Dendrodorididae
Mandelidae
Dendrodorididae
Dendrodorididae

**Sequences retrieved from GenBank, see table 2.2 for details.*

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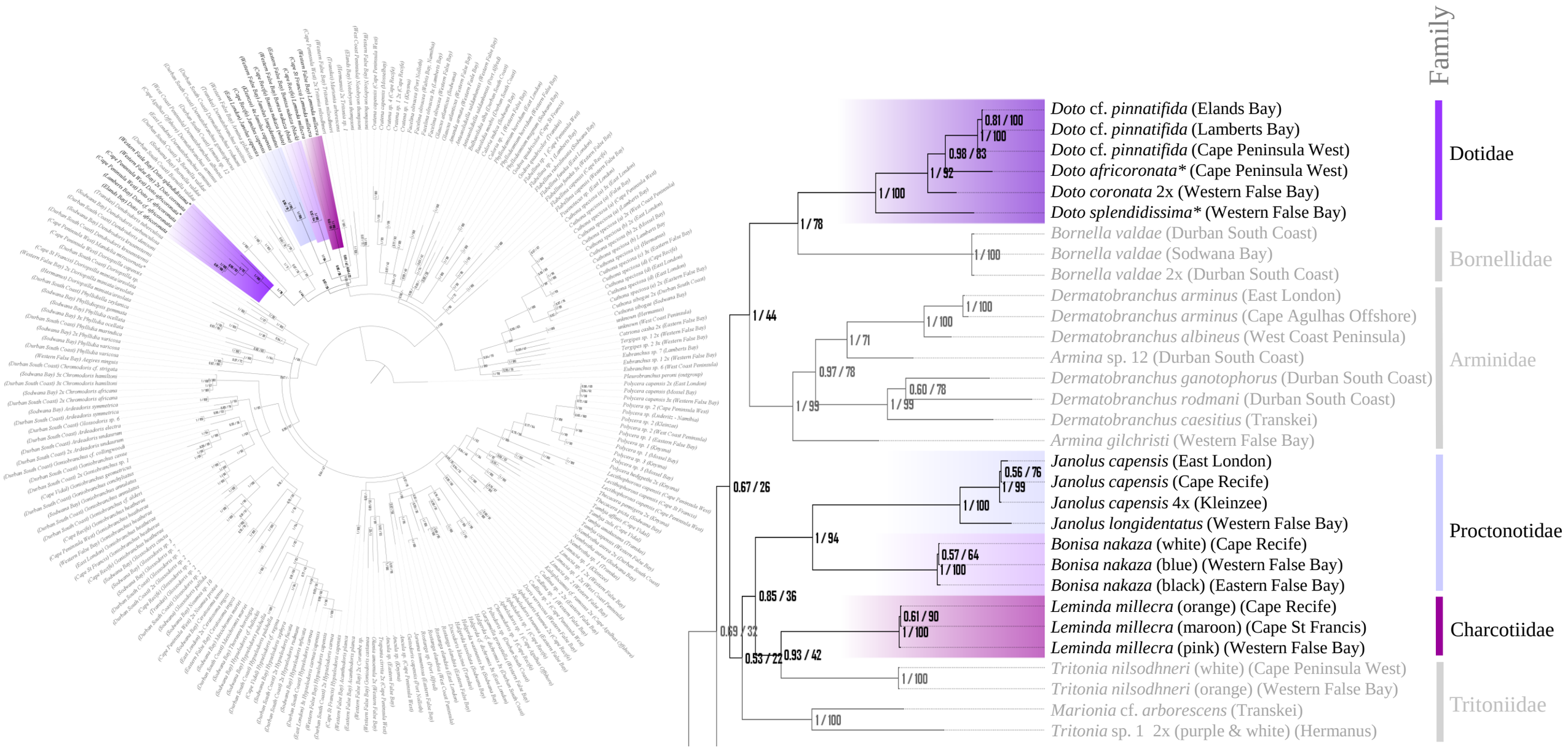
Unassigned Cladobranchia



*Sequences retrieved from GenBank, see table 2.2 for details.

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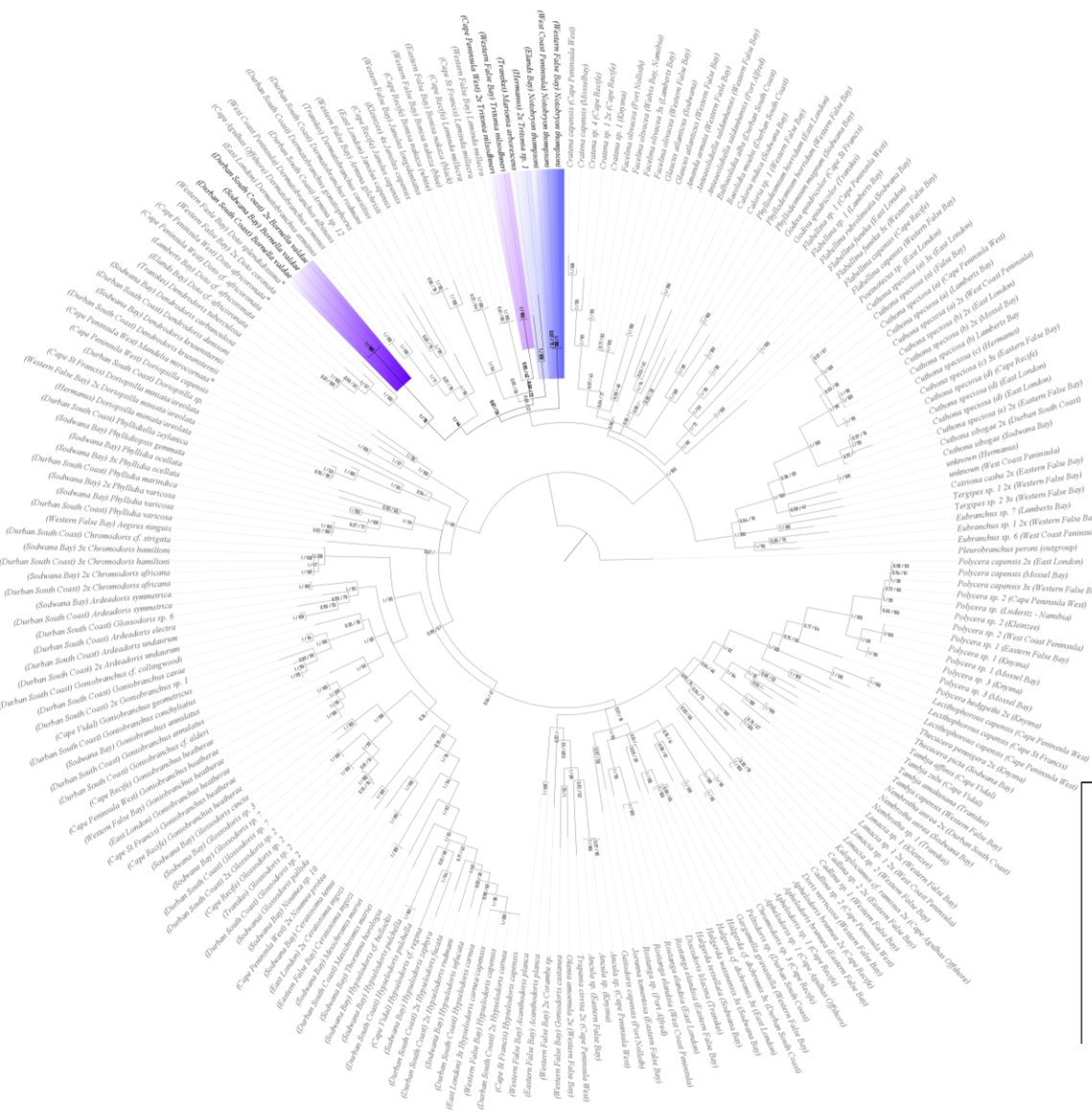
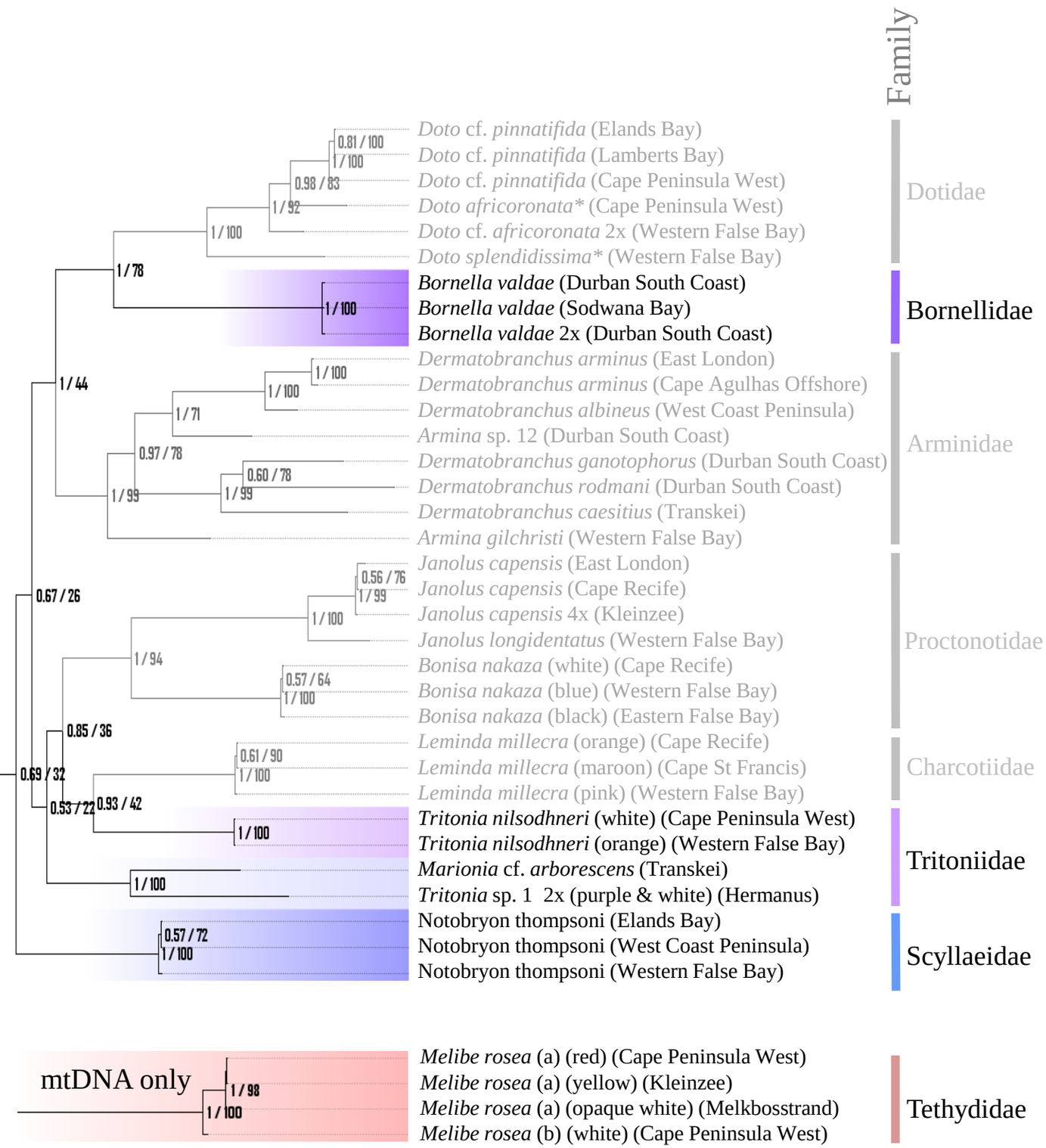
Superfamily Tritonioidea





*Sequences retrieved from GenBank, see table 2.2 for details.

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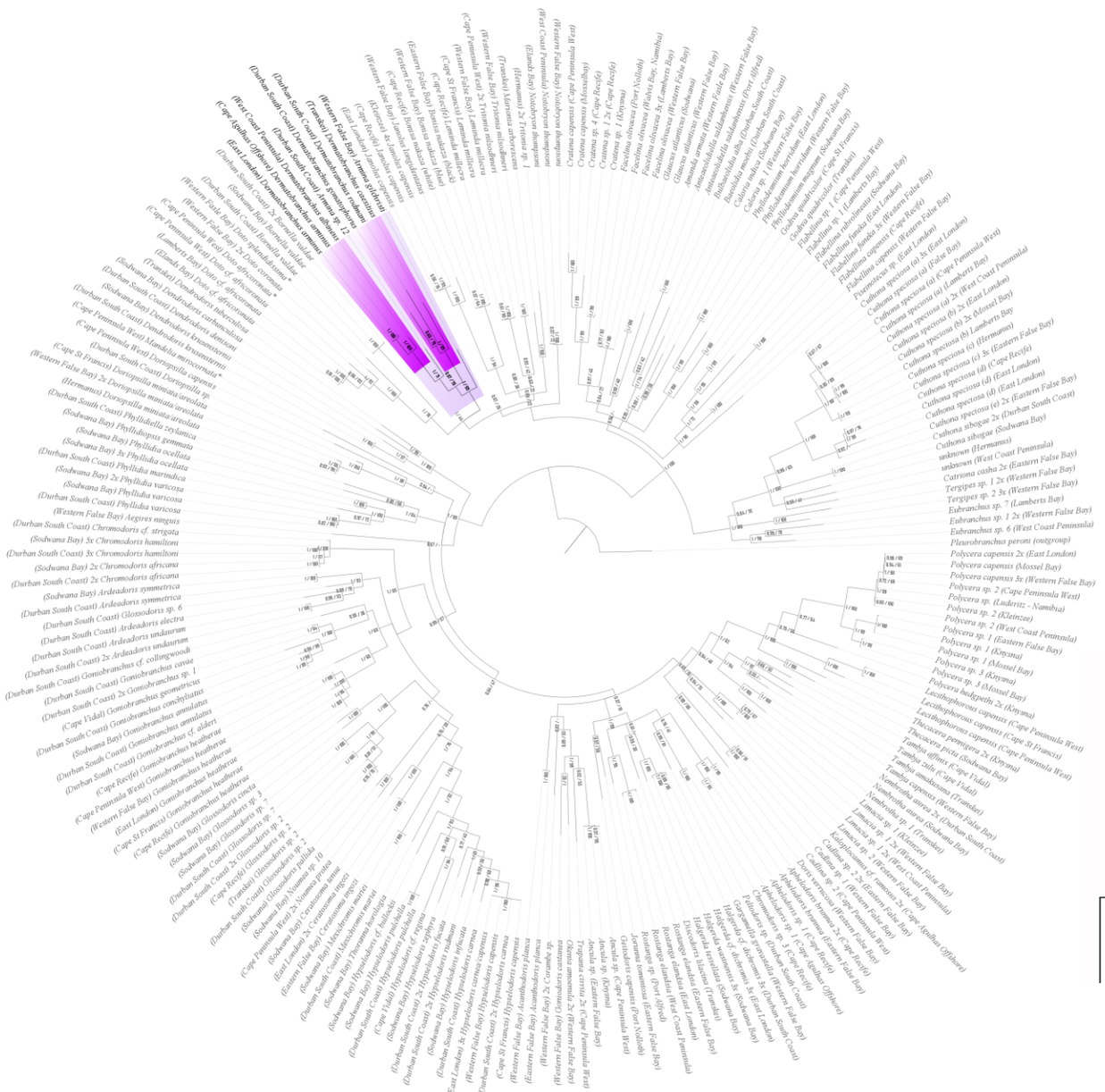
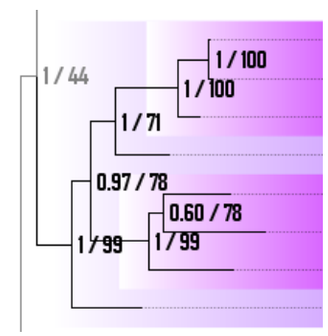
Superfamily Arminoidea

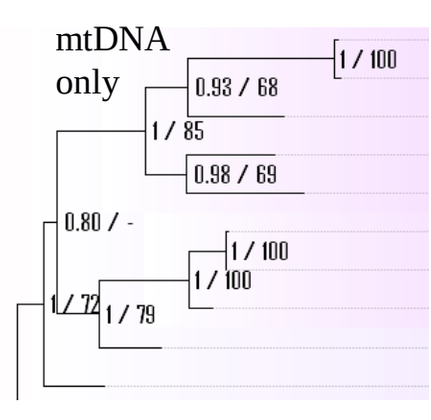




Dermatobranchus arminus (East London)
Dermatobranchus arminus (Cape Agulhas Offshore)
Dermatobranchus ablineus (West Coast Peninsula)
Armina sp. 12 (Durban South Coast)
Dermatobranchus gonatophorus (Durban South Coast)
Dermatobranchus rodmani (Durban South Coast)
Dermatobranchus caesitius (Transkei)
Armina gilchristi (Western False Bay)

Family

Arminidae



Dermatobranchus sp. (Sodwana Bay)
Dermatobranchus sp. (Sodwana Bay)
Dermatobranchus caesitius (Transkei)
Dermatobranchus rodmani (Durban South Coast)
Dermatobranchus gonatophorus (Durban South Coast)
Dermatobranchus arminus (East London)
Dermatobranchus arminus (Cape Agulhas Offshore)
Dermatobranchus ablineus (West Coast Peninsula)
Armina sp. 12 (Durban South Coast)
Armina gilchristi (Western False Bay)

Arminidae

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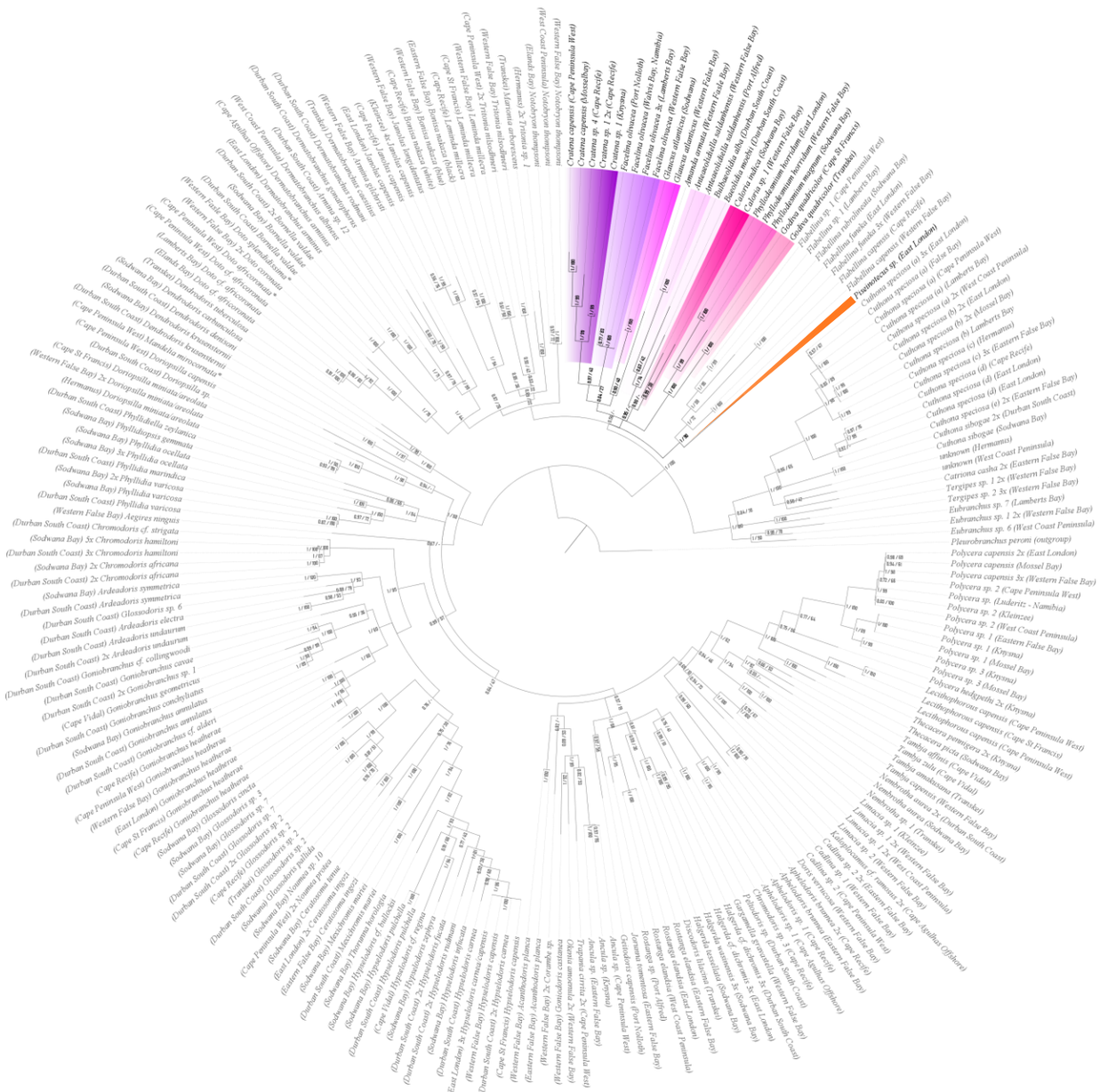
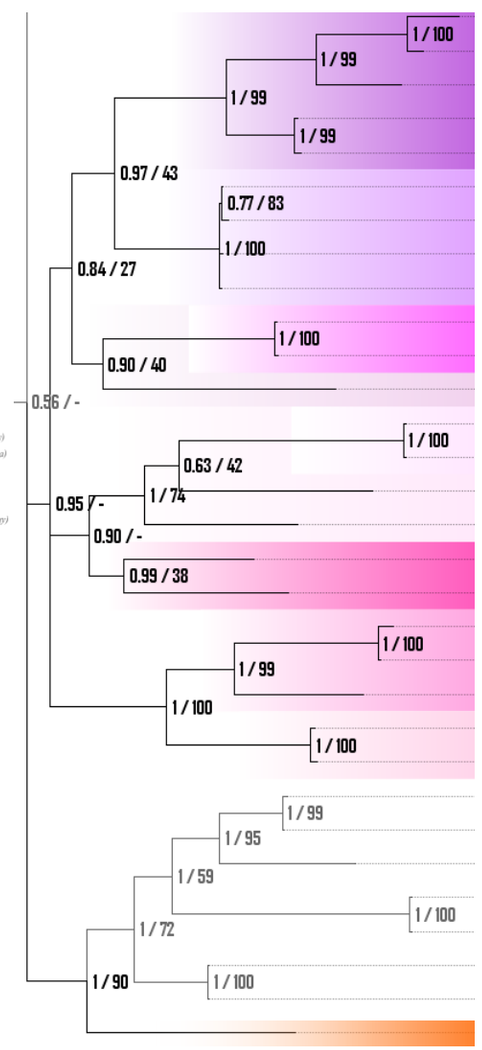
Superfamily Aeolidioidea





Cratena capensis (a) (Cape Peninsula West)
Cratena capensis (b) (Mossel Bay)
Cratena sp. 4 (Cape Recife)
Cratena sp. 1 2x (Cape Recife)
Cratena sp. 1 (Knysna)
Facelina olivacea (red) (Port Nolloth)
Facelina olivacea (brown) (Walvis Bay, Namibia)
Facelina olivacea 3x (blue & white) (Lamberts Bay)
Facelina olivacea (olive) (Western False Bay)
Glaucus atlanticus (Sodwana Bay)
Glaucus atlanticus (Western False Bay)
Amanda armata (Western False Bay)
Anteaeolidiella saldanhensis (Western False Bay)
Anteaeolidiella saldanhensis (Port Alfred)
Bulbaeolidia cf. *alba* (Durban South Coast)
Baeolidia cf. *moebii* (Durban South Coast)
Caloria cf. *indica* (Sodwana Bay)
Caloria sp. 1 (Western False Bay)
Phyllodesmium horridum (East London)
Phyllodesmium horridum (Western False Bay)
Phyllodesmium cf. *magnum* (Sodwana Bay)
Godiva quadricolor (Cape St Francis)
Godiva quadricolor (Transkei)
Flabellina sp. 1 (Cape Peninsula West)
Flabellina sp. 1 (Lamberts Bay)
Flabellina rubrolineata (a) (Sodwana Bay)
Flabellina funeka (East London)
Flabellina funeka 3x (Western False Bay)
Flabellina capensis (Cape Recife)
Flabellina capensis (Western False Bay)
Piseinotecus sp. (East London)

Subfamily

Favorininae

Family

Facelinidae

Glaucidae

Facelinidae

Aeolidiidae

Facelinidae

Flabellinidae

Piseinotecidae

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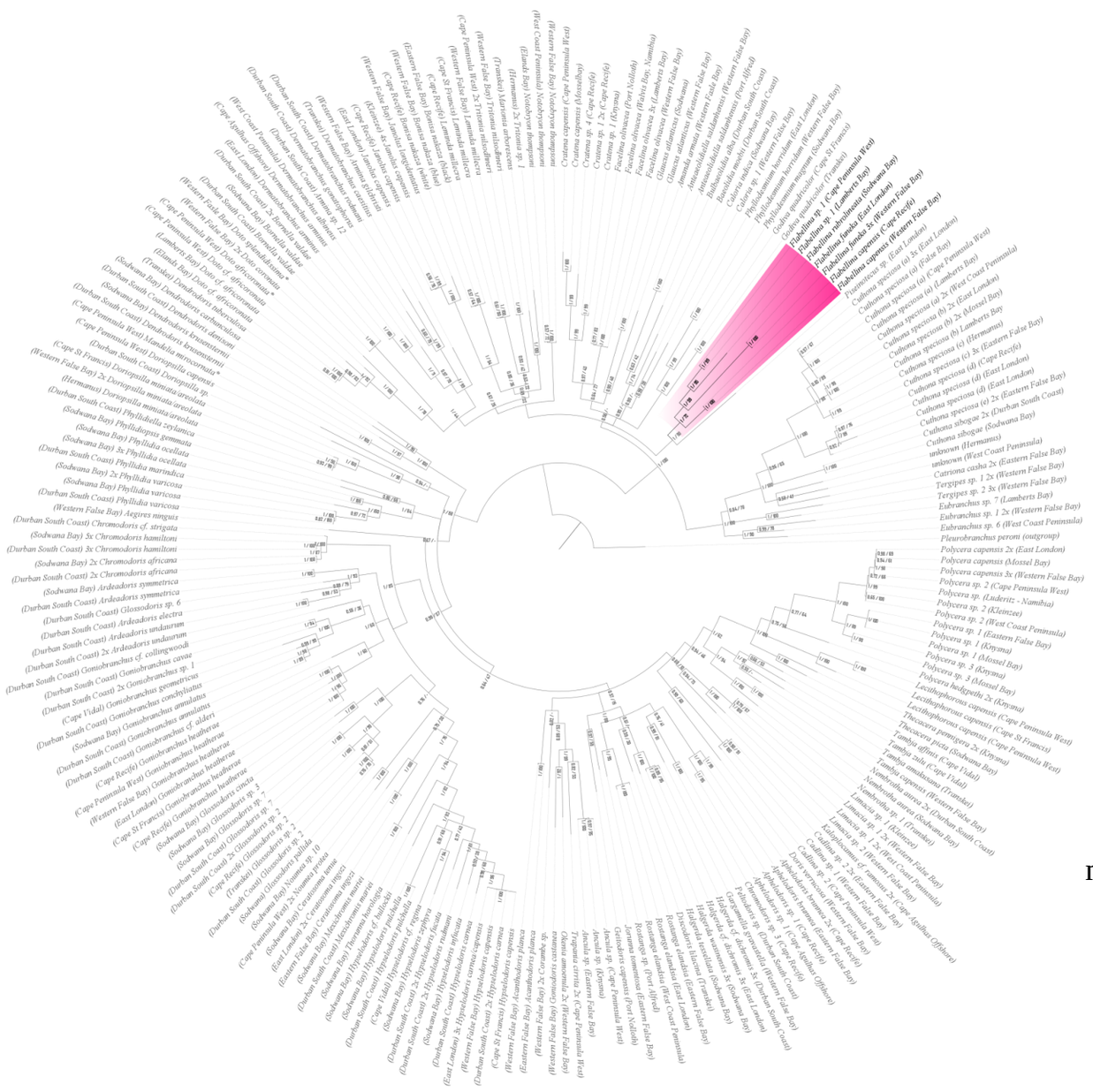
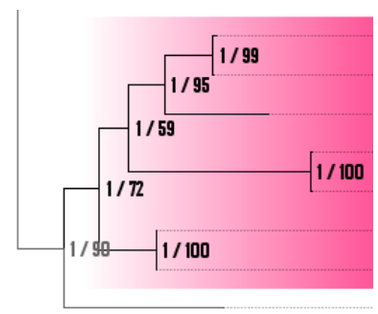
Superfamily Flabellinoidea





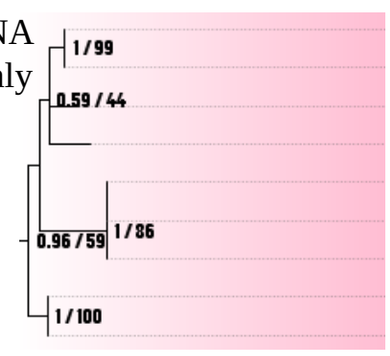
Flabellina sp. 1 (Cape Peninsula West)
Flabellina sp. 1 (Lamberts Bay)
Flabellina rubrolineata (a) (Sodwana Bay)
Flabellina funeka (East London)
Flabellina funeka 2x (Western False Bay)
Flabellina capensis (Cape Recife)
Flabellina capensis (Western False Bay)
Piseinotecus sp. (East London)

Family

Flabellinidae

Piseinotecidae

mtDNA only



Flabellina sp. 1 (Cape Peninsula West)
Flabellina sp. 1 (Lamberts Bay)
Flabellina rubrolineata (a) (Sodwana Bay)
Flabellina rubrolineata (b) (Sodwana Bay)
Flabellina funeka (East London)
Flabellina funeka (Western False Bay)
Flabellina funeka (Western False Bay)
Flabellina capensis (Cape Recife)
Flabellina capensis (Western False Bay)

Flabellinidae

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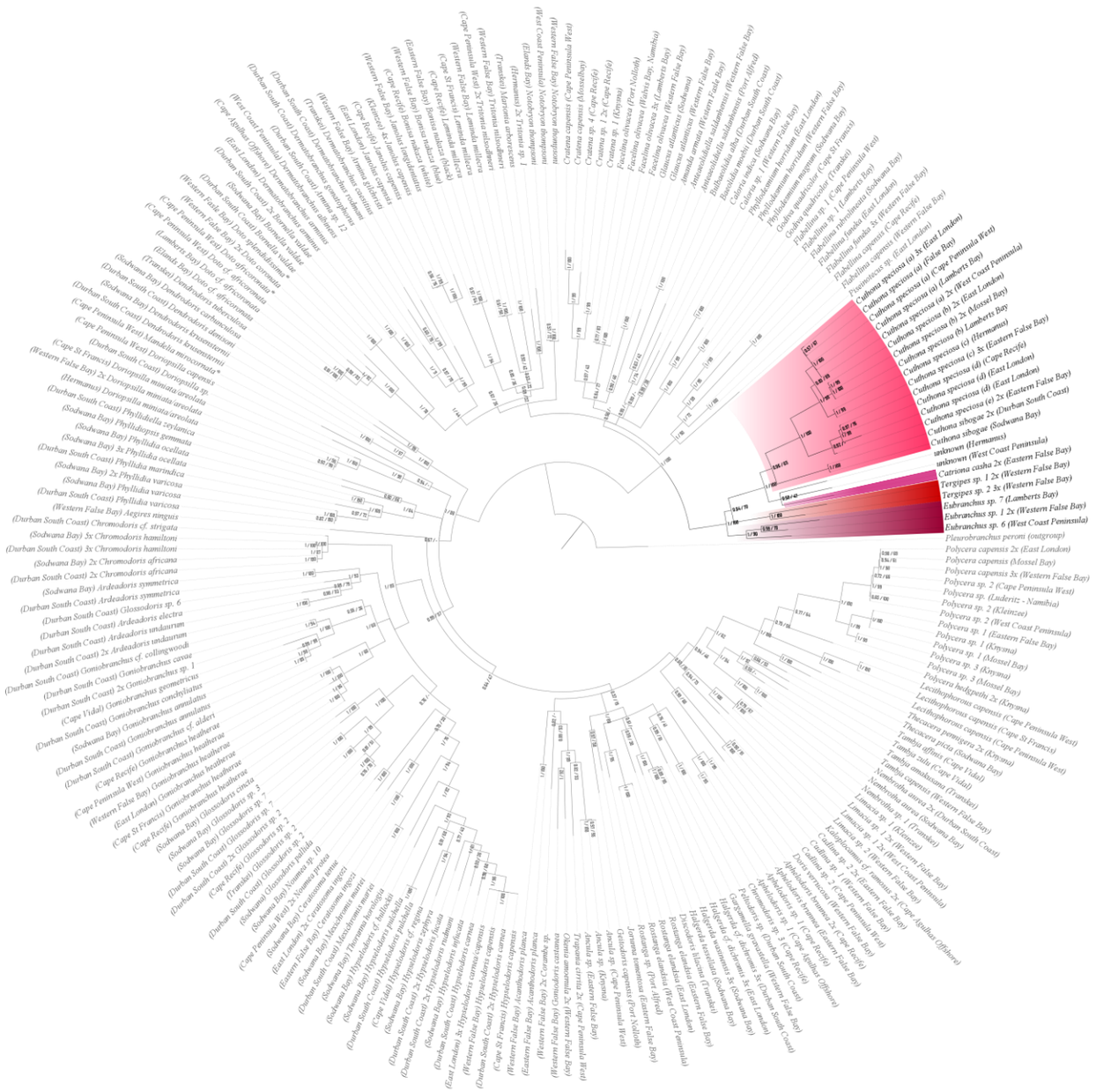
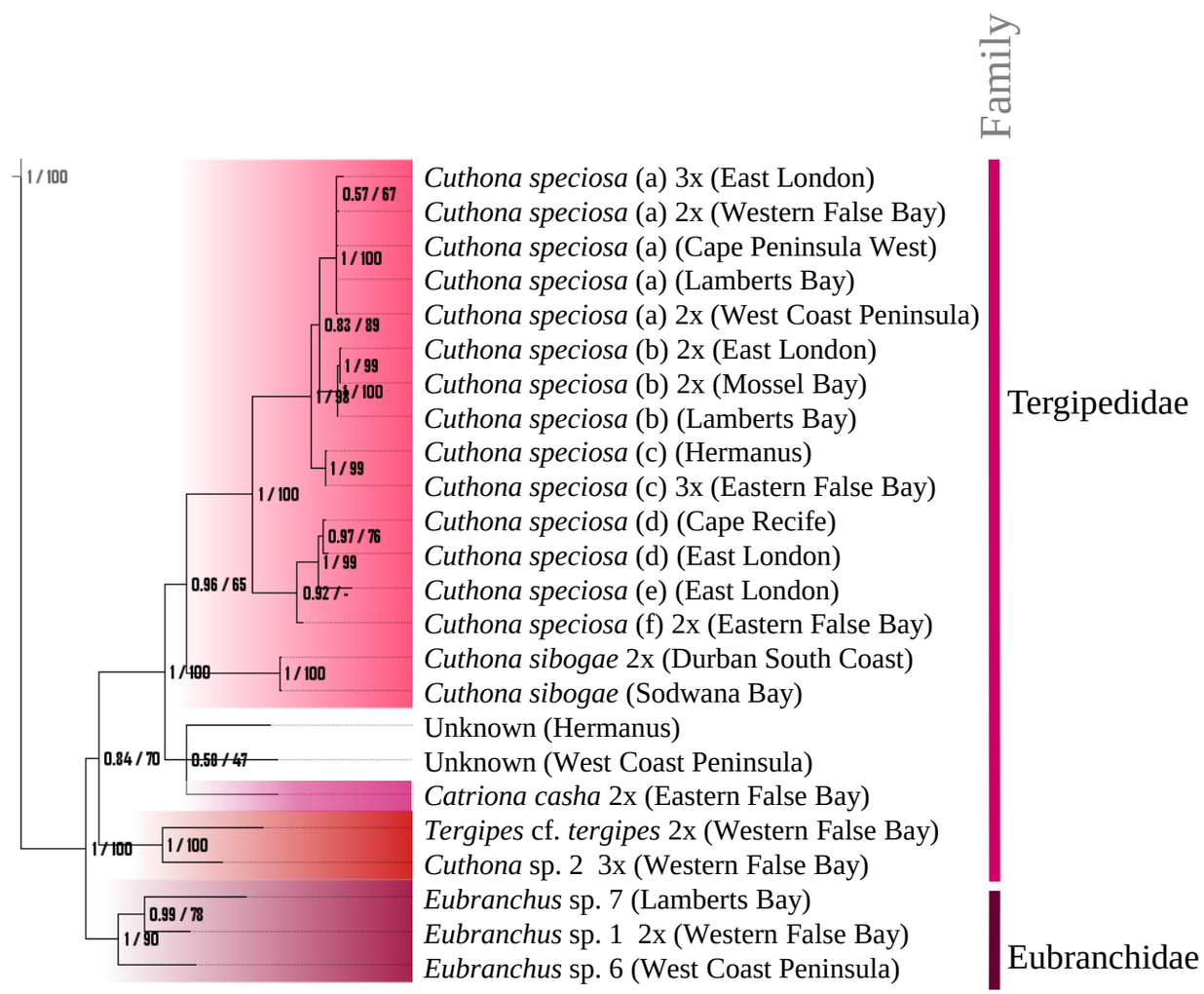
Superfamily Fionoidea





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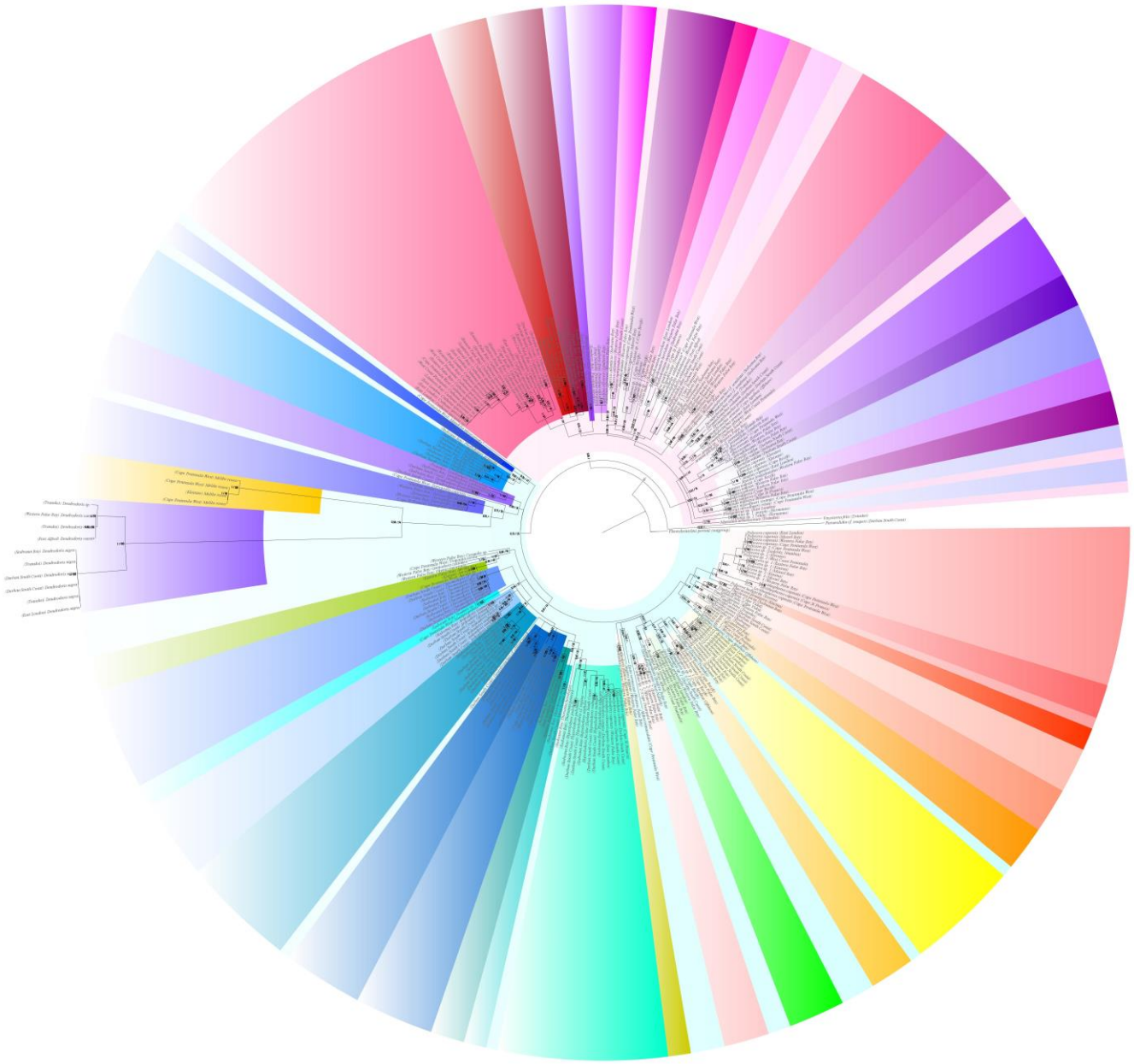
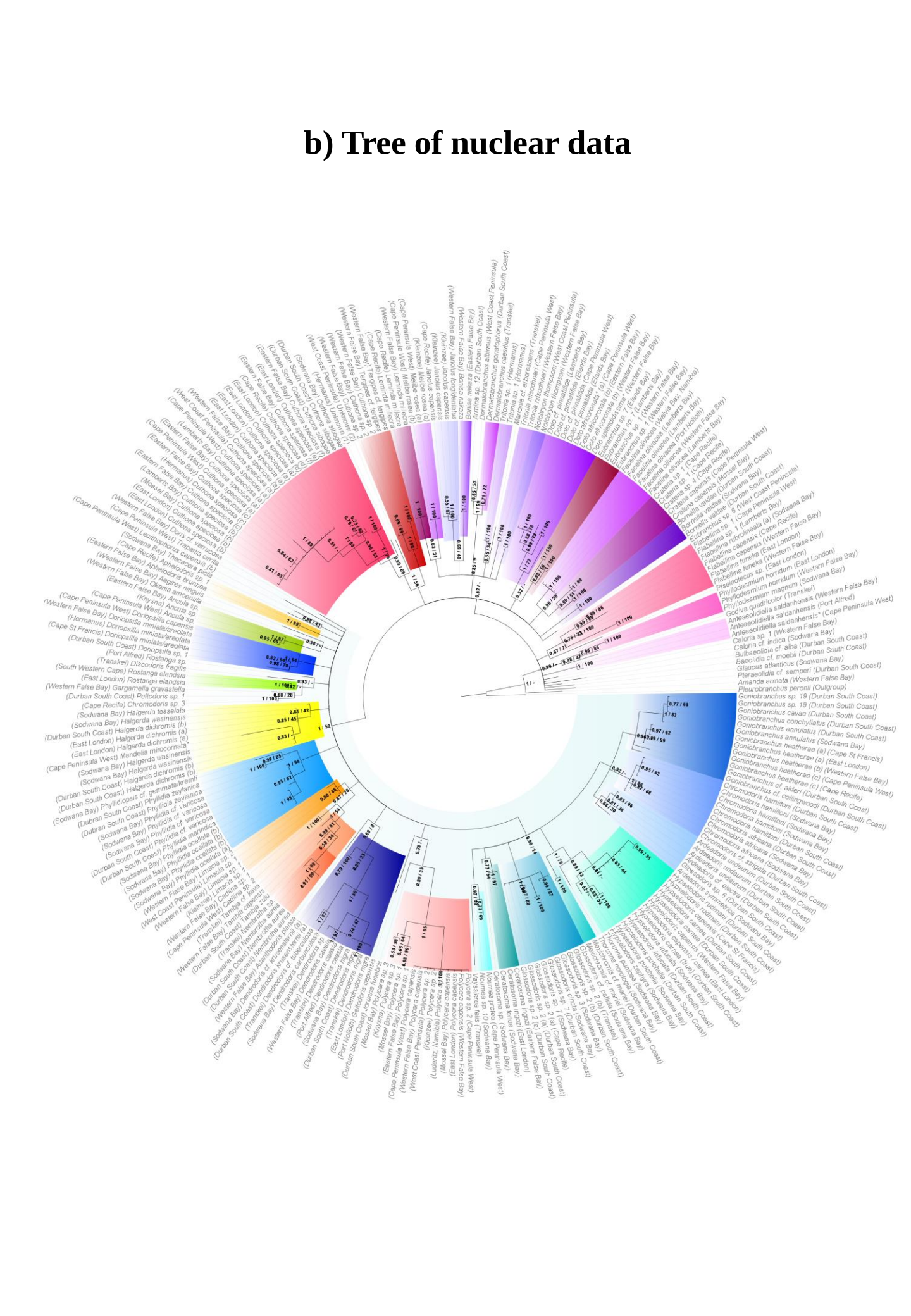
Appendix 2.9

Trees including taxa with long branch lengths and duplicate taxa

a) Tree of mitochondrial data



b) Tree of nuclear data



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Appendix 2.10

Tables of uncorrected p-distances

2.10 a) Distances between cryptic lineages recovered within South Africa

2.10 b) Distances between South African taxa and their global conspecific species retrieved from GenBank

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Species	From	Cryptic to	From	Between groups	Distances COI	Distances 16S	Distances H3	Within group	Distances COI	Distances 16S	Distances H3	Recognized sister species (Accession #; study)	Distances COI	Distances 16S	Distances H3
Cratena capensis (a)	Cape Peninsula West	*C. capensis* (b)	Mossel Bay	(a) vs. (b)	7,01%	5,41%	0,00%	(a)	0,67%	0,00%	-	*Cratena* sp. 1 (this study) vs. *C. peregrina* (HQ616752,HQ616715,HQ616781) (Carmona et al. 2011)	6,21%	1,50%	0,00%
Cuthona cf. *speciosa* (a)	East London, False Bay, Cape Peninsula West, West Coast Peninsula, Lambertsbay	*C. speciosa* (b); (c); (d); (e); (f)	Lambertsbay - East London					(a)	1,08%	0,39%	0,58%	*Cuthona diana* (JQ699569) vs. *Cuthona concinna* (GQ292072) (in Valdés et al. 2016)	1,03%		
Cuthona cf. *speciosa* (b)	East London, Mossel Bay, Lambertsbay	*C. speciosa* (a); (c); (d); (e); (f)	Lambertsbay - East London					(b)	0,53%	0,31%	0,16%	*Cuthona fulgens* (JQ699479) vs. *Cuthona* sp. A (JQ696814) (in Valdés et al. 2016)		8,36%	
Cuthona cf. *speciosa* (c)	Hermanus. Eastern False Bay	*C. speciosa* (a); (b); (d); (e); (f)	Lambertsbay - East London	(a) vs. (b) (a) vs. (c) (a) vs. (d) (a) vs. (e) (a) vs. (f) (b) vs. (c) (b) vs. (d) (b) vs. (e)	6,73% 5,74% 16,76% 15,41% 17,18% 5,53% 16,38% 15,63%	2,52% 3,57% 11,63% 12,09% 5,40% 4,01% 11,55% 12,13%	0,70% 0,82% 4,08% 5,06% 4,41% 0,74% 4,34% 5,33%	(c)	0,25%	0,17%	0,00%	*Cuthona lagunae* (JQ698303) vs. *C. lucine* (KX617955) (in Valdés et al. 2016)			3,45%
Cuthona cf. *speciosa* (d)	Cape Recife. East London	*C. speciosa* (a); (b); (c); (e); (f)	Lambertsbay - East London	(b) vs. (f) (c) vs. (d) (c) vs. (e) (c) vs. (f) (d) vs. (e) (d) vs. (f)	16,36% 15,78% 14,77% 15,68% 6,68% 1,17%	3,83% 11,96% 12,09% 0,17% 5,18% 11,79%	4,67% 4,26% 5,25% 4,59% 1,48% 0,98%	(d)	0,33%	1,04%	1,64%				
Cuthona cf. *speciosa* (e)	Eastern London	*C. speciosa* (a); (b); (c); (d); (f)	Lambertsbay - East London	(e) vs. (f)	6,34%	11,92%	0,98%	(e)	-	-	-				
Cuthona cf. *speciosa* (f)	Eastern False Bay	*Cuthona speciosa* (a); (b); (c); (d); (e)	Lambertsbay - East London					(f)	0,67%	0,00%	0,66%				
Dendrodoris cuanza	Western False Bay. Cape St Francis. Port Alfred. Transkei	*Dendrodoris* sp.	Transkei	*D. cuanza* vs. *Dendrodoris* sp.	6,04%	2,71%	0,33%	*D. cuanza*	0,22%	0,19%	0,00%	*D. tuberculosa* vs. *D. carbunculosa* (this study)	7,46%	8,98%	4,24%
Dendrodoris krusensternii (a)	Sodwana Bay. Durban South Coast	*D. krusensternii* (b)	Cape Vidal	(a) vs. (b)	14,90%	0,67%	-	(a)	0,41%	0,00%	-				
Dermatobranchus redmanni	Durban South Coast	*Dermatobranchus* sp.	Sodwana Bay	*Dermatobranchus* sp. vs. *D. romani*	19,70%	-	-	*Dermatobranchus* sp.	2,84%	-	-	*Aeolidia lovenii* (AF246781) vs. *A. maculata* (KF369111) (from Wollscheid-Lengeling et al. 2001 and Lobo et al. 2013)	13,42%	-	-
Doriopsilla areolata	Western False Bay, Hermanus, Cape St Francis	*Doriopsilla* sp. *1*	Durban South Coast	*Doriopsilla* sp. 1 vs. *D. areolata*	8,60%	2,94%	0,00%	*D. areolata*	0,53%	0,55%	0,00%	*D. albopunctata* (KR002485,KR002431,KR002527) vs. *D.dwehehennui* (KR002529,KR002475,KR002564) (in Horner et al. 2012)	8,36%	2,59%	0,30%
*Doto africoruanula** (a)	Cape Peninsula West	*D. coronata*	False Bay	(a) vs. (b)	10,10%	0,52%	5,56%	(b)	0,17%	0,00%	0,00%	*D. coronata* (KJ489653,KJ489723,KJ489762) vs. *D. millbayana* (KJ489660,KJ489729,KJ489759) (in Shipman & Gosliner 2015)	5,70%	0,70%	1,20%
Flabellina rubrolineata (a)	Sodwana Bay	*F. rubrolineata* (b)	Sodwana Bay	(a) vs. (b)	16,78%	-	-					*Flabellina funeka* (this study) vs. *F. ischitana* (HQ616759; Carmona et al. 2013)	13,80%	-	-
Glossodoris sp. 2 (a) + *G. pallida*	Sodwana Bay. Durban South Coast, Transkei	*Glossodoris* sp. 2 (b)	Cape Recife, Durban South Coast	(a) vs. (b)	0,82%	4,69%	0,66%	(a) (b)	2,17% 0,45%	0,68% 0,17%	0,00% 0,00%	*Glossodoris cincta* vs. *Glossodoris* sp. 3 (this study)	0,68%	0,36%	0,00%
Goniobranchus heatherae (a)	Cape Recife. Cape St Francis. East London	*G. heatherae* (b); (c)	Cape Peninsula West - Cape Recife					(a)	0,11%	0,51%	0,00%				
Goniobranchus heatherae (b)	Western False Bay	*G. heatherae* (a); (c)	Cape Peninsula West - Cape Recife	(a) vs. (b) (a) vs. (c) (b) vs. (c)	4,79% 5,73% 4,58%	3,96% 4,29% 4,21%	0,33% 0,33% 0,00%	(b)	-	0,34%	0,00%	*Goniobranchus annulatus* vs. *G. chorchyllatus* (this study)	5,18%	1,20%	3,28%
Goniobranchus heatherae (c)	Cape Peninsula West, Cape Recife	*G. heatherae* (a); (b)	Western False Bay - East London					(c)	0,11%	-	-				
Halgerda cf. *dichromis* (a)	East London	*H.* cf. *dichromis* (b)	Durban South Coast	(a) vs.(b)	1,84%	0,77%	0,44%	(a) (b)	0,00% 0,00%	0,17% 0,17%	0,00% 0,44%	*Halgerda dichromis* vs. *H. wasinensis* (this study)	2,50%	1,03%	0,66%
Hermelladoris carnea	Durban South Coast	*H. canensis/carnea*	Western False Bay. Cape St Francis. Cape Recife. East London, Durban South Coast	*H. carnea* vs. *H. canensis/carnea*	10,35%	5,09%	0,00%	*H. canensis/carnea*	0,20%	0,00%	0,00%	*Hypselodoris emma* (JQ727860,JQ727773) vs. *H. whitey* (JQ727862,JQ727795) (in Johnson & Gosliner 2012)	10,01%	3,30%	-
Leethophorus capensis (a)	Cape Peninsula West. Cape St Francis	*L. capensis* (b)	Cape Peninsula West	(a) vs. (b)	7,51%	0,44%	-	(a)	1,00%	1,30%	-	*Gymnodoris pseudobrunnea* (KJ196785) vs. *G. brunnea* (KJ196785) (Knutson & Gosliner, 2014)	6,46%	-	-
Limacia sp. *1*	Lambertsbay. West Coast Peninsula, Western False Bay	*Limacia* sp. *2*	Western False Bay	(a) vs. (b)	11,68%	6,22%	1,03%	(a) (b)	0,78% 1,36%	0,44% 0,25%	0,00% 0,00%	*Triophe maculata* (HM416260,HM416260,HM416297). *Triophe catalinae* (HM162890,HM162890,HM162936) (in Pola & Gosliner, 2010)	9,85%	4,96%	0,34%
Melibe rosea (a)	Kleinmond. Melibeea. Cape Peninsula West	*M. rosea* (b)	Cape Peninsula West	(a) vs. (b)	8,40%	3,62%	0,00%	(a)	1,36%	0,54%	0,00%	*Melibe strilds* (JX306075,JX306068,JX306081) vs. *M. digitata* (JX306069,JX306061,JX306076) (in Pola & Gosliner, 2012)	21,12%	27,60%	4,38%
Peluderis sp. *1*	Durban South Coast	*Peluderis* sp. *2*	Cape Recife	*Peluderis* sp. 1 vs. sp. 2	3,34%	1,84%	0,00%		-	-	-	*Halgerda dichromis* vs. *H. wasinensis* (this study)	2,50%	1,03%	0,66%
Phyllidia ocellata (a)	Sodwana Bay	*P. ocellata* (b)	Sodwana Bay	(a) vs. (b)	7,18%	2,78%	0,00%	(b)	0,33%	0,00%	0,00%	*Phyllidiella pustulosa* (KJ000384) vs. *P. zeylanica* (this study) *Phyllidiella pustulosa* (AF249232) vs. *P. zeylanica* (this study) *Phyllidia varicosa* vs. *P. ocellata* (this study)	4,64% 4,21%	 -	 1,35%
Polycerra sp. 2 + sp. (ludertitz) + *P. capensis*	*Polycerra* sp. 2: Kleinzee-Cape Peninsula West *Polycerra* sp. (ludertitz): Luderitz, Namibia *P. capensis*: Cape Peninsula West-East London	*Polycerra* sp. 1; sp.3	False Bay - East London	*P. capensis* vs. sp. 2 *P. capensis* vs. *Polycerra* sp. (ludertitz) *Polycerra* sp. (ludertitz) vs. *Polycerra* sp. 2	2,24% 1,90% 0,67%	0,55% 1,06% 0,51%	0,00% 0,00% 0,00%	*P. capensis* / sp. 2/ sp. (ludertitz)	1,31%	0,42%	0,00%	*P. capensis* (JX274681,JX274849)vs. *P. aurantomarginata* (AJ223274,AJ225190) (in Palomar et al. 2014)	11,76%	6,14%	-
Polycerra sp. 1	Western False Bay, Mossel Bay, Knysna	*P. capensis*/sp.2; sp. 3	Luderitz - East London	*P. capensis* / sp. 2/ sp. (ludertitz) vs. *Polycerra* sp. 1 *P. capensis* / sp. 2/ sp. (ludertitz) vs. *Polycerra* sp. 3 *Polycerra* sp. 1 vs sp. 3	10,61% 9,35% 8,33%	5,08% 5,84% 2,45%	5,25% 5,25% 1,31%	*Polycerra* sp. 1	0,11%	0,17%	0,00%	*P. astra* (KF425277,KF425291) vs. *P. aziaba* (KF425271,KF425283) (in Santander and Valdés, 2013)	-	4,80%	4,47%
Polycerra sp. 3	Mossel Bay, Knysna	*P. capensis*/sp.2; sp. 1	Luderitz - East London					*Polycerra* sp. 3	0,95%	0,00%	0,00%				

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	Species	Location in SA	Location outside SA	Sourcium Voucher	Accession	COI	Accession	18S	Accession	ITS
1	Acanthophora sp. 1	Durban - Sodwana	No autocolonizers							
2	Acanthophora sp. 2	Durban - Sodwana	No autocolonizers							
3	Acanthophora spicifera	Durban - Sodwana	No autocolonizers							
4	Acrosorium uncinatum	KATAMS	Western Australia, Hamelin	CANM 10280	KT377982	1.61%	KT377761	0.38%		
	Acrosorium uncinatum	KATAMS	Western Australia, Hamelin	CANM 10280	KT377982	1.61%	KT377761	0.38%		
	Acrosorium uncinatum	KATAMS	Western Australia, Hamelin	CANM 10280	KT377982	1.61%	KT377761	0.38%		
	C. undarum distance within vs. between genus	**Within South Africa**	**Within W Australia**	**Between Genus**						
	COI	2.14%	0%	10.0%						
	18S	0.38%	0%	0.0%						
5	Aeodes sp. 1 sp. nov.	Durban South Coast	Marshall Islands	MNCN-ALGA-11688	KM867168	14.14%	KM867481	0.38%	KM867549	4.86%
	Aeodes sp. 1 sp. nov.	Durban South Coast	Marshall Islands	MNCN-ALGA-11688	KM867168	14.14%	KM867481	0.38%	KM867549	4.86%
	Aeodes sp. 1 sp. nov.	Durban South Coast	Philippines	CAMM 100233	KJ998784	14.62%	KJ998458	0.38%	KJ998850	4.86%
	Aeodes sp. 1 sp. nov.	Durban South Coast	Philippines	CAMM 100235	KJ998785	14.62%	KJ998459	0.38%	KJ998851	4.86%
	Aeodes sp. 1 sp. nov.	Durban South Coast	Philippines	CAMM 97988	KJ466779	14.62%	KJ466512	0.38%	KJ466789	4.86%
	Aeodes sp. 1 sp. nov.	Durban South Coast	Philippines		KJ466777	14.62%	KJ466510	0.38%	KJ466807	4.86%
	B. aurelii distance within vs. between genus	**Within South Africa**	**Within Indo West Pacific**	**Between Genus**						
	COI	0%	0.00%	10.0%						
	18S	0%	0.00%	0.0%						
	18S	0%	0.00%	0.0%						
6	Aeodes sp. 2 sp. nov.	Durban - Sodwana	No autocolonizers							
7	Boergesenia sp. 1 affin.	Durban South Coast	Cape Verde (Sal Island, Palmeira, stn. 6)	CAAT 60172	KM867162	14.01%	KM867471	0.38%	KM867535	4.86%
8	Boergesenia sp. 1 affin.	Durban South Coast	Madagascar (S. of Tulear)	CAMM 97741	KM867161	14.46%	KM867480	0.38%	KM867548	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Philippines (E. of Luzon)	CAMM 100237	KM867162	14.46%	KM867481	0.38%	KM867549	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Philippines (E. of Luzon)	CAMM 100239	KM867161	14.46%	KM867480	0.38%	KM867548	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Guam (E. of Luzon)	CAMM 97743	KM867163	14.46%	KM867482	0.38%	KM867550	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Guam (E. of Luzon)	CAMM 97742	KM867164	14.46%			KM867551	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Guam (E. of Luzon)	CAMM 97740	KM867165	14.46%	KM867483	0.38%	KM867552	4.86%
	Boergesenia sp. 1 affin.	Durban South Coast	Guam (E. of Luzon)		KM867167	14.46%	KM867484	0.38%	KM867553	4.86%
	B. aff. distance within vs. between genus	**Within South Africa**	**Within Indo West Pacific**	**Between Genus**						
	COI	0.0	0.14%	10.0%						
	18S	0.0	0.00%	0.0%						
	18S	0.0	0.00%	0.0%						
9	Boergesenia sp. 2 affin.	Durban Bay	South Africa	Durban CAT	KM867169	14.46%	KM867477	0.00%	KM867545	4.86%
	Boergesenia sp. 2 affin.	Durban Bay	No further data	PLMM 0000000						
10	Boergesenia sp. 2 affin.	Durban Bay	No further data							
11	Boergesenia sp. 2 affin.	Durban Bay	Australia (Queensland, Mandalay)	CAMM 100077	KT377984	0.00%	KT377765	0.00%		
	Boergesenia sp. 2 affin.	Durban Bay	Australia (Queensland, North Stradbroke Island		KM867169	0.00%				
	Boergesenia sp. 2 affin.	Durban Bay	Cuba, Havana, Marc Montano	CAAT 60172	KM867170	0.00%	KM867486	0.00%		
12	Boergesenia sp. 2 affin.	Durban - Sodwana Bay	Madagascar (Ile de Nosbeas, Nosy Valiha)	CAMM 97985	KT377985	0.00%	KT377769	0.00%		
13	Boergesenia sp. 2 affin.	Durban - Sodwana Bay	Madagascar (Ile de Nosbeas, Nosy Valiha)	CAMM 97989	KT377987	0.00%	KT377771	0.00%		
14	Boergesenia sp. 2 affin.	Durban South Coast	Madagascar (Nosy Boraha)	CAMM 100240	KT377988	0.00%	KT377772	0.00%		
	Boergesenia sp. 2 affin.	Durban South Coast	Madagascar (Ile de Nosbeas, Nosy Kalotaye)	CAMM 97990	KT377989	0.00%	KT377773	0.00%		
	Boergesenia sp. 2 affin.	Durban South Coast	Australia (Moreton, QLD)		KT377991	0.00%	KT377775	0.00%		
15	Boergesenia sp. 2 affin.	Durban - Sodwana	No further data		KT377992	0.00%	KT377776	0.00%		
	Boergesenia sp. 2 affin.	Durban - Sodwana	No further data			0.00%	KT377777	0.00%		
16	Boergesenia sp. 2 affin.	Durban Bay	No further data			0.00%	KT377778	0.00%		
17	Brachidontes (Brachidontes) sp.	Durban - Sodwana	Cape Verde, Caldeira				KT377757	0.00%		
	Brachidontes (Brachidontes) pul	Durban - Sodwana	Japan		KM867482	14.74%				
	Brachidontes (Brachidontes) pul	Durban - Sodwana	Japan		KM867482	14.74%				
	Brachidontes (Brachidontes) pul	Cape Vidal	New Zealand, Falkland		KJ466467	14.11%				
18	Brachidontes (Brachidontes) pul	Cape Vidal	Cape Verde, Caldeira				KT377757	0.00%		
	Brachidontes (Brachidontes) pul	Cape Vidal	Japan		KM867482	15.00%				
	Brachidontes (Brachidontes) pul	Cape Vidal	Japan		KM867482	15.00%				
19	Brachidontes capsus	East London - Sodwana Bay	Australia, Great Barrier Reef		KJ466465	0.00%	KJ466242	0.00%		
	Brachidontes capsus	East London - Sodwana Bay	Australia		KM867483	0.00%				
20	Brachidontes cf. adamsianus	Durban	Cameroon, Douala, Cocal Island		KM867484	14.11%				
	Brachidontes cf. adamsianus	Durban	Cameroon, Douala, Cocal Island				KM867485	14.11%		
21	Brachidontes cf. adamsianus	Durban South Coast	No autocolonizers							
22	Brachidontes cf. adamsianus	Durban South Coast - Sodwana Bay	No autocolonizers							
23	Brachidontes dichotus	Durban	Japan, Mutsure (Dreissena cuspidata)		KJ466466	0.00%	KJ466240	0.00%		
24	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Cape Verde, Sal Island, Santa		KM867485	14.11%	KM867486	0.00%		
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Japan		KM867482	14.11%				
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Japan		KM867482	14.11%				
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	South Africa				KT377757	0.00%		
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	MNCN-ALGA-10371, MNCN-ALGA-11700				KT377757	0.00%		
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Japan/Korea				KT377757	0.00%	KT377688	0.14%
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	CAS/SU 60001-19.1.1.A CM2009-19.1A, MNCN-ALGA-11700				KT377757	0.00%	KT377688	0.14%
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Cape Verde				KT377757	0.00%	KT377688	0.14%
	Brachidontes sp. 1 (= 1 affin.)	Durban South Coast	Cape Verde				KT377757	0.00%		
25	Brachyodontes pseudoni	Little Bay & Brittanny	Cape, Australia, South		KJ466462	0.00%	KJ466240	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan		KM867487	0.00%				
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan		KM867488	0.00%				
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan, Kanazawa				KM867488	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	MNCN-ALGA-10371, MNCN-ALGA-11700				KT377757	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Angola (E)	MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Angola (E)	MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Brazil/Portugal	CAS/SU 60001-19.1.1.A CM2009-19.1A, MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Cape Verde	MNCN-ALGA-11700			KT377757	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan, Okinawa	MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Cape, Australia, South		KJ466462	0.00%	KJ466240	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan		KM867487	0.00%				
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan		KM867488	0.00%				
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan, Kanazawa				KM867488	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	MNCN-ALGA-10371, MNCN-ALGA-11700				KT377757	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Angola (E)	MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Brazil/Portugal	CAS/SU 60001-19.1.1.A CM2009-19.1A, MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
	Brachyodontes pseudoni	Little Bay & Brittanny	Cape Verde	MNCN-ALGA-11700			KT377757	0.00%		
	Brachyodontes pseudoni	Little Bay & Brittanny	Japan, Okinawa	MNCN-ALGA-11700			KT377757	0.00%	KT377688	0.14%
26	Brachyodontes sp. 2 affin.	Durban Bay	Red Gulf of Tadjoura, Southwestern Indi		KM867489	0.00%	KM867489	14.61%		
27	Brachyodontes sp. 2 affin.	Durban Bay - Sodwana Bay	Japan, Kanazawa		KM867490	14.61%	KM867490	0.00%		
	Brachyodontes sp. 2 affin.	Durban Bay - Sodwana Bay	Japan, Kanazawa		KM867491	14.61%	KM867491	0.00%		
	Brachyodontes sp. 2 affin.	Durban Bay - Sodwana Bay	Japan, Kanazawa, Kyoto (Mytilus galloprovincialis)				KM867491	0.00%		
	Brachyodontes sp. 2 affin.	Durban Bay - Sodwana Bay	Japan, Cape Nojimazaki (Mytilus galloprovincialis)		KM867492	0.00%	KM867492	0.00%	KM867492	0.14%
	Brachyodontes sp. 2 affin.	Durban Bay	Japan, Cape Nojimazaki (Mytilus galloprovincialis)		KM867493	0.00%	KM867493	0.00%	KM867493	0.14%
28	Brachyodontes sp. 2 affin.	Durban Bay	Cape Penitentiary, Southern Bay (Mytilus C. trossulosus)		KJ466468	0.00%	KJ466244, KJ466270, KJ466271, KJ466272, KJ466273	0.00%	KJ466246, KJ466274, KJ466275, KJ466276, KJ466277	0.00%
29	Brachyodontes sp. 2 affin. (= HAS-FIRE1)	Durban Bay	Cape Penitentiary, Southern Bay (Mytilus C. trossulosus)		KJ466468	0.00%	KJ466244	0.00%	KJ466246	0.00%
30	Brachyodontes sp. 2 affin. (= HAS-FIRE2)	Durban Bay	Australia (Queensland, North Stradbroke Island		KJ466469	14.61%	KJ466245	0.00%		
31	Brachyodontes sp. 2 affin.	Durban - Sodwana Bay	Australia (Queensland, Moreton Island)		KJ466470	0.00%	KJ466246, KJ466271, KJ466272, KJ466273	0.00%	KJ466246, KJ466274, KJ466275, KJ466276, KJ466277	0.00%
32	Brachyodontes sp. 2 affin.	Durban Bay	Japan, Cape Nojimazaki (Mytilus C. trossulosus)		KM867494	0.00%	KM867494	0.00%		
33	Brachyodontes sp. 3 (cf. cincinn.)	Durban Bay	Madagascar, Nosy Valiha	CAAT 60172	KM867495	14.61%	KM867495	0.00%		
34	Brachyodontes sp. 3 (cf. cincinn.)	Durban Bay	Madagascar, Nosy Valiha	CAAT 60172	KM867496	14.61%	KM867496	0.00%		
35	Brachyodontes sp. 3 (cf. cincinn.)	Durban Bay	Madagascar, Nosy Valiha	CAAT 97103	KT377994	14.61%	KT377779	0.00%		
36	Brachyodontes sp. 3 (cf. cincinn.)	Durban Bay	Madagascar, Nosy Valiha	CAAT 97103	KT377995	14.61%	KT377780	0.00%		
37	Brachyodontes sp. 3 (cf. cincinn.)	Durban Bay	Madagascar, Nosy Valiha	CAAT 97103	KT377996	14.61%	KT377781	0.00%		
38	Brachyodontes sp. 3 (cf. cincinn.)	Durban - Sodwana	No autocolonizers		KT377997	14.61%	KT377782	0.00%		
39	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Australia, Mandalay, QLD (G. tenuistriata)	CAAT 97104	KT377998	14.61%	KT377783	0.00%		
	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Australia, Mandalay, QLD (G. tenuistriata)	CAAT 97105, CAAT 97106	KT377999	14.61%	KT377784	0.00%		
40	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Australia (Queensland, Mandalay) (G. tenuistriata)	CAAT 97107	KT378000	14.61%	KT377785	0.00%		
	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Australia (Queensland, Moreton Island, QLD) (G. tenuistriata)	CAAT 97108	KT378001	14.61%	KT377786	0.00%		
	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Australia (Queensland, North Stradbroke Island) (G. tenuistriata)		KT378002	14.61%	KT377787	0.00%		
	Brachyodontes sp. 3 (cf. cincinn.)	Durban South Coast	Cape Verde, Santa Maria	CAAT 100081	KT378004	14.61%	KT378004	0.00%		
	Brachyodontes sp. 3 (cf. cinnamomeus)	Durban South Coast	Australia, QLD	CAAT 100080	KT377751	14.07%	KT377751	0.00%		
	Brachyodontes sp. 3 (cf. cinnamomeus)	Durban South Coast	Australia, Mandalay, QLD (G. tenuistriata)	CAAT 97108, CAAT 100084	KT378141, KT377947	14.55%	KT378000, KT377756	7.98%		
	Brachyodontes sp. 3 (cf. cinnamomeus)	Durban South Coast	Durban South Coast (G. tenuis)			13.96%		7.98%		0.96%
	Brachyodontes sp. 3 (cf. cinnamomeus)	Durban South Coast	Durban South Coast (Geomitilus tenuis, G. 18)			14.55%		8.37%		0.96%
41	Brachyodontes (mytilisatus)	Durban South Coast	Cape Verde (G. Mirza (G. tenuis))	CAAT 97000	KT377989	14.07%	KT377769	0.00%		
	Brachyodontes (mytilisatus)	Durban South Coast	Cape Verde (G. geomarginata)			13.43%		0.38%		
	Brachyodontes (mytilisatus)	Durban South Coast	Australia (Queensland, Gold Coast Seaway)		KJ466480	14.61%	KJ466463	14.61%		
	Brachyodontes (mytilisatus)	Durban South Coast	Japan (Inaki Mizu)		KJ466481	0.38%				
	Brachyodontes (mytilisatus)	Durban South Coast	Australia (Queensland, Mandalay) (G. tenuistriata)	CAAT 100081	KT377990	14.07%	KT377770	0.38%		
	Brachyodontes (mytilisatus)	Durban South Coast	Madagascar (Ile de Nosbeas, Nosy Valiha) (G. geomarginata)	CAAT 97109	KT377992	14.61%	KT377772	0.00%		
42	Brachyodontes (mytilisatus)	Cape Vidal	Australia (Queensland, Mandalay) (G. tenuistriata)	CAAT 100082	KT377993	14.07%	KT377773	0.38%		
	Brachyodontes (mytilisatus)	Cape Vidal	Madagascar (Ile de Nosbeas, Nosy Valiha) (G. geomarginata)	CAAT 97109	KT377992	14.07%	KT377771	0.38%		
	Brachyodontes (mytilisatus)	Cape Vidal	Australia (Moreton, QLD)		KT377991	14.07%	KT377771	0.38%		
43	Brachyodontes (mytilisatus)	Little Bay	Australia (Gympie Bay)		KT377993	14.07%	KT377772	0.38%		
44	Brachyodontes sp. 4 affin.	Durban Bay	No affin. for affin.		KJ466481	14.61%				
45	Brachyodontes sp. 4 affin.	Durban Bay	No autocolonizers			0.38%				
46	Brachyodontes (cf. hulleyi)	Durban Bay	Philippines (Mactan, Hulley)	CAAT 98000	KT377000	14.46%	KT377752	14.61%		
	Brachyodontes (cf. hulleyi)	Durban Bay	Philippines (Bantayan, Hulley)	CAAT 98002 98003	KT378142	14.46%	KT378779	14.96%		
	Brachyodontes (cf. hulleyi)	Durban Bay	Japan (Okinawa, Hulley)	CAAT 98005	KT377001	14.46%	KT377753	14.61%		
	Brachyodontes (cf. hulleyi)	Durban Bay	Japan (Okinawa, Hulley)	CAAT 97998	KT377994	14.46%	KT377754	14.61%		
	Brachyodontes (cf. hulleyi)	Durban Bay	Madagascar (Ile de Nosbeas (= nosbeas))	CAAT 97108	KT377994	14.46%	KT377755	14.61%		
47	Brachyodontes (cf. hulleyi)	Durban - Sodwana Bay	No autocolonizers							
48	Brachyodontes (silicatus)	Durban Bay	Japan, Niigata	Japan Niigata	KJ466484	0.38%				
	Brachyodontes (silicatus)	Durban Bay	Madagascar	CAAT 97004	KT377002	0.61%	KT377756	0.38%		
	Brachyodontes (silicatus)	Durban - Sodwana Bay	Australia, NSW		KJ466483	0.38%	KJ466260	0.38%		
49	Brachyodontes (silicatus)	Durban - Sodwana Bay	Australia, Heron Island, QLD		KJ466482	0.61%	KJ466260	0.38%		
	Brachyodontes (silicatus)	Durban - Sodwana Bay	New Caledonia, Ouvea		KJ466483	0.38%	KJ466260	0.38%		
50	Brachyodontes (cupsus)	Durban South Coast	No autocolonizers							
51	Brachyodontes (cupsus)	Durban Bay	No autocolonizers							
52	Brachyodontes (cupsus)	Durban Bay	Australia, Lord Howe Island, NSW		KJ466485		KJ466485			
	Brachyodontes (cupsus)	Durban Bay	Australia, Moreton, QLD		KJ466485	0.00%				
	Brachyodontes (cupsus)	Durban Bay	Indonesia, Bali, Tulamben	CAAT 100088	KT377003	0.00%	KJ466485	0.00%		
	Brachyodontes (cupsus)	Durban Bay	Madagascar (Ile de Nosbeas, Nosy Faly)	CAAT 97000	KT377004	0.00%	KT377757	0.00%		
53	Brachyodontes (cupsus)	Durban South Coast	No further data	CAAT 98005	KT378005	0.00%	KT378005		KT378005	0.96%
54	Brachyodontes (cupsus)	Durban South Coast	Australia, Bundaberg, Bundaberg		KJ466487	0.00%	KJ466485	0.00%		
55	Brachyodontes (cf. cupsus)	Cape Andles Offshore	Portugal, Azores		KJ466484	0.61%				
	Brachyodontes (cf. cupsus)	Cape Andles Offshore	Australia, NSW, Nelson Bay	MNCN-ALGA-11671	KT378006	0.00%	KT378006			
	Brachyodontes (cf. cupsus)	Cape Andles Offshore	Australia, NSW, Nelson Bay	MNCN-ALGA-11671	KT378006	14.96%	KT378006	0.00%		
56	Mytilus sp. 1 (Galapagensis)	Durban - False Bay	Australia, Kangaroo, Bulmbula		KJ466488	0.00%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban - False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	0.00%	KJ466488	0.00%		
57	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Australia, Kangaroo, Bulmbula		KJ466488	0.00%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
58	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Australia, Kangaroo, Bulmbula		KJ466488	0.00%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
59	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%	KJ466488	0.00%
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%	KJ466488	0.00%
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
60	Mytilus sp. 1 (Galapagensis)	Durban False Bay	Great Cuttle	MNCN-ALGA-11671	KJ466488	14.61%	KJ466488	0.00%		
61	Mytilus sp. 4	Durban	Philippines (N. coastline)		KJ466492	0.00%	KJ466492			
	Mytilus sp. 4	Durban	Philippines (N. coastline)		KJ466492	0.00%	KJ466492			
	Mytilus sp. 4	Durban	Philippines (N. coastline)	MNCN-ALGA-11671	KJ466492	0.00%	KJ466492	0.00%		
	Mytilus sp. 4	Durban	Philippines (N. Kangaroo)		KJ466492	0.00%				
	Mytilus sp. 4	Durban	Philippines (N. coastline)		KJ466492	0.00%	KJ466492	0.00%		
	Mytilus sp. 4	Durban	Philippines (N. coastline)		KJ466492	0.00%	KJ466492	0.00%		
	Mytilus sp. 4	Durban	Philippines (Bulmbula, sp. 1)	MNCN-ALGA-11671	KJ466492	0.00%	KJ466492	0.00%		
	Mytilus sp. 4	Durban	Philippines (Bulmbula, sp. 1)	MNCN-ALGA-11671	KJ466492	0.00%	KJ466492	0.00%		
	Mytilus sp. 4	Durban	Philippines (Bulmbula, sp. 1)	MNCN-ALGA-11671	KJ466492	0.00%	KJ466492	0.00%		
62	Mytilus sp. 4	Durban - Sodwana Bay	No autocolonizers		KJ466492	0.00%				
63	Mytilus sp. 5	Durban Bay	No autocolonizers							
64	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo	DPM1MUS-10002	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo	DPM1MUS-10002	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo, Middle	DPM1MUS-10006	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Australia, Queensland, Mandalay		KT378016	0.00%	KT378008, NC_008695	0.00%		
	Mytilus sodwana (sp.DPM1)	Durban Bay	Australia, Queensland, Mandalay		KT378017	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	No further data				KT378008			
65	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo	DPM1MUS-10002	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo	DPM1MUS-10002	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Uruguay, Sorgeo, Middle	DPM1MUS-10006	KT378015	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	Australia, Queensland, Mandalay		KT378016	0.00%	KT378008, NC_008695	0.00%		
	Mytilus sodwana (sp.DPM1)	Durban Bay	Australia, Queensland, Mandalay		KT378017	0.00%				
	Mytilus sodwana (sp.DPM1)	Durban Bay	No further data				KT378008			
66	Mytilus cf. galloprovincialis	Durban - Sodwana Bay	Australia, Queensland, Cassel Island		KT378018	0.00%	KT378008	0.00%		
	Mytilus cf. galloprovincialis	Durban - Sodwana Bay	Portugal	CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100	KT378021, ..., KT378021	0.00%	KT378021			
	Mytilus cf. galloprovincialis	Durban - Sodwana Bay	Portugal, Cascais				KT378021	0.00%	KT378021	
67	Mytilus cf. galloprovincialis	Durban - Sodwana Bay	No further data							
68	Mytilus cf. galloprovincialis (sensu stricto)	Durban	Portugal, Cascais	CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100	KT378021, ..., KT378021	0.00%	KT378021, ..., KT378021	0.00%	KT378021, ..., KT378021	
69	Mytilus edulis	Durban South Coast	Canada, Halifax, off Halifax, Nova Scotia		KT378022	0.00%	KT378022, KT378023		KT378022, KT378023	0.48%
	Mytilus edulis	Durban South Coast	Canada, Halifax, off Halifax, Nova Scotia	CAAT 100, CAAT 100, CAAT 100, CAAT 100	KT378023, KT378022	0.00%	KT378022, KT378023		KT378022, KT378023	
	Mytilus edulis	Durban South Coast	Canada, Halifax, off Halifax, Nova Scotia	CAAT 100, CAAT 100, CAAT 100, CAAT 100	KT378023, KT378022	0.48%	KT378022, KT378023	0.48%	KT378022, KT378023	0.48%
	Mytilus edulis	Durban South Coast	Canada, Halifax, off Halifax, Nova Scotia	CAAT 100, CAAT 100, CAAT 100, CAAT 100	KT378023, KT378022	0.48%	KT378022, KT378023	0.48%	KT378022, KT378023	0.48%
70	Mytilus edulis	Durban South Coast	Canada, Nova Scotia, Nelson Bay	MNCN-ALGA-11671	KT378024	0.00%	KT378024	0.00%	KT378024	0.48%
71	Mytilus edulis	Durban South Coast	Canada, Alberta	MNCN-ALGA-11671	KT378025	0.00%				
	Mytilus edulis	Durban South Coast	Canada, Alberta	MNCN-ALGA-11671	KT378026	0.00%				
72	Mytilus edulis (sensu lato)	Durban - False Bay	Canada, Nova Scotia, Nelson Bay	MNCN-ALGA-11671	KT378027	0.00%	KT378027		KT378027	
	Mytilus edulis (sensu lato)	Durban False Bay	Mexico, Pulmo Bay	MNCN-ALGA-11671, MNCN-ALGA-11671, MNCN-ALGA-11671, MNCN-ALGA-11671	KT378028	0.00%	KT378028, KT378029	0.00%	KT378028, KT378029, KT378030, KT378031	0.48%
	Mytilus sp. 1 (galloprovincialis)	Durban False Bay, Mossel Bay Kraaiens	Australia, Queensland, Cassel Island		KT378029	0.00%	KT378029	0.00%	KT378029	0.48%
	Mytilus sp. 1 (galloprovincialis)	Durban False Bay, Mossel Bay Kraaiens	Australia, Queensland, Mandalay	MNCN-ALGA-11671, MNCN-ALGA-11671, MNCN-ALGA-11671, MNCN-ALGA-11671	KT378030, KT378031	0.00%	KT378030, KT378031	0.00%	KT378030	0.48%
	Mytilus: distance within genus	**Within Patterns (no. 3**	**Within P. canaliculus**	**Within P. californicus**						
	COI	0.00%	0.00%	1.78%						
	18S	0.00%	0.00%	0.00%						
	18S	0.00%		0.00%						
73	Mytilus (cf. edulis)	Durban South Coast	Australia, Victoria (NSW) from P. canaliculus	CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100, CAAT 100,

Stellenbosch University https://scholar.sun.ac.za

Appendix 2.11

Tree of three genes inferred using RAxML

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Appendix 3.1

Table of presence/absence data used for analysis in R-studio

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	Port Nolloth	Kleinzee	Lamberts Bay	Elands Bay	West Coast Peninsula	Melkbosstrand	Cape Peninsula West	Western False Bay	Eastern False Bay	Walker Bay	Infanta	Mossel Bay	Knysna	Tsitsikamma	Cape St Francis	Cape Recife	Port Alfred	East London	Coffee Bay	Port St Johns	Durban South Coast	Durban	Durban North Coast	Richards Bay	Sodwana Bay	Kosi Bay
Acanthodoris planca	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Aegires lemoncello	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Aegires ninguis	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
*Aegires sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Aegires sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Aegires villosus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Aldisa benguelae	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Aldisa sp. 2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Aldisa sp. 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Aldisa trimaculata	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Amanda armata	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ancula sp.	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Anteaeolidiella saldanhensis	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Aphelodoris brunnea	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Aphelodoris sp. 1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
*Ardeadoris cf. angustolutea**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Ardeadoris cf. electra**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Ardeadoris cf. tomsmithi**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Ardeadoris sp. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Ardeadoris sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ardeadoris symmetrica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Ardeadoris undaurum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Armina gilchristi	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Armina sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Armina sp. 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Armina sp. 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Atagema cf. gibba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Atagema cf. rugosa	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Atagema sp. 1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
*Baeolidia cf. moebii**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Baeolidia chaka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Baeolidia palythoae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Bonisa nakaza	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Bornella anguilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Bornella stellifer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Bornella valdae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Bulbaeolidia cf. alba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Cadlina sp. 1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadlina sp. 2	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadlina sp. 3	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Cadlina sp. 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cadlina sp. 5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadlinella ornatissima	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Caloria cf. indica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Caloria sp. 1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caloria sp. 2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caloria sp. 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Catriona casha	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Catriona columbiana	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catriona sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ceratophyllidia africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ceratosoma cf. tenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Ceratosoma ingozi	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Ceratosoma sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Ceratosoma sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Ceratosoma sp. 5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Cerberilla affinis**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cerberilla africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Cerberilla sp. 2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Cerberilla sp.**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chromodoris africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Chromodoris boucheti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Chromodoris cf. colemani**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Chromodoris cf. strigata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Chromodoris hamiltoni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Chromodoris strigata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Corambe sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cratena capensis (a)	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Cratena capensis (a)	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
*Cratena capensis (b)**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Cratena capensis (b)**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cratena simba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cratena sp. 1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Cratena sp. 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Cratena sp. 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cratena sp. 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crimora lutea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Cuthona anulata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Cuthona cf. sp 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Cuthona cf. speciosa**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cuthona kanga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cuthona ornata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Cuthona sibogae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Cuthona sp. 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cuthona sp. 5 (sp. 23 IPNUsp. 35 NSSI)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Cuthona sp. 6	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Cuthona speciosa (a)	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
*Cuthona speciosa (b)**	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
*Cuthona speciosa (c)**	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Cuthona speciosa (d)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
*Cuthona speciosa (e)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

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*Cuthona speciosa (f)**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dendrodoris caesia	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Dendrodoris carbunculosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Dendrodoris cf. tuberculosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Dendrodoris fumata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Dendrodoris guttata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dendrodoris krusensternii (a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Dendrodoris krusensternii (b)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dendrodoris krusensternii (c)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Dendrodoris nigra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Dendrodoris sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
*Dendrodoris sp. 2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Dendrodoris tuberculosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Dermatobranchus albineus	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Dermatobranchus albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dermatobranchus arminus	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
Dermatobranchus caesitius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dermatobranchus gonatophorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Dermatobranchus ornatus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dermatobranchus pustulosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dermatobranchus rodmani	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Dermatobranchus rubidus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
*Dermatobranchus sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Diaphorodoris mitsuii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Diaulula sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Discodoris cebuensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Discodoris lilacina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Discodoris sp. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Diversidoris aurantionodulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Diversidoris cf. crocea**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Diversidoris sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Doriopsilla areolata	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Doriopsilla capensis	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Doriopsilla sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0
Doriprismatica atromarginata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Doriprismatica paladentata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Doris ananas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Doris cf. verrucosa	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Doris granulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Doris pecten	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Doris sp. 1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Doto africoronata	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Doto cf. pinnatifida	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Doto coronata**	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Doto rosea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Doto sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Doto splendidissima	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Doto ussi**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Embletonia sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 10	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 2	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 5	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Eubranchus sp. 6**	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Eubranchus sp. 7**	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 8	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eubranchus sp. 9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Facelina bourailli	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Facelina olivacea	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Favorinus ghanensis	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Favorinus japonicus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Favorinus sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
*Favorinus tauruganus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Fiona pinnata	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flabellina bicolor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Flabellina capensis	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Flabellina delicata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Flabellina exoptata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Flabellina funeka	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Flabellina rubrolineata (a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Flabellina rubrolineata (b)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Flabellina rubropurpurata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Flabellina sp. 1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flabellina sp. 2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gargamella bovina	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gargamella gravastella	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Gargamella sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Geitodoris capensis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
*Geitodoris sp.**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glaucus atlanticus	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Glaucus marginatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Glossdoris cf. pallida/ sp. 2 (a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Glossodoris cincta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Glossodoris hikuerensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Glossodoris sp. 2 (b)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0
Glossodoris sp. 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Glossodoris sp. 7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Godiva quadricolor	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*Godiva rachelae**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Goniobranchus albonares**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

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Goniobranchus albopunctatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus alderi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Goniobranchus alius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Goniobranchus annulatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Goniobranchus cavae**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus cf. alderi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus cf. collingwoodi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus conchyliatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
*Goniobranchus fidelis**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Goniobranchus geminus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Goniobranchus geometricus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Goniobranchus heatherae (a)	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
*Goniobranchus heatherae (b)**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Goniobranchus heatherae (c)**	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Goniobranchus kitae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Goniobranchus lekker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus mandapamensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus pruna	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus sp. 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Goniobranchus sp. 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniobranchus tennentanus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Goniobranchus tumuliferus**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Goniobranchus verrieri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Goniodoridella savignyi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Goniodoridella sp. 8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Goniodoris castanea	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Goniodoris mercurialis	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goniodoris sp. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Gymnodoris alba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Gymnodoris aurita	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Gymnodoris bicolor**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Gymnodoris ceylonica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Gymnodoris cf. sp. 20**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
*Gymnodoris cf. sp. 47**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Gymnodoris okinawae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Gymnodoris rubropapulosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Gymnodoris sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Gymnodoris sp. 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gymnodoris sp. 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
*Gymnodoris sp. 5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Gymnodoris sp. 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Gymnodoris sp. 8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda cf. dichromis (a)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
Halgerda cf. dichromis (b)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Halgerda cf. tessellata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Halgerda dalanghita	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Halgerda dichromis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Halgerda formosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Halgerda sp. 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Halgerda sp. 7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Halgerda toliara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Halgerda wasinensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hallaxa albopunctata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Hexabranchus sanguineus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Hypselodoris capensis	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Hypselodoris carnea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Hypselodoris cf. bullocki	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Hypselodoris cf. kanga**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hypselodoris cf. regina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Hypselodoris fucata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Hypselodoris infucata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Hypselodoris maculosa**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Hypselodoris maridadilus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hypselodoris pulchella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Hypselodoris regina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Hypselodoris rudmani	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
*Hypselodoris sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Hypselodoris sp. 5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hypselodoris zephyra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Janolus capensis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Janolus longidentatus	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Janolus sp. 7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Jason sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Jorunna funebris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Jorunna parva	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Jorunna tomentosa	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Kalinga ornata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
*Kaloplocamus cf. ramosus**	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Lecithophorus capensis (a)	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
*Lecithophorus capensis (b)**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lecithophorus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Leminda millecra	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Limacia sp. 1 (cf. clavigera (a))	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Limacia sp. 2 (cf. clavigera (b))	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Madrella ferruginosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Mandelia mirocornata	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Marianina rosea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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Marionia cf. arborescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
*Marionia cf. sp. 13**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
*Marionia rubra**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Marionia sp. 1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Marionia sp. 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Marionia sp. 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Melibe liltvedi	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melibe rosea (a)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
*Melibe rosea (b)**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mexichromis cf. mariei/ macropus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Mexichromis lemniscata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Mexichromis multituberculata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Mexichromis pusilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Miamira magnifica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Moridilla brockii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Nembrotha aurea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Nembrotha cf. livingstonei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Nembrotha purpureolineata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Nembrotha sp. 1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
*Nembrotha sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Notobryon thompsoni	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
*Noumea decussata**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Noumea norba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Noumea protea	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Noumea simplex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Noumea sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
*Noumea sp. 10**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Noumea sp. 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
*Noumea sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Noumea sp. 5**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Noumea sudanica**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Noumea varians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Okenia amoenula	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
*Okenia cf. sp. 1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Okenia cf. sp. 4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Okenia sp. 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Okenia sp. 2**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Okenia virginiae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Paradoris cf. sp. 3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Paradoris sp.	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Paradoris sp.	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
*Paradoris sp. 8**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Peltodoris sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
*Peltodoris sp. 2**	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Phestilla melanobrachia	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Phestilla sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Phyllidia cf. zebrina**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Phyllidia coelestis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Phyllidia marindica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Phyllidia ocellata (a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
*Phyllidia ocellata (b) undula**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Phyllidia varicosa**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Phyllidiella meandrina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Phyllidiella striata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Phyllidiella zeylanica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Phyllidiopsis cardinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Phyllidiopsis gemmata/krempfi**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Phyllodesmium cf. macphersonae**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Phyllodesmium cf. magnum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Phyllodesmium cf. poindimiei**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Phyllodesmium cf. serratum**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Phyllodesmium horridum	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Phyllodesmium hyalinum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Piseinotecus sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Platydoris cruenta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Platydoris sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
*Plocamopherus cf. margaritae**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Plocamopherus maculatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Plocamopherus sp. 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Plocamopherus sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Polycera capensis / sp. 2 / luderitz	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Polycera hedgpethi	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
Polycera sp. 1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Polycera sp. 3	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
*Protaeolidiella cf. atra**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pruvotfolia pselliotes	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Pteraeolidia cf. semperi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Roboastra gracilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Roboastra luteolineata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Rostanga aureamala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rostanga bifurcata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Rostanga elandsia	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Rostanga phepha	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Rostanga sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Sclerodoris apiculata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Sclerodoris coriacea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sclerodoris tuberculata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Tambja affinis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Tambja capensis	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
*Tambja cf. kava**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Tambja morosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Tambja sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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Tambja zulu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Tergipes cf. tergipes	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tergipes sp.	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Tergipid sp. 1 (SWCWC01)**	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Tergipid sp. 2 (HERCUS01)**	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thecacera cf. pennigera	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Thecacera pacifica	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
*Thecacera picta**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thecacera sp. 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Thordisa luteola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thordisa oliva	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thordisa sp. 12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Thorunna australis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
*Thorunna cf. halourga**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thorunna horologia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
*Thorunna punicea**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Trapania cirrita	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Trapania melainia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Tritonia nilsodhneri	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tritonia sp. 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Tritonia sp. 2	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Tritoniopsis elegans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Vayssierea felis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0

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Appendix 3.2

R-script for calculating Jaccard similarity coefficients and cluster analysis

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Jaccard dissimilarity matrix & dendrogram:

Copy matrix data to new excel sheet and save as ” newdata.csv” in the “my documents” folder

In R-studio type:

```
>newdata<-read.csv("newdata.csv")

>dim(newdata)

>library(vegan)

>jaccardscores<-vegdist(newdata[,2:391],method=”jaccard”,binary=”TRUE”)

>jaccardmatrix<-as.matrix(jaccardscores)

>view(jaccardmatrix)

>write.csv(jaccardmatrix,”jaccard1.csv”)

>write.csv(newdata[,1],”labels.csv”)

>hc<-hclust(jaccardscores)

>plot(hc)

>labs<-newdata[,1]

>plot(hc,labels=labs)

>library(ape)

>my_tree<-as.phylo(hc)

>write.tree(phy=my_tree,file=”exported_tree.newick”)
```

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Appendix 3.3

Input data for Tableau (shared species Fig. 3.3)

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SPECIES	SOUTH AFRICAN ECOZONE	SPECIES	LOCALITY	REALM	PROVINCE	GLOBAL MARINE ECOREGION	LAT	LONG	MEOW #
Aegires lemoncello	DELAGOA	*Aegires lemoncello*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Torres Strait Northern Great Barrier Reef	-11,40831600	143,69917700	142
Aegires sp. 4	DELAGOA	*Aegires lemoncello*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Aegires villosus	DELAGOA	*Aegires lemoncello*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Aldisa sp. 2	DELAGOA	*Aegires lemoncello*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Ardeadoris electra	DELAGOA	*Aegires sp. 4*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Ardeadoris sp. 6	DELAGOA	*Aegires villosus*	Australia	Temperate Australasia	Southeast Australian Shelf	Western Bassian	-38,96684000	140,37534800	206
Ardeadoris symmetrica	DELAGOA	*Aegires villosus*	Indonesia	Central Indo-Pacific	western coral triangle	Sulawesi Sea/Makassar Strait	0,56278200	119,41858100	128
Ardeadoris undaurum	DELAGOA	*Aegires villosus*	Japan	Temperate Northern Pacific	Cold Temperate Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Atagema gibba	DELAGOA	*Aegires villosus*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
Atagema rugosa	DELAGOA	*Aegires villosus*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Bornella anguilla	DELAGOA	*Aegires villosus*	Papua New Guinae	Central Indo-Pacific	western coral triangle	Papua	-1,21291400	135,49595100	130
Bornella stellifer	DELAGOA	*Aegires villosus*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Eastern Philippines	11,21789000	126,31897000	127
Bornella valdae	DELAGOA	*Aegires villosus*	Samoa	Eastern Indo-Pacific	central Polynesia	Samoa islands	-14,26737300	-171,19368600	157
Bulbaeolidia cf. alba	DELAGOA	*Aegires villosus*	Sri Lanka	Western Indo-Pacific	west and south indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
Cadlinella ornatissima	DELAGOA	*Aegires villosus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Caloria sp. 4	DELAGOA	*Aegires villosus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
Caloria sp. 5	NATAL	*Aldisa sp. 2*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Catriona columbiana	NATAL / DELAGOA	*Ardeadoris electra*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
Catriona sp.	NATAL / DELAGOA	*Ardeadoris electra*	Japan	Temperate Northern Pacific	Warm Temperate Northwest Pacific	Central Kuroshio Current	33,11884000	134,71829000	51
Ceratophyllidia africana	NATAL / DELAGOA	*Ardeadoris electra*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Ceratosoma sp. 1	NATAL / DELAGOA	*Ardeadoris electra*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
Ceratosoma tenue	NATAL / DELAGOA	*Ardeadoris sp. 6*	Japan (Okinawa)	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Cerberilla africana	NATAL / DELAGOA	*Ardeadoris sp. 6*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Chromodoris africana	NATAL / DELAGOA	*Ardeadoris symmetrica*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Chromodoris boucheti	NATAL / DELAGOA	*Ardeadoris symmetrica*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Chromodoris hamiltoni	NATAL / DELAGOA	*Ardeadoris symmetrica*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Chromodoris strigata	NATAL / DELAGOA	*Ardeadoris symmetrica*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Cratena simba	AGULHAS / NATAL / DELAGOA	*Ardeadoris undaurum*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
Cratena sp. 3	AGULHAS / NATAL / DELAGOA	*Ardeadoris undaurum*	Western Australia	Temperate Australisa	Southwestern Australian Shelf	Leeuwin	-35,17972000	118,09191000	209
Crimora lutea	AGULHAS	*Atagema gibba*	England	Temperate Northern Atlantic	Northern European seas	Celtic Sea	54,84588000	-5,55321000	26
Cuthona anulata	AGULHAS	*Atagema gibba*	Mediterranean (SW France)	Temperate Northern Atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
Cuthona kanga	SOUTH WESTERN CAPE	*Atagema rugosa*	Mediterranean (SW France, SE Italy)	Temperate Northern Atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
Cuthona ornata	NATAL / DELAGOA	*Bornella anguilla*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
Cuthona sibogae	NATAL / DELAGOA	*Bornella anguilla*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
Dendrodoris carbunculosa	NATAL / DELAGOA	*Bornella anguilla*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Papua	-1,21291400	135,49595100	130
Dendrodoris fumata	NATAL / DELAGOA	*Bornella anguilla*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Dendrodoris guttata	NATAL / DELAGOA	*Bornella anguilla*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Dendrodoris krusensterni	NATAL / DELAGOA	*Bornella anguilla*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Dendrodoris nigra	NATAL / DELAGOA	*Bornella anguilla*	Mayanmar	Western Indo-Pacific	Andaman	Andaman and Nicobar Islands	11,00467000	92,67691000	109
Dermatobranchus gonatophorus	NATAL / DELAGOA	*Bornella anguilla*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Dermatobranchus ornatus	NATAL / DELAGOA	*Bornella anguilla*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Dermatobranchus pustulosus	NATAL / DELAGOA	*Bornella anguilla*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Dermatobranchus rodmani	NATAL / DELAGOA	*Bornella anguilla*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
Dermatobranchus rubidus	NATAL / DELAGOA	*Bornella anguilla*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
Diaphorodoris mitsuii	NATAL / DELAGOA	*Bornella anguilla*	Western Australia	Temperate australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
Discodoris cebuensis	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Arafura Sea	Central Indo-Pacific	Sahul Shelf	Arafura Sea	-6,53176000	134,91307000	139
Discodoris lilacina	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Australia	Temperate Australasia	East Central Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
Diversidoris aurantionodulosa	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	China Sea	Central Indo-Pacific	South China Sea	South China Sea Oceanic Islands	14,15607000	115,04238000	114
Doriprismatica atromarginata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	East Africa	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Doris ananas	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Indian Ocean	Western Indo-Pacific	Western Indian Ocean	Western India	20,30503000	69,80714000	103
Doto coronata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Facelina bourailli	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
Favorinus ghanensis	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Favorinus japonicus	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Fiona pinnata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Flabellina bicolor	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Flabellina delicata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	South China Sea (original description)	Central Indo-Pacific	South China Sea	South China Sea Oceanic Islands	14,15607000	115,04238000	114
Flabellina exoptata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Taiwan	Temperate Northern Pacific	warm temperatenorthwest Pacific		23,87517000	118,95447000	113
Flabellina rubrolineata	AGULHAS / NATAL / DELAGOA	*Bornella stellifer*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
Flabellina rubropurpurata	NATAL / DELAGOA	*Bornella valdae*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
Glossodoris cincta	NATAL / DELAGOA	*Bulbaeolidia cf. alba*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Glossodoris hikuerensis	DELAGOA	*Cadlinella ornatissima*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
Glossodoris pallida	DELAGOA	*Cadlinella ornatissima*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
Glossodoris sp. 3	DELAGOA	*Cadlinella ornatissima*	Hong Kong	Central Indo-Pacific	south China Sea	Southern China	23,87517000	118,95447000	113
Godiva quadricolor	DELAGOA	*Cadlinella ornatissima*	Indonesia	Central Indo-Pacific	Sunda Shelf	Malacca Strait	0,99375000	103,96282000	118

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Godiva rachelae	DELAGOA	*Cadlinella ornatissima*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Goniobranchus albonares	DELAGOA	*Cadlinella ornatissima*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Southeast Madagascar	-21,87005000	48,24468000	99
Goniobranchus albopunctatus	DELAGOA	*Cadlinella ornatissima*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
Goniobranchus alius	DELAGOA	*Cadlinella ornatissima*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Goniobranchus annulatus	DELAGOA	*Cadlinella ornatissima*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
Goniobranchus cf. alderi	DELAGOA	*Cadlinella ornatissima*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
Goniobranchus conchyliatus	DELAGOA	*Cadlinella ornatissima*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Goniobranchus fidelis	DELAGOA	*Cadlinella ornatissima*	Philiipines	Central Indo-Pacific	western coral triangle	Eastern Philippines	11,21789000	126,31897000	127
Goniobranchus geminus	DELAGOA	*Cadlinella ornatissima*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Goniobranchus geometricus	DELAGOA	*Cadlinella ornatissima*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
Goniobranchus kitae	DELAGOA	*Cadlinella ornatissima*	Tonga	Central Indo-Pacific	Tropical Soutwestern Pacific	Tonga Islands	-19,72154000	-174,70354000	146
Goniobranchus lekker	DELAGOA	*Caloria sp. 4*	Tanzania	Western Indo-Pacific	Western Indian ocean	East African Coral Coast	-8,39300000	40,87174000	95
Goniobranchus mandapanmensis	DELAGOA	*Caloria sp. 5*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Goniobranchus pruna	SOUTH WESTERN CAPE	*Catriona columbiana*	British Columbia	Temperate Northern Pacific	Cold Temperater Northeast Pacific	Northern California	37,75086000	-122,55593000	58
Goniobranchus sp. 14	SOUTH WESTERN CAPE	*Catriona columbiana*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Goniobranchus sp. 19	DELAGOA	*Catriona sp.*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
Goniobranchus tennentanus	DELAGOA	*Catriona sp.*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Goniobranchus verrieri	DELAGOA	*Ceratophyllidia africana*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Goniodoridella savignyi	DELAGOA	*Ceratophyllidia africana*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Goniodoris castanea	DELAGOA	*Ceratophyllidia africana*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
Goniodoris sp. 6	DELAGOA	*Ceratophyllidia africana*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
Gymnodoris alba	DELAGOA	*Ceratosoma sp. 1*	Aldabra	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
Gymnodoris aurita	DELAGOA	*Ceratosoma sp. 1*	Gaum	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
Gymnodoris okinawae	DELAGOA	*Ceratosoma sp. 1*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Gymnodoris rubropapulosa	DELAGOA	*Ceratosoma sp. 1*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Halgerda dalanghita	DELAGOA	*Ceratosoma sp. 1*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Halgerda dichromis	DELAGOA	*Ceratosoma sp. 1*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Halgerda formosa	DELAGOA	*Ceratosoma sp. 1*	Philippines	Central Indo-Pacifict	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Halgerda sp. 2	DELAGOA	*Ceratosoma sp. 1*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
Halgerda sp. 3	NATAL / DELAGOA	*Ceratosoma tenue*	Australia	Temperate Australasia	east central australian shelf	Tweed-Moreton	-27,38950000	153,30750000	202
Halgerda tessellata	NATAL / DELAGOA	*Ceratosoma tenue*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Halgerda wasinensis	NATAL / DELAGOA	*Ceratosoma tenue*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Hexabranchus sanguineus	NATAL / DELAGOA	*Ceratosoma tenue*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Hypselodoris carnea	NATAL / DELAGOA	*Ceratosoma tenue*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
Hypselodoris fucata	NATAL / DELAGOA	*Ceratosoma tenue*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
Hypselodoris infucata	NATAL / DELAGOA	*Ceratosoma tenue*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Hypselodoris maculosa	NATAL / DELAGOA	*Ceratosoma tenue*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Hypselodoris maridadilus	NATAL / DELAGOA	*Ceratosoma tenue*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Hypselodoris pulchella	NATAL / DELAGOA	*Cerberilla africana*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Hypselodoris regina	NATAL / DELAGOA	*Chromodoris africana*	Comores	Western Indo-Pacific	western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Hypselodoris rudmani	NATAL / DELAGOA	*Chromodoris africana*	Madagascar	Western Indo-Pacific	western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Hypselodoris zephyra	NATAL / DELAGOA	*Chromodoris africana*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
Jason sp. 1	NATAL / DELAGOA	*Chromodoris africana*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
Jorunna funebris	NATAL / DELAGOA	*Chromodoris africana*	Tanzania	Western Indo-Pacific	western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Jorunna parva	NATAL / DELAGOA	*Chromodoris boucheti*	Comoro Islands	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Jorunna tomentosa	NATAL / DELAGOA	*Chromodoris boucheti*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Limacia sp. 1	NATAL / DELAGOA	*Chromodoris boucheti*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
Madrella ferruginosa	NATAL / DELAGOA	*Chromodoris hamiltoni*	Kenya	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Marianina rosea	NATAL / DELAGOA	*Chromodoris hamiltoni*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Marionia rubra	NATAL / DELAGOA	*Chromodoris hamiltoni*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
Mexichromis cf. mariei/ macropu	NATAL / DELAGOA	*Chromodoris hamiltoni*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Mexichromis lemniscata	NATAL / DELAGOA	*Chromodoris strigata*	Australia	Central Indo-Pacific	northeast Australian shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
Mexichromis pusilla	NATAL / DELAGOA	*Chromodoris strigata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Miamira magnifica	NATAL / DELAGOA	*Chromodoris strigata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Moridilla brockii	NATAL / DELAGOA	*Chromodoris strigata*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Nembrotha aurea	NATAL / DELAGOA	*Chromodoris strigata*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
Nembrotha purpureolineata	NATAL / DELAGOA	*Chromodoris strigata*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
Nembrotha sp. 1	NATAL / DELAGOA	*Chromodoris strigata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Noumea norba	NATAL / DELAGOA	*Chromodoris strigata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Eastern Philippines	11,21789000	126,31897000	127
Noumea simplex	NATAL / DELAGOA	*Chromodoris strigata*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
Noumea sp. 1	DELAGOA	*Cratena simba*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Noumea varians	DELAGOA	*Cratena simba*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
Okenia virginiae	DELAGOA	*Cratena simba*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Phestilla melanobrachia	DELAGOA	*Cratena simba*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Phyllidia coelestis	DELAGOA	*Cratena simba*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Phyllidia marindica	DELAGOA	*Cratena sp. 3*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96

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Phyllidia ocellata	DELAGOA	*Cratena sp. 3*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
Phyllidia varicosa	DELAGOA	*Cratena sp. 3*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Phyllidiella meandrina	DELAGOA	*Cratena sp. 3*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Phyllidiella striata	DELAGOA	*Cratena sp. 3*	Midway Atoll	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Phyllidiella zeylanica	DELAGOA	*Cratena sp. 3*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Phyllidiopsis cardinalis	NATAL / DELAGOA	*Crimora lutea*	Australia	Temperate Australasia	Southeast Australian shelf	Cape Howe	-37,57044000	149,98630000	204
Phyllidiopsis gemmata/krempfi	NATAL / DELAGOA	*Crimora lutea*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Phyllodesmium cf. macphersonae	NATAL / DELAGOA	*Crimora lutea*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
Phyllodesmium cf. magnum	NATAL / DELAGOA	*Crimora lutea*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
*Phyllodesmium cf. poindimiei**	DELAGOA	*Cuthona anulata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
*Phyllodesmium cf. serratum**	DELAGOA	*Cuthona kanga*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Phyllodesmium hyalinum	NATAL	*Cuthona ornata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Platydoris cruenta	NATAL	*Cuthona ornata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
Plocamopherus maculatus	NATAL / DELAGOA	*Cuthona sibogae*	Australia	Central Indo-Pacific	sahul shelf	Bonaparte Coast	-12,59012000	130,35794000	141
Polycera capensis	NATAL / DELAGOA	*Cuthona sibogae*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
Polycera hedgpethi	NATAL / DELAGOA	*Cuthona sibogae*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Pruvotfolia pselliotes	NATAL / DELAGOA	*Cuthona sibogae*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Roboastra gracilis	NATAL / DELAGOA	*Cuthona sibogae*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
Roboastra luteolineata	NATAL / DELAGOA	*Cuthona sibogae*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
Rostanga bifurcata	NATAL / DELAGOA	*Cuthona sibogae*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Sclerodoris apiculata	NATAL / DELAGOA	*Cuthona sibogae*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Sclerodoris coriacea	NATAL / DELAGOA	*Cuthona sibogae*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
Sclerodoris tuberculata	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
Tambja affinis	NATAL / DELAGOA	*Dendrodoris carbunculosa*	eastern Pacific of Costa Rica	tropical Eastern Pacific	Tropical East Pacific	Nicoya	8,46509000	-83,93975000	168
Tambja morosa	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Futuna Island	Eastern Indo-Pacific	Central Polynesia	Samoa islands	-14,26737300	-171,19368600	157
Thecacera pacifica	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
Thecacera picta	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Hawai'i	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
Thordisa oliva	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
Thorunna australis	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
Thorunna horologia	NATAL / DELAGOA	*Dendrodoris carbunculosa*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
Thorunna punicea	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
Tritonia nilsodhneri	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
Tritoniopsis elegans	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
Vayssierea felis	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
	NATAL / DELAGOA	*Dendrodoris carbunculosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
	NATAL / DELAGOA	*Dendrodoris carbunculosa*	the Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
	NATAL / DELAGOA	*Dendrodoris carbunculosa*	the Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
	NATAL / DELAGOA	*Dendrodoris fumata*	Australia	Temperate Australiasia	Southeast Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
	NATAL / DELAGOA	*Dendrodoris fumata*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-11,76640000	96,84359000	120
	NATAL / DELAGOA	*Dendrodoris fumata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
	NATAL / DELAGOA	*Dendrodoris fumata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
	NATAL / DELAGOA	*Dendrodoris fumata*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
	NATAL / DELAGOA	*Dendrodoris fumata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
	NATAL / DELAGOA	*Dendrodoris fumata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
	NATAL / DELAGOA	*Dendrodoris fumata*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
	NATAL / DELAGOA	*Dendrodoris fumata*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
	NATAL / DELAGOA	*Dendrodoris fumata*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
	NATAL / DELAGOA	*Dendrodoris fumata*	Singapore	Central Indo-Pacific	Sunda Shelf	Malacca strait	1,38066000	102,95973000	118
	NATAL / DELAGOA	*Dendrodoris fumata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
	DELAGOA	*Dendrodoris guttata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Australia	Temperate Australiasia	Southeast Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Midway	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Singapore	Western Indo-Pacific	Sundra Shelf	Malacca strait	1,38066000	102,95973000	118
	AGULHAS / NATAL / DELAGOA	*Dendrodoris krusensterni*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
	AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Australia	Temperate Australasia	Southeast austrlian Shelf	Cape Howe	-37,57044000	149,98630000	204
	AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120

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AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Comores	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Palau	Central Indo-Pacific	Tropical Northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Palmyra Atoll	eastern Indo-Pacific	central polynesia	Line Islands	2,85448000	-158,41675000	155
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Samoa	Eastern Indo-Pacific	central polynesia	Samoa islands	-14,26737300	-171,19368600	157
AGULHAS / NATAL / DELAGOA	*Dendrodoris nigra*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Dermatobranchus gonatophorus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
NATAL	*Dermatobranchus gonatophorus*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL	*Dermatobranchus gonatophorus*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL	*Dermatobranchus gonatophorus*	southern Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL	*Dermatobranchus gonatophorus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Dermatobranchus ornatus*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
DELAGOA	*Dermatobranchus ornatus*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Dermatobranchus ornatus*	southern Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Dermatobranchus ornatus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Dermatobranchus pustulosus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Northeast Sulawesi	-0,28334000	121,86137000	133
DELAGOA	*Dermatobranchus pustulosus*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Dermatobranchus pustulosus*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Dermatobranchus pustulosus*	southern Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Dermatobranchus rodmani*	Easterns Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	3,26199000	112,83504000	117
NATAL / DELAGOA	*Dermatobranchus rodmani*	Madagascar (NW)	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Dermatobranchus rodmani*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL	*Dermatobranchus rubidus*	Australia	Central Indo-Pacific	sahul shelf	Bonaparte Coast	-12,59012000	130,35794000	141
NATAL	*Dermatobranchus rubidus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL	*Dermatobranchus rubidus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Northeast Sulawesi	-0,28334000	121,86137000	133
NATAL	*Dermatobranchus rubidus*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL	*Dermatobranchus rubidus*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
NATAL	*Dermatobranchus rubidus*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Diaphorodoris mitsuii*	Australia	Temperate Australasia	southeast Australian Shelf	bassian	-40,09700000	145,76179000	205
DELAGOA	*Diaphorodoris mitsuii*	China	Central Indo-Pacific	South china Sea	Southern China	23,87517000	118,95447000	113
DELAGOA	*Diaphorodoris mitsuii*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
DELAGOA	*Diaphorodoris mitsuii*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Halmahera	1,00711000	127,81780000	129
DELAGOA	*Diaphorodoris mitsuii*	Japan = original discription	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Diaphorodoris mitsuii*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
DELAGOA	*Diaphorodoris mitsuii*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Diaphorodoris mitsuii*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Discodoris cebuensis*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Discodoris cebuensis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Discodoris cebuensis*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Discodoris cebuensis*	Papau New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Discodoris cebuensis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Discodoris cebuensis*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Discodoris lilacina*	Canary Islands (recent)	Temperate Northern Atlantic	lusitanian	Azores: Canaries Madeira	38,38929000	-27,73530000	29
NATAL	*Discodoris lilacina*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL	*Discodoris lilacina*	India	Western Indo-Pacific	West and South Indian shelf	South india and Sri lanka	7,10536200	77,87848100	104
NATAL	*Discodoris lilacina*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL	*Discodoris lilacina*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL	*Discodoris lilacina*	Samoa	Central Indo-Pacific	tropical southwestern pacific	Tonga Islands	-19,72154000	-174,70354000	146
NATAL	*Discodoris lilacina*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Diversidoris aurantionodulosa*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Diversidoris aurantionodulosa*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
NATAL / DELAGOA	*Diversidoris aurantionodulosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Doriprismatica atromarginata*	Australia	Central Indo-Pacific	Sahul shelf	Arnhem Coast to Gulf of Carpenteria	-11,11314000	133,05572000	140
DELAGOA	*Doriprismatica atromarginata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Doriprismatica atromarginata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Doriprismatica atromarginata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153

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DELAGOA	*Doriprismatica atromarginata*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Doriprismatica atromarginata*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
DELAGOA	*Doriprismatica atromarginata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Doriprismatica atromarginata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Doriprismatica atromarginata*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Doriprismatica atromarginata*	Society Islands	Eastern Indo-Pacific	Southeast Polynesia	Society Islands	-17,15423000	-150,53824000	161
NATAL	*Doris ananas*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL	*Doris ananas*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
AGULHAS	*Doto coronata*	Goes, The Netherlands	Temperate Northern Atlantic	Northern European seas	North Sea	53,54185000	5,36804000	25
AGULHAS	*Doto coronata*	Kattegat, North Atlantic, Sweden	Temperate Northern Atlantic	Northern European seas	Southern Norway	62,07171000	5,10049000	22
AGULHAS	*Doto coronata*	Spain, NE Atlantic	Temeperate Northern Atlantic	Lusitanian	South European Atlantic Shelf	43,68415000	-1,72157000	27
AGULHAS	*Doto coronata*	USA Maine, Washington County	Temperate Northern Atlantic	Cold Temperate Northwest Atlantic	Gulf of Maine/Bay of Fundy	44,14391000	-68,52664000	40
AGULHAS	*Doto coronata*	Wales Uk	Temperate Northern Atlantic	Northern European seas	Celtic Sea	54,84588000	-5,55321000	26
NATAL / DELAGOA	*Facelina bourailli*	Australia	Central Indo-Pacific	Sahul shelf	Arnhem Coast to Gulf of Carpenteria	-11,11314000	133,05572000	140
NATAL / DELAGOA	*Facelina bourailli*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Facelina bourailli*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Facelina bourailli*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Facelina bourailli*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Facelina bourailli*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
AGULHAS	*Favorinus ghanensis*	Ghana (Tema)	Tropical Atlantic	Gulf of Guine	Gulf of Guinea Central	5,76794000	0,88085000	83
DELAGOA	*Favorinus japonicus*	Aldabra	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Favorinus japonicus*	Australia	Temperate Australasia	East central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Favorinus japonicus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Favorinus japonicus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Favorinus japonicus*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Favorinus japonicus*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
DELAGOA	*Favorinus japonicus*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Favorinus japonicus*	Midway Atoll	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Favorinus japonicus*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Favorinus japonicus*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Favorinus japonicus*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Favorinus japonicus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
AGULHAS	*Fiona pinnata*	Australia	Temperate Australasia	Southeast Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
AGULHAS	*Fiona pinnata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
AGULHAS	*Fiona pinnata*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
AGULHAS	*Fiona pinnata*	Lord Howe Island	Central Indo-Pacific	lord howe and horfolk islands	Lord Howe and Norfolk Islands	-29,03992000	168,01180000	151
AGULHAS	*Fiona pinnata*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
NATAL / DELAGOA	*Flabellina bicolor*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Flabellina bicolor*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Flabellina bicolor*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
NATAL / DELAGOA	*Flabellina bicolor*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Flabellina bicolor*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Flabellina bicolor*	Korea	Temperate Northern Pacific	warm Temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
NATAL / DELAGOA	*Flabellina bicolor*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Flabellina bicolor*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Flabellina bicolor*	Midway	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Flabellina bicolor*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Flabellina bicolor*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Flabellina bicolor*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Flabellina bicolor*	Sri-Lanka	Western Indo-Pacific	west and south indian shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL / DELAGOA	*Flabellina bicolor*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Flabellina bicolor*	western Pacific of Australia	Temperate Australasia	East Central Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
NATAL / DELAGOA	*Flabellina delicata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Flabellina delicata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Flabellina delicata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Flabellina exoptata*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Flabellina exoptata*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Flabellina exoptata*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
DELAGOA	*Flabellina exoptata*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
DELAGOA	*Flabellina exoptata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Flabellina exoptata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Flabellina exoptata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Flabellina exoptata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Flabellina exoptata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Flabellina exoptata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Flabellina exoptata*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98

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DELAGOA	*Flabellina rubrolineata*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Flabellina rubrolineata*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Flabellina rubrolineata*	China	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
DELAGOA	*Flabellina rubrolineata*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Flabellina rubrolineata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Flabellina rubrolineata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Flabellina rubrolineata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Flabellina rubrolineata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Flabellina rubrolineata*	Med (introduced)	Temperate Northern Atlantic	Mediterranean Sea	Aegean Sea	37,44380000	25,67982000	31
DELAGOA	*Flabellina rubrolineata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Flabellina rubrolineata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Flabellina rubrolineata*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Flabellina rubropurpurata*	Kerama Islands	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
DELAGOA	*Flabellina rubropurpurata*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Flabellina rubropurpurata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Flabellina rubropurpurata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Flabellina rubropurpurata*	southern Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Glossodoris cincta*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Glossodoris cincta*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Glossodoris cincta*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
DELAGOA	*Glossodoris cincta*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Glossodoris cincta*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Glossodoris cincta*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Glossodoris cincta*	New Guinea	Central Indo-Pacific	Eastern coral Triangle	Solomon Sea	-9,12627000	151,63627000	136
DELAGOA	*Glossodoris cincta*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Glossodoris cincta*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Glossodoris cincta*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Glossodoris cincta*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Glossodoris hikuerensis*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central and Southern Great Barrier Reef	-20,22413000	148,89282000	143
DELAGOA	*Glossodoris hikuerensis*	Enewetak	Central Indo-Pacific	Tropical Northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Glossodoris hikuerensis*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Glossodoris hikuerensis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Glossodoris hikuerensis*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Glossodoris hikuerensis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Glossodoris hikuerensis*	Society Islands	Eastern Indo-Pacific	Southeast Polynesia	Society Islands	-17,15423000	-150,53824000	161
DELAGOA	*Glossodoris hikuerensis*	Tuamotu Islands	Eastern Indo-Pacific	Southeast Polynesia	Tuamotus	-18,86567000	-142,30202000	158
NATAL / DELAGOA	*Glossodoris pallida*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Glossodoris pallida*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
NATAL / DELAGOA	*Glossodoris pallida*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Glossodoris pallida*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Glossodoris pallida*	New Guinea	Central Indo-Pacific	sahul shelf	Gulf of Papua	-7,92888000	144,45484000	138
NATAL / DELAGOA	*Glossodoris pallida*	Philipines	Central Indo-Pacific	Western Coral Triangle	Eastern Philippines	11,21789000	126,31897000	127
NATAL / DELAGOA	*Glossodoris pallida*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Glossodoris sp. 3*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Glossodoris sp. 3*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
SOUTH WESTERN CAPE / AGULHAS / NA	*Godiva quadricolor*	Ghana	Tropical Atlantic	Gulf of Guine	Gulf of Guinea Central	5,76794000	0,88085000	83
SOUTH WESTERN CAPE / AGULHAS / NA	*Godiva quadricolor*	Mediterranean	Temperate Northern Atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
SOUTH WESTERN CAPE / AGULHAS / NA	*Godiva quadricolor*	Morocco (NW)	Temperate Northern Atlantic	Lusitanian	Saharan Upwelling	32,59864	-9,35884	
NATAL	*Godiva rachelae*	Eastern Australia	Temperate Australiasia	East Central Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL	*Godiva rachelae*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus albonares*	Australia	Central Indo-Pacific	northeast Australian Shelf	Torres strait Northern great barrier reef	-11,40831600	143,69917700	142
NATAL / DELAGOA	*Goniobranchus albonares*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Goniobranchus albonares*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Goniobranchus albonares*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Australia	Temperate Australasia	Southwest Australian Shelf	Leeuwin	-35,17972000	118,09191000	209
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Goniobranchus albopunctatus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Goniobranchus alius*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL	*Goniobranchus alius*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL	*Goniobranchus alius*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL	*Goniobranchus alius*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95

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NATAL / DELAGOA	*Goniobranchus annulatus*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus annulatus*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
NATAL / DELAGOA	*Goniobranchus annulatus*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
NATAL / DELAGOA	*Goniobranchus annulatus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus annulatus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL	*Goniobranchus cf. alderi*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL	*Goniobranchus cf. alderi*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL	*Goniobranchus cf. alderi*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus conchyliatus*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Goniobranchus conchyliatus*	Sri Lanka	Western Indo-Pacific	west and south Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL / DELAGOA	*Goniobranchus conchyliatus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus conchyliatus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Goniobranchus fidelis*	Australia	Central Indo-Pacific	northeast Australian Shelf	Torres strait Northern great barrier reef	-11,40831600	143,69917700	142
NATAL / DELAGOA	*Goniobranchus fidelis*	Enewetak	Central Indo-Pacific	Tropical Northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
NATAL / DELAGOA	*Goniobranchus fidelis*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Goniobranchus fidelis*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Goniobranchus fidelis*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus fidelis*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Goniobranchus fidelis*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Goniobranchus fidelis*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
NATAL / DELAGOA	*Goniobranchus fidelis*	Palmyra Atoll	eastern Indo-Pacific	central polynesia	Line Islands	2,85448000	-158,41675000	155
NATAL / DELAGOA	*Goniobranchus fidelis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus fidelis*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Goniobranchus geminus*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
NATAL / DELAGOA	*Goniobranchus geminus*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus geminus*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Goniobranchus geminus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus geminus*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Goniobranchus geometricus*	Australia	Central Indo-Pacific	northeast Australian Shelf	Torres strait Northern great barrier reef	-11,40831600	143,69917700	142
NATAL / DELAGOA	*Goniobranchus geometricus*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
NATAL / DELAGOA	*Goniobranchus geometricus*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Goniobranchus geometricus*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus geometricus*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus geometricus*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Goniobranchus geometricus*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Goniobranchus geometricus*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Goniobranchus geometricus*	New Guinea	Central Indo-Pacific	Western Coral Triangle	Papua	-1,21291400	135,49595100	130
NATAL / DELAGOA	*Goniobranchus geometricus*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
NATAL / DELAGOA	*Goniobranchus geometricus*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
NATAL / DELAGOA	*Goniobranchus geometricus*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus geometricus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Goniobranchus kitae*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus lekker*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus lekker*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Goniobranchus lekker*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	India	Western Indo-Pacific	West and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Bismarck Sea	-2,34420000	147,01526000	134
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
NATAL / DELAGOA	*Goniobranchus mandapanmensis*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Goniobranchus pruna*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Goniobranchus sp. 14*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Goniobranchus sp. 19*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Goniobranchus tennentanus*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Goniobranchus tennentanus*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
DELAGOA	*Goniobranchus tennentanus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Goniobranchus verrieri*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Goniobranchus verrieri*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Goniobranchus verrieri*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Goniobranchus verrieri*	Midway Atoll	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Goniobranchus verrieri*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
NATAL / DELAGOA	*Goniobranchus verrieri*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Solomon Sea	-9,12627000	151,63627000	136
NATAL / DELAGOA	*Goniobranchus verrieri*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Goniodoridella savignyi*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Goniodoridella savignyi*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49

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DELAGOA	*Goniodoridella savignyi*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Goniodoridella savignyi*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Goniodoridella savignyi*	Russia	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
SOUTH WESTERN CAPE / AGULHAS	*Goniodoris castanea*	Europe	Temperate Northern atlantic	Northern European Seas	North Sea	53,54185000	5,36804000	25
SOUTH WESTERN CAPE / AGULHAS	*Goniodoris castanea*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
SOUTH WESTERN CAPE / AGULHAS	*Goniodoris castanea*	Mediterranean	Temperate Northern atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
SOUTH WESTERN CAPE / AGULHAS	*Goniodoris castanea*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
DELAGOA	*Goniodoris sp. 6*	Australia	Temperate Australiasia	Southeast Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
DELAGOA	*Goniodoris sp. 6*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Goniodoris sp. 6*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Goniodoris sp. 6*	Malaysia	Central Indo-Pacific	Western Coral Triangle	Palawan/North Borneo	6,12718000	118,51347000	126
DELAGOA	*Goniodoris sp. 6*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Goniodoris sp. 6*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL	*Gymnodoris alba*	Australia	Central Indo-Pacific	Sahul Shelf	Arnhem Coast to Gulf of Carpenteria	-11,11314000	133,05572000	140
NATAL	*Gymnodoris alba*	Cargados Carajos	Western Indo-Pacific	Western Indian Ocean	Cargados Carajos/tromelin island	-10,34655000	56,54597000	97
NATAL	*Gymnodoris alba*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL	*Gymnodoris alba*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL	*Gymnodoris alba*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL	*Gymnodoris alba*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL	*Gymnodoris alba*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Palawan/North Borneo	6,12718000	118,51347000	126
DELAGOA	*Gymnodoris aurita*	Australia	Central Indo-Pacific	northeast Australian Shelf	Torres strait Northern great barrier reef	-11,40831600	143,69917700	142
DELAGOA	*Gymnodoris aurita*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Gymnodoris aurita*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Gymnodoris aurita*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Gymnodoris aurita*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Gymnodoris aurita*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Gymnodoris aurita*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Gymnodoris okinawae*	Aldabra	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Gymnodoris okinawae*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Gymnodoris okinawae*	Midway Atoll	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Gymnodoris okinawae*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Gymnodoris okinawae*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Gymnodoris okinawae*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Gymnodoris okinawae*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Gymnodoris rubropapulosa*	Australia	Central Indo-Pacific	Northwest Australian Shelf	Exmouth to Broome	-19,46345000	120,56413000	144
DELAGOA	*Gymnodoris rubropapulosa*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Gymnodoris rubropapulosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Gymnodoris rubropapulosa*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Gymnodoris rubropapulosa*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
DELAGOA	*Gymnodoris rubropapulosa*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Gymnodoris rubropapulosa*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Gymnodoris rubropapulosa*	Singapore	Central Indo-Pacific	Sunda Shelf	Malacca strait	1,38066000	102,95973000	118
DELAGOA	*Gymnodoris rubropapulosa*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Gymnodoris rubropapulosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Halgerda dalanghita*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Halgerda dalanghita*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Halgerda dalanghita*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Halgerda dalanghita*	Western Pacific of Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
NATAL	*Halgerda dichromis*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL	*Halgerda dichromis*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Halgerda formosa*	Australia	Central Indo-Pacific	Northwest Australian Shelf	Exmouth to Broome	-19,46345000	120,56413000	144
DELAGOA	*Halgerda formosa*	Comoro Islands	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Halgerda formosa*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Halgerda formosa*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Halgerda formosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Halgerda formosa*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Halgerda sp. 2*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Halgerda sp. 3*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Halgerda tessellata*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Halgerda tessellata*	Andaman Sea	Western Indo-Pacific	andaman	Andaman sea Coral Coast	11,18125000	98,11037000	110
NATAL / DELAGOA	*Halgerda tessellata*	Australia	Central Indo-Pacific	Northwest Australian Shelf	Exmouth To Broome	-19,46345000	120,56413000	144
NATAL / DELAGOA	*Halgerda tessellata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Halgerda tessellata*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Halgerda tessellata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Halgerda tessellata*	New Guinea	Central Indo-Pacific	Western Coral triangle	Papua	-1,21291400	135,49595100	130
NATAL / DELAGOA	*Halgerda tessellata*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125

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NATAL / DELAGOA	*Halgerda tessellata*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Halgerda tessellata*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Halgerda tessellata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Halgerda wasinensis*	Christmas Islands	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
DELAGOA	*Halgerda wasinensis*	Kenya	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Halgerda wasinensis*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Halgerda wasinensis*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Halgerda wasinensis*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Hexabranchus sanguineus*	Bali	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Hexabranchus sanguineus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Hexabranchus sanguineus*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
NATAL / DELAGOA	*Hexabranchus sanguineus*	Red Sea, Egypt	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Hexabranchus sanguineus*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Hexabranchus sanguineus*	Vietnam	Central Indo-Pacific	Sunda Shelf	Southern Vietnam	9,41062000	106,39088000	116
NATAL / DELAGOA	*Hexabranchus sanguineus*	Western Australia	Central Indo-Pacific	Northwest Australian Shelf	Exmouth to Broome	-19,46345000	120,56413000	144
NATAL / DELAGOA	*Hypselodoris carnea*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Hypselodoris carnea*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
NATAL / DELAGOA	*Hypselodoris carnea*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Hypselodoris carnea*	Yemen	Western Indo-Pacific	Somali/Arabian	Western Arabian Sea	15,43294000	51,93956000	92
NATAL / DELAGOA	*Hypselodoris fucata*	Kenya	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Hypselodoris fucata*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Hypselodoris infucata*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Hypselodoris infucata*	Australia	Central Indo-Pacific	Sahul Shelf	Bonaparte Coast	-12,59012000	130,35794000	141
NATAL / DELAGOA	*Hypselodoris infucata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Hypselodoris infucata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Hypselodoris infucata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Hypselodoris infucata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Hypselodoris infucata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Hypselodoris infucata*	Mediterranean	Temperate Northern Atlantic	Mediterranean Sea	Levantine Sea	35,66070000	31,78821000	32
NATAL / DELAGOA	*Hypselodoris infucata*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Hypselodoris infucata*	Papua New Giunea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Hypselodoris infucata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	10,62623000	121,89346000	128
NATAL / DELAGOA	*Hypselodoris infucata*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Hypselodoris infucata*	Vietnam	Central Indo-Pacific	Sunda Shelf	Southern Vietnam	9,41062000	106,39088000	116
DELAGOA	*Hypselodoris maculosa*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
DELAGOA	*Hypselodoris maculosa*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
DELAGOA	*Hypselodoris maculosa*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Hypselodoris maculosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Hypselodoris maculosa*	Kiribati	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Gilbert/ellis island	-4,02214000	176,44462000	154
DELAGOA	*Hypselodoris maculosa*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Hypselodoris maculosa*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Hypselodoris maculosa*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Hypselodoris maculosa*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Hypselodoris maculosa*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Hypselodoris maculosa*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Hypselodoris maculosa*	Philippines	Central Indo-Pacific	Western Coral Triangle	Eastern Philippines	11,21789000	126,31897000	127
DELAGOA	*Hypselodoris maculosa*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Hypselodoris maculosa*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Hypselodoris maculosa*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Hypselodoris maculosa*	Society Islands	Eastern Indo-Pacific	Southeast Polynesia	Society Islands	-17,15423000	-150,53824000	161
DELAGOA	*Hypselodoris maculosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Hypselodoris maculosa*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Hypselodoris maculosa*	Tonga	Central Indo-Pacific	Tropical Soutwestern Pacific	Tonga Islands	-19,72154000	-174,70354000	146
DELAGOA	*Hypselodoris maculosa*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
NATAL / DELAGOA	*Hypselodoris maridadilus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Hypselodoris maridadilus*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Hypselodoris maridadilus*	Midway Atoll	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Hypselodoris maridadilus*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Hypselodoris maridadilus*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Hypselodoris maridadilus*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Hypselodoris pulchella*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Hypselodoris pulchella*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Hypselodoris pulchella*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Hypselodoris pulchella*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
NATAL / DELAGOA	*Hypselodoris pulchella*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
NATAL / DELAGOA	*Hypselodoris pulchella*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87

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NATAL / DELAGOA	*Hypselodoris pulchella*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Hypselodoris pulchella*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Hypselodoris pulchella*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Hypselodoris regina*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Hypselodoris regina*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Hypselodoris regina*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
AGULHAS / NATAL / DELAGOA	*Hypselodoris rudmani*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Hypselodoris rudmani*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
DELAGOA	*Hypselodoris zephyra*	Australia	Temperate Australasia	East Central Australian shelf	Manning-Hawkesbury	-32,44941000	152,69624000	203
DELAGOA	*Hypselodoris zephyra*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Hypselodoris zephyra*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Hypselodoris zephyra*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Hypselodoris zephyra*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Hypselodoris zephyra*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Hypselodoris zephyra*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Hypselodoris zephyra*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Hypselodoris zephyra*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
DELAGOA	*Hypselodoris zephyra*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
DELAGOA	*Jason sp. 1*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Jorunna funebris*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Jorunna funebris*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
NATAL / DELAGOA	*Jorunna funebris*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Jorunna funebris*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Jorunna funebris*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Jorunna funebris*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Jorunna funebris*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
NATAL / DELAGOA	*Jorunna funebris*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
NATAL / DELAGOA	*Jorunna funebris*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Jorunna funebris*	Persian Gulf	Western Indo-Pacific	Somali/Arabian	Arabian (Persian) Gulf	26,45578000	56,01802000	90
NATAL / DELAGOA	*Jorunna funebris*	Philippines	Central Indo-Pacific	Western Coral Triangle	Palawan/North Borneo	6,12718000	118,51347000	126
NATAL / DELAGOA	*Jorunna funebris*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Jorunna funebris*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Jorunna funebris*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
DELAGOA	*Jorunna parva*	Aldabra Atoll	Temperate Northern Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Jorunna parva*	Australia	Temperate Australasia	Southeast Australian Shelf	Cape Howe	-37,57044000	149,98630000	204
DELAGOA	*Jorunna parva*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
DELAGOA	*Jorunna parva*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Jorunna parva*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Jorunna parva*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Jorunna parva*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Jorunna parva*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
AGULHAS	*Jorunna tomentosa*	Ireland	Temperate Northern Atlantic	Northern European seas	Celtic Sea	54,84588000	-5,55321000	26
AGULHAS	*Jorunna tomentosa*	Netherlands	Temperate Northern Atlantic	Northern European seas	North Sea	53,54185000	5,36804000	25
AGULHAS	*Jorunna tomentosa*	North Sea	Temperate Northern Atlantic	Northern European seas	North Sea	53,54185000	5,36804000	25
NAMAQUA / SOUTH WESTERN CAPE / A	*Limacia sp. 1*	Norway	Temperate Northern Atlantic	Northern European seas	Southern Norway	62,07171000	5,10049000	22
NAMAQUA / SOUTH WESTERN CAPE / A	*Limacia sp. 1*	Portugal	Temeperate Northern Atlantic	Lusitanian	South European Atlantic Shelf	43,68415000	-1,72157000	27
NAMAQUA / SOUTH WESTERN CAPE / A	*Limacia sp. 1*	Spain	Temeperate Northern Atlantic	Lusitanian	South European Atlantic Shelf	43,68415000	-1,72157000	27
NAMAQUA / SOUTH WESTERN CAPE / A	*Limacia sp. 1*	UK	Temperate Northern Atlantic	Northern European seas	Celtic Sea	54,84588000	-5,55321000	26
AGULHAS / NATAL / DELAGOA	*Madrella ferruginosa*	India	Western Indo-Pacific	west and South indian Shelf	Western India	20,30503000	69,80714000	103
AGULHAS / NATAL / DELAGOA	*Madrella ferruginosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
AGULHAS / NATAL / DELAGOA	*Madrella ferruginosa*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Madrella ferruginosa*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Marianina rosea*	Australia	Central Indo-Pacific	northeast Australian Shelf	Torres Strait Northern Great Barrier Reef	-11,40831600	143,69917700	142
NATAL / DELAGOA	*Marianina rosea*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Marianina rosea*	Marianas Islands	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Marianina rosea*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Marianina rosea*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Marianina rosea*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Marionia rubra*	Phillipines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Marionia rubra*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Marionia rubra*	Southern Japan	Temperate Northern Pacific	Warm temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
DELAGOA	*Marionia rubra*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Marionia rubra*	Western Australia	Central Indo-Pacific	Sahul Shelf	Arnhem Coast to Gulf of Carpenteria	-11,11314000	133,05572000	140
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Australia	Central Indo-Pacific	Sahul Shelf	Arnhem Coast to Gulf of Carpenteria	-11,11314000	133,05572000	140
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49

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NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Mexichromis cf. mariei/ macropu*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Mexichromis lemniscata*	Australia	Central Indo-Pacific	sahul shelf	Bonaparte Coast	-12,59012000	130,35794000	141
NATAL / DELAGOA	*Mexichromis lemniscata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Mexichromis lemniscata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Mexichromis lemniscata*	Palmyra Atoll	eastern Indo-Pacific	central polynesia	Line Islands	2,85448000	-158,41675000	155
NATAL / DELAGOA	*Mexichromis lemniscata*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Mexichromis lemniscata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Mexichromis lemniscata*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Mexichromis pusilla*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Mexichromis pusilla*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Mexichromis pusilla*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Mexichromis pusilla*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Mexichromis pusilla*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Mexichromis pusilla*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Mexichromis pusilla*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Mexichromis pusilla*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Mexichromis pusilla*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
NATAL / DELAGOA	*Miamira magnifica*	Australia	Central Indo-Pacific	Sahul Shelf	Arnhem coast to gulf of carpenteria	-11,11314000	133,05572000	140
NATAL / DELAGOA	*Miamira magnifica*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Miamira magnifica*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Miamira magnifica*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Miamira magnifica*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Moridilla brockii*	Australia	Central Indo-Pacific	Sahul Shelf	Arnhem coast to gulf of carpenteria	-11,11314000	133,05572000	140
NATAL / DELAGOA	*Moridilla brockii*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Moridilla brockii*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Moridilla brockii*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Moridilla brockii*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Moridilla brockii*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Moridilla brockii*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
AGULHAS / NATAL / DELAGOA	*Nembrotha aurea*	Comores	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Nembrotha aurea*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
AGULHAS / NATAL / DELAGOA	*Nembrotha aurea*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Nembrotha purpureolineata*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Nembrotha purpureolineata*	Western & Eastern Australia	Central Indo-Pacific	Sahul shelf	Bonaparte Coast	-12,59012000	130,35794000	141
NATAL / DELAGOA	*Nembrotha sp. 1*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Nembrotha sp. 1*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Nembrotha sp. 1*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Noumea norba*	Australia	Temperate Australasia	East Central Australian Shelf	Manning-Hawkesbury	-32,44941000	152,69624000	203
DELAGOA	*Noumea norba*	Gulf of Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
DELAGOA	*Noumea norba*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Noumea norba*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Noumea norba*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Noumea norba*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Noumea norba*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Noumea norba*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Noumea norba*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Noumea norba*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
NATAL / DELAGOA	*Noumea simplex*	Australia	Temperate Australasia	East Central Australian Shelf	Manning-Hawkesbury	-32,44941000	152,69624000	203
NATAL / DELAGOA	*Noumea simplex*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
NATAL / DELAGOA	*Noumea simplex*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
NATAL / DELAGOA	*Noumea simplex*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Noumea simplex*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Noumea simplex*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Noumea simplex*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Noumea simplex*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Noumea simplex*	Samoa	Eastern Indo-Pacific	central polynesia	Samoa islands	-14,26737300	-171,19368600	157
NATAL / DELAGOA	*Noumea simplex*	Society Islands	Eastern Indo-Pacific	Southeast Polynesia	Society Islands	-17,15423000	-150,53824000	161
AGULHAS / NATAL / DELAGOA	*Noumea sp. 1*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
AGULHAS / NATAL / DELAGOA	*Noumea sp. 1*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Noumea varians*	Australia	Central Indo-Pacific	Northeast australian shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Noumea varians*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
NATAL / DELAGOA	*Noumea varians*	Indonesia	Central Indo-Pacific	Java Transitional	Southern Java	-5,33331000	106,53806000	119

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NATAL / DELAGOA	*Noumea varians*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Noumea varians*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Noumea varians*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Noumea varians*	Reunion Island	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Okenia virginiae*	Australia	Central Indo-Pacific	NortheastAustralian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Okenia virginiae*	Oman	Western Indo-Pacific	Somali/Arabian	Gulf of Oman	25,41691000	57,03343000	91
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Australia	Temperate Australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Pacific Mexico	Tropical Eastern Pacific	Tropical East pacific	Mexican Tropical Pacific	17,36056000	-101,59241000	166
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Solomons	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
AGULHAS / NATAL / DELAGOA	*Phestilla melanobrachia*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Phyllidia coelestis*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Phyllidia coelestis*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
DELAGOA	*Phyllidia coelestis*	Comores	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Phyllidia coelestis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
DELAGOA	*Phyllidia coelestis*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Phyllidia coelestis*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Phyllidia coelestis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Phyllidia coelestis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Phyllidia coelestis*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Phyllidia coelestis*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Phyllidia coelestis*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
DELAGOA	*Phyllidia coelestis*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Phyllidia marindica*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Phyllidia marindica*	Cocos Keeling	Central Indo-Pacific	java transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
NATAL / DELAGOA	*Phyllidia marindica*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Phyllidia marindica*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidia marindica*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Phyllidia marindica*	Myanmar	Western Indo-Pacific	Andaman	Andaman Sea Coral Coast	11,18125000	98,11037000	110
NATAL / DELAGOA	*Phyllidia marindica*	northwerstern Australia	Central Indo-Pacific	Northwest Australian Shelf	Ningaloo	-22,53335000	113,43272000	145
NATAL / DELAGOA	*Phyllidia marindica*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidia marindica*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Phyllidia marindica*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllidia marindica*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Phyllidia ocellata*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
NATAL / DELAGOA	*Phyllidia ocellata*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Phyllidia ocellata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
NATAL / DELAGOA	*Phyllidia ocellata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Phyllidia ocellata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Phyllidia ocellata*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidia ocellata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Phyllidia ocellata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllidia ocellata*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidia ocellata*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Phyllidia ocellata*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
NATAL / DELAGOA	*Phyllidia ocellata*	southern Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Phyllidia ocellata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllidia ocellata*	Vanuatu	Central Indo-Pacific	Tropical Soutwestern Pacific	Vanuatu	-15,94528000	167,98463000	148
NATAL / DELAGOA	*Phyllidia varicosa*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,77953000	39,42902000	95
NATAL / DELAGOA	*Phyllidia varicosa*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Phyllidia varicosa*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Phyllidia varicosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Phyllidia varicosa*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Phyllidia varicosa*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Phyllidia varicosa*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
NATAL / DELAGOA	*Phyllidia varicosa*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137

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NATAL / DELAGOA	*Phyllidia varicosa*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllidia varicosa*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Phyllidia varicosa*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidia varicosa*	Society Islands	Eastern Indo-Pacific	Southeast Polynesia	Society Islands	-17,15423000	-150,53824000	161
NATAL / DELAGOA	*Phyllidia varicosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllidiella meandrina*	Indonesia	Central Indo-Pacific	Java Transitional	Southern Java	-5,33331000	106,53806000	119
NATAL / DELAGOA	*Phyllidiella meandrina*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidiella meandrina*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Phyllidiella meandrina*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Phyllidiella striata*	Australia	Central Indo-Pacific	Sahul Shelf	Bonaparte Coast	-12,59012000	130,35794000	141
DELAGOA	*Phyllidiella striata*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
DELAGOA	*Phyllidiella striata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Phyllidiella striata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Phyllidiella striata*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Phyllidiella striata*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Phyllidiella striata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Phyllidiella striata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Phyllidiella striata*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
DELAGOA	*Phyllidiella striata*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Phyllidiella zeylanica*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
NATAL / DELAGOA	*Phyllidiella zeylanica*	Comores	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Phyllidiella zeylanica*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Phyllidiella zeylanica*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Phyllidiella zeylanica*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
NATAL / DELAGOA	*Phyllidiella zeylanica*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Phyllidiella zeylanica*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidiella zeylanica*	Seychelles	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Phyllidiella zeylanica*	Sri lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL / DELAGOA	*Phyllidiella zeylanica*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllidiella zeylanica*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Aldabra	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Lesser Sunda	-8,98372000	116,48348000	132
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllidiopsis cardinalis*	western Australia	Temperate australasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
DELAGOA	*Phyllidiopsis gemmata/krempfi*	Indonesia	Central Indo-Pacific	Sahul Shelf	Arafura Sea	-6,53176000	134,91307000	139
DELAGOA	*Phyllidiopsis gemmata/krempfi*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Phyllidiopsis gemmata/krempfi*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Phyllidiopsis gemmata/krempfi*	Reunion	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
DELAGOA	*Phyllidiopsis gemmata/krempfi*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Phyllodesmium cf. macphersonae*	Australian Western Pacific	Temperate Australasia	southeast australian shelf	Bassian	-40,09700000	145,76179000	205
NATAL / DELAGOA	*Phyllodesmium cf. macphersonae*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
NATAL / DELAGOA	*Phyllodesmium cf. macphersonae*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Phyllodesmium cf. macphersonae*	Malaysia	Central Indo-Pacific	Western Coral Triangle	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Phyllodesmium cf. macphersonae*	the Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Australia	Central Indo-Pacific	northwest Australian Shelf	Exmouth to Broome	-19,46345000	120,56413000	144
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Phyllodesmium cf. magnum*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
DELAGOA	*Phyllodesmium cf. poindimiei**	Australia	Temperate Australiasia	East Central Australian Shelf	Manning-Hawkesbury	-32,44941000	152,69624000	203
DELAGOA	*Phyllodesmium cf. poindimiei**	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152

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DELAGOA	*Phyllodesmium cf. poindimiei**	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Phyllodesmium cf. poindimiei**	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Phyllodesmium cf. poindimiei**	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Phyllodesmium cf. poindimiei**	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Phyllodesmium cf. poindimiei**	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Phyllodesmium cf. poindimiei**	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL	*Phyllodesmium cf. serratum**	Australia	Central Indo-Pacific	Northeast australian shelf	Torres Strait Northern Great Barrier Reef	-11,40831600	143,69917700	142
NATAL	*Phyllodesmium cf. serratum**	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Phyllodesmium hyalinum*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Torres Strait Northern Great Barrier Reef	-11,40831600	143,69917700	142
DELAGOA	*Phyllodesmium hyalinum*	Indonesia	Central Indo-Pacific	Sahul Shelf	Gulf of Papua	-7,92888000	144,45484000	138
DELAGOA	*Phyllodesmium hyalinum*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Phyllodesmium hyalinum*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Phyllodesmium hyalinum*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Phyllodesmium hyalinum*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Phyllodesmium hyalinum*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Platydoris cruenta*	Kenya	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Platydoris cruenta*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL	*Platydoris cruenta*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL	*Platydoris cruenta*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Plocamopherus maculatus*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
DELAGOA	*Plocamopherus maculatus*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Plocamopherus maculatus*	Western Australia	Central Indo-Pacific	Sahul Shelf	Bonaparte Coast	-12,59012000	130,35794000	141
SOUTH WESTERN CAPE / AGULHAS	*Polycera capensis*	Austrailia, NSW	Temperate Australiasia	East Central Australian Shelf	Manning-Hawkesbury	-32,44941000	152,69624000	203
AGULHAS	*Polycera hedgpethi*	Australia	Temperate Australiasia	aoutheast Australian shelf	Cape Howe	-37,57044000	149,98630000	204
AGULHAS	*Polycera hedgpethi*	California	Temperate Northern Pacific	Cold Temperater Northeast Pacific	Northern California	37,75086000	-122,55593000	58
AGULHAS	*Polycera hedgpethi*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
AGULHAS	*Polycera hedgpethi*	Mediterranean	Temperate Northern Atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
AGULHAS	*Polycera hedgpethi*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
AGULHAS	*Polycera hedgpethi*	Spain	Temperate Northern Atlantic	Mediterranean Sea	Western Mediterranean	40,69851000	4,15230000	35
AGULHAS	*Polycera hedgpethi*	West Africa	Tropical Atlantic	west African Transition	Cape Verde	15,81168000	-23,02508000	79
SOUTH WESTERN CAPE / AGULHAS	*Pruvotfolia pselliotes*	France (Atlantic)	Temeperate Northern Atlantic	Lusitanian	South European Atlantic Shelf	43,68415000	-1,72157000	27
DELAGOA	*Roboastra gracilis*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
DELAGOA	*Roboastra gracilis*	Fiji	Central Indo-Pacific	Tropical Soutwestern Pacific	Fiji Islands	-17,37157000	178,91947000	147
DELAGOA	*Roboastra gracilis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
DELAGOA	*Roboastra gracilis*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Roboastra gracilis*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Roboastra gracilis*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Roboastra gracilis*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
DELAGOA	*Roboastra gracilis*	Palau	Central Indo-Pacific	tropical northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125
DELAGOA	*Roboastra gracilis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Roboastra gracilis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Roboastra gracilis*	Saudi Arabia	Western Indo-Pacific	red sea and gulf of aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Roboastra gracilis*	Solomon Islands	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Roboastra gracilis*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Roboastra luteolineata*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL / DELAGOA	*Roboastra luteolineata*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Roboastra luteolineata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Roboastra luteolineata*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
NATAL / DELAGOA	*Roboastra luteolineata*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
NATAL / DELAGOA	*Roboastra luteolineata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL	*Rostanga bifurcata*	Australia	Temperate Australasia	southeast australian shelf	Bassian	-40,09700000	145,76179000	205
NATAL	*Rostanga bifurcata*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL	*Rostanga bifurcata*	Hong Kong	Central Indo-Pacific	South China Sea	Southern China	23,87517000	118,95447000	113
NATAL	*Rostanga bifurcata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL	*Rostanga bifurcata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL	*Rostanga bifurcata*	Singapore	Central Indo-Pacific	sunda shelf	Malacca strait	1,38066000	102,95973000	118
NATAL	*Rostanga bifurcata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL	*Sclerodoris apiculata*	Australia	Central Indo-Pacific	Northeast australian shelf	Central And Southern Great Barrier Reef	-20,22413000	148,89282000	143
NATAL	*Sclerodoris apiculata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL	*Sclerodoris apiculata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL	*Sclerodoris apiculata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL	*Sclerodoris apiculata*	Saudi Arabia	Western Indo-Pacific	red sea and gulf of aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL	*Sclerodoris apiculata*	Southern India	Western Indo-Pacific	West and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
NATAL	*Sclerodoris apiculata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Sclerodoris coriacea*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Sclerodoris coriacea*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95

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NATAL / DELAGOA	*Sclerodoris tuberculata*	Aldabra Atoll	Western Indo-Pacific	Western Indian Ocean	Seychelles	-4,86103000	55,30830000	96
NATAL / DELAGOA	*Sclerodoris tuberculata*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Sclerodoris tuberculata*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Sclerodoris tuberculata*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Sclerodoris tuberculata*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Sclerodoris tuberculata*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Tambja affinis*	Comores	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
DELAGOA	*Tambja affinis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
DELAGOA	*Tambja affinis*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Tambja affinis*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Tambja affinis*	Sri Lanka	Western Indo-Pacific	Weste and South Indian Shelf	South India and Sri Lanka	7,10536200	77,87848100	104
DELAGOA	*Tambja affinis*	Sudan	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Tambja affinis*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Tambja affinis*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Tambja morosa*	Australia	Temperate Australiasia	Southeast Australian Shelf	Bassian	-40,09700000	145,76179000	205
NATAL / DELAGOA	*Tambja morosa*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
NATAL / DELAGOA	*Tambja morosa*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL / DELAGOA	*Tambja morosa*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Tambja morosa*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Tambja morosa*	Mauritius	Western Indo-Pacific	western Indian ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Tambja morosa*	Northern New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
NATAL / DELAGOA	*Tambja morosa*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Tambja morosa*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Tambja morosa*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Tambja morosa*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL / DELAGOA	*Tambja morosa*	Vanuatu	Central Indo-Pacific	tropical southwestern pacific	Vanuatu	-15,94528000	167,98463000	148
AGULHAS / NATAL / DELAGOA	*Thecacera pacifica*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Torres Strait Northern Great Barrier Reef	-11,40831600	143,69917700	142
AGULHAS / NATAL / DELAGOA	*Thecacera pacifica*	Carribean	tropical atlantic	tropical northwestern Atlantic	Southwestern Caribbean	10,16248000	-81,25486000	67
AGULHAS / NATAL / DELAGOA	*Thecacera pacifica*	Gulf of Mexico	Temperate Northern Atlantic	warm temperate nortwest atlantic	Northern Gulf of Mexico	29,20675000	-89,70389000	43
AGULHAS / NATAL / DELAGOA	*Thecacera pacifica*	Mozambique	Western Indo-Pacific	Western Indian Ocean	Delagoa	-24,93765000	34,33516000	102
AGULHAS / NATAL / DELAGOA	*Thecacera pacifica*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
DELAGOA	*Thecacera picta*	Australia, Solomon Islands, Indonesia,	Central Indo-Pacific	Eastern Coral Triangle	Solomon Archipelago	-8,03960000	158,53721000	135
DELAGOA	*Thecacera picta*	Maldives	Western Indo-Pacific	Centeral Indian Ocean Islands	Maldives	4,75619000	73,09609000	105
DELAGOA	*Thecacera picta*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Thecacera picta*	Western Pacific	Central Indo-Pacific	Western Coral Triangle	Eastern Philippines	11,21789000	126,31897000	127
DELAGOA	*Thordisa oliva*	Southern Japan	temperate Northern Pacific	warm temperate Northwest Pacific	East China Sea	33,74369000	127,70234000	52
DELAGOA	*Thorunna australis*	Christmas Island	Central Indo-Pacific	Java Transitional	Cocos-Keeling/Christmas Island	-12,15545000	96,88784000	120
DELAGOA	*Thorunna australis*	Guam	Central Indo-Pacific	Tropical Northwestern Pacific	Mariana Islands	16,86601000	145,74141000	123
DELAGOA	*Thorunna australis*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
DELAGOA	*Thorunna australis*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Thorunna australis*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Thorunna australis*	Okinawa	Central Indo-Pacific	South Kuroshio	South Kuroshio	25,74971000	127,29483000	121
DELAGOA	*Thorunna australis*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
DELAGOA	*Thorunna australis*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Thorunna horologia*	Madagascar	Western Indo-Pacific	Western Indian Ocean	Western and Northern Madagascar	-12,57654000	46,11897000	100
NATAL / DELAGOA	*Thorunna horologia*	Reunion Islands	Western Indo-Pacific	Western Indian Ocean	Mascarene Islands	-20,68597000	56,57158000	98
NATAL / DELAGOA	*Thorunna horologia*	Tanzania	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
DELAGOA	*Thorunna punicea*	Australia	Central Indo-Pacific	Northeast Australian Shelf	Coral Sea	-18,49901000	152,60795000	150
DELAGOA	*Thorunna punicea*	Indonesia	Central Indo-Pacific	Western Coral Triangle	Banda Sea	-4,83386000	126,55452000	131
DELAGOA	*Thorunna punicea*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
DELAGOA	*Thorunna punicea*	Malaysia	Central Indo-Pacific	Sunda Shelf	Sunda Shelf/Java Sea	1,29487300	106,96131500	117
DELAGOA	*Thorunna punicea*	Marshall Islands	Eastern Indo-Pacific	Marshall, gilbert and Ellis Island	Marshall Islands	6,56359200	170,86770300	153
DELAGOA	*Thorunna punicea*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
DELAGOA	*Thorunna punicea*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
DELAGOA	*Thorunna punicea*	Taiwan	Central Indo-Pacific	south China Sea	Southern China	23,87517000	118,95447000	113
SOUTH WESTERN CAPE / AGULHAS	*Tritonia nilsodhneri*	Atlantic coast of France	Temeperate Northern Atlantic	lusitanian	South European Atlantic Shelf	43,68415000	-1,72157000	27
SOUTH WESTERN CAPE / AGULHAS	*Tritonia nilsodhneri*	England	Temeperate Northern Atlantic	northern European Seas	North Sea	53,54185000	5,36804000	25
SOUTH WESTERN CAPE / AGULHAS	*Tritonia nilsodhneri*	Ireland	Temeperate Northern Atlantic	northern European Seas	Celtic Sea	54,84588000	-5,55321000	26
NATAL / DELAGOA	*Tritoniopsis elegans*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL / DELAGOA	*Tritoniopsis elegans*	Kenya	Western Indo-Pacific	Western Indian Ocean	East African Coral Coast	-8,39300000	40,87174000	95
NATAL / DELAGOA	*Tritoniopsis elegans*	Papua New Guinea	Central Indo-Pacific	Eastern Coral Triangle	Southeast Papua New Guinea	-11,15740900	149,55000500	137
NATAL / DELAGOA	*Tritoniopsis elegans*	Philippines	Central Indo-Pacific	Western Coral Triangle	Sulawesi Sea/Makassar Strait	0,44338000	119,41631000	128
NATAL / DELAGOA	*Tritoniopsis elegans*	Red Sea	Western Indo-Pacific	Red Sea and Gulf of Aden	Northern and Central Red Sea	22,29947000	37,72428000	87
NATAL / DELAGOA	*Tritoniopsis elegans*	Thailand	Central Indo-Pacific	Sunda Shelf	Gulf of Thailand	11,50274400	100,99066000	115
NATAL	*Vayssierea felis*	Australia	Temperate Australiasia	East Central Australian Shelf	Tweed-Moreton	-27,38950000	153,30750000	202
NATAL	*Vayssierea felis*	Enewetak Atoll	Central Indo-Pacific	Tropical Northwestern Pacific	West Caroline Islands	7,62234000	134,67074000	125

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NATAL	*Vayssierea felis*	Hawaii	Eastern Indo-Pacific	Hawaii	Hawaii	20,10424100	-157,71904900	152
NATAL	*Vayssierea felis*	Japan	Temperate Northern Pacific	Cold Temperater Northwest Pacific	Sea of Japan	39,76327100	134,26488700	49
NATAL	*Vayssierea felis*	New Caledonia	Central Indo-Pacific	Tropical Southwestern Pacific	New Caledonia	-21,77268000	165,23449500	149
NATAL	*Vayssierea felis*	New Zealand	Temperate Australiasia	Northern New Zealand	Northeastern New Zealand	-34,79938000	173,56072000	196
NATAL	*Vayssierea felis*	Palmyra Atoll	eastern Indo-Pacific	central polynesia	Line Islands	2,85448000	-158,41675000	155
NATAL	*Vayssierea felis*	Russia	Temperate Northern Pacific	Cold temperate Northwest Pacific	Sea of Okhotsk	59,09077000	156,41816000	45
NATAL	*Vayssierea felis*	South China Sea	Central Indo-Pacific	South China Sea	South China Sea Oceanic Islands	14,15607000	115,04238000	114

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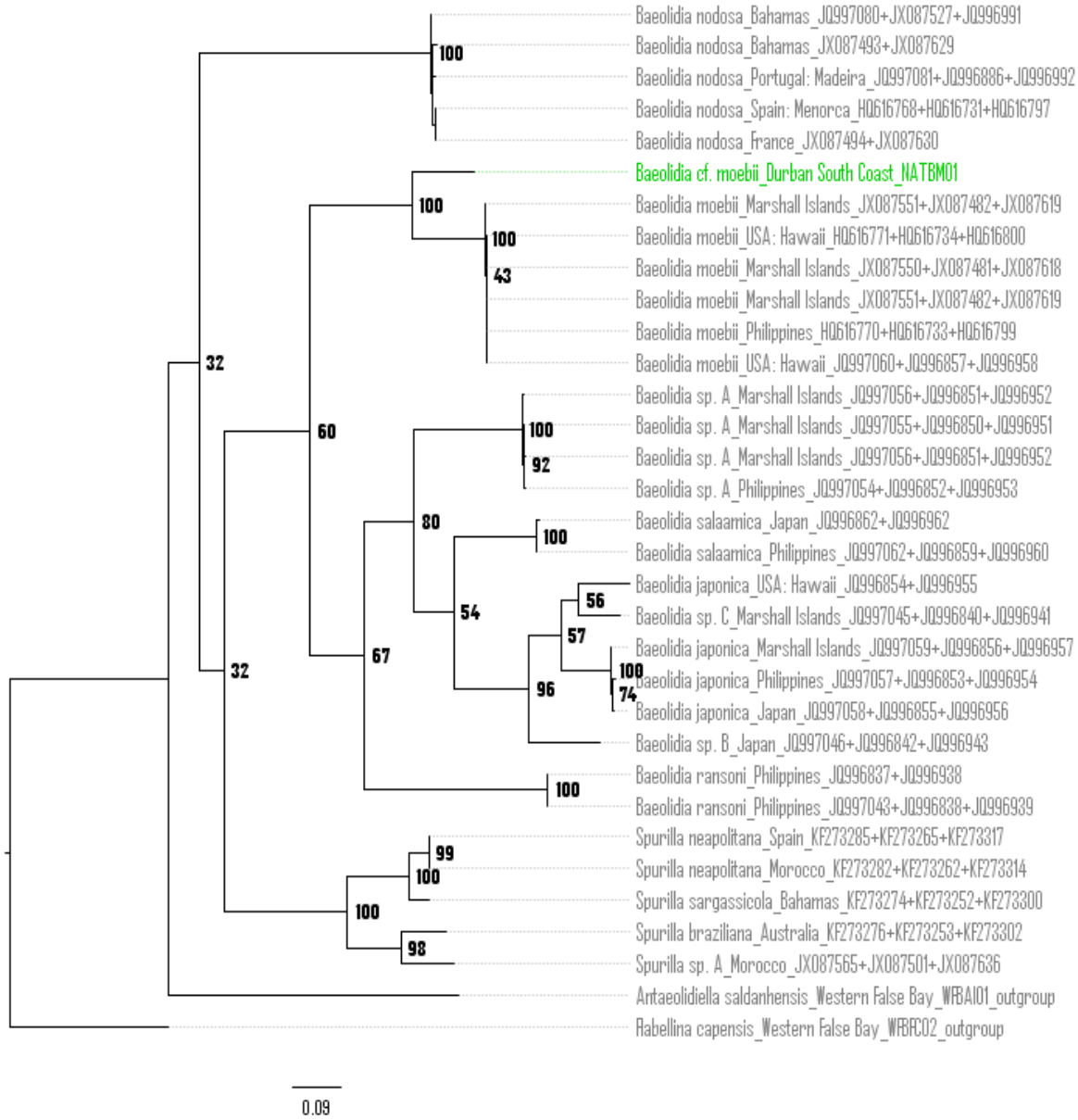
Appendix 3.4

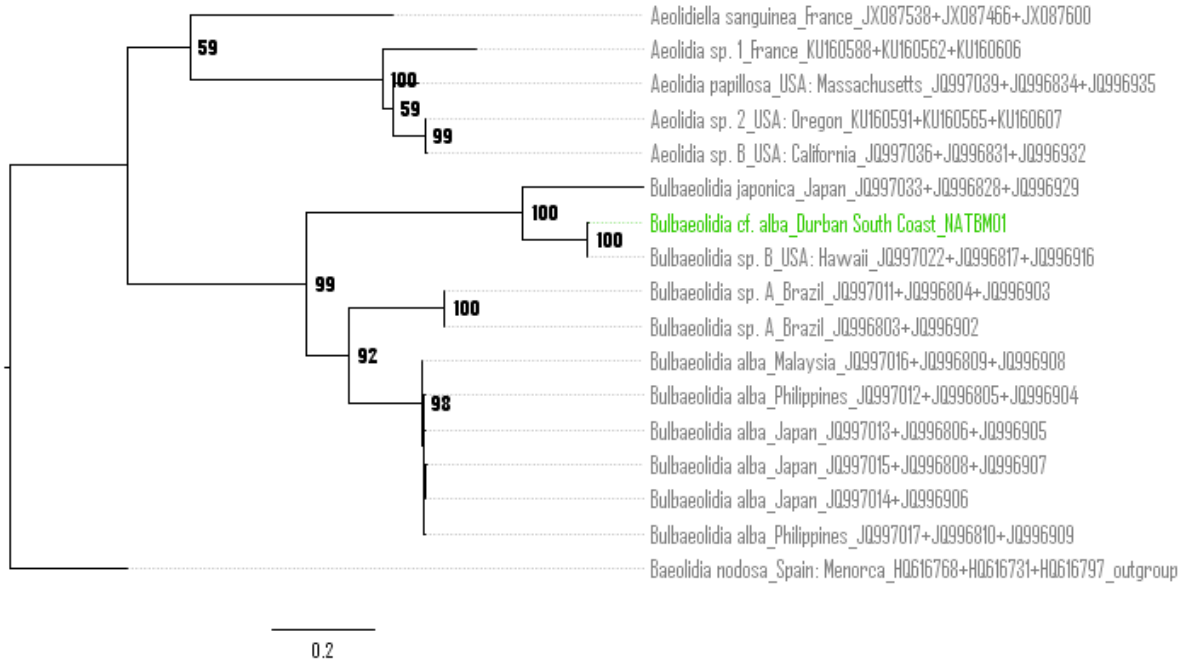
RAxML GUI trees of genera and families including global sequence data retrieved off GenBank

(GenBank accession numbers presented behind taxa)

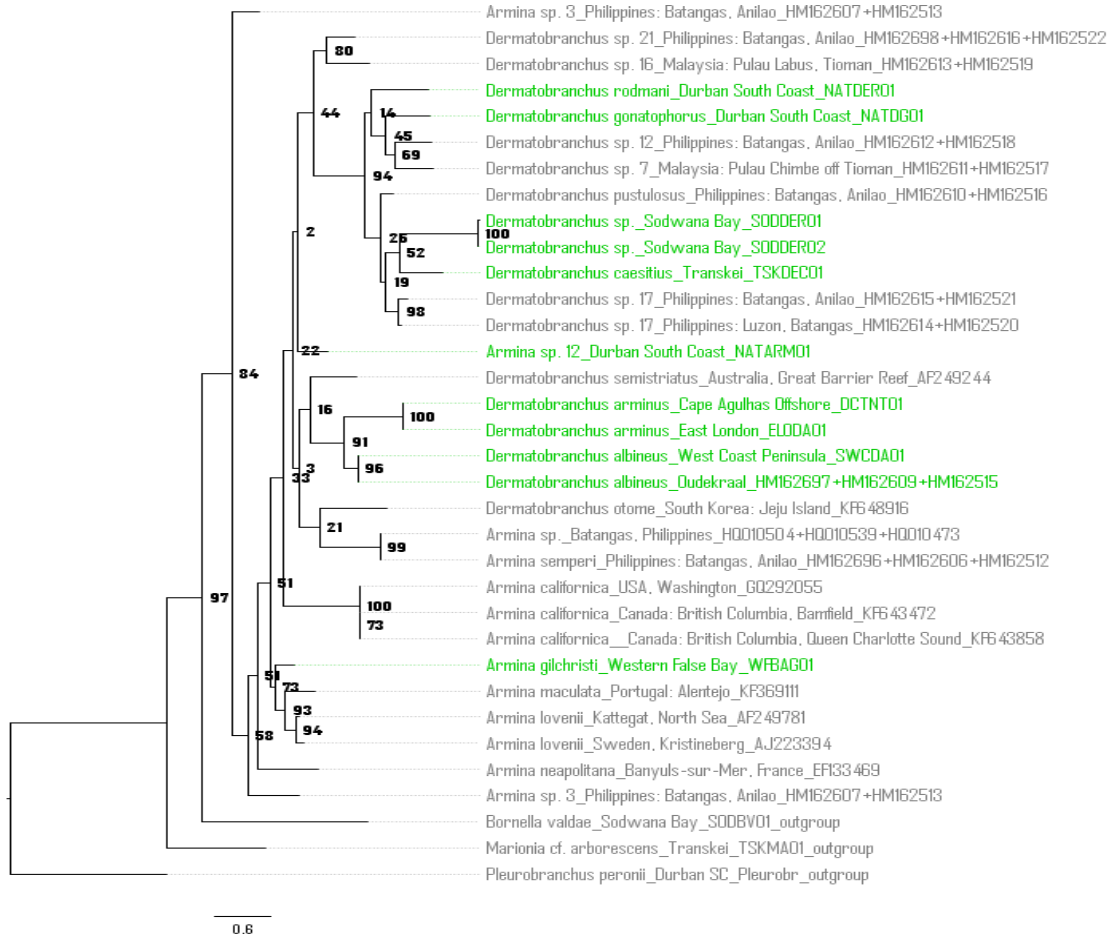
Genus *Baeolidia* COI_16S



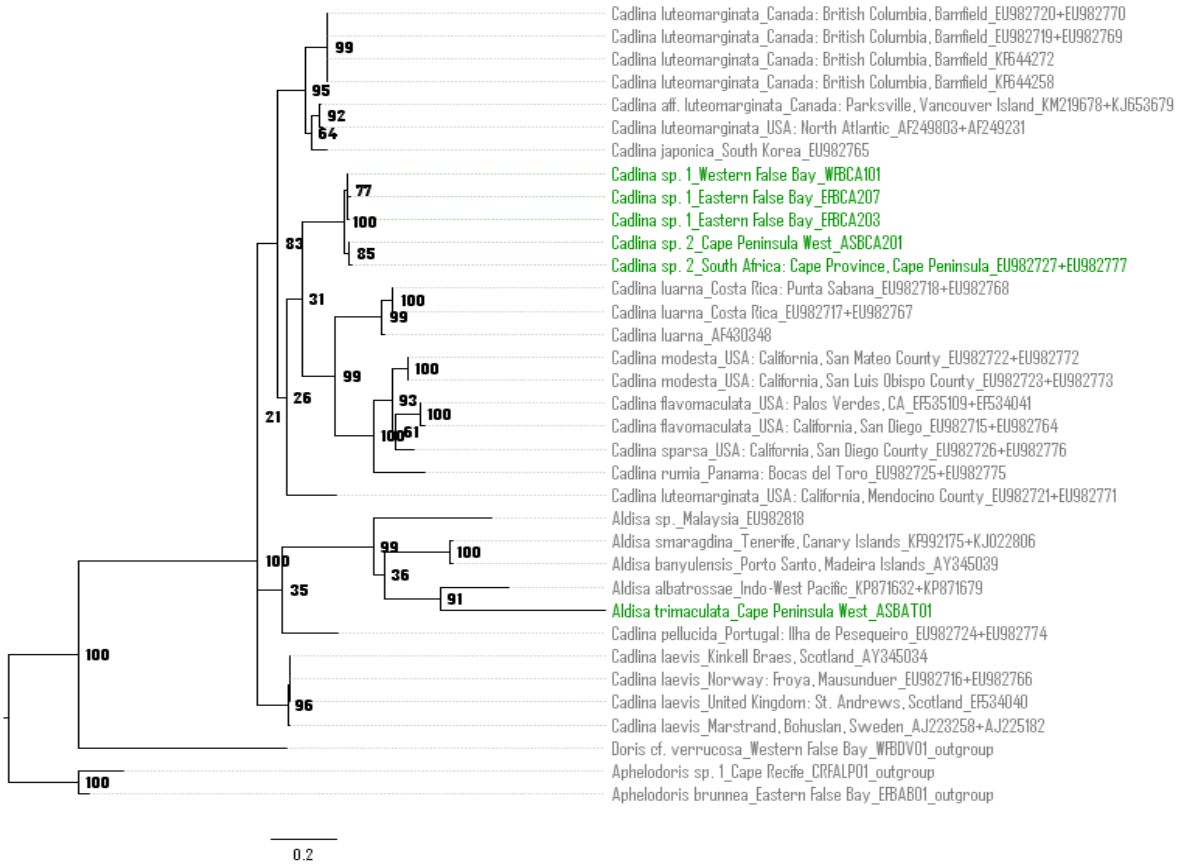
Genus *Bulbaeolidia* COI_16S



Family Arminidae COI_16S_H3

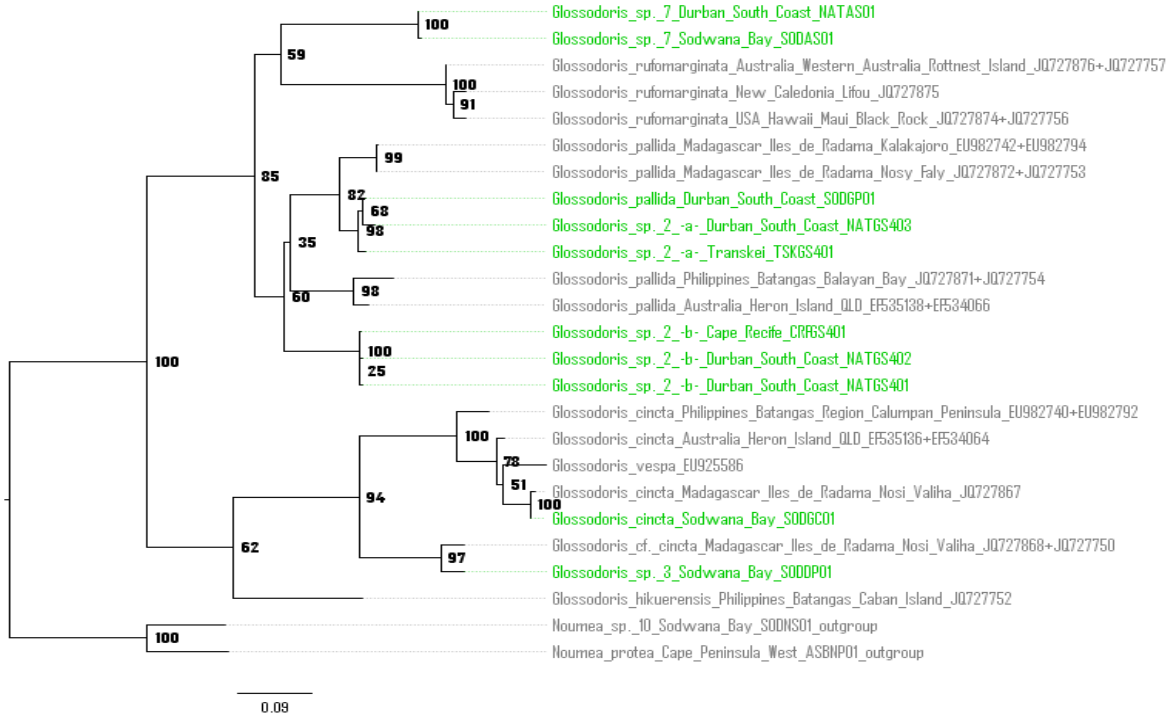


Family Cadlinidae 16S

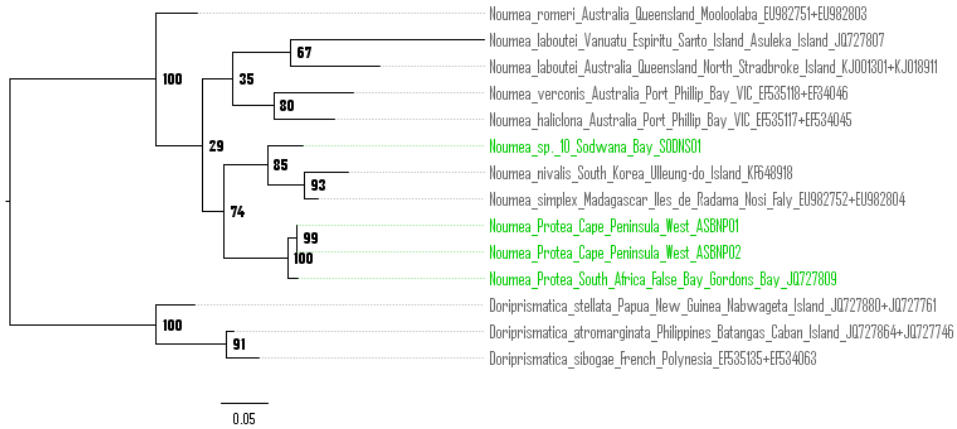


Genus *Ardeadoris* COI_16S

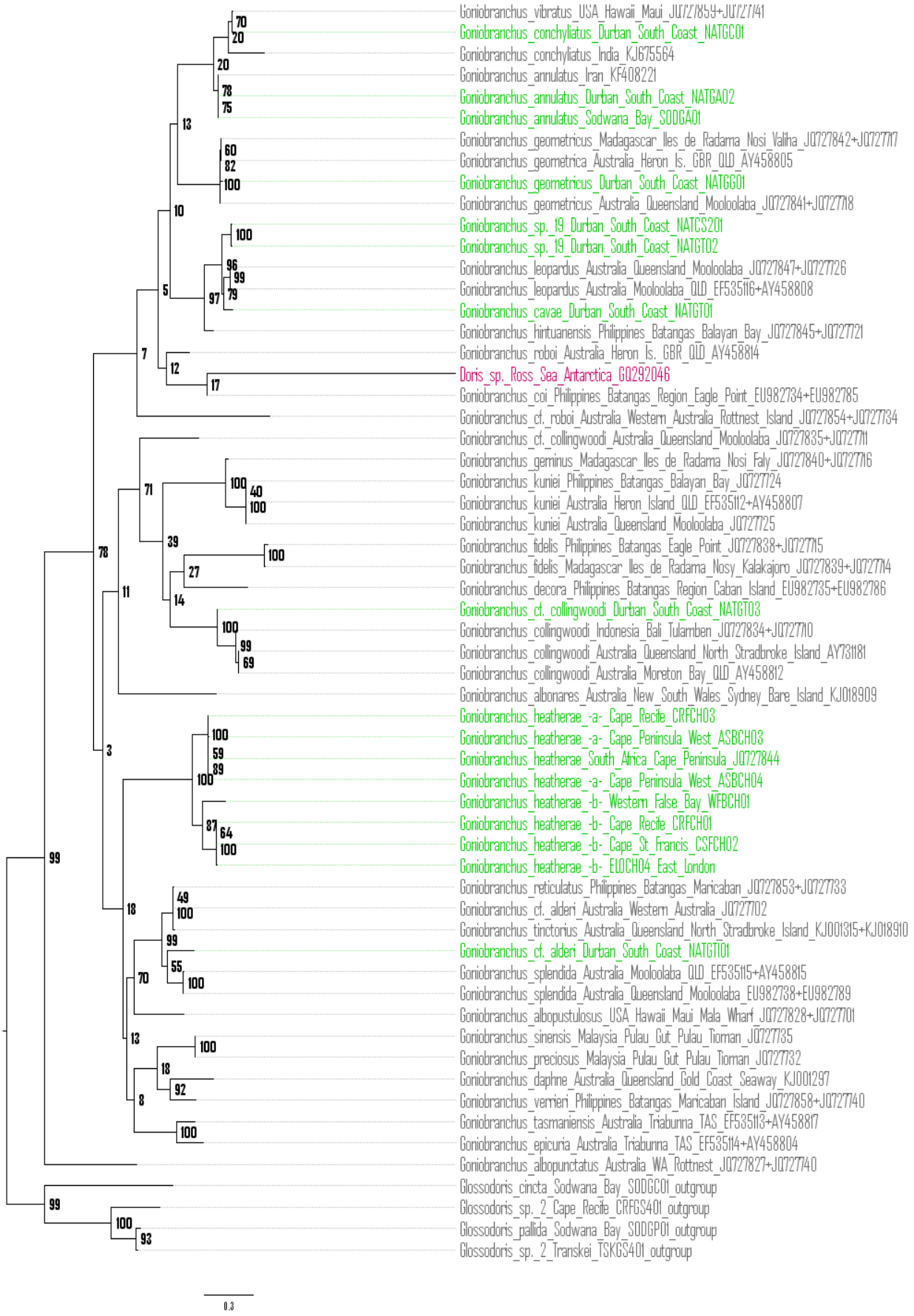
Genus *Glossodoris* COI_16S



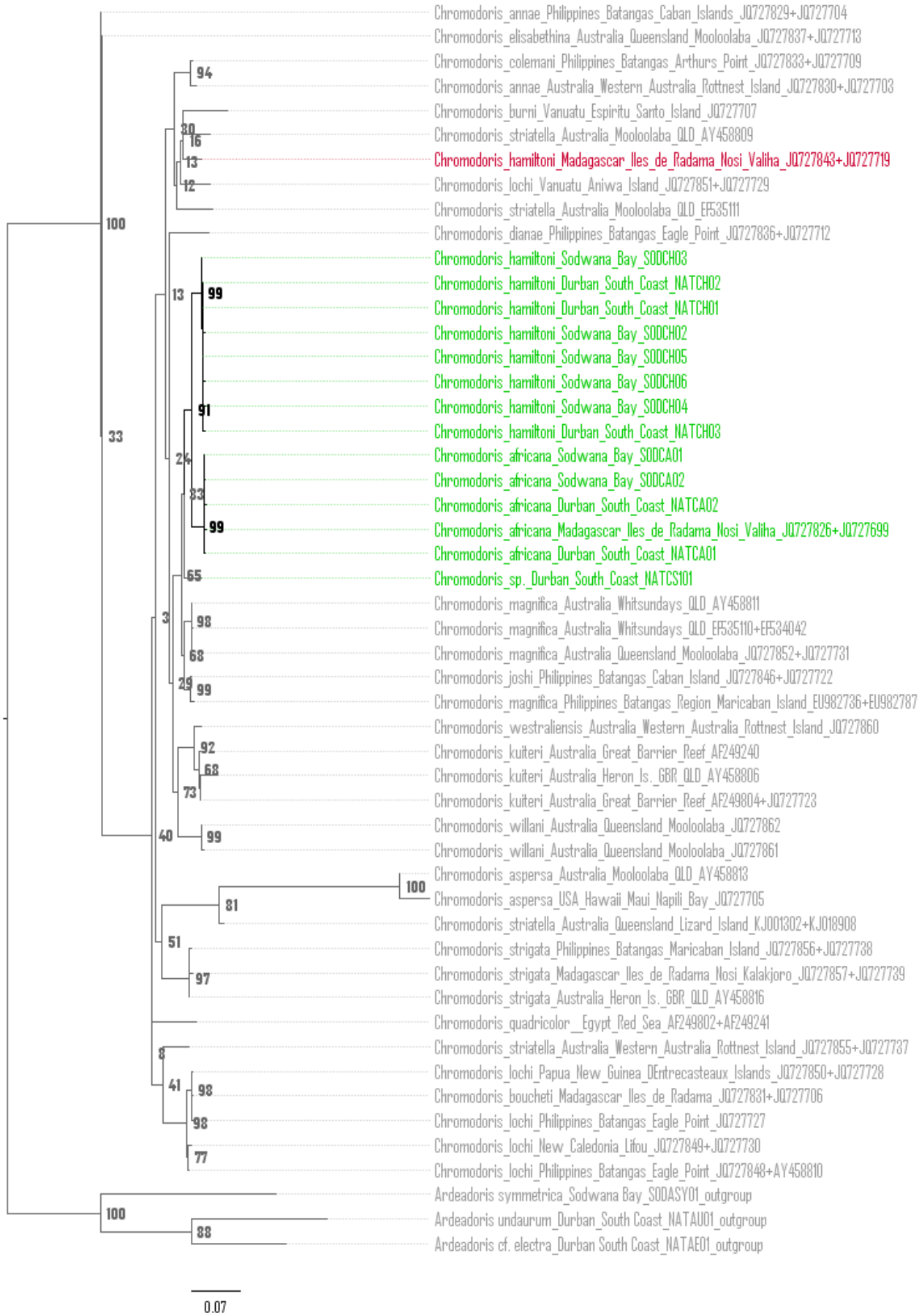
Genus *Noumea* COI_16S



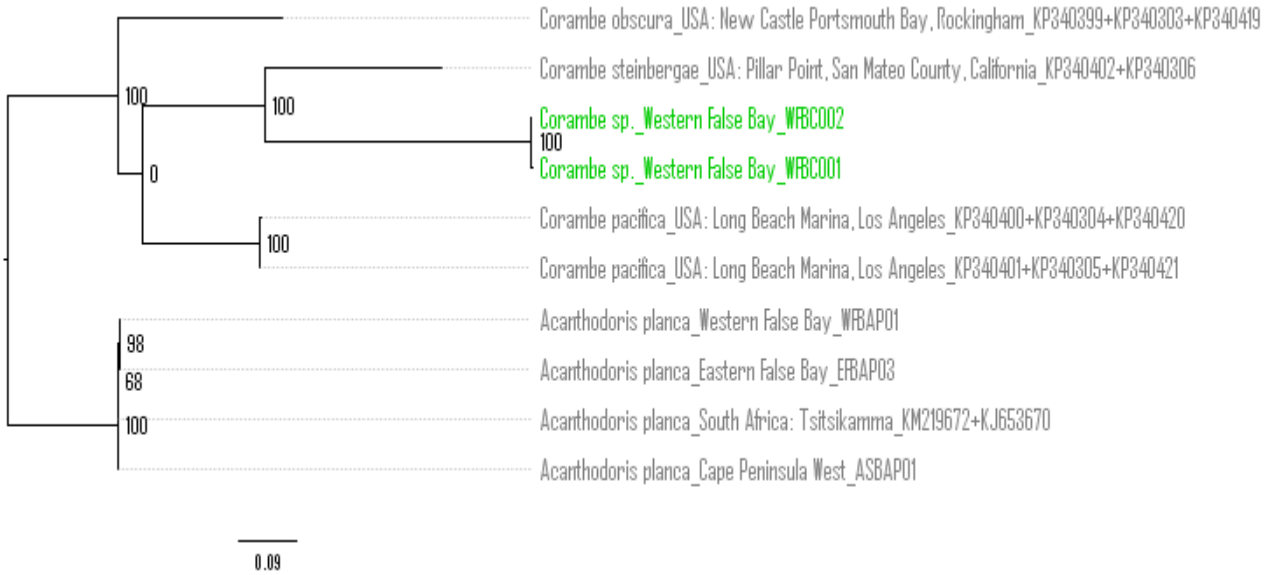
Genus *Goniobranchus* COI_16S



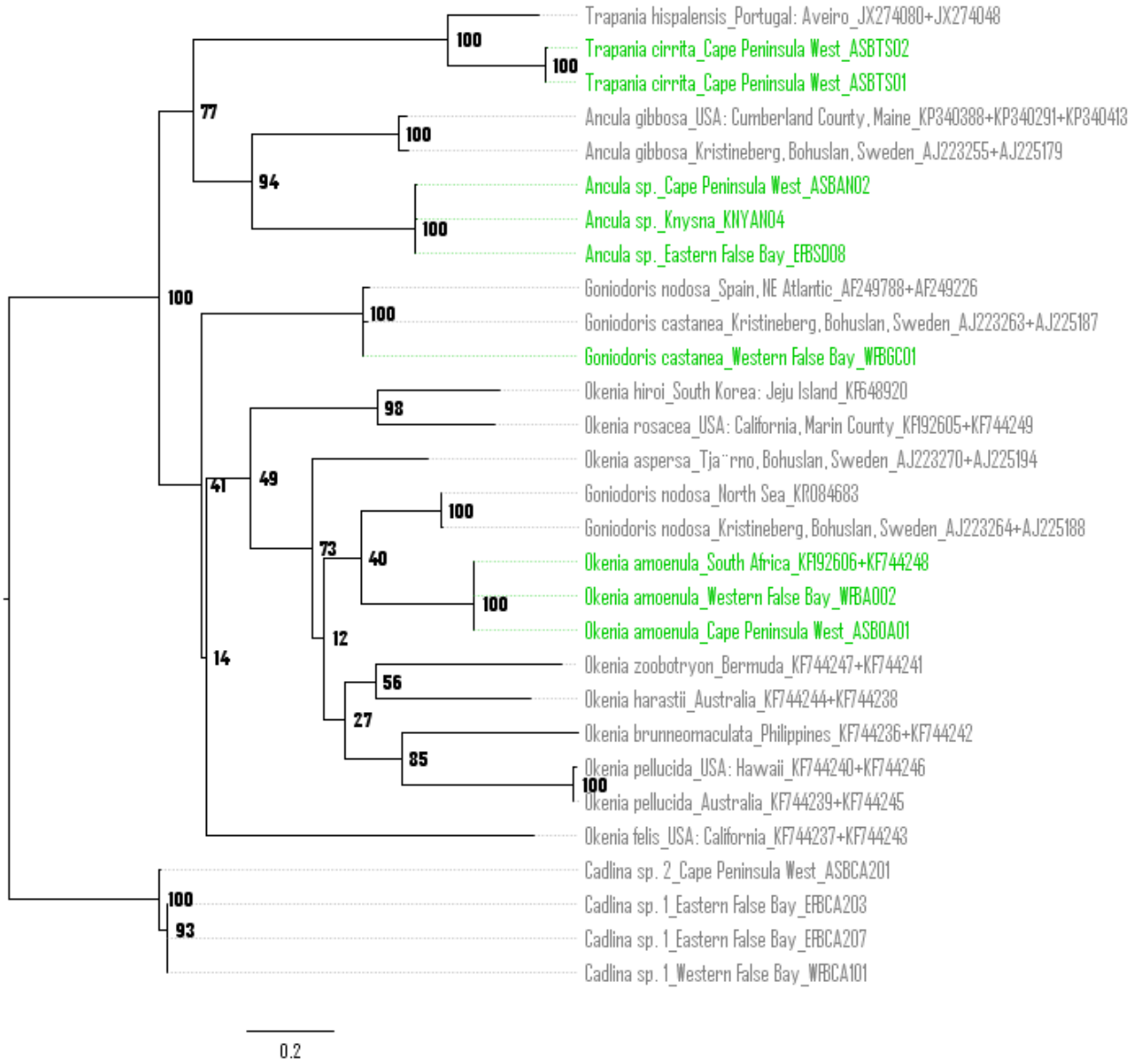
Genus *Chromodoris* COI_16S



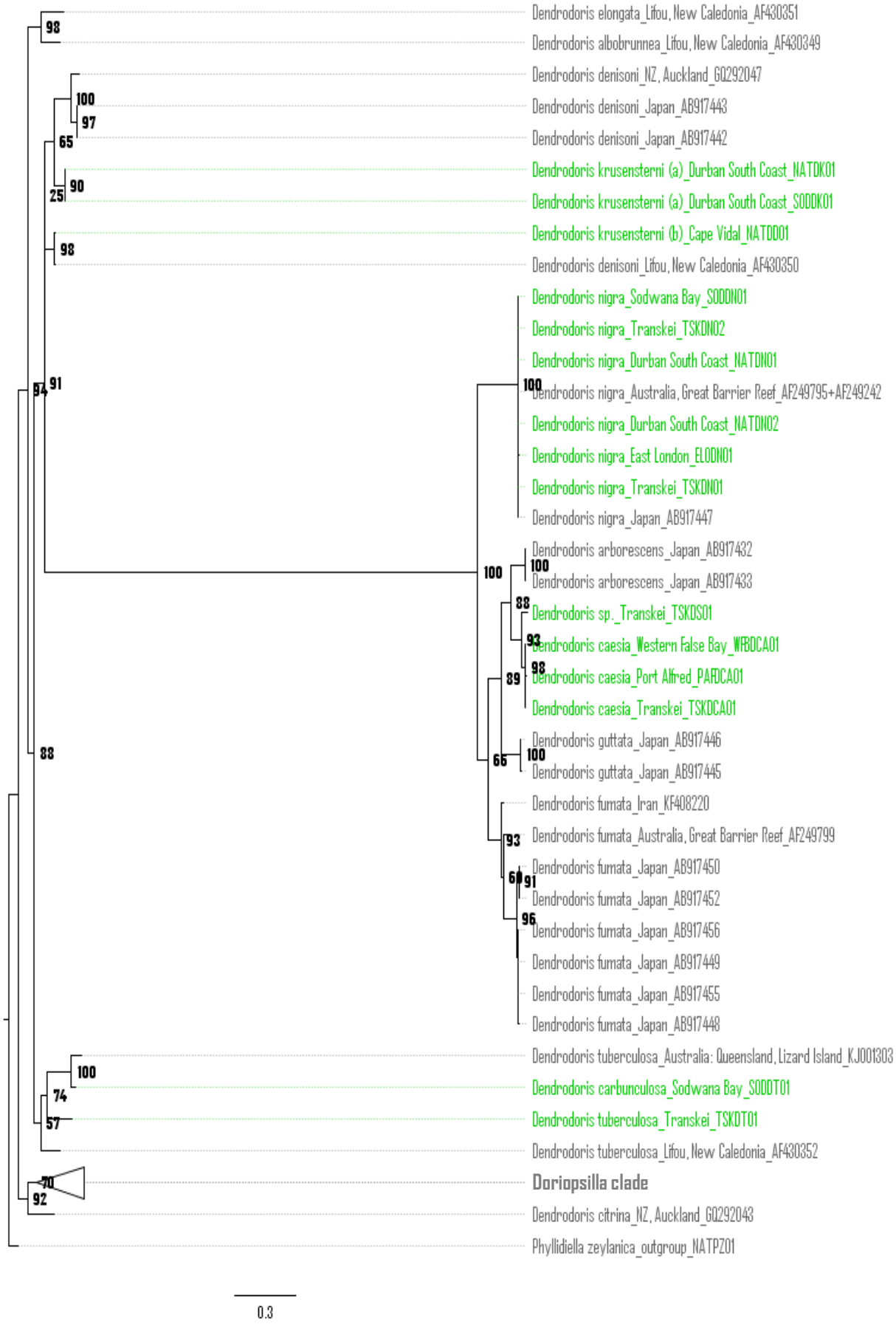
Family Corambidae COI_16S_H3



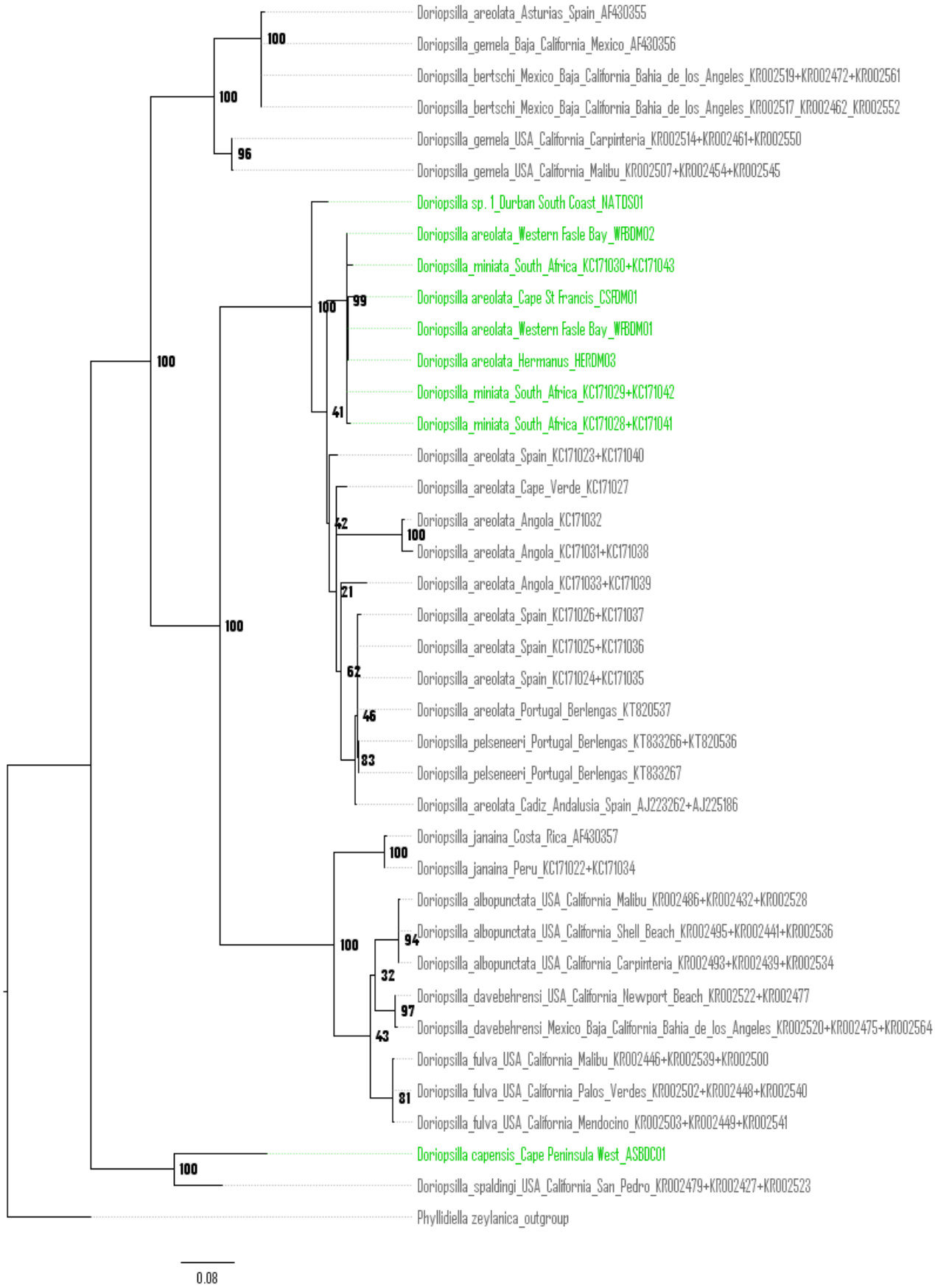
Family Goniodorididae COI_16S_H3



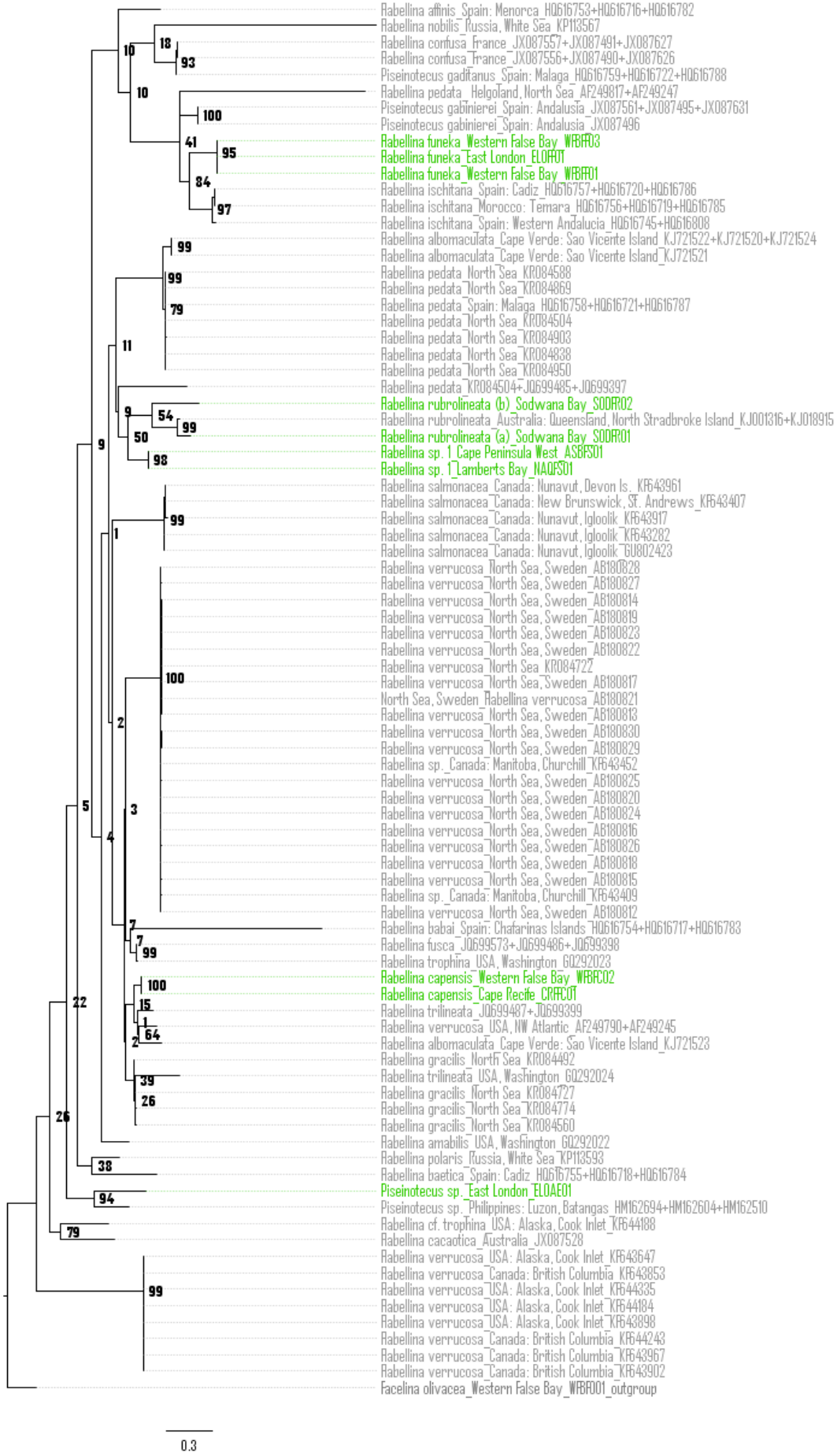
Genus *Dendrodoris* COI_16S



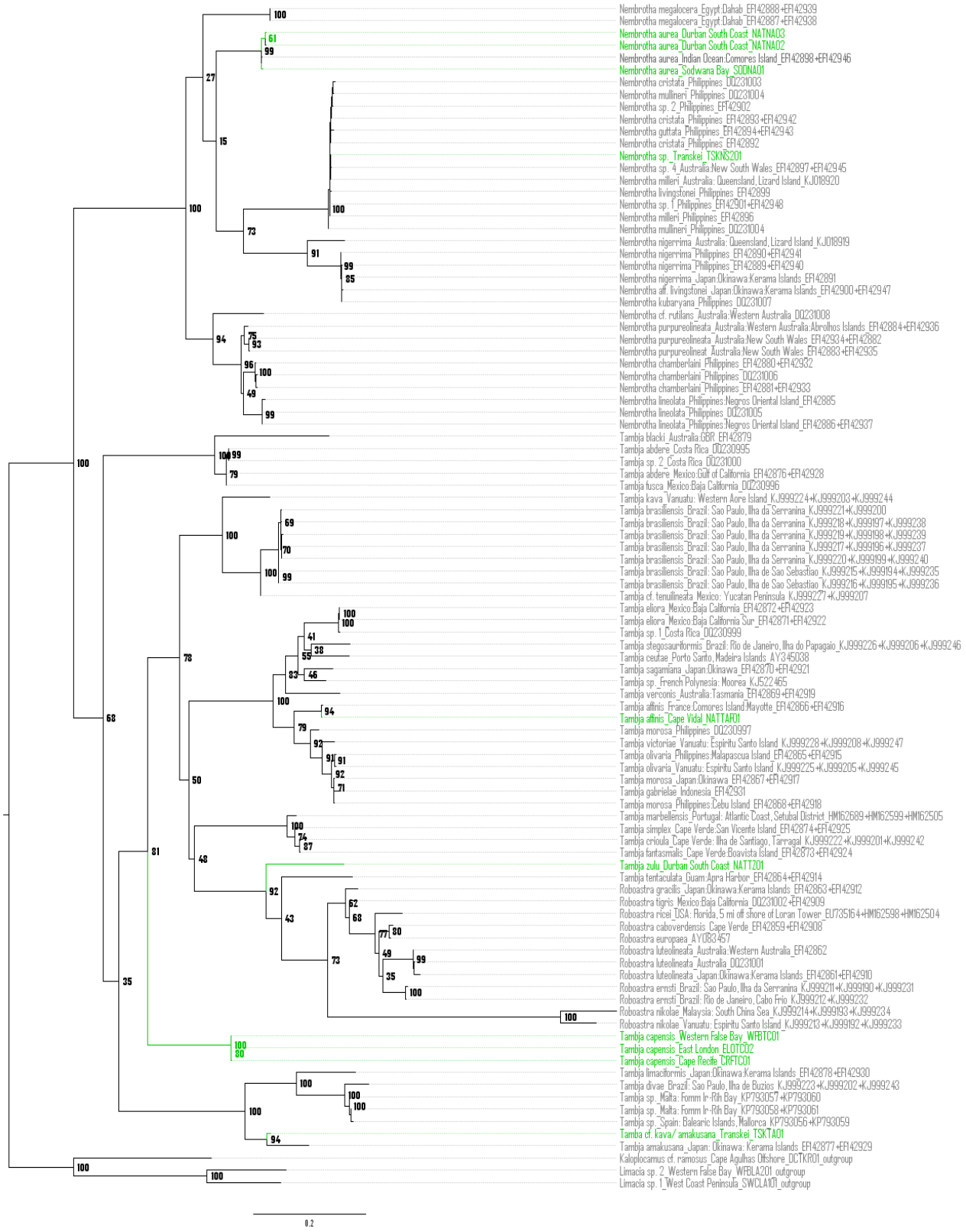
Genus *Doriopsilla* COI_16S_H3



Genus *Flabellina* & *Piseinotecus* COI_16S_H3

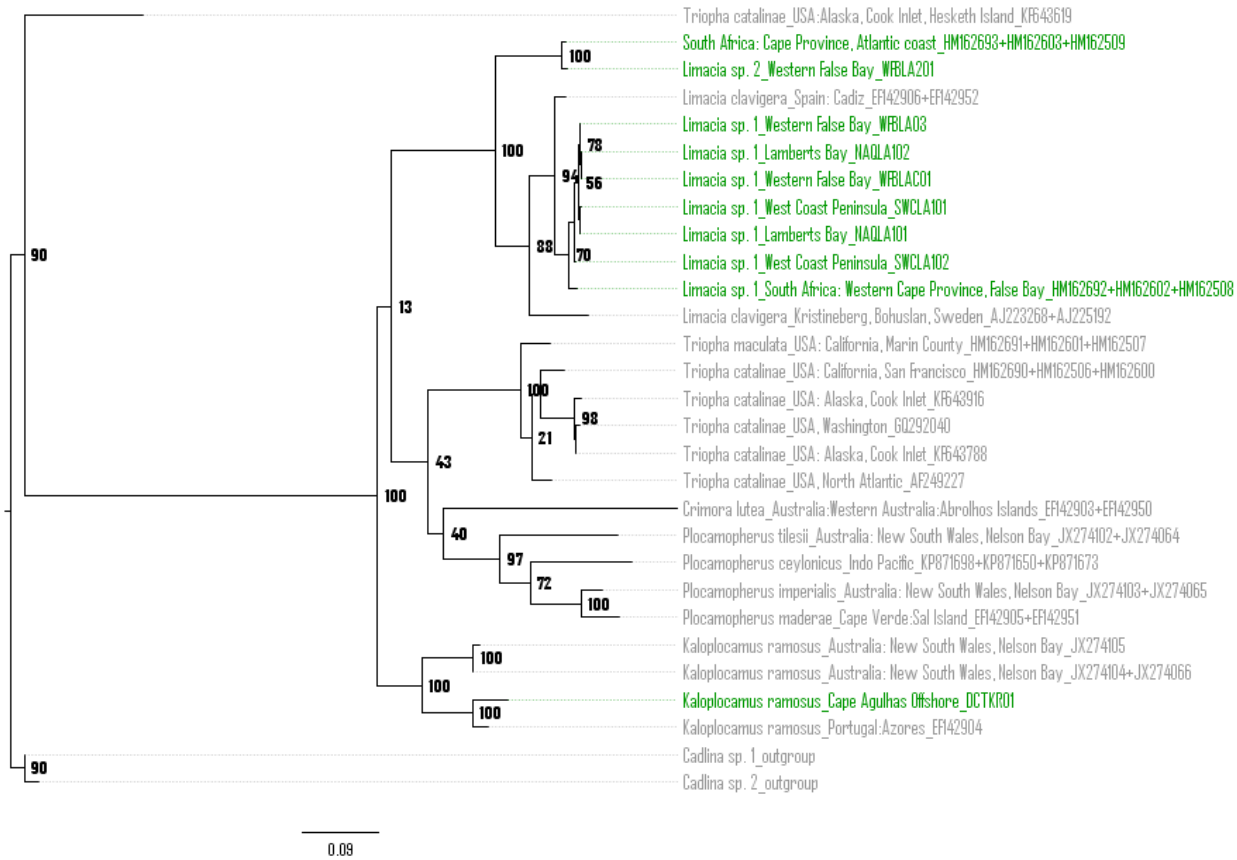


Family Nembrothinae COI_16S_H3

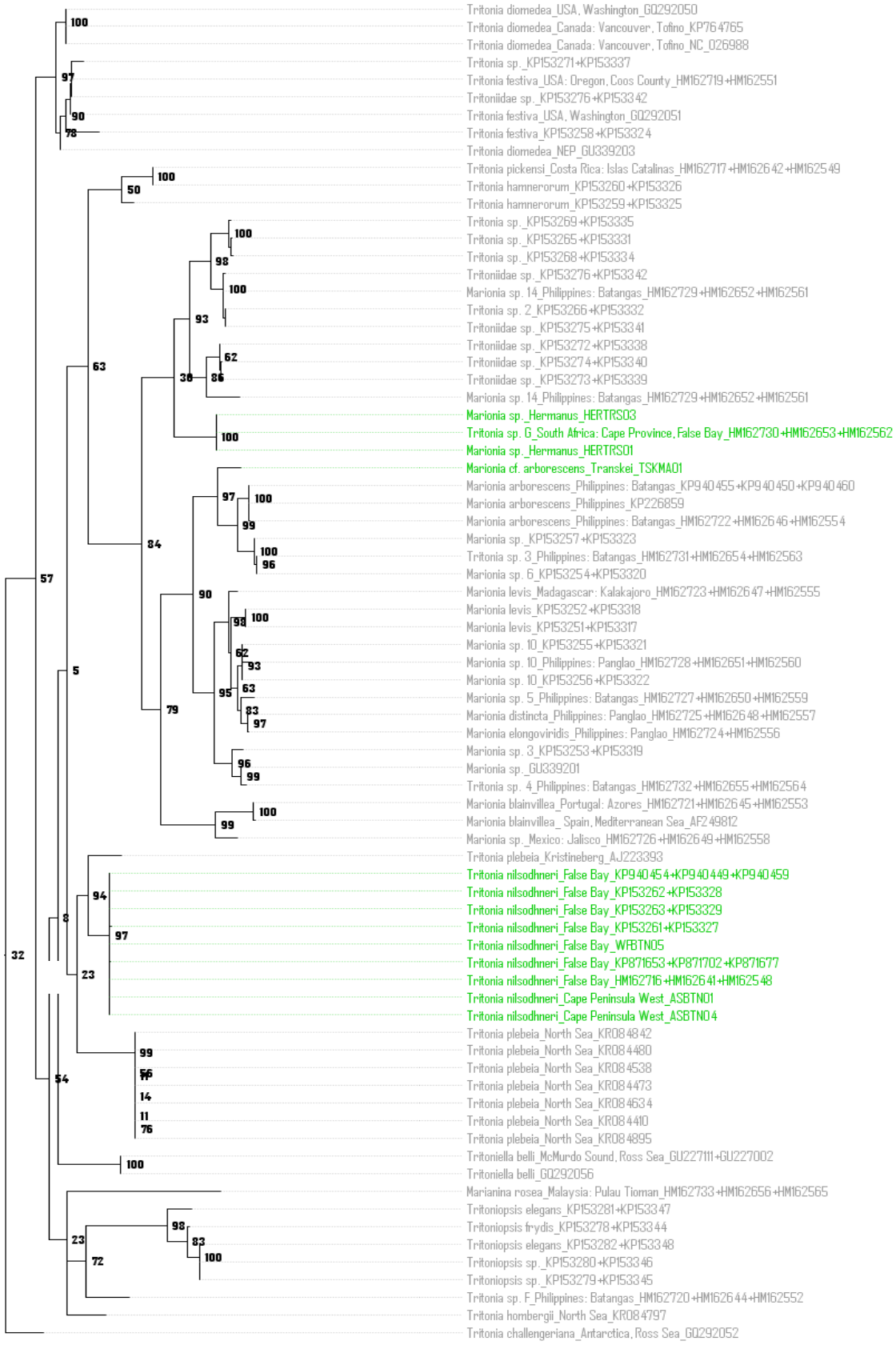


Family Phyllidiidae COI_16S

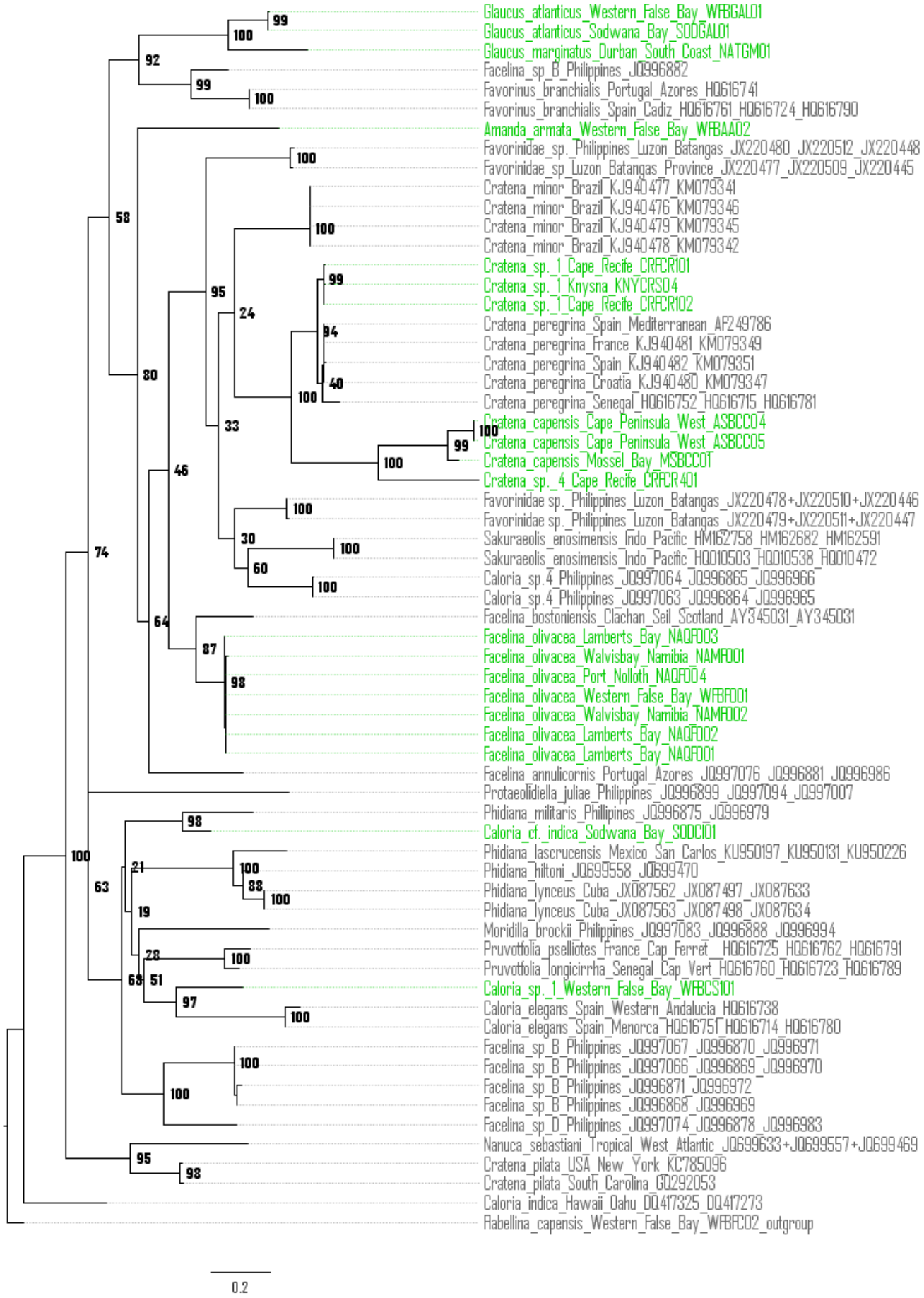
Family Triophinae COI_16S_H3



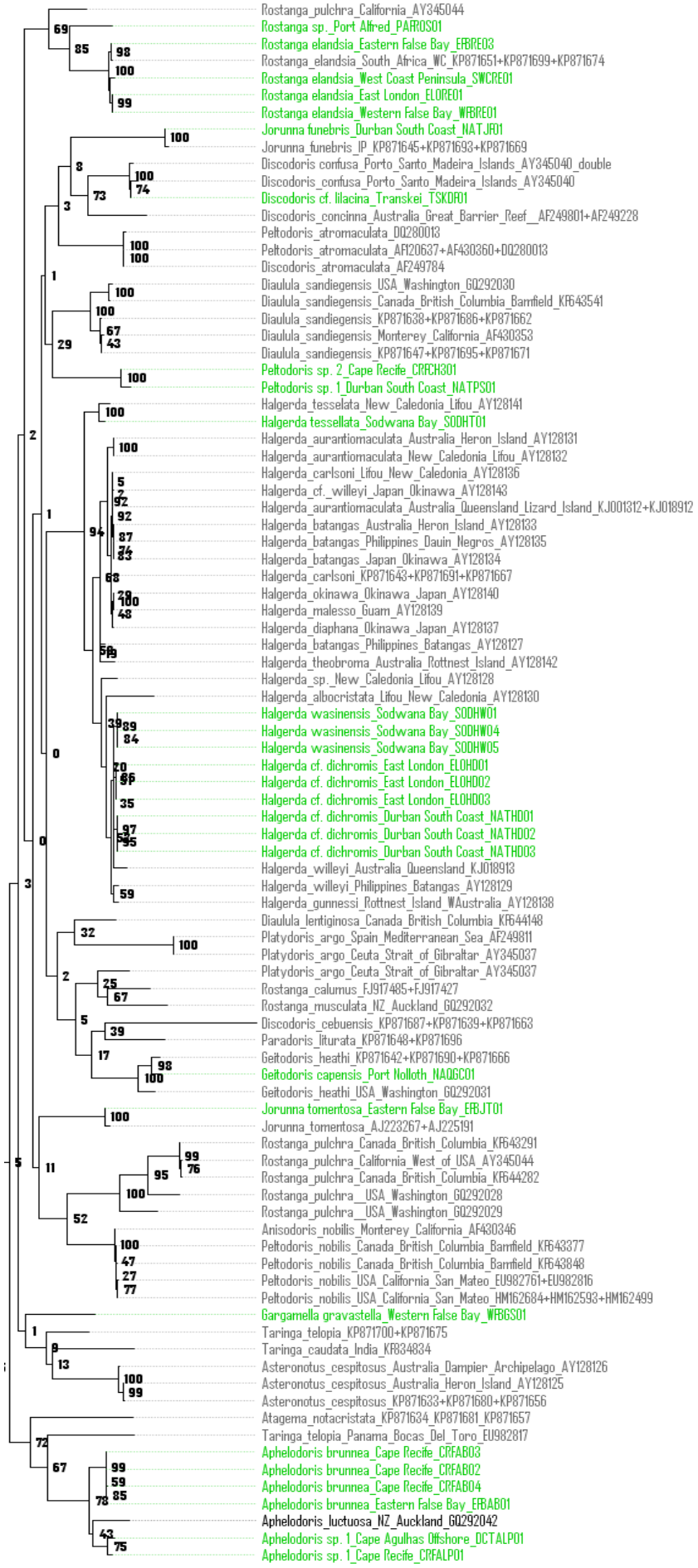
Family Tritoniidae



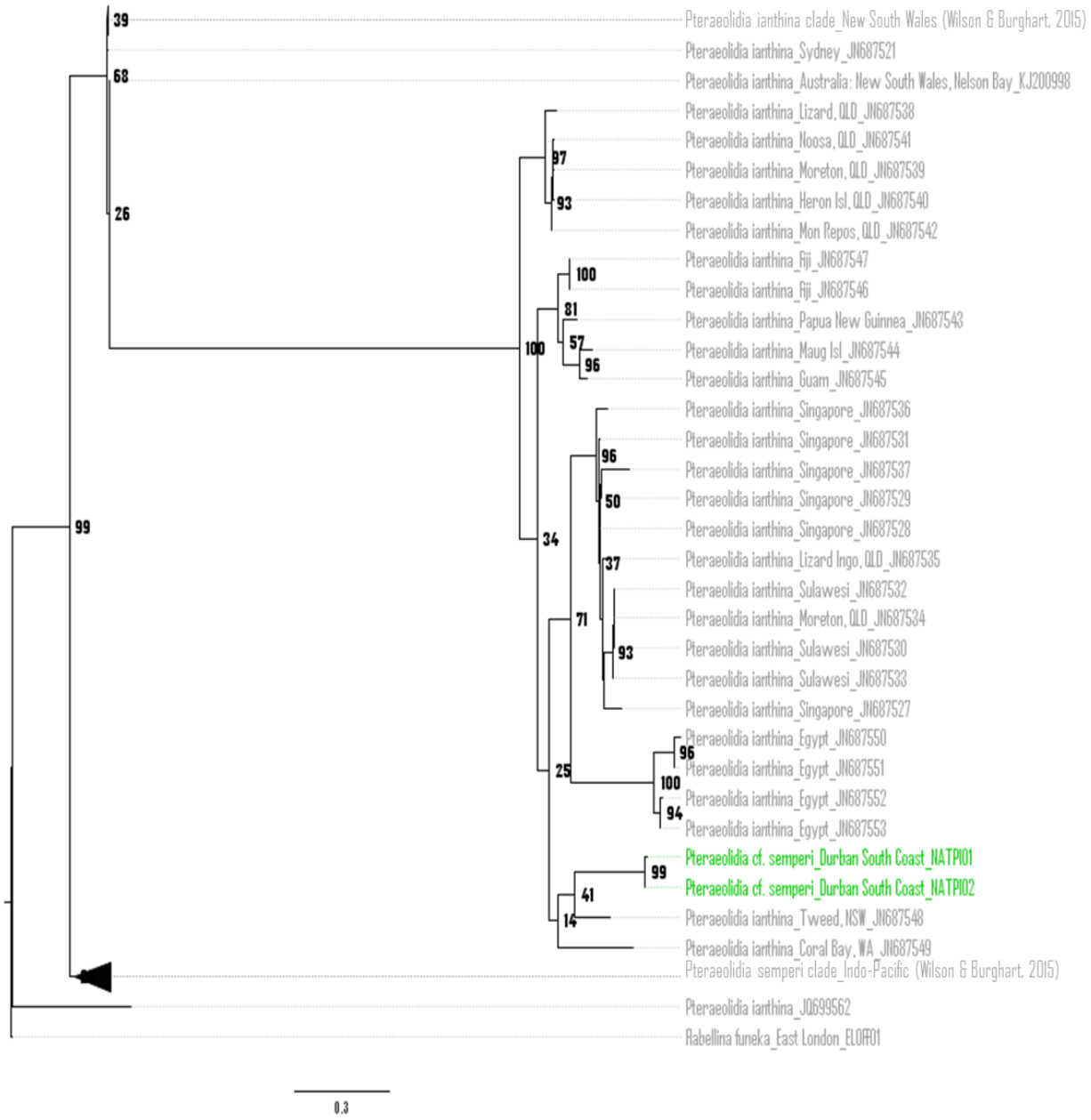
Clade within Facelinidae COI_16S_H3



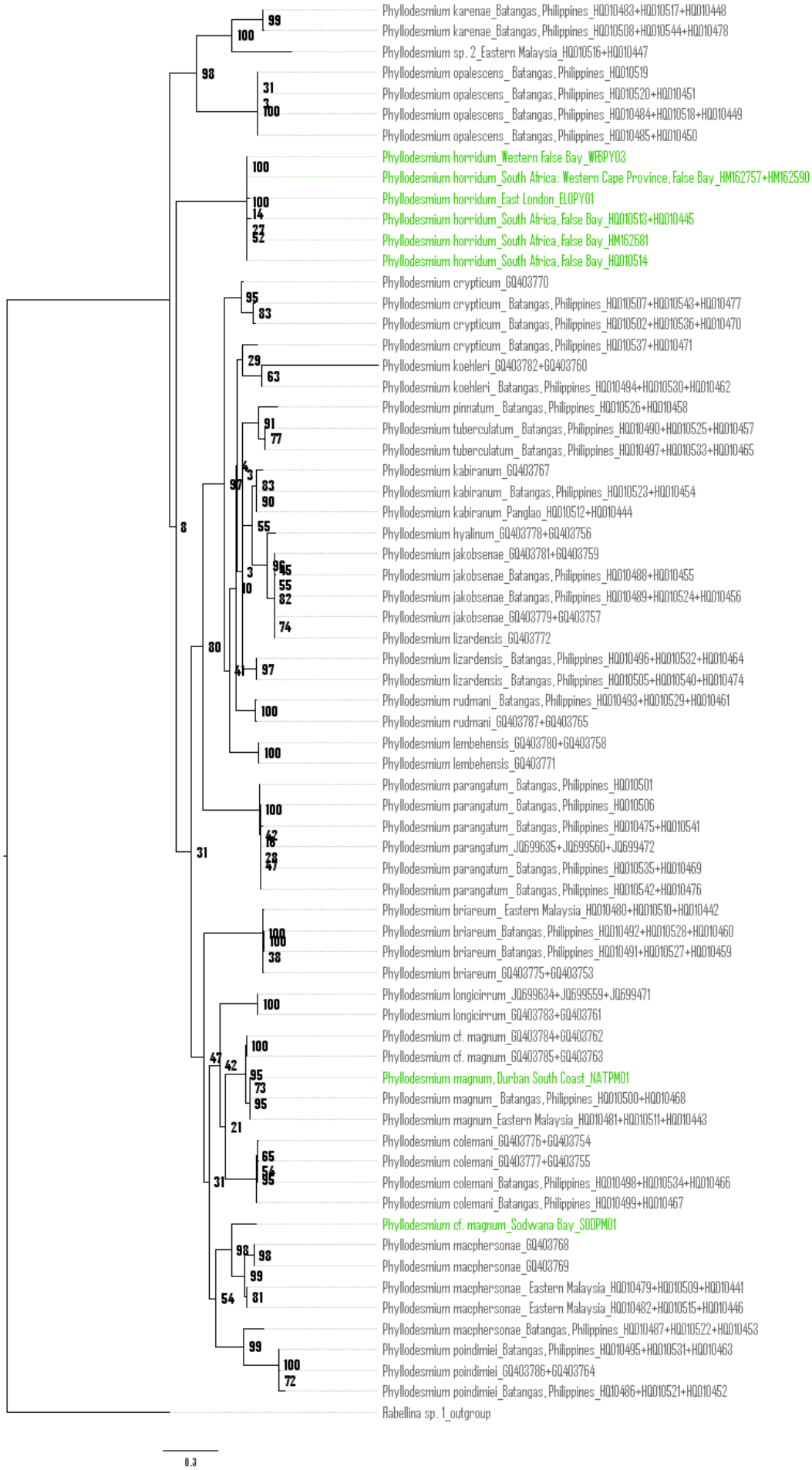
Clade within Family Discodorididae COI_16S_H3



Genus *Pteraeolidia* 16S



Genus *Phyllodesmium* COI_16S_H3



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Appendix 3.5

Properties of datasets and parameters used in BI and ML (Fig. 3.4-3.7)

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Dotidae Dataset	**Number of Taxa**	**Alignment Length (bp)**	**Substitution Saturation** DAMBE	**Best-fit Evolutionary Model (AIC)** MrModeltest	**MrBayes parameters:** Partitioning scheme; # Generations; Sample frequency (Nruns=2; Nchains=4)	**RAxML parameters:** Partititoning scheme; Inference method; # Bootstrap replicates
COI	55	599	Pos 1: $I_{ss}<I_{ss.cSym}$(0,156<0,691) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,098<0,691) *P= 0,0000* Pos 3: $I_{ss}<I_{ss.cSym}$(0,611<0,691) *P= 0,0000*	Pos 1: GTR + I + Γ P_{inv}= *0,6200;* γ= *3.0483* Pos 2: F81 + I P_{inv}= *0,7088; Equal rates* Pos 3: GTR + Γ P_{inv}=*0,0000;* γ= *0.9060*	-	-
16S	54	424	$I_{ss}<I_{ss.cSym}$(0,384<0,694) *P= 0.7902 => SUBSTANTIAL SATURATION*	GTR + I + Γ P_{inv}= *0,1739;* γ= *0,3949*	-	-
H3	52	291	Pos 1: $I_{ss}<I_{ss.cSym}$(0,052<0,8142) *P= 0,0000* Pos 1+2: $I_{ss}<I_{ss.cSym}$(0,033<0,693) *P= 0,0000* Pos 3: $I_{ss}<I_{ss.cSym}$(0,380<0,814) *P= 0,0000*	Pos 1: GTR + Γ P_{inv}= *0,0000;* γ= *0,2673* Pos 2: JC P_{inv}= *0,0000; Equal rates* Pos 3: GTR + I + Γ P_{inv}= *0,1100; y= 3.8727*	-	-
COI + 16S + H3	60	1307	-	-	Partitioned by gene (COI+H3 by codon); Ngen= 50 000 000; Samplefreq= 1000	Partitioned by gene (COI+H3 by codon); GTRGAMMA; Bootstrap replicates (thorough) = 1000

Table 3.2.1: Properties of datasets and parameters used in Bayesian and ML phylogenetic inference. The second and third columns display the alignment properties: number of genetically unique taxa and nucleotide alignment lengths for each dataset. The fourth column shows the results of substitution saturation tests (Xia et al., 2003; Xia & Lemey, 2009) implemented in the programme DAMBE; where $I_{ss}<I_{ss.cSym}$ indicates little saturation and $I_{ss}<I_{ss.cSym}$ indicates substantial saturation. The fifth column displays the best-fit evolutionary models estimated for use in MrBayes, using the Akaike information criterion in MrModeltest (Nylander, 2004), implemented in PAUP*v4.0b10 (Swofford, 2002). The sixth and seventh columns show the parameters used for phylogenetic tree reconstruction in MrBayes v3.2.6 (Huelsenbeck & Ronquist, 2001) and RAxML v8.2.4 (Stamatakis, 2014).

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Dotidae Fionoidea	**Number of Taxa**	**Alignment Length (bp)**	**Substitution Saturation** DAMBE	**Best-fit Evolutionary Model (AIC)** MrModeltest	**MrBayes parameters:** Partitioning scheme; # Generations; Sample frequency (Nruns=2; Nchains=4)	**RAxML parameters:** Partititoning scheme; Inference method; # Bootstrap replicates
COI	107	599	Pos 1: $I_{ss}<I_{ss.cSym}$(0,157<0,691) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,075<0,691) *P= 0,0000* Pos 3: $I_{ss}=I_{ss.cSym}$(0,691=0,691) *P= 0,0000*	Pos 1: GTR + I + Γ P_{inv}= *0.5905; γ= 1.2599* Pos 2: GTR + I + Γ P_{inv}= *0.6323; γ= 0.7488* Pos 3: GTR + I + Γ P_{inv}=*0,0000; γ= 0.8071*	-	-
16S	134	438	$I_{ss}<I_{ss.cSym}$(0,586<0,695) *P= 0.0050*	GTR + I + Γ P_{inv}= *0.2454; γ= 0.5060*	-	-
H3	79	291	Pos 1: $I_{ss}<I_{ss.cSym}$(0,078<0,8140) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,001<0,814) *P= 0,0000* Pos 3: $I_{ss}<I_{ss.cSym}$(0,412<0,814) *P= 0,0000*	Pos 1: GTR + Γ P_{inv}= *0.6708; Equal rates* Pos 2: K80 P_{inv}= *0,0000; Equal rates* Pos 3: GTR + G P_{inv}= *0,0000; y= 1.3408*	-	-
COI + 16S + H3	142	1328	-	-	Partitioned by gene (COI+H3 by codon); Ngen= 150 000 000; Samplefreq= 1000	Partitioned by gene (COI+H3 by codon); GTRMIX; Bootstrap replicates (thorough) = 1000

Table 3.2.2: Properties of datasets and parameters used in Bayesian and ML phylogenetic inference. The second and third columns display the alignment properties: number of genetically unique taxa and nucleotide alignment lengths for each dataset. The fourth column shows the results of substitution saturation tests (Xia et al., 2003; Xia & Lemey, 2009) implemented in the programme DAMBE; where $I_{ss}<I_{ss.cSym}$ indicates little saturation and $I_{ss}<I_{ss.cSym}$ indicates substantial saturation. The fifth column displays the best-fit evolutionary models estimated for use in MrBayes, using the Akaike information criterion in MrModeltest (Nylander, 2004), implemented in PAUP*v4.0b10 (Swofford, 2002). The sixth and seventh columns show the parameters used for phylogenetic tree reconstruction in MrBayes v3.2.6 (Huelsenbeck & Ronquist, 2001) and RAxML v8.2.4 (Stamatakis, 2014).

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Dotidae Miamirinae	**Number of Taxa**	**Alignment Length (bp)**	**Substitution Saturation** DAMBE	**Best-fit Evolutionary Model (AIC)** MrModeltest	**MrBayes parameters:** Partitioning scheme; # Generations; Sample frequency (Nruns=2; Nchains=4)	**RAxML parameters:** Partititoning scheme; Inference method; # Bootstrap replicates
COI	128	593	Pos 1: $I_{ss}<I_{ss.cSym}$(0,142<0,691) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,080<0,691) *P= 0,0000* Pos 3: $I_{ss}<I_{ss.cSym}$(0,685<0,692) *P= 0,0000*	Pos 1: GTR + Γ P_{inv}= *0.0000; γ= 0.0623* Pos 2: F81 + I P_{inv}= *0.0000; Equal rates* Pos 3: GTR + I + Γ P_{inv}= *0,0000; γ= 0.8071*	-	-
16S	147	437	$I_{ss}<I_{ss.cSym}$(0,575<0,695) *P= 0.0006*	GTR + I + Γ P_{inv}= *0.0101; γ= 1.1112*	-	-
COI + 16S	142	1328	-	-	Partitioned by gene (COI by codon); Ngen= 20 000 000; Samplefreq= 1000	Partitioned by gene (COI by codon); GTRMIX; Bootstrap replicates (thorough) = 1000

Table 3.2.3: Properties of datasets and parameters used in Bayesian and ML phylogenetic inference. The second and third columns display the alignment properties: number of genetically unique taxa and nucleotide alignment lengths for each dataset. The fourth column shows the results of substitution saturation tests (Xia et al., 2003; Xia & Lemey, 2009) implemented in the programme DAMBE; where $I_{ss}<I_{ss.cSym}$ indicates little saturation and $I_{ss}<I_{ss.cSym}$ indicates substantial saturation. The fifth column displays the best-fit evolutionary models estimated for use in MrBayes, using the Akaike information criterion in MrModeltest (Nylander, 2004), implemented in PAUP*v4.0b10 (Swofford, 2002). The sixth and seventh columns show the parameters used for phylogenetic tree reconstruction in MrBayes v3.2.6 (Huelsenbeck & Ronquist, 2001) and RAxML v8.2.4 (Stamatakis, 2014).

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Dotidae Polycerinae	**Number of Taxa**	**Alignment Length (bp)**	**Substitution Saturation** DAMBE	**Best-fit Evolutionary Model (AIC)** MrModeltest	**MrBayes parameters:** Partitioning scheme; # Generations; Sample frequency (Nruns=2; Nchains=4)	**RAxML parameters:** Partititoning scheme; Inference method; # Bootstrap replicates
COI	81	599	Pos 1: $I_{ss}<I_{ss.cSym}$(0,183<0,691) *P= 0,0000* Pos 2: $I_{ss}<I_{ss.cSym}$(0,090<0,691) *P= 0,0000* Pos 3: $I_{ss}>I_{ss.cSym}$(0,611<0,691) *P= 0,0000*	Pos 1: GTR + I + Γ P_{inv}*= 0.6154; γ= 2.0710* Pos 2: F81 + I P_{inv}*= 0.7093; Equal rates* Pos 3: GTR + Γ P_{inv}*=0,0000; γ= 0.9364*	-	-
16S	80	416	$I_{ss}<I_{ss.cSym}$(0,681<0,691) *P= 0.0000*	GTR + I + Γ P_{inv}*= 0.3402; γ= 0.6000*	-	-
COI + 16S	90	1015	-	-	Partitioned by gene (COI by codon); Ngen= 20 000 000; Samplefreq= 1000	Partitioned by gene (COI by codon); GTRMIX; Bootstrap replicates (thorough) = 1000

Table 3.2.4: Properties of datasets and parameters used in Bayesian and ML phylogenetic inference. The second and third columns display the alignment properties: number of genetically unique taxa and nucleotide alignment lengths for each dataset. The fourth column shows the results of substitution saturation tests (Xia et al., 2003; Xia & Lemey, 2009) implemented in the programme DAMBE; where $I_{ss}<I_{ss.cSym}$ indicates little saturation and $I_{ss}<I_{ss.cSym}$ indicates substantial saturation. The fifth column displays the best-fit evolutionary models estimated for use in MrBayes, using the Akaike information criterion in MrModeltest (Nylander, 2004), implemented in PAUP*v4.0b10 (Swofford, 2002). The sixth and seventh columns show the parameters used for phylogenetic tree reconstruction in MrBayes v3.2.6 (Huelsenbeck & Ronquist, 2001) and RAxML v8.2.4 (Stamatakis, 2014).

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Appendix 3.6

Input data for Tableau

(sister-species Fig. 3.8)

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	Species		Closest genetic sister relation	y	x	Marine Ecoregions and Provices (as in Spalding et al., 2007)			
		BIOREGION AFFINITY	With (in study)	Latitude	Longitude	Marine Ecoregion	#	Marine Province	Realm
	Leminda millecra	South Western Cape / Agulhas / Natal	*Dirona albolineata* (low ML support) (Pola & Gosliner, 2010)	46,20699	-123,94918	Washington coast and shelf	57	Cold Temperate Northeast Pacific	Temperate Northern Pacific
	Dermatobranchus albineus	South Western Cape / Agulhas	*Armina semperi* (low support) (Pola & Gosliner, 2010)	1,294873	106,961315	Sunda Shelf/Java Sea	117	Sunda Shelf	Central Indo-Pacific
1	*Doto splendidissima*	Agulhas	*Doto* sp. H (Pola & Gosliner 2010, 2015)	17,36056	-101,59241	Mexican Tropical Pacific	166	Tropical East Pacific	Tropical Eastern Pacific
2	*Doto africoronata*	South Western Cape / Agulhas	*D. maculata* (Shipman & Gosliner, 2015)	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
3	*Acanthodoris planca*	South Western Cape / Agulhas	*Acanthodoris falklandica* (Hallas et al. 2016)	-53,12279	-70,57214	Channels and Fjords of Southern Chile	187	Magellanic	Temperate South America
4			Clade with:						
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	36,04317	-2,86202	Alboran Sea	36	Mediterranean Sea	Temperate Northern Atlantic
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	40,69851	4,1523	Western Mediterranean	35	Mediterranean Sea	Temperate Northern Atlantic
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	38,38929	-27,7353	Azores Canaries Madeira	29	Lusitanian	Temperate Northern Atlantic
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	32,32209	-64,75588	Bermuda	62	Tropical Northwestern Atlantic	Tropical Atlantic
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	18,73085	-92,47436	Southern Gulf of Mexico	69	Tropical Northwestern Atlantic	Tropical Atlantic
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	-23,93247	-45,55704	Southeastern Brazil	180	Warm Temperate Southwestern Atlantic	Temperate South America
	Anteaeolidiella saldanhensis	South Western Cape / Agulhas / Natal	*Antaeolidiella lurana* (Carmona et al. 2013)	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
5	*Bonisa nakaza*	South Western Cape / Agulhas / Natal	*Janolus sp. 1, 2 & 7* (Pola & Gosliner, 2010)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
6			Basal to Indo-Pacific clade (Johnson & Gosliner, 2012):						
	Ceratosoma ingozi	South Western Cape / Agulhas	*Ceratosoma cf. tenue*	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
	Ceratosoma ingozi	South Western Cape / Agulhas	*Ceratosoma tenue*	-12,57654	46,11897	Western and Northern Madagascar	100	Western Indian Ocean	Western Indo-Pacific
	Ceratosoma ingozi	South Western Cape / Agulhas	*Ceratosoma cf. tenue*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Ceratosoma ingozi	South Western Cape / Agulhas	*Ceratosoma trilobatum*	6,563592	170,867703	Marshall Islands	153	Marshall, Gilbert, and Ellis Islands	Eastern Indo-Pacific
	Ceratosoma ingozi	South Western Cape / Agulhas	*Ceratosoma gracillimum*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
7	*Godiva quadricolor*	South Western Cape / Agulhas	*Facelina sp. C* (Carmona et al. 2013)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
8	*Janolus capensis & Janolus longidentatus*	Namaqua / South Western Cape / Agulhas	*Janolus barbarensis* (Pola & Gosliner, 2010)	33,98999	-119,27478	Southern California Bight	59	Warm Temperate Northeast Pacific	Temperate Northern Pacific
9	*Mandelia mirocornata*	South Western Cape / Agulhas	*Phyllidia larryi and Phyllidiella pustulosa* (in Mahguib & Valdes, 2015)			No location given; species occurance in NSSI: Phillipines, Gaim & Indo-Pacific			
10	*Thecacera cf. pennigera*	South Western Cape / Agulhas / Natal	*Thecacera pennigera* (Palomar et al. 2014)	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
11	*Marionia sp. (prev: Tritonia sp. 1)*	South Western Cape / Agulhas	*Marionia* sp. 14 (Pola & Gosliner, 2010)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
12	*Bornella valdae*	Natal / Delagoa	*Bornella calcarata* (Pola & Gosliner, 2010)	-20,43198	-40,19643	Eastern Brazil	76	Tropical Southwestern Atlantic	Tropical Atlantic
13	*Melibe rosea*	Namaqua / South Western Cape / Agulhas	*Melibe engeli* (Gosliner & Pola, 2012)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
14	*Notobryon thompsoni*	Namaqua / South Western Cape / Agulhas	*Notobryon wardii* (Pola et al. 2012)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
15			Clade with:						
	Baeloidia cf. moebii	Natal / Delagoa	*Baeolidia moebii*	6,563592	170,867703	Marshall Islands	153	Marshall, Gilbert, and Ellis Islands	Eastern Indo-Pacific
	Baeloidia cf. moebii	Natal / Delagoa	*Baeolidia moebii*	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
	Baeloidia cf. moebii	Natal / Delagoa	*Baeolidia moebii*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
16	*Bulbaeolidia cf. alba*	Natal / Delagoa	*Bulbaeolidia japonica*	39,763271	134,264887	Sea of Japan	49	Cold Temperate Northwest Pacific	Temperate Northern Pacific
17	*Aldisa trimaculata*	South Western Cape	*Aldisa albatrossae*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Ardeadoris symmetrica	Natal / Delagoa	*Ardeadoris tomsmithi* (low support)	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
18			Clade with:						
	Ardeadoris cf. electra	Natal / Delagoa	*Ardeadoris egretta*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Ardeadoris cf. electra	Natal / Delagoa	*Ardeadoris averni*	6,563592	170,867703	Marshall Islands	153	Marshall, Gilbert, and Ellis Islands	Eastern Indo-Pacific
	Ardeadoris cf. electra	Natal / Delagoa	*Ardeadoris angustolutea*	0,44338	119,41631	Sulawesi Sea/Makassar Strait	128	Western Coral Triangle	Central Indo-Pacific
	Ardeadoris cf. electra	Natal / Delagoa	*Ardeadoris egretta*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Ardeadoris cf. electra	Natal / Delagoa	*Ardeadoris scottjohnsoni*	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
	Ardeadoris sp.	Natal / Delagoa	*Ardeadoris pullata* (low support)						
			Clade with						
	Glossodoris sp. 7	Natal / Delagoa	*Glossodoris rufromarginata* (low support)	-35,17972	118,09191	Leeuwin	209	Southwest Australian Shelf	Temperate Australasia
	Glossodoris sp. 7	Natal / Delagoa	*Glossodoris rufromarginata* (low support)	-21,77268	165,234495	New Caledonia;	149	Tropical Southwestern Pacific	Central Indo-Pacific
	Glossodoris sp. 7	Natal / Delagoa	*Glossodoris rufromarginata* (low support)	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
19	*Glossodoris pallida & G. sp. 2 (a)*		*Glossodoris pallida*	-12,57654	46,11897	Western and Northern Madagascar	100	Western Indian Ocean	Western Indo-Pacific
			Clade with all other species of:						
20			*Glossodoris pallida* and *sp. 2 (a)*	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
	Glossodoris sp. 2 (b)	South Western Cape / Agulhas	*Glossodoris pallida* and *sp. 2 (a)*	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Glossodoris sp. 2 (b)	South Western Cape / Agulhas	*Glossodoris pallida*	-12,57654	46,11897	Western and Northern Madagascar	100	Western Indian Ocean	Western Indo-Pacific
	Glossodoris sp. 2 (b)	South Western Cape / Agulhas	*Glossodoris pallida*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Glossodoris sp. 2 (b)	South Western Cape / Agulhas	*Glossodoris pallida*	-20,22413	148,89282	Central and Southern Great Barrier Reef	143	Northeast Australian Shelf	Central Indo-Pacific
21			Clade with:						
	Noumea sp. 10	Delagoa	*Noumea nivalis*	39,763271	134,264887	Sea of Japan	49	Cold Temperate Northwest Pacific	Temperate Northern Pacific
	Noumea sp. 10	Delagoa	*Noumea simplex*	-12,57654	46,11897	Western and Northern Madagascar	100	Western Indian Ocean	Western Indo-Pacific
22			Clade with:						
	Noumea protea	Namaqua / South Western Cape / Agulhas	*Noumea sp. 10*	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
	Noumea protea	Namaqua / South Western Cape / Agulhas	*Noumea nivalis*	39,763271	134,264887	Sea of Japan	49	Cold Temperate Northwest Pacific	Temperate Northern Pacific
	Noumea protea	Namaqua / South Western Cape / Agulhas	*Noumea simplex*	-12,57654	46,11897	Western and Northern Madagascar	100	Western Indian Ocean	Western Indo-Pacific
			Clade with:						
23	*Goniobranchus cf. collingwoodi*	Natal / Delagoa	*Goniobranchus collingwoodi*	-8,98372	116,48348	Lesser Sunda	132	Western Coral Triangle	Central Indo-Pacific
	Goniobranchus cf. collingwoodi	Natal / Delagoa	*Goniobranchus collingwoodi*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
			Clade with:						
24	*G. heatherae (a), (b), (c)*	Namaqua / South Western Cape / Agulhas	*Goniobranchus cf. alderi*	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	G. heatherae (a), (b), (c)	Namaqua / South Western Cape / Agulhas	*Goniobranchus splendida*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	G. heatherae (a), (b), (c)	Namaqua / South Western Cape / Agulhas	*Goniobranchus tinctorius, Goniobranchus cf. alderi*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	G. heatherae (a), (b), (c)	Namaqua / South Western Cape / Agulhas	*Goniobranchus reticulatus*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
			Clade with:						
25	*Goniobranchus cf. alderi*	Natal / Delagoa	*Goniobranchus splendida*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Goniobranchus cf. alderi	Natal / Delagoa	*Goniobranchus tinctorius, Goniobranchus cf. alderi*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Goniobranchus cf. alderi	Natal / Delagoa	*Goniobranchus reticulatus*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
			Clade with:						
26	*Goniobranchus sp. 19*	Natal / Delagoa	*Goniobranchus cavae*	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Goniobranchus sp. 19	Natal / Delagoa	*Goniobranchus leopardus*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
27	*Goniobranchus cavae*	Natal / Delagoa	*Goniobranchus leopardus*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Goniobranchus conchyliatus	Natal / Delagoa	*Goniobranchus conchyliatus* (low support)	7,105362	77,878481	South India and Sri Lanka	104	West and South Indian Shelf	Western Indo-Pacific
			Clade with:						
28	*Chromodoris hamiltoni*	Natal / Delagoa	*Chromodoris africana*	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Chromodoris hamiltoni	Natal / Delagoa	*Chromodoris africana*	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
			Clade with:						
	Chromodoris sp.	Natal	*Chromodoris africana* (low support)	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Chromodoris sp.	Natal	*Chromodoris hamiltoni* (low support)	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
29	*Corambe sp.*	Agulhas	*Corambe steinberge*	37,75086	-122,55593	Northern California	58	Cold Temperate Northeast Pacific	Temperate Northern Pacific
30	*Trapania cirrita*	Agulhas	*Trapania hispalensis* (only other sequenced Trapania)	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
			Clade with:						

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31	*Ancula sp.*	South Western Cape / Agulhas	*Ancula gibbosa* (only other sequence of Ancula)	44,14391	-68,52664	Gulf of Maine/Bay of Fundy	40	Cold Temperate Northwest Atlantic	Temperate Northern Atlantic
	Ancula sp.	South Western Cape / Agulhas	*Ancula gibbosa* (only other sequence of Ancula)	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
			Clade with:						
	Okenia amoenula	South Western Cape / Agulhas	*Goniodoris nodosa* (low support)	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Okenia amoenula	South Western Cape / Agulhas	*Goniodoris nodosa* (low support)	54,84588	-5,55321	North Sea	25	Northern European Seas	Temperate Northern Atlantic
			Clade with:						
	Dendrodoris krusensternii (a)	Natal / Delagoa	*Dendrodoris denisoni* (low support)	-36,34152	174,26754	Central New Zealand	199	Southern New Zealand	Temperate Australasia
	Dendrodoris krusensternii (a)	Natal / Delagoa	*Dendrodoris denisoni* (low support)	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
			Clade with:						
32	*Dendrodoris krusensternii (b)*	Delagoa	*Dendrodoris denisoni*	-21,77268	165,234495	New Caledonia	149	Tropical Southwestern Pacific	Central Indo-Pacific
	Dendrodoris krusensternii (b)	Delagoa	*Dendrodoris denisoni*	-21,77268	165,234495	New Caledonia	149	Tropical Southwestern Pacific	Central Indo-Pacific
33	*Dendrodoris caesia & Dendrodoris sp.*	Agulhas / Natal / Delagoa	*Dendrodoris arborescens*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
34	*Dendrodoris carbunculosa*	Delagoa	*Dendrodoris tuberculosa*	-11,408316	143,699177	Torres Strait Northern Great Torres Strait Northern Great	142	Northeast Australian Shelf	Central Indo-Pacific
			Clade with:						
35	*Dendrodoris cf. tuberculosa*	Natal	*Dendrodoris carbunculosa*	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
	Dendrodoris cf. tuberculosa	Natal	*Dendrodoris tuberculosa*	-11,408316	143,699177	Torres Strait Northern Great Torres Strait Northern Great	142	Northeast Australian Shelf	Central Indo-Pacific
			Clade with:						
	Doriopsilla areolata/ miniata	South Western Cape / Agulhas	*Doriopsilla areolata* and *Doriopsilla pelseneeri*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Doriopsilla areolata/ miniata	South Western Cape / Agulhas	*Doriopsilla areolata* and *Doriopsilla pelseneeri*	15,81168	-23,02508	Cape Verde	79	West African Transition	Tropical Atlantic
	Doriopsilla areolata/ miniata	South Western Cape / Agulhas	*Doriopsilla areolata* and *Doriopsilla pelseneeri*	-8,85398	13,13641	Angolan	86	Gulf of Guinea	Tropical Atlantic
	Doriopsilla areolata/ miniata	South Western Cape / Agulhas	*Doriopsilla areolata* and *Doriopsilla pelseneeri*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
			Clade with:	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
	Doriopsilla sp. 1	Natal / Delagoa	*Doriopsilla areolata/ miniata*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
	Doriopsilla sp. 1	Natal / Delagoa	*Doriopsilla areolata*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Doriopsilla sp. 1	Natal / Delagoa	*Doriopsilla areolata*	15,81168	-23,02508	Cape Verde	79	West African Transition	Tropical Atlantic
	Doriopsilla sp. 1	Natal / Delagoa	*Doriopsilla areolata*	-8,85398	13,13641	Angolan	86	Gulf of Guinea	Tropical Atlantic
	Doriopsilla sp. 1	Natal / Delagoa	*Doriopsilla pelseneeri*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
36	*Doriopsilla capensis*	South Western Cape / Agulhas	*Doriopsilla spaldingi*	33,98999	-119,27478	Southern California Bight	59	Warm Temperate Northeast Pacific	Temperate Northern Pacific
			Clade with:						
37	*Flabellina funeka*	South Western Cape / Agulhas	*Flabellina ischitana*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Flabellina funeka	South Western Cape / Agulhas	*Flabellina ischitana*	32,59864	-9,35884	Saharan Upwelling	28	Lusitanian	Temperate Northern Atlantic
	Flabellina funeka	South Western Cape / Agulhas	*Flabellina ischitana*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
			Clade with:						
	Flabellina sp. 1	Namaqua / South Western Cape	*Flabellina rubrolineata* (low support)	-27,64938	32,86041	Delagoa	102	Western Indian Ocean	Western Indo-Pacific
	Flabellina sp. 1	Namaqua / South Western Cape	*Flabellina rubrolineata* (low support)	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
			Clade with:						
	Flabellina capensis	South Western Cape / Agulhas	*Flabellina trilineata* (low support)	46,20699	-123,94918	Oregon, Washington, Vancouver Oregon, Washington, Vancouver	57	Arctic	Arctic
	Flabellina capensis	South Western Cape / Agulhas	*Flabellina verrucosa* (low support)	58,81399	-93,7875	Hudson Complex	8	Cold Temperate Northwest Atlantic	Temperate Northern Atlantic
	Flabellina capensis	South Western Cape / Agulhas	*Flabellina albomaculata* (low support)	15,81168	-23,02508	Cape Verde	79	West African Transition	Tropical Atlantic
38	*Piseinotecus sp.*	Agulhas	*Piseinotecus sp.*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
39	*Tambja cf. kava*	Natal	*Tambja amakusana*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
40	*Phyllidiopsis krempfi*	Delagoa	*Phyllidiopsis krempfi*	-1,212914	135,495951	Papua	130	Western Coral Triangle	Central Indo-Pacific
41	*Phyllidia marindica*	Natal	*Phyllidia picta*	-1,212914	135,495951	Papua	130	Western Coral Triangle	Central Indo-Pacific
42	*Phyllidiella zeylanica*	Natal / Delagoa	*Phyllidiella pustulosa*	-1,212914	135,495951	Papua	130	Western Coral Triangle	Central Indo-Pacific
43	*Phyllidia ocellata (a)*	Delagoa	*Phyllidia ocellata*	-1,212914	135,495951	Papua	130	Western Coral Triangle	Central Indo-Pacific
			Two clades of:						
44	*Phyllidia varicosa*	Natal / Delagoa	*Phyllidia varicosa*	1,294873	106,961315	Sunda Shelf/Java Sea	117	Sunda Shelf	Central Indo-Pacific
	Phyllidia varicosa	Natal / Delagoa	*Phyllidia varicosa*	-11,408316	143,699177	Torres Strait Northern Great Torres Strait Northern Great	142	Northeast Australian Shelf	Central Indo-Pacific
			Clade with:						
45	*Limacia sp. 2*	Agulhas	*Limacia sp. 1*	-30,811511	17,220396	Namaqua		Benguela	Temperate Southern Africa
	Limacia sp. 2	Agulhas	*Limacia sp. 1*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
	Limacia sp. 2	Agulhas	*Limacia clavigera*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Limacia sp. 2	Agulhas	*Limacia clavigera*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
46	*Limacia sp. 1*	Namaqua / South Western Cape / Agulhas	*Limacia clavigera*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
47	*Kaloplocamus cf. ramosus*	Agulhas	*Kaloplocamus ramosus*	38,38929	-27,7353	Azores Canaries Madeira	29	Lusitanian	Temperate Northern Atlantic
			Clade with:						
48	*Marionia cf. arborescens*	Natal	*Marionia arborescens; Marionia sp. ; Marionia sp. 6 and Tritonia sp. 3*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
			Clade with:						
49	*Marionia sp.*	South Western Cape / Agulhas	*Marionia* sp. 14, *Tritoniidae* sp. and *Tritonia* sp.	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
50	*Tritonia nilsodhneri*	South Western Cape / Agulhas	*Tritonia plebeia*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
			Clade with:						
51	*Amanda armata*	Agulhas	*Cratena, Sakuraeolis, Facelina*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Amanda armata	Agulhas	*Cratena, Sakuraeolis, Facelina*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Amanda armata	Agulhas	*Cratena, Sakuraeolis, Facelina*	-20,43198	-40,19643	Eastern Brazil	76	Tropical Southwestern Atlantic	Tropical Atlantic
52	*Cratena capensis*	South Western Cape / Agulhas	*Cratena sp. 4*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
53	*Cratena capensis (a)*	South Western Cape	*Cratena capensis (b)*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
			Clade with:						
54	*Cratena capensis & Cratena sp. 4*	South Western Cape / Agulhas	*Cratena sp. 1*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
	Cratena capensis & Cratena sp. 4	South Western Cape / Agulhas	*Cratena peregrina*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Cratena capensis & Cratena sp. 4	South Western Cape / Agulhas	*Cratena peregrina*	40,69851	4,1523	Western Mediterranean	35	Mediterranean Sea	Temperate Northern Atlantic
	Cratena capensis & Cratena sp. 4	South Western Cape / Agulhas	*Cratena peregrina*	43,31749	14,95466	Adriatic Sea	30	Mediterranean Sea	Temperate Northern Atlantic
	Cratena capensis & Cratena sp. 4	South Western Cape / Agulhas	*Cratena peregrina*	16,45294	-18,28034	Sahelian Upwelling	80	West African Transition	Tropical Atlantic
			Clade with:						
55	*Cratena sp. 1*	Agulhas	*Cratena peregrina*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Cratena sp. 1	Agulhas	*Cratena peregrina*	40,69851	4,1523	Western Mediterranean	35	Mediterranean Sea	Temperate Northern Atlantic
	Cratena sp. 1	Agulhas	*Cratena peregrina*	43,31749	14,95466	Adriatic Sea	30	Mediterranean Sea	Temperate Northern Atlantic
	Cratena sp. 1	Agulhas	*Cratena peregrina*	16,45294	-18,28034	Sahelian Upwelling	80	West African Transition	Tropical Atlantic
56	*Facelina olivacea*	Namaqua / South Western Cape / Agulhas	*Facelina bostoniensis*	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
57	*Caloria cf. indica*	Delagoa	*Phidiana militaris*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
58	*Caloria sp. 1*	South Western Cape	*Caloria elegans*	40,69851	4,1523	Western Mediterranean	35	Mediterranean Sea	Temperate Northern Atlantic
59	*Rostanga elandsia & Rostanga sp.*	South Western Cape / Agulhas	*Rostanga pulchra*	37,75086	-122,55593	Northern California	58	Cold Temperate Northeast Pacific	Temperate Northern Pacific
60	*Discodoris lilacina*	Natal	*Discodoris confusa*	38,38929	-27,7353	Azores Canaries Madeira	29	Lusitanian	Temperate Northern Atlantic
	Peltodoris sp. 1 & P. sp. 2	Agulhas / Natal	*Diaulula sandiegensis* (low support)	46,20699	-123,94918	Oregon, Washington, Vancouver Oregon, Washington, Vancouver	57	Cold Temperate Northeast Pacific	Temperate Northern Pacific
61	*Halgerda cf. tessellata*	Delagoa	*Halgerda tessellata*			No location			
			Clade with:						
	Halgerda wasinensis & H. dichromis (a) &(b)	Agulhas / Natal / Delagoa	*Halgerda willeyi* (low support)	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Halgerda wasinensis & H. dichromis (a) &(b)	Agulhas / Natal / Delagoa	*Halgerda willeyi* (low support)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
62	*Geitodoris capensis*	Namaqua	*Geitodoris heathi*	46,20699	-123,94918	Oregon, Washington, Vancouver Oregon, Washington, Vancouver	57	Cold Temperate Northeast Pacific	Temperate Northern Pacific
63	*Jorunna tomentosa*	Agulhas	*Jorunna tomentosa*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
64	*Aphelodoris sp. 1*	South Western Cape / Agulhas	*Aphelodoris luctuosa*	-36,34152	174,26754	Central New Zealand	199	Southern New Zealand	Temperate Australasia

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			Clade with:					Agulhas	Temperate Southern Africa
65	*Aphelodoris brunnea*	Agulhas	*Aphelodoris* sp. 1	-34,176805	22,837321	Agulhas			
	Aphelodoris brunnea	Agulhas	*Aphelodoris luctuosa*	-36,34152	174,26754	Central New Zealand	199	Southern New Zealand	Temperate Australasia
			Clade with:						
66	*Armina gilchristi*	South Western Cape / Agulhas	*Armina maculata*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Armina gilchristi	South Western Cape / Agulhas	*Armina lovenii*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Armina gilchristi	South Western Cape / Agulhas	*Armina lovenii*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
67	*Dermatobranchus albineus*	South Western Cape / Agulhas	*Dermatobranchus arminus*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
			Clade with						
	Dermatobranchus rodmani & D. gonatophorus	Natal	*Dermatobranchus* sp. 7 (low support)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Dermatobranchus rodmani & D. gonatophorus	Natal	*Dermatobranchus* sp. 12 (low support)	1,294873	106,961315	Sunda Shelf/Java Sea	117	Sunda Shelf	Central Indo-Pacific
	Dermatobranchus sp.	Delagoa	*Dermatobranchus caesitius* (low support)	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Dermatobranchus sp. & D. caesitius	Natal / Delagoa	*Dermatobranchus* sp. 17 (low support)	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
			Clade with:						
68	*Doto cf. pinnatifida*	Namaqua / South Western Cape	*Doto koenneckeri*	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
	Doto cf. pinnatifida	Namaqua / South Western Cape	*Doto koenneckeri*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
	Doto cf. pinnatifida	Namaqua / South Western Cape	*Doto sp. B*	38,38929	-27,7353	Azores Canaries Madeira	29	Lusitanian	Temperate Northern Atlantic
	Doto cf. pinnatifida	Namaqua / South Western Cape	*Doto lemchei*	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
	Doto cf. pinnatifida	Namaqua / South Western Cape	*Doto floridicola*	36,04317	-2,86202	Alboran Sea	36	Mediterranean Sea	Temperate Northern Atlantic
			Clade with:						
69	*Doto cf. pinnatifida*	Namaqua / South Western Cape	*Doto maculata*	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
	Doto cf. pinnatifida	Namaqua / South Western Cape	*Doto africoronata*	-33,598096	17,977301	South Western Cape		Benguela	Temperate Southern Africa
			Clade with:						
70	*Phestilla sp.*	South Western Cape	*Phestilla* spp.	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
	Phestilla sp.	South Western Cape	*Phestilla* spp.	134,67074	7,62234	West Caroline Islands	125	tropical northwestern Pacific	Central indo-Pacific
	Phestilla sp.	South Western Cape	*Phestilla* spp.	16,86601	145,74141	Mariana Islands	123	Tropical Northwestern Pacific	Central indo-Pacific
	Phestilla sp.	South Western Cape	*Phestilla* spp.	-150,53824	-17,15423	Society Islands	161	Southeast Polynesia	Eastern Indo-Pacific
71	*Cuthona sibogae*	Natal / Delagoa	*Cuthona sibogae*	-11,408316	143,699177	Torres Strait Northern Great Torres Strait Northern Great	142	Northeast Australian Shelf	Central Indo-Pacific
72	*Catriona casha*	Agulhas	*Catriona columbiana*	48,63891	-62,11503	Gulf of St. Lawrence–Eastern Scotian Shelf	37	Cold Temperate Northwest Atlantic	Temperate Northern Atlantic
	Cuthona speciosa (a-f)	Namaqua / South Western Cape / Agulhas	*Cuthona caerulae* (low support)	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Tergipes sp. 1	South Western Cape / Agulhas	*Tergipes sp. 2* (low support)	-34,176805	22,837321	South Western Cape		Benguela	Temperate Southern Africa
			Clade with:						
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	54,84588	-5,55321	Celtic Seas	26	Northern European Seas	Temperate Northern Atlantic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	44,14391	-68,52664	Gulf of Maine/Bay of Fundy	40	Cold Temperate Northwest Atlantic	Temperate Northern Atlantic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	73,65831	41,74732	North and East Barents Sea	18	Arctic	Arctic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	40,69851	4,1523	Western Mediterranean	35	Mediterranean Sea	Temperate Northern Atlantic
	Tergipes sp. 1 & sp. 2	South Western Cape / Agulhas	*Tergipes tergipes* (low support)	44,14391	-68,52664	Gulf of Maine/Bay of Fundy	40	Cold Temperate Northwest Atlantic	Temperate Northern Atlantic
	Eubranchus sp. 1	Agulhas	*Eubranchus ferrani* (low support)	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
			Clade with:						
73	*Eubranchus sp. 6*	South Western Cape	*Eubranchus rupium*	49,10507	-123,42511	Puget Trough/Georgia Basin	56	Cold Temperate Northeast Pacific	Temperate Northern Pacific
	Eubranchus sp. 6	South Western Cape	*Eubranchus rustyus*	49,10507	-123,42511	Puget Trough/Georgia Basin	56	Cold Temperate Northeast Pacific	Temperate Northern Pacific
	Eubranchus sp. 6	South Western Cape	*Eubranchus exiguus*	49,10507	-123,42511	Puget Trough/Georgia Basin	56	Cold Temperate Northeast Pacific	Temperate Northern Pacific
	Eubranchus sp. 6	South Western Cape	*Eubranchus exiguus*	53,54185	5,36804	North Sea	25	Northern European Seas	Temperate Northern Atlantic
	Eubranchus sp. 7	Namaqua	*Eubranchus rustyus* (low support)	46,20699	-123,94918	Washington coast and shelf	57	Cold Temperate Northeast Pacific	Temperate Northern Pacific
			Clade with						
74	*Hypselodoris capensis*	South Western Cape / Agulhas / Natal	*Hypselodoris carnea*	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa
	Hypselodoris capensis	South Western Cape / Agulhas / Natal	*Hypselodoris bollandi*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
75	*Hypselodoris carnea*	Natal	*Hypselodoris bollandi*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Hypselodoris carnea	Natal	*Hypselodoris bollandi*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
76	*Hypselodoris rudmani*	Natal / Delagoa	*Hypselodoris bertschi*	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
77	*Hypselodoris pulchella*	Natal / Delagoa	*Hypselodoris imperialis*	7,105362	77,878481	South India and Sri Lanka	104	West and South Indian Shelf	Western Indo-Pacific
	Hypselodoris pulchella	Natal / Delagoa	*Hypselodoris imperialis*	20,104241	-157,719049	Hawaii	152	Hawaii	Eastern Indo-Pacific
			Clade with:						
78	*Hypselodoris cf. bullocki*	Natal / Delagoa	*Hypselodoris bullocki*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
	Hypselodoris cf. bullocki	Natal / Delagoa	*Hypselodoris bullocki*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Hypselodoris cf. bullocki	Natal / Delagoa	*Hypselodoris apolegma*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
	Hypselodoris cf. bullocki	Natal / Delagoa	*Hypselodoris apolegma*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
			Clade with:						
79	*Hypselodoris cf. regina*	Natal / Delagoa	*Hypselodoris jacksoni*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Hypselodoris cf. regina	Natal / Delagoa	*Hypselodoris krakatoa*	27,34454	123,30934	East China Sea	52	warm Temperate Northwest Pacific	Temperate Northern Pacific
	Hypselodoris cf. regina	Natal / Delagoa	*Hypselodoris krakatoa*	1,294873	106,961315	Sunda Shelf/Java Sea	117	Sunda Shelf	Central Indo-Pacific
	Hypselodoris cf. regina	Natal / Delagoa	*Hypselodoris reidi*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
80	*Ceratosoma cf. tenue*	Durban / Sodwana	*Ceratosoma tenue*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
81	*Polycera capensis & Polycera sp. 2*	Namaqua / South Western Cape / Agulhas	*Polycera autantiomarginata*	32,59864	-9,35884	Saharan Upwelling	28	Lusitanian	Temperate Northern Atlantic
	Polycera capensis & Polycera sp. 2	Namaqua / South Western Cape / Agulhas	*Polycera autantiomarginata*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
82	*Polycera sp. 1 & sp. 3*	Agulhas	*Polycera faeroensis*	43,68415	-1,72157	South European Atlantic Shelf	27	Lusitanian	Temperate Northern Atlantic
			Clade with:						
83	*Lecithophorus capensis (a&b)*	South Western Cape / Agulhas	*Gymnodoris brunnea*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Lecithophorus capensis (a&b)	South Western Cape / Agulhas	*Gymnodoris pseudobrunnea*	11,21789	126,31897	Eastern Philippines	127	Western Coral Triangle	Central Indo-Pacific
	Lecithophorus capensis (a&b)	South Western Cape / Agulhas	*Gymnodoris alba*	-32,44941	152,69624	Manning-Hawkesbury	203	East Central Australian Shelf	Temperate Australasia
	Lecithophorus capensis (a&b)	South Western Cape / Agulhas	*Gymnodoris inornata*	7,62234	134,67074	West Caroline Islands	125	tropical northwestern Pacific	Central indo-Pacific
	Lecithophorus capensis (a&b)	South Western Cape / Agulhas	*Gymnodoris striata*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
			Clade with:						
84	*Pteraeolidia* cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
	Pteraeolidia cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	-22,53335	113,43272	Ningaloo	145	Northwest Australian Shelf	Central indo-Pacific
	Pteraeolidia cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	22,29947	37,72428	Northern and Central Red Sea	87	Red Sea and Gulf of Aden	Western Indo-Pacific
	Pteraeolidia cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	1,38066	102,95973	Malacca Strait	118	sunda shelf	Central indo-Pacific
	Pteraeolidia cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	0,44338	119,41631	Sulawesi Sea/Makassar Strait	128	Western Coral Triangle	Central Indo-Pacific
	Pteraeolidia cf. *semperi*	Natal / Delagoa	*Pteraeolidia ianthina*	-27,3895	153,3075	Tweed-Moreton	202	East Central Australian Shelf	Temperate Australasia
85	*Phyllodesmium* cf. *magnum*	Natal	*Phyllodesmium macphersonae*	1,294873	106,961315	Sunda Shelf/Java Sea	117	Sunda Shelf	Central Indo-Pacific
86	*Aldisa trimaculata*	South Western Cape / Agulhas	*Aldisa albatrossae*	25,74971	127,29483	South Kuroshio	121	South Kuroshio	Central Indo-Pacific
87	*Cadlina sp. 2*	South Western Cape / Agulhas	*Cadlina sp. 1*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
			Clade with:						
88	*G. heatherae (b), (c)*	South Western Cape / Agulhas	*Goniobranchus heatherae (a)*	-33,598096	17,977301	South Western Cape		Benguela	Temperate Southern Africa
	G. heatherae (b), (c)	South Western Cape / Agulhas	*Goniobranchus heatherae (a)*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
89	*Rostanga elandsia*	South Western Cape / Agulhas	*Rostanga sp.*	-30,31832	31,022512	Transkei (natal)		Agulhas	Temperate Southern Africa
			Clade with:						
90	*Cuthona speciosa (a)*	Namaqua / South Western Cape / Agulhas	*Cuthona speciosa (b)*	-30,811511	17,220396	Namaqua		Benguela	Temperate Southern Africa

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	Cuthona speciosa (a)	Namaqua / South Western Cape / Agulhas	*Cuthona speciosa (b)*	-33,598096	17,977301	South Western Cape		Benguela	Temperate Southern Africa
	Cuthona speciosa (a)	Namaqua / South Western Cape / Agulhas	*Cuthona speciosa (b)*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
91	*Cuthona speciosa (a) & (b)*	Namaqua / South Western Cape / Agulhas	*Cuthona speciosa (c)*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
92	*Cuthona speciosa (a) & (b) & (c) & (f)*	Namaqua / South Western Cape / Agulhas	*Cuthona speciosa (d) & (e)*	-34,176805	22,837321	Agulhas (Cape Recife - East London)		Agulhas	Temperate Southern Africa
93	*Polycera capensis*	South Western Cape / Agulhas	*Polycera sp. 2*	-30,811511	17,220396	Namaqua / South Western Cape		Benguela	Temperate Southern Africa
94	*Polycera sp. 1*	Agulhas	*Polycera sp. 3*	-34,176805	22,837321	Agulhas		Agulhas	Temperate Southern Africa
95	*Lecithophorus capensis (a)*	South Western Cape / Agulhas	*Lecithophorus capensis (b)*	-34,176805	22,837321	South Western Cape		Benguela	Temperate Southern Africa
			Clade with:						
96	*Halgerda wasinensis*	Delagoa	*Halgerda dichromis* (a) and (b)	-34,01716	25,71978	Agulhas Bank	192	Agulhas	Temperate Southern Africa
	Halgerda wasinensis	Delagoa	*Halgerda dichromis* (a) and (b)	-30,17106	30,96358	Natal	193	Agulhas	Temperate Southern Africa

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Appendix 3.7

List of sequences (with accession numbers) of taxa included in the phylogenetic analyses of Fig. 3.4-3.7

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Superfamily Fionoidea	**COI**	**16S**	**H3**
Cuthona abronia	JQ699568	JQ699478	JQ699390
Cuthona caerulea	AF249807	-	-
Cuthona cocoachroma	GQ292071	-	-
Cuthona columbiana	KF643448	-	-
Cuthona concinna	GQ292072	-	-
Cuthona divae	JQ699569	JQ699479	JQ699391
Cuthona fulgens	-	JQ699480	JQ699392
Cuthona lagunae	-	JQ699481	JQ699393
Cuthona ocellata	AY345043	-	-
Cuthona sibogae	-	GU550049	-
Cuthona sibogae	-	GU550050	-
Cuthona sp. 1	GQ292068	-	-
Cuthona sp. 2	GQ292078	-	-
Cuthona sp. 3	GQ292066	-	-
Cuthona sp. 4	GQ292069	-	-
Cuthona sp. 5	GQ292067	-	-
Cuthona sp. 6	GQ292070	-	-
Cuthona sp. 7	GQ292074	-	-
Cuthona sp. 8	GQ292073	-	-
Cuthona sp. 9	GQ292075	-	-
Cuthona sp. 9	GQ292076	-	-
Cuthona sp. 9	GQ292077	-	-
Cuthona sp. 35	JQ997026	JQ996820	JQ996921
Cuthona sp.	JQ997019	JQ996814	JQ996913
Cuthona sp.	KJ522457	-	-
Calma glaucoides	JQ699567	JQ699477	JQ699388
Calma glaucoides	HG810893	HG810887	-
Calma glaucoides	HG810894	HG810888	-
Calma gobioophaga	HG810897	HG810891	-
Calma gobioophaga	HG810898	HG810892	-
Calma gobioophaga	HG810895	HG810889	-
Calma gobioophaga	HG810896	HG810890	-
Catriona sp.	JQ997021	JQ996816	JQ996915
Catriona sp.	JQ997024	JQ996819	JQ996918
Catriona sp.	-	-	JQ996919
Eubranchus exiguus	AF249792	AF249246	-
Eubranchus farrani	-	AJ223396	-
Eubranchus pallidus	KR084393	-	-
Eubranchus rupium	KF643670	-	-
Eubranchus rupium	KF643260	-	-
Eubranchus rupium	KF644151	-	-
Eubranchus rupium	KF643338	-	-
Eubranchus rupium	KF643737	-	-
Eubranchus rustyus	GQ292065	-	-
Eubranchus rustyus	KP871641	KP871689	KP871665
Eubranchus sanjuanensis	GQ292079	-	-
Eubranchus sp.	AF249791	-	-
Eubranchus sp.	AY345046	-	-
Eubranchus tricolor	KR084872	-	-
Eubranchus tricolor	KR084833	-	-
Fiona pinnata	JX087558	JX087492	JX087628
Phestilla lugubris	DQ417298	DQ417252	-
Phestilla lugubris	DQ417299	DQ417253	-
Phestilla lugubris	DQ417300	DQ417254	-
Phestilla lugubris	KJ522463	-	-
Phestilla melanobrachia	DQ417277	DQ417231	-
Phestilla melanobrachia	DQ417278	DQ417232	-
Phestilla melanobrachia	DQ417279	DQ417233	-
Phestilla melanobrachia	DQ417274	DQ417228	-
Phestilla melanobrachia	DQ417275	DQ417229	-
Phestilla melanobrachia	DQ417276	DQ417229	-
Phestilla melanobrachia	DQ417280	DQ417230	-
Phestilla melanobrachia	DQ417281	DQ417234	-
Phestilla melanobrachia	DQ417282	DQ417235	-
Phestilla minor	DQ417304	DQ417236	-
Phestilla minor	DQ417305	DQ417256	-

Subfamily Miamirinae	**COI**	**16S**
Ceratosoma amoenum	EU982729	EU982780
Ceratosoma cf. tenue	JQ727824	JQ727697
Ceratosoma gracillimum	JQ727822	JQ727691
Ceratosoma ingozi	-	JQ727692
Ceratosoma ingozi	JQ727823	JQ727693
Miamira magnifica	EU982731	EU982781
Miamira miamirana	EU982732	EU982782
Miamira sinuata	EU982733	EU982783
Ceratosoma sp. 2	JQ727825	JQ727698
Ceratosoma tenue	KJ001300	JQ727696
Ceratosoma trilobatum	EU982730	EU982784
Ceratosoma trilobatum	EF535142	EF534070
Felimare agassizii	JQ727883	JQ727764
Felimare tricolor	LN715210	LN715194
Felimare tricolor	LN715214	LN715198
Felimare tricolor	LN715215	-
Felimare villafranca	KJ911288	KJ911268
Hypselodoris bilineata	EF535125	EF534052
Hypselodoris californiensis	EU982744	EU982796
Hypselodoris elegans	AF249787	AF249238
Hypselodoris picta	HM162685	HM162594
Mexichromis kempfi	EF535121	EF534047
Mexichromis porterae	EF535139	EF534067
Miamira alleni	-	JQ727690
Miamira magnifica	-	JQ727694
Miamira sinuata	-	JQ727695
Hypselodoris apolegma	JQ727886	JQ727766
Hypselodoris apolegma	JQ727885	JQ727767
Hypselodoris bennetti	EF535131	EF534059
Hypselodoris bertschi	-	JQ727769
Hypselodoris bilineata	EF535125	EF534052
Hypselodoris bollandi	-	JQ727770
Hypselodoris bollandi	JQ727887	JQ727771
Hypselodoris bullocki	JQ727888	JQ727772
Hypselodoris bullocki	EU982743	EU982795
Hypselodoris californiensis	EU982744	EU982796
Hypselodoris capensis	-	JQ727773
Hypselodoris cf. maculosa	JQ727896	JQ727786
Hypselodoris cf. nigrolineata	JQ727899	JQ727790
Hypselodoris elegans	AF249787	AF249238
Hypselodoris emma	JQ727890	JQ727775
Hypselodoris emma	JQ727889	JQ727774
Hypselodoris imperialis	JQ727910	JQ727813
Hypselodoris imperialis	JQ727911	JQ727814
Hypselodoris imperialis	KJ643914	-
Hypselodoris infucata	KF250386	-
Hypselodoris infucata	JQ727891	JQ727776
Hypselodoris infucata	FJ917484	FJ917426
Hypselodoris jacksoni	JQ727892	JQ727778
Hypselodoris jacksoni	JQ727893	JQ727777
Hypselodoris kaname	-	JQ727779
Hypselodoris kaname	-	JQ727780
Hypselodoris krakatoa	-	JQ727781
Hypselodoris krakatoa	-	JQ727782
Hypselodoris krakatoa	-	JQ727783
Hypselodoris maculosa	JQ727894	JQ727784
Hypselodoris maculosa	JQ727895	JQ727785
Hypselodoris maritima	JQ727897	JQ727788
Hypselodoris obscura	EU982745	EU982797
Hypselodoris obscura	EF535130	EF534058
Hypseledoris orsinii	AJ223265	AJ225189
Hypselodoris paulinae	EU982746	EU982798
Hypselodoris picta	HM162685	HM162594
Hypselodoris pulchella	-	JQ727815
Hypselodoris purpureomaculosa	JQ727900	JQ727791
Hypselodoris reidi	JQ727901	JQ727792

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Phestilla minor	DQ417306	DQ417257	-
Phestilla minor	DQ417307	DQ417258	-
Phestilla minor	DQ417308	DQ417259	-
Phestilla minor	DQ417301	-	-
Phestilla minor	DQ417302	DQ417255	-
Phestilla minor	DQ417303	-	-
Phestilla minor	-	DQ417262	-
Phestilla minor	-	DQ417263	-
Phestilla minor	-	DQ417264	-
Phestilla minor	DQ417309	DQ417260	-
Phestilla minor	DQ417310	DQ417261	-
Phestilla minor	DQ417311	-	-
Phestilla minor	DQ417312	-	-
Phestilla minor	DQ417313	-	-
Phestilla sibogae	DQ417290	DQ417244	-
Phestilla sibogae	DQ417291	DQ417245	-
Phestilla sibogae	DQ417292	DQ417246	-
Phestilla sibogae	DQ417293	DQ417247	-
Phestilla sibogae	DQ417287	DQ417241	-
Phestilla sibogae	DQ417288	DQ417242	-
Phestilla sibogae	DQ417289	DQ417243	-
Phestilla sibogae	DQ417294	DQ417248	-
Phestilla sibogae	DQ417295	DQ417249	-
Phestilla sibogae	DQ417296	DQ417250	-
Phestilla sibogae	DQ417297	DQ417251	-
Phestilla sp. 1	DQ417314	DQ417265	-
Phestilla sp. 1	DQ417315	DQ417266	-
Phestilla sp. 1	DQ417316	DQ417267	-
Phestilla sp. 1	DQ417317	-	-
Phestilla sp. 1	DQ417318	DQ417268	-
Phestilla sp. 1	DQ417319	DQ417269	-
Phestilla sp. 1	DQ417320	DQ417270	-
Phestilla sp. 1	DQ417321	-	-
Phestilla sp. 1	DQ417322	-	-
Phestilla sp. 1	DQ417323	DQ417271	-
Phestilla sp. 1	DQ417324	DQ417272	-
Phestilla sp. 2	DQ417283	DQ417237	-
Phestilla sp. 2	DQ417284	DQ417238	-
Phestilla sp. 2	DQ417285	DQ417239	-
Phestilla sp. 2	DQ417286	DQ417240	-
Tergipes antarcticus	-	KF713480	-
Tergipes antarcticus	-	GU227007	-
Tergipes antarcticus	GU227106	-	-
Tergipes antarcticus	EU727250	-	-
Tergipes antarcticus	EU727251	-	-
Tergipes antarcticus	EU727252	-	-
Tergipes antarcticus	EU727253	-	-
Tergipes tergipes	KJ434080	-	-
Tergipes tergipes	KJ434081	-	KJ434099
Tergipes tergipes	-	-	KJ434098
Tergipes tergipes	KJ434075	KJ434062	-
Tergipes tergipes	KJ434076	KJ434063	KJ434094
Tergipes tergipes	-	-	KJ434093
Tergipes tergipes	KJ434070	KJ434055	KJ434087
Tergipes tergipes	KJ434071	KJ434056	KJ434088
Tergipes tergipes	KJ434072	KJ434057	KJ434089
Tergipes tergipes	KJ434073	KJ434058	-
Tergipes tergipes	-	KJ434059	KJ434090
Tergipes tergipes	KJ434074	KJ434060	KJ434091
Tergipes tergipes	-	KJ434061	KJ434092
Tergipes tergipes	KJ434069	KJ434054	-
Tergipes tergipes	-	-	KJ434086
Tergipes tergipes	-	-	KJ434085
Tergipes tergipes	AY345032	-	-
Tergipes tergipes	KJ434077	KJ434064	-
Tergipes tergipes	KJ434078	KJ434065	KJ434096
Tergipes tergipes	-	-	KJ434095

Hypselodoris ruthae	EU982747	EU982799
Hypselodoris villafranca	-	AF249237
Hypselodoris whitei	JQ727902	JQ727795
Hypselodoris whitei	JQ727903	JQ727794
Hypselodoris zephyra	JQ727904	JQ727796
Hypselodoris zephyra	JQ727905	JQ727797
Hypselodoris zephyra	-	EF534056
Hypselodoris zephyra	EF535129	EF534057
Mexichromis antonii	-	JQ727798
Mexichromis antonii	EU982748	EU982800
Mexichromis festiva	EF535124	EF534051
Mexichromis kempfi	EF535121	EF534047
Mexichromis macropus	EF535123	EF534050
Mexichromis macropus	-	JQ727801
Mexichromis mariei	EU982749	EU982801
Mexichromis mariei	-	EF534049
Mexichromis multituberculata	JQ727906	JQ727802
Mexichromis multituberculata	JQ727907	-
Mexichromis porterae	EF535139	EF534067
Thorunna australis	JQ727912	JQ727816
Thorunna daniellae	EU982756	EU982809
Thorunna florens	JQ727913	JQ727817
Thorunna furtiva	-	EU982810
Thorunna furtiva	EF535126	EF534053
Thorunna halourga	-	JQ727818
Thorunna montrouzieri	-	JQ727819
Thorunna punicea	JQ727914	JQ727820
Thorunna purpuropedis	-	JQ727821
Subfamily Polycerinae	**COI**	**16S**
Gymnodoris alba	JX274101	JX274063
Gymnodoris brunnea	KJ396780	-
Gymnodoris brunnea	KJ396781	-
Gymnodoris inornata	KC706900	-
Gymnodoris pseudobrunnea	KJ396785	-
Gymnodoris striata	HQ987955	-
Palio dubia	AJ223272	AJ225197
Palio dubia	KF643686	-
Palio dubia	KF643719	-
Palio dubia	JX274100	-
Polycera capensis	JX274081	JX274049
Polycera capensis	JX274082	JX274050
Polycera capensis	JX274083	JX274051
Polycera cf. capensis	HM162687	HM162597
Polycerella emertoni	JX274097	-
Polycerella emertoni	JX274098	JX274061
Polycera faeroensis	JX274088	-
Polycera faeroensis	JX274089	JX274056
Polycera hedgpethi	-	KF425278
Polycera hedgpethi	JX274086	-
Polycera japonica	KC706901	-
Polycera quadrilineata	JX274070	JX274041
Polycera sp.	JX274090	JX274057
Polycera sp.	JX274091	-
Polycera sp.	JX274092	JX274058
Polycera sp.	JX274093	-
Polycera quadrilineata	JX274078	-
Polycera tricolor	JX274087	JX274054
Polycera tricolor	-	JX274055
Polycera alabe	-	KF425269
Polycera alabe	-	KF425274
Polycera alabe	-	KF425267
Polycera alabe	-	KF425268
Polycera alabe	-	KF425271
Polycera alabe	-	KF425270
Polycera atra	JX274084	JX274052
Polycera atra	JX274085	JX274053

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Tergipes tergipes	KJ434079	KJ434066	KJ434097
Tergipes tergipes	KJ434067	KJ434052	-
Tergipes tergipes	KJ434068	KJ434053	KJ434083
Tergipes tergipes	-	-	KJ434084
Tergipes tergipes	-	-	KJ434082
Family Dotidae	**COI**	**16S**	**H3**
Doto africoronata	HM162734	HM162657	HM162566
Doto amyra	KJ486701	-	KJ486672
Doto amyra	KJ486702	KJ486767	KJ486670
Doto amyra	KJ486703	KJ486768	-
Doto antarctica	KJ486705	KJ486765	KJ486686
Doto columbiana	GQ292026	-	-
Doto coronata	AF249794	-	-
Doto coronata	KJ486723	KJ486762	KJ486653
Doto coronata	KJ486722	KJ486764	KJ486652
Doto coronata	KJ486719	KJ486760	KJ486654
Doto coronata	KJ486720	KJ486763	KJ486655
Doto coronata	KJ486721	KJ486761	KJ486656
Doto dunnei	KJ486725	-	KJ486659
Doto eireana	-	AF249248	-
Doto floridicola	AF249820	-	-
Doto fragilis	KJ486735	KJ486755	KJ486668
Doto greenamyeri	KJ486715	KJ486769	KJ486683
Doto koenneckeri	KJ486730	KJ486751	KJ486666
Doto koenneckeri	AF249797	AF249249	-
Doto koenneckeri	KJ486732	KJ486752	KJ486665
Doto koenneckeri	KP940456	KP940451	KP940461
Doto koenneckeri	KJ486729	KJ486750	KJ486664
Doto koenneckeri	HM162735	HM162658	HM162567
Doto lemchei	KJ486727	KJ486749	-
Doto maculata	-	KJ486757	KJ486661
Doto millbayana	KJ486726	KJ486759	KJ486660
Doto pinnatifida	AF249793	AF249250	-
Doto pinnatifida	KJ486736	KJ486748	KJ486689
Doto sp. 15	HM162739	HM162662	HM162571
Doto sp. 2	HM162737	HM162660	HM162569
Doto sp. 7	HM162738	HM162661	HM162570
Doto sp. 7	KJ486711	KJ486771	KJ486685
Doto sp. A	KJ486724	KJ486758	KJ486658
Doto sp. B	KJ486728	KJ486753	KJ486662
Doto sp. H	HM162740	HM162663	HM162572
Doto sp. J	HM162742	HM162665	HM162574
Doto sp. K	HM162743	HM162666	HM162575
Doto sp. A	KJ486724	KJ486758	KJ486658
Doto tuberculata	KJ486733	-	KJ486669
Doto tuberculata	KJ486734	KJ486756	KJ509924
Doto ussi	KJ486706	KJ486780	KJ486675
Doto ussi	KP940457	KP940452	KP940462
Doto sp. I	HM162741	HM162664	HM162573
Kabeiro christianae	-	KJ486782	KJ486691
Kabeiro rubroreticulata	KJ486739	KJ486791	KJ486697

Polycera atra	-	KF425277
Polycera atra	-	KF425275
Polycera aurantiomarginata	AJ223274	AJ225199
Polycera aurantiomarginata	JX274068	JX274038
Thecacera pennigera	AJ223277	AJ225202
Thecacera pennigera	JX274094	JX274059
Thecacera picta	KP871652	KP871701