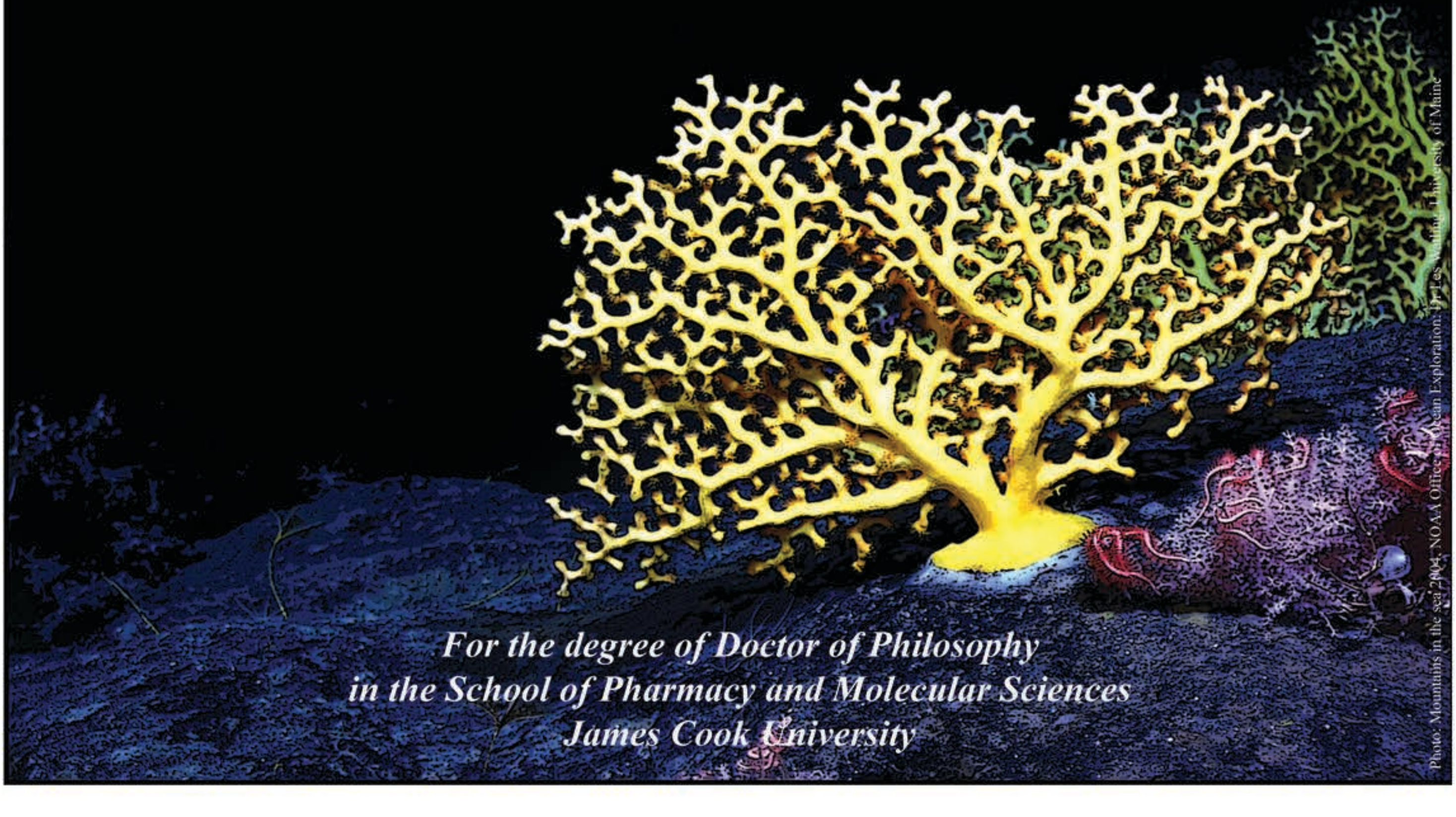
MORPHOLOGICAL AND MOLECULAR SYSTEMATICS OF SCLERACTINIAN CORALS (CNIDARIA, ANTHOZOA), WITH EMPHASIS ON DEEP-WATER SPECIES

Thesis submitted by

Marcelo Visentini Kitahara, Oc (UNIVALI) MSc (UFSC)

in April 2011



For the degree of Doctor of Philosophy
in the School of Pharmacy and Molecular Sciences
James Cook University

Photo: Mountains in the sea 2004, NOAA Office of Ocean Exploration; Dr. Les Watling, University of Maine

MORPHOLOGICAL AND MOLECULAR SYSTEMATICS OF SCLERACTINIAN CORALS (CNIDARIA, ANTHOZOA), WITH EMPHASIS ON DEEP-WATER SPECIES

Thesis submitted by

Marcelo Visentini Kitahara, Oc (UNIVALI) MSc (UFSC)

in April 2011

Advisors

Prof Dr David J. Miller
Dr Stephen D. Cairns
Prof Dr David Blair

For the degree of Doctor of Philosophy
in the School of Pharmacy and Molecular Sciences
James Cook University

To Michelle F. de O. Kitahara

and Isadora Kitahara

This page is intended to be blank

Statement of Access

I, the undersigned author of this thesis, understand that James Cook University will make it available for use within the university library and by electronic digital format, via the Australian digital theses network, for use elsewhere.

I understand that, containing unpublished work, a thesis has significant protection under the Copyright Act. Therefore, all users consulting this work should agree with the following statement:

> "*In consulting this thesis, I agree not to copy or partially paraphrase it in whole or in part without the written consent of the author, and to make proper written acknowledgement of any assistance which I have obtained from it*"

Beyond this, I do not place any restriction on access to this thesis.

Marcelo Visentini Kitahara, April 2011

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text or in the Statement of Contribution of Others and a list of references is given.

Marcelo Visentini Kitahara, April 2011

Scientific Contributions

I gratefully thank the following people and organisations for providing resources and scientific/technical assistance to me during my candidature:

- Dr Stephen D. Cairns (Smithsonian Institution), Dr Philippe Bouchet (Muséum National d'Histoire Naturelle), Dr Carden Wallace (Museum of Tropical Queensland), Ms Felicity McEnnulty (Commonwealth Scientific and Industrial Research Organisation), Dr Jane Fromont (Western Australian Museum) and Dr Karen Miller (University of Tasmania) for generously providing deep-water scleractinian samples.
- Dr David J. Miller (James Cook University), Dr Stephen D. Cairns (Smithsonian Institution), Dr David Blair (James Cook University) and Dr Jaroslaw Stolarski (Instytut Paleobiologii) for providing critical reviews on my research and writing.
- Dr Jaroslaw Stolarski (Instytut Paleobiologii) for providing SEMs, microstructural / microarchitectural data.
- Dr David Blair (James Cook University) for assisting in the phylogenetic reconstructions.
- Dr Tracy Ainsworth (ARC Centre of Excellence for Coral Reef Studies) for providing materials and guidance during histological studies, and Ms Sue Reilly (James Cook University) for embedding coral samples in paraffin.
- Mr Paul Greenhall (Smithsonian Institution), Mrs Barbara Done (Museum of Tropical Queensland), Dr Carden Wallace (Museum of Tropical Queensland), Dr Pierre Lozouet (Muséum National d'Histoire Naturelle), Dr Aude Andouche (Muséum National d'Histoire Naturelle), Ms Felicity McEnnulty (Commonwealth Scientific and Industrial Research Organisation) for logistic

help with loans, CITES permission acquisition and/or providing institutional catalogue numbers for the specimens examined.

- Mr James Robinson (University of Tasmania) and MSc Dustin Edge for technical assistance in laboratorial work and graphical design of maps respectively.
- Dr Hironobu Fukami (Kyoto University) for providing unpublished CO1 sequences from 11 species of shallow-water scleractinian species used in the chapter 5.
- Dr Chaolun A. Chen (Academia Sinica) and MSc Mei-Fang Lin (Academia Sinica) for providing unpublished universal mitochondrial primer sequences that resulted in the amplification of nearly 70% of the mitochondrial genome of *Gardineria hawaiiensis* as well as unpublished mitochondrial genome data from many hexacorallians.
- Dr Sylvain Forêt (ARC Centre of Excellence for Coral Reef Studies) for assisting the gene annotation of the mitochondrial genome of *Gardineria hawaiiensis* and providing support for the phylogenetic analyses.
- Dr Marcos Barbeitos (National Museum of Natural History) for providing personnal protocols for amplification of the nuclear 28S rDNA.
- Dr Jen Whan (James Cook University) for gold coating and assisting the acquisition of SEM images.
- Dr Joel Stake (Rivier College) for providing SEMs of *Agaricia undata* and *Helioseris cucullata*.

Financial Assistance

This research project was funded by Coordination for the Improvement of Higher Education Personnel and James Cook University as detailed below:

- Coordination for the Improvement of Higher Education Personnel PhD scholarship (12/2006 - 10/2010).

- School of Pharmacy and Molecular Sciences PhD scholarship (11/2010 - 04/2011).
- James Cook University Research Graduate Scheme Grant (2008).

Publications Arising from Thesis

At the time of thesis submission, five papers describing the research findings of Chapters 2, 4 and 5 were already published, one manuscript arising from chapter 8 is under review, and other six manuscripts are currently in preparation. The complete taxonomic review arising from chapter 2 will be published as a volume of the book series *Tropical deep-sea benthos*. Details of each manuscript and talks presented during my PhD candidature are provided below:

Manuscripts

- Janiszewska, K., Stolarski, J., Benzerara, K., Meibom, A., Mazur, M., **Kitahara, M. V.** & Cairns, S. D. 2011. A unique skeletal microstructure of the deep-sea micrabaciid scleractinian corals. Journal of Morphology 272: 191-203. (Chapters 2 and 5)
- **Kitahara, M. V.**, Cairns, S. D. & Miller, D. J. 2010. Monophyletic origin of the Caryophyllia (Scleractinia; Caryophylliidae), with description of six new species. Systematics and Biodiversity, 8: 91-118. (Chapters 2 and 4)
- **Kitahara, M. V.**, Cairns, S. D., Stolarski, J., Blair, D. & Miller, D. J. 2010. A comprehensive phylogenetic analysis of the Scleractinia (Cnidaria, Anthozoa) based on mitochondrial CO1 sequence data. Plos One, v. 5, p. e11490. (Chapter 5)
- **Kitahara, M. V.** & S. D. Cairns. 2008. New records of the genus *Crispatotrochus* (Scleractinia; Caryophylliidae) from New Caledonia, with description of a new species. Zootaxa, 1940: 59-68. (Chapter 2)
- **Kitahara, M. V.** & Cairns, S. D. 2009. Revision of the genus *Deltocyathus* (Cnidaria, Scleractinia), with a description of a new species from New Caledonia. Zoosystema, 31(2): 233-249. (Chapter 2)
- Stolarski, J., **Kitahara, M. V.**, Miller, D. J. Cairns, S. D., Mazur, M. & Meibom, A. *Submitted – BMC Evolutionary Biology.* An ancient evolutionary origin of Scleractinia revealed by azooxanthellate corals. (Chapter 8)

- **Kitahara, M. V.** & Cairns, S. D. *In advanced stage of preparation - Invited to be published as a volume of the Tropical Deep-sea Benthos by the Museum National d'Histoire Naturelle.* Deep-water azooxanthellate Scleractinia from New Caledonia. (Chapter 2)
- **Kitahara, M. V.**, Miller, D. J., Cairns, S. D., Stolarski, J. & Wallace, C. *In advanced stage of preparation - Target: Nature*. Was climate change the driving force for deep-water colonization by scleractinian corals? (Chapter 10)
- **Kitahara, M. V.**, Stolarski, J., Cairns, S. D. & Miller, D. J. *In advanced stage of preparation - Target: Coral Reefs*. Reciprocal illumination between molecular phylogeny and morphological characters supports the transfer of *Dactylotrochus cervicornis* (Moseley, 1881) to the Agariciidae (Anthozoa, Scleractinia). (Chapter 6)
- **Kitahara, M. V.**, Cairns, S. D. & Connoly, S. *In preparation - Target: Journal of Biogeography*. Diversity of deep-sea corals from New Caledonia: a central Pacific "hot spot" for azooxanthellate scleractinians. (Chapter 3)
- **Kitahara, M. V.**, Stolarski, J., Cairns, S. D. & Miller, D. J. *In advanced stage of preparation - Target: Zoologica Scripta.* Towards the second unification step between classical taxonomy and molecular phylogeny of Caryophylliidae (Anthozoa, Scleractinia): the elevation of *Deltocyathus* to family rank (Deltocyathiidae fam. nov.). (Chapter 7)
- Mei-Fang, L., **Kitahara, M. V.**, Yong, Y., Fôret, S., Fukami, H., Tracey, D., Miller, D. J. & Chen, C. A. *In advanced stage of preparation - Target: Proceedings of the National Academy of Science, US.* Anthozoa phylogeny based on 50 entire mitochondrial genomes. (Chapter 9)

Talks

- **Kitahara, M. V.** & Cairns, S. D. 2008. Diversity of deep-sea corals (Cnidaria, Scleractinia) from New Caledonia and adjacent waters: a central Pacific hot-spot for azooxanthellate scleractinians. Presented at the 4th International Symposium of Deep-sea Corals (NIWA - Wellington).
- **Kitahara, M. V.** 2009. Global list of cold-water corals (Scleractinia, Filifera, Octocorallia, Antipatharia) from waters deeper than 200 m, vulnerable species, relevant references, list of experts, and draft recommendations for the

production of identification guides. Presented at the Food and Agriculture Organization (FAO - Rome), the United Nations (UN).

- **Kitahara, M. V.**, Miller, D. J., Cairns, S. D. & Stolarski, J. 2009. How do azooxanthellate deep-water Scleractinia fit into the evolutionary history of the order? Presented at the Enciclopedia of Life / Treatise of Invertebrate Paleontology meeting (Smithsonian – Washington, D.C.).
- **Kitahara, M. V.** 2009. Trends among Oculinidae. Presented at the Enciclopedia of Life / Treatise of Invertebrate Paleontology meeting (Smithsonian – Washington, D.C.).
- **Kitahara, M. V.** & Miller, D. J. 2010/2011. Were climate and ocean chemistry changes the driving forces for the colonization of deep-sea environments by scleractinian corals? Presented at the 3rd Bi-annual Symposium Future Ocean (Centre of Excellence Future Ocean – Kiel [2010]) and at the Workshop of Coral Genomics (Academia Sinica – Taiwan [2011]).

Publications arising during my Candidature not directly related to Thesis

During my candidature, I first authored 4 papers in peer-reviewed journals and 1 report. Other 2 manuscripts are under review. Additionally, I authored 1 and co-authored other publication in popular press and published a poster intended for divulgation of deep-water corals. Details of each manuscript are provided below:

- **Kitahara, M. V.** 2007. Species richness and distribution of azooxanthellate Scleractinia in Brazilian waters. Bulletin of Marine Science, 81(3): 497-518.
- **Kitahara, M. V.**, N. O. H. Filho & J. G. N. Abreu. 2008. The utilization of the deep-sea coral records as instrument for mapping different types of sediments at Southern Brazilian continental shelf and slope. Papéis Avulsos em Zoologia, 48(2): 11-18. *(in Portuguese)*
- **Kitahara, M. V.**, R. R. Capítoli & N. O. Horn-Filho. 2009. Distribution of the deep-sea corals (Anthozoa, Scleractinia) in the continental shelf and continental slope in Brazilian waters between 24° e 34°S. Iheringia, 99: 223-236. *(in Portuguese)*
- **Kitahara, M. V. 2009.** The deep-sea demersal fisheries and the azooxanthellate corals from southern Brazil. Biota Neotropica, 99(2): 9pp. *(in Portuguese)*
- Carranza, A., Recio, A. M., **Kitahara, M. V.**, Scarabino, F., Acosta, J. & Fontan, A. *Submitted - Marine Biology*. Deep-water coral reefs from the Uruguayan shelf and Slope.
- McEnnulty, F. R., Gowlett-Holmes, K. L., Williams, A., Althaus, F., Fromont, J., Poore, G. C. B., O'Hara, T. D., Marsh, L., Kott, P., Slack-Smith, S., Alderslade, P. & **Kitahara, M. V.** *Submitted - Records of the Western Australian Museum.* The deepwater invertebrate megafauna on the western Australian continental margin (100-1100 m depths): composition, distribution and novelty.
- Lin, M. –F., **Kitahara, M. V.**, Tachikawa, H., Keshavmurthy, S. & Chen, C. A. *In advanced stage of preparation.* An unusual shallow-water *Polycyathus,*

Polycyathus chaishanesis sp. nov. (Scleractinia; Caryophylliidae) from Chaishan, Kaohsiung, Taiwan and its conservation concerns.

Reports

- **Kitahara, M. V.** 2009. Global list of cold-water corals (Scleractinia, Filifera, Octocorallia, Antipatharia) from waters deeper than 200 m, vulnerable species, relevant references, list of experts, and draft recommendations for the production of identification guides. Prepared for the Food and Agriculture Organization (FAO), the United Nations (UN).

Popular press articles

- Lindner, A. & **Kitahara, M. V.** 2007. Fisheries and Research at deep-sea. Scientific American Brazil, São Paulo, p. 31. *(in Portuguese)*
- **Kitahara, M. V.** 2009. Under the complete darkness: the incredible deep-sea coral reefs from southern Brazil. Ciência Hoje 259: 67-69. *(in Portuguese)*

Poster

- **Kitahara, M. V.** & S. D. Cairns. 2007. Brazilian Deep-sea Corals. Poster. ARC Centre of Excellence for Coral Reef Studies, Townsville.

This project would not have been possible without the guidance, assistance and encouragement of several outstanding individuals. For each one of them, I would like to express my heartfelt gratitude.

First and foremost I would like to thank my supervisors Prof Dr David J. Miller and Dr Stephen D. Cairns for giving me the opportunity to undertake this project, guiding me from the beginning and most importantly for their trust in my work. By giving me absolute freedom to develop my own ideas, yet always available whenever I needed advice, I am deeply grateful.

I gratefully thank Dr Jarosław Stolarski, Dr Carden Wallace, Dr David Blair and Dr Allen Chen for their enthusiastic support to my project, their willingness to collaborate, and for providing information, literature and advice. I am also indebted to Mrs Barbara Done and Mr Paul Greenhall for their unconditional help with specimen exchanges and for providing museum catalog numbers. I also thank Mr Zoli Florian for helping in the acquisition of images.

Very special thanks to Dr Philippe Bouchet who generously loaned the New Caledonian material from the Paris Museum to the Smithsonian Institution, Dr Bertrand Richer de Forges, IRD-Nouméa staff and collaborators for their great effort in collecting and preserving most of the specimens examined in the present study, and to Dr Pierre Lozouet and Dr Aude Andouche for providing museum catalog numbers. I extend my gratitude to Prof Dr Karen Miller, Ms Felicity McEnnulty and Dr Jane Fromont for the loan of material collected around Australia, to Prof Dr Hironobu Fukami for providing unpublished DNA sequences from shallow-water scleractinians, to Dr Joel Stake for providing SEM images of *Agaricia undata* and *Helioseris cucullata*, Dr Luis Felipe Gusmão for assistance in statistical analysis, and Mr Dustin Edge for assistance in map development.

I also thank the research staff and students in the Department of Biochemistry and Molecular Sciences and in the Advance Analytical

Centre at James Cook University for providing technical advice, training when necessary, and access to instrumentation and research facilities. In particular I thank Dr Kevin Blake and Dr Jen Whan for advice in electron microscopy, and Prof Dr James Burnell for comments on my thesis. I also wish to thank all my laboratory colleagues Dr Chuya Shinzato, Dr Akira Iguchi, Dr Zoe Richards, Dr Tracy Ainsworth, Mr James Robinson, Ms Lynda Boldt, Mrs Teressa Bobeszko, Dr Lauretta Grasso, Mr Huibin Zou, Mr Brent Knack, Mrs Lubna Ukani, Mrs Susanne Sprungala, Dr Aurélie Moya, Ms Lotte Huisman, Ms Yvonne Weiss, Ms Daise Ogawa and Ms Svetlana Ukolova for their helpfulness, good company and for helping me to understand that it is "normal" to amplify/sequence my own CO1 gene when you are starting molecular biology. I am especially thankful to Dr Sylvain Forêt for his support on the phylogenetic analyses and for the countless night shift discussions about corals/genomes/transcriptomes/etc.

I extend my gratitude to Dr Michael Maia Mincarone and Dr Alberto Lindner for their support and comments on my thesis, and to Dr Sheila Halsey and Dr Douglas Fenner for providing literature used in this project.

I am also indebted to the many "open source" software authors for providing the numerous tools and systems I have used to produce most of my results and this thesis.

I am grateful to the Coordination for the Improvement of Higher Education Personnel for the PhD scholarship and to the School of Pharmacy and Molecular Sciences for the financial support during my PhD candidature. I also thank the ARC Centre of Excellence for Coral Reef Studies, the Robert Logan Bequest, the scientific committee of the 4th International Symposium of Deep-sea Corals, the Treatise of Invertebrate Paleontology, Food and Agriculture Organization, and Academia Sinica for providing me financial support to attend conferences and workshops.

Despite the geographical distance, my family was always nearby. My mother, Adil M. V. Kitahara, made sure I felt her confidence and encouragement, and her advice was consistently timely and useful. My father, Kingo Kitahara, though no longer with us, remains the compass of my life. I will be forever thankful to them and to my sister Debora

V. K. Grassi for their support, encouragement, and especially for being good examples and for always showing me the right values.

Most importantly, I wish to thank and say that I will be forever grateful to my beloved wife Michelle F. de O. Kitahara and daughter Isadora Kitahara for their unconditional love and unwavering support. They have been my pillar, my joy and my guiding light. " My world just make sense with you both in my life....". This work belongs as much to them as it does to me and to them this thesis is dedicated.

A todos muito obrigado

merci beaucoup

非常感謝

Thankyou very much

Dziękuję bardzo

heel erg bedankt

बहुत बहुत धन्यवाद

Vielen Dank

Б о л ь ш о е с п а с и б о

あなたは非常に感謝

Ubiquitous to all oceans, the phylum Cnidaria is the second most basal metazoan group in the tree of life, with plausible fossil record dating back from the pre-Cambrian. The vast majority of cnidarians are restricted to the marine realm, although few species are known to occur in fresh water systems. The approximately 9000 extant representatives of this phylum are divided into 2 sub-phyla, of which the Anthozoa embraces nearly 7000 species including approximately 1400 extant scleractinians, also commonly known as corals. Corals are the subject of intense scientific, public and media interest because of their ecological and economic importance, and because of the uncertain fate of coral reefs in the face of ever increasing anthropogenic challenges. Despite this, the scleractinian origins are not well understood. They suddenly appeared in the Middle Triassic already represented by a wide variety of solitary and colonial forms. From the level of colony integration to the microstructural organization within individual corallites, the range of morphological variation in the Triassic fossils is comparable to that observed in modern scleractinians. In fossil specimens in which aragonite is preserved, coralla show at least four basic types of microstructural organization suggesting an extensive Palaeozoic evolutionary history for the Order. Two long-lived hypotheses for scleractinian coral evolution are that they are either descendants of late Paleozoic rugose corals that survived the mass extinction at the Permian/Triassic boundary, or that they evolved from soft-bodied corallimorpharian-like ancestors by independently gaining the ability to deposit a calcified skeleton. In the last few years, a third hypothesis known as “naked corals” has received extensive media attention, advocating that some scleractinian lineages, as result of ocean acidification, have the ability to undergo skeleton loss. These contradicting hypotheses all suffer from the absence of data from deep-water corals. Indeed, prior to this thesis, the vast majority of molecular data available was retrieved from shallow-water zooxanthellate species, and despite of accounting for approximately half of the extant species of the order, azooxanthellate corals had rarely been included in molecular phylogenetic reconstructions. Nonetheless, starting from the premise that taxonomy remains essential to credible biological research, and acknowledging that reliable and accurate molecular based phylogenies, and its interpretation relies on taxonomic knowledge, a large segment of the present thesis is dedicated to classical taxonomy of extant azooxanthellate scleractinians from New Caledonia. The examination of more than 3000 specimens, collected between 80 and 1200 m deep, revealed the occurrence of 170 species (including 3 new families, 1 new genus, and at least 12 undescribed species) to this small southwestern Pacific Archipelago. Species rarefaction analysis suggests that the species diversity for this region still underestimated, implying a much more diverse azooxanthellate scleractinian coral fauna than all previously examined regions in the world. Additionally, to better understand broad patterns of coral evolution, I generated molecular data for a broad and representative range of deep-water scleractinians, and conducted the most comprehensive molecular phylogenetic analyses of the order to date. Primarily, I show that there is a striking discrepancy between the taxonomic validity of coral families consisting predominantly of deep- or shallow-water representatives. Most families composed predominantly of deep-water azooxanthellate species are monophyletic but, by contrast, most families composed predominantly of shallow-water zooxanthellate taxa are polyphyletic, although Acroporidae, Caryophylliidae, Poritidae, Pocilloporidae, and Fungiidae were exceptions to this general pattern. Furthermore, using a relaxed molecular clock calibrated against the oldest Mesozoic fossil records that can be indisputably assigned to extant genera/families, I show not only that the divergence of the two major coral clades, the "Robust" and "Complex" corals, took place more than 110 My earlier than previously thought, but also that two families composed exclusively of deep-water corals, the Gardineriidae and Micrabaciidae, diverged even earlier, pushing coral origins to the Middle Ordovician; ca. 450 Ma. These results genetically and morphologically connect the elusive "scleractiniamorph" fossils with extant scleractinians, confirm that the order Scleractinia is monophyletic, suggest that corals evolved from Paleozoic soft-bodied ancestors, and show that modern colonial reef-building corals, which are dependent on symbionts, had solitary, non-symbiotic precursors. In conclusion, I hypothesise that global environmental changes over the past 460 My may have been a major driving force behind the colonization of deep environments by scleractinian corals. Taken together, these results significantly improve our understanding of coral evolution and significantly enrich the debate about how corals are capable to withstand global climate changes.

CHAPTER 1

General Introduction

"Molecular data, abundant and inexpensive, have revolutionized phylogenetics but not diminished the importance of traditional work. Morphology links living and fossil species, is the object of natural selection, inspires the search for causal explanations, and democratizes science."
Wheeler et al., 2004

Ubiquitous to all oceans, the phylum Cnidaria (*gr. cnidos* = "stinging nettle") is the second most basal metazoan group in the tree of life, with plausible fossil record dating back from the pre-Cambrian (ca. 580 Ma - Chen et al., 2002). Cnidarians have only two tissue layers (ectoderm and endoderm) resulting in a very simple body plan. As its name suggests, all representatives of this group contain stinging cells (cnidocytes) advocated to be inherited from a single ancestor (Caldwell, 2008), implying that this phylum is monophyletic. The vast majority of cnidarians are restricted to the marine realm, although a few species are known to occur in fresh water. The approximately 11,000 extant representatives of this phylum are divided into 2 sub-phyla: Anthozoa and Medusozoa. Beside other characteristics, these two cnidarian lineages are differentiated mainly by the lack of the medusa stage and presence of a circular mitochondrial genome (Bridge et al., 1992) in Anthozoa, which is most likely to be the ancestral state of the phylum (Schuchert, 1993; Bridge et al., 1995; Kayal & Lavrov, 2008).

Having the same name as the sub-phylum to which it belongs, the class Anthozoa is the largest cnidarian group, embracing nearly 7000 extant species that are traditionally divided into two sub-classes (Octocorallia and Hexacorallia). The Octocorallia are animals in which each polyp has eight pinnately branched tentacles and eight complete mesenteries (Han et al., 2010). On the other hand, most hexacorallians typically have tentacles and mesenteries in a six fold symmetry. The Hexacorallia comprises six extant orders, of which only the Scleractinia produce aragonitic secretions resulting in a continuous skeleton. Scleractinians are considered to be the most recent evolutionary stage within the Hexacorallia (Brugler & France, 2007), forming some of the most complex habitats in the oceans (i.e. coral reef) and sustaining some of the most diverse ecosystems on the planet (Rogers, 1999; Dower & Perry, 2001; Reed, 2002). Contrary to popular belief, coral "reefs", defined as biogenic, long-lived, three-dimensional, self-sustained structures that change hydrodynamics, locally trapping sediment and providing habitat for many other species (Roberts et al., 2009), are not restricted to shallow-waters. On the contrary, there is a growing body of evidence that some deep-water scleractinians fulfil these ecological and geological criteria (Roberts et al., 2009).

Amongst extant scleractinian species, nearly 40% live in waters deeper than 50 m (Cairns et al., 1999; Cairns, 2007), and are often referred to as cold- or deep-water corals. With reference to the presence/absence of unicellular photosynthetic dinoflagellates (*Symbiodinium* spp.) within the endoderm, scleractinians can be categorized in three ecological types that are independent of taxonomy: zooxanthellate, azooxanthellate, and facultative. The zooxanthellae are unicellular photosynthetic dinoflagellates that are considered to be symbionts, assisting the corals in nutrient production through photosynthetic activities, and typically average densities of 1-5x10^6, per square centimetre of zooxanthellate coral tissue (Drew, 1972; Kawaguti & Nakagama, 1973). In brief, the zooxanthellae provide fixed carbon compounds to the coral host, enhancing calcification and facilitating elemental nutrient fluxes (Pearse & Muscatine, 1971; Barnes & Chalker, 1990; D'Elia & Wiebe, 1990). In return, the host coral polyp provides a protected environment and a steady supply of carbon dioxide for the zooxanthellae photosynthesis (Davies, 1984). The obligate nature of the symbiotic relationship geographically restricts the vast majority of zooxanthellate scleractinians to tropical regions with shallow (less than 90 m), warm and clear waters (Stanley, 2006).

In contrast, azooxanthellate corals do not live in association with photosynthetic dinoflagellates, being considered heterotrophic. This group is reported from off continental Antarctica (Cairns, 1982) to the Arctic Circle (Roberts et al., 2009) and amongst its representatives, some colonial and solitary species are considered cosmopolitan in distribution (e.g. *Enallopsammia rostrata*, *Stenocyathus vermiformis*). Furthermore, the fact that they are not dependent on symbionts enables azooxanthellate corals to thrive in aphotic regions and, although most species commonly occur between 200 and 1000 m (Cairns, 2007), some are able to inhabit waters as deep as 6300 m (Keller, 1976), with temperatures as low as -1ºC (Vaughan & Wells, 1943). However, some are restricted to shallow-waters (e.g. *Tubastraea diaphana*), and some are known only from waters deeper than 3800 m (e.g. *Fungiacyathus pseudostephanus*).

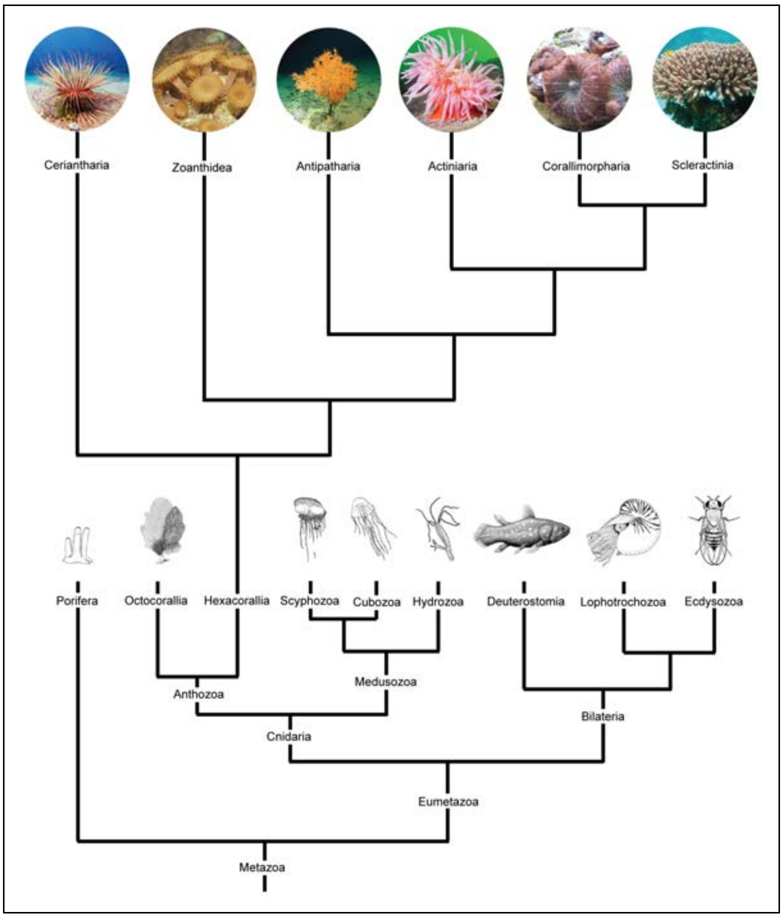


Figure 1.1 - General relationships within metazoans (bottom cladogram), and among hexacorallians (top cladogram).

Despite exceptions are known, most azooxanthellate corals are solitary (Cairns, 2007; Kitahara, 2007) and have large polyps, whereas the vast majority of zooxanthellate corals are colonial (highly integrated corallites) and have small polyps. This correlation (colonial/symbiotic vs. solitary/asymbiotic) is thought to be an evolutionary response by shallow-water species to the symbiotic relationship (Stanley & Swart, 1995). Supporting this idea, a rough comparison shows that most shallow-water zooxanthellate species have a tendency to form colonies with morphologies that increase light exposure (e.g. laminar, foliaceous, massive, branching – see Stanley, 2006), whereas most colonial azooxanthellate species have morphologies that tend to enhance "filtering" capabilities (e.g. anastomosic, fan-shape).

The third "ecological type", the facultative group, consists of species that have the ability to enter symbiotic relationships with photosynthetic dinoflagellates when in advantageous environmental conditions, although this association can be lost or drastically reduced when environmental conditions become disadvantageous (e.g. increase in turbidity, season) without negative impacts for the coral host (Dimond & Carrington, 2008). Such flexibility is quite rare; to date only 11 species are recognized as facultative (Cairns et al., 1999). Interestingly, such ability seems to have independently arisen several times, as it is seen in members 5 coral families (i.e. *Heterocyathus* - Caryophylliidae; *Heteropsammia* - Dendrophylliidae; *Oculina* - Oculinidae; *Madracis* - Pocilloporidae; *Astrangia* - Rhizangiidae).

Figure 1.2 - The two ecological groups of corals. *On the left*: Shallow-water zooxanthellate corals. *On the right*: Deep-water azooxanthellate coral reefs from off Norway (photo credit: C. Dullo, IFM-GEOMAR).

The origins of modern Scleractinia are not well understood. They suddenly appeared in the Middle Triassic (ca. 240 Ma) already represented by a wide variety of solitary and colonial forms (Roniewicz & Morycowa, 1993; Veron, 1995; Stanley, 2003). From the level of colony integration (e.g. phaceloid, meandroid and thamnasteroid) to the microstructural organization within individual corallites (e.g. complex septal ornamentation and axial structures), the range of morphological variation in the Triassic fossils is comparable to that observed in modern scleractinians. In fossil specimens in which aragonite is preserved, coralla show at least four basic types of microstructural organization (Roniewicz, 1989; Roniewicz & Morycowa, 1993) suggesting an extensive Palaeozoic evolutionary history for the Order.

The foundation studies of scleractinian evolutionary relationships carried out in the late 19th and early 20th centuries relied exclusively on macro- and micro-morphological skeletal characteristics of extant and fossil specimens. As they are sedentary or have restricted capacity for movement, corals are subjected to the environmental conditions at their place of settlement, one of the consequences of which is considerable phenotypic plasticity that is often partly by ecological influences (Boschma, 1959; Hoeksema, 1993; Huang et al., 2009; Budd & Stolarski, 2009). According to Lowenstein (1985), analyses based exclusively on morphology have two major limitations: the first arises from convergent evolution, in which two unrelated taxa come to resemble each other simply because they live in similar environments, in this case morphological similarities do not indicate close evolutionary relationships and can, in fact, be misleading; and the second concerns the estimation of time, in which anatomical features may evolve faster in some lineages than in others. Not surprisingly, the small number of "reliable" skeletal characters and the uncertain impact of environmental variables on them have severely hampered attempts to infer relationships among scleractinian sub-orders and families (Romano & Cairns, 2000; Stolarski & Roniewicz, 2001; Le Goff-Vitry et al., 2004; Fukami et al., 2008). As such, evolutionary hypotheses based on morphological characters have resulted in several quite different schemes for scleractinian phylogeny (e.g. Vaughan & Wells, 1943; Wells, 1956; Alloiteau, 1952; Chevalier & Beauvais, 1987; Veron, 1995 - for a broad review of the first 4 schemes see Stolarski & Roniewicz, 2001).

In a comprehensive analysis that was heavily influenced by the skeletal macro-morphological research of Milne Edwards & Haime (1850a; 1850b; 1857), Vaughan & Wells (1943) hierarchically ordered several characters and organized their evolutionary hypothesis in a conventional taxonomic key, providing the most "uniform" and "clear" scheme for coral phylogeny to that date. Although more recent analyses have included additional and more "sophisticated" microstructural data, the revised version of the Vaughan & Wells (1943) scheme published in the *Treatise on Invertebrate Paleontology* (Wells, 1956) is still widely used. The essence of the Wells scheme (Vaughan & Wells, 1943; Wells, 1956) is that 5 sub-orders are distinguished based on characteristics of the "septal trabeculae" and "septal structure", the 33 families then being differentiated by wall type, occurrence of endotheca and type of budding (Fig. 1.3).

The incorporation of microstructural data into scleractinian classification (such as septal microarchitecture and types of sclerenchymal tissue) was pioneered by Alloiteau (1952, 1957). In these studies, Alloiteau recognized a total of 65 families (30 with extant representatives) belonging to 8 sub-orders. These groupings were later revised with greater emphasis on microstructural characters by Chevalier & Beauvais (1987), who proposed 11 sub-orders embracing 55 families. However, according to Stolarski & Roniewicz (2001: 1095), "*the microstructural criteria applied to distinguish suborders containing only extinct taxa were unclear and not supported by following research*".

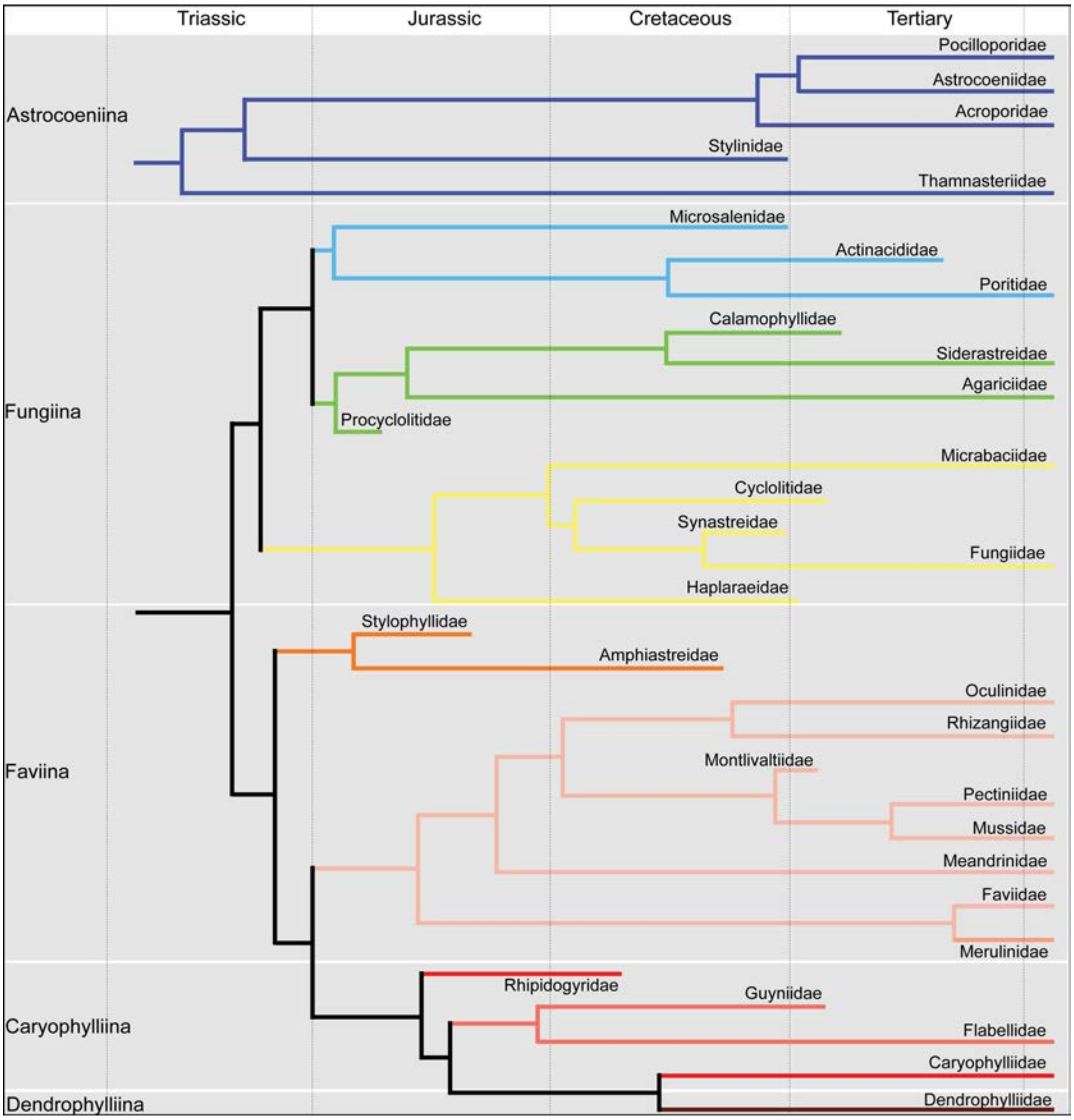


Figure 1.3 - Scleractinia phylogenetic scheme proposed by Wells (1956). Grey boxes represent suborders, coloured clusters represent superfamilies, and branches represent families.

The most recent scleractinian evolutionary scheme divides the order into 13 sub-orders (6 with extant representatives) and 61 families (24 extant) (Veron, 1995). This scheme was based on previous studies with detailed microstructural data (Wells, 1956; 1969;

Alloiteau, 1952; Cuif, [presumably] 1973; 1975; 1976; 1977; Chevalier & Beauvais, 1987; Roniewicz, 1984; 1989; Roniewicz & Morycowa, 1989) but, as is explicitly stated by the author, has many points of uncertainty at subordinal and family ranks. However, according to Budd et al. (2010), this evolutionary scheme has even less resolution among families and suborders than did the scheme of Wells (1956).

In addition to homoplasy and our limited understanding of how morphological structures have evolved in each lineage, the discrepancies amongst the various evolutionary schemes for scleractinians (Table. 1.1) are probably consequences of few morphological characters being available/used, our limited understanding of intraspecific morphological variation, and particularly the small number of taxa (extant and fossil) whose skeletal microstructure and detailed macroscopic characters have been studied with sufficient resolution.

According to Budd et al. (2010), to date, cladistic analyses have not contributed significantly to our understanding on scleractinian evolution. The use of morphological characters to establish phylogenetic relationships within coral families has proved challenging and, as a consequence, this method has been applied to only a small number of extant families – Fungiidae (Cairns, 1984; Hoeksema, 1989; 1991; 1993), Mussidae (Pandolfi, 1992), Siderastreidae (Pandolfi, 1992), Turbinoliidae (Cairns, 1997), Faviidae (Johnson, 1998), Acroporidae (Wallace, 1999), Dendrophylliidae (Cairns, 2001), Atlantic Faviidae and Mussidae (Budd & Smith, 2005), and Pacific Faviidae (Huang et al., 2009). However, the recent realisation that the scleractinian skeleton is biologically controlled down to the microstructural level and is not easily perturbed by environmental factors (e.g. Janiszewska et al., 2011) has led to more “in depth” skeletal microstructural analyzes being undertaken (e.g. Stolarski, 2000) and the utilization of previously “neglected” micromorphological characters (e.g. Budd & Stolarski, 2009). Together with improvements in our understanding of skeletal growth, these miscrostructural studies are shedding new light on evolutionary relationships within the order. In fact, the discovery that intra-fibrous organic matrices, composed of complex assemblages of macromolecules (proteins and polysaccharides - Lowenstam & Weiner, 1989) control nucleation, spatial delineation, and organization of basic microstructural skeletal units have already provided support for some molecular-based clades (Cuif et al., 2003; Benzoni et al., 2007; Budd & Stolarski, 2009; 2011; Janiszewska et al., 2011).

Table 1.1 - Scleractinia suborders and families proposed by the four most comprehensive evolutionary schemes that included all extant and fossil data known to their respective data of publication.

	Vaughan & Wells (1943) Wells (1956)	**Alloiteau (1952)**	**Chevalier and Beauvais (1987)**	**Veron (1995)**
Sub-Orders	Astrocoeniina	Archaecoeniina	Stylophyllina	Stylophyllina
Families	Pocilloporidae	Pinacophyllidae †	Zardinophyllidae †	Zardinophyllidae †
	Astrocoeniidae	Seriatoporidae	Stylophyllidae †	Stylophyllidae †
	Acroporidae	Acroporidae	Pachythecalina	Gigantosstyliidae †
	Stylinidae †	Stylophoridae	Pachythecalidae †	Pachythecalina
	Thamnasteriidae	Actinastraeidae †	Volzeidae †	Pachythecalidae †
	Fungiina	Stylophyllidae †	Distichophyllina	Volzeidae †
	Microsolenidae †	Stylinida	Coryphyllidae †	Cyclophylliidae †
	Actinacididae †	Cyathophoridae †	Distichophyllidae †	Gablonzeriidae †
	Poritidae	Stylinidae †	Margarophyllidae †	Archaeocoeniina
	Calamophyllidae †	Heterocoeniidae †	Archaeofungiina	Tropiphyllidae †
	Siderastreidae	Euheliidae †	Cyclastraeidae †	Astrocoeniidae
	Agariciidae	Astraeoida	Procyclolitidae †	Pocilloporidae
	Procyclolitidae †	Montlivaltiidae †	Cyclophyllopsiidae †	Acroporidae
	Haplaraeidae †	Placosmiliidae †	Archeocaeniina	Pamiroseriidae †
	Fungiidae	Isastraeidae †	Tropiphyllidae †	Archaeofungiina
	Synastreidae †	Clausastraeidae †	Astrocoeniidae	Cyclastraeidae †
	Cyclolitidae †	Faviidae	Seriatoporidae	Cyclophyllopsiidae †
	Micrabaciidae	Heliastraeidae	Acroporidae	Stylinina
	Faviina	Oulastraeidae	Fungiina	Cyathophoridae †
	Stylophyllidae †	Astrangiidae	Agariciidae	Stylinidae †
	Amphiastreidae †	Echinoporidae	Funginellidae †	Fungiina
	Oculinidae	Placocaeniidae †	Andemantastraeidae †	Agariciidae
	Rhizangiidae	Columnastraeidae	Thamnasteriidae †	Funginellidae †
	Montlivaltiidae †	Oculinidae	Dermosmiliidae †	Andemantastraeidae †
	Pectiniidae	Anthemiphylliidae	Synastraeidae †	Thamnasasteriidae †
	Mussidae	Mussidae	Latomeandriidae †	Dermosmiliidae †
	Meandrinidae	Pectinidae	Cunnolitidae †	Synastraeidae †
	Faviidae	Merulinidae	Microsolenidae †	Latomeandriidae †
	Merulinidae	Meandriida	Siderastreidae	Cunnolitidae †
	Anthemiphylliidae	Smilotrochiidae	Psammocoridae	Microsolenidae †
	Caryophylliina	Dendrogyriidae	Fungiacyathidae	Siderastreidae
	Guyniidae †	Meandriidae	Fungiidae	Fungiacyathidae
	Flabellidae	Stylocaeniidae †	Poritidae	Fungiidae
	Caryophylliidae	Hemiporitidae †	Stylinina	Micrabaciidae
	Rhipidogyridae †	Amphiastraeida	Cyathophoridae †	Astraeomorphidae †
	Dendrophylliina	Amphiastraeidae †	Stylinidae †	Procyclolitidae †
	Dendrophylliidae	Mitrodendronidae †	Faviina	Cuifastraeidae †
		Caryophylliida	Montlivaltiidae †	Faviina
		Thecocyathidae †	Faviidae	Montlivaltiidae †
		Turbinoliidae	Trachyphylliidae	Faviidae
		Caryophylliidae	Merulinidae	Trachyphylliidae
		Guyniidae	Diploastraeidae	Merulinidae
		Parasmiliidae †	Mussidae	Mussidae
		Flabellidae	Pectiniidae	Pectiniidae
		Fungiida	Astrangiidae	Rhizangiidae
		Lamellofungiidae †	Oculinidae	Anthemiphylliidae
		Cyclophyllopsiidae †	Anthemiphylliidae	Astraeoina
		Cyclastraeidae †	Meandriina	Pamiroseriidae †
		Conophylliidae †	Meandrinidae	Caryophylliina
		Procyclolitidae †	Galaxeidae	Thecocyathidae †
		Haplaraeidae †	Caryophylliina	Caryophylliidae
		Andemantastraeidae †	Thecocyathidae †	Dasmiidae
		Thamnastreiidae †?	Caryophylliidae	Parasmiliidae
		Agariciidae	Desmophyllidae	Turbinoliidae
		Funginellidae	Dasmiidae	Eusmilidae
		Asteroseriidae †	Parasmiliidae	Guyniidae
		Synastreidae †	Turbinolidae	Flabellidae
		Acrosmilidae †	Eusmilidae	Remimaniphylliidae †
		Cunnolitidae †	Guyniidae	Margarophylliidae †
		Siderastraeidae	Flabellidae	Distichophylliina
		Microsolenidae †	Dendrophylliina	Coryphyllidae †
		Brachyphylliidae †	Dendrophylliidae	Distichophylliidae †
		Dermosmiliidae †	Micrabaciidae	Meandriina
		Latomeandriidae †	Astraraeidae †	Rhipidogyridae †
		Fungiidae	Actinicididae †	Oculinidae
		Micrabaciidae		Meandrinidae
		Agathiphylliidae		Poritiina
		Poritidae		Poritidae
		Actinacididae †		Actinacididae †
		Eupsammida		Dendrophyllina
		Eupsammidae		Actraraeidae †
		Turbinaridae		Dendrophylliidae
Sub-order diagnostic features	Septal trabeculae Septal structure	Synapticulae presence Septal trabeculae Septal symmetry and structure Endotheca development	Septal trabeculae Synapticulae presence Thecal structure	-
Number of sub-orders	5	8	11	13
Family diagnostic features	Septal trabeculae (structure) Wall type Presence of endotheca Budding	Family diagnostic characters specific for each sub-order	Family diagnostic characters specific for each sub-order	-
Number of families with extant taxa	20	30	30	24

Based on the concept that DNA sequences can provide large numbers of phylogenetic characters that are independent of the high morphological variability of the coral skeleton, over the past two decades molecular techniques have cast new light on various aspects of scleractinian evolution, challenging long-standing hypotheses based on morphological characters. Recent molecular studies with larger data sets and broad taxon sampling support the monophyly of the order (Fukami et al., 2008; Barbeitos et al., 2010; Kitahara et al., 2010b [chapter 5]; Stolarski et al., *submitted* [chapter 8]), rejecting the hypothesis that corallimorpharians are scleractinians that have undergone skeleton loss (Stanley & Fautin, 2001; Medina et al., 2006). In addition to the molecular phylogenetic support, consideration of mitochondrial genome size, mitochondrial gene order, and the size of the intron in the CO1 gene provides strong support for scleractinian monophyly (Chen, C. A. *personnal communication*).

Although degrees of incongruence are seen at all taxonomic levels below order, at this time arguably the major discrepancy between morphological and molecular phylogenies is at the sub-ordinal level. While 5 suborders are recognised in the most widely accepted morphological scheme (Wells, 1956), only 3 main clades (i.e. lineages – "Basal", "Complex" and "Robust") are distinguished based on molecular analyses (Romano & Palumbi, 1996, 1997; Kitahara et al., 2010b [chapter 5]). Although every molecular marker tested to date supports these latter groupings (*"Complex" and "Robust" clades*: Romano & Palumbi, 1996 [16S rDNA], 1997 [16S rDNA]; Romano & Cairns, 2000 [16S rDNA and 28S rDNA]; Chen et al., 2002 [12S rDNA]; Cuif et al., 2003 [28S rDNA]; Le Goff-Vitry et al., 2004 [16S rDNA]; Fukami et al., 2008 [CO1, Cyt-B, ß-tubulin and 28S rDNA]; Kitahara et al., 2010a [16S rDNA – chapter 4] – *"Basal" clade*: Kitahara et al., 2010b [CO1 – chapter 5], *in prep.* [12S rDNA, 16S rDNA, CO1 and 28S rDNA – chapter 8]), we have yet to identify morphological characters that correlate with the molecular phylogeny, which means that it is impossible at the present time to allocate exclusively fossil taxa to the molecular scheme.

At the family level, the picture is not different. Although exceptions are known (i.e. Agariciidae, Acroporidae, Fungiidae, Pocilloporidae), most families composed exclusively by zooxanthellate species were shown by molecular techniques to be polyphyletic (Fukami et al., 2004; 2008). Among these, the most poorly understood families are the Faviidae, Merulinidae and Mussidae, which had been split into many groups (Fukami et al., 2008); moreover, according to Huang et al. (2009), many of the genera that comprise these families may not be natural.

Prior to this thesis, the vast majority of molecular data available for scleractinians was from shallow-water zooxanthellate species, and despite accounting for approximately half of the extant species (Cairns, 2007), azooxanthellate corals were poorly represented in molecular phylogenetic reconstructions of the order. To address this, during the course of this thesis, I was able to incorporate many deep-water taxa into phylogenetic analyses, and consequently into the evolutionary scheme of the order. In addition, I demonstrate that the evolutionary origin of scleractinians is best sought in deep-water (i.e. azooxanthellate) rather than shallow-water (primarily zooxanthellate) coral species and I show that the classification of most families composed exclusively or predominantly of azooxanthellate corals is less problematic (i.e. appears to be monophyletic) than for their shallow-water counterparts and is broadly consistent with classical taxonomy.

Starting from the premises that a taxonomic framework is essential to much of biology (Wheeler, 2004), and that solid and reliable taxonomic information is essential for the interpretation of molecular phylogenies, a large segment of the present thesis is dedicated to classical taxonomy of extant azooxanthellate scleractinians. Even for those chapters that are heavily based on molecular data, the corresponding discussion is primarily concerned with the taxonomic implications of the molecular analyses. One consequence of this systematic phylogenetic approach is that the two disciplines reciprocally illuminate each other, enabling the evolutionary past to be uncovered (Hennig, 1957).

Overall, my goals are to improve the state of knowledge of the azooxanthellate scleractinian corals from the New Caledonia archipelago, a group of islands located in the southwestern Pacific Ocean; and to provide molecular data that will enable inclusion of a broad range of deep-water taxa into phylogenetic reconstructions of the order. To achieve these goals, I use classical taxonomic approaches, as well as statistical, molecular and bioinformatics tools to address inconsistencies in the classification of azooxanthellate scleractinians, and examine how deep-water corals fit into the evolutionary history of the order. More specifically I aim to:

1. Morphologically describe all azooxanthellate scleractinians from New Caledonia (Chapter 2).

This chapter is based on nearly 3000 specimens from 178 stations and examines the species richness of the azooxanthellate scleractinian fauna from New Caledonia. In conjunction with an extensive literature review, I identified the occurrence of 170 species, providing detailed morphological descriptions of each of these. This chapter reports new occurrence of 108 species to the region, including one new genus (*Faustinotrochus*) and 16 new species. In addition, a complete synonym list, type-locality data, information about type-material deposition and geographic distribution, and illustrations are provided for each species, making this chapter a comprehensive taxonomic reference for future studies on azooxanthellate corals from the region as well as for the western Pacific Ocean.

2. Demonstrate based on statistical analyses that the New Caledonia Exclusive Economic Zone has a much more diverse azooxanthellate scleractinian coral fauna than previously examined regions around the world (Chapter 3).

Rarefaction analyses were used to investigate how diverse the New Caledonia azooxanthellate scleractinian fauna is in relation to eight geographical western Pacific macroregions. In addition, cluster analysis using the unweighted pair-group average methods followed by non-metric multi-dimensional ordination was employed to establish the zoogeographic affinities between the 8 western Pacific macroregions. These analyses show that the New Caledonia region has the most diverse deep-water scleractinian fauna and that it shares more with the New Zealand region than with Australia.

3. Examine the taxonomic validity of *Caryophyllia*, the most speciose of extant azooxanthellate scleractinian genera, using (partial) 16S rDNA data, and describe six new species (Chapter 4).

Classical taxonomic studies were used to investigate all new records (23) of the genus *Caryophyllia* from New Caledonian and Australian waters. Based on morphological characters I proposed the first identification key that includes all 73 representatives of this genus, and in addition, using DNA sequences from a mitochondrial loci I inspected the monophyly of this genus.

4. Undertake the most comprehensive phylogenetic study on Scleractinia to date (Chapter 5).

To better understand broad patterns of coral evolution, I generated molecular data for a broad and representative range of deep-water scleractinians collected off New Caledonia and Australia, and conducted the most comprehensive molecular phylogenetic analysis of the order to date. Amongst other results, I show that there is a striking discrepancy between the taxonomic validity of coral families consisting predominantly of deep- or shallow-water species. In addition, I propose that the inclusion of deep-water corals into phylogenetic reconstructions is critical to improve our understanding of the origins of the Scleractinia and anthozoan evolution.

5. Transfer the enigmatic deep-water species *Dactylotrochus cervicornis* to the family Agariciidae (Chapter 6).

In a classical case of "reciprocal illumination", I used morphological and molecular data to explore the phylogenetic position of the monotypic caryophylliid genus *Dactylotrochus.* DNA sequence data from one nuclear and two mitochondrial *loci*, combined with a detailed examination of morphological structures, support the transfer of this genus to the family Agariciidae. The transfer of this species means that it becomes the first extant deep-water agariciid known to date, and corroborates the hypothesis that many shallow-water zooxanthellate scleractinian lineages have deep-water azooxanthellate ancestors.

6. Elevate the genus *Deltocyathus* to family rank (Chapter 7).

In a second reconciliation/unification of classical taxonomy and molecular phylogenetics, I investigated the validity and phylogenetic position of the genus *Deltocyathus*. Based on examination of microstructural characters and DNA sequence data (one nuclear and two mitochondrial loci), I propose the elevation of the genus to family rank.

7. Based on a molecular clock calibrated against the fossil record, I show that two extant deep-water coral families (Gardineriidae and Micrabaciidae) represent the oldest scleractinian lineage known to date (Chapter 8).

Using a comprehensive data set composed of 16S and 28S rDNA from more than 110 species, I used a molecular clock calibrated against the fossil record to show not only that the divergence of the two major scleractinian clades, “Robust” and “Complex”, took place in the Devonian (about 100 My earlier than previously thought), but also that two families of deep-sea corals, the Gardineriidae and Micrabaciidae, diverged even earlier.

8. Characterize the first mitochondrial genome of a solitary, deep-water scleractinian species (*Gardineria hawaiiensis*) (Chapter 9).

To further investigate the importance of deep-water scleractinians for phylogenetic reconstruction of the order, I determined the complete nucleotide sequence of the mitochondrial genome of the coral *Gardineria hawaiiensis* (19,429 bp) and reconstructed the phylogeny of the order based on a total of 50 mtgenomes.

9. Correlate key events in coral evolution and major climatic changes that have occurred over the past 460 My (Conclusions - Chapter 10).

Linking morphological, paleontological and molecular data, in this chapter I correlate key events in coral evolution with major global scale changes that have occurred over the past 460 My. Aiming to add to the knowledge of how corals may respond to our rapidly changing world, here is hypothesized that global environmental change may have been a major driving force behind the colonization of deep environments by scleractinian corals, and that simple azooxanthellate deep-water corals may be less affected by anthropogenic based climate change than shallow-water corals.

This page is intended to be blank

CHAPTER 2

Taxonomic Revision of the Azooxanthellate Scleractinia (Cnidaria, Anthozoa) from New Caledonia

---

*The New Caledonia island group is located on the southernmost edge of the tropical zone, about 1200 km east of Australia. The underwater geomorphology of its Exclusive Economic Zone (EEZ) is one of the most complex in the world, and shelters a wide diversity of marine habitats and benthic communities. Among the key species in habitat formation and benthic community support, the scleractinians are particularly important in New Caledonia, represented by approximately 310 zooxanthellate species. In comparison with their shallow-water counterparts, the New Caledonian deep-water Scleractinia species richness is poorly known. Literature review and examination of nearly 3000 specimens from 178 stations originating primarily from the Bathus 4 and Norfolk 2 expeditions, resulted in a total of 170 Recent azooxanthellate scleractinians reported from the New Caledonia Archipelago. Among them, 108 species represent new records, including one new genus (*Faustinotrochus*) and 8 new species. Complete synonym list, type-locality, type-material deposition, description or diagnosis, geographic distribution, and illustrations are provided for each species. Discussion of intraspecific variation and comparison with most similar species are given when necessary.*

2.1 INTRODUCTION

Located around 21º30’S and 165º30’E in the southwest Pacific Ocean, and unlike most of the Pacific islands that have recent volcanic origin, New Caledonia is one of the northernmost parts of a submerged continent called Zealandia (Chardon & Chevillotte, 2006; Mortimer et al., 2006; Grandcolas et al., 2008; Neall & Trewick 2008). The New Caledonia archipelago reached its present position about 63 to 55 Mya (Veevers & Li, 1991; McLoughlin, 2001), and its Economic Exclusive Zone (EEZ) underwater geomorphology is one of the most complex in the world due to numerous seamounts and ridges, with Lord Howe ridge to the west, Loyalty ridge to the east, and Norfolk ridge to the south. Separating these ridges, which are considered as conduits for the migration of deep-water corals (Cairns, 1999), there are two large geological basins: the New Caledonia and Norfolk basins. Together, the ridges and basins provide a geographically complex mosaic of substrates that are available for colonization of deep-water communities. According to Cairns (2007), the Philippines to New Caledonia shelf and slope region is one of the most extensive contiguous area of substrate at 200-1,000 m depth in the world, which is the prime depth for azooxanthellate Scleractinia.

Research on hard corals from the New Caledonian region has been primarily focused on the extensive occurrence of shallow-water species, which form the second largest coral-reef site in the world (Mittermeier et al., 1996). Recently, UNESCO listed the reefs of the region as a World Heritage Area under the name: “*The Lagoons of New Caledonia: Reef Diversity and Associated Ecosystems*”. However, the first coral collection from this region refers to azooxanthellate species obtained from the Loyalty Islands by Arthur Willey during 1895-1897 (Pichon, 2007). These specimens were studied by Gardiner (1899: 161) who quoted “the solitary corals, classified and in part described in this communication, are remarkable for the large number of new species”. After this study, even with a great effort collection made by French expeditions during the early 1990’s to present, the New Caledonia azooxanthellate coral fauna remains broadly *unpublished*. Table 2.1 summarizes all previous records of this fauna for the region.

Table 2.1. –Summary of azooxanthellate Scleractinia previously reported from New Caledonia.

Reference	Species reported
Gardiner (1899a)	*Balanophyllia (B.) profundicella*
	Dactylotrochus cervicornis
	Deltocyathus ornatus
	Endopsammia regularis
	Paracyathus lifuensis
	Paracyathus parvulus
	Rhizotrochus levidensis
	Tethocyathus minor
	Thalamophyllia tenuescens
Gardiner (1900)	*Cladopsammia willeyi*
Pratt (1900)	*Madrepora porcellana*
Hickson (1903)	*Madrepora porcellana*
Wijsman-Best (1970)	*Polycyathus fulvus*
Chevalier (1971)	*Culicia fragilis*
	Culicia rubeola
	Oulangia cyathiformis
Zibrowius & Grygier (1985)	*Anthemiphyllia dentata*
	Balanophyllia sp.
	Cyathoceras sp.
	Endopachys grayi
	Fungiacyathus sp.
Sieg & Zibrowius (1989)	*Trochocyathus* sp.
	Caryophyllia sp. A
	Caryophyllia sp. B
	Flabellidae gen. nov., sp. nov.
Cairns (1989)	*Bourneotrochus stellulatus*
	Guynia annulata
Manning (1991)	*Dendrophyllia alcocki*
Cairns (1995)	*Trochocyathus cepulla*
Guerriero et al. (1995)	*Deltocyathus magnificus*
Stolarski (1996)	*Gardineria hawaiiensis*
Cairns & Zibrowius (1997)	*Balanophyllia (B.) desmophyllioides*
	Caryophyllia (C.) crosnieri
	Dactylotrochus cervicornis
	Truncatoflabellum dens
Cairns (1999)	*Deltocyathus corrugatus*
Stolarski (2000)	*Temnotrochus kermadecensis*
	Truncatoguynia irregularis
Cairns (2004)	*Idiotrochus alatus*
	Stephanocyathus (O.) coronatus
Pichon (2007)	*Heteropsammia cochlea*
	Tubastraea coccinea
	Tubastraea micranthus
Kitahara & Cairns (2008)	*Crispatotrochus rubescens*
	Crispatotrochus rugosus
	Crispatotrochus septumdentatus
Kitahara & Cairns (2009)	*Deltocyathus cameratus*
	Deltocyathus corrugatus
	Deltocyathus crassiseptum
	Deltocyathus heteroclitus
	Deltocyathus inusitatus
	Deltocyathus magnificus
	Deltocyathus ornatus
	Deltocyathus rotulus
	Deltocyathus suluensis
	Deltocyathus vaughani
Kitahara et al. (2010a)	*Caryophyllia (A.) unicristata*
	Caryophyllia (C.) abrupta
	Caryophyllia (C.) aspera
	Caryophyllia (C.) cinticulata
	Caryophyllia (C.) concreta
	Caryophyllia (C.) crosnieri
	Caryophyllia (C.) diomedeae
	Caryophyllia (C.) hawaiiensis
	Caryophyllia (C.) laevigata
	Caryophyllia (C.) lamellifera
	Caryophyllia (C.) oblonga
	Caryophyllia (C.) octopali
	Caryophyllia (C.) quadragenaria
	Caryophyllia (C.) ralphae
	Caryophyllia (C.) rugosa
	Caryophyllia (C.) scobinosa
	Caryophyllia (C.) sp. A
	Caryophyllia (C.) versicolorata
	Rhizosmilia robusta

Intending to demonstrate how diverse the azooxanthellate scleractinian fauna is within the New Caledonian Economic Exclusive Zone (EEZ), and how important this area is for the knowledge regarding the western Pacific azooxanthellate corals, the present study reports on all known (62 – excluding those not identified to species level) and new occurrences (108 – including 8 new species) of cold-water Scleractinia from this region, totaling 170 species. Here, following Kitahara et al. (2010b), for the first time a new phylogenetic schema based on molecular data is used to order the systematic account descriptions of azooxanthellate scleractinians.

2.2 MATERIAL & METHODS

The present study is based on the examination of approximately 3,000 previously unstudied specimens collected by French expeditions during the late 1990's to 2003 (*alphabetically ordered*. –Bathus 3, Bathus 4, Biocal, Gemini, Halical I, Halipro I, Musorstom 5, Musorstom 7, Musorstom 8, Norfolk 1, Norfolk 2, SMIB 1, and SMIB 10), conducted using waren-dredge and beam-trawl, between depths of 80 and 1,200 m across 178 stations (Tab. 2.2) of the New Caledonia EEZ. The examined collection is a subset of the specimens collected during those cruises, with thousands specimens still unstudied at Paris and Marseille (Bouchet, Cairns and Zibrowius, *personal communication*), and Nouméa (Pichon, *personal communication*).

Table 2.2. –List of stations (ordered numerically by station number).

#	Stn.	Latitude (S)	Longitude *	Depth	Date
Halical 1					
1	DW 01	18º56'	163º24'	380-400	21/xi/1994
SMIB 1					
2	DW 06	22º46.0'	167º15.50'	300	05/ii/1986
Biocal					
3	DW 33	23º09.71'	167º10.27'	675	29/viii/1985
Gemini					
4	DW 60	20º59.90'	170º16.60'	80-90	06/vii/1989
SMIB 10					
5	DW 202	24º55'	168º22'	513-525	10/i/1995
6	DW 204	24º57'	168º21'	513-553	10/i/1995
7	DW 205	24º57'	168º21'	517-559	10/i/1995
8	DW 208	24º49'	168º09'	270	10/i/1995
9	DW 210	24º49'	168º09'	308-510	10/i/1995
Musortom 5					
10	DW 290	23º06.20	159º26.30	300	11/x/1986
Musortom 7					
11	DW 535	12º29.6'	176º41.3' W	340-470	16/v/1995
12	DW 538	12º30.8'	176º40.3' W	175-195	16/v/1992
13	DW 586	13º10.7'	176º13.1' W	510-600	22/v/1992
14	DW 605	13º21.3'	176º08.4' W	335-340	26/v/1992
Bathus 3					
15	DW 781	23º53.86'	169º46.27'	625	25/xi/1993
16	DW 784	23º56.12'	169º46.14'	611	25/xi/1993
17	DW 786	23º54.46'	169º49.15'	699-715	25/xi/1993
18	DW 818	23º43.89'	168º16.32'	394	28/xi/1993
19	CP 822	23º19.92'	167º57.45'	950-980	29/xi/1993
20	DW 827	23º22.37'	168º01.33'	381-469	29/xi/1993
21	CP 833	23º02.75'	166º58.23'	441-444	30/xi/1993
Halipro 1					
22	CP 850	21º43.63'	166º39.44'	541-580	19/iii/1994
23	CP 851	21º43.32'	166º37.43'	314-364	19/iii/1994
24	CP 854	22º05.03'	166º38.34'	650-780	19/iii/1994
25	CP 858	21º42.81'	166º41.95'	1000-1200	20/iii/1994

Table 2.2 – Continued.

26	CP 863	21º31.90’	166º20.83’	190-227	22/iii/1994
27	CP 877	23º03.51’	166º59.20’	464-480	31/iii/1994
Bathus 4					
28	DW 882	22º02.43’	165º56.42’	250-350	01/viii/1994
29	DW 883	22º03.43’	165º56.03’	450-600	01/viii/1994
30	DW 884	22º03.43’	165º56.03’	1100-1200	01/viii/1994
31	DW 885	22º05.03’	165º58.28’	250-300	01/viii/1994
32	DW 886	21º00.76’	164º27.86’	250-300	02/viii/1994
33	DW 887	21º06.67’	164º27.62’	320-344	02/viii/1994
34	DW 888	21º00.84’	164º27.28’	430-436	02/viii/1994
35	CP 889	21º00.83’	164º27.34’	416-433	02/viii/1994
36	CP 892	21º01.71’	164º27.32’	580-600	02/viii/1994
37	CP 893	21º01.70’	164º27.23’	600-620	02/viii/1994
38	DW 894	20º15.77’	163º52.03’	245-268	03/viii/1994
39	CP 897	20º15.93’	163º51.75’	305-350	03/viii/1994
40	DW 898	20º16.63’	163º50.21’	500-600	03/viii/1994
41	CP 899	20º16.68’	163º50.26’	500-600	03/viii/1994
42	CP 900	20º16.74’	163º50.06’	580	03/viii/1994
43	DW 902	19º00.84’	163º14.83’	341-351	04/viii/1994
44	DW 903	18º59.93’	163º13.55’	386-400	04/viii/1994
45	CP 905	19º02.45’	163º15.65’	294-296	04/viii/1994
46	DW 908	18º58.38’	163º10.76’	502-527	04/viii/1994
47	CP 910	18º59.32’	163º08.47’	560-608	05/viii/1994
48	CP 913	18º56.23’	163º04.86’	777-820	05/viii/1994
49	DW 914	18º48.79’	163º15.23’	600-616	05/viii/1994
50	DW 915	18º51.26’	163º16.72’	575-580	05/viii/1994
51	DW 916	18º53.30’	163º19.55’	516-570	05/viii/1994
52	DW 918	18º49.02’	163º15.80’	613-647	06/viii/1994
53	DW 919	18º49.83’	163º16.55’	610-660	06/viii/1994
54	CP 922	18º48.04’	163º18.58’	600	06/viii/1994
55	DW 923	18º51.51’	163º24.17’	470-502	06/viii/1994
56	DW 924	18º54.85’	163º24.34’	344-360	07/viii/1994
57	DW 925	18º54.55’	163º23.75’	307-405	07/viii/1994
58	DW 926	18º56.80’	163º25.36’	325-330	07/viii/1994
59	CP 928	18º54.72’	163º23.73’	420-452	07/viii/1994
60	DW 930	18º51.36’	163º23.63’	520-530	07/viii/1994
61	DW 932	19º07.91’	163º29.38’	170-190	08/viii/1994
62	DW 933	19º06.66’	163º29.28’	212-220	08/viii/1994
63	CP 936	19º03.67’	163º28.05’	252-258	08/viii/1994
64	CP 937	19º02.57’	163º27.66’	257-261	08/viii/1994
65	CP 938	19º00.16’	163º26.45’	208-288	08/viii/1994
66	DW 939	18º58.18’	163º25.37’	304-320	08/viii/1994
67	DW 940	18º59.53’	163º25.90’	305	08/viii/1994
68	DW 941	19º02.03’	163º26.93’	270	08/viii/1994
69	DW 943	20º12.28’	164º30.58’	316-347	09/viii/1994
70	DW 944	20º12.17’	164º32.56’	460-491	09/viii/1994
71	DW 945	20º12.10’	164º33.65’	530-620	09/viii/1994
72	DW 947	20º33.72’	164º57.72’	470-490	10/viii/1994
73	CP 948	20º33.13’	164º57.03’	533-610	10/viii/1994
74	CP 950	20º31.93’	164º56.11’	705-750	10/viii/1994
75	CP 951	20º31.44’	164º54.97’	960	10/viii/1994
76	CP 953	21º45.08’	166º36.46’	220-234	11/viii/1994
77	CP 954	21º44.13’	166º35.71’	250-255	11/viii/1994
Musortom 8					
78	DW 958	20º20.75’	169º47.06’	497-570	20/ix/1994
79	CP 967	20º19.45’	169º52.87’	295-334	21/ix/1994
80	DW 969	20º18.62’	169º53.17’	252-280	21/ix/1994
81	DW 984	19º19.62’	169º26.43’	480-544	23/ix/1994
82	DW 1038	16º48.71’	168º30.30’	469-472	30/ix/1994

Table 2.2 – Continued.

Musortom 9					
83	DR 1221	9º43.0’	138º51.0’	1110	30/viii/1997
Norfolk 1					
84	DW 1651	23º27.3’	167º50.4’	276	19/v/2001
85	DW 1652	23º26.1’	167º50.3’	290	19/v/2001
Norfolk 2					
86	DW 2023	23º27’	167º51’	282-297	20/x/2003
87	DW 2024	23º28’	167º51’	370-371	20/x/2003
88	DW 2025	23º27’	167º51’	410-443	21/x/2003
89	DW 2026	23º26’	167º02’	589-762	21/x/2003
90	DW 2029	23º39’	167º44’	438-445	22/x/2003
91	DW 2032	23º39’	167º43’	420-450	22/x/2003
92	DW 2034	23º41’	167º41’	485-505	22/x/2003
93	DW 2035	23º40’	167º40’	515-540	22/x/2003
94	DW 2036	23º38’	167º39’	571-610	22/x/2003
95	DW 2037	23º40’	167º41’	517-570	22/x/2003
96	CP 2038	23º42’	168º10’	290-330	23/x/2003
97	DW 2040	23º41’	168º01’	285	23/x/2003
98	DW 2041	23º41’	168º01’	400	23/x/2003
99	DW 2042	23º41’	168º01’	235-245	23/x/2003
100	DW 2046	23º44’	168º01’	785-810	23/x/2003
101	DW 2047	23º43’	168º02’	759-807	23/x/2003
102	DW 2049	23º43’	168º15’	470-621	24/x/2003
103	DW 2052	23º42’	168º15’	473-525	24/x/2003
104	DW 2053	23º40’	168º16’	670-708	24/x/2003
105	DW 2056	24º40’	168º39’	573-600	25/x/2003
106	DW 2057	24º40’	168º39’	555-565	25/x/2003
107	DW 2058	24º40’	168º40’	591-1032	25/x/2003
108	DW 2060	24º40’	168º39’	582-600	25/x/2003
109	DW 2063	24º41’	168º40’	624-724	25/x/2003
110	DW 2064	25º17’	168º56’	609-691	26/x/2003
111	DW 2065	25º16’	168º56’	750-800	26/x/2003
112	DW 2066	25º17’	168º55’	834-870	26/x/2003
113	DW 2067	25º16’	168º56’	680-980	26/x/2003
114	DW 2068	25º20’	168º57’	680-980	26/x/2003
115	DW 2069	25º20’	168º58’	795-852	26/x/2003
116	DW 2070	25º23’	168º57’	630-1150	26/x/2003
117	DW 2072	25º21’	168º57’	1000-1005	26/x/2003
118	DW 2073	25º24’	168º19’	609	27/x/2003
119	DW 2074	25º24’	168º20’	623-691	27/x/2003
120	DW 2075	25º23’	168º20’	650-1000	27/x/2003
121	DW 2078	25º21’	168º19’	654-877	27/x/2003
122	DW 2080	25º20’	168º19’	764-816	27/x/2003
123	DW 2081	25º54’	168º22’	500-505	28/x/2003
124	DW 2084	24º52’	168º22’	586-730	28/x/2003
125	DW 2086	24º56’	168º22’	707-777	28/x/2003
126	DW 2087	24º56’	168º22’	518-586	28/x/2003
127	DW 2091	24º45’	168º06’	600-896	29/x/2003
128	DW 2092	24º45’	168º07’	320-345	29/x/2003
129	DW 2093	24º44’	168º09’	230	29/x/2003
130	DW 2095	24º46’	168º10’	283-310	29/x/2003
131	DW 2096	24º44’	168º09’	230-240	29/x/2003
132	DW 2097	24º44’	168º06’	580-583	29/x/2003
133	DW 2098	24º42’	168º06’	550-668	29/x/2003
134	DW 2100	23º54’	167º44’	675-709	30/x/2003
135	DW 2102	23º56’	167º44’	700-715	30/x/2003
136	DW 2103	23º57’	167º44’	717-737	30/x/2003
137	DW 2104	23º58’	167º43’	700-752	30/x/2003
138	DW 2106	23º54’	167º42’	685-757	30/x/2003

Table 2.2 – Continued.					
139	DW 2107	23º53’	167º41’	742-820	30/x/2003
140	DW 2108	23º47’	168º17’	403-440	31/x/2003
141	DW 2109	23º47’	168º17’	422-495	31/x/2003
142	DW 2110	23º48’	168º17’	500-1074	31/x/2003
143	DW 2111	23º49’	168º17’	500-1074	31/x/2003
144	DW 2112	23º44’	168º18’	640-1434	31/x/2003
145	DW 2113	23º45’	168º18’	888-966	31/x/2003
146	CH 2115	23º45’	168º17’	377-401	31/x/2003
147	DW 2117	23º24’	168º00’	400	01/xi/2003
148	DW 2119	23º23’	168º02’	300	01/xi/2003
149	CP 2121	23º23’	168º00’	486-514	01/xi/2003
150	DW 2123	23º18’	168º15’	187-197	02/xi/2003
151	DW 2124	23º18’	168º15’	260-270	02/xi/2003
152	DW 2125	23º17’	168º14’	275-348	02/xi/2003
153	DW 2126	23º16’	168º14’	398-550	02/xi/2003
154	DW 2127	23º16’	168º15’	379-381	02/xi/2003
155	DW 2132	23º17’	168º14’	405-455	02/xi/2003
156	DW 2133	23º01’	168º18’	215-270	03/xi/2003
157	DW 2135	23º02’	168º21’	295-330	03/xi/2003
158	DW 2136	23º01’	168º23’	402-410	03/xi/2003
159	DW 2137	23º01’	168º23’	547-560	03/xi/2003
160	DW 2140	22º60’	168º22’	270-350	03/xi/2003
161	CP 2141	23º01’	168º20’	92-100	03/xi/2003
162	DW 2142	23º01’	168º17’	550	03/xi/2003
163	CP 2143	23º01’	168º17’	564-590	03/xi/2003
164	DW 2144	23º09’	167º27’	1004-1009	04/xi/2003
165	CP 2146	22º50’	167º17’	518	04/xi/2003
166	DW 2147	22º50’	167º16’	496	04/xi/2003
167	DW 2148	22º44’	167º16’	386-391	04/xi/2003
168	DW 2150	22º43’	167º16’	245-300	05/xi/2003
169	DW 2151	22º43’	167º14’	353-368	05/xi/2003
170	CP 2153	22º48’	167º12’	395-400	05/xi/2003
171	DW 2155	22º52’	167º13’	453-455	05/xi/2003
172	DW 2156	22º54’	167º15’	468-500	05/xi/2003
173	DW 2157	22º56’	167º19’	553-575	05/xi/2003
174	DW 2158	22º41’	167º14’	265-283	06/xi/2003
175	DW 2159	22º41’	167º12’	300-305	06/xi/2003
176	DW 2160	22º42’	167º10’	313-315	06/xi/2003
177	DW 2162	22º44’	167º07’	318	06/xi/2003
PrFO					
178	?	22º22. 62’	166º25.97’	300	?

* All longitudes are E unless otherwise indicated.

Species identifications were based on Alcock (1898), Gardiner (1899), Zibrowius (1980), Cairns (1984, 1991, 1994, 1995, 1998, 1999, 2004), Cairns & Parker (1992), Owens (1994), and Cairns & Zibrowius (1997). Species descriptions, synonymies, type locality, type material, new records (if any), previous records from New Caledonia (if any), worldwide distribution, a brief discussion, and illustratios are provided for all species. However, description and diagnosis are not provided for those species that are discussed in Chapter 4. Also, generic diagnoses were not re-written in an original manner, most of them being compiled or amended from Cairns (1979, 1982, 1994, 1995, 1997, 2000, 2001).

I tried to provide species synonymies as complete as possible (even acknowledging that some references were probably overlooked). For those species indicated by an asterisk (*), recent citations were not included in the synonym list. Also, the synonymy lists do not include those species that previous identifications are dubious, tentative, or published account unclear.

LIST OF ABBREVIATIONS

Museums and Collection Institutions

AIM	Auckland Institute Museum, Auckland
AM	Australian Museum, Sydney
BLIH	Biological Laboratory of the Imperial Household, Tokyo
BM	British Museum (now The Natural History Museum), London
BPBM	Bernice Pauahi Bishop Museum, Honolulu
CUMZ	University Museum of Zoology, Cambridge
IM	Indian Museum, Calcutta
IO	Institute of Oceanology, Moscow
IRCZM	Indian River Coastal Zone Museum, Harbor Branch Oceanographic Institution, Florida
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge
MNHN	Muséum National d'Histoire Naturelle, Paris
MOM	Muséum Océanographique de Monaco, Monaco
MoNZ	Museum of New Zealand Te Papa Tonga-rewa, Wellington
MTQ	Museum of Tropical Queensland, Townsville
NMV	National Museum Victoria, Melbourne
NMW	Naturhistorisches Museum, Wien
NNM	Nationaal Natuurhistorisch Museum, Leiden
NZOI	New Zealand Oceanographic Institution (now the National Institute of Water and Atmospheric Research), Wellington
OM	Oslo Museum, Oslo
POLIPI	Politbang Oseanologi, Jakarta
SAFM	South African Museum, Cape Town
SAM	South Australian Museum, Adelaide
SMNH	Swedish Museum of Natural History, Stockholm
SZM	Strasbourg Zoological Museum
UCMP	University of California, Museum of Paleontology, Berkeley
USGS	United States Geological Survey, Washington, D. C.
NMNH	United States National Museum (now the National Museum of Natural History, Smithsonian), Washington, D.C.
WAM	Western Australian Museum, Perth
YPM	Yale Peabody Museum, New Heaven
ZMA	Zöologisch Museum, Amsterdam
ZMB	Zoologisches Museum, Berlin
ZMUC	Zoologisk Museum, Copenhagen
ZMUZ	Zoologisches Museum der Universität Zürich, Switzerland

Morphological Terms

D:H	Ratio of diameter to height of a solitary corallum
GCD	Greater calicular diameter
GCD:H	Ratio of greater calicular diameter to height of a solitary corallum

GCD:LCD	Ratio of greater calicular diameter to lesser calicular diameter
H:D	Ratio of height to diameter of a solitary corallum
LCD	Lesser calicular diameter
PD	Pedicel diameter
GPD	Greater pedicel diameter
PD:GCD	Ratio of pedicel diameter to greater calicular diameter of a solitary corallum
Sx,Cx,Px	Septa, costae, or pali (respectively) of cycle designated by number
Sx>Sy	Septa of cycle x wider than septa of cycle y

2.3 RESULTS

Systematic Account

Order Scleractinia

"Basal" Scleractinian Group *sensu* Kitahara et al., 2010b

Family Micrabaciidae Vaughan, 1905

Genus *Letepsammia* Yabe & Eguchi, 1932

Diagnosis. –Corallum solitary, discoidal, and free. Synapticulothecate. Marginal shelf present. Costae thin, ridged and dentate. Intercostal spaces much broader than costae and penetrated by large pores. Septa also highly porous, with complex dentition. Septa alternate in position with costae. Septa arranged in typical micrabaciid pattern, having multiple S3 bifurcations. Number of septa a function of calicular diameter, but 120 is the common adult number. Columella spongy.

Type Species. –*Stephanophyllia formosissima* Moseley, 1876, by original designation.

Letepsammia formosissima (Moseley, 1876)

Plate 1, Figs. A-B

Stephanophyllia formosissima Moseley, 1876: 561-562. –Moseley, 1877: 4. –Moseley, 1881: 201-204, pl. 4: fig. 11, pl. 13: figs. 6-7, pl. 16: figs. 8-9. –Fowler, 1888: 418-419, 429. –Vaughan, 1907: 17, 23, 24, 27, 28, 35, 38, 43, 44, 146, 147, 419, 426, pl. XLIV, figs. 2, 2a. –Boschma, 1923: 144-145, pl. 10, fig. 31. –Faustino, 1927: 244-245, pl. 77, figs. 7-8. –Van der Horst, 1927: 7. –Yabe & Eguchi, 1932d: 61-63, pl. 8, figs. 7, 8. –Eguchi, 1934: 368. –Eguchi, 1938, table 2. –Gardiner & Waugh, 1939: 234. –Yabe & Eguchi, 1942b: 107, 138, 139. –Crossland, 1952: 92. –Wells, 1958: 263, pl. 1, figs. 1-2. –Squires, 1961:

19. –Ralph & Squires, 1962: 4, 16. –Utinomi, 1965: 249. –Maragos, 1977: 164. –Boshoff, 1981: 24. –Owens, 1994: 586. –Zibrowius & Grygier, 1985: 120. –Kuhlmann, 2006: 62, 85, 111.

Stephanophyllia formossisima. –Yabe & Eguchi, 1932b: 443.

Stephanophyllia. –Williams, 1986 (upper left color photo).

Leptopenus discus. –Dennant, 1906: 162. –Howchin, 1909: 248. –Wells, 1964.

Letepsammia formosissima. –Owens, 1986b: 486-487. –Cairns, 1984: 6-7. –Zibrowius & Grygier, 1985: 120. –Cairns, 1989a: 15-18, pl. 6, fig. j, pl. 7, figs. G-I, pl. 8, figs. a-d. –Cairns & Parker, 1992: 8-9, pl. 1, figs. f, h. –Dawson, 1992: 46. –Cairns & Keller, 1993: 230-231, fig. 3D. –Cairns, 1994: 40-41, pl. 15, figs. c, f. –Owens, 1994: 586, 588, 589. –Cairns, 1995: 36-37, pl. 3, figs. f-g. –Cairns & Zibrowius, 1997: 73-75. –Cairns, 1998: 371. –Cairns, 1999: 59. –Cairns et al., 1999: 34. –Plusquellec et al., 1999: 998. –Riemann-Zurneck & Iken, 2003: 383. –Cairns, 2004a: 264, 271. –Cairns, 2006: 47. –Cairns, 2009: 2. –Kitahara et al., 2010b. –Janiszewska et al., 2010.

Type locality. –*Challenger* stns. 192 and 209 (Philippines and Indonesia), 174-236 m.

Type material. –Five syntypes of *S. formosissima* are deposited at the BM (Cairns, 1989a).

New records. –SMIB 10: stn. DW 208 (1). –Bathus 3: stn. CP 833 (2). –Halipro 1: stn. CP 850 (6). –Bathus 4: stn. CP 889 (2); stn. CP 948 (1). –Norfolk 1: stn. DW 1651 (11); stn. DW 1652 (1). –Norfolk 2: stn. DW 2023 (12); stn. DW 2024 (4); stn. DW 2032 (1); stn. DW 2095 (8); stn. DW 2126 (1); stn. DW 2147 (1).

Description. –Corallum discoidal, large, with a flat to concave base. Calice circular; calicular edge slightly serrate. Largest specimen examined (DW 2023) 36.1 mm in CD and 9.0 mm in height. Costae ridged, serrate, and thin. Intercostal spaces always porous and broad near calicular edge (about 5 times width of costae), decreasing in width near epicentre of base. Synapticular bars connect each costa to its 2 adjacent septa near calicular edge, and near epicentre of base synapticular bars connect each costa to its 2 adjacent costae. Pores formed by synapticular bars decrease in size towards epicentre of base. A low marginal shelf about 3 mm in length encircles corallum. Corallum white.

Septa arranged in typical micrabaciid fashion (Cairns, 1989a) with up to 120 septa in larger specimens. S1 porous even in larger specimens examined and displays smooth lateral faces. S1 consist of one independent large lobe that becomes lacerated near calicular edge. S2 similar to S1 but internally, S2 bear septal spines in the region where flanking S3 fuse to it near columella. S3 highly porous and bifurcate repeatedly producing majority of septa. Fulturae linking each S1 to its adjacent S3 more numerous if compared to those between S2 and their adjacent S3. Columella spongy and elliptical in cross section, composed of numerous interconnected papillae as well as axial edges of S1-2 and sometimes S3.

Distribution. –*New Caledonia:* 270-610 m. –*Elsewhere*: Hawaiian Islands; South China Sea; Philippines; Indonesia; Australia; and New Zealand; 97-500 m.

Discussion. –*Letepsammia* is an exclusively azooxanthellate and deep-water micrabaciid genus composed of four species: *L. formosissima* (Moseley, 1876); *L. superstes* (Ortmann, 1888); *L. franki* Owens, 1994; and *L. fissilis* Cairns, 1995. All species belonging to this genus are reported from western Pacific and/or Indian waters. To date, only *L. formosissima* and *L. superstes* are reported from the New Caledonian region and the former is distinguished by having a larger corallum in the adult stage (GCD up to 47 mm for *L. formosissima* and no more than 20 mm for *L. superstes*); a flat-base (*L. superstes* is usually patellate and have slightly conical base); and a spongy columella. Also, according to Cairns (1995), *L. superstes* has a denser, more robust corallum and more closely spaced septa. Soft tissue of freshly collected specimens of *L. formosissima* are pale-pink in color and have dark-brown strips beside each S1 near columella. Also, small green fluorescent spots encircle the corallum and are placed between S3 bifurcations near the calicular edge.

***Letepsammia superstes* (Ortmann, 1888)**

Plate 1, Figs. C-D

Stephanophyllia superstes Ortmann, 1888: 160-161, pl. 6, fig. 5. –Owens, 1986b: 487.

Stephanophyllia japonica Yabe & Eguchi, 1932b: 443. –Yabe & Eguchi, 1934b: 281, figs. 1-3. –Yabe & Eguchi, 1942b: 139, 156-157, pl. 12, fig. 8. –

Micrabacia japonica. –Omura, 1983: 119.

Stephanophyllia japonica. –Zou, 1988: 75, pl. 5. Fig. 7.

Letepsammia formosissima forma *superstes*. –Cairns, 1994: 40-41, pl. 15, figs. c, f.

Letepsammia superstes. –Owens, 1994: 589. –Cairns, 1995: 34-35, pl. 2, figs. f-i. –Cairns & Zibrowius, 1997:75. –Cairns et al., 1999. –Cairns, 1999: 59. –Cairns, 2004a: 271. –Tachikawa, 2005: 6, pl. 2, figs. C-D. –Cairns, 2009: 2.

Type locality. –Sagama Bay (Japan), depth unknow.

Type material. –The holotype is deposited at the SZM (Cairns, 1995).

New records. –PrFO: stn. ? (1). –Bathus 4: stn. DW 887 (2); stn. DW 888 (1); stn. DW 916 (1). –Norfolk 2: stn. DW 2126 (1); stn. DW 2133 (1); stn. DW 2142 (1).

Description. -Corallum patellate with a slightly conical base. Calice circular; calicular edge slightly serrate as result of uneven placement of synapticular plates. Largest specimen examined (DW 887) 19.2 mm in CD and 5.5 mm in height. All costae thin, slightly ridged, and serrate. Intercostal spaces twice to three times width of costae and bear numerous T-shape synapticular bars, resulting in a quite porous base. Most costae do not reach epicentre of base, but all costae project about 0.5 mm beyond distal septal edge perimeter, producing a narrow marginal shelf. Corallum white.

Septa closely spaced and arranged in a micrabaciid fashion totalling 96 in number. S1 only independent septa and semi-circular in profile. S1 bear up to 16 trabecular spines. S2 bear about 13 trabecular spines, of which the three innermost are more robust and slightly inclined toward columella. S3 bifurcate repeatedly producing majority of septa and always bearing trabecular spines. All septa quite porous and covered by pointed granules. Each septum fuses to its adjacent septa by numerous synapticular plates circular in cross section. Fossa shallow, containing an elliptical papillose columella.

Distribution. –*New Caledonia:* 215-570 m. –*Elsewhere*: Japan; Korea Strait; South China Sea; Philippines; Indonesia; and Australia; 77-710 m.

Discussion. –See discussion of *L. formosissima*.

Genus *Rhombopsammia* Owens, 1986a

Diagnosis. –Corallum solitary, discoidal, and free. Synapticulothecate. Broad marginal shelf present. Costae ridged, thin and dentate. Intercostal spaces much broader than costae and penetrated by large pores. Septa imperforate, with complex dentition. Septa alternate in position with costae. Septa arranged in typical micrabaciid pattern, having multiple bifurcations of S3; number of septa a function of calicular diameter, but between 99 and 144 most common adult number. Columella spongy.

Type Species. –*Rhombopsammia squiresi* Owens, 1986a, by original designation.

Rhombopsammia niphada Owens, 1986a

Plate 1, Figs. E-F

Rhombopsammia niphada Owens, 1986a: 252-255, figs. 2B, 3A-D. –Cairns, 1989a: 19-20, text-fig. 2, pl. 9, figs. d-I, pl. 10, figs. a-b. –Cairns, 1994: 41, pl. 15, figs. i-k, pl. 16, figs. a-b. –Owens, 1994: 588. –Cairns & Zibrowius, 1997: 75-76. –Cairns, 1998: 371. –Cairns et al., 1999: 34. –Plusquellec et al., 1999: 998. –Cairns, 2004a: 271. –Cairns, 2009: 2. –Kitahara et al., 2010b. –Janiszewska et al., 2010.

Type locality. –*Albatross* stn. 4911 (31º38’N, 129º19’E – East China Sea), 715 m.

Type material. –The holotype and paratypes are deposited at the NMNH (Cairns, 1994).

New records. –Norfolk 2: stn. DW 2069 (1).

Description. –Corallum discoidal, large, extremely porous, and with a flat base. Calice circular; calicular edge serrate as result of uneven disposition of most peripheral synapticular bars. Specimen examined 26.9 mm in CD and 9.2 mm in height. All costae slightly ridged, equally wide, and serrate. Intercostal spaces broad (about 6 to 7 times width of costae) and porous. T-shaped synapticular bars link each two adjacent costae to its common septum (costae and septa alternate in position), producing two rows of rectangular to circular porous that decrease in size towards epicentre of base. Most costae do not reach epicentre. Specimen examined have a low and small marginal shelve (about 2 mm wide). Corallum white and fragile.

Septa arranged in a micrabaciid fashion totalling 96. S1 tall, independent, solid, and bear several vertical vepreculae on lateral faces. S2 consists of 2 or 3 axial septal spines followed by a solid lobe that also bears vertical vepreculae (slightly less evident than those of S1). S3 also solid but its canopies more porous. Each S3 bifurcates several times producing majority of septa. A row of aligned porous occur on canopies produced at S3 bifurcation regions. Peripheral regions of all septa slightly laciniate. Each septum is linked to its two adjacent septa through synapticular bars, which most of the time are difficult to distinguish from basal ones. Columella solid at base and bearing 5 tall papillae.

Distribution. –*New Caledonia:* 795-852 m. –*Elsewhere*: Japan; Philippines; Indonesia; and Australia; 390-804 m.

Discussion. –*Rhombopsammia niphada* is distinguished from its only congeneric (*R. squiresi* Owens, 1986a) by its thinner costae; flat base (strongly convex in *R. squiresi*);

and narrower marginal shelf. In fact the marginal shelf of *R. squiresi* appears to be unique among micrabaciids as it is virtually flat (see Cairns, 1989a, pl. 8, figs. e-j). *R. niphada* can most easily be confused with *L. formosissima* because they share many similarities (previously noted by Owens, 1986a). However, *R. niphada* has solid S1 in all ontogenetic phases, whereas *L. formosissima* consistently has highly perforate S1. Furthermore, S1 septal faces of *R. niphada* bear faint vepreculae and those of *L. formosissima* are smooth. Additional comparison between these two species can be found in Owens (1986a), Cairns (1989a), and Cairns & Zibrowius (1997).

Genus *Stephanophyllia* Michelin, 1841

Diagnosis. –Corallum solitary, discoidal, and free. Synapticulothecate. A small marginal shelf may be present. Costae granular. Intercostal spaces much broader than costae and penetrated by large pores. Septa imperforate, totalling 96 alternating in position with costae. Septa arranged in typical micrabaciid pattern, having multiple bifurcations of the S3. Septa and costae interconnected by elongate, bar-shaped synapticulae (fulturae). Septal faces synapticulae circular to elliptical in cross section. Columella lamellar to papillose.

Type Species. –*Fungia elegans* Bronn, 1837, by original designation.

Stephanophyllia complicata Moseley, 1876

Plate 1, Figs. G-H

Stephanophyllia complicata Moseley, 1876: 558-561. –Moseley, 1881: 198-200, pl. 4, fig. 12, pl. 13, figs. 3-5. –Alcock, 1902c: 40 (*in part*: *Siboga* stn. 256). –Van der Horst, 1926: 51. –Van der Horst, 1931: 11. –Gardiner & Waugh, 1939: 234. –Pillai, 1972: 204. –Pillai & Scheer, 1976: 14. –Cairns, 1989a: 21, pl. 12, figs. A-b. –Cairns & Keller, 1993: 231-232. –Cairns, 1995: 37-38, pl. 3, fig. h, pl. 4, figs. a-e. –Cairns & Zibrowius, 1997: 77-78. –Cairns, 1998: 363, 371. –Cairns, 1999: 60. –Cairns et al., 1999: 34. –Randall, 2003: 132. –Cairns, 2004a: 264, 271. –Cairns, 2009: 2. –Kitahara et al., 2010. – Janiszewska et al., 2010.

Stephanophyllia japonica. –Wells, 1984: 207, pl. 1, figs. 5-6.

Type locality. –*Challenger* stn. 192 (5º42’S, 132º25’E – Kai Islands, Banda Sea), 236 m.

Type material. –Two syntypes are deposited at the BM (Cairns, 1995).

New records. –Bathus 4: stn. DW 883 (3); stn. DW 885 (1); stn. DW 886 (1); stn. DW 894 (1); stn. DW 902 (2); stn. DW 908 (11); stn. DW 915 (2); stn. DW 916 (1); stn. DW 918 (13); stn. CP 922 (1). –Musorstom 9: stn. DR 1221 (2). –Norfolk 2: stn. DW 2117 (1); stn. CP 2121 (1); stn. DW 2159 (8).

Description. –Corallum discoidal, with a thin, flat to slightly convex base. Calice circular; calicular edge serrate. Largest specimen examined (DW 908) 19.8 mm in CD and 7.0 mm in height, but average corallum size about 14.0 mm in CD. Costae flat and equal in width. Intercostal space porous and about as wide as costae. Each costa bridged to its adjacent costae by synapticular bars at regular intervals. Each costa bears a row of low granules near epicentre of base that separates into two rows towards calicular edge. Central region between these two rows is sharply concave. Well-preserved specimens display slightly upturned bifid costae extending about 0.4 mm beyond calicular perimeter producing a small shelf. Intercostal region porous. Pores decrease in size towards epicentre of base. Epicentre of base sometimes slightly pointed. Corallum white.

Septa arranged in typical micrabaciid fashion (see Cairns, 1989a), invariably 96 in number and alternating in position with costae. S1 entire, tall, and have smooth upper and axial edges. S2 unbranched, each consisting of a variable number of tuberculate spines before a pair of S3 fusing to it near columella. Each S3 bifurcates several times, and is quite porous at each bifurcation regions. All septa solidly linked to their adjacent septa by numerous fulturae. Septal faces bear pointed granules. Fossa shallow, containing a lamellar columella subdivided into smaller lamellar segments at upper edge. Columellar base porous and formed by S1-2 lower axial edges fusion.

Distribution. –*New Caledonia:* 245-647 m. –*Elsewhere*: Saya de Malha Bank; Maldives; Chagos; Indonesia; Vanuatu; French Polynesia; Wallis and Futuna; Australia; and New Zealand; 73-1137 m.

Discussion. –Amongst the extant *Stephanophyllia* species (*S. complicata*, *S. fungulus*, and *S. neglecta*), *S. complicata* is distinguished by its unique thin, lamellar columella. Also, *S. complicata,* in contrast with the other extant congeners, has: a marginal shelf; slightly sinuous septal edges; and appears to attain the largest CD (up to 20 mm against 15.6 mm and 11.2 mm in *S. fungulus* and *S. neglecta* respectively).

Stephanophyllia neglecta **Boschma, 1923**

Plate 1, Figs. I-J

Fungia patella. –Van der Horst, 1921: 57 (*in part*: *Siboga* stn. 260).

Stephanophyllia neglecta Boschma, 1923: 144-145, pl. 10, figs. 28-30. –Yabe & Eguchi, 1932d: 58. –Squires, 1967: 505, 506. –Van Soest, 1979: 109. –Cairns, 1989a: 23-24, pl. 11, figs. c-j. –Cairns & Zibrowius, 1997: 77. –Cairns, 1999: 59. –Cairns et al., 1999: 34. –Plusquellec et al., 1999: 998. –Randall, 2003: 132. –Cairns, 2004a: 271. –Cairns, 2009: 2.

Type locality. –*Siboga* stn. 260 (5º36.5’S, 132º55.2’E – Kai Islands, Banda Sea), 90 m.

Type material. –Three syntypes are deposited at ZMA (Cairns, 2004a).

New records. –Bathus 4: stn. DW 914 (1). –Norfolk 2: stn. DW 2025 (1).

Description. –Corallum discoidal, small, with slightly concave to slightly convex base. Calice circular; calicular edge slightly serrate. No marginal shelf. Largest specimen examined (DW 2025) 9.7 mm in CD and 4.2 mm in height. Theca thick and quite porous. Costae equal in width and ornamented with a row of low rounded granules. Costal granules usually associated with costal/synapticular intersection, but additional granules may occur between synapticular bars. Intercostal spaces and costae equally wide, and regularly transversed by T-shaped synapticulae, producing a series of circular pores. Corallum white.

Septa arranged in micrabaciid fashion. All S1 examined were damaged, but at least 14 trabecular spines project above septal edge. Innermost spines slightly inclined towards columella and display a larger and more ornamented top if compared with its base. S2 non-bifurcated but not independent and consist of 13 projecting trabecular spines, of which the innermost two are most robust and most ornamented. S3 bifurcate several times producing the majority of septa. At the region of each bifurcation S3 become quite porous. Serial circular synapticular bars link each adjacent septum, being quite prominent between S1 and their adjacent S3. Fossa shallow, containing an elliptical columella that is massive at its base and is as ornamented as S1-2 axial trabecular spines.

Distribution. –*New Caledonia:* 410-616 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna region; Vanuatu; and Australia; 49-555 m.

Discussion. –Two *Stephanophyllia* do not have a marginal shelf (*S. fungulus* and *S. neglecta*). *S. neglecta* is dintinguished by having a smaller CD (less than 13 mm in adult stage); blunt to clavate septal face granules (equilateral-triangle-shaped in *S. fungulus)*; and usually a papillose columella (massive, lenticular in *S. fungulus*). *S. neglecta* is compared with the only other New Caledonian congener (*S. complicata*) in the account of the latter species.

Family Gardineriidae Stolarski, 1996

Genus *Gardineria* Milne Edwards & Haime, 1848

Diagnosis. –Corallum solitary, trochoid to turbinate, attached by a polycyclic base and short, contiguous basal rootlets. Epitheca transversely wrinkled. Upper, outer septal edges separated from calicular edge by a deep notch. Fossa shallow; paliform lobes usually present before S2, sometimes before S1; columella papillose or absent.

Type species. –*Gardineria hawaiiensis* Vaughan, 1907, by original designation.

Gardineria alloiteaui sp. nov.

Plate 1, Figs. K-N

Type locality. –*Norfolk 2*: stn. 2125 (23°17'S, 168°14'E – Bank Crypthelia, New Caledonia), 275-348 m.

Holotype. –Norfolk2: stn. DW 2125.

Paratypes. –Norfolk 2: stn. DW 2124 (1); stn. DW 2136 (1).

Description. –Corallum trochoid and firmly attached to substrate by a robust pedicel (PD:GCD = 0.70-0.85). Largest specimen examined (DW 2125) 10.4 x 9.6 mm in CD and 9.0 mm in height. Epitheca transversely corrugated; calicular edge thin and smooth, rising above septal distal upper edges. Corallum white.

Septa octamerally arranged in 3 cycles according to formula: S1>S2≥S3, however holotype contain some rudimentary S4. S1 most exsert and thickest septa, extending 2/3 distance to columella and have straight, vertical axial edges. P1 usually present, but sometimes indistinguishable from columellar elements. S2 only slightly smaller than S1, but otherwise identical in shape. Each S2 bears a taller and wider palus (P2), which is slightly more recessed from columella than P1. S3 about 3/5 size of S2 (the latter if flanked by a pair of S4), bearing lacerated axial edges especially deep in fossa. S1 and

S2 of one paratype bear multiple, irregularly shaped pali, the innermost ones indistinguishable from columellar elements. Septal and palar faces bear large blunt granules, their upper distal edges separated from calicular edge by a U-shaped notch.

Fossa shallow, containing a papillose columella composed of up to 10 pillars.

Distribution. –*New Caledonia:* 260-410 m.

Discussion. –*Gardineria alloiteaui* differs from previously described *Gardineria* species by its octameral septal symmetry. Within the five *Gardineria* species known, four have hexamerally arranged septa (*G. hawaiiensis*, *G. minor*, *G. simplex*, and *G. philippinensis*) and only *G. paradoxa* has septa decamerally arranged in 3 cycles. Comparison between *G. alloiteaui* and *G. paradoxa* can be found in the account of the latter species.

Gardineria hawaiiensis **Vaughan, 1907**

Plate 2, figs. A-C

Gardineria hawaiiensis Vaughan, 1907: 65-66, pl. 4, fig. 1. –Maragos, 1977. –Zlatarski & Estalella, 1980: 158, 302, 303. –Cairns, 1984: 23. –Cairns, 1995: 110-111, pl. 36, figs. c-f, i. –Stolarski, 1996: 348-350, figs. 2F-G, 4A-I, 8A-C. –Cairns & Zibrowius, 1997: 63, 163. –Cairns, 1998: 404. –Cairns, 1999: 128. –Cairns et al., 1999: 33. –Cairns, 2004a: 310. –Cairns, 2006: 48. –Cairns, 2009: 22. –Kitahara et al. 2010b.

Gardineria musorstomica Cairns, 1989a: 82-83, pl. 42, figs. c, e-g.

Gardineria sp. A Cairns, 1995:111, pl. 36, figs. g-h. –Cairns, 2004a: 310.

Type locality. –*Albatross* stn. 3991 (22º15’25’’N, 159º23’15’’W – Kauai, Hawaiian Islands), 497-541 m.

Type material. –The holotype of *G. hawaiiensis* is deposited at the NMNH (Cairns, 1995).

New records. –Halical 1: stn. DW 01. –Bathus 3: stn. DW 784 (1). –Bathus 4: stn. CP 928 (8); stn. DW 943 (1); stn. DW 947 (1). –Norfolk 1: stn. DW 1651 (2). –Norfolk 2: stn. DW 2023 (3); stn. DW 2024 (2); stn. CP 2038 (1); stn. DW 2040 (3); stn. DW 2056 (2); stn. DW 2057 (4); stn. DW 2058 (2); stn. DW 2060 (2); stn. DW 2063 (3); stn. DW 2064 (2); stn. DW 2070 (6); stn. DW 2075 (1); stn. DW 2084 (1); stn. DW 2086 (1); stn. DW 2087 (1); stn. DW 2092 (1); stn. DW 2125 (1); stn. DW 2126 (1); stn. DW 2127 (1); stn. CP 2153 (2); stn. DW 2156 (1).

Previous records from New Caledonia. –Stolarski (1996).

Description. –Corallum trochoid and firmly attached by a robust pedicel (PD:GCD = 0.29-0.50). Regeneration and rejuvenescence of a broken or parent corallum common. Basal angle usually higher then 50º, especially in larger specimens. Calice circular. Largest specimen examined (DW 2092) 28.4 mm in CD, 22.5 mm in height, and 8.6 mm in PD. CD:H between 0.95-1.3, however, smaller specimens sometimes have a smaller ratio (0.5-0.7). Pedicel formed by polycyclic development and usually display small accessory rootlets. Theca internally reinforced, becoming thinner in larger specimens. Epitheca finely wrinkled and often encrusted by other invertebrates. Sometimes thin longitudinal grooves randomly placed around theca. Epitheca rises well above upper, distal septal edges as a calicular rim up to 3 mm in width. Corallum light-cream to white.

Septa hexamerally arranged, but development of cycles quite variable. Specimens with CD<15 mm usually display four incomplete cycles with rudimentary S4. In larger specimens, number of septa can reach 72, or 5 incomplete cycles with rudimentary S5. S1 exsert (especially in coralla with CD:H > 1), extending 3/4 distance to columella, with straight, vertical axial edges that fuse to columellar elements deep in fossa. S2 1/2 to 3/4 width of S1, with slightly concave axial edges, bearing a small to lamellar paliform lobe sometimes indistinguishable from columellar elements. S3 dimorphic in size: those not flanked by a pair of S4, half size of S2 and do not reach columella; but those S3 flanked are enlarged to S2 in size and also fuse to columella, as well as often bearing a paliform lobe equal in width to P2. S4 rudimentary, however, if flanked by a pair of S5, S4 enlarges to half size of S3, extending deeper in fossa. S5, if present, rudimentary, and composed of a row of spines. Fossa of moderate depth, containing a columella consisting of 1-3 papillae.

Distribution. –*New Caledonia*: 275-1150 m. –*Elsewhere*: Hawaii; Philippines; Vanuatu; Australia; and New Zealand; 142-1200 m.

Discussion. –Among the four *Gardineria* species with hexamerally arranged septa, only two are reported from Indo-Pacific waters: *G. hawaiiensis* and *G. philippinensis* Cairns, 1989a. *G. hawaiiensis* is distinguished by its larger corallum (up to 33 mm in CD versus 17.5 mm in *G. philippinensis*); more open calice; presence of rudimentary S5 in larger specimens (only four cycles present in *G. philippinensis*); and lesser number of columellar elements (less than 5 in *G. hawaiiensis* and between 12-17 papilla in *G. philippinensis*).

***Gardineria paradoxa* (Pourtalès, 1868)**

Plate 2, Figs. D-F

Haplophyllia paradoxa Pourtalès, 1868: 140-141; 1871: 52, pl. 2, figs. 11-13. –Dana, 1872: 80. –Duncan, 1872: 34. –Pourtalès, 1880: 97. –Agassiz, 1888: 154-155, figs. 480-481. –Hickson, 1910: 5.

Duncania barbadensis Pourtalès, 1878: 45, pl. 9, figs 5-7. –Lindström, 1877: 13. –Pourtalès, 1880: 97, 112. –Duncan, 1883: 336. –Agassiz, 1888: 155. –Gardiner, 1904: 120-121.

Gardineria barbadensis. –Lewis, 1965: 1063. –Wells, 1973a: 50. –Zibrowius, 1974: 24.

Gardineria paradoxa. –Wells, 1973a: 51. –Cairns, 1979: 160-161, pl. 31, figs. 4-6, 10. –Stolarski, 1996: 348-350, figs. 2C-E, 5A-G. –Cairns & Zibrowius, 1997: 163, figs. 21g-h. –Cairns, 1999: 128-129, fig. 22b. –Cairns et al., 1999: 33. –Cairns, 2000: 153-154, figs. 183-184. –Cairns, 2009: 22. –Kitahara et al. 2010b.

Type locality. –*Bibb* stn. 22 (24º14’20”N, 80º59’40”W – Straits of Florida), 692 m.

Type material. –The holotype soft part of *Haplophyllia paradoxa* and 14 syntypes of *Duncania barbadensis* are preserved at the MCZ (Cairns, 1979).

New records. –Bathus 3: stn. DW 781 (1); stn. DW 784 (3). –Norfolk 2: stn. DW 2084 (2); stn. DW 2097 (1).

Description. –Corallum trochoid to cylindrical, and firmly attached to substratum by pedicel (basally) and as well as theca (laterally). All specimens examined show lateral attachments scars. Calice round to slightly elliptical. Largest specimen examined (DW 784) 10.5 x 10.3 mm in CD, 12.8 mm in height, and 6.5 mm in PD. Wall epithecal, internally thickened by stereome. A thin and white epitheca rises at same or above the level of upper, distal septal edges as a calicular rim. Calicular rim divided into 30-38 longitudinal zones. Below calicular rim, epitheca highly corrugated, due to successive stages of rejuvenescence (Cairns, 1979), and usually very encrusted and worn. Corallum cream to pale-brown.

Septa octamerally to decamerally arranged in 3 cycles (S1≥S2>>S3), but no specimen examined contained a complete third cycle. Specimens from DW 781and DW 2097 have many rudimentary septa, totalling 19 and 26 septa respectively. S1 and S2 are not exsert and separated from calicular edge by a V-shaped notch. Each S1 bears a small and pointed P1, whereas each S2 bears a much wider and taller paliform lobe (P2), all separated from their respective septum by a narrow and deep notch. Septal and palar faces bear large, blunt, randomly arranged granules.

Fossa shallow, containing a papillose columella composed of 1-8 slender pillars.

Distribution. –*New Caledonia:* 580-730 m. –*Elsewhere*: Antilles; Mexico; Indonesia; 91-700 m.

Discussion. –According to Cairns & Zibrowius (1997) the main characters that distinguishes *G. paradoxa* from its congeners are septal symmetry (decameral) and secondary lateral attachement. Even some specimens examined in the present study not having decamerally but octamerally arranged septa, *G. paradoxa* is distinguished from *G. alloiteaui* (the only other species in the genus without hexamerally arranged septa) by septal exsertness (usually not exsert in *G. paradoxa* and well exserted in *G. alloiteaui*); S3 lower axial edge (entire in the former and laciniate in the latter); and better developed paliform lobes in *G. alloiteaui*.

Genus *Stolarskicyathus* Cairns, 2004

Diagnosis. –Corallum conical and firmly attached through a narrow pedicel. Epitheca transversely corrugated, rising above the outer septal edges as a smooth, prominent thecal rim. Septa in 3 cycles; paliform lobes absent; columella labyrinthiform.

Type specie. –*Stolarskicyathus pocilliformis* Cairns, 2004a, by original designation.

Stolarskicyathus pocilliformis Cairns, 2004

Plate 2, Figs. G-I

Stolarskicyathus pocilliformis Cairns, 2004a: 260, 310-311, figs. 11A-E. –Cairns, 2009: 22.

Type locality. –*Franklin*: stn. 03/99/D11 (20º14.49'S, 151º47.53'E – Marion Plateau, Australia), 342 m.

Type material. –The holotype is deposited at the AM. The paratypes are split between the NMNH and ZMUZ (Cairns, 2004a).

New records. –Bathus 3: stn. DW 781 (1). –Norfolk 2: stn. DW 2159 (1).

Description. –Corallum ceratoid, attached, and small. Largest specimen examined (DW 781) 6.2 mm in CD and 10.3 mm in height. Calice circular; calicular edge smooth. Epitheca transversely corrugated (growth lines), rising above distal upper septal edges as a rim. Calicular rim divided by V-shaped grooves into 24 longitudinal zones internally thickened by stereome. Corallum pale-cream.

Septa hexamerally arranged in 3 complete cycles according to formula: S1>S2>S3 (24 septa). S1 have vertical, straight to slightly sinuous axial edges that fuse to columella low in fossa. S2 4/5 width and have same shape as S1. S3 half width of S2 being the only cycle not fusing to columella. Axial edges of S3 slightly lacerated, and more sinuous than secondaries. All septa bear rounded upper edges separated from calicular rim by V-shaped notch. Fossa of moderate depth, containing a lamellar slightly swirled columella.

Distribution. –*New Caledonia*: 300-625 m. –*Elsewhere*: Australia; 342-367 m.

Discussion. –*Stolarskicyathus* was recently described to accommodate gardineriids lacking paliform lobes. Both specimens examined herein are small and do not add to the current morphological knowledge of this species. A detailed description of *S. pocilliformis* is provided by Cairns (2004).

“COMPLEX” SCLERACTINIAN GROUP

Family Turbinoliidae Milne Edwards & Haime, 1848

Genus *Alatotrochus* Cairns, 1994

Diagnosis. –Corallum cuneiform, with a rounded (free) base and prominent, costate thecal edge crests. Theca imperforate. Costae serrate, extending from calice to base. Costae number twice that of septa. Four cycles of highly exsert septa. Pali absent. columella linear-papillose.

Type species. –*Alatotrochus rubescens* (Moseley, 1876) by original designation.

Alatotrochus rubescens (Moseley, 1876)

Plate 2, Figs. J-K

Platytrochus rubescens Moseley, 1876: 545, 546, 553, 567, 568.

Sphenotrochus rubescens. –Moseley, 1881: 157-159, pl. 6, figs. 8, 8a. –Fowler, 1888. –Duerden, 1898: 647, 649. –Squires, 1961: 27.

Alatotrochus rubescens. –Cairns, 1994: 68-69, pl. 29, figs. g-l. –Cairns, 1995: 84, pl. 24, figs. a, b. –Cairns & Zibrowius, 1997: 62, 141-142, 226, fig. 18h. –Cairns, 1998: 364, 390. –Cairns, 1999: 180-109. –Cairns et al., 1999: 40. –Cairns, 2004a: 265, 288. –Cairns, 2009: 16.

Type locality. –*Challenger* stn. 192 (5°49’15’’S, 132°14’15’’E – off Kai Island, Indonesia), 136 m.

Type material. –Four syntypes of *P. rubescens* are deposited at the BM (Cairns, 2004a).

New records. –Bathus 4: stn. DW 902 (5); stn. DW 903 (4); stn. DW 908 (9); DW 918 (2). -Norfolk 2: stn. DW 2157 (3); stn. DW 2158 (1).

Description. –Corallum conical and free, with a rounded base. Calice elliptical (GCD:LCD = 1.2-1.4); calicular edge serrate. Thick and prominent thecal edge crests aligned to GCD plane. Thecal edge crests variable in development: usually entire and square in outline, however, some specimens examined have pointed crests (resembling costal spines), and some have discontinuous and/or quite sinuous crests. Largest specimen examined (DW 908) 16.5 x 12.0 mm in CD and 13.6 mm in height. Costae ridged, entire, very prominent, serrate, and separated by broad grooves near calicular edge, each of them bisected by a small ridge which doubles number of costae in relation to septa. At lower part of corallum costae are low, discontinuous, and sinuous. At base, costae resemble elongated granules. Costae at thecal crests also discontinuous and oriented perpendicularly to corallum face costae. Some costae continuous from calicular edge to base. The two principal costae are aligned to GCD and extend along the sharp-edged thecal crests, meeting one another at centre of base. Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1≥S2>S3>>S4 (48 septa). One specimen examined has two pairs of S5. S1 and S2 equally exsert (up to 4 mm), and usually extend same distance to columella with straight and vertical axial edges. S3 up to 2 mm exsert and extend half-distance to columella with sinuous and slightly concave axial edge, disappearing deep in fossa. S4 about 1 mm exsert and rudimentary in development. All septal faces bear low rounded granules aligned in rows parallel to septal edge. Lower axial edges of each S1-2 fuse to columella at moderate depth. Columella papillose, elliptical in cross section, and composed of 5 to 12 interconnected tuberculate pillars, usually aligned in 1 or 2 rows, and almost reaching calicular edge level.

Distribution. –*New Caledonia:* 265-647 m. –*Elsewhere*: Japan; Philippines; Indonesia; Vanuatu; Australia; and southern Norfolk Ridge; 180-751 m.

Discussion. –Only three genera amongst turbinoliids have representatives with alate edge crests: *Alatotrochus*, *Tropidocyathus*, and *Platytrochus*. Within those, only *Alatotrochus* has costae:septa ratio of 2:1. Both of these morphological characters can be used to distinguish this monotypic turbinoliid genus and consequently its sole species *A. rubescens*. According to the phylogenetical analysis undertaken by Cairns (1997), which grouped *Alatotrochus* and *Pleotrochus* as sister genera, besides the alate edge crest, the following characters from *Alatotrochus* are also diagnostic for distinction from *Pleotrochus* representatives: lack of pali; granular costae; and having independent septa.

Genus *Cyathotrochus* Bourne, 1905

Diagnosis. –Corallum cuneiform, with rounded base and calice elliptical in cross section. GCD up to 25 mm. Costae highly ridged, independent in origin, and serrate in ornamentation. Intercostal region equal to costae in width, not pitted, and quite deep. Septa highly exsert and hexamerally arranged in 4 or 5 cycles (48-96 septa). Lamellar pali in three crowns before all but last septal cycle (P1-3 or P1-4), higher cycle pali arranged in chevrons. Columella papillose to sub-lamellar.

Type species. –*Cyathotrochus herdmani* Bourne, 1905 by monotypy.

Cyathotrochus pileus (Alcock, 1902)

Plate 2, Figs. O-P

Trochocyathus pileus Alcock, 1902a:96-97. –Alcock, 1902c: 15-16, pl. 2, figs. 11, 11a. –Faustino, 1927: 8, 34, 39, 81. –Gardiner & Waugh, 1938: 187. –Yabe & Eguchi, 1942b: 106, 123.

Tropidocyathus pileus. –Cairns, 1989a: 34-35, pl. 17, figs. a-h. –Cairns, 1994: 68, pl. 29, figs. d-e. –Cairns, 1995: 91, pl. 28, figs. a-c. –Cairns & Zibrowius, 1997: 147-148, figs. 19h-i. –Kühlmann, 2006: 64, 103, 112.

Cyathotrochus pileus. –Cairns, 1997: 16, pl. 1, figs. f-g, pl. 4, fig. f. –Cairns, 1998: 392. –Cairns, 1999: 110-111. –Cairns et al., 1999: 40. –Cairns, 2004a: 265, 291, 292. –Cairns, 2009: 16. –Kitahara et al., 2010b.

Type locality. –*Siboga* stn. 95 (5º43'N, 119º40'E – Sulu Archipelago, Philippines), 522 m.

Type material. –Four syntypes of *Tropidocyathus pileus* are deposited at the ZMA (Cairns, 1994).

New records. –Bathus 3: stn. CP 833 (2); stn. DW 888 (1). –Musorstom 9: stn. DR 1221 (1). –Norfolk 2: stn. DW 2136 (2); stn. DW 2137 (3).

Description. –Corallum cuneiform and free. Base rounded, slightly curved and wider in the plane of GCD. Calice strongly compressed (GCD:LCD = 1.4); calicular edge lancetted. Two thecal angles distinguishable in LCD plane: upper theca almost vertical; and lower theca about 50º inclined. Largest specimen examined (CP 822) 17.7 x 12.8 mm in CD and 15.2 mm in height. Costae ridged, serrated, equal in width, and highly granular. However, some costae do not reach base. Three to five rows of pointed and tall granules occurs on each costa. Narrow and deep furrow separate each costa. Corallum white to pale cream.

Septa hexamerally arranged in 5 incomplete cycles. In all specimens examined only half-systems aligned to GCD have (2 or 4) S5. S1 up to 4.5 mm exsert, and extend 4/5 distance to columella with straight axial edge. Each S1 bears a 1 mm wide slightly sinuous paliform lobe. A narrow deep notch separates S1 from P1. However, a wider notch separates those P1 aligned to GCD. P1 aligned to GCD terminate lower in fossa. S2 less exsert and about 4/5 width of S1, bearing a slightly sinuous axial edge. P2 slightly wider than P1. In those half-systems without S5, S3 smaller and less exsert than S4, but bearing the widest pali. S4 dimorphic in development: those adjacent to S1 are wider than those adjacent to S2. S4 fuses to S1 or S2 at calicular edge forming highly triangular apex. In those half-systems with S5, S3 small but bears a very wide P3. S4 adjacent to S2 slightly wider than S3 and bear a wider palus as well. However, those S4 adjacent to S1 do not bear palar elements. S5 dimorphic in development: those adjacent to S1 wider but as exsert as those adjacent to S2. S5 fuses to S1 or S2 at calicular edge forming highly triangular apex. Axial edges of S3, S4 and S5 sinuous. Axial and distal edges of all pali also sinuous. All palar elements terminate higher in fossa than columellar elements, and its height follows formula: P3>P2>P1. Higher-cycle pali arranged in a chevron style. Tall, aligned, pointed granules cover septal and palar faces. Fossa of moderate depth, containing a papillose to sub-laminar columella composed of few ornamented rods (or lamellae) aligned in 1 or 2 rows parallel to GCD plane.

Distribution. –*New Caledonia:* 402-560 m. –*Elsewhere*: widespread from southwest Indian Ocean to Japan, including Philippines; Indonesia; South China Sea; Norfolk Ridge; Vanuatu; French Polynesia; and Australia; 123-1110 m.

Discussion. –Only two extant species compose the turbinoliid genus *Cyathotrochus*: *C. pileus* and *C. nascornatus* (Gardiner & Waugh, 1938), the latter only known from the southwestern Indian Ocean. Apart from its asexual method of reproduction (by fragmentation in *C. nascornatus*) there is no additional morphological character used to distinguish between these two species (Cairns, 1989a). Among confamilial genera, *Cyathotrochus* can be confused with *Tropidocyathus* but is distinguished by having serrate ridged costae (granular in *Tropidocyathus*), and higher septal cycle that fuses to adjacent lower septal cycle (independent on *Tropidocyathus*). Amongst New Caledonian turbinoliids, *C. pileus* is distinguished by having: pali before all but last septal cycle (P1-2 not vestigial); not presenting transverse division; and not offset costal/septal correspondence.

Genus *Deltocyathoides* Yabe & Eguchi, 1932

Diagnosis. –Corallum bowl-shaped, with rounded base, and calice circular in cross section; transverse division absent. Costae ridged and serrate; intercostal regions deep, narrow, and not pitted. Higher cycle costae (C3-4) originate by bi- or trifurcation. Septa hexamerally arranged in 4 complete cycles. Sublamellar to styliform pali before all but last cycles of septa. Columella papillose.

Type species. –*Deltocyathoides japonicus* Yabe & Eguchi, 1932a (junior synonym of *Deltocyathus orientalis* Duncan, 1876, which is the type of *Paradeltocyathus* by original designation) (Cairns, 1997).

Deltocyathoides orientalis (Duncan, 1876)

Plate 2, Figs. L-N

Deltocyathus orientalis Duncan, 1876: 431, pl. 38, figs. 4-7.

Peponocyathus australiensis. –Cairns, 1989a: 29, 30-32, pl. 14, figs. d-j, pl. 15, figs. a-d. –Cairns & Parker, 1992: 39-40, pl. 13, figs. c-d. –Cairns, 1994: 64-65, pl. 28, figs. c-f, pl. 41, fig. i.

Deltocyathus lens Alcock, 1902a: 99. –Alcock, 1902c: 19-20, pl. 2, figs. 16, 16a. –Zou, 1988: 77-78, pl. 5, figs. 6, 6a.

Peponocyathus orientalis. –Wells, 1984: 214. –Veron, 1986: 608.

Deltocyathoides orientalis. –Cairns & Zibrowius, 1997: 144-145. –Cairns, 1997: 17, pl. 1, fig. h, pl. 7, fig. f. –Cairns, 1998: 392. –Cairns, 1999: 111. –Cairns et al., 1999: 40. –Cairns, 2004a: 292.

Type locality. –Souteastern Honshu (34º12’N, 136º20’E – Japan), 95 m.

Type material. –The holotype appears to be lost (Zibrowius, 1980).

New records. –Bathus 4: stn. DW 933 (1).

Description. –Corallum shaped as a bowl with slightly convex thecal lateral faces and a free flat base. Calice circular with 6.8 mm in CD and 4 mm in height. At thecal lateral faces, costae ridged, granular, very prominent, and separated by deep intercostal grooves. At base, intercostal grooves shallow. Only C1 extend from calicular edge to centre of base, almost meeting opposite costae. A pair of C3 fuse to adjacent C4 about half-way from thecal inflection to base, continuing as a single costae that fuse to C2 near base. Epicentre of base granular and about 0.5 mm in diameter. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S4≥S3 (48 septa). S1 only independent septa, almost reach columella, and bear a small pali. S2 about 3/4 width of S1, bearing a palus three times wider than P1. S3 about ½ size of S2, bearing the thinnest and most recessed pali. Axial edge of P3 fuse to distal edge of adjacent P2. S4 dimorphic in size: those adjacent to S1 are wider than S3; and those adjacent to S2 are about as wide as S3. Axial edge of each S4 fuses to distal edge of P3. Small meniane like ridges perpendicular to septal and palar upper edges give to these elements a coarse appearance. Fossa absent. Columella rudimentary composed of 4 interconnected pillars.

Distribution. –*New Caledonia:* 212-220 m. –*Elsewhere*: Japan, Philippines, Indonesia, southwest Indian Ocean, Wallis and Futuna, Vanuatu, Australia; 44-635 m.

Discussion. –Among the 29 turbinoliid genera (6 of which are exclusively fossil), *Deltocyathoides* is most similar to *Australocyathus* Cairns & Parker, 1992 and *Peponocyathus* Gravier, 1915, but is distinguished in not having transverse division. *Deltocyathoides orientalis* is distinguished from New Caledonian turbinoliids by having bowl-shaped corallu, lamellar independent pali (P3), and not pitted intercostal regions.

Genus *Idiotrochus* Wells, 1935

Diagnosis. –Corallum commonly results from transverse division. Anthocyathus cuneiform in shape (elliptical in cross section), with planar thecal faces, rounded edges, and wedge-shaped base that may bear 2 short downward- or outward projecting costal spurs. Anthocaulus conical and up to 6.6 mm in GCD. Costae broad, smooth, alternate in position with septa, and independent in origin. Intercostal spaces narrow, relatively shallow, and not pitted. Septa hexamerally arranged in 3 cycles (24 septa). Crown of 10 or 12 pali before S1-2, the 2 principal P1 often absent or rudimentary. Columella linear-papillose.

Type species. –*Sphenotrochus emarciatus* Duncan, 1865, by original designation.

Idiotrochus alatus Cairns, 2004

Plate 2, Fig. Q, Plate 3, Figs. A-B

Idiotrochus alatus Cairns, 2004a: 296, figs. 7I-K, 8A-C. –Cairns, 2009: 16.

Type locality. –*Franklin* stn. 05/89/40 (26º45.27'S, 159º30.59'E – Gifford Guyot, Lord Howe Seamount Chain), 315-360 m.

Type material. –The holotype is deposited at the AM, and 4 paratypes are deposited at the NMNH (Cairns, 2004a).

New records. –None.

Previous records from New Caledonia. –Cairns (2004).

Description (after Cairns [2004]). –Corallum (anthocyathus) compressed-conical, having rounded thecal faces and edges, the latter diverging at an angle of about 25º, although this measurement is masked by prominent edge spines. Largest known specimen (holotype) 4.21 x 3.45 mm in CD and 4.85 mm in height. Calice elliptical (GCD:LCD = 1.1-1.3). Base of corallum terminates in a crescent-shaped scar, measuring 1.5-2.0 x 1.2-1.3 mm. Costae flat to slightly convex, smooth, often porcellaneous, 0.40-0.50 mm in width, and alternate in position with septa. Intercostal grooves narrow (0.04-0.06 mm) and fairly shallow, one corresponding to the midline of each septum. Prominent thecal edge spines occur on each thecal edge just above basal scar, projecting perpendicular to thecal edge. These spines appear to be a composite of 2 spines, a smaller lower spine having a distal diameter of about 0.25 mm and an upper larger spine having a diameter of about 0.5 mm, both having a common base and thus bifurcating distally. Corallum white. Anthocaulus unknown.

Septa hexamerally arranged in 3 complete cycles (24 septa) according to formula: S1–2>S3. S1 have vertical, extremely sinuous axial edges that extend about half-way to columella. Outer upper septal edge curves downward before meeting theca, resulting in a thin, very delicate thecal rim. S3 less exsert, about three-quarters width but much thinner than S1–2, also having sinuous axial edges. All septa bear prominent horizontal carinae on their faces, sometimes corresponding to summits of septal undulations, but sometimes occurring on opposite sides of a septum and wrapping around the axial edge, thus producing a small platform around septum, which usually overlaps with the platform of adjacent septa at a slightly different level. Paliform lobes of 3 size classes occur before first 2 septal cycles, forming an elliptical crown of 12 elements. The 2 smallest paliform lobes occur before principal S1, and are about as wide as they are thick. The other 4 P1 are about 3 times wider than P1 aligned to GCD. The 6 P2 are about 1.5 times wider than lateral P1 and rise slightly higher in fossa. All paliform lobes highly sinuous. Fossa absent, paliform lobes and columella rising to calicular edge. Columella consists of 4 or 5 linearly arranged, twisted papillae.

Distribution. –*New Caledonia:* 450-600 m. –*Elsewhere*: Australia; 315-600 m.

Discussion. –Amongst the four recognized species of *Idiotrochus* (Cairns, 2004a), only *I. alatus* and *I. australis* have prominent thecal edge spines. Between these two species, *I. alatus* differs in having S1=S2, two pairs of spines, thinner intercostal grooves, and platform-like septal carinae.

Idiotrochus australis **(Duncan, 1865)**

Plate 3, Figs. C-E

Sphenotrochus australis Duncan, 1865: 183, pl. VIII, figs. 1a-d. –Tenison-Woods, 1878: 307-308.

Idiotrochus australis. –Cairns, 2004a: 296, figs. 8D-E.

Type locality. –Hamilton (Victoria, South Australia).

Type material. –Not traced.

New records. –Norfolk 2: stn. DW 2158 (1); stn. DW 2159 (1).

Description. –Corallum (anthocyathus) cuneiform to compressed-conical, having rounded thecal faces and a sharp elongate base, that bears two lateral spurs. Calice elliptical (GCD:LCD = 1.31); calicular edge slightly serrate. Largest specimen examined (DW 2159) 4.9 x 3.8 mm in CD, and 4.3 mm in height. Costae flat to slightly convex, equal in width, and smooth, alternating in position with septa (each costa occupy interseptal space). Intercostal spaces (correspond to each septum) narrow, rectangular in profile, and bisected by a row of small granules. Costal spurs circular in cross section and extend horizontally about 1 mm beyond thecal edges. Costae continues through costal spurs. Corallum white.

Septa hexamerally arranged in 3 complete cycles according to formula: S1>S2>S3 (24 septa). All septa separate from thecal upper edge by a moderate deep notch. S1 project about 0.2 mm above calicular edge, and extend about half-distance to columella with highly sinuous axial edge. P1 highly sinuous and 0.5 mm wide. S2 slightly less wide and less exsert than S1, but bear a wider pali. S3 thin and extend 1/3 distance to columella with slightly sinuous axial edge. Septal faces coarsely granulated, and palar faces bear horizontal carinae. Fossa absent. Columella elongate papillose composed of 12 interconnected papillae also fused to P1-2 axial edges. Columellar elements terminate at same level of pali and upper thecal edge.

Distribution. –*New Caledonia:* 265-305 m. –*Elsewhere*: Middle Miocene (Balcombian) of Victoria, Australia.

Discussion. –Previously known only from fossilized specimens reported from Middle Miocene (Balcombian – of Victoria, Australia) (Duncan, 1865), the specimens examined herein compose the first extant records of this species. The lack of additional records of this species may be related to its small size (among the smallest known slceractinians), which makes collection particularly challenging. *I. australis* is compared with *I. alatus*, the only other congener having thecal edge spines, in the account of the latter species.

Genus *Notocyathus* Tenison-Woods, 1880

Diagnosis. –Corallum solitary, cylindro-conical or cuneiform, with a pointed, unattached base. Transverse division absent. Theca imperforate. Costae serrate and correspond to septa. Septa highly exsert. Pali before all but last cycle, but P1-2 suppressed in adult stage. Pairs of P3 unite in V-shaped structures in each system. Columella papillose.

Type species. –*Caryophyllia viola* Duncan, 1865, by subsequent designation (Felix, 1927).

Notocyathus conicus (Alcock, 1902)

Plate 3, Figs. F-G

Citharocyathus conicus Alcock, 1902b: 118-119. –Alcock, 1902c: 22, pl. 3, figs. 18-18a. –Yabe & Eguchi, 1941c: 212, figs. 4a-b. –Yabe & Eguchi, 1942b: 122, pl. 10, figs. 17-18.

Citharacyathus conicus. –Faustino, 1927: 8, 34, 39, 77, 78.

Sphenotrochus viola. –Gerth, 1921: 393, pl. 57, figs. 10-11.

Notocyathus conicus. –Yabe & Eguchi, 1946: 7. –Eguchi, 1965: 289. –Cairns, 1989a: 28, pl. 13, figs. a-i. –Cairns, 1994: 64-65, pl. 28, figs. a, b. –Cairns, 1995: 91-92, pl. 27, figs. c, g. –Cairns, 1997: 17, pl. 4, fig. j. –Tachikawa, 2005: 8, pl. 3, figs. C-D. –Cairns & Zibrowius, 1997: 143-144. –Cairns, 1999: 111. –Cairns et al., 1999: 40. –Cairns, 2009: 16.

Type locality. –*Siboga* stn. 95 (5°43.5’N, 119°40’E – Sulu Sea, Philippines), 522 m.

Type material. –Two syntypes of *C. conicus* are deposited at the ZMA (Cairns, 1994).

New records. –Bathus 4: stn. DW 902 (1).

Description. –Corallum conical with a broad pointed base. Calicular edge diameter slightly smaller than middle part of corallum. Only specimen examined has a perfectly circular calice (6.8 mm in CD), and is 4.6 mm in height. Costae ridged from calicular edge to base and separated by deep intercostal striae that become shallow towards base. C3 fuse to adjacent C4 and continue tp base as a single costa. Near epicentre of base, C3-4 fuse to adjacent C2. Each costa bear a single row of teeth on its top, as well as lateral granules that project into intercostal spaces. Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S3-S4 (48 septa). S1 up to 1 mm exsert and extending ¾ distance to columella with a straight (?) and almost vertical axial edge. Lateral faces of S1 bear very prominent meniane-like structures (sometimes independent, whereas bifurcating ones were also observed) perpendicular to septal upper edge and slightly oblique at axial edge. These small ridges occur in intercalated fashion with those from opposite septal face (same septa), sometimes giving a sinuous appearance to axial edge. S2 only slightly less exsert and less wide than S1, but bear a low and wide palus that fuses to columella. S3 slightly less exsert than S2 but much smaller. Each S3 bears a tall palus that terminates about same level as calicular edge. Axial edge of each P3 fuses to distal edge of adjacent P2 in a Y-shape. S4 about same size of S3. Palar faces as ornamented as septal faces. Fossa shallow, containing a massive papillose columella composed of few granular papillae that are completely fused at base.

Distribution. –*New Caledonia:* 341-351 m. –*Elsewhere*: Japan; Philippines; Indonesia; Vanuatu; Norfolk and Kermadec Ridges; and New Zealand; 34-1110 m.

Discussion. –Wtihin the family Turbinoliidae, *Notocyathus* is the only genus that have P3 fusing in V-shaped structures before S2. Only two species compose this genus (*N. conicus* and *N. venustus*), both of them reported from New Caledonian waters. As discussed by Cairns (1994) and Cairns & Zibrowius (1997), both species are very similar and coralla of young specimens are difficult or impossible to distinguish. However, the following subtle differences are used to distinguish these species: *N. conicus* has S4 only slightly smaller than S3 (S4 rudimentary in *N. venustus*); the corallum of *N. venustus* is more slender (cylindrical-conical) than that of *N. conicus* (conical); and fossa is absent in *N. venustus* and shallow in *N. conicus*.

***Notocyathus venustus* (Alcock, 1902)**

Plate 3, Figs. H-I

Citharocyathus venustus Alcock, 1902b: 119. –Alcock, 1902c: 22. Pl. 3, figs. 19, 19a. –Yabe & Eguchi, 1932b: 443-444.

Notocyathus venustus. –Cairns, 1989a: 27-28, pl. 12, figs. c-h. –Cairns, 1994: 64, pl. 27, figs. k-l. –Cairns & Zibrowius, 1997: 143. –Cairns, 1998: 364. –Cairns et al., 1999: 40. –Cairns, 2004a: 266, 298. –Cairns, 2009: 16.

Type locality. –*Siboga* stn. 59 (10º22.7'S, 123º16.5'E – Savu Sea, Indonesia), 390 m.

Type material. –Three syntypes are deposited at the ZMA (Cairns, 1994). The fourth syntype location is unknown (Van Soest, 1979).

New records. –Musorstom 8: stn. DW 958 (2); stn. DW 969 (1). –Bathus 4: stn. DW 902 (2); stn. DW 915 (1).

Description. –Corallum conical with a pointed base. Calice circular with a serrate calicular edge. Largest specimen examined (DW 958) only 3.7 mm in CD and 4.5 mm in height. C1-2 extend from calice to base and are slightly wider than C3-4. C3-4 fuse about ¾ distance to base continuing as a single costae. All costae ridged, serrate in ornamentation, and bear tall pointed granules. Intercostal striae narrow and deep. Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 up to 1 mm exsert and almost reach columella. Axial edge of S1 vertical and sinuous. S2 slightly less exsert than S1 and extend about 3/5 distance to columella, also with vertical and sinuous axial edge. S3 as exsert as S2 but slightly smaller. Axial edges of each S3 quite sinuous, each edge bearing a prominent palus (P3). Within a system, a pair of P3 fuses before S2 in a V-shaped layout near columella. S4 rudimentary and less exsert than S3. Septal and palar faces granular. A crown of 12 P3 encircles columella. Columella circular to slightly elliptical in cross section, composed of 10-15 granular papillae completely fused basally. Columellar elements terminate slightly above calicular edge (fossa absent).

Distribution. –*New Caledonia:* 252-580 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; Malaysia; and Australia; 70-555 m.

Discussion. –Comparison between *N. venustus* and its only other congener *N. conicus*, can be found in the discussion of the latter species. Additional differences are discussed by Cairns (1989a).

Genus *Pleotrochus* Cairns, 1989

Diagnosis. –Corallum conical, with pointed base and calice circular to elliptical in cross section. Costae narrow ridges, serrate to finely granular in ornamentation. Intercostal regions relatively shallow, equal in width to costae, and not pitted. Costae independent in origin, those of lower half of corallum often having brief discontinuities. Twice as many costae than septa. Septa exsert and hexamerally arranged in 4 cycles (48 septa). Columella papillose encircled by a crown of 6 prominent lamellar P2.

Type species. –*Ceratotrochus venustus* Alcock, 1902a, by original designation.

Pleotrochus venustus (Alcock, 1902)

Plate 3, Figs. J-K

Ceratotrochus venustus Alcock, 1902a: 92. –Alcock, 1902c: 10, pl. 1, figs. 5, 5a.

Cryptotrochus venustus. –Cairns, 1995: 88 (*in part*: only pl. 27, figs. a-b). –Cairns & Zibrowius, 1997: 142-143.

Pleotrochus venustus. –Cairns, 1997: 14, pl. 1, fig. b, pl. 4, fig. b. –Cairns, 1999: 109, figs. 17 d-e. –Cairns et al., 1999: 40. –Cairns, 2009: 16.

Type locality. –*Siboga* stn. 256 (5º26.6'S, 132º32.5'E – Kai Islands, Indonesia), 397 m.

Type material. –The holotype is deposited at ZMA (Cairns, 1995).

New records. –Bathus 4: stn. CP 913 (1). –Norfolk 2: stn. DW 2026 (2); stn. DW 2104 (3).

Description. –Corallum conical, with a free and usually pointed base. Lower thecal edges (aligned to GCD) sharper than upper thecal edges. Calice elliptical (GCD:LCD = 1.1-1.2); calicular edge serrate. Largest specimen examined (CP 913) 16.5 x 14.1 mm in CD and 14.4 mm in height. Costae ridged, sharp, serrate (giving a rough texture to theca), discontinuous, and usually sinuous. Costae often fuse to one or more adjacent costae before reaching base. Twice as many costae exist than septa. Intercostal striae of moderate depth and as broad as costal ridges. Additionally costae sometimes project slightly above calicular edge (less than 0.5 mm). Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S3>S4 (48 septa). Largest specimen examined has a pair of S5 in each half-system aligned to GCD (56 septa). S1 up to 3.5 mm exsert, and have vertical to slightly concave axial edges that fuse to columella low in fossa. S1 broader at calicular edge than near columella. S2 up to 2.5 mm exsert and only slightly less wide than S1. Axial edge of S2 entire, but two specimens examined display a slightly lacerate axial edge about halfway to columella. Each S2 bears a prominent paliform lobe sometimes quite thick and circular in cross section, whereas lamellar and lancetted paliform lobes were also observed. S2 separated from their corresponding P2 by a deep notch. S3 about 1 mm exsert, 3/5 to ½ size of S2 and with a slightly sinuous and concave axial edge. S4 least exsert septa and quite small. Axial edge of S4 usually slightly sinuous, concave, and lacerated, disappearing low in fossa. Fossa of moderate depth, containing a papillose columella consisting of 4-7 granulated interconnected pillars that are fused to S1 and P2 as well.

Distribution. –*New Caledonia:* 589-820 m. –*Elsewhere*: Indonesia; and Vanuatu; 200-397 m.

Discussion. –Amongst all turbinoliid genera (including the exclusively fossil ones), seven have representatives that display the ratio of costae/septa of 2 to 1: *Alatotrochus*, *Conocyathus*, *Holcotrochus*, *Pleotrochus*, *Sphenotrochus*, *Turbinolia*, and *Wellsotrochus*. Within these seven genera, *Conocyathus* and *Pleotrochus* are the only two to have pali only before S2, but *Pleotrochus* is distinguished from *Conocyathus* by the absence of exterior thecal pits. Two extant species are recognized in this small turbinoliid genus: *P*. *venustus* and *P*. *zibrowii*. The former differs from the latter in having: more elliptical calice; and less prominent P2 (those of *P*. *zibrowii* rise well above columella and sometimes even above the calicular edge).

***Pleotrochus zibrowii* Cairns, 1997**

Plate 3, Figs. L-M

Cryptotrochus venustus. –Cairns, 1995: 88-89 (*in part*: pl. 26, figs. g-i).

Pleotrochus zibrowii Cairns, 1997: 14-15, pl. 1, fig. c, pl. 4, fig. c. –Cairns, 1999: 109, figs. 17g-h. –Cairns et al., 1999: 40. –Cairns, 2009: 16.

Type locality. –*NZOI* stn. U584 (31º26.3'S, 172º35.6'E – Three Kings Ridge, New Zealand), 1137-1150 m.

Type material. –The holotype and 16 paratypes are deposited at NZOI. Four additional paratypes are deposited at the NMNH (Cairns, 1997).

New records. –Bathus 3: stn. CP 822 (1). –Norfolk2: stn. DW 2144 (2).

Description. –Corallum conical with a free pointed base. Calice circular to slightly elliptical (GCD:LCD = 1.01-1.04); calicular edge serrate. Largest specimen examined (DW 2144) 12.7 x 12.2 mm in CD, 11.7 mm in height, and less than 1 mm in base diameter. Costae granular, ridged, equal in width, and separated by wide intercostal grooves (twice as wide as costae). Costae continuous on upper theca, but discontinuous and sometimes sinuous on lower part of corallum. Base of each costal ridge porous. Twice as many costal ridges exist than septa, one corresponding to each septum and one corresponding to each interseptal space. These additional costae project up to 1 mm above calicular edge. Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 most exsert septa (up to 2.5 mm), extending ¾ distance to columella with vertical and straight axial edges. Lower axial edge of each S1 always fused with columella and sometimes with lower part of adjacent P2. Some S1 appears to have a paliform lobe adjacent to columella. S2 less exsert than S1, and extend about half-way to columella with straight and vertical axial edge. A tall and wide paliform lobe (P2) terminating at same level as calicular edge (or slightly above) is separated from each S2 by a wide and deep notch. P2 quite robust in one specimen examined (three times thicker than their septa) but slender in other (as thick as their septa). Axial edge of P2 straight to slightly sinuous. S3 up to 1.3 mm exsert, 4/5 width of S2, and have straight and vertical upper axial edge and slightly concave lower axial edge. S4 about half width and slightly less exsert than S3, usually disappearing deep in fossa. Axial edge of S4 slightly sinuous. Septal and palar faces smooth, however, sometimes palar faces bear some low rounded granules. Fossa shallow, containing a papillose columella composed of few sinuous rods that are fused to one another as well as with S1 and P2.

Distribution. –*New Caledonia:* 950-1009 m. –*Elsewhere*: New Zealand; Wallis and Futuna region; and Vanuatu; 700-1150 m.

Discussion. –*P. zibrowii* is compared with its congener in the previous account. Additionaly, *P. zibrowii* appears to inhabit deeper water than *P. venustus*.

Genus *Tropidocyathus* Milne Edwards & Haime, 1848

Diagnosis. –Corallum cuneiform, with rounded base and calice elliptical in cross section. Costae low, flat, and covered with small granules. Thecal edge costae expanded into alate edge crests and also uniformly granulated. Intercostal regions shallow, narrow, and not pitted. Higher cycle costae originate by trifurcation. Septa highly exsert and hexamerally arranged in 4 complete cycles. Lamellar pali in 3 crowns before all but last septal cycle. Each pair of P3 and single P2 in a system forming a chevron arrangement, but not fused. Columella papillose.

Type species. –*Flabellum lessoni* Michelin, 1842, by monotypy.

***Tropidocyathus labidus* Cairns & Zibrowius, 1997**

Plate 3, Figs. N-O

Tropidocyathus labidus Cairns & Zibrowius, 1997: 148, figs. 20 a-g. –Cairns, 1998: 392. –Cairns, 1999: 110, fig. 2d. –Cairns et al., 1999: 41. –Romano & Cairns, 2000: 1048. –Cairns, 2004a: 300, 302. –Cairns, 2009: 16. –Kitahara et al., 2010a: 115.

Type locality. –*Karubar* stn. 2 (5º47’00’’S, 132º11’35’’E – Kai Islands, Indonesia), 209-240 m.

Type material. –The holotype and 43 paratypes are deposited at the MNHN. Additional paratypes are deposited at NNM (1), POLIPI (1), NMNH (43), and ZMUC (1) (Cairns & Zibrowius, 1997).

New records. –Bathus 4: stn. DW 903 (1); stn. DW 908 (1).

Description. –Corallum conical, compressed laterally (GCD:LCD = 1.1-1.2), and free with a pointed base. Calicular edge serrated. Largest specimen examined (DW 908) 8.5 x 7.1 mm in CD, and 9.6 mm in height. Costae rounded and bearing a single row of low granules. Intercostal striae deep and narrow. Costal ridges usually wider on lower part of corallum. C1-2 extend from calicular edge and almost reach centre of base, terminating about 0.5-1.0 mm before epicentre. C3 extend from calicular edge to base. C4 terminate between ½ to ¾ distance to base allowing room for C1-3. C1 aligned to GCD are slightly wider than other costae. Lower part of corallum and all calicular elements white, however, upper theca vivid orange.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S4>S3 (48 septa). All septa separated from calicular edge by a small notch. S1 highly exsert (up to 1.2 mm) extending about ¾ distance to columella with a thick and sinuous axial edge. S2 only slightly less exsert and less wide than S1, but otherwise similar. S3 as exsert but slightly smaller than S4. Both S3 and S4 bear slightly sinuous axial edges. Three palar crowns encircle columella: the first composed of 6 small and low P1; the second composed of 6 P2 that are slightly wider and taller than P1; and the last and most recessed from columella is composed of 12 P3, which terminate slightly above calicular edge. All pali have sinuous axial and distal edges, and a thin and deep notch separate them from their respective septa. Septal and palar faces bear very prominent granules. Fossa shallow, containing a papillose columella formed by a single row of 4 robust and ornamented papillae.

Distribution. –*New Caledonia:* 386-527 m. –*Elsewhere*: Japan; Indonesia; Vanuatu; and Australia; 206-536 m.

Discussion. –As stated by Cairns & Zibrowius (1997) the placement of *T. labidus* within the genus *Tropidocyathus* is tentative. Between the two extant representatives of this genus, *T. labidus* is distinguished from *T. lessonii* by the presence of alate thecal edge crests in the latter.

Family Fungiacyathidae Chevalier, 1987

Genus *Fungiacyathus* Sars, 1872

Diagnosis. –Corallum solitary, cupolate, free. Septotheca horizontal. Costae either thin serrate ridges or rounded and granular. Four or five cycles of septa. Septal faces carinate. All septa linked to their adjacent septa by synapticular plates. Pali may be present. Columella spongy.

Subgenus *Fungiacyathus* (*Fungiacyathus*) Sars, 1872

Diagnosis. –*Fungiacyathus* with five septal cycles (96 septa).

Type species. –*Fungiacyathus fragilis* Sars, 1872, by monotypy.

***Fungiacyathus* (*Fungiacyathus*) *fragilis* Sars, 1872**

Plate 3, Figs. P-Q

Fungiacyathus fragilis Sars, 1872: 58, pl. 5, figs. 24-32. –Moseley, 1881: 185-186. –Pax, 1932: 278. –Zibrowius, 1980: 23-24, pl. 5, figs. A-J. –Cairns, 1982: 7, pl. 1, figs. 3-7. –Cairns, 1984: 7. –Dawson, 1992: 46. –Fosshagen & Høisaeter, 1992: 291. –Cairns, 1995: 32, pl. 1, figs. d, f. –Cairns & Zibrowius, 1997: 68. –Cairns, 1998: 363, 369. –Cairns et al., 1999: 32. –Plusquellec et al., 1999: 998. –Cairns, 2004a: 264, 270. –Cairns, 2006: 47. –Cairns, 2009: 1. –Kitahara et al., 2010b.

Bathyactis symmetrica. –Verrill, 1882: 313. –Verrill, 1883: 65. –Gravier, 1920: 97 (*in part*). –Thomson, 1931: 9.

Bathyactis hawaiiensis Vaughan, 1907: 145-147, pl. 27, figs. 1, 1a.

Fungiocyathus fragilis. –Jungersen, 1916: 4. –Broch, 1927: 8. – Nordgård, 1929: 103.

Fungiozyathus fragilis. –Jurgersen, 1916: 35-37.

Type locality. –*F. fragilis*: "Skraaven in Lofoten" (Norway), 549 m.

Type material. –One syntype is deposited at OM (Cairns, 1995).

New records. –Halipro 1: stn. CP 850 (2). –Bathus 4: stn. CP 892 (6); stn. CP 893 (2); stn. CP 948 (3). –Norfolk 2: stn. DW 2075 (1).

Description. –Corallum discoidal, large, with a flat to slightly concave base, and extremely fragile (all specimens examined are missing several portions of septa; calicular edge). Base thin and sometimes perforate. Calice supposedly circular. Largest specimen examined (CP 948) 36.5 mm in CD and 7.3 mm in height. Costae thin, discontinuous, and serrate. Intercostal space broad. Freshly collected specimens display a vivid red color surrounding mouth. Corallum white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1-2>S3>S4>S5 (96 septa). All septal upper edges damaged. S1 only independent septa and, like S2, extend to columella. Higher septal cycles progressively smaller and fused to flanked septa by thin, perforate, long, and almost horizontal triangular canopy. All septa linked to their adjacent septa by well-developed synapticulae. Columella elliptical, solid, and horizontal, formed by the loose fusion of S1-2 axial edges.

Distribution. –*New Caledonia:* 533-1000 m. –*Elsewhere*: Norway; Cape Verde Islands; Azores; off eastern coast of United States; Hawaii; Australia; and New Zealand; 200-2200 m.

Discussion. –Due to its corallum fragility, all specimens examined were somehow damaged previous to its examination, and more detailed description of this species are given by Zibrowius (1980) and Cairns (1982). The New Caledonian specimens are particularly similar to those from New Zealand illustrated by Cairns (1995), differing only in the size of their canopies (larger in those specimens examined herein). Among the other representatives of *Fungiacyathus* with 5 septal cycles, *F. fragilis* is more similar to *F. stephanus*; both attaining large calicular diameters and having very fragile coralla. However, *F. fragilis* is distinguished by having lower septal lobes, virtually flat base, lacking a marginal shelf, and in lacking P2.

Fungiacyathus (_Fungiacyathus_) _paliferus_ (Alcock, 1902)

Plate 3, Figs. R-S

Bathyactis palifera Alcock, 1902a: 108. –Alcock, 1902c: 38, pl. 5, figs. 34, 34a. –Van der Horst, 1921: 38. –Yabe & Eguchi, 1942b: 137-138, pl. 12, fig. 5. –Faustino, 1927: 214, pl. 71, figs. 1-2.

Bathyactis symmetrica. –Alcock, 1902c: 37 (*in part*: *Siboga* stn. 95). –Faustino, 1927: 214, pl. 71, figs. 1-2. –Yabe & Eguchi, 1942b: 137 (*in part*: *Soyo Maru* stn. 238, *Soyu Maru* stn. 259)

Bathyactis kikaiensis Yabe & Eguchi, 1932b: 443. –Yabe & Eguchi, 1942b: 138, 155-156, pl. 12, figs. 6-7.

Fungiacyathus symmetricus. –Utinomi, 1965: 248-249.

Fungiacyathus paliferus. –Cairns, 1989a: 9-10, pl. 2, figs. c-I, pl. 3, figs. a-c. –Cairns & Parker, 1992: 6-7, pl. 1, figs. a-b. –Cairns & Keller, 1993: 230. –Cairns, 1994: 37-38, pl. 14, figs. a-e. –Tachikawa, 2005: pl. 2, figs. A-B. –Cairns & Zibrowius, 1997: 69-70. –Cairns, 1998: 369-370. –Cairns, 1999: 57, fig. 2a. –

Cairns et al., 1999: 32. –Plusquellec et al., 1999: 998. –Randall, 2003: 131. –Cairns, 2004a: 264, 270. –Cairns, 2009: 1.

Type locality. –*Siboga* stns. 98 and 153 (Sulu Sea and off Moluccas, Philippines and Indonesia), 143-350 m.

Type material. –Three syntypes are deposited at the ZMA (van Soest, 1979).

New records. –PrFO: stn. ? (2). –Bathus 4: stn. DW 887 (5); stn. DW 898 (4); stn. DW 945 (1). –Norfolk 2: stn. DW 2148 (1); stn. DW 2159 (1).

Description. –Corallum small, discoidal, with a flat to slightly concave base. Calice circular; calicular edge finely serrate. Largest specimen examined (DW 887) 19.0 mm in CD and 6.0 mm in height. Septotheca thin. Costae sharply ridged near calicular edge, decreasing in projection and becoming rounded towards base epicentre. Intercostal space broad. Only C1-2 extend from calicular edge to epicentre. Base bear low rounded granules, and well-preserved specimens display costae very finely serrate near calicular edge. Corallum white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1>S2>S3>S4>S5 (96 septa). S1 consists of 4-6 trabecular spines inclined towards columella, one large septal lobe bearing up to 16 coarsely dentate carinae, and a low peripheral shelf up to 4.0 mm wide. S1 project about 1.0 mm beyond calicular edge. Six to 9 synapticulae occur along each side of S1. S2 consist of 2 or 3 internal trabecular spines, followed by a well-developed paliform lobe (P2), which is separated from intermediate septal lobe by a wide notch that bears additional 1 or 2 trabecular spines. S2 largest lobe bears 13 to 16 dentate carinae, and is followed by low peripheral shelf identical to S1. S2 septal faces bear about the same number of synapticulae as S1, and also project beyond calicular edge. S3 are fused to outer lower edge of P2, and bear 4 or 5 tall trabecular spines before main septal lobe. S4 extend about half-distance to columella and their axial edge fuses to S2 between fourth and fifth trabecular spine. S4 consists of 4 or 6 trabecular spines and a low peripheral shelf. S5 fuses (sometimes quite porously) to S4 near calicular edge, and are not lobate or spinose. Axial edge of P2 vertical and upper edge rounded and thickened. Columella rudimentary and often indistinguishable from axial trabecular spines.

Distribution. –*New Caledonia*: 300-620 m. –*Elsewhere*: Madagascar; Japan; Korea; Philippines; Indonesia; Vanuatu; and Australia; 69-823 m.

Discussion. –Six extant fungiacyathid species are recognized in the *nominal* subgenus, of which, *F. paliferus* is distinguished by its prominent rounded P2 and flat to slightly concave base.

***Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus* Cairns, 1995**

Plate 3, Figs. T-U

Fungiacyathus pusillus pacificus Cairns, 1995: 32-33, pl. 1, figs. g-i, l. –Cairns, 1999: 56. –Cairns et al., 1999: 32. –Cairns, 2004a: 264, 271. –Cairns, 2009: 1. –Kitahara et al., 2010b.

Type locality. –*NZOI* stn. U599 (30º43’S, 173º16’E - northern Three Kings Ridges, New Zealand), 590-640 m.

Type material. –The holotype and 28 paratypes are deposited at the NZOI. Seventeen additional paratypes are deposited at the NMNH (Cairns, 1995).

New records. –Bathus 4: stn. DW 916 (1); stn. DW 919 (9). –Norfolk 2: stn. DW 2025 (2); stn. DW 2034 (1); stn. DW 2058 (1); stn. DW 2066 (3); stn. DW 2068 (2); stn. DW

2069 (1); stn. DW 2070 (1); stn. DW 2074 (3); stn. DW 2078 (1); stn. DW 2091 (8); stn. DW 2097 (1); stn. DW 2098 (6); stn. DW 2106 (1); stn. DW 2113 (2).

Description. –Corallum discoidal, medium sized, with a slightly concave base. Concavity of base more prominent in larger specimens. Calice circular; calicular edge slightly serrate, bearing a calicular shelf variable in width. Largest specimen examined (DW 2068) 20.0 mm in CD and 10.1 mm in height. A small scar often occurs at base epicentre. Costae ridged, straight, and finely serrated. C1-3 reach scar on base epicentre. Near calicular edge, intercostal region about twice as broad as costae. Freshly collected specimens are vivid red. Corallum white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1≥S2>S3>S4>S5 (96 septa). Small coralla examined (7.1 mm in CD) already have a full fifth cycle. S1 consist of 2 or 3 tall spines (vertical to slightly inclined towards columella), followed by a tall septal lobe that bears 9 to 12 serrate ridges on each face (alternating in position on each face). Peripheral to this main septal lobe 5 or 7 smaller lobes, or even spines progressively decrease in size and reach calicular edge. About 11 synapticulae occurs on each face of S1. S2 consist of 4 or 5 internal spines, of which the third is usually broadest. Following these spines, a main septal lobe that is slightly smaller, shorter, and positioned farther from columella than S1 main lobe, bears about 9 ridges on each face. Peripheral to S2 main lobe there are about 5 or 6 smaller lobes similar to those of S1. S3 about 4/5 width of S2, and porously fuses to it near columella. Internally, S3 have well-developed and slightly curved spines followed by a septal lobe (about half size of those of S2) bearing 6-8 ridges. S3 lobe positioned much further from columella than those of S1-2. Distally, S3 have 4 or 5 smaller disjoint lobes. Each S4 consists of 11 or 12 spines, of which the sixth is tallest. A pair of S4 fuses to common S3 about half distance to columella. S5 occur only near calicular edge and bear about 4 or 5 spines. Columella papillose and often indistinguishable from axial septal spines.

Distribution. –*New Caledonia:* 410-1150 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; Australia; and New Zealand; 350-1050 m.

Discussion. –*Fungiacyathus pusillus pacificus* is distinguished from all other Indo-Pacific fungiacyathids with five septal cycles by the following characteristics: planar septal faces and straight septal edges; presence of a small marginal shelf; closely spaced, thin and finely serrate costae; absence of septal canopies; and lack of P2.

Fungiacyathus (*Fungiacyathus*) *sandoi* Cairns, 1999

Plate 3, Figs. V-X

Fungiacyathus sandoi Cairns, 1999: 56-57, figs. 1f-h. –Cairns et al., 1999: 32. –Cairns, 2004a: 264, 271. –Cairns, 2009: 2.

Fungiacyathus sp. –Grygier, 1991: 33.

Type locality. –*Musorstom* 7 stn. DW 538 (12º30.8'S, 176º40.3'W – Waterwitch Bank, Wallis and Futuna), 275-295 m.

Type material. –The holotype and 10 paratypes are deposited at the MNHN. Seven additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Norfolk 2: stn. DW 2097 (1).

Description. –Corallum small with a flat base. Calice circular; calicular edge slightly serrate. Specimen examined 15.4 mm in CD and 5.6 mm in height. C1-4 slightly wider than C5. C1-2 entire only near calicular edge transforming to a row of coarsely rounded granules towards base. C3-5 never entire. All intercostal spaces well defined as narrow and moderately deep furrows. All costae project about 0.3 mm beyond calicular edge. Epicentre of base composed of 4 granules. Corallum white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1>S2>S3>S4>S5 (96 septa). S1 consists of 3 or 4 blunt spines internally, followed by tall septal lobe and 3 or 4 marginal spines near calicular edge. S1 lobe bear about 11 well-developed vertical and dentate carinae perpendicular to septal plane. Seven to 9 synapticulae occurs along each side of S1. Internally each S2 consists of 4 taller than S1 blunt spines, followed by a slightly smaller septal lobe (bearing 9 carinae), and 1 or 2 marginal blunt spines near calicular edge. S3 consists of 4 or 5 tall blunt spines near columella, followed by a short septal lobe bearing about 5 dentate carinae. Sometimes upper edge of S3 lobe laciniate. Marginal shelf of S3 about as wide as those of S1-2 and bear 1 or 2 small spines. Axial edge of S3 curves towards S2 fusing to it near columella. S4 consist of 2 or 3 blunt spines just after its fusion to S3 (about half distance to columella), followed by a low (usually divided into 2 or 3) lobe. Each of these lobes have 2 or 3 carinae. S5 rudimentary, and composed of 4 blunt spines. Columella formed by interconnected S1-2 axial spines.

Distribution. –*New Caledonia:* 580-583 m. –*Elsewhere*: Wallis and Futuna; and Australia; 77-600 m.

Discussion. –Among New Caledonian representatives of the subgenus *Fungiacyathus* (*Fungiacyathus*), *F. sandoi* is most similar to *F. paliferus*, but the former is distinguished by having all costosepta projecting the same distance beyond calicular edge (CS1-2 and their adjacent CS5 in *F. paliferus* project further beyond calicular edge than CS3-4 as small rectangular lancets), coarsely granular costae (finely granular in *F. paliferus*), better developed marginal shelf, and in lacking paliform lobes before S2.

Fungiacyathus (_Fungiacyathus_) _stephanus_ (Alcock, 1893)

Plate 3, Figs. W-Y

Bathyactis stephanus Alcock, 1893: 149, pl. 5, figs. 12-12a.
Bathyactis stephana. –Alcock, 1898: 11, 28-29, pl. 3.

Bathyactis sibogae Alcock, 1902a: 108 (*in part*). –Alcock, 1902c: 38 (*in part*: *Siboga* stn. 95 and large specimen of 57 mm in GCD).

Fungiacyathus stephanus. –Cairns, 1989a: 7-9, pl. 1, figs. a-k, pl. 2, figs. a-b. –Cairns & Keller, 1993: 230. –Cairns, 1994: 37, pl. 13, figs. g-i. –Cairns, 1995: 31-32, pl. 1, figs. a-c. –Cairns & Zibrowius, 1997: 68-69. –Cairns, 1998: 369. –Cairns, 1999: 54-56. –Cairns et al., 1999: 32. –Plusquellec et al., 1999: 998. –Cairns, 2004a: 264, 271. –Cairns, 2009: 1. –Kitahara et al., 2010b.

Type locality. –*Investigator* stn. 133 (15º43’30’’N, 81º19’30’’E – off Kristna Delta, Bay of Bengal), 1240 m.

Type material. –The holotype is presumed to be deposited at the IM (Cairns, 2004a).

New records. –Bathus 4: stn. CP 922 (1); stn. CP 950 (fragment). –Norfolk 2: stn. DW 2066 (fragment).

Description based on the entire specimen examined. –Corallum discoidal with strongly concave base. Calice circular, with a jagged calicular edge. Entire specimen examined (CP 922) 28.1 mm in CD and 12.0 mm in height. All costae thin, ridged, slightly serrate, and straight to slightly sinuous near calicular edge. Towards epicentre of base, C1-3 slightly more ridged than C4-5, and straight. Intercostal space broader near calicular edge than near epicentre. Theca thin and fragile. Corallum white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1>S2>S3>S4>S5 (96 septa). S1 bear a small paliform lobe and consists of extremely tall main lobe (up to 8.0 mm) followed by a lower marginal shelf about 7.0 mm wide. S1 main lobe bears 9 or 10 coarsely dentate carinae, and paliform lobe bears up to 6 rows of aligned pointed granules. S1 marginal shelf sparsely and randomly granulated. Well-developed synapticulae (9 or 10) occurs along each side of S1. S2 only slightly less wide than S1, and bear a prominent paliform lobe up to 4.0 mm tall, followed by a well-developed main lobe and a lower marginal shelf about 5.0 mm wide. S2 main lobe is slightly more recessed from columella than S1 main lobe, and bear 9 to 12 vertical dentate carinae. Nine to 10 synapticulae occurs along each side of S2. Internally, S3 consist of one or two paliform teeth followed by a broad paliform lobe, followed by a main lobe (about half as tall as S2). Some P3 display lacerate upper edge and their axial edges curve and fuse to P2 lower middle region. Main S3 lobe bear 5 or 6 carinae, and about 8 synapticulae occur along each side of S3. S4 join flanked P3 in a small canopied structure and have a small and quite recessed lobe. Marginal shelf of S4 less than 3 mm wide. S5 rudimentary, without any lobe and join S4 in a large porous canopied structure. Upper edge of all septa slightly sinuous. Columella rudimentary formed by the fusion of P1-2 axial edges.

Distribution. –*New Caledonia:* 600-870 m. –*Elsewhere*: India; southwestern Indian Ocean; Japan; Philippines; Indonesia; Malaysia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 245-2000 m.

Discussion. –Beside *F. stephanus*, the only additional species in the subgenus that have sinuous septal edges is *F. fragilis*. A comparison between these two species can be found in the account of the latter. Amongst New Caledonian representatives of these both fungiacyathids, *F. stephanus* has much smaller canopies if compared with those of *F. fragilis*, and almost twice as many carinae per septal face.

Subgenus *Fungiacyathus* (*Bathyactis*) Moseley, 1881

Diagnosis. –*Fungiacyathus* with four septal cycles (48 septa).

Type species. –*Fungia symmetrica* Pourtalès, 1871, by monotypy.

Fungiacyathus (*Bathyactis*) *granulosus* Cairns, 1989

Plate 3, Figs. Z-AA

Bathyactis symmetrica. –Alcock, 1902c: 37 (*in part*: *Siboga* stn. 59).

Fungiacyathus granulosus Cairns, 1989a: 11, pl. 4, figs. d-i. –Cairns, 1994: 39, pl. 15, figs. d-e. –Cairns & Zibrowius, 1997: 71. –Cairns, 1998: 370. –Cairns, 1999: 58. –Cairns et al., 1999: 32. –Cairns, 2004a: 264, 270. –Cairns, 2009: 2.

Type locality. –*Siboga* stn. 59 (4º10’50’’N, 118º39’35E – off Sabah, Philippines), 567 m.

Type material. –The holotype and 15 paratypes are deposited at the USNM. One additional paratype is deposited at the AM (Cairns, 1994).

New records. –Bathus 4: stn. CP 899 (10); stn. CP 900 (1); stn. CP 910 (1); stn. DW 914 (1); stn. DW 915 (8); stn. DW 916 (1); stn. CP 922 (12); stn. DW 945 (1); stn. CP 948 (11); stn. CP 950 (6). –Norfolk 2: stn. DW 2026 (4); stn. DW 2093 (1); stn. DW 2097 (4); stn. DW 2142 (1); stn. CP 2143 (6).

Description. –Corallum discoidal, with a flat to slightly concave base. Calice circular; calicular edge serrate. All costosepta project equally beyond calicular edge. Largest specimen examined (DW 2097) 19.1 mm in CD and 8.0 mm in height. All costae ridged and granular. C1-3 extend from calicular edge to epicentre of base. C4 do not reach base epicentre and often become a row of granules towards centre of base. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S3>S4 (48 septa). S1 only independent septa and consist of up to 5 trabecular spines of which the fifth is the tallest and most vertical. Peripheral to these spines a tall lobe bearing up to 22 thin serrate ridges on each lateral face extend beyond calicular edge. Six to 7 synapticular plates link each S1 face to adjacent S4. S2 consists of 5 or 6 trabecular spines slightly more inclined towards columella than those of S1. Amongst S2 internal spines, the fourth is extremely tall and more robust. Peripherally to these spines, S2 bear a tall lobe with up to 16 thin and serrate lateral ridges. Only four synapticulae links S2 to adjacent S4. S3 consist of 4 wide trabecular spines (taller than those of S2) followed by main septal lobe (positioned far from columella than main lobes of S1 and S2) that bears about 8 lateral ridges. In each system, a pair of S3 solidly fuses to S2 near columella. S4 consist of 8 or 9 thin trabecular spines and a small lobe. Within each half-system a pair of S4 fuses to S3 about half distance to columella. Septa planar and have straight upper edges. Columella elliptical and consists of a solid plate penetrated by internal S1-2 spines.

Distribution. –*New Caledonia:* 230-762 m. –*Elsewhere*: Japan; Philippines; Indonesia; Malaysia; and Australia; 287-1050 m.

Discussion. –Fourteen species of *Fungiacyathus* are recognized by having only four septal cycles and consequently composing the *Bathyactis* subgenus. Among these species, four are reported from New Caledonia (*F. granulosus*, *F. margaretae*, *F. turbinolioides*, and *F. variegatus*). *F. granulosus* is distinguished by having granular base, slightly porous septal canopies, and flat to concave base.

***Fungiacyathus* (*Bathyactis*) *margaretae* Cairns, 1995**

Plate 4, Figs. A-B

Fungiacyathus margaretae Cairns, 1995: 33-34, pl. 2, figs. a-c. –Cairns, 1999: 57-58, figs. 2b-c. –Cairns et al., 1999: 32. –Cairns, 2004a: 264, 270. –Cairns, 2009: 2.

Type locality. –*NZOI* stn. P944 (27º20.8’S, 179º20.9’W – northern Colville Ridge, New Zealand), 673 m.

Type material. –The holotype and two paratypes are deposited at the NZOI. Two additional paratypes are deposited at the NMNH (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2097 (3).

Description. –Corallum discoidal with a strongly concave base. Calice circular to only slightly elliptical. Largest specimen examined (DW 2097) 17.0 x 16.5 mm in CD, and 7.7 mm in height. Costosepta project about 2 mm beyond calicular edge. Near calicular edge all costae sharply ridged, serrated, slightly sinuous, and separated by broad intercostal space bisected by a single row of low granules. About 1/3 distance to epicentre of base, C4 turns to a row of granules, but C1-3 even being coarsely granulated still ridged. C1-2 extend to epicentre while C3 terminate about 1 to 2 mm before epicentre. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 only independent septa, and consist of 1 or 3 short blunt spines inclined towards centre, followed by a well-developed septal lobe bearing up to 20 usually sinuous carinae. Carinae become horizontally oriented near calicular edge. Seven to 9 synapticulae occurs along each side of S1. Internally S2 consist of 1 small spine followed by a tall paliform lobe sometimes bisected into 2 broad spines. S2 septal lobe bear 14 to 17 well-developed carinae. Six or 7 synapticulae occurs along each side of S2. S3 consists of 3 spines (internal one is taller), followed by a small septal lobe that bears about 10 synapticular plates. Each pair of S3 fuse to adjacent S2 through a small canopy like structure. S4 bear 2 blunt spines followed by a short septal lobe with 7 carinae. S4 fuse to flanked S3 through a long and solid canopy. Columella solid, slightly concave, and bordered (often penetrated) by internal S1-2 spines.

Distribution. –*New Caledonia:* 580-583 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; Australia; and New Zealand; 440-1175 m.

Discussion. –*Fungiacyathus margaretae* differs from New Caledonian congeners with 4 septal cycles in having a strongly concave base (flat to slightly concave in *F. granulosus*, *F. turbinolioides*, and *F. variegatus*), well-developed columella (absent in *F. turbinolioides*), and larger calicular diameter than *F. turbinolioides* and *F. variegatus*.

Fungiacyathus (_Bathyactis_) _turbinolioides_ Cairns, 1989

Plate 4, Figs. C-D

Fungiacyathus turbinolioides Cairns, 1989a: 12-13, pl. 6, figs. a-g. –Cairns, 1995: 34, pl. 2, figs. d, e. –Cairns & Zibrowius, 1997: 72. –Randall, 2003: 132. –Cairns, 2004a: 264, 270. –Cairns, 2009: 2. –Kitahara et al., 2010b.

Type locality. –*Albatross* stn. 5586 (4º06’50’’N, 118º47’20’’E – off Sabah, Malaysia), 635 m.

Type material. –The holotype and 65 paratypes are deposited at the USNM. Two additional paratypes are deposited at the AM (Cairns, 1989a).

New records. –Bathus 4: stn. DW 918 (2). –Norfolk 2: stn. DW 2026 (4).

Description. –Corallum discoidal, small, with a slightly convex base. Calice circular and all costosepta project about 1 mm beyond calicular edge. Largest specimen examined (DW 918) 7.5 mm in CD and 3.7 mm in height. Costae ridged and well-developed near calicular edge. Each costa bears a row of granules on top. Lateral faces of costal ridges also have granules. Deep grooves separate each costa. About half-distance to base epicentre costae become flat, their granules become rounded and very low. At this region, intercostal striae narrow and shallow. Epicentre of base slightly prominent and granular. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 consist of about 13 small septal lobes, of which the 6 most axial ones are larger than peripheral ones. These 6 broader internal lobes have well-developed lateral face ridges, giving to them a star configuration in cross section. S2 only slightly smaller and have same number of small lobes as S1. S3 consists of 10 small lobes. About 3/5 distance to columella a pair of S3 fuses to S2 in each system. S4 has 8 or 9 lobes and fuses to flanked S3 about half-distance to columella. Near calicular edge, all septal faces bear tall blunt aligned granules. Columella papillose composed of 9-15 interconnected papillae also fused with S1 axial spines.

Distribution. –*New Caledonia:* 589-762 m. –*Elsewhere*: Mariana Islands; South China Sea; Malaysia; Philippines; Indonesia; Australia; and New Zealand; 600-930 m.

Discussion. –Amongst New Caledonian *Fungiacyathus* (*Bathyactis*), *F. turbinolioides* is probably the most distinctive one, being distinguished by having small calicular diameter, absence of septal canopies, costae equal in width, and deep intercostal furrows near calicular edge that become very shallow and narrow half-way to epicentre of base.

***Fungiacyathus* (*Bathyactis*) *variegatus* Cairns, 1989**

Plate 4, Figs. E-F

Fungiacyathus fragilis. –Wells, 1984: 205-207, pl. 1, figs. 1, 2 (*in part*: USGS 24918).

Fungiacyathus variegatus Cairns, 1989a: 11-12, pl. 5, figs. a-h. –Cairns, 1994: 38-39, pl. 15, figs. a-b. –Cairns & Zibrowius, 1997: 71-72. –Cairns, 1998: 370. –Cairns, 1999: 58, fig. 2d. –Cairns et al., 1999: 32. –Cairns, 2004a: 264, 270. –Cairns, 2009: 2.

Type locality. –*Albatross* stn. 5113 (13º52’N, 120º51’E – Verde Island Passage, Philippines), 291 m.

Type material. –The holotype and 132 paratypes are deposited at the USNM. One additional paratype is deposited at the AM (Cairns, 1989a).

New records. –Bathus 3: stn. DW 786 (1). –Bathus 4: stn. DW 882 (5); stn. DW 883 (7); stn. DW 898 (1); stn. DW 902 (9); stn. DW 944 (4).

Description. –Corallum discoidal, small, with flat to slightly concave base. Calice circular; calicular edge serrate. Largest specimen examined (DW 883) 13.0 mm in CD and 3.2 mm in height. C1-2 wider than C3-4, ridged from calicular edge to almost epicentre of base. C3-4 variable: sometimes ridged only near calicular edge, each continuing towards base epicentre as a granular row; however, sometimes C3-4 not ridged and almost indistinguishable from basal granules. Base covered with low and rounded granules. Epicentre sometimes slightly pointed. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-S2>S3>S4 (48 septa). S1 only independent septa, projecting about 0.7 mm from calicular edge, and extend to columella. S1 consists of one large triangular septal lobe that bears 9 well-developed, flat, and laterally ornamented spines. S1 axial spines inclined towards columella, but distal ones (usually at middle septa) vertical in projection. Each of these spines corresponds to serrate carinae on septal face. In total there are about 16 cariane on each face, and eventually some, even not bearing a spine, slightly projected beyond upper septal edge. Four or 5 synapticulae occur along each side of S1. S2 identical to S1 but bears about 7 spines. S3 about ¾ width of S2, bearing about 3 well-developed spines on their axial portion, followed by 9-12 smaller spines towards calicular edge. Two or 3 synapticulae link each S3 to adjacent S4. Near columella each S3 fuses to adjacent S2 through a inclined canopy like structure. S4 bears 9 to 10 small ornamented spines and fuses to adjacent S3 through a well-developed and solid canopy about half-distance to columella. Septal faces bear tall pointed granules often associated with carinae. S4 canopies also granulated. Interseptal spaces between S1-4 and S2-4 narrower than between S3-4. At calicular edge, each pair of S4 form a triangular lancet with adjacent S1, and in a smaller scale to S2. Columella rudimentary, composed of fusion of axial S1-2 lower edges.

Distribution. –*New Caledonia:* 250-715 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; Vanuatu; and Australia; 84-715 m.

Discussion. –*Fungiacyathus variegatus* is the only New Caledonian *Bathyactis* representative to have a rudimentary columella and small triangular lancets formed by the fusion of S1-4 or S2-4 at the calicular edge. Some specimens examined display a light brownish-green pigmentation on upper edge of S1. According to Cairns (1989a), no other species of *Fungiacyathus* has a pigmented corallum, and only few other species have such small adult calicular diameter.

Family Flabellidae Bourne, 1905

Genus *Flabellum* Lesson, 1831

Diagnosis. –Corallum solitary, fixed or free. Corallum ceratoid, campanulate or compressed. Base not reinforced with stereome. Wall epithecal, usually lacking costae. Transverse division absent. Pali absent. Columella rudimentary.

Subgenus *Flabellum* (*Flabellum*) Lesson, 1831

Diagnosis. –*Flabellum* with a smooth calicular edge.

Type species. –*Flabellum pavoninum* Lesson, 1831, by monotypy.

Flabellum (*Flabellum*) *arcuatile* Cairns, 1999

Plate 4, Figs. G-H

Flabellum arcuatile Cairns, 1999: 116-117, figs. 19a-d. –Cairns et al., 1999: 30. –Cairns, 2009: 18. –Kitahara et al., 2010b.

Flabellum angiostomum. –Cairns, 1995: 99, pl. 32, figs. d-f.

Type locality. –*NZOI* stn. I97 (32º22.9’S, 167º28.2’E – southern Norfolk Ridge, New Zealand), 540-544 m.

Type material. –The holotype and 21 paratypes are deposited at the NZOI. Twenty-seven and 9 additional paratypes are deposited at the NMNH and MNHN respectively (Cairns, 1999).

New records. –SMIB 10: stn. DW 202 (1); stn. DW 205 (2). –Bathus 4: stn. DW 918 (5); stn. DW 919 (3); stn. DW 930 (1). –Norfolk 2: stn. DW 2024 (1); stn. DW 2025 (3); stn. DW 2032 (2); stn. DW 2034 (3); stn. DW 2035 (7); stn. DW 2037 (3); stn. DW 2049 (4); stn. DW 2057 (1); stn. DW 2058 (1); stn. DW 2060 (1); stn. DW 2064 (1); stn. DW 2081 (4); stn. DW 2084 (2); stn. DW 2087 (3); stn. DW 2091 (3); stn. DW 2098 (3); stn. DW 2109 (2); stn. DW 2110 (1); stn. DW 2111 (1); stn. DW 2132 (14); stn. DW 2137 (1); stn. CP 2143 (1); stn. CP 2146 (10); stn. DW 2147 (10); stn. DW 2148 (2).

Description. –Corallum flabellate, robust, and weakly attached (or free) by a slender (PD:GCD = 0.06-0.13), circular to slightly elliptical pedicel. Calice highly compressed (GCD:LCD = 2.0-2.9); calicular edge smooth. Largest specimen examined (DW 930) 36.7 x 13.1 mm in CD, 26.4 mm in height, and 2.5 mm in greater pedicel diameter. Thecal faces slightly concave, usually forming an angle smaller than 25º. Thecal edges rounded and highly concave: lower 10 mm of corallum has edge angle between 30 and 50º, changing to a more open angle with height (>110º). Theca glisteny, non-granular, and covered by thin transverse ridges peaking at each C1-3 in a chevron pattern. Costae represented by white longitudinal lines between dark pigmented regions. Corallum variable in color: some have uniformly reddish-brown pigmented theca; some have dark stripes corresponding to each S1-3 (or S1-4); and some are completely light beige. Pedicel and calicular elements white, but one specimen examined (DW 2081) have upper and outer septal edges pigmented.

Septa hexamerally arranged in 7 cycles according to formula: S1-4>S5>S6>S7. S1-4 meet calicular edge at right angle, and almost meet their oposite side septum with extremely sinuous vertical axial edge. S5 only slightly smaller than S1-4 and bear less sinuous axial edge. S6 about 3/5 width of S5 and have slightly sinuous axial edge. S7 ½ width of S6 with almost straight axial edge. All septal faces covered with pointed granules. Fossa deep and narrow, containing a rudimentary elongate columella formed by lower axial edges of S1-4.

Distribution. –*New Caledonia*: 370-1074 m. –*Elsewhere*: Wallis and Futuna; and New Zealand; 300-640 m.

Discussion. –*Flabellum* (*F.*) *arcuatile* is the only New Caledonian species in the subgenus that have rounded thecal edges. Among the other 23 extant representatives of this subgenus, only additional two share the corallum shape of *F. arcuatile*: *F. impensum* Squires, 1962 and *F. knoxi* Ralf & Squires, 1962. The flabellate form of *F. impensum* is distinguished by its less concave thecal edges and less axial edges sinuosity. According to Cairns (1999), *F. arcuatile* is most similar to *F. knoxi*, but differs in having a more robust corallum, less developed columella, and more compressed corallum. However, it is worth to note that *F. arcuatile* can also be confused with *F. pavoninum* Lesson, 1831, and within their differences, the rounded thecal edges in *F. arcuatile* is probably the easiest character for distinguishing these two species. In some of specimens examined herein, burrows of acrothoracican crustaceans were observed.

***Flabellum* (*Flabellum*) *politum* Cairns, 1989**

Plate 4, Figs. I-J

Flabellum pavoninum paripavoninum. –Yabe & Eguchi, 1942a: 91-93 (*in part*: *Soyo Maru* stn. 419, pl. 5, figs. 8a-c). –Yabe & Eguchi, 1942b: 129-130 (*in part*: pl. 11, figs. 9a-c).

Flabellum politum Cairns, 1989a: 53-54, pl. 28, figs. a-f. –Cairns, 1989b: 67. –Cairns, 1994: 73, pl. 32, figs. a-c. –Cairns & Zibrowius, 1997: 153-154. –Cairns, 1998: 394. –Cairns et al., 1999: 31. –Cairns, 2004a: 303. –Cairns, 2009: 18.

Flabellum sp. 1. –Cairns, 1989b: 63.

Type locality. –*Albatross* stn. 5391 (12º13’15’’N, 124º05’03’’E – Samar Sea, Philippines), 216 m.

Type material. –All types are deposited at the NMNH (Cairns, 1994).

New records. –Bathus 4: stn. CP 905 (3); stn. DW 932 (1); stn. DW 933 (12).

Description. –Corallum flabellate and with an elongate, circular, unattached pedicel. Calice highly compressed (GCD:LCD = 1.8-2.4); calicular edge highly arched in profile. Largest specimen examined (DW 933) 30.4 x 14.0 mm in CD, 24.3 mm in height, and 1.4 mm in PD. Thecal faces planar, meeting in an acute angle, and bear a small crest. Angle of thecal edges (including crests) between 110 and 130º. Thecal crests straight to slightly sinuous (sometimes slightly laciniate), about 1 mm high, and terminate near pedicel. Well preserved specimens glisteny. Costae represented as narrow and shallow striae separated by broad, flat intercostal spaces. Thin transverse growth lines present from calicular edge to pedicel. Corallum usually white, but one small specimen examined have longitudinally reddish-brown stripes.

Septa hexamerally arranged in six incomplete cycles according to formula: S1-3>S4>S5>S6. S1-3 slightly thicker than other septal cycles, and have vertical and highly sinuous axial edges. S4 only slightly smaller than S1-3, and have moderate sinuous axial edge. S5 about half-size of S4 and bear straight to slightly sinuous axial edge. Sometimes S5 adjacent to S1-2 slightly wider than those adjacent to S3. S6 rudimentary. Septal faces bear small pointed granules aligned in rows perpendicular to septal edge. Fossa narrow, elongate, and of moderate depth containing a rudimentary columella formed by lower axial edges of S1-3.

Distribution. –*New Caledonia*: 170-296 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; and Australia; 40-402 m.

Discussion. –*Flabellum politum* is compared with the only other New Caledonian species in the subgenus in the account of that species. For a comprehensive comparison within other *Flabellum* (*Flabellum*) species see Cairns (1989a; b).

Subgenus *Flabellum* (*Ulocyathus*) Sars, 1851

Diagnosis. –*Flabellum* having a jagged or lacerate calicular edge.

Type species. –*Ulocyathus arcticus* Sars, 1851 (=*Flabellum macandrewi* Gray, 1849), by monotypy.

Flabellum (*Ulocyathus*) *aotearoa* Squires, 1964

Plate 4, Figs. K-L

Flabellum aotearoa Squires, 1964: 7-9, pl. 2, figs. 15-18. –Squires & Ralph, 1965: 261. –Dawson, 1992: 44. –Cairns, 1995: 102-103, pl. 33, figs. d-f, i. –Cairns, 1999: 117, fig. 19e. –Cairns et al., 1999: 30. –Cairns, 2004a: 266, 303. –Cairns, 2009: 19.

Flabellum sp. cf. *F. deludens*. –Wells, 1984: 215, pl. 4, figs. 8-10.

Type locality. –*Ikatare* stn. B-26 (35º04’S, 174º23.2’E – Bay of Islands, New Zealand), 184 m.

Type material. –The holotype is deposited at the AIM. A paratype is deposited at the NMNH (Cairns, 1995).

New records. –Bathus 4: stn. DW 902 (1); stn. DW 903 (2). –Norfolk 2: stn. DW 2117 (2); stn. DW 2151 (1).

Description. –Corallum conical and fixed to substrate by a slender elliptical pedicel (PD:GCD = 0.01-0.15) and a very small encrusting base usually having same diameter as pedicel. Angle of thecal faces between 20 and 35º. Thecal edges sharp and carinate, forming a wide angle (90-130º). Crests on thecal edges thin, up to 2.5 mm in height, and often straight and continuous; however, some specimens display discontinuous and slightly sinuous crests. Calice compressed (GCD:LCD = 1.4-2.3); calicular edge scalloped and highly arched. Largest specimen examined (DW 903) 25.5 x 15.8 mm in CD, 1.6 mm in PD, and 20.3 mm in height. Theca robust, glisteny, and covered with low rounded granules. Sometimes granules aligned in a chevron pattern. C1-4 slightly ridged with blunt top. Theca longitudinally striped with reddish-brown pigment usually corresponding to intercostal spaces. Calicular edge and calicular elements white.

Septa hexamerally arranged in five complete cycles according to formula: S1-2>S3>S4>>S5 (96 septa). S1-2 up to 1.5 mm exsert and extend to columella with vertical and extremely sinuous low axial edge. S3 less exsert and about 4/5 width of S1-2, and also fuse to columella deep in fossa with vertical and sinuous axial edge. S4 about 2/5 width of S3 and have slightly sinuous axial edge. S5 rudimentary (not extending deep in fossa) and have straight axial edge. At calicular edge each S5 form a triangular lancet with adjacent septa (S1, S2 or S3). Septal faces bear rows of well-developed pointed granules perpendicular to septal edge. Fossa narrow and deep, containing an elongate columella formed by lower axial edges of S1-3.

Distribution. –*New Caledonia*: 341-400 m. –*Elsewhere*: Vanuatu; Australia; and New Zealand; 130-1300 m.

Discussion. –*Flabellum* (*U.*) *aotearoa* is one of the four species from New Caledonia that compose the subgenus *Ulocyathus*, of which all four have thecal edge crests. Among them, three have hexamerally arranged septa: *F. aotearoa, F. deludens, and F.*

disaequabilis (*F. hoffmeisteri* being the only octamerally one). *F. aotearoa* is distinguished from *F. disaequabilis* by the unusual asymetric profile in the latter species (see discussion of *F. disaequabilis*), and from *F. deludens* by the absence of long rectangular lancets.

***Flabellum* (*Ulocyathus*) *deludens* Marenzeller, 1904**

Plate 4, Figs. M-N

Flabellum japonicum. –Marenzeller, 1888a: 45-46.

Flabellum deludens Marenzeller, 1904b: 269–272, pl. 17, figs. 10, 10a. –Faustino, 1927: 48-50. –Yabe & Eguchi, 1932e: 387. – Eguchi, 1938: table 2. –Yabe & Eguchi, 1942a: 101-103, pl. 5, figs. 9a, 9c, 10a, 10c, 11a, 11c. –Yabe & Eguchi, 1942b: 135-136, pl. 12, figs. 1a-c. –Eguchi, 1965: 292. –Utinomi, 1965: 256. –Eguchi, 1968: C44-45, pl. C22, figs. 4-5, pl. C25, figs. 3-4. –Pillai, 1972: 211. –Eguchi & Miyawaki, 1975: 58. –Maragos, 1977: 164. –Zibrowius & Grygier, 1985: 122, figs. 16-17. –Veron, 1986: 603. –Cairns, 1989a: 55–56, pl. 29, figs. a–f. –Cairns, 1994: 73, pl. 32, figs. d, e. –Cairns & Zibrowius, 1997: 154–156. –Cairns, 1998: 395. –Cairns, 1999: 117. –Cairns et al., 1999: 30. –Cairns, 2004a: 303. - Kühlmann, 2006: 64, 103, 111. –Cairns, 2009: 19.

Type locality. –*Valdivia* stns. 185 and 203 (west of Sumatra), 614-660 m.

Type material. –The syntypes are deposited at the ZMB (Cairns & Zibrowius, 1997).

New records. –Norfolk 2: stn. DW 2142 (1).

Description. –Corallum flabellate-compressed, with slightly concave thecal faces joined at sharp thecal edges. Upper thecal edges carinate only near calicular edge. Near pedicel, thecal edges round. Angle of thecal edges about 100º and inclination of thecal faces nearly 63º. Only specimen examined 29.6 x 16.9 mm in CD, 18. 8 mm in height, and 2 mm in PD. Theca bear uniformly distributed granulation and weak chevron-shaped growth lines. Calicular edge deeply lacerate, with each S1-2 and their adjacent S4 forming a rectangular extension up to 5 mm in height. A much smaller triangular apex corresponds to each S3 and adjacent S5. C1 and C2 form round ridges, decreasing towards pedicel. C3 narrower and less projecting than C1-2. Base and pedicel white, but rest of corallum dark-brown.

Septa hexamerally arranged in 5 incomplete cycles according to formula: S1-2>S3>S4>>>S5 (72 septa). In all half-systems S5 absent between S1 and S2. S1-2 highly exsert, and extend and define a narrow fossa with vertical and sinuous axial edges. S3 about 3/5 width of S1-2, 1.5 mm exsert, and also have sinuous axial edge. Upper edges of S1-3 slightly sinuous as well. S4 about half-width of S3 but almost as exsert as S1-2. Axial edge of S4 slightly sinuous, and upper edge curve and fuse to adjacent S1 or S2. S5 rudimentary. Fossa deep and narrow. No columella detected.

Distribution. –*New Caledonia*: 550 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; Sumatra; northern Indian Ocean; Australia; 106-1035 m.

Discussion. –The deeply lacerated calicular edge resulted from 12 long rectangular lancets formed by S1-2 and their adjacent S4 makes *Flabellum* (*U.*) *deludens* one of the most distinctive species in the genus. The only other congener that have long rectangular lancets (usually shorter than those of *F. deludens*) and not curved corallum is *F.* (*U.*) *marenzelleri* Cairns, 1989a. The New Caledonian species is distinguished by its septal symmetry (hexameral versus octameral in *F. marenzelleri*).

***Flabellum* (*Ulocyathus*) *disaequabilis* sp. nov.**

Plate 4, Figs. O-P

Flabellum sp. –Cairns & Zibrowius, 1997: 158-159, figs. 21d-f.

Type locality. –Bathus 3: stn. DW 786 (23º54.46'S, 169º49.15'E – New Caledonia), 699-715 m.

Holotype. –Bathus 3: stn. DW 786.

Paratype. –Bathus 3: stn. DW 786 (1).

Description. –Corallum flabellate, curved between 45 and 90º in GCD plane, and free or weakly attached by a slender rudimentary circular pedicel (PD:GCD ~ 0.09). Base small and revealing 6 protosepta. Calice elliptical (GCD:LCD = 1.3-1.4); calicular edge lancetted. Largest specimen examined (DW 786 - holotype) 28.3 x 20.3 mm in CD, 2.4 mm in PD, and 26.4 mm in height. Angle of thecal edges between 45 and 67º and face angle is approximately 50º, however, lower part of corallum has smaller thecal face and thecal edge angles. One thecal face is highly convex and other slightly to high concave. This divergence of thecal faces curvature results in an asymmetrical corallum. Thecal faces meet in an acute angle at thecal edge forming small (less than 0.3 mm in height) discontinuous crests. Theca smooth, almost porcellanous, and covered by low growth lines in a chevron pattern that peak at each C1-2. C1-2 ridged, C3 slightly ridged, and C4-5 flat. Corallum white with faint reddish-yellow pigmentation associated with C1-2 and upper distal edges of S1-2.

Septa hexamerally arranged in 5 cycles according to formula: S1-2>S3>S4>>>S5. Holotype is missing only one pair of S5, totalling 94 septa, but paratype have no S5. S1-2 slightly exsert forming small triangular lancets with their adjacent septa (S4 or S5) and extend to columella with vertical to slightly concave slightly sinuous axial edges. S3 sinuous, about 4/5 width of S1-2, and form small triangular lancets with adjacent septa at calicular edge. S4 about ½ width of S3 and has sinuous and vertical axial edge. S5 rudimentary. Pairs of S5 insert firstly between S3/S4 and latter between S1-2/S4. Fossa of moderate depth, containing a rudimentary, spongy, elongate columella formed by lower axial edges of S1-2 and eventually S3.

Etymology. –The species name is from the Latin *disaequabilis* (*dis* = not and *aequabilis* = consistent, uniform, equal), and refers to the uneven corallum profile of this species.

Distribution. –*New Caledonia*: 699-715 m. –*Elsewhere*: Philippines; and New Zealand; 441-1058 m.

Discussion. –*Flabellum* (*U.*) *disaequabilis* have been reported as *F.* (*U.*) sp. by Cairns & Zibrowius (1997) from Philippines, Norfolk ridge, and New Zealand. Among their reasons to not name this species, even considering that it represented an underscribed species, was its similarity with *F.* (*U.*) *moseley* Pourtalès (1880) from the Caribbean. However, the specimens examined in the present study, additionally with those previously reported by Cairns & Zibrowius (1997) consistently differs from *F. moseley* by having fewer septa at a corresponding GCD, less prominent triangular lancets, and sinuous S1-4 axial edges (axial septal edges of *F. moseley* are straight).

***Flabellum* (*Ulocyathus*) *hoffmeisteri* Cairns & Parker, 1992**

Plate 4, Figs. Q-R

Flabellum japonicum. –Hoffmeister, 1933: 7, pl. 1, figs. 1-2. –Wells, 1958: 262. –Squires, 1961: 18. –Veron, 1986: 603.

Flabellum n. sp. Cairns, 1989a: 57, pl. 29, figs. j-k.

Flabellum hoffmeisteri Cairns & Parker, 1992: 47-48, pl. 16, figs. d-f. –Stranks, 1993: addendum. –Cairns, 1995: 103-104, pl. 33, figs. g-h. –Cairns & Zibrowius, 1997: 157-158. –Cairns, 1998: 394-395. –Cairns, 1999: 118. –Cairns et al., 1999: 30. –Cairns, 2004a: 303-304. –Cairns, 2009: 19.

Type locality. –*Soela* stn. 27 (37º59’S, 150º05’E – off Victoria, Australia), 452 m.

Type material. –The holotype and 44 paratypes are deposited at SAM. Fourty-two and 7 additional paratypes are deposited at the NMV and NMNH respectively (Cairns & Parker, 1992).

New records. –Bathus 4: stn. CP 922 (3).

Description. –Corallum flabellate with evenly convex thecal faces, and loosely attached by a rudimentary pedicel elliptical in cross section (about 3 mm in great pedicel diameter). Angle formed by thecal faces about 65º, and they meet in an acute angle in thecal edges. Calice compressed (GCD:LCD = 1.3-1.6); calicular edge scalloped. Each S1-2 and adjacent S5 forming a triangular lancet (more prominent in smaller specimens); smaller lancets correspond to each S3. Largest specimen examined (CP 922) 41.5 x 24.8 mm in CD and 27.0 mm in height. Thecal edges bear thin crests up to 2.5 mm in height. Crests usually continuous, slightly sinuous, and moderate serrate, but sometimes crests can be disrupted. Theca covered by low rounded granules especially over costae. C1-2 ridged, well-developed, and broad. C3-5 represented by aligned granules. C4-5 do not reach pedicel. Intercostal spaces between C3 and C5, and between C4-5 less granular and sometimes bear thin longitudinal lines. Corallum white to light-purple.

Septa octamerally arranged in 4 cycles according to formula: S1-2>S3>S4>>S5. S1-2 slightly exsert (less than 2 mm) and extend to columella with vertical and highly sinuous axial edges. S3 only slightly less wide and less exsert than S1-2, and bear less sinuous axial edge. S4 about 3/5 width of S3 and have slightly sinuous axial edge. S5 rudimentary. All septal faces bear scarce pointed granules apparently aligned in rows perpendicular to septal edge. Fossa deep and narrow, containing a rudimentary columella formed by lower axial edges of S1-3.

Distribution. –*New Caledonia*: 600 m. –*Elsewhere*: Indonesia; Vanuatu; Australia; and New Zealand; 110-842 m.

Discussion. –Amongst the 17 extant species in the subgenus, only three have septa octamerally arranged: *F. hoffmeisteri*, *F. marenzelleri* Cairns, 1989a, and *F. tuthilli* Hoffmeister, 1933. *F. tuthilli* is distinguished from the other two species in having lower S1 triangular lancets, a more convex thecal faces, and much shorter thecal edge crests (present only at point of thecal inflection, whereas in *F. hoffmeisteri* and *F. marenzelleri* thecal edge crests usually extend from base to calicular edge). However, very subtle differences distinguishes *F. hoffmeisteri* and *F. marenzelleri*. According to Cairns (1995), *F. marenzelleri* differs by having a more compressed corallum (face angle <50º); and in having a more lacerated calicular edge (S1 and adjacent septa form rectangular lancets instead of small triangular lancets as found in *F. hoffmeisteri*).

Genus *Javania* Duncan, 1876

Diagnosis. –Corallum solitary, sub-cylindrical to turbinate, and attached by a pedicel that is strongly reinforced with numerous layers of dense stereome (tectura). Three to five cycles of highly exsert septa present, resulting in a lacerate calicular edge. Pali absent. Columella rudimentary or absent.

Type species. –*Javania insignis* Duncan, 1876, by monotypy.

Javania amplissima sp. nov.

Plate 4, Figs. S-T

Javania sp. nov. Kitahara et al., 2010b.

Type locality. –*Norfolk 2*: stn. CH 2115 (23°45'S, 168°17'E - Bank Jumeau east, New Caledonia), 377-401 m.

Holotype. –Norfolk 2: stn. CH 2115.

Paratype. –Norfolk 2: stn. CH 2115 (1).

Description of Holotype. –Corallum ceratoid, extremely robust, and with a serrate calicular margin. Holotype measures 75.8 x 62.6 mm in calicular diameter (GCD:LCD = 1.21), 66.0 mm in height (base is broken), and 15 mm in PD. Lower corallum subcylindrical, but upper corallum extremely flared, attaining nearly 180º. Pedicel elliptical in cross-section and have multiple, concentric, high-density layers of tectura. Tectura glisteny white, granular, and enclosing all circumference of pedicel, where can be counted at least 13 layers of 0.2 mm in width each. Calicular edge uniformly serrate, with a triangular lancet of about 1.5 mm in height corresponding to each septa. Theca relatively thick and smooth (porcellanous), costae equal and better developed from calicular edge to point of thecal inflection. Each ridge corresponds to each interseptal space, being separated by V-shaped furrows, which in turn correspond to each septum. Below inflection point, all costae become flat to slightly convex and thin and shallow intercostal striae separate them. Upper thecal faces bear very fine white chevron-shaped growth lines between intercostal ridges. Theca yellowish-brown, but paratype completely white.

Septa hexamerally arranged in 5 complete cycles according to formula: S1-2>S3>S4>S5 (96 septa). Upper, outer septal edges separated from calicular edge by a low, slightly concave notch. S1-2 almost meeting their counterparts from opposite calicular side with thick, vertical and slightly sinuous axial edges. Middle portion of S1-2 upper edges project above calicular margin. S3 extends almost as far as S1-2 inot fossa with straight and vertical axial edge. S4 about ¾ width of S3. S5 slender and only 3/5 width of S4. Septal faces bear low round granules, especially those of fourth cycle, which granules are more coarsely granulated. Fossa extremely deep, columella absent.

Etymology. – The species name is from the Latin *amplissimus* (largest), and refers to the large size of this species.

Distribution. –*New Caledonia*: 377-401 m.

Remarks. –Among the 10 extant *Javania* species, five have five or more septal cycles in adult stage: *J. antarctica*, *J. erhardti*, *J. lamprotichum*, *J. insignis*, and *J. borealis*. Among them, *J. amplissima* is distinguished by having extremely flared upper corallum; outer septal edges separated from calicular edge by a notch; and ridged intercostal spaces.

Javania antarctica (Gravier, 1914)

Plate 4, Figs. U-V

Desmophyllum antarcticum Gravier, 1914a: 236-238. –Gravier, 1914b: 122-125, pl. 1, figs. 1-3 (*in part*).

Javania antarctica. –Cairns, 1982: 48, 50, pl. 15, figs. 1-4. –Cairns et al., 1999: 31. –Cairns, 2004b: 8. –Cairns, 2009: 20.

Type locality. –*Pourquoi-Pas (?)* stn. 8 (64º50'S, 63º30'W – off Anvers Island, Antarctic), 53 m.

Type material. –One syntype is deposited at the MNHN (Cairns, 1982).

New records. –Bathus3: stn. CP 833 (1). –Halipro 1: stn. CP 877 (1).

Description. –Corallum trochoid, curved, and firmly attached by a slender pedicel (PD:GCD = 0.20-0.25) that expands into a thin and small encrusting base. Largest specimen examined (CP 833) 43.7 x 39.5 mm in CD, 10.8 mm in PD, and 83.4 mm in height. Calice elliptical (GCD:LCD = 1.10-1.17). Theca fragile near calicular edge, and glisteny. Narrow and shallow striae (costa) corresponding to each septum extends from pedicel to calicular edge. Intercostal regions flat to slightly convex. Chevron-shaped growth lines peak at each costal striae. Pedicel solid, porcellanous, and white-opaque. Corallum white.

Septa hexamerally arranged in five complete cycles according to formula: S1-S2>S3>S4>>S5 (96 septa). Septa of both specimens examined damaged above calicular edge, disabling measurements of septal exsertness. S1-2 almost reach opposite side septa with sinuous axial edges. S3 only slightly less wide and less sinuous than S1-2. S4 about 4/5 width of S3 with moderate sinuous axial edge. S5 about ½ size of S4 and only slightly sinuous. Septal faces granulation low and scarce. Fossa very deep containing no columella.

Distribution. –*New Caledonia*: 441-480 m. –*Elsewhere*: Antarctic; 53-1280 m.

Discussion. –*Javania antarctica* was previously known only from Antarctic and Subantarctic waters. In fact its previous distribution was restricted to off western Antarctic Peninsula. Together with th New Caledonian records presented herein, *J. antarctica* has one of the most disjunct coral distribution known to date. Amongst congeners, *J. antarctica* is most similar to *J. lamprotichum* but differs in having a non pigmented and much taller corallum; and corallum not flared distally. Also, large specimens of *J. lamprotichum* tends to have constricted upper corallum in the LCD plane.

Javania deforgesi **sp. nov.**

Plate 4, Figs. X-W

Type locality. –*Norfolk 2*: stn. CP 2038 (23°42'S, 168°10'E - Bank Jumeau west, New Caledonia), 290-330 m.

Holotype. –Norfolk 2: stn. CP 2038.

Paratypes. –Norfolk 2: stn. DW 2125 (1)

Description. –Corallum ceratoid, firmly attached, and distally flared. Holotype 22.8 x 15.9 mm in calicular diameter and 26.4 mm in height (base broken), with a thick pedicel with 6.2 mm in diameter. Pedicel reinforced by several concentric tectura deposits (up to 12). Calice elliptical; calicular edge slightly serrate, each S1-2 (and usually S3) projecting as small isosceles triangular apexes. Costae not ridged, however, near calicular edge C1-2 distinguished as shallow grooves. Theca glisteny, bearing several (22 in holotype and 12 in paratype) longitudinal reddish-brown growth lines near calicular edge. Pigmentation becomes faint and less crowded in direction of pedicel, which is white. Calicular edge and upper septal edges of S1-3 also pigmented.

Septa hexamerally arranged in 5 cycles according to formula: S1>S2>S3≥S4>>S5, but last cycle never complete. All septa thickened near calicular edge, becoming thinner in direction to centre of fossa. S1 most exsert septa (up to 3 mm) and almost meet opposite side septum deep in fossa. S1 aligned to GCD smaller than lateral S1. Septal axial edges of holotype slightly sinuous, but straight in paratype. S2 just slightly smaller and less exsert than S1. S3 ¾ width of S2, about 1 mm exsert, and have moderate sinuous axial edge. S4 ½ to ¾ width of S3, not exsert, and with axial edges as sinuous as S3. S4 flanked by a pair of S5 less thick than unflanked S4. S5 1/2 to 3/5 width of S4 with slightly sinuous axial edges. Fossa deep, columella absent.

Etymology. –The species is named in honour of Dr. Richard Bertrand de Forges, for all his effort in collecting and preserving deep-water scleractinians from New Caledonian waters.

Distribution. –*New Caledonia*: 275-348 m.

Discussion. –Amongst the five *Javania* species with 5 septal cycles (see *J. amplissima* discussion), *J. deforgesi* is distinguished in having S1>S2 (not S1=S2); axial septal edges thinner than outer upper edges; and characteristic pigmentation following calicular edge layout.

Javania exserta Cairns, 1999

Plate 5, Figs. A-B

Desmophyllum sp. cf. *D. cristagalli*. –Wells, 1954: 470.

Javania sp. –Cairns & Zibrowius, 1997: 165, figs. 22b-c.

Javania exserta Cairns, 1999: 126-127, figs. 21g-i. –Cairns et al., 1999: 31. –Cairns, 2004b: 8. –Cairns, 2006: 47. –Cairns, 2009: 21. –Kitahara et al., 2010b.

Type locality. –*Karubar* stn. 44 (7º52’22’’S, 132º48’24’’E –south of Tanibar Island, Indonesia), 291-295 m.

Type material. –The holotype and 25 paratypes are deposited at the MNHN. Thirteen additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –SMIB 10: stn. DW 208 (2). –Norfolk 1: stn. DW 1651 (3). –Norfolk 2: stn. DW 2024 (26); stn. CP 2038 (2); stn. DW 2040 (1); stn. DW 2063 (1); stn. DW 2065 (2); stn. DW 2070 (1); stn. DW 2091 (3); stn. DW 2124 (16); stn. DW 2125 (34); stn. DW 2135 (2); stn. DW 2148 (1); stn. DW 2160 (5); stn. DW 2162 (1).

Description. –Corallum ceratoid to trochoid, straight to slightly curved, and firmly attached to substrate by a robust pedicel (PD:GCD = 0.30-0.62) and a thin encrusting base. Pedicel reinforced by numerous concentric rings of tectura. Calice elliptical (GCD:LCD = 1.07-1.33). Largest specimen examined (DW 2024) 19.6 x 15.5 mm in CD, 5.9 mm in PD, and 36.6 mm in height. Theca porcellanous often bearing chevron-like transverse growing lines that peak on each C1-2. C1-2 slightly convex to highly ridged near calicular edge. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S3>S4, but additional S5 occur in larger specimens (up to 74 septa). S1 highly exsert (up to 5 mm), thick, and almost meet opposite septa with straight to slightly concave axial edge. S2 slightly less exsert, less wide, and having a slightly more concave axial edge than S1. S3 absent at calicular edge, but increase to almost ¾ S2 width deep in fossa. Axial edge of S3 slightly sinuous. S4 rudimentary. In half-systems with four S5, S3 slightly exsert, and each S5 fuses to S1, S2, or S3 near calicular edge. Fossa deep and narrow.

Distribution. –*New Caledonia*: 260-1150 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; Pelau; and Marshall Islands; 91-455 m.

Remarks. –Amongst congeners, *J. exserta* is most similar to *J. insignis*, but is distinguished by having S3 not or only slightly exsert (S3 of *J. insignis* up to 2.5 mm exsert), and less developed developed S4. Also, *J. insignis* apparently has a more robust corallum. Within the *J. exserta* specimens examined herein, some contain acrothoracican cirripede borings.

Javania fusca (Vaughan, 1907)

Plate 5, Figs. C-D

Placotrochus fuscus Vaughan, 1907:66-67, pl. 4, figs. 2-3. –Cairns, 1989a: 45, 75.

Javania pachytheca Cairns, 1995: 112-113, pl. 36, figs. j-l, pl. 37, fig. a. –Cairns & Zibrowius, 1997: 165.

Javania fusca. –Cairns, 1999: 125-126, figs. 20g-i. –Cairns et al., 1999: 31. –Cairns, 2004a: 266, 304. –Cairns, 2004b: 8. –Cairns, 2009: 20. –Kitahara et al., 2010b.

Type locality. –*Albatross* stns. 3886 and 3999 (Kauai and Molokai Islands, Hawaii), 271 m.

Type material. –Three syntypes are deposited at the NMNH (Cairns, 1999).

New records. –Bathus 3: stn. DW 786 (6); stn. DW 818 (3). –Norfolk 2: stn. DW 2023 (8); stn. DW 2024 (9); stn. DW 2032 (2); stn. DW 2035 (2); stn. DW 2036 (4); stn. DW 2037 (5); stn. DW 2040 (3); stn. DW 2046 (2); stn. DW 2049 (4); stn. DW 2052 (5); stn. DW 2057 (4); stn. DW 2058 (7); stn. DW 2060 (18); stn. DW 2063 (2); stn. DW 2064 (7); stn. DW 2065 (2); stn. DW 2066 (3); stn. DW 2067 (3); stn. DW 2068 (6); stn. DW 2069 (20); stn. DW 2070 (19); stn. DW 2072 (1); stn. DW 2075 (28); stn. DW 2078 (6); stn. DW 2080 (6); stn. DW 2081 (1); stn. DW 2084 (1); stn. DW 2086 (8); stn. DW 2087 (1); stn. DW 2091 (2); stn. DW 2098 (1); stn. DW 2100 (1); stn. DW 2102 (10); stn. DW 2103 (3); stn. DW 2106 (13); stn. DW 2107 (10); stn. DW 2110 (3); stn. DW 2111 (3); stn. DW 2112 (1); stn. DW 2113 (2); stn. DW 2124 (1); stn. DW 2125 (2); stn. DW 2140 (1); stn. DW 2144 (1); stn. CP 2146 (2); stn. DW 2147 (12); stn. DW 2148 (15); stn. DW 2156 (4); stn. DW 2157 (13); stn. DW 2158 (1).

Description. –Corallum ceratoid to sub-cylindrical, straight to slightly curved, and attached by a tectura reinforced pedicel that expands into a thin encrusting base. Calice circular to slightly elliptical (GCD:LCD = 1.05-1.23); calicular edge slightly serrate. Largest specimen examined (DW 2066) 14.9 x 13.6 mm in CD, but a broken pedicel unable measurement of height. However, specimens over 34.0 mm in height not unusual. Theca thick and sometimes reinforced by white porcellanous epitheca. C1-3 often slightly ridged until pedicel. Intercostal spaces flat and broad. If present, transverse growth lines peak on each C1-3 in a chevron-like pattern. Theca finely granular. Most corallum white with reddish-brown longitudinal stripes corresponding to C1-3. Same colour pigmentation usually encircles upper thecal edge and upper peripheral faces of S1-3. However, some specimens completely white.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S3>>S4 (48 septa). S1-2 thick, up to 2.5 mm exsert, extending about ¾ distance to centre of fossa with straight to slightly sinuous axial edges. S3 about half as exsert and ¾ width of S1-2. Axial edge of S3 sinuous. S4 not exsert and only 1/5 width of S3, but also have a sinuous axial edge. Granulation of septal faces quite variable: some specimens have numerous low, but pointed, granules aligned to septal upper edge; but smooth septal faces more common. Fossa deep and lacking columella.

Distribution. –*New Caledonia*: 260-1434 m. –*Elsewhere*: Hawaii; Wallis and Futuna; Vanuatu; Indonesia; Malaysia; Australia; and New Zealand; 271-1045 m.

Discussion. –This commonly collected *Javania* species in New Caledonian waters can be grouped with three congeners that have only four septal cycles: *J. cailleti*; *J. exserta*; and *J. pseudoalabastra*. Among them, *J. fusca* is distinguished from *J. pseudoalabastra* by its smaller GCD:LCD ratio (or more circular calice, <1.5 in *J. fusca* and usually about 2 in *J. pseudoalabastra*). The former species is distinguished from *J. cailleti* and *J. exserta* by having a smaller adult corallum size; S4 much smaller than S3; theca often pigmented (theca of *J. cailleti* and *J. exserta* usually completely white); and less crowded septa.

Javania insignis **Duncan, 1876**

Plate 5, Figs. F-G

Javania insignis Duncan, 1876: 435, pl. 39, figs. 11-13. –Marenzeller, 1907b: 23, pl. 2, fig. 6. –Yabe & Eguchi, 1932e: 388. –Zibrowius, 1974c: 8-9, pl. 1, figs. 1-6. –Fricke & Schuhmacher, 1983: 184. –Scheer & Pillai, 1983: 165-166, pl. 37, figs. 9-12. –Cairns, 1984: 23, pl. 4, figs. F-H. –Cairns, 1989a: 77-78, pl. 40, figs. d-e, g-h, j-k. –Cairns, 1994: 80, pl. 34, figs. i-k. –Cairns & Keller, 1993: 272. –Tachikawa, 2005: 10, pl. 4, figs. C-D. –Cairns & Zibrowius, 1997: 163-164. –Cairns et al., 1999: 31. –Cairns, 2004a: 304. –Cairns, 2004b: 8. –Cairns, 2009: 20.

Flabellum weberi Alcock, 1902a: 107.

Desmophyllum cf. *insigne*. –Yabe & Eguchi, 1942b: 115, pl. 9, figs. 5, 6.

Desmophyllum insignis. –Eguchi, 1965: 290. –Eguchi, 1968: C41-C42, pl. C9, figs. 4-9. –Song, 1982: 136, pl. 2, figs. 5-6. –Song, 1988: 27-28, pl. 3, figs. 9-11. –Song, 1991: 134.

Type locality. –Owase (34º13'N, 136º13'E – Japan), 88 m.

Type material. –The holotype is deposited at the BM (Cairns, 1994).

New records. –Norfolk 1: stn. DW 1651 (2). –Norfolk 2: stn. DW 2023 (8); stn. DW 2040 (4); stn. DW 2072 (1); stn. DW 2080 (1); stn. DW 2126 (1).

Description. –Corallum ceratoid, quite robust, with slightly flared elliptical calice, and attached by tectura reinforced pedicel (PD:GCD = 0.40-0.57) and a thin encrusting base. Calice always elliptical (GCD:LCD = 1.10-1.50); calicular edge jagged. Largest specimen examined (DW 2023) 23.5 x 20.2 mm in CD, 13.3 mm in PD, and 34.9 mm in height. Theca robust, smooth (porcellanous) and covered with extremely small granules. C1-3 sometimes slightly ridged near calicular edge, and sometimes thin transverse lines peak at each C1-3. Corallum white usually bored by acrothoracican cirripeds.

Septa hexamerally arranged in 5 cycles (no specimens examined display a full fifth cycle) according to formula: S1≥S2>S3>>S4>S5. S1 thick, up to 6 mm exsert, and almost meeting opposite septa with vertical, straight, and thickened axial edge. S2 about as exsert and as wide as S1, but have slightly sinuous axial edge. S3 up to 2.5 mm exsert, about 4/5 width of S2, and has slightly sinuous axial edge. S4 thin, non-exsert, about ½ size of S3, and have moderate sinuous axial edge. S5 rudimentary. Septal faces covered by low rounded granules. Fossa elongate and deep. Columella absent.

Distribution. –*New Caledonia*: 276-1005 m. –*Elsewhere*: Hawaii; Japan; Philippines; Indonesia; Red Sea; southwest Indian Ocean; and Australia; 46-1050 m.

Remarks. –*Javania insignis* is most similar to *J. exserta* and is compared with the latter in the account of that species.

***Javania lamprotichum* (Moseley, 1880)**

Plate 5, Figs. E, J

Desmophyllum lamprotichum Moseley, 1880: 41-42, figs. 1-2.

Javania lamprotichum. –Cairns, 1984: 21, pl.4, figs. D-E. –Cairns, 1995: 112, pl. 37, figs. b-c. –Cairns & Zibrowius, 1997: 164. –Cairns, 1998: 365, 403, figs. 8j-m. –Cairns, 1999: 124-125. –Cairns et al., 1999: 31. –Cairns, 2004a: 304. –Cairns, 2004b: 8. –Cairns, 2006: 47. –Cairns, 2009: 20. –Kitahara et al., 2010b.

Type locality. –Unknown.

Type material. –The holotype is deposited at the BM (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2065 (1); stn. DW 2066 (1); stn. DW 2069 (1); stn. DW 2070 (1).

Description. –Corallum large, ceratoid, fragile, and attached to substrate through a pedicel reinforced by concentric tectura and an also reinforced encrusting base. Pedicel circular and tectura formed by numerous thin concentric layers of white and dense stereome. Calice flared distally, elliptical in smaller specimens (GCD:LCD = 1.3-1.5) and more compressed in older coralla (GCD:LCD = 1.8). Calicular margin serrate. Largest specimen examined (DW 2070) 55.0 x 30.8 mm in CD, 8.5 mm in PD, 42.3 mm in height (but base is broken), and have calice constricted at LCD plane. Theca thin, glisteny, and covered by small granules. C1-4 slightly ridged and bearing well defined inverted V-shaped stereome white depositions strengthening theca, especially on regions where it was previously damaged. C5 marked as narrow and shallow striae. All specimens examined display a intense reddish-brown pigmentation along C1-3, a slightly lighter pigmentation on C4, and a white pedicel. Septa also pigmented, notorious darker in older coralla.

Septa hexamerally arranged in five complete cycles according to formula: S1-2>S3>S4>>S5 (96 septa). S1-2 up to 5 mm exsert and almost meet their opposite septa with convex to vertical, sinuous axial edges. Largest specimen examined have S1-2 axial edges wider than other septal regions. S3 about ¾ width of S1-2 and only slightly sinuous. S4 ½ to ¾ width of S3, also with a slightly sinuous (or even straight) axial edge. S5 rudimentary in smaller and about ½ size of S4 in larger specimens. All septal faces bear numerous well-developed blunt granules. At calicular margin, each S5 fuses to adjacent S1 or S2 or S3, forming triangular to rectangular lancets. Fossa deep, containing a rudimentary columella composed of fused lower axial edges of S1-2.

Distribution. –*New Caledonia*: 750-1150 m. –*Elsewhere*: Hawaii; Johnston Atoll; Philippines; Australia; and New Zealand; 191-881 m.

Discussion. –Among New Caledonian congeners, *J. lamprotichum* is distinguished by having a more flared calice (only less flared than *J. amplissima*); S1-3 forming triangular or rectangular lancets at calicular edge with their adjacent S5; coarsely granulated septal faces; and in having tickened S1-2 lower axial edges.

Genus *Placotrochides* Alcock, 1902c

Diagnosis. –Corallum solitary and compressed-cylindrical. Transverse division present, resulting in an anthocyathus with a basal scar almost as large as calicular diameter. Thecal spines absent. Three to four cycles of non-exsert septa. Calicular edge smooth. Columella well-developed, trabecular.

Type species. –*Placotrochides scaphula* Alcock, 1902b, by subsequent designation (Wells, 1936).

***Placotrochides minuta* Cairns, 2004**

Plate 5, Figs. H-I

Placotrochides minuta Cairns, 2004a: 305, 307, figs. 10E-H. –Cairns, 2006: 47. –Cairns, 2009: 20.

Type locality. –*Franklin* stn. 03/99/D11 (20º14.49'S, 151º47.53'E – Marion Plateau, Australia), 342 m.

Type material. –The holotype is deposited at the AM. The paratypes are deposited at NMNH (55), ZMUZ (2), and MTQ (4) (Cairns, 2004a).

New records. –Bathus 4: stn. DW 902 (4); stn. DW 933 (5). –Norfolk 2: stn. DW 2025 (1); stn. DW 2159 (1).

Description. –Anthocyathus compressed-cylindrical with almost parallel thecal faces and thecal edges. Thecal faces meet in an acute angle. Base always open displaying a V-shaped basal scar projecting downward, and revealing 24 septa. Calice compressed (GCD:LCD = 1.5-1.8); calicular edge smooth. Largest specimen examined (DW 933) 8.4 x 5.0 mm in CD, 4.5 x 2.0 mm in basal scar diameter, and 12.9 mm in height. Theca smooth and glisteny, covered with close spaced circumferential transverse growth lines that peak on longitudinal striae corresponding to each septum. Corallum white, and growth lines intercalate between milk-white and greyish-white. However, one specimen examined display longitudinal pigmented stripes through theca associated with intercostal spaces.

Septa hexamerally arranged in four always incomplete cycles according to formula: S1-2>S3>>S4. S1-2 project about 0.5 mm above calicular edge and have very sinuous upper and axial edges that meet columella deep in fossa. Lower axial edges of S1-2 even more sinuous and often fuse to each other deep in fossa. S3 about 3/5 width of S1-2, and also have sinuous edges. S4 only 2/5 width of S3 and have laciniate axial edge. All septal faces covered with aligned rows of low rounded granules. Fossa of moderate depth, containing a rudimentary elongate columella composed of fused S1-2 lower axial edges.

Distribution. –*New Caledonia*: 212-443 m. –*Elsewhere*: Hawaii; Indonesia; and Australia; 119-458 m.

Discussion. –Amongst the New Caledonian two flabellid genera that have transverse division as main reproduction mode, *Placotrochides* minuta is distinguished from *Truncatoflabellum* representatives by its smaller size (GCD < 9 mm); absence of thecal spines; cylindrical corallum shape; and in having trabecular columella. According to Cairns (2004), another character that distinguishes *Placotrochides* from *Truncatoflabellum* is the anthocaulus stereome-reinforced base in the former species.

Genus *Polymyces* Cairns, 1979

Diagnosis. –Corallum solitary, ceratoid to trochoid, and firmly attached by a symmetrically (6 pairs around circumference) or asymmetrically (2 pairs on corallum edge) reinforced by exothecal rootlets pedicel. Four to five cycles of septa. Calicular edges lacerate to serrate. Pali absent. Columella rudimentary.

Type species. –*Rhizotrochus fragilis* Pourtalès, 1871, by original designation.

Polymyces wellsi Cairns, 1991

Plate 5, Figs. Q-R

Javania sp. cf. *J. pseudolabastra*. –Wells, 1983: 238.

Polymyces wellsi Cairns, 1991a: 22, pl. 8, figs. f, I, pl. 9, figs. a-b. –Cairns, 1995: 108-109, pl. 35, figs. d-f. –Cairns & Zibrowius, 1997: 160-161. –Cairns, 1998: 403-404. –Cairns, 1999: 128. –Cairns et al., 1999: 31. –Cairns, 2004a: 266, 308. –Cairns, 2009: 21.

Type locality. –*Johnson-Sea-Link* stn. 1916 (1º18.7'S, 89º48.8'W – Española, Galápagos), 545-562 m.

Type material. –The holotype and 10 paratypes are deposited at the USNM. One additional paratype is deposited at the IRCZM (Cairns, 1991a).

New records. –One specimen with no label.

Description. –Corallum ceratoid with flared calice, and attached to substratum through reinforced pedicel and base. Calice elliptical (GCD:LCD = 1.37); calicular edge thin and fragile (specimen examined have broken calicular edge). Specimen examined 18.2 x 13.3 mm in CD, 20.0 mm in height, and 7.5 mm in PD. Pedicel strongly reinforced by four asymmetrically developed rootlets that form empty chambers under theca. Rootlets start about 0.8 mm above base, having flat and slightly curved profile (especially the two external rootlets). These 4 rootlets ultimately completely encircle pedicel, meeting itself in a U-shaped junction just above base. Theca extremely thin (about 0.1 mm wide), glisteny, and covered with finely granules. C1-2 slightly ridged and bear inverted V-shaped lines uniting them to their adjacent C3. C4-5 absent. Upper theca reddish-brown in color, and C1-2 darker pigmented. Lower theca, rootlets, and base white.

Septa hexamerally arranged in five incomplete cycles according to formula: S1>S2>S3>S4>S5 (56 septa). S1 extends to columella with vertical and slightly sinuous axial edge. S2 slightly less wide than S1, but has a slightly more sinuous vertical axial edge. S1-2 thicker than other septa. S3 about ½ width of S2 and is also vertical and sinuous. S4 ½ size of S3 and only slightly sinuous. If S5 present, they take S4 dimensions, S4 increases to S3 size, and S3 accelerates to almost reach S2 width. Septal faces bear sparse pointed granules. Fossa deep, narrow, and elongate, containing a rudimentary columella formed by fused S1-2 lower axial edges.

Distribution. –*New Caledonia*: depth unknown. –*Elsewhere*: Galápagos; Philippines; Indonesia; Australia; and New Zealand; 355-1203 m.

Discussion. –The specimen of *Polymyces wellsi* examined herein differs slightly from those specimens described by Cairns (1991a; 1995) and Cairns & Zibrowius (1997) in septal size and S1 sinuosity: The New Caledonian specimen has S1>S2 and axial edge of S1 slightly sinuous; whereas those specimens of *P. wellsi* described from Galápagos, New Zealand, Philippines and Indonesia have S1=S2 and S1 with straight axial edge. However, amongst the three extant species of *Polymyces*, the four asymmetrically arranged rootlets is a unique characteristic of *P. wellsi* and is used to distinguish it. The other two congeners *P. fragilis* (Pourtalès, 1868) *and P. montereyensis* (Durham, 1947) having six pairs of symmetrically arranged rootlets.

Genus *Rhizotrochus* Milne Edwards & Haime, 1848a

Diagnosis. –Corallum ceratoid to turbinate or compressed. Transverse division absent. Pedicel small and not reinforced by stereome, however, 2-20 slender hollow rootlets anchor corallum base. Thecal spines absent. Three to six cycles of non-exsert septa, the lower septal cycle being usually highly concave near calicular edge. Pali absent. Columella rudimentary.

Type species. –*Rhizotrochus typus* Milne Edwards & Haime, 1848a, by monotypy.

Rhizotrochus flabelliformis Cairns, 1989

Plate 5, Figs. K-L

Flabellum latum. –Alcock, 1902c: 31.

Rhizotrochus flabelliformis Cairns, 1989a: 81, pls. 41, figs. k, l, pl. 42, figs. b, d. –Cairns, 1995: 109–110, pl. 35, figs. g–i, pl. 36, figs. a, b. –Cairns & Zibrowius, 1997: 161–162. –Cairns, 1999: 127. –Cairns et al., 1999: 31. –Cairns, 2004a: 308. –Cairns, 2009: 21.

Type locality. –*Siboga* stn. 105 (6º08'N, 121º19'E – Sulu Archipelago, Philippines), 275 m.

Type material. –The holotype is deposited at the ZMA (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2049 (1).

Description. –Corallum robust, highly compressed (GCD:LCD = 2.13 [including only the largest "corallite" – see Plate 5, figs. K-L]), and resembling those of *Flabellum* and *Truncatoflabellum.* Thecal edges rounded and having an angle of about 90º. Thecal faces markedly disturbed during ontogenetic development, having one deep depression on each side. Calicular edge smooth. Specimen examined 42.0 x 14.3 mm in CD, 24.1 mm in height, and 2.0 mm in PD. Pedicel circular and quite small. Lower thecal edges bear one massive rootlet of about 4 to 5 mm in diameter curved downward. One thecal face of examined specimen much more worn than other face and slighltly encrusted. Unencrusted thecal face display faint costae and circumferential transverse lines peaking on each costa. Upper theca reddish-brown, with more intense pigmentation on each C1-3. Middle theca and pedicel white. Lower theca slightly pigmented. Upper and outer septal faces reddish-brown, but axial edges white.

Septa hexamerally arranged in 6 incomplete cycles (105 septa) according to formula: S1-3>S4>S5>>S6. Upper outer edges of S1-3 meet calicular edge in a right angle, and their axial edges meet their counterparts from opposite face deep in fossa. Upper axial edges of S1-3 slightly sinuous but lower axial edges quite sinuous and vertical. S4 about

½ to ¾ width of S1-3 and have straight to slightly sinuous axial edge. If S6 absent, S5 rudimentary. However, if S6 present, flanked S5 accelerates to S4 width and adjacent S4 becomes as wide as S1-3. S6 rudimentary. Septal faces covered with tall pointed granules aligned perpendicular to septal edge. Fossa deep and quite narrow containing a rudimentary columella formed by lower axial edges of S1-3 and eventually S4.

Distribution. –*New Caledonia*: 470-621 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Australia; and New Zealand; 228-1050 m.

Discussion. –The only specimen examined is undergoing intratentacular division, which has never been reported to this species and genus before. Also, there is a sharp arched depression about 10 mm above pedicel, resembling those of *Truncatoflabellum* that are undergoing transverse division. *R. flabelliformis* is distinguished from New Caledonian congeners in having only two symmetrical rootlets; six septal cycles; compressed corallum; and a "flabellate" corallum shape.

Rhizotrochus levidensis Gardiner, 1899

Plate 5, Figs. M-N

Rhizotrochus levidensis Gardiner, 1899: 162, pl. 19, figs. 2a-b. –Cairns & Parker, 1992: 49. –Cairns et al., 1999: 31. –Cairns, 2004a: 308. –Cairns, 2009: 21.

Monomyces levidensis. –Veron, 1986: 603.

Type locality. –Lifu, Loyalty Islands, 73 m.

Type material. –Two syntypes are deposited at the BM (Gardiner, 1899).

New records. –None.

Previous records from New Caledonia. –Gardiner (1899).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum conical, attached, and covered with a well-developed epitheca. Two to three small hollow rootlets arise from lower theca. Calice elliptical; calicular edge smooth. Largest specimen examined by Gardiner (1899) 6.0 x 4.6 mm in CD and 12.0 mm in height. Septa hexamerally arranged in 3 cycles. S1 meet opposite septa deep in fossa, and have vertical and straight axial edge. S1 aligned to GCD smaller and not as vertical as lateral S1. S2 about as wide and as thick as S1. S3 rudimentary, being about ½ width of S2. Fossa deep.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: Australia; 1-10 m.

Discussion. –With no new records from New Caledonian waters, nothing can be added to the knowledge of this rarely collected species. Among congeners, *R. levidensis* is distinguished by having the smaller adult corallum (< 7 mm in GCD); and only three septal cycles.

***Rhizotrochus typus* Milne Edwards & Haime, 1848**

Plate 5, Figs. O-P

Rhizotrochus typus Milne Edwards & Haime, 1848a 282, pl. 8, fig. 16. –Pourtalès, 1871: 13. –Studer, 1881: 28. –Moseley, 1881: 131. –Yabe & Sugiyama, 1936: 346-348, figs. 3, 3a. –Cairns, 1989a: 79-81, pl. 41, figs. f-j. –Cairns, 1994: 81, pl. 35, figs. a-c, pl. 40, figs. h-i. –Tachikawa, 2005: 10-11, pl. 4, figs. E-H. –Cairns & Zibrowius, 1997:161, figs. 22d-e. –Cairns, 1999: 127, fig. 22a. –Cairns et al., 1999: 31. –Cairns, 2009: 21.

New records. –Norfolk 2: stn. DW 2124 (19); stn. DW 2125 (3).

Description. –Corallum conical and attached by a very slender pedicel less than 3 mm in diameter, and a small, often curved, almost pointed base. Up to 12 hollow rootlet structures occur on lower theca, firmly anchoring corallum to substratum. Rootlets often separated into 2 groups: 6 associated with primary septa, and 2 to 6 additional roots apparently randomly placed occur lower in corallum. Roots variable in diameter, some quite robust (up to 3.5 mm) whereas some quite fragile (less than 1.5 mm). Theca thin, easily broken, and usually slightly encrusted. Costae equal in width, slightly ridged, and separated by broad intercostal grooves. Thin transversal lines occur from calicular edge to base. Some specimens also have large circumferential depressions. Calice elliptical (GCD:LCD = 1.2-1.4); calicular edge highly flared, especially in larger specimens. Largest specimen examined (DW 2124) 51.3 x 38.0 mm in CD, 44.5 mm in height, 2.9 mm in PD, and bear 9 root like structures. Apparently there is no relation between CD and number of roots (smallest specimen examined have 10 roots). Upper corallum white becoming beige near base.

Septa hexamerally arranged in 6 cycles, , according to formula: S1-2>S3>S4>S5>S6. Sixth septal cycle hardly complete even in larger specimens. S1-3 upper axial edges (about 3 mm from calicular edge) inclined toward fossa, and upper outer edges usually horizontally flat. This change in septal angle results in no septal projection above calicular edge. S1-2 almost meet their opposite counterparts with vertical and straight axial edges. Higher septal cycles progressively smaller in width. If present, S6 rudimentary. Septal faces bear low rounded granules, giving a smooth texture. Fossa deep. Columella rudimentary or absent.

Distribution. –*New Caledonia*: 260-348 m. –*Elsewhere*: Japan; Philippines; Indonesia; South China Sea; Malaysia; Red Sea; Persian Gulf; Bay of Bengal; Singapore; Pelau; and Vanuatu; 20-1048 m.

Discussion. –*Rhizotrochus typus* is distinguished from congeners by its larger calicular diameter, flared corallum, larger number of rootlets (> 8), and ratio between GCD and LCD around 1.2-1.4.

Genus *Truncatoflabellum* Cairns, 1989a

Diagnosis. –Corallum solitary and highly compressed. Asexual reproduction by transverse division, resulting in a free anthocyathus budded from a basal anthocaulus. Calicular edge smooth to highly serrate. Thecal edge spines or crests common. Pali absent. Columella rudimentary.

Type species. –*Euphyllia spheniscus* Dana, 1846, by original designation.

Truncatoflabellum candeanun (Milne Edwards & Haime, 1848)

Plate 5, Figs. S-T

Flabellum candeanum Milne Edwards & Haime, 1848a: 278, pl. 8, fig. 13. –Marenzeller, 1888a: 46-48.

Flabellum elegans Milne Edwards & Haime, 1848a: 277.

Flabellum rubrum. –Yabe & Eguchi, 1942a: 96-98 (*in part*: form C, pl. 8, figs. 13-15, 21-22).

Flabellum candeanum. –Tenison-Woods, 1878: 311. –Yabe & Eguchi, 1942b: 133-134. –Kikuchi, 1968: 8.

Truncatoflabellum candeanum. –Cairns, 1989a: 70-71, pl. 36, figs. d-h. –Cairns, 1994: 76-77, pl. 33, figs. 33e-f. –Cairns & Zibrowius, 1997: 167. –Cairns, 1999: 123-124. –Cairns et al., 1999: 31. –Kühlmann, 2006: 64, 103, 111. –Cairns, 2009: 19. –Kitahara et al., 2010b.

Type locality. –*Albatross* stn. 5369 (13º48’N, 121º43’E – Luzon, Philippines), 194 m.

Type material. –The neotype of *F. candeanum* is deposited at the NMNH (Cairns, 1989a).

New records. –Bathus 4: stn. CP 897 (1); stn. DW 933 (1); stn. CP 954 (1). –Norfolk 2: stn. DW 2133 (2); stn. DW 2158 (4). –PrFO: stn. ? (1).

Description. –Corallum flabellate conical, with rounded thecal edges. Anthocyathus display an elongate to elliptical basal scar, slightly concave near theca, and V-shaped in profile. Thecal edges slightly concave and rounded, with angle between 50-90º. Inclination of thecal faces between 30-40º. Largest anthocyathus examined (DW 2133) 38.2 x 22.1 mm in CD, 25.8 mm in height, and 6.5 mm in greater basal diameter. Three pairs of thecal spines occur on thecal edges of anthocyathus, but one specimen have four pairs on one edge. First pair of spines originates directly above basal scar and face downward. Second pair of spines about 1 mm above primaries, and third pair usually 1-2 mm above secondaries. Upper pair of spines more horizontal than lower spines. All anthocaulus also display an open base, but circular in profile, and containing 6 septa. Anthocaulus compressed conical, with pedicel diameter of about 1 mm, and smooth calicular edge. One pair of long (about 5 mm), horizontal, and elliptical in cross-section spines occurs between middle sector of thecal edges. Below thecal spines, thecal edges of anthocaulus display a shallow furrow extending to base. Largest anthocaulus examined (DW 2133) 14.2 x 7.4 mm in CD and 17.5 mm in height, however it is apparently going through transverse division just below spines, where theca is becoming slightly constricted horizontally and whiter in color. Theca of both, anthocyathus and anthocaulus transversely wrinkled in a chevron pattern that peak on each costa. Costae represented as thin and shallow striae (usually white) and intercostal spaces broad and flat. Theca longitudinally stripped with reddish-brown pigment.

Septa arranged in three size classes, and variable in number depending on GCD. Primary septa moderately exsert and meet calicular edge at right angle. Upper edge of primaries quite convex but axial edge vertical and sinuous deep in fossa. Secondaries slightly exsert, about ½ to ¾ width of primaries and bear slightly sinuous upper and axial edges. Tertiaries not exsert and only ½ size of secondaries. All septal faces bear low ridges (or row of aligned granules) perpendicular to septal edge. Fossa of moderate depth, and narrowing with depth. Columella elongate and spongy.

Distribution. –*New Caledonia*: 212-350 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; Malaysia; and Vanuatu; 70-290 m.

Discussion. –Amongst New Caledonian congeners, *Truncatoflabellum candeanum* is most similar to *Truncatoflabellum* sp. C, sharing the same number of thecal spines (3 pairs); about same GCD:LCD ratio (between 1.6 and 1.8); and somehow similar pigmentation pattern. However, *T. candeanum* has more inclined thecal faces (30-40º against ~22º in *T*. sp. C); larger basal scar diameter (often larger than 6.0 mm, whereas *T*. sp. C is less than 5.0 mm); and S1>S2 in *T. candeanum* and S1=S2 in *T.* sp. C.

Truncatoflabellum dens **(Alcock, 1902)**

Plate 6, Figs. A-B

Flabellum dens Alcock, 1902a: 106-107. –Alcock, 1902c: 32, pl. 4, figs. 30, 30a. –Faustino, 1927: 59, pl. 4, figs. 6-7. –Cairns, 1989a: 54, pl. 28, figs. g-k.

Truncatoflabellum dens. –Cairns, 1995: 114-115 (*in part*: pl. 37, fig. g). –Cairns & Zibrowius, 1997: 170-171. –Cairns, 1999: 120, figs. 19g-h. –Cairns et al., 1999: 31. –Cairns, 2009: 19.

Type locality. –*Siboga* stn. 95 (5º43.5’N, 119º40’E – Sulu Archipelago, Philippines), 522 m.

Type material. –All syntypes are deposited at the ZMA (Cairns, 1989a).

New records. –None.

Previous records from New Caledonia. –Cairns & Zibrowius (1997).

Diagnosis (after Cairns [1995]). –Corallum small and highly compressed (GCD:LCD = 1.7-2.3). Inclination of lateral thecal faces only 14-18º. Angle of thecal edges usually bimodal, at a height of 5-6 mm changing from 58-80º to a narrower 21-35º. Lower thecal edges sharp to carinate, their upper edges rounded and non-spinose. Separated anthocyathi similar in shape to pedicellate coralla as viewed from above thecal edge inflection, and usually have 2 or 3 pairs of edge spines and a basal scar diameter of 3.3-3.7 x 2.2-2.6 mm. All septa non-exsert, producing a smooth, porcellanous theca bearing reddish-brown stripes corresponding to every interseptal space.

Septa hexamerally arranged in 3 to 5 cycles, the last cycle never complete. Small coralla of 6-7 mm GCD often have only 4 pairs of S4, one pair in each end half-system, resulting in 32 septa. As corallum increases in size, additional pairs of S4 develop within 2 lateral half-systems until a full fourth cycle is achieved (48 septa). S1-2 have extremely sinuous axial edges. Sinuosity extending from calicular edge to columella. S3 about half width of S1-2 and have less sinuous axial edge. S4 about half width of an S3 and have straight axial edge. Upper edges of all septa quite narrow and broadly concave near calicular edge. Fossa deep and elongate, containing a trabecular columella 0.7-0.8 mm wide composed of axial edges of S1-2.

Distribution. –*New Caledonia*: 320-555 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; and New Zealand; 286-555 m.

Discussion. –According to Cairns (1995), *T. dens* is distinguished from congeners by having a unique tooth-like corallum shape; relatively small corallum; and low number of septa at adult-stage. Amongst New Caledonian *Truncatoflabellum*, *T. dens* is most similar to *T. pusillum* but differs in having a relatively larger basal scar; bimodal and usually larger thecal edge angle; S1-2 with sinuous upper edges; and tendency to do not undergo transverse division.

***Truncatoflabellum formosum* Cairns, 1989**

Plate 6, Figs. C-D

Flabellum rubrum. –Faustino, 1927: 53 (*in part*: *Albatross* stns. 5265 and 5658). –Yabe & Eguchi, 1942a: 96-98 (*in part*: pl. 8, fig. 14).

Truncatoflabellum formosum Cairns, 1989a: 69-70, pl. 35, figs. j-k, pl. 36, figs. a-b (*in part*: not *Albatross* stns. 5137, 5484, 5162, and 5483). –Cairns & Keller, 1993: 265, figs. 10I, 11A. –Cairns, 1994: 77, pl. 33, figs. g-h. –Cairns & Zibrowius, 1997: 169-170. –Cairns, 1998: 396. –Cairns et al., 1999: 31. –Cairns, 2004a: 266, 309. –Cairns, 2009: 20.

Truncatoflabellum sp. nov. –Cairns, 1989a: 73, pl. 38, figs. g-h.

Type locality. –*Albatross* stn. 5249 (7º06’06’’N, 125º40’08’’E – Mindanao, Philippines), 42 m.

Type material. –The holotype and five paratypes are deposited at the NMNH (Cairns, 1989a).

New records. –Bathus 4: stn. DW 884 (2). –Norfolk 2: stn. DW 2127 (1); stn. DW 2137 (1); stn. DW 2142 (1); stn. DW 2147 (1).

Description. –Corallum small, compressed conical, and with a small open base. Angle of thecal faces 19º-22º, and thecal edges around 45º. Near base, thecal faces slightly more compressed and thecal edges more rounded. Upper and lower thecal edges rounded, but space between thecal edge spines slightly crested. Anthocyathus have two (sometimes three) pairs of thecal spines. The lower pair cylindrical, 1.5 to 4.0 mm above basal scar, and projecting downward. Second pair has wider triangular base, usually project horizontally, and is localised about midway of thecal edge. Basal scar small (less than 3 mm in greater diameter) and reveals 12 protosepta. Calice elliptical (GCD:LCD = 1.8-2.2); calicular edge smooth and slightly arched. Largest specimen examined (DW 2147) 13.3 x 6.3 mm in CD, 3.0 x 1.9 mm in basal scar diameter, and

16.2 in height. Theca thin, glisteny, and covered by thin transversal corrugations that peak on each costal striae. Corallum white, encrustation rare.

Septa arranged in three size classes according to formula: 20:20:40 (80 septa). All septa non-exsert. Primary septa meet calicular margin in a slightly concave arch, and extend to columella with highly sinuous and vertical axial edge. Secondaries about half width of primaries, have moderate sinuous vertical axial edge, and are finely dentate near calicular edge. Tertiaries rudimentary, slightly sinuous, and disappear deep in fossa. Septal faces bear blunt granules, obliquely aligned in rows along septal undulations. Fossa of moderate depth, containing an elongate columella formed by lower axial edges of primary septa.

Distribution. –*New Caledonia*: 379-1200 m. –*Elsewhere*: Japan; Philippines; Indonesia; southwest Indian Ocean; and Australia; 42-933 m.

Discussion. –*Truncatoflabellum formossum* is unique amongst New Caledonian congeners in having a triangular second thecal edge spine base; thecal edge crested only between spines; upper outer S2 edge finely dentate; and in having attenuate larger septa.

***Truncatoflabellum incrustatum* Cairns, 1989**

Plate 6, Figs. E-F

Flabellum rubrum. –Faustino, 1927: 53 (*in part*: *Albatross* stns. 5249, 5250, 5251, and 5253).

Truncatoflabellum incrustatum Cairns, 1989a: 68-69, pl. 35, figs. d-e. –Cairns & Zibrowius, 1997: 168. –Cairns et al., 1999: 32. –Cairns, 2009: 20.

Truncatoflabellum formosum Cairns, 1989a: 69-70 (*in part*: *Albatross* stns. 5137 and 5484).

Type locality. –*Albatross* stn. 5251 (7º05’12’’N, 125º39’35’’E – Davao Gulf, Philippines), 37 m.

Type material. –The holotype and eight paratypes are deposited at the USNM. One additional paratype is deposited at the AM (Cairns, 1989a).

New records. –Bathus 4: stn. DW 902 (1); stn. DW 933 (17).

Description. –Corallum elongate, compressed-conical, with rounded thecal edges and solid open base. Upper basal scar margin highly arched, and lower edge V-shaped in profile and bear 12-24 protosepta. Thecal edge straight to slightly concave, forming an angle of about 25º. Thecal faces slightly convex in small specimens becoming slightly concave in larger specimens. Inclination of thecal faces between 20-23º. Calice compressed (GCD:LCD = 1.5-2.1); calicular edge slightly serrate and slightly flared in some specimens. Largest anthocyathus examined (DW 933) 14.3 x 7.1 mm in CD, 15.9 mm in height, and 4.8 mm in greater basal diameter. One pair of short downward-projecting thecal spines occurs just below basal scar. Thin transversal and white growth lines usually peak on each C1-3 in a chevron pattern. Theca often encrusted by sessile organisms, but non-encrusted specimens display a white theca with dark pigmented longitudinal stripes.

Septa hexamerally arranged in five incomplete cycles according to formula: S1-2>S3>S4>S5. Largest specimen examined has only 62 septa. S1-2 slightly exsert, and have smooth upper edges that meet calicular edge in a right angle or with a small notch. Upper axial edges of S1-2 convex and straight, but lower axial edges vertical and sinuous. S3 only slightly less exsert and less wide than S1-2, usually meet calicular edge with a right angle, and have a slightly sinuous axial edge. S4 about 1/3 width of S3 and if not flanked by a pair of S5, S4 become rudimentary low in fossa. However, if flanked by a pair of S5, S4 accelerate to ½ size of S3. S5 rudimentary. Septal faces covered by low pointed granules usually aligned perpendicular to septal edge. Fossa deep, elongate, and narrow, containing a rudimentary trabecular columella composed of lower axial edges of S1-2.

Distribution. –*New Caledonia*: 212-351 m. –*Elsewhere*: South China Sea; Philippines; and Indonesia; 30-415 m.

Discussion. –*Truncatoflabellum incrustatum* is distinguished from New Caledonian congeners by having only one pair of thecal edge spines occurring just above basal scar. The other two New Caledonian species displaying only one pair of thecal edge spines, *T.* sp. B and *T.* sp. D also differ from *T. incrustatum* in having a smaller basal scar in relation to their calicular diameter.

***Truncatoflabellum paripavoninum* (Alcock, 1894)**

Plate 6, Figs. G-H

Flabellum pari-pavoninum Alcock, 1894: 187.

Flabellum paripavoninum. –Alcock, 1898: 21, pl. 2, figs. 3a-b. –Faustino, 1927: 46-47, pl. 2, figs. 3, 4 (*in part*: *Albatross* stns. 5548, 5648, 5656, 5586, and NMNH 40721).

Flabellum sp. –Alcock, 1902a: 31 (in part: *Siboga* stn. 316).

Truncatoflabellum paripavoninum. –Cairns, 1989a: 72-73, pl. 37, figs. j-l, pl. 38, fig. a. –Cairns, 1995: 113-114, pl. 37, figs. d-e. –Cairns & Zibrowius, 1997: 169, fig. 22f. –Cairns, 1998: 399. –Cairns et al., 1999: 32. –Cairns, 2004a: 309. –Cairns, 2009: 19.

Type locality. –*Investigator* stn. 177 (13º47’49’’N, 73º07’E – off Pedro Bank, Luccadive Sea), 1163 m.

Type material. –The holotype is presumed to be deposited at the IM (Cairns, 1989a).

New records. –Norfolk 2: stn. DW 2046 (1); stn. DW 2103 (1); stn. DW 2144 (1).

Description. –Anthocyathus flabellate-conical with an open base. Thecal edges straight to slightly concave. Angle of thecal edges 45 to 70º, and inclination of thecal faces between 25 and 40º. Calice elliptical (GCD:LCD = 1.4-1.7); calicular edge highly arched and slightly serrate. Largest specimen examined (DW 2046) 26.1 x 16.2 mm in CD, 25.9 mm in height, and 7.4 mm in greater basal diameter. Basal scar flat to slightly concave, V-shape in profile, variable in size, and displaying 24. Thecal edge spines absent. Costae distinguished as narrow and shallow grooves. Intercostal spaces broad and flat. Thin transversal lines cover theca from calicular edge to basal scar, and peak on each costal grooves forming a chevron-like pattern. Corallum light beige to white.

Septa hexamerally arranged in five complete cycles according to formula: S1-2>S3>S4>S5 (96 septa). Anthocyathus with GCD smaller than 13 mm do not display any S5. S1-2 have horizontal upper edges and vertical axial edges. Axial edges of S1-2 straight on upper part, and thickened and sinuous deep in fossa. Lower axial edges of S1-2 fuse and intermingle deep in fossa forming a well-developed columella. S3 only slightly smaller than S1-2, extending to columella deep in fossa with no thickened and less sinuous axial edge. S4 1/3 to ¼ width of S3, and its axial edge is only slightly sinuous and quite thin. S5 about ½ size of S4, slightly sinuous, and only several mm long. Septal faces bear sparse low granules. Fossa of moderate depth, containing a well-developed massive to sponge columella.

Distribution. –*New Caledonia*: 717-1009 m. –*Elsewhere*: Laccadive Sea; Malaysia; Philippines; Indonesia; Australia; and New Zealand; 394-1450 m.

Discussion. –*T. paripavoninum* is the only New Caledonian *Truncatoflabellum* representative that has no thecal edge spines and a highly arched calicular edge. According to Cairns (1989a), *T. paripavoninum* is distinguished *from T. trapezoideum* (Keller, 1981a), which is the only other non-spinose Pacific congener, by having sharp thecal edges.

Truncatoflabellum pusillum **Cairns, 1989**

Plate 6, Figs. I-J

Truncatoflabellum pusillum Cairns, 1989a: 71-72, pl. 37, figs. a-e. –Cairns & Keller, 1993: 265, pl. 11, fig. E. –Cairns & Zibrowius, 1997: 170. –Cairns, 1999: 120, figs. 19g-h. –Cairns et al., 1999: 32. –Randall, 2003: 136. –Cairns, 2009: 19.

Type locality. –*Albatross* stn. 5178 (12º43'N, 122º06'15''E – Sibuyan Sea, Philippines), 143 m.

Type material. –The holotype and four paratypes are deposited at the NMNH (Cairns, 1989a).

Material examined. –Bathus 4: stn. DW 882 (3). –Norfolk 2: stn. DW 2151 (1).

Description. –Corallum compressed elongate, small, and with a flat to V-shape in profile open base (result of transverse division) that contains 12 septa. Thecal edges almost parallel and rounded, and thecal faces slightly convex and forming an angle of about 15º. Calice compressed (GCD:LCD = 1.4-2.0); calicular edge slightly serrate. Largest anthocyathus examined (DW 882) 6.6 x 3.4 mm in CD, 3.5 x 2.1 mm in basal scar diameter, and 10.4 mm in height. Up to three pairs of slender, elliptical in cross section (triangular basally), and elongate (up to 5 mm long) thecal edge spines occur on anthocyathus, all curving downward and spaced at about 1.8 mm. Two specimens examined have 3 spines on one thecal edge but only two on opposite edge. Another specimen have two spines on each edge. Theca bear thin transverse chevron-shaped ridges that peak on each costa. Costae represented as thin and shallow striae and intercostal spaces broad and flat. Corallum white or bearing longitudinal reddish brown stripes.

Septa hexamerally arranged in 4 cycles according to formula: S1-2>S3>S4 (48 septa). Axial edges of S1-2 vertical, sinuous, and fusing low in fossa to form a rudimentary columella. S3 vertical, slightly sinuous, and extending about half-size of S1-2 or slightly less. S4 quite short, vertical and straight. S1-2 slightly exsert (less than 0.5 mm). Septal faces bear scarce pointed granules. Fossa narrow and of moderate depth, containing a rudimentary elongate columella.

Distribution. –*New Caledonia*: 250-368 m. –*Elsewhere*: Mozambique; Philippines; Indonesia; Vanuatu; and Mariana Islands; 85-460 m.

Discussion. –Aside from *Truncatoflabellum pusillum*, the following five New Caledonian congeners have 2 or 3 pairs of thecal edge spines; and GCD:LCD ratio spawning between 1.4 and 2.2: *T. candeanum*; *T. dens*; *T. formossum*; *T*. sp. C; and *T. vigintifarium*. Amongst these six species, all but *T. candeanum*, *T. formossum*, and *T. vigintifarium* have S1=S2. *T. pusillum* is distinguished from the remaining two species in having the smallest corallum edge angle (almost parallel); small corallum size; elongate compressed corallum; and smallest basal scar size (GBD usually smaller than 3.5 mm). *T. pusillum* is compared in greater detail with *T. dens* in the account of the latter species.

***Truncatoflabellum* sp. A**

Plate 6, Figs. K-L

Material examined. –Bathus 4: stn. DW 894 (1).

Description. –Corallum elongate conical with a small (4.0 x 3.0 mm in diameter) flat and solid basal scar revealing 12 protosepta. Thecal faces straight and forming an angle of 25º. Angle of rounded thecal edges about 20º and bearing four pairs of short thecal spines. First pair 2.5 mm above basal scar and inclined downward; second pair 5.0 mm above first pair and horizontal; third pair about 2.0 mm above secondaries and as fourth pair inclined upward; last pair about 2.0 mm below calicular edge. Calice compressed (GCD:LCD = 1.39); calicular edge smooth. Specimen examined 12.5 x 9.0 mm in CD and 17.3 mm in height. Theca highly encrusted. Corallum supposedly reddish-brown but pigmentation obscured by encrustation.

Septa hexamerally arranged in four complete cycles according to formula: S1-2>S3>S4 (48 septa). S1-2 almost meet opposite septa with thickened, vertical, and sinuous axial edges. S3 ½ to ¾ width of S1-2 and have slightly sinuous axial edge. S4 short and have vertical, straight, and serrate axial edge. Septal faces bear blunt granules. Fossa deep and narrow, containing a rudimentary trabecular columella formed by S1-2 lower axial edges.

Distribution. –*New Caledonia*: 245-268 m.

Discussion. –The only specimen examined herein is quite distinctive if compared to New Caledonian congeners in having: 4 pairs of thecal edge spines; and axial edge of S4 serrate. Even with the possibility that this specimen may represent an undescribed species, additional material is needed to properly describe and comprehend the intraspecific morphological variation of this species.

Truncatoflabellum **sp. B**

Plate 6, Figs. M-N

Material examined. –Bathus 4: stn. DW 894 (1).

Description. –Corallum elongate conical with a small, almost circular (GBD:LBD = 1.05), flat, and solid basal scar. Thecal faces slightly concave and forming an angle of 15º. Angle of rounded thecal edges about 30º and bearing one pairs of thecal spines slightly elliptical in cross section. Thecal spines occur midway between calicular edge and basal scar and are inclined downward. Calice compressed (GCD:LCD = 1.57); calicular edge slightly serrate. Specimen examined 12.1 x 7.7 mm in CD and 13.5 mm in height. Costae represented by thin shallow striae separated by flat to slightly convex broad intercostal spaces. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-2>S3>S4 (48 septa). S1-2 slightly exsert, having convex and slightly sinuous upper edge, and vertical and extremely sinuous lower axial edge. S3 less exsert, ½ width of S1-2, and have slightly sinuous axial edge. S4 short and have vertical, straight, and serrate axial edge. Septal faces bear pointed granules aligned perpendicularly to septal edge. Fossa deep and narrow, containing a rudimentary trabecular columella formed by lower axial fusion of S1-2.

Distribution. –*New Caledonia*: 245-268 m.

Discussion. –*T*. sp. B can be grouped with two New Caledonian congeners that bear only one pair of thecal edge spines: *T. incrustatum* and *T*. sp. D. The specimen described above is distinguished from *T. incrustatum* in having thecal spines located half-distance between calicular edge and base (in *T. incrustatum* thecal edge spine is always located just above basal scar). *T*. sp. B is distinguished from the other undescribed species in having S1-2>S3, whereas the first three septal cycles have the same width in *T*. sp. D. Additionally, *T*. sp. B appears to be the only species in the genus to have only one pair of thecal edge spines and a circular (or almost circular) basal scar, however, until more specimens of this species be available for examination, a proper description is postponed.

***Truncatoflabellum* sp. C**

Plate 6, Figs. O-P

Material examined. –Bathus 4: stn. DW 886 (3); stn. DW 887 (1); stn. CP 953 (2). –Norfolk 2: stn. DW 2158 (2); stn. DW 2159 (1).

Description. –Anthocyathus compressed conical with a solid, elliptical, and serrate basal scar. Thecal faces straight to slightly concave meeting in an acute thecal edge. Angle formed by thecal faces 22º, and thecal edges about 45º. Three pairs of well-developed thecal spines occurs on thecal edges. First pair inclined downward and about 1.5 mm above basal scar. Second spine pair 2 mm above first pair, and third occur at calicular edge and are inclined upward. Anthocaulus small, and have a circular, and slender pedicel revealing 6 protosepta. Only one pair of thecal spines occur on anthocaulus near calicular edge. Calice compressed (GCD:LCD ~1.85 on anthocyathus, and ~2.2 on anthocaulus); calicular edge slightly serrate. Largest anthocyathus (DW 887) 14.3 x 7.7 mm in CD, 13 mm in height, and 4.8 x 2.4 mm in basal diameter. Theca glisteny, non-granular, but covered with thin growth lines in a chevron pattern. Corallum longitudinally striped with reddish-brown pigmentation. Spines and pedicel white.

Septa hexamerally arranged in four complete cycles (even in small anthocaulus) according to formula: S1-2>S3>>S4 (48 septa). S1-2 slightly exsert and extend to columella with vertical and sinuous axial edges. S1 aligned to GCD always enclosed in the space formed by upper thecal spine and do not reach calicular edge. S3 slightly less exsert and extend ½ distance to columella with slightly sinuous axial edge. S4 rudimentary. Septal faces bear scarce low granules. Fossa of moderate depth, containing a rudimentary trabecular columella composed of lower axial edges of S1-2.

Distribution. –*New Caledonia*: 220-344 m.

Discussion. –*Truncatoflabellum* sp. C appears to be unique among congeners in having principal S1 (those aligned to GCD plane) enclosed in the space formed by the upper thecal edge spine. Amongst New Caledonian congeners, *T*. sp. C is most similar to *T. candeanum*, both being about the same size, sharing number of spines, and having almost identical color pattern; however, aside the enclosed S1, *T*. sp. C consistently differs in having S3 smaller than S1-2 (S1-3 share the same size in *T. candeanum*); lower spine slightly above basal scar (directly above basal scar in *T. candeanum*); and less crowded septa. *T*. sp. C may represent a new species, however, we prefer to postpone a formal description until more specimens be available for comparison.

***Truncatoflabellum* sp. D**

Plate 6, Figs. Q-R

Material examined. –Norfolk 2: stn. DW 2159 (1).

Description. –Corallum compressed conical with smooth calicular edge. Angle of thecal faces around 20º, and that of thecal edges about 35º. Anthocaulus still attached to anthocyathus, and only one pair of thecal edge spines present. Spines highly triangular and inclined upward. Apparently, thecal spines pertain to anthocaulus. Calice compressed (GCD:LCD = 1.9). Specimen examined measure 17.0 x 8.8 mm in CD, 29.1 mm in height, with a small pedicel of 0.8 mm in diameter. Theca obscured by encrustation, but near calicular edge theca have well defined transversal corrugations. Corallum apparently pigmented.

Septa hexamerally arranged in five incomplete cycles according to formula: S1-3>S4>S5 (60 septa). Principal S1 nonaligned to GCD. S1-3 define a narrow fossa with vertical and sinuous axial edges, however, axial edge of S1 more sinuous than those of S2 and S3. S4 about 3/5 width of S1-3 and have slightly sinuous axial edge. S5 ½ width of S4. Septal faces bear tall pointed granules aligned in rows perpendicular to septal edge. Fossa narrow, columella absent.

Distribution. –*New Caledonia*: 300-305 m.

Discussion. –Amongst New Caledonian congeners, *Truncatoflabellum* sp. D appears to be unique in having a very tall corallum with low thecal angle, and anthocyathus apparently nonspinose. Because only one specimen of this species was examined, its identity remains uncertain and a formal description is postponed until more specimens be available for comparison pruposes.

Truncatoflabellum vigintifarium Cairns, 1999

Plate 6, Figs. S-T

Truncatoflabellum vigintifarium Cairns, 1999: 121-122, figs. 20c-f. –Cairns et al., 1999: 32. –Cairns, 2004a: 266, 309. –Cairns, 2009: 20.

Type locality. –*Musorstom* 8 stn. CP 1098 (15º04'S, 167º10'E – northeast of Espiritu Santo, Vanuatu), 277-285 m.

Type material. –The holotype and 29 paratypes are deposited at the MNHN. Ten additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –SMIB 1: stn. DW M06 (3). –Halipro 1: stn. CP 851 (2). –Norfolk 2: stn. DW 2151 (1). –PrFO: stn. ? (1).

Description. –Anthocyathus flabellate, elongate conical, with an almost circular open base. Angle formed by the straight to slightly concave thecal edges between 60 and 70º; and thecal faces angle between 22 and 27º. Calice compressed (GCD:LCD = 1.7-2.6); calicular edge only slightly serrate. Largest specimen examined (CP 851) 26.6 x 12.3 mm in CD, 22.3 mm in height, and about 5.0 mm in greater basal diameter. Thecal edges bear 3 pairs of elongate (up to 5 mm long), flatter near base, hollow spines. First spine pair occurs 3.5-4 mm above basal scar, with second pair about 2.5 mm above, and third 3-4 mm apart from the second. All spines horizontal to slightly curved downward. Basal scar bear 12 protosepta (6 S1 and 6 smaller S2). Theca thin and quite delicate near calicular edge. All costae represented very shallow and thin striae (especially C1-2). Thin transverse lines in chevron pattern peak at each costa. Theca longitudinally striped with brown to light-beige pigment. Outer upper edge of S1 slightly pigmented as well.

At calicular edge septa decamerally arranged in three complete cycles according to formula: S1>S2>S3 (80 septa). S1 not exsert and have upper edge that do not project above calicular edge. Axial edge of S1 vertical and straight on upper part and sinuous low in fossa. S2 narrow near calicular edge but low in fossa they usually reach their greatest width (about ½ width of S1). Axial edge of S2 slightly sinuous. S3 narrow (about half width of S2) and variable in development: some occur only near calicular edge, but some extend deep in fossa. All septal faces covered with pointed granules. Fossa deep and narrow, containing an elongate columella composed of low axial edge fusion of each S1.

Distribution. –*New Caledonia*: 300-368 m. –*Elsewhere*: Vanuatu; Australia; 288-1050 m.

Discussion. –Among the 31 known extant species of *Truncatoflabellum*, the decameral septal symmetry appears to be restricted to *T. vigintifarium* and *T. formossum,* both of which are reported herein from New Caledonian waters. *T. vigintifarium* is distinguished by having a more flared corallum; smaller (in relation to GCD) and more circular basal scar; striped pigmented corallum; and a higher GCD:LCD ratio.

Family Dendrophylliidae Gray, 1847

Genus *Balanophyllia* Wood, 1844

Diagnosis. –Corallum solitary, turbinate to trochoid, fixed or free. Costae usually well-developed. Synapticulotheca especially well-developed near calice. Septa arranged in Pourtalès plan. Pali may or may not be present. Columella spongy.

Subgenus *Balanophyllia* (*Balanophyllia*) Wood, 1844

Diagnosis. –*Balanophyllia* having a conical corallum firmly attached through a polycyclic base.

Type species. –*Balanophyllia calyculus* Wood, 1844, by monotypy.

Balanophyllia (*Balanophyllia*) *laysanensis* Vaughan, 1907

Plate 7, Figs. A-B

Balanophyllia laysanensis Vaughan, 1907:150-151, pl. 45, figs. 2a-b. –Maragos, 1977: 164. –Cairns & Zibrowius, 1997: 182. –Cairns, 1999: 130, figs. 22d-e. –Cairns et al., 1999: 26. –Cairns, 2006: 48. –Cairns, 2009: 23.

Type locality. –*Albatross* stn. 3937 (25º52’05’’N, 171º46’47’’W – Laysan Island, Hawaii), 238-271 m.

Type material. –The holotype is deposited at the NMNH (Vaughan, 1907).

New records. –Norfolk 1: stn. DW 1651 (1).

Description. –Corallum ceratoid and firmly attached to substrate by a robust pedicel (PD:GCD = 0.51), and a slightly larger encrusting base. Calice elliptical (GCD:LCD = 1.13); calicular edge highly serrate. Specimen examined 11.3 x 10.0 mm in CD, 5.9 in PD, and 12.9 mm in height. Theca quite thick and granular. Upper theca quite porous and lower theca reinforced by stereome, which obscure the porous nature of theca. Near base, a transversely corrugated epitheca encircles corallum. Costae poorly defined, being distinguishable only near calicular edge. Corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1≥S4>S2>>S3 (48 septa). S1 highly exsert (up to 2 mm), about 1 mm thick near calicular edge, and extend to columella with straight and vertical axial edge. S2 about half as exsert and half as thick as S1, and not reach columella. S3 least exsert septal cycle and rudimentary. In each half-system, a pair of S4 bend towards common S3 but not fuse. S4 adjacent to S1 much larger than those adjacent to S2. Fossa of moderate depth, containing a discrete swirled columella.

Distribution. –*New Caledonia*: 276 m. –*Elsewhere*: Hawaii; and Vanuatu; 238-400 m.

Discussion. –The specimen reported herein is similar to typical *B. laysanensis*, and virtually identical to the Vanuatu specimen illustrated by Cairns (1999). Among the 11 *Balanophyllia* reported herein from New Caledonia, a small subset of four species (*B. laysanensis, B. cylindrica, B. galapagensis,* and *B*. sp.) have lower theca transversely corrugated. *B. laysanensis* is distinguished based on the following characters: S1 and S2 much thicker than other septa; calicular edge highly serrate as result of highly exsert S1 and S2; and discrete clockwise swirled columella.

***Balanophyllia* (*Balanophyllia*) *cornu* Moseley, 1881**

Plate 7, Figs. C-D

Balanophyllia cornu Moseley, 1881: 192-193, pl. 12, figs. 11-15. –Jourdan, 1895: 27-28, 33, figs. 20a-b, 21a-b. –Alcock, 1902c: 41. –(?) Gardiner, 1939: 240. –Cairns, 1994: 82-83, pl. 35, figs. f-i. –Cairns & Zibrowius, 1997: 178-179, figs. 24d-f. –Cairns, 1998: 404-405. –Cairns et al., 1999: 25. –Cairns, 2004a: 267, 312. –Cairns, 2009: 24. –Kitahara et al., 2010b.

Type locality. –*Challenger* stn. 192 (5º49’15’’S, 132º14’15’’E – Kai Islands, Indonesia), 256 m.

Type material. –Four syntypes are deposited at BM (Cairns, 1994).

New records. –Norfolk 2: stn. DW 2035 (4); stn. DW 2037 (8); stn. DW 2052 (1); stn. DW 2132 (1); stn. DW 2147 (25); stn. DW 2160 (5).

Description. –Corallum ceratoid elongate, slightly curved, and firmly attached through a robust pedicel (PD:GCD = 0.55-0.63) and a thin encrusting base. Calice elliptical (GCD:LCD = 1.12-1.20); calicular edge slightly serrate. Largest specimen examined (DW 2037) 14.0 x 11.9 mm in CD, 8.1 mm in PD, and 26.5 mm in height (but base is broken). Theca porous and granular. Costae flat to slightly convex, equal in width, and separated by deep and narrow intercostal striae. Lateral faces of costae bear pointed granules. Not all costae reach pedicel. Apparently, some costae randomly fuse to adjacent costae and continue towards pedicel as one. Usually no epitheca, but when present, restricted to lower pedicel. Corallum light-beige.

Septa hexamerally arranged in four complete (or five incomplete) cycles according to formula: S1>S2≥S4>S3. S1 slightly exsert and extend to columella with straight and vertical axial edge. S1 not aligned to GCD usually slightly constrict columella. S2 as exsert as S1 but slightly less wide. S3 least exsert septa and have 1/3 to ½ size of S2. S4 dimorphic in size: those adjacent to S1 almost as exsert and as wide as S2; and those adjacent to S2 less exsert and less wide than S2. Each pair of S4 in a half-system without S5 curve toward each other (not fusing) forming a weak Pourtalès plan. Any half-system examined complete, instead, there is usually one pair of S5 in a quarter-system adjacent to S1. Fossa of moderate depth, containing an elongate fused fascicular columella swirled in a clockwise direction, and usually slightly constricted by 4 lateral S1.

Distribution. –*New Caledonia*: 313-570 m. –*Elsewhere*: Japan; South China Sea; Formosa Strait; Philippines; Indonesia; and Australia; 60-520 m.

Discussion. –Among New Caledonian congeners that have swirled columella, *Balanophyllia cornu* is distinguished in having well-defined costae (not defined in *B. spinosa*); and lacking transversal corrugations on lower corallum (lower corallum transversally corrugated in *B. laysanensis* and *B. galapagensis*).

Balanophyllia (_Balanophyllia_) _cylindrica_ sp. nov.

Plate 7, Figs. E-F

Type locality. –*Bathus 4*: stn. CP 938 (19°00.16'S, 163°26.45' – New Caledonia), 280-288 m.

Holotype. –Bathus 4: stn. CP 938.

Paratypes. –Bathus 4: stn. DW 925 (7); stn. DW 926 (4); stn. CP 937 (3); stn. CP 938 (1); stn. DW 941 (5). –Norfolk 1: stn. DW 1652 (3); –Norfolk 2: stn. DW 2023 (17); stn. DW 2024 (11); stn. DW 2135 (2); stn. DW 2162 (1).

Description. –Corallum elongate-cylindrical usually attached to upper theca of a parent corallum, sometimes giving impression of a colonial corallum. Pedicel robust (PD:GCD = 0.8-0.9). Calice circular to slightly elliptical (GCD:LCD = 1.0-1.1); calicular edge almost smooth. Holotype 8.4 x 8.1 mm in CD, 7.0 mm in PD, and 31.6 mm in height. Largest specimen examined (DW 941) 12.8 x 12.0 mm in CD. Pedicel of largest specimen examined is too encrusted for a precise measurement of diameter. Theca quite robust. Upper theca highly porous and lower theca covered by a thin transversely corrugated epitheca usually covered by encrusting sessile organisms. Intercostal spaces usually absent, but if present, they are thin and highly porous. Costae flat, C1-2 slightly broader than C3-4. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S4>S3 (48 septa). S1 broad at calicular edge and extend to columella with straight, slightly thickened, vertical axial edge. S2 about 4/5 width of S1 and have straight vertical axial edge. S3 quite short and disappear deep in fossa. S4 always wider than S3, but dimorphic in development: those adjacent to S1 larger than those adjacent to S2. Each pair of S4 in a half-system is slightly curved towards common S3 sometimes fusing but more usually not meeting. Lower axial edge of S4 slightly laciniate. Fossa deep, containing a papillose columella. Columella sometimes constricted by lateral S1. Central columellar elements usually aligned with GCD plane.

Etymology. –The species name is from Latin *cylindrica* (cylindrical), and refers to the cylindrical corallum shape of this species.

Distribution. –*New Caledonia*: 208-405 m.

Discussion. –*Balanophyllia cylindrica* is quite distinctive among extant congeners in having elongate-cylindrical corallum, theca thick, septa virtually nonexsert, and columella aligned on the GCD plane and slightly constricted by the 4 lateral S1. Among New Caledonia congeners *B. cylindrica* is most similar to *Balanophyllia* sp. and is discussed in the account of the latter.

***Balanophyllia* (*Balanophyllia*) *desmophyllioides* Vaughan, 1907**

Plate 7, Figs. G-H

Balanophyllia desmophyllioides Vaughan, 1907: 149-150, pl. 45, fig. 1. –Cairns & Zibrowius, 1997: 177-178, figs. 23g-h. –Cairns, 1999: 129-130, fig. 22c. –

Cairns et al., 1999: 25. –Cairns, 2004a: 267, 312. –Cairns, 2006: 48. –Cairns, 2009: 24.

Balanophyllia sp. –Maragos, 1977: 164.

Balanophyllia desmophylloides. –Cairns, 1984: 26.

Type locality. –*Albatross* stn. 4061 (20º16'10''N, 155º53'20''W – Hawaii), 44-152 m.

Type material. –The holotype is deposited at the NMNH (Vaughan, 1907).

New records. –Bathus 4: stn. DW 932 (1). –Norfolk 1: stn. DW 1651 (5). –Norfolk 2: stn. DW 2024 (49); stn. DW 2041 (1); stn. DW 2065 (1); stn. DW 2081 (9); stn. DW 2119 (2); stn. DW 2135 (1); stn. CP 2146 (2); stn. DW 2150 (2); DW 2155 (1); stn. DW 2160 (2).

Previous records from New Caledonia. –Cairns & Zibrowius (1997).

Description. –Corallum elongate-conical to trochoid and firmly attached through a robust pedicel (PD:GCD = 0.4-0.5) that expands into a thin encrusting base. Calice strongly compressed in adult stage (GCD:LCD = 1.4-2.3), calicular edge serrate and arched (constricted on LCD plane). Largest specimen examined (DW 2081) 22.8 x 11.3 mm in CD, 9.4 mm in PD, and 27.5 mm in height. Upper theca more porous than lower theca. Pedicel and base usually solid. Near calicular edge costae well defined, slightly convex, and separated by deep and porous intercostal striae.C1-3 slightly broader than C4-5. A row of short pointed granules occurs at middle region of each costa and is distinguishable 3 to 6 mm below calicular edge. Granules lateral to this row also present. Not all costae reach pedicel and all of them faint and disappear towards base. Corallum white.

Septa hexamerally arranged in five complete cycles according to formula: S1-5>S4 (96 septa). S1-3 independent, thick, slightly exsert, and extend to columella with concave to oblique axial edges. Axial edges of S1-3 smooth at upper half and coarsely dentate on lower half. Dentitions regularly placed. S4 slightly less exsert and only 2/3 width of S1-3. S4 dentitions smaller than those of S1-3 but also regularly placed. A pair of S5 fuse before S4 within each quarter-system about half distance to columella and continue as one septum. S5 dentitions start slightly before fusing region and continues throughout lower septal edge as those of S1-3. Septal faces covered with aligned rows of low blunt granules. Fossa open and of moderate depth containing an elongate field of numerous small papillae that terminate all at same level.

Distribution. –*New Caledonia*: 170-800 m. –*Elsewhere*: Hawaii; Philippines; Indonesia; Vanuatu; Wallis and Futuna; and Australia; 95-1050 m.

Discussion. –*Balanophyllia desmophyllioides* is one of the most distinctive species in the genus and is distinguished from congeners in having: arched calice; elongate discrete papillose columella composed of numerous small papillae that terminate all at same the same level; its coarsely dentate septal axial edges; and all but S4 reaching and fusing to columellar elements.

***Balanophyllia* (*Balanophyllia*) *galapagensis* Vaughan, 1906**

Plate 7, Figs. I-J

Balanophyllia galapagensis Vaughan, 1906: 67-68, pl. 4, figs. 2-2b. –Durham & Barnard, 1952: 10. –Durham, 1962: 46. –Durham, 1966: 125. –Wells, 1983: 239, pl. 14, figs. 4, 5. –Cairns, 1991a: 22-23, pl. 9, figs. c-g. –Cairns et al., 1999: 25. –Cairns, 2009: 24.

Balanophyllia osburni Durham & Barnard, 1952: 100-101, pl. 15, figs. 63a-d. –Durham, 1962: 46. –Durham, 1966: 125. –Wells, 1983: 239.

Type locality. –*Albatross* stn. 4643 (Galápagos), 182 m.

Type material. –The holotype is deposited at the NMNH (Cairns, 1991b).

New records. –Bathus 4: stn. DW 941 (2). –Norfolk 2: stn. DW 2023 (1); stn. DW 2024 (1); stn. DW 2092 (4); stn. DW 2124 (2); stn. DW 2125 (2); stn. DW 2135 (2); stn. DW 2160 (1); stn. DW 2162 (1).

Description. –Corallum ceratoid, small, and firmly attached through a robust pedicel (PD:GCD = 0.55-0.88) and a thin and small encrusting base. Calice circular to slightly elliptical (GCD:LCD = 1.03-1.16). Calicular edge quite porous and slightly lancetted. Largest specimen examined (DW2024) 10.6 x 9.2 in CD, 5.8 mm in PD, and 15.5 mm in height. Upper theca porous and lower theca epithecated. Epitheca usually heavily encrusted by sessile organisms, however, if not encrusted epitheca bear by thin circumferential ridges. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-S2>S4>S3 (48 septa). S1-2 up to 2 mm exsert and extend to columella with vertical and straight axial edges. In larger specimens those S1 not aligned to GCD slightly constrict columella, and those S2 aligned to LCD slightly smaller than other S2. S3 least exsert and smallest septa. S4 only slightly less exsert than S1-2. In each half-system, a pair of S4 fuses before flanked S3 in a Pourtalès plan forming a well-developed palus, which project slightly into columella. Outer upper septal edges quite porous. Septal and palar faces covered with small granules. Fossa very shallow, containing a large fused fascicular columella swirled in a clockwise direction.

Distribution. –*New Caledonia*: 260-371 m. –*Elsewhere*: Galápagos; 18-462 m.

Discussion. –Previously known only from Galápagos Archipelago, *Balanophyllia galapagensis* is distinguished from New Caledonian congeners in having a small adult corallum; transversely corrugated middle/lower epitheca; and well-developed pali before S3. Among Pacific congeners, *B. galapagensis* has the same corallum size and share other characters with *B. gemma* (Moseley, 1881), but they are distinguished by the fusion of S4 before common S3 in the former, and the absence of pali in the latter.

Balanophyllia (_Balanophyllia_) cf. _B. generatrix_ Cairns & Zibrowius, 1997

Plate 7, Figs. K-L

Balanophyllia generatrix Cairns & Zibrowius, 1997: 183-184, figs. 25g-i, 26a-b. –Cairns, 1998: 365. –Cairns et al., 1999: 26. –Cairns, 2004a: 267, 313. –Cairns, 2009: 24.

Type locality. –*Karubar* stn. 82 (9º30'S, 131º02'41''E – off Melville Island, Australia), 215-218 m.

Type material. –The holotype and one paratype are deposited at the MNHN. Additional paratypes are deposited at NMNH (2+), ZMA (5+), and NNM (1) (Cairns & Zibrowius, 1997).

New records. –Norfolk 2: stn. DW 2024 (29); stn. DW 2095 (3); stn. DW 2096 (6).

Description. –Corallum elongate, slightly flared near calicular edge, and fixed through a robust pedicel (PD:GCD = 0.4-0.7). New coralla often attached to theca of a dead or parent corallum. Calice circular in smaller specimens to compressed in older coralla (GCD:LCD = 1.0-2.1). Calicular edge highly serrate. Largest specimen examined (DW 2024) 8.0 x 5.6 mm in CD, 5.4 mm in PD, and 23.9 mm in height. Upper theca more porous than lower theca. Costae well defined and granular. Intercostal furrows deep and porous. Epitheca absent. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-2≥S4>S3 (but largest specimen have additional S5). S1-2 about 1 mm exsert and extend to columella with almost vertical axial edges finely dentate on lower part. S3 about 0.5 mm exsert and enclosed by a pair of S4. In each half-system, a pair of S4 fuse high in fossa before common S3 and extend as far as S1-2 to columella. Axial edge of united S4 coarsely dentate. All septa closely spaced. Septal faces bear small granules. Fossa of moderate depth, containing an elongate discrete columella composed of numerous small interconnected papillae.

Distribution. –*New Caledonia*: 230-371 m. –*Elsewhere*: Philippines; Indonesia; and Australia; 96-535 m.

Discussion. –Among New Caledonian congeners, *Balanophyllia generatrix* is distinguished by its highly jagged calicular margin; discrete papillose columella composed of numerous small papillae; and by its tendency to have new coralla attached to the theca of a parent corallum. According to Cairns & Zibrowius (1997), larger specimens of *B. generatrix* resembles *B. gigas*, both having large corallum and 5 cycles of septa. However, the same authors suggest the following characters to distinguish *B. generatrix*: quasicolonial habit; very deep fossa; finer columella; and coarse dentition of the S5.

***Balanophyllia* (*Balanophyllia*) *gigas* Moseley, 1881**

Plate 7, Figs. M-N

Balanophyllia gigas Moseley, 1881: 193. –Jourdan, 1895: 27. –Van der Horst, 1922: 58-59, pl. VIII. –Yabe & Eguchi, 1942b: 139-140. –Utinomi, 1965: 256. –Cairns, 1994: 83, pl. 35, figs. j-l. –Cairns, 1995: 119-120, pl. 40, figs. f-h. –Cairns & Zibrowius, 1997: 182. –Cairns, 1999: 131. –Cairns et al., 1999: 26. –Randall, 2003: 136. –Cairns, 2004a: 267, 313. –Cairns, 2006: 48. –Cairns, 2009: 24.

Balanophyllia alta. –Ralph & Squires, 1962: 15 (*in part*: pl. 8, figs. 2-3).

Dendrophyllia japonica. –Ralph & Squires, 1962: 15-16, pl. 8, figs. 4-5. –Squires & Keyes, 1967: 28 (*in part*: miscellaneous stations 44, 56, C627).

Balanophyllia hawaiiensis Vaughan, 1907: 148-149, pl. 44, figs. 4-5. –Maragos, 1977: 165-166.

Type locality. –Japan, depth unknown.

Type material. –The holotype is deposited at the BM (Cairns, 1994).

New records. –Bathus 4: stn. DW 932 (1); stn. DW 933 (32). –Norfolk 2: stn. CP 2141 (1).

Description. –Corallum ceratoid and elongate, large, straight to slightly curved, and attached by a robust pedicel (PD:GCD = 0.40-0.60) that expand into a thin encrusting base. Calice elliptical (GCD:LCD = 1.1-1.75, larger ratio usually from larger specimens); calicular edge finely serrate. Largest specimen examined (DW 933) 26.1 x 14.9 mm in CD, 15.5 in greater pedicel diameter, and 71.6 mm in height. Theca porous. Costae equal in width, slightly convex, separated by porous thin intercostal striae, and covered with fine pointed granules. Intercostal striae slightly sinuous. Lower theca slightly more solid than upper theca. Largest specimen examined display a thick epitheca. Corallum white.

Septa hexamerally in five incomplete cycles according to formula: S1≥S2>S3>S5≥ or ≤S4. No specimen examined have a full fifth cycle. S1 about 2 mm exsert, and extend to columella with smooth, straight, vertical, and slightly thickened axial edge. S2 slightly less exsert and less wide than S1 (however some systems display S1=S2), also having smooth vertical axial edge. S3 2/3 width of S2, half as exsert, and also have smooth, vertical, and straight axial edge. S4-5 arranged in a Pourtalès plan. In quarter systems lacking S5, a pair of S4 encloses S3, and S3 have dentate axial edge. Fused S4 extend to columella with extremely laciniate axial edge. However, if a quarter system has a pair of S5, S3-4 independent with S3 having entire axial edge, and S4 laciniate axial edge.

S5 dimorphic in development: those adjacent to S1 quite exsert (they fuse to S1 forming small triangular apex) and bent towards S2; but those adjacent to S3 quite short near calicular edge, increasing in size deep in fossa where they fuse to axial edge of adjacent S4. Whereas axial edges of S1-3 are entire and their faces solid, axial edges of S4-5 quite laciniate and their faces porous near endotheca. Fossa of moderate depth, containing a slender and elongate trabecular columella. Columella sometimes constricted by lower axial edges of lateral S1.

Distribution. –*New Caledonia*: 92-220 m. –*Elsewhere*: Japan; Hawaii; Mariana Islands; Philippines; Indonesia; Australia; and New Zealand; 90-640 m.

Discussion. –The specimens reported herein appears to morphologically link the Japanese and New Zealand *Balanophyllia gigas* populations, because some have epitheca (absent from New Zealand, but present in Japanese specimens) and its costal prominence apparently is between the well-defined costae from the Japanese population and the weakly defined costae from the New Zealand population. Among New Caledonian congeners, *B. gigas* is distinguished by its larger adult corallum size; laciniate S5 axial edge; and high porosity of higher septal cycle.

***Balanophyllia* (*Balanophyllia*) *profundicella* Gardiner, 1899**

Plate 7, Figs. O-P

Balanophyllia profundicella Gardiner, 1899: 169, pl. 19, figs. 9a-b. –Harrison & Poole, 1909b: 903-904. –Cairns et al., 1999: 26. –Cairns, 2009: 24.

Balanophyllia produndacella. –Pillai, 1972: 212.

Type locality. –Lifu (Loyalty Islands), 73 m.

Type material. –The syntype is deposited at the CUMZ.

New records. –None.

Previous records from New Caledonia region. –Gardiner (1899).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum almost straight, cylindrical, and attached by a encrusting base. Gardiner's specimens 5.0 x 4.1 mm in CD, and 11.0 mm in height. Calice elliptical. Costae broad, sub-equal, and slightly ridged. Intercostal spaces narrow and porous. No epitheca. Septa hexamerally arranged in four complete cycles. All septa rather thin, and have finely granular septal faces and entire axial edges. S1 prominently exsert and fuse to adjacent S4 at calicular edge. S2 half as exsert and slightly less wide than S1. Axial edges of S1-2 vertical. S3 and S4 arranged in a Pourtalès plan. In each system, fused S4 curves toward common S2, usually fusing before it near columella. Fossa of moderate depth.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: Burma; depth unknown.

Discussion. –Because no new specimens of this species were available for the present study, the description provided herein is entirely based on Gardiner (1899).

Balanophyllia **(*Balanophyllia*)** ***rediviva*** **Moseley, 1881**

Plate 8, Figs. A-B

Balanophyllia rediviva Moseley, 1881: 193-194, pl. 15, figs. 10-12. –Marenzeller, 1907b: 14-16. –Vaughan, 1907: 152, 416, 426. –Van der Horst, 1922: 59. –Yabe & Eguchi, 1942b: 107, 142. –Cairns & Zibrowius, 1997: 181-182, figs. 25d-f. –Cairns, 1999: 130-131. –Cairns et al., 1999: 26. –Cairns, 2009: 24.

Type locality. –*Challenger* stn. 192 (5º49'15''S, 132º14'15''E – Kai Islands, Indonesia), 256 m.

Type material. –The syntype is deposited at the BM (Cairns & Zibrowius, 1997).

New records. –Norfolk 2: stn. DW 2123 (2).

Description. –Corallum elongate-cylindrical, slightly bent, and attached by a robust pedicel (PD:GCD = 0.79-0.83). One specimen examined show 1 episode of rejuvenescence. Calice slightly elliptical (GCD:LCD = 1.08-1.17); calicular edge jagged. Theca porous. Epitheca occurs only near base. C1-3 slightly ridged and C4 slightly broader than other costae. All costae bear a row of pointed granules, but smaller granules sometime occur on lateral costal faces. Intercostal striae thin and porous. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S4>S3 (48 septa). S1 up to 1 mm exsert, having vertical, straight, and smooth axial edge that extend to columella. S2 about 0.5 mm exsert, ½ width of S1, also with straight and vertical axial edge. S3 least exsert septa and about ½ width of S2. Above calicular edge S4 and adjacent to S1 form triangular lancets (these S4 almost as exsert as S2); but those S4 adjacent to S2 only slightly more exsert than S3. Each pair of S4 in a half-system fuse before common S3 in a Pourtalès plan and extend to columella as one septum. Axial edge of S4 dentate and only vertical near columella. Fossa of moderate depth, containing a lamellar columella sometimes constricted by lateral S1.

Distribution. –*New Caledonia*: 187-197 m. –*Elsewhere*: Japan (?); Philippines; Indonesia; and Vanuatu; 90-256 m.

Discussion. –*Balanophyllia rediviva* is most similar to *B. laysanensis* but is distinguished in having an elongate-cylidnrical corallum; ridged costae; C4 broader than C1-3; and a non-swirled and often constricted columella.

Balanophyllia (_Balanophyllia_) sp.

Plate 8, Figs. C-D

Material examined. –Bathus 4: stn. DW 902 (2). –Norfolk 1: stn. DW 1652 (1). –Norfolk 2: stn. DW 2041 (1); stn. DW 2124 (1); stn. DW 2125 (1).

Description. –Corallum cylindrical-conical to ceratoid, always attached through a robust pedicel (PD:GCD = 0.43-0.74), and wide and thin encrusting base. Calice slightly elliptical (GCD:LCD = 1.1-1.3); calicular edge slightly serrate. Largest specimen examined (DW 2125) 12.8 x 11.4 mm in CD, 9.4 mm in PD, and 26.4 mm in height (but base is broken). Upper theca porous and granular. Lower theca covered with epitheca that bear fine transversal striae and completely obscure porous nature of theca. Epitheca usually scarcely encrusted by sessile organisms such bryozoans, filiferans, and polychaetes. Costae distinguishable only on upper theca where they are flat and separated by shallow and highly porous intercostal furrows. Corallum white and sometimes epitheca light-beige.

Septa hexamerally arranged in four complete cycles according to formula: S1>S4≥S2>S3 (48 septa). S1 about 1 mm exsert, with an almost flat upper edge, and vertical and straight axial edge. S2 about 0.7 mm exsert and 4/5 width of S1. Otherwise, S2 similar in profile to S1. S3 least exsert septa, only ½ width of S2, and have upper edge slightly oblique and vertical lower axial edge. S4 dimorphic in development: those adjacent to S1 slightly wider and more exsert than those adjacent to S2. In each half-system a pair of S4 fuses deep in fossa before common S3, continuing to coluella as one septum. Columella usually well-developed, but those specimens in which columella is small, septum formed by fusion of each pair of S4 in a half-system curves towards the

S4 from its complementary half-system, fusing to it before common S2. Axial edge of S4 laciniate. Fossa shallow, containing a well-developed spongy to lamellar columella usually swirled in a clockwise direction. Lower axial edges of lateral S1 constrict columella, and axial edge of S4 usually fuse to columellar elements.

Distribution. –*New Caledonia*: 260-400 m.

Discussion. –Among New Caledonian congeners, *Balanophyllia* sp. is most similar to *B. cylindrica*, but is distinguished in having S4 always fused before S3; spongy columella; S4≥S2; a slightly larger GCD:LCD ratio (1.1-1.3 in *B*. sp. and between 1-1.1 in *B. cylindrica*); and more serrate calicular margin.

***Balanophyllia* (*Balanophyllia*) *spinosa* sp. nov.**

Plate 8, Figs. E-F

Type locality. –*Norfolk 2*: stn. DW 2092 (24°45'S, 168°07'E - Bank Kaimon Maru, New Caledonia), 320-345 m.

Holotype. –Norfolk 2: stn. DW 2092.

Paratypes. –Halipro 1: stn. CP 877 (16). –Bathus 3: stn. DW 827 (6); stn. CP 833 (1). –Norfolk 2: stn. DW 2040 (5); stn. DW 2049 (3); stn. DW 2081 (4); stn. DW 2091 (2); stn. DW 2092 (3); stn. DW 2117 (2); stn. DW 2123 (1); stn. DW 2124 (1); stn. DW 2132 (4); stn. DW 2133 (1); stn. DW 2136 (1).

Description. –Corallum trochoid, slightly curved, and attached through a robust pedicel (PD:GCD = 0.40-0.52), and a wide and thin encrusting base. Calice elliptical

(GCD:LCD = 1.1-1.3); calicular edge lancetted. Holotype 17.9 x 13.8 mm in CD, 7.5 mm in PD, and 26.1 mm in height. Upper theca highly porous, coarsely granular, and usually with no apparent costae. Lower theca (including pedicel and base) covered with a solid stereome obscuring porous nature of theca. Stereome highly spinose, especially on lower pedicel. Spines tall, slender, and pointed. New coralla usually budds on upper theca of a parent corallum. Corallum white.

Septa hexamerally arranged in four complete cycles (with no additional S5) according to formula: S4≥S1>S2>S3 (48 septa). S1 moderate exsert (about 2.5 mm), quite thick near calicular edge, and almost reach columella with vertical to slightly oblique smooth axial edge. S2 slightly less exsert and less wide than S1. S3 least exsert septa and about ¾ width of S2. S4 as wide to slightly more wide than S1. Each pair of S4 in a half-system curves towards common S3 in a distinctive Pourtalès plan. S4 not always fuse to each other, but if fused they extend to columella as one septum. P4 more evident in smaller specimens with fused S4. Upper axial edge of S4 slightly laciniate. Upper outer septal edges quite porous, and septal faces coarsely granular. Fossa of moderate depth, containing a well-developed, convex, elliptical to elongate columella composed of many short lamellae swirled in a clockwise direction.

Etymology. –The species name is from Latin *spinosa* (spiny, thorny), and refers to the well-developed pointed spinose granules on the theca of this species.

Distribution. –*New Caledonia*: 187-896 m.

Discussion. –Among the all known species of *Balanophyllia*, *B. spinosa* appears to be unique in having slender, well-developed, spinose granules on theca.

Genus *Cladopsammia* Lacaze-Duthiers, 1897

Diagnosis. –Small phaceloid colonies formed by extratentacular budding from a common basal coenosteum and from edge zone of larger corallites. Pourtalès plan well-developed. Pali absent. Columella spongy.

Type species. –*Cladopsammia rolandi* Lacaze-Duthiers, 1897, by monotypy.

***Cladopsammia* sp.**

Plate 8, Figs. G-I

Material examined. –Norfolk 1: stn. DW 1651 (21 corallites). –Norfolk 2: stn. DW 2023 (29 corallites); stn. DW 2024 (6 corallites).

Description. –Small colonies formed by extratentacular budding from a common basal coenosteum, but more often from lower theca of a larger corallite, resulting in a bushy clump of corallites. Encrusting base of one specimen examined (DW 2023) bear scars of five corallites. New corallites bud in all directions. Pedicel quite robust (PD:GCD = 0.5-1.0). Calice elliptical (GCD:LCD = 1.1-1.3). Calicular edge slightly serrate and quite porous. Largest colony examined (DW 2023) 38.0 x 32.5 mm in diameter, 25.4 mm in height, and bear 17 corallites. Largest corallite examined (same station) 10.0 x 8.3 mm in CD, 10.0 mm in PD, and 26.5 mm in height. Theca very robust (up to 2.5 mm thick) and quite porous. Upper theca porous and inconspicuously costate. Larger corallites usually display slightly delimited costae by shallow and porous intercostal striae. In smaller corallites costae usually indistinguishable. Lower theca often epithecate in older corallites. Epitheca thin and sparsely corrugated. Corallum white.

Septa apparently arranged in a hexameral symmetry in 4 cycles, however, septal symmetry quite hard to determined due to incompleteness. Largest corallite have only 36 septa. S1 slightly exsert (about 0.3 mm) and extend to columella with vertical and straight axial edge. S2 about ¾ width of S1, and have straight to slightly laciniate vertical axial edge. S3 rudimentary. When present, a pair of S4 often fuse before common S3 in a porous structure and have laciniate axial edge, however, some pair of S4 do not quite fuse. S4 extend as far as S1 into fossa and usually is loosely fused to columella. Fossa of moderate depth, containing a quite variable columella. Most specimens examined have elongate columella, however, spongy elongate columella also observed.

Distribution. –*New Caledonia*: 276-371 m.

Discussion. –The specimens described above fall within the morphological range of the genus *Cladopsammia* Lacaze-Duthiers, 1897, which has intermediate corallite integration if compared with *Rhizopsammia* (stoloniferus/reptoid) and *Dendrophyllia* (branching). A literature comparison made with all valid species of *Cladopsammia* resulted in no similar species within the genus. Within western Pacific waters this genus is represented by *C. gracilis* (Milne-Edwards & Haime, 1848a), *C. eguchii* (Wells, 1982), and *C. echinata* Cairns, 1984. The specimens of *Cladopsammia* sp. reported herein differs from all western Pacific congeners in having a quite thick theca, usually very incomplete septal cycles, and a lamelar to spongy columella. Even probably representing a new species, we postponed a formal description waiting for the possibility to compare it with the congener type specimens.

***Cladopsammia willeyi* (Gardiner, 1900)**

Coenopsammia willeyi Gardiner, 1900: 357-375, pl. 34, figs. 1-22.

Dendrophyllia willeyi. –Van der Horst, 1922: 56, pl. 8, figs. 17-18. –Hoffmeister, 1925: 48.

Cladopsammia willeyi. –Cairns et al., 1999: 26. –Cairns, 2009: 26.

Type locality. –Sandal Bay (Loyalty Islands), depth unknown (shallow).

Type material. –Not traced.

New records. –None.

Previous records from New Caledonia. –Gardiner (1900).

Description (amended from Gardiner [1900] original description). –Corallum colonial and bushy, with new corallites budding from base of parent corallite. Three generation buds common. Calice slightly elliptical (GCD:LCD ~ 1.12). Largest corallite examined by Gardiner (1900) 9.0 mm in CD and 14.0 mm in height. Theca thin. Epitheca absent. Costae low, rough, and subequal, and correspond in number and position to S1-4. Most costae continuous between different corallites. Intercostal furrows highly porous especially near calicular edge.

Septa hexamerally arranged in 4 cycles. S1 extend to about half-distance to centre of corallite with horizontal upper edge and almost vertical and smooth axial edge. S1 aligned to GCD smaller than lateral S1. S2 smaller than S1 but meet columella deep in fossa. S3 small. S4 rudimentary. All septa slightly porous and bearing sparse granules. Columella spongy and elliptical in profile.

Distribution. –*New Caledonia*: depth unknown (shallow). –*Elsewhere*: Japan (?); Fiji (?); Fanning-Island (?); depth unknown (shallow).

Discussion. –Until more material of this species be available for examination, nothing can be added to its morphological knowledge.

Genus *Dendrophyllia* Blainville, 1830

Diagnosis. –Colonies formed by extratentacular budding, resulting in three general forms: arborescent colonies with axial corallites; small bushy colonies with sparse branching; or dendroid colonies with sympodial branching. All forms originate from a single basal stem. Synapticulothecate. Costae usually well-defined. Septa arranged in Pourtalès plan. Pali may be present. Columella spongy. Tabular endothecal dissepiments may be present.

Type species. –*Madrepora ramea* Linnaeus, 1758, by subsequent designation (Milne Edwards & Haime, 1850b).

Dendrophyllia alcocki (Wells, 1954)

Plate 8, Figs. J-L

Sclerhelia alcocki Wells, 1954: 465-466, pl. 177, figs. 1-2.

Dendrophyllia minuscula. –Gardiner & Waugh, 1939: 237 (*in part*: *John Murray* stn. 157).

Dendrophyllia palita Squires & Keyes, 1967: 28-29, pl. 6, figs. 9-10. –Dawson, 1979: 28.

Dendrophyllia alcocki. –Zibrowius, 1974b: 570-573, figs. 10-14. –Manning, 1991: 518. –Dawson, 1992: 45. –Cairns, 1995: 126-127, pl. 43, figs. g-I, pl. 44, figs. a-b. –Cairns & Zibrowius, 1997: 193. –Cairns, 1998: 408, fig. 9g. –Cairns et al., 1999: 26. –Cairns, 2004a: 267, 315. –Cairns, 2009: 27.

Enallopsammia sp. Zibrowius & Grygier, 1985: 134.

Type locality. –Bikini Atoll (Marshall Islands), 177-243 m.

Type material. –The holotype is broken in four pieces, three of which are deposited at the NMNH and one at the BM (Cairns, 1995).

New records. –Halipro 1: stn. CP 877 (1 fragment). –Bathus 4: stn. DW 924 (1 fragment); stn. DW 925 (1 fragment, and 1 colony broken into small fragments); stn. CP 938 (2 fragments); stn. DW 939 (6 fragments). –Norfolk 2: stn. DW 2024 (1 colony fragment); stn. CP 2038 (2 fragments); stn. DW 2053 (2 fragments); stn. DW 2084 (2 fragments); stn. DW 2092 (1 colony fragment); stn. DW 2096 (1 fragment); stn. DW 2108 (1 colony fragment); stn. DW 2111 (3 fragments); stn. DW 2117 (3 fragments); stn. DW 2126 (2 fragments); stn. DW 2127 (1 fragment); stn. DW 2135 (1 fragment); stn. DW 2136 (3 fragments); stn. DW 2140 (21 fragments); stn. DW 2147 (1 fragment); stn. CP 2153 (6 fragments); stn. DW 2156 (3 fragments); stn. DW 2160 (2 fragments); stn. DW 2162 (1 fragment).

Previous records from New Caledonia: –Manning (1991).

Description. –Colonies uniplanar to arborescent formed by extratentacular sympodial budding. Branch anastomosis absent. No entire colonies examined, being most specimens examined represented by broken fragments of distal branches. Calice circular; calicular edge slightly serrate. Corallite project about 2 mm from coenosteum. Coenosteum dense, covered with small granules, and slightly porous only near calicular edge. Costae inconspicuous, but coenosteum granules usually aligned along branch axis. Corallum white.

Septa hexamerally arranged in three complete cycles according to formula: S1>S3>S2 (24 septa). S1 slightly exsert, much thicker than other septa, and extend to columella with straight and vertical to slightly concave axial edge. S2 about half width of S1 and have sinuous and laciniate axial edge. A pair of S3 fuse before S2 and form a tall palus (P2). Axial edge of S3 laciniate. Septal and palar faces coarsely granulated. Fossa of moderate depth, containing a papillose columella, in which lower axial edges of S1 and S3 are fused.

Distribution. –*New Caledonia*: 208-1074 m. –*Elsewhere*: Maldives; South China Sea; Philippines; Indonesia; Vanuatu; Wallis and Futuna; Marshall Islands; Solomon Islands; Australia; and New Zealand; 118-1200 m.

Discussion. –*Dendrophyllia alcocki* is distinguished from other branching azooxanthellate scleractinians from New Caledonia in having well-developed Pourtalès plan (Pourtalès plan absent in *Tubastraea micrantha, Madracis kauaiensis, Madrepora oculata*, and *Madrepora porcellana*); and corallites not restricted on only one side of the colony as in *Enallopsammia rostrata*. Among congeners belonging to the "third group" of *Dendrophyllia* (Cairns, 1995), *D. alcocki* is distinguished in having prominent P2; S3>S2; and very dense coenosteum porous only near calicular edge.

Dendrophyllia cf. *D. arbuscula* Van der Horst, 1922

Plate 8, Figs. M-N

Dendrophyllia arbuscula Van der Horst, 1922: 53, pl. 8, fig. 6 (*in part*: *Siboga* stn. 277, pl. 8, fig. 6). –Yabe & Eguchi, 1932e: 388. –Yabe & Eguchi, 1942b: 162, 166-167. –Crossland, 1952: 92. –Eguchi, 1968: C55-C56, pl. C21, figs. 5, 13. –Wells, 1964: 108. –Pillai & Scheer, 1974: 462, fig. 7a. –Betterton, 1981: 242, figs. 197-198. –Pillai, 1983: 89. –Veron, 1986: 578. –Song, 1991: 136, pl. 1, fig. 4, pl. 3, fig. 1. –Cairns, 1994: 90-91, pl. 38, figs. i-l. –Cairns, 1995: 125-126, pl. 43, figs. e-f. –Ogawa & Takahashi, 1995: 17, pl. 1, figs. 1-7. –Cairns & Zibrowius, 1997: 192-193, figs. 29a-c. –Cairns, 1998: 408-409. –Cairns, 1999: 133-134. –Cairns et al., 1999: 26. –Cairns, 2004a: 267, 315. –Lam et al., 2009, 732-733, figs. 1E-I. –Cairns, 2009: 26.

Dendrophyllia micranthus. –Van der Horst, 1922: 50 (*in part*: *Siboga* stn. 277).

Dendrophyllia subcornigera Eguchi, 1968: C64, pl. C32, figs. 3-4.

Dendrophyllia horsti Gardiner & Waugh, 1939: 237-238, pl. 2, figs. 5-6.

Dendrophyllia sp. cf. *D. horsti*. –Cairns & Keller, 1993: 278, pl. 13, figs. F, I.

Type locality. –*Siboga* stns. 260 and 277 (Banda Sea, Indonesia), 45-90 m.

Type material. –Three syntypes are deposited at the ZMA (Cairns, 1995).

Material examined. –Norfolk 2: stn. DW 2125 (4).

Description. –Colony examined quite small and having only four corallites, of which one is axial, other two budded from lower theca, and one very small (about 1 mm in height) corallite was budding from secondary corallite. Primary corallite elongate cylindrical and firmly attached to substrate through a robust pedicel (PD:GCD = 0.95) enlarged by layers of stereome. Secondary corallites ceratoid/trochoid to cylindrical. Calice circular to slightly elliptical (GCD:LCD = 1.0-1.2); calicular edge lancetted. Largest corallite examined (axial) 11.0 x 9.4 mm in CD, 10.5 mm in PD, and 32.7 mm in height. Costae broad, equal in width, flat, slightly porous, and granular. Intercostal furrows shallow and quite porous. Theca white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S4>S2>>S3 (48 septa). At calicular margin upper outer edges of S4 fuse to S1 or S2 forming small triangular lancets, of which those including S1 are slightly more exsert than those including S2. S1 independent, about 1 mm exsert, and extend to columella with vertical and straight axial edge. S2 also independent, slightly less exsert and less wide than S1. Axial edge of S2 also vertical and straight. S3 rudimentary and least exsert septa. In each half-system a pair of S4 curves towards common S3 fusing before it deep in fossa. Axial edge of S4 entire, and those adjacent to S1 are much wider than those adjacent to S2. Septal faces finely granular. Fossa of moderate depth, containing a massive columella usually swirled in a clock wise direction. Columella constricted into 3 contiguous sections by lateral S1.

Distribution. –*New Caledonia*: 275-348 m. –*Elsewhere*: Japan; East China Sea; China; Philippines; Indonesia; southwestern Indian Ocean to Strait of Malacca; Vanuatu; Australia; and New Zealand; 2-253 m.

Remarks. –The identity of the specimen reported herein is tentative, because even most of its morphological characters being in accordance with previously published descriptions of *D. arbuscula* (see Cairns, 1994; 1995), the New Caledonian specimen differs slightly in not having porous S4 faces or dentate/laciniate axial S4 edges.

Dendrophyllia ijimai Yabe & Eguchi, 1934

Plate 9, Figs. A-B

Dendrophyllia ijimai Yabe & Eguchi, 1934a: 2026. –Eguchi, 1965: 294, 2 figs. –Eguchi, 1968: C65 (*in part*: pl. C16, figs. 1-2, pl. C22, fig. 1). –Kikuchi, 1968: 9, pl. 15, fig. 2. –Eguchi & Miyawaki, 1975: 54. –Cairns & Keller, 1993: 280, fig. 13G. –Cairns, 1994: 89, pl. 38c, f. –Cairns, 1999: 133. –Cairns et al., 1999: 26. –Cairns, 2004a: 267, 315. –Cairns, 2009: 26.

Dendrophyllia micranthus. –Eguchi, 1965: 294, 1 fig. –Eguchi, 1968: C66, pl. C24, figs. 2-3.

Dendrophyllia minuscula. –Utinomi, 1965: 257. –Tribble & Randall, 1986: 159.

Dendrophyllia subcornigera cylindrica Eguchi, 1968: C64-C65, pl. C32, figs. 1-2.

Dendrophyllia subcornigera. –Wells, 1984: 215-216, fig. 5.

Dendrophyllia sp. cf. *D. ijimai*. –Cairns & Zibrowius, 1997: 191-192, fig. 29e.

Type locality. –Presumed to be off Japan.

Type material. –Unknown (Cairns, 1994).

New records. –Bathus 4: stn. DW 932 (1 fragment); stn. DW 933 (6 fragments). –Norfolk 2: stn. DW 2093 (3 fragments).

Description. –All colonies examined composed of one elongate, virtually straight to slightly curved axial corallite that attenuates in diameter in direction to calice. Numerous robust corallites bud from the axial corallite in all directions, with some with more than 23 mm in length. These “second generation buds” usually bear some stout “third generatio” buds as well. Axial corallite slightly elliptical in cross section. Theca quite porous especially near calicular edge. Costae well defined, slightly ridged, and highly granular (1 or sometimes 2 rows of aligned pointed granules). Intercostal furrows deep and quite porous. Corallum white.

Septa hexamerally arranged in 4 cycles in a strongly developed Pourtalès plan according to formula: S1>S4>S2>S3. No corallite examined have a complete fourth cycle. S1 independent and extend to columella with straight and vertical axial edge. Lower axial edge of S1 fuse to columella deep in fossa. S2 about ¾ width of S1 and have slightly sinuous axial edge not as vertical as those of S1. If S4 absent from a half-system, S3 is slightly larger than S2 and usually curves towards it. However, S3 is about ½ width of S1 and have laciniate axial edge if flanked by a pair of S4. A pair of S4 in a half-system curves towards common S3, fusing before it and extending to columella as one septum. If a system have four S4, each united S4 from a half-system curves towards S2 sometimes fusing before it near columella. Axial edge of S4 laciniate, and lateral faces porous. Septal faces finely granular. Fossa of moderate depth (slightly deeper in axial and longer lateral corallites), containing a non-discrete spongy columella.

Distribution. –*New Caledonia*: 170-230 m. –*Elsewhere*: Japan; East China Sea; Philippines; Indonesia; southwestern Indian Ocean to Strait of Malacca; Australia; New Zealand; 10-366 m.

Discussion. –According to Cairns (1994), *Dendrophyllia ijimai* can be grouped with those congeners that have arborescent colonies with axial corallite. To date, the only other known western Pacific congener that groups in this colony form is *D. cribosa* Milne Edwards & Haime, 1851. According to Cairns (1994), *D. ijimai* is distinguished in having nonanastomotic branches and exsert corallites.

Genus *Eguchipsammia* Cairns, 1994

Diagnosis. –Colony commonly unattached, resulting from sparse, irregular, extratentacular budding from parent corallum. Third generation buds rare. Intratentacular budding infrequently. Theca costate and hispid, usually partially covered with epitheca. Pourtalès plan present. Paliform lobes may be present. Columella spongy. Endothecal dissepiments absent.

Type species. –*Dendrophyllia cornucopia* Pourtalès, 1871, by subsequent designation (Cairns, 1994).

Eguchipsammia fistula (Alcock, 1902)

Plate 9, Figs. C-D

Balanophyllia (*Thecopsammia*) *fistula* Alcock, 1902a: 109. –Alcock, 1902c: 42, pl. 5, figs. 36, 36a. –Marenzeller, 1907a: 8-9, text-fig. 6. –Marenzeller, 1907b: 16-17, pl. 1, figs. a-h.

Dendrophyllia oahensis Vaughan, 1907: 154-155, pl. 46, fig. 1. –Cairns, 1984: 25.

Dendrophyllia fistula. –Gardiner & Waugh, 1939: 237. –Wells, 1964: 116, pl. 2, figs. 4-5. –Pillai & Scheer, 1976: 16. –Scheer & Pillai, 1983: 170. –Veron, 1986: 578. –Cairns & Keller, 1993: 281.

Eguchipsammia fistula. –Cairns, 1994: 86, pl. 36, figs. f, g. –Cairns, 1995: 123-124, pl. 42d-h. –Cairns et al., 1999: 27. –Cairns, 2004a: 315. –Cairns, 2006: 48. –Cairns, 2009: 25.

Type locality. –*Siboga* stns. 105 and 107 (Sulu Archipelago, Philippines), 270-275 m.

Type material. –Three syntypes are deposited at the ZMA (Cairns, 1995).

New records. –Norfolk 1: stn. DW 1651 (9); stn. DW 1652 (23). –Norfolk 2: stn. DW 2023 (123); stn. DW 2024 (24); stn. DW 2063 (1); stn. DW 2112 (13); stn. DW 2125 (22); stn. DW 2148 (2).

Description. –Corallum usually consists of one elongate, cylindrical, axial corallite from which several corallites bud at right angle. Fourth bud generation observed in one specimen examined, but three generations more common found. Calice slightly elliptical (GCD:LCD = 1.1-1.4); calicular edge finely serrate. Largest corallite examined (DW 2023) 6.7 x 4.8 mm in CD, 50.2 mm in height (curved 90º), and support

6 secondary generation buds, and 2 third generation buds. However, axial corallites supporting up to 12 buds not uncommon. Most specimens examined free, but two axial corallites have indication that they were attached to hard substrate. Also, some specimens attached to small objects such sea-urchin spines observed. Upper theca quite porous and bear well-defined flat and granular costae separated by thin and porous intercostal striae. About 3 mm below calicular edge, theca completely covered by a thick, transversely corrugate epitheca that mask underlaying costae. However, in some specimens costae still distinguishable through epitheca. Epitheca usually highly encrusted by sessile organisms. Tissue does not invest epitheca. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-2>S4>S3 (48 septa). S1-2 slightly exsert (about 0.7 mm), and extend to columella with straight and vertical axial edges. In some corallites S1 is slightly larger than S2. S3 least exsert septa and quite short. In each half-system, a pair of S4 meet before common S3 in a well-developed Pourtalès plan, often forming a small pali. Those S4 adjacent to S1 exserter and larger than those adjacent to S2, usually forming small triangular apex at calicular edge. Near calicular edge all septal edges quite porous. Septal and palar faces coarsely granulated. Fossa shallow, containing a well-developed convex fascicular columella composed of closely swirled elements.

Distribution. –*New Caledonia*: 276-1434 m. –*Elsewhere*: Mozambique; Zanzibar; Tanzania; Red Sea; Maldives Islands; Hawaii; Philippines; Australia; and New Zealand; 86-910 m.

Discussion. –Among the 8 extant species of *Eguchipsammia*, four were previously reported from western Pacific: *E. fistula*; *E. gaditana*; *E. japonica* (Rehberg, 1892); and *E. wellsi* (Eguchi, 1968). Along with *E. fistula*, *E. wellsi* is the only other western Pacific congener that have a discrete columella (columellar edges are vertical and do not merge directly with the axial septal edges). The former is distinguished in having a well-developed epitheca (epitheca lacking in *E. wellsi*).

Eguchipsammia gaditana (Duncan, 1873)

Plate 9, Figs. E-F

Balanophyllia gaditana Duncan, 1873: 333.

Balanophyllia praecipua Gardiner & Waugh, 1939: 240, pl. 1, fig. 2.

Dendrophyllia praecipua. –Wells, 1964: 116, pl. 2, figs. 6-7. –Veron, 1986: 578.

Dendrophyllia gaditana. –Cairns, 1979: 181, pl. 36, figs. 5-10. – Zibrowius, 1980: 176-178, pl. 89, figs. A-N. –Cairns, 1984: 25, pl. 4, fig. I. –Cairns et al., 1991: 48. –Cairns & Keller, 1993: 279-280.

Eguchipsammia gaditana. –Cairns, 1994: 85-86. –Cairns, 1995: 122-123, pl. 42, figs. a-c. –Cairns & Zibrowius, 1997: 190. –Cairns et al., 1999: 27. –Cairns, 2000: 172-173. –Cairns, 2004a: 315. –Tachikawa, 2005: 12-13, pl. 5, fig. F, pl. 6, figs. D-F. –Cairns, 2006: 48. –Kitahara, 2007: 504, 505, 511, 513. –Cairns, 2009: 25.

Type locality. –*Porcupine* stn. 29 (36º20’N, 6º47’W – Iberian-Morocco Gulf), 417 m.

Type material. –The holotype is deposited at the BM (Cairns, 1995).

New records. –SMIB 10: stn. DW 205 (3). –Norfolk 2: stn. DW 2047 (2); stn. DW 2060 (4); stn. DW 2063 (16); stn. DW 2069 (4); stn. DW 2081 (36); stn. DW 2087 (5); stn. DW 2096 (4); stn. DW 2111 (16); stn. DW 2113 (2); stn. DW 2136 (1).

Description. –Axial corallite delicate, elongate-cylindrical, slender, and irregularly bent. Smaller corallites bud at irregular intervals from axial corallite. Buds usually detach from parent corallite before third generatio, but some specimens examined have third generation buds. All specimens examined free, having no evidence of previous attachment to substrate. Calice slightly elliptical (GCD:LCD = 1.05-1.20); calicular edge slightly serrate. Upper theca porous and granular, lower theca covered by a thin, solid, and highly granular epitheca. C1 usually slightly ridged giving a hexagonal profile to calice. Theca white to light-beige.

Septa hexamerally arranged in three complete cycles with additional S4 in larger corallites. S1 up to 0.4 mm exsert and fused at calicular edge to adjacent septa forming 6 small triangular apexes. Axial edge of S1 vertical and entire. S2 slightly sinuous, quite short, and enclosed by two adjacent S3 in a Pourtalès plan. Axial edge of S3 laciniate and after fusing before S2, they continue to columella as one septum. If a pair of S4 flanks a S3, S2 is only slightly smaller than S1, S3 become rudimentary, and flanking S4 fuse before S3 and continue as one septum. Fossa of moderate depth, containing a non-discrete, rudimentary, spongy columella.

Distribution. –*New Caledonia*: 230-1074 m. –*Elsewhere*: United States; Venezuela; Brazil; Iberian-Morocco Gulf; Madeira Archipelago; Great Meteor Bank; Gulf of Guinea; Mozambique; Tanzania; Madagascar; Hawaii; Japan; Australia; and New Zealand; 30-988 m.

Discussion. –Apart from the non-discrete nature of the columella (see discussion of previous species), *E. gaditana* is distinguished from the only other New Caledonian congener (*E. fistula*) in having a more delicate corallum; a spongy columella (vs fascicular in the latter); and laciniate axial higher septal edge.

Genus *Enallopsammia* Michelotti, 1871

Diagnosis. –Colonial, arborescent colonies formed by extratentacular budding. Corallites often, but not always, unifacially arranged. Coenosteum dense, synapticulotheca porous only near calice and on distal branches. Septa arranged normally. Columella small.

Type species. –*Coenopsammia scillae* Seguenza, 1864, by monotypy.

Enallopsammia rostrata (Pourtalès, 1878)*

Plate 9, Figs. G-I

Amphihelia rostrata Pourtalès, 1878: 204, pl. 1, figs. 4-5. –Agassiz, 1888: 152, fig. 473. –Gourret, 1906: 122, pl. 12, figs. 11A-B.

Stereopsammia rostrata. - Pourtalès, 1880: 97, 110-111.

Amphihelia adminicularis Rehberg, 1892: 10, 50.

Dendrophyllia (*Coenopsammia*) *amphelioides* Alcock, 1902: 43-44, pl. 5.

Anisopsammia amphelioides. –Vaughan, 1907: 156-157, pl. 47, figs. 1-2.

Coenopsammia amphelioides var. *cucullata* Vaughan, 1907: 157, pl. XLVIII, figs. 1-4.

Anisopsammia rostrata. –Gravier, 1915: 3. –Gravier, 1920: 102, pl. 12, figs. 181-185.

Enallopsammia rostrata. –Squires, 1959a: 40. –Laborel, 1970: 156. –Zibrowius, 1973: 44-45, pl. 2, figs. 14-15. –Cairns, 1978: 9. –Cairns, 1979: 186-188, pl. 37, figs. 2-3, 6. –Zibrowius, 1980: 201-203, pl. 105, figs. A-K, pl. 106, figs. A-C. –Cairns, 1982: 57, pl. 18, figs. 1-4. –Cairns, 1984: 27-28. –Zibrowius & Grygier, 1985: 131, figs. 48-50. –Zibrowius, 1985: 314, 319, 322, 323. –Zibrowius & Gili, 1990: 39-42, pl. 6, figs. A-F, pl. 7, figs. A-F. –Cairns, 1991a: 26, pl. 12, fig. b. –Dawson, 1992: 45. –Cairns & Parker, 1992: 52-53, pl. 18, figs. e-i. –Cairns & Keller, 1993: 281-282. –Cairns, 1994: 92-93, pl. 39, figs. d-f. –Cairns, 1995: 127-128, pl. 44, figs. c-f. –France et al., 1996. –Cairns & Zibrowius, 1997: 195. –Cairns, 1999: 134-135. –Cairns et al., 1999: 27. –Rogers, 1999: 325-326. –Romano & Cairns, 2000: 1049. –Hall-Spencer et al., 2002: 507, 509, 510. –Daly et al., 2002: 503, 505, 506, figs. 1-2. –Randall, 2003: 136. –Cairns, 2004a: 267, 316. –Le Goff-Vitry et al., 2004: 170, 176. –Adkins et al., 2004. –Schroeder-Ritzrau et al., 2005: 160. –Burgess & Babcock, 2005. –Waller, 2005: 691-700. –Waller & Tyler, 2005: 514-522. –Cairns, 2006: 48. –Flint et al., 2007: 843. –Kitahara, 2007: 504, 505, 511, 513, 516, fig. 5G. –Pires, 2007: 269. –Cairns, 2009: 27. –Roberts et al., 2009. –Kitahara et al., 2010b.

Enallopsammia amphelioides. –Zibrowius, 1973: 45-46. –Cairns, 1979: 187, pl. 40, figs. 4-5. –Zibrowius, 1980: 203-204, pl. 106, figs. D-I. –Grygier & Newman, 1985: 6, figs 2a-d.

Type locality. –*Blake* stn. 2 (23º14'N, 82º25'W – Florida, United States), 1472 m.

Type material. –Two lots of syntypes are deposited at the MCZ (Cairns, 1979).

New records. –SMIB 10: stn. DW 205 (1 fragment). –Halipro 1: stn. CP 877 (4 fragments). –Bathus 4: stn. CP 951 (2 fragments). –Norfolk 2: stn. DW 2024 (18 fragments); stn. DW 2025 (1 fragment); stn. DW 2032 (24 fragments); stn. DW 2034 (1 fragment); stn. DW 2041 (2 fragments); stn. DW 2046 (4 fragments); stn. DW 2047 (14 fragments); stn. DW 2052 (1 fragment); stn. DW 2056 (1 fragment); stn. DW 2057 (2 fragments); stn. DW 2058 (3 fragments); stn. DW 2060 (3 fragments); stn. DW 2063 (3 fragment); stn. DW 2066 (3 fragments); stn. DW 2067 (1 fragment); stn. DW 2068 (1 fragment); stn. DW 2069 (2 fragments); stn. DW 2072 (1 fragment); stn. DW 2074 (1 fragment); stn. DW 2075 (3 fragments); stn. DW 2078 (5 fragments); stn. DW 2080 (1 fragment); stn. DW 2081 (4 fragments); stn. DW 2084 (2 fragments); stn. DW 2087 (5 fragments); stn. DW 2100 (1 fragment); stn. DW 2102 (2 fragments); stn. DW 2113 (2 fragments); stn. CP 2121 (1 fragment); stn. DW 2162 (1 fragment).

Description. –Uniplanar colonies formed by extratentacular budding and firmly attached to substratum by a broad encrusting base. All corallites confined to one face of corallum, and project about 3 mm from branch. Calice circular to slightly elliptical; calicular edge serrate. Costae well-developed especially on acalicular branch face, where they are slightly convex and covered with small granules. Costae separated by deep, thin, and porous intercostal striae. Theca on calicular branch face finely granular and costae poorly defined. C1 sometimes slightly ridged near calicular edge. Freshly collected colonies vary between vivid-red and yellow. Corallum white.

Septa hexamerally arranged in three complete cycles according to formula: S1>S2>S3 (24 septa). S1 slightly exsert and extend to columella with finely serrate and concave axial edge. S2 slightly less exsert and about ¾ width of S1. Lower axial edge of S2 also finely serrate. S3 least exsert septa, rudimentary, and have dentate axial edge. A pair of S3 usually fuse to adjacent S2. Fossa deep, containing a small, rudimentary columella.

Distribution. –*New Caledonia*: 370-1032 m. –*Elsewhere*: Cosmopolitan (except for eastern Pacific and continental Antarctica); 110-2165 m.

Discussion. –*Enallopsammia rostrata* is easily distinguished from all other branching New Caledonian colonial species in having all corallites occurring on only one side of the colony. Amongst the specimens examined herein, some display septocostal rostrum (especially the colonies with larger corallites), but most do not have this structure. Grygier (1985) and Grygier & Newman (1985) reported the occurrence of *Petrarca azorica* Grygier, 1985 (Crustacea) living in *E. rostrata*.

Genus *Endopachys* Lonsdale, 1845

Diagnosis. –Corallum solitary and free, resulting from transverse division or budding from corallum edge. Corallum straight. Shape of corallum variable, including cuneiform, compressed-cylindrical, and flabellate. Some species with 6 or 12 robust ridges or flanges aligned to C1 and C2. Epitheca absent. Base of corallum covered with spines arranged in no order. Toward calice, spines usually aligned into narrow costae. Pourtalès plan present. Up to 5 cycles of septa. P3 or P4 usually present. Columella elongate, discrete, and spongy.

Type species. –*Turbinolia maclurii* Lea, 1833, by subsequent designation (Milne Edwards & Haime, 1850b).

Endopachys grayi Milne Edwards & Haime, 1848

Plate 9, Figs. J-K

Endopachys grayi Milne Edwards & Haime, 1848b: 82-83, pl. 1, figs. 2, 2a. –Semper, 1872: 267. –Van der Horst, 1922: 68, 74. –Van der Horst, 1926: 51. –Van der Horst, 1927: 6-7, pl. 2, fig. 12. –Faustino, 1927: 240-241. –Gardiner & Waugh, 1939: 241. –Yabe & Eguchi, 1942b: 139. –Squires, 1961: 17. –Pillai, 1972: 213. –Boshoff, 1981: 42. –Cairns, 1984: 27, pl. 5, fig. E. –Zibrowius & Grygier, 1985: 137. –Veron, 1986: 610. –Cairns, 1989b: 34. –Cairns, 1991a: 24-25, pl. 10, figs. i, j, pl. 11, figs. a, b. –Cairns & Keller, 1993: 276. –Cairns, 1994: 84-85, pl. 36, figs. e, h, pl. 37, fig. i. –Cairns, 1995: 121-122, pl. 41, figs. c-h. –Cairns & Zibrowius, 1997: 185-186. –Cairns, 1998: 362, 365. –Cairns, 1999: 132, fig. 22f. –Cairns et al., 1999: 27. –Cairns, 2001: 25, pl. 7, fig. g. –Cairns, 2004a: 267, 316. –Cairns, 2006: 49. –Cairns, 2009: 25.

Endopachys weberi Alcock, 1902a: 109-110.

Endopachys oahense Vaughan, 1907: 147-148, pl. 44, fig. 3.

Endopachys japonicum Yabe & Eguchi, 1932e: 388, 399. –Yabe & Eguchi, 1932b: 443. –Yabe & Eguchi, 1932a: 14-17, pl. 2, figs. 1-6. –Eguchi, 1934: 268. -Yabe & Eguchi, 1942b: 139. –Eguchi, 1965: 293. –Eguchi & Miyawaki, 1975: 59.

Endopachys vaughani Durham, 1947: 39-40, pl. 11, figs. 6-8, 10, 11. –Durham & Barnard, 1952: 103, pl. 16, figs. 67a-b. –Squires, 1959b: 426-427.

Type locality. –Unknown.

Type material. –Presumed lost (see Cairns, 1994).

New records. –Bathus 4: stn. DW 933 (10). –Norfolk 2: stn. DW 2095 (2); stn. DW 2158 (2); stn. DW 2159 (4).

Description. –Corallum triangular, compressed, free. Base highly compressed and rounded on GCD plane. Thecal edges alate (up to 5 mm), slightly porous, and straight to slightly sinuous. Lower part of crest sometimes thicker than upper part. Upper thecal faces meet in acute angle and often support one bud oblique oriented (or scars of bud) on each side. Costal equal in width and flat to slightly convex. Intercostal striae thin, narrow, and porous. One to 3 granules occur across width of each costa. Near base costae absent. Largest specimen examined (DW 933) 14.7 x 8.6 mm in CD (excluding crests) and 15.0 mm in height. Corallum white.

Septa hexamerally arranged in five incomplete cycles according to formula: S1-2>S5>S3>S4. S1-2 thick, porous at upper outer edge, up to 2 mm exsert, and extend to columella with straight, vertical, and finely dentate axial edges. S3 about 0.8 mm exsert and ¾ width of S1-2. Axial edge of S3 dentate and do not reach columella. If not flanked by a pair of S5, both S4 in a half-system bent towards each other meeting before S3 in a characteristic Pourtalès plan. However, if flanked, S4 display highly laciniate axial edge and is enclosed by a pair of S5 (Pourtalès plan). S5 dimorphic in development: those adjacent to S1more exsert and wider than those adjacent to S2. Each Pourtalès plan terminate in a palus like structure not separated from septa. All septal faces granular. Fossa deep, containing a rudimentary spongy columella formed by lower axial edges of S1-2 and S4 (or S5 if present).

Distribution. –*New Caledonia*: 212-310 m. –*Elsewhere*: South Africa; Mozambique; Tanzania; Mauritius; Arabian Sea; Hawaii; United States; Japan; Philippines; Indonesia; Malaysia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 37-386 m.

Discussion. –Only two species are known from this small dendrophyllid genus: *E. grayi* and *E. bulbosa* Cairns & Zibrowius (1997), the latter only known from Indonesian and Australian waters (North Territory and Western Australia). *E. grayi* is distinguished in not having C1-2 highly ridged; and much less exsert S1-2.

Genus *Endopsammia* Milne Edwards & Haime, 1848

Diagnosis. –Corallum solitary, conical to subcylindrical, and firmly attached. Epitheca thin, covering most of the synapticulotheca. Underlying epitheca weakly costate, covered with low granules. Septa arranged in normal insertion pattern in up to 4 cycles. Axial edges of all septa coarsely dentate to laciniate. Columella spongy, nondiscrete. Tabular endothecal dissepiments present in elongate coralla.

Type species. –*Endopsammia philippinensis* Milne Edwards & Haime, 1848, by monotypy.

Endopsammia regularis (Gardiner, 1899)

Plate 9, Figs. L-M

Thecopsammia regularis Gardiner, 1899: 169-170, pl. 19, figs. a-b. –Stephenson & Wells, 1956: 59.

Balanophyllia regularis. –Van der Horst, 1922: 63, 73.

Endopsammia regularis. –Cairns et al., 1999: 27. –Cairns, 2001: 23. –Cairns, 2004a: 267, 316. –Cairns, 2009: 25.

Type locality. –Sandal Bay (New Caledonia), 73 m.

Type material. –Two syntypes are deposited at the CUMZ (Cairns, 2004a).

Material examined. –None.

Previous records from New Caledonia. –Gardiner (1899) (as *Thecopsammia regularis*).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum straight and cylindrical (about same diameter between calice and base). Calice slightly elliptical; calicular edge slightly serrate. Largest specimen examined by Gardiner (1899) 5.5 x 4.3 mm in CD and 9.5 mm in height. Upper theca porous. Costae flat and defined by porous intercostal striae. Epitheca thin and transversely corrugate, covering lower two thirds of corallum.

Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2>S3>S4. Septa thick, with faces slightly porous and bearing pointed granules aligned in rows. Axial septal edges bluntly lobed. All lower septal edges fuse to columella. Fossa deep, containing a small columella composed of twisted lamellae.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: Australia; 8 m.

Discussion. –Since no new material was available for the present study, nothing can be added to the actual knowledge of this species.

Genus *Heteropsammia* Milne Edwards & Haime, 1848

Diagnosis. –Corallum solitary or colonial. Latter condition achieved by intratentacular budding and resulting in up to 40 contiguous corallites. Adult corallum free and mobile, globular in shape. Juvenile coralla usually attached to small gastropod shells, these subsequently overgrown. Each specimen apparently in obligate symbiosis with a sipunculid worm, which lives in base of corallum. Epitheca absent. Synapticulotheca covered with finely serrate ridges, usually 1-3 ridges per corresponding septum (not considered to be conventional costae). Pourtalès plan present. Paliform lobes may be present. Columella spongy, not discrete. Endotheca absent.

Type species. –*Heteropsammia michelinii* Milne Edwards & Haime, 1848, by monotypy.

Heteropsammia cochlea (Spengler, 1781)*

Plate 9, Figs. N-P

Madrepora cochlea Spengler, 1781: 240-248, figs. A-D.

Psammoseris cylicioides Tenison-Woods, 1879a: 10-11 (*in part*: paralectotypes). - Tenison-Woods, 1880: 297-299.

Lobopsammia michelinii. - Tenison-Woods, 1880: 295.

Heteropsammia michelini. –Kent, 1893: 106, 177. –Wells, 1964: 108, 120.

Heteropsammia cochlea. –Veron & Pichon, 1980: 416-420 (*in part*: figs. 727, 729). –Fisk, 1981. –Fisk, 1983: 287, 290, 291, 292, 293, 294. –Zibrowius & Grygier, 1985: 129, figs. 43-44. –Veron, 1986: 576-577. –Veron & Marsh, 1988: 123. –Hoeksema & Best, 1991: 234-237, figs. 24-28 (*in part*). –Cairns, 1998: 406-408. –Cairns, 1999: 132-133. –Cairns et al., 1999: 27. –Veron, 2000: 407. –Cairns, 2001: 19-20, pl. 2, figs. h-j, pl. 3, figs. a-e. –Cairns, 2004a: 316. –Pichon, 2007: 149, 153.

Heteropsammia cochleata. –Cairns, 2009: 25.

Type locality. –Tranquebar, India. Depth unknown.

Type material. –The location of the type is unknown (Cairns, 2004a).

New records. –Bathus 4: stn. DW 894 (1). –Norfolk 2: stn. DW 2026 (1)

Previous records from New Caledonia. –Pichon (2007).

Description. –Corallum solitary and completely encapsulating a gastropod shell. One large efferent pore project downward from base of corallum, and several smaller pores placed on lower theca. Calice elliptical (GCD:LCD = 1.2); calicular edge lancetted. Largest specimen examined (DW 894) 9.3 x 7.7 mm in CD and 9.0 mm in height. Upper theca highly porous and usually composed of discontinuous interconnected granular rows. Lower theca granular. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1-2>S4>S3 (48 septa). S1-2 highly exsert and have straight and concave axial edges. Lower axial edges of S1-2 fuse to columellar elements. S3 least exsert septa and not reach columella. S4 fuse to S1 or S2 near calicular edge forming well-developed and porous triangular lancets. Each pair of S4 in a half-system arranged in a Pourtalès plan, fusing before flanked S3 and reaching columella as one septum. Upper axial edge of each S4 highly concave, and almost vertical after fusing to adjacent S4 near columella. Fossa of moderate depth, containing a spongy elliptical columella.

Distribution. –*New Caledonia*: 245-762 m. –*Elsewhere*: widespread throughout Indo-West Pacific; 6-622 m.

Discussion. –Amongst New Caledonian scleractinians, only two genera display this interesting symbiotic association with a sipunculid worm (one pertaining to the complex coral group [*Heteropsammia*], and another to the robust coral group [*Heterocyathus*]).

Heteropsammia is distinguished in having septa arranged according the Pourtalès plan. For a complete synonym list see Hoeksema & Best (1991) and Cairns (2009). Fisk (1981) and Grygier (1985) reported infestation of ascothoracid crustaceans in *H. cochlea*.

Genus *Tubastraea* Lesson, 1829

Diagnosis. –Colonies dendroid, bushy, or plocoid, all achieved by extratentacular budding. Costate, no epitheca. Septa arranged normally. Pali absent. Columella usually small and spongy.

Type species. –*Tubastraea coccinea* Lesson, 1829, by monotypy.

Tubastraea coccinea Lesson, 1829*

Plate 10, Figs. A-B

Tubastraea coccinea Lesson, 1829: 93. –Wells, 1936: 132. –Scatterday, 1974: 86. –Scheer & Pillai, 1974: 10, 64-65, pl. 30. –Maragos, 1977: 197, 199-200. –Cairns, 1979: 207. –Zlatarski, 1982: 320-321, 323-324, 341-342, figs. 70-71, 149-152. –Wells, 1982: 216. –Wells, 1983: 243-244, pl. 18, figs. 1-2. –Wood, 1983: 66. –Veron, 1986: 580-581. –Prahl, 1987: 230-231, fig. 8. –Prahl & Erhardt, 1989: 55, fig. 10. –Wilson, 1990: 137-138, fig. 1. –Cairns et al., 1991: 48. –Cairns, 1991a: 26-27, pl. 12, figs c-e. –Humann, 1993: 164-165. –Ogawa & Takahashi, 1993: 98, pl. 1, figs. 1-8, pl. 2, figs. 1-4, pl. 5, figs. 1-5. –Cairns & Keller, 1993: 282-284. –Cairns, 1994: 93-94, pl. 39, figs. g-i. –Cairns & Zibrowius, 1997: 197. –Cairns, 1998: 409. –Cairns et al., 1999: 27. –Cairns, 2000: 178-180, figs. 212-215. –Romano & Cairns, 2000: 1049. –Song, 2000: 286-288. –Cairns, 2001: 29, pl. 10, figs. i-l. –Fenner, 2001: 1175-1183. –DeFelice et al., 2002: 26, 51. –Randall, 2003: 136. –Cairns, 2004a: 318. –Paula & Creed, 2004: 175-183. –Fenner, 2005: 26, 82. –Tachikawa, 2005: 20, pl. 13, figs. A-C. –Cairns, 2006: 49. –Creed, 2006: 350, fig. 1b-c. –Kitahara, 2007: 504-505, 515, fig. 5K. –Pires, 2007: 269. –Cairns, 2009: 27. –Lam et al., 2009: 736, figs. 2A-B. –Kitahara et al., 2010a: 115. –Barbeitos et al., 2010. –Kitahara et al., 2010b.

Lobopsammia aurea Quoy & Gaimard, 1833: 195, pl. 15, figs. 7-11.

Dendrophyllia aurantiaca (?) Quoy & Gaimard, 1833: 195. –Dana, 1846: 388.

Coenopsammia coccinea. –Milne Edwards & Haime, 1848b: 107-108.

Coenopsammia ehrenbergiana Milne Edwards & Haime, 1848b: 109, pl. 1, fig. 12.

Coenopsammia gaimardi Milne Edwards & Haime, 1848b: 109.

Coenopsammia tenuilamellosa Milne Edwards & Haime, 1848b: 110, pl. 1, fig. 11.

Coenopsammia urvillii Milne Edwards & Haime, 1848b: 109.

Coenopsammia radiata Verrill, 1864: 44.

Coenopsammia manni Verrill, 1866: 30-31. –Verrill, 1869: 101.

Pachypsammia valida Verrill, 1866: 30.

Astropsammia peterseni Verrill, 1869: 392.

Dendrophyllia surcularis Verrill, 1869: 393.

Dendrophyllia manni. –Quelch, 1886: 30, 196. –Vaughan, 1907: 156, pl. 46, figs. 6, 6a, 7, 7a. –Hoffmeister, 1925: 48.

Dendrophyllia (*Coenopsammia*) *affinis* Duncan, 1889: 18-19, pl. 1, figs. 29-30.

Coenopsammia willeyi. –Vaughan, 1918: 143-144, pl. 60, figs. 4, 4a.

Dendrophyllia ehrenbergiana. –Van der Horst, 1922: 55-56, 74, pl. 7.

Dendrophyllia aurea. –Eguchi, 1934: 367. –Macnae & Kalk, 1958: 123.

Tubastraea tenuilamellosa. –Durham, 1947: 38-39, pl. 11, figs. 1, 2, 4, 9, pl. 12, figs. 6, 7. –Durham & Barnard, 1952: 105-106, pl. 12, fig. 50d. –Boschma, 1953: 109-117, pl. 9, figs. 1-4, pl. 10, figs. 1, 3-5, pl. 11, figs. 1, 3. –Roos, 1971: 84, pl. 53.

Tubastrea tenuilamellosa. –Boschma, 1951: 44-46. –Goreau, 1959: 70, 75, 85. –Durham, 1962: 42, 44-46. –Roos, 1964: 17, 48. –Keith & Weber, 1970: 271. –Olivares, 1971: 75-77, pl. 2, figs. a-b. –Smith, 1971: 95. –Erhardt, 1974: 407. –Erhardt & Meinel, 1975: 246.

Tubastraea aurea. –Boschma, 1953: 111-118 (*in part*: pl. 10, figs. 2, 6, pl. 11, figs. 4-6, pl. 12, figs. 1-6). –Searles, 1956: 24, pl. 38B. –Stephenson & Wells, 1956: 59. –Squires, 1959b: 427-428. –Pichon, 1964: 191. –Eguchi, 1965: 295. –Utinomi, 1965: 257-258. –Squires, 1966: 169. –Pfaff, 1969: 23. –Eguchi, 1968: C68-70, pl. C16, figs. 5-6, pl. 17, fig. 17, pl. C26, figs. 2-3. –Kikuchi, 1968: 9. –Utinomi, 1971: 220-221. –Porter, 1972: 113. –Wells & Lang, 1973: 58. –Eguchi & Miyawaki, 1975: 54, pl. 7, fig. 3. –Pichon, 1978: 441. –Best et al., 1980: 621. –Betterton, 1981: 242-243, fig. 201. –Castañares & Soto, 1982. –Scheer & Pillai, 1983: 173-174, pl. 40, fig. 8. –Wood, 1983: 121, 124. –Schuhmacher, 1984: 94-95. –Tribble & Randall, 1986: 159. –Veron, 1986: 584-585, fig. 1. –Latypov, 1990: 65-66, pl. 27, fig. 4, pl. 32, fig. 5. –Pichon, 2007: 149, 153.

Tubastrea aurea. –Zans, 1959: 29, 35. –Almy & Carrión-Torres, 1963: 161, pl. 21, fig. b. –Wells, 1964: 109. –Goreau & Wells, 1967: 449. –Land et al., 1977: 170. –Colin, 1978: 291, 293. –Prahl & Erhardt, 1985: 181-182, figs. 108a-b, 109.

Dendrophyllia turbinata Nemenzo, 1960: 18-19, pl. IX, fig. 2.

Dendrophyllia coccinea. –Eguchi, 1965: 296. –Utinomi, 1965: 257.

Tubastrea coccinea. –Latypov, 1990: 66-67, pl. 27, fig. 1, pl. 32, fig. 3. –Steiner, 2003: 5, 10. –Goffredo et al., 2005: 492.

Type locality. –Bora-Bora (Society Islands), depth unknown.

Type material. –The holotype is deposited at MNHN (Wells, 1936).

New records. –None.

Previous records from New Caledonia. –Pichon (2007).

Description (after Cairns [1994]). –Mature colonies roughly spherical. Corallites closely spaced in a plocoid arrangement. Corallites bud extratentacularly at colony edge and between older corallites, thus maintaining a plocoid structure as colony increases in size. Calicular edges often directly adjacent to one another, but occasionally corallites project 1-10 mm above basal coenosteum. Corallites circular to slightly elliptical in shape. Largest examined being about 13 mm in GCD, but averange about 7-9 mm in GCD. Costae equal in width and coarsely granular, separated by wide, deep and highly porous intercostal furrows. Corallum white, coenosarc orange.

Septa hexamerally arranged in 4 cycles. S1-2 virtually equal in size, but S1 slightly thicker and slightly wider, penetrating further into columella than S2. Upper edges of S1-2 nonexsert and slightly tapered, reaching their greatest width 3-4 mm into fossa, where they have vertical, smooth axial edges. S3 much smaller than S1-2, only 0.2-0.3 mm in width. Axial edges of S3 dentate to highly laciniate from top to bottom. S4 rudimentary or of same size as S3, 1 or both lacking from each half-system. Axial edges of S4 also laciniate, occasionally loosely fused to adjacent S3. Fossa of moderate depth, containing a columella of variable size, but usually containing a rather large, spongy columella.

Distribution. –*New Caledonia*: shallow. –*Elsewhere*: cosmopolitan in tropical and warm temperate waters; 0-110 m.

Discussion. –*Tubastraea coccinea* is distinguished from the only other congener known from New Caledonia, *T. micranthus*, by its plocoid colony shape versus arborescent in the latter.

Tubastraea micranthus (Ehrenberg, 1834)

Plate 10, Figs. C

Oculina micranthus Ehrenberg, 1834: 304.

Dendrophyllia nigrescens Dana, 1846: 387. –Vaughan, 1918: 143-144, pl. 60, figs. 1, 1a. –Searles, 1956: 24, pl. 39A. –Stephenson & Wells, 1956: 55. –Wells, 1964: 108.

Coenopsammia viridis Milne Edwards & Haime, 1848b: 110.

Coenopsammia aequiserialis Milne Edwards & Haime, 1848b: 110-111. –Semper, 1872: 267.

Dendrophyllia micranthus. –Van der Horst, 1922: 49-51 (*in part*: *Siboga* stn. 277). –Van der Horst, 1926: 43-44, pl. pl. 2, figs. 6-7. –Faustino, 1927: 218-220, pl. 72, figs. 1-2. –Crossland, 1952: 171-172. –Stephenson & Wells, 1956: 55. –Nemenzo, 1960: 16-17, pl. 8, fig. 2. –Scheer & Pillai, 1974: 63, pl. 29, fig. 3. –Pillai & Scheer, 1976: 16. –Betterton, 1981: 242, figs. 199-200.

Dendrophyllia micranthus var. *grandis* Crossland, 1952: 173, pl. 55, fig. 1, pl. 56, fig. 1.

Tubastrea micrantha. –Wells, 1964: 108. –Ogawa & Takahashi, 1993: 99-100, pl. 4, figs. 1-6, pl. 6, figs. 5-6. –Cuif et al., 2003: 468.

Dendrophyllia cf. *micrantha*. –Best et al., 1980: 621.

Tubastraea micranthus. –Macnae & Kalk, 1958: 123. –Scheer & Pillai, 1983: 175-176, pl. 41, figs. 7-8. –Schuhmacher, 1984: 94, figs. 1a-b, 4. –Zibrowius & Grygier, 1985: 130. –Cairns & Zibrowius, 1997: 195-196. –Cairns, 1998: 410. –Cairns et al, 1999: 28. –Paula & Creed, 2004: 176, 181. –Cairns, 2004a: 267, 318. –Tachikawa, 2005: 20-21, pl. 13, figs. G-K. –Sammarco et al., 2010: 131-140, figs. 2a, 3a, 4a. –Cairns, 2009: 28.

Tubastraea micrantha. –Pichon, 1978: 441. –Rosen, 1979: 20. –Wells, 1983. –Veron, 1986: 583, fig. 3, 585, figs. 3, 7. –Veron et al., 1986. –Cairns & Keller, 1993: 282. –Romano & Cairns, 2000: 1049.

Tubastrea micranthus. –Latypov, 1990: 68, pl. 26, figs. 1-2.

Type locality. –Unknown.

Type material. –Not traced (Cairns, 2004a).

New records. –None.

Previous records from New Caledonia. –Pichon (2007).

Description (after Cairns & Zibrowius [1997]). –Corallum dendroid, but more or less uniplanar, achieved by profuse extratentacular budding from a relatively small number (2-8) of massive axial corallites. Coralla may attain a large size: *e.g.* 1 m in height and 5 cm in basal diameter. Corallites of small-diameter distal branches generally occur only on branch edges, but on larger-diameter branches corallites more uniformly distributed on all branch faces. Corallites usually project upward at a 45º angle from axial branch and stand 5-7 mm above branch coenosteum. Corallites usually 6-8 mm in GCD. Costae well defined, 0.4-0.5 mm in width, convex to ridged, bearing 1-3 low granules across their width at any point. Intercostal furrows long and continuous, 0.15-0.20 mm wide, and occasionally punctuated with circular pores about 0.3 mm in diameter that penetrate deeper into branch core. Branch porosity greatest in distal parts. Corallum white, live tissue a striking dark-green or brownish-black.

Septa hexamerally arranged in 3 cycles: S1>S2>>S3. S1 nonexsert, having straight axial edges that attain columella. S2 ¾ width of an S1, also having straight axial edge that attains columella. S3 usually rudimentary, represented by a very narrow dentate to laciniate lamella. Fossa deep, especially in axial corallites. Columella rudimentary composed of a solid, elongate fusion of lower, axial edges of S1-2.

Distribution. –*New Caledonia*: shallow. –*Elsewhere*: widespread in tropical Indo-West Pacific; 0-50 m.

Discussion. –*Tubastraea micranthus* is compared with *T. coccinea* in the account of that species.

Family Guyniidae Hickson, 1910

Genus *Guynia* Duncan, 1872

Diagnosis. –Solitary, ceratoid to scolecoid, free or fixed laterally. Chain of individuals sometimes produced by extratentacular budding. Wall epithecal. A row of mural "pores" present in every interseptal space. Pali absent. Columella composed of one twisted ribbon.

Type species. –*Guynia annulata* Duncan, 1872, by monotypy.

Guynia annulata Duncan, 1872

Plate 10, Figs. D

Guynia annulata Duncan, 1872: 32, pl. 1, figs. 1-8. –Duncan, 1873: 335-336, pl. 47, figs. 9-16. –Pourtalès, 1874: 44, pl. 9, figs. 3-4. –Pourtalès, 1878: 209. –Pourtalès, 1880: 97, 112. –Hickson, 1910: 5. –Gardiner & Waugh, 1938: 172. –Rossi, 1961: 34. –Zibrowius, 1969: 327-328. –Wells, 1972: 6, figs. 11-14. –Wells & Lang, 1973: 58. –Wells, 1973b: 59-63, figs. 1-3. –Bourcier & Zibrowius, 1973: 827. –Zibrowius & Saldanha, 1976: 101-102. –Zibrowius & Grieshaber, 1977: 381. –Cairns, 1977a: 5. –Cairns, 1978: 11. –Cairns, 1979: 164-165, pl. 32, figs. 1-3. –Zibrowius, 1980: 161-162, pl. 83, figs. A-Q. –Gili, 1982: 131, 137-138, fig. 62H. –Cairns, 1984: 23, pl. 5, figs. A-B. –Rezak et al., 1985: 225. –Cairns et al., 1986: 187-188, pl. 56. –Cairns & Wells, 1987: 42-43, pl. 11, figs. 8-9, 12-13. –Cairns, 1989a: 42-43, pl. 21, fig. f, pl. 42, figs. a-e. –Cairns et al., 1991: 48. –Cairns & Parker, 1992: 42-43, pl. 14, figs. g-h. –Cairns & Keller, 1993: 273, figs. 12H-I. –Cairns & Zibrowius, 1997: 150. –Cairns, 1998: 392. –Cairns, 1999: 113-114. –Cairns, 2000: 148-149, figs. 170, 173. –Stolarski, 2000: 13-33, figs. 1A, 2, 3A-C, E-F, 4G. –Romano & Cairns, 2000: 1048, 1052, 1054, -Stolarski, 2000: 13-38, figs.1, 2, 3A-C, 4D, –Cuif et al., 2003: 461, 467, 468, 469. –Randall, 2003: 136. –Cairns, 2004a: 266, 302. –

Le Goff-Vitry et al., 2004: 170. –Zibrowius & Taviani, 2005: 811. –Cairns, 2006: 48. –Cairns, 2009: 21.

Pyrophyllia inflata Hickson, 1910: 1-7.

Guynia n. sp. sensu Goreau & Wells, 1967: 449.

Type locality. –*Porcupine* (Adventure Bank, Mediterranean), 168 m.

Type material. –Eighteen syntypes are deposited at the BM (Cairns, 1979).

New records. –None.

Previous records from New Caledonia. –Cairns (1989).

Description (after Cairns [1989]). –Corallum cylindrical and scolecoid. Calice circular, 1.0-1.1 mm in diameter. Corallum basally or laterally attached to small sand grains, foraminifera, or bits of shell. Epitheca periodically ringed by slightly imbricate growth ridges, each ridge about 0.06 mm thick, occurring at intervals of about every 0.20 mm. Sixteen vertical ridges (costae) also usually present, one corresponding to each septum. Intersections of vertical and circumferential ridges form a grid-like rectangular pattern. Within each rectangle is a round mural pore, each 0.08-0.11 mm in diameter.

Septa octamerally arranged in two size groups (8 primary and 8 secondary septa). Primary septa nonexsert, about 0.05 mm thick, and have highly sinuous axial edges. The nonexsert nature of S1 is reinforced by having very narrow upper edges that only gradually widen deeper in fossa. Secondary septa much smaller, less sinuous, and about 0.01 mm in diameter. Secondary septa recessed (0.6-1.0 mm) from calicular edge and, like primaries, have very narrow upper edge. Fossa shallow. Columella a single twisted or flanged ribbon.

Distribution. –*New Caledonia*: depth unknown. –*Elsewhere*: cosmopolitan in tropical and warm temperate regions; 28-653 m.

Discussion. –*Guynia annulata* is the only extant representative of the family Guyniidae, and belongs to the scleractinian group of cosmopolitan species, even attaining one of the smallest sizes within the order. No new records of this cryptic species was available for the present study. However, based on detailed descriptions from many ocean basins (Zibrowius, 1980; Cairns, 1979; 1989; Cairns & Parker, 1992) and previous records from New Caledonia, all following morphological characters appears to be unique for *G. annulata*: very small corallum; CD usually smaller than 1.5 mm; mural pores distributed evenly across theca; septa hexamerally arranged in only 2 cycles; and a grid-like pattern of rectangles formed by thetransverse circumferential ridges, and 16-20 longitudinal costal ridges.

Family Agariciidae Gray, 1847

Genus *Dactylotrochus* Wells, 1954

Diagnosis. –Corallum solitary and always attached. Base polycyclic achieved by thecal bridging of raised costal ridges. Theca and corresponding internal septa divided into several elongate, tapered and sometimes bifurcating thecal extensions. Septa closely spaced and symmetry difficult to determine. Prominent menianes present of septal faces. Columella absent.

Type species. –*Tridacophyllia cervicornis* Moseley, 1881, by subsequent designation (Wells, 1954).

***Dactylotrochus cervicornis* (Moseley, 1881)**

Plate 10, Figs. E-G

Tridacophyllia cervicornis Moseley, 1881: 183-184, pl. 10, figs. 2a-d, 3a. –Bassett-Smith, 1890: 368.

Tridacophyllia primordialis Gardiner, 1899a: 168, pl. 19, figs. 7a-e.

Dactylotrochus cervicornis. –Wells, 1954: 470-471, pl. 178, figs. 1-3. –Fricke & Schuhmacher, 1983: 183, 184. –Scheer & Pillai, 1983: 158-159, fig. 3, pl. 40, fig. 4. –Cairns & Zibrowius, 1997: 131. –Cairns, 1999: 106-107, figs. B, 16a-f. –Cairns et al., 1999: 21. –Randall, 2003: 135. –Tachikawa, 2008: 9, 13, figs. 3a-h. –Cairns, 2009: 14. –Kitahara et al., 2010b.

Type locality. –Unknown.

Type material. –Five syntypes of *T. primordialis* are deposited at the CUMZ (Cairns, 1999).

New records. –SMIB 10: stn. DW 208 (11). –Norfolk 1: stn. DW 1651 (6); stn. DW 1652 (2). –Norfolk 2: stn. DW 2023 (74); stn. DW 2024 (19); stn. DW 2025 (1); stn. DW 2069 (12); stn. DW 2095 (7); stn. DW 2096 (1); stn. DW 2124 (1); stn. DW 2125 (5); stn. DW 2133 (3); stn. DW 2135 (2).

Previous records from New Caledonia. –Gardiner (1899a) and Cairns & Zibrowius (1997).

Description. –Corallum assumed to be solitary, and attached by a robust pedicel (up to 15 mm in diameter) that expand into a thin encrusting base. Larger specimens sometimes display bases almost twice as larger as pedicel. Lower corallum have thin transversal ridges encircling base. Base polycyclic. Costae flat and bearing 2 or 3 small rounded granules. Costae detectable only near calicular edge, fainting towards pedicel. Intercostal striae shallow and narrow. Above pedicel, theca and corresponding internal septa divided into several, elongate, tapered and sometimes bifurcating thecal extensions. Largest thecal extensions originate on the plane of LCD, and can achieve more than 20 mm in basal width, beyond which it bifurcates into two or more smaller extensions. Several other extensions (usually nonbifurcating) are oriented outward from calicular edge. Largest specimen examined (DW 2023) 27.7 x 19.1 mm in CD, 37.6 mm in height, and 15.1 x 14.2 mm in PD. Corallum white.

Septal symmetry difficult to determine. Larger coralla have up to 470 septa, usually progressively narrowing in higher septal cycles and originating closer to calicular edge. Septa closely spaced. Septal faces bear well-developed menianes oriented parallel to septal edge. Fossa deep and narrow. Columella absent.

Distribution. –*New Caledonia*: 215-852 m. –*Elsewhere*: Japan; South China Sea; Red Sea; Philippines; Vanuatu; Wallis and Futuna; Guam; and Marshall Islands; 73-400 m.

Discussion. –The classification of *Dactylotrochus cervicornis* as a solitary species still tentative. Even the large majority of the specimens examined having only one elongate fossa, at least three specimens present some “colonial” features (appears to have two separated mouths in the same corallum). The classification of *D. cervicornis* as Agariciidae will be discussed elsewhere (Chapter 6). Among New Caledonian azooxanthellate scleractinians, *D. cervicornis* is distinguished by its unique thecal extentions and unusual high number of septa.

Genus *Thalamophyllia* Duchassaing, 1870

Diagnosis. –Colonial, forming reptoid colonies by extratentacular budding from thin common basal coenosteum. Corallites ceratoid. Pali and columella absent. Fossa deep, endotheca absent.

Type species. –*Desmophyllum riisei* Duchassaing & Michelotti, 1860, by monotypy.

Thalamophyllia riisei (Duchassaing & Michelotti, 1860)

Plate 10, Figs. H-I

Desmophyllum rusei Duchassaing & Michelotti, 1860: 61, pl. 9, fig. 5. –Keith & Weber, 1970: 271.

Desmophyllum riisei. –Duchassaing & Michelotti, 1864: 66. –Pourtalès, 1880: 96, 106, pl. 1, fig. 14. –Agassiz, 1888: 150, fig. 469. –Goreau & Wells, 1967: 449. –Porter, 1972: 113. –Wells & Lang, 1973: 58. –Lang, 1974: 278, fig. 7. –Land et al., 1977: 170. –Colin, 1978: 289, 290-291. –Castañares & Soto, 1982: table 1.

Thalamophyllia riisei. –Duchassaing, 1870: 28. –Cairns, 1978: 9. –Cairns, 1979: 121-123, pl. 23, figs. 1, 4-6, 9-10 (*in part*: not G-103). –Wood, 1983: 63, 120. –Hubbard & Wells, 1986: 136-138, figs. 27-28. –Viada & Cairns, 1987: 132. –Messing, 1987: 12. –Humann, 1993: 160-161. –Fenner, 1993: 14. –Bayer & Grasshoff, 1997: 11-12. –Cairns et al., 1999: 24. –Cairns, 2000: 98-100, fig. 113. –Romano & Cairns, 2000: 1047. –Reyes et al., 2005: 317, 319. –Cairns, 2009: 14. –Reyes et al., 2009: 14, fig. 3O. –Barbeitos et al., 2010.

Desmophyllum simplex Verrill, 1870: 371, fig. 2. –Gravier, 1920: 81.

Desmophyllum solidum Pourtalès, 1871: 17, pl. 5, figs. 5-6. –Pourtalès, 1880: 96. –Agassiz, 1888: 150, fig. 470.

Lophohelia exigua. –Lindström, 1877: 14.

Cyathoceras riisei. –Vaughan, 1907: 68.

Desmophyllum striatum Cairns, 1979: 121 (in part: Nekton stn. 563).

Desmophyllum reesei. –Bouchon & Laborel, 1986: 204.

Type locality. –St. Thomas (Virgin Islands), depth unknow.

Type material. –The holotype is presumed lost (Cairns, 1979).

New records. –Norfolk 2: stn. DW 2125 (2).

Description. –Both specimens examined solitary, straight or slightly curved, and attached by a slender pedicel (PD:GCD = 0.23-0.37) that expand into a wide encrusting base. Corallum ceratoid and calice flared. Calice elliptical (GCD:LCD = 1.25-1.30); calicular edge slightly serrate. Largest specimen examined (DW 2125) 13.3 x 10.5 mm in CD, 3.6 mm in PD, and about 19.0 mm in height. Theca thin and finely granular. Highly ridged, thin, and finely serrate C1 extends to base. C2 less prominent and usually disappears near pedicel. C3 ridged only near calicular edge. C4 absent. Corallum white.

Septa hexamerally arranged in 4 cycles according to formula: S1>S2>S3>>S4 (largest specimen examined have 46 septa). S1 highly exsert (up to 2 mm), with rounded upper edge, and slightly concave and straight axial edge. S2 slightly less exsert and less wide than S1. S3 quite short near calicular edge but almost as wide as S2 deep in fossa, and have slightly sinuous axial edge. S4 usually starting 3 mm below calicular edge and rudimentary. Broad space separate each adjacent septa. Septal faces bear small granules aligned parallel to septal edge. Fossa extremely deep. Columella absent.

Distribution. –*New Caledonia*: 275-348 m. –*Elsewhere*: United States; Bahamas; Panama; Gulf of Mexico; Colombia; Trinidad; Suriname; 4-914 m.

Discussion. –This is the first record of *Thalamophyllia riisei* outside the Atlantic ocean, and in fact, the specimens examined herein are quite similar to the one illustrated by Cairns (1979: pl. 23, fig. 9), but has more slender septa. Among New Caledonian azooxanthellate corals, *T. riisei* is most similar to *Desmophyllum dianthus*, but is distinguished in having a much thinner theca; less septa at the same CD; and S4 rudimentary and starting lower in fossa.

Thalamophyllia tenuescens **(Gardiner, 1899)**

Plate 10, Figs. J-L

Desmophyllum tenuescens Gardiner, 1899a: 161-162, pl. 19, figs. 1a-b. –Veron, 1986: 608.

Desmophyllum delicatum. –Wells, 1954: 470.

Thalamophyllia tenuescens. –Cairns, 1995: 78, pl. 21, figs. g-i. –Cairns, 1998: 386. –Cairns & Zibrowius, 1997: 133, figs. 17d-e. –Cairns, 1998: 364. –Cairns, 1999: 105. –Cairns et al., 1999: 24. –Cairns, 2004a: 386. –Cairns, 2009: 14.

Type locality. –Sandal Bay (Loyalty Islands), 73 m.

Type material. –Four syntypes are deposited at the BM, and another two syntypes are deposited at the CUMZ (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2040 (2); stn. DW 2042 (4); stn. DW 2095 (15); stn. DW 2096 (2). Additional 4 specimens supposed to be from the same station were not labelled.

Previous records from New Caledonia. –Gardiner (1899).

Description. –Colonies composed of few corallites united basally by thin coenosteum, however, solitary corallites with lateral buds more often collected. Corallites elongate-ceratoid, slightly curved, and usually resembling solitary corallum. Calice perfectly hexagonal in outline in smaller specimens and having two opposite sides wider in larger specimens. Largest corallite examined (DW 2042) 6.0 x 4.2 mm in calicular width, 34.6 mm in height, and bear three small buds about middle way in theca. Theca covered by low rounded granules. C1 highly ridged, slightly serrate and shape the hexagonal cross-section profile of calice. C2-3 slightly ridged and serrate. Costae usually absent on lower 1/3 of corallite. Intercostal spaces flat and broad. Corallum white.

Septa hexamerally arranged in three complete cycles according to formula: S1>S2>S3 (24 septa). S1 slightly exsert and having straight slightly oblique to concave upper axial edge that become vertical deep in fossa. S2 less exsert and less wide than S1, and also have straight axial edge. S3 rudimentary and sometimes absent near calicular edge. Fossa extremely deep.

Distribution. –*New Caledonia*: 73-310 m. –*Elsewhere*: Philippines; Indonesia; Marshall Islands; Wallis and Futuna; Australia; and New Zealand; 8-360 m.

Discussion. –*Thalamophyllia tenuescens* is distinguished from *T. riisei*, in having calice hexagonal in shape; upper corallum not flared; and S3 rudimentary.

"ROBUST" SCLERACTINIAN GROUP

Family Anthemiphylliidae Vaughan, 1907

Genus *Anthemiphyllia* Pourtalès, 1878

Diagnosis. –Solitary, patellate or discoidal, and free. Septotheca thick, porcellanous or costate. Septal edges lobate to laciniate. Pali absent. Columella papillose.

Type species. –Anthemiphyllia patera Pourtalès, 1878, by monotypy.

Anthemiphyllia dentata (Alcock, 1902)

Plate 10, Figs. M-O

Discotrochus dentatus Alcock, 1902a: 104. –Alcock, 1902c: 27, pl. 4, figs. 26, 26a. –Faustino, 1927: 63, pl. 7, figs. 1, 2. –Yabe & Eguchi, 1932b: 443. –Yabe & Eguchi, 1937: 143-145, pl. 20, figs. 15a-c. –Gardiner & Waugh, 1938: 194. –Pillai, 1972: 211. –Pillai & Scheer, 1976: 16.

Anthemiphyllia dentata. –Yabe & Eguchi, 1942b: 128-129. –Eguchi, 1968: C29-30, pl. C6, figs. 12-21. –Zibrowius & Grygier, 1985: 137. –Veron, 1986: 604. –Best & Hoeksema, 1987: 398-399, figs. 9a-c. –Zou et al., 1988: 195. –Grygier, 1991: 39-41 (*in part*: only *Kimbla* stn. 3/2639). –Cairns & Parker, 1992: 16-17, figs. 4e, f (*in part*: only specimens from Western Australia). –Cairns & Keller, 1993: 233, fig. 3E. –Cairns, 1994: 44, pl. 18, figs. d-f. –Cairns, 1995: 41-42, pl. 6, figs. c-g (*in part*: not NZOI stns. K842, K872 and C527). –Grygier, 1995: 85, 87, figs. 3-5. –Cairns & Zibrowius, 1997: 86. –Cairns, 1998: 374-375. –Cairns, 1999: 63. –Cairns et al., 1999: 19. –Randall, 2003: 134. –Cairns, 2004a: 264, 275. –Cairns, 2009: 5. –Kitahara et al., 2010b.

Anthemiphyllia dentatus. –Eguchi, 1965: 285.

Deltocyathus andamanicus. –Keller, 1982: 52 (*in part*: pl. 1, figs. 3, 4, and *Dimitri Mendeleev* stn. 1411).

Type locality. –*Siboga* stns. 95, 98, 100 (Sulu Sea), 350-522 m.

Type material. –Seven syntypes are deposited at the ZMA (van Soest, 1979).

New records. –Bathus 4: stn. DW 914 (4); stn. DW 918 (1); stn. DW 947 (1). –Norfolk 2: stn. DW 2058 (1); stn. DW 2081 (4); stn. DW 2137 (1); stn. DW 2142 (1); stn. DW 2147 (2).

Previous records from New Caledonia. –Zibrowius & Grygier (1985).

Description. –Corallum discoidal or shaped as shallow bowl. All specimens examined free, but displaying a circular to irregular shaped scar at centre of base. Largest specimen examined (DW 2058) 23.3 mm in CD and 4.4 mm in height. Some specimens irregularly shaped as result of fragmentation (during substrate detachment?) or rejuvenation from a parent corallum. Well defined rounded costae usually of different widths (C1-2 slightly wider than C3-5) and separated by deep intercostal furrows become less evident towards base epicentre. Basal scar usually smooth. Sometimes very discrete ridges bisect each intercostal furrow. Costae finely granular bearing 5 to 7 low, rounded granules across width. Corallum white. Soft tissue occurs until basal region where deep furrows separate costae. Base of largest specimen examined have two additional scars that encircle the central one, which is believed to be related to corallum growth.

Septa hexamerally arranged in five complete cycles according to formula: S1-2>S3>S4>S5. Number of septa strongly dependent on corallum size. S1 and S2 distinguished from other septal cycles by their thickness (up to 1 mm). In specimens with CD over 22 mm, S1-2 bear up to 11 prominent septal lobes. Septal lobes circular in cross section near columella, but become increasingly wider and thicker toward calicular edge, sometimes displaying a blunt tip in some specimens. S3 only slightly less wide than S1-2, and bear up to 15 septal lobes. Lobes from most exsert part of S3 slightly wider than those at calicular edge or near columella. Flanked S4 wider than unflanked ones, and bear up to 12 septal lobes. Axial S4 septal lobes sometimes difficult to distinguish from columellar elements. S5 about half-width of S4 and bear laciniate tall and slender teeth. All septal faces (including septal lobes) highly granular. Granules usually separated by non-granular regions that correspond to spaces between septal lobes. Outer region of all septa taller than axial region (more evident in smaller specimens). Fossa shallow, containing a granular, papillose columella composed from a few to numerous papillae.

Distribution. –*New Caledonia*: 470-1032 m. –*Elsewhere*: Japan; South China Sea; Maldives; Arabian Sea; Saya de Malha; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Mariana Islands; Australia; and New Zealand; 50-1050 m.

Discussion. –Among New Caledonian anthemiphylliids, *A. dentata* is distinguished by its larger corallum and corallum shape; up to 5 septal cycles; and number of septal lobes. Several studies have reported petracid galls on *A. dentata* (Zibrowius & Grygier, 1985; Grygier, 1991; Grygier, 1995).

***Anthemiphyllia pacifica* Vaughan, 1907**

Plate 10, Figs. P-Q

Anthemiphyllia pacifica Vaughan, 1907: 79-80, pl. 7, fig. 5. –Maragos, 1977: 164. –Cairns, 1984: 10-11. –Cairns, 1991b: 43. –Cairns, 1999: 65-66, figs. 2g-h. –Cairns et al., 1999: 19. –Cairns, 2006: 47. –Cairns, 2009: 5.

Anthemiphyllia dentata. –Cairns, 1995: 41-42 (*in part*: NZOI stns. K842 and K872).

Type locality. –*Albatross* stn. 3858 (21º01'25''N, 156º47'20''W – off Molokai, Hawaii), 225-252 m.

Type material. –The holotype and paratypes are deposited at the NMNH (Cairns, 1991b).

Material examined. –Musorstom 5: stn. DW 290 (1). –Bathus 4: stn. DW 902 (1).

Description. –Corallum trochoid and firmly attached by a robust pedicel: PD:GCD = 0.64. Calice circular. Largest specimen examined (DW 290) 8.2 mm in CD, 8.1 mm in height and 5.2 mm in PD. Epitheca well-developed and rises above upper outer septal edges as a circular lip. First millimetre of epitheca bear several thin transversal striae. Low, slightly convex and very finely granular costae extend from transversal striae to base. Costae equal in width and separated by shallow intercostal grooves. Very thin ridges bisect each intercostal groove. Corallum white.

Septa hexamerally arranged in 4 cycles (48 septa) according to formula: S1>S2>S3-4. S1 most exsert septa, being separated from calicular lip by a small pointed tooth. S1 straight with vertical outer and axial edges. At half distance to columella, S1 bisected by 2 or 3 large and circular in cross section septal lobes. S2 slightly smaller than S1 but otherwise similar. S3 smaller and slightly less exsert than S2. However, main S3 septal lobe is much smaller if compared with those of S1 or S2. Deep in fossa, S3 bear 2 or 3 smaller septal lobes. S4 less prominent septa, only reaching half-distance to columella and usually composed of 4 or 5 small septal lobes. All septal lobes smooth or finely granular. Upper edge of main septal lobe usually bear small and low ridges perpendicular to septal edge. Robust and almost rectangular granules cover septal faces. Fossa of moderate depth, containing a granular, papillose columella composed of 7(?) papillae.

Distribution. –*New Caledonia*: 300-351 m. –*Elsewhere*: Hawaii; Vanuatu; Australia; and New Zealand; 205-342 m.

Discussion. –Aside *Anthemiphyllia pacifica*, other 6 species are recognized in this family: *A. dentata*; *A. frustum* Cairns, 1994; *A. macrolobata* Cairns, 1999; *A. multidentata* Cairns, 1999; *A. patera costata* Cairns, 1999; *A. patera patera* Pourtalès, 1878; and *A spinifera*. Apart from *A. dentata* discussed previously, only *A. pacifica*, *A. macrolobata*, and *A. p. patera* have specimens been reported to be attached. However, *A. pacifica* is distinguished in having well-developed epithecal bands, especially near calicular edge, where epitheca is transversely corrugated. Among New Caledonian anthemiphylliids, *A. pacifica* was the only representative to have firmly attached trochoid corallum.

Anthemiphyllia patera costata Cairns, 1999

Plate 11, Figs. A-C

Anthemiphyllia patera costata Cairns, 1999: 66-67, figs. 3e-h, 4a-b. –Cairns et al., 1999: 19. –Cairns, 2009: 5. –Kitahara et al., 2010b.

Type locality. –*Musorstom 7* stn. DW 586 (13º10.7’S, 176º13.1’W – North of Wallis), 510-600 m.

Type material. –The holotype and 29 paratypes are deposited at the MNHN. Thirty-nine additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Bathus 3: stn. DW 786 (15). –Norfolk 2: stn. DW 2066 (4); stn. DW 2070 (3); stn. DW 2075 (3); stn. DW 2080 (6); stn. DW 2086 (1); stn. DW 2103 (2); stn. DW 2104 (1).

Description. –Corallum shaped as a small bowl. Largest specimen examined (DW 2103) 10.0 mm in CD and 5.4 mm in height. All examined coralla free, but all display a smooth to porcellanous circular to elliptical scar 2 to 3 mm in diameter at centre of base. Costae well-developed, ridged, equal in width, and separated by deep and narrow intercostal striae. Majority of costae reach outer border of basal scar. Costae granular, 4 to 6 small granules occurring across costal width near calicular edge. Granules more prominent near calicular edge than near basal scar. Corallum white.

Septa hexamerally arranged in 4 complete cycles (48 septa) according to formula: S1>S2-3>S4. All septa bear septal lobes dependent in number to corallum size. S1 robust, independent, and bearing 6 to 8 massive, granular, and irregularly shaped lobes. Fifth septal lobe is usually the tallest. S2 as robust as S1 but slightly smaller, and bear 7 to 9 septal lobes similar in shape to those from first cycle. S3 similar to S2 in profile. Each pair of S3 within a system fuses to flanked S2 near columella. S4 independent, half-size of S2-3, and bear 4 or 5 small septal lobes. Axial edge of S4 vertical and laciniate. Angle between septal lobes and columella increase towards calicular edge, and axialmost lobes usually less ornamented if compared to middle septal ones. All septa have granular faces. Fossa extremely shallow, containing a well-developed, massive columella.

Distribution. –*New Caledonia*: 650-1150 m. –*Elsewhere*: Wallis and Futuna; 320-700 m.

Discussion. –The new records presented herein are the first report of this species since its description and are virtually indistinguishable from the type series. *A. p. costata* is distinguished from New Caledonian congeners that do not undergo transverse division in having small corallum size; only four septal cycles; massive columella; and S2-3 about the same size. For a comparison between *A. p. costata* and the Atlantic *A. p. patera* see Cairns (1999).

Anthemiphyllia spinifera **Cairns, 1999**

Plate 11, Figs. D-F

Discotrochus sp. Alcock, 1902c: 27-28.

Deltocyathus andamanicus. –Keller, 1982: 52 (*in part*: pl. 1, figs. 5a-b).

Anthemiphyllia spinifera Cairns, 1999: 67-69, figs. A, 4c-j. –Cairns et al., 1999: 19. –Romano & Cairns, 2000: 1047. –Cairns, 2004a: 275-276. –Cairns, 2009: 5.

Type locality. –*Musorstom* 7 stn. DW 605 (13º21.3'S, 176º08.4'W – southeast of Wallis), 335-340 m.

Type material. –The holotype is deposited at the MNHN. The paratypes are deposited at NMNH (10) and MNHN (40) (Cairns, 1999).

New records. –Bathus 4: stn. CP 889 (1). –Norfolk2: stn. DW 2117 (9); stn. DW 2142 (1); stn. DW 2144 (1)

Description. –Corallum small, discoidal, with a flat to slightly convex base and vertical lateral edges. Calice circular to slightly polygonal (the latter as result of long lateral spines). Largest specimen examined (DW 2117) 9.5 mm in GCD and 4.0 mm in height. All examined coralla free, but all have a smooth to porcellanous, usually concave, circular to elliptical scar up to 2.5 mm in diameter at centre of base. Shallow intercostal furrows separate low, slightly concave and equally wide costae. Majority of costae extend from calicular edge to outer scar edge. However, costa that bears long spines occurs only near calicular edge. Larger specimens have porcellanous base turning costae difficult to distinguish. Usually six straight, elongate, smooth to sparse granular costal spines project from calicular edge. Angle formed by costal spines and base usually between 170º and 180º. Placement of costal spines very peculiar, and usually associated with S3 flanked by pairs of S4, one of which occurs in each half-system (see Cairns 1999). Amongst specimens examined, 7 display costal spines equal to those reported by Cairns (1999), however, 3 specimens have additional spines (always related to C3) displaying up to 10 spines. Corallum usually white with reddish-brown septal lobe tips. Soft tissue does not completely invest skeleton, being absent from the level of costal spines to base.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S3>>S4 (48 septa). S1 independent, extend to columella, and bear 5 to 7 granular and irregular shaped lobes. Innermost lobes slightly inclined toward columella and peripheral ones perpendicular to septal edge. S2 equal to slightly smaller than S1, but otherwise similar. S3 4/5 the size of S2, and bear 4 to 6 slightly smaller lobes. Near columella, axial edges of a pair of S3 fuse to flanked S2. S4 half size of S3, bearing 3 or 4 slender lobes. A narrow circumferential delineation about half-distance to columella is formed by different septal lobe angles. Septal faces ornamentation consists of low to tall, pointed, sparse granules. Fossa shallow, containing a massive columella. Columellar elements usually basally fused and distinguished from axial septal lobes.

Distribution. –*New Caledonia*: 400-1009 m. –*Elsewhere*: Philippines; Indonesia; Malaysia; Wallis and Futuna; Vanuatu; and Australia; 282-650 m.

Discussion. –*A. spinifera* is the only species in the family to have costal spines.

Family A

Genus *Deltocyathus* Milne Edwards & Haime, 1848

Diagnosis. –Solitary, discoidal to patellate, usually free. Septotheca costate. Septa arranged in 4-5 cycles, only S1 being independent. Pali before all but last cycle. Axial edges of higher cycle pali join to faces of adjacent septa (*deltas*). Columella papillose.

Type species. –*Turbinolia italica* Michelotti, 1838, by monotypy.

Deltocyathus cameratus **Cairns, 1999**

Plate 11, Figs. G-I

Deltocyathus cameratus Cairns, 1999: 95, figs. 12g-i, 13a. –Cairns, 2004a: 280. –Kitahara & Cairns, 2009: 1, 2, 4, 12-13, figs. 1I. –Cairns, 2009: 12.

Type locality. –Musorstom 8 stn. CP 1007 (18º52'S, 168º 52'E - Erromango, Vanuatu), 720-830 m.

Type material. –The holotype and 53 paratypes are split between the MNHN (38) and (15) at the NMNH (Cairns, 1999).

New records. –Norfolk 2: stn. DW 2024 (1); stn. DW 2060 (1); stn. DW 2075 (1).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Calice circular with lancetted margin. Lancets correspond to each C3 and C4 that project outward. All costae ridged and covered with low rounded granules. Intercostal grooves more prominent at calicular edge, where they bear pointed spines. Between C3 and C4, intercostal grooves slightly shallower than others, and just C1 and C2 originate at centre of base. C4 smaller than C3. Base slightly conical. Corallum white but reddish-brown in well-preserved coralla.

Septa hexamerally arranged in 4 complete cycles (S1>S2>S4>S3). S1 only independent septa and extend half-distance to columella. Each S1 bears a lamellar paliform lobe, that altogether encircle columella forming a palar crown. S2 less wide and less exsert than S1, bearing a palus more recessed from columella than P1. S3 smallest septa, but posses the tallest palus. P3 fuse to S2 in a well-developed lamellar structure. P3 form outermost crown. S4 less exsert but slightly wider than S3. Each pair of S4 fuses to common S3 with a porous lamella. All septa and palar faces coarsely granulated. Fossa nonextant containing a well-developed papillose columella composed of 10-15 granular rods.

Distribution. –*New Caledonia*: 370-1000 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; and Australia; 305-1175 m.

Discussion. –Among the other four non-spined species of *Deltocyathus* from New Caledonia with four septal cycles, *D. cameratus* is distinguished by the conical base with pointed centre, calicular margin lancetted, and the well-developed lamellar fusions of the S4 to P3 and S3 to P2.

Deltocyathus corrugatus **Cairns, 1999**

Plate 11, Figs. J-L

Deltocyathus corrugatus Cairns, 1999: 98. –Cairns et al., 1999: 21. –Kitahara & Cairns, 2009: 235, 243-244, figs. 1G. –Cairns, 2009: 12.

Type locality. –NZOI stn. P27 (28º54’36’’S, 167º44’12’’E - Norfolk Islands), 390 m.

Type material. –The holotype and 5 paratypes are at the NZOI. Ten additional paratypes are at the NMNH (Cairns, 1999).

New records: –Bathus 4: stn. DW 888 (1); stn. CP 899 (1); stn. CP 900 (2); stn. DW 943 (1); stn. DW 944 (6); stn. DW 945 (1).

Previous records from New Caledonia. –Cairns (1999 [*in part*: as *D. ornatus*]) and Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular. Calice lancetted, lancets correspond to each C3 flanked by C4. Largest specimen examined by Kitahara & Cairns (2009) 15 mm in CD and 4.2 mm in height. Corallum usually white but sometimes slightly reddish-brown pigmented. Base flat to slightly convex, having a small scar of previous attachment (during early stages) in centre. All costae well-developed. C1-2 more prominent near calicular edge, becoming a row of granules near centre of base. C3 thickest and tallest costae, extending up to 2 mm and normally upturned slightly beyond calicular edge as granulated costal spines. C4 and C3 form a broad three-step ridge. Costae granular especially near calicular edge.

Septa hexamerally arranged in 4 complete cycles (S1≥S2>S4>S3). S1 independent, extending half-distance to columella and bearing a wide lamellar palus, which is often fused to columella. S2 equal to or slightly less wide than S1, also bearing a palus of same size of P1, forming a crown more recessed from columella than that formed by P1. S3 smallest septa, each bearing a tall palus that fuses to adjacent P2. S4 slightly wider than S3, and have a spinose margin. Each S4 fuses to adjacent P3 through a long porous lamella. All pali equal sized (P1 sometimes dimorphic) and septa and palar faces bear pointed granules. Fossa shallow with an elliptical papillose columella.

Distribution. –*New Caledonia*: 250-620 m. –*Elsewhere*: Australia; New Zealand; 280-390 m.

Discussion. –See discussion of *D. ornatus*.

***Deltocyathus crassiseptum* Cairns, 1999**

Plate 11, Figs. M-O

Deltocyathus crassiseptum Cairns, 1999: 94, figs. 12c-f. –Cairns et al., 1999: 21. –Kitahara & Cairns, 2009: 235, 244, figs. 1H. –Cairns, 2009: 12.

Type locality. –*Musorstom 8* stn. CP 980 (19º21'S, 169º25'E – Tanna, Vanuatu), 433-450 m.

Type material. –The holotype and 78 paratypes are deposited at the MNHN. Thirty-nine additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Norfolk 2: stn. DW 2098 (2).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular to slightly elliptical shaped as a shallow bowl. Theca thick. Base flat to slightly convex, usually with a scar, and sometimes protuberant. Largest specimen examined by Kitahara & Cairns (2009) 14.2 mm in calicular diameter and 4.6 mm in height. However, smaller coralla show a CD:HT ratio near 2. Costae unequal in width and more prominent at calicular edge where intercostal grooves bisected by a row of low and rounded granules separate them. C1-2 broader than other costae. Corallum white to reddish-brown.

Septa hexamerally arranged in 4 cycles (48 septa) with septal formula: S1>S2>S3>S4. Larger specimens have some S5. S1 thick and most exsert septa, extending half distance to columella and bear a dimorphic lamellar paliform lobe. Those paliform lobes from principal S1 are narrower than other P1, but all reach columella. S2 equal to slightly smaller and less exsert than S1, also bearing a paliform lobe that reaches columella by a small paliform teeth. S3 about 3/4 width of S2, bearing a tall recessed palus that fuses P2 in a chevron arrangement. S4 smallest septa and in some coralla composed of a row of spines. All septal and palar faces very granular. Fossa shallow to moderately deep, containing a papillose columella.

Distribution. –*New Caledonia*: 370-668 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; 413-536 m.

Discussion. –*D. crassiseptum* is distinguished from the New Caledonia congeners by having: a slighty thicker S1-2 in relation to the other septa, corallum shaped as a bowl, absence of costal spines, well arranged crowns formed by paliform lobes, and paliform lobes and columellar elements that terminate below septal upper edges. Different pigmentation patterns can be found in New Caledonia specimens of *D. crassiseptum*: some have the entire calicular edge and septa reddish-brown, other specimens have only the S3 and paliform lobes pigmented, some are completely pigmented and some are entirely white.

Deltocyathus heteroclitus Wells, 1984

Plate 11, Figs. P-R

Deltocyathus heteroclitus Wells, 1984: 210, figs. 3, 1-6. –Cairns & Zibrowius, 1997: 124. –Cairns, 1999: 69, 97-98, figs. 13 d-g, text-fig. A. –Cairns et al., 1999: 21. –Kitahara & Cairns, 2009: 235, 242-243, figs. 1F. –Cairns, 2009: 12.

Type locality. –Navaka River, Espiritu Santo, Vanuatu (Late Pleistocene).

Type material. –The holotype and 5 paratypes are deposited at the NMNH (Wells, 1984).

New records. –Bathus 4: stn. 886 (2); stn. DW 943 (1). –Norfolk 2: stn. 2135 (1).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum polygonal and lancetted in calicular margin, each lancet corresponding to each P3 and P4. Largest specimen examined by Kitahara & Cairns (2009) 11.9 mm in CD and 4.1 mm in height. Base conical with a pointed centre, but one specimen (BATHUS 4, stn DW 887) have a large depression at middle of base. All costae well-developed and equal sized, extending from calicular margin to centre of base, being separated by shallow intercostal furrows. However, when flanked, C3 are broader and most prominent costae, extending up to 1 mm beyond calicular edge forming robust costal spines, not reaching centre of base. All costae bear several granules near calicular edge. Corallum white.

Septa hexamerally arranged in 4 cycles (S1>S2>S4>S3), however, no specimen examined have a complete fourth cycle, usually resulting in 39-42 septa. Number of spines (C3) dependent of number of flanked S3. S1 only independent septa extending 1/2 to 3/4 distance to columella, being separated from a lamellar palus by a slender notch. S2 slightly smaller than S1 but bear a wider palus. S3 dimorphic in size: those unflanked by S4 slightly smaller than S2, being fused by axial edges to adjacent P2; however, those S3 flanked by S4 are the smallest septa, but bear the widest and tallest paliform lobe, and sometimes 2 or 3 small paliform teeth near columella. P3 most recessed pali from columella and have high granular, sinuous upper edge. S4 fuse to adjacent P3 through a solid lamella at level of S3-P3 notch. All septal faces granulated and slightly sinuous at upper edge. Fossa shallow, containing an elliptical papillose columella composed of several granular elements.

Distribution. –*New Caledonia*: 245-600 m. –*Elsewhere*: Wallis and Futuna; and Vanuatu 208-335 m.

Discussion. –See Kitahara & Cairns (2009) identification key and discussion of *D. ornatus*.

Deltocyathus inusitatus Kitahara & Cairns, 2009

Plate 11, Figs. S-U

Deltocyathus inusitatus Kitahara & Cairns, 2009: 245-246, figs. 1J. –Cairns, 2009: 12. –Kitahara et al., 2010b.

Type locality. –*Norfolk 2* stn. DW 2097 (24º44’S, 168º06’E - Bank Kaimon Maru, New Caledonia), 580-583 m.

Type material. –The holotype and six paratypes are deposited at the MNHN. Two additional paratypes are deposited at the NMNH (Kitahara & Cairns, 2009).

New records. –Norfolk 2: stn. DW 2035 (4); stn. DW 2081 (1); stn. DW 2106 (1); stn. DW 2113 (1); stn. DW 2147 (11); stn. DW 2157 (1).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum free and patellate, with flat to very slightly convex base. Well-preserved coralla show a small and usually convex epicentre boss in base. Specimens range from 11 to 13.4 mm in GCD and 2.9 to 4 mm in height. Holotype measures 13.3 x 13.2 mm in CD and 3.6 mm in height. Well-preserved specimens have a circular calice, and worn specimens appear to have a polygonal margin. Calicular margin not lancetted or serrate, projection of all septa being equal. Costae granular and more conspicuous near calicular edge, where shallow intercostal grooves separate them. Granules small and low, becoming more slender and taller near calicular edge. All specimens analyzed show a reddish-brown to purple calicular edge, including all septal edges and approximately 3 mm of base edge in direction to centre.

Septa always hexamerally arranged in 5 incomplete cycles (S1≥S2>S3≥S5>S4), normally having 69 to 72 septa. All systems display two dimorphic half-systems: one composed of 1 S1, 1 S2, 1 S3, 2 S4, and 4 S5; and other composed of 1 S1, 1 S2, 1 S3 and 2 S4. S1 about 1.8 mm exsert and only independent septa, extending half-distance to columella. P1 well-developed and separated from S1 by a wide notch which contains a slender paliform tooth. S2 similar in shape and exserteness, but sometimes slightly less wide than S1. Notch separating S2 from their paliform lobes less wide than those of S1, and sometimes bearing a small paliform tooth. One to 3 paliform teeth occurs at region that S3 joins S2. S3 dimorphic in width, those in half-systens lacking S5 equal to slightly less wide than flanking S4 (specially S4 near S1), extending 1/4 to 1/2 distance to columella. P3 as wide as S3, and separated by a small notch. However, those S3 in half-systens with S5 are larger than flanking S4, extending about 1/3 distance to columella. Before joining columella, all P3 usually bear 1 to 4 paliform teeth. Axial edges of each pair of S5 solidly fused as a thick lamella to outer edge of adjacent P4. Usually those S5 beside S1 or S2 are wider than other S5. P4 of crowded half-systens join P3 at approximately 3/5 distance from columella and in half systems without S5, P4 fuse P3 as thick lamella. P3 join P2 near columella and axial edges of P1 and P2 fuse to columella. All septa and palar faces bear sparse, pointed granules. Fossa extremely shallow to nonextant, containing a well-developed papillose columella, consisting of 7 to 20 often fused granular rods.

Distribution. –*New Caledonia*: 410-966 m.

Discussion. –Among the 24 Recent species belonging to the genus *Deltocyathus*, *D. inusitatus* can most be distinguished by its unusually dimorphic septal cycles, one half system composed of 1 S1, 1 S2, 1 S3, 2 S4, and 4 S5, and the other composed of 1 S1, 1 S2, 1 S3 and 2 S4. All specimens consist of 3 half-systems with S5 oriented to the right of the half systems with less septa, and 3 to the left. Other characters are the flat base, all septa extending same distance beyond the calicular margin, and usually a small paliform tooth occurs between S1 and P1. Two examined specimens (DW 2087) display evidence of calicular regeneration.

Deltocyathus ornatus **Gardiner, 1899**

Plate 11, Figs. V-W

Deltocyathus ornatus Gardiner, 1899: 163-164, pl. 20, figs. 25a-b. –Gardiner & Waugh, 1938: 195. –Veron, 1986: 606. –Cairns, 1999: 98, figs. 13 h-i. –Cairns et al., 1999: 21. –Cairns, 2004a: 280. –Kitahara & Cairns, 2009: 235, 242, figs. 1E. –Cairns, 2009: 12. –Kitahara et al., 2010b.

Type locality. –Sandal Bay (Loyalty Islands), 73 m.

Type material. –The holotype is deposited at the BM (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2136 (1); stn. DW 2142 (1).

Previous records from New Caledonia. –Gardiner (1899) and Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular, lancetted and shaped as a shallow bowl with upturned edges. Base flat to slightly concave, sometimes with small scar at centre. C1-2 equal and always reach centre of base, being separated from adjacent costae by moderately deep intercostal furrows. C3 most developed costae projecting up to 1.5 mm beyond calicular edge as 12 granular spines. C4 do not reach centre of base, but fuse adjacent C3 beyond calicular margin producing 12 well-developed apexes. Corallum white.

Septa hexamerally arranged in 4 cycles (S1>S2>S4>S3). S1 only independent septa, extending ¾ distance to columella, being separated from their dimorphic paliform lobe (as in *D. crassiseptum*) by a deep notch. S2 slightly narrower than S1 and bear a small palus. S3 smallest septa (1/3 of S2) but bear largest paliform lobes, which fuse to P2 near columella. S4 fuses outer edge of flanked P3. Fossa shallow, containing an elliptical papillose columella aligned to principal S1. Columella consists of small, short, fused tuberculate papillae.

Distribution. –*New Caledonia*: 73-550 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; and Australia; 295-360 m.

Discussion. –Among the five spined species of *Deltocyathus* three occur in New Caledonia waters: *D. ornatus, D. heteroclitus, and D. corrugatus*. *Deltocyathus ornatus* and *D. corrugatus* are separated from *D. heteroclitus* using the number of spines present: 12 versus 6-8 in *D. heteroclitus*, and the P1 dimorphism: dimorphic in *D. ornatus* and *D. corrugatus* and not dimorphic in *D. heteroclitus.* However, the differences between the other two species with 12 spines that occur in New Caledonia region are very subtle: *D. corrugatus* usually posses a circular basal scar; C3 are very prominent; and they have longer and more slender costal spines (also see Cairns [1999]).

***Deltocyathus rotulus* (Alcock, 1898)**

Plate 12, Figs. A-C

Trochocyathus rotulus Alcock, 1898: 16, pl. 2, figs. 1, 1a.

Deltocyathus fragilis Alcock, 1902a: 99-100. –Alcock, 1902c: 21, pl. 1, figs. 15, 15a.

Deltocyathus rotulus. –Van der Horst, 1931: 6. –Gardiner & Waugh, 1938: 196. –Yabe & Eguchi, 1937: 129. –Keller, 1982: 50. –Cairns & Keller, 1993: 245, pl. 5, fig. I. –Cairns, 1994: 55-56, pl. 24, figs. j-k. –Cairns & Zibrowius, 1997: 125-126, figs. 16 a-c. –Cairns et al., 1999: 22. –Cairns, 1999: 91-92. –Cairns, 2004a: 280. –Kitahara & Cairns, 2009: 235, 238-239, figs. 1B. –Cairns, 2009: 12. –Kitahara et al., 2010b.

Type locality. –North Maldive Atoll, 1408-1756 m.

Type material. –The holotype is presumed to be deposited at the IM (Cairns, 2004a).

New records. –Norfolk 2: stn. DW 2080 (1).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular to slightly elliptical with lancetted calicular margin. Each apex corresponds to those C4 flanked by a pair of C5. Base normally slightly conical and pointed in centre. However, largest specimen examined by Kitahara & Cairns (2009) (CP 842) is 19 mm in CD and 4 mm in height, showing a flat base with upturned edges. Costae more prominent near calicular edge as low serrate ridges. Only C1-3 extend to centre of base. C5 slightly wider than C4. Corallum white to reddish-brown.

Septa hexamerally arranged in 5 cycles according to formula: S1-2>S3>S4>S5. S1-2 do not fuse to any adjacent septa, each bearing a palus about 1-2.5 mm wide. S3 less exert with irregularly shaped paliform lobes, sometimes P3 wider than P1-2, but some specimens have very small P3. Adjacent to P3, sometimes 2 or 3 small paliform teeth present near columella. S4 less wide and exsert than S3 but bear a wide and tall palus, producing a prominent palar crown encircling columella. Each P4 fuses to flanked P3 near columella. S5 fuses to axial edge of adjacent P4 close to basal theca through a long and porous lamella. Fossa extremely shallow containing a well-developed papillose columella composed of several interconnected rods.

Distribution. –*New Caledonia*: 699-830 m. –*Elsewhere*: South Africa; Mozambique; Tanzania; Zanzibar; Maldive Islands; Yemen; Sri Lanka; Japan; Philippines; Indonesia; Malaysia; Wallis and Futuna; Vanuatu; and Australia; 143-1986 m.

Discussion. –Among the deltocyathids from New Caledonia with five septal cycles, *D. rotulus* is distinguished from *D. suluensis* by having a scalloped calicular edge, a pigmented columella and paliform lobes, and paliform lobes that reach the same high of the septa. For comparism with "*Deltocyathus*" *magnificus* see account of that species under "*incerta sedis*".

Deltocyathus suluensis **Alcock, 1902**

Plate 12, Figs. D-F

Deltocyathus italicus. –Alcock, 1902c: 19 (in part).

Deltocyathus magnificus var. *suluensis* Alcock, 1902c: 20-21. –Faustino, 1927: 76-77. –Yabe & Eguchi, 1937: 129. –van Soest, 1979: 111, pl. 2, figs. 3-4.

Deltocyathus formosus Cairns, 1995: 73-74, pl. 19, figs. f, g.

Deltocyathus suluensis. –Cairns & Zibrowius, 1997: 125, fig. 16d. –Cairns, 1998: 382. –Cairns, 1999: 92. –Cairns et al., 1999: 22. –Cairns, 2004a: 281. –Kitahara & Cairns, 2009: 235, 239-240, figs. 1C. –Cairns, 2009: 12. –Kitahara et al., 2010b.

Type locality. –*Siboga* stns. 95 and 100 (5º43'N, 119º40'E and 6º11'N, 120º37'E - Sulu Archipelago, Philippines), 450-522 m.

Type material. –Six syntypes are deposited at the ZMA, and another is deposited at the IM (van Soest, 1979).

New records: –Bathus 4: stn. DW 888 (2); stn. CP 892 (1); stn. CP 950 (2). –Norfolk 2: stn. DW 2098 (1); stn. DW 2142 (2); stn. CP 2143 (4).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular with base flat to slightly convex. Calicular margin serrate but not lancetted. Largest specimen examined by Kitahara & Cairns (2009) (DW 786) 22 mm in CD and 7 mm in height. Costae occur as round granular ridges separated by well-defined, equally wide, intercostal furrows. Only C1-2 originates at centre of base.

Septa hexamerally arranged in 5 complete cycles (S1≥S2>S3>S4>>S5). S1 only independent septa and extend half distance to columella, being separated from their pali by a moderately wide notch. Higher septal cycles progressively less wide. S1-4 and P1-4 arranged in a typical *Deltocyathus* fashion, fusing through porous processes. S5 rudimentary. Fossa shallow, containing a well-developed papillose columella.

Distribution. –*New Caledonia*: 416-752 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 142-1050 m.

Discussion. –See discussion of "*Deltocyathus*" *magnificus* and *D. rotulus*.

***Deltocyathus vaughani* Yabe & Eguchi, 1932**

Plate 12, Figs. G-I

Levipalifer orientalis Vaughan, 1900: 201-202, pl. 16, figs. 3-7.

Deltocyathus vaughani Yabe & Eguchi, 1932e: 388-389. –Yabe & Eguchi, 1937: 130, 135-138, pl. 20, figs. 11a-c, 12a-c. –Yabe & Eguchi, 1942b: 113, 126. –Eguchi, 1965: 287, 3 figs. –Eguchi, 1968: C35. –Eguchi & Miyawaki, 1975: 57. –Zibrowius & Grygier, 1985: 121, fig. 12. –Hu, 1987: 39. –Cairns, 1994: 54-55, pl. 23, figs. i-j, pl. 24, figs. a-c, f. –Grygier, 1995: 85, fig. 2. –Cairns & Zibrowius, 1997: 122. –Cairns, 1999: 93-94. –Cairns et al., 1999: 22. –Kitahara & Cairns, 2009: 235, 240, 242, figs. 1D. –Cairns, 2009: 12.

Type locality. –Bosyu (Japan), depth unknown.

Type material. –The holotype of *Levipalifer orientalis* is deposited at the NMNH (Cairns, 1994).

New records. –Norfolk 2: stn. DW 2049 (3).

Previous records from New Caledonia. –Kitahara & Cairns (2009).

Description (after Kitahara & Cairns [2009]). –Corallum circular with base flat to slightly convex bearing a small epicentre boss. Largest specimen examined by Kitahara & Cairns (2009) (DW 2037) 21 mm in CD and 9.1 mm in height. Costae rounded, granular and separated by deep intercostal furrows at calicular edge. Near calicular edge, lateral faces of costae bear numerous pointed granules. All costae extend to base as a row of low and round granules, except for those of C3 and C4, which do not reach centre of base. Corallum white.

Septa hexamerally arranged in 4 complete cycles (S1>S2>S4>S3) for a total of 48 septa. S1 highly exsert and only independent septa, almost reaching columella and bearing a wide lamellar paliform lobe that fuses to columella. S2 less exsert and wide than S1, each bearing a paliform lobe (P2) recessed from columella moreso than P1. S3 smallest septa, bearing a wide palus. S4 as exsert as S3, slightly wider and often bear a narrow paliform lobe, which fuses to enclosed P3. If P4 absent, axial edge of S4 fuses to P3. All septal and palar faces show sparsely pointed granules. Fossa shallow, containing and elongate columella composed of small interconnected, sometimes granulated papillae.

Distribution. –*New Caledonia*: 470-621 m. –*Elsewhere*: Japan; Philippines; Indonesia; and Vanuatu; 88-1097 m.

Discussion. –Among the three New Caledonia *Deltocyathus* representatives that do not have spines at the calicular edge and have four septal cycles (*D.vaughani*, *D. cameratus*, *D. crassiseptum*), *D. vaughani* is distinguished by having: a more robust corallum, a non-jagged calicular edge, all septa reaching the same distance from calicular margin, dimorphic S4 (those S4 near flanking S1 are larger than S3 and those flanking S2 are equal in width to S3) and the presence of P4. According to Cairns (1994) the presence of P4 can be used to distinguish this species from all other deltocyathids with four septal cycles. Petracid galls were recorded in specimens of *D. vaughani* from Japanese waters (Zibrowius & Grygier, 1985; Cairns, 1994; Grygier, 1995).

Family B

Genus *Aulocyathus* Marenzeller, 1904

Diagnosis. –Corallum solitary, ceratoid and free. Evidence of budding from a longitudinally fragmented parent corallum common. Costae poorly defined. Upper, outer septal edges join theca below upper thecal edge, usually forming a calicular thecal rim. Slender paliform lobes occasionally present on S1-3. Columella trabecular.

Type species. –*Aulocyathus juvenescens* Marenzeller, 1904a, by monotypy.

Aulocyathus recidivus (Dennant, 1906)

Plate 12, Figs. J-K

Ceratotrochus recidivus Dennant, 1906: 159-160, pl. 6, figs. 1-2. –Howchin, 1909: 246. –Squires, 1961: 18. –Squires, 1969: 16. –Zibrowius, 1980: 107. –Stranks, 1993: 20-21.

Ceratotrochus (Conotrochus) typus. –Wells, 1958: 265-266, pl. 1, figs. 14-15.

Ceratotrochus typus. –Squires, 1961: 18.

Paracyathus conceptus. –Squires & Keyes, 1967: 23 (*in part*: NZOI stn. C648, pl. 2, figs. 7-8).

Aulocyathus recidivus. –Cairns, 1982: 25-26, pl. 7, figs. 7-9, pl. 8, fig. 1. –Veron, 1986: 607. –Cairns & Parker, 1992: 22-24, pl. 6, figs. d-e, g-h. –Cairns & Keller, 1993: 247, pl. 5, fig. C. –Cairns, 1994: 59-60, pl. 26, figs. a-b. –Cairns, 1995: 75, pl. 20, figs. c-f. –Cairns & Zibrowius, 1997: 129-130. –Cairns, 1999: 103-104. –Cairns et al., 1999: 19. –Cairns, 2004a: 276, fig. 3D. –Cairns, 2009: 13.

Type locality. –Off Cape Jaffa and Neptune Island (South Australia), 165-190 m.

Type material. –Five syntypes are deposited at the NMV (Stranks, 1993).

New records. –Bathus 3: stn. CP 822 (2). –Halipro 1: stn. CP 850 (1). –Norfolk 2: stn. DW 2046 (2); stn. DW 2047 (9); stn. DW 2053 (4); stn. DW 2065 (1); stn. DW 2066 (2); stn. DW 2111 (1). –One specimen not labeled.

Description. –Corallum ceratoid to cornute, and slightly curved. Calice circular to slightly elliptical; calicular edge evenly serrate, a very small rounded apex corresponding to each septum. Largest specimen examined (DW 2047) 12.4 x 12.8 mm in CD and 23.5 mm in height. Corallum usually still attached (basally and laterally) to a parent corallum from which it supposedly asexually budded. However, some specimens even showing the same pattern of lateral and basal attachment display other types of substratum. Theca well-developed and costae more evident near calicular edge, being flat to slightly ridged, equal in width, and bearing low and randomly placed granules giving it a rough texture (as sand paper). Upper thecal edge extends slightly further than upper distal septal edges, forming a calicular rim marked by a notch in small specimens, and as a septal angle change in larger specimens. Some small transverse thecal ridges occur in some specimens. Theca often highly encrusted by other organisms. Theca light-brown in color, otherwise corallum white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2≥S3>S4 (48 septa). In smaller specimens S1 project above calicular rim, but in larger specimens no septum projects beyond calicular rim. S1 extend to columella with straight and vertical axial edge (1 specimen examined [DW2065] has sinuous S1-2 axial edges). S2 about ¾ width of S1, and have a straight to slightly sinuous axial edge. S3 equal or slightly smaller than S2 and have a sinuous low axial edge. S4 ½ to ¾ width of S3. Septal faces bear scarce low, rounded to pointed granules. Paliform lobes indistinguishable from columellar elements. Fossa deep, containing a papillose columella composed of up to 30 tall and slender granular papillae.

Distribution. –*New Caledonia*: 541-1074 m. –*Elsewhere*: Japan; Indonesia; Malaysia; Wallis and Futuna; Madagascar; Australia; New Zealand; and 128-1137 m.

Discussion. –Even though not included in the scleractinian phylogenetic hypothesis from Kitahara et al. (2010b), due to its morphological characters, it is expected that *Aulocyathus recidivus* would group with representatives of "Family B". However, its position within this family is just tentative. The genus *Aulocyathus* is composed of four extant species, all but *A. atlanticus* Zibrowius, 1980 are reported from the Pacific ocean. *A. recidivus* is distinguished in having a notch separating theca and upper outer septal edges.

Genus *Conotrochus* Seguenza, 1864

Diagnosis. –Solitary, ceratoid to trochoid, free or attached through a small pedicel, which is often augmented by lateral thecal attachment. Theca thick but covered with epitheca. Costae usually obscure. Septa exsert, but upper outer septal edges joins theca below the upper thecal edge, forming an exsert calicular rim. Pali absent. Columella prominent composed of elongate, twisted lamellar elements.

Type species. –*Conotrochus typus* Seguenza, 1864, by original designation.

Conotrochus funicolumna (Alcock, 1902)

Plate 12, Figs. L-M

Ceratotrochus (Conotrochus) funicolumna Alcock, 1902a: 93. –Alcock, 1902c: 11-12, pl. 1, figs. 6, 6a. –Faustino, 1927: 34.

Conotrochus funicolumna. –Yabe & Eguchi, 1942b: 105, 117. –Cairns, 1984: 14, pl. 2, figs. I-J. –Cairns, 1994: 58-59, pl. 24, fig. I, pl. 25, figs. g-l. –Cairns & Zibrowius, 1997: 127. –Cairns, 1998: 385. –Cairns, 1999: 100-101. –Cairns et al., 1999: 21. –Cairns, 2004a: 279. –Cairns, 2009: 13.

Conotrochus sp. cf. *funicolumna*. –Cairns & Parker, 1992: 22, figs. 6c, f.

Conotrochus brunneus. –Cairns & Parker, 1992: 22.

Type locality. –*Siboga* stns. 95 and 100 (Sulu Archipelago, Indonesia), 450-522 m.

Type material. –Three syntypes are deposited at the ZMA (Cairns, 1994).

New records. –Bathus 4: stn. DW 886 (1); stn. DW 888 (1); stn. CP 889 (2); stn. DW 944 (1); stn. CP 967 (8). –Norfolk 2: stn. DW 2026 (1); stn. DW 2035 (2); stn. DW 2066 (1); stn. DW 2136 (2); stn. DW 2144 (1); stn. DW 2159 (3).

Description. –Corallum trochoid to ceratoid, straight to gently curved, and attached to substratum basally and often by lower theca as well. Bivalve and scaphopod shells were observed as substratum. Calice circular; calicular edge smooth and slightly flared. Largest specimen examined (CP 967) 10.0 mm in CD, 13.3 mm in height, and has a pointed base. Theca thin and coarsely granulated, giving a rough texture or even a worn appearance to corallum. In some specimens costae are slightly ridged and separated by broad grooves bisected by a smaller ridge. Calicular edge project about 0.5-1.0 mm above upper outer septal edges, forming a well-defined calicular rim. Corallum white or longitudinally brown striped. Stripes variable in width.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4. All but S4 have straight vertical axial edges (S4 vertical but laciniate). S1-2 fuse to columella deep in fossa. Fossa of moderate depth, containing an interconnected lamellar (or eventually papillose) columella. Columellar elements usually oriented clockwise.

Distribution. –*New Caledonia*: 250-1009 m. –*Elsewhere*: Japan; Hawaii; Indonesia; Philippines; Wallis and Futuna; Vanuatu; Mariana Islands; Australia; and New Zealand; 80-1078 m.

Discussion. –*Conotrochus funicolumna* is very similar to *C. brunneus*, but differs in having more septa (usually 48 vs 36-40 in C. brunneus); a larger corallum (*C. brunneus* <9.1 mm in CD); and occasionally a pigmented streaked theca.

Genus *Faustinotrochus*, gen. nov.

Diagnosis. –Corallum solitary and cylindrical. Asexual reproduction by transverse division present. Calicular margin smooth. Upper, outer septal edges separated from calicular edge by a notch. Septa hexamerally arranged in 3 complete cycles (some S4 usually present). Pali before S2. Columella papillose.

Type species. –*Faustinotrochus neocaledonensis,* here designated.

Etymology. –Named in honour of Leopoldo A. Faustino for his work on scleractinians from Indonesia. The suffix is from the Greek *trochos* (round), and is a common suffix for coral generic names. Gender: masculine.

Discussion. –According to Kitahara et al. (2010b) the family “B” is composed by a group of previously scleractinian assigned to the family Caryophylliidae. Among the genera belonging to this undescribed family, *Faustinotrochus* is the only to have elongate cylindrical corallum and asexually reproduce by transverse division. Sieg & Zibrowius (1988) examined specimens from New Caledonia and were the first to note that they represented an undescribed genus/species. The same authors suggested that their undescribed specimens were related to Flabellidae, once they observed a typical epithecal wall, especially near calicular edge of younger specimens. The same authors also suggested the columellar resemblance between the undescribed genus/species with that of the non-flabellid genus *Aulocyathus.* In fact, I believe that *Aulocyathus* is related to *Faustinotrochus*, but based on molecular phylogenetic reconstructions, the placement of *Faustinotrochus* within flabellids is not supported. *Faustinotrochus* also shares some morphological characters with Gardineriidae representatives, especially with *Stolarskicyathus*, which also reproduce by transverse division. However, the possession of P2 and a well-developed papillose columella distinguishes *Faustinotrochus* from all gardineriids and flabellids.

***Faustinotrochus neocaledonensis* sp. nov.**

Plate 12, Figs. N-S

Flabellidae, n. gen., n. sp. sensu Seig & Zibrowius 1988: 192, figs. g-j.
Gen. nov. sp. nov. sensu Kitahara et al., 2010b.

Type locality. –*Bathus 4* stn. DW 916 (18°53.30'S, 163°19.55'E – New Caledonia), 516-570 m.

Holotype. –Bathus 4: stn. DW 916.

Paratype. –Biocal: stn. DW 33 (1). –Bathus 4: stn. DW 902 (2); stn. DW 914 (2); stn. DW 916 (2); stn. DW 918 (8); stn. DW 923 (24). –Norfolk 2: stn. DW 2035 (5); stn. DW 2060 (8); stn. DW 2093 (1); stn. DW 2112 (2); stn. DW 2136 (1).

Description. – Corallum cylindrical, becoming free at very early stage, with an open scar of transverse division in lower end of corallum. Scars range from circular to elliptical in cross section. All specimens examined have lower 2/3 to 1/2 of corallum compressed, and slightly curved on GCD plane. Calice elliptical, calicular edge smooth and slightly higher (1-2 mm) than upper outer septal edges, forming a calicular rim. All septa separated from calicular rim by a V-shape notch. Largest specimen (DW 918) 6.0 x 4.6 mm in CD, 17.7 mm in height, and 2.2 x 1.8 mm in scar diameter. Elongated specimens often display evidence of regeneration and/or rejuvenescence.

Septa hexamerally arranged in 3 complete cycles (24 septa), according to formula: S1>S2>S3. Larger specimens containg several S4 (up to 32 septa), but always with only three size classes of septa: S1; S2 and flanked S3; and unflanked S3 and S4. S1 have vertical to slightly concave, straight axial edge that extends 3/4 distance to columella, fusing deep in fossa to columellar elements. S2 a smaller version with 3/4 to 4/5 width of an S1, bearing a paliform lobe (P2) usually indistinguishable from columellar elements. S3 half width of S2. Some specimens examined have axial edges of some S2 and S3 slightly sinuous. All septa and palar faces bear pointed granules. Fossa of moderate depth, containing a papillose columella formed by 2-15 rods basally interconnected.

Etymology. –This species is named for the country from which it was collected.

Distribution. –*New Caledonia*: 230-1434 m.

Discussion. –Among recent azooxanthellate scleractinians that commonly reproduce by transverse division, *Faustinotrochus neocaledonensis* is distinguished by having an elongate-cylindrical corallum; only three septal cycles; and a calicular margin separated by a V-shaped notch from upper outer septal edges. At first sight, *F. neocaledonensis* appears to be morphologically related to the family Gardineriidae, however, molecular data (see Kitahara et al., 2010b) and skeleton microstructure and microarchictecture

(Stolarski, *personal comunnication*) support the placement of this genus/species within the undescribed family B.

Genus *Stephanocyathus* Seguenza, 1864

Diagnosis. –Corallum solitary, bowl-shaped, and free. Septotheca costate. In some species the C1 bearing long spines or the C1-2 bearing tubercles. Paliform lobes usually occur before all but last cycle. Columella papillose or a solid fusion of axial septal edges.

Subgenus *Stephanocyathus* (*Odontocyathus*) Moseley, 1881

Diagnosis. –*Stephanocyathus* with 12-18 short basal spines or tubercles (C1-2, sometimes C3), sometimes fusing into a basal rim.

Type species. –*Platytrochus coronatus* Pourtalès, 1867, by monotypy.

Stephanocyathus (*Odontocyathus*) *coronatus* (Pourtalès, 1867)

Plate 13, Figs. A-D

Platycyathus coronatus Pourtalès, 1867: 114.

Trochocyathus coronatus. –Pourtalès, 1871: 14-15, pl. 6, fig. 16. –Moseley, 1876: 550-551. –Pourtalès, 1880: 96, 106.

Odontocyathus coronatus. –Moseley, 1881: 148-151, pl. 2, figs. 4a-b, 5a-b. –Tizard et al., 1885: fig. 280.

Sabinotrochus flatiliseptis Alcock, 1902a: 103. –Alcock, 1902c: 26, pl. 4, figs. 24, 24a.

Stephanocyathus (Odontocyathus) coronatus. –Gardiner & Waugh, 1938: 191. –Cairns, 1977b: 736-738, figs. 13-16. –Cairns, 1978: 11. –Cairns, 1979: 109-111, pl. 20, figs. 5-6, 8-9. –Veron, 1986: 607. –Cairns, 1995: 69, pl. 17, figs. j-l, pl. 18, figs. a-b. –Cairns, 1999: 89, figs. 11d-f. –Cairns et al., 1999: 24. –Cairns, 2004a: 285. –Cairns, 2009: 11. –Reyes et al., 2009: 3.

Stephanocyathus (Odontocyathus) sp. Keller, 1975: 179.

Type locality. –*Blake* (30º41'N, 77º33'W – Blake Plateau, off northern Florida), 841 m.

Type material. –The holotype is deposited at the MCZ (Cairns, 1979).

New records. –Halipro 1: stn. CP 854 (10). –Bathus 4: stn. CP 913 (4); stn. CP 948 (3); stn. CP 950 (27). –Norfolk 2: stn. DW 2026 (1).

Previous records from New Caledonia. –Cairns (2004).

Description. –Corallum shaped as a crown, with a slightly convex base. Calice circular to slightly elliptical,; calicular edge jagged as result of septal exsertness. Comparison with previously published descriptions of this species implies that all specimens examined herein are relatively small. Largest specimen examined (CP 950) 30.3 x 27.5 mm in CD, 22.5 mm in basal diameter, and 18.0 mm in height. Thecal edges slightly concave and covered by well-developed slightly convex costae separated by thin and shallow intercostal striae. C1-2 slightly wider than C3-4 (1.3 vs 1.0 mm in width respectively). All costae covered with low rounded granules. Lower thecal edge diverge from base at an angle of 80-90º. Some specimens display a slightly worn base. However, base usually costate and C1-2 more prominent, sinuous, and often discontinuous. Epicentre of base sometimes displays a scar of attachement often with a piece of substrate attached (bivalve and gastropod shells). At point of inflection between theca and base, 12 well-developed, highly ornamented tubercules extend usually 5 mm or more horizontally or downward (hewever, some specimens have much less-developed tubercles). Freshly collected specimens display a pale-orange tissue. Corallum white.

Septa hexamerally arranged in five incomplete cycles according to formula: S1≥S2>S3>S4>S5. S1 highly exsert (up to 6 mm), extending about ¾ distance to columella with straight and oblique axial edge. When present, P1 pointed and separated from S1 by a wide and rounded notch. S2 equal or only slightly less exsert and less wide than S1. P2 similar to P1. S3 about 3 mm exsert, ½ width of S1-2, and bear a wide, tall, and rounded paliform lobe. S4 adjacent to S1 slightly more exsert than those adjacent to S2. S4 about ¾ width of S3, sometimes with a slightly lacerate upper axial edge and bear no paliform lobe. Complete fifth cycle not observed in any half-system of any specimen examined, however, one pair of S5 per half-system quite common. When present in a half-system, S5 about same size of unflanked S4, and flanked S4 accelerate to S3 size, fusing to it before P3. All septal faces only finely granulated (smooth) and axial edges straight. Fossa of moderate depth, containing a papillose columella.

Distribution. –*New Caledonia*: 533-1250 m. –*Elsewhere*: Wallis and Futuna; Vanuatu; Indonesia; Australia; New Zealand; Bahamas; and Gulf of Mexico; 543-1989 m.

Discussion. –Among extant representatives of *Stephanocyathus* (*Odontocyathus*), *S. coronatus* can be confused with *S. weberianus* (Alcock, 1902). A comparison between these two species is provided by Cairns (1995: 69). *S. coronatus* is distinguished from New Caledonian congeners in having well-developed ornamented costal tubercles.

Subgenus *Stephanocyathus* (*Stephanocyathus*) Seguenza, 1864

Diagnosis. –*Stephanocyathus* without elongate spines or tubercles.

Type species. –*Stephanocyathus elegans* Seguenza, 1864, by subsequent designation (Wells, 1936).

Stephanocyathus (*Stephanocyathus*) *regius* Cairns & Zibrowius, 1997

Plate 13, Figs. E-F

Stephanocyathus nobilis. –Zou, 1988: 74-75 (*in part*: pl. 1, figs. 4-7).

Stephanocyathus (Stephanocyathus) regius Cairns & Zibrowius, 1997: 117-118, figs. 14a-c. –Cairns, 1999: 88-89, figs. 10h, 11a-c. –Cairns et al., 1999: 24. –Cairns, 2004a: 286. –Cairns, 2009: 11.

Type locality. –*Hakuho Maru* stn. KH72-1-26 (9º27'S, 127º58.6'E – timor Sea), 610-690 m.

Type material. –The holotype and 34 paratypes are deposited at the NMNH, and 4 additional paratypes are deposited at the MNHN (Cairns & Zibrowius, 1997).

New records. –Halipro 1: stn. CP 858 (11).

Description. –Corallum bowl-shaped and free. Base slightly convex (never flat). Some specimens display a rudimentary circular pedicel, some a scar, and others have a small part of substratum (bivalve shell?) still attached. Calice circular; calicular edge slightly scalloped. Largest specimen examined (CP 858) 24.0 mm in CD and 9.3 mm in height. Costae better defined near calicular edge, where they are ridged, serrate, and separated by thin intercostal furrows. About 2 mm below calicular edge, costae become flat and their intercostal striae almost indistinguishable. However, in some specimens C1-3 slightly ridged from calicular edge to pedicel. Corallum white, but base (including epicentre) sometimes milk-white or light-beige.

Septa hexamerally arranged in five incomplete cycles according to formula: S1>S2>S3>S4>S5. S1 up to 3 mm exsert, extending half-distance to columella with slightly sinuous but not vertical axial edge. Each S1 bears a lamellar paliform lobe (separated from S1 by a wide and shallow notch), and a small pointed tooth near columella. This tooth is always fused to columella making it sometimes indistinguishable from columellar elements. S2 slightly less exsert and less wide than S1, but bear a larger lamellar paliform lobe, and one or sometimes two palar teeth. S3 slightly less exsert and less wide than S2, but bear the largest paliform lobe (sometimes divided into 2) and two to three paliform teeth near columella. These most internal teeth usually fused to lower P2 axial edge. S4 equal to only slightly less exsert and less wide than S3, and bear a lamellar paliform lobe (P4) that fuses deep in fossa to adjacent P3. S5 independent and dimorphic in development: those flanking S1 slightly larger than those flanking S2. Septal and palar granulation quite variable: some specimens have septal and palar faces almost smooth; but some bear tall pointed granules, sometimes resembling “meniane-like” structures at palar faces. Fossa shallow, containing a circular to elliptical papillose columella composed of up to 30 interconnected elements.

Distribution. –*New Caledonia*: 1000-1200 m. –*Elsewhere*: South China Sea; Philippines; Malaysia; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 563-2160 m.

Discussion. –Amongst New Caledonian *Stephanocyathus*, *S. regius* is the only that do not have costal tubercles or spines. A comparison between *S. regius* and its most similar congener, *S. paliferus* Cairns, 1977 is provided by Cairns & Zibrowius (1997).

Subgenus *Stephanocyathus* (*Acinocyathus*) Wells, 1984

Diagnosis. –*Stephanocyathus* with 6 elongate spines corresponding to the C1.

Type species. –*Stephanotrochus spiniger* Marenzeller, 1888, by original designation.

Stephanocyathus (*Acinocyathus*) *spiniger* (Marenzeller, 1888)

Plate 13, Figs. G-H

Stephanotrochus spiniger Marenzeller, 1888b: 21-22.
Stephanotrochus tatei Dennant, 1899: 117-119, pl. 3, figs. 1a-c.
Odontocyathus sexradiis Alcock, 1902: 23, pl. 3, figs. 2, 2a, 2b.
Odontocyathus stella Alcock, 1902: 24, pl. 3, figs. 21a-b.
Odontocyathus japonicus Yabe & Eguchi, 1932c: 149-152, pl. 14, text figs. 1-3.

Odontocyathus sexradii. –Hoffmeister, 1933: 10, pl. 1, figs. 6-8.

Stephanocyathus (Odontocyathus) sexradii. –Wells, 1958: 262.

Odontocyathus spiniger. –Yabe & Eguchi, 1942b: 124-125, pl. 10, figs. 26-28. –Eguchi, 1968: C39-40, pl. C20, figs. 12-14, pl. C23, figs. 1-2.

Stephanocyathus spiniger. –Eguchi, 1965: 288. –Boshoff, 1981: 39. –Veron, 1986: 607.

Stephanocyathus (Odontocyathus) spiniger. –Utinomi, 1965: 254. –Eguchi & Miyawaki, 1975: 57. –Song, 1982: 136, pl. 4, figs. 1-2. –Song, 1991: 134.

Stephanocyathus (Odontocyathus) spinifer. –Eguchi & Miyawaki, 1975: 57.

Stephanocyathus (Acinocyathus) spiniger. –Wells, 1984: 209, pl. 2, figs. 10-13. –Cairns & Parker, 1992: 26-27, pl. 7, figs. g-i. –Cairns & Keller, 1993: 243. –Cairns, 1994: 57, pl. 25, figs. a-c. –Cairns, 1995: 67-68, pl. 17, figs. d-f, pl. 18, fig. c. –Cairns & Zibrowius, 1997: 118-119, figs. 13f, 14d. –Cairns, 1998: 381. –Cairns, 1999: 90. –Cairns et al., 1999: 24. –Cairns, 2004a: 285. –Cairns, 2009: 11. –Kitahara et al., 2010b.

Stephanocyathus sp. Veron, 2000: II, 411, fig. 11.

Type locality. –Sagami Bay (Japan), depth unknown.

Type material. –The holotype is deposited at the NMW (Cairns, 2004a).

New records. –Bathus 3: stn. CP 833 (3). –Halipro 1: stn. CP 877 (2). –Norfolk 2: stn. DW 2098 (1); stn. DW 2136 (4); stn. DW 2137 (1); stn. DW 2142 (3). –PrFO: stn. ? (1).

Description. –Corallum shaped as a bowl, free with a flat to slightly convex base. However, a small scar of attachment or small substratum piece often visible at base epicentre. Basal diameter smaller than calicular diameter. Calice circular to slightly elliptical (GCD:LCD = 1.03-1.12) with highly lancetted calicular margin. Three lancet sizes easily distinguishable: a taller one formed by the fusion between S1 and adjacent S4-5; a middle sized lancet formed by S2 and adjacent S5; and the least prominent lancet formed by the fusion of an S3 and flanking S4. Largest specimen examined (CP 877) 29.0 x 27.1 mm in CD, and 25.6 mm in height. Near calicular edge, costae ridged, thin and separated by broad intercostal grooves (twice as broad as costa). Towards base costae become less ridged and increase in width completely faint about half-distance to base epicentre. At the point of inflection between base and thecal lateral faces, 6 long (up to 25.0 mm), usually straight, and circular in cross section spines corresponding to each C1 elevate corallum above substratum. Corallum white, but S1 faces brownish-purple. Soft tissue completely invests skeleton.

Septa hexamerally arranged in 5 complete cycles according to formula: S1>S2>S3>S4>S5 (96 septa). S1 up to 8.0 mm exsert and extend about 3/5 distance to columella. P1 separated from their septa by a wide and moderately deep notch. Axial edge of P1 fuse to columellar elements. S2 up to 6.0 mm exsert and only slightly smaller than S1. P2 slightly larger than P1 and also fuse to columellar elements. S3 about 3/5 width of S2 but bear the largest paliform lobe, only slightly more recessed from columellar elements than P1-2. S4 adjacent to S1 is slightly larger and more exsert than those adjacent to S2. Each S4 bear a small paliform lobe quite far from columella. Each pair of P4 fuses to common P3 low in fossa. S5 always smaller than S4, however, those adjacent to S1 are almost as exsert as S2; those adjacent to S2 equally or only slightly less exsert than S4; and those flanking S3 are the least exsert septa. Three paliform lobe crowns encircle columella. First palar crown composed of 12 P1-2; second composed of 12 well-developed P3; and last composed of 24 recessed P4. Fossa shallow, containing an elliptical papillose columella composed of numerous fused papillae all of which terminate at same level.

Distribution. –*New Caledonia*: 402-668 m. –*Elsewhere*: Japan; South Korea; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; New Zealand; South Africa; Mozambique; and Madagascar; 120-1188 m.

Discussion. –*Stephanocyathus* (*Acinocyathus*) *spiniger* is easily distinguished from all congeners (including all three subgenera) in having long thecal spines. Thecal spines are much shorter in the other known *Acinocyathus* representative *S.* (*A.*) *explanans* (Marenzeller, 1904b).

Genus *Vaughanella* Gravier, 1915

Diagnosis. –Corallum solitary, patellate to trochoid, and usually firmly attached by a robust pedicel. Septotheca costate. Paliform lobes present on all but last septal cycle. Columella papillose.

Type species. –*Caryophyllia margaritata* Jourdan, 1895, by monotypy.

Vaughanella concinna Gravier, 1915

Plate 13, Figs. I-J

Vaughanella concinna Gravier, 1915: 10. –Gravier, 1920: 63, pl. 9, figs. 138-143. –Zibrowius, 1980: 104-105, pl. 52, figs. A-K, pl. 53, figs. A-L. –Cairns, 1999: 90-91, figs. 11g-h. –Cairns et al., 1999: 25. –Cairns, 2009: 12.

Cyathoceras rubescens. –Jourdan, 1895: 17.

Caryophyllia clavus. –Gravier, 1920: 16 (in part).

Vaughanella oreophila. –Cairns, 1995: 70, pl. 18, figs. d-e.

Type locality. –*Prince de Monaco* stn. 1349 (38º35'30''N, 28º05'45''W – Azores), 1250 m.

Type material. –The lectotype and 6 paralectotypes are deposited at the MOM (Zibrowius, 1980).

New records. –Bathus 4: stn. DW 943 (1). –Norfolk 2: stn. DW 2058 (2); stn. DW 2064 (1); stn. DW 2065 (1); stn. DW 2066 (2); stn. DW 2068 (2); stn. DW 2070 (1); stn. DW 2072 (1); stn. DW 2075 (3); stn. DW 2078 (2); stn. DW 2080 (9); stn. DW 2086 (7); stn. DW 2103 (1); stn. DW 2106 (3); stn. DW 2107 (3); stn. DW 2113 (1).

Description. –Corallum trochoid, robust, straight, and firmly attached through a stereome-reinforced pedicel (PD:GCD = 0.25-0.50) and a thin, small, encrusting base (usually only slightly larger than PD). Sometimes calicular edge slightly flared. Calice slightly elliptical (GCD:LCD = 1.04-1.07); calicular edge highly serrate. Largest specimen examined (DW 2070) 32.5 x 31.2 mm in CD, 9.3 mm in PD, and 34.9 mm in height. Theca smooth and almost porcellanous, however, near calicular edge theca bear very small granules and costae distinguishable. Costae equal in width, slightly ridged, and separated by thin intercostal grooves. Costae completely disappear towards pedicel. Corallum white but some specimens display a light brown lower theca.

Septa hexamerally arranged in four complete cycles according to formula: S1-S2>S3>S4. However, some specimens examined have several pairs of S5, for a total of up to 62 septa. S1-2 highly exsert (up to 5 mm), thicker than other septal cycles, and extend to columella with vertical to slightly concave straight axial edges. Lower axial edges of S1-2 bear a pointed paliform lobe, usually difficult to distinguish from columellar elements. S3 up to 3 mm exsert, about 4/5 width of S1-2, and bear a well-developed, tall, wide, rounded, lamellar paliform lobe. Each P3 separated from their septum by a wide notch, and altogether compose a well-defined palar crown encircling columella. P3 thicker, rise higher in fossa, and more recessed from columella than P1-2. S4 slightly less exsert and less wide than S3. If a pair of S5 flanks an S4, S4 accelerates to S3 size and develops a paliform lobe only slightly less wide than P3. S5 as wide and as exsert as unflanked S4. Fossa of moderate depth, containing a papillose columella formed by few granular rods usually fused basally.

Distribution. –*New Caledonia*: 316-1150 m. –*Elsewhere*: Wallis and Futuna; New Zealand; Celtic Sea; Azores; and Madeira Archipelago; 500-3018 m.

Discussion. –*Vaughanella* is composed of 4 species: *V. concinna*; *V. margaritata* (Jourdan, 1895); *V. multipalifera* Cairns, 1995; and *V. oreophila* Keller, 1981a. Among them, *V. concinna* is distinguished from Pacific congeners (all but *V. margaritata* which is known only from Newfoundland) by having P3 (absent in *V. oreophila*); and only one paliform lobe per septa (multiple paliform lobes occur in *V. multipalifera*).

***Vaughanella* sp. A**

Plate 13, Figs. K-L

Material examined. –Norfolk 2: stn. DW 2066 (1).

Description. –Corallum robust and firmly attached through a stereome-reinforced pedicel (PD:GCD = 0.33) and a thin encrusting base. Calice hexagonal in shape; calicular edge highly serrate. Specimen examined 24.5 x 22.6 mm in CD, 8.1 mm in PD, and 37.4 mm in height. Theca thick, smooth and covered near calicular edge by aligned low granules. Costae flat to slightly convex. C1-2 slightly broader and more ridged than C3-5. All costae separated by thin and shallow intercostal striae. Upper theca including calicular elements white, lower theca dark brown.

Septa hexamerally arranged in 5 incomplete cycles according to formula: S1>S2>S3>S4>S5. S1 up to 6.5 mm exsert, and have perfectly round upper edges and extend to columella with slightly concave axial edges. About middle distance to columella, 5 of the 6 S1 become extremely thick and extend horizontally for about 1mm before become vertical again. S2 about 3 mm exsert and 4/5 width of S1. S2 similar in profile to S1. S3 only slightly less exsert and less wide than S2, and similar in profile to S1-2. However, thickened S3 region laciniate. S4 about ½ size of S3 and dimorphic in exsertness: those adjacent to S1 are as exsert or even more exsert than S2; those adjacent to S2 are least exsert septa. Axial edge of S4 straight and vertical. If flanked by a pair of S5, S4 enlarge to S3 size. S5 short and as exsert as those S4 adjacent to S2. Axial lower edges of S1-3 bear pointed paliform lobes usually indistinguishable from columellar elements. Fossa of moderate depth, containing a papillose columella composed of few fused rods.

Distribution. –*New Caledonia*: 834-870 m.

Discussion. –*Vaughanella* sp. A appears to be unique among Pacific congeners in having a calicular edge hexagonal in shape; slightly laciniate lower S3 axial edge; and middle axial septal edges that thicken and extend horizontally before turning vertical again. *Vaughanella* sp. A probably represent an undescribed species. However, a formal description is postponed because only one specimen was available for examination.

Family Pocilloporidae Gray, 1842

Genus *Madracis* Milne Edwards and Haime, 1849

Diagnosis. –Colonial, extratentacular budding producing massive, encrusting, or branching coralla. Coenosteum solid. Septa arranged in groups of 6, 8 or 10, but rarely in more than 2 cycles. Columella styliform. Paliform lobes sometimes present.

Type species. –*Madracis asperula* Milne Edwards & Haime, 1849, by monotypy.

***Madracis kauaiensis* Vaughan, 1907**

Plate 13, Fig. M

Madracis kauaiensis Vaughan, 1907: 83-84, pl. 9, figs. 1-4. –Cairns, 1984: 6. –Cairns, 1999: 53-54, figs. 1a-e. –Cairns et al., 1999: 36. –Cairns, 2006: 46. –Cairns, 2009: 1.

Type locality. –*Albatross* stn. 3982 (21º56'25''N, 159º21'40''W – Kauai, Hawaii), 73-426 m.

Type material. –The holotype and paratypes are deposited at the NMNH (Vaughan, 1907).

New records. –Gemini: stn. DW 60 (44 fragments). –Bathus 4: stn. DW 882 (1 fragment). –Norfolk 2: stn. DW 2096 (19 fragments).

Description. –Colonies bushy and irregularly branched. All lots examined composed of small fragments believed to be from distal parts of colony due to their small diameters. Branches circular in cross section, bearing many slightly elliptical corallites well spaced from each other. GCD of each corallite usually aligned to branch, but corallites positioned at branch division are perfectly circular. Average diameter of a corallite from distal branches 1.5 x 1.2 mm. Coenosteum completely covers some corallites. Coenosteum bear coarse pointed granules, which sometimes fuse to adjacent granules forming small and short ridges. Freshly collected specimens have bright orange to red tissue pigmentation. Coenosteum white.

Septa decamerally arranged usually in only one cycle, but some corallites have rudimentary S2 between each S1. S1 about 0.1 mm exsert, each bearing a small paliform lobe. S1 separated from their paliform lobe by a moderately wide and shallow notch. S2, if present, composed of aligned, pointed granules. Septal and palar faces covered by pointed granules. Fossa shallow, containing a flat base that interconnect each S1 and P1, and centrally supports a styliform columella which has greater axis aligned to branch.

Distribution. –*New Caledonia*: 80-350 m. –*Elsewhere*: Hawaii; Johnston Island; Wallis and Futuna; Vanuatu; and New Zealand; 44-541 m.

Discussion. – Approximatelly 16 species are recognized in the pocilloporid genus *Madracis*, which is one of the few scleractinian genus that have zooxanthellate, azooxanthellate, and facultative representatives. Among colonial azooxanthellate scleractinians from New Caledonia, *Madracis kauaiensis* is distinguished in having a prominent styliform columella; usually one decamerally arranged septal cycle; corallites close spaced; and a fossa with a flat base.

Family C

Genus *Madrepora* Linnaeus, 1758

Diagnosis. –Colonial, extratentacular sympodial budding forming dendroid colonies. Coenosteum dense. Costae and pali absent. Columella papillose or absent.

Type species. –*Madrepora oculata* Linnaeus, 1758, by subsequent designation (Verrill, 1901).

Madrepora oculata Linnaeus, 1758*

Plate 13, Fig. Q

Madrepora oculata Linnaeus, 1758. 789. –Esper, 1791: 108, pl. 12, figs. 1-3. –Marenzeller, 1904b: 79. –Durham & Barnard, 1952: 11. –Squires, 1959a: 5. –Pax & Müller, 1962: 232. –Eguchi, 1968: C29, pl. C8, figs. 1-9. –Zupanovic, 1969: 484, fig. 10. –Best, 1970: 298, fig. 2. –Bourcier & Zibrowius, 1973: 826, figs. 6-7. –Zibrowius, 1974a: 762-766, pl. 2, figs. 3-5. –Zibrowius & Grieshaber, 1977: 377. –Cairns, 1979: 39-42, pl. 3, fig.2, pl. 4, fig. 5, pl. 5, figs. 1-3. –Zibrowius, 1979: 21. –Zibrowius, 1980: 36-40, pl. 13, figs. A-P. –Cairns, 1982: 15, pl. 3, figs. 4-6. –Cairns, 1984: 10, pl. 1, fig. H. –Cairns, 1991a: 9-10, pl. 2, fig. j, pl. 3, figs. a-b. –Fosshagen & HøisSter, 1992: 291. –Tyler & Zibrowius, 1992: 227. –Cairns & Keller, 1993: 233. –Cairns, 1994: 18-19, pl. 3, figs. f-h. –Cairns, 1995: 41, pl. 5, figs. e-f, pl. 6, figs. a-b. –Grygier & Cairns, 1996: 63-64, 68, figs. 1A-F. –Cairns & Zibrowius, 1997: 79-80. –Cairns, 1998: 372-373, figs. 1f-i. –Cairns, 1999: 61, figs. 2e-f. –Cairns et al., 1999: 35. –Cairns, 2004a: 274-275. –Le Goff-Vitry et al., 2004: 171, 173. –Cairns, 2006: 47. –Schroeder et al., 2005: 297-307. –Cairns, 2006: 47. –Kitahara, 2006: 58, figs. 2A-B. –Kitahara, 2007: 500, 501, fig. 2G. –Pires, 2007: 268, 270. –Orejas et al., 2008: 255. –Cairns, 2009: 4. –Kitahara et al., 2010b. –Miller et al., 2010: 3, 4, 5, 7, 9, 10, 12.

Amphelia oculata. –Milne Edwards & Haime, 1850a: 85. –Joubin, 1929: figs. 1-7. –Carlgren, 1945: 152, fig. 75.

Amphihelia oculata. –Milne Edwards & Haime, 1857: 119. –Duncan, 1873: 326, pl. 45, figs. 1-3. –Jourdan, 1895: 26. –Pruvot & Racovitza, 1895: 403, fig. 6. –Lacaze-Duthiers, 1897: 142, pl. 8, figs. 1-7. –Alcock, 1902c: 35. –Marenzeller, 1904a: 308-310, pl. 14, fig. 1. –Gourret, 1906: 122, pl. 13, fig. 12. –Gravier, 1920: 89, pl. 10, fig. 158-164. –Joubin, 1922: 7, fig. 1. – Nordgård, 1929: 103, fig. 3. –Brunelli & Bini, 1934: 734, fig. 1. –Chevalier, 1966: 938 (*in part*).

Amphihelia ramea. –Duncan, 1873: 326, pl. 44, figs. 1-3, pl. 45, figs. 4-6,pl. 46, figs. 1-19. –Jourdan, 1895: 26. –Alcock, 1902c: 35.

Lophohelia candida Moseley, 1881: 179-180, pl. 9, figs. 6-13.

Lophohelia tenuis Moseley, 1881: 180-181, pl. 8, figs. 11-14. –Bourne, 1903: 26.

Cyathohelia formosa Alcock, 1898: 26-27, pl. 3, figs. 2, 2a.

Lophohelia investigatoris Alcock, 1898: 24-25.

Amphihelia (Diplohelia) moresbyi Alcock, 1898: 25-26.

Sclerohelia formosa. –Alcock, 1902c: 36.

Amphihelia arbuscula. –Alcock, 1902c: 35 (*in part*: *Siboga* stn. 95, 156).

Amphihelia tenuis. –Alcock, 1902c: 36.

Desmophyllum sp. –Alcock, 1902c:28.

Madrepora galapagensis Vaughan, 1906: 63-64, pl. 1, fig. 2, pl. 2, figs. 1, 1b. Durham & Barnard, 1952: 11. –Wells, 1983: 234, pl. 13, figs. 1-2.

Madrepora kauaiensis Vaughan, 1907: 81-83, pl. 8, figs. 1-2. –Gardiner & Waugh, 1939: 227. –Crossland, 1952: 121. –Wells, 1964: 109. –Veron, 1986: 599. –Cairns, 2006: 47.

Amphihelia sp. –Gardiner, 1913: 689.

Lophohelia prolifera. –Gravier, 1920: 87 (in part).

Madrepora tenuis. –Faustino, 1927: 107-108, pl. 14, figs. 2, 5.

Madrepora alcocki Faustino, 1927: 106.

Madrepora (*Sclerhelia*) sp. –Eguchi, 1938: table 2.

Madrepora (*Amphelia*) sp. –Yabe & Eguchi, 1941b: 102.

Madrepora cf. *oculata*. –Eguchi, 1942: 136-137, pl. 6, fig. 1.

Madrepora kauiensis. –Stephenson & Wells, 1956: 57.

Madrepora vitiae Squires & Keyes, 1967: 22, pl. 1, figs. 4-8. –Dawson, 1979: 29-30.

Madrepora formosa. –Zibrowius, 1974b: 568-570, figs. 6-9.

Madrepora sp. –Veron, 1986: 599.

Lophelia tenui. –Hu, 1987: 40-41, pl. 2, figs. 8-10, 12.

Type locality. –Tyrrhenian Sea and Sicily (Mediterranean Sea), depth unknown.

Type material. –The types are lost (Zibrowius, 1980).

New records. –Norfolk 2: stn. DW 2029 (3 colonies); stn. DW 2034 (1 colony); stn. DW 2041 (1 colony fragment); stn. DW 2046 (1 colony fragment); stn. DW 2052 (1 colony); stn. DW 2072 (1 colony fragment); stn. DW 2133 (1 colony fragment); stn. DW 2142 (2 colony fragments); stn. CP 2146 (1 colony fragment attached to substrate).

Description. –Corallum delicate forming bushy colonies with anastomosing branches basally and uniplanar and sympodially budded corallites distally. All colonies examined associated with an eunicid polychaete worm. Corallites from basal region usually recessed in coenosteum, but distally they project up to 3 mm from branch. Corallites circular in cross section having about 2.5 mm in CD. Coenosteum slightly granular, with no indication of longitudinal striae. However, near calicular edge, thin and slightly ridged costae correspond to each S1-2. Corallum light-beige to white.

Septa hexamerally arranged in 3 complete cycles according to formula: S1>S2>S3 (24 septa). S1 highly exsert (up to 0.6 mm) and extend ¾ distance to columella, having vertical sometimes laciniate axial edges. A small P1 sometimes occur near columella. S2 slightly less exsert and about ½ size of S1. S2 axial edge usually bear several teeth and a well-developed sinuous paliform lobe. S3 rudimentary, usually discontinuous, and sometimes composed of aligned spines. Fossa of moderate depth, containing a papillose columella.

Distribution. –*New Caledonia*: 215-1005 m. –*Elsewhere*: Cosmopolitan; 55-1950 m.

Discussion. –Apart from *Lophelia pertusa* (Linnaeus, 1758), *Madrepora oculata* is one of the most studied azooxanthellate deep-water Scleractinia. This species has been reported world-wide, and apparently its distributional record is broader than that of *L. pertusa*. Amongst the five recognized species in the genus, only two are reported from

New Caledonian waters: *M. oculata* and *M. porcellana*. The former is distinguished in having septa hexamerally arranged (vs pentamerally in *M. porcellana* typical form). Additionally, the colonies of *M. oculata* examined herein have much more branches than those of *M. porcellana.*

Madrepora porcellana **(Moseley, 1881)**

Plate 13, Fig. R

Neohelia porcellana Moseley, 1881: 176-177, pl. 10, figs. 7, 7a. –Pratt, 1900: 591-603, pls. 62-63. –Hickson, 1903: 344.

Madrepora porcellana. –Wells, 1984: 207, figs. 1, 7-9. –Cairns, 1999: 62-63. –Cairns et al., 1999: 36. –Cairns, 2009: 5.

Neohelia sp. cf. *N. porcellana*. –Cairns & Zibrowius, 1997: 84-85, figs 5c-e, g-h.

Type locality. –*Challenger* stn. 177 (16º45’S, 168º07’E – Vanuatu), 115 m.

Type material. –The type series is deposited at the BM (Moseley, 1881).

New records. –Musorstom 8: stn. DW 1038 (7 small fragments). –Norfolk 2: stn. DW 2106 (2 fragments); stn. DW 2132 (1 fragment).

Previous records from New Caledonia. –Pratt (1900) and Hickson (1903).

Description. –Corallum attached, forming small bushy colonies. Branches usually short, consisting of only 2 or 3 slender sympodial corallites. All specimens examined incrust a parchment-like tube of an eunicid polychaete. Two main apertures from polychaete tube easily distinguished, and additional pores also penetrate coenosteum. Corallites near polychaete tube usually recessed in coenosteum. More prominent corallites occurs on branches. Calice circular and small (about 1.5 mm in CD). Theca white, covered by low rounded granules and thin longitudinal striae. Costae equally wide and slightly ridged near calicular edge. Corallum white.

Septa pentamerally arranged in 3 complete cycles according to formula: S1>S2>S3 (20 septa). S1 only 0.2 mm exsert, narrow, and have vertical axial edge slightly thickened and sinuous deep in fossa. S2 only slightly smaller and less exsert than S1, but otherwise similar. S3 rudimentary and usually disappear deeper in fossa. Sometimes axial edges of all septa slightly laciniate or bear small teeth. Fossa wide and variable in depth: encrusting corallites usually have shallower fossa than branches corallites. Columella rudimentary composed of irregularly shaped papillae.

Distribution. –*New Caledonia*: 405-757 m. –*Elsewhere*: Indonesia; Wallis and Futuna; and Vanuatu; 55-516 m.

Discussion. –*Madrepora porcellana* is compared with *M. oculata* in the previous account. All specimens of *M. porcellana* examined herein consistently have a tubular cavity that runs the entire length of the corallum. This tubular cavity has several additional pores and was inhabited by polychaetes.

Family Caryophylliidae Dana, 1846

Genus *Bourneotrochus* Wells, 1984

Diagnosis. –Corallum solitary and discoidal, reproducing by transverse division resulting in a free anthocyathus with a large basal scar. Costal spines associated with C1. Septotheca porcellanous basally and costate laterally. Pali present before all but last septal cycle. Columella papillose.

Type species. –*Bourneotrochus veroni* Wells, 1984, by original designation.

***Bourneotrochus stellulatus* (Cairns, 1984)**

Plate 13, Figs. N-P

Trochocyathus hastatus Bourne, 1903: (*in part*) 32-37, pl. 6, figs. 9-11.

Deltocyathus stellulatus Cairns, 1984: 15-16, pl. 3, figs. C-D.

Bourneotrochus veroni Wells, 1984: 213-214, pl. 3, figs. 7-8.

Bourneotrochus stellulatus. –Veron, 1986: 606. –Cairns, 1991b: 13, 49, 52. –Cairns, 1995: 71-72, pl. 18, figs. f, I, pl. 19. figs. a-c. –Cairns & Zibrowius, 1997: 115. –Cairns, 1999: 87-88, figs. 8c, 10d-g. –Cairns et al., 1999: 19. –Randall, 2003: 135. –Cairns, 2004a: 264, 276. –Cairns, 2006: 47. –Cairns, 2009: 11.

Type locality. –*Hon* stn. 9-3 (19º48'N, 154º58'W – off Hawaii), 337 m.

Type material. –The holotype and 2 paratypes are deposited at the NMNH, and twenty-teo additional paratypes are deposited at the BPBM (Cairns, 1984).

New records. –Bathus 4: stn. DW 887 (1). –Norfolk 2: stn. DW 2060 (1); stn. DW 2091 (1).

Previous records from New Caledonia. –Cairns (1999).

Description of anthocyathus. –Corallum discoidal and free. Calice circular but calicular diameter smaller than basal diameter. Largest specimen examined (DW 887) 3.3 mm in CD, 1.6 mm in height, and 4.0 mm in basal diameter. Theca thick and glisteny. Costae equally wide, slightly convex, and separated by shallow intercostal furrows. Six costal spines up to 1.5 mm in length corresponding to each CS1 project horizontally from thecal edge. Additional spines occurs on one specimen examined as follow: 4 systems have additional 2 spines; another system has 3 spines; but 1 do not have additional spines. Costal and costal spines covered by low rounded granules. Granules slightly more prominent on costal spines. Base flat to concave. Scar of detachment on epicentre of base usually flat. Corallum white.

Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2≥S3≥S4. Both specimens examined have 36 septa (only one pair of S4 in each system). S1 slightly exsert, extend about half-distance to columella with slightly sinuous axial edge, and bear a granulated lamelar pali. S2 equally exsert but slightly smaller than S1. P2 more robust and wide than P1. If flanked by a pair of S4, S3 is as wide as S2 and bear a palus equal to but slightly more recessed from columella than P2. However, if not flanked, P3 absent and S3 is slightly thinner, but as wide and as exsert as S2. All pali have sinuous axial edges that fuses to columella, and are highly granulated or bear obliquely oriented carinae. Septal faces covered by tall and large blunt granules. Fossa shallow, containing a robust papillose columella composed of numerous interconnected papillae.

Distribution. –*New Caledonia*: 320-896 m. –*Elsewhere*: Hawaii; Indonesia; Wallis and Futuna; Vanuatu; Cook Islands; Chesterfield Islands; Funafuti and Tuvalu; Australia; and New Zealand; 210-566 m.

Discussion. –This monotypic Caryophylliidae genus is distinguished from other New Caledonian scleractinian representatives by having asexual reproduction by transverse division; and septal spines usually associated with CS1. According to Cairns & Zibrowius (1997), *Bourneotrochus stellulatus* is probably related to the genus *Trochocyathus,* and according to Kitahara et al. (2010b), *Trochocyathus* does not belong to the family Caryophylliidae. Because specimens of *B. stellulatus* were never genetically tested, its position among caryophylliids is a conservative approach and remains tentative.

Genus *Caryophyllia* Lamarck, 1816

Diagnosis. –Corallum solitary, attached or free: if attached, corallum cylindrical, trochoid, or ceratoid; if free, corallum usually cornute. Calice circular, elliptical, or compressed; thecal edge spines present on species having compressed coralla. Septal symmetry variable, but hexameral symmetry with four cycles of septa most common. One crown of paliform lobes present before penultimate or rarely the antepenultimate cycle of septa. Columella fascicular, composed of several twisted laths. Exclusively azooxanthellate and common in deep water.

Subgenus *Caryophyllia* (*Caryophyllia*) Lamarck, 1816

Diagnosis. –*Caryophyllia* with calice circular to elliptical (not compressed), and not having thecal edge spines or crests.

Type species. –*Madrepora cyathus* Ellis & Solander, 1786, by subsequent designation (Broderip, 1828).

Caryophyllia (*Caryophyllia*) *abrupta* Cairns, 1999

Plate 13, Figs. S-T

Caryophyllia abrupta Cairns, 1999: 71-72, figs. 5d-e. –Cairns et al., 1999: 19. –Cairns, 2009: 5. –Kitahara et al., 2010a: 95-96, 112, figs. 7-10.

Type locality. –*Musorstom* 7 stn. DW 535 (12º29.6'S, 176º41.3'W – Waterwitch Bank), 340-470 m.

Type material. –The holotype and 33 paratypes are deposited at the MNHN. Twenty-two additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Bathus 4: stn. DW 923 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –New Caledonia: 470-699 m. –*Elsewhere:* Wallis and Futuna; Vanuatu; 300-650 m.

Discussion. –Among the 66 previously described Recent species of *Caryophyllia*, only two propagate by transverse division: *C. secta* and *C. abrupta*. However, *C. abrupta* is distinguished by the octamerally or decamerally arranged septa versus the consistent hexameral symmetry of *C. secta*. This species was recently described by Cairns (1999) and Kitahara et al. (2010a).

Caryophyllia (Caryophyllia) aspera Kitahara, Cairns & Miller, 2010

Plate 13, Figs. U-V

Caryophyllia aspera Kitahara et al., 2010a: 97, 113, figs. 12-15.

Type locality. –*Norfolk 2* stn. DW2117 (23º24'S, 168º00'E - New Caledonia), 400 m.

Type material. –The holotype and paratype are deposited at the MNHN (Kitahara et al., 2010a).

New records. –Norfolk 2: stn. DW 2142 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 400-550 m.

Discussion. –Among the six Recent congeners that have theca covered with transverse ridges, three have hexamerally arranged septa and are sympatric in New Caledonian waters: *C. aspera*, *C. corrugata*, and *C. lamellifera*. *C. aspera* is distinguished by having septal and palar faces that are highly granular. This species is fully described by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) *cinticulata* (Alcock, 1898)**

Plate 14, Figs. A-B

Thecocyathus cinticulatus Alcock, 1898: 17-18, pl. ii, figs. 5, 5a.

Trochocyathus cincticulatus. –Gardiner, 1904: 99, 103-104, pl. II, fig. 2. –Squires, 1961: 17. –Cairns et al., 1999: 24. –Cairns, 2009: 6.

Caryophyllia cinticulata. –Kitahara et al., 2010a: 98, 113, figs. 17-21.

Type locality. –*Investigator* (off Maldives), 384 m.

Type material. –The type is purported to be deposited at the IM (see Alcock, 1898: prefatory note).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 282-378 m. –*Elsewhere*: Maldives; and South Africa; 384 m.

Discussion. –Of the 66 previously described species of *Caryophyllia*, only a small group of six have circumferential transverse ridges on the theca: *C. rugosa; C. lamellifera*; *C. corrugata*; *C. cinticulata*; and *C. aspera*, the others having theca ranging from porcellanous to granular and/or longitudinally ridged (i.e., costate). *Caryophyllia cinticulata* is distinguished from congeners that have transversely ridged theca by its decameral septal symmetry; adult size larger than 10 mm in GCD; S3 smaller than S2; and extremely sinuous axial edges of S1 and S2. This species is fully described by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) *concreta* Kitahara, Cairns & Miller, 2010**

Plate 14, Figs. C-D

Caryophyllia concreta Kitahara et al., 2010a: 98-99, 113, figs. 22-32.

Type locality. –*Norfolk 2* stn. DW2024 (23º28'S, 167º51'E - New Caledonia), 370-371 m.

Type material. –The holotype and 8 paratypes are deposited at the MNHN. Five additional paratypes are deposited at the NMNH (Kitahara et al., 2010a).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 215-570 m.

Discussion. –*C. concreta* appears to be unique among *Caryophyllia* due to its extremely thick theca, and septa that are arranged in 3 cycles. This species is fully described by Kitahara et al. (2010a).

Caryophyllia (*Caryophyllia*) *crosnieri* Cairns & Zibrowius, 1997

Plate 14, Figs. E-F

Caryophyllia elongata Cairns in Cairns & Keller, 1993: 236-237, pl. 4, figs. A-B. –Cairns, 1995: 52, pl. 10, figs. d-f.

Caryophyllia crosnieri Cairns & Zibrowius, 1997: 87, 89. –Cairns, 1999: 70, figs. 5a, b. –Cairns et al., 1999: 20. –Cairns, 2004a: 277. –Cairns, 2009: 6. –Kitahara et al., 2010a: 99-100, 113, figs. 33-36.

Type locality. –*Vityaz* stn. 2716 (33º17’S, 44º55’E – off Walter’s Shoal, Madagascar Plateau), 630-680 m.

Type material. –The holotype is deposited at the IO (Cairns & Keller, 1993).

New records. –None.

Previous records from New Caledonia. –Cairns & Zibrowius (1997) and Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 165-1434 m. –*Elsewhere*: Madagascar Plateau; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 133-1050 m.

Discussion. –*Caryophyllia crosnieri* is distinguished from New Caledonian and Australian congeners by having well-developed S1 that separate a pair of pali, or, as observed by Cairns & Zibrowius (1997), by having small "paired" pali. This species was recently described by Kitahara et al. (2010a).

Caryophyllia (*Caryophyllia*) *diomedeae* Marenzeller, 1904

Plate 14, Figs. G-H

Caryophyllia diomedeae Marenzeller, 1904a: 79-80, pl. 1, fig. 2. –Durham & Barnard, 1952: 10, 82, pl. 9, fig. 43. –Cairns, 1991a: 11-13, pl. 4, figs. c-e. –Cairns, 1995: 49-50, pl. 9, figs. a-d. –Cortés, 1997: 330. –Cairns & Zibrowius, 1997: 88. –Koslow & Gowlett-Holmes, 1998: 38. –Cairns, 1999: 74. –Cairns et al., 1999:20. –Piñón, 1999: 20, 81. –Cairns, 2004a: 264, 277, 328. –Cairns et al., 2005: 17, 25, 28, figs. 2D-E. –González-Romero et al., 2008: 1-2, fig. 1. –Cairns, 2009: 5. –Kitahara et al., 2010a: 100, 102, 113-114, figs. 37-46. –Kitahara et al., 2010b.

Caryophyllia profunda. –Cairns, 1982: 17-19 (in part: *Eltanin* stn. 1403).

Caryophyllia sarsiae. –Cairns & Parker, 1992: 19-20, figs. 5c, e, f.

Type locality. –*Albatross* stn. 3358 (6º30'N, 81º44'W – Pacific coast of Panama), 1043 m.

Type material. –One syntype is deposited at the NMNH (Cairns, 1995).

New records. –Bathus 4: stn. DW 888 (2). –Norfolk 2: stn. DW 2035 (1); stn. DW 2060 (3); stn. DW 2075 (1); stn. DW 2080 (2); stn. DW 2106 (6); stn. DW 2126 (1); stn. DW 2142 (3); stn. DW 2157 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 398-1150 m. –*Elsewhere*: Philippines; Indonesia; Vanuatu; Australia; New Zealand; Cook Islands; Panama; Cocos Islands; Galapagos Islands; off northern Pacific from 0º to 31ºN; Chile; northeastern Atlantic from the Mediterranean to the Azores; and Bermuda; 225-2200 m.

Discussion. –Among the species belonging to the genus *Caryophyllia*, *C. diomedeae* groups with species that are fixed and contain four complete septal cycles, which is the most common morphologic pattern within the genus. *C. diomedeae* can be distinguished from the other species from New Caledonia and Australian regions by the presence of a complete fourth septal cycle; well-developed pali before the penultimate septal cycle; and a septal formula of S1-2>S3≥S4. This species was recently described by Kitahara et al. (2010a).

Caryophyllia (_Caryophyllia_) _hawaiiensis_ Vaughan, 1907

Plate 14, Figs. I-J

Caryophyllia hawaiiensis Vaughan, 1907: 76, pl. 5, figs. 4a, b. –Cairns, 1984: 11. Cairns, 1991a: 12. –Cairns, 1995: 44-45, pl. 7, figs. d-f. –Cairns & Zibrowius, 1997: 93. –Cairns, 1999: 69-70. –Cairns et al., 1999: 20. –Cairns, 2004a: 277. –Tachikawa, 2005: 7, pl. 2, figs. G-H. –Cairns, 2006: 47. –Cairns, 2009: 6. –Kitahara et al., 2010a: 102-103, 113, figs. 56-57, 60-61.

Type locality. –*Albatross* stn. 3838 (21º04’05’’N, 157º10’35’’W – off Molokai, Hawaii), 168-388 m.

Type material. –Four syntypes are deposited at the NMNH (Vaughan, 1907).

New records. –Norfolk 2: stn. DW 2135 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 295-351 m. –Elsewhere: Hawaii; Japan; South China Sea; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 85-650 m.

Discussion. –Within the New Caledonian *Caryophyllia* group, *C. hawaiiensis* is distinguished by the presence of highly exsert S1 (which are larger than S2), and S4 that are larger than S3. This species was recently described by Kitahara et al. (2010a).

Caryophyllia (_Caryophyllia_) _laevigata_ Kitahara, Cairns & Miller, 2010

Plate 14, Figs. K-L

Caryophyllia laevigata Kitahara et al., 2010:103-104, 114, figs. 62-63.

Type locality. –*Norfolk 2* stn. DW 2066 (25º17'S, 168º55'E – Bank Athos, New Caledonia), 834-870 m.

Type material. –The holotype and 20 paratypes are deposited at the MNHN. Nine additional paratypes are deposited at the NMNH (Kitahara et al., 2010a).

New records. –Norfolk 2: stn. DW 2035 (1); stn. DW 2111 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 410-1074 m.

Discussion. –*Caryophyllia laevigata* morphologically groups with congenerics that have hexameral symmetry in four complete cycles. However, it can be distinguished by the presence of the following characters: porcellanous theca; S4 usually larger than S3 (especially in mature coralla); and slightly (instead of highly) exsert S1-2. This species was recently described by Kitahara et al. (2010a).

Caryophyllia (_Caryophyllia_) _lamellifera_ Moseley, 1881

Plate 14, Figs. M-N

Caryophyllia lamellifera Moseley, 1881: 140-141, pl. 1, figs. 7a, b. –Hutton, 1904: 315. –Cairns, 1991a: 12. –Cairns, 1995: 51-52, pl. 9, fig. i, pl. 10, figs. a-c. –Cairns& Zibrowius, 1997: 90. –Cairns, 1999: 74-75. –Cairns et al., 1999: 20. –Cairns, 2004a: 278. –Cairns, 2009: 6. –Kitahara et al., 2010a: 104, 105, 113, 115, figs. 64-68. –Kitahara et al., 2010b.

Type locality. –*Challenger* stn. 170 (29º55'S, 178º14'W - Kermadec Ridge, New Zealand), 1152 m.

Type material. –Two uncataloged syntypes are deposited at BM (Cairns, 1995).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 250-350 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 89-1152 m.

Discussion. –Among the six species of *Caryophyllia* that have theca covered with transverse ridges (sometimes as aligned granules), *C. lamellifera* is most easily distinguished in having S1=S2 and S3>S4, different septal symmetry and septal exsertness (especially the primaries), and lacking costae. This species was recently described by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) *oblonga* Kitahara, Cairns & Miller, 2010**

Plate 14, Figs. O-P

Caryophyllia oblonga Kitahara et al., 2010a: 104,106, 114, figs. 69-71.

Type locality. –*Norfolk 2* stn. DW 2053 (New Caledonia), 670-708 m.

Type material. –The holotype and one paratype are deposited at the MNHN. One additional paratype is deposited at the NMNH (Kitahara et al., 2010a).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 670-1005 m.

Discussion. –Not many species of *Caryophyllia* have an elongate, subcylindrical corallum with small calicular diameter. Among the ones that do, *Caryophyllia oblonga* is most similar to *C. marmorea*, but is distinguished by septal symmetry (octameral in *C. marmorea*). This species was recently described by Kitahara et al. (2010a).

Caryophyllia (_Caryophyllia_) _octopali_ Vaughan, 1907

Plate 14, Figs. Q-R

Caryophyllia octopali Vaughan, 1907: 74-75, pl. 5, fig. 4. –Cairns, 1984: 11. –Cairns, 1991a: 12. –Cairns & Zibrowius, 1997: 92. –Cairns et al., 1999: 20. –Cairns, 2006: 47. –Cairns, 2009: 6. –Kitahara et al., 2010a: 106, 113, figs. 72-75.

Type locality. –*Albatross* stn. 3827 and 3828 (South of Molokai, Hawaii), 513-678 m.

Type material. –The holotype and paratypes are deposited at the NMNH (Kitahara et al., 2010a).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 410-443 m. –*Elsewhere*: Hawaii; 457-627 m.

Discussion. –Among the four previously described *Caryophyllia* that lack transverse ridged theca, and have octamerally arranged septa with tertiaries equal to or wider than secondaries (*C. octopali, C. barbadensis, C. marmorea* and *C. octonaria*), *C. octopali* is distinguished by having non-granular pali, PD:GCD ≥ 0.5, and elongate to subcylindrical corallum. This species was recently described by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) *quadragenaria* Alcock, 1902**

Plate 14, Figs. S-T

Caryophyllia quadragenaria Alcock, 1902a: 91-92. –Alcock, 1902b: 10, pl. 1, figs. 4, 4a. –Keller, 1981a: 18. –Cairns, 1991a: 12. –Cairns, 1994: 46-47, pl. 20, figs. c-h, pl. 51, figs. c-d. –Cairns, 1995: 45-46, pl. 7, figs. g-h. –Cairns & Zibrowius, 1997: 88, 93. –Cairns, 1998: 375. –Cairns, 1999: 73. –Cairns et al., 1999:20. –Cairns, 2004a: 278. –González-Romero et al., 2008: 1-2, fig. 2. –Cairns, 2009: 6. –Kitahara et al., 2010a: 107,113, figs. 78-81.

Caryophyllia scobinosa. –Yabe & Eguchi, 1942b: 119 (*in part*).

Caryophyllia scobinosa decapali Yabe & Eguchi, 1942b: 120, 149, pl. 10, figs. 6, 7. –Eguchi, 1968: C33-34. –Eguchi & Miyawaki, 1975: 56. –Cairns, 1991a: 12.

Caryophyllia profunda. –Squires & Keyes, 1967: 23 (*in part*).

Caryophyllia decapali. –Grygier, 1983: 420. –Zibrowius & Grygier, 1985: 120, figs. 10, 11.

Type locality. –*Siboga* stns. 90, 251, and 289 (Makassar Strait, Banda, and Timor Seas), 54-281 m.

Type material. –Two syntypes are deposited at the ZMA (Cairns, 1995).

New records. –Bathus 4: stn. DW 886 (1). –Norfolk 2: stn. DW 2159 (3).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 245-443 m. –*Elsewhere*: Japan; East China Sea; Indonesia; Wallis and Futuna; Vanuatu; Australia; New Zealand; and eastern North Pacific; 54-440 m.

Discussion. –*C. quadragenaria* is distinguished from congeners having decameral septal symmetry by having sinuous palar axial edges, granular theca, and PD:GCD between 0.22 and 0.39. This species was fully described by Kitahara et al. (2010a). Crustaceans endoparasites have been found in this species by Grygier (1983b).

Caryophyllia (_Caryophyllia_) _ralphae_ Cairns, 1995

Plate 15, Figs. A-B

Caryophyllia ralphae Cairns, 1995: 48-49, pl. 8, figs. f-i. –Cairns et al., 1999:20. –Cairns, 2004a: 278. –Cairns, 2009: 6. –Kitahara et al., 2010a: 107-108, 114-115, figs. 83-87. –Kitahara et al., 2010b.

Type locality. –*NZOI* stn. I741 (22º43'S, 159º16'E – northern Lord Howe Seamount Chain), 328 m.

Type material. –The holotype is deposited at the NZOI. Three paratypes are deposited at AM and another at NMNH (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2065 (1); stn. DW 2135 (3); stn. DW 2136 (2).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 270-896 m. –*Elsewhere*: Australia; 328 m.

Discussion. –Morphologically, *C. ralphae* can be grouped with another three species that are characterized by having pali before the antepenultimate septal cycle: *C. paucipalata*, *C. capensis*, and *C. eltaninae* (Lesser Antilles, off South Africa, and off South Georgia, respectively). *C. ralphae* is distinguished by its highly exsert septa and very deep fossa. Full description of New Caledonian specimens and comparisons between *C. ralphae* and *Rhizosmilia* are provided by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) *rugosa* Moseley, 1881**

Plate 15, Figs. C-D

Caryophyllia rugosa Moseley, 1881: 141-143, pl. 1, figs. 8a-b. –Kock, 1889: 10-20, 7 figs. –Faustino, 1927: 70-71, pl. 8, figs. 12-14. –Wells, 1954: 469, pl. 177, figs. 5-6. –Cairns, 1984: 11-13, pl. 2, figs. A-B, pl. 4, fig. I. –Cairns, 1991b: 12. –Cairns & Keller, 1993: 236, pl. 3, fig. 1. –Cairns, 1994: 47, pl. 20, fig. i, pl. 21, fig. a. –Cairns, 1995: 43-44, pl. 6, fig. h, pl. 7, figs. a-c. –Cairns & Zibrowius, 1997: 91-92. –Cairns, 1998: 375. –Cairns, 1999: 71. –Cairns et al., 1999:20. –Cairns, 2004a: 264, 278. –Tachikawa, 2005: 7, pl. 2, figs. E-F. –Cairns, 2006: 47. –Ogawa, 2006:105, 109. –Cairns, 2009: 6. –Kitahara et al., 2010a: 108, 113, 115, figs. 93-97. –Kitahara et al., 2010b.

Caryophyllia paraoctopali Yabe & Eguchi, 1942b: 120, 150, pl. 10, fig. 12.

Type locality. –*Challenger* stns. 192 and 201 (Banda and Sulu Seas), 187-230 m.

Type material. –The syntypes are deposited at BM (Cairns, 1994).

New records. –Norfolk 2: stn. DW 2024 (2); stn. CP 2038 (1); stn. DW 2063 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 212-724 m. –*Elsewhere*: Hawaii; Japan; East China Sea; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; New Zealand; off Zululand; Mozambique; Kenya; and Maldives; 71-581 m.

Discussion. –This small, commonly collected species of *Caryophyllia* is distinguished from congeners by having transversed ridged theca, and extremely sinuous septa and pali. Full description of New Caledonian specimens is provided by Kitahara et al. (2010a).

Caryophyllia (*Caryophyllia*) *scobinosa* Alcock, 1902

Plate 15, Figs. E-F

Caryophyllia cultrifera Alcock, 1902a: 89-90. –Alcock, 1902b: 7-8, figs. 1, 1a. –Faustino, 1927: 67-68, pl. 8, figs. 8-9. –Veron, 1986: 905.

Caryophyllia scobinosa Alcock, 1902a: 90. –Alcock, 1902b: 8, pl. 1, figs. 2, 2a. –Faustino, 1927: 68-69, pl. 8, figs. 10-11. –Yabe & Eguchi, 1942b: 119-120 (in part). –Utinomi, 1965: 254. –Eguchi, 1965: 285. –Keller, 1981a: 17, fig. 2. –Cairns, 1991b: 12. –Cairns & Keller, 1993: 235. –Cairns, 1994: 45-46, pl. 20, figs. a-b (in part). –Cairns, 1995: 52-53, pl. 10, figs. g-i, pl. 11, figs. a-c. –Cairns & Zibrowius, 1997: 94. –Cairns, 1999: 75. –Cairns et al., 1999:20. –Kitahara, 2007: 498, 507, 510, fig. 2K. –Kitahara et al., 2008: 16, fig. 2D. –Cairns, 2004a: 278. –Cairns, 2009: 7. –Kitahara et al., 2010a: 109, 113, 115, figs. 113, 117.

Caryophyllia cf. *scobinosa*. –Utinomi, 1956: 42.

Type locality. –*Siboga* stns. 45 and 102 (Flores and Sulu Seas), 535-794 m.

Type material. –Six syntypes are deposited at the ZMA (Cairns, 1995).

New records. –None.

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 354-830 m. –*Elsewhere*: Tanzania; Madagascar; off Tonga and Samoa; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and Brazil; 302-2450 m.

Discussion. –*Caryophyllia scobinosa* is distinguished from the other Indo-Pacific unattached species of *Caryophyllia* by the presence in the adult corallum of 48-72 septa (not 96 as in *C. ambrosia* and *C. grandis*); 12 to 14 pali; and in having an extremely jagged calicular margin. It is fully described by Kitahara et al. (2010a).

***Caryophyllia* (*Caryophyllia*) sp. A**

Plate 15, Figs. G-H

Caryophyllia sp. A sensu Kitahara et al., 2010a: 109-110, figs. 98-102.

New records. –None.

Previous records from New Caledonia. –Kitahara el al. (2010a).

Distribution. –*New Caledonia*: 416-433 m.

Discussion. –*Caryophyllia* sp. A is almost indistinguishable from *C. lamellifera* but does not have transverse thecal ridges, which are diagnostic for that species. Otherwise, septal symmetry and exsertness are the same. Interestingly, the skeleton pigmentation of *C.* sp. A is indistinguishable from some specimens of *C. versicolorata*, however, as *C. lamellifera*, *C. versicolorata* has transversal thecal ridges. *Caryophyllia* sp. A may represent an undescribed species, but a formal description is postponed until more specimens be available for examination and comparison.

***Caryophyllia* (*Caryophyllia*) *versicolorata* Kitahara, Cairns & Miller, 2010**

Plate 15, Figs. I-J

Caryophyllia versicolorata Kitahara et al., 2010a: 111-112, 113, figs107-112.

Type locality. –*Norfolk* 2 stn. DW 2037 (23º40’S, 167º41’E – New Caledonia), 517-570 m.

Type material. –The holotype and 8 paratypes are deposited at the MNHN. Four additional paratypes are deposited at the NMNH (Kitahara et al., 2010a).

New records. –Norfolk 2: stn. DW 2035 (9); stn. DW 2036 (7).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 215-708 m.

Discussion. –Among the six previously described species of *Caryophyllia* with transversely ridged theca, *C. versicolorata* is unique in having: septa hexamerally arranged in four complete cycles; septa only slightly exsert; C1-3 and S1-3 usually pigmented dark-brown. Palar and columellar elements white. Full description of this species is provided by Kitahara et al. (2010a).

Subgenus *Caryophyllia* (*Acanthocyathus*) Milne Edward & Haime, 1848

Diagnosis. –*Caryophyllia* having coralla with edge spines or crests.

Type species. –*Acanthocyathus grayi* Milne Edwards & Haime, 1848a, by subsequent designation (Milne Edwards & Haime, 1850b: xiii).

Caryophyllia (*Acanthocyathus*) *unicristata* Cairns & Zibrowius, 1997

Plate 15, Figs. K-L

Caryophyllia unicristata Cairns & Zibrowius, 1997: 101-102, figs. 9d, e. –Cairns, 1998: 337. –Cairns et al., 1999:20. –Cairns, 2004a: 277. –Cairns, 2009: 7. –Kitahara et al., 2010a: 111, 112, 115, figs. 114-116.

Type locality. –*Karubar* stn. 76 (8º49'S, 131º36'E – South of Tanimbar Islands), 400 m.

Type material. –The holotype and 28 paratypes are deposited at the MNHN. Additional paratypes are deposited at the POLIPI (8) and NMNH (79) (Cairns & Zibrowius, 1997).

New records. –Bathus 4: stn. CP 850 (4); stn. DW 888 (1); stn. CP 892 (7); stn. CP 899 (3); stn. CP 900 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Distribution. –*New Caledonia*: 386-620 m. –*Elsewhere*: Indonesia; and Australia; 251-477 m.

Discussion. –Among the *Caryophyllia* that bear edge spines or lateral crests, *C. unicristata* is distinguished by the presence of a highly sinuous crest only on the convex thecal edge. It was recently fully described by Kitahara et al. (2010a).

Genus *Crispatotrochus* Tenison–Woods, 1878

Diagnosis. –Corallum solitary, ceratoid to turbinate, and usually attached. Septotheca costate or covered with transverse ridges. Pali absent; columella fascicular composed of discrete, twisted elements.

Type species. –*Crispatotrochus inortatus* Tenison–Woods, 1878, by monotypy.

Crispatotrochus rubescens (Moseley, 1881)

Plate 15, Figs. M-N

Cyathoceras rubescens Moseley, 1881: 157, pl. 2, figs. 8a–c. –Marenzeller, 1888: 21–22. –Yabe and Eguchi, 1942: 117. –Wells, 1964: 112. –Cairns, 1982: 22. –Cairns, 1984: 5, 15.

Cyathoceras tydemani Alcock, 1902a: 93–94; 1902b: 14, pl. 1, figs. 7, 7a. –Faustino, 1927: 65, pl. 9, figs. 5–6. –Cairns, 1982: 22.

Cyathoceras diomedeae Vaughan, 1907: 77–78, pl. 7, figs. 1–2. –Vaughan, 1919: 1917, pl. XIII, figs. 2, 2a. –Yabe and Eguchi, 1942: 116–117, pl. 9, fig. 8. –Vaughan and Wells, 1943: 333, pl. 41, figs. 14, 14a. –Wells, 1964: 112. –Cairns, 1982: 22.

Crispatotrochus rubescens. –Cairns, 1991b: 15; –Cairns, 1994: 22, 51, pl. 22, figs. g–h. –Cairns and Zibrowius, 1997: 103–104, figs. 10a–c. –Cairns, 1999: 76–77. –Cairns et al. 1999: 21. –Cairns, 2004a: 265, 279–280. –Cairns, 2006: 47. –Kitahara & Cairns, 2008: 60, 63-64, pl. 1, figs. A-D, F-G. –Cairns, 2009: 8.

Type locality. –Kai Islands (5°49’15’’S, 132º14’15’’E – Banda Sea), 236 m.

Type material. –According to Cairns (1984) the holotype is lost.

New records. –Bathus 4: stn. DW 943 (1). –Norfolk 2: stn. DW 2025 (1); stn. DW 2066 (2 wrongly reported as part of DW 2065 by Kitahara et al., 2010a).

Previous records from New Caledonia. –Kitahara & Cairns (2008).

Description (after Kitahara & Cairns [2008]). –Corallum ceratoid, elongate, slightly curved, and flared distally. Pedicel robust ranging from 4.2 to 5.5 mm in diameter (PD:GCD = 0.26–0.31), expanding to a thin encrusting base. Largest specimen examined (NMNH 1115428) 21 x 16.8 mm in CD and 37.2 mm in height. Costae more prominent (as low ridges) near calicular edge, fading towards pedicel. Theca granular. Corallum white.

Septa hexamerally arranged in five complete cycles according to formula S1-2>S3>S4>S5, but largest specimen displays some rudimentary S6. S1-2 highly exsert, with sinuous vertical axial edges that fuse to columella. S3 four fifths width of S1-2 with slightly less sinuous axial edges. S4 three fourths width of S3, with less sinuous axial edges. S5 half width of S4. S6, if present, rudimentary. Fossa of moderate depth, containing an elongate columella consisting of 4-9 slender, twisted elements.

Distribution. –*New Caledonia*: 316-870 m. –*Elsewhere*: Hawaii; Japan; China; Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and Christmas Islands; 110–634 m.

Discussion. –Among the species of *Crispatotrochus* that have 5 complete hexamerally arranged septal cycles (*C. rubescens*, *C. foxi*, and *C. niinoi*), all of which occur in temperate Pacific, *C. rubescens* is distinguished in having S1-2 axial edges sinuous, and costate theca at least near the calicular margin. One new record reported herein (NMNH 1115428) has 96 rudimentary S6.

Crispatotrochus rugosus **Cairns, 1995**

Plate 15, Figs. O-P

Crispatotrochus rugosus Cairns, 1995: 57, pl. 13, figs. a–b. –Cairns & Zibrowius, 1997: 104. –Cairns, 1998: 363, 368, 378. –Cairns, 1999: 77, figs. 6 a–b. –Cairns et al. 1999: 21. –Romano & Cairns, 2000: 1048. –Cairns, 2004a: 265. –Kitahara & Cairns, 2008: 60, 62, 64-65, pl. 1, figs. E, H-J, M, S. –Cairns, 2009: 8. –Barbeitos et al., 2010.

Type locality. –Lord Howe Seamount Chain (26º59.7’S, 159º18.9’E), 376 m.

Type material. –The holotype and 3 paratypes are deposited at the NZOI. Twenty additional paratypes are deposited at the NMNH (Cairns, 1995).

New records. –Norfolk 1: stn. DW 1651 (1). –Norfolk 2: stn. DW 2151 (3); stn. DW 2159 (2); stn. DW 2160 (1).

Previous records from New Caledonia. –Kitahara & Cairns (2008).

Description (after Kitahara & Cairns [2008]). -Corallum ceratoid, elongate, usually curved, and slightly flared distally. Two specimens examined are attached to calicular margin of an older coralla. Pedicel robust and massive (PD:GCD = 0.32-0.45), expanding to a thin encrusting base. Holotype measures 15.1 x 13.3 mm in CD and 29 mm in height. Calice slightly elliptical (GCD:LCD = 1.05-1.1), and serrated, however, smallest specimen 4.4 x 4.0 mm in CD displays a hexagonal calicular margin with each corner corresponding to each S1. Theca covered with thin transverse ridges, usually more prominent near base. Well preserved coralla bear slightly ridged costae (C1-4) separated by very thin shallow striae. One specimen analysed has C4 broader than C3, which in turn is broader than C1–2. Corallum white, but a specimen from Norfolk 2 stn. DW 2150 has C–1 and upper edges of S1–2 pigmented brown.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4. S1 highly exsert (up to 3 mm), thicker than higher septal cycles, with rounded upper margin, and vertical sinuous axial edges almost reaching columella. S2 less exsert, about four fifths width of S1, and have very sinuous axial edges. Axial edge sinuosity of secondaries starts above sinuosity of primaries. S3 equal to slightly less exsert, but wider and more sinuous than S4. Usually sinuosity of tertiaries starts above sinuosity of secondaries. Upper outer edge of S4 fuse to adjacent S1 or S2, becoming more exsert than S3. Fossa of moderate depth, containing a columella composed of 3–5 slender twisted elements.

Distribution. –*New Caledonia*: 245-402 m. –*Elsewhere*: Philippines; Malaysia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 142-1050 m.

Discussion. –Only reported from the Pacific Ocean, and grouping with the species with septa hexamerally arranged in four complete cycles (*C. cornu*, *C. curvatus, C. galapagensis, C. inortatus, C. irregularis*, and *C. septumdentatus*), *C. rugosus* is distinguished by the presence of transverse ridged theca and the absence of septal teeth in the lower axial septal margin of S1. Among the new records presented herein, one lot (DW 2024, composed of 5 specimens collection number) contains a specimen without twisted elements in the columella. Also in the same lot, two specimens are attached near the calicular margin of dead coralla of the same species, being both curved 90º, with the calices staying in the same orientation as the older coralla. Both older coralla encrusted with bryozoans, barnacles, polychaetes, and stylasterids (?).

Another specimen examined (DW 2150), displays S1-2 and outer edge of S3, and their corresponding costae (only near calicular margin) dark brown pigmented, the costal pigmentation being less dark, similar to two specimens from NZOI Stn C527, examined by Cairns (1995).

Crispatotrochus septumdentatus Kitahara & Cairns, 2008

Plate 16, Figs. A-B

Crispatotrochus septumdentatus Kitahara & Cairns, 2008: 60, 65, pl. 1, figs. K-L, N-R.

Type locality. –*Norfolk 2* stn. DW 2124 (23º18'S, 168º15'E – New Caledonia), 260-270 m.

Type material. –The holotype and 5 paratypes are deposited at the MNHN. Two additional paratypes are deposited at the NMNH (Kitahara & Cairns, 2008).

New records. –None.

Previous records from New Caledonia. –Kitahara & Cairns (2008).

Description (after Kitahara & Cairns [2008]). -Corallum ceratoid, elongate, curved, and usually slightly flared distally. Corallum attached through a robust pedicel (PD:GCD = 0.32-0.47) and a thin encrusting base of approximately 0.2–0.4 mm in width. Largest specimen examined (NMNH 1115444) 9.4 x 9.0 mm in CD and 21.5 mm in height. Calice circular to slightly elliptical even in small coralla (GCD:LCD = 1.04-1.15), calicular margin jagged, with high lancets corresponding to fusion of each pair of S4 with their adjacent S1 and smaller lancets to fusion of each pair of S4 with their adjacent S2. All costae ridged near calicular edge, slightly convex, and separated by thin intercostal striae. C1-2 more prominent and usually wider than C3-4, sometimes extending to pedicel. Theca uniformly covered by small pointed granules. Almost all specimens analysed bear some very thin, not uniform, continuous transverse ridges (more prominent in worn specimens). Corallum white.

Septa hexamerally arranged in 4 cycles according to formula S1>S2>S3>>S4. S1 most exsert septa (up to 2 mm), and much thicker than higher septal cycles, with straight axial edge that reach and fuses to columella deep in fossa. Near columella some specimens bear septal teeth (?) on S1. S2 less exsert (about 1 mm) also with straight axial edge that sometimes fuses to columella. If S2 fuse to columella they also bear septal teeth, however, if not fusing, S2 disappear deep in fossa. S3 about one fourth to half width of S2, slightly sinuous, and commonly have lacerate axial edge. S4 rudimentary, composed of a row of granules, and dimorphic in exsertness. A pair of S4 fuse with each S1–2 near calicular edge forming lancets that alternate in height. Those fused with S1 almost as exsert as S2, and those fused to S2 are the least exsert septa. Septal faces bear sparse, low, pointed granules. Fossa deep, containing a large elliptical columella composed of closely grouped, slender ribbons, usually fused into a solid mass.

Distribution. –*New Caledonia:* 187-400 m.

Discussion. –Among the 14 Recent species of *Crispatotrochus*, *C. septumdentatus* is most distinguished by the unusual presence of septal teeth on the lower axial edges of S1 and S2, the latter only when fused with the columella. The presence of transverse ridges in some specimens is probably related to the expansion of the tissue over the external part of theca (e.g.: the specimen Bathus 4 station DW 894 has lower 3/4 of corallum very encrusted, being separated from the unencrusted higher part by thin transverse ridges).

Genus *Desmophyllum* Ehrenberg, 1834

Diagnosis. –Solitary, trochoid, fixed. Pali absent. Columella absent or rudimentary. Sparse endothecal dissepiments.

Type species. –*Desmophyllum dianthus* Ehrenberg, 1834, by subsequent designation (Cairns, 1994).

Desmophyllum dianthus* (Esper, 1794)

Plate 16, Figs. C-D

Madrepora dianthus Esper, 1794: pl. 69, figs. 1-3. –Esper, 1795: 85-86. –Scheer, 1990: 406.

Desmophyllum cristagalli Milne Edwards & Haime, 1848a: 253, pl. 7, figs. 10, 10a. –Milne Edwards & Haime, 1857: 76. –Saville-Kent, 1870: 459. –Duncan, 1873: 321. –Pourtalès, 1878: 203 (*in part*: *Blake* stn. 2). –Pourtalès, 1880: 96, 106 (*in part*: BL-288). –Verrill, 1885: 150. –Agassiz, 1888: 151. –Jourdan, 1895: 22. –Roule, 1896: 318. –Lacaze-Duthiers, 1897: 131, pl. 6, figs. 7-11. –Alcock, 1902c: 28. –Marenzeller, 1904a: 267-268, pl. 15, figs. 2a-b. –Gourret, 1906: 119, pl. 11, fig. 8. –Marion, 1906: 119, pl. 11, fig. 8. –Hickson, 1907: 12. –Vaughan, 1907: 67, pl. 7, figs. 3, 3a-b. –Verrill, 1908: 494. –Stephens, 1909: 25. –Döderlein, 1913: 126, pl. 8, figs. 45, 45a. –Cecchini, 1917: 148. –Gravier, 1920: 72-76 (*in part*), pl. 8, figs. 130-135. –Joubin, 1928: figs. 1-3. –Gardiner, 1929: 125-126. –Nobre, 1931: 65-66. –Hoffmeister, 1933: 8-9, pl. 2, figs. 1-4. –Brunelli & Bini, 1934: 734, figs. 1-2. –Durham, 1947: 36-37, pl. 1, figs. 6, 10, 15, 17. –Ralph, 1948: 108, fig. 2. –Durham, 1949: 158-159, pl. 4, figs. 2, 4, 7, 8. –Durham & Barnard, 1952: 86-87, pl. 11, fig. 48 (*in part*: not Cortego Bay specimens). –Wells, 1958: 262. –Squires, 1958: 91. –Squires, 1959a: 18-19 (*in part*: stn. V7-12). –Squires, 1961: 18. –Wells, 1961: 18-19. –Pax & Müller, 1962: 242, fig. 122. –Ralph & Squires, 1962: 9-10, pl. 3, figs. 1-10. –Parker, 1964: 150. –Wells, 1964: 109. –Squires & Keyes, 1967: 25, pl. 3, figs. 12-14. –Squires, 1969: 16-17. –Wells, 1969: 17, pl. 6. –Best, 1970: 310, fig. 11. –Laborel, 1970: 156. –Livingston & Thompson, 1971: 788. –Talmadge, 1972: 81. –Zibrowius, 1974a: 758-761, pl. 3, figs. 1-10. –Beurois, 1975: 46. –Keller, 1975: 176. –Zibrowius et al., 1975: 98, pl. 4, figs. A-B. –Sorauf & Jell, 1977: 2, pl. 1, fig. 1. –Zibrowius & Grieshaber, 1977: 379. –Zibrowius, 1978: 535. –Zibrowius, 1979: 19, pl. 1, figs. 5-6. –Cairns, 1979: 117-119, pl. 21, figs. 7-8, pl. 22, fig. 8. –Zibrowius, 1980: 117-121, pl. 61, figs. A-O, pl. 62, figs. A-M. –Cairns, 1981: 10. –Cairns, 1982: 29, pl. 8, figs. 9-12, pl. 9, figs. 1-3. –Austin, 1985: 81. –Bythell, 1986: 16-17, pl. 8, figs. A-D. –Veron, 1986: 608. –Kozloff, 1987: 72. –Messing, 1987: 12. –Zibrowius, 1988: 136. –Zibrowius & Gili, 1990: 35-36. –Cairns, 1991a: 17, pl. 6, figs. g-i. –Cairns & Parker, 1992: 28-29, figs. 8b-c. –Fosshagen & HøisSter, 1992: 291. –Tyler & Zibrowius, 1992: 227. –Cairns & Keller, 1993: 246. –Cuif et al., 2003: 468.

Desmophyllum costatum Milne Edwards & Haime, 1848a: 254. –Milne Edwards & Haime, 1857: 77.

Desmophyllum cumingii Milne Edwards & Haime, 1848a: 254, pl. 7, fig. 11. –Milne Edwards & Haime, 1857: 77.

Desmophyllum ingens Moseley, 1881: 160-162, pl. 4, figs. 1-6, pl. 5, figs. 1-4a. –Squires, 1969: 17, pl. 16.

Desmophyllum serpuliforme Gravier, 1915: 12, figs. 4-5. –Gravier, 1920: 78, pl. 7, fig. 121-129, pl. 15, fig. 212, pl. 6, fig. 215.

Desmophyllum capense. –Gardiner, 1939: 329-330. –Wells, 1958: 262. –Cairns, 1979: 206.

Desmophyllum capensis. –Squires, 1961: 23, fig. 5.

Desmophyllum dianthus. –Ehrenberg, 1834: 299-300. –Milne Edwards & Haime, 1848a: 254-255. –Milne Edwards & Haime, 1857: 77-78. –Yabe & Eguchi, 1942b: 113-114, pl. 9, figs. 1-3. –Eguchi, 1965: 290. –Eguchi, 1968: C41, pl. C33, fig. 6. –Cairns, 1994: 26-27, pl. 9, figs. a-d. –Cairns, 1995: 77, pl. 21, figs. d-f. –Cairns & Zibrowius, 1997: 131, figs. 17g-h. –Cairns, 1998: 385-386. –Koslow & Gowlett-Holmes, 1998: 38. –Cairns, 1999: 104-105. –Cairns et al., 1999: 22. –Stolarski, 2003: 508, fig. 7a-g. –Cairns, 2004a: 281. –Cairns, 2006: 47. –Kitahara, 2007: 502, 503, figs. 3K-L. –Pires, 2007: 269. –Cairns, 2009: 13. –Kitahara et al., 2010b. –Miller et al., 2010: 3, 4, 5, 6, 7, 9, 10.

Desmophyllum sp. Veron, 2000: II, 411, fig. 12.

Type locality. –Sagami Bay (Japan), depth unknown.

Type material. –The neotype is deposited at the NMNH (Cairns, 1994).

New records. –Bathus 3: stn. CP 833 (8). –Halipro 1: stn. CP 877 (10). –Bathus 4: stn. DW 885 (1); stn. DW 914 (1); stn. DW 923 (1); stn. DW 943 (1). –Musorstom 9: stn. DR 1221 (1). –Norfolk 2: stn. DW 2024 (5); stn. DW 2025 (2); stn. DW 2034 (1); stn. DW 2041 (3); stn. DW 2047 (1); stn. DW 2049 (1); stn. DW 2052 (1); stn. DW 2058 (1); stn. DW 2060 (5); stn. DW 2084 (1); stn. DW 2097 (13); stn. DW 2098 (2); stn. DW 2111 (1); stn. DW 2112 (2); stn. DW 2113 (4); stn. DW 2132 (4); stn. DW 2137 (7); stn. DW 2142 (17); stn. DW 2144 (1).

Description. –Corallum variable in shape (ranging from serpentine to ceratoid/trochoid) and always attached by a pedicel (PD:GCD = 0.27-0.50) that expand into a thin encrusting base. Calice slightly elliptical in small specimens becoming more elliptical in larger specimens (GCD:LCD = 1.1-1.3). Calicular edge highly serrate. Largest specimen examined (DW 2112) 24.8 x 19.6 mm in CD, 7 mm in PD, and 33.7 mm in height. Theca smooth and covered with small low granules. Costae more prominent near calicular edge. C1-3 ridged and sometimes discontinuous. Corallum white to light-beige.

Septa hexamerally arranged in five complete cycles according to formula: S1-2>S3>S4>S5 (96 septa). S1-2 highly exsert (up to 6 mm) and almost meet their opposite septa with vertical and straight axial edges. S3 up to 3 mm exsert, about ¾ width of S1-2, and also have straight and vertical axial edge. S4 least exsert septa and extend 4/5 width of S3. S5 fuse to adjacent S1-3 at calicular edge and are more exsert than S4. S5 only ½ size of S4. Fossa deep. Columella usually absent.

Distribution. –*New Caledonia*: 250-1434 m. –*Elsewhere*: Cosmopolitan except from continental Antarctica and northern Boreal Pacific; 8-2460 m.

Discussion. –Without any doubt, *Desmophyllum dianthus* is the most studied azooxanthellate solitary scleractinian coral. It is ubiquitous in all oceans and seas around the globe except from continental Antartica and northern Boreal Pacific. Interestingly, some populations of this species, especially those ones on the southwestern Pacific (New Zealand) display an enourmous corallum, sometimes with more than 55.0 mm in CD and 190.0 mm in height. In contrast, the New Caledonian specimens examined herein rarely exceed 15.0 mm in GCD and 20.0 mm in height. Amongst New Caledonian solitary scleractinians that do not bear columella, *D. dianthus* is distinguishes in having straight axial septal edges; highly exsert S1-2; absence of thecal extensions; 5 or more septal cycles; and corallum firmly attached to substratum often ceratoid to trochoid in shape. The specimens examined herein were found attached to a variety of substrata, including other scleractinians (*Madrepora oculata*); Stylasteridae; Polychaeta tubes; older *Desmophyllum dianthus*, etc.

Genus *Heterocyathus* Milne-Edwards and Haime, 1848

Diagnosis. –Corallum free and usually encapsulating a gastropod or scaphopod shell inhabited by a sipunculid worm. Costae at lateral theca distinct and either equal or unequal in thickness. At base costae transform into granulations. Lower part of each corallum shows a relatively large worm opening (occasionally two) and several small pores.

Type species. –*Heterocyathus aequicostatus* Milne Edwards & Haime, 1848, by subsequent designation (Milne Edwards & Haime, 1850b).

Heterocyathus aequicostatus Milne Edwards & Haime, 1848*

Plate 16, Figs. E-G

Heterocyathus aequicostatus Milne Edwards & Haime, 1848a: 324, pl. 10, fig. 8. –Milne Edwards & Haime, 1857: 51. –Alcock, 1893: 141. –Bouvier, 1895: 10. –Gardiner, 1904: 105-112, 125 (*in part*), pl. 3 figs. 1-11, 22-32, 39-43. –Gardiner, 1905: 955. –Bourne, 1905: 193-194, 213-226, pl. 3, pl. 4 figs. 12-21. –Harrison & Poole, 1909a: 898-899, pl. 85, figs. la-f. –Harrison & Poole, 1909b: 913. –Harrison, 1911: 1026, pl. 58, fig. 12. –Folkeson, 1919: 8-10 (i*n part*), pl. 1, figs. 8-9. –Faustino, 1927: 83-87, pl. 8, figs. 1-7. –Yabe & Eguchi, 1932b: 443. –Sakakura, 1935: 185-186, pl. 5, figs. 10-11. –Gardiner & Waugh, 1938: 186-187. –Umbgrove, 1938: 265. –Eguchi, 1941: 417. –Yabe & Eguchi, 1941c: 213, figs. 6a-b. –Yabe & Eguchi, 1941d: 270, figs. 3-4. –Yabe & Eguchi, 1942b: 127. –Umbgrove, 1946: 88. –Umbgrove, 1950: 643. –Crossland, 1952: 102-103. –Durham & Barnard, 1952: 87-88, pl. 11, figs. 49a-d. –Stephenson & Wells, 1956: 57. –Schindewolf, 1958: pl. 2, fig. 6. –Wells, 1964: 108. –Eguchi, 1968: C36-C37, pl. C28, fig. 1, pl. C29, figs. 8-9. –Pichon, 1974: fig. 6. –Ditlev, 1980: 82-83, fig. 360. –Wijsman-Best et al., 1980: 620. –Boshoff, 1981: 37. –Fisk, 1983: 287, 290, 291, 292, 293, 294. –Scheer & Pillai, 1983: 158, pl. 36, fig. 9. –Wells, 1984: 310, fig. 4.1. –Zibrowius & Grygier, 1985: 121. –Pillai, 1986: 188. –Veron, 1986: 558-559 (*in part*). –Hu, 1988: 146, 147, pl. 3, figs. 9, 12-13, 16-17. –Nishihira, 1988: 221. –Nishihira & Poung-In, 1989: fig. 2. –Hoeksema & Best, 1991: 226-230, figs. 1-11. – Hodgson & Carpenter, 1995: 243. –Cairns, 1998: 382-384, figs. 3a-b. –Cairns et al., 1999: 22. –Veron, 2000: II, 412-413, figs. 1-4. –Stolarski et al., 2001: 324, figs. 6A-D. –Cairns, 2004a: 281. –Pérez-Vivar et al., 2006: 262, 263. –Cairns, 2009: 12.

Type locality. –Unknown.

Type material. –Not traced (Cairns, 2004a).

New records. –Bathus 4: stn. DW 894 (1); stn. DW 932 (1); stn. DW 933 (9).

Description. –Corallum squat and always completely encapsulates a gastropod (or scaphopod [Cairns, 1998]) shell colonised by a sipunculid worm. Sipunculid efferent pore usually circular (1 mm in CD) and aborally located. However, two specimens examined display lateral and not circular pores, and another two specimens apparently grew from a parent corallum. Base flat, but pore area more prominent often lending an asymmetry to corallum. Overall, in both upper and basal views, corallum has a “pear” distinctive shape. Calice circular to slightly elliptical (GCD:LCD = 1.0-1.2); calicular edge lancetted. Largest specimen examined (DW 894) 8.2 x 7.1 mm in CD, and 5.7 mm in height. Costae flat and separated by narrow intercostal striae near calicular edge. Three to 4 granules occur across each costa. Base coarsely granulated. Costal and basal granules low and rounded. Corallum white, however, one specimen has a brown stripe surrounding calicular edge.

Septa hexamerally arranged in four complete cycles according to formula: S1>S4≥S2>S3 (48 septa). S1 up to 2 mm exsert, with a perfect rounded upper edge, and an oblique axial edge. Each S1 bear one large paliform lobe often bisected into two smaller ones. S2 only slightly less exsert but substantially smaller than S1. Two or 3 P2 merge with columellar elements. S3 smallest and least exsert septa, but bearing up to 5 paliform lobes. S4 adjacent to S1 about as exsert as S2 but extend further towards columella, however, those S4 adjacent to S2 less exsert and less wide. Multiple paliform lobes usually occurs before S4, and they often fuse to adjacent P3. Innermost P3-4 fuse to P2 near columella. All paliform lobes inclined toward columella. Within each septa, paliform lobes adjacent to columella usually more robust. Septal and palar faces coarsely granulated. Fossa shallow, containing a papillose columella composed of few papillae.

Distribution. –*New Caledonia*: 170-268 m. –*Elsewhere*: Zanzibar; Japan; China Sea; Philippines; Indonesia; Thailand; and Australia; 0-20 m.

Discussion. –This facultative species could be easily confused with *Heretopsammia* representatives because they share the symbiotic relationship with a sipunculid worm that inhabits a gastropod shell, and have paliform lobe fusion that could be interpreted as Pourtalès plan. However, *Heterocyathus* is distinguished by having distinct costae and multiple paliform lobes. *Heterocyathus aequicostatus* is distinguished from *H. sulcatus* in having columella and septa white; and closely packed septa. For a comprehensive synonym list see Hoeksema & Best (1991).

***Heterocyathus sulcatus* (Verrill, 1866)**

Plate 16, Figs. H-I

Stephanoseris sulcata Verrill, 1866: 48. –Vaughan, 1905: 416.

Psammoseris cyclicioides Tenison-Woods, 1879a (*in part*): 10-11, pl. 1, figs. 1-5. -Tenison-Woods, 1880: 299-300.

Heterocyathus sulcatus. –Marenzeller, 1888: 19. –Hoeksema & Best, 1991: 231, 233, figs. 19-23. –Cairns, 1998: 384. –Cairns, 1999: 98-99, figs. a-d. –Cairns et al., 1999: 22. –Stolarski et al., 2001: 320. –Randall, 2003: 135. –Cairns, 2004a: 281-282, fig. 3K. –Cairns, 2009: 13.

Heterocyathus pulchellus Rehberg, 1892: 8-9, pl. 1, figs. 7a-b.

Homophyllia incrustans Dennant, 1906: 161, pl. 6, figs. 3a-b. –Howchin, 1909: 247. –Stranks, 1993: 21.

Heterocyathus aequicostatus. –Folkeson, 1919: 8-10 (*in part*), pl. 1, figs. 4-7.

Heterocyathus cyclicioides. –Wells, 1964: 109.

Type locality. –Sri Lanka, depth unknown.

Type material. –The holotype is deposited at the YPM (Cairns, 2004a).

New records. –SMIB 1: stn. DW M06 (1). –Bathus 4: stn. DW 902 (1).

Description. –All specimens examined completely encapsulates a gastropod shell, leaving only its pore in direct contact with water. Calice elliptical; calicular edge lancetted. Costae slightly ridged only in upper part of theca where it is separated by thin and moderately deep intercostal striae. Three to four granules occurs across each costal ridge. Costae progressively fainting towards base. Base smooth in texture and bearing randomly placed granules. Upper half of corallum, S1, S2, pali, and columellar elements dark brown pigmented. Lower part of corallum, S3, and S4 white.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S4>S3 (48 septa). S1 most exsert septa (up to 1 mm exsert), extending half - distance to columella with sinuous axial edge, and bearing a well-developed sinuous pali. S2 slightly less exsert (up to 0.6 mm) and less wide than S1, also with a sinuous axial edge and bearing a small version of P1. S3 least exsert septa (not more than 2.5 mm) extending about 1/3 distance to columella with sinuous axial edge. P3 variable in development: some as tall and wide as P2; however, some quite small. All P3 also have a very sinuous axial and distal edges. S4 dimorphic in exsertness and width: those adjacent to S1 more exsert and wider than those adjacent to S2. All S4 fuse to adjacent S1 or S2 at calicular edge, forming well-developed triangular apex. All septal and palar faces bear well-developed obliquely oriented menianes. Granules usually aligned perpendicular to septal edge also occur on upper septal faces. Fossa shallow, containing a papillose columella composed of 8 interconnected pillars that also contains “meniane” like structures.

Distribution. –*New Caledonia*: 300-351 m. –*Elsewhere*: Sri Lanka; Indonesia; Wallis and Futuna; Vanuatu; and Australia; 11-312 m.

Discussion. –*H. sulcatus* is compared with New Caledonian congener (*H. aequicostatus*) in the account of that species.

Genus *Labyrinthocyathus* Cairns, 1979

Diagnosis. –Corallum solitary, ceratoid to subcylindrical, and firmly attached. Costae poorly defined or composed of transverse epithecal ridges. Pali absent. Columella well-developed and composed of an interconnected maze of lamellar plates.

Type species. –*Labyrinthocyathus langae* Cairns, 1979, by original designation.

Labyrinthocyathus limatulus (Squires, 1964)

Plate 16, Figs. J-K

Ceratotrochus (Ceratotrochus) limatulus Squires, 1964: 3-5, pl. 1, figs. 5-9. –Squires & Keyes, 1967: 24, pl. 2, figs. 9-10.

Labyrinthocyathus limatulus. –Cairns, 1979: 70. –Cairns, 1995: 58, pl. 13, figs. c-f. –Cairns, 1999: 77. –Cairns et al., 1999: 22. –Cairns, 2004a: 282. –Tachikawa, 2008: 9, 11-13, fig. 2a-i. –Cairns, 2009: 8.

Type locality. –Off Coromandel Peninsula (New Zealand), 102 m.

Type material. –The holotype and 12 paratypes are deposited at the AIM (Cairns, 2004a).

New records. –Bathus 4: stn. DW 894 (1); stn. CP 936 (5). –Norfolk 2 stn. DW 2148 (3).

Description. –Corallum solitary, ceratoid to trochoid, and attached by a robust pedicel and a thin encrusting base. Largest specimen examined (CP 936) 12.5 x 12.0 mm in CD, 15.8 mm in height, and 7.7 mm in PD. Calice circular to slightly elliptical (GCD:LCD = 1-1.18). Theca up to 2.6 mm thick ornamented by thin transverse ridges.

Transversal ridges more distinctive near base, being faint near calicular edge or formed by aligned granules. C1 and C2 slightly ridged from calicular edge to middle of corallum. C3 and C4 occur only near calicular edge. Costae separated by broad and flat intercostal furrows sometimes bisected by low ridges near calicular edge. Corallum predominantly white, however, well-preserved specimens display a brownish stripe near calicular edge.

Septa hexamerally arranged in four complete cycles according to formula: S1≥S2>S3>S4 (48 septa). S1 equal or only slightly more exsert, thicker, and wider than S2, almost reaching columella. Septa of higher cycles progressively less exsert and smaller. Axial edges of S1-3 highly sinuous and those of S4 only slightly sinuous. Septal faces smooth or bearing low rounded granules. Fossa of moderate depth, containing a large columella composed of clockwise maze of interconnected lamellae.

Distribution. –*New Caledonia*: 245-391 m. –*Elsewhere*: Vanuatu; Australia; and New Zealand; 20-508 m.

Discussion. –Amongst the five extant representatives of the genus *Labyrinthocyathus*, *L. limatulus* is the only to have transversely ridged theca, and is the only species in the genus to be reported from New Caledonian waters. One specimen examined (DW 894) display dried tissue covering all corallum.

Genus *Monohedotrochus* Kitahara & Cairns, 2005

Diagnosis. –Corallum solitary, attached, straight, and elongate-conical to trochoid. Base monocyclic. Septotheca costate. Pedicel and base thick. Pali or paliform lobes absent. Columella papillose.

Type species. –*Monohedotrochus capitolii* Kitahara & Cairns, 2005, by original designation.

Monohedotrochus circularis (Cairns, 1998)

Plate 16, Figs. L-M

Oxysmilia circularis Cairns, 1998: 378, figs. 2i-k. –Griffith & Fromont, 1998: 230-231. –Cairns, 1999: 78, figs. 6g-h, 7a. –Cairns et al., 1999: 22. –Cairns, 2004a: 282.

Monohedotrochus circularis. –Kitahara & Cairns, 2005: 117, 119. –Cairns, 2009: 8.

Type locality. –*Soela* stn. 02/82/16 (18º41'S, 117º54'E – off Port Hedland, Australia), 200-204 m.

Type material. –The holotype and 10 paratypes are deposited at the WAM. Three additional paratypes are deposited at the NMNH (Cairns, 1998).

New records. –Norfolk 2: stn. DW 2124 (3); stn. DW 2133 (1).

Description. –Corallum gently curved and elongate-conical, attached through a slender pedicel (PD:GCD = 0.20-0.30) and a thin encrusting base. Calice circular; calicular edge slightly serrate. Largest specimen examined (DW 2124) 13.9 mm in CD, 22.0 mm in height, and 3.9 mm in PD. All costae flat and separated by narrow intercostal striae. C1-2 slightly wider than C3-4. About 1/3 distance towards base costae start to faint, disappearing above pedicel. Theca coarsely granulated (small pointed granules) giving to it a rough texture. All specimens examined budding from upper theca of a parent corallum. Corallum white.

Septa hexamerally arranged in four complete cycles with additional S5 randomly placed according to formula: S1>S2>S3>S4>S5. S1 only 1-1.5 mm exsert, reaching columella low in fossa. Axial edge of S1 vertical, straight, and slightly thickened deep in fossa. S2 only slightly less exsert and less wide than S1, also with straight and vertical axial edge. S3 smaller but otherwise similar in profile to S2. S4 occur only near calicular edge. However, if S5 present in a half-system, S4 almost as wide as S3. Septal faces bear numerous small rounded granules. Fossa of moderate depth, containing small elongate papillae.

Distribution. –*New Caledonia*: 215-270 m. –*Elsewhere*: Vanuatu; Australia; and New Zealand; 190-545 m.

Discussion. –Recently described to accommodate those *Oxysmilia* representatives with a monocyclic base, the genus *Monohedotrochus* is composed of three extant species, of which two are reported from New Caledonia herein: *M. circularis* and *M. epithecatus*. The latter is distinguished from *M. circularis* in having transverse ridged theca; less septa at a corresponding GCD (*M. circularis* usually display some S5); dentate S4 axial edge; and better developed columella.

Monohedotrochus epithecatus (Cairns, 1999)

Plate 16, Figs. N-O

Oxysmilia epithecata Cairns, 1999: 79, figs. 6d-e, 7b-g. –Cairns et al., 1999: 22.
Monohedotrochus epithecatus. –Kitahara & Cairns, 2005: 117, 119. –Cairns, 2009: 8.

Type locality. –*Musorstom 8* stn. CP 1018 (17º53'S, 168º25'W – Efaté, Vanuatu), 300-301 m.

Type material. –The holotype and 21 paratypes are deposited at the MNHN, and Twenty-seven additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Bathus 4: stn DW 984 (1). –Norfolk 2: stn. DW 2095 (8); stn. DW 2096 (3); stn. DW 2133 (2).

Description. –Corallum ceratoid to trochoid, small, and attached by a robust pedicel (PD:GCD = 0.50-0.83) that expands into a thin encrusting monocyclic base. Calice circular in small specimens and slightly elliptical in larger ones (GCD:LCD = 1.05-1.15). All specimens but those from DW 984 originate from upper thecal edge of a parent corallum. Largest specimen examined (DW 2133) 6.0 x 5.3 in CD, 9.7 mm in height, and 3.0 mm in PD. Upper theca covered by slightly ridged granular costae. Narrow intercostal groove separate each costa. Three to 4 aligned granules occurs across each costa. Lower theca bear sharp, thin and well separated epithecal transverse ridges. Corallum white.

Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2>S3>S4. S1 up to 1 mm exsert, and extend to columella with straight to slightly sinuous vertical axial edge. S2 slightly less exsert and about ¾ width of S1. Near columella, lower axial edge of S2 sometimes finely dentate. Unflanked S3 occur only near calicular edge. However, if flanked by a pair of S4, S3 only slightly less exsert and slightly smaller than S2. S4 occur only near calicular edge and bear dentate axial edge. Septal faces granulated. Fossa of moderate depth, containing a papillose columella formed of up to 14 granulate and interconnected papillae.

Distribution. –*New Caledonia*: 215-544 m. –*Elsewhere*: Wallis and Futuna; and Vanuatu; 240-455 m.

Discussion. –*Monohedotrochus epithecatus* is compared with the other New Caledonian congener (*M. circularis*) in the account of that species (above).

Genus *Oxysmilia* Duchassaing, 1870

Diagnosis. –Solitary, ceratoid to trochoid, fixed. Corallum base increase in diameter by successive deposition of exothecal dissepiments, producing partitioned concentric rings.

Septotheca costate. Pali absent. Columella papillose or elongate, fused mass, not composed of twisted ribbons.

Type species. –*Lophosmilia rotundifolia* Milne Edwards & Haime, 1849, by monotypy.

Oxysmilia corrugata Cairns, 1999

Plate 16, Figs. P-Q

Oxysmilia corrugata Cairns, 1999: 78-79, figs. 6g-h, 7a. –Cairns et al., 1999: 22. –Cairns, 2009: 14.

Type locality. –*Musorstom 8* stn. DW 1030 (17º51'S, 168º30'E – Efaté, Vanuatu), 180-190 m.

Type material. –The holotype is deposited at the MNHN. Ten paratypes are split between MNHN (7) and NMNH (3) (Cairns, 1999).

New records. –Norfolk 2: stn. DW 2119 (1); stn. DW 2124 (1); stn. DW 2125 (2); stn. DW 2150 (2).

Description. –Corallum ceratoid to trochoid, and firmly attached by a robust pedicel (PD:GCD = 0.5-0.6) and a thin encrusting polycyclic base. Calice elliptical in cross section (GCD:LCD = 1.08-1.4); calicular edge serrate. Largest specimen examined (DW 2125) 15.0 x 10.8 mm in CD, 25.1 mm in height, and 9.0 mm in PD. Theca thick especially in adult specimens, and covered by sinuous and discontinuous transversal ridges. Transverse ridges run uninterrupted on pedicel circumference. Larger specimens have well-developed epitheca, which is often encrusted by other organisms on lower part. Costae ridged only near calicular edge, where shallow intercostal striae separate each of them. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 quite thick, up to 2 mm exsert, and extend to columella with vertical and straight axial edge. Higher septal cycles progressively less wide and less exsert (with minimal size difference between cycles). Lower axial edge of S3 thicker and occupy the space created between S1-2. Septal faces coarsely granulated. Fossa of moderate depth, containing a papillose (in small specimens) or solid (in large specimens) columella. Columellar shape modified by intrusion of lower axial edges of S1, and sometimes S2.

Distribution. –*New Caledonia*: 245-348 m. –*Elsewhere*: Vanuatu; 180-190 m.

Discussion. –Amongst New Caledonian caryophylliids, *Oxysmilia corrugata* can be confused with *Monohedotrochus epithecatus*. However, as noted by Kitahara & Cairns (2005) the nature of the base is the diagnostic character dividing these two genera. Additionally, *O. corrugata* has thicker septa; and a better developed columella, which is usually fused into one massive structure in larger specimens.

Genus *Premocyathus* Yabe & Eguchi, 1942

Diagnosis. –Corallum solitary, cornuted, compressed, and with a carinate (not spinose) convex thecal edges. Septal hexamerally arranged. One crown of paliform lobe before penultimate septal cycle. Base invariably an open scar. Columella fascicular or papillose.

Type species. –*Premocyathus compressus* Yabe & Eguchi, 1942b by original designation.

Premocyathus dentiformis (Alcock, 1902)

Plate 16, Fig. R

Placotrochides dentiformis Alcock, 1902b: 121.

Caryophyllia compressa Yabe & Eguchi, 1932b: 443.

Premocyathus compressus Yabe & Eguchi, 1942b: 121, 151-152, pl. 10, figs. 13-14.

Caryophyllia (Premocyathus) compressa. –Mori, 1987: 21-30, 9 figs. –Cairns, 1994: 50-51, pl. 22, figs. e-f. –Cairns, 1995: 54-55, pl. 11, figs. f-i.

Premocyathus dentiformis. –Cairns & Zibrowius, 1997: 102-103, figs. 9f-j. –Cairns et al., 1999: 24. –Cairns, 2004a: 284. –Tachikawa, 2005: 7-8, pl. 2, figs. K-L. –Cairns, 2009: 7.

Type locality. –*Siboga* stn. 59 (10º22.7'S, 123º16.5'E – off Timor), 390 m.

Type material. –The holotype is deposited at the ZMA (Cairns, 2004a).

New records. –Bathus 4: stn. DW 903 (1).

Diagnosis. –Corallum cornute, compressed (GCD:LCD = 1.48), free, and gently curved on GCD plane (about 30º). Epicentre of base open. Convex thecal edge slightly crested, and concave thecal edge rounded. Specimen examined 7.4 x 5.0 mm in CD, and 12.0 mm in height. Equal in width, and slightly ridged costae occur from calicular edge to base. Calicular edge serrate. Corallum white (poorly preserved and severe worn).

Septa decamerally arranged in 3 cycles according to formula: S1>S2>>S3 (30 septa?). S1 extend about 2/3 distance to columella with sinuous axial edge. S2 about 2/3 size of S1, also sinuous and bearing a lamelar pali. S3 thin and small. Fossa of moderate depth, containing a fascicular columella composed of few twisted elements.

Distribution. –*New Caledonia*: 386-400 m. –*Elsewhere*: Japan; Philippines; Indonesia; Australia; 22-960 m.

Discussion. –Based on the poorly preserved specimen available, nothing can be added to the description of *P. dentiformis*. Among New Caledonian caryophylliid representatives, *P. dentiformis* is the only to always have an open base. This characteristic distinguishes it from *Caryophyllia unicristata* the only confamilial New Caledonian species that have only one thecal edge crested.

Genus *Rhizosmilia* Cairns, 1978

Diagnosis. –Colonies formed by extratentacular budding from a common basal coenosteum. Corallite base increase in diameter by adding exothecal dissepiments over raised costae producing concentric rings of partitioned chambers that resemble polycyclic development. Septotheca costate and granular. Septal axial edges smooth. Paliform lobe occur before penultimate septal cycle. Columella papillose or lamellar. Vesicular endotheca present.

Type species. –*Rhizosmilia gerdae* Cairns, 1978, by original designation.

Rhizosmilia multipalifera Cairns, 1998

Plate 16, Figs. S-T

Paracyathus porphyreus. –Folkeson, 1919: 12-13, figs. 16-17. –Veron, 1986: 608.

Rhizosmilia multipalifera Cairns, 1998: 386, figs. 4b-c, e-f. –Griffith & Fromont, 1998: 231. –Cairns, 2004a: 284.

Rhizosmilia multipaliferus. –Cairns, 2009: 15.

Type locality. –*Sprightly* stn. 41M (30º16.8'S, 114º39.6'E – Jurien Bay, Western Australia), 82 m.

Type material. –The holotype and 9 paratypes are deposited at the WAM. Additional paratypes are deposited at the NMNH, and SMNH (Griffith & Fromont, 1998).

New records. –Norfolk 2 stn. DW 2125 (1).

Description. –Corallum trochoid in shape. All specimens examined represented as individual corallites, and attached through a robust pedicel and thin expansive base attached over a parent corallite. Specimen examined 10.0 x 8.0 mm in CD, 16.6 mm in height, and 9.0 x 7.4 mm in PD. Base reinforced with concentric rings of hollow chambers. Calice elliptical and calicular margin serrate. Narrow and shallow intercostal striae separate slightly concave costae. Each costa bear 3 or 4 pointed granules across width. Corallum white, but upper axial edge of S1 and S2 pigmented light brown.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 most exsert septa (up to 2 mm above calicular edge), almost reaching columella with vertical and straight axial edge. Interestingly, S2 (not S1) are aligned to GCD. Septa of higher cycles progressively less exsert and smaller. Lower axial edge of S2 slightly sinuous; axial edge of S3 moderated sinuous; and those of S4 slightly sinuous. All septal faces bearing pointed granules aligned parallel to septal edge. A crown of 12 rudimentary paliform lobes formed by 6 P1 and 6 P2 occur low in fossa almost at same level of columellar elements. Another crown of 12 well-developed paliform lobes (P3) separated from S3 by deep narrow notch stand higher in fossa. Axial and outer edges of P3 very sinuous. Fossa deep, containing a well-developed elliptical papillose columella composed of 19 tuberculate rods.

Distribution. –*New Caledonia*: 275-348 m. –*Elsewhere*: Australia; 11-165 m.

Discussion. –According to Cairns (1998) the placement of *R. multipalifera* in the genus *Rhizosmilia* is tentative due to the presence of P1-2, which differentiates this species from all other congeners. Within New Caledonia congeners, the upper theca pigmentation of *R. multipalifera* is shared with *R. sagamiensis*, but apart from the presence of paliform lobes before S1-2 (absent in *R. sagamiensis*) there is no major morphological difference between these two species.

Rhizosmilia robusta **Cairns, 1993**

Plate 16, Figs. U-V

Rhizosmilia robusta Cairns in Cairns & Keller, 1993: 250-253, pl. 6, figs. F-I. –Cairns & Zibrowius, 1997: 133-134. –Cairns, 1999: 107. –Cairns et al., 1999: 24. –Cairns, 2009: 14. –Kitahara et al., 2010a: 105. –Kitahara et al., 2010b.

Type locality. –*Anton Bruun* stn. 373B (26º00’S, 33º05’E – Mozambique), 135 m.

Type material. –The holotype is deposited at the NMNH and the paratypes are split between NMNH (12) and SAFM (2) (Cairns & Keller, 1993).

New records. –SMIB 10: stn. DW 210 (1). –Norfolk 2: stn. DW 2124 (10); stn. DW 2135 (1); stn. DW 2150 (1).

Previous records from New Caledonia. –Kitahara et al. (2010a).

Description. –All specimens examined solitary. Corallum trochoid to ceratoid, quite robust, and attached by a pedicel and base thickened with concentric rings of hollow chambers formed by layers of exothecal dissepiments that bridge raised costae. Calice slightly elliptical (GCD:LCD = 1.13-1.31); calicular edge lancetted. Largest specimen examined (DW 2135) 34.0 x 30.0 mm in CD, 21.6 mm in PD, and 51.3 mm in height. Theca up to 2.3 mm thick and covered by small low granules. Costae more prominent near calicular edge. All costae slightly ridged and separated by shallow intercostal grooves. Corallum white.

Septa hexamerally arranged in 5 cycles according to formula: S1>S2>S3>S4>S5. However, larger specimens have additional S6. S1 highly exsert (up to 5 mm) and extend to columella with vertical to slightly concave straight axial edge. S2 only slightly less exsert and less wide than S1, but otherwise similar. S3 less exsert and about ¾ width of S2. S4 have vertical and straight axial edge that bear a lamelar paliform lobe. Deep in fossa a pair of P4 sometimes fuse to common S3 before columella. S5 about 1/3 width of S4. At calicular edge each S5 fuses to adjacent S1-3 forming small triangular lancets. Fossa deep, containing a papillose columella composed of granular rods usually strongly fused into a massive structure.

Distribution. –*New Caledonia*: 245-510 m. –*Elsewhere*: South Africa; Mozambique; Madagascar; Philippines; Vanuatu; and Wallis and Futuna; 66-360 m.

Discussion. –*Rhizosmilia robusta* is distinguished from the other two New Caledonian congeners in having a much larger and white corallum (including septal edges); adult specimens having S5 and eventually some S6; axial edge of S5 "laciniate"; and a pair of P4 fusing before S3 near columella. In fact, specimens of *R. robusta* that did not formed colonies could be easily confused with *Caryophyllia ralphae.* Full comparison between these two species is provided by Kitahara et al. (2010a).

***Rhizosmilia sagamiensis* (Eguchi, 1968)**

Plate 17, Fig. A

Coenocyathus sagamiensis Eguchi, 1968: C34, pl. C10, figs. 6-7.

Rhizosmilia sagamiensis. –Cairns, 1994: 62-63, pl. 27, figs. c-e. –Cairns & Zibrowius, 1997: 134. –Cairns et al., 1999: 24. –Cairns, 2009: 14.

Type locality. –Amadaiba, Sagami Bay, Japan, 60-80 m.

Type material. –The holotype is deposited at the BLIH (Cairns, 1994).

New records. –Norfolk 1: stn. DW 1651 (1). –Norfolk 2: stn. DW 2024 (1); stn. DW 2124 (4); stn. DW 2135 (2); stn. DW 2140 (3).

Description. –All specimens examined solitary in growth form, and all but (DW 2024) have smaller corallites attached near calicular edge. Corallites ceratoid to trochoid and firmly attached through a reinforced pedicel (PD:GCD = 0.5-0.7) and polycyclic base. Calice circular to elliptical (GCD:LCD = 1.1-1.9); calicular edge serrate. Largest specimen examined (DW 2024) 19.3 x 17.0 mm in CD, 11.1 in PD, and 35.3 mm in height. Theca coarsely granular. Costae equally wide. C1-3 and sometimes C4 slightly ridged near calicular edge. Lateral costal faces finely granular. Largest specimen examined also bears small thecal transverse rugae. Corallum white, but upper S1-2 edges brown pigmented in a crescent-shaped pattern.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). S1 most exsert septa and extend to columella with vertical and straight axial edge. S2 slightly less exsert and less wide than S1. Axial edge of S2 vertical and straight to slightly sinuous. S3 about ¾ width of S2, and bear a lamellar, slightly sinuous paliform lobe. P3 separated from S3 by a moderate deep notch. S4 equal to slightly more exsert than S3, always fusing to adjacent septa (S1 or S2) at calicular edge forming small triangular lancets. S4 axial edge slightly sinuous. Septal and palar faces bear low pointed granules. Fossa of moderate depth, containing a papillose columella composed of irregularly shaped rods.

Distribution. –*New Caledonia*: 260-371 m. –*Elsewhere*: Japan; Philippines; and Indonesia; 60-98 m.

Discussion. –Amongst the three *Rhizosmilia* representatives known from New Caledonia, *R. sagamiensis* is most similar to *R. multipalifera* and is compared with the latter in the account of that species. Young coralla of *R. sagamiensis* do not have the brown-pigmented S1-2 edges (characteristic of older coralla) and have a more circular calice.

Genus *Stenocyathus* Pourtalès, 1871

Diagnosis. –Corallum solitary, ceratoid to cylindrical, free or attached. Wall epithecal with rows of thecal spots (pores) flanking each S3. Pali, if present, opposite S2. Columella composed of 1 or 2 twisted, crispate ribbons.

Type species. –*Coenocyathus vermiformis* Pourtalès, 1868, by monotypy.

Stenocyathus vermiformis (Pourtalès, 1868)

Plate 17, Figs. B-C

Coenocyathus vermiformis Pourtalès, 1868: 133-134.

Stenocyathus vermiformis. –Pourtalès, 1871: 10, pl. 1, figs. 1-2, pl. 3, figs. 11-13. –Lindström, 1877: 19-21, pl. 3, figs. 35-36. –Pourtalès, 1878: 202. –Pourtalès, 1880: 96, 101 (*in part*: not BL-210), pl. 1, figs. 15-16. –Duncan, 1883: 368. –Lindström, 1884: 107. –Agassiz, 1888: 148, fig. 483. –Marenzeller, 1904a: 298-300, pl. 18, fig. 16. –Gravier, 1915: 2. –Gravier, 1920: 30-32, pl. 3, figs. 35-37, pl. 13, figs. 193-197. –Gardiner & Waugh, 1938: 172. –Wells, 1947: 167, pl. 10, figs. 1-5. –Wells, 1958: 262. –Rossi, 1958: 6, 11-12. –Squires, 1959a: 23. –Rossi, 1961: 39-40. –Zibrowius, 1969: 328. –Laborel, 1970: 153. –Zibrowius, 1971: 244. –Zibrowius, 1974a: 769-770. –Cairns, 1977a: 5. –Cairns, 1978: 11. –Cairns, 1979: 168-170, pl. 32, figs. 8-10, pl. 33, figs. 1-2. –Zibrowius, 1980: 163-165, pl. 84, figs. A-Q. –Cairns, 1982: 52, pl. 16, figs. 8-11. –Cairns, 1984: 23, 25, pl. 5, fig. C. –Veron, 1986: 609. –Cairns et al., 1991: 48. –Cairns & Parker, 1992: 43, figs. 14b-c. –Dawson, 1992: 45. –Cairns & Keller, 1993: 273, figs. 12e-f. –Cairns, 1994: 69-70, pl. 22, fig. g, pl. 29, figs. c, f. –Cairns, 1995: 94-95, pl. 30, figs. c-g. –Cairns et al., 1999: 33. –Rogers, 1999: 347. –Cairns, 2000: 151-153, fig. 178. –Cuif et al., 2003: 468. –Cairns, 2004a: 302. –Álvarez-Pérez et al., 2005: 215. –Zibrowius & Taviani, 2005: 811. –Cairns, 2006: 48. –Kühlmann, 2006: 64, 104, 113. –Kitahara, 2007: 504, 505, 511, 512, fig. 5F. –Pires, 2007: 269. –Cairns, 2009: 22. –Kitahara et al., 2010b.

Caryophyllia simplex Duncan, 1878: 237, pl. 43, figs. 32-34.

Caryophyllia carpenteri Duncan, 1878: 237, pl. 43, figs. 28-31.

Caryophyllia arcuata. –Lacaze-Duthiers, 1897: 106, text fig. 9.

Stenocyathus washingtoni Cecchini, 1914: 151-152. –Cecchini, 1917: 143-145, pl. 13, figs. 4-5.

Stenocyathus decamera Ralph & Squires, 1962: 11-12, pl. 4, figs. 2-6 (*in part*: not specimen from Mayor Island). –Squires & Keyes, 1967: 28, pl. 6, figs. 3-5. –Squires, 1969: 17, pl. 6. –Dawson, 1979: 30.

Type locality. –*Bibb* stn. 10, 11 and 21 (off Florida Keyes – United States), 274-329 m.

Type material. –Thirty-eight syntypes are deposited at the MCZ (Cairns, 1979).

New records. –Norfolk 2: stn. DW 2053 (1); stn. DW 2060 (8); stn. DW 2063 (1); stn. DW 2068 (1); stn. DW 2073 (6); stn. DW 2074 (15); stn. DW 2075 (3).

Description. –Corallum solitary, small, sub-cylindrical to cylindrical in shape, and usually free with an open base. However, attached coralla not uncommon. Calice circular; calicular edge smooth. Largest specimen examined (DW 2053) 6.4 mm in CD and 16.7 mm in height. Theca thin and costae absent. However, thin transversely ridged epithecal growth lines present from calicular edge to base, as well as a 24 rows of aligned (white) and circular spots that become porous later on ontogeny. If attached, base and lower part of pedicel coarsely granular. Corallum white, and epitheca usually light brown.

Septa hexamerally arranged in three complete cycles according to formula: S1>S3>S2 (24 septa). Upper outer septal edges separated from calicular edge by a small and shallow notch. S1 extend about ¾ distance to columella with highly sinuous vertical axial edge. S2 about half-size of S1, also with a sinuous axial edge. Each S2 bear a well-developed sinuous lamelar pali. S3 slightly wider than S2 and have a slightly sinuous axial edge. Fossa shallow to moderate in depth, containing a single tight-twisted columellar element.

Distribution. –*New Caledonia*: 582-1000 m. –*Elsewhere*: virtually cosmopolitan except from eastern Pacific and Antarctic; 110-1500 m.

Discussion. –*Stenocyathus vermiformis* is distinguished from other New Caledonian scleractinians that have rows of aligned thecal spots on interseptal space by its smaller corallum size, and in having only 3 septal cycles of which S3>S2. According to Kitahara et al. (2010b), *S. vermiformis* is part of the family Caryophylliidae, what corroborates with the hypothesis that thecal pores originated independently in different scleractinian lineages (Stolarski, 2000). This hypothesis suggests stability of the basic microstructural architecture of the skeleton. However, the other representatives of the family Stenocyathidae (*Truncatoguynia irregularis* and *Pedicellocyathus keyesi* Cairns, 1995) were never tested regarding their phylogenetical position within the order. Consequently, *T. irregularis*, the only other "Stenocyathidae" reported from New Caledonia is discussed in the "incerta sedis" group.

Family D

Genus *Tethocyathus* Kühn, 1933

Diagnosis. –Corallum solitary, turbinate to trochoid, fixed or free. Septotheca covered by thick epitheca. Paliform lobes before all but last septal cycle in two distinct crowns. Columella papillose at top.

Type species. –*Thecocyathus microphyllus* Reuss, 1871, by original designation.

Tethocyathus cylindraceus (Pourtalès, 1868)

Plate 17, Figs. D-E

Thecocyathus cylindraceus Pourtalès, 1868: 134. –Pourtalès, 1871: 13-14 (*in part*: not *Bibb* stn. 173), pl. 2, figs. 14-15. –Pourtalès, 1880: 96, 101 (*in part*: not *Blake* stn. 296). –Agassiz, 1888: 149: fig. 464.

Trochocyathus (Thecocyathus) sp. Gardiner, 1929: 126. –Ralph & Squires, 1962: 17. –Squires & Keyes, 1967: 29.

Tethocyathus cylindraceus. –Cairns, 1979: 83-84, pl. 13, figs. 8-11. –Cairns, 1995: 64-65, pl. 15, figs. i-k, pl. 16, figs. a-b. –Cairns et al., 1999: 24. –Kitahara, 2007: 502-503. –Cairns, 2009: 9.

Paracyathus conceptus. –Ralph & Squires, 1962: 7-8, pl. 2, figs. 3-4. –Squires & Keyes, 1967: 23 (*in part*: not NZOI stn. C627, C648, or pl. 2, figs 7-8). –Dawson, 1979: 30 (*in part*: NZOI stn. A904, C814).

Type locality. –Off Florida Reef (United States), 183-366 m.

Type material. –Thirteen syntypes are deposited at the MCZ (Cairns, 1979).

New records. –Norfolk 2: stn. DW 2023 (1); stn. DW 2024 (5).

Description. –Corallum solitary, ceratoid to sub-cylindrical, and attached by a robust pedicel. All specimens examined display broken pedicel suggesting a strong attachment between base and substratum. Largest specimen examined (DW 2024) 15.0 x 13.4 mm in CD, 18.3 mm in height (base broken), and 10.4 mm in PD. PD:GCD between 0.7 and 1. Calice circular to slightly elliptical (GCD:LCD = 1-1.12). Most specimens bear a extremely thick, transversely striate epitheca completely obscuring costae, and forming a small lip encircling calice. However, one specimen examined do not bear epitheca, displaying a 2 mm septotheca, and a circular, transverse ridged stripe 3 mm wide below calicular edge. Costae thin and slightly ridged, separated by wide and granular intercostal spaces. Corallum predominantly white, but some specimens display a reddish-brown calicular edge and/or internal part of S1-2.

Septa hexamerally arranged in 4 cycles according to formula: S1>S2>S3≥S4. Two specimens examined have 48 septa, other 2 have 44, and one have only 38 septa. All septa slightly exsert to some degree (ES1>ES2>ES3>ES4). S1 only slightly wider but as thick as S2, both having slightly sinuous axial edges. S3 less thick and less wide than S2, and have a slightly more sinuous axial edge. S4 as wide or slightly smaller than S3 with straight to slightly sinuous axial edge. All septal faces bear low rounded granules, which sometimes fuse into small ridges perpendicular to septal edge. Two non-discrete crowns of paliform lobes encircle columella. The inner crown of 12 P1-2 lie low in fossa, with P2 slightly wider than P1. Within P1, those belonging to principal S1 are notorious smaller than P1 from lateral S1. Second palar crown (formed by 12 P3) slightly more recessed from columella. P3 much wider and taller than P1-2. Lateral faces of paliform lobes highly ornamented, usually bearing small horizontal ridges giving it a quite thick appearance. Fossa of moderate depth, containing a circular to elliptical papillose columella composed of 14 to 38 rods that usually terminate at same level.

Distribution. –*New Caledonia*: 282-371 m. –*Elsewhere*: United States; Jamaica; Barbados; Brazil; and New Zealand; 183-649 m.

Discussion. –Three species of *Tethocyathus* are reported herein from New Caledonian waters (*T. cylindraceus, T.* sp., and *T. virgatus*). Additionally, *T. minor* was previously recorded for the same region by Gardiner (1899) (as *Thecocyathus minor*). *Tethocyathus cylindraceus* differs from New Caledonian congeners in having S1-2 completely or predominantly white (those of *T.* sp. and *T. virgatus* being consistently pigmented); a more cylindrical corallum (PD:GCD between 0.7-1); and S2>S3≥S4 (S2-4 about the same size). In fact, those specimens of *T. cylindraceus* examined herein differs slightly from those reported by Cairns (1995) from New Zealand region in having a more developed epitheca; less transversely striate epitheca; and a slightly pigmented calicular edge. However, these small differences are believed to fall within the intraspecific variation of this species.

Tethocyathus minor **(Gardiner, 1899)**

Plate 17, Figs. F-G

Thecocyathus minor Gardiner, 1899: 163. –Crossland, 1952: 89, 103.

Tethocyathus minor. –Wells, 1964: 108. –Veron, 1986: 605. –Cairns et al., 1999: 24. –Lattig & Cairns, 2000: 591. –Fenner, 2005: 26, 87, 125. –Cairns, 2006: 47. –Cairns, 2009: 9.

Type locality. –Sandal Bay (Loyalty Islands), 73 m.

Type material. –The syntype is deposited at the CUMZ.

Material examined. –None.

Previous records from New Caledonia. –Gardiner (1899) (as *Thecocyathus minor*).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum solitary, straight, and cylindrical. Calice almost circular; calicular edge slightly serrate. Specimen examined by Gardiner (1899) 4.0 mm in CD and 7.0 mm in height. Epitheca completely cover theca. Epitheca dense and transversely corrugated. Septa hexamerally arranged in four incomplete closely spaced cycles. S1 thicker and extend further into fossa than other septal cycles. S2-4 equally wide. Each S1 and S2 bear a single palus, but P2 is wider and terminate higher in fossa. Each flanked S3 also bear a single palus near columella. P4 absent. Septal faces coarsely granular. Fossa shallow, containing a papillose columella.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: Hawaii; and Australia; 73? m.

Discussion. –No new specimens of this “cryptic” species were available for the present study, and its record from New Caledonian waters follows Gardiner (1899).

***Tethocyathus* sp.**

Plate 17, Figs. H-I

Material examined. –Norfolk 2: stn. DW 2117 (1).

Description. –Corallum solitary, ceratoid, slightly curved, and attached by a pedicel that expands into a thin encrusting base. Specimen examined 6.6 x 6.3 mm in CD, 27.0 mm in height, and 3.2 mm in PD. Calice slightly elliptical (GCD:LCD = 1.05). Flat and unequally wide costae separated by narrow intercostal furrows distinguishable only near calicular edge, where C3 is slightly wider than C4. C4 wider than C1-2. Three to 5 aligned granules occur across each costa. Thick and granulated epitheca obscure underlying costae 3 mm below calicular edge. Corallum predominantly dark reddish-brown, but epitheca white.

Septa hexamerally arranged in 4 incomplete cycles according to formula: S1>S2>S4≥S3 (40 septa). However, development of half-systems uneven: 6 half-systems have 5 septa (1 S1, 1 S2, 1 S3, and 2 S4); 5 miss both S4; and 1 have two additional S5. S1 up to 1.8 mm exsert and extend ¾ distance to columella. S2 second most exsert cycle, but extending only about half-distance to columella. S3 as exsert as those S4 flanking S2, and slightly smaller than S2. S4 variable in exsertness and width, depending on their position. Those adjacent to S1 almost as wide and as exsert as S2, each pair of S4 flanking an S1 fuses to it to form an exsert triangular lancet. The pair of S4 that flanks each S2 form a much smaller lancet and are as wide as S3. All septal faces bear several aligned low and rounded granules perpendicular to septal edges, often fusing and forming small ridges. Upper and axial edges of S1, S2, and S4 slightly sinuous, but those of S3 moderately sinuous. A inner crown of 6 paliform lobes (P1) occurs low in fossa. A second crown of 6 P2 terminates slightly higher and is slightly more recessed from columella. The third crown (P3) lies higher than P2 and is more recessed from columella. In each system, a triad of 2 P3 and 1 P2 display the characteristic chevron-shaped configuration of *Tethocyathus* and *Trochocyathus*.

Paliform lobes well-ornamented, sometimes bearing lateral structures like “menianae”, giving to it a very robust appearance. Fossa of moderate depth, containing an elliptical papillose columella formed by 17 tuberculate rods.

Distribution. –*New Caledonia*: 400 m.

Discussion. –*Tethocyathus* sp. may represent an undescribed species but until more specimens be available for examination, a formal description is postponed. *Tethocyathus* sp. is distinguished from New Caledonian congeners in having upper corallum (including septa, paliform lobes and columellar elements) completely pigmented; S4≥S3; and less organized paliform lobes. In fact, the identification of this specimen as *Tethocyathus* is tentative because the morphological boundary between *Tethocyathus*-*Trochocyathus* still poorly understood. The specimen examined herein have epitheca covered by numerous encrusting organisms (e.g. polychaetas, briozoans) and also bored by acrothoracid barnacles. Interestingly, the septa corresponding to the place where the thecal acrothoracid bore is present, is less pigmented than other septa.

Tethocyathus virgatus (Alcock, 1902)

Plate 17, Figs. J-K

Trochocyathus (Thecocyathus) virgatus Alcock, 1902a: 98-99. –Alcock, 1902c: 16-17, pl. 2, fig. 13.

Tethocyathus virgatus. –Cairns, 1995: 65-66, pl. 16c-f. –Cairns & Zibrowius, 1997: 114-115. –Cairns, 1999: 86. –Cairns et al., 1999: 24. –Cairns, 2004a: 286. –Cairns, 2009: 9. –Kitahara et al., 2010a: 115.

Type locality. –*Siboga* stns. 96 and 105 (Sulu Archipelago), 275 m.

Type material. –Two syntypes are deposited at the ZMA (Cairns, 2004a).

New records. –SMIB 10: stn. DW 202 (4); stn. DW 204 (1); DW 205 (6); stn. DW 208 (1). –Norfolk 2: stn. DW 2025 (1); stn. DW 2057 (1); stn. DW 2081 (35); stn. DW 2084 (6); stn. DW 2087 (8).

Description. –Corallum solitary, ceratoid to sub-cylindrical, and attached by a robust pedicel that expands into a polycyclic thin encrusting base. Specimens usually collected with broken pedicel suggesting strong attachement between base and substratum. Largest specimen examined (DW 2025) 17.8 x 16.2 mm in CD, 28.2 mm in height, and 15.1 mm in PD. Calice circyular to slightly elliptical (GCD:LCD = 1.05-1.4) usually having 2 S1 aligned to GCD axis. Most specimens display a thick epitheca covering from 3-5 mm below calicular edge to base, usually completely obscuring costae. Epitheca often highly encrusted by other invertebrates (e.g. sponges, octocorallians) and also bored by acrothoracid barnacles. However, epitheca less thick or eventually absent in some specimens. Costae flat, granular, unequal in width (C1-2>C3>C4), and separated by thin and shallow intercostal striae. However, sometimes C1-3 slightly ridged. Four to 6 granules occurs across each costa. Costal definition gradually fade towards pedicel. Corallum predominantly white, but all specimens examined display S1 and associated costae brownish pigmented. S2 and C2 also pigmented in some specimens. Sometimes a pigmented stripe parallel to calicular edge present in some coralla.

Septa hexamerally arranged in 4 complete cycles (48 septa) according to formula: S1>S2>S3≥ (or) <S4. S1 up to 2 mm exsert, quite thick, and extending half-distance to columella. Axial lower part of S1 usually with blunt edge. S2 as exsert, but slightly less thick and less wide than S1. S3 extending about 2/5 distance to columella, slightly less exsert than S1-2 but considerable less thick. S4 equally to slightly less exsert than S3 and dimorphic in size: those adjacent to S1 wider or as wide as adjacent S3; whereas those adjacent to S2 are less wide than adjacent S3. All septa have straight axial edges, however, upper edges usually in a zig-zag fashion. Septal granules always aligned perpendicular to septal edge, most of the time forming small discontinuous ridges (especially on S1). A crown of 24 paliform lobes encircles columella. Six P1

(sometimes very thick) lies deep in fossa. Six P2 rise slightly higher than P1. P3 slightly more recessed from columella than P1-2. Lateral faces of all paliform lobes highly granular. Granules sometimes form small ridges, giving a robust appearance to paliform lobe. Axial and distal paliform lobe edges sinuous. Fossa relatively deep containing a circular to slightly elliptical papillose columella formed by few to numerous tuberculate elements.

Distribution. –*New Caledonia*: 270-730 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 137-1200 m.

Discussion. –*Tethocyathus virgatus* is probably the most distinctive species in the genus in having pigmented CS1; S1-2 much thicker than S3-4; and well-developed lamellar paliform lobes. Additionally, it apparently attains the largest corallum size amongst congeners. Within the specimens examined herein, some were observed to be budding from the theca of a parent corallum.

Genus *Trochocyathus* Milne Edwards & Haime, 1848a

Diagnosis. –Corallum solitary, turbinate to ceratoid, or bowl-shaped, fixed or free. Transverse division may be present. Septotheca costate, sometimes covered with a thin epitheca. Pali before all but last cycle of septa. Columella papillose.

Subgenus *Trochocyathus* (*Trochocyathus*) Milne Edwards & Haime, 1848a

Diagnosis. –*Trochocyathus* lacking basal costal spines and with other than discoidal coralla.

Type species. –*Turbinolia mitrata* Goldfuss, 1827, by subsequent designation (Milne Edwards & Haime, 1850b).

Trochocyathus (_Trochocyathus_) _caryophylloides_ Alcock, 1902

Plate 17, Figs. L-M

Trochocyathus caryophylloides Alcock, 1902a: 94. –Alcock, 1902c: 14-15, pl. 2, figs. 10, 10a. –Faustino, 1927: 80, pl. 7, figs. 5-6. –Yabe & Eguchi, 1942b: 123-124, pl. 10, fig. 21. –Cairns, 1994: 52-53, pl. 23, figs. a-c, h. –Cairns & Zibrowius, 1997: 106. –Cairns et al., 1999: 24. –Cairns, 2004a: 287. –Cairns, 2009: 9.

Type locality. –*Siboga* stns. 95, 251 and 253 (Celebes and Banda Seas, Indonesia), 115-304 m.

Type material. –Five syntypes are deposited at the ZMA (Cairns, 2004a).

New records. –Norfolk 2: stn. DW 2049 (1); stn. DW 2063 (1).

Description. –Corallum trochoid and firmly attached. Specimen examined 12.1 x 10.6 mm in CD and 6.8 mm in PD (base broken). Calicular edge serrate. Equal, broad costae (about 1 mm in width) separated by thin and shallow intercostal striae faint towards pedicel. Some C1-3 slightly ridged below calicular edge. Two or 3 low rounded granules occur across each costa. Theca thick. Corallum light brown.

Septa hexamerally arranged in four complete cycles according to formula: S1-S2>S3-S4 (only 2 septal sizes). Primary septal size (S1 and S2) about 2 mm exsert, and extend ¾ distance to columella with moderated sinuous axial edges. Each S1-2 bear a small (0.5 mm width) and low palus that altogether (6 P1 and 6 P2) encircle columella. P1-2 upper outer edges terminate higher than their respective upper axial edges. S3 slightly more exsert than S4 but equally wide, extending half-distance to columella with sinuous axial edges. Each S3 bear a taller and wider version of P1-2 (12 P3). Septal faces covered by low rounded granules, whereas palar faces have “meniane” like structures. Axial and distal edges of pali quite sinuous. Each septum is separated from palus by a deep narrow notch. Fossa of moderate depth, containing a papillose columella composed of 12 twisted basally interconnected laths.

Distribution. –*New Caledonia*: 470-724 m. –*Elsewhere*: Japan; Philippines; Indonesia; and Australia; 115-344 m.

Discussion. –Although the specimens reported herein appear to be conspecific to those *Trochocyathus caryophylloides* examined by Cairns & Zibrowius (1997: 106) in having septa hexamerally arranged in 4 cycles, they consistently differ in septal symmetry from the type series specimens, which are decahexameral. However, because the New Caledonian specimens are much smaller than those examined by Alcock (1902c), it is believed that additional septa would be formed with corallum enlargement. Amongst New Caledonian congeners, *T. caryophylloides* is most similar to *T. efateensis* but is distinguished in having S1 and S2 much more exsert and only slightly thicker than S3 and S4 (S1 and S2 quite thick in *T. efateensis*). Granular pali (in *T. efateensis* paliform lobes bear very fine “meniane” like ridges formed by the fusion of very small blunt granules) and P3 size (P3 of *T. efateensis* completely fulfil the space between each P1 and P2) also distinguish *T. caryophylloides* from *T. efateensis*.

***Trochocyathus* (*Trochocyathus*) *cepulla* Cairns, 1995**

Plate 17, Figs. N-O

Trochocyathus sp. Sieg & Zibrowius, 1988: 192, figs. 1k-m.

Trochocyathus cepulla Cairns, 1995: 62-63, pl. 15, figs. a-b. –Cairns et al., 1999: 24. –Cairns, 2004a: 287. –Cairns, 2009: 9.

Type locality. –*NZOI* stn. P13 (32º10.5’S, 167º21.2’E – Wanganella Bank, southern Norfolk Ridge), 449 m.

Type material. –The holotype is deposited at the NZOI, and paratypes are split between the NMNH (2) and NZOI (3) (Cairns, 1995).

New records. –Bathus 4: stn. DW 914 (11); stn. DW 919 (1). –Norfolk 2: stn. DW 2064 (1); stn. DW 2067 (1); stn. DW 2142 (1); stn. DW 2147 (14).

Previous records from New Caledonia. –Sieg & Zibrowius (1989) (as *Trochocyathus* sp).

Description. –Corallum free and shaped as bowl with a flat to slightly convex base. Centre of base (of anthocyathus) always bear a circular to elliptical scar of detachment from anthocaulus (transverse division). Some anthocyathus examined horizontally constricted at middle corallum. Calice circular to slightly elliptical (GCD:LCD = 1-1.18). Largest specimen examined (DW 914) 11.4 x 11.3 mm in CD and 4.6 mm in height. However, anthocyathus often much taller (GCD:H = 0.98-2.47). Nine of the 12 specimens examined have CD smaller than middle corallum diameter (i.e. corallum at calicular level curves inward resulting in a smaller diameter). Slightly ridged, granular and equally wide costae well defined near calicular edge, where narrow intercostal striae separate them. Depth of intercostal striae decrease towards base, fading costal appearance. Theca of moderate robustness, sometimes covered by epitheca near base. Epitheca scarcely covered by encrusting organisms. Corallum white to light-pink.

Septa hexamerally arranged in four complete cycles according to formula: $S1>S2\geq S3\geq$ or $\leq$ S4 (48 septa). S1 up to 2 mm exsert, quite thick, extend about ¾ distance to columella with a slightly sinuous axial edge, and bear a small palus. S2 less exsert and less wide than S1, but also bear a slightly sinuous axial edge that is bordered by a slightly taller palus. S3 much less exsert and about ¾ width of S2. S3 have moderated sinuous axial edge. P3 as wide to slightly wider than P2, but taller and more recessed from columella. S4 very thin and dimorphic in development: those adjacent to S1 more exsert and wider than S3; and those adjacent to S2 have the same size (rarely smaller) but are less exsert than S3. Pointed and tall granules occurs in all septal and palar faces.

Axial and distal palar edges very sinuous. Fossa depth ranging from shallow to moderated deep, containing a papillose columella composed of numerous tuberculate rods. However, sometimes columella is composed of slender twisted elements.

Distribution. –*New Caledonia*: 496-980 m. –*Elsewhere*: Australia; and New Zealand; 398-610 m.

Discussion. –Amongst the 11 *Trochocyathus* reported herein from New Caledonia, only two (*T. cepulla* and *T. discus*) undergo transverse division. *T. cepulla* is distinguished in having incurved upper thecal edge (slightly flared in *T. discus*); a thicker theca; and a not lancetted calicular margin (in *T. discus* each pair of S4 fuses to adjacent S1 or S2 at calicular edge forming well-developed rectangular lancets).

Trochocyathus (_Trochocyathus_) _discus_ Cairns & Zibrowius, 1997

Plate 17, Figs. P-Q

Trochocyathus discus Cairns & Zibrowius, 1997: 112, figs. 11g-h, 12a-c. –Cairns, 1999: 84. –Cairns et al., 1999: 24. –Cairns, 2004a: 287. –Cairns, 2009: 9.

Type locality. –*Karubar* stn. 3 (5º48’S, 132º12’E – Kai Islands, Indonesia), 278-300 m.

Type material. –The holotype and 6 paratypes are deposited at the MNHN. Additional paratypes are deposited at the POLIPI (3) and NMNH (12) (Cairns & Zibrowius, 1997).

New records. –Norfolk 2: stn. DW 2142 (1).

Description. –Corallum bowl-shaped and free, with a flat to slightly convex base. Calice elliptical; calicular edge lancetted and slightly flared. Specimen examined 11.7 x 9.0 mm in CD and 8.9 mm in height. Costae ridged and coarsely granular. Intercostal furrows deep, about half-width of costae, and progressively wider near calicular edge. Epicentre of base bear small granules but no costae, and a discrete detachment scar. Corallum white.

Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2>S4≥S3 (44 septa). S1 highly exsert (up to 2.5 mm), and extend about 2/3 to 4/5 distance to columella with vertical and slightly sinuous axial edge. S2 less exsert and less wide than S1, also with a slightly sinuous axial edge. S3 about 2/3 width of S2, having slightly to moderately sinuous axial edge. S4 dimorphic in development: those adjacent to S1 slightly wider and more exsert than S3; but those adjacent to S2 about same size of S3. At calicular edge each S4 fuses to adjacent S1 or S2 forming rectangular lancets. Three palar crowns easily distinguishable: P1, P2, and P3. Palar upper, axial, and outer edges sinuous. Septal and palar faces covered with low rounded granules. Fossa of moderate depth, containing a papillose columella formed by 9 irregularly shaped interconnected papillae.

Distribution. –*New Caledonia*: 500 m. –*Elsewhere*: Indonesia; Wallis and Futuna; Vanuatu; and Australia; 240-700 m.

Discussion. –*Trochocyathus discus* is compared with the only other New Caledonian congener that undergo transverse division (*T. cepulla*) in the account of that species.

***Trochocyathus* (*Trochocyathus*) *efateensis* Cairns, 1999**

Plate 17, Figs. R-S

Trochocyathus efateensis Cairns, 1999: 82, figs. 8d-e. –Cairns et al., 1999: 24. –Cairns, 2009: 9. –Kitahara et al., 2010a: 115. –Kitahara et al., 2010b.

Type locality. –*Musorstom 8* stn. DW 1019 (17º38'S, 168º34'E – Efaté, Vanuatu), 397-430 m.

Type material. –The holotype and 21 paratypes are deposited at the MNHN. Five additional paratypes are deposited at the NMNH (Cairns, 1999).

New records. –Bathus 3: stn. DW 818 (1). –Bathus 4: stn. DW 887 (1); stn. DW 894 (2); stn. CP 937 (2); stn. DW 947 (1). –Norfolk 2: stn. DW 2041 (1); stn. DW 2108 (2); stn. DW 2125 (2); stn. DW 2132 (2); stn. DW 2156 (1).

Description. –Corallum trochoid, slightly bent, and firmly attached by a robust pedicel that expands into a thin encrusting base. Largest specimen examined (DW 2156) 14.9 x 12.7 mm in CD, 12.5 mm in height, and 6.5 mm in PD. Calice often elliptical even in juvenil specimens (GCD:LCD = 1.06-1.43),; calicular edge serrate. Septotheca costate and usually free of encrustations in upper corallum. Costae always granulated but variable in appearance: some specimens have broad, flat, equal costae separated by narrow intercostal striae; however, some have slightly ridged costae separated by slightly broader intercostal striae which in turn are bisected by low ridges. Costal definition gradually fades towards pedicel. Juvenil specimens do not bear epitheca, making costae visible from calice to pedicel. However, one specimen examined is completely covered by epitheca. Epitheca often covered by encrusting organisms (e.g. foraminiferans, bryozoans, polychaetes). Corallum beige, epitheca usually light-brown. Tissue do not completely invest corallum, terminating between 1 and 2 mm below calicular edge.

Septa hexamerally arranged in four complete cycles according to formula: $S1 \geq S2 > S4 \geq S3$ (48 septa). Smallest specimens examined (DW 894 – 6.2 mm in GCD) is missing four pairs of S4. S1 thick, up to 1.3 mm exsert, extending ¾ distance to columella, and bear a small paliform lobe (P1). S2 slightly smaller than S1, but otherwise identical. Higher septal cycles progressively less exsert, however, S4 are as wide to slightly larger than S3. Each S3 bears a large and tall paliform lobe that occupy the space formed between S3-S4 axial edges and columella. Two crowns of paliform lobes easily distinguishable: one composed of 6 P1 and 6 P2; and the second recessed from columella and composed of 12 large and tall P3. Septal faces granulated. Granules usually aligned parallel to septal edge. Lateral faces of paliform lobes usually bearing transversed ridges formed by blunted granules fusion. Fossa of moderate depth, containing an elliptical slightly convex papillose columella formed by less than 20 tuberculated rods.

Distribution. –*New Caledonia*: 245-500 m. –*Elsewhere*: Vanuatu; 391-437 m.

Discussion. –This is the first record of this species since its description. The New Caledonian specimens reported herein are much shorter than those from the type series, and lack S5. These small differences are believed to compose intraspecific variation. *T. efateensis* is most similar to *T. caryophylloides* and is compared witht the latter in the account of that species.

Trochocyathus (_Trochocyathus_) _maculatus_ Cairns, 1995

Plate 19, Figs. D-E

Trochocyathus maculatus Cairns, 1995: 61, pl. 14, figs. c-d. –Cairns & Zibrowius, 1997: 107. –Cairns, 1999: 81-82. –Cairns et al., 1999: 25. –Cairns, 2004a: 265, 287. –Cairns, 2009: 9.

Type locality. –*NZOI* stn. P115 (31º25.9’S, 159º02.2’E – off Lord Howe Island, Australia), 183 m.

Type material. –The holotype and two paratypes are deposited at the NZOI. Four additional paratypes are deposited at NMNH (3) and AM (1) (Cairns, 1995).

New records. –Norfolk 2: stn. DW 2119 (1).

Description. –Corallum ceratoid and firmly attached by a robust pedicel (PD:GCD = 0.52). Calice elliptical (GCD:LCD = 1.14); calicular edge serrate. Specimen examined 10.5 x 9.2 mm in CD, 5.5 mm in PD, and 12.2 mm in height. Theca thin. Costae very prominent especially near calicular edge, where they are ridged and very granular. Deep intercostal furrows separate costae near calicular edge, but decrease in depth towards pedicel. Specimen examined have exothecal dissepiments appearing to be deposited over raised costae on one side of base. Corallum white but theca and S1-2 edges mottled with dark-brown pigment.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3≥S4 (48 septa). S1 up to 1.3 mm exsert, and almost reach columella with straight and vertical axial edge. S2 only slightly less wide and less exsert than S1, and have vertical, straight to slightly sinuous axial edge. S3 least exsert septa and about 4/5 width of S2. S4 dimorphic in development: those adjacent to S1 more exsert but as wide as S3; those adjacent to S2 slightly less exsert and less wide than S3. Paliform lobes arranged in three crowns: one composed of 6 P1 form lower innermost crown; another formed by 6 P2 equal in width to P1, but rise higher in fossa; and 12 well-developed P3 compose the most recessed crown. Paliform lobes have slightly to moderate sinuous axial edges. Septal faces highly granular. Fossa of moderate depth, containing a papillose columella.

Distribution. –*New Caledonia*: 300 m. –*Elsewhere*: Philippines; Indonesia; Wallis and Futuna; Vanuatu; Australia; and New Zealand; 77-550 m.

Discussion. –Among the 30 extant species in the genus *Trochocyathus*, *T. maculatus* is unique in having theca and S1-2 edges mottled with dark-brown pigment. However, it is quite similar to "solitary" specimens of *Rhizosmilia maculata* (Pourtalès, 1874). *R. maculata* differs in having paliform lobes only before penultimate septal cycle.

***Trochocyathus* (*Trochocyathus*) *philippinensis* Semper, 1872**

Plate 17, Figs. T-U

Trochocyathus philippinensis Semper, 1872: 253, pl. 20, fig. 16. –Faustino, 1927: 79-80. –Cairns & Zibrowius, 1997: 107-108, figs. 10d-e. –Cairns, 1998: 380. –Cairns, 1999: 81. –Cairns et al., 1999: 25. –Cairns, 2004a: 287. –Cairns, 2009: 9.

Type locality. –Pandanon, Philippines, 27-54 m.

Type material. –Three syntypes are deposited at the NMW (Cairns, 2004a).

New records. –Halipro 1: stn: CP 863 (1).

Description. –Corallum ceratoid to conical, slightly bent on GCD plane near base, and free. Calice elliptical (GCD:LCD = 1.31); calicular edge serrated. Specimen examined 10.5 x 8.0 mm in CD, 11.2 mm in height, and base rounded. C1-3 slightly ridged near calicular edge (C4 flat) and bear low rounded granules. Towards base costae become less evident. Intercostal striae ½ width of costae and quite low. Both C1 aligned to GCD more prominent than other C1. Within these principal C1, the one in the convex thecal edge have 1 small spine (0.5 mm long) about half-distance to base, and 3 additional nubs: two above spine, and one below it. Theca glisteny. Near base theca milk-white. Upper theca and septa brownish pigmented, but palar and columellar elements white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1-S2>S3>S4, but one half system has 1 additional septum (49 septa). S1-2 about 1 mm exsert, extending ¾ distance to columella with vertical and slightly sinuous axial edges. Each

S1 bear a small, rounded, and low palus that almost touch columellar elements. P2 equal or slightly wider than P1. S3 about 0.7 mm exsert, and 2/3 width of S1-2. Axial edge of S3 vertical, quite sinuous, and bearing a lamellar pali (about 1 mm in length) more recessed from columella than P1-2. S4 thin, slightly smaller than S3, and bear a straight axial edge. Axial palar edges less sinuous than distal edges. Fossa of moderate depth, containing a papillose columella composed of 5 aligned and interconnected tuberculate papillae.

Distribution. –*New Caledonia*: 190-227 m. –*Elsewhere*: Japan; South China Sea; Philippines; Indonesia; Wallis and Futuna; Vanuatu; and Australia; 54-330 m.

Discussion. –Amongst New Caledonian species in the subgenus *Trochocyathus* only *T. philippinensis* has thecal edge spines. Within all extant species in the subgenus, additional two species, *T. semperi* Cairns & Zibrowius, 1997 and *T. cooperi* (Gardiner, 1905) also have thecal edge spines and are comprehensive compared with *T. philippinensis* by Cairns & Zibrowius (1997: 108). To reiterate *T. cooperi* is distinguished by showing evidence of transverse division, and *T. semperi* by having septa decamerally arranged in 3 cycles. The only specimen examined herein has a rounded free base, which is probably atypical and the result of being dislodged from the substratum.

***Trochocyathus* (*Trochocyathus*) cf. *T. rawsonii* Pourtalès, 1874**

Plate 17, Figs. V-X

Trochocyathus rawsonii Pourtalès, 1874: 35, pl. 6, figs. 7-10. –Pourtalès, 1878: 199 (*in part*: not *Blake* stn. 68). –Pourtalès, 1880: 96, 101 (*in part*: not *Blake* stn. 280). –Zibrowius, 1974a: 767. –Cairns, 1977a: 5. –Cairns, 1978: 11. –Cairns, 1979: 77-79, pl. 13, figs. 5-7, pl. 14, figs. 1-6. –Cairns et al., 1991: 47. –Cairns, 2000: 78-79. –Kitahara, 2007: 502-503, 508, 513, fig. 3B. –Pires, 2007: 268. –Cairns, 2009: 9. –Reyes et al., 2009: 1, 3, 7, 9.

Montlivaultia poculum Pourtalès, 1878: 205-206, pl. 1, figs. 21-22. –Pourtalès, 1880: 96.

Paracyathus laxus Pourtalès, 1880: 96, 104-105, pl. 1, figs. 9-11.

Trochocyathus sp. cf. *T. rawsonii*. –Cairns in Cairns & Keller, 1993: 241-242, figs. 4E, H.

Type locality. –West of Florida and *Hassler* (Barbados), 183 m.

Type material. –Ten syntypes are deposited at the MCZ (Cairns, 1979).

Material examined. –Halipro 1: stn. CP 858 (2). –Bathus 4: stn. DW 886 (1); stn. CP 948 (1). –Norfolk 2: stn. DW 2024 (1?); stn. DW 2040 (1); stn. DW 2047 (2); stn. DW 2086 (4); stn. DW 2113 (1); stn. DW 2133 (4).

Description. –Corallum ceratoid to trochoid. Pedicel variable in diameter (PD:GCD = 0.22-0.43) and expanding into a thin encrusting base. Some specimens bud from a parent corallum. Calice circular; calicular edge serrate. Largest specimen examined (DW 2113) 13.2 mm in CD, 3.1 mm in PD, and 18.7 mm in height. Theca granular, with 2 to 4 small granules occurring across width of each costa. Costae slightly convex and separated by thin and shallow intercostal furrows. Some specimens have intercostal spaces bisected by a thin and low ridge. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S3>S4 (48 septa). Some specimens have 1 or 2 pairs of additional S5. S1 quite thick, up to 2 mm exsert, and extend to columella with vertical and slightly sinuous axial edge. Each S1 bear a small pointed to lamellar palus sometimes difficult to distinguish from columellar elements. S2 about 1.5 mm exsert and 4/5 width of S1, having a moderate sinuous axial edge that bears a slightly larger pali. S3 up to 1 mm exsert and extend half-distance to columella with sinuous axial edge. P3 tall and most recessed pali. S4 as exsert as S3 but quite short. Axial edge of S4 straight and vertical. Septal and palar faces coarsely granulated. Axial and distal palar edges sinuous. Fossa of moderate depth, containing a papillose columella composed of up to 10 interconnected papillae.

Distribution. –*New Caledonia*: 215-1200 m. –*Elsewhere*: United States; Bahamas; Gulf of Mexico; Jamaica; Nicaragua; Venezuela; Colombia; Antilles; Brazil; and Madagascar; 55-700 m.

Discussion. –*Trochocyathus rawsonii* was previously reported only from Atlantic waters, been the south-western Indian ocean records made by Gardiner (1904) believed to by a result of mis-identification (Cairns, 1979). Cairns & Keller (1993) reported the occurrence of *T.* sp. cf. *rawsonii* from Madagascar and Madagascar Plateau. Because *T. rawsonii* is a quite variable species, the identification of the New Caledonian specimens are only tentative.

***Trochocyathus* (*Trochocyathus*) *vasiformis* Bourne, 1903**

Plate 18, Figs. A-B

Trochocyathus vasiformis Bourne, 1903: 27-28, pl. 5, figs. 6-7. –Cairns, 1999: 80, figs. 8a-b, f. –Cairns et al., 1999: 25. –Cairns, 2009: 9.

Type locality. –Tutanga, Funafuti, Tuvalu Islands, 366 m.

Type material. –The syntypes are deposited at the BM (Cairns, 1999).

New records. –SMIB 10: stn. DW 205 (1). –Bathus 3: stn. DW 781 (1). –Bathus 4: stn. DW 914 (1); stn. DW 941 (3). –Norfolk 2: stn. DW 2024 (5); stn. DW 2025 (1); stn. DW 2032 (2); stn. DW 2036 (1); stn. DW 2041 (1); stn. DW 2049 (3); stn. DW 2058 (6); stn. DW 2060 (4); stn. DW 2063 (5); stn. DW 2064 (1); stn. DW 2067 (4); stn. DW

2070 (7); stn. DW 2074 (5); stn. DW 2075 (1); stn. DW 2081 (2); stn. DW 2087 (1); stn. DW 2097 (2); stn. DW 2098 (1); stn. DW 2132 (5); stn. DW 2135 (1); stn. DW 2142 (1); stn. DW 2144 (1).

Description. –Corallum ceratoid to elongate, bent, and always attached by a quite robust pedicel that expands into a thin encrusting base (PD:GCD = 0.55-0.8). Largest specimen examined (DW 2081) 20.5 x 14.0 mm in CD, 33.9 mm in height, and 12.4 mm in PD. Calice circular to compressed (GCD:LCD = 1-1.46); calicular edge serrate. Septotheca up to 4.0 mm thick, and usually covered by epitheca. Sometimes costae completely obscured below calicular edge by well-developed epitheca. When present, epitheca usually encrusted by many differente invertebrates. Costae better developed near calicular edge. Narrow intercostal striae separates unequally wide costae (C3>C1-2>C4). Five to 7 low, rounded, aligned granules occur across width of each costa. Corallum predominantly light brown, but columella and paliform lobes usually white or light-beige. Two specimens examined (DW 2081) completely white.

Septa hexamerally arranged in 4 complete cycles according to formula: S1-2>S3-4 (48 septa). S1-2 quite thick, up to 3 mm exsert, and extend about half-distance to columella with straight to slightly sinuous axial edge bordered by a small palus. Those S1 aligned to GCD bear the smallest palus. Largest specimen examined have blunt S1-2 axial edges. Sometimes S3 slightly more exsert than S4, but specimens with S3 as exsert as S4 more common. S3-4 about ¾ width of S1-2, bearing straight to slightly sinuous axial edges. Lateral septal faces have low rounded granules. A well-defined palar crown formed by 6P1, 6P2, and 12 taller and wider P3 encircles the elliptical columella. Palar axial edges terminate at same distance from columella. However, outer edge of P3 more recessed from columella, and have notoriously broader and more sinuous outer edge than P1-2. Each palus is separated from respective septum by a very deep and narrow notch. Lateral faces of septa and pali equally granulated. However, pali of some specimens have finely dentate menianes. Fossa deep, columella papillose composed of numerous (slightly twisted) rods that terminate at same level.

Distribution. –*New Caledonia*: 270-1150 m. –*Elsewhere*: Indonesia; Wallis and Futuna; and Vanuatu; 323-650 m.

Discussion. –Among New Caledonian *Trochocyathus*, only *T. vasiformis* and *T. caryophylloides* have S1-2>S3-4 (2 septal sizes), but the former is distinguished in having a much more dense and taller corallum; larger coralla with a more compressed calice (GCD:LCD >1.3); and all septal cycles with about the same exsertness (S1-2 much more exsert than S3-4 in *T. caryophylloides*).

***Trochocyathus* (*Trochocyathus*) *wellsi* Cairns, 2004**

Plate 18, Figs. C-D

Trochocyathus virgatus. –Wells, 1964: 112-113, pl. 1, figs. 8-10. –Veron, 1986: 606.
Trochocyathus wellsi Cairns, 2004a: 288, figs. 5A-B. –Cairns, 2009: 9.

Type locality. –*Kimbla* stn. 1 (27º31'S, 153º40'E – off Moreton Island, Australia), 75-81 m.

Type material. –The holotype is deposited at the AM. Three paratypes are split between NMNH (2) and AM (1) (Cairns, 2004a).

New records. –Norfolk 2: stn. DW 2093 (5).

Description. –Corallum ceratoid to trochoid, attached through a slender pedicel and a thin and small encrusting base (usually smaller than LCD). Calice elliptical; calicular edge lancetted. Largest specimen examined (DW 2093) 9.0 x 7.6 mm in CD, 14.4mm in height, 3.7 mm in PD, and widest part of base only 6.5 mm in length. Shallow and thin intercostal furrows separate broad costae near calicular edge (sometimes C1-2 slightly ridge). Towards pedicel costae obscured by discontinuous transversal ridges. Corallum white.

Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2>S3≥S4 or S1>S2>S4≥S3. All specimens examined, including one with 5.5 mm in GCD, display only 40 septa. S1 highly exsert (up to 2.5 mm), thick, and almost reach columella with straight axial edge. S2 about 1.7 mm exsert and extend ¾ to 3/5 distance to columella with slightly sinuous axial edge. S3 dimorphic in development: when flanked by a pair of S4, S3 are the smallest septa; but those unflanked almost attain S2 width, and fuse to adjacent S1 at calicular edge forming a triangular apex. S4 also dimorphic in development: those adjacent to S2 are as wide to only slightly smaller than adjacent S3; however, those adjacent to S1 are wider than S3 they flank. Three specimens examined have all S3 flanked (and enclosed) by pairs of S4. Septal faces smooth, but become highly granular at calicular edge level. P1 and P2 usually difficult to distinguish from columellar elements. P3 tall and easily distinguishable, however, one specimen display quite low P3. Fossa of moderate depth, containing a papillose columella formed by few, sometimes lamellar, elements.

Distribution. –*New Caledonia*: 230 m. –*Elsewhere*: Australia; 75-86 m.

Discussion. –*Trochocyathus wellsi* is distinguished from New Caledonian congeners in having a transverse ridged lower theca. *T. wellsi* is compared with *T.* sp. cf. *T. wellsi* in the account of the latter (below).

Trochocyathus (_Trochocyathus_) sp. cf. _T. wellsi_ Cairns, 2004

Plate 18, Figs. E-F

Material examined. –Norfolk 2: stn. DW 2133 (1).

Description. –Corallum ceratoid to trochoid, firmly attached by a robust pedicel (PD:GCD = 0.52) and a thin encrusting base. Calice elliptical in cross section (GCD:LCD = 1.12) with lancetted calicular edge. Each S4 fuses to adjacent S1 or S2 forming high triangular apex (much higher in those apex composed of S1). Specimen examined 9.8 x 8.7 mm in CD, 16.3 mm in height, and 5.0 mm in PD. Theca thin, and only C3 slightly ridged at upper third of corallum. Theca bear slightly sinuous and discontinuous transversal ridges. Corallum white.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2≥S4≥S3 (48 septa). S1 extremely thick (about 0.5 mm), up to 3 mm exsert, and extend to columella with straight vertical axial edge. S2 less thick, half as exsert, but only slightly smaller than S1, extending about 5/6 distance to columella with sinuous axial edge. Upper outer edges of S2 and S3 project slightly beyond calicular edge. S3 usually least exsert septa, and about same size of those S4 flanking S2. However, those S4 adjacent to S1 are quite exsert, and sometimes extending as much as S2 to columella. Lancets formed by S1-4 W-shaped. Septal faces coarsely granular. Presumably 3 crowns of pali present. However, P1 practically indistinguishable from columellar elements. P2 quite small and low. P3 larger, circular in cross section, more recessed from columella than P2, and sometimes bi- or trilobate. Fossa shallow, containing a papillose columella composed of more than 15 interconnected pillars that terminate about the same level as calicular edge.

Distribution. –*New Caledonia*: 215-270 m.

Discussion. –Even sharing many morphological characters with *T. wellsi*, the nature of P3 of *T.* sp. cf. *wellsi* described above may suggest its placement in the genus *Paracyathus.* However, before more specimens of this species be available for examination and because it is similar to the examined *T. wellsi*, its identification remains tentative. Nonetheless, the specimen examined differs slightly from typical *T.*

wellsi in having much thicker and more exsert S1 and much higher septal lancets (formed by S1 and adjacent S4).

Subgenus *Trochocyathus* (*Aplocyathus*) d'Orbigny, 1849

Diagnosis. –Corallum bowl-shaped and unnatached. Corallum bear one or more basal spines on 5 or 6 C1.

Type species. –*Turbinolia armata* Michelotti, 1838, by monotypy.

Trochocyathus (*Aplocyathus*) *brevispina* Cairns & Zibrowius, 1997

Plate 18, Figs. G-I

Trochocyathus (Aplocyathus) brevispina Cairns & Zibrowius, 1997: 113, figs. 12d-f. –Cairns, 1999: 85-86. –Cairns et al., 1999: 24. –Cairns, 2004a: 286. –Cairns, 2009: 9.

Type locality. –*Karubar* stn. 3 (5º47'40''S, 132º12'11''E – Kai Islands, Indonesia), 278-300 m.

Type material. –The holotype is deposited at the MNHN. Thirty-two paratypes are split between NMNH (19), MNHN (8), NNM (3), POLIPI (1), and ZMA (1) (Cairns & Zibrowius, 1997).

New records. –Halipro 1: stn. CP 851 (1).

Description. –Corallum free and shaped as a shallow bowl. Specimen examined 13.6 x 12.1 mm in CD and 7.0 mm in height. Calice hexagonal (each corner formed by each S1). Flat and poorly defined costae occur only near calicular edge. Six circular to elliptical in cross section costal spines associated with C1 extend less than 5 mm from thecal edge. Basally, these spines are strongly ridged, forming an hexagonal field in centre of base. Base flat and smooth, however, epicentre slightly worn and have a small fragment of substratum still attached. Corallum predominantly white, however, each S1 brownish purple in color, and border between septa and costae dispaly a light brown stripe.

Septa hexamerally arranged in four complete cycles according to formula: S1>S2>S4≥S3 (48 septa). S1 up to 4.5 mm exsert and extending ¾ distance to columella. S2 about 1 mm less exsert than S1 and extend only half-way to columella. S3 up to 2.5 mm exsert and about 4/5 width of S2. S4 dimorphic in development: those adjacent to S1 more exsert and wider than S3; and those adjacent to S2 have same size (rarely smaller) but are particularly less exsert than S3. Different exsertness between septal cycles form a "stair-like" pattern in each half-system starting from those S4 adjacent to S2 and progressively increasing to S1. All septal axial edges straight. Three palar crowns easily distinguishable: one composed of 6 P1 near columella; other composed of 6 P2 slightly more recessed from columella; and the last composed of 12 smaller P3. Lower axial edge of P3 often fuse to adjacent P2. Deep narrow notch separate paliform lobes from their respective septa. All septal faces bear aligned low granules. Granules on palar faces larger, randomly placed, and sometimes with blunt tip. Fossa of moderated depth containing a papillose columella composed of irregularly-shaped pilars.

Distribution. –*New Caledonia*: 314-364 m. –*Elsewhere*: Indonesia; Vanuatu; and Australia; 240-560 m.

Discussion. –Three species are recognized in the nominated subgenus: *Trochocyathus* (*A.*) *hastatus* Bourne, 1903; *T.* (*A.*) *brevispina*; and *T.* (*A.*) *longispina* Cairns & Zibrowius, 1997. A comprehensive comparison between *T. brevispina* and *T. longispina* (the only two species to have 6 thecal spines) is provided by Cairns & Zibrowius (1997:114).

Family E

Genus *Paracyathus* Milne Edwards & Haime, 1848

Diagnosis. –Corallum solitary, turbinate to trochoid, fixed or free. Septotheca costate. Pali often bi- or tri-lobate, and opposite all but last septal cycles. Columella papillose, often indistinguishable from inner paliform lobes.

Type species. –*Paracyathus procumbens* Milne Edwards & Haime, 1848, by subsequent designation (Milne Edwards & Haime, 1850b).

Paracyathus peysonneli sp. nov.

Plate 18, Figs. J-K

Paracyathus sp. Cairns & Zibrowius, 1997: 116-117, figs. 13 g-i.

Type locality. –*Norfolk 2* stn. DW 2024 (23°28'S, 167°51'E - Bank Brachiopode, New Caledonia), 370-371 m.

Holotype. –Norfolk 2: stn. DW 2024.

Paratypes. –Bathus 4: stn. DW 940 (1). –Norfolk 2: stn. DW 2024 (3); stn. DW 2132 (1).

Description. –Corallum trochoid and elongate, robust, and firmly attached through a polycyclic pedicel and a thin encrusting base. Calice circular to slightly elliptical (GCD:LCD = 1.05-1.23); calicular edge slightly lancetted (each S4 fuses to adjacent S1-2 above calicular edge forming small triangular apexes). Theca robust and lower half usually epithecate and highly encrusted by other invertebrates. Upper theca glisteny and covered with low, rounded granules sometimes aligned in transverse rows. Shallow intercostal striae separate flat and poorly developed costae. Sometimes C1-2 slightly ridged near calicular edge. Corallum pigmentation variable: septa, pali, and columella usually uniformly reddish-brown; but within these calicular elements, two paratypes (DW 940 and DW 2024) display light-yellow paliform lobes and columellar elements. Upper theca of all specimens but holotype mottled with a brown pigmentation, usually coinciding with C1-3.

Septa hexamerally arranged in four complete cycles according to formula: $S1 \geq S2 > S4 \geq S3$ (48 septa). S1 about 1.5 mm exsert and extend 4/5 distance to columella with thickened vertical axial edge. Each S1 bear a triangular paliform lobe that have well-developed oblique carinae on its faces. Those P1 aligned to GCD usually much less-developed than lateral P1. Sometimes P1 bisected into two smaller paliform lobes. S2 only slightly less exsert and sometimes less wide than S1. Each S2 is bordered by 1 to 3 paliform lobes. S3 about 3/5 width of S2 and least exsert septa, each bearing 1 to 3 slender paliform lobes. S4 dimorphic in development: those adjacent to S1 wider and more exsert than S3, and those adjacent to S2 about same size and as exsert as S3. Small P4 may be present, but usually there is no space for P4 development due to P3 size. Axial edges of S3-4 and sometimes S2 slightly sinuous. All septal faces covered with well-developed granules that sometimes fuse forming carinae oblique to upper septal edge. All paliform lobes have slightly sinuous axial and distal edges, and bear oblique to vertical carinae. Fossa shallow, containing a slightly concave papillose columella formed by numerous irregularly shaped rods usually hard to distinguish from axial pali.

Etymology. – This species is named in honour of Jean André Peysonnel, who was the first one to declare that corals were animals, not plants.

Distribution. –*New Caledonia*: 305-455 m. –*Elsewhere*: Indonesia; 90-397 m.

Discussion. –Among the 23 Recent species in the genus *Paracyathus*, *P. peysonneli* is distinguished in having a mottled pigmented upper theca; S1, S2 and adjacent S4 forming small triangular apexes above calicular edge; and paliform lobe lateral faces bearing well-developed oblique carinae. The description and figures of *Paracyathus* sp. (Indonesia) provided by Cairns & Zibrowius (1997: 116) appears to be conspecific with *P. peysonneli*.

Paracyathus lifuensis **Gardiner, 1899**

Paracyathus lifuensis Gardiner, 1899: 164. –Gardiner, 1905: 956. –Wells, 1964: 108. –Pillai, 1972: 210. –Cairns et al., 1999: 23. –Cairns, 2009: 10.

Type locality. –Sandal Bay, Lifu, Loyalty Islands, 73 m.

Type material. –Two syntypes are probably deposited at the BM or UCMZ.

New records. –None.

Previous records from New Caledonia. –Gardiner (1899).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum small, almost straight, and attached by large, flat, and irregular base. Calice elliptical (GCD:LCD = 1.3); calicular edge slightly serrate. Largest specimen examined by Gardiner (1899) 9.0 x 7.0 mm in CD and 10.0 mm in height. Costae sub-equal, broad, granular, and ridged. Usually two rows of granules occurs on each costa. Narrow intercostal furrows extend from calice to base. Septa hexamerally arranged in five incomplete cycles. S1 about 2 mm exsert and bear a well-developed elongate pali. S2 about 1.5 mm exsert and bear a slightly more elongate pali. S3 and S4 about 1 mm exsert and usually have bi- or tri-lobated pali. Septal faces coarsely granular. Palar crowns terminate slightly higher than columella elements. Fossa shallow, containing an elliptical columella (about 2.5 x 1.4 mm in diameter) composed of numerous small, rounded, and granular papillae.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: India; Maldives; 73 (?) m.

Discussion. –Nothing can be added to the knowledge on *P. lifuensis* since no additional specimens were available for the present study.

Paracyathus montereyensis Durham, 1947

Plate 18, Figs. L-M

Paracyathus montereyensis Durham, 1947: 34-35, pl. 2, figs. 10, 19. –Durham & Barnard, 1952: 11. –Austin, 1985. –Bythell, 1986: 18. –Cairns et al., 1991: 47. –Cairns, 1994: 24, pl.7, figs. g-i. –Cairns et al., 1999: 23. –Cairns, 2009: 10.

Type locality. –Off Point Lopez (California), 146 m.

Type material. –The holotype and two paratypes are deposited at the UCMP (Cairns, 1994).

New records. –Bathus 4: stn. DW 943 (1). –Norfolk 2: stn. DW 2023 (1); stn. DW 2024 (2).

Description. –Corallum cylindrical to elongate, robust, and firmly attached through a robust pedicel (PD: GCD = 0.75-0.9) and a thin encrusting base. Calice circular to slightly elliptical (GCD:LCD = 1.0-1.1); calicular edge slightly serrate. Largest specimen examined (DW 2023) 10.5 x 9.8 mm in CD, 9.4 mm in PD, and 12.6 mm in height. Both specimens from DW 2024 display more elongate coralla with rejuvenescence episode from parent corallum. Theca quite thick, finely granular, and covered with flat costae. Corallum white to light-brown.

Septa decamerally arranged in three complete cycles according to formula: S1>S3≥S2 (40 septa, but largest specimen examined have additional 2 pairs of S4, totalling 44 septa). S1 less than 1 mm exsert, and extend about ¾ distance to columella with slightly sinuous axial edge. Upper edge of S1 almost horizontally flat. Each S1 bears a small and slightly sinuous lamellar paliform lobe (P1). A narrow notch separates each P1 form their respective S1. S2-3 about 4/5 width of S1 (sometimes S3 slightly larger than S2), but S2 slightly more exsert, more sinuous, and thicker than S3. Each S2 is bordered by a wide sinuous paliform lobe (P2) sometimes bisected into 2 or even 3 smaller lobes. P2 taller than P1, and slightly more recessed from columella. Altogether, 20 paliform lobes form two distinct crowns easily distinguished by size and height. All septal and palar faces slightly granular. Fossa of moderate depth, containing a papillose columella composed of 12 to 14 slender elements.

Distribution. –*New Caledonia*: 282-371 m. –*Elsewhere*: Pacific coast of United States; 75-146 m.

Discussion. –*Paracyathus montereyensis* differs from all other New Caledonian congeners in having septa decamerally arranged in only three cycles. Since its description in 1947, which was based on three specimens, only one additional specimen was collected. The four New Caledonian specimens reported herein expand the distributional record of this species from eastern to western Pacific waters.

***Paracyathus parvulus* Gardiner, 1899**

Plate 18, Figs. N-P

Paracyathus parvulus Gardiner, 1899: 165. –Gardiner, 1904: 122-123. –Gardiner, 1905: 956. –Wells, 1954: 469-470, pl. 17. –Pillai, 1972: 210. –Cairns et al., 1999: 23. –Cairns, 2009: 10.

Type locality. –Sandal Bay (Loyalty Islands), 73 m.

Type material. –The syntypes are deposited at the BM.

Material examined. –None.

Previous records from New Caledonia. –Gardiner (1899).

Diagnosis (extracted from Gardiner [1899] original description). –Corallum elongate and attached through a robust pedicel (almost as wide as calice). Calice elliptical; calicular edge serrate. Largest specimen examined by Gardiner (1899) 4.5 x 3.0 mm in CD and 16.0 mm in height. Costae broad, slightly ridged, sub-equal in width, and granular. Intercostal furrows narrow and deep. Epitheca thin and extending from 3 to 5 mm below calicular edge to base. Septa hexamerally arranged in four incomplete cycles according to formula: S1>S2≥S3>S4. S1 about 0.75 mm exsert and extend about half-distance to columella. Rounded pali occur before all but last septal cycle. P2 distinctly larger than P1 and P3 and sometimes bi-lobated. Fossa of moderate depth, containing a small papillose columella composed of 8-12 small rounded papillae.

Distribution. –*New Caledonia*: 73 m. –*Elsewhere*: Maldives; and Marshall Islands; depth unknown.

Discussion. –*Paracyathus parvulus* is another species that since its description had no additional specimens collected from New Caledonia. Consequently, the diagnosis provided herein is based on the original species description. Among New Caledonian congeners *P. parvulus* is distinguished in having P2>P1 and P3.

***Paracyathus* sp.**

Plate 18, Figs. Q-R

Material examined. –Norfolk 2: stn. DW 2072 (1).

Description. –Corallum trochoid, with slightly flared calice, and firmly attached by a robust pedicel. Calice elliptical; calicular edge serrate. Specimen examined 12.4 x 9.4 mm in CD, 7.0 mm in PD, and 15.7 mm in height. Theca robust and covered by pointed small granules. Costae flat and unequally wide visible only near calicular edge. However, two principal S1 slightly ridged near calicular edge. Intercostal striae thin and shallow. Tissue complete invest corallum. Corallum white.

Septa hexamerally arranged in five incomplete cycles according to formula: S1≥S2>S3>>S4≥S5. S1 about 1.5 mm exsert, and extend half-distance to columella with sinuous and vertical axial edge. S2 equal to only slightly less exsert and less wide than S1. S3 0.5 mm exsert and ¾ width of S2, also having sinuous and slightly concave axial edge. S4 less than 0.2 mm exsert and much smaller than S3 (1/6 width). S5 rudimentary. Three distinct and tall lamellar palar crowns encircle columella. The first composed of 6 P1 and 6 P2; the second composed of 12 wider P3; and the last formed by 24 recessed but widest P4. P3 and P4 sometimes bisected into 2 smaller lobes. All paliform lobes axial and distal edges sinuous. Septal and palar faces covered by coarsely granules. Columella papillose composed of 22 slightly twisted and granular elements that terminate about the same level.

Distribution. –*New Caledonia*: 1000-1005 m.

Discussion. –The description provided above is based on only one specimen considered insufficient to properly characterize this species.

Genus *Polycyathus* Duncan, 1876

Diagnosis. –Corallum colonial. Cylindrical to slightly conical corallites bud from a common coenosteum or from stolons. Septotheca costate. Three to 4 cycles of septa. Pali present before all but last cycle of septa. Columella papillose.

Type species. –*Polycyathus atlanticus* Duncan, 1876, by monotypy.

Polycyathus fulvus Wijsman-Best, 1970

Plate 18, Figs. T-U

Polycyathus fulvus Wijsman-Best, 1970: 79-83, figs. 1-4. –Cairns et al., 1999: 23. –Cairns, 2009: 10.

Type locality. –Bay of Prony (New Caledonia), 0.3-0.5 m.

Type material. –The holotype and three paratypes are deposited at the ZMA (Wijsman-Best, 1970).

New records. –None.

Previous records from New Caledonia. –Wijsman-Best (1970).

Diagnosis (after Wijsman-Best [1970]). –Colonies small. Corallites conical and projecting up to 20 mm from base. Base of corallite usually narrower than calice. Extratentacular budding common. Calice circular to elliptical with GCD not exceeding 6.0 mm. Costae distinct near calicular edge, but they vanish towards base. Theca bear coarse granules. Septa hexamerally arranged in five incomplete cycles. S1-2 slightly exsert. Septal and palar faces covered by granules. P3 and P4 bisected into few lobes. A pair of P4 usually fuses to common P3. Columella is a continuation of paliform lobes. Fossa shallow.

Distribution. –*New Caledonia*: 0.3-0.5 m.

Discussion. –Although zooxanthellae were found in those specimens living in aquarium (Wijsman-Best, 1970), due to the environmental characteristics of their collecting stations "the water is very turbid and of a red color, due to sediments brought down by some rivers" (Wijsman-Best, 1970), it is possible that *Polycyathus fulvus* represent a facultative species, once it is improbable that a zooxanthellate coral would be thriving on such environmental conditions. To date it is the only *Polycyathus* representative known from New Caledonia.

Family Rhizangiidae d'Orbigny, 1851

Genus *Culicia* Dana, 1846

Diagnosis. –Corallum colonial and consisting of low cylindrical corallites linked together by stolons. Corallites epithecate. S1 weakly dentate or lobate. Higher septal cycles finely dentate. Pali absent. Columella rudimentary.

Type species. –*Culicia stellata* Dana, 1846, by subsequent designation (Wells, 1936).

Culicia fragilis **Chevalier, 1971**

Culicia fragilis Chevalier, 1971: 100-101, pl. 2, fig. 4. –Cairns et al., 1999: 39. –Cairns, 2009: 3.

Type locality. –Stn. C54 (Laurent reef, New Caledonia), 14-20 m.

Type material. –According to Guillaume and Saihi (*unpublished*) the holotype is deposited at the MNHN.

New records. –None.

Previous records from New Caledonia. –Chevalier (1971).

Diagnosis (after Chevalier [1971] original description). –Corallites short and small. Septa usually arranged in 2 cycles. If present, third septal cycle rudimentary. All septa independent and with enteire edges. Paliform teeth scarce and short. Columella absent.

Distribution. –*New Caledonia*: 14-20 m.

Discussion. –For a complete description see Chevalier (1971).

Culicia rubeola **(Quoy & Gaimard, 1833)**

Dendrophyllia rubeola Quoy & Gaimard, 1833: 197-198, pl. 15, figs. 12-15. –Dana, 1846: 389.

Angia rubeola. –Milne Edwards & Haime, 1848c: pl. 7, figs. 6, 6a. – Milne Edwards & Haime, 1849: 176.

Cylicia rubeola. –Milne Edwards & Haime, 1857: 607-608.

Cylicia huttoni Tenison-Woods, 1879b: 132, pl. 12, fig. 1. –Hutton, 1904: 315.

Culicia rubeola. –Squires, 1960: 6-7, figs. 5-6. –Ralph & Squires, 1962: 4-5, pl. 1, figs. 1-5. –Squires, 1964: 3. –Squires & Keyes, 1967: 21, pl. 1, fig. 1. –Morton & Miller, 1968: 159-160, pl. 7, fig. 4. –Chevalier, 1971: 93-100, pl. 3, fig. 6, text figs. 62-65. –Grace & Grace, 1976: 99. –Dawson, 1979: 28. –Brook, 1982: 168-169. –Wells, 1983: 232, pl.11, figs. 1-2. –Hayward et al., 1985: 101. –Cairns, 1995: 38-39, pl. 4, figs. g-h, pl. 5, figs. a-c. –Cairns et al., 1999: 39. –Cairns, 2009: 3.

Culicia sp. cf. *C. rubeola*. –Cairns, 1991a: 7, pl. 1, figs. i-j.

Type locality. –Tamise (=Thames) River (New Zealand), depth unknown.

Type material. –The type specimens are probably at the MNHN (Cairns, 1995).

New records. –None.

Previous records from New Caledonia. –Chevalier (1971).

Diagnosis (after Chevalier [1971] New Caledonian *C. rubeola* description). –Colony reptoid with small corallites. Epitheca sometimes present. Septa hexamerally arranged in four incomplete cycles. S1 independent, with one large distal lobe, internally bordered by 1 to 3 teeth. Distal lobes of S2-3 may be absent. Septal teeth vertical and hard to distinguish from columellar elements. Septal lateral faces granulated. Columella well-developed.

Distribution. –*New Caledonia*: 10-20 m. –*Elsewhere*: New Zealand; 0-82 m.

Discussion. –According to Cairns (1995), *C. rubeola* is a relatively shallow-water Rhizangiidae probably endemic to New Zealand region, and to date, there was any attempt to taxonomically review the 13 species of this genus. Because we were not able to examine the New Caledonian specimens of *C. rubeola*, the above record follows Chevalier (1971).

Genus *Oulangia* Milne Edwards & Haime, 1848

Diagnosis. –Corallum colonial and corallites connected by stolons. Corallites shaped as low wide cylinders. Theca costate. Septa exsert, usually in 5 cycles. Axial septal edges finely dentate or laciniate. Pali absent. Columella papillose, merging with the lower, axial septal processes.

Type species. –*Oulangia stokesiana* Milne Edwards & Haime, 1848a, by subsequent designation (Milne Edwards & Haime, 1850b).

Oulangia cyathiformis Chevalier, 1971

Oulangia cyathiformis Chevalier, 1971: 102-104, pl. 1, fig. 6. –Cairns et al. 1999: 39. –Cairns, 2009: 4.

Type locality. –Stn. C22 (Desmoulin reef, New Caledonia), 10-20 m.

Type material. –According to Guillaume & Saihi (*unpublished*) the holotype is deposited at the MNHN.

New records. –None.

Previous records from New Caledonia. –Chevalier (1971).

Diagnosis based on the original description (Chevalier, 1971). –Corallum solitary, trochoid to ceratoid, slightly curved. Calice circular and flared distally. Epitheca absent. Septa hexamerally arranged in 5 complete cycles (S1>S2>S3>S4≥S5) totaling 94 septa, and resembling the arrangement of a Pourtalès Plan. S1 independent, robust and exsert, reaching columella with straight and slightly convex axial edge. S2 about ¾ width of S1, and slightly thinner and less exsert than S1. Axial edge of S2 fuse to S4. S3 extend 1/3 distance to columella, and is less exsert and thinner than lower septal cycles. S3 also fused to S4. S4 well-developed. S5 usually rudimentary. Columella composed by several papillae terminating at same level, and usually fusing to the axial S1 teeth. Fossa shallow.

Distribution. –*New Caledonia*: 10-20 m.

Discussion. –See Chevalier (1971).

Incertae Sedis

***Deltocyathus magnificus* Moseley, 1876**

Plate 19, Figs. A-C

Deltocyathus magnificus Moseley, 1876: 552-553. –Moseley, 1881: 147-148, pl. 4, fig. 10, pl. 13, figs. 1-2. –Gardiner, 1899: 164. –Alcock, 1902b: 20. –Alcock, 1902c: 49. –Faustino, 1927: 76, pl. VI, figs. 3-5. –Yabe & Eguchi, 1937: 128-130, 138-140, pl. 20, figs. 13-14. –Eguchi, 1938: 2, table 2, figs. 1a-b. –Yabe & Eguchi, 1942b: 126. –Eguchi, 1965: 286, 2 figs. –Utinomi, 1965: 254. –Eguchi & Miyawaki, 1975: 57. –Keller, 1982: 50. –Hu, 1987: 39. –Grygier, 1991: 43, fig. 21 G. –Cairns & Parker, 1992: 27-28, pl. 7, figs. j-l, pl. 8, fig. a. –Cairns & Keller, 1993: 245. –Cairns, 1994: 56, pl. 24, figs. d-e, g-h. –Cairns, 1995: 74. –Grygier, 1995: 85, fig. 1. –Cairns & Zibrowius, 1997: 126-127. –Cairns, 1998: 381-382, fig. 4a. –Cairns et al., 1999: 21. –Cairns, 1999: 91, fig. 11i. –Cairns, 2009: 12. –Cairns, 2004a: 280. –Kitahara et al., 2010b.

Bathyactis palifera. –Hoffmeister, 1933: 14, pl. 4, fig. 6.

Fungiacyathus paliferus. –Wells, 1958: 262. –Veron, 1986: 598. –Cairns & Parker, 1992: 6-7.

Fungiacyathus sp. Veron, 1986: 598.

Type locality. –*Challenger* stn. 192 (5º49'S, 132º14'E - off Kei Islands, Banda Sea), 236 m.

Type material. –One syntype is deposited at the BM (Cairns, 1994).

New records. –None.

Previous records from New Caledonia. –Guerriero et al. (1995) and Kitahara & Cairns (2009).

Description. -Corallum discoidal to hexagonal with a slightly concave base. Largest specimen examined by Kitahara & Cairns (2009) 25.5 mm in CD and 7 mm in height, with a depression of 6 mm in diameter in centre of base. Costae equal thin ridges, finely dentate, being separated by wide furrows and extending up to 1 mm beyond calicular margin. C3-5 absent at centre of base. All costae laterally spinose especially near calicular edge, where intercostal furrows are deeper. Corallum white.

Septa hexamerally arranged in 5 cycles (S1≥S2>S3>S4-5), but any specimen examined display a complete fifth cycle, denoting their juvenile stage. S1 only independent septa, 6 mm exsert, joining columella through a wide palus. S1 sometimes divided at upper margin into 3 paliform lobes. S2 equal to slightly less wide than S1, also joining columella through a wide and tall pali. S3 4/5 width of S3, less exsert and bear a paliform lobe that fuses to P2 near columella. S4 half size of S3 and less exsert, joining P3 through a typical deltocyathid chevron arrangement. S5 less exsert but equal in width to S4, also bearing a paliform lobe that fuses P4. Fossa very shallow, aligned to principal S1, containing a papillose columella variable in size, shape, and number of rods.

Distribution. –*New Caledonia*: 464-480 m. –*Elsewhere*: Hawaii; Japan; east China sea; Philippines; Malaysia; Indonesia; Vanuatu; and Australia; 88-1500 m.

Discussion. –Despite the morphological similarity with representatives of the genus *Deltocyathus*, following Kitahara et al. (2010b) *D. magnificus* groups with turbinoliid representatives. Because of this divergence between morphological and molecular data, *D. magnificus* is provisorily placed in *incertae sedis,* but is compared with *Deltocyathus* representatives due to their morphological resemblance. Among congeners that do not have coastal spines, only four reach five cycles of septa in the adult stage: *D. sarsi, D. magnificus, D. suluensis, and D. rotulus*. Within these species, *D. sarsi* is known only from Vanuatu islands (Gardiner & Waugh 1938) and western Australia (Cairns 2004). Among the other 3 species, all were collected off New Caledonia, and *D. magnificus* is distinguished by having a more robust corallum, a flat to concave base, and usually has no skeleton pigmentation, whereas *D. rotulus* and *D. suluensis* often dispaly reddish-brown pigmentation in some skeleton regions. Ascothoracidan crustaceans were reported to produce galls in D. magnificus from Australian (Grygier, 1991) and Japanese regions (Grygier, 1995).

***Trochocyathus* (*Trochocyathus*) *rhombcolumna* Alcock, 1902**

Plate 18, Figs. S-T

Trochocyathus rhombcolumna Alcock, 1902a: 98. –Alcock, 1902c: 16, pl. 2, fig. 12. –Faustino, 1927: 39. –Cairns & Keller, 1993: 240. –Cairns, 1995: 60-61, pl. 13, fig. 1, pl. 14, figs. a-b. –Cairns & Zibrowius, 1997: 106-107. –Cairns, 1999: 81. –Cairns et al., 1999: 25. –Cairns, 2004a: 287. –Cairns, 2006: 47. –Cairns, 2009: 9. –Kitahara et al., 2010b.

Paracyathus tenuicalyx Vaughan, 1907: 69-70, pl. 6, figs. 1a-b.

Paracyathus gardineri. –Gardiner & Waugh, 1938: 183-184 (*in part*: JM-157, pl. 3, fig. 5).

Type locality. –*Siboga* stn. 95 (5º43.5’N, 119º40’E - Sulu Sea, Philippines), 522 m.

Type material. –The holotype is deposited at the ZMA (Cairns, 2004a).

New records. –SMIB 10: stn. DW 202 (3); stn. DW 204 (1); stn. DW 210 (1). –Bathus 3: stn. DW 818 (3); stn. DW 827 (1). –Norfolk 1: stn. DW 1651 (1). –Norfolk 2: stn. DW 2024 (1); stn. DW 2034 (1); stn. DW 2037 (1); stn. DW 2041 (1); stn. DW 2049 (1); stn. DW 2081 (7); stn. DW 2087 (4); stn. DW 2109 (1); stn. DW 2110 (1); stn. DW 2117 (2); stn. DW 2132 (9); stn. DW 2133 (10); stn. CP 2146 (13); stn. DW 2147 (14); stn. DW 2148 (14); stn. CP 2153 (9); stn. DW 2157 (1); stn. DW 2160 (1).

Description. –Corallum trochoid to ceratoid, straight to slightly bent, and firmly attached through a robust pedicel (PD:GCD = 0.36-0.65) and a thin encrusting base. Calice circular to slightly elliptical (GCD:LCD = 1.0-1.2); calicular edge serrate. Largest specimen examined (DW 2087) 16.0 x 14.6 mm in CD, 38.0 mm in height, and 10.5 mm in PD. Upper theca ridged and separated by narrow intercostal furrows. Costal definition gradually fading towards pedicel. From calice to base, theca is covered by thin, small, and discontinuous transversal ridges. Transverse ridges usually better developed on lower theca. Corallum white to light-brown.

Septa hexamerally arranged in 4 complete cycles according to formula: S1>S2>S4≥S3 (48 septa). Specimens with 9 mm in GCD already have a full fourth septal cycle. S1 up to 2.5 mm exsert, and extend 5/6 distance to columella with straight and vertical axial edge. Some specimens have S1 and S2 thicker than S3 and S4. S2 slightly less exsert and less wide than S1 (about 7/8), and also with a straight vertical axial edge. S3 about ¾ width of S2 and only slightly less exsert. Axial edge of S3 straight to slightly sinuous. S4 least exsert septa but usually slightly wider than S3, and also have straight to slightly sinuous axial edge. In some specimens axial edge of S4 moderated sinuous. Those S4 adjacent to S1 slightly wider than S3, but those adjacent to S2 usually as wide as S3. Three palar crowns easily distinguishable: first composed of 6 small P1 low in fossa; second composed of 6 P2 slightly wider and terminating slightly higher in fossa than P1; and third more recessed from columella and composed of 12 well-developed P3. Axial edges of both P3 from same system form a chevron-shaped configuration. Axial edges of all pali straight and vertical. All septa and palar faces bear low rounded granules. Fossa of moderate depth, containing a papillose columella formed by less than 8 coarse papillae.

Distribution. –*New Caledonia*: 215-1074 m. –*Elsewhere*: Mozambique; Maldives; Philippines; Indonesia; Hawaii; Vanuatu; Australia; and New Zealand; 110-530 m.

Discussion. –*Trochocyathus rhombcolumna* is another Caryophylliidae representative that grouped with turbinoliids when molecular approach were used. A more "in-depth" examination of skeleton is underway, however, until morphological characters explain such odd grouping, *T. rhombcolumna* is provisorily considered *incertae sedis*.

Family Schizocyathidae Stolarski, 2000

Genus *Temnotrochus* Cairns, 1995

Diagnosis. –Corallum solitary, compressed cylindrical, and elongate. Asexual reproduction by transverse division predominate. Anthocaulus unknown. Calicular margin smooth, expressed as a thin rim that extends beyond upper outer septal edges. Rows of thecal spots occur in every interseptal space. Columella papillose. Paliform lobes present before S1-2.

Type species. –*Temnotrochus kermadecensis* Cairns, 1995, by original designation.

Temnotrochus kermadecensis **Cairns, 1995**

Plate 19, Figs. H-J

Temnotrochus kermadecensis Cairns, 1995: 96, pl. 31, figs. a-d. –Cairns, 1999: 114-115, figs. 18 d-e. –Cairns et al., 1999: 34. –Stolarski, 2000: 20-24, figs. 6D-F, L. –Cairns, 2009: 22.

Type locality. –*MoNZ* stn. BS441 (Nugent Island, Kermadec Ridge), 366-402 m.

Type material. –The holotype and three paratypes are deposited at the MoNZ, and four additional paratypes are deposited at the NMNH (Cairns, 1995).

New records. –None.

Previous records from New Caledonia. –Stolarski (2000).

Description (after Cairns [1995]). –Corallum quite small, with a straight corallum, and an elliptical calice (GCD:LCD = 1.32-1.40). Holotype only 1.78 x 1.35 mm in CD and 3.06 mm in length. Largest specimen examined by Cairns (1995) 4.22 mm long. Corallum rejuvenescence or incomplete transverse division not observed. Basal scar convex to V-shaped in profile, and equal in size to distal calice. Calice smooth (not serrate), rising about 0.3 mm above upper outer septal edges, producing a delicate calicular rim. Epitheca porcellanous and relatively smooth, but bearing numerous very fine (10-20 μm wide), closely spaced growth ridges. Theca white and translucent near calicular edge. Small white thecal spots, slightly more opaque than surrounding theca, occur in rows in every interseptal space, seemingly paired across each S3. Spots also evidenced inside calice as small depressions of the same size.

Septa hexamerally arranged in 3 complete cycles according to formula: S1>S2-3 (24 septa). Although upper, outer edges of S1 do not reach the top of calicular margin, their upper margins form exsert lobes that rise as much as 0.4 mm above calicular rim. Axial edge of S1 quite sinuous. S2 about three-quarters width of S1 and also have sinuous axial edge. S3 equal in width to S2, but, because they have less sinuousity, they appear to be thinner. Axial edges of all 6 S2 and 4 lateral S1 (excluding principal S1) bear tall, slender, highly sinuous paliform lobes in one elliptical crown of 10 elements. P2 0.20-0.25 mm wide, whereas P1 only about 0.11 mm wide and note quite as tall. Within the palar crown lies a papillose columella composed of 1-3 linearly arranged pillars similar in size and shape to P1. Fossa shallow.

Distribution. –*New Caledonia*: 425 m. –*Elsewhere*: Vanuatu; and New Zealand; 321-402 m.

Discussion. –The family Schizocyathidae is represented by three monotypic genera: *Schizocyathus* Pourtalès, 1874; *Pourtalocyathus* Cairns, 1979; and *Temnotrochus* Cairns, 1995. Because none of the three species were analyzed using molecular techniques, the family, and consequently *T. keradecensis* position within the Scleractinia is not known. Here, we provisorily place this species in incertae sedis.

Family Stenocyathidae Stolarski, 2000

Genus *Truncatoguynia* Cairns, 1989a

Diagnosis. –Corallum solitary, compressed-cylindrical, elongate, and often curved. Asexual reproduction by transverse division predominates. Calicular margin smooth. Rows of thecal spots occur in every interseptal space. Pali absent. Columella a fusion of the primary septa lower axial edges.

Type species. –*Truncatoguynia irregularis* Cairns, 1989a, by original designation.

Truncatoguynia irregularis Cairns, 1989a

Plate 19, Figs. F-G

Truncatoguynia irregularis Cairns, 1989a: 43, pl. 22, figs. f-g, pl. 23, figs. a-c, f. –Cairns, 1994: 70, pl. 30, figs. e-f. –Cairns, 1995: 93-94, pl. 29, figs. g-h, pl. 30, figs. a-b. –Cairns, 1999: 114, fig. 18c. –Cairns et al., 1999: 34. –Stolarski, 2000: 13-33, figs. 5A-E, J. –Tachikawa, 2005: 9-10, pl. 3, figs. I-K. –Cairns, 2009: 22.

Truncatoguynia sp. Cairns, 1989a: 43, pl. 23, figs. d-e.

Type locality. –*Albatross* stn. 5311 (21º33’N, 116º15’E – north of Pratas Island, South China Sea), 161 m.

Type material. –The holotype and 10 paratypes are deposited at the USNM. One additional paratype is deposited at the AM (Cairns, 1995).

New records. –Bathus 4: stn. DW 902 (1). –Norfolk 2: stn. DW 2117 (4); stn. DW 2123 (1); stn. DW 2133 (2).

Previous records from New Caledonia. –Stolarski (2000).

Description. –Corallum elongate, slightly bent on GCD plane, and free. Regeneration common. Transverse division present, resulting in an open base where all septal cycles can be identified. Epicentre of base prominent. Calice slightly elliptical (GCD:LCD = 1.06-1.25); calicular edge very delicate and usually broken, but when entire smooth. Largest specimen examined (DW 2117) 3.5 x 3.3 mm in CD, 36.8 mm in height, and 2.4 x 2.0 mm in base diameter. Thecal edges rounded. Theca glisteny especially near calicular edge. Two rows of white, aligned pores corresponding to each tertiary septum visible from 3 mm below calicular edge to base. Evenly distributed, thin, and low transverse ridges covers theca. Well preserved specimens brown to light-brown in color. Thecal pores always white.

Septa hexamerally arranged in three complete cycles according to formula: S1>S2>>S3 (24 septa). Septa not exsert. Axial edges of S1-2 vertical and sinuous, and lateral faces bear randomly placed, tall, pointed granules. S3 rudimentary and straight. Fossa deep, containing a rudimentary columella formed by S1-2 lower axial edges fusion.

Distribution. –*New Caledonia*: 187-400 m. –*Elsewhere*: Japan; South China Sea; Vanuatu; and New Zealand; 80-334 m.

Discussion. –Amongst species morphologically recognized in the family Stenocyathidae, only *Stenocyathus vermiformis* was tested using molecular techniques and grouped with representatives of *Caryophyllia*, *Dasmosmilia*, and *Rhizosmilia* Kitahara et al., 2010b). The only other stenocyathid known from New Caledonia, *Truncatoguynia irregularis* is provisorily placed as incertae sedis until its position amongst scleractinians be better understood.

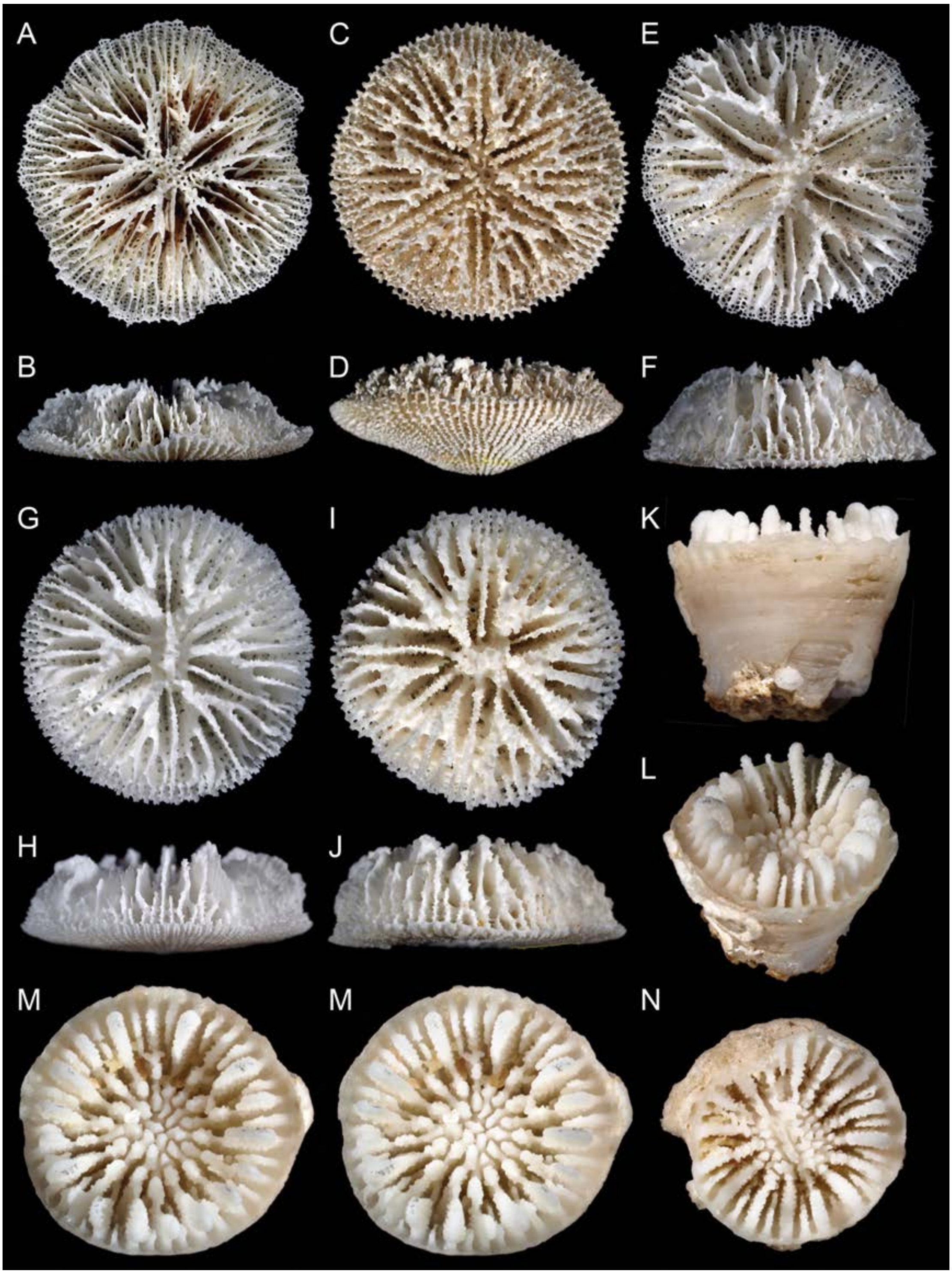


PLATE 1. –*Letepsammia formosissima*: A-B (DW 2032), calicular and lateral (x 1.6) views. ***Letepsammia superstes***: C-D (DW 916), calicular and lateral (x 3.5) views. ***Rhombopsammia niphada***: E-F (DW 2069), calicular and lateral (x 1.8) views. ***Stephanophyllia complicata***: G-H, calicular and lateral (x 3) views. ***Stephanophyllia neglecta***: I-J (DW 914), calicular and lateral (x 5.1) views. ***Gardineria alloiteaui* sp. nov.**: K-M (DW 2125), lateral (x 3.2), oblique (x 3.1), and calicular (x 3.8 - stereo pair) views of holotype; N (DW 2124), calicular view (x 3.9) of paratype.

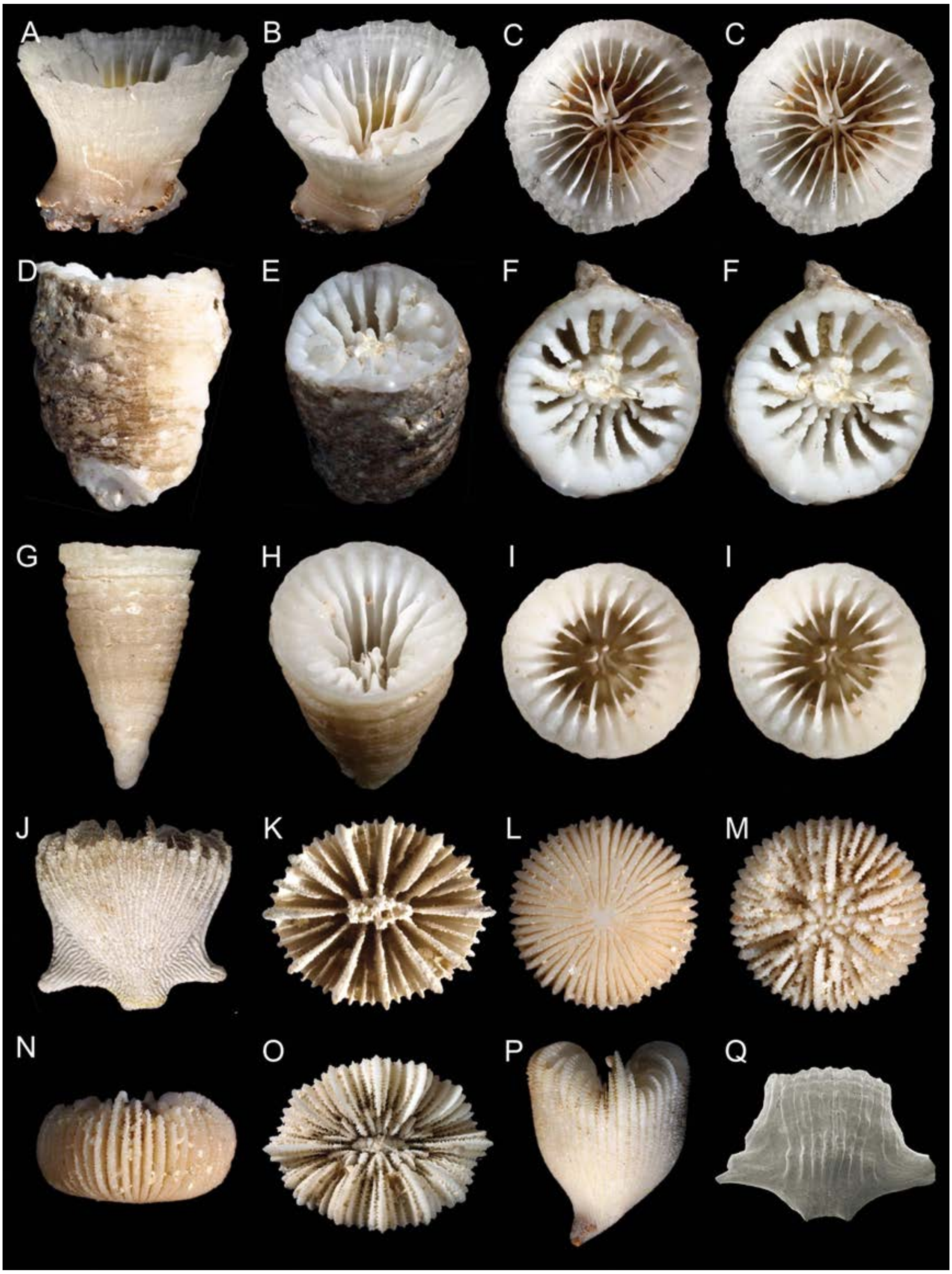


PLATE 2. –*Gardineria hawaiiensis*: A-C (DW 2086), lateral (x 1.6), oblique (x 1.6), and calicular (x 1.4 - stereo pair) views. ***Gardineria paradoxa***: D-F (DW 781), lateral (x 3), oblique (x 2.9), and calicular (x 3.2 - stereo pair) views. ***Stolarskicyathus pocilliformis***: G-I (DW 781), lateral (x 3.1), oblique (x 4.2), and calicular (x 4.2 - stereo pair) views. ***Alatotrochus rubescens***: J-K (DW 908), lateral (x 3.7) and calicular (x 3.2) views. ***Deltocyathoides orientalis***: L-N (DW 933), basal (x 4.1), calicular (x 4.1) and lateral (x 4.2) views. ***Cyathotrochus pileus***: O-P (CP 833), calicular (x 1.8) and lateral (x 1.7) views. ***Idiotrochus alatus***: Q (AM G16699), lateral (x 5) view.

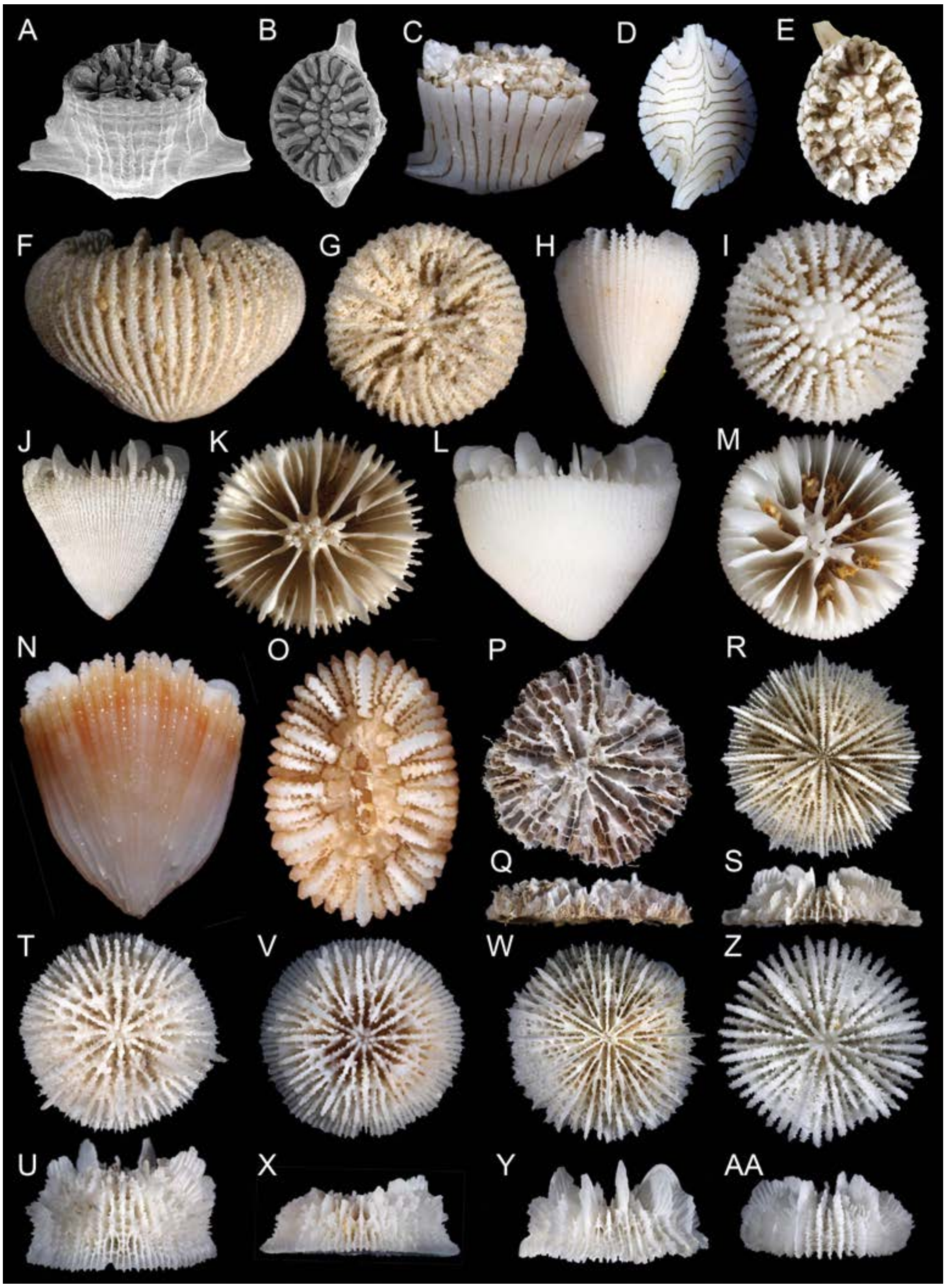


PLATE 3. –*Idiotrochus alatus*: A-B (AM G16699), oblique (x 4.2) and calicular (x 4.5) views. ***Idiotrochus australis***: C-E (DW 2158), lateral (x 5.8), basal (x 5), and calicular (x 4.4) views. ***Notocyathus conicus***: F-G (DW 902), lateral (x 5.6) and calicular (x 4) views. ***Notocyathus venustus***: H-I (DW 958), lateral (x 5.1) and calicular (x 7.1) views. ***Pleotrochus venustus***: J-K (DW 2104), lateral (x 1.2) and calicular (x 1.7) views. ***Pleotrochus zibrowii***: L-M (CP 822), lateral (x 2.4) and calicular (x 2.1) views. ***Tropidocyathus labidus***: N-O (DW 903), lateral (x 5) and calicular (x 6.1) views. ***Fungiacyathus fragilis***: P-Q (CP 948), calicular (x 1) and lateral (x 1) views. ***Fungiacyathus paliferus***: R-S (DW 887), calicular (x 1.6) and lateral (x 1.6) views. ***Fungiacyathus pusillus pacificus***: T-U (DW 2091), calicular (x 1.7) and lateral (x 1.7) views. ***Fungiacyathus sandoi***: V-X (DW 2097), calicular (x 1.5) and lateral (x 1.5) views. ***Fungiacyathus stephanus***: W-Y (CP 922), calicular (x 0.8) and lateral (x 0.8) views. ***Fungiacyathus granulosus***: Z-AA (CP 922), calicular (x 2) and lateral (x 1.7) views.

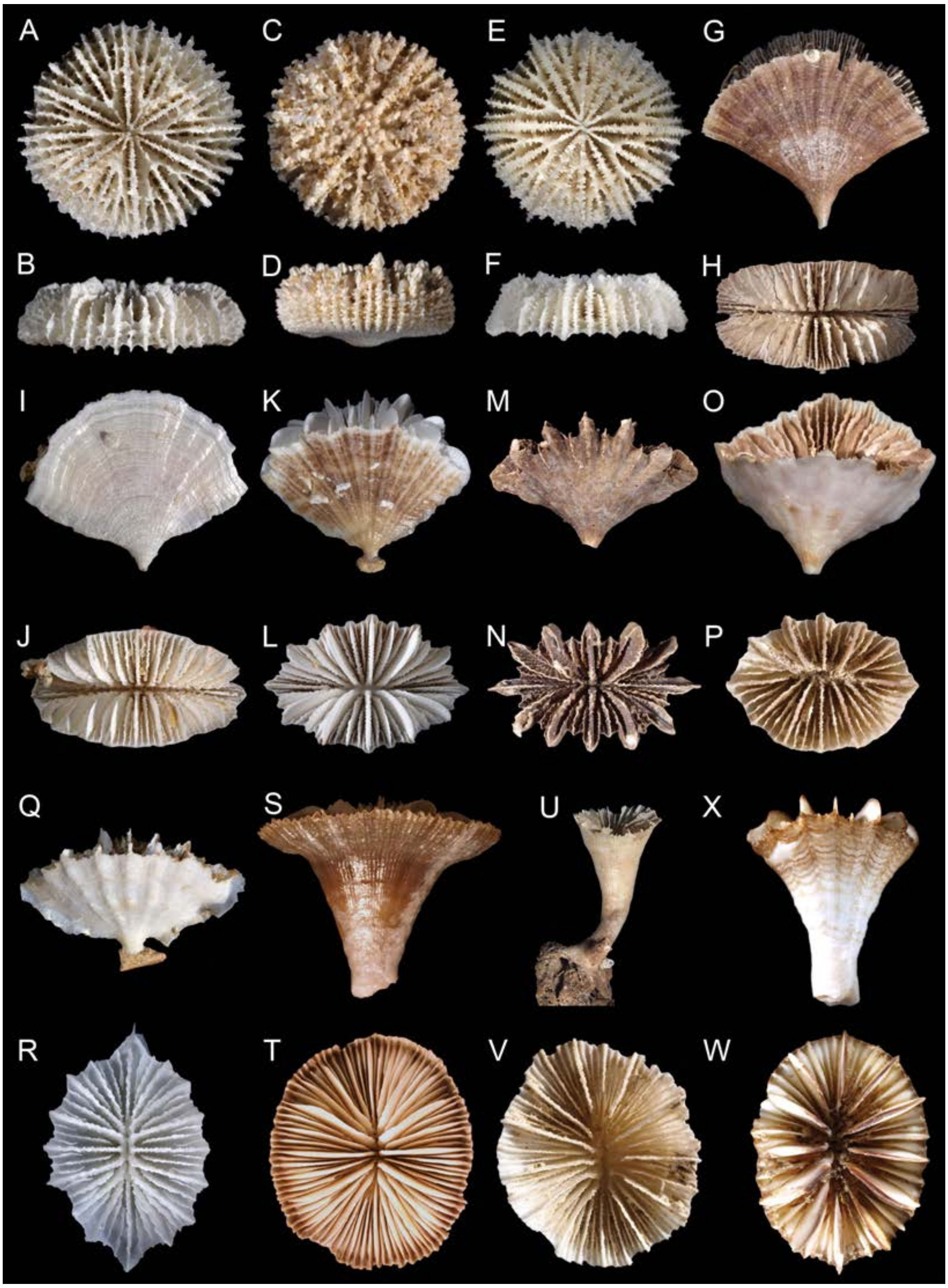


PLATE 4. –*Fungiacyathus margaretae*: A-B (DW 2097), calicular (x 2.1) and lateral (x 2.2) views. ***Fungiacyathus turbinolioides***: C-D (DW 918), calicular (x 3.8) and lateral (x 3.4) views. ***Fungiacyathus variegatus***: E-F (DW 898), calicular (x 3.5) and lateral (x 3.3) views. ***Flabellum arcuatile***: G-H (DW 2087), lateral (x 1.1) and calicular (x 1.2) views. ***Flabellum politum***: I-J (DW 933), lateral (x 1.2) and calicular (x 1.1) views. ***Flabellum aotearoa***: K-L (DW 903), lateral (x 1) and calicular (x 1) views. ***Flabellum deludens***: M-N (CP 2142), lateral (x 1.2) and calicular (x 1.2) views. ***Flabellum disaequabilis* sp. nov.**: O-P (DW 786), lateral (x 1.1) and calicular (x 1) views. ***Flabellum hoffmeisteri***: Q-R (CP 922), lateral (x 1.1) and calicular (x 1.2) views. ***Javania amplissima* sp. nov.**: S-T (CH 2115), lateral (x 0.4) and calicular (x 0.4) views. ***Javania antarctica***: U-V (CP 877), lateral (x 0.3) and calicular (x 0.6) views. ***Javania deforgesi* sp. nov.**: X-W (DW 2125), lateral (x 1.1) and calicular (x 1.6) views.

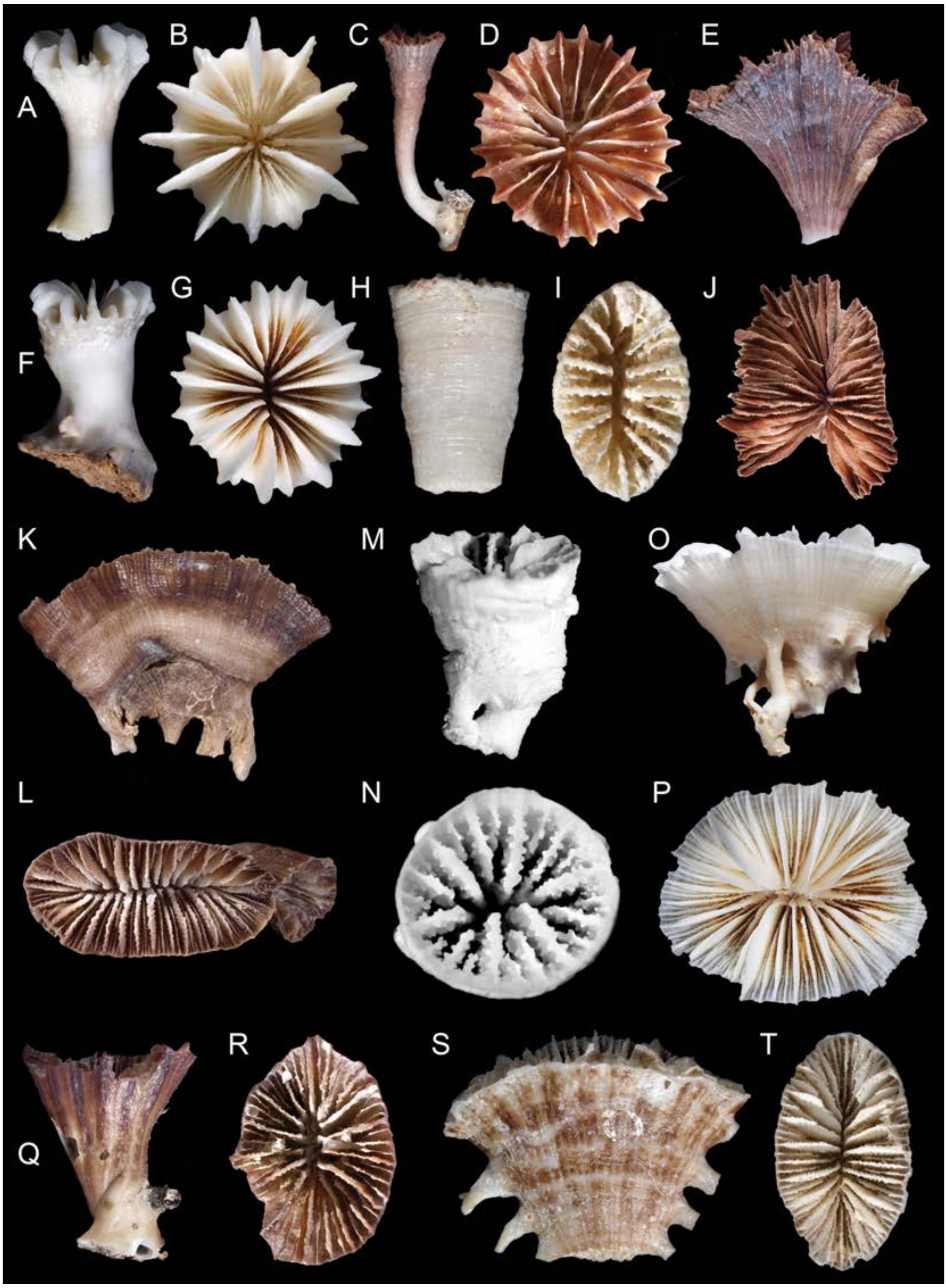


PLATE 5. –*Javania exserta*: A-B (DW 2124), lateral (x 1.2) and calicular (x 2) views. ***Javania fusca***: C-D (DW 2069), lateral (x 1) and calicular (x 2.3) views. ***Javania lamprotichum***: E and J (DW 2070), lateral (x 0.7) and calicular (x 0.5) views. ***Javania insignis***: F-G (DW 2023), lateral (x 0.7) and calicular (x 1.3) views. ***Placotrochides minuta***: H-I (DW 933), lateral (x 2.7) and calicular (x 4.2) views. ***Rhizotrochus flabelliformis***: K-L (DW 2049), lateral (x 0.9) and calicular (x 0.9) views. ***Rhizotrochus levidensis***: M-N (BM 1970.1.26.9-10), lateral and calicular views. ***Rhizotrochus typus***: O-P (DW 2124), lateral (x 0.9) and calicular (x 0.9) views. ***Polymyces wellsi***: Q-R (no label), lateral (x 1.3) and calicular (x 1.6) views. ***Truncatoflabellum candeanum***: S-T (PrFO), lateral (x 2.2) and calicular (x 1.6) views.

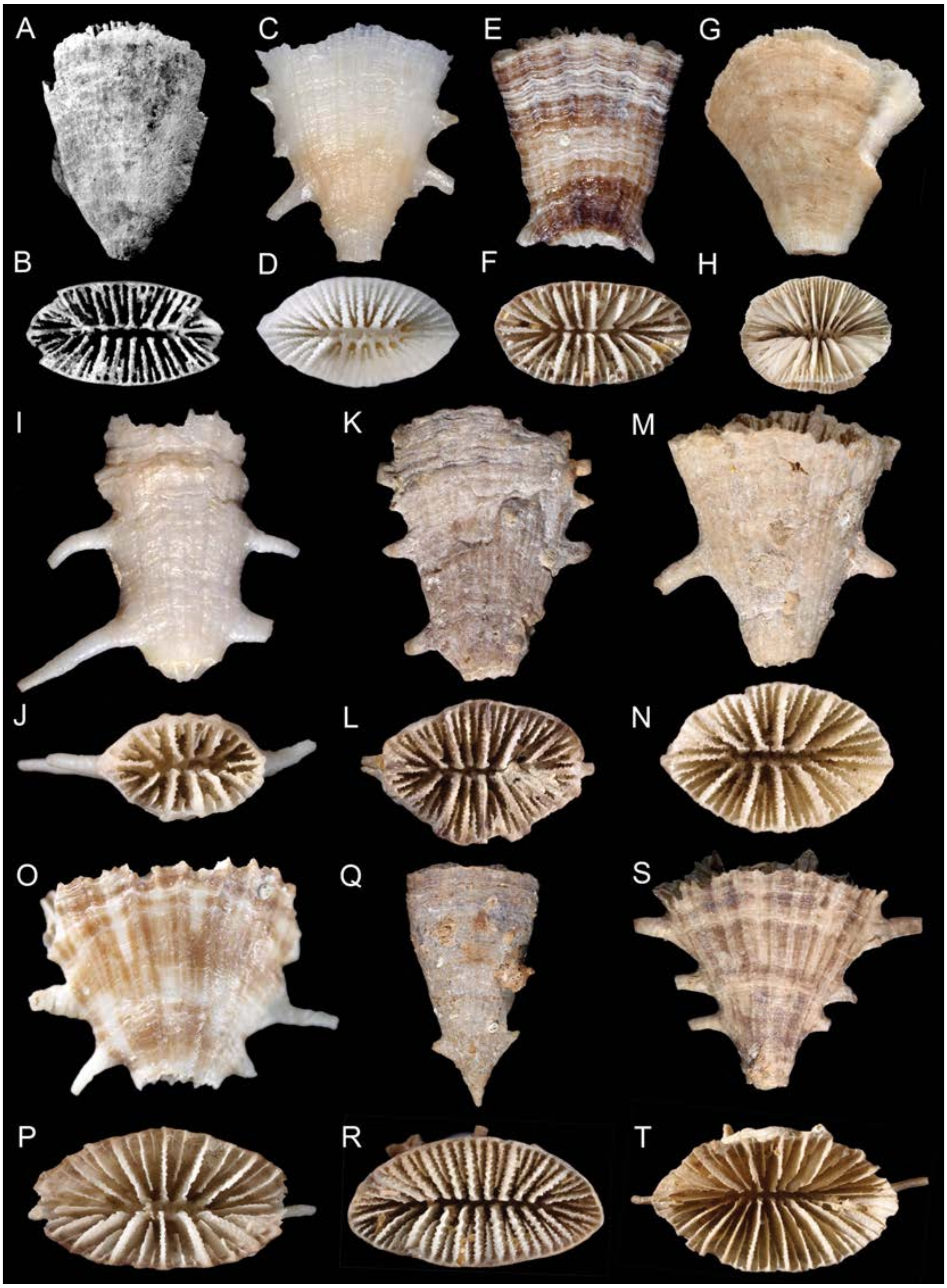


PLATE 6. –*Truncatoflabellum dens*: A-B (*Siboga* 95), lateral and calicular views. ***Truncatoflabellum formosum***: C-D (DW 2127), lateral (x 2.6) and calicular (x 2.3) views. ***Truncatoflabellum incrustatum***: E-F (DW 933), lateral (x 2.6) and calicular (x 2.7) views. ***Truncatoflabellum paripavoninum***: G-H (DW 2046), lateral (x 1.1) and calicular (x 0.8) views. ***Truncatoflabellum pusillum***: I-J (DW 882), lateral (x 4) and calicular (x 4.3) views. ***Truncatoflabellum* sp. A**: K-L (DW 894), lateral (x 2.1) and calicular (x 1.9) views. ***Truncatoflabellum* sp. B**: M-N (DW 894), lateral and calicular (x 2.4) views. ***Truncatoflabellum* sp. C**: O-P (DW 887), lateral (x 2.6) and calicular (x 2.4) views. ***Truncatoflabellum* sp. D**: Q-R (DW 2159), lateral (x 0.9) and calicular (x 1.5) views. ***Truncatoflabellum vigintifarium***: S-T (CP 851), lateral (x 1.8) and calicular (x 2) views.

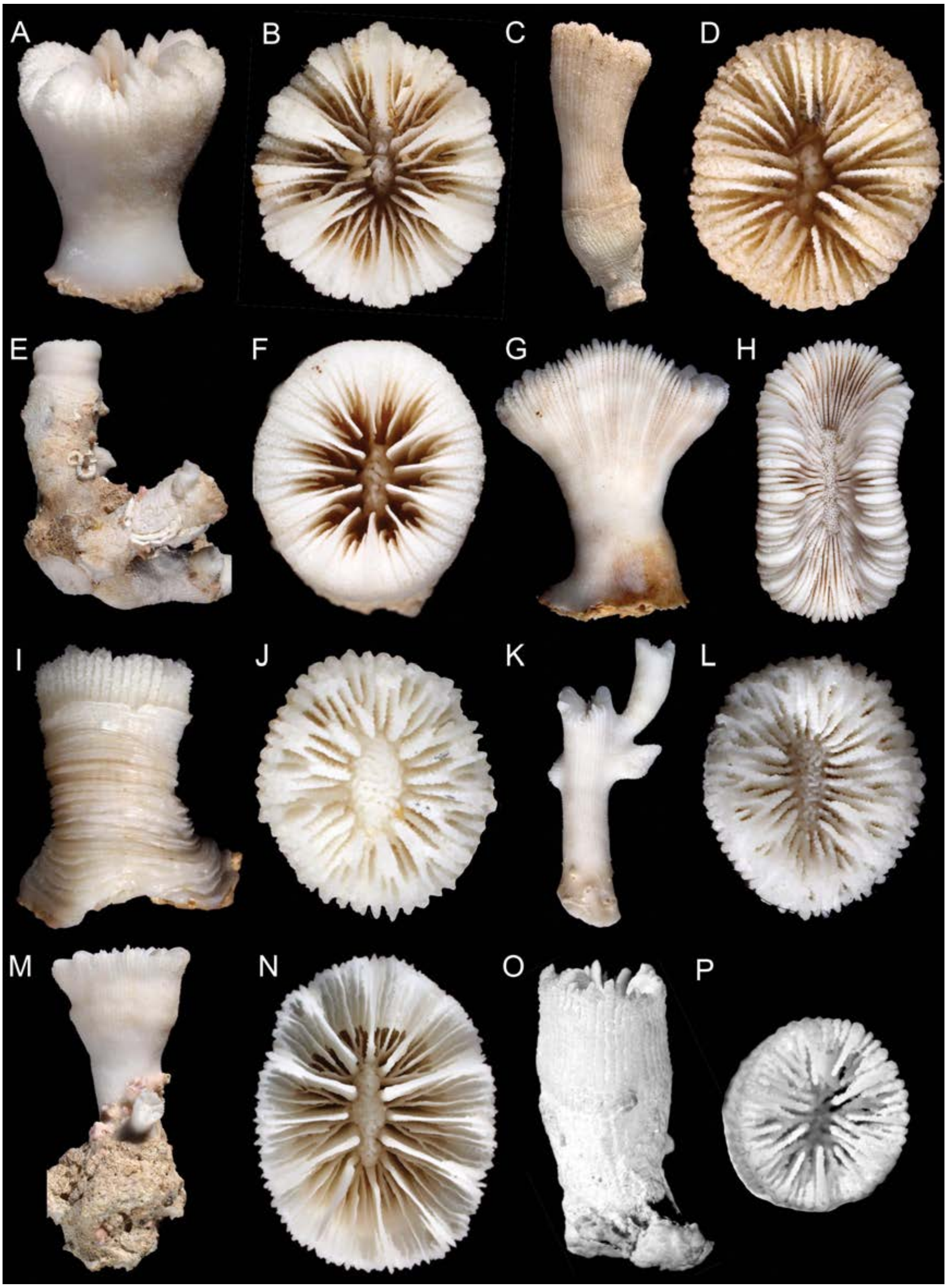


PLATE 7. –*Balanophyllia laysanensis*: A-B (DW 1651), lateral (x 2.9) and calicular (x 3.4) views. ***Balanophyllia cornu***: C-D (DW 2037), lateral (x 1.6) and calicular (x 3.6) views. ***Balanophyllia cylindrica* sp. nov.**: E-F (DW 941), lateral (x 1.1) and calicular (x 3.9) views. ***Balanophyllia desmophyllioides***: G-H (DW 2081), lateral (x 1.3) and calicular (x 1.6) views. ***Balanophyllia galapagensis***: I-J (DW 2124), lateral (x 4) and calicular (x 6.5) views. ***Balanophyllia* cf. *B. generatrix***: K-L (DW 2024), lateral (x 1.1) and calicular (x 3.9) views. ***Balanophyllia gigas***: M-N (DW 933), lateral (x 1) and calicular (x 2.6) views. ***Balanophyllia profundicella***: O-P, lateral and calicular views of holotype.

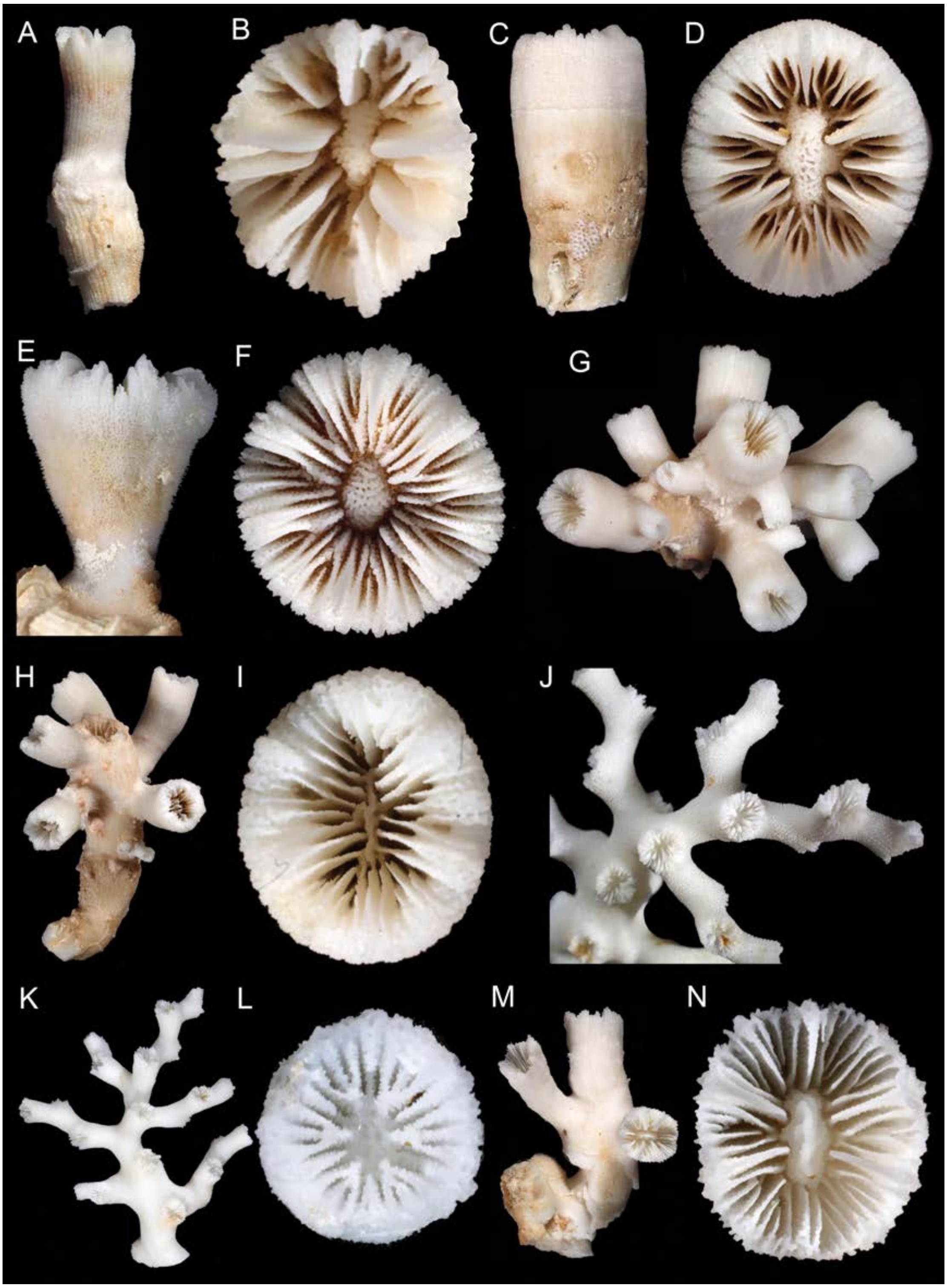


PLATE 8. –*Balanophyllia rediviva*: A-B (DW 2123), lateral (x 2.4) and calicular (x 6.6) views. ***Balanophyllia* sp.**: C-D (DW 2125), lateral (x 1.6) and calicular (x 2.4) views. ***Balanophyllia spinosa* sp. nov.**: E-F (CP 877), lateral (x 3.3) and calicular (x 4.9) views. ***Cladopsammia* sp.**: G and I (DW 2023) and H (DW 2024), colony (G - x 1.3; H - x 1.2) and calicular (x 5.1) views. ***Dendrophyllia alcocki***: J-K (DW 2135) colony (J x 2.6 and K x 1.6) views, and L (DW 2111) calicular (x 12.5) view. ***Dendrophyllia* cf. *D. arbuscula***: M-N (DW 2125), colony (x 0.9) and calicular (x 4) views.

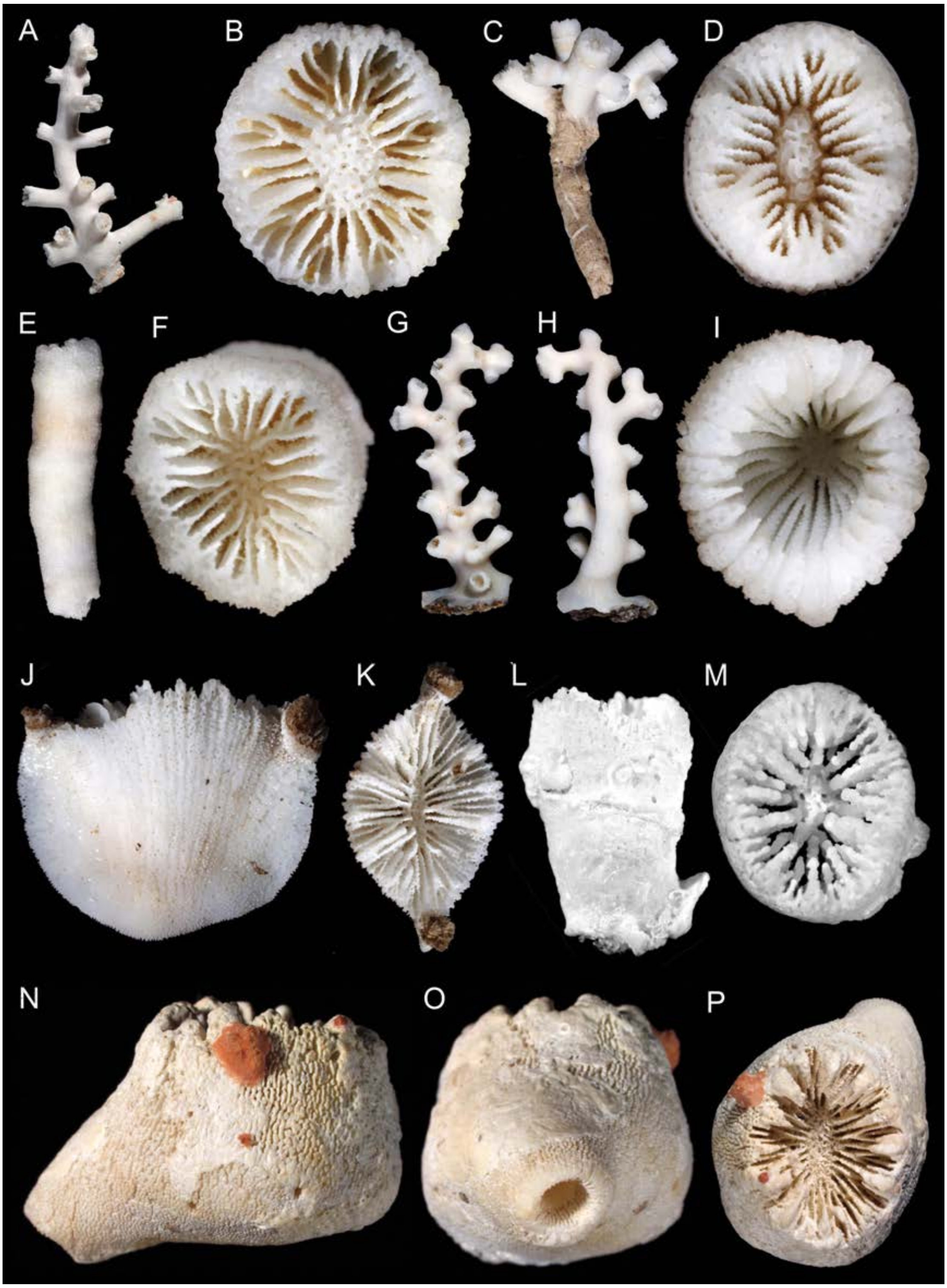


PLATE 9. –*Dendrophyllia ijimai*: A-B (DW 933), colony (x 0.5) and calicular (x 5.2) views. ***Eguchipsammia fistula***: C-D (DW 2024), colony (x 1.1) and calicular (x 7.3) views. ***Eguchipsammia gaditana***: E-F (DW 205), lateral (x 2.2) and calicular (x 6.5) views. ***Enallopsammia rostrata***: G-I (DW 2056), colony (G and H - x 0.4) and calicular (x 5.4) views. ***Endopachys grayi***: J-K (DW 2158), lateral (x 2.7) and calicular (x 2.5) views. ***Endopsammia regularis***: L-M (syntype), lateral and calicular views of syntype. ***Heteropsammia cochlea***: N-P (DW 894), lateral (N x 3.9 and O x 4) and calicular (x 2.9) views.

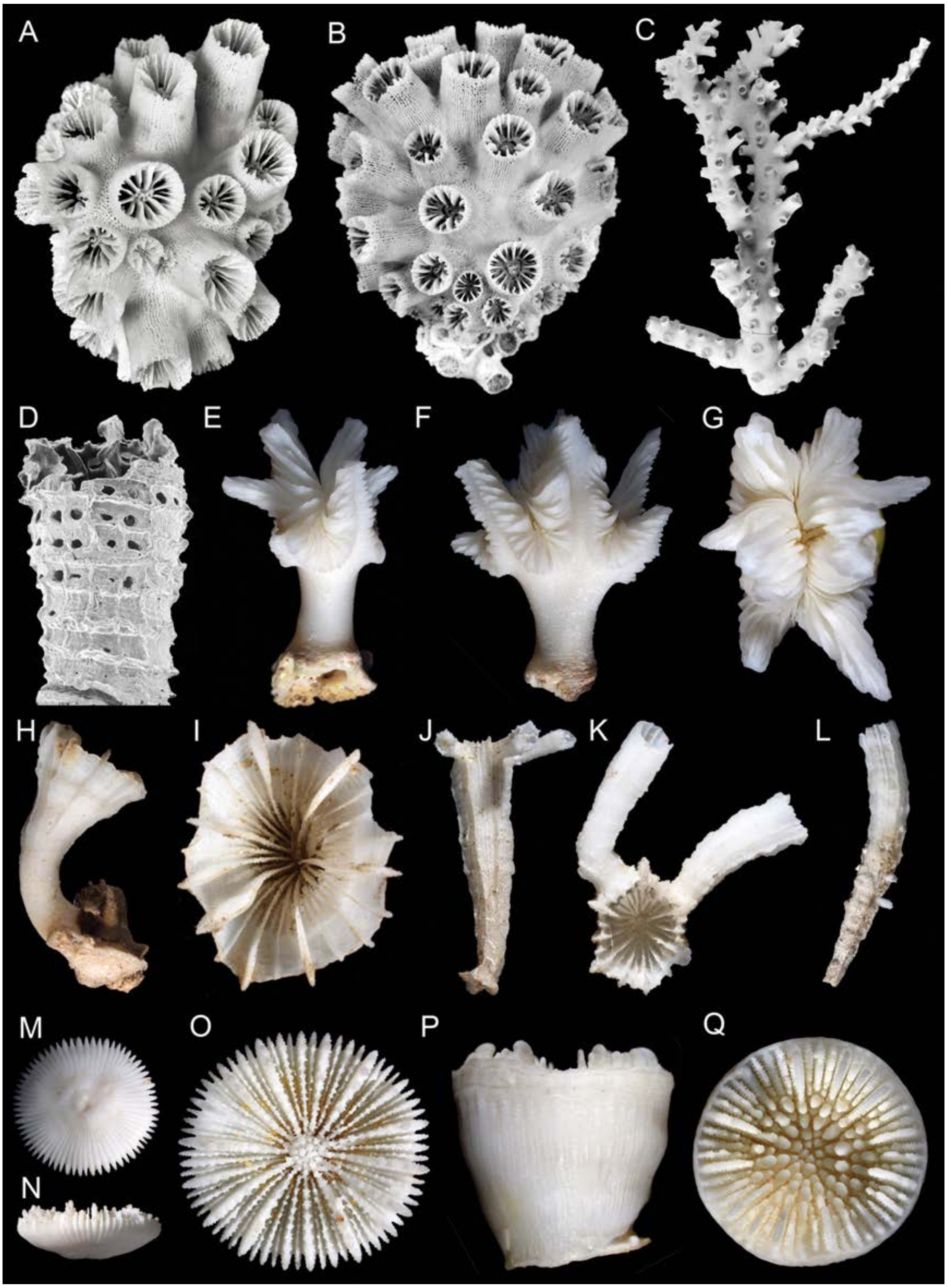


PLATE 10. –*Tubastraea coccinea*: A-B (USNM 86822), colony (A x 1 and B x 1.4) views. ***Tubastraea micranthus***: C (USNM 97647), colony (x 0.3) view. ***Guynia annulata***: D (CJ87-14-1), lateral (x 22) view. ***Dactylotrochus cervicornis***: E-G (DW 208), LCD aligned lateral (x 1.8), GCD aligned lateral (x 2.2), and calicular (x 2.1) views. ***Thalamophyllia riisei***: H-I (DW 2125), lateral (x 1.7) and calicular (x 2.7) views. ***Thalamophyllia tenuescens***: J-L (DW 2095), lateral (J x 2 and L x 1.2) and calicular (x 3.5) views. ***Anthemiphyllia dentata***: M-O (DW 914), basal (x 1.2), lateral (x 1.2) and calicular (x 2.1) views. ***Anthemiphyllia pacifica***: P-Q (DW 290), lateral (x 3.8) and calicular (x 4) views.

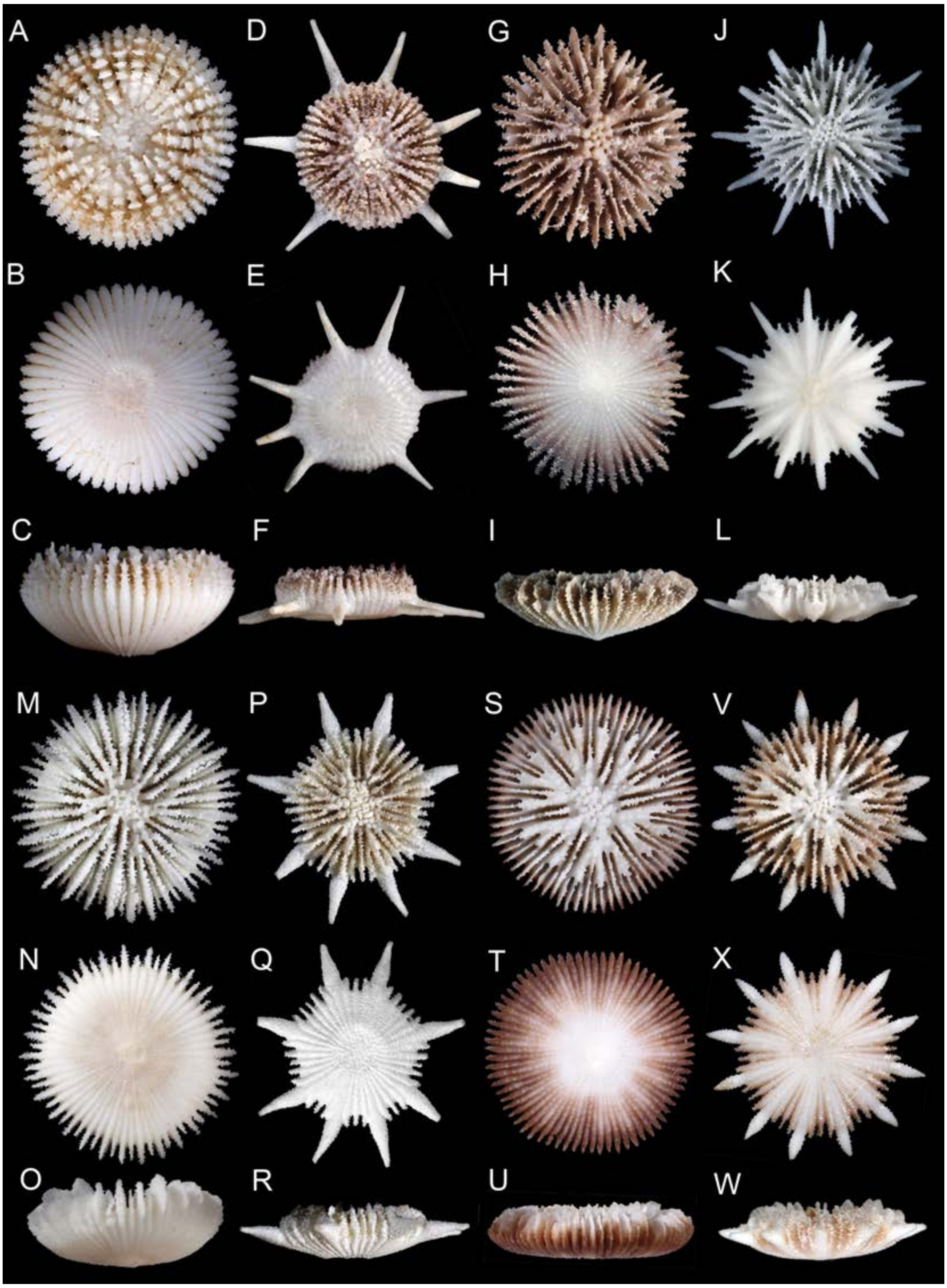


PLATE 11. –*Anthemiphyllia patera costata*: A-C (DW 2066), calicular, basal and lateral (x 3.5) views. ***Anthemiphyllia spinifera***: D-F (DW 2117), calicular (x 3.1), basal (x 3) and lateral (x 3.2) views. ***Deltocyathus cameratus***: G-I (USNM 1114123), calicular (x 2.5), basal (x 2.4) and lateral (x 2.2) views. ***Deltocyathus corrugatus***: J-L (MNHN-Scl.2008-0023), calicular, basal and lateral (x 2.2) views. ***Deltocyathus crassiseptum***: M-O (MNHN-Scl.2008-0026), calicular (x 1.8), basal (x 1.8) and lateral (x 1.6) views. ***Deltocyathus heteroclitus***: P-R (USNM 1114160), calicular, basal and lateral (x 2.8) views. ***Deltocyathus inusitatus***: S-U (USNM 1114137), calicular (x 2.5), basal (x 2.4) and lateral (x 2.4) views. ***Deltocyathus ornatus***: V-W (USNM 1114145), calicular, basal and lateral (x 2.2) views.

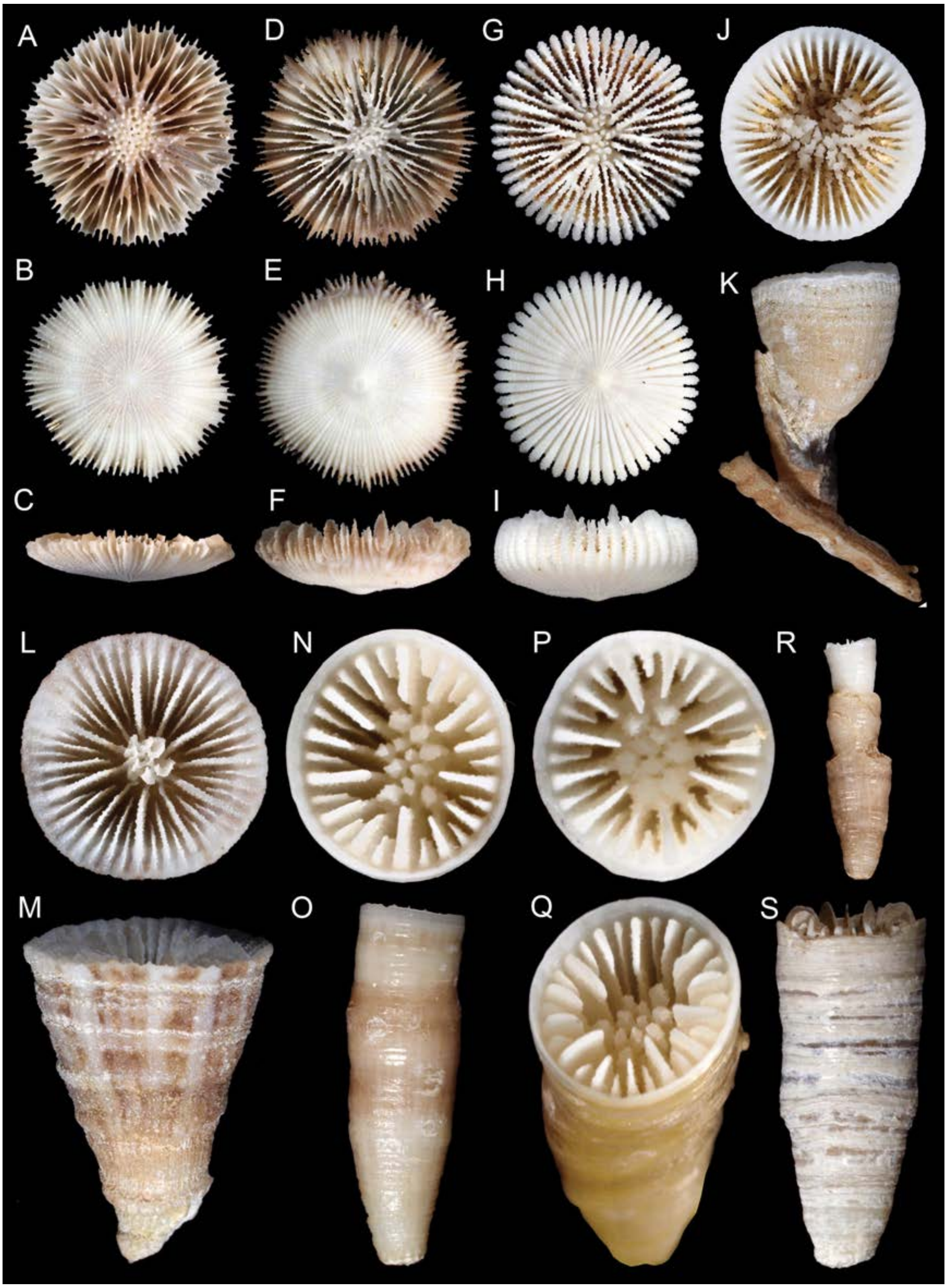


PLATE 12. –*Deltocyathus rotulus*: A-C (MNHN-Scl.2008-0004), calicular, basal and lateral (x 1.6) views. ***Deltocyathus suluensis***: D-F (MNHN-Scl.2008-0006), calicular (x 1.5), basal (x 1.6) and lateral (x 1.6) views. ***Deltocyathus vaughani***: G-I (MNHN-Scl.2008-0009), calicular, basal and lateral (x 1.4) views. ***Aulocyathus recidivus***: J-K (CP 822), calicular (x 2.6) and lateral (x 1.8) views. ***Conotrochus funicolumna***: L-M (CP 967), calicular (x 3.6) and lateral (x 3.5) views. ***Faustinotrochus neocaledonensis* gen. nov., sp. nov.**: N-O, Q (DW 916), calicular (x 6.7), lateral (x 2.2) and oblique (x 5.9) views of holotype; P, R (DW 923), calicular (x 7.7) and lateral (x 1.8) views of paratype; S (DW 916), lateral (x 4) view of paratype.

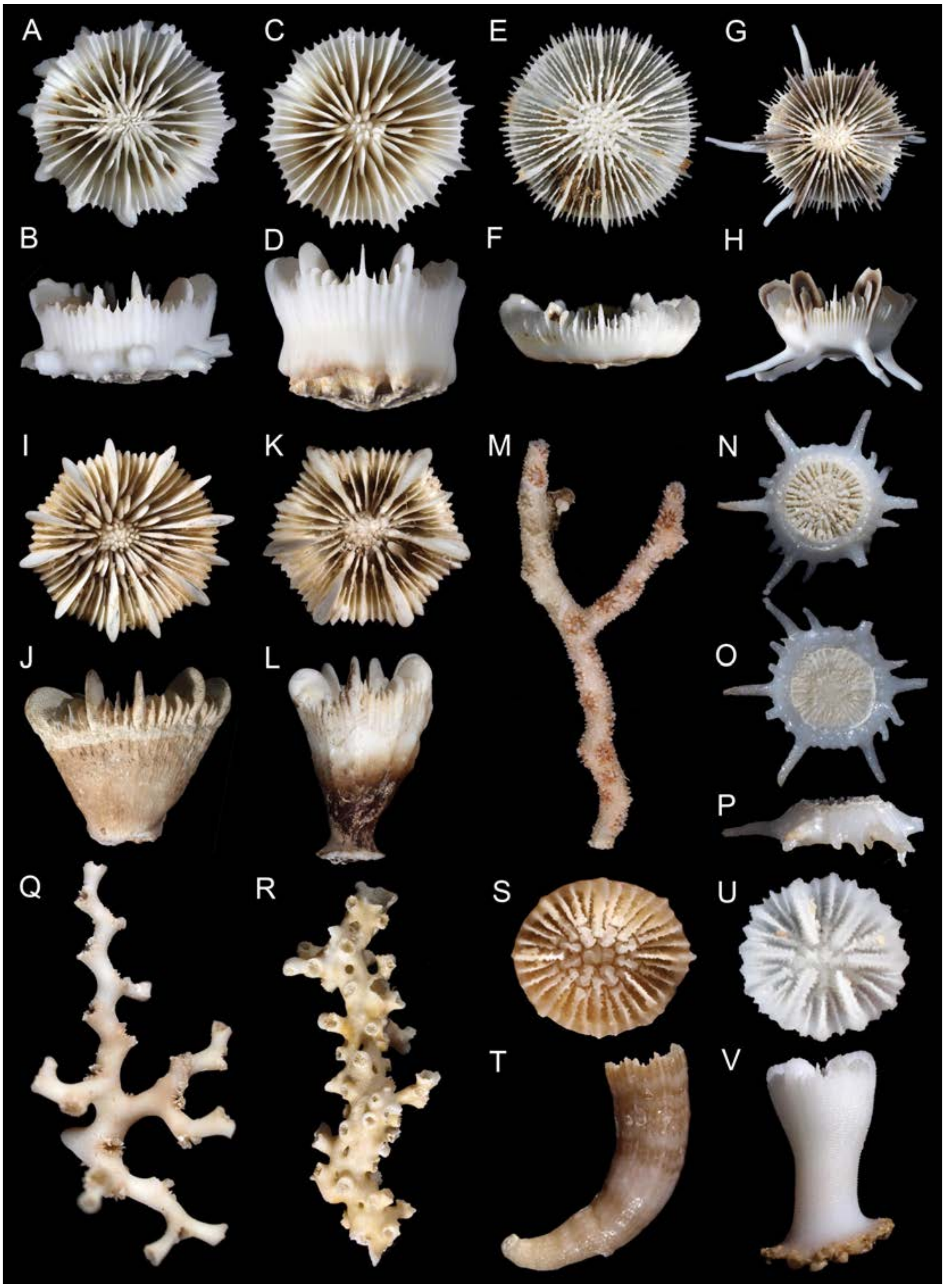


PLATE 13. –*Stephanocyathus coronatus*: A-B (CP 950), calicular (x 0.9) and lateral (x 1) views; C-D, calicular (x 1.1) and lateral (x 1) views. ***Stephanocyathus regius***: E-F (CP 858), calicular and lateral (x 1.2) views. ***Stephanocyathus spiniger***: G-H (CP 877), calicular and lateral (x 0.7) views. ***Vaughanella concinna***: I-J (DW 2070), calicular and lateral (x 0.7) views. ***Vaughanella* sp. A**: K-L (DW 2066), calicular (x 1) and lateral (x 0.6) views. ***Madracis kauaiensis***: M, colony (x 2.3) view. ***Bourneotrochus stellulatus***: N-P (DW 887), calicular (x 3.7), basal (x 3.7) and lateral (x 3.6) views. ***Madrepora oculata***: Q (DW 2034), colony (x 1.9) view. ***Madrepora porcellana***: R (DW 1038), colony (x 1.8) view. ***Caryophyllia abrupta***: S-T (MNHN-Scl.2009-0067), calicular (x 3.4) and lateral (x 2) views. ***Caryophyllia aspera***: U-V (MNHN-Scl.2009-0083), calicular (x 5.3) and lateral (x 3.4) views.

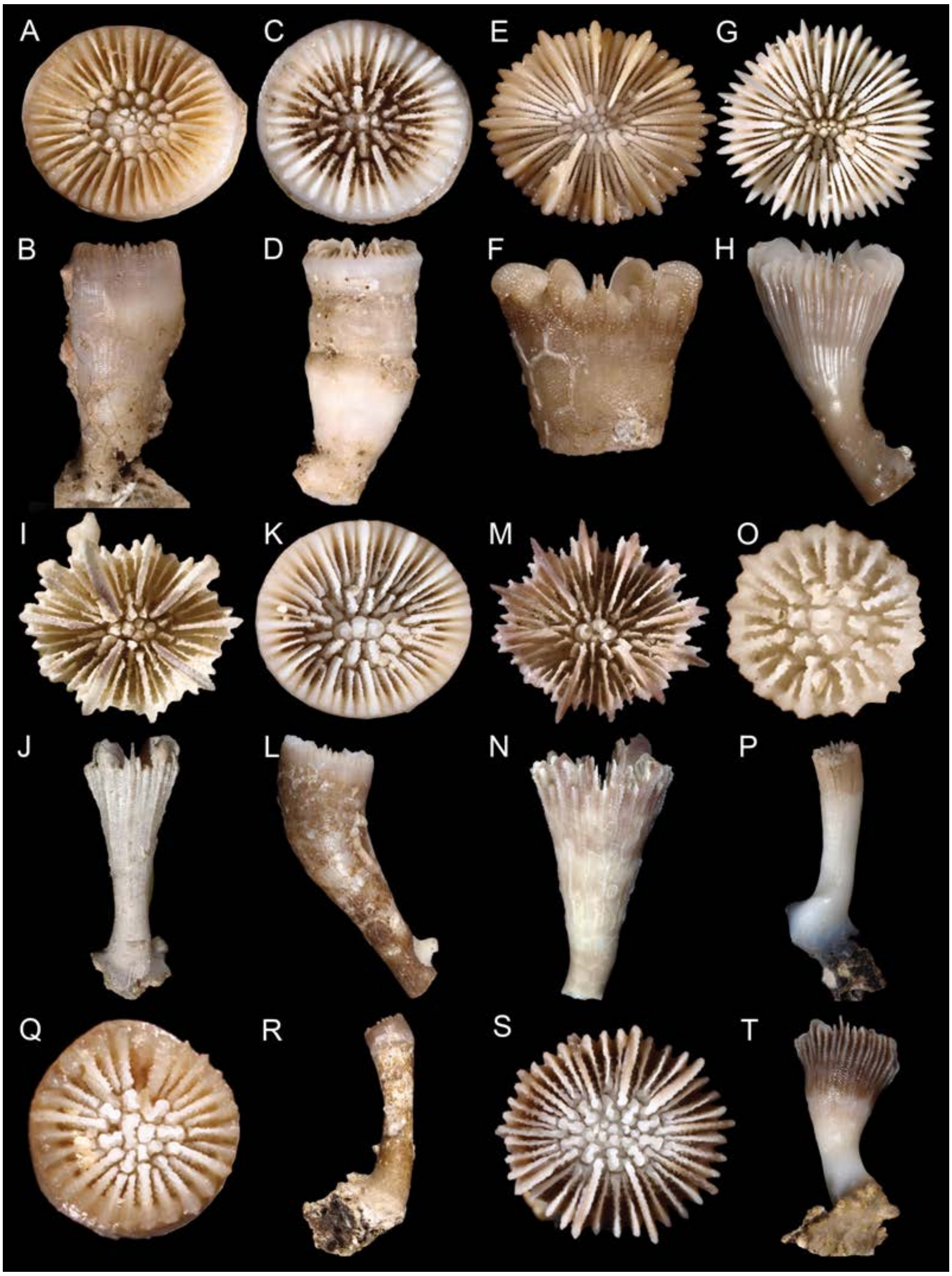


PLATE 14. –*Caryophyllia cinticulata*: A-B (USNM 1131001), calicular (x 3.6) and lateral (x 1.7) views. ***Caryophyllia concreta***: C (MNHN-Scl.2009-0058) and D (MNHN-Scl.2009-0060), calicular (x 3.3) and lateral (x 1.8) views. ***Caryophyllia crosnieri***: E-F (MNHN-Scl.2009-0041), calicular and lateral (x 2.8) views. ***Caryophyllia diomedeae***: G-H (MNHN-Scl.2009-0015), calicular (x 1.3) and lateral (x 1) views. ***Caryophyllia hawaiiensis***: I-J (MNHN-Scl.2009-0043), calicular (x 2.2) and lateral (x 1.7) views. ***Caryophyllia laevigata***: K-L (MNHN-Scl.2009-0023), calicular (x 1.7) and lateral (x 1.4) views. ***Caryophyllia lamellifera***: M-N (MNHN-Scl.2009-0044), calicular (x 3) and lateral (x 1.8) views. ***Caryophyllia oblonga***: O-P (MNHN-Scl.2009-0085), calicular (x 6.5) and lateral (x 1.6) views. ***Caryophyllia octopali***: Q-R (MNHN-Scl.2009-0066), calicular (x 5.7) and lateral (x 1.5) views. ***Caryophyllia quadragenaria***: S-T (MNHN-Scl.2009-0070), calicular (x 2.7) and lateral (x 1.6) views.

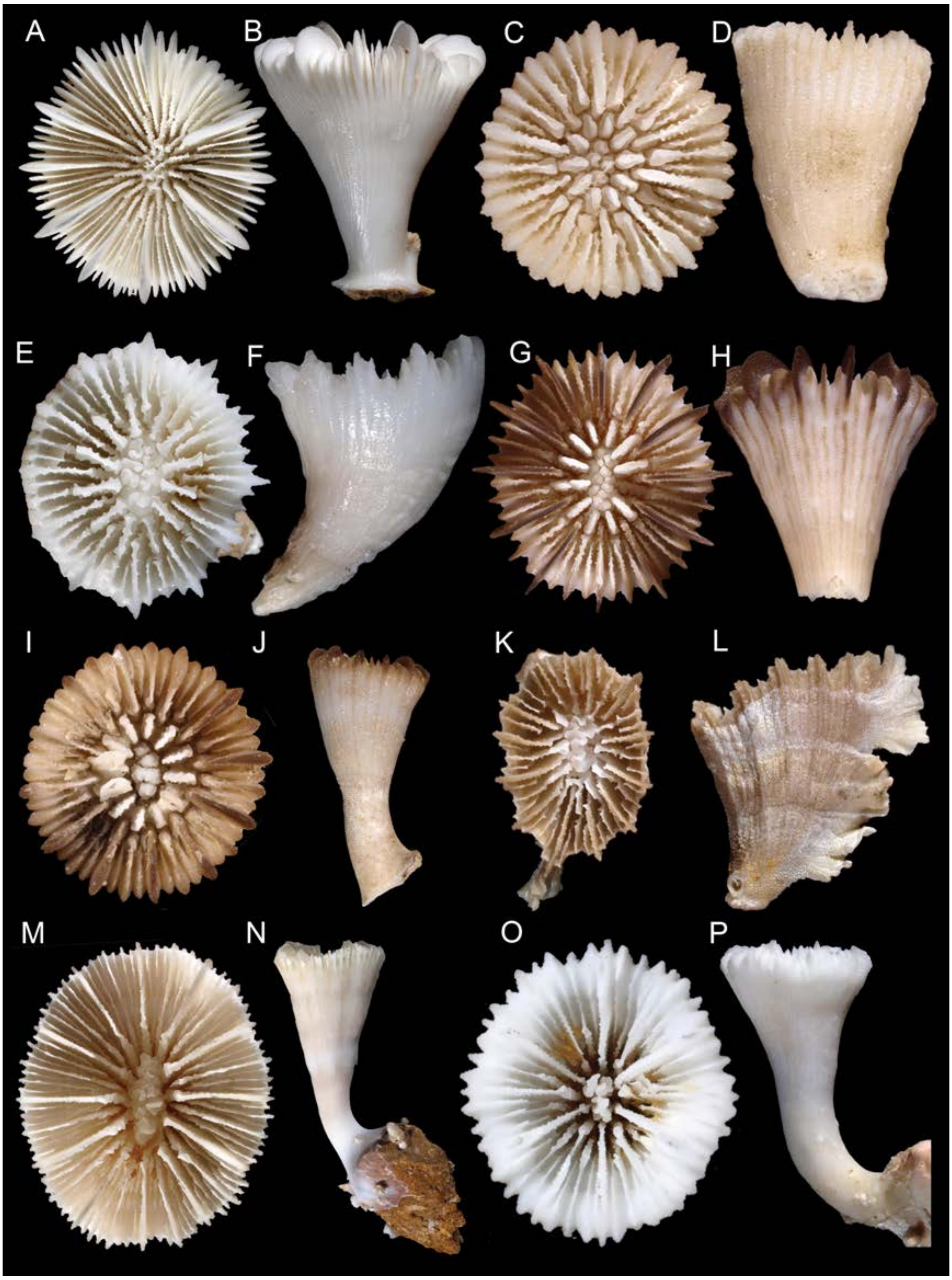


PLATE 15. –*Caryophyllia ralphae*: A-B (MNHN-Scl.2009-0077), calicular (x 1.5) and lateral (x 1.2) views. ***Caryophyllia rugosa***: C-D (MNHN-Scl.2009-0055), calicular (x 4.1) and lateral (x 3.7) views. ***Caryophyllia scobinosa***: E-F (MNHN-Scl.2009-0089), calicular (x 2.9) and lateral (x 2.7) views. ***Caryophyllia* sp. A**: G-H (MNHN-Scl.2009-0087), calicular (x 2) and lateral (x 1.7) views. ***Caryophyllia versicolorata***: I-J (MNHN-Scl.2009-0045), calicular (x 4.2) and lateral (x 2) views. ***Caryophyllia unicristata***: K-L (MNHN-Scl.2009-0094), calicular (x 2.5) and lateral (x 2) views. ***Crispatotrochus rubescens***: M-N (USNM 1115428), calicular (x 1.7) and lateral (x 0.8) views. ***Crispatotrochus rugosus***: O-P (USNM 1115430), calicular (x 3.7) and lateral (x 1.9) views.

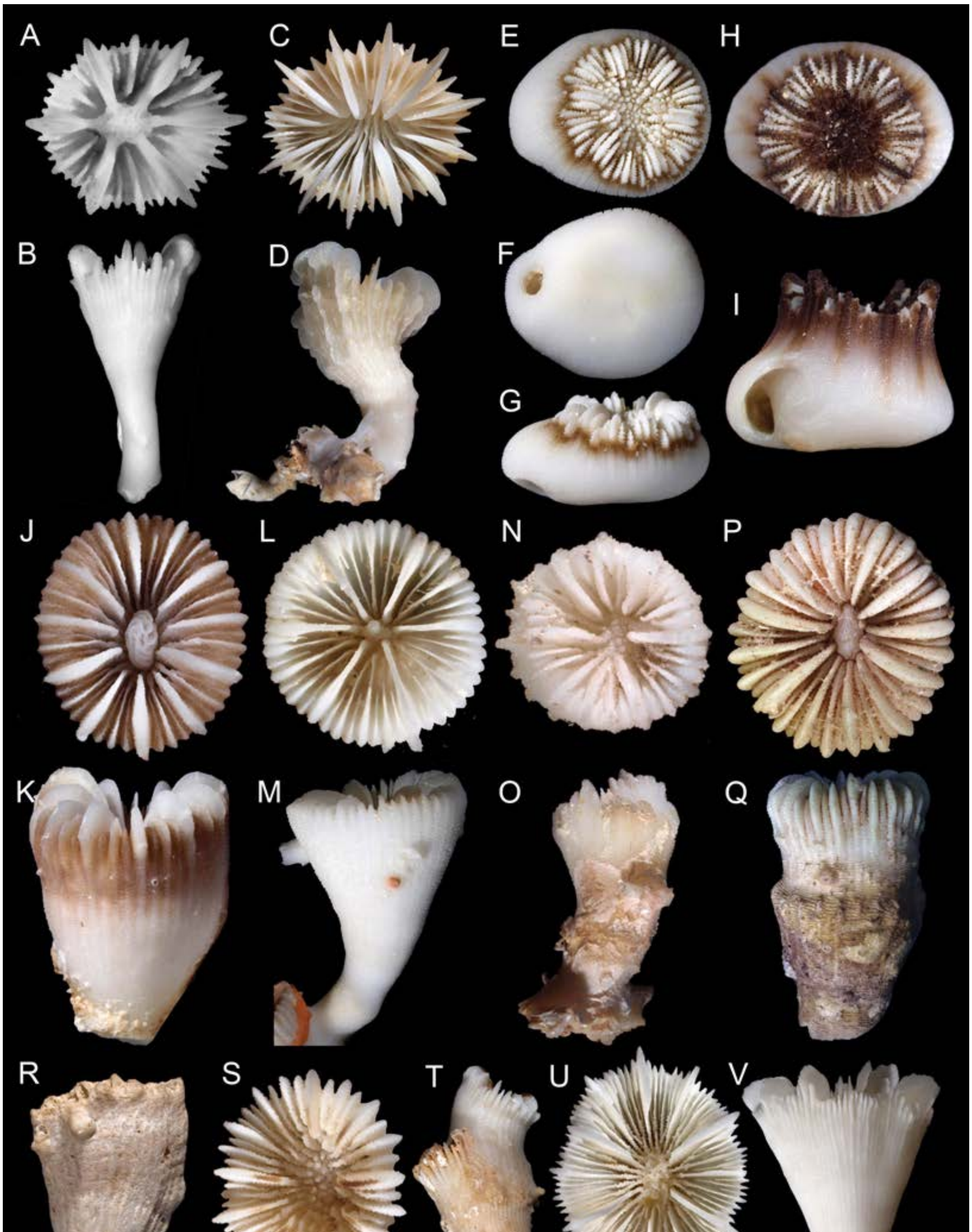


PLATE 16. – ***Crispatotrochus septumdentatus***: A-B (MNHN-Scl.2008-0046), calicular (x 4.3) and lateral (x 2.3) views. ***Desmophyllum dianthus***: C-D (CP 877), calicular (x 1.9) and lateral (x 1.6) views. ***Heterocyathus aequicostatus***: E-G (DW 933), calicular, basal and lateral (x 2.7) views. ***Heterocyathus sulcatus***: H-I (DW 902), calicular (x 3.7) and lateral (x 3.6) views. ***Labyrinthocyathus limatulus***: J-K (DW 936), calicular (x 3) and lateral (x 2.7) views. ***Monohedotrochus circularis***: L-M (DW 2124), calicular (x 1.9) and lateral (x 1.5) views. ***Monohedotrochus epithecatus***: N-O (DW 2133), calicular (x 4.4) and lateral (x 2.5) views. ***Oxysmilia corrugata***: P-Q (DW 2125), calicular (x 3.6) and lateral (x 1.7) views. ***Premocyathus dentiformis***: R (DW 903), lateral (x 2.6) view. ***Rhizosmilia multipalifera***: S-T (DW 2140), calicular (x 2.5) and lateral (x 1.3) views. ***Rhizosmilia robusta***: U-V (DW 2124), calicular (x 1.2) and lateral (x 0.9) views.

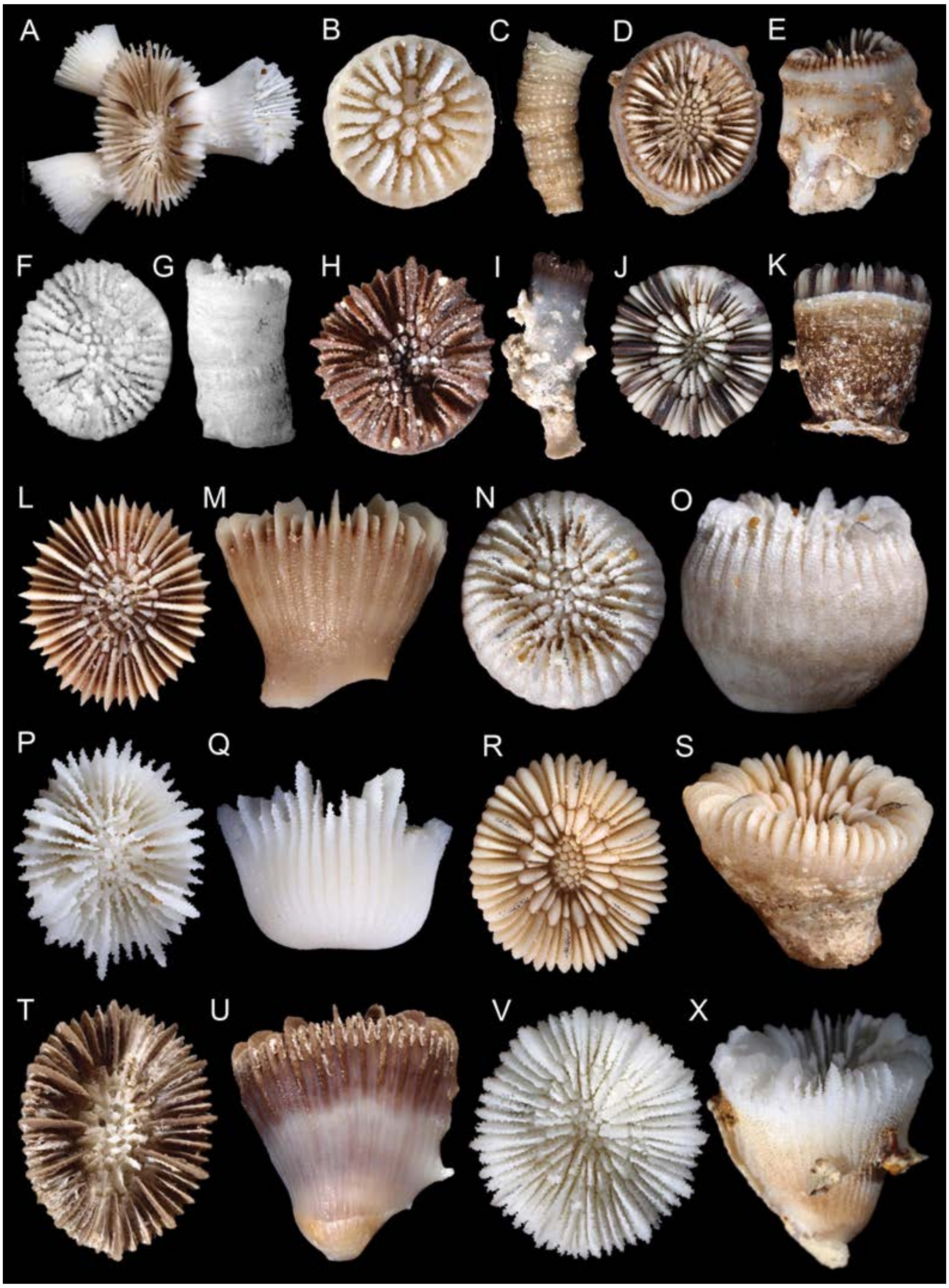


PLATE 17. –*Rhizosmilia sagamiensis*: A (DW 2124), calicular (x 1.4) view. ***Stenocyathus vermiformis***: B-C (blank lable), calicular (x 4.1) and lateral (x 2.2) views. ***Tethocyathus cylindraceus***: D-E, calicular (x 1.8) and lateral (x 1.5) views. ***Tethocyathus minor***: F-G, calicular and lateral views of holotype. ***Tethocyathus* sp.**: H-I (DW 2117), calicular (x 3.2) and lateral (x 1.4) views. ***Tethocyathus virgatus***: J-K (DW 205), calicular (x 1.5) and lateral (x 1) views. ***Trochocyathus caryophylloides***: L-M (DW 2063), calicular (x 2.2) and lateral (x 2.3) views. ***Trochocyathus cepulla***: N-O (DW 914), calicular (x 3.7) and lateral (x 4.2) views. ***Trochocyathus discus***: P-Q (CP 2142), calicular (x 2.8) and lateral (x 2.7) views. ***Trochocyathus efateensis***: R-S (DW 818), calicular (x 2.3) and lateral (x 2.6) views. ***Trochocyathus philippinensis***: T-U (CP 863), calicular (x 3.1) and lateral (x 3) views. ***Trochocyathus* cf. *T. rawsonii***: V-X (CP 858), calicular (x 3.2) and lateral (x 2.9) views.

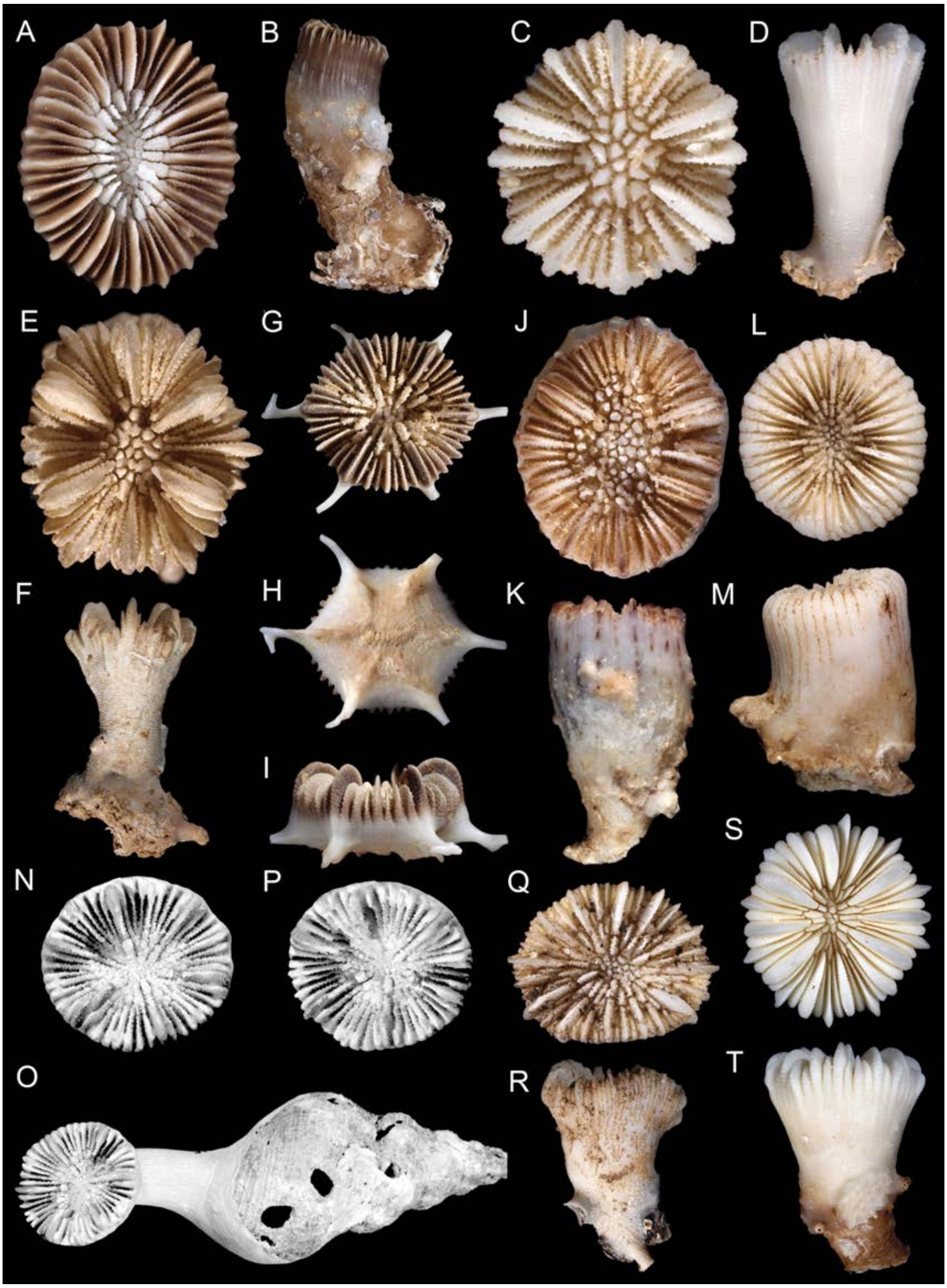


PLATE 18. – ***Trochocyathus vasiformis***: A-B (DW 2025), calicular (x 2.7) and lateral (x 1) views. ***Trochocyathus wellsi***: C-D (DW 2093), calicular (x 6.7) and lateral (x 4.3) views. ***Trochocyathus* sp. cf. *T. wellsi***: E-F (DW 2133), calicular (x 3.3) and lateral (x 1.6) views. ***Trochocyathus brevispina***: G-I (CP 851), calicular (x 2.2), basal (x 2.2) and lateral (x 2.1) views. ***Paracyathus peysonneli* sp. nov.**: J-K (DW 2024), calicular (x 3) and lateral (x 2) views of holotype. ***Paracyathus montereyensis***: L-M (DW 2024), calicular (x 2.8) and lateral (x 2.2) views. ***Paracyathus parvulus***: N-P (*Soela* 1-84-54), calicular (N and P) and lateral (O) views. ***Paracyathus* sp.**: Q-R (DW 2133), calicular (x 2.1) and lateral (x 1.9) views. ***Trochocyathus rhombcolumna***: S-T (DW 210), calicular (x 1.9) and lateral (x 1.5) views.

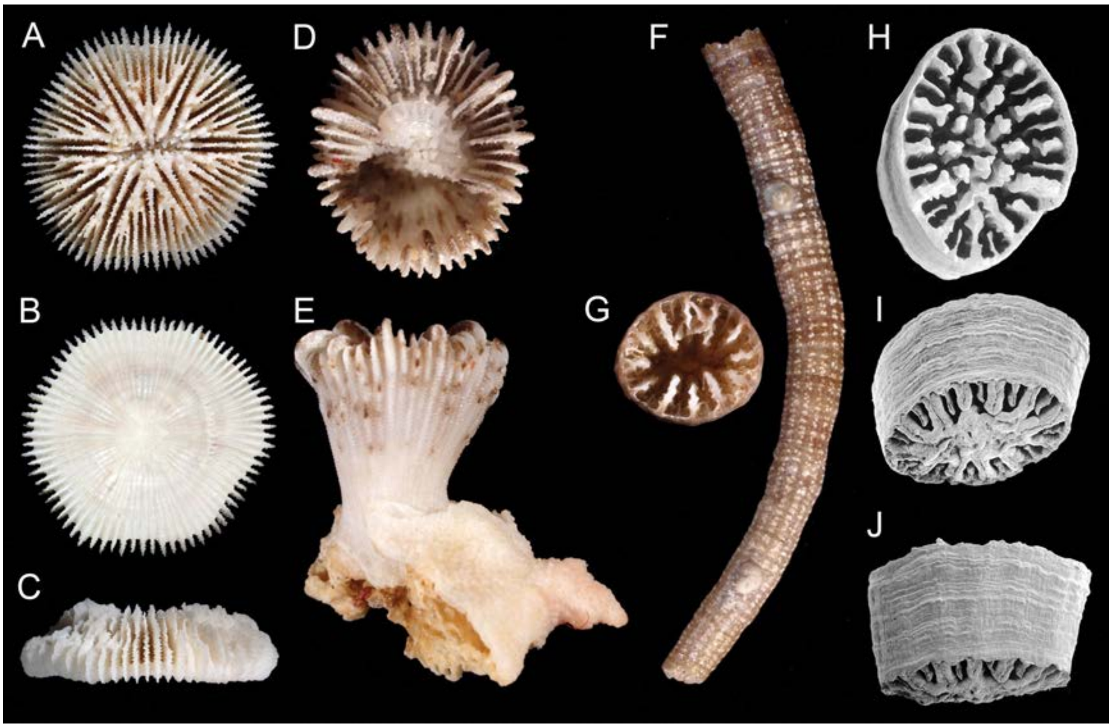


PLATE 19. – *Deltocyathus magnificus*: A-C (MNHN-Scl.2008-0001), calicular, basal and lateral (x 1.3) views. ***Trochocyathus maculatus***: D-E (DW 2119), calicular and lateral (x 2.7) views. ***Truncatoguynia irregularis***: F-G (DW 2117), calicular (x 6.3) and lateral (x 2.5) views. ***Temnotrochus kermadecensis***: H-J (Co 258/BS441), calicular (x 17), oblique (x 15.8) and lateral (x 16) views of paratype.

This page is intended to be blank