



Assembling the Echinoderm Tree of Life

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Conferences

CONFERENCES in 2012

2012 Geological Society of America Annual Meeting

Date: 4-7 November 2012

Place: Charlotte, North Carolina, USA

PRESENTATIONS and ABSTRACTS

- 1) Messing, C. G. and Baumiller, T. K. 2012. The status of the tropical western Atlantic deep-water crinoid fauna.
- 2) Syverson, V. J. and Baumiller, T. K. 2012. Evolutionary response in Paleozoic crinoid arm branching patterns to grazing predators.

14th International Echinoderm Conference

Date: 20-24 August 2012

Place: Brussels, Belgium

PRESENTATIONS and ABSTRACTS

- 1) Baumiller, T. K. 2012. Arm regeneration frequencies in the *Florometra serratissima* (Crinoidea, Echinodermata): impact of depth of habitat on rates of arm loss.
- 2) Foltz, D. and Mah, C. 2012. Emergent trends & patterns in modern phylogenetics of the Asteroidea.
- 3) Mah, C., Mercier, A., Eleaume, M., Markello, K., Neil, K., Howell, K., Nizinski, M., York, A. and Foltz, D. 2012. Discovery of a globally distributed species of *Hippasteria* (Goniasteridae; Valvatida) and its implications for classification and taxonomy
- 4) Borrero-Perez G.H. , Honey M. , Bin Kamarudin B.K.R. , Kerr A. , Kim S. , Menez A. , Michonneau F. , Ochoa J.A. , Olavides R.D. , Paulay G. , Samyn Y. , Setyastuti A. , Solis-Marin F. , Starmer J. and VandenSpiegel D. The littoral sea cucumber (Echinodermata: Holothuroidea) fauna of Guam re-assessed – A diversity curve that still does not asymptote.

The Micronesian island of Guam has been an important site for the study of tropical holothuroid taxonomy for almost 200 years. Despite such substantial attention by both expeditions and resident taxonomists, new records are being regularly added to the fauna demonstrating the challenge of documenting the biota of even a small hyper-diverse area. Guam is the type locality of species described by Quoy & Gaimard (1833) and Brandt (1835). A survey of the sea cucumber fauna by Rowe & Doty (1977) led to one of the most used guides for the identification of tropical Pacific sea cucumbers because of the color illustrations of living animals it presented. Focus on echinoderms including holothuroids continued with numerous new records added in the following decades. Paulay (2003) summarized the fauna last, recording 46 species, including 9 new records. At this stage the fauna was thought to be well documented. A week-long workshop on holothuroid systematics sponsored by the NSF PEET project in 2010 included a substantial field work component, sampling both during the day and night, with snorkeling and SCUBA, across a variety of habitats, yielding more than 40 species. 10 of these proved new records for Guam; two proved new to science. Further sampling by Kerr's lab since the workshop has added two additional species. The holothuroid fauna of Guam thus now comprises 58 species that belong to 17 genera and 7 families. This contribution presents them as an illustrated and briefly annotated checklist.

- 5) Samyn Y., Michonneau F., Starmer J., Uyeno D., Naruse T., Kerr A., and Paulay G. 2012. The enigmatic sea cucumber *Holothuria* (*Stichothuria*) *coronopertusa* Cherbonnier, 1980 (Echinodermata: Holothuroidea) reexamined.

In 1980, the reknown French taxonomist G. Cherbonnier introduced the new subgenus *Stichothuria* to accommodate a remarkable New Caledonian species, *Holothuria coronopertusa*, characterised by enlarged dorsal and terminal papillae and an ossicle assemblage that combines tables, buttons and C-shaped bodies. Recent surveys in Eastern South Africa, Palau, Guam, and Okinawa obtained additional specimens of *H. coronopertusa*. In Palau, Guam and Okinawa the species was encountered in deep water (30-100m), while in South Africa it came from relatively shallow depths. Re-examination of the holotype in the Paris Museum and new material allowed us to redescribe the species and determine its affinities. We found that the C-shaped ossicles derive from the longitudinal muscles and not from the body wall as thought by Cherbonnier. Such ossicle distribution fits with the diagnosis of the subgenus *Mertensiothuria*. Phylogenetic analysis based on DNA sequence data clearly place *H. coronopertusa* among other species of *Mertensiothuria*. While these results suggest that the species is not that divergent, it remains remarkable because of its large size (to ~1 m), deep habitat in the tropics, and relatively high latitude occurrence.

The 12th International Coral Reef Symposium

Date: 9-13 July 2012

Place: Cairns, Queensland, Australia

PRESENTATIONS and ABSTRACTS

1) Brunson, D. and Kerr, A. M. 2012. Stock assessment of sea cucumbers on Guam, Micronesia

Sea cucumbers (Holothuroidea) are commercially valuable echinoderms found in abundance on many tropical reefs. Holothuroids used for food are known as trepan or beche-de-mer and demand for it has led to collapse of sea-cucumber populations in several island ecosystems. To prevent overharvesting on Guam, in the Mariana Islands, Micronesia, we have begun a comprehensive stock assessment of the population structure of commercially important species. We are also exploring the role of marine protected areas in the management of holothuroids. Stock surveys are done using transects, timed swims and length measurements done in situ. Preliminary findings include the possibility of a small sustainable fishery for several species and evidence of the overharvesting of some species by subsistence fishermen. Our goal is to establish the circum-island distribution of species and provide the government of Guam with a management plan for the sustainable harvest of sea cucumbers.

2) Kim SW, Kerr AM and Paulay G. 2012. Molecular systematics of the tropical sea cucumbers, *Bohadschia* (Holothuriidae: Holothuroidea)

Even with uncountable numbers of reef biodiversity studies, we are still ignorant of the majority of the reef biodiversity. Regardless of its ubiquity throughout the Indo-Pacific and Caribbean Oceans, a large portion of the evolution history of the class Holothuroidea; sea cucumbers, has not been studied at all. Within the class, the genus *Bohadschia* (Holothuroidea: Holothuriidae) is often considered one of the most taxonomically controversial groups. For example, the morphologically and ecologically distinct *B. argus* is derived within the taxonomically muddled marmorata-complex. Also, a clade, *B. bivittata* in part, has tiny lines over its dorsum, a character that was not previously considered taxonomically important. In addition, several species including *B. koellikeri* appear to be hybrids. Finally, we have a lot more to learn about their systematics as we are discovering many new *Bohadschia* species.

3) Miller AK and Kerr AM. 2012. Higher Level Systematics of Holothuroidea

The higher-level systematics of sea cucumbers (Holothuroidea) is currently in a neglected state. The monophyly of most higher level taxonomic groups and their inter-relationships remain uncertain. As part of the NSF-sponsored Assembling the Echinoderm Tree of Life Project (<http://echinotol.org/>), we will use phylogenomic methods based on transcriptome profiling to develop the most comprehensive Holothuroidea phylogeny to date. We are sampling widely, from the shallow reefs of Malaysia to the deep regions of Antarctica to construct complementary DNA (cDNA) libraries (via transcriptome profiling) from rare and seldom collected species. Molecular and morphological phylogenetic analyses of circa 200 exemplars, including fossil taxa, will be used in conjunction with previously developed data sets to redefine higher taxa. We seek to resolve the monophyly of all subclass through most family-level relationships. Preliminary results indicate that the orders Elaspodida, Aspidochirotida, and Dendrochirotida, as well as the subclasses Dendrochirotacea and Aspidochirotacea, are probably non-monophyletic. This indicates that the higher level taxonomy of the class requires major revision. Our full analysis will enable us to resolve relationships between the deep branches within Holothuroidea, an essential preliminary step to understanding a variety of other systematic and comparative evolutionary questions.

The First Joint Congress on Evolutionary Biology

Date: 6-10 July 2012

Place: Ottawa, Ontario, CANADA

PRESENTATIONS and ABSTRACTS

1) Foltz, D., Fatland, S. and Mah, C. 2011. Genetic structure of a deepsea seastar species, *Hippasteria phrygiana*, on a global scale.

1st Annual South Pacific Asia Marine Science Workshop

Date: 28-31 March 2012

Place: Seoul, South Korea

PRESENTATIONS and ABSTRACTS

1) Kerr A. 2012. Phylogenetics of Holothuroidea (Echinodermata)

Holothuroids, or sea cucumbers, are a morphologically diverse group of echinoderms with over 1400 described species occurring from the intertidal to the deepest oceanic trenches. My lab investigates the evolution and systematics of this group via phylogenetic analyses of DNA nucleotide sequences, morphological characters and fossil first occurrences. To date, the cladistic structure of the group appears at considerable odds with the conventional higher level taxonomic classification. The topology within at least one order, Apodida, is in contrast largely congruent with the Linnaean scheme. Branching order is significantly associated with fossil first occurrences and the fossil-calibrated tree indicates that holothuroids survived the end Permian extinction more successfully than other echinoderms. Like many other marine invertebrates, at least one clade radiated rapidly during the Triassic. A test of imbricate plates and a complex calcareous ring resembling the ambulacral skeleton of other echinoderms are derived features in holothuroids.

CONFERENCES in 2011

2011 1^o Congreso Latinoamericano de Equinodermos

Date: 13-18 November 2011

Place: Puerto Madryn, Argentina

PRESENTATIONS and ABSTRACTS

1) Baumiller, T. K. 2011. Post-Paleozoic crinoid diversity history.

2) Gahn, F. J. and Baumiller, T. K. 2011. Paleontological evidence for the origin of autotomy abilities in crinoids.

2011 Geological Society of America Annual Meeting

Date: 9-12 October 2011

Place: Minneapolis, Minnesota, USA

PRESENTATIONS and ABSTRACTS

1) Syverson, V. J. and Baumiller, T. K. 2011. Morphological variability and developmental constraints in crinoid arms. Geological Society of America Abstracts with Programs, Vol. 43: 85

2) Rhodes, K. and Baumiller, T. K. 2011. Evaluating modern and fossil diversity in comatulid crinoids. Geological Society of America Abstracts with Programs, Vol. 43: 85

CONFERENCES in 2010

2010 Geological Society of America Annual Meeting

Date: 31 October - 3 November 2010

Place: Denver, Colorado, USA

PRESENTATIONS and ABSTRACTS

Paper No. 32-8

ASSEMBLING THE ECHINODERM TREE OF LIFE: CHALLENGES AND PLANS

A multidisciplinary team of biologists have recently assembled to study echinoderm phylogeny. The team has an award from the National Science Foundation Program, Assembling the Tree of Life. The five living classes of echinoderms are Asterozoa, Crinozoa, Echinozoa, Holothurozoa, and Ophiurozoa. However, these classes represent a shadow of both the full morphological disparity and diversity of Lower Paleozoic echinoderms that includes as many as 21 classes. Phylogenetic analysis of living echinoderms remains challenging. Moreover a complete echinoderm evolutionary tree will have to incorporate all echinoderm lineages and key outgroups to link echinoderms into the broader tree of life. The project is organized with the following working groups: genomics, morphology, informatics, and outreach. Our goals include genomic sampling of numerous exemplars among the five living echinoderm classes, integration of genomic and morphologic data of living echinoderms with Cenozoic and Mesozoic fossil data, definition of Paleozoic clades, and positioning sister group relationships among the stem group echinoderm clades. Homology among distinctive echinoderm groups must be established first despite diverse nomenclature. Data will be analyzed with multiple hypotheses of outgroups and characters by teams of echinoderms specialists. Collaborations are welcome. Outreach will include videos and broadcasts about marine exploration and applications of fundamental biological research across the biomedical sciences.
