

The Echinoderm Files: a database-facilitated access to a hidden treasure trove

Andreas KROH¹, Michel JANGOUX^{2,3}, Georgy V. MIRANTSEV⁴ and Alexander ZIEGLER⁵

(1) *Geologisch-Paläontologische Abteilung, Naturhistorisches Museum Wien, Burgring 7, 1010 Wien, Austria*
Fax: +43-1-521-77-459, Tel: +43-1-521-77-576, E-mail: andreas.kroh@nhm-wien.ac.at

(2) *Laboratoire de Biologie Marine, Université Libre de Bruxelles, 50 Avenue F. D. Roosevelt, 1050 Bruxelles, Belgium*

(3) *Biologie Marine, Université de Mons-Hainaut, 20 Place du Parc, 7000 Mons, Belgium*

(4) *A.A. Borisyak Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya Ulitsa 123, 117997 Moskva, CIS*

(5) *Museum of Comparative Zoology, Harvard University, 26 Oxford Street, Cambridge, MA 02138, USA*

Abstract: During the fifty years that have passed since the first echinoderm meeting was held in 1963, numerous scientific articles on the phylum Echinodermata have been published in conference proceedings volumes or as special symposium journal issues. In order to provide the research community with a more rapid access to the information contained within these publications, we have compiled a database that lists all abstracts and articles published following the main gatherings of the echinoderm scientific community over the past half century. This database, *The Echinoderm Files*, is available online and contains bibliographical data on abstracts and articles from proceedings of International Echinoderm Conferences, European Conferences on Echinoderms, and all major international echinoderm symposia. Analyses performed based on the content of the database illustrate trends related to the echinoderm scientific community, its conferences, and related proceedings. Among other aspects, these studies reveal a steady increase in conference attendance, an uneven distribution of taxonomic research foci, and a relatively low visibility of research published in conference proceedings. In addition, the article lists the additional past echinoderm conferences, provides data on future echinoderm meetings, and discusses the accessibility of echinoderm-related publications.

Résumé : *The Echinoderm Files* : la base de données des actes publiés. Depuis la première réunion scientifique sur les échinodermes en 1963, voici cinquante ans, de nombreuses contributions les concernant ont été publiées dans des actes de conférences ou des numéros spéciaux de revues scientifiques. Pour faciliter l'accès aux informations contenues dans ces ouvrages, une banque de données (*The Echinoderm Files*) a été établie qui reprend toutes les informations bibliographiques sur les articles et résumés publiés dans les actes des conférences internationales sur les échinodermes, dans ceux des conférences européennes sur les échinodermes et dans ceux des autres symposiums qui leur ont été consacrés. L'analyse des données ainsi rassemblées montrent le nombre croissant de participants à ces manifestations; elle pointe aussi la faible visibilité des résultats scientifiques publiés dans leurs actes; elle témoigne enfin de l'existence d'un intérêt inégal des chercheurs pour les diverses classes d'échinodermes. En outre, l'article présente les réunions à venir, et propose d'améliorer l'accès à certains écrits encore trop confidentiels.

Keywords: Echinodermata • Database • Publications • Meetings • Digital resource

This article is dedicated to Professor John M. Lawrence, who has been an integral part of the echinoderm research community for over fifty years. Professor Lawrence has attended most of the international, regional, and national meetings held since the first echinoderm symposium in 1963. He has coauthored and edited a multitude of scientific publications and has inspired countless young students to study echinoderms.

Introduction

In a recent contribution aimed at furthering an understanding of the history of echinoderm conferences, we provided a compendium of echinoderm conferences and symposia held from 1963 to 2012 (Ziegler & Kroh, 2012). The inquiries leading to this list of active and interrupted conference series revealed that a vast number of studies involving the phylum Echinodermata has been published in the form of abstracts and articles in conference proceedings volumes or special symposium journal issues. These mostly peer-reviewed contributions constitute a scientific treasure trove that is rather difficult to access for a large part of the research community. We therefore set out to provide scientists with an electronic database that would permit obtaining a rapid overview of the articles and abstracts published in the proceedings volumes of past echinoderm conferences and symposia.

In its current form, this database allows analysing a number of historical and statistical aspects related to the echinoderm research community, its conferences, and related proceedings. Previous studies have performed statistical analyses of *International Echinoderm Conference* (IEC) participants and articles, investigating, for example, the total numbers of conference attendees and published papers (Nichols, 1994), the track record of paleontological studies echinoderm research (Mooi, 2001), or how the analysis of echinoderm evolution developed in proceedings articles (David et al., 2010). To celebrate half a century of successful echinoderm conferences and their related conference proceedings, the present article extends such statistical analyses to all IEC and *European Conference on Echinoderms* (ECE) meetings as well as to the international echinoderm symposia held since 1963.

The Echinoderm Files: database content and format

The database which we introduce here is named *The Echinoderm Files* and contains metadata on all articles and abstracts published in the proceedings volumes of the ECES held from 1979 to 2010 (i.e., ECE 1-7) and the IECs held from 1975 to 2009 (i.e., IEC 2-13). No proceedings were published following the 1st IEC, while the 14th IEC is represented by the present journal issue. Because most of the independent echinoderm symposia were in fact international meetings that often resulted in extensive

publications, we have included all published articles and abstracts derived from these meetings as well (i.e., the echinoderm symposia held in 1963, 1966, 1973, 1986, January 1999, December 1999, 2000, and 2006). See the next section as well as Ziegler & Kroh (2012) for detailed information about conference and symposium names, locations, dates, and related publications.

The Echinoderm Files currently contains 2,450 article and abstract entries. In addition, we have accumulated data on the participants of each IEC and ECE (taken from the proceedings volumes, abstract booklets, and associated matter) in order to permit studying various historical and demographical aspects of the echinoderm research community. *The Echinoderm Files* (Kroh et al., 2013) is available at the *World Register of Marine Species* (Appeltans et al., 2012a), where the raw data can also be downloaded in the form of a CSV or an XLS file. In addition, a web-based interface has been created using the software *Exhibit 3.0* (Massachusetts Institute of Technology, 2012), which permits online browsing, filtering, and searching of the database as well as exporting the results in various formats. The homepage of *The Echinoderm Files* (Kroh et al., 2013) contains detailed information on how to employ the *Exhibit 3.0* web interface.

The database currently contains the following fields: article author(s), article title, proceedings author(s), proceedings title, journal title, place of publication, publisher, date of publication, volume, issue, pages, language of article, ISSN, ISBN, and conference/symposium title. We have also assigned four categories to each entry: i) echinoderm class(es) covered in the study (i.e., Crinoidea, Asteroidea, Ophiuroidea, Holothuroidea, Echinoidea, Extinct echinoderms), ii) the general topic of the study (i.e., aquaculture & fisheries, behavior, biogeography, ecology, morphology & function, physiology, reproduction & development, systematics & evolution, other), iii) whether a paleontological approach was chosen (yes or no), and iv) whether the individual contribution represents a full research paper or a published abstract.

We estimate that the participants and authors involved in research presented at the IECs and ECES as well as at the independent symposia represent a large part of the researchers actually studying the taxon Echinodermata. Therefore, the data collected in *The Echinoderm Files* should allow deducing trends, not only for the conferences, but for the echinoderm scientific community as a whole.

Additional echinoderm meetings

In a contribution on the history of echinoderm conferences (Ziegler & Kroh, 2012), we aimed at providing a concise list of echinoderm meetings held from 1963 to 2012. However, the following meetings had escaped our attention:

UK-Eire Echinoderms Colloquium

London, UK, 11-13 July 1978

Organized by Roland H. Emson and Edward P. F. Rose

Proceedings or abstracts volume: none published

International Symposium on Fertilization and Development of Sea Urchin and Marine Invertebrates

Tokyo, Japan, 9-11 December 1999

Organized by Toru Higashinakagawa

Abstracts volume: *Zygote*, 8, Supplement 1, S1-S91, ISSN 0967-1994

Symposium on Echinoderm Physiology (as part of The Society of Experimental Biology Annual Meeting)

Exeter, UK, 27-31 March 2000

Organized by Maurice R. Elphick, Robert B. Hill, and Michael C. Thorndyke

Proceedings volume: *Journal of Experimental Biology*, 204, 815-921, ISSN 0022-0949

A few echinoderm conference series such as the *Florida Echinoderm Festival* or the *Séminaire International sur les Échinodermes* have ceased to exist, numerous meetings are still well and alive. Table 1 lists dates, locations, and organizers for the next scheduled echinoderm meetings as of September 2013. We are particularly pleased that with the 15th IEC to be held in Mexico, the international echinoderm meeting has conquered in Central America.

Database analyses I: the echinoderm scientific community

Despite its considerable size and almost world-wide distribution, the community of echinoderm researchers is notable for not being formally organized like researchers of other phyla (e.g., Crustacea or Mollusca). Although the members of the echinoderm scientific community still “have no official organization, no constitution, no official publication, and no officers” (Nichols, 1994), they are nonetheless “capable of self-organization without a formal body” (Lawrence, 1998). However, the absence of such a formal body requires that motivated individuals take responsibility and that these responsibilities are handed over in time to the next generation of equally motivated individuals. One advantage of the absence of any kind of hierarchical organization is certainly that the echinoderm community is largely immune to nepotism and other negative side effects of human power structures. The following results, based entirely on information contained within the database, illustrate the changes that the echinoderm community underwent over the past five decades.

Increase in total number of scientists involved in echinoderm research

A summary of the authors of studies published following the various echinoderm conferences and symposia reveals that the total number of echinoderm researchers has tripled over the last fifty years (Fig. 1A). The pronounced oscillation seen in the data is primarily related to two effects: i) most ECE proceedings volumes do not include abstracts and thus their authors are missing in the graph, and ii) ECEs and the thematically restricted echinoderm symposia in general tend to attract less participants than the IECs.

Table 1. List of future echinoderm meetings as of September 2013, arranged in chronological order.

Conference	Date	Location	Organizer (s)
2° Congreso Latinoamericano de Echinodermos (CLE)	19-26 October 2013	São Sebastião, Brazil	José Roberto Machado Cunha da Silva
5. Arbeitstreffen deutschsprachiger Echinodermenforscher (ADE)	22-24 November 2013	Stuttgart, Germany	Janina F. Dynowski
10. Kyokuhi-Doubutsu Kenkyuu Shuukai (KKS)	7 December 2013	Toyama, Japan	Mieko Komatsu
7 th North American Echinoderm Conference (NAEC)	1-6 June 2014	Pensacola, Florida, USA	Christopher M. Pomory
8 th European Conference on Echinoderms (ECE)	20-24 July 2014	Portsmouth, UK	Andrew S. Gale & Andrew B. Smith
15 th International Echinoderm Conference (IEC)	18-22 May 2015	Cancun, México	Francisco A. Solis Marín & Alfredo Laguarda-Figuera

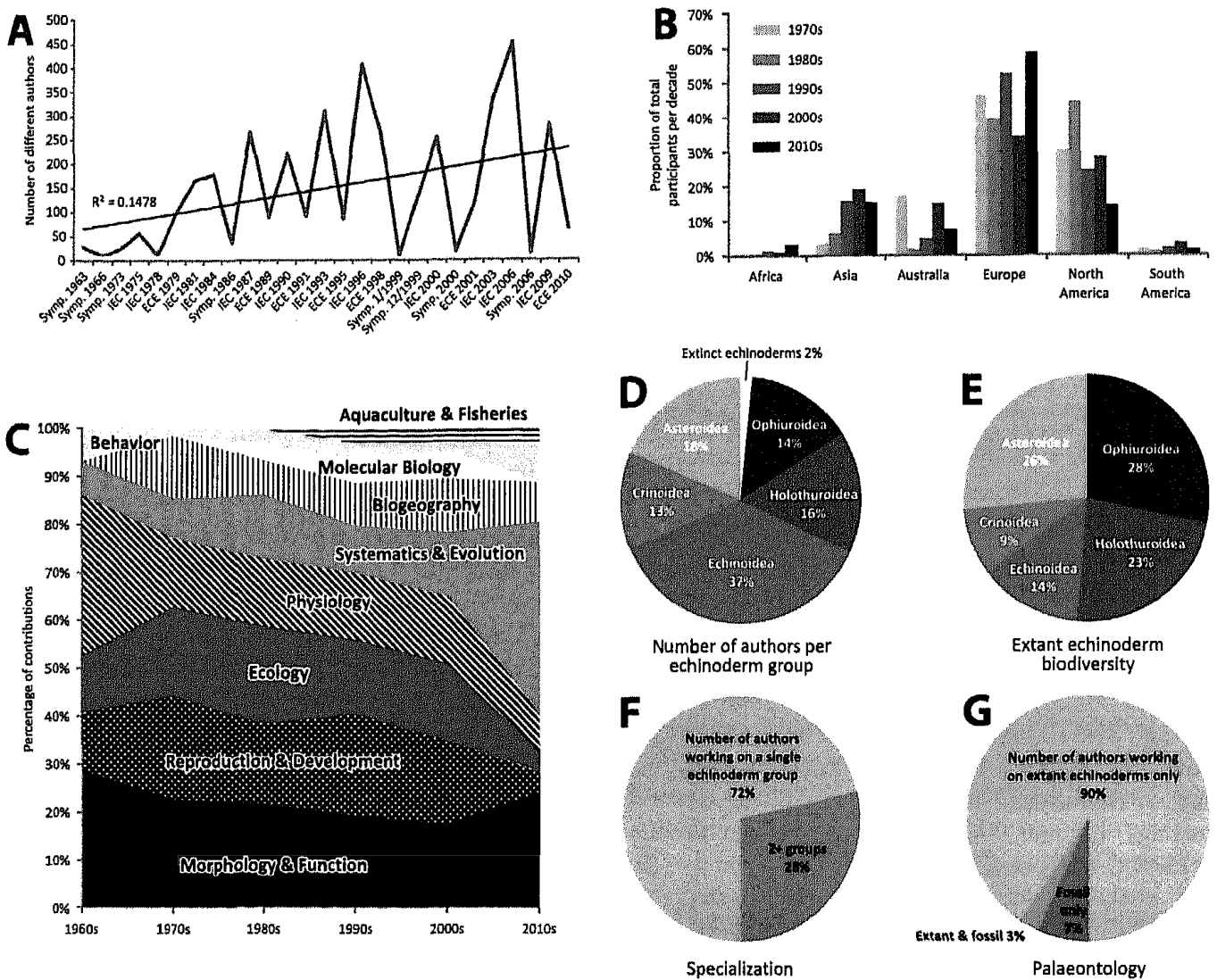


Figure 1. Statistical analyses of the composition and thematic foci of the echinoderm research community. Data obtained from *The Echinoderm Files*. **A.** Graph illustrating the number of researchers involved in echinoderm research. **B.** Bar chart showing the geographical origin of conference participants. **C.** Diagram illustrating the distribution of research topics over time. **D-F.** Pie charts showing different aspects of taxonomic and thematic specialization of echinoderm researchers.

Certain parts of the world dominate echinoderm research

Throughout the history of echinoderm conferences, European and North American participants have dominated these meetings (Fig. 1B). However, the participation of Asian researchers has increased considerably over time. They now account for almost 20% of the conference attendees. Colleagues from the Australian region (including New Zealand) have formed a significant proportion of participants in decades where IECs were held in that region. Unfortunately, despite the growing amount of research performed in South America, there is still a relatively low conference attendance of researchers from this part of the world. However, the situation is likely to change, given the recent inception of the *Red Iberoamericano de Equinodermos* (Ziegler & Kroh, 2012).

Echinoderm research is particularly strong at selected institutions

Similar to the geographical origins of conference participants, distinct patterns become obvious when the institutional affiliations of echinoderm researchers are analysed. While the majority of institutions have harbored echinoderm researchers for only a few years, there are a number of institutions that are 'hot spots' for echinoderm research. Most notable among these are universities in Belgium, in particular the *Université Libre de Bruxelles*, with over one hundred participations in ECEs and IECs - this value is more than 2.5 times higher than any other institution. The presence of two other Belgian universities (i.e., *Université Catholique de Louvain* and *Université de Mons-Hainaut*) among the top twenty echinoderm research

institutions world-wide illustrates the particular importance of echinoderm research in this country. France is represented primarily by researchers from the *Université de Bourgogne* and the *Museum National d'Histoire Naturelle*, while in the UK it is mainly the *Natural History Museum* and to a lesser extent the *University of London* where echinoderm research was strongly represented over the past decades. Other top-ranking institutions are: *University of Sydney* (Australia), *Georg-August Universität Göttingen* and *Ludwig-Maximilians-Universität München* (Germany), *Universita degli Studi di Milano* (Italy), *Tokyo University*, *Tokyo Institute of Technology*, *Toyama University*, and *University of the Ryukyus* (Japan), *University of Otago* (New Zealand), *Russian Academy of Sciences* (Russia), and the *Smithsonian Institution*, *University of New Hampshire*, as well as *University of South Florida* (USA). However, at several institutions [e.g., *Universität Wien* (Austria), *University of California* (USA), and *National University of Ireland, Galway* (Ireland)] echinoderm research has almost completely ceased, as can be deduced from a strong decline of conference participants coming from these previously well-represented institutions.

What topics are 'hot' in echinoderm research?

The focus of echinoderm research has shifted over time - some topics became more and others less attractive. A

comparison of the general approach chosen in studies published after echinoderm meetings provides an impression of which topics were 'hot' in echinoderm research over the past five decades (Fig. 1C). It is apparent that primarily studies relating to morphology and function of echinoderms have continuously been *en vogue*. The number of physiological and ecological studies, in contrast, has declined since the 1980s, while studies on systematics and evolution have proliferated. New topics to evolve in the 1970s and 1980s were aquaculture and fisheries as well as molecular biology. Surprisingly, the total number of molecular studies published in echinoderm conference proceedings has remained relatively low, most likely because such manuscripts are preferentially being sent to international journals with a wider audience.

Negative correlation of taxonomic focus with echinoderm biodiversity

One might expect that the different echinoderm groups are more or less homogeneously studied. However, this is not the case. A comparison of the proportion of authors that study specific echinoderm classes (Fig. 1D) with the known biodiversity of these groups (Fig. 1E, species counts from Appeltans et al., 2012b) reveals that sea urchins are clearly the 'sexiest' echinoderms, attracting a disproportionately high number of researchers. Crinoids are likewise more

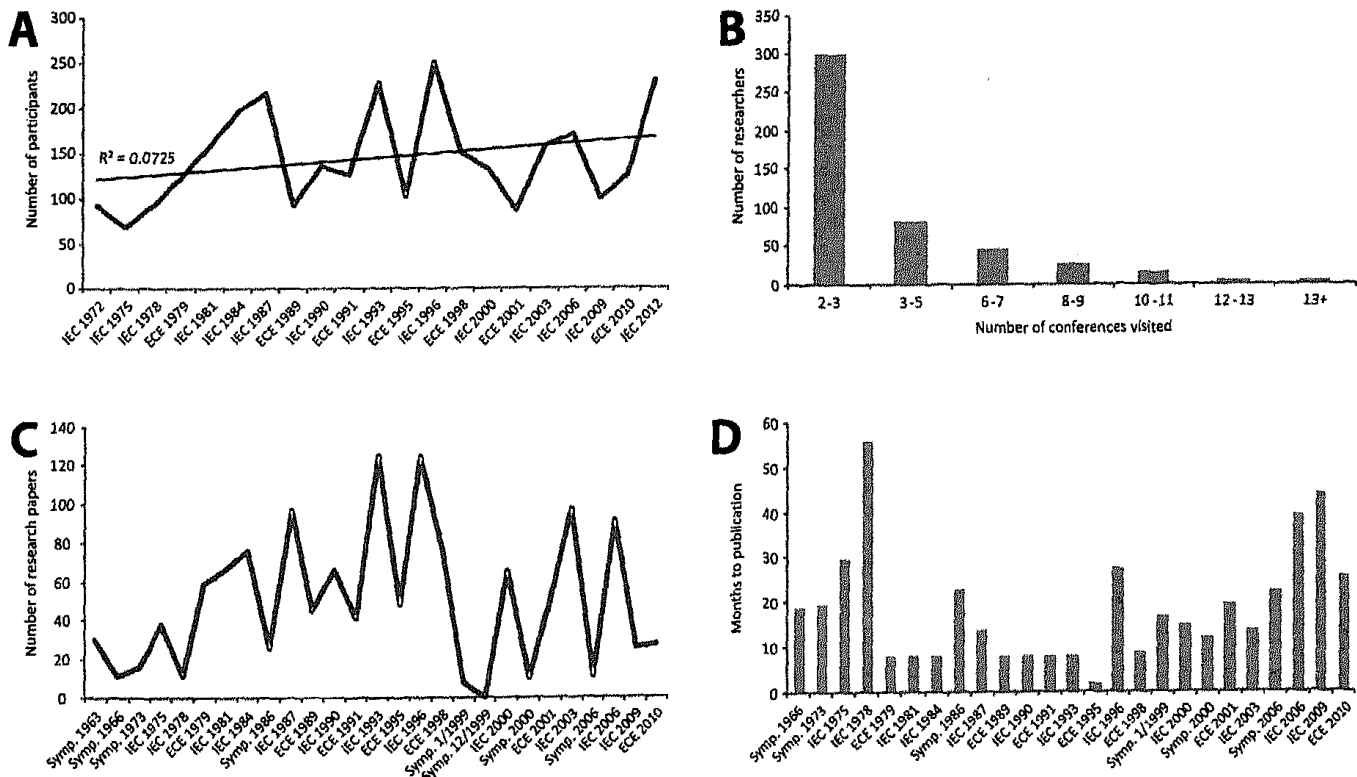


Figure 2. Statistical analyses of data on participants and proceedings of echinoderm meetings from 1963 to 2012. Data obtained from *The Echinoderm Files*. **A.** Graph illustrating the number of participants per echinoderm conference. **B.** Bar chart showing the number of conferences visited by each researcher. This chart excludes 1,117 singletons. **C.** Graph illustrating the number of research papers published following each meeting. **D.** Bar chart showing the time to publication of conference and symposium proceedings.

actively studied than would be expected from their species richness, while the remaining classes are 'under-studied' - brittle stars appear to be the least attractive group. Most researchers focus their efforts on a single echinoderm class (Fig. 1F), only slightly less than a third are involved in research that covers two or more echinoderm groups. Likewise, only few researchers combine studies on extant and fossil echinoderms: a mere 3% of all authors are involved both in palaeontological and neontological research (Fig. 1G). Studies that bridge all echinoderm classes are usually related to topics relevant for the entire phylum (e.g., physiological or systematical studies).

Database analyses II: the echinoderm conferences

The history of echinoderm conferences is remarkably diverse, and in addition to the IEC series, there are currently active regional meetings on three continents (Ziegler & Kroh, 2012). Statistical analyses of echinoderm conferences reveal a number of interesting aspects about these gatherings and their participants.

Conference participation on the rise

The number of researchers that attend echinoderm conferences is strongly affected by the location of these conferences, as was already shown by Nichols (1994). Nevertheless, it is surprising that the number of participants was relatively low in the 2000s as compared to the 1990s (Fig. 2A). While during the 2000s two of the four IECs took place in the southern hemisphere (i.e., New Zealand in 2000 and Australia in 2009) and therefore attracted less participants, the other two IECs (i.e., Germany in 2003 and USA in 2006) should have compensated for this, which they did not. In contrast, the most recent conference (i.e., Belgium in 2012) was a large event and attracted almost as many researchers as the all-time-champion, the 9th IEC held 1996 in San Francisco. Nonetheless, the average number of participants at echinoderm meetings is constantly increasing, albeit at a low rate.

The inner core of echinoderm research

Despite the fact that for some echinoderm researchers the IECs and ECEs possess the character of a family reunion, there are indeed a lot of new faces at each event. However, most of these colleagues do not appear again at later meetings. In fact, almost 70% of the participants over the past five decades attended only a single conference. A further 20% have attended two or three meetings (Fig. 2B), while less than 2% have attended more than ten conferences. The inner core of participants is thus relatively small and it is from this group of echinoderm enthusiasts

that the conference organizers are usually selected. The list of these dedicated echinoderm researchers reads like the 'who's who' of echinoderm research. It might suffice here to list the top five representatives, all of whom have been principal organizers of IEC or ECE meetings: John M. Lawrence (17 participations), Bruno David (15), Jean-Pierre Féral (15), Michael F. Barker (14), and Andrew B. Smith (14).

A changing conference landscape

The following observation might help to illustrate the considerable logistical changes that have occurred since the 1st IEC was held 1972 in Washington, DC: the program booklet of this event states that the registration fee was 2.50 US-\$ (which translates to about 14 US-\$ in 2013). Obviously, the demands of conference attendees have changed since then, and simply "reserving a room and getting a coffee pot" (Lawrence, 1998) is not sufficient. Obviously, increased demands by conference attendees are in turn reflected by higher conference costs. The publication of large proceedings volumes has certainly contributed to this development.

Database analyses III: the echinoderm conference proceedings

The main reason for the absence of a conference proceedings volume following the 1st IEC was that the organizers, Maureen E. Downey and David L. Pawson, simply did not want to publish such a book. Instead, they encouraged attendees to present "work in progress, so that the audience could participate actively during discussion periods" (David L. Pawson, pers. comm.). But, as the two organizers found out during the conference, speakers nonetheless presented projects they had already finished and that were either published or in press. In the absence of a journal dedicated to echinoderms, the organizers of the following two IECs, Dušan Zavodnik and Francis W. E. Rowe, therefore decided that it would be scientifically and politically appropriate to publish a proceedings volume, in particular because this would "clearly locate the place and year of a conference" (Francis W. E. Rowe, pers. comm.). The articles published in echinoderm conference proceedings represent "thousands of pages of peer-reviewed material" (David et al., 2010), and a closer look at the statistics of these publications reveals a number of informative aspects.

Conference proceedings are an attractive means of publishing scientific results

For a number of times, the pressing issue of the appeal of echinoderm conference proceedings has arisen, as has the

question if these publications are still a viable outlet for scientific research in times of the *impact factor*. Surprisingly, a large part of the community apparently still thinks so, as the constantly high number of research papers published in proceedings volumes suggests (Fig. 2C). While there was a notable decrease from the 1990s to the next decade, a large amount of primary data is still being published in echinoderm proceedings volumes. However, the nature of these papers has changed. The earliest volumes, in particular those resulting from the symposia that predate the first IEC in 1972 contained long papers (up to 62 pages) and were thematic volumes (e.g., Booloottian, 1965) rather than the typical mix found in conference proceedings. Overall, the average proceedings paper consisted of about 5-8 pages (mean: 6.7), although very long papers of up to 32 pages have also been published. In contrast, manuscripts that were published following the later symposia again tended to be longer (mean: 13.5 pages).

Echinoderm researchers in general prefer to publish in small teams of up to five colleagues. Very few studies involve larger teams of up to 16 individuals. A small number of authors has been particularly active, authoring more than ten research papers each. Their studies account for about one fifth of all papers in the proceedings volumes and for about one third of the total number of pages.

Time to publication

One of the main arguments raised against proceedings volumes is the perceived long delay between submission and publication of a manuscript. However, a comparison of the time that passed between conference and publication of echinoderm proceedings volumes shows, that this is largely a misconception (Fig. 2D). In fact, 40% of all volumes were published within a year after the conference and more than three quarters were published within a time span of two years. The record holder is the volume of the 4th ECE (London, 1995), which was published just two months after the meeting. In general, however, time to publication has steadily increased over the last decade. One of the reasons for this unfavorable development are the submission deadlines, which for many of the earlier meetings used to be the last days of the conference, while the editors of the more recent meetings decided to set deadlines that post-date the conference by many months. Another reason might be the generally increased workload of scientists, which affects editors, authors, and reviewers alike. Although digital tools have considerably sped up the entire publishing process, organizing a rapid peer review has become an increasingly complicated affair for the editors.

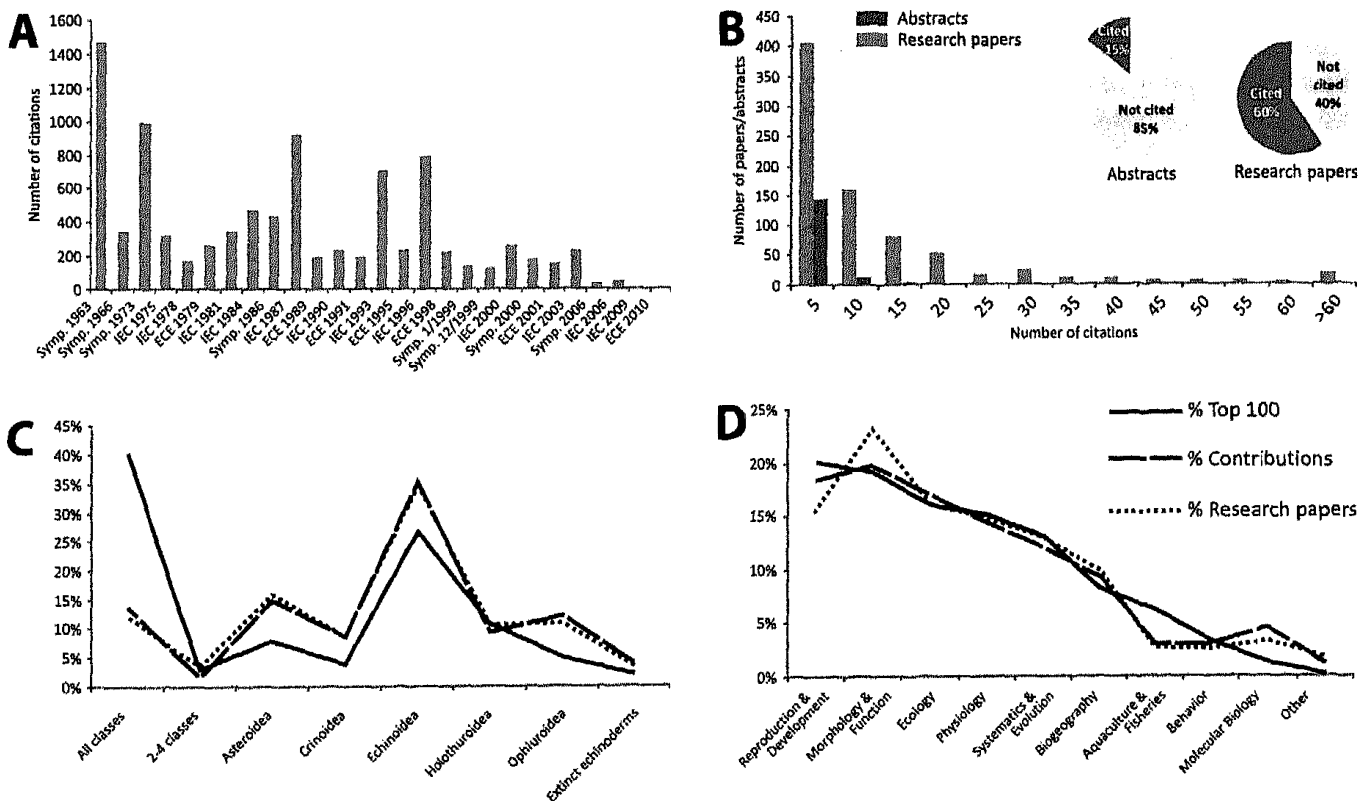


Figure 3. Statistical analyses of the visibility of research published in echinoderm proceedings. Citation numbers were taken from the *Google Scholar* web service in March 2013. Data obtained from *The Echinoderm Files*. **A.** Bar chart illustrating the cumulative number of citations received by each proceedings volume. **B.** Bar chart showing the distribution of citation numbers for abstracts ($N = 1,106$) and for research papers ($N = 1,344$). **C.** Graphs showing the distribution of taxonomic foci in echinoderm research. **D.** Graphs illustrating the distribution of research topics across all articles published in conference proceedings.

Visibility of research published in echinoderm proceedings

One of the important considerations for conference participants and potential authors of proceedings papers is how visible their contributions will be. In order to analyse the performance of past proceedings volumes, we have employed the *Google Scholar* web service to obtain citation rates for all of the 2,450 entries in our database. A comparison of the cumulative number of citations per volume (Fig. 3A) reveals that there is a distinct lag of a few years before proceedings volume papers get widely cited. The highly cited volumes of the IECs held in 1987, 1993, and 1996 are also those that contained most research papers (Fig. 2C). In contrast, the volumes from the international symposia held in 1963, 1966, and 1973 contain only relatively few contributions, but show exceptionally high citation rates per individual research paper - up to ten times higher than the mean citation rate of later volumes. The reasons for this are manifold, but must be partly related to the publication of these volumes many decades ago in the 1960s and 1970s. Several of the proceedings volumes published in journals (i.e., IECs held in 1975 and 1978 as well as symposia held in 1973, 1999, and 2000) received two or three times the number of citations per individual research paper as compared to those published in the classical book format. This effect might be caused by the wider dissemination of journals as well as by their generally better visibility and easier accessibility. Citation rates of individual papers, however, are unevenly distributed (Fig. 3B). Two fifths of the papers published in proceedings volumes were never cited at all and only a very limited subset of papers acquired more than a handful of citations each. Surprisingly, quite a large number of abstracts (161) was cited, some of them repeatedly (up to 19 times). In summary, there is still much room for improvement regarding the visibility of proceedings volumes published following echinoderm conferences. We hope to improve this situation in part with our database *The Echinoderm Files*.

Visibility of researchers that publish in conference proceedings

The individual visibility of researchers publishing in echinoderm proceedings is quite diverse. The most productive authors were not necessarily those that managed to attract the most citations, although the list of authors that received one hundred or more citations once again reads like the 'who's who' in echinoderm research. These 29 researchers alone account for about 4,300 citations. A further 1,052 authors received 1 to 99 citations each, which in total amounts to 13,018 citations, while the contributions of 1,421 authors were unfortunately never cited at all. Papers that address questions pertaining to all echinoderm

classes clearly managed to attract the most citations, as a comparison of echinoderm class proportions between the one hundred most cited papers ('Top 100', Fig. 3C) and other contributions reveals. Ophiuroids seem to be the most under-represented class within these top one-hundred papers. In relation to research topic (Fig. 3D), these papers represent more or less the average distribution seen in all contributions, except for an overemphasis on studies on aquaculture and fisheries at the cost of molecular biology. This phenomenon can probably be explained by the fact that most molecular studies presented during echinoderm conferences are being published in the more widely read scientific journals instead of in proceedings volumes.

Publication of abstracts in conference proceedings

Of interest is that some proceedings editors have decided to include abstracts of poster and oral presentations into their volumes, while others have decided not to do so. However, from a scientific point of view, abstracts do not constitute formal publications, because they lack the necessary presentation of data as well as a proper discussion. According to one author, the publication of abstracts in proceedings volumes constitutes "an undesirable trend in scientific reporting" (Blake, 1983). A practical approach to avoiding this dilemma could be the publication of an abstracts volume alongside the main proceedings volume (see, for example, Reich et al., 2010 and Kroh & Reich, 2012).

Concluding remarks

Although knowledge about the title or the bibliographical data of a certain article or abstract can already be considered an important step towards obtaining the information contained therein, this obviously does not mean access to the publication itself. Some of the manuscripts published in echinoderm conference proceedings have recently become available online (see *CRCnetBASE*), but many older articles may never be offered electronically by the respective publisher. In order to make the valuable scientific resource of echinoderm proceedings articles and abstracts more accessible, we therefore propose a concerted digitization effort similar to those performed by other scientific communities. A good example for such a program is the world taxonomist page of the *AntWiki* project (Lubertazzi, 2010), which provides ant researchers with direct access to often hard-to-locate scientific literature. The database presented here is intended to form the nucleus for similar archiving, indexing, and digitization efforts.

Because *The Echinoderm Files* are meant to serve as a practical tool for the echinoderm research community, it

would be desirable to incorporate information on the many articles and abstracts published in other echinoderm conference proceedings, for example those issued after Soviet, French, Russian, or German meetings (see Ziegler & Kroh, 2012). But in principle, all those echinoderm-related articles and chapters that have been published in books such as *Echinoderm Nutrition* (Jangoux & Lawrence, 1982) should also be added in order to avoid that valuable research remains inaccessible or unknown to a larger audience - as is reflected by the surprisingly low citation numbers that many articles in conference volumes receive.

Acknowledgements

We are grateful for the outstanding support from numerous members of the echinoderm community, listed here in alphabetical order: William C. Austin (Sidney, Canada), Robert D. Burke (Victoria, Canada), José Roberto Machado Cunha da Silva (São Sebastião, Brazil), Janina F. Dynowski (Stuttgart, Germany), Andrew S. Gale (Southampton, UK), Craig R. Johnson (Hobart, Australia), Mieko Komatsu (Toyama, Japan), Philip Lambert (Victoria, British Columbia, Canada), David Nichols (Exeter, UK), Masanori Okanishi (Wakayama, Japan), Ronald L. Parsley (New Orleans, Louisiana, USA), David L. Pawson (Washington, DC, USA), Christopher M. Pomory (Pensacola, Florida, USA), Francis W. E. Rowe (Hoxne, UK), Andrew B. Smith (London, UK), Francisco A. Solís Marín (México, DF, México). We would like to thank John M. Lawrence (Tampa, Florida, USA) and two anonymous reviewers for their helpful comments on an earlier version of the manuscript. We are grateful to the *Vlaams Instituut voor de Zee* for hosting *The Echinoderm Files* and would like to thank Bart Vanhoorne (Oostende, Belgium) and Leen Vandepitte (Oostende, Belgium) for technical support. Funding for this research was provided by the Deutsche Forschungsgemeinschaft through grant no. ZI-1274/1-2.

References

- Appeltans W., Bouchet P., Boxshall G.A., De Broyer C., de Voogd N.J., Gordon D.P., et al. 2012a. *World Register of Marine Species*. Available online at <http://www.marinespecies.org> [accessed september 2013].
- Appeltans W., Ah Yong S.T., Anderson G., Angel M.V., Artois T., Bailly N., et al. 2012b. The magnitude of global marine species diversity. *Current Biology*, **22**: 2189-2202.
- Blake D.B. 1983. Book review - Echinoderms: present and past. *The Quarterly Review of Biology*, **58**: 576-577.
- Boooloatian R.A. 1965. *Physiology of Echinodermata*. Interscience: New York. 822 pp.
- David B., Lefebvre B. & Mooi R. 2010. Echinoderm evolution since 1972 and since the Cambrian: tales from a dozen IECs. In: *Echinoderms: Durham* (L. Harris et al. eds), pp. 3-7. Taylor & Francis Group: London.
- Jangoux M. & Lawrence J.M. 1982. *Echinoderm Nutrition*. Balkema: Rotterdam. 654 pp.
- Kroh A. & Reich M. 2012. Echinoderm Research 2010. *Zoosymposia*, **7**: 1-316.
- Kroh A., Jangoux M., Mirantsev G.V. & Ziegler A. 2013. *The Echinoderm Files*. Available online at: <http://www.marinespecies.org/echinodermfiles/> [accessed september 2013].
- Lawrence J.M. 1998. A history of meetings on Echinodermata in North America. *Gulf of Mexico Science*, **16**: 112-114.
- Lubertazzi D. 2010. *AntWiki - world ant taxonomists*. Available online at http://www.antwiki.org/wiki/world_ant_taxonomists [accessed september 2013].
- Massachusetts Institute of Technology 2012. *Exhibit 3.0 - publishing framework for large-scale data-rich interactive web pages*. Available online at <http://simile-widgets.org/exhibit3/> [accessed september 2013].
- Mooi R. 2001. Not all written in stone: interdisciplinary syntheses in echinoderm paleontology. *Canadian Journal of Zoology*, **79**: 1209-1231.
- Nichols D. 1994. The International Echinoderm Conferences - a retrospect. In: *Echinoderms through Time* (B. David et al. ed), pp. 3-6. Balkema: Rotterdam.
- Reich M., Reitner J., Roden V. & Thuy B. 2010. *Echinoderm Research 2010*. Universitätsverlag Göttingen: Göttingen. 145 pp.
- Ziegler A. & Kroh A. 2012. Echinoderm conferences and symposia: a concise history and bibliography. *Zoosymposia*, **7**: 1-24.