

Introduction

The *Neuropterida Species of the World* (NSW) is a systematic catalogue and developing monograph of the world species and subspecies of the four insect orders Neuroptera (lacewings, antlions, owlflies, and their allies), Megaloptera (fishflies and Dobsonflies), Raphidioptera (snakeflies), and Glosselytrodeia (glosselytrodeans), which are treated here collectively as the superorder Neuropterida. Versions 2.0 to 5.6 of the NSW presented information on neuropterid taxa through a suite of “Catalogue Record” pages, which organized information primarily on the basis of individual available and unavailable names. Beginning with version 6.0, in addition to retaining the Catalogue Record page presentations, the NSW also implements a suite of “Monograph Record” pages, which organize information primarily on the basis of individual valid species and subspecies. The new Monograph Record pages contain several new data presentations that we believe will be useful for NSW users. These include full synonymical listings for all valid species and subspecies, tables containing metadata that index and annotate more than 80,000 figures of neuropterid species contained in the primary scientific literature (organized by valid taxon), links to keys that contain each valid species as a terminal taxon, and country-level geographic distribution lists for each valid species and subspecies.

The latest version of the NSW documents, integrates, and synthesizes a wide variety of systematics-related information from thousands of papers and books published primarily between 1758 and 2018, in more than 680 different journals, and in at least 22 languages. The NSW owes much to the variety of regional synopses, checklists, catalogues, and monographs (see [Classification](#) below) that have been published by many authors over the past several decades. With respect to the cataloguing of basic taxonomic and nomenclatural data, the NSW may be viewed as the successor to Herman Hagen’s 1866 “Hemerobidarum Synopsis synonymica” (for the Neuroptera), Herman van der Weele’s 1910 “Megaloptera. Collections Zoologiques du Baron Edm. de Selys Longchamps.” (for the Megaloptera), and Horst Aspöck et al.’s 1991 “Die Raphidiopteren der Erde” (for the Raphidioptera), which represent the last printed works in which the world species of the orders Neuroptera, Megaloptera and Raphidioptera were comprehensively catalogued. The *Neuropterida Species of the World* is the only modern work that contains comprehensive species-level coverage of all three orders on a global scale, and the only work that includes both extant and extinct taxa at the species level across that taxonomic domain. With respect to species-level monography of the Neuropterida, the new Monograph Record pages of version 6.0 provide a solid digital foundation for continuing efforts to develop a comprehensive, interactive, and interconnected synthesis of current knowledge of the superorder.

Since 2008, data derived from the NSW has been used as the primary global species database for the Neuropterida segment of the [Catalogue of Life](#), the most comprehensive and authoritative global index to the world’s species, and an international resource that is playing an increasingly central role in the efforts of many national and international programs and organizations to integrate and disseminate planetary biodiversity information.

Additional information on several aspects of NSW content and development is given below. For comparative notes on the current and past versions of the NSW, including summary information on the numbers of names and taxa treated, see the [Versions](#) page.

Updates

The NSW is committed to a program of regular enhancement. Improvements include the regular updating of taxonomic and nomenclatural data (e.g., incorporating new taxa and updating classifications in accordance with modern revisions and phylogenetic research), and the addition of new classes of systematics-related data, as such datasets become mature enough for incorporation. Most new nomenclatural and taxonomic changes that fall within the domain of the NSW are incorporated into the project within 12 months of their original publication (but generally sooner). Users who are aware of the existence of new

corrected in future versions. Authors who publish new information that augments or extends our knowledge of the systematics or biology of the Neuropterida are requested to send copies of such works to the author in order to help ensure the timely addition of relevant information to the NSW. All communications – additions, comments, corrections, publications, etc. – should be sent to the author at j-oswald@tamu.edu.

Scope

The *Neuropterida Species of the World* is comprehensive in geographic scope and includes information on both extant and fossil taxa. It provides detailed information on the taxonomy and nomenclature of individual neuropterid species-group names (through its Catalogue Record pages), and synthetic presentations of these and other data for individual valid species and subspecies (through its Monograph Records pages). Detailed information on genus-group names is not provided in this work. Catalogue Record pages are provided for all available neuropterid species-group names databased as of the posted version or release date; Monograph Record pages are provided for all species- and subspecies-ranked taxa treated as valid on the same date.

The following classes of unavailable species-group names are also reported on separate Catalogue Record pages: (1) unavailable "specimen label names" that are known to be explicitly mentioned in the published scientific literature; (2) taxon names that were inadvertently published in an unavailable manner prior to their subsequent publication as available names; and (3) other neuropterid species-group names mentioned in the scientific literature that do not meet the criteria of availability defined in the International Code of Zoological Nomenclature, except for the following classes of names, which are explicitly excluded: (a) known, but unavailable "thesis/dissertation names"; (b) known, but unpublished, "specimen label names", and (c) "misspellings" that do not qualify as emendations (these include, among others, "lapsus calami" names, printers' errors, and names with incorrect nomenclatural gender endings). For the classes of unavailable names that it treats, NSW practice is to include on a separate Catalogue Record page the earliest known use of each such name, and to attribute its authorship to the author(s) of the work in which it appeared (in a manner similar to the customary citation of available names). Throughout the NSW, unavailable names are indicated by an asterisk (*) placed at the end of each use of such names. Citations to subsequent uses of what are deemed to be the same unavailable name are treated as such in the synonymical listings that are displayed on Monograph Record pages, and related notes may be placed in the nomenclatural or general notes fields on both Catalogue and Monograph Record pages.

The long history and diverse taxonomies of the name/taxon "Neuroptera" have been the source of several special problems for the NSW. Used by Linnaeus (1758) as a polyphyletic receptacle of convenience for species now included in approximately ten orders of holometabolous and non-holometabolous insects, the taxonomic history of the Neuroptera has been characterized by successive waves of reductionism, and its concept has been refined over the years primarily through the sequential removal of internally cohesive segregates. During most of its history, multiple different taxonomic concepts of the Neuroptera have co-existed in the scientific literature. One historical consequence of this pluralism has been that for much of its history (particularly prior to ca. 1910) at least one very broad concept of the Neuroptera has existed in which diverse (now extraordinary) insects could be included. Throughout the late 19th and early 20th centuries, many taxa that are now considered extraordinary continued to be placed by some authors within broad concepts of the Neuroptera. However, as the dominant concept of the Neuroptera continued to narrow during this period most of the extant taxa that now fall outside of our present concept of the superorder Neuropterida were removed from the Neuroptera. But, many extinct taxa known only from fossils remained poorly known and weakly documented, and some fossil "neuropteroid" taxa of dubious ordinal position have remained in the group up until the present day, or have only very recently been removed. To better document the taxonomic position of these taxa, a small number of names belonging to species that were formerly included in one or more of the neuropterid orders, but which have since been excluded from the superorder, are also included in the catalogue as separate Catalogue Records. In addition, an attempt has been made to include as separate Catalogue Records all species-group names that have ever been combined with a genus-group name that is currently considered to be valid (or combined with a synonym of such a valid genus-group name) within the current concept of the Neuropterida, even if the valid species to which such names are currently assigned currently lie outside the Neuropterida. These records are included as a convenience to users who have cause to research the early (generally pre mid-19th century) literature of the group.

Classification

The major taxonomic monographs, catalogues and checklists of global or broad regional scope that have been used as “baseline taxonomic references” for this work are shown in Tables 1 and 2 below. The taxonomic information contained in these works (e.g., generic combinations, synonyms and higher classifications) has generally been followed in the NSW, unless altered by subsequent work. Where recent works present different opinions about the proper taxonomic treatment of particular taxa, the author has used his personal judgment in determining the usage presented in the NSW. In many such cases, the General Notes field of the appropriate Catalogue or Monograph Record page contains information on alternative views. The higher classification used in the current NSW dataset is shown on the [Classification](#) page.

Subgenera that are commonly recognized and cited in the recent taxonomic literature are generally included in the combinations shown in the Catalogue Record: Current Combination field, unless phylogenetic work has shown that the recognition of such subgenera is inadvisable because of the likelihood of applying subgeneric names to paraphyletic groups. Similarly, informal aggregates of species denoted by the use of a species-group name interposed between a generic (or subgeneric) and a specific name (i.e., informal “species groups”; Art. 6.2) may be recognized as informal subdivisions of genera where they have been used as such in the taxonomic literature. It should not be assumed that the genera, subgenera, or “species groups” used in the NSW are monophyletic, unless specific phylogenetic data are available to substantiate such conclusions.

Table 1. Baseline Taxonomic References: works primarily restricted by taxon. The works included in this table are relatively recent works that cover broad geographic regions and wide taxonomic domains (worldwide and family wide unless otherwise indicated), or represent phylogenetic works of particular relevance to the taxonomy/classification of the Neuropterida. Revisions/reviews of individual genera have been excluded. Works included in Table 2 are not repeated here.

Taxon	References
Neuroptera	New 1989 [r#6615]; Oswald & Penny 1991 [r#7138]
Ascalaphidae	Ghosh 1988 [r#9656] (E. India); New 1984 [r#4490] (Australia); Penny [1982] [r#5105] (New World); Sziráki 1998 [r#9362] (Asia and Pacific islands); Tjeder 1992 [r#7246] (Afrotropical Haplogleniinae); Tjeder & Hansson 1992 [r#7247] (Afrotropical Ascalaphini)
Berothidae	U. Aspöck 1986 [r#1425]; U. Aspöck 1990 [r#1430] (Africa); U. Aspöck & Mansell 1994 [r#7532] (Rhachiberothinae); Nel et al. 2005 [r#11744] (fossil Rhachiberothinae); U. Aspöck & Randolph 2014 [r#15696] (phylogeny)
Chrysopidae	Brooks 1997 [r#9322]; Brooks & Barnard 1990 [r#6991]; Ghosh 1990 [r#9484] (India); Nel et al. 2005 [r#11761] (fossils); New 1980 [r#4464] (Australia); Tsukaguchi 1995 [r#8409] (Japan); Winterton & Brooks 2002 [r#10215] (Apochrysininae); X.-K. Yang 1997 [r#8956] (China)
Coniopterygidae	Johnson 1980 [r#3144] (North America); Meinander 1972 [r#4121]; Meinander 1990 [r#4147]; Engel 2004 [r#11170] (fossils); Sziráki 2011 [r#14094]
Dilaridae	Monserrat 1988 [r#4308] (Iberian peninsula); Oswald 1998 [r#9236]; X.-y. Liu et al. 2017 [r#16192] (phylogeny)
Hemerobiidae	Monserrat 1990 [r#4311]; New 1988 [r#4514] (Australia); Oswald 1993 [r#7349]; Garzón-Orduña et al. 2016 [r#15951] (phylogeny)
Ithonidae	Riek 1974 [r#5415] (Australia), Barnard 1981 [r#1510] (Rapismatidae), Archibald & Makarkin 2006 [r#11800] (fossils [Polystoechotidae]); Winterton & Makarkin 2010 [r#13510] (phylogeny)
Mantispidae	Hoffman 1992 [r#8849] (New World Mantispinae); Lambkin 1986a,b [r#3615, 3616] (Australia); Ohl 2004 [r#11556]; Penny 1982 [r#5106] (New World); Penny & da Costa [1985] [r#5113] (Brazil); X.-y. Liu et al. 2014 [r#15683] (phylogeny)
Myrmeleontidae	Ghosh 1984 [r#2587] (India); Hölzel 1972 [r#2968] (near Asia), 1987 [r#3001] (Distoleonini); New 1985a, b, c [r#4494, 4495, 4496] (Australia); Stange 1989 [r#6545] (Dimarini), 1994 [r#7533] (Brachynemurini), 2004 [r#11168]; Stange & Miller 1985 [r#5823] (Acanthaclisini), 2003 [r#10553] (Taiwan); Michel et al. 2017 [r#15981] (phylogeny)
Nemopteridae	Hölzel 1975 [r#2980] (Crocinae); Mansell 1983 [r#4008] (Crocinae); Tjeder 1967 [r#6050] (S. Africa); Sole et al. 2013 [r#15013] (phylogeny)
Nevrorthidae	Monserrat 1977 [r#4246]
Nymphidae	New 1996 [r#4465] (Australia)

Osmyliidae	New 1983 [r#4476] (Australian Kempyninae); New 1988 [r#6510] (Irian Jaya); New 1991 [r#7212] (Oriental region)
Psychopsidae	Andersen 2001 [r#10152] (fossils); New 1988 [r#6511] (Australia and Oriental region); Oswald 1993 [r#7341]; Bakkes et al. 2017 [r#16256] (phylogeny)
Sisyridae	Flint 2006 [r#11913] (New World); Monserrat 1977 [r#4246], 1981 [r#4272] (Oriental region)
Megaloptera	Theischinger 1983 [r#6004] (Australia); Oswald & Penny 1991 [r#7138]; New & Theischinger 1993 [r#7701]; Yang & Liu 2010 [r#13492] (China)
Corydalidae	Glorioso 1981 [r#2625] (Corydalinae); X.-y. Liu & D. Yang 2006 [r#11832] (Chauliodinae, phylogeny)
Sialidae	Hayashi & Suda 1995 [r#7774] (Japan); X.-y. Liu & D. Yang 2006 [r#11697] (Oriental China); Vshivkova 1985 [r#6189] (Europe & Caucasus); Whiting 1994 [r#6988] (North America); Wichard & Engel 2006 [r#11833]; X.-y. Liu et al. 2015 [r#15506] (phylogeny)
Raphidioptera	H. Aspöck et al. 1991 [r#6999]; Oswald & Penny 1991 [r#7138]; Engel 2002 [r#10270] (fossils)
Inocelliidae	H. Aspöck et al. 1991 [r#6999]
Raphidiidae	H. Aspöck et al. 1991 [r#6999]

Table Key: [Show](#).

Table 2. Baseline Taxonomic References: works primarily restricted by geographic region. Works included in this table are prominent national or regional faunas that treat the entire Neuropterida (unless otherwise indicated). No attempt has been made to include all recent national faunal lists.

Region	References
Nearctic	Oswald et al. 2002 [r#10033] (Mexico); Penny et al. 1997 [r#8867] (America north of Mexico)
Neotropical	Oswald et al. 2002 [r#10033] (Mexico); Penny 1977 [r#5098] (South America); Penny [ed.] 2002 [r#10000] (Costa Rica)
Palaearctic	H. Aspöck et al. 1980 [r#6747] (Europe); H. Aspöck et al. [r#9847] (western Palearctic); Kuwayama 1962 [r#10914] (Japan); Makarkin 1995a, b [r#8360, 8361], Vshivkova 1995 [r#8504] (eastern Russia); Nielsen 2015 [r#15913] (Denmark); Rintala et al. 2014 [r#15679] (Finland)
Ethiopian	---
Oriental	New 2003 [r#10897] (Malesia)
Australian	New 1996 [r#8585] (Australia); Wise 1991 [r#7137] (New Zealand)
Oceania	Zimmerman 1957 [r#6440] (Hawaiian Islands)

Table Key: [Show](#).

Nomenclature

The fourth edition of the International Code of Zoological Nomenclature ("the Code") has been applied to matters of nomenclature throughout the NSW. Considerable effort has been expended in an attempt to represent information concerning names and nomenclatural acts in a Code-compliant manner, without individual bias. In cases where interpretation of the Code has seemed problematic, external opinions from authorities on zoological nomenclature have frequently been sought and followed.

Gender Matching of Species-Group Names

All species-group names included in the catalogue are searchable (and reported) only in the name forms that are believed to be correct, given the nomenclatural genders of the genus names with which they are combined. The masculine, feminine, and neuter forms of all species-group names, as used in the NSW, are given in the Gender Forms data field of the relevant Catalogue Record page, and the Nomenclatural Gender Forms field(s) on the relevant Monograph Record page. Whether or not these gender forms have been specifically researched for correctness, or are used as preliminary "working" name forms, is also indicated. Approximately 65% of the ca. 31,700 gender form names cited in the NSW have been researched to date.

Data Completeness

During the lengthy period of data collection for the NSW the priorities of data capture have shifted several times to address intermediate objectives. Consequently, not all records are equally complete, and certain classes of information are more thoroughly represented across the full range of species. Some general notes are presented below regarding the relative

completeness of several important classes of NSW data.

Original Publication Data

The original publication data associated with 99.9+% of NSW names have been verified by the author from personal examination of originals or facsimile copies (e.g., photocopies, digital scans, published facsimile reprints [not “separates”]) of the relevant literature. The Verified data field on each Catalogue Record page (and the “verified” flag in the Original Combination field(s) on each Monograph Record page) indicates whether the original publication data have been verified for individual taxon names. The working records for unverified names may contain particularly incomplete and non-standard data entries.

Distribution Data

Summary data on the geographical distributions of essentially all valid neuropterid species and subspecies are included in the NSW (in the “Short Record: Distribution” field on each Catalogue Record page, and in the “Geographic Distribution: Summary Statement” field on each Monograph Record page). In general, where the documented distribution of a taxon consists of five or fewer countries, a complete list of those countries is given. Where a taxon is documented from six or more countries, the summary statement of its distribution is generally briefly described in terms of the known limits of its range. For some larger countries (especially Australia, Canada, Mexico, and the United States, and with somewhat less consistency Brazil, China, and Russia) first-order political subdivisions within the country (e.g., states, provinces) are included in the distribution statements, generally in abbreviated format. In addition, the “Geographic Distribution: Countries” data block on each Monograph Record page provides more complete country-level distribution data in several tabular formats. Most of the baseline taxonomic reference works shown in Tables 1 and 2 have provided significant amounts of distributional information for the NSW. Other distributional data have been derived from hundreds of additional publications, including taxonomic revisions and country and regional faunas. While the geographical distributions reported in the NSW are believed to be substantially correct, as a practical matter it is difficult to keep up with all newly-published distribution records reported worldwide in a group of 7500+ valid species, even at “country level”. Catalogue distribution statements are, however, reviewed and updated as new records become known to the author.

With very few exceptions, the reported distribution data have been derived from records contained in the published scientific literature. The few exceptional records are based on reliably identified specimens examined by the author or other neuropterists. Distributions reported for unavailable names generally cite the country(ies) of origin of the specimen(s) attributed to those names in the publications in which the names originally appeared in unavailable form.

Primary Type Data

Complete or partial primary type data (principally type kind, sex, depository and type locality) are currently reported for ca. 90% of all available species-group names included in the NSW. Many of these data are preliminary, being based on an assessment of some, but not necessarily all, of the relevant literature. Primary type data are actively being updated as additional literature is examined for type-relevant information. In order to provide users with a basis for assessing the status and quality of the primary type data presented for particular names, direct quotes from the source(s) from which the standardized data statements given for each species have been derived are provided in the Type Extracts data field of each Catalogue Record. With few exceptions, only the sources quoted in the Type Extracts field have been used to derive data for type-related NSW fields. Thus, if a type-relevant statement is found by a user in a publication that is not cited in the Type Extracts field, it can generally be assumed that that statement has not been considered when entering data for type-relevant NSW fields. Hence, users should consider such statements, together with the data presented in the NSW, to determine the correct type information of interest.

Fossil Taxon Data

The current version of the NSW contains records for ca. 950 species-group names pertaining to extinct neuropterans known only from fossils. In general, the level of data capture for these species is somewhat less than that for extant species. The capture of data relevant to fossil neuropterans continues to be an active area of NSW development.

Combinations

Access to individual Catalogue and Monograph Record pages is provided through interactive search functionality. User-entered search criteria are used to generate Search Results pages

that display lists of combinations (any different arrangement of genus- and species-group names) that match the user's criteria. More than 20,500 different combinations are available for matching in the current NSW data set. Some searchable combinations involve juxtapositions of generic and subgeneric names that are not technically correct nomenclaturally; these are included only as representations of combinations that are present in the literature. However, all combinations given in the Original Combination, Current Combination, and Current Name fields on Catalogue Record pages (and combinations displayed in analogous locations on Monograph Record pages) are nomenclaturally correct to the best knowledge of the author.

Variety and Form names

In accordance with Art. 15.2 of the Code, names originally published as varieties or forms after 1960 are treated as infrasubspecific, and thus unavailable. Variety and form names published before 1961 have been interpreted as subspecific, and thus available, except in cases where the intent of the original author is very clear that such names were intended to be infrasubspecific (Art. 45.6). Under this interpretation, the vast majority of variety and form names proposed by authors such as Navás and Lacroix are available names. Although some such names have been cited by later authors as either valid names or synonyms, the NSW contains a number of variety and form names that appear to have been overlooked or ignored by previous catalogers and revisers. In this catalogue, previously overlooked variety and form names are generally treated taxonomically as invalid junior synonyms of the species names with which they were originally combined (rather than as valid subspecies of the originally combined species), and are included here in the synonymy of the appropriate valid species (either the originally combined species or its senior valid synonym). While this procedure is consistent with the species placement of these variety/form names by their original authors, and has the added benefit of relegating most of these generally poorly documented names to synonymy, it should be noted that until the types of such names have been located and examined this procedure has the potential to include as synonyms some names that may turn out eventually to be valid species or subspecies names.