Thesis abstract

Cavernicole diversity and ecology in Tasmania

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Extended Abstract
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The five cave zone regions, ten macro-habitats and 44 micro-habitats for invertebrate species recorded from caves in two adjoining karst areas of southern Tasmania (Hastings and Ida Bay) are described. The information for these two karst areas is a sub-set of the 7,861 cave or karst area invertebrate occurrence records listed in six relationally linked tables together with 309 database queries or tabulations (contained in a Microsoft Access database) that documents collections and observations of 1,292 species from 749 occurrence sites in karst and non-karst cave areas of Tasmania. The cave related data and its content including a comprehensive micro-habitat site analysis and species taxonomy detail in a relational database is unique, making it the only cave fauna database of its kind in the world.

The database provides a historical account dating back to the early 1840s when glow-worms were first reported from caves in Tasmania; these are recorded along with accounts of the first cave spider and cave beetle species described in Australia. Together with anecdotal accounts from some of the early entomologists and naturalists who studied Tasmania's cave fauna, the significant role of modern day cave biologists is commended along with their contributions that have vastly expanded our knowledge base. The history of the study of cave biology is discussed, together with the development of cave fauna related ecological terms and theories or explanations for the colonisation of caves and evolution of troglomorphic characters in aquatic and terrestrial hypogean obligates. Following a brief introduction of geomorphic processes, the term "karst bio-space" is introduced to encompass the total living space for all hypogean species in the saturated or unsaturated karst and karst-like cavities, crevices and voids including caves. The concept of cave ecology is expanded to describe the five cave zone regions, ten macro-habitats and the 44 micro-habitats deployed in the detailed analysis of habitat data for species in the Hastings and Ida Bay karst areas. A comprehensive explanation of the database fields is provided, along with guidelines for operating the database and constructing queries to answer questions related to the diversity and ecology of Tasmanian cave species.

Incorporating the most up to date and current taxonomy for cave species in Tasmania, this thesis provides a detailed overview of the diversity of the most common groups of cave dwelling invertebrates and the first records of new species not previously recorded in the speleological or cave biology literature. The major species groups discussed include glow-worms, cave crickets, land snails, springtails, multipedes (centipedes, millipedes, symphylans, pauropods and onychophorans), aquatic and terrestrial amphipods and isopods, bathynellacean and anaspidacean syncarids, aquatic snails, cave beetles and the arachnids (ticks, mites, pseudoscorpions, harvestmen and spiders).

In addition to factors related to cave morphology and hydrological influences (stream recharge or input etc.), the two predominant factors influencing the distribution of invertebrate species are the intensity of karst bio-space development and the input of organic matter, its re-distribution and dilution as it is transported further into the subterranean domain. In most of the wild caves at Ida Bay, this organic material is naturally derived, but at Hastings where tourist caves have been developed, much of the organic matter has been introduced to the cave. The source of organic input in tourist caves is varied and includes the artificial introduction of exotics in the form of tree trunks, rough sawn timber and other plant matter used in the construction of stairs and fern log pathways, plus the litter "inadvertently" placed in caves by natural processes, carried in by humans or dumped as refuse in the course of the continuing development of caves for tourism.

Aside from organic input, the survival and distribution of cave species is dependent on a range of factors including the presence or absence of surface disturbance and the impacts of human use of caves or other components of the karst bio-space, including groundwater. Within the karst bio-space itself, there are the complexities of inter-relationships of species and predator-prey relationships within the subterranean food chain, together with the presence of cave bacteria and other micro-organisms found deep within the dark zone of caves; the dependence of cave species on these micro-organisms has not been studied here in Tasmania. A proportion of the cave species are obligates, totally dependent on the cave for survival and some of these species are cave adapted (troglobites or stygobites). The number of cave adapted species in Tasmanian caves generally exceeds the numbers found in most areas of mainland Australia and five caves in the study area at Hastings and Ida Bay are rated as being at world standard in the number of obligate species.