

## Book review

GUIRY M.D., JOHN D.M., RINDI Fabio & MCCARTHY T.K. (Eds), *New Survey of Clare Island*. Volume 6: The Freshwater and Terrestrial Algae. Dublin, Royal Irish Academy, 2007, 254 p. (Ordering: <http://www.ria.ie>, ISBN: 978-1-904890-31-7, price: € 40.00).

Ever since it was first surveyed in the early 20<sup>th</sup> century, Clare Island in Ireland has been acknowledged as having a rich and diverse freshwater algal flora. The eminent British phycologists William and George West recorded several hundred species in 1910-11 and already it appeared that the many different freshwater habitats on this small, uncontaminated island harboured a high percentage of the algal species found in the British Isles as a whole. To date however, the freshwater algae of Clare Island have never been the object of another comprehensive survey in spite of the high diversity brought to light by West and West during the course of their pioneering investigation.

The book edited by Guiry, John, Rindi and McCarthy attempts to fill a century-long gap by identifying and describing the algal species found in samples collected in 1990 and 2001-2005 from 56 freshwater and terrestrial sites on Clare Island. By comparing the results of this New Survey with those of West and West it ought to become possible to evaluate if and how much overall change in algal diversity has occurred during the years, and relate any such changes to possible environmental ones – for instance, habitat loss, eutrophication and other kinds of environmental perturbation. This sort of information could also be used for applied purposes, especially within the context of the planning, maintenance and control of environmental quality, and management of the environment at large.

From an operational point of view the New Survey is a traditional alpha-taxonomic account whose underlying philosophy is simple: collect, observe and describe. The authors of the individual chapters are internationally renowned taxonomic specialists in their respective algal groups and most have carried out their sampling personally. I think that this is praiseworthy not only for scientific reasons (it is always best to have complete control over all the stages of a scientific investigation if possible), but also because it demonstrates a certain resilience on their part (the weather in Ireland is not always known for being particularly dry and calm, as some photographs in this book very effectively illustrate). I find it very refreshing to see that the authors have the necessary determination for carrying out such tasks as collecting algae by hand from rather cold water bodies and taking them back personally to the laboratory for analysis (senior scientists are not always known for being particularly accommodating towards the idea of carrying out unglamorous manual chores in person).

Following a preface (M.D. Guiry) and a general introduction (D.M. John), there are sections on field and laboratory methods, the freshwater and terrestrial habitats investigated, distribution and ecology, and an introduction to the major algal groups (all by D.M. John). Here the reader is provided with historical background on the West and West investigation, information on collection procedure and fixation (4% neutralised formaldehyde or Lugol's solution, 50% alcohol in the case of diatoms), and it is also underlined that the scope of the work is that of providing qualitative rather than quantitative information. The reader is also introduced to the very numerous permanent or ephemeral freshwater and terrestrial habitats of the island. Among the freshwater ones, innumerable pools of varying size and degree of permanency are associated with the blanket bog

which characterizes the island from a vegetational point of view. The approach to the higher-level systematics of the algal groups dealt with here is intentionally conservative, to the extent that in some of the fourteen “traditional” phyla recognized there is no effort to follow any particular class- and order-level classification. This is a sensible option when one considers that suprageneric classification within those phyla is currently in a state of flux and will be until such time when a lasting consensus is reached.

The book then moves on to the taxonomic sections: desmids (D. Williamson), charophytes (J. Bryant formerly Moore), green algae and most other phyla (D.M. John), diatoms (P. Sims), cyanophytes/cyanoprokaryotes (B.A. Whitton), and subaerial algae (F. Rindi and M.D. Guiry), all of which follow a similar layout: Following brief introductory notes on the morphology, ecology and systematics of the group at hand there is a systematic or alphabetical list of species (many of which are illustrated with line-drawings or photomicrographs, the latter largely provided by professional photomicrographer Peter York), with brief descriptions similar in style and length to those found in *The Freshwater Algal Flora of the British Isles*<sup>1</sup>, to which all the authors of the present book also contributed as authors and editors. Finally, there is a section giving a summary of results and conclusions (D.M. John), tables listing all the algal and diatom species found on Clare Island, and a 5-page or so glossary of descriptive and other specialized terms used in the book.

The main findings can be summarized as follows. The non-marine algal flora of Clare Island now stands at just over 800 species, a figure which overall represents 20% of the 4000 or so non-marine algal species known in the British Isles, with desmids and cyanoprokaryotes numbering about one-third of known British species in their respective groups. The total number of species makes the island the most diverse region of the British Isles in relation to its size as far as the non-marine algae are concerned. The most species-rich groups on the island are the green algae, especially desmids (just under 400 species in total), the diatoms (just under 300 species) and the cyanoprokaryotes (about 100 species). Other groups are represented by few or very few species each (1 to 14). However, the authors point out that this result is probably very negatively biased by the little time spent during the New Survey in identifying the lesser known groups (especially the flagellated algae), a situation which is attributed to the lack of available taxonomic expertise. Two water-bodies in particular, Lough Leinapollbauty and Creggan Lough, are the single most diverse algal habitats on Clare Island. There are no clear-cut conclusions concerning any possible changes in algal diversity since the time of the West and West investigation. A number of species found in the old survey have not been found again, and vice-versa numerous species detected during the New Survey were not found by West and West. Several different explanations can be envisaged for this, ranging from basic problems with validating or re-identifying species listed by West and West, to true changes in diversity as a result of environmental perturbation. The authors point out that it is too early to make definitive statements; the knowledge of Clare Island algae is still incomplete, and seasonality has been taken into very little account both in the New Survey and the old one.

I think that the New Survey makes a significant step forward in the knowledge of the Clare Island algal flora by providing very useful biodiversity

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1. John D. M., Whitton B. A. & Brook, A. J. (eds), 2002 — *The Freshwater Algal Flora of the British Isles. An identification guide to freshwater and terrestrial algae*. Cambridge, Cambridge University Press.

information. The quality and reliability of the taxonomy is assured by the authors' long-standing experience and the excellent illustrations will be a useful tool for other workers needing to identify Clare Island algae. In this respect it is somewhat regrettable that not all the algae found are illustrated, especially some of those not identified to species level. Similarly, taxonomic keys would have been another useful identification tool for other workers; at present there are none and future surveys might want to consider including simple keys at least for the genera.

From the point of view of the wider significance of the results, as far as I can see no species reported here are described as new. It is interesting to compare this finding with the so-called "guess-estimates" of numbers of total (= described + undescribed) species in the various groups of organisms which were fashionable in the early 1990's<sup>2</sup>. Based on those estimates it could be predicted that the rate at which new species would be discovered and described in the future would be high in most groups (if not all), especially during thorough investigations such as the Clare Island New Survey. Why this prediction has not materialized in this case is unclear, and simple anthropological explanations – whereby "guess-estimates" may have been over-inflated in order to make a case for increased availability of research funding on such and such group of organisms to the detriment of others – cannot be ruled out entirely. Additionally, there might be new species yet to be discovered in the neglected groups mentioned below. Biogeographically, many algal species found on Clare Island appear to be common elsewhere in the British Isles and worldwide. It would have been interesting to address the question of the apparent scarcity of endemisms, particularly in the case of the unicellular algae. The occurrence of cosmopolitan versus restricted geographical distribution in the microbial realm continues to generate debate worldwide<sup>3</sup> and it is investigations of the New Survey kind that can add reliable and testable information to the ongoing discussions.

I agree with the idea that the species diversity reported in the New Survey within the "neglected" groups has been largely underestimated, particularly in the case of flagellates such as chrysomonads, dinoflagellates, euglenoids (especially *Trachelomonas*, an extremely large genus which often presents itself with a good number of species when found at any particular site) and cryptomonads. I think it would be useful if future surveys made an additional effort for these groups. The argument of available taxonomic expertise is a valid one, but my feeling is that at least some of the few existing specialists would be happy to lend a hand if asked to do so. I would also suggest that future fixation protocols might benefit from the inclusion of other chemicals in addition to those used in this instance, so as to preserve as many flagellate cells as possible. The decision not to include heterotrophic forms is one of choice, but I think that in future it would be useful to take heterotrophs in due account. All of the flagellate groups mentioned above have phago-, osmo- or mixotrophic representatives, which might help to provide a more complete picture of diversity in relation to the environment. For instance, mixotrophs may have the ability to switch between heterotrophic and photosynthetic nutrition according to local variations of environmental factors such as nutrient availability, density of food particles/bacteria and others. Finding a given assemblage of mixotrophs feeding in one way or the other at a particular site, therefore, might provide clues towards

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2. Andersen R. A., 1992 – Diversity of eukaryotic algae. *Biodiversity and Conservation* 1: 267-292.

3. Finlay B. J., 2002 – Global dispersal of free-living microbial eukaryote species. *Science* 296: 1061-1063.

Foissner W., 1999 – Protist diversity: estimates of the near-imponderable. *Protist* 150: 363-368.

understanding local environmental quality, or help to confirm information on environmental quality obtained using other measures.

The lack of clear indications on possible biodiversity changes since the time of West and West suggests that a newer survey might benefit from the inclusion of quantitative measures such as formal ecological diversity indices, which might make this question easier to address. While a full quantitative survey of all the sampling sites studied here is probably unrealistic, perhaps the particularly high species richness of Lough Leinapollbaity and Creggan Lough makes them good candidates for detailed case-studies aimed at long-term qualitative monitoring of algal diversity. Any such investigations would also have the benefit of introducing seasonal sampling in the survey, which is mostly lacking so far.

In summary, in spite of having suggested a few areas for possible improvement I think that the quality of the New Survey is very good. I recommend the book for purchase especially by institutional libraries because I think that it provides a baseline reference in its field. Individual users interested in algal morphology, taxonomy and ecology will also find it useful and the price is quite reasonable for such an illustrated book containing this much information. The editors and the authors ought to be congratulated for their hard work and enthusiasm, and I wish them an even more successful newer survey of Clare Island sometime in the future.

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