

COMMENT

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AGONIZING OVER LIMNOLOGY *CComro&nhJ*

Comment from J. Gwynfryn Jones

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Some of you may have followed the exchange of views on the future of limnology which has appeared in *Limnology and Oceanography* (Jumars 1990; Wetzel 1991a, b; Kalff 1991). I would not wish to prolong the debate, but I do feel that there is a peculiarly British perspective to the problem which has not been considered to date. Amongst the problems identified by the authors listed above are "the failure of political leaders to appreciate the importance of freshwater resources and the failure of teachers of limnology to produce scientists who can deal effectively with the physics, chemistry, and biology of the resources". One solution proposed is to provide better and more integrated teaching in schools of limnology. Whether limnology (or environmental sciences, or even ecology) is a suitable subject for a first degree without some previous specialisation is a matter for debate. Some would argue that it would be more appropriate for an advanced degree course, and that limnological problems are better tackled by multidisciplinary institutions than by generalists.

In any event, Kalff (1991) argued the "contemporary limnology is . . . increasingly irrelevant in helping to solve the major environmental problems and . . . unable to prepare students . . . to contribute to resource management". This was considered to be in sharp contrast with the role of limnologists in eutrophication research in the 1970s. Work on acid rain and contaminants requires a basin-wide, integrated approach for which limnology is poorly prepared.

Whereas oceanography was seen as benefitting from the recognition by the public that the oceans' fate will affect mankind as a whole, "freshwater resources are valued sufficiently only when crises occur", (there has been a very slow realisation of the current water shortage). I would argue that, in the UK at least, the limnological community is extremely well equipped to deal with the problems of the 1990s. Over the past decade we have seen successful programmes on acid rain and

the expertise is available to tackle problems associated with global climate change. We have demonstrated that fundamental research can be translated into extremely effective and sensitive freshwater management. The erstwhile Thames Water Authority estimated that research of kind performed by the FBA had saved the Authority approximately £60 million in operational costs. More recently, research at the FBA and IFE by Colin Reynolds (reservoir, lake and river phytoplankton modelling), Malcolm Elliott (brown and sea trout population ecology), John Wright and colleagues (RIVPACS and land use) and Bill Davison (reclamation of acid lakes) has shown that fundamental knowledge can, and should, be applied for the greater good of the freshwater environment. This success has, to my mind, brought its own problems in Britain, particularly in raising the spectre of "near-market" research. I do not believe that there is a lack of intellectual ability and necessary back-ground knowledge to solve the problems of this decade. What concerns me is the lack of investment in fundamental research to provide the information necessary to solve the problems of future decades. Clearly the Research Councils have been constrained by their budgets, but new proposals for community research programmes have failed to find favour because the research was considered to be too close to the responsibility of the National Rivers Authority or even the Water Companies.

The NRA will have its own programme, but it is only natural that this programme will be geared to its immediate policy objectives. Which organisation will, then, take responsibility for the volume and quality of fundamental and strategic research called for by the authors in *Limnology and Oceanography*? The founding fathers of the FBA provided a secure base for this century; we must now turn to the new Office of Science and Technology to see whether we will be prepared for the next century. One thing is clear, a blanket call for more funding will not be successful. We must be prepared to argue our case on the basis of past successes and a clearly defined programme for the future.

References

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- Kalff, J. (1991). On the teaching and funding of limnology. *Limnology and Oceanography*, 36, 1499-1501.
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LAKE OUTLETS: A HABITAT WORTH PRESERVING *C^mntzir'J***Comment from Donald Scott**

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The article by Roger Wotton (1992) on suspension feeders in lake outlets prompts me to remark on the exploitation of these animals by others, such as fish. If the density of these suspension feeders is high then it seems likely that there will be some exploitation of this production, and of course there is. In a study of trout populations in New Zealand rivers (Teirney & Jowett 1990), 158 sites were examined by drift diving; their results for trout are reported as numbers per kilometre, kilograms per kilometre, and grams per square metre. As there is considerable variation in river size in the series investigated, ranging from 4.5 to 100 metres in width, the biomass per unit area is used here for comparison. There are more lakes in the South Island of New Zealand than in the North Island, and out of the South Island series of 73 sites, five lake outlets were examined. A further two sites were examined on two of the rivers a short distance downstream from the outlets. With such a small sample size for lake outlets, a Mann-Whitney test was used to compare biomass, and the results are shown in Table 1.

Table 1. Comparison of trout biomass (grams per square metre) in lake outlets and rivers, South Island, New Zealand.

<i>Site categories</i>	<i>Biomass</i>	<i>S.E.</i>	<i>P</i>
5 outlets + 2	6.92	1.74	0.0002
66 river sites	1.56	0.18	—

While a larger sample size for the outlets category would be desirable, the fact is that seven lakes in the South Island have been dammed to generate hydro-electricity, and the samples still indicate a greater trout biomass in this category than for rivers in general. The species involved are brown trout (*Salmo trutta* L.) and rainbow trout (*Onchorhynchus mykiss* Walbaum). Both feed on caddisfly (Trichoptera) pupae and adults, and on mayflies (Ephemeroptera), and although I have not so far located any estimates for the numbers of benthic invertebrates, I would expect high densities at the lake outlets. An associated question is the extent to which high density extends downstream.

I am sure that workers elsewhere have noted this relationship, and if this comment stimulates someone (a Canadian worker?) to produce a wide-ranging review of what is now a finite and decreasing habitat, I shall be delighted. In the South Island of New Zealand we have lost seven out of 15 large lake outlets which have been obliterated by dams.

Perhaps it is time we fully recognised that these outlets and their associated *fauna and flora* represent a highly *productive community* in a restricted but valuable habitat.

References

- Teirney, L. D. & Jowett, I. G. (1990). Trout Abundance in New Zealand Rivers: an Assessment by Drift Diving. *New Zealand Freshwater Fisheries Report*, No. 118, 1-31.
- Wotton, R. S. (1992). Animals that exploit lake outlets. *Freshwater Forum*, 2, 62-76.