497

3/77

INSTITUTE OF TERRESTRIAL ECOLOGY
(NATURAL ENVIRONMENT RESEARCH COUNCIL)

AN INTERIM REPORT TO THE NATURE CONSERVANCY COUNCIL ON THE MONITORING OF LOCH LEVEN MACROPHYTES

(NCC/NERC CONTRACT NO F3/03/73 : ITE PROJECT NO 497)

A E BAILEY-WATTS

12 HOPE TERRACE
EDINBURGH

MARCH 1977

MONITORING OF LOCH LEVEN MACROPHYTES

This report outlines, first, the schedule of work done since the project was proposed, and, second, the plans for 1977, with special attention to field work. Reference is made to the NCC contract, particularly where a modification of this contract is likely to result in increased scientific benefit. Finally, a note is made of the integration of this work and extensions of it, with other studies in the ITE Loch Leven Project Group and the Loch Leven Research Group, involving outside organisations.

Work to date

Initial proposals for renewing macrophyte research, following Mr. R.H. Britton's resignation, arose from an NCC (Scotland) request (April 1976) for an overall monitoring package for Loch Leven; this package was to include hydrological, zoological and other botanical work.

In May 1976, Dr. A.E. Bailey-Watts (Loch Leven Project Group Leader) discussed with ITE Management a possible project on macrophytes; the level of funding proposed by NCC (£3000 pa) indicated the order of research effort expected.

The project leader was assigned in July, by which time assurance had been given by the NCC that it would support the work for at least 3 years. By the end of August, a formal project plan had been completed and some of the relevant scientific literature read, including all published work on Loch Leven macrophytes, and reviews of higher aquatic plant studies elsewhere.

During September, several possible field sampling strategies were discussed (with Mr. P. Rothery, ITE Biometrics); in addition, with considerable help from Mr. A. Alison (NCC Warden for the Loch Leven NNR) and Mr. P. Ainsworth (ITE Coastal Ecology), the possibility of a concurrent programme of macrophyte assessment based on aerial photography was examined.

In order to gain field experience and to assess the time necessary for sampling and attending to taxonomic problems, two field trials were done in October. The conclusions drawn from these trials are incorporated into the following section.

Main findings and proposals for future work

As a statistically rigorous sampling procedure has yet to be tested, there are no numerical data to report. The following comments are confined, therefore, to

general impressions gained from the activities described above, but with the emphasis on the plans, as they stand at present, for field work in 1977-78.

Results of the 1972-1975 studies indicate that rooted vegetation away from the loch edge consists largely of submerged species (dominated by Potamogeton filiformis Pers., P. pectinatus L. and Zannichellia palustris L.). The next most important "macro-plant" assemblage is composed of algae; these comprise forms belonging to the Classes Charophyceae (especially Chara aspera Willd., and Nitella opaca Agardh) and Ulothricophyceae (including Cladophora and Stigeoclonium species). Considering the total assemblage as a whole, plant abundance appears to decrease with increase in depth, although sediment type and subjection to wind-induced turbulence affects the relation. Figure 1a shows areas of greatest plant abundance as evidenced from the previous work. Currently, very few plants are found in depths greater than 1.5 metres (cf. depth contours in Figure 1b).

It is as well to justify the time spent on these general matters and the formulation of a new sampling strategy; adoption of previous methods might appear to be the more efficient course to have followed, as at least some numerical data for 1976 would have been gained. However, adoption of the previous scheme without modification, would have contributed little to achieving the aims of the contract.

Major flaws in the earlier work are:-

a. inadequate sampling, e.g. insufficient allowance made for the spatial disposition of transects of the macrophyte community, (cf studies on selected stands of single species by Prof. D.H. Spence et al.). This limits the analyses to which the results can be subjected and thus our quantitative understanding of the macrophyte contribution to the whole ecosystem.

b. the temporal distribution of sample collections suggested, but did not account for, either seasonality or annual variation in plant performance.

c. the method of estimating abundance (drag rake "fullness") was subjective and allowed little chance of repeatability by future workers.

The new sampling strategy has been developed in several stages; its current form is as follows. First, the population to be sampled will be restricted to the area of water less than 5 m deep (Figure 1b); as this is still quite large

(10.8 km^2 and 80% of the loch total area), sampling effort will be concentrated mainly in the 0-3 m zone (6.6 km^2 and 50% of the loch total area). This zone is to be stratified into sub-zones for sampling purposes. Figure 2 shows the approximate disposition of these sub-zones, one of which is shown subdivided further (into 3 parts) to ensure adequate coverage by random transect sampling.

Transect sampling will involve:-

a. drag raking along straight lines, perpendicular to the shoreline, in contiguous 50-, 75- or 100- metre sections. The drag rake was adopted in the previous studies; whilst it has certain shortcomings, it appears to be the only feasible method for assessing a plant community covering 5% of the sampling population,

b. recording of water depth at the boundary of each section of transect,

c. weighing fresh the "catch" from each section and subsampling by weight for species composition and dry weight analysis.

This programme will detect the dense stands of plants in which more conventional techniques of biomass estimation (e.g. coring) can be tested. These results will be compared with those of the drag rake method. The schedule may have to be modified, following early field trials, to assess its general feasibility and its sensitivity with respect to spatial variation in plant abundance.

The contract states "sensitive estimates of macrophyte populations will be assessed in July/August". As inadequate attention has been paid to seasonality in the previous work, it is hoped that the new programme can be repeated at, say, 6-weekly intervals, from April to October; this procedure would result in a time series of 4 or 5 points within one calendar year.

Advice has been sought regarding the potential of aerial photography as an aid to this study. A camera designed for such purposes has been borrowed from the ITE Colney station. Further discussions on techniques are planned for late March 1977 with specialists at the Glasgow University Geography Department. At present, a support bracket is being made for mounting the camera on a small 2-seater aircraft based at the Loch Leven Glider Club, and which is to be put at the disposal of this project; owing to the generosity of Mr. R. Rozycki, C. Eng., the costs will be minimal.

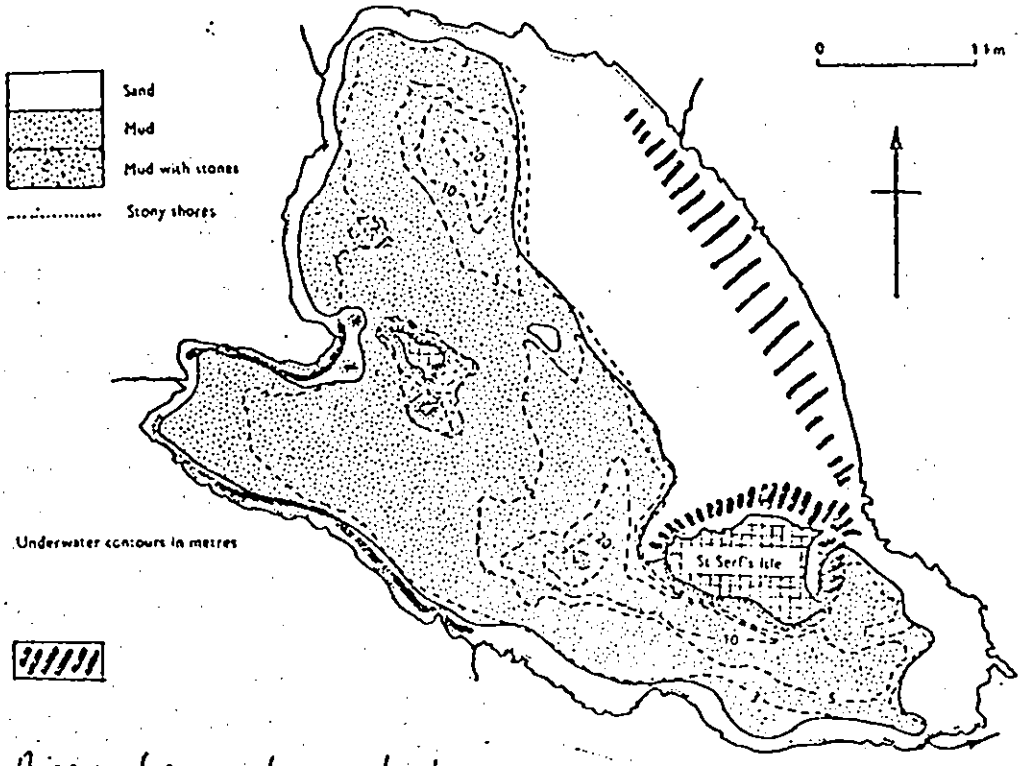
Links with other studies on Loch Leven

This work integrates with other studies done under the Loch Leven Project Group (ITE) and Research Group (ITE plus outside organisations). Both the NCC and the Geography Department at Glasgow contribute to discussions, within the Loch Leven Research Group in particular. In addition, a recently-awarded NERC (CASE) Studentship to Dr. Bailey-Watts and Professor Spence (St. Andrews University) is to support work on the inter-relations between macrophytes and their investment of algae.

Concluding remarks

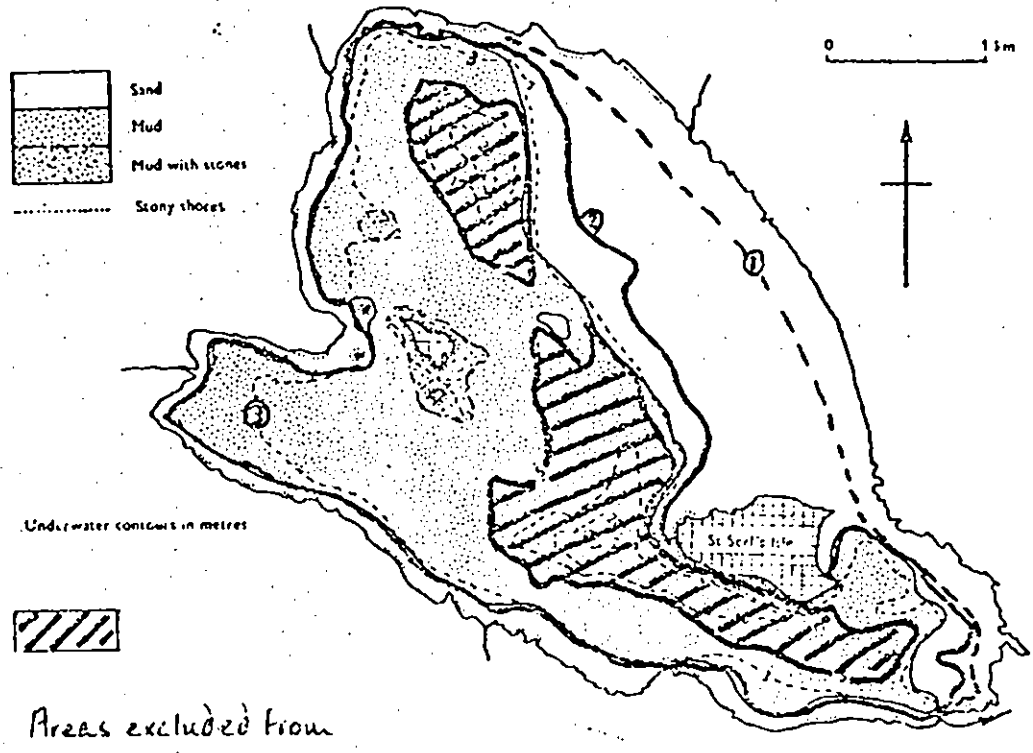
As a comparative newcomer to aquatic macrophyte work, it is inappropriate for me to comment in detail at this stage. However, it is felt that monitoring studies, even at this preliminary level, are rare; previous research has apparently only dealt with water bodies in which macrophytes are the dominant primary producers. In Loch Leven this is far from the case, although the charophytes were extremely abundant earlier this century and may become so again. In spite of the present low density of macrophytes, their importance to some bird species is undoubtedly high. The aquatic plants also play an important role in modifying the character of the sediments and many of the physical, chemical and biological interactions of the sediment-water column in their vicinity.

FIGURE 1a



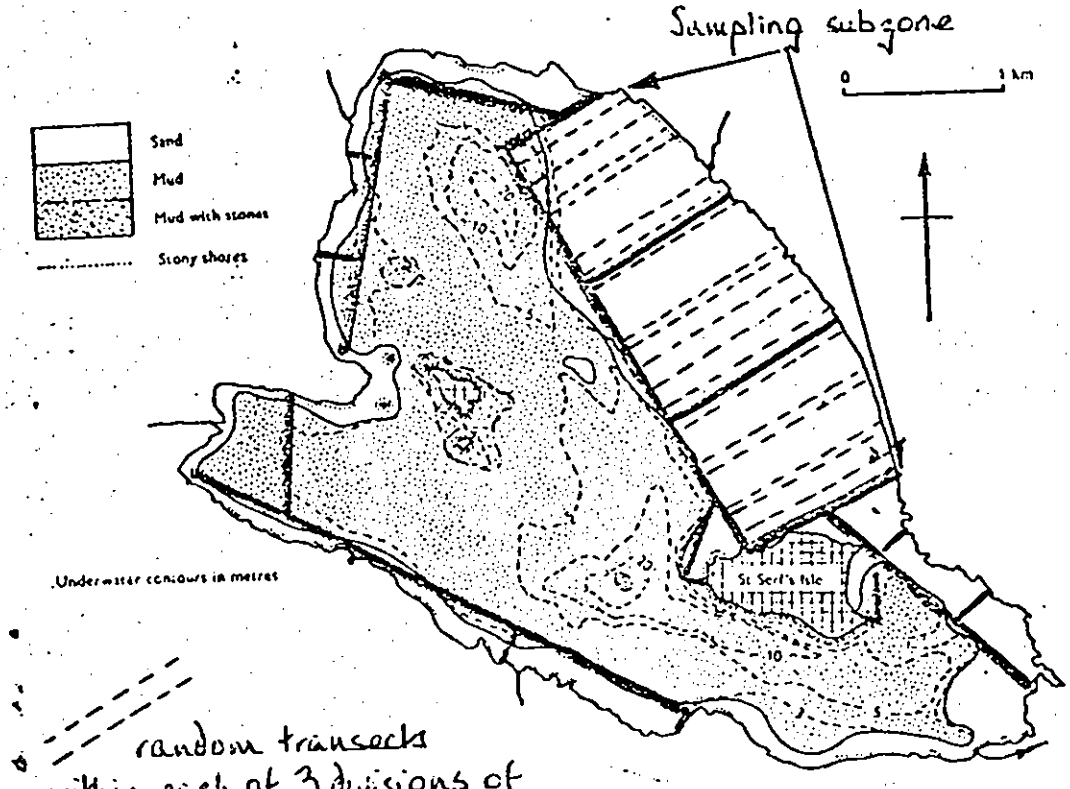
Areas of current greatest plant abundance

FIGURE 1b



Areas excluded from the current sampling propocals (being >5m deep)

FIGURE 2



random transects within each of 3 divisions of a subzone