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INSTITUTE OF TERRESTRIAL ECOLOGY
(NATURAL ENVIRONMENT RESEARCH COUNCIL)

SECOND 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)

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MONITORING OF LOCH LEVEN MACROPHYTES

Report on progress during the year ending March 1978

Introduction

This report outlines progress during the second year of the currently projected three-year surveillance programme on the aquatic vegetation of Loch Leven NNR, Kinross, Scotland. Detailed results from field sampling and photographic reconnaissance will not be covered until the third year (? final) report; however, brief reference to these is made in relation to the realisation of the main objectives of the work. On the basis of findings so far, some recommendations are made for the next (and future?) year's programme. It is hoped that a fairly immediate customer response is forthcoming on these points, with any proposals to extend the contract. Finally the general nature of related projects on the Loch Leven ecosystem is mentioned.

Progress 1977/78

The previous report appraised the results of earlier work on the aquatic vascular and macro-algal communities in Loch Leven. The main point made was the need for a repeatable sampling strategy that took better account of temporal (seasonal) variation in plant abundance and species composition.

To these ends, a stratified random sampling scheme, still based however on drag raking, was proposed. During the past year, this scheme has been put into practice and data will be available eventually from sampling done at approximately six-weekly intervals from May to September. A somewhat different field trial was done in October, aimed at establishing permanent quadrats (25 x 25 m or 50 x 50 m) for, amongst other things, a fairly detailed account of temporal variation in shoot density.

This programme has established that:-

(i) Overall plant density is still (cf earlier findings outlined in last year's report) greatest on the mainly exposed NE side of the loch, although small pockets of absolute maximum density occur in sheltered and very shallow areas bordering the northern edge of St Serf's Island.

(ii) From a 'whole ecosystem' viewpoint, the major angiosperm constituent is Potamogeton filiformis Pers.; Characeae are as abundant in similar areas, but often at different depth zones.

(iii) Plant abundance is greatest in July. Even then, however, eg over much of the extensive NE shore, a drag raking of ca. 100 m yields currently only a few grammes dry weight of plant material. Maxima of 40-50 g are recorded in the shallows (less than 0.5 m).

(iv) Absolute greatest densities occur in a 'patch' of around 0.25 km² (25 ha) north of St Serf's Island.

Two major problems arise from this work; they each are basically a function of the size of the area under surveillance (the 0 to 3 m zone alone totals 6.6 km²) and the now established fact of extremely low average plant density. The first, is the large manpower necessary; experience so far shows that 3 people are needed in the field and each sampling takes at least two full days (depending very much on weather conditions). Second, accurate position fixes whilst on the water are essential, but have proved extremely difficult to establish by the technique of magnetic bearings. The manpower problem could be overcome by restricting the major 'whole loch' - surveillance to a single trial, presumably in the summer. Total staff costs would be reduced, but, since an account of seasonal variation is necessary, a programme of less extensive repeat sampling must be established. As regards position fixing, some other, perhaps far more sophisticated, technique should be employed; any developments along these lines would be of wide application to aquatic field sampling. The potential application of aerial photography to the Loch Leven macrophyte project was considered partly in an effort to overcome some of these problems. It was felt that, under the favourable conditions of clear water (at phytoplankton population minima) and fairly calm weather, aerial photographs might produce a standard pictorial record of plant cover over the whole shallow region. Whilst more work on this subject is needed, the results obtained so far are encouraging. The attached pair of colour prints are an example.

The following points should be noted:-

A. Advantages:

- (i) the aerial coverage possible is far in excess of that achievable with the conventional 'ground' sampling;
- (ii) present arrangements with the lochside Gliding Club enable photographic runs to be carried out extremely cheaply - a full coverage run at one altitude costs approximately £30 (excluding film and processing charges);

(iii) long-term changes in total vegetation cover could be assessed;

(iv) with more experience, and together with 'calibration' runs using ground information at a few known reference points, different plant associations could be distinguished.

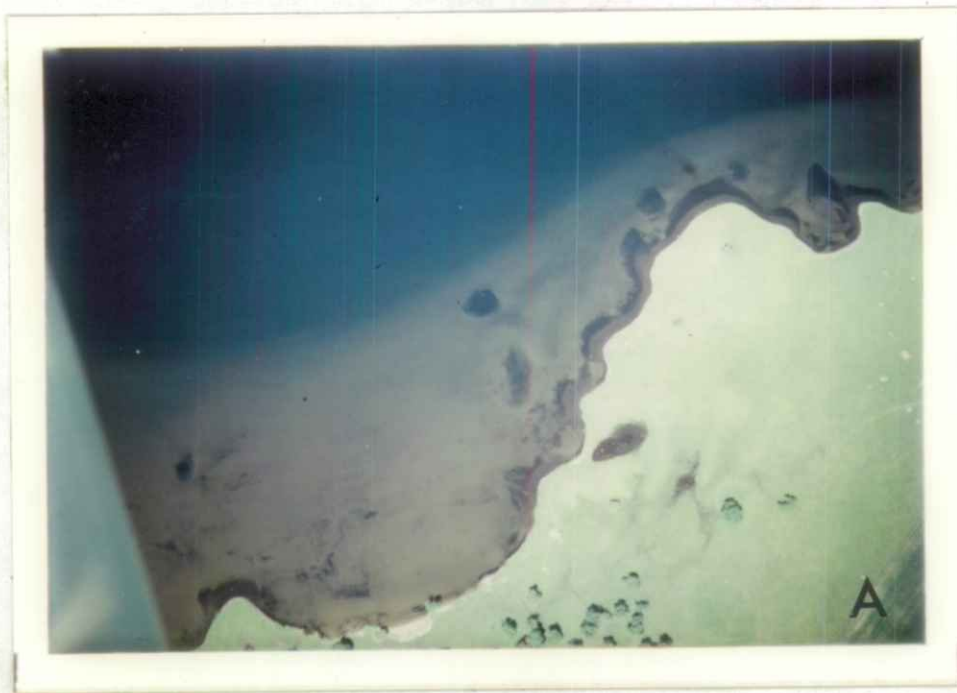
B. Disadvantages:

(i) aerial runs have to be done as and when the right meteorological and water clarity conditions coincide -- a co-occurrence which is relatively infrequent.

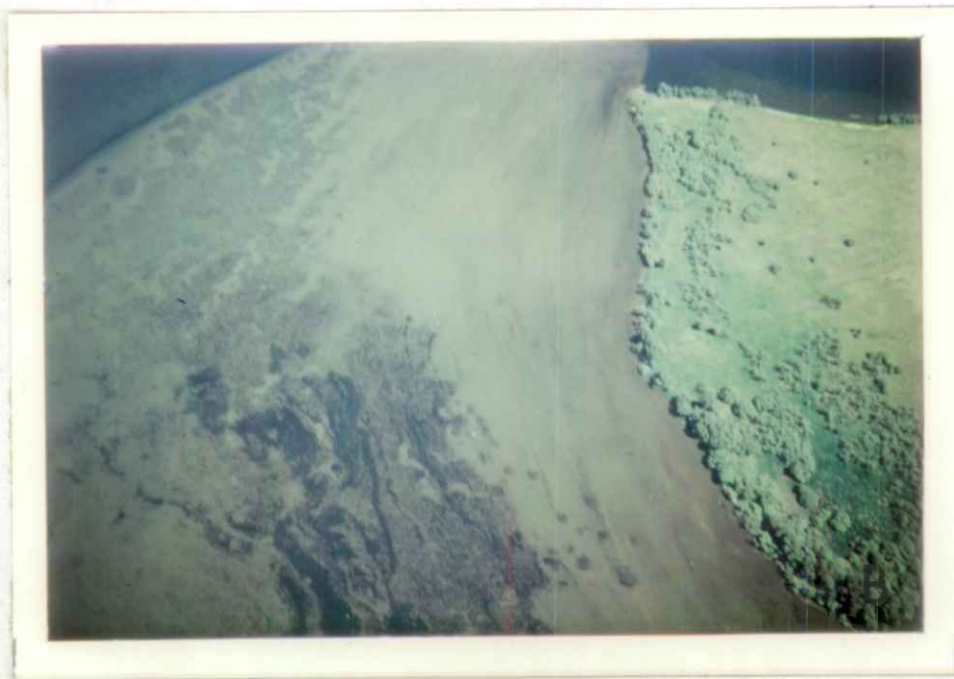
Recommendations for 1978/79

The current plan is to investigate the possible greater reliance on aerial sensing for the extensive loch coverages. At the same time, ground reference points would be worked by conventional field sampling. It is hoped also that these methods might be combined with fairly frequent quadrat work throughout the 'growing season' as part of an investigation of the interactions between macrophytes and their algal epiphyton. Certainly, without a far more reliable position fixing technique, the time and effort spent on the whole loch assessment of plant cover, eg by drag raking, is considered relatively unrewarding.

FIGURE 1



A Shallow water area off Carden Point on the south shore of Loch Leven 21st June 1977 taken from 2000 ft. Restricted areas of benthic macro-algae including Charophyta are apparent as dark patches inshore. Deeper water offshore shows as uniform dark blue; blue-grey object at lower left is the motor-glider fuselage.



B Shallows (ca 0.5m) to the north of St Serf's Island (on right of picture), Loch Leven 21st June 1977 taken from 2000 ft. Dense beds of Potamogeton filiformis and Chara spp blue shades on otherwise fairly clean sand. Uniform dark blue areas at top left and right are zones of deeper water.