

LOCH NESS & MORAR PROJECT

Supported and approved by The Scientific Exploration Society

PATRONS: NORMAN COLLINS

THE HON. SIMON FRASER, MASTER OF LOVAT.

THE RT. HON. LORD GLENDEVON, P.C.

DAVID JAMES, M.B.E., D.S.C., M.P.

SIR ROBERT McEWEN, Q.C.

SIR PETER SCOTT, C.B.E., D.S.C.

Field Leader: Adrian J. Shine F.R.G.S.

PAGE 1

Report on Easter 1979 Exercise

Following the decision to extend our activities to Loch Ness, a short reconnaissance was mounted between 13th April and 20th April 1979 with the following objectives:

- (1) To make administrative arrangements for a base camp and P. R. centre. Approaches were also initiated with the Highlands and Islands Development Board with a view to obtaining support for our work.
- (2) To familiarise ourselves with the general geography and conditions of Loch as a basis for our future plans.
- (3) To gain an understanding of the bathymetrical characteristics of the Loch with a view to the application of underwater equipment. In particular, we wished to resolve the recent controversy over the Loch's maximum depth which resulted from a report from a submersible of depths of up to 970 feet. These depths are greatly in excess of those recorded by Murray and Fullar's bathymetric survey, their greatest depth being 754 feet. There have also been reports of liquid silt several thousand feet deep overlaying the bed of the Loch.
- (4) To discover where the largest accumulations of fish are to be found and, in particular, the depth to which they extend.
- (5) To carry out test photography underwater to help in the design of underwater camera equipment for use in Loch Ness.
- (6) To make a general plankton collection as the starting point for a biological survey of the Loch.

The following officers took part: B. Bell, R. Gardiner, N. Ray, R. Raynor, R. Shepherd, A. Shine, S. Volk. Valuable help was received at Loch Ness from R. Raynor and Mr. G. Menzies.

Regarding our objectives:

- (1) We are pleased to report that a suitable base camp site near DORES has been agreed. (Ballachladaich Farm) and that facilities for a P.R. Centre are being arranged.
- (2) Loch Ness has many advantages from a logistics point of view due to the roads and villages around its shores. A survey of the shore-line was completed to determine the possible sites for out-stations and areas affording some shelter for boats. In comparison with Loch Morar, the shores are very steep and rocky. There are very few beaches or bays to give shelter. This must be borne in mind when planning boat work. This is especially so due to the water surface conditions which can be

severe owing to the prevailing north westerly winds blowing directly down the Loch which provides a 20 mile "fetch" to the resulting waves.

- (3) We were equipped with a Kelvin Hughes N. S. 48 Echo Sounder working on a frequency of 35KHz, through the help of Mr. Thomas of the Operations Sub-Committee. This machine is of the precision necessary to resolve the problems posed. These arise from the conflicting results of various surveys and experiments which have taken place over the years. The Bathymetric Survey of the Scottish Lochs, 1897 - 1907, carried out by Murray and Pullar was the first, and last, comprehensive survey. Between 1903 and 1904 the team took over 1700 soundings in Loch Ness with a wire sounding machine. Their comments are as follows:

"Previous to 1903, no systematic soundings had been made in Loch Ness with the exception of those taken early last century at the time of the making of the Loch and a maximum depth of 774 feet (129 fathoms) obtained. The Lake Survey did not find so great a depth, the maximum obtained being 751 feet (125 fathoms) at a spot almost in the centre of the Loch $1\frac{1}{4}$ miles to the south of URQUART BAY. On the old charts supplied by the canal authorities, the soundings in the shallower portion of the Loch practically agree with those taken by the Survey, but in the deeper water the depths differ by 5 or 6 fathoms, and in some cases the differences are greater. Similar differences have occurred in other Lochs which have been sounded by means of rope lines. Loch Morar, which lies in the South West of Invernesshire, and which in all probability is the deepest Loch in the United Kingdom, was stated to have a depth of 1,080 feet but the greatest depth obtained by the Lake Survey during many hours search over the limited 1,000 feet area was 1017 feet "

These differences result, of course, from the greater stretches of rope as compared to wire and also to the far greater difficulties of ensuring that the greater cross-section of rope is truly perpendicular. At Loch Morar over the past five years we have come to respect and admire the work of the Lake Survey and although a slightly greater depth of 1,028 feet has been recorded and two new areas of 1,000 feet discovered these are partly due to the increase in Loch level due to the building of the hydro-electric dam. The maximum depth of Loch Ness was accepted to be 754 feet until 1969 when the Vickers Pisces submersible was undergoing trials in the Loch. The following is the report of the Master, Captain W. Eastor:-

"In all 47 dives were made in Loch Ness (Urquart Bay) varying between 120 feet and 820 feet, these dives represented some 250 hours of bottom time, during these dives certain scientific data was obtained and the

deepest recorded depth off Urquart Castle, some quarter of a mile south, of 970 feet was registered by sonar." Clearly this discrepancy in the maximum depth over 200 feet, is most surprising and the position over this fundamental fact of geography in our largest lake is highly unsatisfactory. One explanation advanced stems from a recent claim by an American team that the steep Loch walls were indicated by sonar to extend as much as 3,000 feet beneath an extremely liquid ooze covering the Loch bed. Here again this would have most important consequences when applying under-water equipment. Accordingly we took considerable precautions to ensure the accuracy of our observations. Echo-sounders, of course, rely upon a sound pulse transmitted to and reflected from the bottom.

In precision echo-sounding it is most important to take into account the factors of salinity and temperature. Great complications arise through the formation of thermal layers in lakes during the summer, these vary in thickness and cause problems through the differing speeds of sound in waters of varying temperatures. Salinity also has an influence. For example an echo-sounder calibrated for use in sea-water will indicate a greater than actual depth when used in fresh water. Also thermal-clines can cause interference and refraction of sonar beams. Our exercise, therefore, was timed to take place before the warming of the spring months resulted in stratification and whilst the Loch was a constant temperature.

Prior to the commencement of the search, the echo-sounder was set for an expected salinity of zero and a temperature of 5°C. An empiric bar check, consistent with hydrographic practice, was then made of the comparatively great depth of 100 metres (300 ft) which showed the machine to be precisely accurate. This is a simple process of lowering a sonar target on an accurately calibrated wire and checking this known depth against the echo-sounder scale. It is a feature of the Kelvin Hughes MS 48 that it incorporates many scales which, in effect, allow the smallest changes in depth to be readily visible on the relevant scale. For example, raising the calibration bar 5 inches was immediately demonstrable. We now had grounds for complete confidence in our equipment.

Working from Urquart Bay (the area of the Pisces tests), we began with a search by 'feel' in zig-zags across the Loch covering the areas mentioned. The Loch walls slope away very steeply, sufficient, sometimes, to reflect the sonar beam and this contrasts with the remarkable flatness of the bottom. The depth of the bed was an almost uniform 220 metres and at no time was a depth of more than 225 metres registered. Runs were then made off the John Cobb Memorial where another deep area had been reported with the same result. In conclusion a set of transits, South of Urquart Castle, were run no further than 50 metres apart to cover the possibility that the 'hole' was of very narrow diameter.

Although our work cannot be considered a survey it was, never-the-less, a most careful search for the deep areas reported in the areas reported and it has proved negative (Roger Parker of Partech has reported finding a depth of over 800 feet to the North West of Urquart Bay using a well calibrated echo-sounder in the summer of 1976). Any area of greater depth, and a full 200 feet is what has been described, would have had to be of improbably small and improbably narrow dimensions to have escaped detection. Alternatively, it would have to lie within the Loch wall rather than in the body of the Loch, which is most unlikely. If deeper holes exist then they must either be elsewhere or be so narrow as to constitute a most exceptional feature.

Speculation has also arisen over the nature of the Loch walls. A sonar chart has been widely published suggesting to the layman that the walls extend great distances below a very fine silt, as much as 3,00 feet. We must explain immediately that this results from a mis-interpretation of the sonar chart. It is due to a well recognized phenomena of 'side-echo'. The downward sound beam from an echo-sounder is not perfectly straight but broadens considerably to form a cone. At great depth this can be quite wide and as the vessel moves out from the wall, the wall will continue to be registered by the outer fringes of the beam at ever-increasing distances (and apparently depths) on the sonar chart.

- (4) Many fish echoes were recorded mostly in local concentrations inshore. These extended to a depth of about 90 feet. The ease of locating these concentrations was a satisfactory result of the programme. No very large echoes were recorded.
- (5) Mr. Neil Ray carried out some tests with an under-water camera system to determine the characteristics and limitations of Loch Ness from this point of view. In general, we consider that useful under-water photography is possible but especially designed equipment is necessary.
- (6) A general collection of plankton was made for Royal Holloway College.