The Loch Ness Investigation

ANNUAL REPORT

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Each year the *Encyclopaedia Britannica* lists the ten subjects of greatest public interest thrown up by an analysis of the enquiries they receive from all over the world; and this year Loch Ness is right up at the top of the league table alongside landing on the moon, crimes of violence and atmospheric pollution. This fact is reflected in Bureau membership which for the first time exceeds the thousand mark. A recent breakdown by country is of interest, viz.:

England	495	Australia	3
United States	393	Germany	3
Scotland	80	Denmark	2
Canada	14	Italy	2
Wales	13	Portugal	1
Ireland	7	Basutoland	1
Sweden	6	Czechoslovakia	1
France	4	Falkland Islands	1
Norway	3	Switzerland	1
		TOTAL MEMBERSHIP	1030

This year we have an even larger number of companies, universities and other groups to whom our thanks are due. First, once again, is the Field Enterprises Educational Corporation of Chicago, publishers of the *World Book Encyclopaedia*, for a sizeable grant and for directly financing the operations of the miniature submarine *Viper-Fish*. In addition, our thanks go to Vickers Ltd. of Barrow-in-Furness for making available the research material obtained by Captain R. Eastaugh, master of their submarine *Pisces*; to the Plessey Company for sonar operations in conjunction with Professor D. Gordon Tucker, Dr Hugh Braithwaite and Dr D. J. Creasey of Birmingham University; to the Scottish Department of Agriculture and Fisheries for a chemical sampling in Loch Ness undertaken on July 27th, 1969; to the University of Chicago for analytical data in Appendix II; to Field Enterprises, the Honeywell Company, the Griffis Foundation and the U.S. Liaison Committee on Oceanographical Research for supporting the invaluable programme of sonar research initiated and undertaken by the Texan engineer, Mr Robert Love, and to the Dukane Corporation for the loan of UW equipment. Also thanks are due to the Independent Television News Company for sympathetic coverage of much of our activity; and to Mr Ken Peterson of Disney Studios for the devoted care and trouble he took over a film of our activities which has yet to be screened.

As usual, my personal thanks are due to all members of the Bureau, who encourage us with their support, and especially to the 160 who participated in last season's field-work. Finally an extra word of thanks is owing to Clem Lister Skelton, who left the Bureau's employment at the end of the year after eight seasons' work.

The following have also completed eight or more consecutive seasons in the field—Tim Dinsdale, Lionel Leslie, Ted Holiday, John Luff, Sir Peter Ogilvy-Wedderburn and myself.

* * *

Last year's Annual Report gave details of Professor Tucker's findings in Loch Ness and mentioned that they were promptly attacked in *Nature*, which attack was reproduced in full by *The Times*, but pressure of space prevented my giving the text of the *Nature* article (Volume 220, December 28th, 1968) in full. I now reproduce it below:

The Loch Ness monster has once more been disinterred from its proper habitat in the underworlds of fable. Dr Hugh Braithwaite and Professor D. Gordon Tucker announced in the Christmas number of *New Scientist* that they have detected echoes from the loch which they find a "temptation to suppose must be the fabulous Loch Ness monsters, now observed for the first time in their underwater activities"! The furtive kraken has flown into the headlines on the viewless wings of sonar. A new type of equipment developed at Birmingham University was set up to monitor the loch during two weeks in August. Two objects, one about 50 metres in length and the other much shorter, are believed by their fast rates of ascent and descent—up to 7.5 metres a second—to be groups of large animals. On the advice of their biological colleagues the two engineers exclude the possibility that shoals of fish could attain these speeds, but they say that studies with more refined equipment are needed before definite conclusions can be drawn.

The Loch Ness monster seems to have been invented in 1933, the date when it first allowed itself to be photographed. Before this time few, if any, people claimed to have seen it. The most famous photograph of the monster was taken by a London surgeon in 1943. Dr Maurice Burton, a zoologist with a long-standing interest in the monster's affairs, believes that this photograph shows an otter in the act of diving, and that all other films and photographs so far published are of commonplace objects such as otters, birds or floating debris. The monster legend holds that Loch Ness, once an arm of the sea, was pinched off by movement of the land, so trapping the monsters in its salty depths. In fact the loch was excavated by Pleistocene glaciers and has always been a freshwater lake. Although parts of Scotland have subsided some 100 feet in recent times, there is little chance of marine life having been washed into the loch, let alone surviving there.

The sonar equipment used by the Birmingham engineers has been tested by the Fisheries Laboratory at Lowestoft, where it seems to have been discovered to be prone to ambiguities. For example, two targets at the same range but different bearings tend to appear on the screen as a single object while, under certain circumstances, a shoal of fish swimming horizontally through the sonar beam could give the impression of a rapidly diving object. In other words, there is little reason to take seriously the claims of Dr Braithwaite and Professor Tucker to have found a monster.

Apart from the gratuitously offensive tone of this piece towards Professor Tucker, who has an international reputation in the field of electronic engineering, the following comments come to mind:

1. "*The Loch Ness monster seems to have been invented in 1933.*"

This is quite untrue. There are written references to it in the 7th, 16th, 17th and 19th centuries.

2. "*Before this time few, if any, people claimed to have seen it.*"

There are people still alive today who saw it well before this date, including Mrs Cary of Drumnadrochit (see Sighting No. 3), who saw it as a child during the First World War.

3. "*The most famous photograph . . . was taken . . . in 1943.*"

It was taken in 1934. This may be just a misprint, but to let it pass in proof does not argue any great care on the part of the author.

4. "*Dr Maurice Burton, a zoologist with a long-standing interest in the monster's affairs, believes that this photograph shows an otter in the act of diving. . . .*"

It is true that Dr Burton has published this view; but the late Gavin Maxwell, the greatest authority on otters, took the view that it could be no such thing. I had this from him personally only a few weeks before his death. The most cursory inspection of the photograph, moreover, would show that, whatever else it might be, it most certainly is not a diving otter. Indeed, only the late Lewis Carroll could have done full justice to this ludicrous proposition. Viz.:

He thought he saw an otter's tail
A'diving in Loch Ness.
He looked again and saw it was
The Caxton Printing Press.
"If that thing were alive", he said.
" We would be in a mess."
(With apologies to the Mad Gardener in *Sylvie and Bruno*, Chapter VIII)

5. "*All other films and photographs so far published are of commonplace objects such as otters, birds or floating debris.*"

This is not so. The R.A.F.'s Joint Air Reconnaissance Intelligence Centre (J.A.R.I.C.) reporting on Tim Dinsdale's 1960 film, submitted to them in 1965, said that the portion filmed above water was 12–16 ft. long, 6 ft. in beam, 3 ft. high and travelling at a speed of 10 knots. After considering all possibilities they concluded that "it probably is an animate object". Obviously it was beyond their sphere to estimate the mass under water necessary to sustain that bulk above it.

6. "*The monster legend holds that Loch Ness, once an arm of the sea, was pinched off by movements of the land. . . .*"

Local folk-lore is full of geologically improbable under-water connections with the North Sea, Loch Morar and elsewhere; but no one in the locality has ever heard of a raised beach, let alone appreciated its geological significance. The idea of Loch Ness having been cut off from the sea was first mooted, at least in relation to large unidentified creatures, by Mrs Constance Whyte in her book *More Than a Legend*, p. 165, first published by Hamish Hamilton in 1957. As there is a very well-known raised beach at the 100-ft. level at Craigton on the Black Isle immediately opposite Inverness, it is perfectly certain that Loch Ness was an arm of the sea until 5–10,000 years ago. Hence any animal trapped in the loch must be post-glacial in origin.

7. "*The sonar equipment used by the Birmingham engineers has been tested by the Fisheries Laboratory at Lowestoft, where it seems to have been discovered to be prone to ambiguities.*"

This equipment has never been out of Professor Tucker's hands and certainly has never been anywhere near Lowestoft.

8. "*In other words, there is little reason to take seriously the claims of Dr Braithwaite and Professor Tucker to have found a monster.*"

No such claims were ever made. The precise words used were: "It is a temptation to suppose they must be the fabulous Loch Ness monsters now observed for the first time in their underwater activities! The present data, while leaving this as a possibility, *are quite inadequate to decide the matter*. (My italics—D.J.) A great deal of further investigation with more refined equipment—which is not at present available—is needed before definite conclusions can be drawn."

In all, the above constitutes a substantial list of errors to be published in one of the leading scientific monthlies in the world, repeated moreover in a national daily with a historically deserved reputation for accuracy. To be fair, *The Times* did publish a short letter of refutation from Norman Collins, Chairman of the Bureau, but a detailed rebuttal has had to await the publication of this report.

* * *

Within days of this controversy I received a long paper from Robert Love setting out the advantages of a mobile sonar probe proceeding up and down the loch for a protracted period; and a few days later he supported his detailed proposals by a personal appearance in my office. I found myself much struck both by his great experience of every type of underwater survey and salvage work and also by the meticulous thought he had put into the proposed operation, and, following our Bureau policy of providing a framework within which anyone can co-operate with us, I was delighted to recommend him to Professor Roy Mackal in Chicago with a view to his getting further financial support in the U.S., since our budget was already fully committed.

* * *

Active work on the loch started in early May when Major Eustace Maxwell chartered the 49 ft. drifter *Penorva* for a week on behalf of the Bureau. Present were Major Maxwell and myself with Lord Richard Percy of the University of Newcastle and Dr Ian Lyster of the Royal Scottish Museum as zoologists. We had two major objectives: one, to get a better idea of the underwater profile of the loch by echo-sounder for the use of *Viper-Fish*, the one-man miniature submarine that we knew was being lent to us from the U.S.; and two, to long-line and trawl for the alleged huge eels. We found the bottom of the loch on the whole to be surprisingly flat at about 700 ft. with heavily serrated sides plunging down at an angle of about 45°. A trawl of the bottom produced nothing but leaves and some plastic potato-crisp bags! Long-lining at various depths produced a couple of trout close inshore but nothing from the bottom, though three hooks had been torn off, possibly by eels.

A few days later Bob Love arrived back from the U.S. to make arrangements for his own work later in the

season and we made all the *Penorva* records available to him. His more detailed analysis reads as follows:

I. *Channel Wall and Bottom Topography:*

"Depth recordings had been made using a Marconi depth sounder. . . . Additional depth recordings were made using a Raytheon Model 729 Fathometer and Seascribe depth finder.

Transverse runs across the Loch at various points show irregular sloping upper channel walls dropping to 100–200 ft. within 50–200 yards from shore. From here the main channel drops with a general slope of about 45° to the relatively flat bottom at depths of 600–750 ft. Longitudinal runs parallel to and at distances of 25–100 yards from shore show irregular, and presumably rocky, protrusions from shore sloping down the channel walls. A longitudinal section through this slope along the shore would show typical vertical rises in the steeper regions of the order of 20°. *No indication of caverns or overhanging ledges was seen on any of the recordings.* (My italics—D.J.)

Raytheon Fathometer recordings show what is apparently a layer of loose sediment overlying more compacted earth or rock along the upper slopes of the channel. The thickness of this sediment varies from zero on rocky protrusions at 40–80 ft. depths to as much as 50 ft. in depressions at 200-ft. depths. Presence of this very loose silt was confirmed in interviews with divers who described being able to insert their full arm length into the sediment without reaching harder material. As would be expected the silt tends to fill depressions smoothing out bottom irregularities. Fathometer recordings were run from a point 510 yards from shore (610 yards from the H.Q. Range-finder) opposite Achnahannet on a course toward the shore. Initial bottom depth was 750 ft. with an apparent silt layer 10–15 ft. thick over a more compact bottom. The silt remained flat until 430 yards from shore where the bottom meets the channel walls which rise to 650 ft. during the next 150 yards toward shore.

A longitudinal depth contour recording made along the centreline of the loch shows a smooth bottom with several shallower areas due to silt outflow from river mouths. Slopes of these rises are quite gentle as would be expected from silt dispersion, being approximately 1 to 56 or 1° opposite the River Foyers."

Bob Love went on to describe some other experiments he carried out on the same visit. (Paper of June 18th, 1969.) I quote:

II. *Bottom Samples:*

"A coring type bottom sampler was constructed from a 5-ft. length of 4-in. plastic pipe weighted at the lower end. First drops with this device did not retrieve a bottom sample, apparently because the composition of the sediment was too loose for retention in the open tube. The upper end of the tube was then partially closed by a 50% perforated plate and the retrieval line rigged to the lower end to invert the sampler for retrieval after penetration into the bottom. This was also unsuccessful although surface wind conditions prevented a conclusive trial. The design was then modified, returning to the open tube with two semi-circular doors hinged at the lip of the lower end. During drop these doors are folded back along the outer edges of the tube. After penetration they are forced closed over the end of the tube by lift on the retrieval line.

Bottom mud samples were taken from a 12-ft. thick sediment layer 120–150 ft. deep at a location 300 yards from shore and 850 yards N.E. of Bureau headquarters at Achnahannet. Fresh samples were of loose consistency which became more dense upon loss of water. Preliminary microscopic analysis shows a basic composition of very fine sand particles, diatom skeletons, and few if any protozoa and bacteria. *The sediment appears to have little organic content or nutritional value, thus discounting its role in the life cycle of large creatures in the loch. On the whole, caves or potential hidden lairs which are not susceptible to sonar search do not appear to be a feature of the Loch Ness topography.* (My italics—D.J.)

III. *Light Absorption and Underwater Visibility:*

A submersible light meter was built from a "Prinzlite II" photograph exposure meter. The selenium photo-electric element was removed and connected remotely by 125 ft. of electric cable to the exposure meter movement. The cell was sealed in a liquid-filled glass castor-oil bottle attached to a vertical weight in such a way that it could be positioned to accept light from an upward direction, a 45° upward angle, or a horizontal direction. Light readings were read from the meter in a boat on the surface. The meter scale had a usable range of about 6½ f-stops representing a light value range of about 100 to 1.

Readings were made on three days representing good to bad sunlight strengths and surface conditions from flat calm to 1-ft. waves. Readings are referenced to light values with the cell just submerged and rotated through all horizontal angles. The same pattern of underwater light absorption was found for various sunlight and surface conditions.

Incident light levels 10 ft. down are about 3½ f-stops below those just under the surface, representing an ambient light level about 10% of that at the surface.

Light levels at 20 ft. are about 6½ f-stops below surface levels, representing an ambient light level about 1% of that at the surface.

Generally, a light absorption of about 3 f-stops or 90% can be expected for every 10 ft. of light path, due to colloidal peat stain in the water. The difficulty in visual submarine search under these visibility conditions is evident. A single 50-watt quartz-halogen photoflood light would provide only about 2% of the light required for still photography at a range of 10 ft., even with fast lenses and black-and-white film.

This suggests the use of more directional automotive spotlights for submarine navigation and high-intensity flash for photography.

Observations of divers confirm the virtually complete black-out at 60–80 ft.

IV. *Temperature Measurements:*

A temperature cell was constructed by installing a thermometer in an open small-mouth milk bottle. This cell was attached to 750 ft. of fishing line on a salmon reel mounted on a broomstick handle. The cell was lowered to various depths in the loch, suspended for 15 minutes time to allow convection currents to introduce a water sample from that level, and rapidly reeled up to the surface for reading. The thermal mass of the entrapped pint of water was adequate to prevent a

significant change in temperature, as evidenced by the low and consistent readings from various depths.

Temperature measurements were made between 1500 and 1600 on June 5th under clear bright sunlight. Initially the water surface was flat with a water temperature of 56°F. Temperature at 30 ft. was 46°F., at 150 ft. was 43°F., and at 650 ft. in 700 ft. of water was 42°F.

During the period of the measurements a slight breeze had risen developing a 2–3-in. ripple on the water surface. A remeasurement of the surface water temperature showed a 5° drop to 51°F. in the half-hour since the initial reading. This is attributed to wave motion mixing of deeper cooler water with the warmer and lighter water near the surface. It also explains a very weak acoustic reflection layer observed generally in the loch at 150 ft. on the Raytheon Fathometer only on the previous day. Wind velocity on this day was 10–12 knots at the water surface creating waves of 2–3 ft. Such surface wave motion apparently carries warmed surface water to depths of 100–200 ft. with a resultant density gradient detectable by the Fathometer with its 125 kH. operating frequency.

Two temperature readings of 44°F. at 200 ft. and 48°F. at 20 ft. made on this day are higher than those made on the calm day, confirming this mixing phenomenon.

These temperature data corroborate results reported by other scientific groups although details of their techniques are not known to the writer. *Local legends of thermoclines*[1] *and temperature inversion with a layer at the bottom warmed by the earth's core must be discounted as groundless.* (My italics—D.J.)

V. *Surface Conditions and Observations:*

Many observers have commented on the apparent trend of increased frequency in surface sightings of creatures in Loch Ness on calm sunny days. This could be a function of water temperature leading fish or eels on which the creatures might feed to rise nearer the surface or to a preference by the creatures themselves for the warmer temperatures. Loch Ness, and other deep, still, peat-stained waters in which 99% of the sun's radiant energy is converted to heat in the upper 20 ft. of water, can be expected to show a remarkable rise in surface water temperature during calm sunny days. A period of several such days would doubtless raise these temperatures still more before thermal conduction and diffusion dissipated the heat to reach a stabilised temperature gradient."

* * *

Headquarters was available, as previously, to private groups of members from Easter onwards but organised watching started on May 17th when I brought up a party of 12. Subsequent groups were considerably larger as the huge amount of publicity we received brought a splendid flow of volunteers, so that for the first time we had enough people for any and every task. I could only have wished that the many hundreds of man-hours spent watching had been better rewarded, but 1969 was again a comparatively poor year for sightings, possibly because once more it was an unusually dry summer with a consequential small run of salmon. There may be a subjective factor, too, though, as I am conscious of the fact that with growing experience we become more and more critical of what we accept and may throw out genuine sightings for want of corroborative evidence which previously would have gained acceptance. For example, I am now loath to publish accounts of stationary "upturned boats" unless there are several witnesses and the range is close or powerful binoculars are employed.

What criteria then does the Bureau adopt in accepting accounts for publication?

In the first instance, nothing is published unless our own sighting report form is filled in giving the answers to 36 specific questions, and unless permission to publish witnesses' names is granted. Both of these stipulations are important as many accounts come from the general public. Some reach us via a careful study of the local press, in which case a sighting report form is sent by post. In the vast majority of cases, though, the first we know of an incident is because someone, or a group of people, has taken the trouble to come to us especially to report the fact; and hence obviously believe they have had a genuine experience. Alas, more than half of these have to be sent away politely and with profuse thanks, since obviously they are the victims of *bona fide* error. Sometimes this is caused by a floating log or box (whose path we would have plotted for as long as it was waterborne) but more frequently people are fooled by the bow waves from vessels long since passed, since these rebound off the shore to create "standing waves" looking just like a series of humps. Throughout the five summer months the movement of every vessel through the loch is logged and no report of humps is accepted within half an hour of a ship's passing unless quite exceptional circumstances prevail.[1]

Those who pass the test of a preliminary interview are conducted to separate caravans and asked to fill in forms. A family may naturally have discussed their experience in general terms on their way to visit us by car but they can hardly have expected to be requested to answer a detailed questionnaire on range, direction, speed, time-length of episode, colour, texture, length, height, craft in the vicinity, wash, reaction to noise, weather conditions, surface of loch, visibility, and characteristics of binoculars and cameras carried. A certain difference in view on such matters of judgment as size and speed would be acceptable, but any gross discrepancy would cause the episode to be disregarded. On the other hand, due allowance has to be made for the fact that many observant people (particularly children) can't spell, while many lucid and literate people can't draw. In the last resort, an opinion can only be reached as a resultant of all the factors—range, light conditions, number of witnesses, quality of witnesses, nature of sighting, and so on. While this procedure cannot be regarded as perfect, it probably means that more genuine sightings are rejected than spurious ones accepted; and we would sooner have it that way.

From the list that follows there are only two accounts that have been accepted from one witness without corrobation: No. 3 (Mrs Cary) a very well-known and

[1]The use of the word "thermocline" refers to highly stratified layers where large temperature differences such as 10°F occur within a few feet of depth. More complete temperature profiles were subsequently obtained by Captain Easthaugh of Vickers who referred to them as "thermal layers" (see p. 7) since their density change affects submarine operations.—D.J.

[1]Notwithstanding this, a national newspaper insisted on publishing a photograph of a known and recorded wake against our most urgent advice. We had to deal with quite a large post from readers, who were less gullible than the Editor.

experienced local inhabitant, and No. 10 (Graham Bayley), who sent in an exceptionally detailed and careful description of an episode seen from a perfect vantage-point under ideal weather conditions.

In the light of the criteria listed it is easy to see why episodes No. 11 and No. 12 witnessed by the Bury and Skeldon families respectively gained credence. Both of these were of heads and necks within 45 minutes of time and four miles of distance of each other. In previous reports I have drawn attention to groups of sightings over a short period suggesting that an individual creature may occasionally come to the surface for a few hours or even days; so these two accounts tend to strengthen each other. Then again both families, who were utterly unaware of each other's existence, had to motor more than 30 miles around the loch to report to us (which they did on consecutive days), and both created an excellent impression on those who cross-examined them. It seems inconceivable that two such families, one from Lancashire and one from Warwickshire, should have thought up an identical leg-pull almost simultaneously and equally unlikely that any inanimate object such as a log should have drifted such a distance in so short a time under flat calm conditions. If one assumes that people with eyesight as good as Mr. Skeldon would be unlikely to mistake a diving bird for a creature six times the size, then the balance of probability would seem to favour their having seen a long-necked creature; and the same one at that.

* * *

Loch Ness Sightings 1969

Although 1969 was a poor year for sightings, the following gained acceptance, three of them being supported by film. Expedition members are marked*:

1. April 7th, 1045–1048 B.S.T. Mr Bruce Marshall* (19), car salesman, and Bill Jobes* (19), top line operator, were standing on the ramparts of Urquhart Castle watching a rowing boat pass by in the direction of Inverness. After the boat had proceeded about two miles toward Lochend, they spotted a grey glistening hump on the opposide side of the loch moving at "great speed" toward Inverness. The hump quickly disappeared but they continued to watch the spot and "two grey slimy humps appeared with a great splash and continued in the Inverness direction for about 20 yards. . . . The humps then sank. Everything seemed sudden and jerky." They estimated the length of the object to be 20–24 ft. Weather: "very sunny"; loch calm.
2. May 27th, 1400–1405 B.S.T. Harvey Barsky (34), a U.S. civil servant, was up with a troop of Scouts on the south side of the loch opposite Temple Pier. While waiting for lunch to be cooked one of his Scouts reported something moving in the loch. There were no field glasses available but several people had a look through the magnifying camera viewfinder. "The object sat low in the water and moved in a slow erratic manner." At a range of less than a mile it appeared to be 15–20 ft. long, greenish in colour and with a smooth texture. Film exposed on a Canon 814 Super 8 Cine camera fully bears out the written account but owing to the use of a zoom lens, measurement is not possible. Weather: "clear and calm and fairly bright".
3. June 1st, 1103–1105 B.S.T. Mrs Winifred Cary (62) was looking at the loch from the road above Strone Point when she saw "numbers of fish rising in a straight line towards Temple Pier in an area of about 30 or 40 ft. long in a most peculiar way. Some of them seemed to be jumping right out of the water. The wash in the water then appeared among the fish." At first she thought it was a small boat with an outboard but she could not see any boats in the area. "The light grey hump then appeared at the front of the wash moving towards Temple Pier." She called to a friend to come and see it but by the time he arrived it had submerged and only a ripple on the water showed where it had been. Mrs Cary estimated the hump was 15–20 ft. long and about "6 ft. at the highest part of the hump". Weather: fine; loch "flat calm".

   Note: Mrs Cary is a very experienced local witness with other sightings to her credit, going back to 1917.
4. June 5th, 1530–1531 B.S.T. Mr A. F. Best (59), civil servant, and his wife Elizabeth (58) were enjoying a leisurely lunch at a lay-by about four miles south of Dores, almost directly opposite Urquhart Castle. Mr Best was walking down the road to take some photographs when his wife saw a dark disturbance moving in a north-easterly direction down the middle of the loch. She called Mr Best and he came back and looked through the binoculars (Ross 12×40) to see on the wave, just above the surface, three small glistening black "bumps" like "three curling waves covered with oil slick". Overall the object seemed to be about 10 ft. long. Some time after the object submerged a large wake hit the shore. Surface of the loch "like a millpond".
5. June 21st, circa. 1130 B.S.T. Mrs Eileen Matthews (49), housewife, and her husband were parked at a lay-by on the north side of the loch near Lochend when they heard a splashing sound and ". . . saw a creature surface" around 150 yards away, travelling in the direction of Fort Augustus. "We saw two or three humps and the head rising out of the water black and shiny in the sunlight. It swam slowly then disappeared to reappear a few seconds later." It submerged and surfaced again closer inshore and swam about for around one to two minutes when it disappeared. There were other people at the lay-by watching and all agreed they had definitely seen something out of the ordinary. The object caused large ripples which reached to the shore near the lay-by. Weather: "warm and sunny"; loch "very smooth".
6. June 23rd, 1009–1013 B.S.T. Mrs Alison Skelton* (23), housewife and Peter Davies* (20), assistant technician, were having coffee at H.Q. when they noticed a V-shaped wash moving diagonally across the loch from west to east past Inverfarigaig. Peter rushed to the main rig camera and shot film of the disturbance which moved in an irregular fashion, submerging and resurfacing as it continued toward the opposite shore. "The propulsion appeared to come from *behind* the leading part of the wash." The film confirmed this observation and showed what appeared to be something moving in a jerky fashion at a variable speed just under the surface of the water. Martin Wylde* (29), mechanic, also observed the wake pattern from H.Q. and confirmed its irregular movement. Weather: overcast, light rain; loch "smooth and oily slick".
7. July 26th, 1530–1535 B.S.T. Mr D. Clayton (37), technical representative, and his wife Margaret (35) were driving past the lay-by opposite Dores toward

Fort Augustus when they spotted a black hump about 350–400 yards offshore travelling at a speed of 5–6 knots in a north-easterly direction. They pulled into the lay-by to watch and estimated it to be about 6 ft. long and 3 ft. high out of the water which created a substantial wake that was visible for some time after the object submerged. Mr Maurice Smith (24) and his wife with their baby were driving by at the same time in the opposite direction and also sighted the same black object, which Mr Smith considered much longer, and also noted the substantial waves which broke on shore. No camera crew was at this station as they were needed for work on the submarine *Viper-Fish*. Weather: "dull, light rain"; loch rippled.

8. August 1st, 2030 B.S.T. R. A. Moyse (40), Royal Marines Career Adviser, and his two sons and one of their friends were motoring along the north-west shore of the loch towards Inverness, approximately six miles from Drumnadrochit when they saw a black, three-humped object about 100 yards from the near shore. They pulled into a lay-by to watch, by which time the object had submerged. ". . . the sighting was brief, lasting only fifteen seconds approximately. The animal appeared to react to the noise of my car drawing near and gracefully slid from view but continuing to provide a distinct wash some three minutes after submerging." The object was 20–30 ft. long, 12–14 in. out of the water, with the two end humps being "more pointed than the rounded central hump". Estimated speed three knots. Weather: sunny, flat calm.

   Note: Mr Moyse was interviewed by two experienced watchers and proved a most impressive witness. He had hitherto been a staunch unbeliever.

9. August 6th, 0920 B.S.T. Geoffrey Craven (35), plumber, his wife (34) and their two children, Nick (11) and Tina (13), were parked at a lay-by on the south-east side of the loch near Whitefield caravan park (approximately two miles south of Dores) when they saw and heard a tremendous disturbance in the water some 60 yards from shore. The disturbance broke and a black two-humped object emerged but submerged a few seconds later when Mr Craven honked his horn to attract the attention of friends in a car in front. The estimated size at this very close range was 25–30 ft. and the height above water 3–4 ft. Colour "black-grey", "muddy black", "silky black". Weather: "fine"; loch "rippled".

10. August 6th, 1850–1851 B.S.T. Graham Bayley (18), progress chaser, was looking at the loch from a point high above it near the Foyers Hotel when "an object surfaced quietly" from the Foyers River mouth "and began to veer out towards the centre of the loch just as a small boat was coming past the hotel down loch half a mile away". He didn't pay any particular attention to this object except to note that it was about 10 ft. long by 5 ft. wide and of a tawny "straw brown colour, like fur from a lion". He thought at first it was a small boat or raft but "the object was casting out a long, thin but strong high wake, white and surging, the speed 20 m.p.h. or more, and after ten seconds the hump began to turn towards Foyers in a wide sweep as if the object had sensed the boat approaching". It began to move toward the trees near Lower Foyers and out of vision. He ran to get a pair of binoculars but when he returned the object had disappeared. He estimated that the phenomenon was of considerable size underwater, some 30 ft. long. ". . . what struck me as being incredible was the fact that it was moving out across the loch at 25 m.p.h. and that there was a 50 ft. wash of slow foamy waves at the maximum 3 ft. high." Weather: fine; loch "slightly rippled".

11. August 12th, 1030 B.S.T. Mr Alan Bury (63), form and die maker, his wife and two sons, Adrian (15) and Ian (13), stopped at a lay-by near Foyers on their way to Inverness. Ian and Adrian were sitting on the wall overlooking the loch when close inshore in the direction of Inverness Ian saw "a long tapering" neck appear suddenly and submerge just as he pointed it out to his brother who saw the concentric rings left by the sinking object. Ian climbed closer to shore and as he was waving at his family to attract their attention "a long black member of something came out of the water, rather like a black tapering piece of rubber about 4 or 5 ft. long . . . and gently subsided again" as the whole family watched. They estimated that it was about 6 to 8 in. thick and their individual drawings indicated that the object was poised at a 45° angle to the water while in sight. Weather: fine; loch "mirror calm".

12. August 12th, 1115–1118 B.S.T. Mr James N. Skeldon (45), garden supplies manager, Mrs Skeldon (43), housewife, their son, and two other ladies were stopped along the southern shore opposite the Clansman Hotel watching the loch when "the water stirred and a wake appeared approximately one half to three quarters of a mile from our position. A definite neck appeared and the object moved towards the shore, and then turned and made out towards the centre of the loch, only to turn and make for the shore once more. There seemed to be three distinct wakes at the one time, behind each other, and the centre wake seemed to indicate a sort of mass beneath the water. . . . The movement was in a series of dashes rather than a fixed speed." The neck was about 4 ft. out of the water and "dark grey", "black", but the mass behind looked "chalky white". The total object was estimated at eight to ten times the length of the neck. Weather: fine; loch "very calm".

    Group Commander's note: "Mr Skeldon volunteered that he had read 'The Great Orm' but tried to put it out of his mind. He demonstrated his eyesight by picking out a 12-ft. dinghy at 5/6 miles range just offshore on the opposite side of the loch, which some expedition members could not see without binoculars even when he pointed it out. Both he and his wife impressed me as truthful, intelligent and objective, being careful to state only the exact facts."

13. September 16th, 1015–1020 approx. B.S.T. Ian Shield* (19), student, and Gerry Barker* (23) were on watch at the Dores lay-by station when they noticed "what at first appeared to be long silver waves in the water" going toward Lochend on the far side of Tor Point. When the first wake had passed into Dores Bay they began to film the second wake as it moved in the same direction. "Later one wake only emerged out of Dores Bay. At first it moved slowly then suddenly shot forward at high speed. We then lost it and assumed it had submerged." The film shot confirms this description exactly. Weather: partly cloudy; water slightly rippled.

    Mr Thomas Johnson (33), welfare officer, and his mother Mrs I. Johnson (53) were present at the

Dores lay-by during the above sighting and came to H.Q. independently of our watchers to fill in report forms which tallied exactly with the reports and film from members Shield and Barker.

14. October 10th, 0915–45 B.S.T. T. M. Rickards (55), U.S. Company President, and his wife (49) were staying at the Clansman Hotel. After breakfast she was standing at the window watching a calm loch when she heard other residents talking with excitement. She looked out and saw "a large wake coming very slowly at an angle towards our shore". She called her husband and ". . . we watched it for several minutes as it leisurely continued westerly toward our location at the Clansman Hotel. . . . It changed course several times but the speed seemed constant. I speculated at first that it might be a speedboat at a larger distance than was apparent but as it came closer this obviously was not the case; I then speculated to my wife that perhaps it was a duck much more close than was apparent, but this had to be discounted; when about one quarter mile from shore a small, black point was visible at the head of the wake. It was much as I might expect the wake to be from a submarine which was cruising just under the surface and which raised its periscope a foot or two above the surface as it approached shore. The fact that the wake was so large and spread so far was the interesting point for us to consider. It simply did not fit into the usual pattern of water happenings, and I have all my life lived on a lake quite similar to Loch Ness as to width and length and have observed boats, fish and birds on the water all my life, and whatever this was, it was new to me."

In addition to the foregoing, that very experienced investigator Tim Dinsdale, author of *The Loch Ness Monster* and *The Leviathans*, on his fifteenth one-man visit to the loch spent a total of 82 days and nights drifting and cruising on the loch, during which time he saw major water disturbances that cannot be accounted for in a conventional manner on five separate occasions.

* * *

On May 21st the much-publicised yellow submarine *Viper-Fish*, piloted by Dan Taylor, arrived by freighter from the U.S. Her proposed role was to back up subsequent sonar probes by being in readiness to dive and chase any unidentified contact; but in the event she was foiled by the depth of the loch and by its impenetrable darkness.

By sheer chance (though some local inhabitants were indignant because they thought it was by design), another small submarine arrived in the loch under different sponsorship at about the same time. This was the very much more powerful (and more expensive to operate) Vickers research vessel *Pisces*. She added so much to our general knowledge of the loch that I cannot do better than gratefully reprint the full and most valuable report of her master, Captain R. W. Eastaugh:

Loch Ness was chosen for freshwater trials of *Pisces* for the following reasons:

1. Largest and deepest, accessible freshwater loch.
2. An operating pier with the necessary depth of water at Temple Pier.
3. Good road access—available craneage.
4. Contract with a film company.

Vickers' operation from start to completion took place between June 11th and August 18th, 1969. The object of these trials was thoroughly to test *Pisces* in a freshwater environment. Her sea trials had been successfully concluded off Vancouver.

In all, 47 dives were made in Loch Ness (Urquhart Bay) varying between 120 ft. and 820 ft. These dives represented some 250 hours of bottom time.

During these dives, certain scientific data were observed as follows:

1. Deepest recorded depth off Urquhart Castle, some ½ mile south, of 970 ft. was registered by sonar.
2. U.H.F. (surface) radio communication was maintained to depth of 120 ft. although the normal was 90 ft.
3. Distinct thermal layers at depths varying between 60 ft. and 140 ft.—the layers being up to 60 ft. thick—these layers were sufficient to cause complete interference on sonar—echo sounder—underwater telephone and of sufficient density to cause *Pisces* to "ceiling" under these layers when surfacing very slowly.
4. The bottom of Urquhart Bay where *Pisces* operations were mainly confined was soft silt, 8 ft. thick, almost totally devoid of life. The bottom had craters of varying sizes and depths, the sides steep-sided, usually 60° to 70°. Further into the loch proper, the bottom is hard clay covered with a layer of silt 6 in. thick with large valleys stretching out into the loch, steep-sided, 70°, stretching hundreds of feet. *Pisces* did encounter one such valley which it traversed for some 600 ft., going deeper the whole time. *Pisces* was recalled before completing this traverse.
5. Bottom currents. These do exist but vary from crater to crater—some have currents, some do not. In one particular crater, to the north of Urquhart Bay at a depth of 750 ft. an almost circular current existed, whirling around *Pisces* in an anti-clockwise motion. Current also existed at 820 ft.
6. Natural light was lost at a depth of 30 ft. below the surface. Even at 20 ft., with the surface visible, the horizontal visibility was nil.
7. The most interesting topography was found just south of Urquhart Castle, where the area is precipitous, with steep sides, and several deep craters in relatively shallow water.
8. A sonar target was picked up, whilst *Pisces* was hovering 50 ft. off the bottom. The target was picked up at a distance of 600 ft. *Pisces* homed on the target and when at a distance of 400 ft., the target rapidly disappeared from the screen. *Pisces* maintained its course and speed on the last heading but no further contact was made. Nothing conclusive can be given upon this observation, nor have Vickers tried to so—it is quoted here as an observation only. Depth of water 520 ft. Main channel 300 yds. towards Inverness from Urquhart Castle. Observers: S. Boulton, T. Story and B. Peach (ITV).
9. Animate life was concentrated around river outlets where we found an abundance of fish life that again vanished at about 30 ft.
10. However, on three occasions animate life was observed at depths below 30 ft. These were as follows:
    July 5th, 1969. Depth 350 ft. One small bottom fish, white in colour, possibly 6 in. size, similar to a seawater plaice. This fish seemed to burrow along through the silt.

Observers: R. W. Eastaugh, M. McDonald.
July 7th, 1969. Depth 820 ft. Small white eel, approx. 4 in. long.
Observed by A. Johnson and D. White.

11. July 30th. Depth 120 ft. White eel, approx. 18 in. to 24 in. long. Observers were S. Boulton and E. Marsden, also P. G. Twinn.
12. Discovery of a wreck off Temple Pier in approx. 100 ft. of water. This wreck appeared to be that of a sailing coal barge and was recorded on video-tape.

These observations, together with those we had obtained from *Penorva*, together with Bob Love's early work, convey a very much more accurate picture of Loch Ness as an environment than had ever been obtained before. In particular they go to show that the original naval soundings (taken primarily for navigational purposes) obtained by lead line in 1901 are seriously out, and that the loch is actually more than 200 ft. deeper than had hitherto been supposed. The first-ever positive record of currents at depth are of great importance, too, though at present their origins and cause must remain a mystery.

* * *

As already indicated, this submarine activity caused some anxiety locally. Why, it is hard to understand as all our plans, including a proposal to get a tissue sample of one hundred millionth of the body weight of any large creature by use of a biopsy dart, had been duly cleared with the Scottish Office and with the local Chief Constable. However, this concern gave rise to the following exchange in the House of Lords on a question put by Lord Kilmany.[1]

LOCH NESS MONSTER: SUBMARINE RESEARCH

2.46 p.m.

Lord Kilmany: My Lords, I beg to ask the Question which stands in my name on the Order Paper.

(The Question was as follows:

To ask Her Majesty's Government whether they are satisfied, from assurances given by persons operating submarines in Loch Ness, that any monsters that may chance to inhabit that loch will not be subjected to damage or assault.)

The Joint Parliamentary Under-Secretary of State for Scotland (Lord Hughes): My Lords, we proceed from one monster to another. The Answer to the Question is, Yes. The organiser of The Loch Ness Phenomena Investigation Bureau Limited has given assurances to the Chief Constable of the Inverness Constabulary that submarine operations have no aggressive intent.

Lord Kilmany: My Lords, arising out of that reply, may I ask whether the noble Lord is aware that the Chief Constable has in fact given permission for an attempt to be made to obtain a tissue sample from whatever monsters can be found? Is the noble Lord satisfied that this could be done without danger and disturbance, and does the Secretary of State for Scotland condone this course?

Lord Hughes: My Lords, the organiser has said that the main objective of the submarine will be to try to get a positive identification of any echo which may be picked up by the Bureau's sonar equipment. For this purpose it will be fitted with arc lights and photographic gear. In addition, it will have a small compressed-air gun designed to fire a retrievable dart so shaped as to extract a small sample of tissue for subsequent analysis: this technique is widely used for tagging whales. In the particular context of this scientific expedition I hardly think it constitutes damage or assault.

On the other question which the noble Lord has asked, while I have no reason to doubt the assurances that have been given to the Chief Constable, I must point out that my right honourable friend the Secretary of State has no real *locus* in the matter. Unless and until the monster is found and examined we cannot even say whether the provisions of the Cruelty to Animals Act 1876 would be relevant, since that Act does not apply to invertebrates.

Viscount Massereene and Ferrard: My Lords, may I ask the Minister whether he is aware that news has just come through that an enormous, apparently prehistoric, monster has been washed up on the Ross of Mull at a place called Uisken? Everybody is very excited about it up there.[1]

Lord Hughes: Is it alive or dead?

Viscount Massereene and Ferrard: Dead.

Lord Blyton: My Lords, is my noble friend aware that it will be an act of sacrilege to take away from the Scottish Tourist Board the myth of the monster of Loch Ness by which they get many gullible tourists each year?

Lord Hughes: I do not know on what scientific ground my noble friend says that the monster is a myth.

Lord Lovat: My Lords, is the noble Lord aware that neither the Inverness County Council nor the police, nor the riparian owners on the shore were alerted to the fact that two submarines were coming to operate in the loch? May I further ask him whether he is aware that, according to reports in the Press, "nature study" goes so far as for the "Phenomena" promoters to say that if they cannot contact the monster with lance or submarine they propose to detonate charges below the surface and blow the animal on to the top of the water[2]—something we very much regret in the country where the monster still remains our greatest invisible asset.

Lord Hughes: My Lords, there are many rumours about the monster, and I know that there were other suggestions about what might be done. An American group were interested in an alternative way of trying to find it, but when they discovered that it would involve them in expenditure of half-a-million dollars they changed their mind.

Viscount St Davids: My Lords, will my noble friend make clear to his right honourable friend the Secretary of State for Scotland that there is legislation under which these creatures could be protected and that the British Waterway Board, as the navigation authority, have the right to remove the licences for these vessels if they start annoying the local livestock?

Lord Hughes: My Lords, I should be very interested to examine any information my noble friend can give me in that direction.

Lord Hawke: My Lords, how would the noble Lord like to be "potted" by an airgun to take samples of his tissue?

[1]House of Lords Official Report, Vol. 304, No. 95, Cols. 262–264.

[1]This proved to be the remains of a basking shark.—D.J.

[2]No such idea was even mooted by anyone connected with the Bureau.—D.J.

Lord Hughes: My Lords, provided that the relevant part of my tissue was no greater than the small amount, in proportion, that was taken from the bulk of the whale, I doubt whether I should notice it.

Lord Lovat: My Lords, the noble Lord's answer is not entirely satisfactory. Is he aware that in America there is considerable embarrassment that these two submarines should have arrived without local authority? They quite rightly take the view that we can hardly launch an expedition on Lake Okeechobee in similar circumstances.

This exchange had the merit from our point of view of putting the Under-Secretary of State in the position of actually defending the possibility that there might be a large species in the loch. It is noteworthy that the substance of this mini-debate, too, was broadcast to the crew of Apollo Eleven on their historic voyage to the moon. The comment it drew from the Mayor of neighbouring Palm Beach was that he would be honoured to have Lord Lovat lead a scientific expedition to Lake Okeechobee!

* * *

Shortly after this debate we heard from Disney Studios in Los Angeles that they wished to make a film about Loch Ness; and on August 6th Norman Collins and I dined with Mr and Mrs Ken Peterson in London to establish the lines of our collaboration, since in return for a very handsome grant to our research funds we had offered them all the help in our power, including all local introductions.

A few days later Ken Peterson arrived in Drumnadrochit with a Scots-recruited crew of camera and sound technicians; and during the course of the next three weeks he covered every aspect of our research activities, obtained some splendid helicopter sequences to illustrate the geological history and formation of the area, and also shot a series of notable interviews with many of the best living eye-witnesses.

Ken proved to be an outstandingly charming and sincere film-maker who had the happy knack of getting exactly what he wanted from everyone without ever putting them to any inconvenience; and his patience with inexperienced people before the cameras was unlimited. Just after Christmas I was lucky enough to be able to visit him in Hollywood and saw much of the beautiful colour material he had obtained. Knowing his studio's known skill in story-telling and animation techniques, I am confident we can look forward to an outstanding piece of work, though it will not be released until late autumn as he wishes to include a few sequences of our proposed 1970 techniques.

* * *

In mid-September sonar teams from Birmingham University and the Plessey Company came up accompanied by a group from the Independent Television News Company and Vincent Mulchrone of the *Daily Mail*, since both organisations were jointly concerned with ourselves in financing this aspect of the research programme. Professor Tucker and his colleagues once again operated a vertical fixed beam digital sonar across the loch from Temple Pier, while the Plessey Company operated a long-range Model 195 beam up and down the loch from a stationary vessel in the middle, the object being to try to get a "fix" from two angles on anything entering a box-like area.

As it turned out, no contacts were obtained during the two weeks of the operation. It is easy to be wise after the event but this is possibly because Plessey, in a laudable attempt to achieve long range up and down the loch (which incidentally also gave them much trouble from acoustic reverberations from the steep sides), employed a low and plainly audible frequency of 10 kHz; and the resultant noise may well have been sufficient to keep any potential target out of the selected area.

Throughout this period the I.T.V. group employed various other devices such as night cameras, underwater cameras and skin-divers; but these techniques, quite properly from their point of view, were more designed to provide nightly coverage on the television screens than to add to the total of scientific knowledge. In any event on the law of averages it is hardly surprising that they failed to achieve in a fortnight what protracted expeditions have failed to achieve over ten years.

However, the fact that this much-publicised fortnight of activity drew a blank was undoubtedly a serious setback from the point of view of our "public image"; and this was enhanced when Vincent Mulchrone, a sympathetic and very experienced reporter, concluded *merely on the strength of this period alone* and not on the cumulative evidence of the previous decade that there could be no unidentified creature in the loch ("The Loch Ness Monster does not exist. Nessie is a myth, a delusion, a tourist bait, a fraud . . ." *Daily Mail*, September 27th, 1969).

His view may understandably have been affected by the absurd episode of "the bone". Early during his stay he was rung up by three young men from Yorkshire who said they had discovered an extraordinary bone on the shores of the loch earlier in the summer. With my full personal concurrence, since one cannot afford to ignore any lead, he invited these young men up and we met them under conditions of secrecy in Inverness. The following morning they led us without any hesitation to the spot and there, sure enough, was a massive bone. For the record we were duly photographed with it and news editors' telephone lines hummed throughout the world, but almost from the outset I made it clear that no matter how important and interesting it might be, it was no concern of ours since there was no component of any creature described to us into which it could ever have fitted.

The following day the curator of a Yorkshire Museum reported that he was missing part of the left-hand ramus, or side, of the lower jaw of a large Blue Whale; and the police arrived to interview the young men. They stuck to their story, however, and refused to hand over the bone, which they said was their property and which they had hidden; and the police took no further action against them. Subsequently, and on seeing its photograph, the zoo curator had second thoughts as to whether it was his in any case; and the young men disappeared. . . . And there the matter rests. It will always be a mystery as to who was pulling whose leg and why; or whether, indeed, any leg-pull was ever intended, but at least the Bureau remained untainted except by association.

Throughout this hectic period our routine work of watching, recording and interviewing eye-witnesses continued without interruption.

* * *

While the I.T.V. operation was still in progress Bob Love and his team, including experienced scuba divers,

The commonest source of error, bow waves from a vessel which has already passed out of sight.

arrived back once more, since they wanted to work when the main tourist activity was over and the loch was quiet; and they set up their headquarters in a caravan down at Temple Pier. For his purpose Bob had chartered the 30-ft. diesel fishing boat *Rangitea* from Beauly, whose owner, Don Boddington, entered fully into the spirit of the enterprise, being prepared to turn out at any time of the day or night. Several days were spent fitting the vessel out as the Honeywell Scanner II sonar equipment had to be installed with its console, developed by the Atlantic Scientific Foundation, in a dark and curtained-off area below deck with a clock, compass and other controls alongside, with two Bolex 16-mm cameras fitted up to record single-frame time exposures of the sonar screen and other displays during each sonar scan. In all over 20,000 frames were to be recorded on Tri-X film.

During the following six weeks *Rangitea* ran 160.4 miles up and down the loch in 45.4 operating hours, carried out 77.5 miles of depth sound profiles in 17.4 hours and also ten miles of channel wall slope in 1.75 hours. The degree of concentration needed to monitor the screen for this aggregate length of time is not hard to imagine.

The basic mode of operation was for the search beam, which operated on 100 kHz, to start 10° abaft the port beam (100° to the left of the vessel's line of advance) and to move 5° clockwise at 3/4-second intervals for each sweep to a similar bearing to starboard (see Diagram 1), all this at a depression angle of 8° (or Hi-Beam). The beam then automatically returned to its starting point and carried out the same operation through 200° at a depression angle of 20° (or Lo-Beam) (see Diagram 2). Thus the entire scanning operation to cover the whole width of the loch took almost exactly a minute, during which time the ship at 3 knots would have gone forward 100 yards. Since the search beam is a cone 15° in diameter it is obvious that there would be a slight vertical overlap (see Diagram 2), also that a single object in the middle of a scan on the horizontal plane would be visible on three successive "blips" before the beam moved past it (see again Diagram 1, Diagram 3, and frames 4, 6 and 7). Two further points to note on Diagram 1 are, firstly, that the four concentric rings round the boat are at intervals of 200 yards, and secondly that the steep sides of

Rangitea berthed near Temple Pier, Urquhart Bay.
Note: Miniature submarine *Viper Fish* almost immediately under the helicopter in the background.

Bob Love at the controls aboard *Rangitea*.

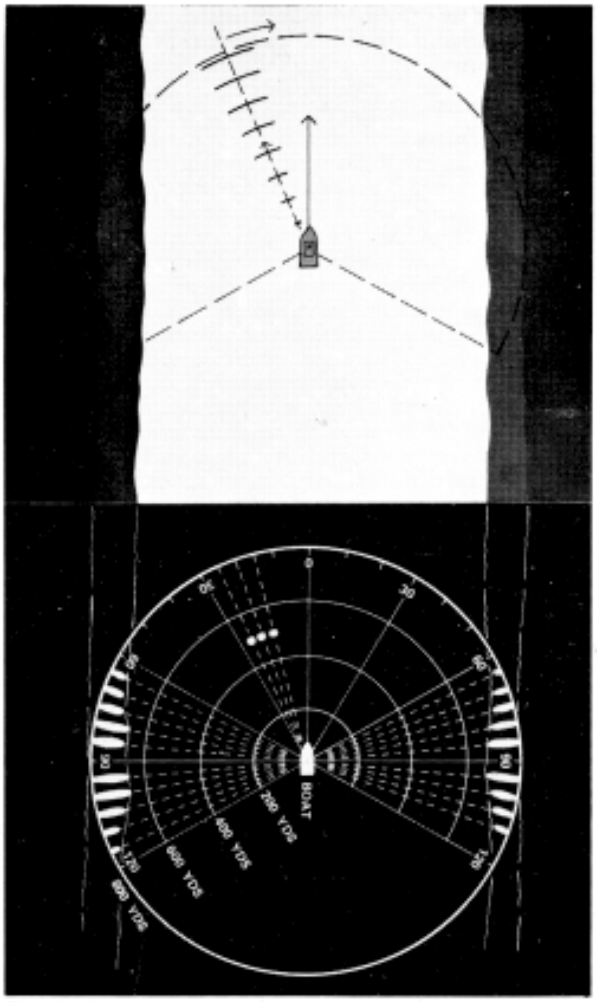


Diagram 1.

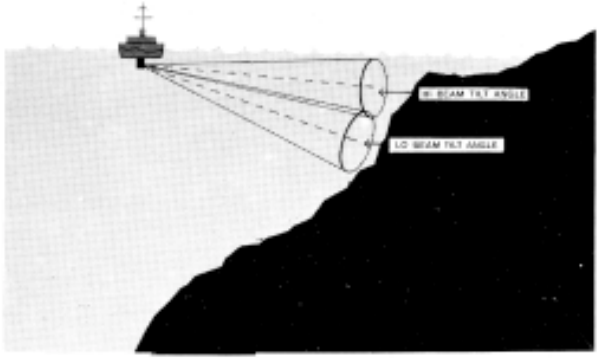


Diagram 2.

the loch would show up as indicated (see also frames 1, 2, 3 and 4). Thus in practice the "cut-out" occasioned by the forward movement of the boat between the blanking-off effect of the sides was sufficient to reduce the area of effective search to 56% of the loch's total volume, with little chance, moreover, of being able to pick up any creature lying inertly on the bottom or on the sides. Nonetheless Bob Love worked out that the statistical probability of seeing any single randomly moving creature

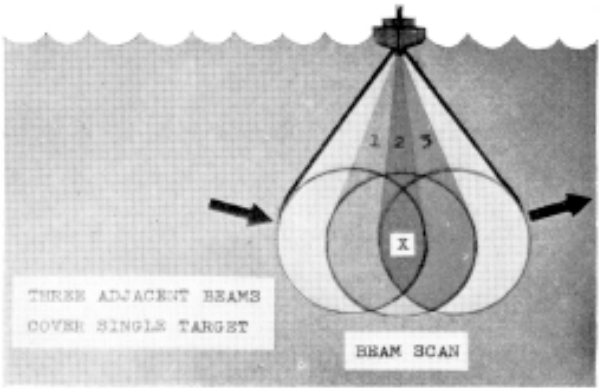


Diagram 3.

during a traverse of 21 miles was, of course, 56%, during two traverses 78%, during three traverses 85% and, during the 160.4 miles actually covered, 96%. How accurately this prediction worked out we shall soon see. It should, however, be explained that on obtaining a firm contact it was possible to switch over to a sector scan mode of operation whereby the arc scanned was reduced from 200° to 40° and the time taken to sweep reduced to 6 seconds, and the tilt was manually operated to facilitate tracking. The only complication in interpretation arises from side lobes from the main beam, the effect of which is shown on Diagrams 4 and 5. These can be ignored by an experienced operator.

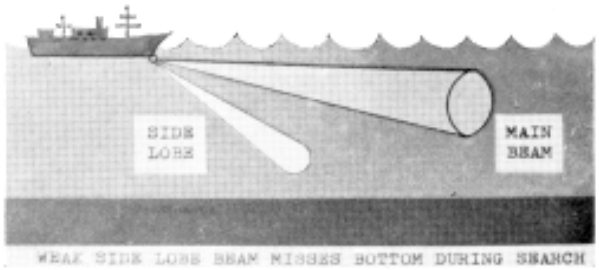


Diagram 4.

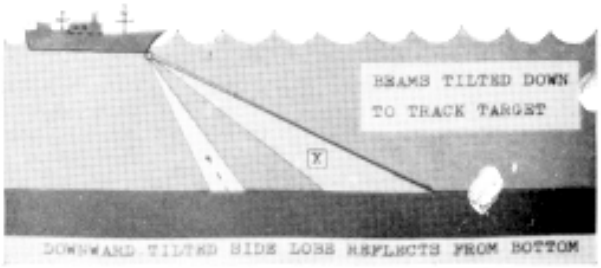


Diagram 5.

With this background information the time has come to quote from Bob Love's own summary of results:[1]

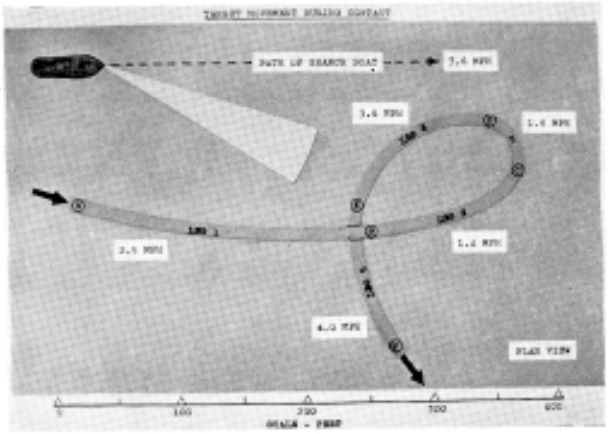
> "Several sonar contacts were made with targets of possible interest. One of these occurred near Invermoriston during a nocturnal depth-sounding traverse. This weak target echo appeared at a depth of 510 ft. in water 585 ft. deep. It remained in position for over 15 minutes while the search boat executed a criss-cross pattern over several hundred yards to determine the expanse of the target. Such large distributed targets

[1]Dated January 14th, 1970.

may be produced by groups of fish or eels above the bottom.

Seven other possible target contacts made during mid-water search traverses are assigned a low probability of significance due to the brevity of contact, reflections from stationary surfaces nearby, or their intermittent nature.

One target observed on October 10th, 1969, was more conclusively animate in nature. Initial contact was made one and one-quarter miles north-east of Foyers at a range of 1,440 ft. The target was tracked on sonar for 2 minutes 19 seconds during which time it moved 620 ft. along a looping path ahead of the boat. After moving parallel to the course of the approaching boat at 2.5 miles per hour, the target slowed to 1.4 m.p.h. as it turned toward the boat, then accelerated to 4.0 m.p.h. as it turned and drew away from the intruding boat. At this point the boat, moving at 3.6 m.p.h., had approached within 825 ft. and sonar contact was lost as tracking manipulation became more critical. The target was not re-encountered during 10 subsequent searches of this area.



Target movement during contact.

The physical width of the 15° conical sonar beam does not permit precise determination of the depth of this target. The bottom in the area is 690 ft. below the surface and is flat without projecting peaks or depressions. Upon initial contact the target was at least 220 ft. deep. At closer tracking ranges the beam is more narrow and more precise depth limits can be calculated. Near the conclusion of the sonar contact the target was moving at a depth of between 210 and 540 ft., a minimum of 150 ft. above the bottom.

Exact size analysis of a target such as this is not possible from sonar data since little acoustic energy is reflected from tissue surfaces which probably have a density comparable to that of water. The majority of the echo observed on sonar from an animate creature is due to reflection from air volumes contained within the creature, or, to a lesser extent, from its skeletal structure.

Sonar target strength does yield an approximation of the size of such contained air volumes. Calibration against cylindrical test target 14 in. in diameter and 40 in. high at a range of 1200 ft. showed target strengths comparable to the target tracked near Foyers. Another approach to determination of target size involves calculation of the maximum range at which targets of known geometry such as a spherical air volume can be detected by sonar in water of known chemical composition. Analysis of water samples taken from Loch Ness indicates very low attenuation of sonar energy. Computations show that a spherical air volume with a diameter of 2–3 ft. would be required for sonar detection at the range of intial observation of the Foyers target.

These two approaches yield similar air volumes. Air passages containing such large volumes point to development of any known aquatic species to immense proportions, or to some unknown species. This is all the more true since a volume of air inhaled at the surface would be greatly compressed as any creature containing it submerged. At a depth of 500 ft. a spherical air volume would be reduced to about 25% of its cross-section when inhaled at the surface, with a corresponding reduction in its target strength as seen on sonar. Sonar tracking of this target at depth tends to imply that the creature is not a surface air breather but rather extracts its air from the water at the depth in which it functions.

The possibility that the Foyers target returns resulted from a school of fish must be considered. A school of fish containing swim bladders whose total acoustic reflection could produce a target strength comparable to that of the Foyers target would be quite large. At the closer tracking ranges such a distributed target having a width of over 50 ft. could probably be distinguished from a single discrete target by its appearance on the sonar screen. While the "school of fish" argument cannot be conclusively ruled out this is considered an unlikely explanation due to the discrete nature of the Foyers target as seen on the sonar screen."[1]

While Bob Love himself is careful to say that this episode, considered in isolation, cannot be regarded as conclusive, it bears a striking resemblance to Professor Tucker's 1968 experience and, taken in conjunction, these two records must be regarded as very significant indeed. *In any event, the reader has only to see how heavily I have drawn on Love's written analysis to appreciate that his was the outstanding personal contribution to the season's work.*

[1]For a detailed examination of this incident see Appendix I.

:: SUMMARY ::

Serious study of Loch Ness has now been going on for a decade, with two Oxford and Cambridge Expeditions in 1960 and 1962 organised by Dr Peter Baker, one waterborne expedition organised by Col. H. G. Haslar in 1962, 15 personal one-man expeditions undertaken by Tim Dinsdale between 1960 and 1969, and yearly Bureau expeditions, each one expanding in scope, carried out between 1962 and 1969. In addition several senior members of the Bureau, including Professor Roy Mackal and myself, have paid visits to Loch Morar and to various

Irish loughs where substantially similar stories are told, suggesting we may be dealing with a widespread phenomenon.

In 1968 Dr Bernard Heuvelmans, D.Sc., F.Z.S., published his *In the Wake of the Sea Serpents* in an English edition (Rupert Hart-Davis). In this work he considered 358 sightings from all over the world between 1639 and the present day and concluded that 48 of them referred to creatures similar to those described in Loch Ness. If he is correct in his surmise, then we are dealing with a stranded pelagic species of a yet unidentified type.

So far, so good; but how much nearer are we to *proof* that such large creatures exist? The answer to this question lies in what you mean by proof, as standards of overwhelming probability that would be accepted by a jury in a court of law, or by any prudent man in the conduct of his own affairs, are not by any means acceptable to those who say "Show me a limb or a bone and I'll believe you". And yet creatures have found their way into the textbooks on the strength of a single sighting, the outstanding example being Wilson's Dolphin, described by Dr Edward Wilson on Captain Scott's *Discovery* Expedition in 1901. Other examples abound, too, of aquatic creatures of whom one specimen only has ever been washed ashore. All we can say, then, is that at present all the evidence points in the same direction. In the first instance eye-witness accounts over the last 40 years from Loch Ness and elsewhere are remarkably consistent, even when they come from people who had no preconceptions and have read and heard nothing of the subject. In the last four years alone, 80 sightings from Loch Ness (several supported by film) have commanded acceptance even after the most rigorous pruning of all accounts by those on the spot. These have been handed in by people from all over the United Kingdom and indeed from all over the world. Is it likely that they would all come to this one spot on the earth's surface to concoct an identical lie?

The film evidence has a similar impact. While the pre-war photos, notably the Surgeon's head and neck, are not susceptible of measurement at least they bear a strong resemblance to what other people have described, whilst more recent Bureau photography, which has been evaluated by the most impartial experts in the world, does prove that "probably animate" objects of a size unknown in Scotland have been observed moving in Loch Ness. If to all this the independent results of two separate sonar probes be added, then the case is formidable for believing we are dealing with a living creature and not a myth.

* * *

While evidence of a living creature grows steadily, we are still no nearer identification. Probably Professor Mackal is best qualified to express a view:

> "By the process of elimination, we can narrow down the types of animals—if there are animals—the Loch Ness 'monsters' might be. First, reptiles are doubtful, since no known reptiles would be sufficiently active in the average 42° temperature of the loch.
>
> Second, vegetarians are high questionable; there is little vegetation in Loch Ness, and plankton are sparse. There is, however, a considerable fish population, constantly replenished from the sea, and eels are known to be present. The obvious conclusion would be that any such animal would be feeding on fish, eels, or both.
>
> Would these animals be air-breathers or non-air-breathers? The two sonar fixes we have do not suggest air-breathers, because of their underwater activity; but sonar does not rule out air-breathers, either. If air-breathers are involved, my best choice would be a variety of sirenian, perhaps related to the manatee or sea cow. An Arctic sea cow, now thought to be extinct, did once exist.
>
> Non-air-breathers could still account for the sonar fixes, either because of their enormous body content, or because they might still contain a quantity of air, as fish or eels do in their air bladders. The possibility exists, of course, of giant eels, which are carnivorous and cannibalistic and could live on the fish or eels in the lake. Molluscs, too, are still a possibility; thousands of varieties of molluscs are known to exist. And, of course, there is always the possibility that we have here animals of a type hitherto simply unknown to us.
>
> If these animals are not reproducing in the loch, they could be a migratory species, coming into Loch Ness as juveniles, then growing to a size too large to permit them to leave."

Having thus established the probability of there being a large unidentified species in the loch and at the same time raised the whole subject from the level of a music-hall joke to one of serious world-wide interest, we must now either demolish the probability or turn it into established fact; and, if the latter, find out the creatures' identity. This becomes easier than seemed possible a decade ago, since growing interest makes available techniques which in earlier days we simply could not have contemplated on grounds of expense.

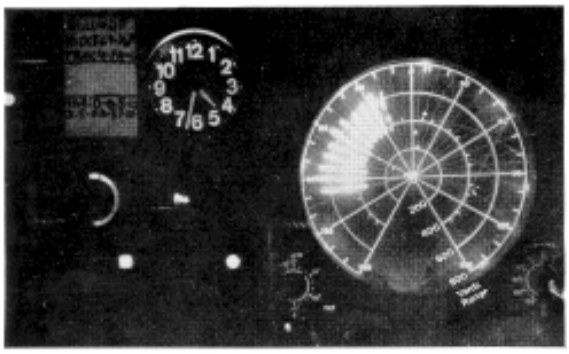
For every reason the Bureau rejects any attempt at live capture, since not only would this understandably be offensive to local sentiment, but also it might endanger the very existence of a species about whose population status we know nothing. This leaves only close-up photography, sonar sweeps, obtaining a tissue sample, passive acoustic monitoring, comparison with known underwater sounds and an underwater search for dead remains as weapons at our disposal, and all these techniques will be deployed in 1970.

As usual, surface cameras, this year under the direction of Tim Dinsdale, will be manned from May 23rd until October 17th, and they will be supported for four weeks by an autogyro, piloted by Wing Commander Ken Wallis, for vertical observation and photography. Professor Tucker will be back once more for two weeks at Temple Pier, this time with a horizontal as well as a vertical scanning set, while in August Bob Love and Don Boddington in *Rangitea* will return to the scene. At present Bob Love is attempting to develop a tissue-sampler with a "homing" device to shorten the odds against getting a flesh sample; and he is hoping, while on his sonar runs up and down the loch, to tow a sledge along the bottom equipped for flashlight photography in an attempt to locate skeletal or other remains.

Time alone will tell whether any of these convergent lines of approach will lead to success, but the positive evidence unearthed in the last decade is too great for us to be deterred by temporary set-back or failure.

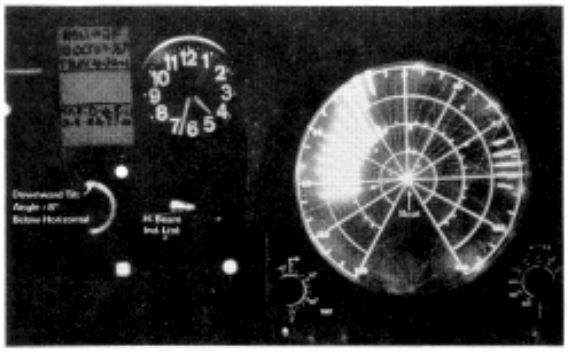
DAVID JAMES

R. Love's Interpretation of Frames



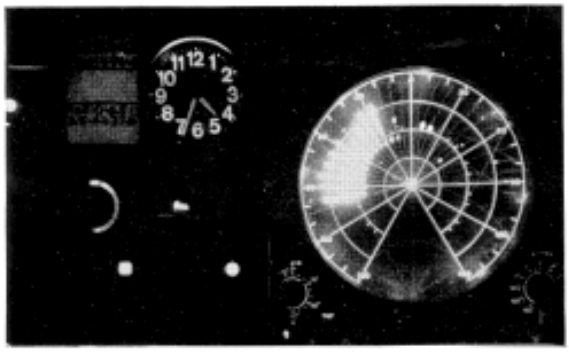
Frame 1. 1st Target Frame—Lo Beam.

In frame 1 a single dot appears indicating that the target is probably near the lower extremity of the beam and is therefore illuminated during only sweep when the scan angle is pointing the beam directly toward it.



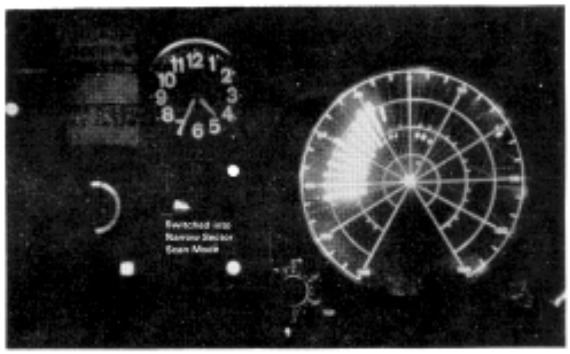
Frame 2. No Target—Hi Beam.

Frame 2 is at Hi-Beam tilt angle and the target is probably below the beam during the scan. You will note the long bright "streaks" on one or both sides of the screen. These are the echoes from the channel walls and/or bottom and you will see a variation from frame to frame. Random acoustic noise from waves, etc., will appear as it does in frame 2 as occasional bright dots in one sweep, not followed by dots at the same range on successive sweeps. Since each sweep of 0–800 yards in range requires one second, the probability of a noise "target" reoccurring at the same range on two successive sweeps is nil.



Frame 3. 2nd Target Frame—Lo Beam.

Frame 3 is Lo-Beam again and the target appears as dots just beyond the 400-yard range circle in two successive sweeps. This is such a rare occurrence that it fairly jumps out of the screen toward an operator and at this point I became super-interested in the next Lo-Beam scan, particularly since the target was absent in the Hi-Beam scan of frame 4.



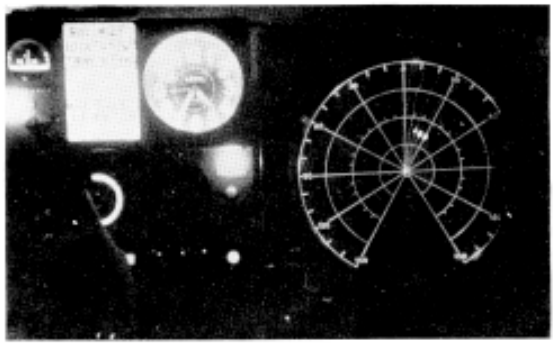
Frame 4.

When the target reappeared as dots in three adjacent sweeps just inside the 400-yard range circle I was sure we had a real one. At this point I switched to the sector scan mode of operation which is indicated in the print by illumination of the light just on the lower right of the clock. This reduces the normal scan arc from 200° to a more narrow arc of about 40° to provide a more frequent look at the target area. You will note that in frame 5 the light sweep lines are interrupted at about 60° right upon pressing the sector scan mode button. One other change occurs in the sector scan mode; the alternate Hi-Beam–Lo-Beam tilt angle variation is disabled and the tilt control whose pointer is sometimes visible in the lighted

Frame 5. Lo Beam—Full '3-sweep' Target Display.

arc below the data card remains in control of the tilt angle.

The remainder of the frames show a scan arc composed of five sweeps which I am in the process of trying to get pointed to completely cover the target area. This might seem easy when looking at the prints, but each of the narrow scans requires about 6 seconds and there is a finite feedback time through the operator's mind in trying to visualise how much more tilt angle to feed in as range decreases, which way is the target likely to move next, etc., etc., all compounded by a jolt of adrenalin.

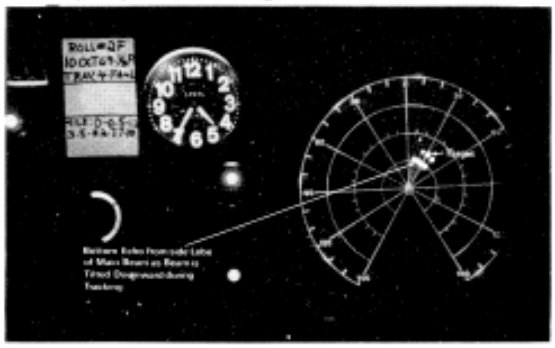


Frame 9. Lo Beam—Still trying to move scan arc to right.

Frame 9 shows the target appearing again in three sweeps as the narrow scan arc is moved to fully cover it.

A sonar "beam" is actually a pattern of beams with the strongest one, in this case having a beam width of 15°, surrounded by several side lobes with much reduced sensitivity pointing downward at 30 and 60° from the axis of the main beam. Since the sonar display depends only on the echo time to display the range of a target it has no way to discriminate between echoes from targets in these various lobes.

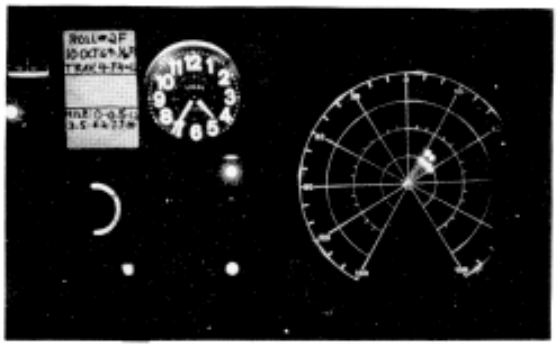
Starting with frame 10, by which point I had increased the tilt angle downward to 27°, the side lobes are tilted downward enough to strike the bottom and produce echoes just outside the 200-yard range circle. Depending on the acoustic composition of the bottom it was normally possible to get side lobe bottom echoes in Loch Ness if the sensitivity control were turned up too high. During normal operation I constantly adjusted sensitivity to just eliminate side lobe bottom echoes. During the remainder of this contact, however, I was too busy trying not to lose the target to worry about bottom echoes. As a matter of fact the display of the target distinctly separate in range from the bottom echoes



Frame 12.

provides one means of confirming that this sonar target was not a "rock on the bottom".

The remaining frames show the target in one or more sweeps with tracking becoming more and more difficult as the physical beam width decreases with range and as the tilt angle increases. Honeywell engineers were amazed that I was able to maintain contact with a moving target for several minutes, pointing out that they often lose contact with stationary targets when operating on 800-yard range with each sweep requiring one second. The value of the narrow Sector Scan mode of operation is apparent.



Frame 16. Beginning to lose Target, apparently wrong tilt.

Note: This interpretation is entirely supported by Honeywell's expert engineers.

9 Dec. '69
Plot No. 1
R. Love, Jr.

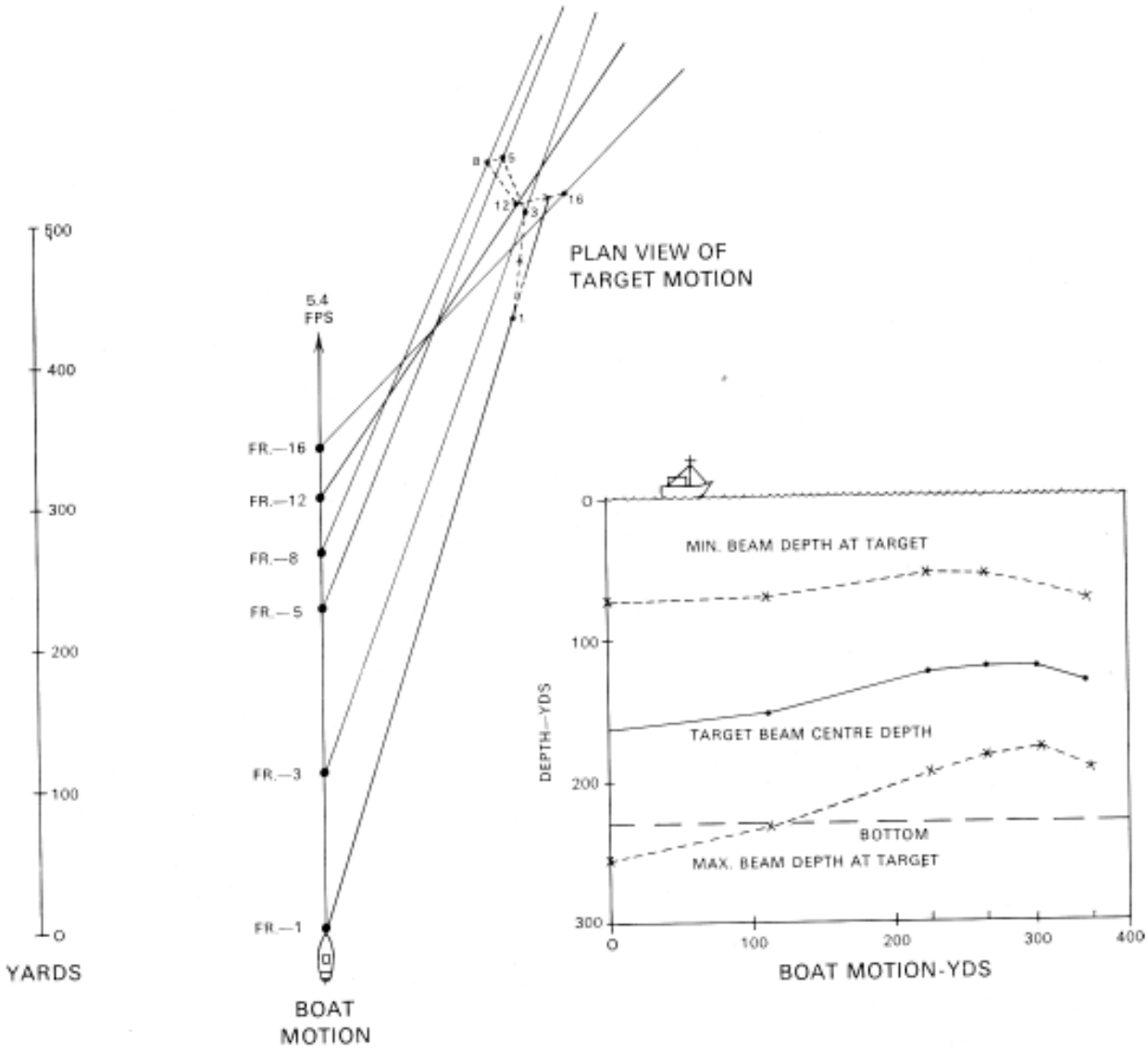
SYNOPSIS OF SONAR TARGET CONTACT

I. *Date:*
October 10th, 1969. Traverse No. 4, Ft. Augustus to Loch End, 1632–1634.
Transmitter power output — 50% max.

II. *Target Contact:*
Initial: 480 yds. slant range at 18° rt./20° tilt.
Final: 275 yds. slant range at 41° rt./30° tilt.
Tracked 2 minutes 19 seconds in 15° conical beam.

III. *Target Behaviour: (Absolute)*
Position: 1.24 miles north-east of Foyers' Point.
Location: 0.33 miles from west shore.
Motion during contact: 621 ft. (horizontal).
Direction: Varying; from parallel to, towards, and away from boat.
Max. target speed: 5.7 f.p.s. = 3.8 m.p.h. = 3.4 kts.
Ave. target speed: 3.2 f.p.s. = 2.1 m.p.h. = 1.9 kts.
Initial target depth: 493 ft., beam centre (216–768 ft.).
Final target depth: 403 ft., beam centre (225–585 ft.).
Bottom depth: 690 ft., flat.
Target lost during manipulation of beam tilt angle.
Target not present during ten later runs over same area.

IV. *Target Characteristics:*
Single discrete target (not distributed like school of fish, etc.).
Acoustic reflective surface less than 50 ft. wide (normal/beam).



Target strength comparable to 14-in. × 40-in. cycle target at 400 yds. range.

V. *Boat:*
Course: Standard.
Heading: 055° M.
RPM: 750.

Speed: 1.8 yds./sec. = 5.4 f.p.s. = 3.6 m.p.h. = 3.2 kts.

VI. *Film Records:*
3 low beam frames at approx. 30 sec./frame.
11 definite sector-scan frames at approx. 6 sec./frame.

APPENDIX II

Some Additional Notes on Loch Ness by R. Love

Magnesium = 0.042 milli-Moles/litre.
Calcium = 0.011 milli-Moles/litre.
Phosphorous = less than 5 mg. p/litre.
Sulphate as SO_4 = 3.0 p.p.m.
Dissolved Mineral Solids = 30.4 p.p.m.
Specific Resistance = 21,500 ohm-cm.
Specific Conductance at 25°C = 50.7 micro-mhos/cm.

From the standpoint of dissolved mineral solids the purity of the water is surprisingly high with a specific resistance approaching that of rainwater. This confirms that the majority of water entering the loch is derived from precipitation which is exposed only to soil of volcanic origin in its run-off path to Loch Ness. If there were a significant sub-surface contribution via a subterranean channel in underlying limestone strata, or a substantial fraction of limestone near the surface, a much greater amount of dissolved solids could be expected in loch water. Legend that their might be underwater caves or channels such as are common in limestone was further reduced this summer when investigation of the one known cave in the area (Gorrie's Cave) proved it to be a geological fault.

Organic decomposition in such water is apparently quite slow. A section of tree trunk was found with its bark intact at 80 ft. with silt deposited around it to a deth of about 10 in. The rate of silt deposition is probably a small fraction of an inch annually indicating that this log may have lain at rest for over 100 years without visible sign of decay. Loch Ness and other similar lakes owe their peculiar preservative properties to an unusual combination of natural characteristics. Several forms of stemmed algae grow in the shallow water along shore but disappear at depths below 20 ft. where insufficient light penetrates to support photosynthesis. It is likely that other associated biological activity is correspondingly reduced. Rapid light absorption prevents radiant heating at depth and the bulk of water in the loch remains at a constant low temperature all the year round. Water added by canal lock operation and precipitation is mixed with warm surface water resulting in increased run-off through shallow weirs probably without significant current effects to the deep water. This permits silting and limits chemical deterioration which normally results as fresh surfaces are exposed by erosion. Failure of tissue to decompose and float in this cold water offers an explanation for the legend that Loch Ness never gives up its drowned, and might explain why bodies of any large creatures it contains are not found; such preservation does provide some unique benefits.

A sunken ship near Temple Pier was described by crew members of the *Pisces* submarine as being a three-masted schooner 80–100 ft. long with bronze spikes protruding from the hull planking. This led to speculation that she might be a frigate reported brought overland into Loch Ness by Oliver Cromwell's forces in the middle of the 17th century. Several dives were made to measure and photograph this shipwreck lying in 108 ft. of water.

The shipwreck is resting on a sloping silt bottom with her bow pointing roughly toward Urquhart Castle. She measured 42 ft. in length with a beam of 17 ft. and is of clinker built, double-ender construction. The single mast about one-fourth of the way back from the bow is broken off about 15 ft. above the deck and may have extended another 15 ft. when built. A typical lug sail probably hung from this mast. Hull planks measure 6 in. by 1¼ in. and were held in place by square hand-forged iron nails which are nearly invisible in the dark wood. Planking is of a timber known locally as knotty larch and the protruding knots were apparently mistaken for bronze spikes by the *Pisces* crew. One of the deck beams, also of larch, measures about 4½ in. square and shows 52 growth rings. Hull planking near the stern is largely intact although seams have opened with age. Bow planking is missing in some areas although ribs still seem to be in place. It is possible that she may have damaged her bow planks against the pier while trying to moor in a storm and gone down a short distance away. Gunwales still mount iron belaying pins and main members are sound and well joined with iron spikes.

Research has not yielded a clue to the age or identity of this shipwreck. She obviously went down before the memory of present owners of the Temple Pier property who have been resident over 50 years. The condition of iron hardware and wooden members would indicate an age of 100–150 years, or more. Brief research at the British Maritime Museum in London reveals scanty knowledge of such vessels built much over 100 years ago.

Loch Ness has certainly maintained this example of the ancient shipbuilder's handiwork in a remarkable state of preservation. Study of underwater photographs may yield further information, but she must be seen to be appreciated.

APPENDIX III

CHEMICAL SAMPLING IN LOCH NESS ON 22/7/69

Station in the Middle of the Loch
Opposite Urquhart Castle
Depth 220 Metres

Depth in metres	Temp. °C	Salinity (‰)	Oxygen cc/l	BOD	Saturation w/oxygen (%)	Phosph.	Nitrate NO_3	Nitrite NO_2	Silicate	PH
0	14.50	Nil	7.49	0.57	102.7	Nil	6.27	0.09	25.9	6.40
10	12.10	—	7.55	0.41	98.4	—	6.82	0.05	26.9	6.50
30	10.71	—	7.75	0.62	98.1	—	—	—	—	—
40	9.53	—	—	—	—	—	7.29	0.08	26.6	—
60	6.10	—	8.19	0.82	93.1	—	—	—	—	6.50
100	5.88	—	8.20	0.57	92.8	—	7.30	0.02	29.2	—
125	5.68	—	8.15	0.85	92.1	—	—	—	—	—
150	5.55	—	8.18	1.68	92.0	—	—	—	—	—
175	5.50	—	8.16	1.37	91.5	—	—	—	—	—
180	5.51	—	—	—	—	0.02	7.37	0.07	28.8	6.25
190	5.49	—	8.13	0.95	91.2	—	—	—	—	—
200	5.49	—	8.07	1.28	90.5	0.05	5.74	0.07	29.3	6.20
210	5.45	—	7.97	0.90	89.4	—	5.05	0.12	28.1	—
220	5.45	—	6.47	—	72.6	0.11	4.87	0.03	34.07	6.20

APPENDIX IV

Sightings from other Lochs

A Bureau expedition to Ireland led by Captain Lionel Leslie did not come up with any positive results, though some loughs with recent accounts to their credit were netted; but two important Scottish accounts came from Loch Morar:

1. August 11th, 1969. James Hanratty (49), fisherman, and J. MacVarish[1] (42), hotel worker, were travelling in their boat between the islands at the west end of the loch when they saw a dark brown object approximately 30 ft. long some 500 yards away. "It was travelling at a high speed between two islands. We went after it in our boat but it had submerged by the time we had cleared the islands. It came back towards us underwater and passed our boat at about 20 yards. It was leaving a wake like an outboard motor." They estimated it swam 3 to 4 ft. out of the water when first seen and travelled at a speed of 30 knots, judging by the time it took to cover the space between the islands. Weather: calm and sunny; loch "flat calm".
2. August 16th, *circa* 2130 B.S.T. Duncan McDonell (35) and William Simpson (22), both long-distance lorry drivers, were out in the latter's 18-ft. cabin cruiser proceeding back to Morar village at 6–7 knots when a large object surfaced astern of them, rapidly overtook their boat and gave it a glancing blow. This was of sufficient severity to knock a kettle off the gas-ring below. William Simpson slipped down to turn off the gas but was interrupted by shouts from his partner: he returned on deck to find him fending off a creature 20–30 ft. long with an oar which snapped in two. He thereupon picked up a .22 rifle and fired a shot in its general direction. Either the noise of the rifle or the impact of the bullet scared the creature, which dived from view.

Simpson was interviewed within hours by Professor Mackal and myself and subsequently by I.T.V. newscaster Richard Lindley. McDonell, who had already gone off on a lorry trip, was run to earth by the B.B.C. in Glasgow. Their stories tallied well and no one could talk to either without realising that they had had an extremely un-nerving experience, particularly for people who could not swim. Neither doubted for a moment that it was a living creature that had overtaken them but both considered it struck them inadvertently.

Particular interest attaches to this story owing to a reputedly shy creature surfacing so close to a running outboard engine; and also owing to how soon this episode followed on after the previous report. The weather was dull and the surface of the loch flat calm. The sun set that day in that latitude at 2110, so with a long northern twilight it was still broad daylight, with car lighting-up time not till 2155.

[1]See 1968 Annual Report Page 4, Cols. 1 and 2, for details of MacVarish's earlier sighting.