DISCUSSION FOLLOWING THE PAPER BY MR.J.I.EDWARDS : PRELIMINARY ANALYSIS OF THE VARIATION IN TARGET STRENGTH OF MULTIPLE TARGETS AT VARIOUS DEPTHS; LOCH ETIVE 1975.

MR.H.R.STEWARDSON: An interesting experiment, difficult to do but providing much valuable information. Were you able to observe the fish whilst the cage was being moved ?

MR.EDWARDS: I glossed over the fact that we took stereo camera photographs every 35 minutes. 2,500 stereo pairs were exposed, but unfortunately the only way we can analyse the photographs is by making large prints (50cm x 40cm) and then encode them with a suitable analysing table. Using a cursor and a foot treadle to mark the position of the fish, the analyser punches the co-ordinates of the head and tail of the fish onto paper tape. The paper tape is used as the input to a computer programme which calculates the length of the fish and the directional cosines of its major axis. It takes about 2 hours to analyse one stereo pair. Seven pairs have been analysed so far which gives interesting answers. All the fish were nose down between zero and 10 degrees.

MR.SHOTTON: Could you tell me why you used so many fish ?

MR.EDWARDS: Sixty fish were used in the first experiment.

MR.SHOTTON: It seems unlikely that 60 saithe would be found in such close proximity as they were in the cage.

MR.EDWARDS: If you look at Ehrenberg's work on variance then, providing that you take more than 1,000 transmissions, the largest source of error comes from the number of fish and the variance is approximately the number of fish in the beam at any one time.

DR.F.R.HARDEN JONES: You would need to use one fish at a time to understand what is happening and get 1,000 pings per observation.

MR.EDWARDS: We set out to investigate what happened with depth to multiple fish with particular relevance to integration.

DR.WELSBY: The fish started off swimming more or less horizontally; if you suddenly drop them wouldn't they be pressed against the top and also wouldn't they be vertical swimming and trying to get up. Could it be that the sudden drop in TS is simply due to the fact that they have gone from dorsal to head aspect ?

DR.McCARTNEY: There is one difference between a bubble and a swimbladder. If you take a fish which is equilibrated at 8 m and then put it down further, in the first instance it cannot produce gas fast enough to fill the swimbladder up to normal size so that the gas becomes compressed and the swimbladder becomes flaccid and behaves very like a bubble. Take a reverse situation after equilibration; on bringing the fish up, the swimbladder first expands to its normal size and perhaps a bit beyond. It then becomes very stiff and as you raise the fish further the size of the swimbladder cannot change and the pressure of the gas inside remains higher than the external water pressure.

MR.EDWARDS: This conflicts with Dr.Hawkins' work. He did experiments with fish in a cylinder. He varied the pressure above and below the adaptation pressure and he found that the fish cannot hold any internal pressure inside the swimbladder at all. The paper by Hawkins and Sands says just that.

DR.McCARTNEY: So you are saying that the fish are releasing this gas ?

MR.EDWARDS: No, I wouldn't venture to say anything on this subject.

DR.McCARTNEY: Measurements on resonant frequency tell you that the size is not going up as you would expect from the mass of gas at depth when you raise the fish.