In confidence: Not to be quoted without reference to the Laboratory.

CRUISE REPORT

F.R.S. "M A R A"

April 16 - May 25, 1966

Objectives

(a) To study the acoustic properties of fish swim bladders by the analysis of echoes and sounds produced by single fish.

(b) To observe the effects of different rates of decompression on haddock on being brought to the surface.

General

"Mara" left Buckie on 21st April and arrived at Kyle at 09.30 hours on 24th April. Work began on 25th when cages were laid off "Moll" in the northern approaches to Loch Ainort. Further time was then spent in installing electronic equipment on board at Kyle. An echo-survey of the area was carried out on 26th and a suitable depth was found for Dr. McCartney and Mr. Stubbs' programme (at 1 on chart). Meanwhile a shore laboratory was set up so that further work could be carried out independently of "Mara" (3 on chart). "Mara" left Kyle for the Loch Eil survey on 13th May, arriving at Corpach on the 14th. The survey was completed by 18th and "Mara" then made passage through the Caledonian Canal to Buckie.

Results

(a) Acoustic experiments aboard F.R.S. "Mara"

The investigations aboard "Mara" were aimed at obtaining echoes from single fish using low frequency pulsed sound sources. The fish were held in small cages which were made from courlene netting around a frame of rigid PVC tubing and were effectively transparent to low frequency sound. These were suspended in mid water from the anchored ship. Several resonant sources and a broadband sound source were tried. Ultimately success was obtained using a 3 Kc array when echoes were obtained from a single whiting. For future work, much more acoustic power is needed at lower frequencies nearer to the resonant frequency of the swim bladder. Hence Bouger pulse lengths will be necessary and deeper water will be required.

Bad weather during the programme was a severe handicap in these experiments making it difficult to secure and handle fish underwater and causing mortality of fish in mid water cages due possibly to surging of the cage under motion of the ship.

(b) Acoustic experiments ashore

Again bad weather was instrumental in curtailing the shore-based programme. In addition, the diesel generator broke down and attempts to repair it were unsuccessful. It was not possible to record sounds from haddock in isolation so that sounds free from distortion were not obtained. Measurements were made of ambient noise and as in other similar environments short impulsive snapping sounds were frequently heard. These would appear to be 'biological' but as yet are unidentified. Recordings of diver's demand valve noise were made for later analysis. This noise could be detected on our hydrophone at distances of several miles depending on the type of valve used.

Fishing

Haddock were not as abundant in Loch Ainort as on previous occasions, only small catches being taken. Amongst the catch was one haddock which had

been tagged in the area in February 1966 and was recaptured on 20th April. Whiting were available irregularly and these were used in the N.I.O. experiments. The fish were caught on handlines, brought to working depth and then removed by divers who then placed them in mid water cages. Both haddock and whiting appeared to survive transfer from the bottom (30 fathoms) to a cage at 17 fathoms and equilibration of the swim bladder was complete if the fish were left overnight (see below).

(c) Diving observations

1. The main task of the divers was to handle fish underwater to prevent damage to swim bladders during decompression and check the survival of fish in mid water cages in the acoustic experiments.

In addition, an attempt was made to determine the optimum rate of ascent to surface in order to obtain live haddock with intact swim bladders. To do this two haddock were caught on handlines in 30 fathoms and then raised to 10 fathoms to allow divers to remove them from hooks and transfer them to small netting cages. It was then possible to move the fish up and down and make observations on their behaviour. The following procedure was followed.

Transfer from 30 to 10 fathoms was too great a pressure change so the fish were immediately lowered until they appeared reasonably happy and could swim well in spite of excess buoyancy. This occurred at 15 fathoms. Two days were allowed for equilibration and the fish were then brought up again to 8 fathoms when it was obvious that they were too uncomfortable to withstand further decompression. On the following day these fish were brought to the surface in a 'bloated' condition and they appeared to have lost a large proportion of their scales. This was presumably due to chafing against the top of the cage whilst positively buoyant. The swim bladders of the fish were swollen but intact. These results indicate that haddock can withstand a sudden pressure reduction to about 60% of original depth.

2. On 11th May one night dive was carried out in the vicinity of an underwater 200 watt light which had a large aggregation of organisms below it as seen by ship's echosounder. On diving it was found that quite large numbers of whiting and sprats were aggregated by the light and these would have largely accounted for the observed echo trace. The depth of water was 34 fathoms and the light was at about 7 fathoms.

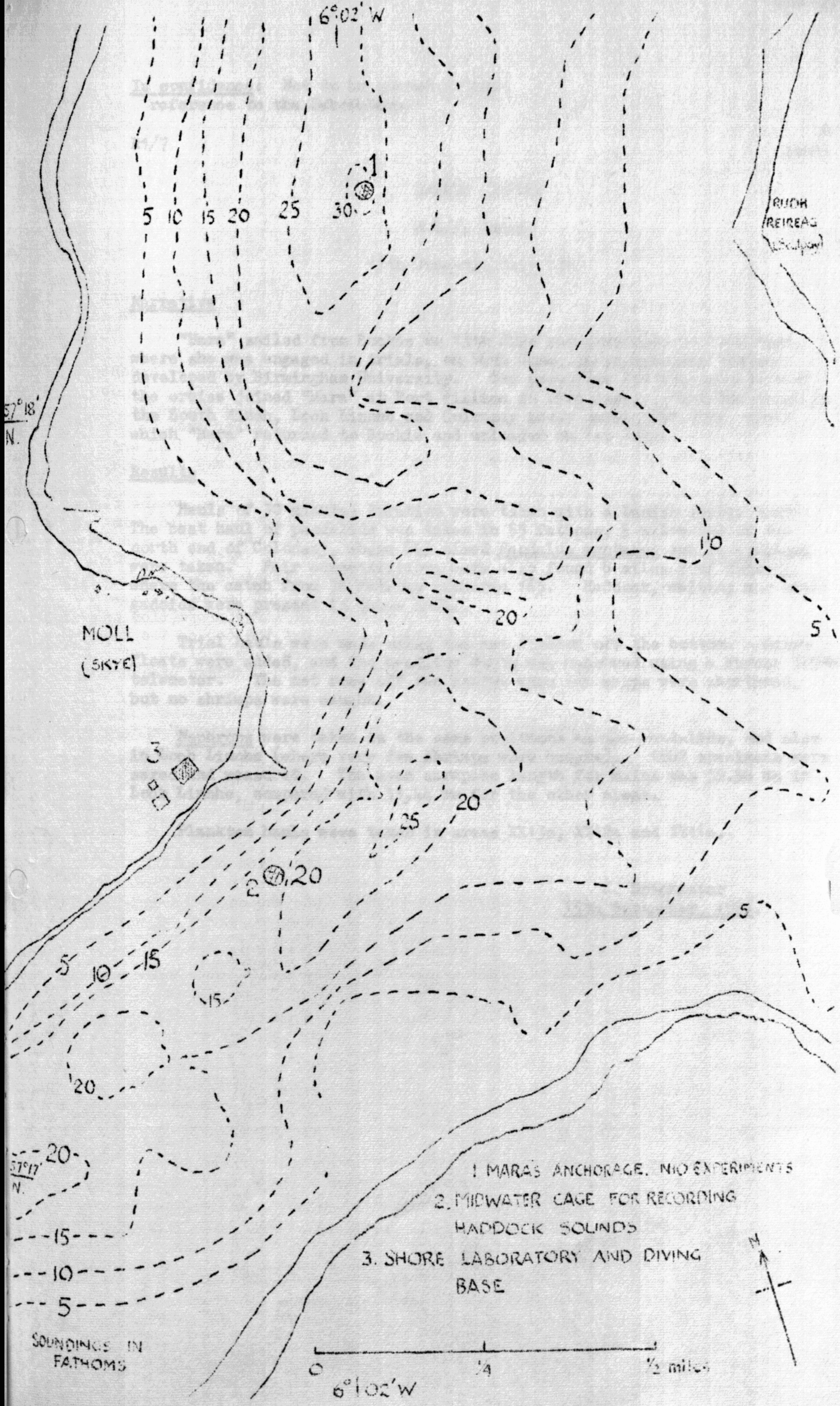
3. An interesting observation was the apparent attraction of small shoals of Gadus minutus L. to one of the bottom haddock cages in 17 fathoms of water near "Moll". These fish were able to swim into the cage through the meshes and there they remained for at least 7 days when observations were possible during the course of other activities.

4. It appears that Nephrops are to be found in the area. One large specimen was observed in daylight at 17 fathoms near the bottom cage at "Moll".

Loch Eil Survey

The routine bottom fauna and hydrographic survey of Loch Linnhe and Loch Eil was carried out by Mr. Burns and Dr. Pearson (Millport) on 17th, 18th May.

C.J. CHAPMAN
21st June, 1966


6°02' W
57°18' N.
57°17' N.
MOLL
(SKYE)
RUDH REIREAG
5
10
15
20
25
30
1
2
3
1 MARA'S ANCHORAGE. NIO EXPERIMENTS
2. MIDWATER CAGE FOR RECORDING HADDOCK SOUNDS
3. SHORE LABORATORY AND DIVING BASE
N
0
¼
½ miles
SOUNDINGS IN FATHOMS
6°1.02'W