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TARGET STRENGTH OF SANDEELS

by

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SUMMARY

This paper describes further measurements in a series designed to investigate the acoustic target strength of pelagic fish. In this case the target strength of sandeels has been measured, and was found to be of the same order of magnitude as in the previous year's experiments, ie -45 dB to -55 dB re 1 kg at 38 kHz.

INTRODUCTION

This paper reports further work in the series of target strength experiments performed at the Loch Duich Field Station (Edwards, 1980; Edwards and Armstrong, 1981, 1982 and 1983; Edwards et al., 1984 and Armstrong and Edwards, 1985).

The current experiments were conducted to measure the target strength of sandeels. Sandeels have been observed as dense pelagic shoals and are often caught in the pelagic trawl hauls carried out during acoustic surveys. Although acoustic surveys of sandeels are not carried out at present, on occasions the contribution of "unwanted" species may be required to be removed from the overall biomass estimate, using trawl samples to provide proportions. This requires that the target strength of the "unwanted" species be known.

MATERIALS AND METHODS

The experimental apparatus was similar to that described by Edwards et al., 1984.

The sandeels used in the experiment were caught by the commercial sandeel trawler FV "Reul Na Maidne" and transported to the Loch Duich field site in GRP tanks as described in Armstrong and Edwards, 1985. The tanks were flushed continuously with salt water from the fishing vessel's "donkey" pump. On arrival at the experimental site the fish were transferred into the Fish Barge (Edwards, 1980a) and stored there

until required. The experimental cage used in the previous year's experiment was found to have a high acoustic reflectivity, so a cage was constructed of a different material which was equally good at containing the sandeels but had a much lower acoustic reflectivity at 38 kHz; the reflectivity at 120 kHz was also lower but only by a small amount making analysis of the data difficult. Despite this improvement a large quantity of sandeels were still required to give reasonable signal levels making it impractical to measure fish tilt angles using the 35 mm stereo camera system.

Figures 1-3 illustrate the results obtained in this set of experiment for 38 kHz and although a cyclic nature is observed it is not clear whether this is related to light level or tidal effects or possibly a combination of both these factors. The one hour running mean takes values between a maximum of -48 dBs per kilo and a minimum of -60 dBs per kilo this being a much narrower range than in the 1984 experiments which gave a range of -42 dBs per kilo to -60 dBs per kilo. Table 1 lists the average results for the sandeel experiments performed during both the 1984 and 1985 field season.

The results of Dalen et al. (1976) are shown for comparison, as target strength per individual.

Table 1 Summary of Sandeel Target Strength Data

Expt No	Mean length (cm)	Mean weight (gm)	Total weight (kg)	TS per kilo @ 38 kHz	TS per fish	Dalen et al.
1/84	13.26	7.81	19.625	-47.8	-68.9	-46.0
2/84	11.93	5.96	51.000	-50.8	-73.0	-48.1
3/84	12.32	6.75	25.545	-46.9	-68.6	-47.5
1/85	12.87	7.01	23.839	-52.3	-73.9	-46.6
2/85	12.32	5.68	21.290	-52.8	-75.4	-47.5
3/85	11.94	4.88	37.865	-54.7	-77.9	-48.1

DISCUSSION

As discussed in Armstrong and Edwards (1985) sandeel and mackerel have two features in common when considered as acoustic targets. They do not have swimbladders and they are negatively buoyant. Bearing this in mind it is not surprising that target strengths per kilo of the two species should be similar in magnitude. The variations observed although displaying a cyclic variation do not display the strong diurnal character of mackerel. However, sandeels unlike mackerel can rest on the sea bed (or the base of the experimental cage) without sustaining significant damage. Thus, whilst the change in mackerel target strength with time is thought to be caused by an increase in tilt angle which is in turn caused by lower swimming speeds, it is not clear whether the changes in sandeel target strength with time are caused by changes in tilt angle or changes in the distribution of fish within the cage.

CONCLUSIONS

The target strength of sandeels is similar to that of mackerel in magnitude (-45 to -55 dBs per kilo) at 38 kHz.

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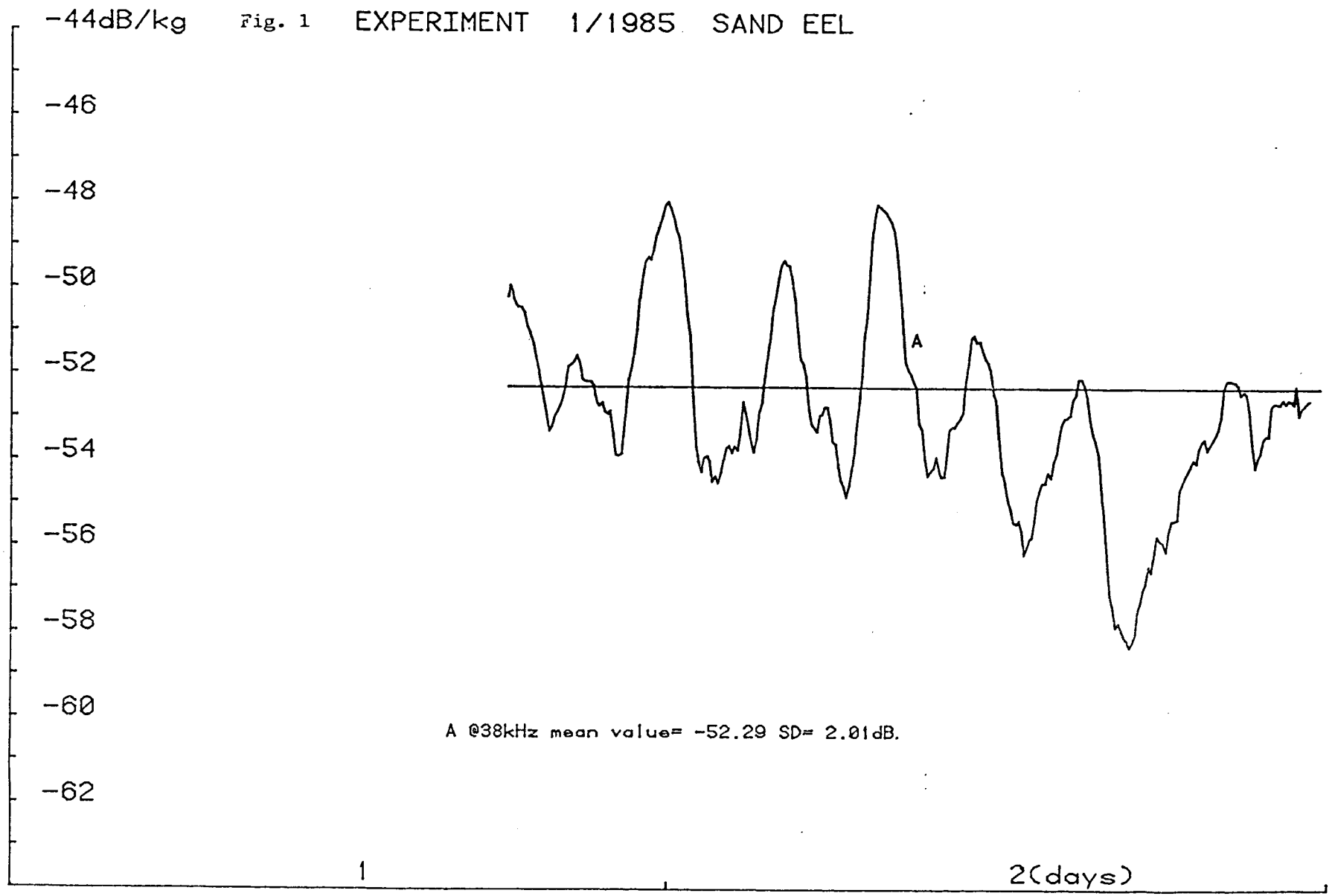
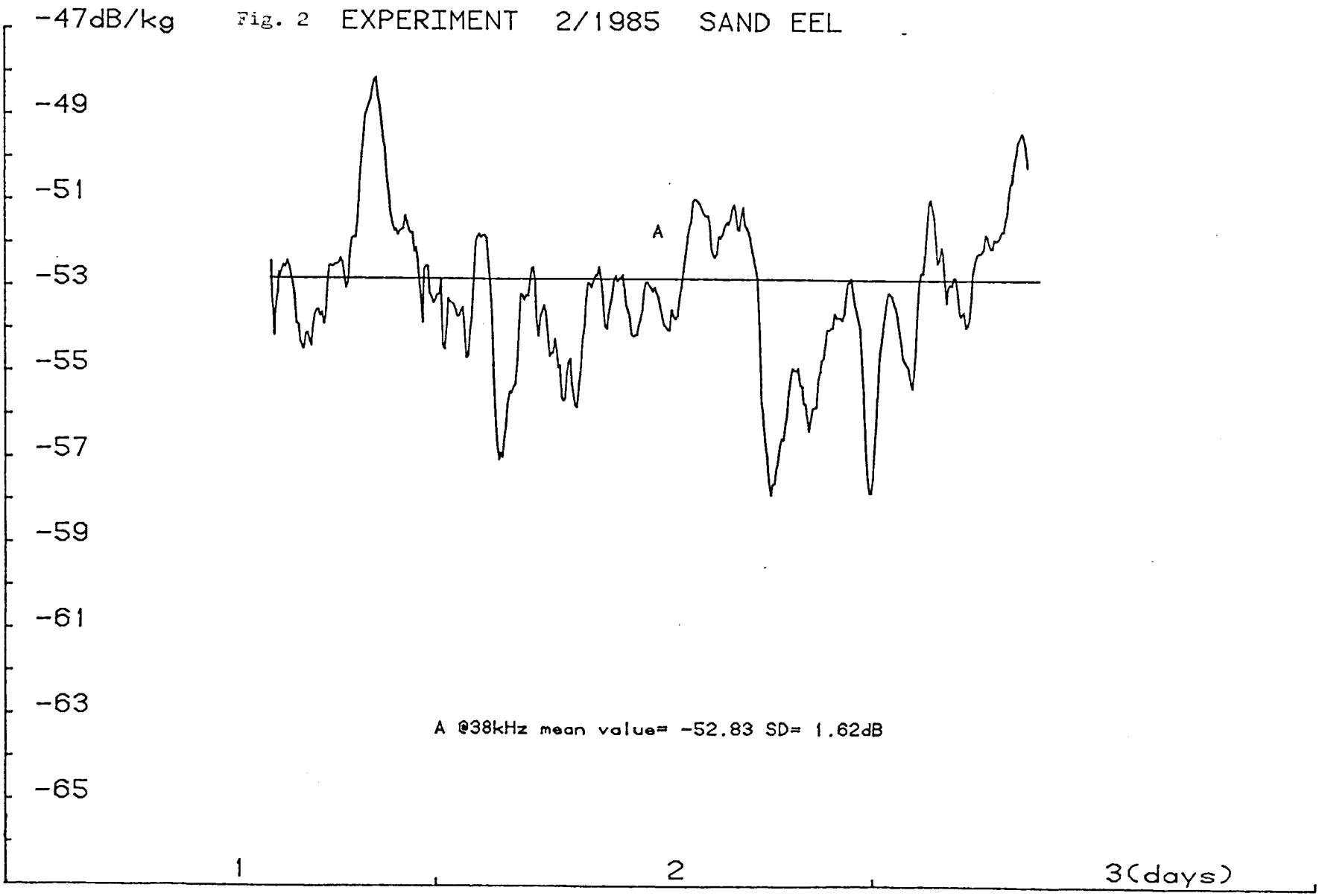
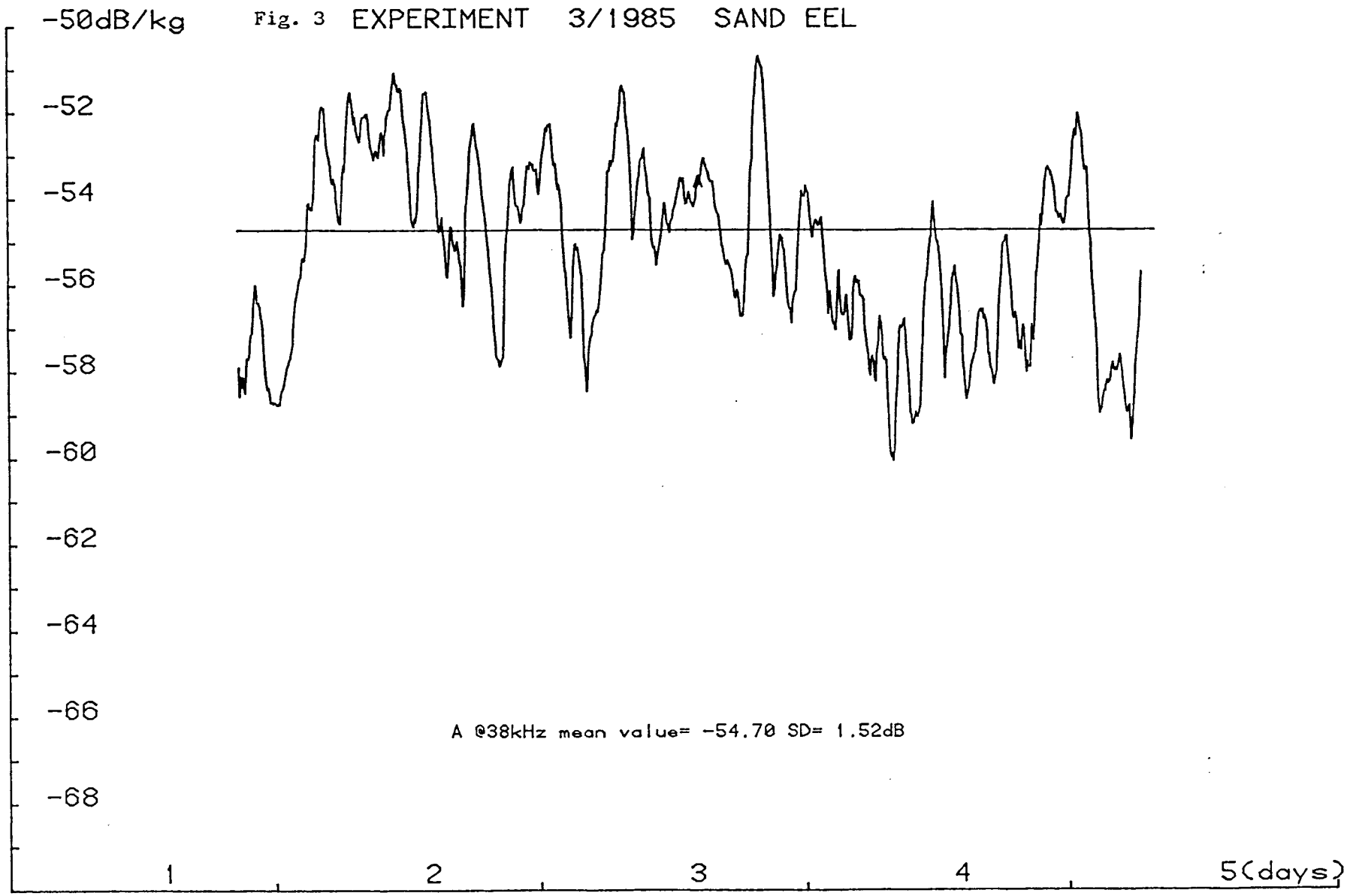

-44dB/kg
Fig. 1 EXPERIMENT 1/1985 SAND EEL
-46
-48
-50
-52
-54
-56
-58
-60
-62
A
A @38kHz mean value= -52.29 SD= 2.01dB.
1
2(days)


-47dB/kg
Fig. 2 EXPERIMENT 2/1985 SAND EEL
-49
-51
-53
-55
-57
-59
-61
-63
-65
A
A @38kHz mean value= -52.83 SD= 1.62dB
1
2
3(days)


-50dB/kg
Fig. 3 EXPERIMENT 3/1985 SAND EEL
-52
-54
-56
-58
-60
-62
-64
-66
-68
A @38kHz mean value= -54.70 SD= 1.52dB
1
2
3
4
5(days)