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ACOUSTIC SURVEY OF DEEP-WATER FISH OF THE SKAGERRAK

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Introduction

Two fish species, the greater silver smelt *Argentina silus* and the roundnose grenadier *Coryphaenoides rupestris*, are highly abundant in the deep-water areas of the Skagerrak. Since the 1970s, a small aimed trawl fishery for the smelt has developed and now also some grenadier is landed. The biology and general distribution of both species have been described from the Skagerrak and elsewhere. Due to their benthopelagic distribution at depths from 200 to 700 m, previous attempts at estimating abundance and biomass of the Skagerrak concentrations yielded unsatisfactory results.

In April 1992, during what appears as a major spawning season of the greater silver smelt, abundance estimation by the SIMRAD EK 500 echo sounder and integrator was attempted. Comparisons were made between observations made by the hull-mounted transducer and a transducer mounted in a newly developed towed body .

Material and methods

In the period 23-26 April 1992, areas of the Skagerrak deeper than 300 m were surveyed by the RV G.O.Sars (Fig. 2). In the easternmost area where highest densities were expected, a two-stage stratified random design was used. Further to the west a zig-zag track was followed because of a shortage of time. The EK 500 sounder with a hull-mounted ES 38 B transducer was run continuously. At intervals, also an ES 38 7D transducer mounted in a vehicle towed at various depths was used and separate recordings from both transducers were obtained for comparison.

Results

Recordings made by hull-mounted and deep-towed transducers along the same track are compared in Figure 1. In the deep-towed transducer recording, the reduced influence of noise is apparent, and single fish recordings are very distinct even at great depth.

Based on recordings by the hull-mounted transducer, area backscattering coefficients attributed to the mixture of greater silver smelt and roundnose grenadier were estimated (Fig. 2). The highest densities occurred in central and eastern parts of the area.

The two species co-occur but the echograms yield no information of their relative abundance. Trawl samples give some indication of the relative abundance in different areas, also information obtained from the commercial trawlers fishing in the area at the same time. This, and experience from earlier bottom trawl surveys suggested that recordings from the rougher lower slope waters at around 10 E were almost pure greater silver smelt recordings. Further to the west in the central deeps over soft substrates the roundnose grenadier was dominant. To evaluate this information, the area was divided up into 15′ latitude by 30′ longitude rectangles for which values for the grenadier/smelt fraction was assigned.

Using the integrator values and the target stength (TS) vs. length relationship given by Foote *et al.* (1986), an estimate of abundance of *Argentina silus* was calculated. With a mean body length and weight of 37.7 cm and 0.43 kg (based on trawl samples), the estimate abundance obtained was 53 million individuals corresponding to 23,000 tonnes.

For the grenadier, no target strength values are available, hence no estimates of abundance could be obtained. From comparisons of the distributions of the two species, it seems reasonable to assume that the abundance of grenadier is considerable and most probably greater than that of the silver smelt.

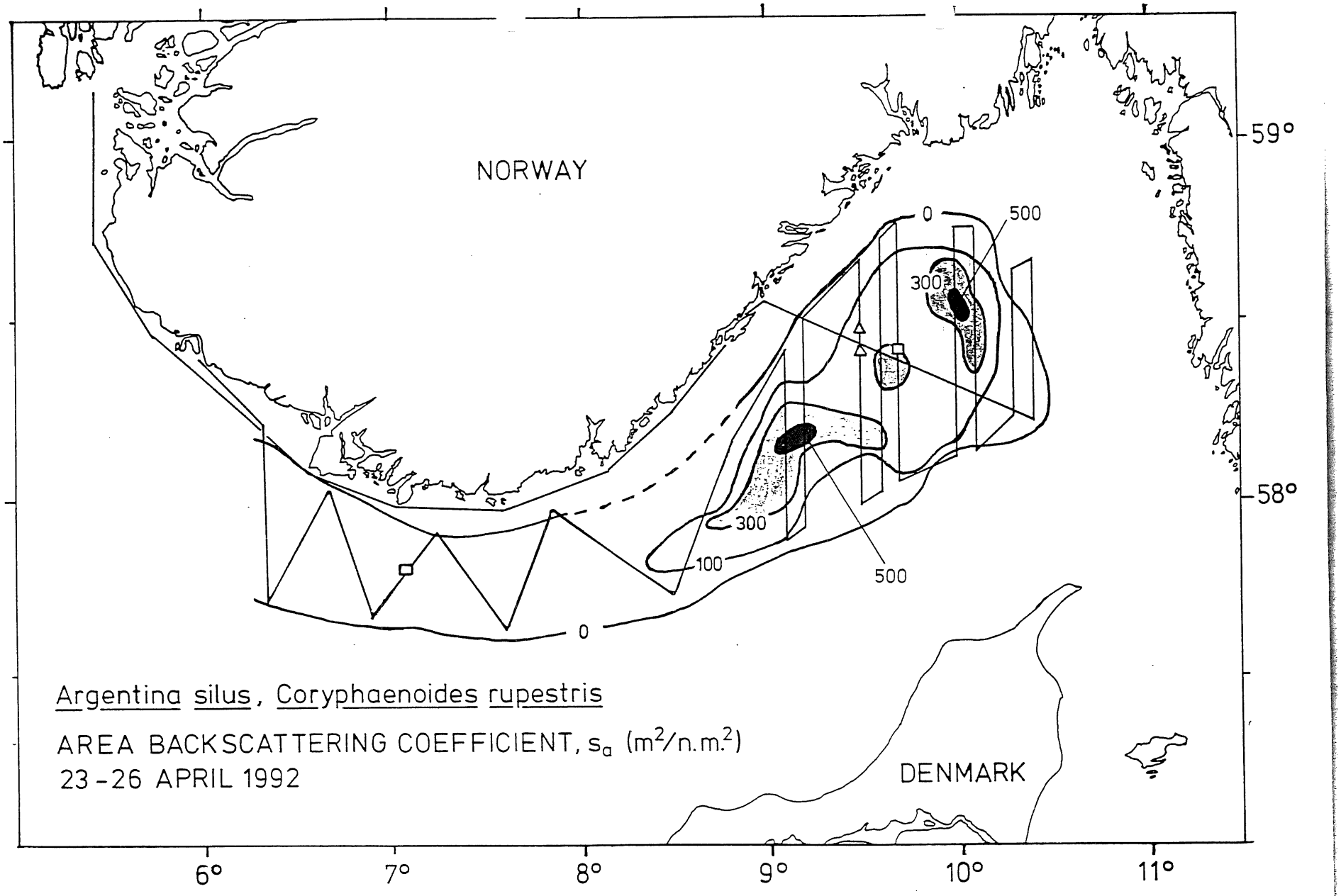
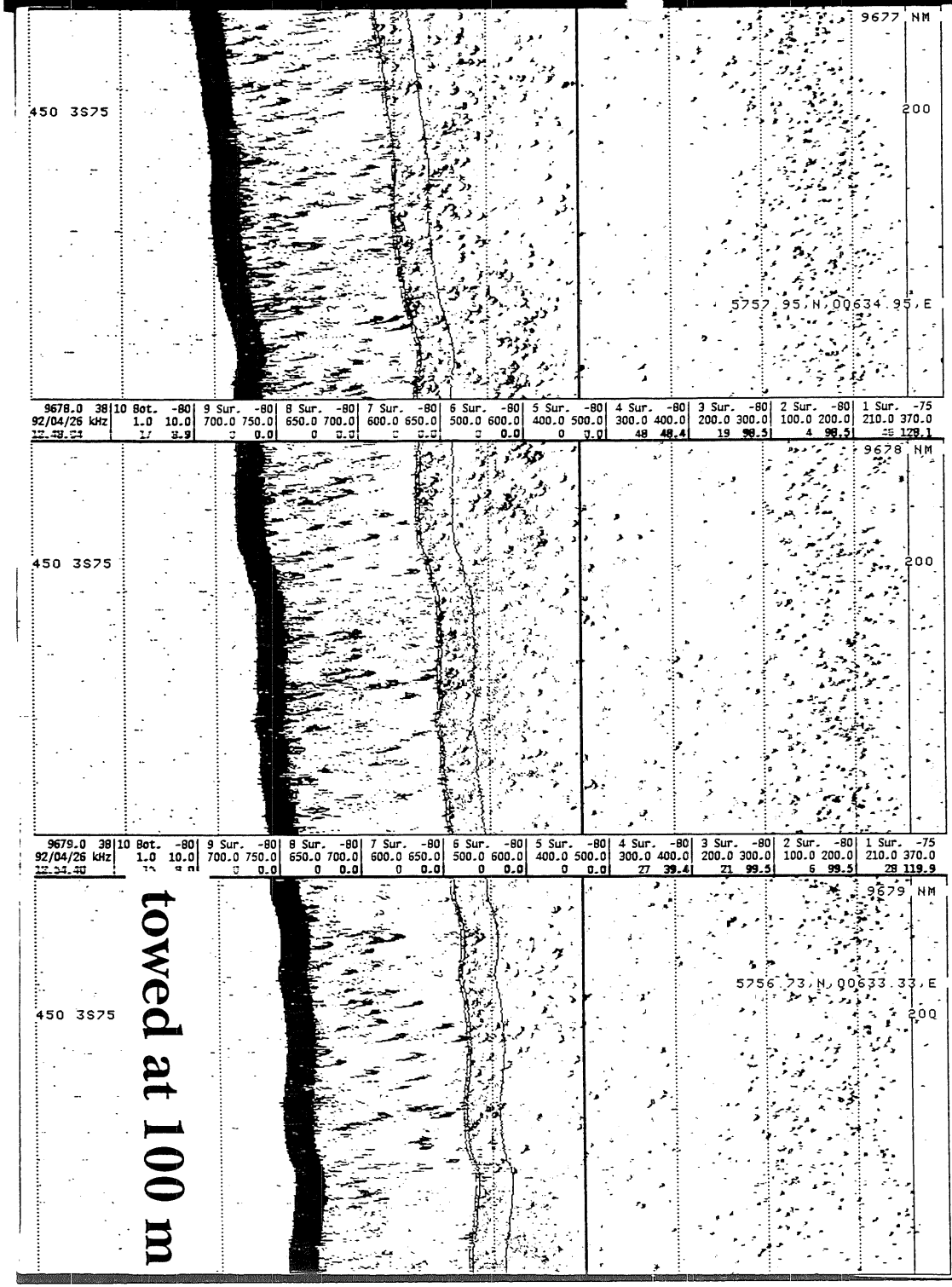


Fig. 2. Echo abundance of deep-water fish


towed at 100 m
450 3S75
9677 NM
200
5757.95,N,00634.95,E
9678.0 38 10 Bot. -80 | 9 Sur. -80 | 8 Sur. -80 | 7 Sur. -80 | 6 Sur. -80 | 5 Sur. -80 | 4 Sur. -80 | 3 Sur. -80 | 2 Sur. -80 | 1 Sur. -75
92/04/26 kHz 1.0 10.0 | 700.0 750.0 | 650.0 700.0 | 600.0 650.0 | 500.0 600.0 | 400.0 500.0 | 300.0 400.0 | 200.0 300.0 | 100.0 200.0 | 210.0 370.0
48 48.4 | 19 98.5 | 4 98.5
450 3S75
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9679.0 38 10 Bot. -80 | 9 Sur. -80 | 8 Sur. -80 | 7 Sur. -80 | 6 Sur. -80 | 5 Sur. -80 | 4 Sur. -80 | 3 Sur. -80 | 2 Sur. -80 | 1 Sur. -75
92/04/26 kHz 1.0 10.0 | 700.0 750.0 | 650.0 700.0 | 600.0 650.0 | 500.0 600.0 | 400.0 500.0 | 300.0 400.0 | 200.0 300.0 | 100.0 200.0 | 210.0 370.0
27 39.4 | 21 99.5 | 6 99.5
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hull-mounted
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5757.95,N,00634.95,E
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9678.0 38 10 Bot. -80 | 9 Sur. -80 | 8 Sur. -80 | 7 Sur. -80 | 6 Sur. -80 | 5 Sur. -80 | 4 Sur. -80 | 3 Sur. -80 | 2 Sur. -80 | 1 Sur. -75
92/04/26 kHz 1.0 10.0 | 700.0 750.0 | 650.0 700.0 | 600.0 650.0 | 500.0 600.0 | 400.0 500.0 | 300.0 400.0 | 200.0 300.0 | 100.0 200.0 | 210.0 370.0
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450 1S75
9678 NM
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9679.0 38 10 Bot. -80 | 9 Sur. -80 | 8 Sur. -80 | 7 Sur. -80 | 6 Sur. -80 | 5 Sur. -80 | 4 Sur. -80 | 3 Sur. -80 | 2 Sur. -80 | 1 Sur. -75
92/04/26 kHz 1.0 10.0 | 700.0 750.0 | 650.0 700.0 | 600.0 650.0 | 500.0 600.0 | 400.0 500.0 | 300.0 400.0 | 200.0 300.0 | 100.0 200.0 | 210.0 370.0
12.54.40 1665 9.0 | 0 0.0 | 0 0.0 | 0 0.0 | 0 0.0 | 0 0.0 | 1768 56.1 | 19 100.0 | 4 100.0 | 23 137.1
450 1S75
9679 NM
5756.73,N,00633.33,E
200

Literature

Foote, K.G., Aglen, A. and Nakken, O. 1986. Measurement of fish target strength with a split-beam echo sounder. *Journal of the Acoustical Society of America* 80: 612 - 621