

This paper not to be citet without prior reference to the author.

International Council for the
Exploration of the Sea

C.M.1980/J:17
Baltic Fish Committee



Digitalization sponsored
by Thünen-Institut

The spawning stock of sprat in the Baltic

By

Armin Lindquist, Institute of Marine Research, S-453 00 Lysekil, Sweden

Abstract

According to VPA the spawning stock of the Baltic sprat shows a steady decrease of its size. Independent assessments are based on egg surveys and on acoustic surveys and comparisons are made.

The geographical distribution of the spawning stock changes very much from year to year. In acoustic surveys much of the sprat with 2 w.-r. escapes detection and must be in areas or layers not surveyed.

Introduction

In a previous contribution the present author has discussed the size of the spawning stock of the Baltic sprat by using other means than the VPA (Lindquist, 1979b). Calculations were made with figures from egg surveys and acoustic surveys from 1967 onwards and some conclusions have been drawn about the order of magnitude of the spawning stock (> 600 000 t). In the present paper some new material is added and some older material has been recalculated and the results are discussed more in detail.

Material and methods

The spawning stock is defined as sprat \geq 2 w.-r. VPA. The figures are taken from Anon. 1980, Table 4.2.6. There are no estimates previous to 1970.

Acoustic surveys. The figures have been taken from the following sources.

Survey April - June 1976 (R/V "Argos"): from Lindquist 1979a, weight figures from Anon. 1977;

Survey Jan. - March 1977 (R/V "Argos"): from Lindquist 1979a, weight figures from unpublished data;

Survey October 1978 (R/V "Argos" and R/V "Eisbär"): from Håkansson et al. 1979, Tab. 4;

Survey October 1979 (R/V "Argos" and R/V "Eisbär"): from Anon. 1980, Tab. 7.1., weight figures from unpublished data.

In Lindquist (1979a) a C-value of 2.09 has been used, which according to Håkansson et al. 1979 is too low. A recalculation has been made so that all 4 surveys are based on an overall $C = 6 \text{ t/N.M.}^2$.

The coverage of the Baltic in 1976 and 1977 was poor in comparison to 1978 and 1979, the area was less and relatively few trawl hauls were made to identify echotraces. In 1978 and 1979 the work has been carried out as a joint investigation between the institutes in Rostock and in Lysekil, where the R/V "Eisbär" made most of the trawl hauls. In both the latter years the coverage of the Baltic is good, acoustically as well as regarding to trawling. In 1976 and 1977 the echosounder did not always function properly. The results from these years should therefore be used with care. However, they are included here as it is thought that they are of a certain interest.

Egg surveys. For methods see Lindquist (1979b) from where all information has been taken for 1967 - 1971, without changing the basic assumptions. Some recalculation has been done in order to get means per sub-division and year.

Results

Tab. 1 summarizes the different assessments of the size of the Baltic sprat spawning stock. The VPA shows a dramatic and steady decline of the size of the spawning stock from 1970 (> 1 100 000 t) to 1980 (> 300 000 t). In fact the only break in this trend is observed in 1974 when the stock increased by 100 000 t.

Five years of egg surveys 1967-1971 showed no clear trend only large variations, see also Fig. 2a. For the years 1970 and 1971, as well as 1977 there are estimates both from VPA and egg surveys. The cal-

culations based on egg surveys in 1970 and 1971 gave only a tiny fraction of the VPA estimate; in 1977 the results from both methods are very similar.

Fig. 2 shows clearly that sub-divisions 25-28 are important reproduction areas for sprat, although the importance of the different sub-divisions changes from year to year.

The acoustic surveys 1976 and 1978 show a very good agreement with VPA for those years and half or a third of the VPA-assessment for the years 1977 and 1979. (Care should again be taken when using the material from 1976 and 1977.) Both VPA and acoustic surveys showed that from 1978 to 1979 the spawning stock decreased to half of its size.

In Fig. 1 the material from the four acoustic surveys is split up into sub-divisions. As in the egg surveys it is difficult to recognize a certain pattern in the distribution of the spawning stock. The surveys inform us that in sub-division 29, too, an important part of the spawning stock can be found.

Discussions

The difficulties of the assessments according to VPA have been discussed in the reports of the Baltic pelagic fish working group. Acoustic surveys have the weakness that coastal areas are omitted, as well as surface layers down to 7 m and near bottom waters. For these and other reasons (see Håkansson et al. 1979) they are considered minimum-values. It has been pointed out in the a.m. papers that the C-value may have to be adjusted according to different fish lengths (although the size range of Baltic sprat is moderate). The physical properties of the sea water may also require some further adjustment of the C-value. For these reasons cage experiments with live herring and sprat are needed and will be carried out in a near future.

Assessments of spawning stock sizes from egg numbers are based on many assumptions about fecundity and individual weight. It is interesting to note that different years and areas (sub-divisions) show such a great variation.

Tab. 7.1. in Anon. 1980 gives the number of individuals per sub-

division and age-group. Sprat from age-groups 3 or 4 onwards seem to be fully represented in the acoustic surveys (from those age-groups onwards there is a decrease in the number of individuals). In some way age-group 2 escapes complete detection either by being in coastal areas or close to the surface etc.

It may not become easy to detect the missing part as the distribution of the spawning stock shows such a great geographical variation from year to year, both according to egg surveys and to acoustical surveys (Figs. 1 and 2). It may therefore be questioned whether there is any reason for TACs for parts of the Baltic.

Both acoustic surveys and VPA indicate a decreasing size of the spawning stock the last two years. When discussing absolute values the shortcomings of the acoustic method should be kept in mind. However, the different methods show an interesting similarity in results during the last 4 years.

References

- Anon., 1977: Report of the Working Group on Assessment of Pelagic Stocks in the Baltic, Helsinki 21-25, March 1977. - C.M. 1977/P:3, 29 pp.
- "- , 1980: ibid., Copenhagen, 5-13 May 1980. - C.M. 1980/J:4, 110 pp.
- Håkansson, Nils, Sven Kollberg, Ulrich Falk, Eberhard Goetze, Otto Rechlin, 1979: A Hydroacoustic and Trawl Survey of Herring and Sprat of the Baltic Proper in October 1978. - Fischerei-Forschung, Rostock 17 (2): 7-23.
- Lindblom, Roger, 1973: Abundance and horizontal distribution of pelagic fish eggs and larvae in the Baltic Sea 1967-1971. - Medd.fr. Havsfiskelab., Lysekil, nr 140, 33 pp, tabs. & figs.
- Lindquist, Armin, 1979a: Investigations on sprat: Results of echo-integrations in the Baltic in 1976 and 1977. - Ann. Biol. 34: 190-193, figs. 163-164, Tab. 230.
- "- , 1979b: Sprat (Sprattus sprattus) in the Baltic and the Skagerrak/Kattegat: stock sizes calculated from VPA, egg surveys and echo-integrations. - ICES C.M. 1979/J:9, 10 pp.
- Shvetsov, F.G., A.G. Polivaiko, G.B. Grauman, 1978: Estimations of the Baltic Sprat Absolute Resources. - ICES C.M. 1978/J:9, 6 pp.

Tab. 1. Spawning stock of sprat (≥ 2 w.-r.) in the Baltic according to different estimates. $\times 10^3$ t.

Method	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
VPA ¹⁾ 1980				1168	1143	908	771	873	680	436	602	437	292	339
Egg- ●veys ²⁾	426	773	115	118	419						540			
Acoustic surveys ³⁾										459	309	436	191	

1) acc. to Anon. 1980, Tab. 4.2.6.

2) acc. to Lindquist 1979a, recalculated; 1977 from Shvetsov et al. (1978)

3) 1978 from Håkansson et al. (1979), 1978 from Anon. 1980 and unpubl. figures

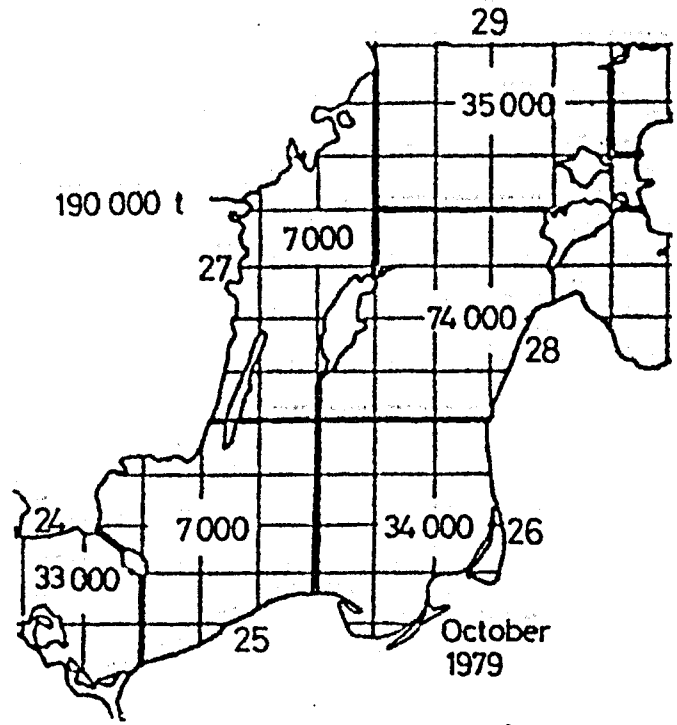
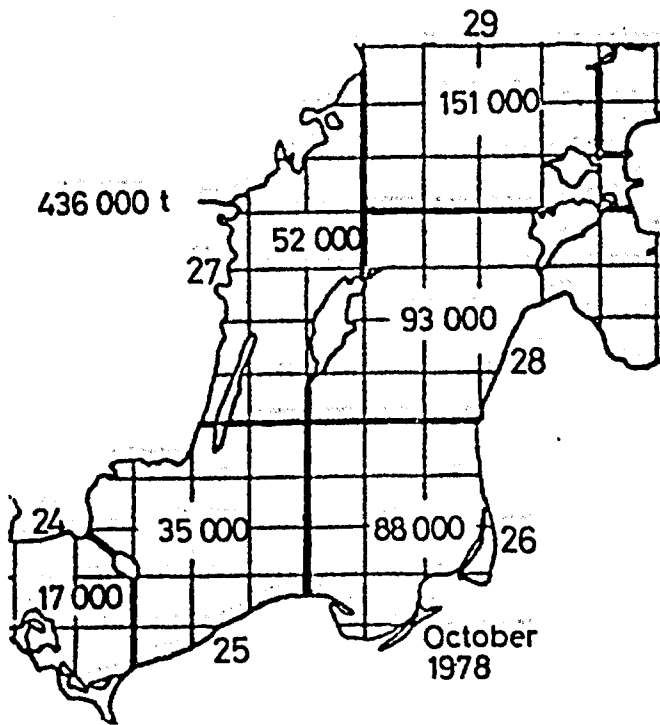
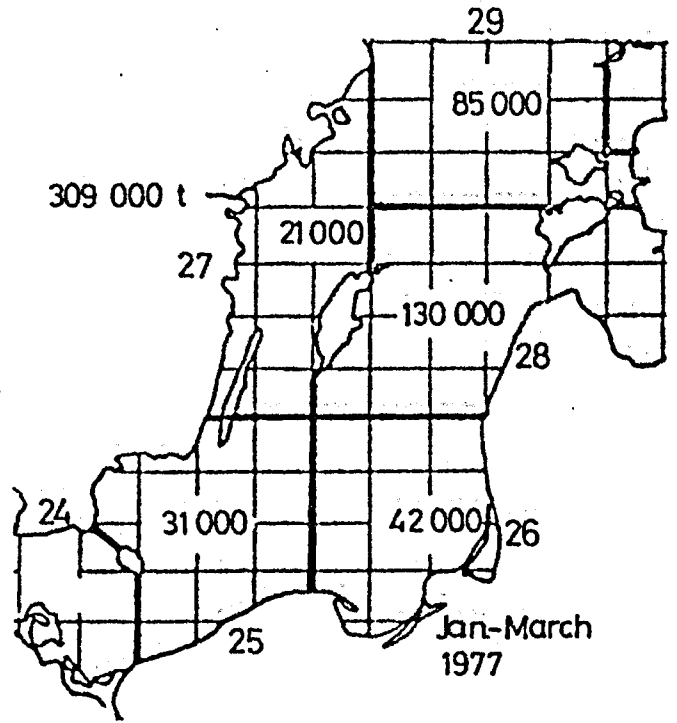
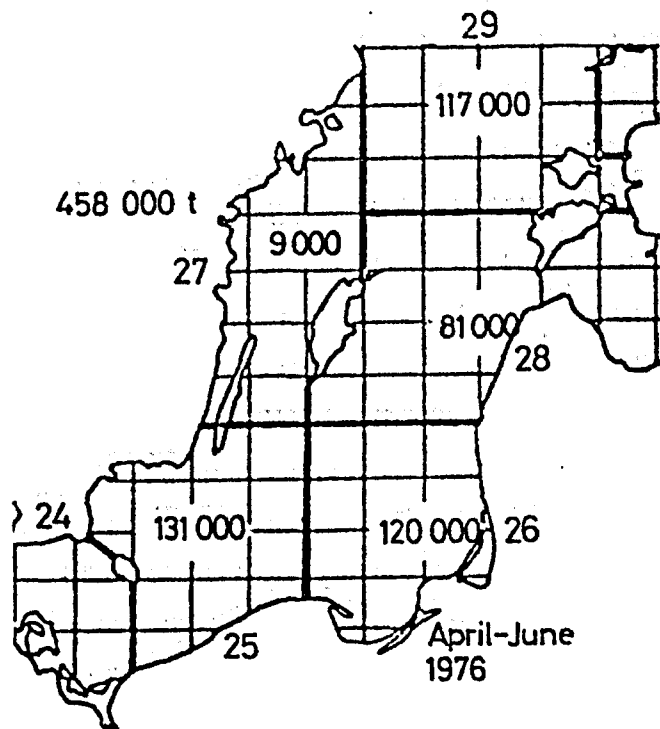
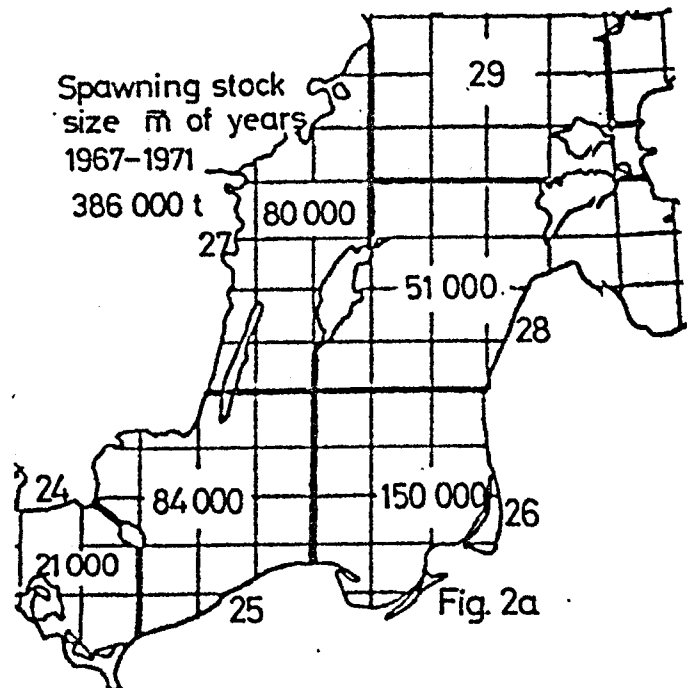
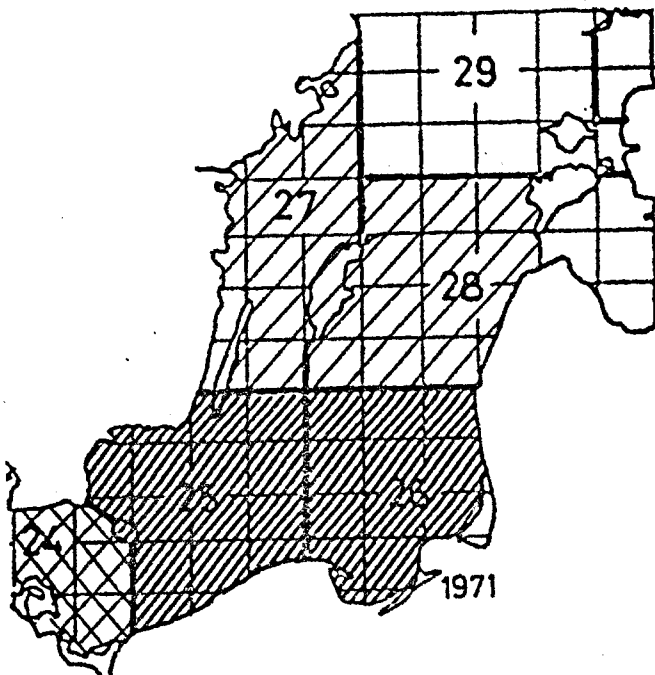
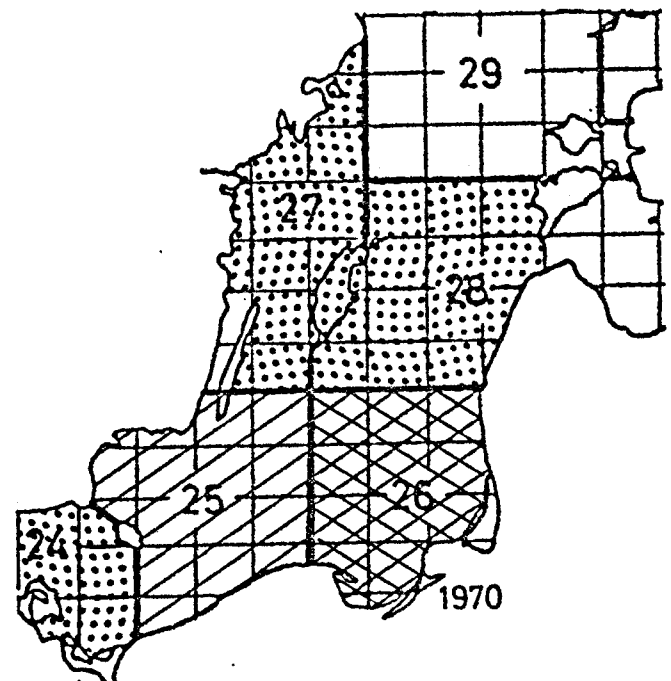
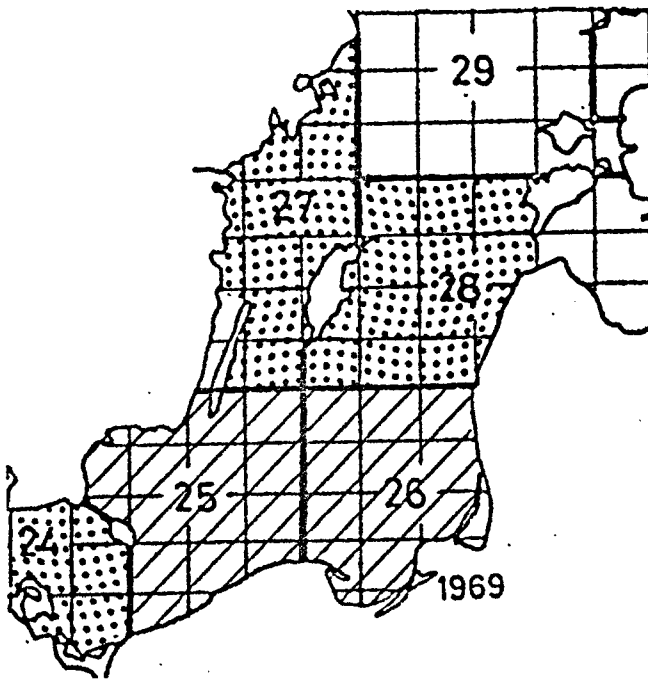
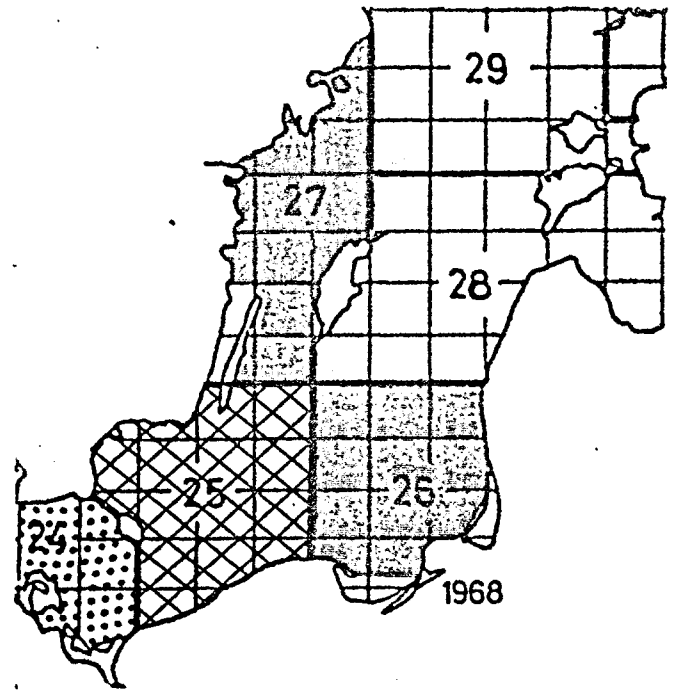
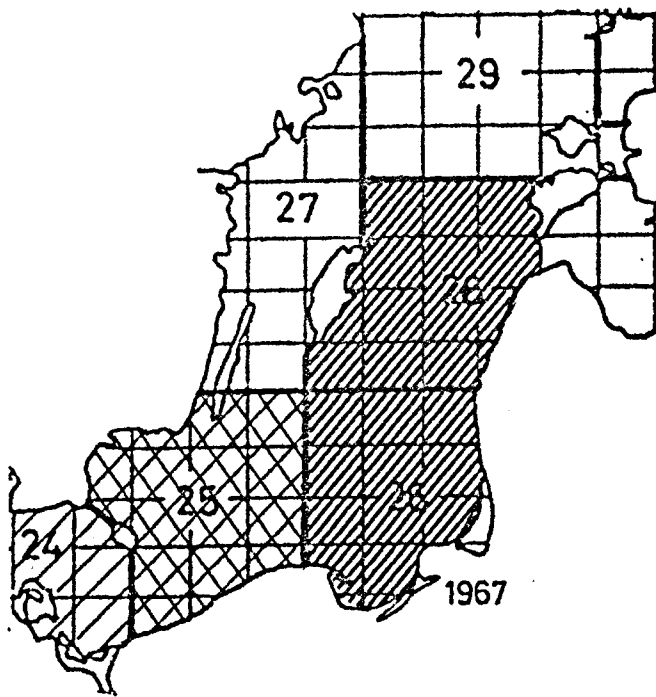
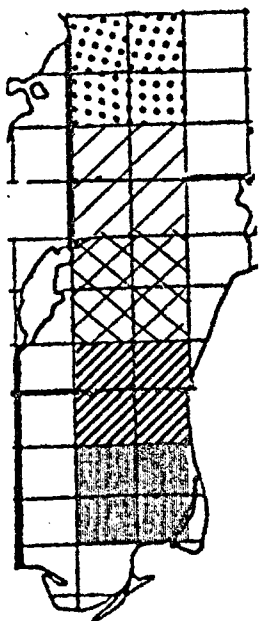
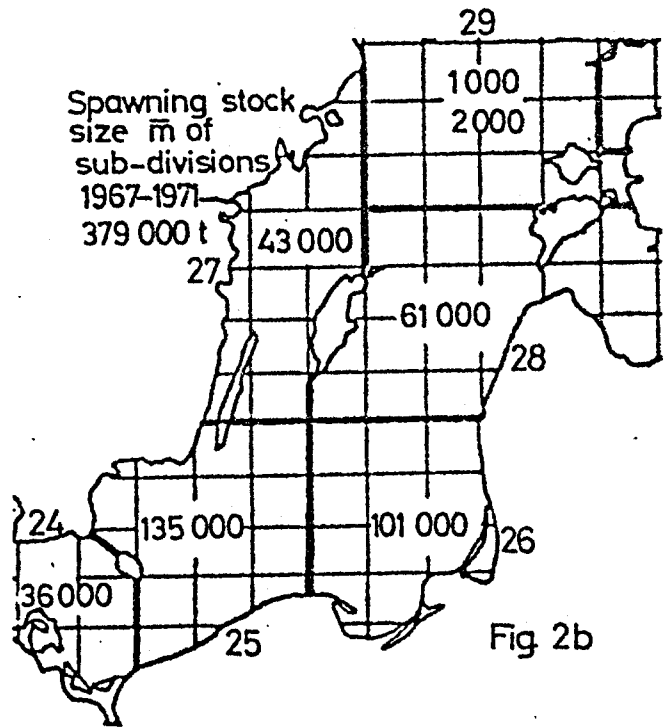
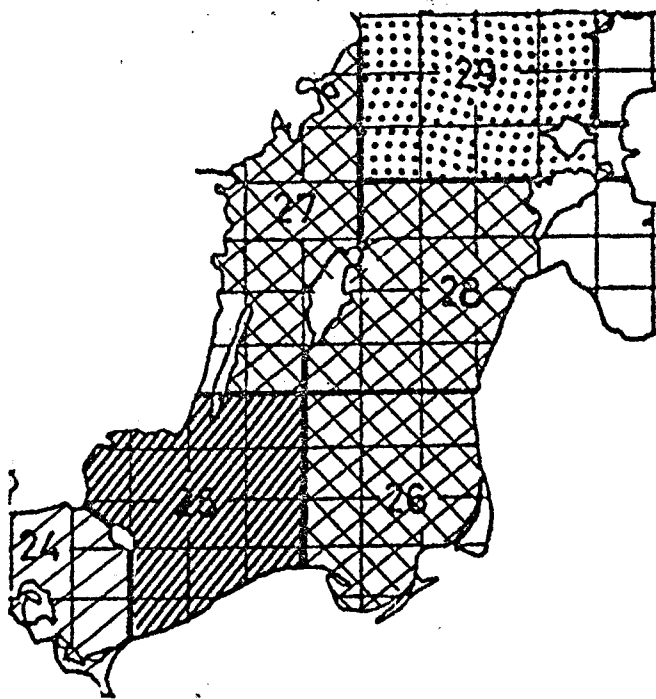


Fig. 1. The spawning stock of sprat ≥ 2 w.-r. in different sub-divisions. According to acoustic surveys.





0-9

10-19

20-49

50-99

100- $\times 10^{12}$

(blank sub-divisions: no information)

Legend:

Number of eggs
in the spawning period

Fig. 2. Numbers of eggs and spawning stock sizes (after Lindquist 1979a, using the material from Lindblom 1973).

a. mean values of different years

b. mean values of different sub-divisions