Tanumål, Kville sn, Bohuslän

Hällristning Rock carving
Fiskare från Bronze age
bronsåldern   fishermen
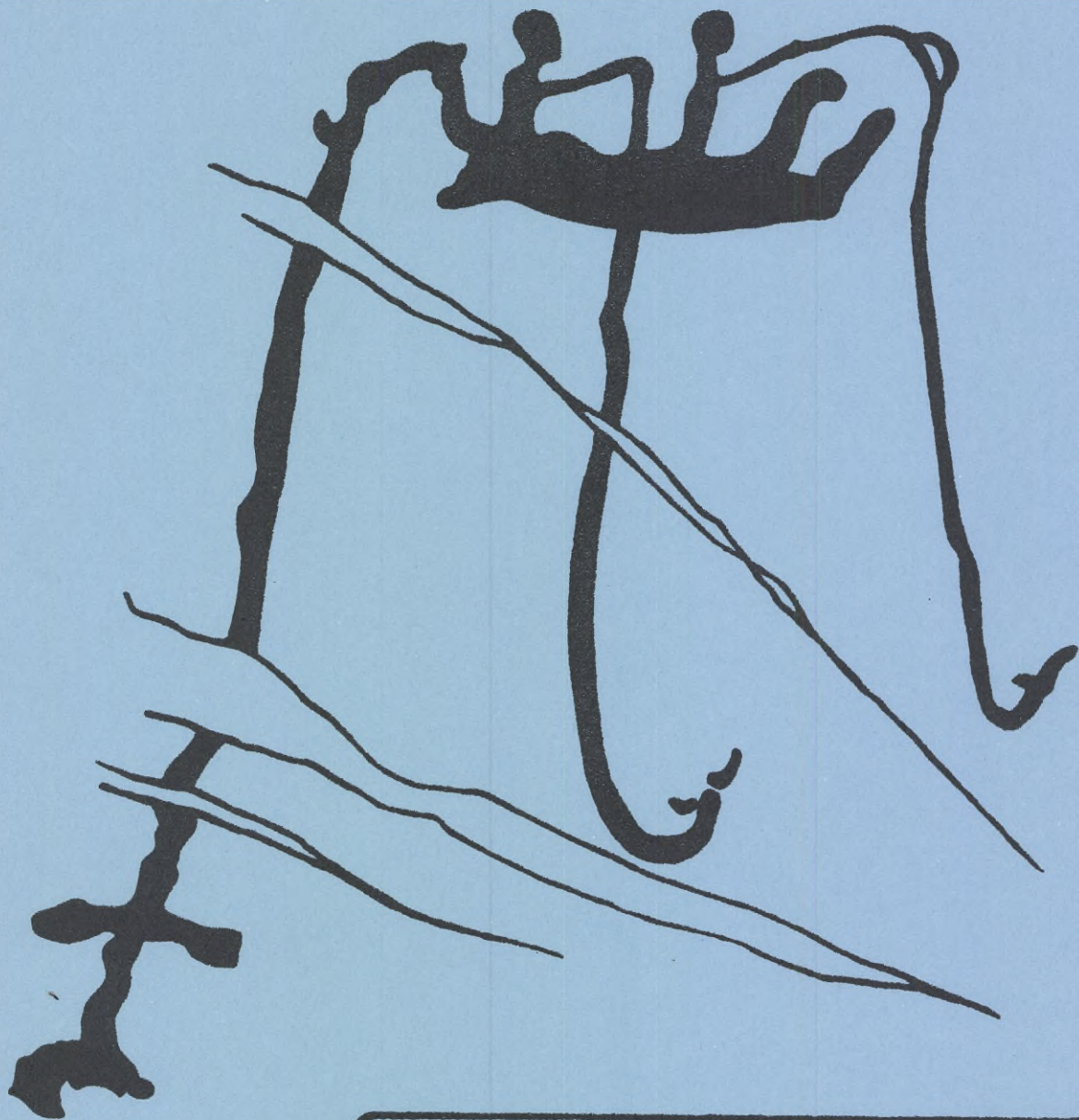
The life-cycle of Kattegat Spring Spawners in
relation to growth rate, the development of
gonads and the fat content

by

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ABSTRACT

The majority of the Kattegat Spring Spawners mature at the age of three years. The first spent herring are found in March and the majority of the herring spawn in April-May. From June the content of fat increases rapidly from ˅less than/ 10 per cent to more than 25 per cent. The gonads start to develop from stage VIII to stage III in August. Successively the fat content decreases from July-August until May. From November until January most of the herring are in stage IV.

INTRODUCTION

The adult herring fishery in the Kattegat is nowadays mainly based on the Kattegat Spring Spawners. This herring population is characterized by the following meristic characters; VS = 55.7 - 56.5, K_2 = 13.8 - 14.2 (Ackefors 1977). This type cannot be distinguished from the Kattegat Coastal Spring Spawners which spawn in the Danish fiords with VS = 55.5 - 56.1 and K_2 = 13.7 - 14.2. The spawning time is overlapping and the maximum spawning for both populations appears in April and/or May. It seems reasonable to suppose that the life-cycle is very similar to the one of the Kattegat Spring Spawners. Except for the spawning time the two populations are mixed in the Kattegat and have to be regarded as one stock. The aim with this paper is to describe the growth rate, the development of gonads and the yearly fat-cycle for the adult herring of the Kattegat spring spawning herring.

METHODS AND MATERIAL

Herring samples taken from commercial trawlers in the Kattegat and Skagerrak, 1972-1976, were analysed. The calculations were based only on samples with VS = 55.8 - 56.2. This was, because samples with higher VS up to 56.5 might be a mixture with a fraction of other spring spawners, e.g. Skagerrak Spring Spawners. In total nearly 5000 herrings were analysed. The fat analyses were based on four herrings for each sample analysed. Altogether 42 samples were analysed. The analyses refer to herring of 24 cm or longer.

The mean length for each sample and age group was used to calculate the growth rate according to the Bertalanffy growth function. The analyses of the gonad stages were made according to the recommended scale by ICES.

The fat analyses were performed with a method used by the canning industry. The sample is homogenized and put into a Baboockbottle. A mixture of concentrated acetic acid and percloric acid is added. The sample is then heated in a water-bath up to $92^{o}C$. When the sample is dissolved, it is placed in a centrifuge by which the fat is concentrated in the neck of the bottle. The amount of fat can then be calculated according to a formula.

RESULTS AND DISCUSSION

The Kattegat Spring Spawners spawn from the end of March until May mainly in the Kattegat. A single herring sample with the same characters as the Kattegat Spring Spawners in maturity stage V was also found in the inner Skagerrak. The exact position of the spawning places has not been located. All the samples were taken not far from the coast or in the coastal zone (cf. Ackefors 1977).

The growth curve according to the Bertalanffy growth function is reproduced in fig. 1. At the age of one year the herring is 16-17 cm long. The slope of the curve decreases continously with increasing age indicating a faster growth rate for the younger age-groups. The L_{∞} is 31.419 cm, $K = 0.457$ and $t_o = - 0.516$.

A few individuals being maturing in the second spring of their life-cycle. The majority, however, mature in the third year of their life and the rest with a few exceptions in the fourth year. The mean length of three-year-old herring is about 26 cm, when they spawn in March-May.

The maturity cycle for adult herring as well as the maturity stages for juvenile herring is shown in table 1. The first herrings to spawn appear in March when 3 per cent of the analysed herring were in stage VII. The majority of the adult herring is in stage III or IV during this time. In April and May the majority of the herring spawns. They seem to recover very rapidly to stage VIII after spawning. In June most of the adult herring are still in stage VIII while the juvenile herring is in stage I-II. During the month of June the fat content of the herring increases very rapidly from less than 10 per cent to more

than 25 per cent fat on wet weight basis (fig. 2). From then onwards, fat is released from the flesh of the body and in August the gonads start to develop into stages III and IV. Analyses of fillets only from this time indicate that the fat content is slightly lower in the fillets than in the whole herring including the gonads. In September and October the majority of the adult herring is in stage III and to a lesser extent in stage IV. From November until January most of the adult herring are in stage IV although many herring are also in stage III. During this time the fat content decreases from about 20 per cent or more to about 12 per cent. Thus mature herring, which have spawned at least once, appear during a long period from August until March in stage III or IV.

Before the spawning starts in the end of March the percentage of stage III herring is higher than that of stage IV. This indicates that a lot of juvenile herring mature and they reach stage III for the first time in their life. From April until August the highest number of recovered herring (stage VIII) is found which succesively develop into stage III and IV.

The fat-cycle is very conspicuous when looking at fig. 2. The hatched line indicates an eye fitted curve with decreasing fat content from July-August until May. In June the fat content starts to increase very rapidly to the maximum in July. Analyses of juveniles do not show a regular pattern and the values are very dispersed during the whole year. The values range from 0 to 13 per cent.

REFERENCE

Ackefors, H., 1977: On the winter-spring spawning herring in the Kattegat. - Medd. Havsfiskelab., Lysekil, nr 225.

Table 1. The Kattegat Spring Spawners maturity stage by month in percentages. Herring samples with VS = 55.80 – 56.20 from the years 1974 – 1977.

Month	n	Maturity stages in percentages						
		I - II	III	IV	V	VI	VII	VIII
Jan	126	12.6	22.2	63.4	1.6			
Feb	517	78.3	12.8	8.7	0.1			
Mar	201	31.8	36.8	27.9	1.0		3.0	
Apr	450	4.8	2.4	1.1	1.6	1.1	68.7	20.2
May	296	2.4	1.3	1.0	0.7	0.3	68.4	26.0
Jun	321	79.4	7.2	0.9			0.6	11.8
Jul	172	95.3	2.3	1.2				1.2
Aug	543	61.0	15.8	10.9	0.2			12.0
Sep	848	61.3	22.2	14.7				1.8
Oct	194	18.0	41.8	35.0				5.2
Nov	285	38.6	22.8	30.2				8.4
Dec	183	30.6	28.4	35.0				7.0

LEGENDS

Fig. 1. The growth curve of the <u>Kattegat Spring Spawners</u> calculated
according to the Bertalanffy growth function.

Fig. 2. The fat-cycle of the Kattegat Spring Spawners. Whole herring
including the gonads are analysed. The values are expressed
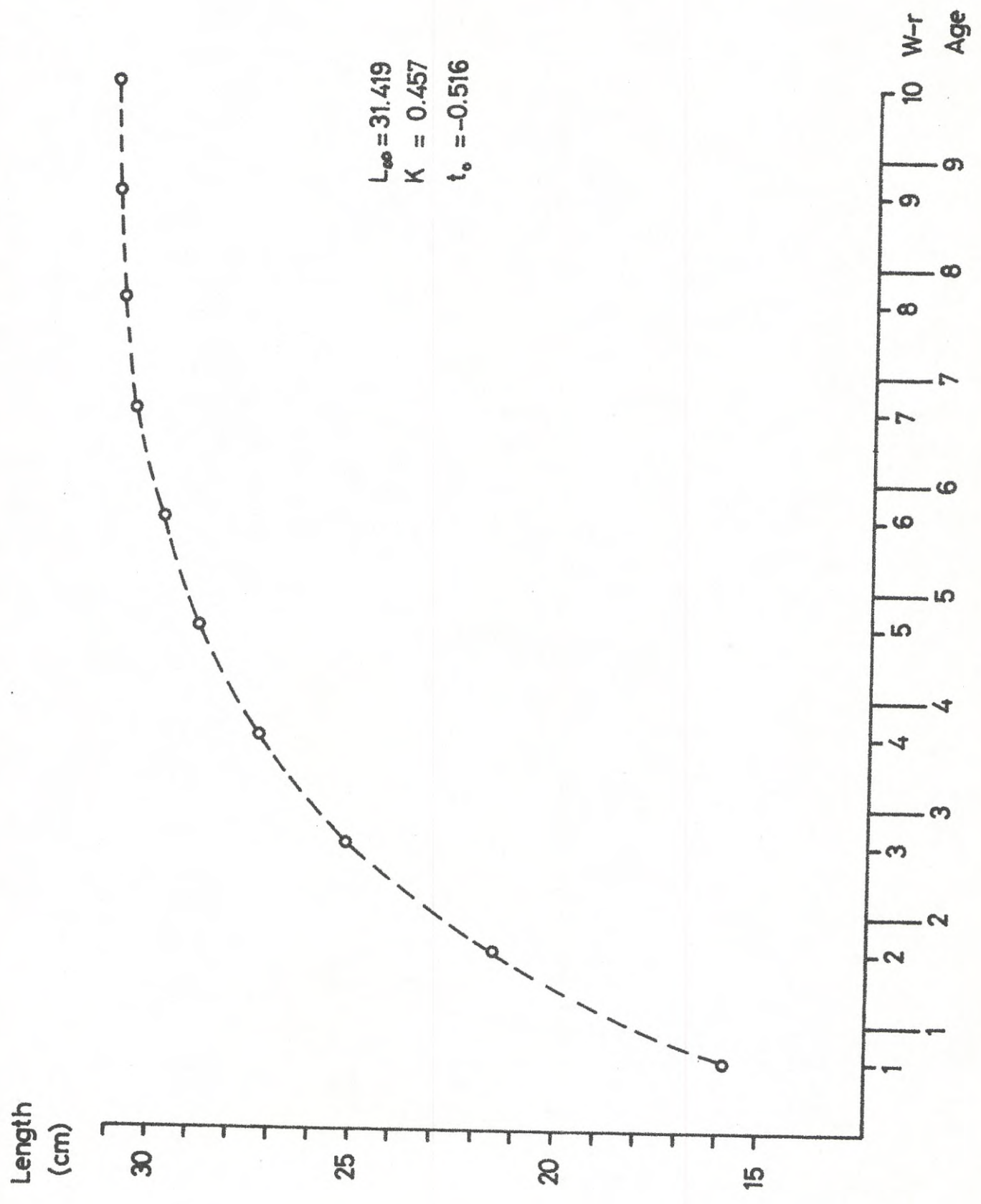as percentages on wet weight basis.

Fig. 1

Fig. 2

-⊙- mean value

⌶ range