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Hällristning
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Rock carving
Bronze age
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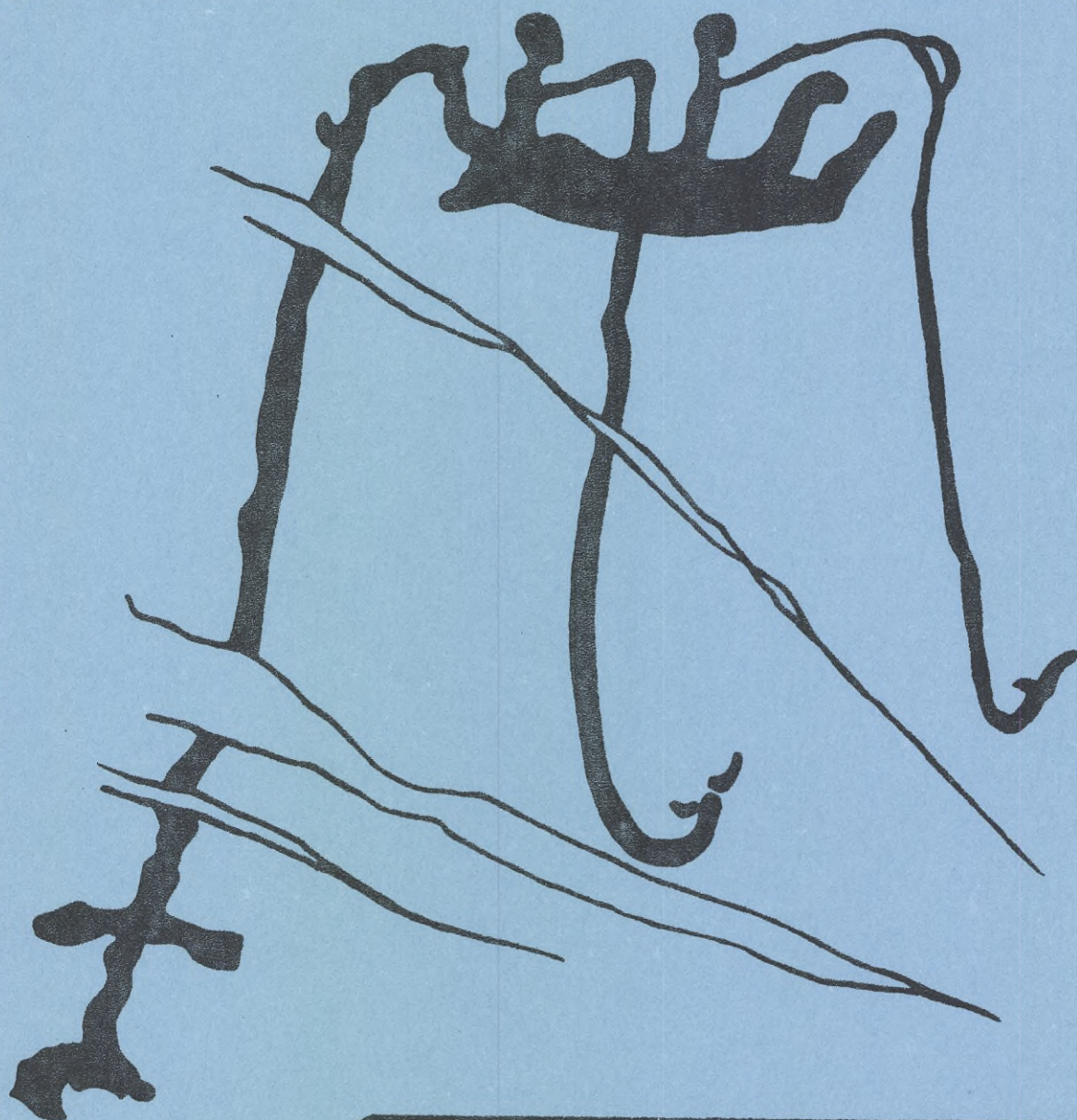
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On the Kattegat autumn spawning herring
(the Kobbergrund herring)

by

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ABSTRACT

The Kattegat Autumn Spawners were once an important herring popula-
tion, which spent the second part of the year in the Kattegat. Accord-
ing to our analyses of adult herring and larval surveys the popula-
tion seems to be nearly extinct. The mean vertebrae number of our
samples from 1965-1968 ranges from 56.14 to 56.34, the mean value
of keeled scales was 14.2 (only two samples) and the l_1 values range
from 14.00 to 15.21. The L_∞ was 32.5 cm and W_∞ was 331 g according
to the Bertalanffy growth function.

INTRODUCTION

The autumn and winter fishery of herring in the Skagerrak and Katte-
gat in the 20th century was earlier based on the Kattegat Autumn
Spawners, the Skagerrak Spring Spawners and the autumn spawning
North Sea bank herring (Andersson 1958). During the first part of
the period from September until December the fishery was based on
the first two stocks. It was mainly a purse-seine fishery and the
principal fishing grounds were at Kobbergrund, Läsö, Groves Flak
and off the lighthouse stations at Nidingen and Tistlarna. During
the second part of the fishing season (from December until March),
the fishery moved farther north into the Skagerrak area. The fishery
was then mainly based on the above-mentioned North Sea bank herring.
This herring migrated from the North Sea during its winter migration
into the Skagerrak area and down to Tistlarna in the northern Kattegat
(at least during certain periods).

During the last ten years the whole fishing pattern has changed very
much. The heavy exploitation of herring in the sixties in the North
Sea and adjacent areas has depleted the North Sea bank herring but
also the Kattegat autumn spawning herring. The latter stock migrated
through Skagerrak into Kattegat from the North Sea and spawned on
the banks in the Kattegat in September and October. In late autumn
or winter they migrated back to the North Sea. According to our lar-
val surveys the stock disintegrated in the late sixties and early
seventies. The aim of this paper is to summarize the results of
herring analyes of this stock and the larval surveys.

METHODS AND MATERIAL

Samples from commercial catches in the Kattegat, 1965-1968, were analysed. All samples were taken in September-October. The following parameters were measured; weight, length, age from scales and otoliths, sex, maturity stage, intestinal fat, vertebrae number (VS), keeled scales (only two samples) (K_2) and length at the age of one year (l_1) was backcalculated from the scales. Data for the whole samples and for the samples split up into year-classes are given in tables 1 and 2.

The herring larval surveys were performed in October, 1969-1973. Gulf III was used with a metal gauze of 300 μ. The larvae were sampled with an oblique haul. The station net is shown in fig. 1. The sampling time was 30 minutes and the towing speed 5 knots. The number per m^2 (n_m2) was calculated according to the following formula:

$$n_m2 = \frac{N \times D}{V}$$

N = Number of larvae in the sample

D = Maximum depth

V = Volume of water filtered by the sampler in m^3

The filtered volume (V) of the sampler was calculated according to the following formula:

$$V = \frac{A \times S \times T}{61.023}$$

A = Area of the nose cone in m^2

S = Speed of the vessel in meters per second

T = Duration of the haul in seconds

RESULTS AND DISCUSSION

a. Analyses of herring samples

Seven samples were analysed from the commercial fishery in the Kattegat in September or October, 1965-1968 (table 1). The VS data for the whole samples vary from 56.14 to 56.34, which indicates that the samples consisted of Kobbergrund herring. However, when the samples were split up into year-classes, it became obvious that the three last samples from 1967 and 1968 were mixed with 3- or 4-year-old herring belonging to another stock, probably the Kattegat spring spawning herring (table 2). This is indicated by the VS values and the maturity stages. The analyses of the various year-classes within the samples indicate, however, that the main part of the herring

consisted of the <u>Kobbergrund herring</u> (the <u>Kattegat Autumn Spawners</u>).
The VS values for different year-classes (comprising at least 15
herrings) with maturity stages V or VI vary from 56.17 to 56.42.
The two samples with K_2-values are very difficult to analyse in the
same way. The number of herrings per year-class, which are supposed
to be <u>Kattegat Autumn Spawners</u>, is very small. The l_1-values vary
within the different year-classes from 13.99 to 16.06.

The growth curve for length calculated from the Bertalanffy function
$(L_t = L_\infty (1 - e^{-K(t - t_o)}))$ is shown in fig. 2 and the corresponding
curve for weight is shown in fig. 3. At the age of one year the her-
ring is on average between 16 and 17 cm. The growth rate then de-
creases with increasing age. L_∞-value is 32.5 cm, K = 0.424 and
t_o = - 0.831.

The weight curve is slightly sigmoid. At the age of one year the her-
ring is on average 33 g. The increase in weight is very rapid for
the population between 1 and 3 years of age. After the 5th birthday
the weight growth is small. The W_∞-value is 331 g, K = 0.424 and
t_o = - 1.316.

b. Larval surveys in the Kattegat

The abundance of herring larvae was investigated in October from
1969 until 1973. The sampling stations are obvious in fig. 1. The
following table shows the results:

Year	Number of stations visited	Total number of larvae	Number per m^2
1969	25	695	8.7
1970	14	84	2.2
1971	20	38	0.4
1972	17	11	0.3
1973	18	5	0.1

The greatest concentrations of larvae were always found in the area
south of the Kungsbacka fiord from station 9 to station 16 on the
eastern side of the Kattegat (fig. 1). It is quite obvious that the
total number of larvae caught by the Gulf III sampler decreased very
much during the period 1969-1973. It is feasible to suppose that the
decreasing number of larvae reflects the decreasing stock abundance
during those years.

The heavy exploitation of herring in the North Sea as well as in the Skagerrak and Kattegat has depleted this stock. The fishermen used to follow this stock during its migration through the Skagerrak into the Kattegat. This is not possible any longer. The analyses of at least four samples of herring per month from the Kattegat (1972-1976), the larval surveys (1969-1973) and the observations of the fishermen show the same thing, that this herring stock is now nearly extinct.

REFERENCE

Andersson, K.A., 1958: The Stock of Herring and the Herring Fisheries on the West Coast of Sweden in the first Half of the Twentieth Century. - Inst. Mar. Res., Lysekil, Ser. Biol. Rep., No. 8:1-41.

Table 1. Analysed herring samples from the Kattegat, 1965 – 1968, in September and October.

Sample	Date	Place	Catch position	VS	K_2	l_1 (cm)	Mean length (cm)	Mean weight (g)	Maturity stage
K 101	1965-10-06	S Groves Flak	N 57°03' E 11°35'	56.34 (200)	–	14.77 (175)	29.8 (200)	249.9 (200)	V, VI
K 102	1965-10-07	ESE Läsö	N 57°12'9 E 11°27'0	56.19 (110)	–	14.10 (114)	29.4 (114)	223.9 (114)	V, VIII
K 103	1966-09-19	NE Anholt	N 56°50' E 11°40'	56.23 (198)	–	14.23 (191)	29.7 (206)	293.1 (206)	IV, V
K 104	1967-09-19	NNE Anholts fyr	N 56°46' E 11°35'	56.23 (202)	–	14.00 (180)	23.6 (210)	110.9 (210)	I-II, IV
K 105	1967-10-17	Fyrbanken	N 57°12' E 11°42'	56.14 (200)	–	14.69 (155)	24.0 (205)	129.3 (205)	I-II, V, VI
K 106	1968-09-19	S Groves Flak	N 57°03' E 11°35'	56.14 (131)	14.23 (128)	14.94 (128)	27.9 (136)	223.6 (136)	IV, V
K 107	1968-09-23	N Groves Flak	N 57°10' E 11°30'	56.20 (131)	14.20 (124)	15.21 (120)	30.1 (133)	279.0 (133)	IV, V

Table 2. Analysed herring samples from the Kattegat, by year-classes. Mean values for VS and K_2 are given. Other data according to table 1. A = autumn.

Year	Sample	A 65	A 64	A 63	A 62	A 61	A 60	A 59	A 58	A 57	A 56	A 55⁺
1965	K 101				55.83 (6)	56.62 (21)	56.34 (128)	56.25 (4)	56.31 (16)	56.33 (3)	56.23 (17)	56.20 (5)
1965	K 102			57.00 (1)	55.50 (6)	56.33 (15)	56.27 (67)	56.33 (3)	56.00 (3)	56.00 (6)	55.86 (7)	56.00 (2)
1966	K 103		56.00 (1)	56.27 (30)	56.40 (10)	56.42 (26)	56.14 (114)	56.17 (6)	56.67 (3)		56.50 (8)	
1967	K 104	56.28 (114)	56.24 (63)	55.67 (3)	55.50 (4)	56.50 (6)	55.87 (8)			55.67 (3)		
1967	K 105	56.37 (8)	56.08 (91)	56.16 (70)	56.14 (7)	55.67 (3)	56.37 (8)	56.00 (3)	56.75 (4)	56.00 (1)	56.00 (5)	
1968	K 106	56.31 (55), 14.27 (55)	55.85 (48), 14.24 (46)	56.00 (2), 14.50 (2)	56.33 (3), 14.00 (2)	56.50 (2), 14.50 (2)	56.37 (16), 14.06 (17)	56.00 (1), 15.00 (1)	56.00 (1), 13.67 (3)			
1968	K 107	56.18 (27), 13.91 (23)	55.92 (25), 14.04 (24)	56.00 (10), 14.13 (8)	56.22 (9), 14.44 (9)	56.50 (10), 14.40 (10)	56.33 (39), 14.41 (39)	56.00 (1), 15.00 (1)	56.30 (10), 14.01 (10)			

LEGENDS

Fig. 1. The sampling stations in the Kattegat for larval surveys.

Fig. 2. The growth curve for length of the Kattegat Autumn Spawners
calculated from the Bertalanffy function.

Fig. 3. The growth curve for weight of the Kattegat Autumn Spawners
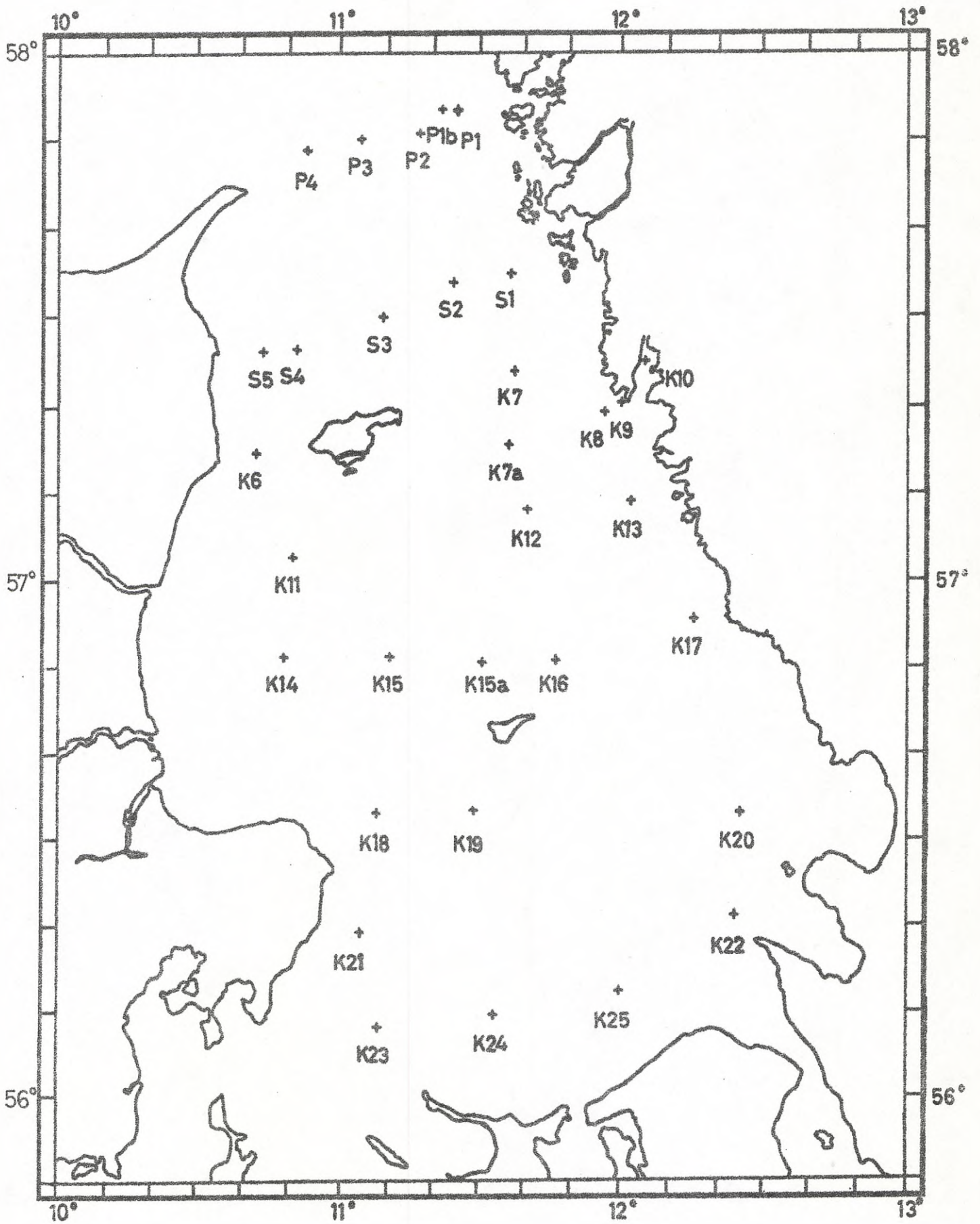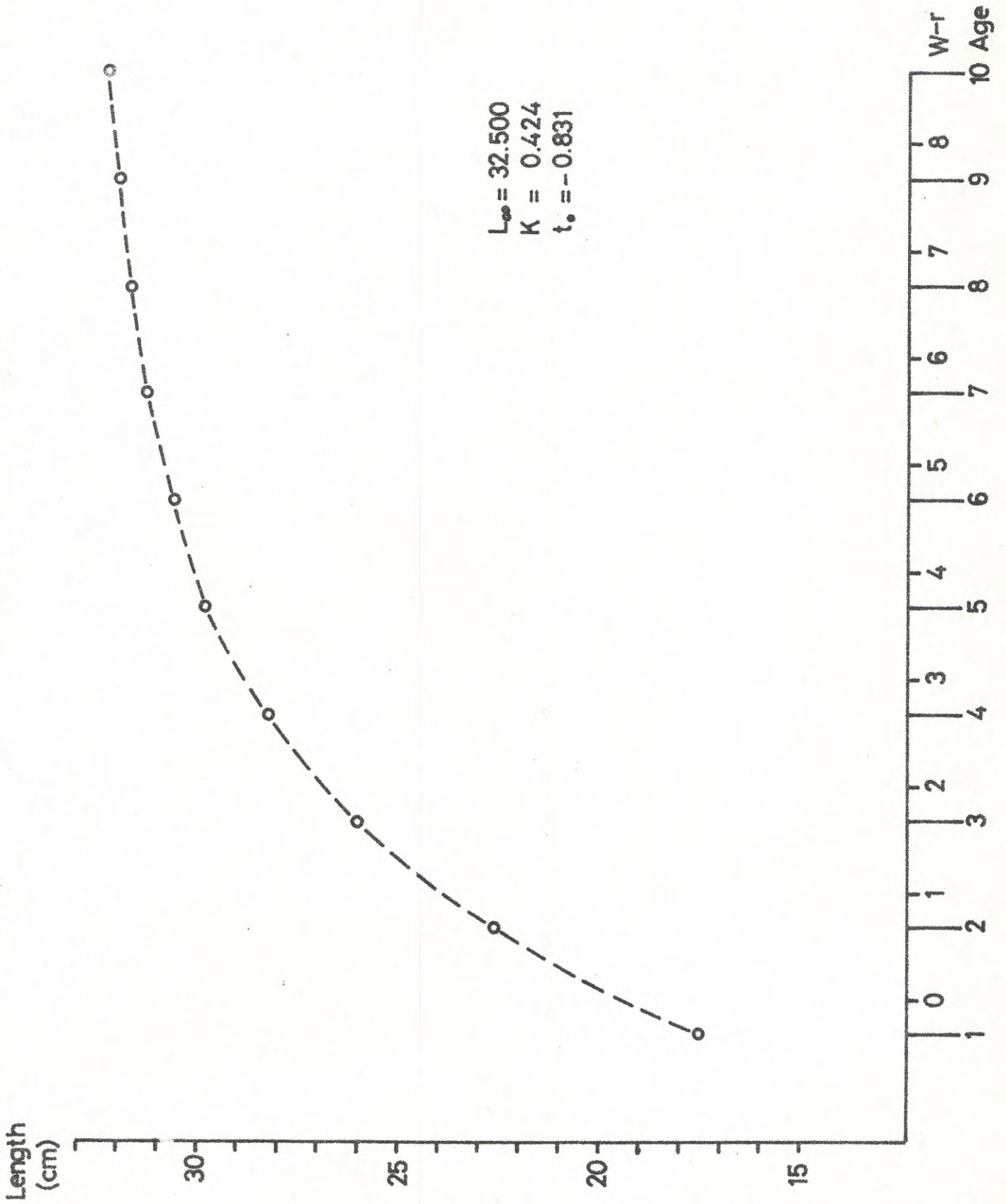calculated from the Bertalanffy function.

Fig. 1

Fig. 2

Fig. 3

Weight (g)

$W_\infty = 330.989$
$K = 0.470$
$t_o = -1.316$

W-r Age