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Report on Meeting on Scale and Otolith Typing and Other Methods in Atlanto-Scandian Herring Research

Bergen, March 26th - 29th 1962

At the last meeting in the Herring Committee in Copenhagen it was recommended that a meeting of herring experts and their scale and otolith reading assistants should be held to make "a comparative study of scale and otolith patterns and types, as a means for identifying the spawning components and a comparative study of other methods used in herring research in the Atlanto-Scandian area".

Participants

Invitation to participation in the meeting was sent to Denmark, Iceland, Norway, Scotland, Sweden and U.S.S.R. The representation was as follows:-

Mr. O. J. Østvedt (Convener)	Norway
Mr. J. Jakobsson	Iceland
Mr. E. Jónsson	Iceland
Mr. B. B. Parrish (Chairman of Herring Committee)	Scotland
Dr. H. Höglund	Sweden
Mr. F. Devold	Norway
Mr. O. Dahl	Norway
Mr. S. Haraldsvik	Norway
Mr. P. Skjoldal	Norway
Dr. Á. Fridriksson, Secretary General, ICES.	

Unfortunately no participants from Denmark ar U.S.S.R. were present at the meeting.

Objectives

The following methods were considered by the group:-

(a) Length measurement.
(b) The estimation of maturity stages.
(c) The calculation of growth from scales and/or otoliths (l_1 etc.)
(d) Scale and otolith typing.

Special attention was paid to (d) in accordance with the recommendation by the Herring Committee.

For each of the above items the principle objectives of the meeting were:-

(a) To make a survey of the basic measurements and criteria used at present by each country.

(b) To compare and assess the relative merits of different basic measurements, criteria and methods of measurement.

(c) To formulate, where possible, standard measurements, criteria, methods and form of presentation.

Length measurements

The length measurements at present used by the participating countries are given in Table 1 (page4). The group considered the four different items and reached the following conclusions:-

(i) The dimension used should be total length.

(ii) This should be the length from the snout to the tip of longest caudal fin ray brought into the middle line.

(iii) Centimeter grouping intervals are sufficiently small for reporting of length composition data for Atlanto-Scandian herring. The length should be expressed to the nearest cm.

(iv) Owing to the shrinkage occurring with storage, the state of the fish should be described when length composition data are reported. The group also stresses the need for more information on the shrinkage occurring with different methods of storing fish (i.e., iced, frozen, salted, etc.).

Growth calculations from skeletal structures

The methods used by the participants are shown in Table 2.

The discussion on this item revealed that in some countries the values of l_1 are "corrected" (Iceland, Norway) whereas in others (Sweden, Scotland) no "correction" is made. In view of the uncertainty regarding the precise form of the "correction" to be made, the group considers that all l_1 data should be reported with no "correction" applied. It is strongly recommended that further work is carried out on the relationship between the growth of the scale and the fish.

It is agreed that an exchange of scale samples would be made between the laboratories concerned in order to test the comparability of growth calculations from scales. The required grouping intervals reporting l_1 data could not be defined owing to lack of data on Atlanto-Scandian herring.

Maturity stages

Reports presented to the meeting showed that the maturity scales used in participating countries differed in some respects. The scales used in Iceland, Norway and Scotland are given in the appendix. The chief difference between these scales is in stage II, VII-II and VIII.

The group considered it of importance to distinguish between the recovering spents and early maturing recruits.

It was concluded that the Johansen scale (1919) was more appropriate than the Heincke (1898) and Hjort (1910) scales for this purpose. The following revised Johansen scale was therefore drawn up for use in Atlanto-Scandian herring studies, based on fresh material:-

Stage I	Virgin herring. Gonads very small, threadlike, 2-3 mm broad. Ovaries wine red, testes whitish or grey brown.
Stage II	Virgin herring, with small gonads. The breadth of ovaries and testes about 3-8 mm. Eggs not visible to naked eye, but can be seen with a magnifying glass. Ovaries bright red colour, testes a reddish grey colour.
Stage III	Gonads occupying about half of the ventral cavity. Breadth of gonads between 1-2 cm. Eggs small, but can be distinguished with the naked eye. Ovaries orange, testes reddish grey or greyish.
Stage IV	Gonads almost as long as body cavity. Eggs larger, varying in size, opaque. Ovaries orange or pale yellow, testes whitish.
Stage V	Gonads fill body cavity. Eggs large, round, some are transparent. Ovaries yellowish, testes milk white. Sperm does not flow, but can be extruded by pressure.
Stage VI	Eggs transparent. Testes white. Eggs and sperm flow freely.

Stage VII	Spents. Gonads baggy, bloodshot. The ovaries empty or containing only a few residual eggs. Testes may contain remains of sperm.
Stage VIII	Recovering spents. Ovaries and testes firm and larger than in Stage II. Eggs not visible to naked eye. Walls of gonads striated, blood vessels prominent. Gonads wine-red colour (This stage passes into Stage III).

Scale and otolith typing

Samples of scales and/or otoliths from the following areas were considered by the group: Skagerak (off Bohuslän), Norwegian West Coast, Viking Bank, Shetland, Icelandic East-, North-, West-, and South-Coast.

Of the four main types in the Atlanto-Scandian herring only the "Northern Norwegian Type" appeared to be easily identified by all members of the group.

The type classified by the Norwegians as the "Southern Norwegian Type" (SN) was determined by the Icelandic workers in nearly 50% of the cases as Icelandic spring spawners (ISPR), both in samples from north coast of Iceland and from the Norwegian west coast (Winter Herring).

The demonstration showed that the Icelandic summer spawners (ISUM) may be confused with the "Southern Norwegian Type" (SN), but these two types can during the main part of the year be separated by the stage of maturity.

Individuals of the "Northern Norwegian Type" were identified by the workers in samples of spring spawning herring from Shetland. Other spring spawning types in the Shetland material showed some resemblance to the southern Norwegian and Skagerak spring spawning types.

The criteria used for identification of the Skagerak spring spawners appeared to be clearly defined and this group was easily distinguished from the Atlanto-Scandian types. It was shown, however, that it can occasionally be confused with the "Southern Norwegian Type".

The group considered that the main difficulty in scale and otolith typing of Atlanto-Scandian herring is the distinction of the "Southern Norwegian Type" from the Icelandic spring spawners.

In view of the importance of these questions the group stresses the necessity of an exchange of reading experts (and material) between the countries working on Atlanto-Scandian herring, and recommends that the reading experts meet again as soon as possible in 1962.

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Table 1. "Methods" Length measurement.

	Iceland	Norway	Scotland	Sweden
i) The dimension used in measurement	Total length	Total length	Total length	Total length
ii) The description of the dimension used	Snout to tip of longest caudal fin ray	Snout to the middle part of a vertical line drawn between the flukes of the tail	Snout to tip of longest caudal fin ray	Snout to tip of ventral part of caudal fin
iii) The form of recording length data	Nearest cm	Nearest $\frac{1}{2}$ cm	Nearest cm	Nearest mm (grouped to the nearest $\frac{1}{2}$ cm)
iv) The state of the fish measured	Generally fresh	Generally fresh or stored on ice	Variable, Shetland samples usually frozen or stored on ice.	Fresh or stored on ice rarely frozen

Table 2. "Methods" Growth calculations from skeletal structures

	Iceland	Norway	Scotland	Sweden
i) Skeletal structures used in growth calculations	Scales	Scales	Scales, otolith studies in progress	Scales
ii) Apparatus and method	Mirror reflector fixed on a microscope	Mirror reflector fixed on a miscroscope	Projector	Eye-piece micrometer

Appendix

ICELAND

Maturity Stages

Stage I	The size of the gonads, i.e. width less than 3 mm, no eggs visible.
Stage II	Width of gonads less than 6 mm, no eggs visible.
Stage III	Small eggs visible by the naked eye. Width of gonads 1-2 cm.
Stage IV	Length of gonads equals that of body cavity.
Stage V	Gonads fill the body cavity, a few eggs have become transparent, sperm sacks white, but sperm not running.
Stage VI	Eggs and sperms running.
Stage VII	Spawning finished, but gonads have not recovered. A few eggs still in ovaries. Sperm sacks dark red.
Stage VIII	Gonads recovered, but no eggs visible by the naked eye.

NORWAY

Maturity Stages

Stage I	Virgin herring. Gonads very small, 2-3 mm broad. Ovaries wine red, torpedo shaped. Testes whitish or grey brown, knife shaped.
Stage II	Virgin herring. Gonads more of the form of those of adult herring but still small, 5-6 mm broad. Eggs not visible with the naked eye.
Stage III	Gonads more thick and swollen, 1-2 cm broad. Ovaries yellowish, eggs visible with the naked eye. Testes greyish.
Stage IV	Gonads almost as long as the body cavity. Ovaries orange coloured or pale yellow. Eggs large uneven, opaque. Testes whitish.
Stage V	Gonads fill up body cavity. Ovaries yellowish. Eggs round, some hyaline. Testes milk white.
Stage VI	Flowing roe and milt.
Stage VII	Spent herring. Gonads slack. Ovaries blood red, testes greyish red.
Stage VIII	Recovering spent herring. Gonads in firmer condition, about 1 cm broad. Colour dark wine red.

SCOTLAND

Maturity Stages

Stages: Hjort International	Herring	Description
I	Imm	Virgin individuals. Very small sexual organs close under vertebral column. Female wine-coloured torpedoshaped ovaries about 2-3 cm long and 2-3 mm thick. Eggs invisible to naked eye. Male whitish or greyish brown knife-shaped testes 2-3 cm long and 2-3 mm broad.
II	< 1/4	Maturing virgins or recovering spents. Ovaries somewhat longer than half the length of ventral cavity, about 1 cm diam. Eggs small but visible to naked eye. Milt whitish, somewhat bloodshot, same size as ovaries, but still thin and knife-shaped.
III	1/4	Sexual organs more swollen, occupying about half of ventral cavity.
IV	1/2	Ovaries and testes nearly filling 2/3 of ventral cavity. Eggs not transparent, milt whitish swellen.
V	3/4	Sexual organs filling ventral cavity. Ovaries with some large transparent eggs. Milt white, not yet running.
VI	R. & R.R.	Roe and milt running (spawning).
VII	Spt.	Spents. Ovaries slack with residual eggs. Testes baggy, bloodshoot.
VII-II	Spt.+	Recovering spents. Ovaries and testes taking up the slack. No eggs visible. Testes empty.

The II Group is sometimes divided into II + II - III groups.
