

*GEF BALTIC SEA REGIONAL PROJECT
PHASE 1: 2003 – 2005*

REPORT OF THE TRAINING ON HERRING GROWTH ANALYSIS

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International Council for the Exploration of the Sea

Report of the training on herring growth analysis

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Institution: Lead Laboratory on Age Determination and Fish Stomach Analysis within BSRP, Latvian Fish Resources Agency (LATFRA), Riga, Latvia

Justification: ICES Study Group on Fish and Fisheries Issues in Support of the BSRP proposed to perform analysis of historical herring growth changes in the Baltic Sea using the historical national database from research and commercial sampling of herring in the Baltic Sea. Dr. M. Cardinale volunteered to perform the analysis of the research sampling database and a three weeks period was assigned to perform this task.

Background: The higher trophic levels of the Baltic fish ecosystem has undergone large changes during the last two decades, including a severe reduction in cod and herring biomass but, at the same time, a large increase in sprat abundance. The lower trophic levels of the Baltic Sea also changed due to the fluctuations of abiotic factors including variation in salt concentration and the volume of oxygenated water which both are mainly determined by the degree of inflows from the North Sea. In this shifting environment, the condition of herring has undergone large inter-annual variations during the past 15-20 years.

The prediction of the mean weight-at-age (WAA) is a crucial step in the management since WWA are used in short and long-term stock projections within ICES stock assessment. A vast amount of data on herring growth is stored in national laboratories around the Baltic Sea but inaccessible in the present format. Therefore, within ICES Study Group on Fish and Fisheries Issues was agreed to collate all available individual herring data from different laboratories as a first step to construct a common database to be used to estimate historical growth changes of herring stocks in the Baltic Sea and individualize factors responsible for those changes.

As established within the ICES Study Group on Fish and Fisheries Issues, the work should include the following tasks:

- 1) Acquisition of the individual herring data from research sampling
- 2) Screening of the data and correction if necessary
- 3) Construction of a database merging individual data from different laboratories
- 4) Estimating herring growth rates in the Baltic Sea (SD 25-32)
- 5) Analysis of herring growth changes from 1986 and onwards using data from the international herring hydroacoustic survey in the Baltic Sea in the 4th quarter
- 6) Modelling of changes of herring growth rates using both abiotic and biotic predictors

Results: During the three weeks training period, Dr. M. Cardinale has carried out the first four (4) tasks. For task (1), individual herring data from the following countries were acquired: Estonia, Finland, Latvia, Germany, Poland and Sweden. After

screening and correction (Task 2), data were merged into a single database (Task 3) (Table 1) that comprehends the following data field:

Country, Type, Year, Quarter, Month, SD, ICES Rectangle, Station, Bottom depth, Length, Age, Weight, Yearclass, Ln Length, Ln Weight, Sex, Maturity

A similar database was started for the national data from commercial catches and at present it includes Estonian, Finnish, Latvian and Swedish data for Sub-divisions 25-32 from 1984 onwards. This data base is established by Georgs Kornilovs and Tiit Raid and it is expected that it will be finished till spring, checked for mistakes and a similar analysis will be performed as for the hydroacoustic data.

As established within the ICES Study Group on Fish and Fisheries Issues, estimation of herring growth was performed following the work done by Cardinale and Arrhenius, (2000); Cardinale *et al.* (2002), and Möllmann *et al.*, 2003. For the analysis of fish condition, the (double natural logarithmic) length-weight regression was used as it has been considered the most reliable index of fish condition (Bolger and Connoly, 1989; Patterson, 1992) and usually related to the feeding conditions in the sea. It has been shown to be particularly suitable when studying pelagic fish (Winters and Wheeler, 1994; Tanasichuk, 1997) and it has been previously used for estimating the condition of herring and sprat in the Baltic Sea and its relation to biotic and abiotic factors (Cardinale and Arrhenius, 2000; Cardinale *et al.*, 2002; Möllmann *et al.*, 2003). Herring condition (i.e. total body weight in grams at the common length) was estimated (Task 4) for each year (1986-2003) at the total length of 150, 200 and 250 mm.

Besides the construction of a Baltic Sea herring growth database and estimation of condition factor, the three weeks period included training of Latvian and Estonian scientists. This would allow these institutes to establish the data base for the national commercial herring data and to perform independently such kind of analysis for herring. The trained scientist were: Georgs Kornilovs and Maris Plikshs (Latvia), Tiit Raid (Estonia).

Table 1. Number of herring individuals stored in the common database and used for herring condition analysis (From international herring hydroacoustic survey in the Baltic Sea in the 4th quarter).

Year	SD25	SD26	SD27	SD28	SD29	Total
1986	3023	3379	2906	2879	1739	13926
1987	1064	2089	2723	2656	1007	9539
1988	4030	2996	1766	3785	271	12848
1989	2804	2590	3663	2098	1226	12381
1990	2189	1240	3883	2979	1707	11998
1991						
1992	2461	1222	1975	659	632	6949
1993		659		574		1233
1994	1874	688	1101	2079	683	6425
1995	1165	580		625	2527	4897
1996	2073	1885	965	1837	710	7470
1997	329	1258		1958		3545
1998	1538	1282	2420	431	812	6483
1999	1239	1247	538	2806	480	6310
2000	1282	3469	383	2545	186	7865
2001	1848	1449	677	2902	506	7382
2002	1040	361	873	70	587	2931
2003	1661	1209	1077	2835	921	7703

Future works: After completing the first four tasks, the next necessary step will be to perform tasks 5 and 6 as established by the ICES Study Group on Fish and Fisheries Issues. This would allow analysing and comparing growth changes from different regions of the Baltic Sea and will represent the necessary step for the inclusion of forecaster of herring growth changes into short and long-term projections. Successively, the same analysis, including the construction of a common database and the analysis of growth changes should be made for sprat as the same kind of data as for herring exist for this species. A suitable time frame would be at the end of the summer 2005 and the next training period should include:

- Tasks 4 and 5 for herring as established by the ICES Study Group on Fish and Fisheries Issues (see page 1).
- Tasks 1 to 5 for sprat
- Realization of a complete report of the analysis of growth changes of pelagic fish in the Baltic Sea and publication of the work in peer-review journals

This work would take approximately between 5 and 6 weeks and M. Cardinale would volunteer to perform such analysis together with Georgs Kornilovs and Christian Möllmann at the Latvian Fish Resources Agency.

References

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