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International Council for the
Exploration of the Sea

C.M.1993/J:7
Baltic Fish Committee

REPORT OF THE STUDY GROUP ON YOUNG FISH SURVEYS IN THE BALTIC

Pärnu, Estonia, 24-29 August 1992

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1 INTRODUCTION

The Study Group on Young Fish Surveys in the Baltic met in Pärnu, Estonia, 24-29 August 1992.

1.1 Participants

Mr R. Aps	Estonia
Mr E. Aro	Finland
Mr J. Bay	Denmark
Mr W. Grygiel	Poland
Mr E. Kondratovich	Latvia
Mr P. Kotilainen	Finland
Mr A. Lankov	Estonia
Mr J. Modin	Sweden
Mr S. Munch-Petersen	Denmark
Mr M. Plikshs	Latvia
Mr T. Raid (Chairman)	Estonia
Mr B. Vaske	Germany
Mr M. Vitinsh	Latvia
Mr W. Weber	Germany

1.2 Terms of Reference

At the 79th Statutory Meeting of ICES, it was decided (C.Res.1991/2:25) that the Study Group on Young Fish Surveys in the Baltic should meet in Pärnu, Estonia, from 4-9 May 1992. It was later decided that the meeting would be held in Pärnu from 24 to 29 August 1992 in order to:

a) evaluate in detail young fish survey data from the Baltic including those for pelagic species and differences in distribution by area and depth;

b) evaluate, by comparative age readings, the criteria to be used for age determination of Baltic cod, especially concerning the interpretation of the timing of the hyaline and opaque zone formation;

c) evaluate the feasibility of including herring and sprat in the Young Fish Survey database and specify a record format;

d) report to the 1992 meetings of the working Group on Multispecies Assessments of Baltic Fish and the Working Group on the Assessment of Demersal Stocks in the Baltic.

2 DATA-BASE

2.1 Research Surveys according to species

The data-base available to the Study Group is presented in Table 2.1. The data-base was compiled as ASCII-files on floppy disks and these will be distributed to participants after the meeting.

2.2 Cod

2.2.1 Cod in the Western Baltic (Sub-divisions 22 and 24)

Data on young cod are available from 64 surveys from 1978-1992 and the preliminary data from the 1992 surveys used by the Baltic Demersal Assessment Working Group were updated. Surveys were conducted in November-December, January-February and March. The German data are not yet computerized.

2.2.2 Cod in the Eastern Baltic (Sub-divisions 25-32)

The data-base was updated during the meeting with data from 1991 and 1992. Furthermore, Denmark and Latvia submitted revised data for earlier years. Denmark has revised the data for the whole time series from 1982-1992, whereas Latvian data for 1986, 1988, 1989 and 1990 still need to be revised.

At present the data-base contains data for 2,820 hauls according to the text table below:

	Years	Sub-divisions	Total No.of hauls
Denmark	1982-1992	25,26,28,29	453
Germany	1980-1992	25,26,28	725
Latvia	1982-1992	25,26,28,29,32	831
Poland	1981-1992	26	576
Sweden	1986-1992	25,26,27,28	235

2.3 Herring

2.3.1 Herring in Sub-divisions 22 and 24

The data-base on young herring in Sub-divisions 22 and 24, established at the last meeting of the Study Group and covering the years 1981-1990, was updated with new data from German surveys conducted in 1991 and 1992. A total of 2,106 tows is now included in the data-base (Table 2.1).

2.3.2 Herring in Sub-divisions 25-32

New data were provided by Poland, Estonia and Finland (Table 2.1).

The Polish data cover Sub-division 26 for the years 1988-1992. A standard grid of stations has been divided into four depth layers (20-100 m) in the Gulf of Gdansk, and into three layers (30-60 m) in Puck Bay. Surveys were conducted in January, March, December and, occasionally, in May, September and October. The gear used since 1976 is a bottom trawl type P 20/25 with a mesh size of 6 mm bar length in the codend (Anon., 1988). Thirty minute hauls were performed.

The new data, a total of 431 hauls on herring from 12 Polish young fish surveys in the area mentioned above were included in the data-base.

No new data from young herring surveys in Sub-divisions 25 and 28 were presented during this Study Group meeting.

The Finnish young herring data-base (age groups 0, 1 and 2) was completed. The total number of hauls was 1,123, covering the period 1975-1991. The data-base consists of 415 pelagic hauls and 708 Isaacs-Kidd midwater trawl hauls (Tables 2.3.1-2.3.6). The pelagic trawl samples were taken in July-August and Isaacs-Kidd midwater trawl samples in September-November each year.

A total of 9 hauls made by Estonia in 1991 were not included in the data-base.

2.4 Sprat

2.4.1 Sprat in Sub-divisions 22 and 24

Sprat data from surveys conducted during the period 1980-1990 have been included in the data-base. In total information from 567 tows is available. Additional surveys have also been carried out in 1991 and 1992. The data will be included in the data-base at the next meeting of the Working Group on Assessment of Pelagic Stocks in the Baltic.

2.4.2 Sprat in Sub-divisions 25, 26, 28 and 29

Sprat data were provided by Poland for Sub-division 26 (14 surveys) and Sub-division 25 (5 surveys). Data for Sub-division 29 (one survey in 1991) were presented by Estonia.

Poland has been using a bottom trawl (type P 20/25) with a mesh-size of 6 mm bar length in the codend in its surveys since 1976. The survey methods used are the same as described in Section 2.3.2. A total of 477 hauls has been included in the data-base.

No new data on sprat in Sub-divisions 25 and 28 were presented at the meeting.

2.5 Flounder

2.5.1 Flounder in Sub-divisions 22 and 24

There are flounder survey data available for both sub-divisions for the period 1980-1992. The data were partly entered into the data-base. The missing data will be added at the 1993 meeting of the Working Group on the Assessment of Demersal Stocks in the Baltic.

2.5.2 Flounder in Sub-divisions 26, 28, 29 and 32

Some additional data on flounder were provided by Poland for Sub-division 26 (1987-1989). A standard grid of stations has been divided into 9 depth layers (20-100m) in the Gulf of Gdansk and into 4 layers (30-60m) in Puck Bay. The surveys have been conducted in the first and fourth quarters of each year. The gear used was a bottom herring trawl (type P20/25) with a mesh-size of 6 mm bar length in the codend. The duration of hauls was 30 min, but the data are given in number per hour.

For six young fish surveys the mean CPUE (kg/h) of flounder by depth layer, the average length (in cm) of fish and the percentage by-catch of young flounder (below the commercial size of 21 cm) are presented in Table 2.5.1.

Latvian young fish beach-seine survey data from the Kolka area (rectangle 4467) were updated by including data from 1991 and preliminary 1992 data. The survey methods used were the same as described in Anon. (1991). Altogether, 37 hauls were performed in 1991 and 42 hauls in 1992, of which 18 and 13 hauls respectively were in the standard survey area at Kolka. Regular surveys were also started in the Lielirbe area (19 and 22 hauls in 1991 and 1992) and started along the open sea coast south of Liepaja (Sub-division 26) - 6 hauls in 1992.

Young fish survey data for flounder were also available from Finland. The hauls were made with a beach-seine (length with ropes about 100 m and codend mesh-size 4 mm). The haul depth varied from 0.1 to 1.5 m. The total number of hauls, which were made twice a year (in spring, April-May and in autumn, October-November) from 1979 to spring 1992, was 491.

2.6 Future activities

The main objective of the Study Group has been to compile and analyse national research surveys on young fish in the Baltic. The exercise has been pursued in three major steps:

1. to review and compare sampling designs from national surveys.

2. to establish and continuously update a data-base on the number of fish caught per age group and haul.

3. to evaluate possible methods to calculate recruitment indices.

The results have been used by the Baltic Assessment Working Groups to estimate recruitment of cod and, to some extent, herring, and by the Baltic Multispecies Working Group to assess the spatial distribution of cod.

Further work is needed. The data-base is not fully updated as several surveys known to have taken place have not yet been incorporated. Other remaining tasks include studies on the components of variance and possible bias in the surveys.

Additional tasks of the Study Group should include studies on the sampling of age-length keys (see Section 5).

At the present stage it was felt that updating of data-files could be managed between meetings of the Assessment Working Groups by national coordination. Members of the Study Group agreed that collection and compilation of basic data (numbers per age group and haul) should be assigned to national laboratories on a stock by stock basis as follows:

Fish Stock	National laboratory
Cod in Sub-divisions 22 and 24	Finland, Germany
Cod in Sub-divisions 25 to 32	Denmark
Cod in Kattegat	Sweden
Herring in Sub-divisions 22 and 24	Germnay
Herring in Sub-divisions 25-29 and 32	Poland
Herring in Sub-divisions 30 and 31	Finland
Sprat in Sub-divisions 22-29 and 32	Estonia and Latvia
Flounder in Sub-divisions 22 and 24	Germany
Other flounder stocks in the Baltic	Finland
Sole in Division IIIa	Sweden
Plaice in Kattegat	Sweden

Data should be assembled by correspondence and presented at future meetings of the Study Group and the Baltic Assessment Working Groups.

3 SURVEY RESULTS AS AN INDEX OF YEAR-CLASS STRENGTH

3.1 Cod

3.1.1 Cod in Western Baltic (Sub-divisions 22 and 24)

The Study Group applied the GLM to analyse the data (Tables 3.1.1 and 3.1.2). All available monthly data were used to estimate year-class strengths. The model was adopted from Anon. (1992b):

$$\log(\text{CPUE}) = Y + C + S + D + Q + e$$

where,

CPUE = catch in numbers at age per hour
Y = year effect (year-class strength)
C = country effect (the different surveys)
S = sub-division effect (spatial distribution)
D = depth effect
Q = quarter of the year

Log-transformed data were used. No interaction terms (depth, quarter, sub-divisions) were used, because it was considered that, in the western Baltic, the coverage of the surveys from year to year does not vary very much and the main contributors to the estimates are year-class strength and country.

Tables 3.1.1 and 3.1.2 show the GLM results for age groups 1 and 2, respectively. The regressions between GLM-estimates and VPA are shown in Table 3.1.3. The estimated indices correlate well with the VPA estimates of both age groups. No changes in the year-class strength estimates were observed compared to those produced by the Baltic Demersal Working Group (Table 3.1.3). The 1991 year class was estimated to be 51.5 million instead of 50.7 million (Anon., 1992b).

The conclusion from comparing GLM-estimates and RCT3 estimates (Anon., 1992b) in Sub-divisions 22 and 24 is that GLM gave more conservative estimates than did RCT3, and that the 1991 year-class seems to be above average.

3.1.2 Cod in Eastern Baltic (Sub-divisions 25-32)

At the 1992 meeting of the ICES Working Group on the Assessment of Demersal Stocks in the Baltic (Anon., 1992b) recruitment indices were obtained by combining all survey data by a GLM as recommended by this Study Group in 1990 (Anon., 1991).

Since the results from analysing similar data by GLMs has indicated sensitivity of the index estimates to log-transformation, due to the way zero observations are handled (Anon., 1992c), the Study Group also considered this problem. No analyses regarding this problem were carried out, however.

Table 3.1.4 gives the frequency of zero observations of age group 2 in the hauls by survey (country). The percentage of zero observations of age group 2 varied from 3% (Danish data) to 38% (Polish data). It has not yet been possible to offer a fully satisfactory explanation for the difference in frequency of zero observations in the Danish, German and Swedish survey data (3%-12%) on one side and the Polish and USSR/Latvian data (28%-38%). There seems to be no clear trend by year in the zero frequencies, (see Figure 3.1). The high number of zero observations in the Polish data could be explained by the small geographical area covered by this survey in relation to a variable distribution of cod in the Baltic (Munch-Petersen and Bay, 1991). The procedures for allocating ages to survey catches may also be responsible in some surveys.

In previous analyses (GLM) of the survey data (Munch-Petersen and Bay, 1991; Anon., 1992b) a constant = 0.5 has been added to all observations to avoid zeroes before log-transformation. However, changing the value of this constant to 0.1 or 1.0 only alters the relative values of the GLM estimates slightly. The value of 0.5 has been maintained in the GLM based on the updated data set presented in Tables 3.1.5a and b.

The new GLM estimates are very similar to the ones used in Anon. (1992b) and do not alter the trend in year-class strength (Table 3.1.5b). However, as stated in Section 2.2.2 the Latvian data for 1986-1990 (USSR data) are still not fully revised.

3.2 Herring

3.2.1 Herring in Sub-divisions 25-29 and 32

The correlation between herring stock size in numbers of age group 1 in Sub-divisions 25-29 and 32 (Anon., 1992a) and year-class indices from Polish young fish surveys in the Gulf of Gdansk was analysed. The geometric mean year-class abundance indices for 1976-1990 (excluding 1986) were used (Table 3.2.1). Regression analysis revealed a rather weak correlation between year-class indices and recruitment values (Table 3.2.2). The results obtained are not surprising because the abundance indices for herring in only a very limited area (coastal spring-spawning populations in the Gulf of Gdansk) were used to correlate with herring recruitment values for most of the Baltic.

CPUE at ages 0, 1 and 2 were calculated for herring in Sub-divisions 29 and 32 as numbers at age from the total catches (age 0) or subsamples from the total catch (at ages 1 and 2). Herring smaller than 10 cm were considered to belong to the 0-group. The numbers of specimens at ages 1 and 2 were calculated using weighted mean weights at age in each haul.

For input to RCT3, arithmetic means of CPUE by year and sub-division were used. The VPA estimates were taken from Anon. (1992a) separately for Sub-divisions 30 and 25-29, 32. In the RCT3 runs the abundance indices of adult Copepoda in June and July, juvenile Copepoda in June, Copepoda nauplii in June and CPUE data of 0-group herring in pelagic commercial catches (Anon., 1992a) were used.

For the year-class strength estimates the best fit was obtained between Sub-division 29 and VPA (Tables 3.2.3-3.2.8). The reason for this might be in the timing of sampling. Migration of bigger and older herring from the Gulf of Finland (Sub-division 32) to the Baltic proper (Sub-division 29) after spawning might give biased and higher shares of catch for 1- and 2-year old herring than other seasons. The higher r^2-values of year-class strength indicated this. Predictability of year-class strength by these survey indices is highly variable, but gave a better fit than respective indices of copepods.

Application of GLM (Generalized Linear Model)

GLM procedures in SAS were also used to analyse the exploratory and Isaacs-Kidd midwater trawl data in order to calculate the logarithmic least square mean indices for age groups 0, 1 and 2. The data were based on CPUE in each haul at ages 0, 1 and 2. The model takes account of distribution differences in space and time.

The GLM model used was simply:

$$\log(\text{CPUE}) = Y + S + e$$

Y = year effect (year-class strength)
S = sub-division effect (spatial distribution)
e = error factor

Linear regression was used between the estimated recruitment indices from GLM and VPA year-class estimates (Tables 3.2.9-3.2.11).

Recruitment indices at age 1 correlated only moderately with VPA estimates from Sub-division 30 at age 1 (Tables 3.2.12-3.2.14). The rest of the recruitment indices correlated weakly with the VPA estimates or they were uncorrelated. The GLM model at age 1 explained 43% of the total variation and at ages 0 and 2, 12% and 20%, respectively. In most cases the error factor explains the greatest share of the variation of the model.

3.3 Sprat in Sub-divisions 22-32

The correlation between sprat stock size in numbers at age 1 in Sub-divisions 25 to 32 (Anon., 1992a) and year-class abundance indices from Polish young fish surveys in the Gulf of Gdansk (Table 3.3.1) was calculated. The geometric mean year-class abundance indices (1976-1990, excluding 1986) were used. A simple linear regression produced a correlation coefficient of $r = 0.60$ which is rather low (Table 3.3.2). Inclusion of year-class abundance indices for other Baltic areas in future analyses would be reasonable.

3.4 Flounder

On the basis of the arithmetic mean abundance of age group 1 by haul (Table 3.4.1) the 1986, 1989 and 1990 year-classes seem to be strong.

The abundance of the 1991 year-class was below the average at the standard survey site near Kolka, but in the Lielirbe area, 13 km west of Kolka, the same year-class was about average. Therefore, the preliminary 1991 year-class strength can be estimated as average or below.

Arithmetic means of CPUE and C.V. of CPUE for young flounder ($\leq$3 years old) were calculated by Sub-division, season (spring, autumn) and year (Table 3.4.2). Variation in catches in numbers between hauls was great.

4 COMPARATIVE AGE READINGS

Several sets of otoliths were made available to the Study Group. The species covered were cod, flounder, herring and sprat.

Cod otoliths originating from Sub-division 25 were of special interest. The material, covering eight months in 1986, had already been presented to the Study Group at the 1990 meeting. Though only some of the members are regularly involved in cod otolith reading, the time of year at which the hyaline ring is deposited was considered.

As ring structures are often clearly detectable only after their deposition is finished, the readings made during the meeting show a remarkable variance. All readers confirm that hyaline rings in cod of Sub-division 25 are being formed throughout the year. There is, however, a certain maximum during the summer months. Considering only those fish above 40 cm in length, which are mostly fish participating in spawning, the summer deposition is somewhat more pronounced (Figure 4.1). This observation is in accordance with that of Bingel (1981) who found the hyaline zone being formed during the growing season when cod are spawning. As the spawning season in this area extends over more than half the year the results found reflect this situation.

5 INCLUSION OF LENGTH AND WEIGHT DATA BY AGE GROUP IN THE DATA-BASE

The Study Group discussed whether and how data on length and weight should be included in the existing data-base of the Study Group.

The purpose of including the size data in the data-base is <u>not</u> for making detailed analyses of growth, but rather for observing substantial changes in the age-size relationship. The main purpose of such inclusions would then be to make data on mean size (length or weight) available to the Baltic Assessment Working Groups. This would make it easier to have regular checks on consistency of age readings and, if possible, to observe any significant changes in size distributions (length or weight) by age group in the stock.

At present the basic data available to this Study Group are on a single haul basis, i.e. <u>estimated</u> number of all age groups in each trawl catch and total weight, together with data on position, depth etc. These numbers by age group have been estimated from some age-length key which covers a distinct group of trawl hauls. In most cases an age-length key is made for each sub-division and all hauls within this area are then distributed according to this age-length key. In some sprat and herring surveys, however, age-length keys are made for each haul.

a) In the **Danish** and **Swedish** young cod surveys in Sub-divisions 22-28, age-length keys are made for each Sub-division. The otolith sampling is done according to the "fixed number of otoliths per length group" principle, here 10 otoliths per 1 cm group. The otolith sampling for a particular sub-division begins in the first haul and continues with the following hauls until 10 otoliths in all cm groups are obtained. The length distribution in each haul in the sub-division is then distributed by age according to the age-length key.

b) In the **German** surveys in Sub-division 22 age-length keys for cod and flounder, and in Sub-division 24 for cod, herring, sprat and flounder, are compiled. The age-length keys are based on the "fixed number of otoliths per length group" principle, including at least 10 otoliths per 1 cm group in the case of cod. For herring, at least 10 otoliths per 0.5 cm group between 5 and 20 cm are obtained and 15 otoliths per 0.5 cm for larger fish. In the case of sprat, 15 otoliths per 0.5 cm group are taken. The length distributions in each haul in the two Sub-divisions are then distributed by age according to the common age-length key.

c) In the Estonian surveys for herring and sprat in Sub-divisions 29 and 32 age-length keys are made for each haul or group of hauls in an area within a sub-division. They are based on random samples of 100 fish from which otoliths are taken.

d) In the Polish surveys in Sub-division 26 all cod are presently being aged. Age-length keys are made for herring and sprat. They are based on the "fixed number of otoliths per length group" principle, with 10 otoliths per 0.5 cm group.

e) In the Latvian surveys age-length keys for cod, herring and sprat are made for different areas within a sub-division. They are based on random samples of 100 fish from which otoliths are taken. The length distribution in each haul is then distributed by age according to the relevant age-length key,

f) From Finland surveys for herring and sprat are conducted in Sub-divisions 29, 30 and 32. The age-length keys are based on samples stratified by length group (0.5 cm) in the hauls. A single age-length key is applied for each sub-division.

It appears that the age-length keys are not obtained in the same way in all surveys, and that only those age-length samples which are obtained either by random sampling or by using the "fixed number of otoliths per length group" principle, can be used directly to provide unbiased estimates of mean length by age group.

Since combination and statistical comparison of, for example, mean lengths from different areas and/or years should be based on the age-length key observations (i.e. otolith readings and corresponding size measurement), it is necessary to specify in the data-base exactly the areas or group of hauls to which the age-length keys refer. How detailed the data should be was discussed, for instance whether the age-length keys should be made available together with the relevant length distributions, or whether the mean lengths and weights by length group and the corresponding variance from the age-length key would suffice.

The Study Group came to the conclusion that the age-length data should be stored on a separate file. During the meeting, however, there was insufficient time to discuss the format of the data in detail. Sweden agreed to circulate a proposal to the members in the near future.

6 RECOMMENDATIONS

The Study Group recommends that:

a) the Working Group on the Assessment of Demersal Stocks in the Baltic considers the cod year-class strength estimation results in this report.

b) The survey results for all species considered should be reported annually in appropriate format to the Baltic Assessment Working Groups.

c) Studies should be undertaken to evaluate further the sampling and calculation methods for both surveys and the commercial fishery in the Baltic. Results should be utilized to assess the quality of data used by the Baltic Assessment Working Groups and to improve sampling and assessment procedures.

d) A data-base should be set up containing age-length relationships and length distributions from primary observations. A suggestion for such a data-base, including specified formats, should be presented by the Swedish laboratory before the next meeting of the Working Group on the Assessment of Demersal Stocks in the Baltic.

e) The next meeting of the Study Group should concentrate on more detailed analysis of survey results including new data on age-length keys.

f) Taking into account possible uncertainties in age readings of cod, otolith samples for comparative age-readings should be circulated and the results should be finally evaluated by a special workshop.

g) The next meeting should be held in Gdynia, Poland for 5 days in June 1993.

7 REFERENCES

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Table 2.1 Number of research vessel trawl hauls by country, sub-division, year and species

cod

Sub-division 22	Germany	total
1978	19	19
1979	19	19
1980	122	122
1981	122	122
1982	98	98
1983	101	101
1984	119	119
1985	123	123
1986	111	111
1987	107	107
1988	132	132
1989	94	94
1990	69	69
1991		0
1992		0
total	1236	1236

cod

Sub-division 24	Denmark	Sweden	Germany	total
1978			24	24
1979			55	55
1980			15	15
1981			73	73
1982	3		49	52
1983	5		51	56
1984	5		76	81
1985			73	73
1986	4	1	73	78
1987	11		36	47
1988	4	2	51	57
1989	12	4	86	102
1990	3	14	52	69
1991	10	10	48	68
1992	9	4	7	20
total	66	35	769	870

cod

Sub-division 25	Denmark	Sweden	Germany	Latvia	total
1978					0
1979					0
1980			57		57
1981			37		37
1982	18		53	2	73
1983	20		85	5	110
1984	23		72		95
1985	23		61		84
1986	15	8	52	2	77
1987	41	20	24		85
1988	33	11	62		106
1989	14	25	66		105
1990	18	24	55	22	119
1991	26	25	36	12	99
1992	26	13	21		60
total	257	126	681	43	1107

cod

Sub-division 26	Denmark	Sweden	Germany	Latvia	Poland	total
1978						0
1979						0
1980						0
1981					42	42
1982	3			59	58	120
1983	10			54	31	95
1984	8			54	61	123
1985	11			79	30	120
1986	9		2	25		36
1987	14	1	3	62	43	123
1988	32		3	31	68	134
1989	13	2	11	17	67	110
1990	10	2	2	25	71	110
1991	22	2	9	26	70	129
1992	16		4	8	35	63
total	148	7	34	440	576	1205

cod

Sub-division 27	Sweden	total
1978		0
1979		0
1980		0
1981		0
1982		0
1983		0
1984		0
1985		0
1986	2	2
1987		0
1988	4	4
1989	10	10
1990	14	14
1991	14	14
1992	9	9
total	53	53

cod

Sub-division 28	Denmark	Sweden	Germany	Latvia	total
1978					0
1979					0
1980					0
1981					0
1982	3			49	52
1983	5			56	61
1984	7			38	45
1985	5			33	38
1986		2		30	32
1987			1	38	39
1988	3	7		31	41
1989	3	7		9	19
1990	6	11		10	27
1991	6	13		19	38
1992	5	9	9	4	27
total	43	49	10	317	419

cod

Sub-division 29	Denmark	Latvia	total
1978			0
1979			0
1980			0
1981			0
1982		6	6
1983	2	3	5
1984		3	3
1985		1	1
1986		4	4
1987			0
1988	3	4	7
1989		1	1
1990			0
1991			0
1992			0
total	5	22	27

cod

Sub-division 32	Latvia	total
1978		0
1979		0
1980		0
1981		0
1982	1	1
1983		0
1984	5	5
1985		0
1986	1	1
1987		0
1988	1	1
1989	1	1
1990		0
1991		0
1992		0
total	9	9

Continued....

TABLE 2.1 (cont)

HERRING

SD22		SD24			
YEAR	GER	YEAR	GER	POL	Total
1979		1979			0
1980		1980			0
1981	37	1981	57		57
1982	20	1982	31		31
1983	20	1983	27		27
1984	39	1984	62		62
1985	38	1985	61	2	63
1986	39	1986	55		55
1987		1987			0
1988	20	1988	27		27
1989	38	1989	46		46
1990	20	1990	40		40
1991		1991	48		48
1992		1992			0
TOTAL	271	TOTAL	454	2	456

SD25		SD26		SD29			
YEAR	POL	YEAR	POL	YEAR	FIN	EST	Total
1979				1979	11		11
1980				1980	13		13
1981				1981	22		22
1982				1982	22		22
1983				1983	21		21
19[illegible]		1984		1984	21		21
1985	11	1985	76	1985	22		22
1986	18	1986	50	1986	28		28
1987		1987	114	1987	27		27
1988	21	1988	126	1988	29		29
1989		1989	74	19989	64		64
1990		1990	107	1990	66	9	75
1991		1991	107	1991	6	4	10
1992		1992	33	1992			0
TOTAL	50	TOTAL	687	TOTAL	352	13	365

Continued.....

TABLE 2.1 (cont.) HERRING

SD30		SD32			
YEAR	FIN	YEAR	FIN	EST	Total
1979	20	1979	26		26
1980	20	1980	17		17
1981	15	1981	28		28
1982	18	1982	28		28
1983	19	1983	27		27
1984	17	1984	27		27
1985	19	1985	30		30
1986	15	1986	34		34
1987	15	1987	32		32
1988	25	1988	26		26
1989	13	1989	24	12	36
1990		1990	45	14	59
1991	12	1991	8		8
1992		1992			0
TOTAL	208	TOTAL	352	26	378

SPRAT

SD22		SD24			
YEAR	GER	YEAR	GER	POL	Total
1979		1979			0
1980		1980		2	2
1981		1981			0
1982		1982			0
1983	20	1983	27		27
1984	39	1984	62		62
1985	38	1985	59	2	61
1986	39	1986	56		56
1987		1987	25		25
1988	19	1988	31		31
1989	38	1989	60		60
1990	20	1990	40		40
1991		1991	48		48
1992		1992			0
TOTAL	213	TOTAL	408	4	412

Continued......

TABLE 2.1 (cont.) SPRAT

SD25		SD26				SD28	
YEAR	POL	YEAR	POL	LAT	Total	YEAR	LAT
1979		1979			0	1979	
1980		1980			0	1980	
1981		1981			0	1981	
1982		1982		8	8	1982	2
1983		1983		6	6	1983	3
1984		1984		3	3	1984	4
1985	11	1985	76	1	77	1985	
1986	18	1986	50	4	54	1986	1
1987		1987	114	1	115	1987	
1988	21	1988	126	15	141	1988	12
1989		1989	74	10	84	1989	5
1990		1990	72		72	1990	
1991		1991			0	1991	
1992		1992			0	1992	
TOTAL	50	TOTAL	512	48	560	TOTAL	27

SD29		SD32	
YEAR	EST	YEAR	EST
1983		1983	
1984	1	1984	
1985		1985	
1986		1986	
1987		1987	
1988		1988	1
1989	3	1989	1
1990		1990	
1991		1991	
1992		1992	
TOTAL	4	TOTAL	2

Continued......

TABLE 2.1 (Cont.) **FLOUNDER**

SD22		SD26		SD28	
Year	GER	Year	LAT	Year	LAT
1979		1979		1979	
1980		1980		1980	
1981		1981		1981	
1982		1982		1982	
1983		1983		1983	
1984		1984		1984	
1985	85	1985		1985	
1986	72	1986		1986	34
1987	87	1987		1987	57
1988	112	1988		1988	30
1989	56	1989	12	1989	39
1990	68	1990		1990	24
1991	74	1991		1991	37
1992	50	1992	6	1992	35
TOTAL	604	TOTAL	18	TOTAL	256

SD29				SD32			
Year	EST	FIN	Total	Year	EST	FIN	Total
1979		12	12	1979		17	17
1980		27	27	1980		12	12
1981		26	26	1981		11	11
1982		17	17	1982		7	7
1983		29	29	1983		15	15
1984		33	33	1984		4	4
1985		39	39	1985		12	12
1986		37	37	1986		11	11
1987		35	35	1987		13	13
1988	4	39	43	1988	6	12	18
1989	16	46	62	1989	20	13	33
1990		20	20	1990	10	6	16
1991			0	1991			0
1992	20	360	380	1992			0
TOTAL			0	TOTAL	36	133	169

Continued......

Table 2.3.1 Input data of herring at age 1 in Sub-division 30 for the RCT3-program.

```
HERRING EXPLORATORY TRAWL AT AGE 1, SD 30
9 18 2
1974 1918 2.2 11.3 1.5 4.1 3.8 56 2279 -11 66
1975 4024 4.6 8.4 2.9 16.5 0.1 416 34 27 1547
1976 1397 0.7 1.8 0.8 2.6 3.1 9 1 0 13
1977 868 1.3 4.5 0.6 3.5 0.1 0 0 0 5
1978 719 1.0 3.4 1.1 4.6 0.1 0 0 0 15
1979 1370 1.8 6.0 2.8 17.9 0.1 6 40 328 1639
1980 1333 1.8 3.2 0.8 4.0 0.1 104 191 1 734
1981 1844 1.4 5.8 1.0 14.4 10.8 323 22 0 1242
1982 2458 0.4 1.8 0.1 1.6 0.1 7 41 208 262
1983 3820 1.8 4.3 2.0 9.5 3.3 266 660 13 278
1984 3176 1.1 2.4 0.7 6.2 0.1 195 10 0 791
1985 1270 0.1 0.2 0.2 0.7 0.1 0 14 9 34
1986 2018 1.2 3.4 1.5 9.2 0.1 39 109 1 636
1987 879 0.8 2.0 0.7 2.3 0.1 0 8 0 357
1988 4036 1.6 2.9 0.5 5.4 0.7 498 3069 -11 480
1989 3072 2.5 4.0 4.1 9.9 7.3 1846 -11 -11 1796
1990 2025 2.4 5.5 2.0 8.9 0.8 1568 244 -11 897
1991 -11 8.6 33.8 4 21.4 0 -11 -11 -11 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
EXP129
EXP130
EXP131
EXP132
```

Table 2.3.2 Input data of herring at age 1 in Sub-divisions 25-29, 32 for the RCT3-program.

```
HERRING EXPLORATORY TRAWL AT AGE 1, SD 25-29, 32
9 18 2
1974 274 2.2 11.3 1.5 4.1 3.8 56 2279 -11 66
1975 538 4.6 8.4 2.9 16.5 0.1 416 34 27 1547
1976 320 0.7 1.8 0.8 2.6 3.1 9 1 0 13
1977 375 1.3 4.5 0.6 3.5 0.1 0 0 0 5
1978 328 1.0 3.4 1.1 4.6 0.1 0 0 0 15
1979 478 1.8 6.0 2.8 17.9 0.1 6 40 328 1639
1980 573 1.8 3.2 0.8 4.0 0.1 104 191 1 734
1981 598 1.4 5.8 1.0 14.4 10.8 323 22 0 1242
1982 511 0.4 1.8 0.1 1.6 0.1 7 41 208 262
1983 743 1.8 4.3 2.0 9.5 3.3 366 660 13 278
1984 576 1.1 2.4 0.7 6.2 0.1 195 10 0 791
1985 266 0.1 0.2 0.2 0.7 0.1 0 14 9 34
1986 619 1.2 3.4 1.5 9.2 0.1 39 109 1 636
1987 219 0.8 2.0 0.7 2.3 0.1 0 8 0 357
1988 426 1.6 2.9 0.5 5.4 0.7 498 3069 -11 480
1989 783 2.5 4.0 4.1 9.9 7.3 1846 -11 -11 1796
1990 490 2.4 5.5 2.0 8.9 0.8 1568 244 -11 897
1991 -11 8.6 33.8 4 21.4 0 -11 -11 -11 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
EXP129
EXP130
EXP131
EXP132
```

Table 2.3.3 Input data of herring at age 2 in Sub-division 30 for the RCT3-program.

```
HERRING EXPLORATORY TRAWL AT AGE 2, SD 30
9 18 2
1974 1538 2.2 11.3 1.5 4.1 3.8 434 208 58 225
1975 3214 4.6 8.4 2.9 16.5 0.1 431 90 32 125
1976 1127 0.7 1.8 0.8 2.6 3.1 424 105 11 287
1977 686 1.3 4.5 0.6 3.5 0.1 132 361 2 532
1978 586 1.0 3.4 1.1 4.6 0.1 413 178 5 716
1979 1062 1.8 6.0 2.8 17.9 0.1 328 280 117 590
1980 1088 1.8 3.2 0.8 4.0 0.1 8158 108 79 3126
1981 1487 1.4 5.8 1.0 14.4 10.8 388 128 203 391
1982 1925 0.4 1.8 0.1 1.6 0.1 1338 1017 2604 787
1983 3043 1.8 4.3 2.0 9.5 3.3 1878 356 104 2934
1984 2527 1.1 2.4 0.7 6.2 0.1 658 292 32 1123
1985 1022 0.1 0.2 0.2 0.7 0.1 150 118 12 275
1986 1613 1.2 3.4 1.5 9.2 0.1 1416 228 359 4798
1987 713 0.8 2.0 0.7 2.3 0.1 116 317 -11 84
1988 3204 1.6 2.9 0.5 5.4 0.7 1252 -11 -11 1014
1989 2354 2.5 4.0 4.1 9.9 7.3 3446 921 -11 4131
1990 1614 2.4 5.5 2.0 8.9 0.8 -11 -11 -11 -11
1991 -11 8.6 33.8 4 21.4 0 -11 -11 -11 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
EXP229
EXP230
EXP231
EXP232
```

Table 2.3.4 Input data of herring at age 2 in Sub-divisions 25-29, 32 for the RCT3-program.

```
HERRING EXPLORATORY TRAWL AT AGE 2, SD 25-29,32
9 18 2
1974 135 2.2 11.3 1.5 4.1 3.8 434 208 58 225
1975 274 4.6 8.4 2.9 16.5 0.1 431 90 32 125
1976 166 0.7 1.8 0.8 2.6 3.1 424 105 11 287
1977 165 1.3 4.5 0.6 3.5 0.1 132 361 2 532
1978 112 1.0 3.4 1.1 4.6 0.1 413 178 5 716
1979 142 1.8 6.0 2.8 17.9 0.1 328 280 117 590
1980 229 1.8 3.2 0.8 4.0 0.1 8158 108 79 3126
1981 230 1.4 5.8 1.0 14.4 10.8 388 128 203 391
1982 209 0.4 1.8 0.1 1.6 0.1 1338 1017 2604 787
1983 328 1.8 4.3 2.0 9.5 3.3 1878 356 104 2934
1984 253 1.1 2.4 0.7 6.2 0.1 658 292 32 1123
1985 145 0.1 0.2 0.2 0.7 0.1 150 118 12 275
1986 372 1.2 3.4 1.5 9.2 0.1 1416 228 359 4798
1987 130 0.8 2.0 0.7 2.3 0.1 116 317 -11 84
1988 270 1.6 2.9 0.5 5.4 0.7 1252 -11 -11 1014
1989 535 2.5 4.0 4.1 9.9 7.3 3446 921 -11 4131
1990 324 2.4 5.5 2.0 8.9 0.8 -11 -11 -11 -11
1991 -11 8.6 33.8 4 21.4 0 -11 -11 -11 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
EXP229
EXP230
EXP231
EXP232
```

Table 2.3.5 Input data of herring at age 0 in Sub-division 30 for the RCT3-program.

```
HERRING ISAACS-KIDD, SD 30
8 18 2
1974 1918 2.2 11.3 1.5 4.1 3.8 -11 -11 -11
1975 4024 4.6 8.4 2.9 16.5 0.1 -11 -11 -11
1976 1397 0.7 1.8 0.8 2.6 3.1 -11 -11 -11
1977 868 1.3 4.5 0.6 3.5 0.1 -11 -11 -11
1978 719 1.0 3.4 1.1 4.6 0.1 -11 -11 -11
1979 1370 1.8 6.0 2.8 17.9 0.1 371 72 68
1980 1333 1.8 3.2 0.8 4.0 0.1 151 20 86
1981 1844 1.4 5.8 1.0 14.4 10.8 32 13 68
1982 2458 0.4 1.8 0.1 1.6 0.1 228 174 133
1983 3820 1.8 4.3 2.0 9.5 3.3 292 82 270
1984 3176 1.1 2.4 0.7 6.2 0.1 313 34 148
1985 1270 0.1 0.2 0.2 0.7 0.1 107 19 67
1986 2018 1.2 3.4 1.5 9.2 0.1 95 124 153
1987 879 0.8 2.0 0.7 2.3 0.1 155 61 29
1988 4036 1.6 2.9 0.5 5.4 0.7 361 168 170
1989 3072 2.5 4.0 4.1 9.9 7.3 131 716 -11
1990 2025 2.4 5.5 2.0 8.9 0.8 369 446 -11
1991 -11 8.6 33.8 4 21.4 0 272 994 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
ISAA29
ISAA30
ISAA32
```

Table 2.3.6 Input data of herring at age 0 in Sub-divisions 25-29, 32 for the RCT3-program.

```
HERRING ISAACS-KIDD SD 25-29, 32
8 18 2
1974 274 2.2 11.3 1.5 4.1 3.8 -11 -11 -11
1975 538 4.6 8.4 2.9 16.5 0.1 -11 -11 -11
1976 320 0.7 1.8 0.8 2.6 3.1 -11 -11 -11
1977 375 1.3 4.5 0.6 3.5 0.1 -11 -11 -11
1978 328 1.0 3.4 1.1 4.6 0.1 -11 -11 -11
1979 478 1.8 6.0 2.8 17.9 0.1 371 72 68
1980 573 1.8 3.2 0.8 4.0 0.1 151 20 86
1981 598 1.4 5.8 1.0 14.4 10.8 32 13 68
1982 511 0.4 1.8 0.1 1.6 0.1 228 174 133
1983 743 1.8 4.3 2.0 9.5 3.3 292 82 270
1984 576 1.1 2.4 0.7 6.2 0.1 313 34 148
1985 266 0.1 0.2 0.2 0.7 0.1 107 19 67
1986 619 1.2 3.4 1.5 9.2 0.1 95 124 153
1987 219 0.8 2.0 0.7 2.3 0.1 155 61 29
1988 426 1.6 2.9 0.5 5.4 0.7 361 168 170
1989 783 2.5 4.0 4.1 9.9 7.3 131 716 -11
1990 490 2.4 5.5 2.0 8.9 0.8 369 446 -11
1991 -11 8.6 33.8 4 21.4 0 272 994 -11
COADJN
COADJL
COJUJN
CONAJN
PELCAO
ISAA29
ISAA30
ISAA32
```

Table 2.5.1 Mean CPUE (kg/h), mean length (cm) and by-catch of young flounder (%) in Subdivision 26. Polish survey in 1987-1989.

Depth,m	Survey	CPUE	L-tot	% of young
20	Dec-87	126.7	18.6	44.9
20	Jan-88	96.9	22.8	14.3
20	Mar-88	9.4	16.6	77
20	Dec-88	65.1	19.3	62.1
20	Jan-89	38.6	20.3	52.7
20	Nov-89	16.7	17.2	73.6
30	Dec-87	99.2	25	9.6
30	Jan-88	21.2	23.8	10.1
30	Mar-88	25.2	16.8	63.8
30	Dec-88	138	18.3	65.6
30	Jan-89	29.9	21.3	31.1
30	Nov-89	8.7	16.2	77.1
40	Dec-87	258	24.4	13.7
40	Jan-88	24.3	21.1	46.4
40	Mar-88	6.8	18.6	55.1
40	Dec-88	62.8	22.8	27.2
40	Jan-89	57.3	21.8	28.2
40	Nov-89	23.2	20.7	42.8
50	Dec-87	73.1	24.9	7.8
50	Jan-88	20.7	21.7	35.3
50	Mar-88	8.1	20.4	52.9
50	Dec-88	93.7	23.7	21.8
50	Jan-89	75.1	22.7	21.1
50	Nov-89	19.3	21	37.8
60	Dec-87	42.7	25.5	6.1
60	Jan-88	39.5	23.4	17.6
60	Mar-88	11	21.1	45
60	Dec-88	73.4	24	13
60	Jan-89	83.6	23.2	13.3
60	Nov-89	8.1	21.2	40.5
70	Dec-87	12.8	27.2	7.2
70	Jan-88	36.9	25	9.6
70	Mar-88	7.8	21.7	32.6
70	Dec-88	34.8	27.2	0
70	Jan-89	88.2	24.7	5.5
70	Nov-89	12	22.6	2.3
80	Dec-87	6.3	27.2	7.4
80	Jan-88	6.8	26.7	0
80	Mar-88	59.3	24.3	17.2
80	Dec-88	7.8	26.7	0
80	Jan-89	71	27.2	0.6
80	Nov-89	20.3	25.5	3.7
90	Dec-87	no haul	no haul	no haul
90	Jan-88	8.6	28.2	0
90	Mar-88	111.6	23.3	21.8
90	Dec-88	9	27.1	0
90	Jan-89	4	26.6	no haul
90	Nov-89	59.3	24.3	9.2
100	Dec-87	no haul	no haul	no haul
100	Jan-88	0	0	0
100	Mar-88	117.1	25.7	8.5
100	Dec-88	4	29	0
100	Jan-89	2.7	22	no haul
100	Nov-89	63.7	23.7	10

Table 3.1.1 Cod in Sub-divisions 22 and 24 (age group 1). Year-class strength estimates (natural logarithms) by GLM.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
COUNTRY	3	DEN FRG GDR
YEAR	15	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992
QUARTER	4	1 2 3 4
SD	2	22 24
DSTR	2	1=<25m 2=>25m

Number of observations in data set = 2210

General Linear Models Procedure

Dependent Variable: LNA1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	4251.219288	202.439014	114.21	0.0
Error	2188	3878.352792	1.772556		
Corrected Total	2209	8129.572079			

R-Square	C.V.	Root MSE	LNA1 Mean
0.522933	66.05076	1.331374	2.01568283

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	2	764.462974	382.231487	215.64	0.0001
YEAR	14	2834.004319	202.428880	114.20	0.0001
QUARTER	3	315.938444	105.312815	59.41	0.0001
SD	1	52.624693	52.624693	29.69	0.0001
DSTR	1	284.188856	284.188856	160.33	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	2	457.421501	228.710751	129.03	0.0001
YEAR	14	2391.520962	170.822926	96.37	0.0001
QUARTER	3	345.623266	115.207755	65.00	0.0001
SD	1	15.121250	15.121250	8.53	0.0035
DSTR	1	284.188856	284.188856	160.33	0.0001

2

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		3.946130088 B	21.17	0.0001	0.18636033
COUNTRY	DEN	-1.600218252 B	-7.70	0.0001	0.20781135
	FRG	-1.114486757 B	-15.20	0.0001	0.07333009
	GDR	0.000000000 B	.	.	.
YEAR	1978	0.272109074 B	0.99	0.3229	0.27520313
	1979	0.003455486 B	0.01	0.9883	0.23643028
	1980	1.385540813 B	6.35	0.0001	0.21815940
	1981	0.905438388 B	4.69	0.0001	0.19293017
	1982	0.521504396 B	2.62	0.0089	0.19930911
	1983	1.284995500 B	6.51	0.0001	0.19733039
	1984	-0.667728981 B	-3.50	0.0005	0.19070046
	1985	-1.126361420 B	-5.84	0.0001	0.19273348
	1986	-0.211213896 B	-1.10	0.2725	0.19244297
	1987	-0.214365869 B	-1.08	0.2817	0.19906367
	1988	-1.649277475 B	-8.64	0.0001	0.19078101
	1989	-1.774107048 B	-9.25	0.0001	0.19184596
	1990	-1.872710780 B	-9.25	0.0001	0.20239194
	1991	-1.425962964 B	-6.95	0.0001	0.20507644
	1992	0.000000000 B	.	.	.

Continued......

Table 3.1.1 Continued

QUARTER	1	-0.839051262 B	-12.94	0.0001	0.06483062
	2	-1.732734913 B	-7.20	0.0001	0.24070553
	3	-0.317861011 B	-1.03	0.3044	0.30943366
	4	0.000000000 B	.	.	.
SD	22	0.247279963 B	2.92	0.0035	0.08466328
	24	0.000000000 B	.	.	.
DSTR	1	-0.902187461 B	-12.66	0.0001	0.07125138
	2	0.000000000 B	.	.	.

General Linear Models Procedure
Least Squares Means

YEAR	LNA1 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1978	2.26347195	0.24459847	0.0001
1979	1.99481836	0.20325871	0.0001
1980	3.37690369	0.13663746	0.0001
1981	2.89680126	0.15801087	0.0001
1982	2.51286727	0.16500132	0.0001
1983	3.27635837	0.16208896	0.0001
1984	1.32363389	0.15340389	0.0001
1985	0.86500145	0.15298121	0.0001
1986	1.78014898	0.15565698	0.0001
1987	1.77699700	0.16901568	0.0001
1988	0.34208540	0.15930471	0.0319
1989	0.21725582	0.15672848	0.1658
1990	0.11865209	0.17306691	0.4930
1991	0.56539991	0.17306759	0.0011
1992	1.99136287	0.20104370	0.0001

Table 3.1.2 Cod in Sub-divisions 22 and 24 (age group 2). Year-class strength estimates (natural logarithms) by GLM.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
COUNTRY	3	DEN FRG GDR
YEAR	15	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992
QUARTER	4	1 2 3 4
SD	2	22 24
DSTR	2	1 2

Number of observations in data set = 2210

General Linear Models Procedure

Dependent Variable: LNA2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	21	3294.922852	156.901088	86.61	0.0001
Error	2188	3963.632527	1.811532		
Corrected Total	2209	7258.555379			

R-Square	C.V.	Root MSE	LNA2 Mean
0.453936	54.35162	1.345932	2.47634160

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	2	343.230154	171.615077	94.73	0.0001
YEAR	14	2287.151897	163.367993	90.18	0.0001
QUARTER	3	116.170490	38.723497	21.38	0.0001
SD	1	372.948072	372.948072	205.87	0.0001
DSTR	1	175.422240	175.422240	96.84	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	2	82.350814	41.175407	22.73	0.0001
YEAR	14	2341.117415	167.222673	92.31	0.0001
QUARTER	3	75.878902	25.292967	13.96	0.0001
SD	1	64.396057	64.396057	35.55	0.0001
DSTR	1	175.422240	175.422240	96.84	0.0001

Continued.

Table 3.1.2 Continued

Parameter		Estimate	T for H0: Parameter=0	Pr > ¦T¦	Std Error of Estimate
INTERCEPT		2.092905810 B	11.11	0.0001	0.18839810
COUNTRY	DEN	-1.037985850 B	-4.94	0.0001	0.21008367
	FRG	-0.397185358 B	-5.36	0.0001	0.07413192
	GDR	0.000000000 B	.	.	.
YEAR	1978	1.510045826 B	5.43	0.0001	0.27821235
	1979	1.700995659 B	7.12	0.0001	0.23901554
	1980	0.923800164 B	4.19	0.0001	0.22054488
	1981	2.581868921 B	13.24	0.0001	0.19503977
	1982	2.374059831 B	11.78	0.0001	0.20148847
	1983	1.839156114 B	9.22	0.0001	0.19948811
	1984	1.902026451 B	9.87	0.0001	0.19278568
	1985	0.916827585 B	4.71	0.0001	0.19484094
	1986	0.626369760 B	3.22	0.0013	0.19454725
	1987	2.042280265 B	10.15	0.0001	0.20124034
	1988	0.895294094 B	4.64	0.0001	0.19286712
	1989	-0.460523534 B	-2.37	0.0177	0.19394371
	1990	-0.482320722 B	-2.36	0.0185	0.20460500
	1991	-0.697465914 B	-3.36	0.0008	0.20731886
	1992	0.000000000 B	.	.	.
QUARTER	1	0.407303165 B	6.21	0.0001	0.06553951
	2	0.171472374 B	0.70	0.4811	0.24333753
	3	-0.303470817 B	-0.97	0.3321	0.31281718
	4	0.000000000 B	.	.	.
SD	22	-0.510299005 B	-5.96	0.0001	0.08558903
	24	0.000000000 B	.	.	.
DSTR	1	-0.708819392 B	-9.84	0.0001	0.07203048
	2	0.000000000 B	.	.	.

General Linear Models Procedure
Least Squares Means

YEAR	LNA2 LSMEAN	Std Err LSMEAN	Pr > ¦T¦ H0:LSMEAN=0
1978	2.58382822	0.24727304	0.0001
1979	2.77477805	0.20548125	0.0001
1980	1.99758255	0.13813152	0.0001
1981	3.65565131	0.15973865	0.0001
1982	3.44784222	0.16680554	0.0001
1983	2.91293850	0.16386133	0.0001
1984	2.97580884	0.15508129	0.0001
1985	1.99060997	0.15465399	0.0001
1986	1.70015215	0.15735902	0.0001
1987	3.11606265	0.17086378	0.0001
1988	1.96907648	0.16104663	0.0001
1989	0.61325886	0.15844223	0.0001
1990	0.59146167	0.17495931	0.0007
1991	0.37631648	0.17496000	0.0316
1992	1.07378239	0.20324202	0.0001

Table 3.1.3 Regression of VPA estimates of Ages 1 and 2 on GLM estimated indices of Ages 1 and 2 in Sub-divisions 22 and 24

YEAR CLASS	GLMLOGA1	VPA-A1	LOG-VPA1		
1977	2.26347	83147	11.3284		
1978	1.99482	37664	10.5365		
1979	3.37690	100443	11.5173		
1980	2.89680	72993	11.1981		
1981	2.51287	77092	11.2528		
1982	3.27636	93499	11.4457		
1983	1.32363	30095	10.3121		
1984	0.86500	23614	10.0696		
1985	1.78015	67552	11.1207	PREDICTED	
1986	1.77700	39167	10.5756	Year class:	
1987	0.34209	14302	9.5682		
1988	0.21726	20413	9.9239	1988	20352
1989	0.11865	14177	9.5594	1989	19328
1990	0.56540	66225	11.1008	1990	24423
1991	1.99136			1991	51540

YEAR CLASS	GLMLOGA2	VPA-A2	LOG-VPA2		
1976	2.58383	88885	11.3951		
1977	2.77478	65041	11.0828		
1978	1.99758	30259	10.3175		
1979	3.65565	78604	11.2722		
1980	3.44784	58981	10.9850		
1981	2.91294	54882	10.9129		
1982	2.97581	65757	11.0937		
1983	1.99061	21747	9.9872		
1984	1.70015	18257	9.8123		
1985	3.11606	53204	10.8819	PREDICTED	
1986	1.96908	29924	10.3064	Year class:	
1987	0.61326	11131	9.3175		
1988	0.59146	16136	9.6888	1988	15249
1989	0.37632	10949	9.3010	1989	13528
1990	1.07378	53324	10.8841	1990	19947

Age group 1

Regression Output:		
Constant		9.807153389
Std Err of Y Est		0.383376404
R Squared		0.719091379
No. of Observations		14
Degrees of Freedom		12
X Coefficient(s)	0.523750	
Std Err of Coef.	0.094498	

Age group 2

Regression Output:		
Constant		9.302966246
Std Err of Y Est		0.401577485
R Squared		0.704090598
No. of Observations		15
Degrees of Freedom		13
X Coefficient(s)	0.556780	
Std Err of Coef.	0.100110	

Table 3.1.4 Total number of hauls in Sub-divisions 25, 26 and 28 by country and number of hauls with no 2-group cod by country.

Country	Total number of hauls	Number of hauls with zero 2-group cod	Percent hauls with zero 2-group cod
Denmark	448	13	2.9
Germany	631	89	14.1
Latvia	800	225	28.1
Poland	534	204	38.2
Sweden	182	23	12.6

Table 3.1.5 a. Cod in Sub-Div. 25-32. GLM for age group 2.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	11	1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992
COUNTRY	5	DENMARK GERMANY LATVIA POLAND SWEDEN
SUBDIV	3	25 26 28
DSTR	5	1 2 3 4 5
QUARTER	3	1 2 4

Number of observations in data set = 2242

Dependent Variable: LOGAG2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	54	3388.09736	62.74254	20.86	0.0001
Error	2187	6576.67720	3.00717		
Corrected Total	2241	9964.77456			

R-Square	C.V.	Root MSE	LOGAG2 Mean
0.340007	66.65620	1.73412	2.60159

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	10	1527.13679	152.71368	50.78	0.0001
COUNTRY	4	749.91890	187.47973	62.34	0.0001
SUBDIV	2	26.06555	13.03278	4.33	0.0132
DSTR	4	491.97468	122.99367	40.90	0.0001
QUARTER	2	4.21854	2.10927	0.70	0.4960
DSTR*QUARTER	8	180.87723	22.60965	7.52	0.0001
SUBDIV*QUARTER	4	55.62459	13.90615	4.62	0.0010
YEAR*SUBDIV	20	352.28108	17.61405	5.86	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	10	1199.02052	119.90205	39.87	0.0001
COUNTRY	4	420.10632	105.02658	34.93	0.0001
SUBDIV	2	15.63887	7.81944	2.60	0.0745
DSTR	4	130.47504	32.61876	10.85	0.0001
QUARTER	2	5.70055	2.85027	0.95	0.3877
DSTR*QUARTER	8	155.39317	19.42415	6.46	0.0001
SUBDIV*QUARTER	4	40.11933	10.02983	3.34	0.0099
YEAR*SUBDIV	20	352.28108	17.61405	5.86	0.0001

Continued.....

Parameter		Estimate		T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		-2.310217638	B	-1.29	0.1986	1.79635758
YEAR	1982	4.541623793	B	9.57	0.0001	0.47446088
	1983	4.161517804	B	9.41	0.0001	0.44223828
	1984	2.007193776	B	4.30	0.0001	0.46679374
	1985	2.330051381	B	4.97	0.0001	0.46880891
	1986	3.172200329	B	5.89	0.0001	0.53825608
	1987	2.062945777	B	4.05	0.0001	0.50887656
	1988	3.160516896	B	7.13	0.0001	0.44307813
	1989	2.451430605	B	4.64	0.0001	0.52793262
	1990	1.634619221	B	3.36	0.0008	0.48698146
	1991	0.947545312	B	2.14	0.0324	0.44257964
	1992	0.000000000	B	.	.	.
COUNTRY	DENM.	-0.156161797	B	-0.95	0.3442	0.16506695
	GERM.	-0.476848719	B	-2.88	0.0040	0.16542040
	LATVIA	-0.712980924	B	-3.87	0.0001	0.18409871
	POLAND	-1.884481296	B	-9.23	0.0001	0.20427427
	SWEDEN	0.000000000	B	.	.	.
SUBDIV	25	1.230480148	B	2.48	0.0132	0.49635787
	26	1.597075495	B	3.01	0.0026	0.53005097
	28	0.000000000	B	.	.	.
DSTR	1	3.867451437	B	2.16	0.0305	1.78690855
	2	4.476379101	B	2.52	0.0117	1.77388469
	3	3.393962127	B	1.91	0.0567	1.78004069
	4	2.441275871	B	1.37	0.1714	1.78453868
	5	0.000000000	B	.	.	.
QUARTER	1	2.083692402	B	1.17	0.2414	1.77821645
	2	2.203056977	B	1.23	0.2194	1.79322652
	4	0.000000000	B	.	.	.

Table 3.1.5 b. GLM-estimated indices.

General Linear Models Procedure
Least Squares Means

YEAR	LOGAG2 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1982	4.13731846	0.20599915	0.0001
1983	3.33012210	0.19249064	0.0001
1984	2.53490922	0.19273515	0.0001
1985	2.56593165	0.18483630	0.0001
1986	2.59533674	0.23581845	0.0001
1987	2.54249324	0.20024466	0.0001
1988	2.78274319	0.19204644	0.0001
1989	1.87532703	0.21579945	0.0001
1990	1.97703305	0.20579384	0.0001
1991	0.96954090	0.19400879	0.0001
1992	1.12299292	0.21683523	0.0001

Table 3.2.1 Herring in Sub-divisions 25-29 and 32. Geometric mean year-class abundance index (0- and 1-group combined) from Polish young fish surveys in the Gulf of Gdansk and the abundance of corresponding year classes from VPA (millions at age 1, Anon., 1992a).

Year	Index	VPA
1976	2.392	31,970
1977	0.536	37,549
1978	0.138	32,758
1979	0.763	47,756
1980	1.284	57,276
1981	0.657	59,781
1982	0.705	51,065
1983	1.44	74,256
1984	1.043	57,581
1985	0.500	26,568
1986	No data	61,921
1987	0.302	21,889
1988	0.894	42,622
1989	1.030	78,309
1990	0.798	48,954
1991	0.645	No data

Table 3.2.2 Results of regression analysis between herring stock size in numbers (age 1) in Sub-divisions 25-29 and 32 plus Gulf of Riga (Anon., 1992a) and year-class abundance indices from Polish young fish surveys in the Gulf of Gdansk.

Regression Analysis - Multiplicative model: Y = aX^b

Dependent variable: index Independent variable: stock

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept*	-6.07864	2.80795	-2.1648	0.0512696
Slope	0.945052	0.459059	2.05867	0.0619157

* NOTE: The Intercept is equal to Log a.

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.6416867	1	1.6416867	4.2381417	.06192
Error	4.648320	12	.387360		
Total (Corr.)	6.290007	13			

Correlation Coefficient = 0.510881 R-squared = 26.10 percent
Stnd. Error of Est. = 0.622383

Regression of index on stock

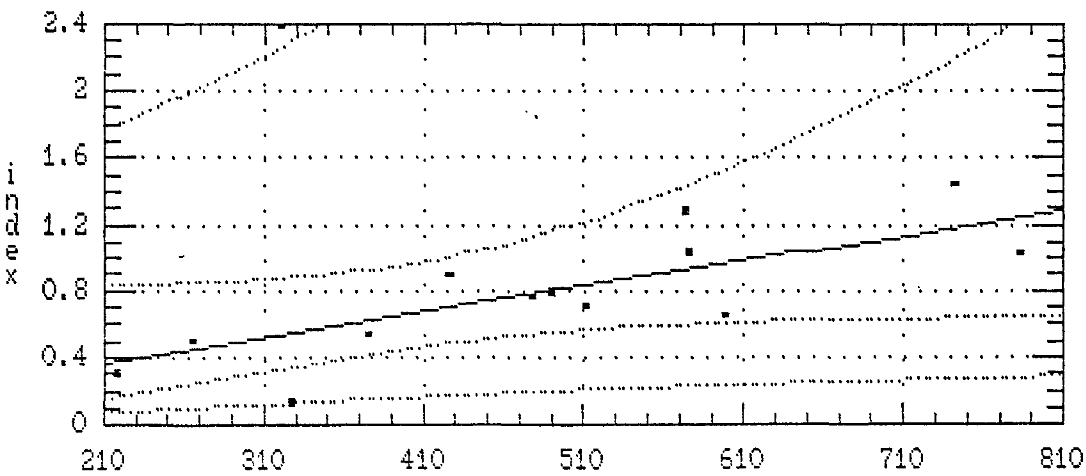


Table 3.2.3 . Year class estimates for 1988-1991 in SD 30.

Analysis by RCT3 ver3.1 of data from file :

c:\paernu92\programs\ringisaa.txt

HERRING ISAACS-KIDD, SD 30

Data for 8 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1988

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	4.21	4.20	1.52	.123	14	.96	8.22	1.763	.017
COADJL	4.19	1.52	2.40	.053	14	1.36	7.22	2.754	.007
COJUJN	5.25	3.85	2.01	.074	14	.41	5.98	2.359	.009
CONAJN	1.80	4.18	1.31	.158	14	1.86	7.52	1.508	.023
PELCAO	2.52	6.12	2.06	.071	14	.53	7.46	2.368	.009
ISAA29	2.14	-3.29	1.64	.091	9	5.89	9.29	2.118	.011
ISAA30	1.88	.18	1.70	.084	9	5.13	9.82	2.283	.010
ISAA32	.79	3.89	.21	.859	9	5.14	7.97	.264	.738
					VPA Mean =		7.43	.541	.176

Yearclass = 1989

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	4.42	4.10	1.50	.139	15	1.25	9.64	1.855	.062
COADJL	5.51	-.14	3.00	.039	15	1.61	8.73	3.463	.018
COJUJN	11.64	-.07	4.46	.018	15	1.63	18.90	6.475	.005
CONAJN	2.17	3.59	1.54	.133	15	2.39	8.78	1.813	.065
PELCAO	2.98	5.98	2.33	.063	15	2.12	12.29	3.128	.022
ISAA29	1.62	-.72	1.17	.186	10	4.88	7.18	1.398	.110
ISAA30	1.29	2.40	1.13	.195	10	6.58	10.87	1.823	.065
ISAA32									
					VPA Mean =		7.51	.574	.652

Yearclass = 1990

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	3.69	4.60	1.24	.187	16	1.22	9.12	1.504	.080
COADJL	4.93	.73	2.54	.052	16	1.87	9.96	3.011	.020
COJUJN	4.93	4.00	2.26	.065	16	1.10	9.41	2.651	.026
CONAJN	1.97	3.93	1.35	.163	16	2.29	8.44	1.568	.074
PELCAO	1.86	6.38	1.58	.124	16	.59	7.47	1.808	.055
ISAA29	1.85	-1.81	1.28	.155	11	5.91	9.11	1.590	.072
ISAA30	.89	3.82	.97	.241	11	6.10	9.25	1.266	.113
ISAA32									
					VPA Mean =		7.56	.568	.561

Continued.

Table 3.2.3 Continued

Yearclass = 1991

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----	Regression	----	----I		I----	Prediction	----	----I
COADJN	3.61	4.59	1.23	.175	17	2.26	12.74	2.150	.040
COADJL	4.58	1.13	2.32	.057	17	3.55	17.38	4.226	.010
COJUJN	4.82	3.96	2.20	.063	17	1.61	11.71	2.868	.023
CONAJN	1.92	3.98	1.28	.165	17	3.11	9.94	1.642	.069
PELCAO	1.78	6.45	1.45	.133	17	.00	6.45	1.696	.064
ISAA29	1.86	-2.04	1.30	.139	12	5.61	8.42	1.530	.079
ISAA30	.91	3.55	1.09	.186	12	6.90	9.85	1.475	.085
ISAA32									
					VPA Mean =		7.58	.542	.630

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1988	2625	7.87	.23	.13	.35	4036	8.30
1989	3266	8.09	.46	.53	1.32	3073	8.03
1990	3440	8.14	.43	.30	.48	2025	7.61
1991	4145	8.33	.43	.64	2.20		

Table 3.2.4 . Year class estimates for 1988-1991 in SD 25-29 and 32.

Analysis by RCT3 ver3.1 of data from file :

c:\paernu92\programs\isaacs29.txt

HERRING ISAACS-KIDD SD 25-29, 32

Data for 8 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1988

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
COADJN	2.24	4.37	.76	.229	14	.96	6.52	.881	.066
COADJL	1.65	3.76	.88	.181	14	1.36	6.01	1.011	.050
COJUJN	2.68	4.26	.98	.151	14	.41	5.35	1.155	.038
CONAJN	.80	4.65	.48	.427	14	1.86	6.13	.551	.168
PELCAO	1.92	5.09	1.58	.064	14	.53	6.11	1.814	.016
ISAA29	6.92	-28.87	5.55	.006	9	5.89	11.93	7.179	.001
ISAA30	3.03	-5.65	2.83	.024	9	5.13	9.87	3.793	.004
ISAA32	.78	2.61	.31	.673	9	5.14	6.61	.394	.328
					VPA Mean =		6.09	.393	.330

Yearclass = 1989

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
COADJN	2.23	4.37	.71	.239	15	1.25	7.17	.881	.093
COADJL	1.56	3.93	.77	.212	15	1.61	6.44	.889	.091
COJUJN	2.59	4.41	.92	.160	15	1.63	8.62	1.331	.041
CONAJN	.80	4.66	.46	.434	15	2.39	6.56	.537	.251
PELCAO	1.76	5.19	1.36	.079	15	2.12	8.91	1.830	.022
ISAA29	11.10	-50.96	8.87	.002	10	4.88	3.22	10.610	.001
ISAA30	3.96	-9.83	3.86	.012	10	6.58	16.18	6.195	.002
ISAA32									
					VPA Mean =		6.09	.380	.500

Yearclass = 1990

	I-----------Regression----------I					I-----------Prediction---------I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
COADJN	1.91	4.61	.58	.349	16	1.22	6.95	.697	.123
COADJL	1.58	3.96	.72	.257	16	1.87	6.91	.852	.082
COJUJN	1.61	4.98	.64	.306	16	1.10	6.75	.748	.107
CONAJN	.82	4.64	.44	.475	16	2.29	6.51	.516	.225
PELCAO	1.01	5.50	.82	.211	16	.59	6.09	.935	.068
ISAA29	484.24	******	364.13	.000	11	5.91	389.96	******	.000
ISAA30	1.00	1.88	1.18	.122	11	6.10	8.00	1.535	.025
ISAA32									
					VPA Mean =		6.15	.403	.369

Continued.

Table 3.2.4 Continued

Yearclass = 1991

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
COADJN	1.84	4.63	.56	.350	17	2.26	8.79	.975	.070
COADJL	1.47	4.08	.65	.286	17	3.55	9.31	1.182	.048
COJUJN	1.54	4.99	.60	.317	17	1.61	7.48	.785	.108
CONAJN	.81	4.64	.42	.483	17	3.11	7.15	.544	.225
PELCAO	.96	5.54	.74	.238	17	.00	5.54	.858	.090
ISAA29	121.89	******	91.25	.000	12	5.61	56.56	******	.000
ISAA30	.97	1.84	1.21	.108	12	6.90	8.53	1.639	.025
ISAA32									
						VPA Mean =	6.15	.391	.435

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1988	535	6.28	.23	.15	.41	427	6.06
1989	681	6.52	.27	.30	1.22	784	6.66
1990	664	6.50	.24	.17	.49	490	6.20
1991	953	6.86	.26	.39	2.28		

Table 3.2.5. Year class estimates for 1988-1991 in SD 30.

Analysis by RCT3 ver3.1 of data from file :

C:\PAERNU92\PROGRAMS\EXPHE1.TXT

HERRING EXPLORATORY TRAWL AT AGE 1, SD 30

Data for 9 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1988

Survey/ Series	Regression: Slope	Regression: Inter-cept	Regression: Std Error	Regression: Rsquare	Regression: No. Pts	Prediction: Index Value	Prediction: Predicted Value	Prediction: Std Error	Prediction: WAP Weights
COADJN	4.21	4.20	1.52	.123	14	.96	8.22	1.763	.032
COADJL	4.19	1.52	2.40	.053	14	1.36	7.22	2.754	.013
COJUJN	5.25	3.85	2.01	.074	14	.41	5.98	2.359	.018
CONAJN	1.80	4.18	1.31	.158	14	1.86	7.52	1.508	.044
PELCAO	2.52	6.12	2.06	.071	14	.53	7.46	2.368	.018
EXP129	.28	6.61	.42	.648	14	6.21	8.36	.520	.365
EXP130	.44	6.00	.77	.356	14	8.03	9.50	1.062	.088
EXP131									
EXP132	.57	4.35	.93	.272	14	6.18	7.87	1.077	.085
					VPA Mean =		7.43	.541	.338

Yearclass = 1989

Survey/ Series	Regression: Slope	Regression: Inter-cept	Regression: Std Error	Regression: Rsquare	Regression: No. Pts	Prediction: Index Value	Prediction: Predicted Value	Prediction: Std Error	Prediction: WAP Weights
COADJN	4.42	4.10	1.50	.139	15	1.25	9.64	1.855	.035
COADJL	5.51	-.14	3.00	.039	15	1.61	8.73	3.463	.010
COJUJN	11.64	-.07	4.46	.018	15	1.63	18.90	6.475	.003
CONAJN	2.17	3.59	1.54	.133	15	2.39	8.78	1.813	.037
PELCAO	2.98	5.98	2.33	.063	15	2.12	12.29	3.128	.012
EXP129	.28	6.63	.40	.697	15	7.52	8.71	.512	.460
EXP130									
EXP131									
EXP132	.66	3.86	1.02	.257	15	7.49	8.82	1.238	.078
					VPA Mean =		7.51	.574	.365

Continued....

Table 3.2.5 Continued

Yearclass = 1990

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression			----------I		I-----------Prediction		---------I	
COADJN	3.69	4.60	1.24	.187	16	1.22	9.12	1.504	.039
COADJL	4.93	.73	2.54	.052	16	1.87	9.96	3.011	.010
COJUJN	4.93	4.00	2.26	.065	16	1.10	9.41	2.651	.012
CONAJN	1.97	3.93	1.35	.163	16	2.29	8.44	1.568	.035
PELCAO	1.86	6.38	1.58	.124	16	.59	7.47	1.808	.027
EXP129	.25	6.66	.39	.696	16	7.36	8.52	.486	.369
EXP130	.35	6.22	.61	.497	15	5.50	8.12	.724	.166
EXP131									
EXP132	.63	3.94	.94	.285	16	6.80	8.24	1.097	.072
					VPA Mean =		7.56	.568	.270

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1988	2954	7.99	.31	.24	.57	4036	8.30
1989	4400	8.39	.35	.36	1.08	3073	8.03
1990	3617	8.19	.30	.18	.35	2025	7.61
1991	3520	8.17	.47	.79	2.84		

Table 3.2.6. Year class estimates for 1988-1991 in SD 25-29 and 32.

Analysis by RCT3 ver3.1 of data from file :

C:\PAERNU92\PROGRAMS\EXPHE1B.TXT

HERRING EXPLORATORY TRAWL AT AGE 1, SD 25-29, 32

Data for 9 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1988

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	2.24	4.37	.76	.229	14	.96	6.52	.881	.054
COADJL	1.65	3.76	.88	.181	14	1.36	6.01	1.011	.041
COJUJN	2.68	4.26	.98	.151	14	.41	5.35	1.155	.031
CONAJN	.80	4.65	.48	.427	14	1.86	6.13	.551	.138
PELCAO	1.92	5.09	1.58	.064	14	.53	6.11	1.814	.013
EXP129	.20	5.51	.29	.669	14	6.21	6.74	.361	.323
EXP130	.38	4.84	.72	.246	14	8.03	7.90	1.006	.041
EXP131									
EXP132	.38	4.02	.60	.320	14	6.18	6.39	.699	.086
						VPA Mean =	6.09	.393	.272

Yearclass = 1989

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	2.23	4.37	.71	.239	15	1.25	7.17	.881	.062
COADJL	1.56	3.93	.77	.212	15	1.61	6.44	.889	.061
COJUJN	2.59	4.41	.92	.160	15	1.63	8.62	1.331	.027
CONAJN	.80	4.66	.46	.434	15	2.39	6.56	.537	.167
PELCAO	1.76	5.19	1.36	.079	15	2.12	8.91	1.830	.014
EXP129	.20	5.45	.34	.573	15	7.52	6.96	.442	.247
EXP130									
EXP131									
EXP132	.41	3.86	.61	.300	15	7.49	6.90	.737	.089
						VPA Mean =	6.09	.380	.333

Continued.

Table 3.2.6 Continued

Yearclass = 1990

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------	Regression	----------		I	I-----------	Prediction	---------	I
COADJN	1.91	4.61	.58	.349	16	1.22	6.95	.697	.078
COADJL	1.58	3.96	.72	.257	16	1.87	6.91	.852	.052
COJUJN	1.61	4.98	.64	.306	16	1.10	6.75	.748	.067
CONAJN	.82	4.64	.44	.475	16	2.29	6.51	.516	.142
PELCAO	1.01	5.50	.82	.211	16	.59	6.09	.935	.043
EXP129	.18	5.49	.31	.654	16	7.36	6.84	.379	.263
EXP130	.39	4.65	.87	.179	15	5.50	6.77	1.034	.035
EXP131									
EXP132	.40	3.85	.57	.358	16	6.80	6.58	.658	.087
					VPA Mean =		6.15	.403	.232

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1988	605	6.41	.20	.16	.63	427	6.06
1989	775	6.65	.22	.22	.98	784	6.66
1990	720	6.58	.19	.11	.30	490	6.20
1991	913	6.82	.26	.45	2.94		

Table 3.2.7. Year class estimates for 1988-1991 in SD 30.

Analysis by RCT3 ver3.1 of data from file :

C:\PAERNU92\PROGRAMS\EXPHE2.TXT

HERRING EXPLORATORY TRAWL AT AGE 2, SD 30

Data for 9 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1987

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	4.05	4.04	1.54	.112	13	.59	6.42	1.806	.059
COADJL	5.00	-.03	3.00	.032	13	1.10	5.46	3.530	.016
COJUJN	5.24	3.57	2.10	.064	13	.53	6.35	2.444	.032
CONAJN	2.04	3.45	1.54	.113	13	1.19	5.89	1.837	.057
PELCAO	2.84	5.65	2.43	.049	13	.10	5.92	2.848	.024
EXP229	1.25	-.83	1.41	.132	13	4.76	5.12	1.787	.061
EXP230	3.21	-10.01	2.27	.055	13	5.76	8.47	2.658	.027
EXP231									
EXP232	2.73	-10.96	3.10	.030	13	4.44	1.17	4.207	.011
					VPA Mean =		7.26	.521	.712

Yearclass = 1988

Survey/ Series	Regression: Slope	Inter- cept	Std Error	Rsquare	No. Pts	Prediction: Index Value	Predicted Value	Std Error	WAP Weights
COADJN	4.14	4.03	1.49	.125	14	.96	7.99	1.734	.057
COADJL	4.20	1.28	2.40	.052	14	1.36	7.00	2.763	.023
COJUJN	5.24	3.63	2.01	.073	14	.41	5.76	2.358	.031
CONAJN	1.80	3.96	1.31	.156	14	1.86	7.30	1.507	.076
PELCAO	2.43	5.95	1.98	.075	14	.53	7.23	2.278	.033
EXP229	.93	1.29	1.05	.223	14	7.13	7.94	1.231	.114
EXP230									
EXP231									
EXP232	1.17	-.43	1.42	.136	14	6.92	7.69	1.638	.064
					VPA Mean =		7.21	.535	.602

Continued.....

Table 3.2.7 Continued

Yearclass = 1989

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
COADJN	4.36	3.92	1.48	.140	15	1.25	9.38	1.825	.060
COADJL	5.53	-.39	3.02	.038	15	1.61	8.51	3.477	.017
COJUJN	11.72	-.35	4.49	.017	15	1.63	18.75	6.520	.005
CONAJN	2.17	3.38	1.54	.131	15	2.39	8.56	1.810	.061
PELCAO	2.88	5.81	2.25	.066	15	2.12	11.90	3.015	.022
EXP229	.93	1.31	1.00	.262	15	8.15	8.89	1.245	.129
EXP230	3.88	-13.89	2.69	.042	14	6.83	12.57	3.695	.015
EXP231									
EXP232	1.16	-.37	1.34	.165	15	8.33	9.33	1.670	.072
					VPA Mean =		7.29	.568	.620

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1987	974	6.88	.44	.33	.55	713	6.57
1988	1518	7.33	.42	.15	.14	3205	8.07
1989	3279	8.10	.45	.48	1.16	2355	7.76
1990	2139	7.67	.47	.29	.40	1614	7.39
1991	2754	7.92	.47	.78	2.84		

Table 3.2.8. Year class estimates for 1988-1991 in SD 25-29 and 32.

Analysis by RCT3 ver3.1 of data from file :

C:\PAERNU92\PROGRAMS\EXPHE2B.TXT

HERRING EXPLORATORY TRAWL AT AGE 2, SD 25-29,32

Data for 9 surveys over 18 years : 1974 - 1991

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1987

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression			----------I	I-----------Prediction			---------I	
COADJN	3.06	2.90	1.17	.099	13	.59	4.69	1.374	.039
COADJL	4.34	-1.01	2.63	.021	13	1.10	3.76	3.087	.008
COJUJN	4.15	2.40	1.67	.051	13	.53	4.61	1.949	.020
CONAJN	1.23	3.03	.90	.157	13	1.19	4.50	1.079	.064
PELCAO	3.33	3.44	2.90	.018	13	.10	3.75	3.396	.006
EXP229	.56	1.71	.55	.330	13	4.76	4.37	.703	.151
EXP230	4.18	-17.19	3.02	.016	13	5.76	6.90	3.536	.006
EXP231									
EXP232	.55	1.64	.51	.372	13	4.44	4.09	.685	.159
					VPA Mean =		5.33	.369	.547

Yearclass = 1988

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression			----------I	I-----------Prediction			---------I	
COADJN	2.90	3.07	1.05	.127	14	.96	5.84	1.214	.039
COADJL	3.06	.97	1.76	.049	14	1.36	5.14	2.019	.014
COJUJN	3.75	2.74	1.44	.071	14	.41	4.26	1.689	.020
CONAJN	1.10	3.31	.78	.207	14	1.86	5.35	.896	.072
PELCAO	2.36	4.07	1.97	.039	14	.53	5.32	2.257	.011
EXP229	.48	2.23	.47	.414	14	7.13	5.68	.553	.189
EXP230									
EXP231									
EXP232	.44	2.42	.42	.479	14	6.92	5.48	.479	.251
					VPA Mean =		5.30	.378	.403

Continued......

Table 3.2.8 Continued

Yearclass = 1989

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I-----------Regression----------I					I-----------Prediction---------I			
COADJN	2.74	3.22	.92	.154	15	1.25	6.65	1.138	.044
COADJL	2.98	1.19	1.61	.056	15	1.61	5.99	1.859	.016
COJUJN	4.67	2.29	1.76	.047	15	1.63	9.89	2.557	.009
CONAJN	1.13	3.29	.77	.208	15	2.39	5.99	.901	.070
PELCAO	2.29	4.15	1.81	.045	15	2.12	9.01	2.432	.010
EXP229	.47	2.33	.44	.449	15	8.15	6.13	.541	.194
EXP230	7.05	-33.10	4.99	.006	14	6.83	15.06	6.849	.001
EXP231									
EXP232	.43	2.47	.38	.513	15	8.33	6.09	.476	.250
					VPA Mean =		5.33	.374	.406

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1987	131	4.88	.27	.19	.51	131	4.88
1988	224	5.42	.24	.09	.14	271	5.60
1989	357	5.88	.24	.25	1.12	536	6.28
1990	311	5.74	.32	.19	.37	325	5.78
1991	472	6.16	.32	.55	2.94		

Table 3.2.9. GLM procedure for Isaacs-Kidd midwater trawl data.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	13	1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
SD	3	29 30 32

Number of observations in data set = 709

General Linear Models Procedure

Dependent Variable: LOGA0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	57.17950390	3.81196693	6.46	0.0001
Error	693	409.09939374	0.59033102		
Corrected Total	708	466.27889764			

R-Square	C.V.	Root MSE	LOG Mean
0.122629	45.80490	0.768330	1.67739697

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	12	55.10646245	4.59220520	7.78	0.0001
SD	2	2.04980499	1.02490250	1.74	0.1770
SQ	1	0.02323645	0.02323645	0.04	0.8428

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	12	48.21312796	4.01776066	6.81	0.0001
SD	2	1.87291939	0.93645970	1.59	0.2054
SQ	1	0.02323645	0.02323645	0.04	0.8428

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		1.514393108 B	3.91	0.0001	0.38780737
YEAR	1979	0.133453111 B	0.85	0.3983	0.15788388
	1980	-0.369336283 B	-2.25	0.0245	0.16385709
	1981	-0.461791055 B	-3.12	0.0019	0.14786924
	1982	0.058040669 B	0.40	0.6912	0.14605428
	1983	0.166228840 B	1.14	0.2564	0.14633466
	1984	0.146716875 B	0.99	0.3231	0.14837938
	1985	-0.364157671 B	-2.37	0.0182	0.15379564
	1986	0.183707152 B	1.24	0.2140	0.14769451
	1987	-0.120702115 B	-0.81	0.4169	0.14858450
	1988	0.317658728 B	2.15	0.0319	0.14770508
	1989	0.015241798 B	0.11	0.9107	0.13587179
	1990	0.497389401 B	3.62	0.0003	0.13748128
	1991	0.000000000 B	.	.	.
SD	29	0.131138106 B	1.64	0.1025	0.08019562
	30	0.018115036 B	0.15	0.8826	0.12258624
	32	0.000000000 B	.	.	.
SQ		0.001322848	0.20	0.8428	0.00666765

NOTE: Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Continued......

Table 3.2.9 Continued

General Linear Models Procedure
Least Squares Means

YEAR	LOG LSMEAN	Std Err LSMEAN	Pr > ¦T¦ H0:LSMEAN=0
1979	1.76594132	0.11627419	0.0001
1980	1.26315193	0.12669923	0.0001
1981	1.17069716	0.10387200	0.0001
1982	1.69052888	0.10115093	0.0001
1983	1.79871705	0.10198704	0.0001
1984	1.77920509	0.10489686	0.0001
1985	1.26833054	0.11122801	0.0001
1986	1.81619536	0.10426335	0.0001
1987	1.51178610	0.10611357	0.0001
1988	1.95014694	0.10512983	0.0001
1989	1.64773001	0.10288842	0.0001
1990	2.12987761	0.10524938	0.0001
1991	1.63248821	0.10451473	0.0001

Table 3.2.10. GLM procedure for herring at age 1 exploratory trawl data.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	17	1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
SD	4	29 30 31 32

Number of observations in data set = 415
General Linear Models Procedure

Dependent Variable: LOGA1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	19	292.3415513	15.3863974	15.91	0.0001
Error	395	381.9974010	0.9670820		
Corrected Total	414	674.3389522			

R-Square	C.V.	Root MSE	LOGA1 Mean
0.433523	88.85067	0.983403	1.10680463

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	16	205.6212517	12.8513282	13.29	0.0001
SD	3	86.7202996	28.9067665	29.89	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	16	176.4924018	11.0307751	11.41	0.0001
SD	3	86.7202996	28.9067665	29.89	0.0001

Parameter		Estimate		T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		2.675924190	B	12.81	0.0001	0.20891712
YEAR	1975	-0.898068966	B	-3.02	0.0027	0.29758659
	1976	-0.024494330	B	-0.09	0.9262	0.26419768
	1977	-1.643584325	B	-6.27	0.0001	0.26221837
	1978	-1.840768660	B	-7.09	0.0001	0.25966188
	1979	-1.652152982	B	-5.35	0.0001	0.30853552
	1980	-0.659994746	B	-2.14	0.0330	0.30853552
	1981	-0.561424638	B	-1.78	0.0751	0.31461053
	1982	-0.614019013	B	-1.95	0.0517	0.31461053
	1983	-0.676817870	B	-2.15	0.0319	0.31434162
	1984	-0.080514693	B	-0.26	0.7975	0.31366007
	1985	-0.805298506	B	-3.06	0.0024	0.26310563
	1986	-1.532259907	B	-5.78	0.0001	0.26527614
	1987	-1.027969049	B	-3.84	0.0001	0.26735973
	1988	-1.271916144	B	-4.94	0.0001	0.25751328
	1989	0.001757163	B	0.01	0.9945	0.25654248
	1990	0.148031661	B	0.48	0.6288	0.30602287
	1991	0.000000000	B	.	.	.
SD	29	-0.875399415	B	-6.67	0.0001	0.13130495
	30	-1.040597704	B	-7.93	0.0001	0.13121455
	31	-1.215358589	B	-7.84	0.0001	0.15508471
	32	0.000000000	B	.	.	.

Continued.

Table 3.2.10 Continued

General Linear Models Procedure
Least Squares Means

YEAR	LOGA1 LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0
1975	0.99501630	0.22852977	0.0001
1976	1.86859093	0.17664496	0.0001
1977	0.24950094	0.17384278	0.1520
1978	0.05231660	0.17132215	0.7602
1979	0.24093228	0.23855892	0.3131
1980	1.23309052	0.23855892	0.0001
1981	1.33166062	0.24585082	0.0001
1982	1.27906625	0.24585082	0.0001
1983	1.21626739	0.24598541	0.0001
1984	1.81257057	0.24603577	0.0001
1985	1.08778676	0.17680157	0.0001
1986	0.36082536	0.17966952	0.0453
1987	0.86511621	0.18272291	0.0001
1988	0.62116912	0.16931779	0.0003
1989	1.89484243	0.17196560	0.0001
1990	2.04111692	0.23745264	0.0001
1991	1.89308526	0.19630883	0.0001

Table 3.2.11 . GLM procedure for herring at age 2 exploratory trawl data.

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	17	1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991
SD	4	29 30 31 32

Number of observations in data set = 415

General Linear Models Procedure

Dependent Variable: LOGA2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	19	121.1937135	6.3786165	5.26	0.0001
Error	395	479.2846775	1.2133789		
Corrected Total	414	600.4783910			

R-Square	C.V.	Root MSE	LOGA2 Mean
0.201829	58.18127	1.101535	1.89328092

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	16	71.88063013	4.49253938	3.70	0.0001
SD	3	49.31308338	16.43769446	13.55	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	16	64.97921761	4.06120110	3.35	0.0001
SD	3	49.31308338	16.43769446	13.55	0.0001

Parameter		Estimate		T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		2.615002322	B	11.17	0.0001	0.23401333
YEAR	1975	-0.744923733	B	-2.23	0.0260	0.33333424
	1976	-0.484782432	B	-1.64	0.1022	0.29593448
	1977	-0.788403366	B	-2.68	0.0076	0.29371740
	1978	-0.811250105	B	-2.79	0.0055	0.29085381
	1979	-1.014129564	B	-2.93	0.0035	0.34559841
	1980	-0.602968388	B	-1.74	0.0818	0.34559841
	1981	-0.202599304	B	-0.57	0.5657	0.35240318
	1982	0.089234446	B	0.25	0.8002	0.35240318
	1983	-0.118597072	B	-0.34	0.7364	0.35210197
	1984	0.283391821	B	0.81	0.4204	0.35133855
	1985	0.130500387	B	0.44	0.6581	0.29471124
	1986	-0.324726476	B	-1.09	0.2751	0.29714249
	1987	-0.858352236	B	-2.87	0.0044	0.29947638
	1988	-0.082245539	B	-0.29	0.7757	0.28844711
	1989	-0.821073946	B	-2.86	0.0045	0.28735970
	1990	0.026330627	B	0.08	0.9388	0.34278393
	1991	0.000000000	B	.	.	.
SD	29	-0.134952883	B	-0.92	0.3594	0.14707798
	30	-0.354858589	B	-2.41	0.0162	0.14697673
	31	-1.056080599	B	-6.08	0.0001	0.17371429
	32	0.000000000	B	.	.	.

Continued..

Table 3.2.11 Continued

General Linear Models Procedure
Least Squares Means

YEAR	LOGA2 LSMEAN	Std Err LSMEAN	Pr > ¦T¦ H0:LSMEAN=0
1975	1.48360557	0.25598195	0.0001
1976	1.74374687	0.19786447	0.0001
1977	1.44012594	0.19472568	0.0001
1978	1.41727920	0.19190226	0.0001
1979	1.21439974	0.26721586	0.0001
1980	1.62556092	0.26721586	0.0001
1981	2.02593000	0.27538370	0.0001
1982	2.31776375	0.27538370	0.0001
1983	2.10993223	0.27553446	0.0001
1984	2.51192112	0.27559087	0.0001
1985	2.35902969	0.19803990	0.0001
1986	1.90380283	0.20125236	0.0001
1987	1.37017707	0.20467254	0.0001
1988	2.14628376	0.18965713	0.0001
1989	1.40745536	0.19262300	0.0001
1990	2.25485993	0.26597669	0.0001
1991	2.22852930	0.21989047	0.0001

Table 3.2.12. Regressions between Isaacs-Kidd midwater trawl recruitment indices and VPA estimates in SD 30 and 25-29, 32.

YEAR	X	Y30		Y25	
CLASS	RIND	LOGVPA30	VPA30	LOGVPA25	VPA25
1979	1.769413	6.136642	1369752	5.679034	477567
1980	1.263152	6.124884	1333165	5.757980	572769
1981	1.170697	6.265743	1843926	5.776565	597812
1982	1.690529	6.390659	2458434	5.708129	510657
1983	1.798717	6.582084	3820178	5.870735	742566
1984	1.779205	6.501923	3176309	5.760286	575819
1985	1.268331	6.103846	1270125	5.424372	265688
1986	1.816195	6.304944	2018104	5.791844	619218
1987	1.511786	5.943942	878905	5.340234	218894
1988	1.950147	6.605979	4036261	5.629643	426229
1989	1.647730	6.487437	3072111	5.893814	783095
1990	2.129878	6.306322	2024521	5.689791	489543

Regression Output:VPA SD 30 VS. RIND ISAACS-KIDD DATA

Constant		5.693036	
Std Err of Y Est		.1858761	corr.coeff.
R-Squared(Adj,Raw)		.2789706	.5281766
No. of Observations		12	
Degrees of Freedom		10	
Coefficient(s)	.3757355		
Std Err of Coef.	.1910203		

Regression Output:VPA SD 25-29, 32 VS. RIND ISAACS-KIDD DATA

Constant		5.492164	
Std Err of Y Est		.1686297	corr.coeff.
R Squared(Adj,Raw)		.0472717	.2174206
No. of Observations		12	
Degrees of Freedom		10	
Coefficient(s)	.1220692		
Std Err of Coef.	.1732966		

Table 3.2.13. Regressions between recruitment indices at age1 and VPA estimates in SD 30 and 25-29, 32.

YEAR CLASS	X RIND	Y30 LOGVPA		Y25 LOGVPA	
1974	.9950163	6.282880	1918138	5.438338	274371
1975	1.868591	6.604683	4024235	5.730419	537550
1976	.2495009	6.145214	1397056	5.504743	319700
1977	.0523166	5.938416	867792	5.574605	375496
1978	.2409323	5.856930	719333	5.515317	327580
1979	1.233091	6.136642	1369752	5.679034	477567
1980	1.331661	6.124884	1333165	5.757980	572769
1981	1.279066	6.265743	1843926	5.776565	597812
1982	1.216267	6.390659	2458434	5.708129	510657
1983	1.812571	6.582084	3820178	5.870735	742566
1984	1.087787	6.501923	3176309	5.760286	575819
1985	.3608254	6.103846	1270125	5.424372	265688
1986	.8651162	6.304944	2018104	5.791844	619218
1987	.6211691	5.943942	878905	5.340234	218894
1988	1.894842	6.605979	4036261	5.629643	426229
1989	2.041117	6.487437	3072111	5.893814	783095
1990	1.893085	6.306322	2024521	5.689791	489543

Regression Output:VPA SD 30 VS. RIND AT AGE 1

Constant		5.935117	
Std Err of Y Est		.1431360	corr.coeff.
R Squared(Adj,Raw)		.6621196	.8137073
No. of Observations		17	
Degrees of Freedom		15	
Coefficient(s)	.2985637		
Std Err of Coef.	.0550687		

Regression Output:VPA SD 25-29, 32 VS. RIND AT AGE 1

Constant		5.462693	
Std Err of Y Est		.1222439	corr.coeff.
R Squared(Adj,Raw)		.4628854	.6803568
No. of Observations		17	
Degrees of Freedom		15	
Coefficient(s)	.1690954		
Std Err of Coef.	.0470309		

Table 3.2.14. Regressions between recruitment indices at age 2 and VPA estimates in SD 30 and SD 25-29, 32.

YEAR CLASS	X RIND	Y30 LOGVPA		Y25 LOGVPA	
1974	1.483606	6.186937	1537930	5.129767	134824
1975	1.743747	6.507100	3214402	5.437519	273854
1976	1.440126	6.051791	1126654	5.219558	165790
1977	1.417279	5.836395	686112	5.216219	164520
1978	1.214400	5.768068	586230	5.048884	111914
1979	1.625561	6.026080	1061892	5.153055	142251
1980	2.02593	6.036585	1087890	5.359722	228940
1981	2.317764	6.172340	1487101	5.361992	230140
1982	2.109932	6.284484	1925238	5.320080	208968
1983	2.511921	6.483277	3042823	5.515887	328010
1984	2.359030	6.402520	2526505	5.403242	253071
1985	1.903803	6.009378	1021829	5.160927	144853
1986	1.370177	6.207757	1613456	5.570174	371684
1987	2.146284	5.853250	713264	5.115228	130385
1988	1.407455	6.505746	3204393	5.432066	270437
1989	2.254860	6.371754	2353714	5.728247	534869
1990	2.228529	6.207957	1614197	5.510725	324134

Regression Output:VPA SD 30 VS. RIND AT AGE 2

Constant	5.773510	
Std Err of Y Est	.2249100	corr.coeff.
R Squared(Adj,Raw)	.1445392	.3801831
No. of Observations	17	
Degrees of Freedom	15	

Coefficient(s)	.2142477
Std Err of Coef.	.1345792

Regression Output:VPA SD 25-29, 32 VS. RIND AT AGE 2

Constant	4.969518	
Std Err of Y Est	.1741607	corr.coeff.
R Squared(Adj,Raw)	.1916028	.4377245
No. of Observations	17	
Degrees of Freedom	15	

Coefficient(s)	.1964958
Std Err of Coef.	.1042123

Table 3.3.1 Sprat in Sub-divisions 22-32. Geometric mean year-class abundance index (0- and 1-group combined) from Polish young fish surveys in the Gulf of Gdansk and the abundance of corresponding year-classes from VPA (millions at age 1, Anon., 1992a).

Year	Index	VPA
1976	0.559	80,231
1977	0.016	40,578
1978	0.052	89,823
1979	1.047	57,010
1980	1.026	124,273
1981	0.034	66,299
1982	1.421	222,354
1983	1.160	90,362
1984	0.567	50,300
1985	0.397	17,694
1986	No data	38,011
1987	0.024	9,864
1988	0.808	68,426
1989	0.730	52,763
1990	0.675	49,521
1991	0.715	No data

Table 3.3.2 Results of regression analysis between sprat stock size in numbers (age 1) in Sub-divisions 22-32 and 32 plus Gulf of Riga (Anon., 1992a) and year-class abundance indices from Polish young fish surveys in the Gulf of Gdansk.

Regression Analysis - Linear model: Y = a+bX

Dependent variable: INDEX — Independent variable: STOCK

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	0.206303	0.200422	1.02934	0.323621
Slope	5.9518E-4	2.26429E-4	2.62855	0.0220345

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	Prob. Level
Model	1.2556255	1	1.2556255	6.9092851	.02203
Error	2.180762	12	.181730		
Total (Corr.)	3.436387	13			

Correlation Coefficient = 0.604476 R-squared = 36.54 percent
Stnd. Error of Est. = 0.426298

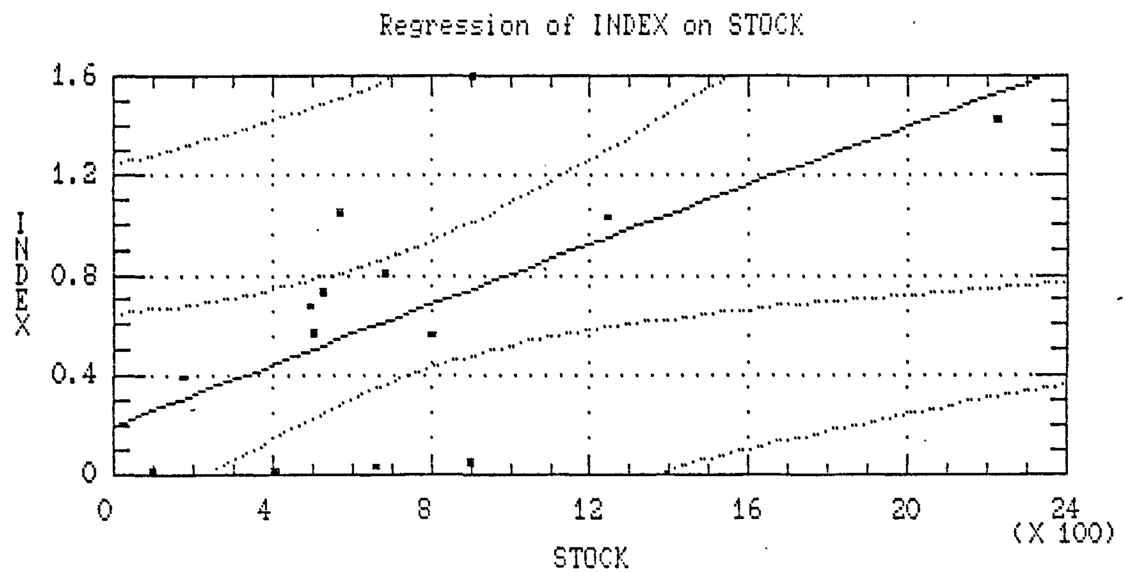


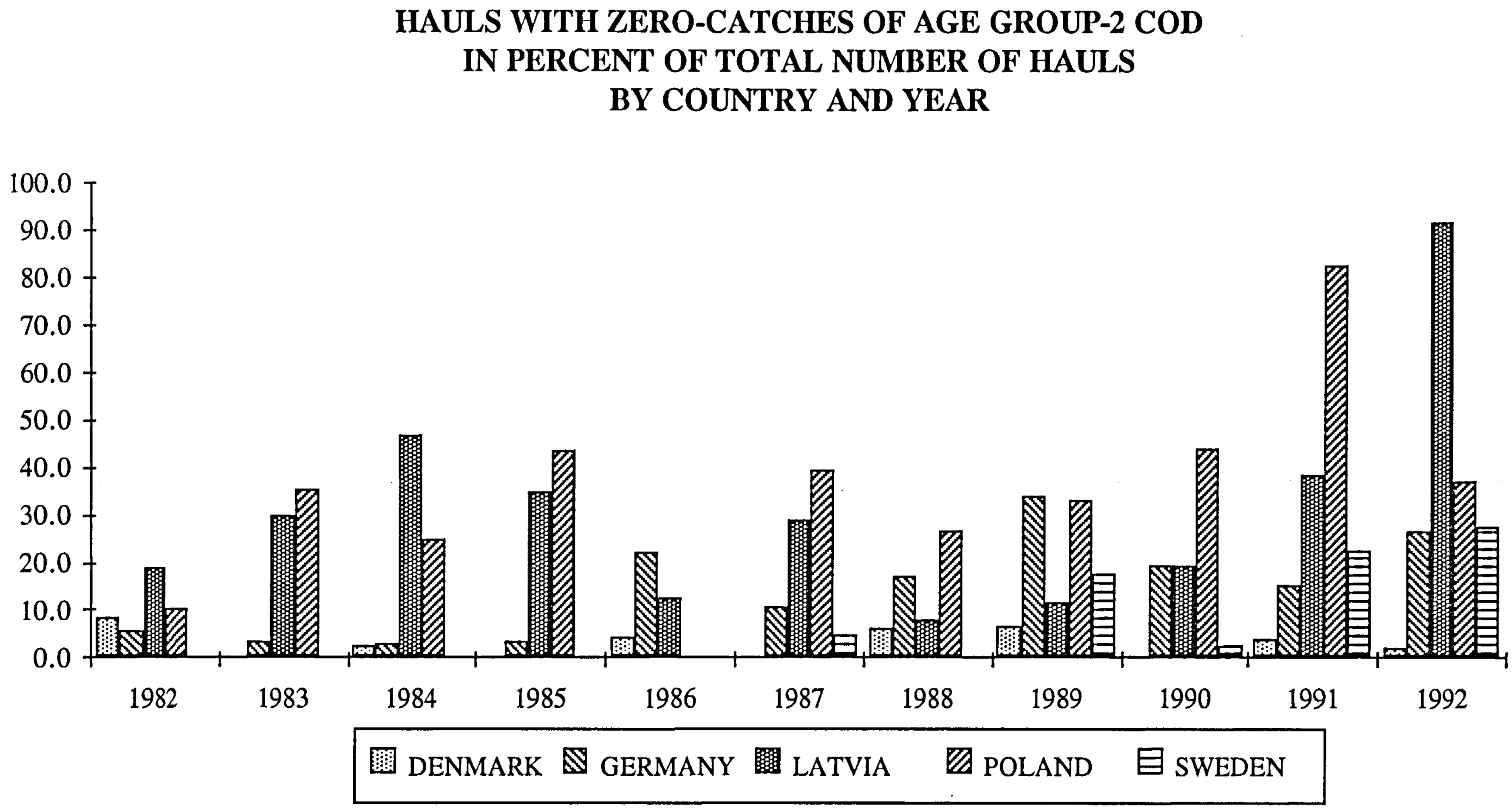
Table 3.4.1 Flounder in Sub-division 28. Mean number per haul in Latvian survey. ICES rectangle 4467.

Year	Age 1			Age 2		
	Mean	CV%	n	Mean	CV%	n
1986	28.8	54.1	15	11.5	82.5	15
1987	72.0	78.5	16	27.4	74.4	16
1988	36.9	40.6	13	49.8	86.9	13
1989	49.1	60.7	17	37.6	132.1	11
1990	75.8	81.9	11	4.8	118.8	11
1991	79.2	55.1	18	3.5	77.7	15
1992	37.2	37.9	13			
Mean	54.1	58.4		22.4	95.4	

Table 3.4.2 CPUEs of young flounder (≤ 3 years old) from years 1979-1992 in Sub-divisions 29 and 32.

Sub-division	Season	Year	MCPUE	CVCPUE	N	Total
29	spring	1979	12	126	6	
29	spring	1980	12	127	16	
29	spring	1981	65	80	16	
29	spring	1983	41	143	19	
29	spring	1984	46	94	15	
29	spring	1985	13	124	24	
29	spring	1986	66	119	25	
29	spring	1987	26	108	24	
29	spring	1988	51	80	28	
29	spring	1989	47	84	29	
29	spring	1990	24	100	25	
29	spring	1991	21	98	25	
29	spring	1992	22	105	29	281
29	autumn	1979	8	95	15	
29	autumn	1980	11	118	16	
29	autumn	1981	32	122	16	
29	autumn	1982	48	105	19	
29	autumn	1983	7	141	20	
29	autumn	1984	14	151	22	
29	autumn	1985	15	121	26	
29	autumn	1986	21	102	24	
29	autumn	1987	14	82	25	
29	autumn	1988	24	106	23	
29	autumn	1989	12	92	29	
29	autumn	1990	4	161	30	
29	autumn	1991	6	122	26	291
32	spring	1979	11	59	4	
32	spring	1980	8	49	3	
32	spring	1981	11	64	3	
32	spring	1983	10	60	3	13
32	autumn	1979	2	108	4	
32	autumn	1980	2	132	3	
32	autumn	1981	29	97	3	
32	autumn	1982	28	136	4	
32	autumn	1983	11	24	4	18

 Figure 3.1


HAULS WITH ZERO-CATCHES OF AGE GROUP-2 COD
IN PERCENT OF TOTAL NUMBER OF HAULS
BY COUNTRY AND YEAR
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
DENMARK
GERMANY
LATVIA
POLAND
SWEDEN

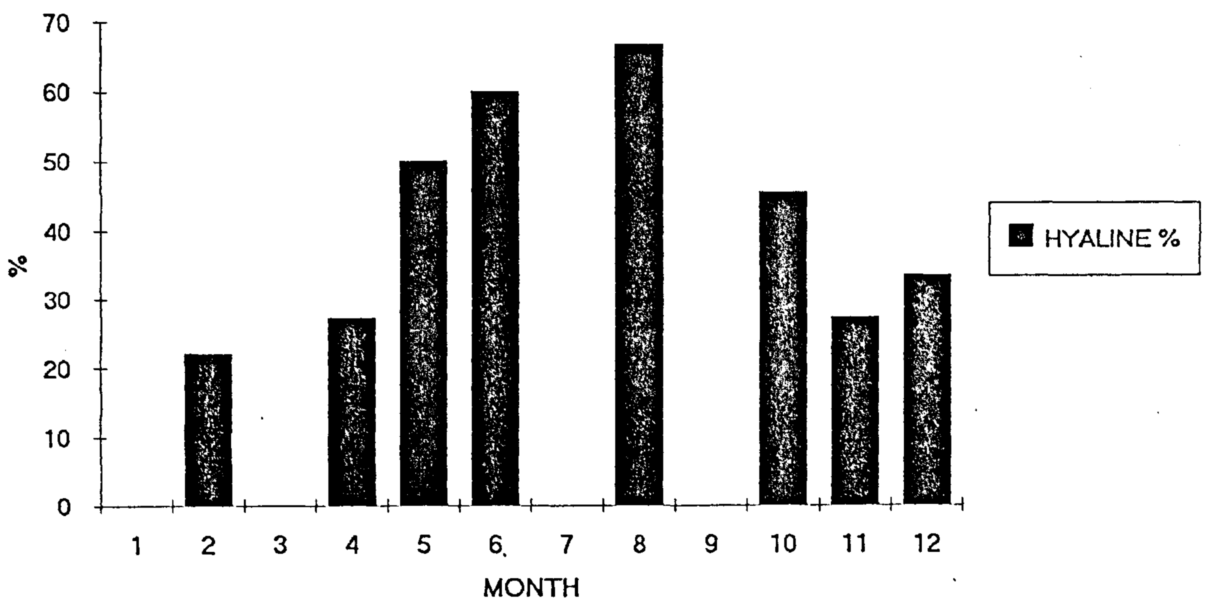


Figure 4.1: Cod in sd 25 - Otolith structures deposited in the course of the year.