International Concil for The Exploration of the Sea

CM 2003/Y: 09
Theme Session on Reference Point Approaches to the Management within the Precautionary Approach (Y)

RANGING YEAR-CLASS STRENGTH AND SURVIVAL RATES DURING EARLY LIFE HISTORY OF THE BARENTS SEA FOOD FISHES TO ESTABLISH BIOLOGICAL REFERENCE POINTS AND EVALUATE ENVIRONMENTAL EFFECTS

by M.V. Bondarenko, A.S. Krovnin & V.P. Serebryakov

All-Russian Federal Research Institute of Fisheries and Oceanography, V.Krasnoselskaya, 17, Moscow 107140, Russia [tel: 007 (095) 264 90 43,264 84 01, fax: 007 (095) 264 91 87, e-mail: ontogeny@vniro.ru; akrovnin@vniro. ru ; vserebryakov@yahoo.com.au

Abstract

Survival index (SI) of a year class in early life history is defined as the ratio of abundance of fish at age 3 to population fecundity (PF), or to the spawning stock biomass (SSB). SI is considered here to be an integrated indicator of survival conditions during early life, i.e. periods of egg, larval and fry development.

Ranking of SI by means of cluster analysis revealed three types of survival conditions – favourable, moderate and unfavourable. The corresponding values of SI ($*10^{-6}$) to these three types of conditions were estimated in spring spawning Norwegian herring as 152.49, 28.27, 4.97; in Northeast Arctic cod – 16.94, 6.40, 3.05; in Northeast Arctic haddock – 24.18, 8.55, 2.00; and in Greenland halibut of the Barents Sea – 219.29, 101.24, 45.60. Regression equations were obtained describing dependence of reqruitmtent on spawning stock size in three types of survival condtitions for each of the stocks considered. Three levels of PF and SSB - safe, minimal required acceptable and critical were calculated correspondingly to the types of survival conditions in the food fish populations studied.

An attempt was made to collate long term changes in survival conditions (logorithm of SI) with the same of some indicators (three main components) of ambient conditions in the ocean (IO). There is a good correspondence between shifts in the state of ckimatic characteristics and SI of most North Anlantic fish stocks on decadal and inerdecadal time scales. However, the significant relationships between SI of spring spawning Norwegian herring, Northeast Arctic cod and haddock ranged into three groups of years corresponding to favourable, moderate and unfavouable survival condtitions and basin-scale and regional climatic indices were not found. The local oceanographic conditions (wind mixing, local eddy structure, vertical fluxes, etc.) should be also taken into account.

Keywords: Abundance of fish, ambient conditions, Barents Sea, fecundity, spawning, survival index, decadal and interdecadal time scale, North Atlantic Oscillation.

1. Introduction

The present-day methods of fishery management, including a precautionary approach, are based on a number of biological assumptions with the most essential one stating that recruitment is stock-dependent. Confirming this statement are three traditional models developed by Ricker (Ricker, 1954 & 1958), Beverton and Holt (Beverton & Holt, 1957) and Cushing (Cushing, 1971). These popular models as well as their various modifications (Paulik, 1973; Shepherd, 1982, and others) employ natural mortality rates taken as both dependent and independent of population density.

Stock-recruitment relationships are masked considerably by extremely high rates and significant year-to year fluctuations in natural mortality during early fish ontogeny even when comparison is drawn between spawning stock size and the resultant recruitment values over a period of several decades. The effect of ambient conditions on survival rates during embryo, larva and fry development (i.e. during early ontogeny) is extremely high and spawning stocks of identical size may produce generations differing in abundance at the age of recruitment by several orders as was the case with spring-spawning Norwegian herring and northeast arctic cod. Failing attempts to express recruitment as a simple function of stock size led to a new (and in fact, old enough) paradigm put forward and defended by Gilbert (Gilbert, 1997) proclaiming that recruitment is not stock-dependent. Since the analysis of stock-recruitment relationships presents considerable difficulties irrespective of the models employed (Miller,1990; Sissenwine & Shepherd,1988; Walters & Ludwig,1981) none of the models have so far been widely used in marine fish stock management (O'Boyle,1993). Questioned was the extend to which spawning stock biomass reflected population reproductive capacity and to which the latter depended on the age and selection of spawning pairs (Marshall et al.,1998)

The effect of ambient conditions on survival rates during early ontogeny was repeatedly attempted to be established by means of distinguishing recurrent groups of generations of equally high or low abundance in a long-term series. The ranging (or grouping) of year-classes of northern marine food fishes based on the occurrence in commercial catches of individuals of certain size and age was performed as early as in the rise of the last century (Hjort, 1914; Sund, 1920, 1926 & 1936). Later, Marty (1956) established a total of 6 groups of relative abundance of the Murman herring and Maslov (1957) made use of a 3-point scale to describe year-classes of cod and haddock from the southern Barents Sea as weak, moderate or strong. A slightly modified though basically the same method of ranging relative year-class abundance was used by Baranenkova (1957, 1961, 1968 & 1974). Saetersdal and Loeng (1984) also applied a 3-point scale to assess year-class abundance of cod as low, medium or high for the period from 1902 to 1983. They combined data on relative year-class abundance (Sund, 1920, 1926 &1936; Rollefsen, 1952 &1954; Saetersdal & Hylen, 1959; Randa, 1983; Anon, 1982) with VPA-estimated absolute year-class abundance (Anon., 1982).

An attempt to expand the traditional knowledge of year-class strength by using VPA-derived absolute abundance of three-year olds was made by Serebryakov (Serebryakov et al.,1984) within the framework of population fecundity concept aimed at estimating survival rates during early ontogeny. Ranging of survival rates in compliance with the traditional concept of weak, moderate and strong year-classes was performed to estimate different levels of reproductive capacity in terms of population fecundity and spawning stock biomass, i.e. applying biological reference points (Serebryakov, 1990,1991 &1992). Since the traditional notion of year-class abundance may not be the most objective one, the survival rates might bear a shade of subjectivism too (Solemdal, 1997; Maguire & Mace, 1993; Marshall et al., 1998; Frank and Brickman, 2001). In view of the above-said the detection within a long-term data series of actual groups of certain year class strength and survival rates using cluster analysis formed one of the goals of the present work.

Another task was to reveal differences in population reproductive capacity as estimated based on traditional concepts and on the results of cluster analysis.

Attempts have been made recently to calculate the threshold values of spawning stock biomass on the basis of population fecundity concept referred to as Serebryakov's method (Maguire & Mace, 1993; Kiseleva, 2001; Borisov & Bondarenko, 2002). Applying this method Maguire and Mace (1993) found that 5 out of 9 spawning stocks of the Northwest Atlantic cod were at a critical level. Due to a certain lack of enthusiasm among fishery management decision-makers about biological reference points obtained by the above method, a total fishery ban had to be introduced several years later as the forecasted drastic drop in the abundance of 4 out of 5 mentioned stocks did took place (Frank & Brickman, 2001). The reason for the lack of enthusiasm lied in the extreme complexity of the analysis itself and of using stock-recruitment relationships for management purposes (O'Boyle, 1993).

The possibility to distinguish actual groups indicating the effects of environmental factors (e.g. through year-class survival rates) within a long-term data series allowed for exploring stock-recruitment relationships against the background of certain ambient conditions, namely favorable, moderate or unfavorable rather than in a general mode for the entire period of observations. This task embodied the third goal of this work.

As a result of comparison between year-class strengths in different species spawning off the Norwegian coast drawn by Dragesund (Dragesund, 1971) a clearly-pronounced tendency was revealed of occurrence of strong year-classes in several species simultaneously. This finding was confirmed by the results of a similar analysis made by Saetersdal and Loeng (Saetersdal & Loeng, 1984) with reference to cod, haddock and herring for the period from 1950 to 1983 and a conclusion was drawn that ambient conditions favoring the emergence of strong year-classes were related to processes or phenomena of oceanographic nature of a large space-time scale. Multiple analyses of year-class abundance as related to various environmental parameters were performed to involve the following climatic periods: cold, temperate, warm and, occasionally, very warm (Saetersdal, & Loeng, 1984; Mukhin & Dvinina, 1982; Bondarenko et al., 2001, and others). It was noted that the frequency of occurrence of strong year-classes of cod, haddock and herring was significantly higher in warm than in cold or temperate years (Ponomarenko I.,1984; Seliverstov, 1968 &1974; Baranenkova, 1968 & 1974; Saetersdal & Loeng, 1984). Consequently, survival rates can be considered as a far more reliable criterion of successful development during early ontogeny as compared to year-class abundance. With this in view another aim of the present study was to establish relationships between fluctuations in survival rates and climatic changes in the ocean.

2. Material and Methods.

With regard to herring use was made of abundance at age data for 1907-2002 presented in Report of the Pelagic and Blue Whiting Working Group(Anon., 2002). Initial data for cod, haddock and Greenland halibut were derived from Report of the Arctic Fisheries Working Group (Anon., 2002).

For ranging year-class strengths of herring, cod and haddock three year olds were chosen since VPA-derived abundance of younger age-groups brings multifold errors. In compliance with traditional concepts of year-class strength (Marti, 1956; Yudanov, 1964 &1966; Seliverstov, 1968 & 1974; Saetersdal & Loeng, 1984) herring generations of three year olds exceeding 10,000*10^6 indiv. were regarded as strong, varying from 2,000 to 10,000^6 indiv. as moderate and below 2,000*10^6 indiv. as weak

The northeast arctic cod generations were considered strong, moderate or weak at the abundance of three year olds of 900*10^6 indiv. from 400 to 900*10^6 indiv. and below 400*10^6 indiv. respectively. The corresponding values for three year old haddock were above 400*10^6 indiv, 150 - 400*10^6 indiv.and below 150*10^6 indiv..

With reference to Greenland halibut the abundance of five year olds was taken as year-class strength criterion and it comprised more than 35*10^6 indiv., from 20 to 35*10^6 indiv.and less than 20*10^6 indiv. for strong, moderate and weak year-classes, respectively (Nizovtsev, 1989).

Table 1 summarizes data on year-class abundance gradation in herring, cod, haddock and halibut obtained with traditional methods and by means of cluster analysis on survival rates as determined for unfavorable, satisfactory (moderate) and favorable ambient conditions.

A certain amount of subjectivism appeared to be inevitably involved in the traditional process of year-class strength ranging (Solemdal, 1997; Maguire & Mace, 1993). A far more objective approach would be based on distinguishing actual groups of recruit abundance in a long-term series applying a more realistic statistical method, which is cluster analysis. The latter is employed when data series seems to comprise both more and less homogeneous groups, which cannot be detected using other methods.

Cluster analysis involves several different methods of classification, which can be identified as hierarchic and non-hierarchic. Non-hierarchic methods imply initial selection of several elements from the data set to serve as cluster centers while clusters themselves are to be formed around these centers. Average “proximity” of each cluster element to its center is assessed at every step and then new centers are selected and individual elements are redistributed between clusters. The process is repeated up to the point when the average “proximity” between the center of each cluster and all its elements goes down a certain pre-selected value. Hierarchic method considers each element of the data set as a separate cluster at the initial stage and two elements showing minimal “proximity” within all possible cluster pairs are combined at every step. The number of clusters is expertly determined based on a priori information and loaded in the program.

One of the methods of cluster analysis, namely Ward’s method of minimal dispersion (Ward, 1963) was chosen by the authors for ranging year-class abundance and survival rates in herring, cod, haddock and halibut. Tested were three, four and five clusters and the three most appropriate ones in view of a priori information were selected. Stratgraf and Statistica programs were employed to perform the estimates.

Survival rate (R_3) is ratio between the number of individuals in a given year-class (three year olds for herring, cod and haddock and five year olds for halibut) and the total number of eggs spawned (E), which represents population fecundity (E_p) in this paper.

I.e. if $R_3 = S*E$ (1), where

S is survival rate up to the age of 3 years, or age at maturity

then $S = R_3/Ep$ (2)

Population fecundity E_p is estimated as a sum of contributions of all age groups participating in spawning in a given year:

$E_p = \Sigma^i_n * C$ (3), where

i is age at maturity,
n is age of the eldest age group in the spawning part of population,
C is contribution into population fecundity of a single age group estimated as:

$$C = E_{ind}*N*m*r \qquad (4)$$, where:

E_{ind} –average individual fecundity in a given age group,
N is number of individuals in a given age-group,
m is proportion of mature individuals as obtained from maturation ogive,
r is proportion of females, i.e. sex ratio in a given age group.

Table I of Appendix presents data on estimated population fecundity based on individual absolute fecundity of every age-group and contribution of each age-group in every year investigated. Use was made of Seliverstova's (1990) data on individual fecundity of herring, , the respective data on cod were derived from the papers by Borisov (1976), Serebryakov et al.(1984) and Kiseleva (2001) and on haddock Sonina's (1971)material was. Original data were obtained for halibut.

Apart of survival rates (*S*)calculated with formula (2), (S_b) were calculated from spawning stock biomass :

$$S_b = R_3/SSB \qquad (5)$$, where

SSB is spawning stock biomass
R_3 is abundance of three year olds,
S_b is survival rate from *SSB*

Tables 2 to 5 in Appendix present the results of ranging year-class abundance and survival-related ecological conditions using both traditional method and cluster analysis.

Student's test was made to evaluate differences in arithmetical mean values of different groups of abundance in each species and of different groups of survival-related ambient conditions as estimated by traditional method and using cluster analysis (Table 2). In 55 out of 77 cases the differences in the average values proved to be negligible and it is worth mentioning that no tangible differences were recorded in the average year-class abundance in strong generations of all the species studied and under favorable conditions as identified based on survival rates. The latter might lead to the conclusion that spawning stock size values obtained earlier (Serebryakov et al., 1984; Serebryakov, 1990 & 1991; Maguire & Mace, 1993; Bondarenko et al., 2001) based on traditional gradation of year-class abundance and of ambient conditions were fairly reliable.

The levels of reproductive capacity in terms of population fecundity and spawning stock biomass are classified in this paper as safe, minimal permissible (acceptable) and critical.

A safe level of population fecundity (E_{safe}) and spawning stock biomass (SSB_{safe}) secures the emergence of a strong year class even under moderate ambient conditions.
It is estimated as follows:

$$E_{safe} = R_{str}/S_{fmod} \qquad (6),$$

$$SSB_{safe} = R_{str}/S_{bmod} \qquad (6a),$$

where R_{str} is threshold (minimal) abundance of a strong year-class,

S_{fmod} and S_{bmod} are arithmetical means of observed survival rates under moderate conditions of survival as derived from population fecundity and spawning stock biomass, respectively.

Minimal acceptable levels of population fecundity (E_{min}) and spawning stock biomass (SSB_{min}) result in the emergence of strong, moderate and weak year-classes under favorable, moderate and unfavorable ambient conditions respectively. They are estimated as follows:

$$E_{min} = R_{mod} / S_{fmod} \quad (7)$$

$$SSB_{min} = R_{mod} / S_{bmod} \quad (7a),$$

where R_{mod} is threshold (minimal) abundance of a moderate year-class,
S_{fmod} and S_{bmod} arithmetical mean of survival indeces specific for moderate survival conditions.

At critical, or dangerous (Maguire & Mace, 1993; Frank & Brickman, 2001) levels of population fecundity (E_{crit}) and spawning stock biomass (SSB_{crit}) the emergence of a strong year-class is likely to occur under extremely favorable conditions for egg, larva and fry survival. A drop in population reproductive capacity below the critical level makes the formation of a strong year-class theoretically impossible. This level can be estimated as follows:

$$E_{crit} = R_{str}/S_{max} \quad (8),$$

$$SSB_{crit} = R_{str}/S_{bmax} \quad (8a), \text{ where}$$

S_{fmax} and S_{bmax} are maximum survival rates estimated from population fecundity and spawning stock biomass, respectively.

All the above-discussed levels of population fecundity and spawning stock biomass were calculated for each stock using traditional method of grouping year-class strength and survival rates and recalculated applying cluster analysis.

3.Results

Using traditional approach and cluster analysis a total of three groups differing in abundance and survival rates were distinguished in three year olds of herring, cod and haddock and five year olds of halibut. The grouping results are compared in the Appendix Tables 6- 11 (herring), 12-17 (cod), 18-23 (haddock) and 24-29 (halibut).

3.1. Spring-spawning Norwegian herring

Based on traditional ranging a total of 31 generations with the abundance of three year olds below 2,000*10^6 indiv. were classified as weak for the period from 1907 to 1998 (Table 6 of Appendix). The automatically-chosen abundance criterion of less than 4,000*10^6 indiv. for cluster analysis resulted in identification of 45 year-classes as poor, i.e. those which were traditionally considered to be of medium abundance. Student's test revealed tangible differences in the average abundance values obtained by the two methods while the average survival rates did not differ significantly.

As a result of traditional ranging a total of 40 generations were identified as moderate based on the abundance criteria between 2,000 and 10,000*10^6 and cluster analysis resulted in 30 moderate year-classes with the abundance of 4,000- 12,000*10^6 indiv. (Table 7 of

Appendix). Similar to weak year-classes no tangible differences in the average survival rates were revealed by Student's test while the average abundance values differed significantly.

The abundance of 10,000*10^6 indiv. was chosen as the lower limit for a strong year-class during traditional ranging and cluster analysis gave the respective figure of 12,000*10^6 indiv. (Table 8 of Appendix). As a result the corresponding numbers of abundant year-classes were found to be 21 and 17. Noteworthy is the fact that no expected differences were observed in the average values of year-class abundance and survival rates obtained by the two methods.

Both traditional method and cluster analysis were employed to range the survival rates of generations exposed to unfavorable, satisfactory or favorable environmental conditions during early life.

Traditional ranging involved the survival criterion against population fecundity below 3*10^-6 to reveal a total of 28 years of unfavorable ambient conditions while the respective figures obtained by cluster analysis were 16*10^-6 and 67 (Table 9 of Appendix). Student's test revealed tangible differences between all the average values compared.

Based on traditional gradation a total of 44 years of moderate (satisfactory) ambient conditions were distinguished to be characterized by the survival rates varying from 3 to18*10^-6. The respective figures revealed by cluster analysis were 19 and 18-50*10^-6 (Table 10 of Appendix). Significant differences were found in all the average values obtained by the two methods.

In accordance with traditional approach a total of 20 generations enjoyed favorable environmental conditions during early life with the survival rate exceeding 20*10^-6 while cluster analysis revealed 6 favorable years only based on the survival criterion of 50*10^-6 (Table 11 of Appendix). Student's test did not establish tangible differences between the average abundance and survival values.

The above findings allowed for concluding that traditional data ranging based on year-class abundance at maturity and on survival rates tends to provide a more optimistic picture of year-class strength formation in spring-spawning Norwegian herring as compared to cluster analysis.

The reproductive parameters of the herring population presented in Table 2 of Appendix and those ranged in Tables 6 –11 of Appendix are generalized in Table 3 to be used as a basis for estimating population fecundity and spawning stock biomass. Safe level is calculated using formulae (6) and (6a), minimal permissible one with (7) and (7a) and critical one with (8) and (8a). Results of these calculations are given in Table 4. Data presented in Table 4 indicate differences in reproductive capacity levels obtained with traditional method and using cluster analysis. The safe level appeared to be 27-30 % higher while the minimal acceptable and critical levels 18-27% lower based on traditional approach as compared to cluster analysis.

Since it is minimal permissible and critical levels of spawning stock biomass which are dealt with in the majority of cases, cluster analysis is viewed as a more appropriate means of ranging year-class strengths and ambient conditions and the resultant higher figures as more reliable.

3.2. Northeast arctic cod

Within the framework of traditional gradation of year-class strengths the abundance of three year olds of 400*10^6 indiv. and below was assumed to manifest a weak generation, and a total of 20 generations fell into this category in the period from 1946 to 2001 (Table 12 of Appendix). As a result of cluster analysis a total of 22 year-classes were recognized as weak based on the assumed abundance of 430*10^6 indiv. The difference between average abundance and survival rates estimated from the number of eggs spawned and from spawning stock biomass using the two methods was negligible (Table 2).

On the basis of traditional approach the total number of generations of medium abundance (400-900*10^6 indiv. at the age of 3 years) was found to be 27 and cluster analysis resulted in the respective figure of 25 at the lower abundance limit of 430*10^6 indiv. and the upper limit equal to that of traditional method (Table 14 of Appendix). Similar to the previous case, no tangible differences were revealed in the average abundance and survival rates obtained by the two methods.

Identical generations were classified as strong based on traditional ranging and on cluster analysis, which, consequently, resulted in equal average values in both cases (Table 14 of Appendix).

Since no significant differences were revealed in the average year-class strength values obtained by the two methods it is concluded that both traditional grouping and cluster analysis can be equally employed in ranging year-class abundance in the cod population.

. As a result of traditional evaluation of ambient conditions based on the upper limit of survival rate of 2.5*10^-6 a total of 9 unfavorable years were distinguished in the period from 1946 to 2001 (Table 15 of Appendix). Based on computer-selected upper survival limit of 5,000*10^-6 a total of 32 years were identified as unfavorable as a result of cluster analysis. The difference in the average abundance and survival rates of three year olds obtained by the two methods proved to be negligible when estimated from the population fecundity and it was significant in the average survival rates taken against the spawning stock biomass. (Table 2).

A total of 38 years characterized by satisfactory (moderate) ambient conditions were revealed as a result of traditional ranging based on the survival rates of 2.5 - 10*10^-6' (Table 16 of Appendix). Cluster analysis resulted in the survival rate ranging from 5.5 to10*10^-6, which gave 15 years only of satisfactory ambient conditions. Student's test did not reveal tangible differences in the average year-class abundance obtained by the two methods while the average survival rates differed significantly.

The lower limit of survival rate under favorable environmental conditions was assumed to be 10*10^-6 both for cluster analysis and traditional ranging, which resulted in identical average values and equal number of favorable years (Table 17 of Appendix).

Reproductive parameters of the cod population presented in Table 4 and those obtained as a result of data ranging in Tables 12-17 of Appendix are generalized in Table 22 to be used for estimates of reproductive capacity in terms of population fecundity and spawning stock biomass. Similar to herring, formulae 6 and 6a, 7 and 7a, and 8 and 8a were used to estimate safe, minimal acceptable and critical (dangerous) levels, which are given in Table 4.

Differences in the reproductive capacity levels obtained by traditional methods and applying cluster analysis were found to be less significant in the cod population as compared to those in herring as they did not exceed 6.08% for the estimated minimal permissible spawning stock biomass and population fecundity. The above fact indicates that earlier estimated levels of population fecundity and spawning stock biomass (Serebryakov, 1990; Borisov, Bondarenko & Krovnin, 2001; Kiseleva, 2001) can be regarded as completely reliable.

3.3. Northeast arctic haddock.

According to traditional ranging the haddock generation was considered as weak at the abundance of three-year olds below150*10^6 indiv. while cluster analysis resulted in the respective figure of 200*10^6 indiv. Consequently, a total of 29 and 35 year-classes were referred to as weak based on the former and latter methods, respectively (Table 18 of

Appendix). However, despite the above discrepancy no tangible differences were revealed in the average values of any of the parameters obtained by the two methods.

The abundance of three year olds varying from 150 to 400*10^6 indiv. and from 200 to 500*10^6 indiv. was assumed as medium based on traditional methods and on cluster analysis respectively, which gave the corresponding numbers of moderate year-classes of 19 and13 (Table 19 of Appendix). Similar to poor generations the difference between the average year-class abundance and survival rates was negligible.

The number of strong year-classes derived from cluster analysis and from traditional ranging proved to be the same despite different lower limits of abundance (Table 20 of Appendix) and, consequently, all the average values were identical.

A conclusion can be drawn that no significant differences in the average values were revealed when two different methods of ranging year-class abundance were used.

Traditionally ambient conditions were identified as unfavorable at the survival rate below 1.5*10^-6 while cluster analysis gave the respective figure as high as 4*10^-6. Accordingly, a total of 12 and 31 years were referred to as unfavorable in the former and latter case (Table 21 of Appendix). Student's test revealed tangible differences in the average values of all the parameters (Table 2).

Based on traditional ranging the ambient conditions were assumed to be satisfactory (moderate) at the survival rates varying from 1.5 to 11*10^-6 and cluster analysis resulted in the corresponding figure of 5 -13*10^-6. The resultant numbers of satisfactory years were 34 and 16, respectively (Table 22 of Appendix). The average survival rates obtained with the two methods were found to differ significantly based on Student's test while the average abundance values showed no tangible differences (Table 2).

With regard to favorable ambient conditions the lower limits of survival rate were assumed at 11*10^-6 and 13*10^-6 for traditional ranging and cluster analysis, respectively, which gave 5 and 6 favorable years in the former and latter case (Table 23 of Appendix). No tangible differences were found between the average values of all the parameters obtained by the two methods.

Reproductive characteristics of the haddock population presented in Table 5 and Tables 23-28 were generalized in Table 6 to be used for estimating three levels of reproductive capacity (Table 4). Data presented in Table 4 indicate that cluster analysis resulted in higher minimal acceptable levels of population fecundity and spawning stock biomass as compared to traditional method. With reference to other parameters the difference varied from 1.6 to 7.0%.

3.4.Greenland halibut.

Fluctuations in year-class strength are less distinctly pronounced in Greenland halibut as compared to cod, herring and haddock. A rich generation would exceed a poor one in abundance by 2.5 times at the maximum while in the other three species the difference can reach several orders.

The abundance of five-year olds of 20*10^6 indiv and 16*10^6 indiv. was established as the upper limit for a poor generation based on traditional method and cluster analysis respectively, which resulted in the corresponding numbers of weak year-classes of 24 and as low as 9 (Table 24 of Appendix). Student's test revealed tangible differences in the average parameters obtained by the two methods while those in survival rates were negligible (Table 2).

The abundance of five year olds of 20-35*10^6 indiv. and 16-30*10^6 indiv. was assumed to demonstrate moderate generations for traditional method and cluster analysis, respectively, and the resultant numbers of such generations proved to be 10 and 22 accordingly (Table 25 of Appendix). As was the case with weak generations significant difference was recorded in the average abundance of five year olds rather than in survival rates up to this age (Table 2).

As a result of traditional ranging 2 generations with the abundance exceeding 35*10^6 indiv. were identified as strong while cluster analysis revealed 5 rich year-classes based on the abundance above 30*10^6 indiv.(Table 26 of Appendix). Student's test did not establish tangible differences in the average values of any of the parameters obtained by the two methods.

Using traditional method the survival rate below 70*10^-6 was chosen to manifest unfavorable ambient conditions while cluster analysis gave the exact figure of 55*10^-6. As a result, a total of 8 years were classified as unfavorable based on traditional approach and cluster analysis resulted in the respective number of 7 years (Table 27 of Appendix). Student's test did not reveal tangible differences in the average values of any of the parameters.

Based on traditional gradation a total of 8 years with the survival rates varying from 70 to 110*10^-6 were assumed to be characterized by satisfactory (moderate) ambient conditions (Table 28 of Appendix). Cluster analysis resulted in the respective figure of 17 based on the survival rate ranging from 55 to 140*10^-6. No significant differences were revealed between the average abundance and survival rates obtained by the two methods.

Traditional grouping identified ambient conditions as favorable at the survival rates exceeding 110*10^-6 and cluster analysis gave the respective figure of 140*10^-6. The corresponding numbers of favorable years were 20 and 12 (Table 29 of Appendix). No tangible differences were recorded between the average parameters obtained by the two methods.

Reproductive characteristics of the Norwegian and Barents Sea populations of Greenland halibut presented in Table 5 and Tables 24-29 of Appendix are generalized in Table 7 to be used for estimating reproductive capacity of Greenland halibut in terms of population fecundity and spawning stock biomass using formulae 6-8a which are given in Table 4.

As clearly seen from Table 4 the traditional ranging of abundance and survival rates resulted in a nearly twofold overestimate of safe and minimal permissible reproductive capacity levels and in an only 20% higher critical level as compared to the respective values derived from cluster analysis.

3.5 Stock and Recruitment

3.5.1. Analysis of Variants

Using one-way multi-variant analysis an attempt was made to establish relationships between recruitment (abundance of three year old herring, cod and haddock and five year old halibut) and stock size (population fecundity and spawning stock biomass). The results of analysis of reproductive characteristics presented in Tables 2,3,4 and 5 are summarized in Tables 30-32 of Appendix and generalized in Table 8.

The proportional role of population fecundity in formation of abundance variants in three year old herring, cod and haddock was found to be below 11.3% and that of biomass accounted for 11% only, which was considerably lower than the residual or random variation and indicated no effect of stock size on recruitment (Tables 40 and 41). The role of population fecundity and spawning stock biomass was found to be significantly higher (44.5 and 43.2%, respectively) in halibut, but it was lower than the residual variant figure. The effect of ambient conditions on survival rates was estimated at 25.6% in herring and as high as 73.5% in haddock. However, both in cod and haddock it remained below the residual variance value and in halibut the respective figures were even less significant (Table 8).

The results of multi-variant analysis with reference to the four species for the period from 35 to 92 years did not reveal apparent stock-recruitment relationships. However, since the effect of ambient conditions and the resultant survival rates proved to be more significant as compared to that of stock size (Table 8) this trend of further investigations might be regarded as promising for establishing distinct stock-recruitment relationships. Ranging of survival rates, which are viewed as a general indicator of ambient conditions
during early ontogeny provides an opportunity to study stock-recruitment relationships under various environmental effects determining year-class abundance formation. This approach was used to study the abundance of three year old herring, cod and haddock and five year old halibut as dependent on population fecundity and spawning stock biomass under unfavorable, satisfactory (moderate) and favorable environmental conditions.

3.5.1.1. Spring-spawning Norwegian herring

The role of population fecundity and spawning stock biomass in the formation of year-class abundance was found to be considerably higher during the years characterized by under unfavorable ambient conditions as compared to the rest of the period of observations but it proved to be lower than the residual variant value (Table 38-39 of Appendix). Under moderate ambient conditions, which were ranged using cluster analysis, the effect of population fecundity and spawning stock biomass was estimated at 79.2% and 79.2%, respectively. Traditional method resulted in the respective figures of 73.2% and 73.7% and cluster analysis did not reveal reliable interdependence (Table 9).

3.5.1.2. Northeastern arctic cod.

Contrary to herring, the effect of spawning stock size on recruitment was quite distinctly pronounced in cod under unfavorable (37.2-75.6%) and moderate (47.2-91.9%) environmental conditions while no relationship was established under favorable ambient conditions (Table 9).

3.5.1.3. Northeastern arctic haddock.

Statistically-reliable stock(population fecundity)-recruitment relationship (71.4%) was established in haddock under unfavorable ambient condition based on traditional ranging of survival rates, and cluster analysis resulted in the figure lower than the residual variant (Table 9). Under moderate environmental conditions the reliable relationship (50.1-65.4%) in terms of population fecundity and spawning stock biomass was revealed as a result of cluster ranging of survival rates. Under favorable ambient conditions the relationship was found to be more clearly expressed, however, the only statistically reliable value was of 89.8% in terms of the spawning stock biomass (Table9).

3.5.1.4. Greenland halibut from the Norwegian and Barents Sea

No statistically-reliable stock-recruitment relationship was established in the years which were characterized by unfavorable environmental conditions and it was distinctly pronounced under moderate and favorable conditions (89.4 and 98.9%, respectively) (Tables 34-39 of Appendix and Table 9)

Based on the results obtained it can be concluded that one-way variant analysis allowed for quantitative description of relationship between fish abundance at recruitment age and spawning stock biomass with reference to the three types of ambient conditions as distinguished based on survival rates. Table 9 shows that the maximum effect of stock size on recruitment was observed in herring, haddock and halibut under favorable ambient conditions while in cod the same was true for moderate and unfavorable conditions and under favorable conditions no relationship was found. I.e. stock-recruitment relationships were recorded in every of the four species studied under at least two types of ambient conditions, which provides theoretical background for further research in this field. The application of regression analysis for establishing stock-recruitment relationships is justifiable due to the revealed effect of stock size on the variants of the resultant characteristics of year-class abundance under certain types of ambient conditions during early ontogeny, which are expressed quantitatively based on survival rates.

3.5.2. Regression analysis

Regression analysis is used to study function variations resulting from changes in one or several arguments. In the present study the abundance of three year old herring, cod and haddock and five-year-old halibut was assumed to serve as the function, and the arguments were represented by population fecundity and spawning stock biomass.

The results of dispersion analysis given in Table 9 revealed stock-recruitment relationships in all the four species studied. A distinctly-pronounced statistically reliable (the effect of stock upon recruitment exceeding 50%) relationship to be described by a regression equation was established in 24 out of 48 cases. These cases included the abundance of three-year-old Norwegian herring as function of the population fecundity and the spawning stock biomass under traditionally-detected favorable and unfavorable ambient conditions and under moderate conditions as identified by cluster analysis. Regression analysis was also made to study stock-recruitment relationships in cod under unfavorable and moderate conditions as ranged by both methods In haddock the same was done for traditionally- identified favorable and unfavorable conditions and for moderate conditions as established by cluster analysis. Reliable regression equations were obtained to describe stock-recruitment relationships in halibut under moderate and favorable conditions revealed by both methods.

Results of regression analysis are presented in Table 10

The dependence of the abundance of three-year-old herring upon the population fecundity and the spawning stock biomass was found to be described by a power regression equation in all the cases considered (Table 10) Relationship between recruitment size and population fecundity in the northeastern arctic cod under traditionally- detected unfavorable ambient conditions proved to be described by a power equation too, and that between recruitment and spawning stock biomass under traditionally-detected favorable conditions and under moderate conditions revealed by cluster analysis followed an exponential pattern. The abundance of three-year-old cod as function of population fecundity under traditionally-classified unfavorable conditions was described by a linear regression equation (Table 10).

Stock-recruitment relationship in haddock followed a polynomial pattern except for the abundance of three year olds as function of population fecundity under moderate ambient conditions identified by cluster analysis, which was described by a power regression equation. In 6 out of 8 cases in halibut the relationship between the abundance of five-year-olds and spawning stock size was described by a polynomial regression equation. Recruitment size as function of population fecundity under moderate and favorable ambient conditions revealed by cluster analysis followed power and linear equations, respectively.

A total of 24 regression equations, which were obtained to describe stock-recruitment relationship in the four populations under the three types of ambient conditions, can be used to solve the following tasks:

* to predict year-class strength at a given spawning stock size;
* to determine spawning stock size required to produce average year-class abundance under the three types of ambient conditions;
* to estimate spawning stock size to be used as a biological reference point under forecasted type ambient conditions.

The first task was solved using regression equations to describe the relationship between recruitment size and spawning stock biomass (equations 10, 12, 14, 17, 20, 23, 24, 27, and 32). The results are presented in Table 11. The solution of the second task is exemplified in Table 12. Based on comparison between the data presented in the above tables and those from Table 4, which shows the estimated spawning stock biomass, the following conclusions can be drawn to provide assistance in fisheries management:

- The spawning stock biomass of herring, cod and haddock is presently at the level exceeding the minimal acceptable one and that of halibut is at its critical level.
- None of the stocks studied showed the potential to produce a rich generation under unfavorable ambient conditions. The spawning stock size of cod and haddock in 2001 allows for the emergence of a year-class of medium abundance under moderate environmental conditions. The spawning stock biomass of herring is high enough to provide the appearance of a strong or almost strong generation under moderate ambient conditions. In halibut, on the contrary, the spawning stock biomass is so low that a medium-size year-class is likely to appear under extremely favorable ambient conditions exclusively.
- Assuming the minimal acceptable levels of population fecundity and spawning stock biomass presented in Table 4 as biological reference points the reproductive capacity in cod and haddock is recognized to be in the vicinity of this level in 2001. The spawning stock biomass of herring was twice as high as the minimal acceptable level in 2001 and it was actually reaching the safe level during the following years. The Norwegian and Barents Sea population of halibut appeared to be in the dangerous zone since the spawning stock reached its critical level and a further decrease might cause a serious depression.

4. Survival during early ontogeny

Early ontogeny embraces embryonic (eggs and, occasionally, pre-larvae prior to change to active feeding), larval (before metamorphosis is completed) and fry (up to the age at maturity) stages of fish development. Survival rates during embryonic period in pelagic (pelagophyllous?) fishes are extremely low (0.05% at the average in sole (Riley, 1974), 2% in the North Sea cod (Daan, 1981) and 7-13% in the Argentine anchovy (Ciachomski & Capezani, 1973). Survival rates in substrate-dwellers (substratophyllous?) are usually higher and they can exceed 90% in Atlantic herring, round herring and capelin (Baxter, 1971; Rannak, 1971; Soin, 1971 and Gjosaetre & Saetre, 1974). In herring they depend upon the number of egg layers laid on the spawning substrate (Dushkina, 1991). An extensive review of material on egg and larva mortality in marine fishes was provided by Bunn (Bunn et al., 2000). Based on the results of ichthyolankton surveys aimed at estimating the total number of eggs laid, and the consequential spawning stock biomass, both exogenous and endogenous factors affecting egg mortality at sea were analysed by the above-mentioned authors who came to the conclusion that the causes of natural mortality of fish embryos at sea remain unclear (Bunn et al., 2000).

The survival of pelagic pre-larvae constituted 2% in winter flouder (Pearcy, 1962), 2.3% in Atlantic herring (Dragesund & Nakken, 1973) and 68% in plaice (Bannister et al.,1974). Extensive studies of larval mortality followed the 1970 ICES "Stock and Recruitment "symposium when the concept was approved postulating that year-class abundance formation is confined to the larval period exclusively (Heath, 1992 and Rotschild, 2000). A comprehensive insight into the problem of larval mortality was made by Chambers and Trippel (Chambers & Trippel, 1997).

As a general approach, causes of high natural mortality and its fluctuations during larvae development can be classified as follows:

- factors, which are related to Hjort's first concept of critical period (Hjort, 1914), i.e. to food availability for larvae during change to exogenous feeding and the resultant match and mismatch of peaks in the forage zooplankton development and larva abundance;
- factors governing predation rate on larvae;
- factors causing endogenous differences in the progeny including inherited viability, selection of parents, and some others;
- factors of oceanographic nature which depend on short-and-long-term climatic fluctuations in the ocean and are related, inter alia, to Hjort's second concept (Hjort, 1914) dealing with one-way drifts of larvae to areas of unfavorable ambient conditions and the failure to reach the fry feeding grounds.

Each of the above groups of factors are comprehensively dealt with in literature reviews (May, 1974; Moller,1980; Sharp,1980; Chambers & Trippel, 1997; Solemdal,1997; Sundby, 1996; Purcell,1989; Legget & DeBlois, 1994; Baily & Houde, 1989; Bakun, 1996, and others).

The present study did not specifically attempt at revealing the causes of annual fluctuations in natural mortality rates during early ontogeny of the four species investigated. However, the comparison drawn between these fluctuations indicated a clearly pronounced coincidence in the peaks of survival rates in certain years. The year of 1983 provides a vivid example of maximum survival rates in spring-spawning Norwegian herring, northeastern arctic cod and northeastern arctic haddock and the resultant abundant generations. In halibut, too, the survival rate was considerably higher in 1983 as compared to 18 preceding years and the following 5 years. Similar patterns, though less distinctly pronounced, were recorded in 1963 and 1969 (excluding halibut). However, herring generation was poor due to extremely low spawning stock biomass as a result of overfishing while cod and haddock year-classes were rich. Based on survival rates in herring in 1975 a strong generation might have been expected similar to cod population which was characterized by high survival rates and abundance during this year.

Similar coincidence was observed in the occurrence of low survival rates and weak generations as was the case with herring and cod in the period from 1946 to 1949, from 1951 to 1955 and from 1965 to 1967.

Simultaneous emergence of extremely poor and rich year-classes in different species can not be attributed to parallel effects of endogenous factors or of predation, or to a joint compensatory or depensatory (?) reaction. The most probable reason seems to lie in the direct effect of a complex of factors related to climatic changes in the ocean on natural mortality during early ontogeny, the mechanism of which is embodied in both of Hjort's concepts.

The study of what seemed to be extreme or extraordinary oceanographic characteristics during the years, when survival rates in several species were unusually high or low, might assist in elucidating some indicators of the causes of this phenomenon if not revealing the causes as they are.

5. Possible impact of climatic changes on survival.

In recent decades there was a growing interest in studying the effects of climate variability on marine ecosystems and fish productivity. These effects are especially clearly seen on decadal and interdecadal time scales with a substantial degree of synchrony between climate regime shifts and changes in the state of fish stocks (Kawasaki, 1983; Lluch-Belda et al., 1989; Klyashtorin, 2001; Bondarenko et al., 2001).

In this paper we used principal component analysis (PCA) to isolate objectively the most important factors of common variability in the 44 physical and biological time series in the North Atlantic for the 1970-1995 period. The biological characteristics are the survival indices of four species studied calculated as a natural logarithm of the ratio between recruitment and spawning stock biomass and the same for other North Atlantic fish stocks. Scores for the three first components are shown in Fig.5 and the loadings on these components are given in Table 13. The PC loadings are the correlations between individual time series and the associated PC score. The first three PC account for 21.4%, 14.3%, and 9.5% of the total variance, respectively.

The first principal component is associated with the North Atlantic Oscillation (NAO) (r=-0.90) which is a primary mode of climate variability in the North Atlantic (Hurrell, 1995; Marshall et al., 1997). It was mostly positive from 1970 to 1982 and strongly negative beginning from 1983. High loadings (r>| 0.4|) on PC1 occur for 20 of the time series. In particular, high loadings are observed for Norht-east Arctic cod (r=-0.53), North-east Arctic haddock (r=-0.70), Greenland halibut (r=-0.47). For Norwegian spring spawning herring the loading is less (r=-0.33) though positively related to the NAO index.

The second principal component (PC2) shows three regimes, with abrupt shift in the mid-1970s, and small variations around zero after 1988. This PC is associated with winter water temperature in the Northeast Atlantic (Region 1, Krovnin, 1995). High loadings on this component occur for some herring and saithe stocks.

The third principal component (PC3) is obviously not related to physical parameters but instead reveals a synchrony in variations of survival index of cod and haddock stocks in the Northwest Atlantic.

The association between interdecadal climatic changes characterized by the NAO index and variations in survival index of Norwegian herring is further illustrated by Fig.6 where cumulative sums of anomalies of the NAO index and survival index of herring are presented. This stock is taken just as an example. As seen from the Figure, there was a rather synchronous shift from one state to another both in the state of the NAO index and survival conditions of Norwegian herring in 1970-1971.

The above results evidence the good correspondence between shifts in the state of climatic characteristics and survival indices of most North Atlantic fish stocks on decadal and interdecadal time scales. However, when we consider the changes from year to year, especially from the point of view of formation of the year class strength and survival conditions of any stock for particular year the situation is not so clear. In most cases the correlations between basin-scale or regional atmospheric and oceanic indices and survival indices are weak. This is especially true for moderate conditions of survival. As to extreme cases of favorable or unfavorable survival conditions sometimes it is possible to distinguish a large-scale factor which may influence the formation of the year class strength. But even in this situation the sign of relationship may be opposite to that observed on decadal time scale. For example, favorable survival conditions for NE Arctic cod occur mainly during the negative phase of the NAO (r=-0.80), while on decadal time scale the correlation is positive. However, there is no a statistically significant association between the low survival index of cod and the NAO index. At the same time, the high correlation coefficients are found between high (low) survival index and the low (high) index of the so-called East Atlantic pattern in the middle troposphere (Barnston and Livezey, 1987), which is similar to the NAO (r=-0.74 and 0.65, respectively). The signs of these correlations also indicate on inverse relationship between favorable (unfavorable) survival conditions of cod and negative (positive) phase of the NAO. For Norwegian herring favorable survival conditions are formed mainly during the positive phase of the NAO though the correlation coefficient is rather low (r=0.48). But as in case of NE Arctic cod a clear association between unfavorable survival conditions and climatic indices was not found. The same situation is true for NE Arctic haddock: a rather high positive correlation with the winter NAO index (r=0.70) for favorable conditions of survival and low correlation with the climatic and oceanic parameters for unfavorable conditions.

Thus, there is no doubt that climatic variability affects largely a strength of year class of most North Atlantic fish stock on decadal and interdecadal time scales. However, there is no apparent relationships between survival indices of three North Atlantic fishes (NE Arctic cod and haddock, Norwegian herring) ranged into three groups of years corresponding to favorable, moderate and unfavorable survival conditions and basin-scale and regional climatic indices. This problem needs a further study. The local oceanographic conditions (wind mixing, local eddy structure, vertical fluxes, etc.) should be taken into account for this study.

6. Summary and conclusions.

1. With the purpose of to reveal recruitment-stock relationship in four species of food fishes of the Barents and Norwegian Seas – Norwegian spring-spawning herring, North-east Arctic cod, North-east Arctic haddock and Greenland halibut, classification into weak, average and strong year-classes was made by means of traditional image and cluster analysis based on the long term data series.

2. Using one-way multi-variant analysis an attempt was made to establish relationships between recruitment (abundance of three year old herring, cod and haddock and five year old halibut) and stock size (population fecundity and spawning stock biomass). The proportional role of population fecundity in formation of abundance variants in three year old herring, cod and haddock was found to be below 11.3%. The results of one-way variant analysis with reference to the four species for the period from 35 to 92 years did not reveal apparent stock-recruitment relationships. The effect of ambient conditions and the resultant survival rates proved to be more significant – from 25.6% in herring to 73.5% in haddock.

3. Ranging of survival rates, which are viewed as a general indicator of ambient conditions during early ontogeny provides an opportunity to study stock-recruitment relationships under various environmental effects determining year-class abundance formation. This approach was used to study the abundance of three year old herring, cod and haddock and five year old halibut as dependent on population fecundity and spawning stock biomass under unfavorable, satisfactory (moderate) and favorable environmental conditions.

4. One-way variant analysis allowed for quantitative description of relationship between fish abundance at recruitment age and spawning stock biomass with reference to the three types of ambient conditions as distinguished based on survival rates. A distinctly-pronounced statistically reliable the effect of stock upon recruitment was established in 24 out of 48 cases.

5. 24 distinctly-pronounced statistically reliable cases of impact of stock on recruitment were processed by means of regression analysis which resulted in 24 regression equations describing the 3-year olds abundance dependancy on population fecundity and spawning stock biomass under three types of ambient conditions of survival.

6. Nine equations of recruitment dependancy on spawning stock biomass out of 24 with determination coefficients from 0.69 to 0.98 were used in calculations the future year-classes abundance which the 2001 spawning stock of the species studied can produce under three types of survival conditions.

7. The spawning stock biomass required to produce average abundant year-class under three types of ambient conditons was also calculated in four species of food fishes under consideration.

8. The followng conclusions can be drawn based on the calculations executed:

- The spawning stock biomass of herring, cod and haddock is presently at the level exceeding the minimal acceptable one and that of halibut is at its critical level.
- None of the stocks studied showed the potential to produce a rich generation under unfavorable ambient conditions. The spawning stock size of cod and haddock in 2001 allows for the emergence of a year-class of medium abundance under moderate environmental conditions. The spawning stock biomass of herring is high enough to provide the appearance of a strong or almost strong generation under moderate ambient conditions. In halibut, on the contrary, the spawning stock biomass is so low that a medium-size year-class is likely to appear under extremely favorable ambient conditions exclusively.
- Assuming the minimal acceptable levels of population fecundity and spawning stock biomass presented in Table 4 as biological reference points the reproductive capacity in cod and haddock is recognized to be in the vicinity of this level in 2001. The spawning stock biomass of herring was twice as high as the minimal acceptable level in 2001 and it was actually reaching the safe level during the following years. The Norwegian and Barents Sea population of halibut appeared to be in the dangerous zone since the spawning stock reached its critical level and a further decrease might cause a serious depression.

9. Principal component analysis was used to reveal common variability in survival indices fluctuations in four species in this study as well as many other species in the 44 physical and biological time series in the North Atlantic for the 1970-1995 period. There is a good correspondence between shifts in the state of climatic characteristics and survival indices of most North Atlanic fish stocks on decadal and interdecadal time scales. However, on the annual and interannual scales the significant relationships between survival indices classified by survival conditions of Norwegian spring spawning herring, North-east Arctic cod and haddock and basin-scale and regional climatic indices were not found. Survival conditions are perhaps more strongly impacted by the local oceanoghaphic conditions (wind mixing, local eddy structure, vertical fluxes, etc.) that should be taken into account in a thorough study of these factors.

References

Anon., 1982 Report of the Arctic Fisheries Working Group.ICES, C/M.

Anon., 2002. Report of the Arctic Fisheries Working Group. ICES CM 2002, ACFM: 19.

Anon., 2002. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group. ICES CM 2002, ACFM:

Bailly, K.M. and Houde, E.D., 1989. Predation on eggs and larvae of marine fishes and the recruitment problem. Adv. Mar. Bio., 25: 1-83.

Bakun, A. 1996. Patterns in the Ocean: Ocean Processes and Marine Population Dynamics. California Sea Grant College System, NOAA, La Jolla, California.

Bannister, R.C., Harding, A.D., Lockwood, S.J.,1974 Larval mortality and subsequent year-class strength in the plaice (Pleuronectes Platessa L.). In: (J.H.S. Blaxter, ed.) The Early Life History of Fish. : 27-37.

Baranenkova, A. S, 1957. Comparative abundance of year classes of the cod and haddock in the Barents Sea according to the quantitative estimation of the young fish and the data of fisheries. Transactions of the Knipovich Polar Institute of sea-fisheries and oceanography PINRO), v. 10: 54-77 (in russian)

Baranenkova, A. S, 1961. On the Methodology of the young fish surveys. PINRO Scientific Bulletin, No. 2-3 (16-17): 10-13 (in russian)

Baranenkova, A. S, 1968. The PINRO research of abundance estimates of year class strength and causes of a year class success. Transactions of the Knipovich Polar Institute of sea-fisheries and oceanography (PINRO), vol. 23: 193-216 (in russian)

Baranenkova, A. S., 1974. Long-term fluctuations in abundance of fish eggs and larvae in the Barents Sea. . The PINRO Proceedings on fisheries research in the North. No. 21: 93-100. (in russian)

Barnston, A.G., and Livezey, R.E., 1987. Classification, seasonality and persistence of low-frequency atmospheric circulation patterns. Monthly Weather Review, 115: 1083-1126

Baxter, J. G. 1971. Developmental rates and mortalities in Clyde herring eggs. Rapp. Et proc.-verb. Reun. Cons. Perm. Intern. Explor. Mer., vol. 160: 27-29.

Beverton, R. J. and Holt, S. J. 1957. On the dynamics of exploited fish populations. Fisheries Investigation Series 2, vol. 19. UK Ministry of Agriculture, Food and Fisheries

Bondarenko, M.V., Borisov, V.M., A. Krovnin, N.V.Klovach, and G.V. Mury, 2001. Large-scale fluctuations of stocks in marine animals subjected to commercial fishery. The VNIRO Information Bull. No. 2 "World Ocean Living Resources Exploitation": 87-94. (in russian)

Borisov V.M., 1976. Results of the application of P.V. Tyurin's metod for the determination of natural mortality in the Arctic-Norwegian cod Gadus morhua morhua. Journal of Ichtiology, 16 (5) : 805-813 (in russian).

Borisov, V.M., Bondarenko, M.V. and A. Krovnin, 2001. To the problem of the stock management of north-east Arctic cod(Gadus morhua). ICES ASC 2001/V: 02, 12pp.

Bunn, N. A.,Fox, D.J. and T. Webb, 2000. A literaature review of studies on fish egg mortality: implications for the estimation of spawning stock biomass by the annual egg production method. Sci. Ser., Tech. Rep.,CEFAS, Lowestoft, (111), 37pp.

Chambers C. and E. A Trippel, 1997. Early Life History and Recruitment in Fish Populations.

Ciachomski, J. D., Capezani, D. A., 1973. Studies on the evalution of the spawning stocks of the Argentinean anchovy (Engraulis anchoita) on the basis of egg survey. Rapp. et Proc.-Verb. Reun. Cons. Perm. Intern. Explor. Mer., vol. 164: 203-301.

Cushing, D. H. 1971. The dependence of recruitment on parent stock in different groups of fishes. Journal du Conseil International pour l'Exploration de la Mer. 33: 340-362.

Daan, N., 1981. Comparison of estimates of egg production of the Southern Bight cod stock from plankton surveys and market statistics.Rapp. P.-v. Reun. Cons.int Explor. Mer, 172: 39-57.

Dragesund, D., Nakken O., 1973. Relationship of parent stock size and year-class strength in Norwegian spring spawning herring. Rapp. et Proc.-Verb. Reun. Cons. Perm. Intern. Explor. Mer., vol. 164: 15-2

Dragesung, G., 1971. Comparative analysis of yearclass strength among fish stocks in the North Atlantic. Fisk. Dir. Skr. Ser., Hav. Undersokelser. 16: 49-64.

Dushkina L.A., 1988. Marine Herrings Early Life History, 192pp.(in russian)

Frank, K. T. and D.Brickman, 2001. Contemporary issues confronting fisheries science. J. Sea Research: 173-187.

Gilbert, D.J.,1997. Towards a new recruitment paradigm for fish stocks. Can. J. Fish.Aquat. Sci. 54: 969-977.

Gjosaetre, J., Saetre, R., 1974. The use of data on eggs and larvae for estimating spawning stock of fish populations with demersal eggs. In: (J.H.S. Blaxter, ed.) The Early Life History of Fish. : 139-149.

Heath, M. R. 1992. Field investigations on the early life stages of marine fish. Anvances in Marine Biology, 28: 1-174.

Hjort, J., 1914. Fluctuations in the great fisheries of northern Europe viewed in the light of biological research. Rapp. P.-v. Reun. Cons. Int. Explor. Mer, 20; 1-228

Hurrell, J.W. 1995. Decadal trends in the North Atlantic Oscillation, regional temperatures and precipitation. Science, 269, 676-679.

Kawasaki, T (1983). Why do some pelagic fishes have wide fluctuations in their number? Biological basis of fluctuation from the viewpoint of evolutionary ecology. In: G. D. Sharp and J. Csirke (Eds.). Reports of the Expert Consultation to Examine Changes in Abundance and Species Composition of Neritic Fish resources. FAO Fisheries Report, 291, 1065-1080.

Kiseleva, V.M, 2001. Population fecundity of the Barents Sea cod in 1990's. Arctic Fisheries Working Group, Working Document.

Klyashtorin, L.B. 2001. Climate change and long-term fluctuations of commercial catches. The possibility of forecasting. FAO Fisheries Technical paper, 410, 86 p.

Krovnin, A.S. 1995. A. Comparative study of climatic changes in the North Pacific and North Atlantic and their relation to the abundance of fish stocks. In: R.J. Beamish (ed.). Climate change and northern fish populations. Can. Spec. Publ. Aquat. Fish. Sci., 121, p.181-198.

Legget, W.C. and E. DeBlois, 1994. Recruitment in marine fishes: Is it regulated by starvation and predation in the egg and larval stages? Neth.J. Sea Res., 32: 119-134.

Lluch-Belda, D., Crawford, R.J.M., Kawasaki, T., MacCall, A.D., Parrish, R.H., Schwartzlose, R.A., and Smith, P. 1989. World-wide fluctuations of sardine and anchovy stocks: the regime problem. South African Journal of Marine Science, 8, 195-205.

Maguire, J. J. and P. A. Mace, 1993. Biological reference points for Canadian Atlantic gadoid stocks. In: (Smith J. S., J.J. Hunt and D. Rivard, eds.) Risk Evaluation and Biological Reference Points for Fisheries Management. Canadian Special Publication of Fish. Aquatic Sci. 120: 321-331.

Marshall C.T., O.Kjesbu, N.Yaragina, P. Solemdal and O. Ulltang, 1998. Is spawner biomass a sensitive measure of the reproductive and recruitment potentials of Northeast Arctic cod? Can. J. Fish. Aquat. Sci. 55:1766-1783

Marshall, J., Kushnir, Y., Battisti, D., Chang, P., Hurrel, J., McCartney, M, and Visbeck, M. 1997. A White Paper on Atlantic Climate Variability. http://geoid.mit.edu/accp/avehtml.html

Maslov, N. A., 1957. On the precision of long term predictions of the state of stocks of cod and haddock Transactions of the Knipovich Polar Institute of sea-fisheries and oceanography (PINRO), v. 10, : 30-53 (in russian).

Marty, Yu.Yu., 1956. Basic stages of the atlanto-scandian herring life cycle.Transactions of the Knipovich Polar Institute of sea-fisheries and oceanography (PINRO), v. 9: 5-61.(in Russian)

May, R. C. 1974. Larval mortality in marine fishes and the critical period concept. In: (J.H.S. Blaxter, ed.) The Early Life History of Fish. : 3-19.

Miller, R.J. 1990. Properties of a well-managed nearshore fishery. Fisheries 15:7-12.

Moller, H., 1980. Scyphomedusae as predators and food competitors of larval fish. Ber. Dt.Wiss. Kommiss. Meeresforsch., Bd. 28, H.2/3, S. 90-100.

Mukhin, A. I., Dvinina, E. A., 1982. Long-term fluctuation of temperature and salinity in spring-summer season in the area of the Norwegian-Barents Sea border. The PINRO Collection of Scientific Papers on Ecology and Fisheries. : 137-148. (in russian)

Nizovtsev, G.P, 1989. Recommendations on the rational exploitation of the Norwegean-Barents Sea Greenland halibut. Murmansk, PINRO: 1-98. (in russian)

O'Boyle, R. 1993. Fisheries management organizations: a study of uncertainty. In: (Smith J. S., J.J. Hunt and D. Rivard, eds) Risk Evaluation and Biological Reference Points for Fisheries Management. Canadian Special publication of Fish. Aquatic Sci. 120:

Paulik, G. J. 1973. Studies of the possible form of the stock and recruitment curve. Rapp. Proc.-ver. Reun. Cons. Int. Explor. Mer, 164: 302-315.

Pearcy, W. G., 1962. Ecology of an estuariane population of winter flounder, Pseudopleuronectes americanus (Walbaum). Bull.Bingham Oceanogr. Coll. Yale Univ., vol.18: 1-78

Ponomarenko, I.Ya, 1984 Survival of bottom-dwelling young cod in the Barents Sea and the factors determining it. Contribution to the PINRO/HI-symposium in Leningrad, September 1983.

Purcell, J.E., 1989. Predation on fish eggs and larvae by hyddromedusa Aequorea victoria at a herring spawning ground in British Columbia. Can. J. Fish. Aquat. Sci., 46:1416-1427.

Randa, K., 1983. Abundance and distribution of 0-group Arcto-Norwegian cod and haddock 1965-1982. Contribution to the PINRO/HI-symposium in Leningrad, September 1983.

Rannak, L., 1971. On recuitment to the stock of spring spawning hering in the North-eastern Baltic.Rapp. et Proc.-Verb. Reun. Cons.Perm. Intern. Explor. Mer., vol. 160: 76-82

Ricker, W. E, 1958. Handbook of computations for biological statistics of fish populations. Bull.Fish. Res.Voard Canada. Vol.119: 1-300.

Ricker, W. E. 1954. Stock and recruitment Journal of the Fishtries Rsearch Board of Canada, 11: 559-623

Riley, J.K., 1974. The distribution and mortality of sole eggs (Solea solea L.) in inshore areeas.In: (J.H.S. Blaxter, ed.) The Early Life History of Fish. : 30-52.

Rollefsen, G., 1952. Beretning 1950-1952 fra Fiskeridirekroratets Havforskiningsinstitutt. Arsberetn. Norg. Fisk. (6): 1-108

Rollefsen, G., 1954. Observations on the cod and cod fisheries of Lofoten. Rapp.- Proc.-Verb. Cons. Int. Explor. Mer., v. 136: 40-47

Rotschild, B.J.,2000. “Fish stocks and recruitment”:the past thirty years. ICES J. Marine Science, 57: 191-201.

Saetersdal , G. and H. Loeng, 1984.Ecological adaptation of reproduction in Arctic cod. Contribution to the PINRO/HI-symposium in Leningrad, September 1983.

Saetersdal, G. and Hylen, A., 1959. Skreiundersokelsene og skreifisket i 1959. Fisken Hav. (1): 1-20.

Seliverstov, A. S., 1968. The herring larvae speed and direction in the area of the Norwegian Shoals in 1968. The PINRO Proceedings on fisheries research in the North. No. 16, part 1: 240-253 (in russian)

Seliverstov, A. S., 1974. Impact of ambient abiotic factors on year-classes abaundance in atlanto-scandian herring. Abstracts of Contributions to the All-Union Conference on Early Life History of Fish held in Murmansk in 1974: 193-196. (in russian)

Seliverstova, E.A, 1990. Spawning stock structure and population fecundity of atlanto-scandian herring. In: Proceedings of the Fourth Soviet-Norwegian Symposium “Biology and Fishery of Norwegian Spring-spawning Herring and Blue Whiting in the North-east Atlantic”. Murmansk : 61-121.

Serebryakov, V. P., V. M. Borisov and V. K. Aldonov. 1984. Population fecundity and bundance of year-classes of the Arcto-Norwegian cod. Contribution to the PINRO/HI-symposium in Leningrad, September 1983.

Serebryakov, V.P. 1990. Population fecundity and reproductive capacity of some food fishes in relation to year-class strength fluctuations. J. Con. Int. Explor. Mer 47: 267-272.

Serebryakov, V.P. 1991. Prediction of year-class strength under uncertainties related to survival in early life history of some Nortn Atlantic commercial fish. NAFO SCR Doc.90/115.

Serebryakov,V. P. 1992. Spawning Stock, Population Fecundity and year class strength of Greenland halibut (Reinhardtius hippoglossoides) in the Northwest Atlantic,1969-88. J. Northw. Atl. Fish. Sci., vol. 14: 107-113.

Sharp, G. D., 1980. Report of the Workshop on Effects of Environmental Variation on Survival of Larval Pelagic Fishes. In: IOC Workshop Report No. 28. : 15-61.

Shepherd, J. G., 1982. A versatile new stock-recruiment relationship of fisheries and construction of sustainable yeld curves. J.Cons, Int. Explor. Mer. 40: 67-75

Sissenwine, M. P. and J. G. Shephard, 1988. An alternative perspective on recruitment overfishing and biological reference points.Can.J. Fish Aquat. Sci. 44: 913-918.

Soin, S.G., 1971.Ecological and morphological pecularities of the development of two forms of White Sea herring (Clupea harengus harengus maris alba Berg). Rapp. et Proc.-Verb. Reun. Cons perm. Intern. Explor. Mer.Vol. 160: 42-45

Solemdal, P., 1997. Maternal effects – a link between the past and the future. J. Sea Res., 37: 213-227.

Sund, O., 1920. Undersokelser over torskefiskene. Arsberetn. Norg. Fisk. : 46-50

Sund, O., 1926. Torskebestanden in 1926.Arsberetn. Norg. Fisk. (1): 113-121

Sund, O.,1936. The fluctuations in the European stocks of cod. Rapp. Proc.- Verb. Cons. Int. Explor. Mer. V.CI

Sundby, S., 1996. Turbulence and ichthyoplankon: influence on vertical distributions and encounter rates. Sci. Mar., 61: 159-176.

Trippel E. A., O. Kjesbu and P. Solemldal, 1997. Effects of adult age and size structure on reproductive output in marine fishes. In: (Chambers E. and E. A Trippel eds) Early Life History and Recruitment in Fish Populations.: 31-61.

Walters, C. J, and D. Ludwig.1981. Effects of measurement errors on the assessment of stock-recruitment relationships. Can. .J. Fish. Aquat. Sci. 38: 704-710.

Ward, J. H. Jnr. 1963. Hierarchical grouping to optimise an objective function. Journ.Amer. Statist. Assoc., 58 : 236-244.

Yudanov, I. G., 1964. Assessment of of the atlanto-scandian herring year classess abundance. The PINRO Proceedings on Fisheries Research in the North. No. 2: 6-9. (in russian)

Yudanov, I. G., 1966. Atlanto-scandian herring spawning efficiancy and the classes abundance in 1964-1965. The PINRO Proceedings on fisheries research in the North. No. 7: 5-18.

Table 1. Classification of year-classes abundance and survival ideces (SI) in four food fishes of the Barents and Norwegian Seas by means of traditional mode and cluster analysis.

Species	**Year-class strength*, in millions.**			**Survival conditions expressed as SI per million of eggs**		
Type of grouping	**weak**	**average**	**strong**	**Unfavour-able**	**Moderate**	**Favourable**
Norwegian spring spawning herring						
Traditional	< 2000	2000-10000	> 10000	< 3.0	3.0-18.0	>20.0
Cluster analysis	< 4272	4272-12246	> 12246	< 16.0	16.0-61.0	>61.0
North-east Arctic cod						
Traditional	< 400	400-900	> 900	< 2.5	2,5-10.0	>10.0
Cluster analysis	< 420	420-860	> 860	< 5.0	5.0-9.5	>9.5
North-east Arctic haddock						
Traditional	< 150	150-400	> 400	< 1.5	1.5-11.0	>11.0
Cluster analysis	< 218	218-424	> 424	< 4.6	4.6-13,6	>13.6
Greenland halibut						
Traditional	< 20	20-35	> 35	< 70.0	70.0-110.0	>110.0
Cluster analysis	< 16	16-29	> 29	< 57.0	57.0-142.0	>142.0

* Three years old were used in case of herring, cod and haddock and five years old in case of halibut

Table 2. Significance of differences between arithmetical means (Student's t-test) in year classes and survival indeces classified by means of traditional mode and by means of cluster analysis, with P = 0.05.

	Year class strength groups			**Survival conditions groups**		
Species	**Recruits****	**SI of PF**	**SI of SSB**	**Recruits****	**SI of PF**	**SI of SSB**
	Weak year classes			**Unfavourable conditions**		
Norwegian spring spawning herring	3.10	0.58*	0.55*	3.63	3.47	4.5
North-east Arctic cod	0.58*	0.35*	0.37*	0.95*	1.44*	3.32
North-east Arctic haddock	1.62*	0.91*	1.42*	9.90	3.40	2.97
Greenland halbut	5.70	0.55*	0.35*	0.32*	0.47*	1.03
	Average year classes			**Moderate conditions**		
Norwegian spring spawning herring	3.45	0.56*	1.31*	4.50	10.35	9.75
North-east Arctic cod	0.39*	0.08*	0.04*	1.34*	3.63	3.68
North-east Arctic haddock	1.80*	0.90*	0.50*	2.09*	3.77	3.20
Greenland halbut	4.30	1.69*	1.84*	0.02*	1.05*	1.06*
	Strong year classes			**Favourable conditions**		
Norwegian spring spawning herring	0.71*	0.11*	0.08*	1.05*	1.66*	1.78*
North-east Arctic cod	*	*	*	*	*	*
North-east Arctic haddock	*	*	*	0.33*	0.51*	0.54*
Greenland halbut	1.12*	1.20*	1.04*	0.22*	1.25*	1.90*

* - statistically insignificant
** - three year olds for herring, cod and haddock and five year olds for Greenland halibut

Table 3. Reproductive parameters of Norwegian spring spawning herring in 1907 - 1999

	Mean	**Max**	**Min**
Population parameters			
Spawning stock biomass (SSB, $*10^3$t)	6066.57	15832.24	1.85
Population fecundity (PF) ($eggs*10^{12}$)	829.57	2122.67	0.33
Three year olds abundance ($*10^6$)	6923.83	47045.80	0.93
Survival index (per million of eggs)	19.40	451.31	0.09
Survival index (per 1t SSB)	2284.00	43082.21	13.82

Way of grouping :	**traditional**			**clusterig**		
	Mean	**Max**	**Min**	**Mean**	**Max**	**Min**
Year classes strength classified by abunance of three year olds ($* 10^6$)						
Strong	19531.13	47045.80	10338.20	21595.96	47045.80	13118.50
Average	5295.46	9594.40	2076.01	7131.86	11373.10	4607.10
Weak	484.52	1976.80	0.93	1242.34	3937.60	0.93
Survival index (per million of eggs)						
Strong	44.55	451.31	5.44	48.35	451.31	7.41
Average	9.14	91.51	1.94	14.25	91.50	2.27
Weak	15.60	127.59	0.09	11.99	127.58	0.09
Survival index (per 1t SSB)						
Strong	5211.97	43082.21	743.08	5493.76	43082.21	973.95
Average	1173.49	10416.64	261.98	1873.26	12865.66	310.09
Weak	1733.49	13135.14	13.82	1345.26	13135.14	13.82
Survival conditions classified by survival index (per million of eggs)						
Favourable	68.19	451.31	20.23	152.49	451.31	72.79
Moderate	8.72	19.41	3.16	28.27	49.86	16.60
Unfavourable	1.34	2.98	0.09	4.97	15.03	0.09
Survival conditions classified by survival index (per 1t SSB)						
Favourable	7698.12	43082.21	2102.54	16248.05	43082.21	6596.44
Moderate	1164.08	2780.37	399.00	3601.71	5752.93	1980.88
Unfavourable	176.65	395.46	13.82	659.81	2044.10	13.82

Table 4. Reproductive capacity levels in four species of food fishes in the Barents and Norwegian Seas, calculated traditionally and by means of clustering.

Norwegian spring spawning herring

Way of grouping :	traditional			clustering		
Levels	Safe	Minimal acceptable	Critical	Safe	Minimal acceptable	Critical
Population fecundity (eggs*10^{12})	1093.77	218.75	22.16 81.02*	859.23	299.74	27.13 102.80*
Spawning stock biomass (thousand tonns)	8521.74	1704.35	232.11 803.50*	6537.27	2280.52	284.25 998.70*

* the second highest survival index was used as in 1983 it was unbelievably high.

North-east Arctic cod

Population fecundity (eggs*10^{12})	168.84	75.04	35.60	163.60	79.90	34.02
Spawning stock biomass (thousand tonns)	518.20	230.31	111.07	498.96	243.68	106.14

North-east Arctic haddock

Population fecundity (eggs*10^{12})	50.56	18.96	10.58	47.23	24.28	11.22
Spawning stock biomass (thousand tonns)	168.35	63.13	43.01	165.61	85.15	45.60

Table 4 continued.
Greenland halibut

Population fecundity (eggs*10^{12})	0.47	0.27	0.12	0.24	0.14	0.10
Spawning stock biomass (thousand tonns)	104.25	59.57	27.80	56.09	30.94	23.03

Table 5. Reproductive parameters of North-east Arctic cod in 1946 – 2002

	Mean	Max	Min
Population parameters			
Spawning stock biomass (SSB, $*10^3$t)	373.9498	1165.0590	102.3150
Population fecundity (PF) (eggs$*10^{12}$)	132.9944	651.3163	32.7118
Three year olds abundance ($*10^6$)	564.6569	1818.9490	112.0390
Survival index (per million of eggs)	6.18	25.28	0.78
Survival index (per 1t SSB)	1983.94	8102.87	346.26

Way of grouping :	**traditional**			**clusterig**		
	Mean	**Max**	**Min**	**Mean**	**Max**	**Min**
Year classes strength classified by abunance of three year olds ($* 10^6$)						
Strong	1269.490	1818.950	916.840	1269.490	1818.950	916.840
Average	580.300	804.780	404.770	594.210	804.780	439.600
Weak	226.370	397.410	112.040	242.740	408.090	112.040
Survival index (per million of eggs)						
Strong	14.12	25.28	1.94	14.12	25.28	1.94
Average	5.33	14.43	0.78	5.26	14.43	0.78
Weak	3.75	8.49	1.31	3.97	8.49	1.31
Survival index (per 1t SSB)						
Strong	4683.07	8102.87	1063.43	4683.07	8102.87	1063.43
Average	1736.77	4495.52	420.88	1723.59	4495.52	420.88
Weak	1102.99	2380.79	346.26	1175.60	2380.79	353.38
Survival conditions classified by survival index (per million of eggs)						
Favourable	16.94	25.28	10.57	16.94	25.28	10.57
Moderate	4.74	8.49	2.51	6.40	8.49	5.16
Unfavourable	1.50	2.09	0.45	3.05	4.81	0.78
Survival conditions classified by survival index (per 1t SSB)						
Favourable	5419.25	8102.87	2839.78	5419.25	8102.87	2839.78
Moderate	1511.39	2584.55	767.91	2058.70	2584.55	1603.96
Unfavourable	543.82	1063.43	221.01	982.71	1684.06	346.26

Table 6. Reproductive parameters of North-east Arctic haddock in 1950 – 2002

	Mean	**Max**	**Min**
Population parameters			
Spawning stock biomass (SSB, $*10^3$t)	112.375	232.810	34.560
Population fecundity (PF) (eggs$*10^{12}$)	32.495	85.083	7.402
Three year olds abundance ($*10^6$)	182.216	1023.250	4.810
Survival index (per million of eggs)	6.15	37.80	0.31
Survival index (per 1t SSB)	1800.06	9299.11	63.28

Way of grouping :	**traditional**			**clusterig**		
	Mean	**Max**	**Min**	**Mean**	**Max**	**Min**
Year classes strength classified by abunance of three year olds ($* 10^6$)						
Strong	798.540	1023.250	524.960	798.540	1023.250	524.980
Average	241.690	322.650	164.310	270.350	322.650	237.490
Weak	58.240	135.430	4.810	79.040	199.000	4.810
Survival index (per million of eggs)						
Strong	26.46	37.80	17.98	26.46	37.80	17.98
Average	7.91	15.09	3.10	8.98	15.09	3.79
Weak	2.19	9.94	0.31	2.78	10.02	0.31
Survival index (per 1t SSB))						
Strong	7794.86	9299.11	6082.40	7794.86	9299.11	6082.40
Average	2376.00	4931.69	742.18	2560.20	4931.69	1275.10
Weak	595.86	1961.36	63.28	832.61	3661.45	63.28
Survival conditions classified by survival index (per million of eggs)						
Favourable	22.17	37.80	12.13	24.18	37.80	15.09
Moderate	5.22	10.81	1.58	8.55	12.13	5.00
Unfavourable	0.76	1.33	0.31	2.00	4.23	0.31
Survival conditions classified by survival index (per 1t SSB)						
Favourable	6420.63	9299.11	2412.63	7222.23	9299.11	4931.69
Moderate	1536.83	3661.45	306.29	2430.18	3661.45	1157.38
Unfavourable	235.63	455.52	63.28	600.30	1385.89	63.28

Table 7. Reproductive parameters of Greenland halibut in 1964 – 2002

	Mean	Max	Min
Population parameters			
Spawning stock biomass (SSB, $*10^3$t)	47.736	139.620	14.095
Population fecundity (PF) (eggs$*10^{12}$)	0.217	0.652	0.054
Three year olds abundance ($*10^6$)	20.886	55.930	10.490
Survival index (per million of eggs)	129.77	300.05	34.57
Survival index (per 1t SSB)	558.24	1258.97	161.44

Way of grouping :	**traditional**			**clusterig**		
	Mean	**Max**	**Min**	**Mean**	**Max**	**Min**
Year classes strength classified by abunance of five year olds (* 10^6)						
Strong	48.521	55.930	41.112	38.640	55.930	31.060
Average	25.539	33.550	20.590	19.744	26.640	16.280
Weak	16.644	19.930	10.490	13.813	15.170	10.490
Survival index (per million of eggs)						
Strong	143.75	164.23	123.27	109.52	164.23	71.67
Average	74.52	132.33	34.57	118.46	300.05	34.57
Weak	151.63	300.05	45.19	168.67	266.18	74.42
Survival index (per 1t SSB)						
Strong	681.78	769.92	593.64	520.69	769.92	342.36
Average	335.73	536.55	161.44	517.06	1259.00	161.44
Weak	640.66	1259.00	215.26	679.76	1015.30	310.68
Survival conditions classified by survival index (per million of eggs)						
Favourable	179.15	300.05	110.82	219.29	300.05	151.28
Moderate	88.72	105.99	71.67	101.24	132.33	59.80
Unfavourable	47.38	59.80	34.57	45.60	53.56	34.57
Survival conditions classified by survival index (per 1t SSB)						
Favourable	756.93	1258.97	477.22	908.24	1258.97	696.97
Moderate	396.39	505.33	310.68	452.72	593.64	285.23
Unfavourable	223.37	285.23	161.44	214.53	249.68	161.44

Table 8. Role of population fecundity (PF), spawning stock biomass (SSB) and survival conditions (SI) in formation year classes strength in four species of food fishes in the Barents and Norwegian Seas, measured by means of one way variance analysis (%).

Species	PF	SSB	SI	
			traditional	**clustering**
Norwegian spring spawning herring	11,3	11,0	25,6	31,4
North-east Arctic cod	2,2*	1,1*	35,1	40,1
North-east Arctic haddock	8,2*	2,2*	63,7	73,5
Greenland halibut	44,5	43,2	0,4	1,4

* - statistically nonsignificant

Table 9. Role (%) of population fecundity (PF), spawning stock biomass (SSB) in formation year classes strength in four species of food fishes in the Barents and Norwegian Seas under three types of survival conditions defined traditionally and by clustering, measured by means of one way variance analysis.

Classification :	**traditional**		**clustering**	
	PF	**SSB**	**PF**	**SSB**
Norwegian spring spawning herring				
Favourable conditions	71.8	71.8	20.9	19.6
Moderate conditions	23.6	21.7	79.2	79.2
Unfavourable conditions	73.2	77.2	58.1*	58.1*
North-east Arctic cod				
Favourable conditions	75.6	74.2	66.9	37.2
Moderate conditions	70.1	47.2	91.9	91.9
Unfavourable conditions	6.4 *	16.3 *	6.4 *	16.3 *
North-east Arctic haddock				
Favourable conditions	71.4	44.2 *	39.3	34
Moderate conditions	11.2 *	1.6*	65.4	50.1
Unfavourable conditions	83.2*	89.8	85.8 *	85.8*
Greenland halibut				
Favourable conditions	53.8*	53.8 *	43.3 *	43.3 *
Moderate conditions	89.4	89.4	59.5	59.5
Unfavourable conditions	92.1	92.1	98.9	98.9

* - nonreliable statistically.

Table 10. Relationship between recruitment (3-years old) and spawning stock (population fecundity – PF, spawning stock biomass – SSB) described by regression equations in four species of food fishes in the Barents and Norwegian Seas under three types of ambient survival conditions classified traditionally (T) and by means of clustering (K)

Norwegian spring spawning herring

3-years old / PF			**3-years old / SSB**		
Unfavourable conditions					
$y = 0.8189x^{1.0113}$		T (9)	$y = 0.0941x^{1.0295}$		T (10)
$R^2 = 0.756$			$R^2 = 0.7796$		
Standard error	1083.04		Standard error	1078.24	
N	28.00		N	28.00	
Moderate conditions					
$y = 40.922x^{0.925}$		K (11)	$y = 3.673x^{0.9892}$		K (12)
$R^2 = 0.9591$			$R^2 = 0.9481$		
Standard error	6138.21		Standard error	6116.77	
N	19.00		N	19.00	
Favourable conditions					
$y = 86.458x^{0.862}$		T (13)	$y = 11.673x^{0.8888}$		T (14)
$R^2 = 0.8929$			$R^2 = 0.895$		
Standard error	6649.87		Standard error	6566.60	
N	20.00		N	20.00	

North-east Arctic cod

Unfavourable conditions					
$y = 5.03x^{0.7662}$		T (15)	$y = 90.659e^{0.0018x}$		T (17)
$R^2 = 0.8749$			$R^2 = 0.7987$		
Standard error	9.00		Standard error	9.00	
N	184.98		N	220.07	
$y = 17.146x^{0.6182}$		K (16)			
$R^2 = 0.6541$					
Standard error	32.00				
N	190.75				
Moderate conditions					
$y = 10.898x^{0.8031}$		T (18)	$y = 201.87e^{0.0034x}$		K (20)
$R^2 = 0.7137$			$R^2 = 0.9017$		
Standard error	38.00		Standard error	15.00	
N	169.08		N	112.16	
$y = 4.8769x + 119.08$		K (19)			
$R^2 = 0.9549$					
Standard error	15.00				
N	70.19				

Table 10 (continued)

3-years old / PF			3-years old / SSB		
North-east Arctic haddock					
Unfavourable conditions					
$y = -0.0048x2 + 1.5208x - 15.467$	T	(21)			
$R^2 = 0.769$					
Standard error	11.36				
N	12.00				
Moderate conditions					
$y = 6.8177x^{1.0618}$	K	(22)	$y = -0.0242x^2 + 6.3193x - 132.6$	K	(23)
$R^2 = 0.7749$			$R^2 = 0.7073$	0.77	
Standard error	50.57		Standard error	52.67	
N	16.00		N	16.00	
Favourable conditions					
			$y = 0.0789x^2 - 11.855x + 882.79$	T	(24)
			$R^2 = 0.6371$		
			Standard error	250.83	
			N	6.00	
Greenland halibut					
5-years old / PF			**5-years old / SSB**		
Moderate conditions					
$y = -251.07x^2 + 214.71x - 13.266$	T	(25)	$y = -0.0075x^2 + 1.2976x - 23.626$	T	(27)
$R^2 = 0.9474$			$R^2 = 0.9132$		
Standard error	3.27		Standard error	3.86	
N	8.00		N	8.00	
$y = 69.646x^{0.7792}$	K	(26)	$y = -0.004x^2 + 0.8273x - 7.7736$	K	(28)
$R^2 = 0.7001$			$R^2 = 0.6691$		
Standard error	4.87		Standard error	5.07	
N	17.00		N	17.00	
Favourable conditions					
$y = 482.18x^2 - 72.663x + 18.462$	T	29)	$y = 0.0129x^2 - 0.5236x + 20.976$	T	(31)
$R^2 = 0.9347$			$R^2 = 0.9532$		
Standard error	4.68		Standard error	4.79	
N	20.00		N	20.00	
$y = 451.68x^2 - 37.381x + 16.268$	K	(30)	$y = 0.7016x + 3.6091$	K	(32)
$R^2 = 0.9892$			$R^2 = 0.9620$		
Standard error	2.48		Standard error	2.36	
N	12.00		N	12.00	

Table 11 . Prognosis of the year classes strength under three types of survival conditions in four species of food fishes of the Barents and Norwegian Seas calculated by means of regression equations in Table 10.

Species	SSB th.t 2001г	Abundance of recruits in millions. Unfavourable conditions	Moderate conditions	Favourable conditions
Norwegian spring spawning herring	5217.729	632.03 ±1078.2	17472.61±6116.8	23511.48±6566.6
North-east Arctic cod	297.853	154.72±220.1	554.04±112.2	
North-east Arctic haddock	89.715	82.34±11.4	239.56±53	454.27±251
Greenland halibut	22.695		9.78±3.9	15.90±4.8

Table 12. Spawning stock biomass in four species of food fishes in the Barents and Norwegian Seas required to produce year classes of average strength under three types of survival conditions defined traditionally and by means of cluster analysis.

Classification :	traditional SSB $*10^3$ t	clustering SSB $*10^3$ t
Norwegian spring spawning herring		
Favourable conditions	687.890	438.936
Moderate conditions	4549.052	1980.132
Unfavourable conditions	29977.130	10808.960
North-east Arctic cod		
Favourable conditions	107.081	109.648
Moderate conditions	383.951	288.634
Unfavourable conditions	1067.081	604.658
North-east Arctic haddock		
Favourable conditions	37.643	37.433
Moderate conditions	157.265	111.247
Unfavourable conditions	1025.718	450.358
Greenland halibut		
Favourable conditions	33.742	21.732
Moderate conditions	64.431	43.603
Unfavourable conditions	114.339	92.015

Table 13. Loadings of the first 4 PC of the 44 physical and biological time series in the North Atlantic. The loadings are correlation coefficients between each time series and each PC score.

Time series	**PC1 21.40%**	**PC2 14.30%**	**PC3 9.50%**
Western Atlantic pattern (WA)	**0.62**	-0.28	-0.15
Eastern Atlantic pattern (EA)	**0.41**	-0.14	0.37
Eastern Atlantic-Jet Pattern (EA-JET)	-0.39	0.02	-0.06
Scandinavian pattern (SCA)	0.40	0.15	**0.48**
Winter NAO Index	**-0.90**	0.11	-0.30
SLP (Iceland)	**0.76**	-0.36	0.11
SLP (Gibraltar)	**-0.82**	0.06	-0.25
Arctic Oscillation (ARCTIC)	**-0.76**	0.33	-0.25
SST in Region a1 (Northeast Atlantic)	**-0.55**	**0.61**	0.31
SST in Region a2 (Southwest North Atlantic)	**-0.61**	0.07	0.15
SST in Region a3 (NW Atlantic)	**0.61**	-0.11	0.31
SST in Region a4 (Southeast North Atlantic)	0.21	**-0.52**	0.34
SST in Region a5 (Central North Atlantic)	**-0.51**	**-0.52**	0.16
SST in Region a6 (Newfoundland Region)	-0.40	0.28	**-0.43**
Tw (0-200 m) at Kola Section	**-0.57**	0.38	0.01
Herring Norwegian (ICES)	-0.33	0.38	0.23
Cod NE Arctic	**-0.53**	0.03	0.15
Haddock NE (ICES)	**-0.70**	0.05	0.30
Halibut NE (ICES)	**-0.47**	**-0.59**	-0.15
Cod in Region 4X (NAFO)	0.29	**0.42**	0.22
Cod in Region 4VW (NAFO)	0.11	0.06	**-0.76**
Cod in Region 7ek (ICES)	0.02	**-0.44**	-0.05
Cod in Region 6a (ICES)	-0.26	-0.07	0.16
Cod Faroes (ICES)	-0.10	-0.07	0.04
Cod Iceland(ICES)	-0.25	-0.29	-0.19
Cod Ireland (ICES)	0.22	-0.31	0.32
Cod in Region 3a+4+7d (ICES)	0.05	**-0.45**	-0.15
Haddock in Region 5Z (NAFO)	-0.17	0.52	-0.26
Haddock in Region 4X (NAFO)	0.15	**0.46**	**-0.51**
Haddock in Region 4VW (NAFO)	**0.44**	0.25	**-0.69**
Haddock in Region 6a (ICES)	-0.26	-0.06	0.16
Haddock Faroe (ICES)	-0.15	0.28	-0.35
Herring Celtic (ICES)	-0.02	**-0.69**	-0.35
Herring in Region 6aS+7bc (ICES)	0.30	-0.29	**-0.55**
Herring Iceland (ICES)	0.15	**0.54**	0.23
Herring Ireland (ICES)	**0.65**	0.01	**-0.45**
Herring North Sea (ICES)	0.36	**-0.44**	-0.15
Saithe in Region 4+3a (ICES)	**-0.52**	**-0.55**	0.23
Saithe NE (ICES)	**-0.62**	**-0.42**	0.02
Saithe in Region 5a (ICES)	-0.20	**-0.47**	-0.29
Saithe Faroe (ICES)	-0.34	**-0.70**	0.19
Sole in Region 7fg (ICES)	**-0.56**	**-0.47**	-0.10
Sole in Region 7e (ICES)	-0.22	**0.47**	-0.17
Whiting in Region 47d (ICES)	0.33	**0.60**	**0.47**

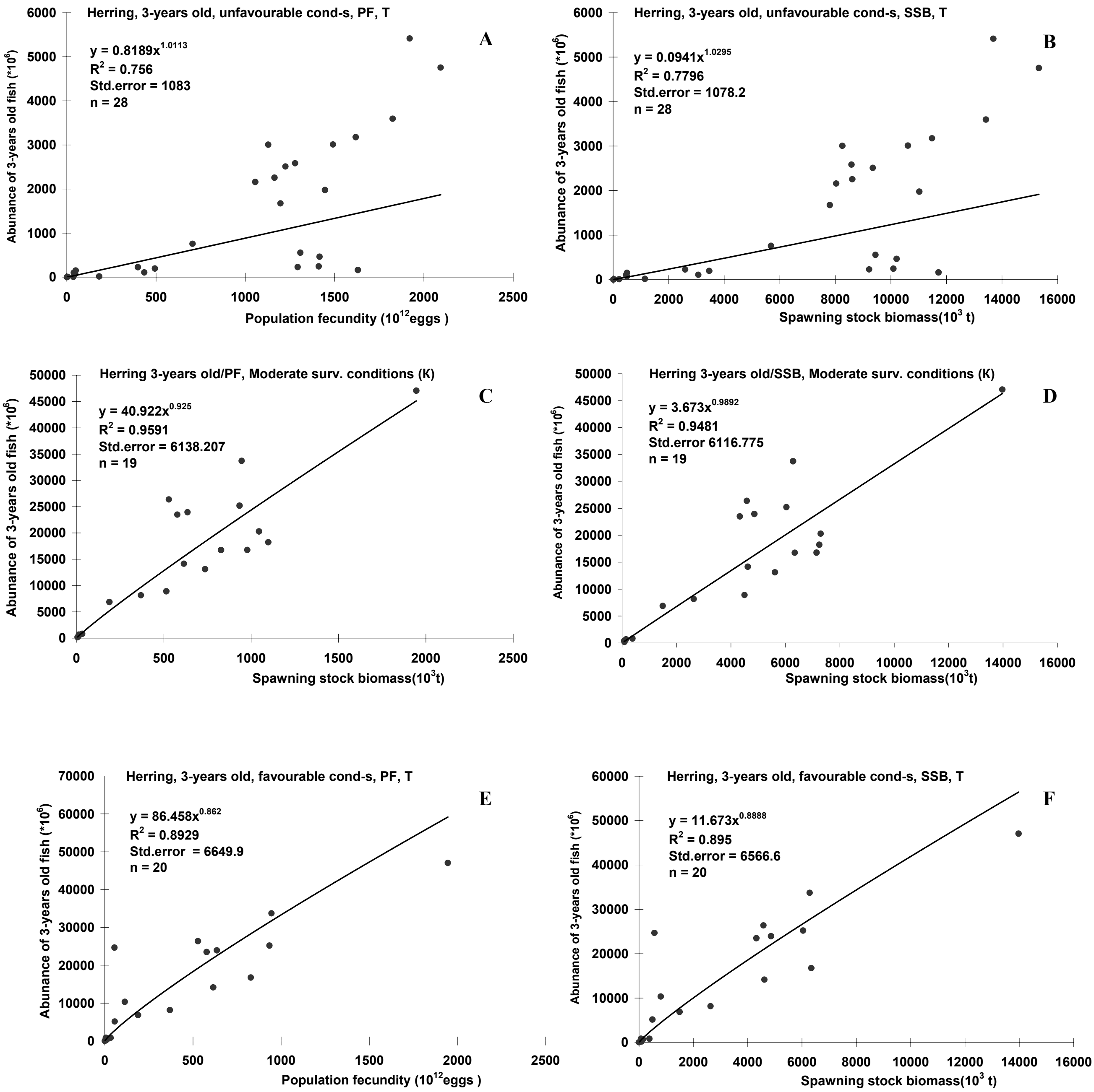

Figure 1. Norwegian spring spawning herring. Recruitment and stock plots with best fitting regression lines and equtions describing dependence of recruitment on spawning stock under three types of ambient survival conditions defined traditionally (T) and by means of cluster analysis (K): A and B – unfavourable conditions; C and D – moderate conditions; E and F – unfavourable conditions.

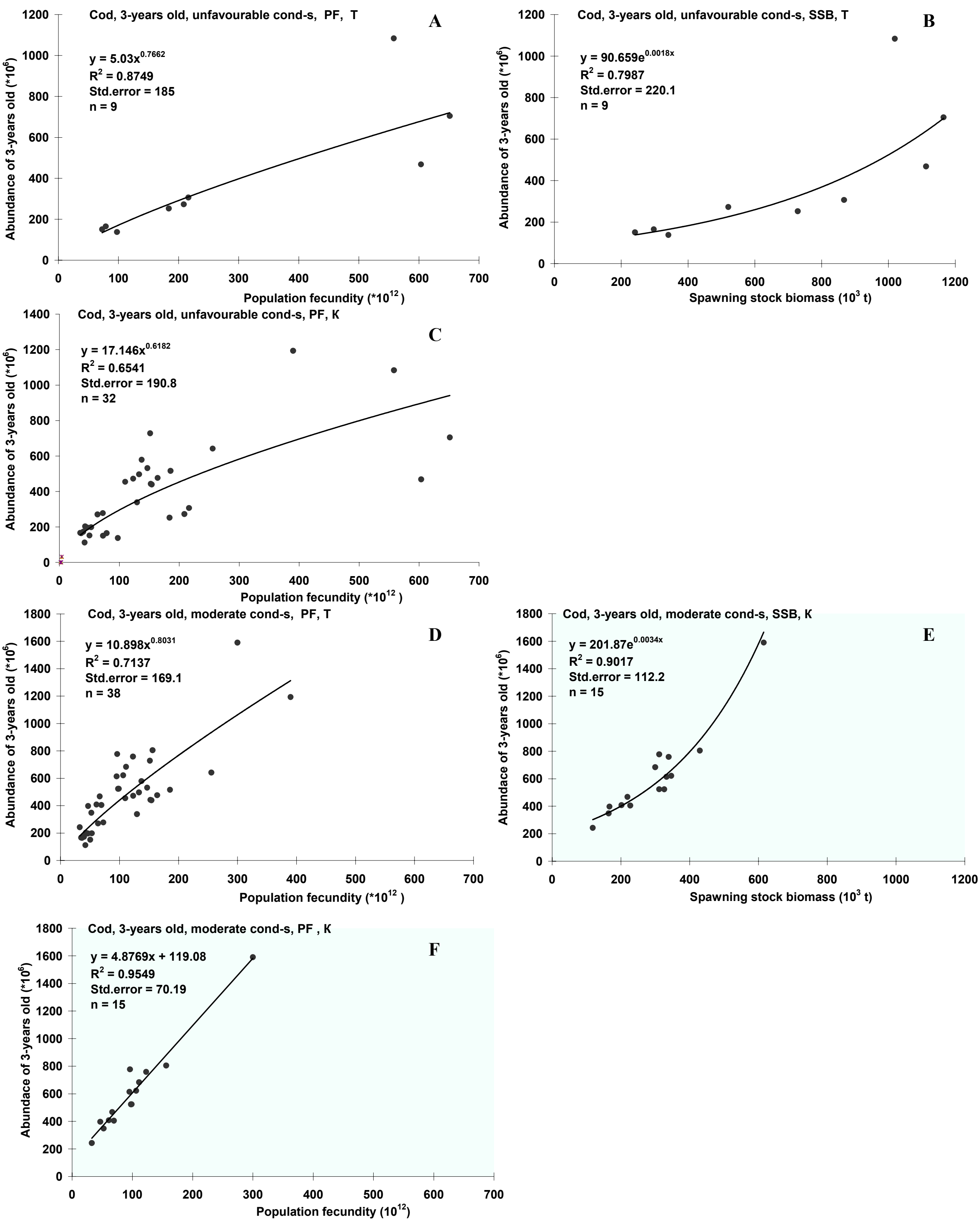

Figure 2. North-east Arctic cod. Recruitment and stock plots with best fitting regression lines and equations describing dependence of recruitment on spawning stock under two types of ambient survival conditions defined traditionally (T) and by means of cluster analysis (K):
A, B and C– unfavourable conditions; D, E and F – moderate conditions.

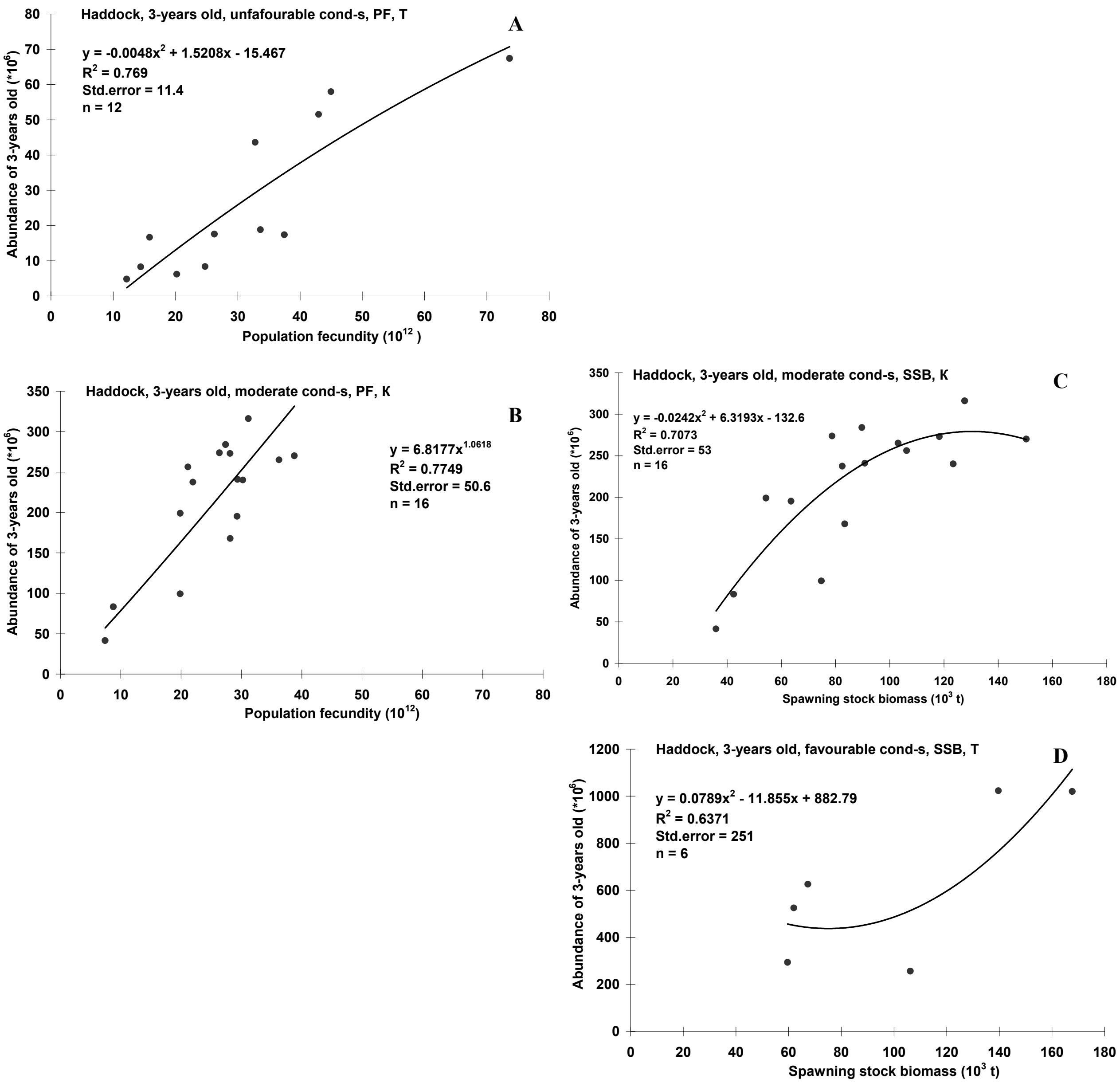

Figure 3. North-east Arctic haddock. Recruitment and stock plots with best fitting regression lines and equations describing dependence of recruitment on spawning stock under three types of ambient survival conditions defined traditionally (T) and by means of cluster analysis (K):
A– unfavourable conditions; B and C – moderate conditions, D – favourable conditions

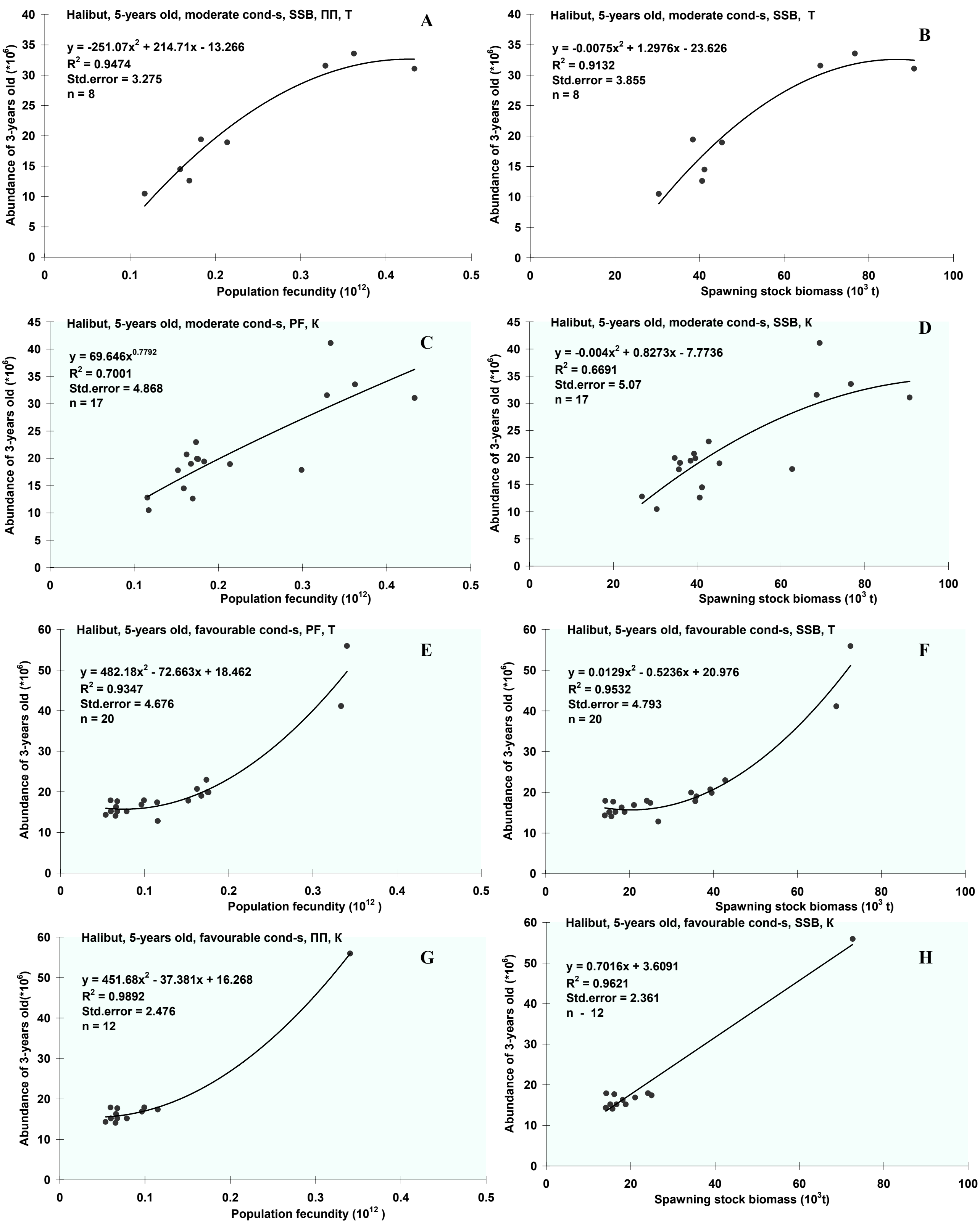

Figure 4. Greenland halibut of the Norwegian and Barents Seas. Recruitment and stock plots with best fitting regression lines and equtions describing dependence of recruitment on spawning stock under three types of ambient survival conditions defined traditionally (T) and by means of cluster analysis (K): A, B, C, D – moderate survival conditions, E, F, G, H – favourable survival conditions.

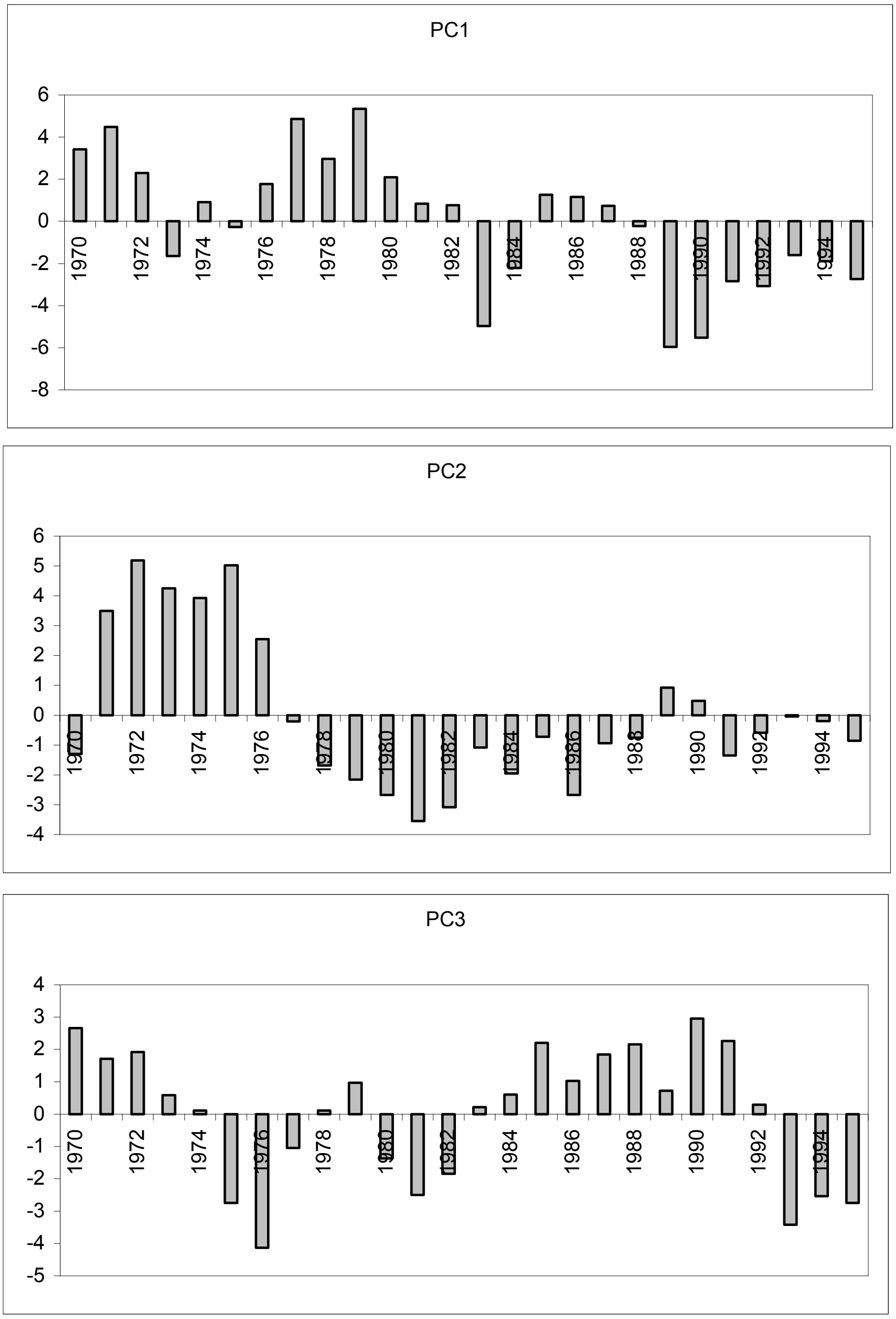

Fig 5. The First 3 principal components of 44 phyical and biological time series in the North Atlantic.

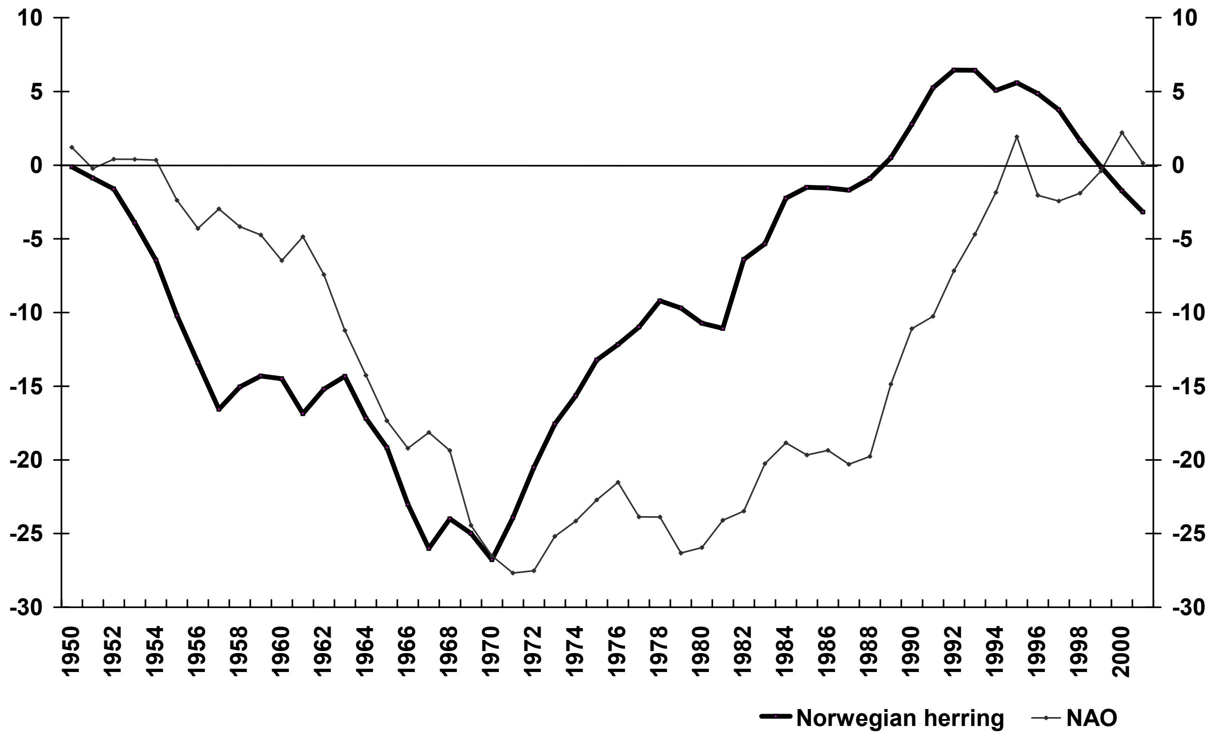

Fig 6. Cumulative sums of anomalies of winter (Dec-Feb) NAO index and survival index of Norwegian spring spawning herring.

APPENDIX

Tabl 1. Norwegian spring spawning herring. Population fecundity (PF) calculations

YEAR	Age	Individual fecundity (eggs*10^3)	Age group abundance (10^5)	Proportion of mature fish	Proportion of females	Age group contribution to PF (10^{12})
1	2	3	4	5	6	7
1907	3	41.5	286811	0.03	0.5	17.85
	4	44.9	18210	0.16	0.5	6.54
	5	54.6	6745	0.38	0.5	7.00
	6	66.4	6213	0.74	0.5	15.26
	7	70.7	4943	0.97	0.5	16.95
	8	83.2	6209	1	0.5	25.83
	9	86.7	1033	1	0.5	4.48
	10	88.9	1026	1	0.5	4.56
	11	92.2	703	1	0.5	3.24
	12	95.0	921	1	0.5	4.37
	13	92.1	923	1	0.5	4.25
	14	98.5	655	1	0.5	3.23
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		113.57
1908	3	41.5	165312	0.03	0.5	10.29
	4	44.9	242589	0.16	0.5	87.14
	5	54.6	14246	0.38	0.5	14.78
	6	66.4	4618	0.74	0.5	11.35
	7	70.7	4397	0.97	0.5	15.08
	8	83.2	3445	1	0.5	14.33
	9	86.7	4106	1	0.5	17.80
	10	88.9	671	1	0.5	2.98
	11	92.2	736	1	0.5	3.39
	12	95.0	496	1	0.5	2.36
	13	92.1	652	1	0.5	3.00
	14	98.5	736	1	0.5	3.62
	15	99.3	532	1	0.5	2.64
	16	99.3	0	1	0.5	0.00
				TOTAL:		188.76
1909	3	41.5	78618	0.03	0.5	4.89
	4	44.9	137712	0.16	0.5	49.47
	5	54.6	208004	0.38	0.5	215.78
	6	66.4	11782	0.74	0.5	28.95
	7	70.7	3430	0.97	0.5	11.76
	8	83.2	3215	1	0.5	13.37
	9	86.7	2517	1	0.5	10.91
	10	88.9	2873	1	0.5	12.77
	11	92.2	326	1	0.5	1.50
	12	95.0	446	1	0.5	2.12
	13	92.1	258	1	0.5	1.19
	14	98.5	413	1	0.5	2.03
	15	99.3	577	1	0.5	2.86
	16	99.3	0	1	0.5	0.00
				TOTAL:		357.62
1910	3	41.5	103382	0.03	0.5	6.44
	4	44.9	60516	0.16	0.5	21.74
	5	54.6	118504	0.38	0.5	122.94
	6	66.4	177086	0.74	0.5	435.06
	7	70.7	9607	0.97	0.5	32.94
	8	83.2	2750	1	0.5	11.44
	9	86.7	2530	1	0.5	10.97
	10	88.9	1866	1	0.5	8.29
	11	92.2	1821	1	0.5	8.39
	12	95.0	174	1	0.5	0.83
	13	92.1	281	1	0.5	1.29
	14	98.5	162	1	0.5	0.80
	15	99.3	270	1	0.5	1.34
	16	99.3	0	1	0.5	0.00
				TOTAL:		662.47
1911	3	41.5	68686	0.03	0.5	4.28
	4	44.9	84372	0.16	0.5	30.31
	5	54.6	51472	0.38	0.5	53.40
	6	66.4	101595	0.74	0.5	249.60
	7	70.7	150052	0.97	0.5	514.52
	8	83.2	7968	1	0.5	33.15
	9	86.7	2243	1	0.5	9.72
	10	88.9	1997	1	0.5	8.88
	11	92.2	1495	1	0.5	6.89
	12	95.0	1399	1	0.5	6.65
	13	92.1	114	1	0.5	0.52
	14	98.5	211	1	0.5	1.04
	15	99.3	126	1	0.5	0.63
	16	99.3	0	1	0.5	0.00
				TOTAL:		919.57
1912	3	41.5	35857	0.03	0.5	2.23
	4	44.9	55744	0.16	0.5	20.02
	5	54.6	72605	0.38	0.5	75.32
	6	66.4	44169	0.74	0.5	108.51
	7	70.7	86662	0.97	0.5	297.16
	8	83.2	126729	1	0.5	527.19
	9	86.7	6696	1	0.5	29.03
	10	88.9	1855	1	0.5	8.25
	11	92.2	1616	1	0.5	7.45
	12	95.0	1245	1	0.5	5.91
	13	92.1	1155	1	0.5	5.32
	14	98.5	91	1	0.5	0.45
	15	99.3	182	1	0.5	0.90
	16	99.3	0	1	0.5	0.00
				TOTAL:		1087.75

Continuation of Table 1.

1	2	3	4	5	6	7
1913	3	41.5	47272	0.03	0.5	2.94
	4	44.9	29796	0.16	0.5	10.70
	5	54.6	47942	0.38	0.5	49.74
	6	66.4	62398	0.74	0.5	153.30
	7	70.7	37838	0.97	0.5	129.74
	8	83.2	73957	1	0.5	307.66
	9	86.7	106893	1	0.5	463.38
	10	88.9	5487	1	0.5	24.39
	11	92.2	1507	1	0.5	6.95
	12	95.0	1279	1	0.5	6.08
	13	92.1	1023	1	0.5	4.71
	14	98.5	942	1	0.5	4.64
	15	99.3	71	1	0.5	0.35
	16	99.3	0	1	0.5	0.00
				TOTAL:		1164.58
1914	3	41.5	29104	0.03	0.5	1.81
	4	44.9	38997	0.16	0.5	14.01
	5	54.6	25567	0.38	0.5	26.52
	6	66.4	41089	0.74	0.5	100.95
	7	70.7	53422	0.97	0.5	183.18
	8	83.2	32434	1	0.5	134.93
	9	86.7	62984	1	0.5	273.04
	10	88.9	88043	1	0.5	391.35
	11	92.2	4493	1	0.5	20.71
	12	95.0	1104	1	0.5	5.24
	13	92.1	1047	1	0.5	4.82
	14	98.5	634	1	0.5	3.12
	15	99.3	811	1	0.5	4.03
	16	99.3	0	1	0.5	0.00
				TOTAL:		1163.71
1915	3	41.5	55938	0.03	0.5	3.48
	4	44.9	23919	0.16	0.5	8.59
	5	54.6	33432	0.38	0.5	34.68
	6	66.4	21800	0.74	0.5	53.56
	7	70.7	35021	0.97	0.5	120.09
	8	83.2	45721	1	0.5	190.20
	9	86.7	27596	1	0.5	119.63
	10	88.9	53347	1	0.5	237.13
	11	92.2	72740	1	0.5	335.33
	12	95.0	3559	1	0.5	16.91
	13	92.1	751	1	0.5	3.46
	14	98.5	708	1	0.5	3.49
	15	99.3	443	1	0.5	2.20
	16	99.3	0	1	0.5	0.00
				TOTAL:		1128.74
1916	3	41.5	46994	0.03	0.5	2.93
	4	44.9	47266	0.16	0.5	16.98
	5	54.6	20533	0.38	0.5	21.30
	6	66.4	28242	0.74	0.5	69.38
	7	70.7	18503	0.97	0.5	63.45
	8	83.2	29840	1	0.5	124.13
	9	86.7	39141	1	0.5	169.68
	10	88.9	23431	1	0.5	104.15
	11	92.2	45159	1	0.5	208.18
	12	95.0	59389	1	0.5	282.10
	13	92.1	2828	1	0.5	13.02
	14	98.5	586	1	0.5	2.89
	15	99.3	549	1	0.5	2.73
	16	99.3	0	1	0.5	0.00
				TOTAL:		1080.91

1	2	3	4	5	6	7
1917	3	41.5	22564	0.03	0.5	1.40
	4	44.9	38326	0.16	0.5	13.77
	5	54.6	40058	0.38	0.5	41.56
	6	66.4	17210	0.74	0.5	42.28
	7	70.7	23337	0.97	0.5	80.02
	8	83.2	15675	1	0.5	65.21
	9	86.7	25388	1	0.5	110.06
	10	88.9	33444	1	0.5	148.66
	11	92.2	19872	1	0.5	91.61
	12	95.0	38162	1	0.5	181.27
	13	92.1	48834	1	0.5	224.88
	14	98.5	2299	1	0.5	11.32
	15	99.3	466	1	0.5	2.31
	16	99.3	0	1	0.5	0.00
				TOTAL:		1014.35
1918	3	41.5	30058	0.03	0.5	1.87
	4	44.9	17979	0.16	0.5	6.46
	5	54.6	31447	0.38	0.5	32.62
	6	66.4	33358	0.74	0.5	81.95
	7	70.7	14583	0.97	0.5	50.00
	8	83.2	19634	1	0.5	81.68
	9	86.7	13339	1	0.5	57.82
	10	88.9	21686	1	0.5	96.39
	11	92.2	28652	1	0.5	132.09
	12	95.0	16906	1	0.5	80.30
	13	92.1	32375	1	0.5	149.09
	14	98.5	40274	1	0.5	198.35
	15	99.3	1883	1	0.5	9.35
	16	99.3	0	1	0.5	0.00
				TOTAL:		977.98
1919	3	41.5	52879	0.03	0.5	3.29
	4	44.9	24733	0.16	0.5	8.88
	5	54.6	15348	0.38	0.5	15.92
	6	66.4	25006	0.74	0.5	61.43
	7	70.7	27576	0.97	0.5	94.56
	8	83.2	12225	1	0.5	50.86
	9	86.7	16182	1	0.5	70.15
	10	88.9	11236	1	0.5	49.94
	11	92.2	18438	1	0.5	85.00
	12	95.0	24443	1	0.5	116.10
	13	92.1	14143	1	0.5	65.13
	14	98.5	27093	1	0.5	133.43
	15	99.3	31987	1	0.5	158.82
	16	99.3	0	1	0.5	0.00
				TOTAL:		913.52
1920	3	41.5	49063	0.03	0.5	3.05
	4	44.9	43565	0.16	0.5	15.65
	5	54.6	20811	0.38	0.5	21.59
	6	66.4	12683	0.74	0.5	31.16
	7	70.7	18241	0.97	0.5	62.55
	8	83.2	22494	1	0.5	93.58
	9	86.7	10284	1	0.5	44.58
	10	88.9	13461	1	0.5	59.83
	11	92.2	9472	1	0.5	43.67
	12	95.0	15651	1	0.5	74.34
	13	92.1	20869	1	0.5	96.10
	14	98.5	11924	1	0.5	58.73
	15	99.3	23131	1	0.5	114.85
	16	99.3	0	1	0.5	0.00
				TOTAL:		719.67

Continuation of Table 1.

1	2	3	4	5	6	7
1921	3	41.5	167707	0.03	0.5	10.44
	4	44.9	41293	0.16	0.5	14.83
	5	54.6	37227	0.38	0.5	38.62
	6	66.4	17558	0.74	0.5	43.14
	7	70.7	10653	0.97	0.5	36.53
	8	83.2	13806	1	0.5	57.43
	9	86.7	18596	1	0.5	80.61
	10	88.9	8639	1	0.5	38.40
	11	92.2	11258	1	0.5	51.90
	12	95.0	8056	1	0.5	38.27
	13	92.1	13375	1	0.5	61.59
	14	98.5	17840	1	0.5	87.86
	15	99.3	10141	1	0.5	50.35
	16	99.3	0	1	0.5	0.00
				TOTAL:		609.97
1922	3	41.5	66162	0.03	0.5	4.12
	4	44.9	142361	0.16	0.5	51.14
	5	54.6	35471	0.38	0.5	36.80
	6	66.4	31210	0.74	0.5	76.68
	7	70.7	14962	0.97	0.5	51.30
	8	83.2	8997	1	0.5	37.43
	9	86.7	10659	1	0.5	46.21
	10	88.9	15488	1	0.5	68.84
	11	92.2	7303	1	0.5	33.67
	12	95.0	9509	1	0.5	45.17
	13	92.1	6841	1	0.5	31.50
	14	98.5	11419	1	0.5	56.24
	15	99.3	15298	1	0.5	75.95
	16	99.3	0	1	0.5	0.00
				TOTAL:		615.04
1923	3	41.5	92807	0.03	0.5	5.78
	4	44.9	52999	0.16	0.5	19.04
	5	54.6	121731	0.38	0.5	126.28
	6	66.4	29039	0.74	0.5	71.34
	7	70.7	25798	0.97	0.5	88.46
	8	83.2	12797	1	0.5	53.24
	9	86.7	7527	1	0.5	32.63
	10	88.9	8132	1	0.5	36.15
	11	92.2	13026	1	0.5	60.05
	12	95.0	6164	1	0.5	29.28
	13	92.1	8022	1	0.5	36.94
	14	98.5	5786	1	0.5	28.50
	15	99.3	9699	1	0.5	48.16
	16	99.3	0	1	0.5	0.00
				TOTAL:		635.83
1924	3	41.5	91660	0.03	0.5	5.71
	4	44.9	78412	0.16	0.5	28.17
	5	54.6	45302	0.38	0.5	47.00
	6	66.4	101026	0.74	0.5	248.20
	7	70.7	23797	0.97	0.5	81.60
	8	83.2	21331	1	0.5	88.74
	9	86.7	10901	1	0.5	47.26
	10	88.9	6286	1	0.5	27.94
	11	92.2	6126	1	0.5	28.24
	12	95.0	10993	1	0.5	52.22
	13	92.1	5174	1	0.5	23.83
	14	98.5	6799	1	0.5	33.49
	15	99.3	4902	1	0.5	24.34
	16	99.3	0	1	0.5	0.00
				TOTAL:		736.71

1	2	3	4	5	6	7
1925	3	41.5	141646	0.03	0.5	8.82
	4	44.9	78524	0.16	0.5	28.21
	5	54.6	67257	0.38	0.5	69.77
	6	66.4	38371	0.74	0.5	94.27
	7	70.7	83979	0.97	0.5	287.96
	8	83.2	19404	1	0.5	80.72
	9	86.7	17655	1	0.5	76.53
	10	88.9	9227	1	0.5	41.01
	11	92.2	5248	1	0.5	24.19
	12	95.0	4879	1	0.5	23.18
	13	92.1	9356	1	0.5	43.08
	14	98.5	4383	1	0.5	21.59
	15	99.3	5789	1	0.5	28.74
	16	99.3	0	1	0.5	0.00
				TOTAL:		828.08
1926	3	41.5	239427	0.03	0.5	14.90
	4	44.9	121310	0.16	0.5	43.57
	5	54.6	67331	0.38	0.5	69.85
	6	66.4	57405	0.74	0.5	141.03
	7	70.7	32358	0.97	0.5	110.95
	8	83.2	68758	1	0.5	286.03
	9	86.7	15393	1	0.5	66.73
	10	88.9	14194	1	0.5	63.09
	11	92.2	7740	1	0.5	35.68
	12	95.0	4359	1	0.5	20.71
	13	92.1	3707	1	0.5	17.07
	14	98.5	7903	1	0.5	38.92
	15	99.3	3702	1	0.5	18.38
	16	99.3	0	1	0.5	0.00
				TOTAL:		926.93
1927	3	41.5	131185	0.03	0.5	8.17
	4	44.9	204898	0.16	0.5	73.60
	5	54.6	104277	0.38	0.5	108.18
	6	66.4	56469	0.74	0.5	138.73
	7	70.7	48954	0.97	0.5	167.86
	8	83.2	27210	1	0.5	113.19
	9	86.7	56517	1	0.5	245.00
	10	88.9	12061	1	0.5	53.61
	11	92.2	11535	1	0.5	53.18
	12	95.0	6485	1	0.5	30.80
	13	92.1	3592	1	0.5	16.54
	14	98.5	2787	1	0.5	13.73
	15	99.3	6701	1	0.5	33.27
	16	99.3	0	1	0.5	0.00
				TOTAL:		1055.86
1928	3	41.5	167524	0.03	0.5	10.43
	4	44.9	112064	0.16	0.5	40.25
	5	54.6	174633	0.38	0.5	181.16
	6	66.4	88600	0.74	0.5	217.67
	7	70.7	47849	0.97	0.5	164.07
	8	83.2	41672	1	0.5	173.36
	9	86.7	22688	1	0.5	98.35
	10	88.9	45652	1	0.5	202.92
	11	92.2	9305	1	0.5	42.90
	12	95.0	9239	1	0.5	43.89
	13	92.1	5409	1	0.5	24.91
	14	98.5	2865	1	0.5	14.11
	15	99.3	2162	1	0.5	10.73
	16	99.3	0	1	0.5	0.00
				TOTAL:		1224.76

Continuation of Table 1.

1	2	3	4	5	6	7
1929	3	41.5	39376	0.03	0.5	2.45
	4	44.9	134551	0.16	0.5	48.33
	5	54.6	95698	0.38	0.5	99.28
	6	66.4	147212	0.74	0.5	361.67
	7	70.7	74793	0.97	0.5	256.46
	8	83.2	40428	1	0.5	168.18
	9	86.7	35134	1	0.5	152.31
	10	88.9	18252	1	0.5	81.13
	11	92.2	37426	1	0.5	172.53
	12	95.0	7454	1	0.5	35.41
	13	92.1	7598	1	0.5	34.99
	14	98.5	4455	1	0.5	21.94
	15	99.3	2324	1	0.5	11.54
	16	99.3	0	1	0.5	0.00
				TOTAL:		1446.22
1930	3	41.5	21589	0.03	0.5	1.34
	4	44.9	27437	0.16	0.5	9.86
	5	54.6	114297	0.38	0.5	118.57
	6	66.4	80932	0.74	0.5	198.83
	7	70.7	123810	0.97	0.5	424.54
	8	83.2	62761	1	0.5	261.09
	9	86.7	34250	1	0.5	148.47
	10	88.9	29415	1	0.5	130.75
	11	92.2	14440	1	0.5	66.57
	12	95.0	30765	1	0.5	146.13
	13	92.1	5908	1	0.5	27.21
	14	98.5	6285	1	0.5	30.95
	15	99.3	3695	1	0.5	18.35
	16	99.3	0	1	0.5	0.00
				TOTAL:		1582.66
1931	3	41.5	25111	0.03	0.5	1.56
	4	44.9	18110	0.16	0.5	6.51
	5	54.6	23296	0.38	0.5	24.17
	6	66.4	96958	0.74	0.5	238.21
	7	70.7	68559	0.97	0.5	235.09
	8	83.2	102898	1	0.5	428.06
	9	86.7	51868	1	0.5	224.85
	10	88.9	28618	1	0.5	127.21
	11	92.2	24074	1	0.5	110.98
	12	95.0	11298	1	0.5	53.67
	13	92.1	23868	1	0.5	109.91
	14	98.5	4384	1	0.5	21.59
	15	99.3	5059	1	0.5	25.12
	16	99.3	0	1	0.5	0.00
				TOTAL:		1606.91
1932	3	41.5	19768	0.03	0.5	1.23
	4	44.9	20557	0.16	0.5	7.38
	5	54.6	15565	0.38	0.5	16.15
	6	66.4	19833	0.74	0.5	48.73
	7	70.7	81378	0.97	0.5	279.04
	8	83.2	57926	1	0.5	240.97
	9	86.7	86077	1	0.5	373.14
	10	88.9	43318	1	0.5	192.55
	11	92.2	24091	1	0.5	111.06
	12	95.0	20110	1	0.5	95.52
	13	92.1	9194	1	0.5	42.34
	14	98.5	18633	1	0.5	91.77
	15	99.3	3486	1	0.5	17.31
	16	99.3	0	1	0.5	0.00
				TOTAL:		1517.19

1	2	3	4	5	6	7
1933	3	41.5	113731	0.03	0.5	7.08
	4	44.9	16896	0.16	0.5	6.07
	5	54.6	17226	0.38	0.5	17.87
	6	66.4	13332	0.74	0.5	32.75
	7	70.7	16563	0.97	0.5	56.79
	8	83.2	67575	1	0.5	281.11
	9	86.7	48883	1	0.5	211.91
	10	88.9	71048	1	0.5	315.81
	11	92.2	35570	1	0.5	163.98
	12	95.0	20202	1	0.5	95.96
	13	92.1	16725	1	0.5	77.02
	14	98.5	7576	1	0.5	37.31
	15	99.3	14350	1	0.5	71.25
	16	99.3	0	1	0.5	0.00
				TOTAL:		1374.91
1934	3	41.5	52226	0.03	0.5	3.25
	4	44.9	83740	0.16	0.5	30.08
	5	54.6	14439	0.38	0.5	14.98
	6	66.4	14412	0.74	0.5	35.41
	7	70.7	11394	0.97	0.5	39.07
	8	83.2	13657	1	0.5	56.81
	9	86.7	55533	1	0.5	240.74
	10	88.9	40782	1	0.5	181.28
	11	92.2	58373	1	0.5	269.10
	12	95.0	29197	1	0.5	138.69
	13	92.1	16927	1	0.5	77.95
	14	98.5	13957	1	0.5	68.74
	15	99.3	6394	1	0.5	31.75
	16	99.3	0	1	0.5	0.00
				TOTAL:		1187.83
1935	3	41.5	89418	0.03	0.5	5.57
	4	44.9	41632	0.16	0.5	14.95
	5	54.6	71913	0.38	0.5	74.60
	6	66.4	11898	0.74	0.5	29.23
	7	70.7	11892	0.97	0.5	40.78
	8	83.2	9743	1	0.5	40.53
	9	86.7	11469	1	0.5	49.72
	10	88.9	46633	1	0.5	207.28
	11	92.2	34578	1	0.5	159.40
	12	95.0	49182	1	0.5	233.61
	13	92.1	24454	1	0.5	112.61
	14	98.5	14429	1	0.5	71.06
	15	99.3	11920	1	0.5	59.18
	16	99.3	0	1	0.5	0.00
				TOTAL:		1098.54
1936	3	41.5	150425	0.03	0.5	9.36
	4	44.9	75541	0.16	0.5	27.13
	5	54.6	35205	0.38	0.5	36.52
	6	66.4	55446	0.74	0.5	136.22
	7	70.7	9456	0.97	0.5	32.42
	8	83.2	9520	1	0.5	39.60
	9	86.7	8298	1	0.5	35.97
	10	88.9	9209	1	0.5	40.93
	11	92.2	38009	1	0.5	175.22
	12	95.0	28767	1	0.5	136.64
	13	92.1	40098	1	0.5	184.65
	14	98.5	19688	1	0.5	96.96
	15	99.3	12193	1	0.5	60.54
	16	99.3	0	1	0.5	0.00
				TOTAL:		1012.19

Continuation of Table 1.

1	2	3	4	5	6	7
1937	3	41.5	157660	0.03	0.5	9.81
	4	44.9	128330	0.16	0.5	46.10
	5	54.6	62927	0.38	0.5	65.28
	6	66.4	28140	0.74	0.5	69.13
	7	70.7	38516	0.97	0.5	132.07
	8	83.2	7210	1	0.5	29.99
	9	86.7	7567	1	0.5	32.80
	10	88.9	7026	1	0.5	31.23
	11	92.2	7252	1	0.5	33.43
	12	95.0	30856	1	0.5	146.57
	13	92.1	23783	1	0.5	109.52
	14	98.5	32607	1	0.5	160.59
	15	99.3	15946	1	0.5	79.17
	16	99.3	0	1	0.5	0.00
				TOTAL:		945.70
1938	3	41.5	182318	0.03	0.5	11.35
	4	44.9	134365	0.16	0.5	48.26
	5	54.6	109107	0.38	0.5	113.19
	6	66.4	50364	0.74	0.5	123.73
	7	70.7	23057	0.97	0.5	79.06
	8	83.2	25858	1	0.5	107.57
	9	86.7	5573	1	0.5	24.16
	10	88.9	6084	1	0.5	27.04
	11	92.2	5905	1	0.5	27.22
	12	95.0	5854	1	0.5	27.81
	13	92.1	24843	1	0.5	114.40
	14	98.5	19695	1	0.5	97.00
	15	99.3	26820	1	0.5	133.16
	16	99.3	0	1	0.5	0.00
				TOTAL:		933.96
1939	3	41.5	59035	0.03	0.5	3.67
	4	44.9	156251	0.16	0.5	56.13
	5	54.6	114721	0.38	0.5	119.01
	6	66.4	90587	0.74	0.5	222.55
	7	70.7	37299	0.97	0.5	127.90
	8	83.2	18453	1	0.5	76.76
	9	86.7	15396	1	0.5	66.74
	10	88.9	4333	1	0.5	19.26
	11	92.2	4627	1	0.5	21.33
	12	95.0	5009	1	0.5	23.79
	13	92.1	4551	1	0.5	20.96
	14	98.5	20088	1	0.5	98.93
	15	99.3	16414	1	0.5	81.50
	16	99.3	0	1	0.5	0.00
				TOTAL:		938.54
1940	3	41.5	337170	0.03	0.5	20.99
	4	44.9	50447	0.16	0.5	18.12
	5	54.6	134235	0.38	0.5	139.26
	6	66.4	97883	0.74	0.5	240.48
	7	70.7	74938	0.97	0.5	256.96
	8	83.2	28456	1	0.5	118.38
	9	86.7	15055	1	0.5	65.26
	10	88.9	10024	1	0.5	44.56
	11	92.2	3596	1	0.5	16.58
	12	95.0	3510	1	0.5	16.67
	13	92.1	4222	1	0.5	19.44
	14	98.5	3754	1	0.5	18.49
	15	99.3	16581	1	0.5	82.32
	16	99.3	0	1	0.5	0.00
				TOTAL:		1057.50

1	2	3	4	5	6	7
1941	3	41.5	251987	0.03	0.5	15.69
	4	44.9	287360	0.16	0.5	103.22
	5	54.6	43392	0.38	0.5	45.01
	6	66.4	115329	0.74	0.5	283.34
	7	70.7	81641	0.97	0.5	279.94
	8	83.2	62225	1	0.5	258.86
	9	86.7	21306	1	0.5	92.36
	10	88.9	12390	1	0.5	55.07
	11	92.2	5674	1	0.5	26.16
	12	95.0	3012	1	0.5	14.31
	13	92.1	2550	1	0.5	11.74
	14	98.5	3579	1	0.5	17.63
	15	99.3	3176	1	0.5	15.77
	16	99.3	0	1	0.5	0.00
				TOTAL:		1219.10
1942	3	41.5	95944	0.03	0.5	5.97
	4	44.9	211524	0.16	0.5	75.98
	5	54.6	247192	0.38	0.5	256.44
	6	66.4	37274	0.74	0.5	91.57
	7	70.7	98863	0.97	0.5	339.00
	8	83.2	67963	1	0.5	282.73
	9	86.7	52330	1	0.5	226.85
	10	88.9	17060	1	0.5	75.83
	11	92.2	10322	1	0.5	47.58
	12	95.0	3837	1	0.5	18.23
	13	92.1	2451	1	0.5	11.29
	14	98.5	2061	1	0.5	10.15
	15	99.3	3043	1	0.5	15.11
	16	99.3	0	1	0.5	0.00
				TOTAL:		1456.72
1943	3	41.5	104553	0.03	0.5	6.51
	4	44.9	80168	0.16	0.5	28.80
	5	54.6	182003	0.38	0.5	188.81
	6	66.4	212289	0.74	0.5	521.55
	7	70.7	31932	0.97	0.5	109.49
	8	83.2	84436	1	0.5	351.25
	9	86.7	56052	1	0.5	242.99
	10	88.9	44036	1	0.5	195.74
	11	92.2	13764	1	0.5	63.45
	12	95.0	8528	1	0.5	40.51
	13	92.1	2677	1	0.5	12.33
	14	98.5	2081	1	0.5	10.25
	15	99.3	1617	1	0.5	8.03
	16	99.3	0	1	0.5	0.00
				TOTAL:		1779.70
1944	3	41.5	74535	0.03	0.5	4.64
	4	44.9	87199	0.16	0.5	31.32
	5	54.6	68792	0.38	0.5	71.36
	6	66.4	155891	0.74	0.5	382.99
	7	70.7	180374	0.97	0.5	618.49
	8	83.2	27323	1	0.5	113.66
	9	86.7	72207	1	0.5	313.02
	10	88.9	47093	1	0.5	209.33
	11	92.2	37225	1	0.5	171.61
	12	95.0	11449	1	0.5	54.38
	13	92.1	7061	1	0.5	32.52
	14	98.5	2116	1	0.5	10.42
	15	99.3	1777	1	0.5	8.82
	16	99.3	0	1	0.5	0.00
				TOTAL:		2022.57

Continuation of Table 1.

1	2	3	4	5	6	7
1945	3	41.5	46071	0.03	0.5	2.87
	4	44.9	63425	0.16	0.5	22.78
	5	54.6	74736	0.38	0.5	77.53
	6	66.4	58884	0.74	0.5	144.67
	7	70.7	132547	0.97	0.5	454.50
	8	83.2	152806	1	0.5	635.67
	9	86.7	23320	1	0.5	101.09
	10	88.9	61515	1	0.5	273.43
	11	92.2	39214	1	0.5	180.78
	12	95.0	31328	1	0.5	148.81
	13	92.1	9486	1	0.5	43.68
	14	98.5	5726	1	0.5	28.20
	15	99.3	1744	1	0.5	8.66
	16	99.3	0	1	0.5	0.00
				TOTAL:		2122.67
1946	3	41.5	175662	0.03	0.5	10.93
	4	44.9	39236	0.16	0.5	14.09
	5	54.6	54126	0.38	0.5	56.15
	6	66.4	63229	0.74	0.5	155.34
	7	70.7	50098	0.97	0.5	171.78
	8	83.2	112381	1	0.5	467.50
	9	86.7	128471	1	0.5	556.92
	10	88.9	19834	1	0.5	88.16
	11	92.2	52041	1	0.5	239.91
	12	95.0	31798	1	0.5	151.04
	13	92.1	26178	1	0.5	120.55
	14	98.5	7700	1	0.5	37.92
	15	99.3	4773	1	0.5	23.70
	16	99.3	0	1	0.5	0.00
				TOTAL:		2094.01
1947	3	41.5	149922	0.03	0.5	9.33
	4	44.9	149673	0.16	0.5	53.76
	5	54.6	33254	0.38	0.5	34.50
	6	66.4	46041	0.74	0.5	113.11
	7	70.7	53374	0.97	0.5	183.02
	8	83.2	42435	1	0.5	176.53
	9	86.7	94658	1	0.5	410.34
	10	88.9	106971	1	0.5	475.49
	11	92.2	16596	1	0.5	76.51
	12	95.0	43771	1	0.5	207.91
	13	92.1	25051	1	0.5	115.36
	14	98.5	21707	1	0.5	106.91
	15	99.3	6292	1	0.5	31.24
	16	99.3	0	1	0.5	0.00
				TOTAL:		1994.01
1948	3	41.5	67562	0.03	0.5	4.21
	4	44.9	127745	0.16	0.5	45.89
	5	54.6	126092	0.38	0.5	130.81
	6	66.4	28036	0.74	0.5	68.88
	7	70.7	39112	0.97	0.5	134.11
	8	83.2	45033	1	0.5	187.34
	9	86.7	36064	1	0.5	156.34
	10	88.9	79884	1	0.5	355.08
	11	92.2	89561	1	0.5	412.88
	12	95.0	13894	1	0.5	66.00
	13	92.1	36894	1	0.5	169.90
	14	98.5	20015	1	0.5	98.57
	15	99.3	18196	1	0.5	90.34
	16	99.3	0	1	0.5	0.00
				TOTAL:		1920.34

1	2	3	4	5	6	7
1949	3	41.5	47534	0.03	0.5	2.96
	4	44.9	57012	0.16	0.5	20.48
	5	54.6	105477	0.38	0.5	109.42
	6	66.4	98697	0.74	0.5	242.48
	7	70.7	23270	0.97	0.5	79.79
	8	83.2	32918	1	0.5	136.94
	9	86.7	37814	1	0.5	163.92
	10	88.9	30438	1	0.5	135.30
	11	92.2	66519	1	0.5	306.65
	12	95.0	73587	1	0.5	349.54
	13	92.1	11414	1	0.5	52.56
	14	98.5	30435	1	0.5	149.89
	15	99.3	15278	1	0.5	75.86
	16	99.3	0	1	0.5	0.00
				TOTAL:		1825.79
1950	3	41.5	108558	0	0.5	0.00
	4	44.9	40165	0.1	0.5	9.02
	5	54.6	47909	0.3	0.5	39.24
	6	66.4	85994	0.6	0.5	171.30
	7	70.7	79923	0.9	0.5	254.28
	8	83.2	19630	1	0.5	81.66
	9	86.7	28024	1	0.5	121.48
	10	88.9	32020	1	0.5	142.33
	11	92.2	25817	1	0.5	119.02
	12	95.0	56309	1	0.5	267.47
	13	92.1	61467	1	0.5	283.06
	14	98.5	9515	1	0.5	46.86
	15	99.3	25669	1	0.5	127.45
	16	99.3	56929	1	0.5	282.65
				TOTAL:		1945.80
1951	3	41.5	54134	0	0.5	0.00
	4	44.9	90878	0.1	0.5	20.40
	5	54.6	32858	0.3	0.5	26.91
	6	66.4	41064	0.6	0.5	81.80
	7	70.7	68950	0.9	0.5	219.36
	8	83.2	62971	1	0.5	261.96
	9	86.7	16159	1	0.5	70.05
	10	88.9	23300	1	0.5	103.57
	11	92.2	26545	1	0.5	122.37
	12	95.0	21416	1	0.5	101.73
	13	92.1	46664	1	0.5	214.89
	14	98.5	49494	1	0.5	243.76
	15	99.3	7575	1	0.5	37.61
	16	99.3	48758	1	0.5	242.08
				TOTAL:		1746.49
1952	3	41.5	35944	0	0.5	0.00
	4	44.9	46533	0.1	0.5	10.45
	5	54.6	74664	0.3	0.5	61.15
	6	66.4	26685	0.6	0.5	53.16
	7	70.7	33821	0.9	0.5	107.60
	8	83.2	54572	1	0.5	227.02
	9	86.7	48627	1	0.5	210.80
	10	88.9	13194	1	0.5	58.65
	11	92.2	19288	1	0.5	88.92
	12	95.0	21893	1	0.5	103.99
	13	92.1	17436	1	0.5	80.29
	14	98.5	37816	1	0.5	186.24
	15	99.3	39378	1	0.5	195.51
	16	99.3	47336	1	0.5	235.02
				TOTAL:		1618.80

Continuation of Table 1.

1	2	3	4	5	6	7
1953	3	41.5	470458	0	0.5	0.00
	4	44.9	30573	0.1	0.5	6.86
	5	54.6	39490	0.3	0.5	32.34
	6	66.4	58688	0.6	0.5	116.91
	7	70.7	21705	0.9	0.5	69.05
	8	83.2	27216	1	0.5	113.22
	9	86.7	43450	1	0.5	188.36
	10	88.9	38355	1	0.5	170.49
	11	92.2	10623	1	0.5	48.97
	12	95.0	15808	1	0.5	75.09
	13	92.1	17846	1	0.5	82.18
	14	98.5	14018	1	0.5	69.04
	15	99.3	30821	1	0.5	153.03
	16	99.3	73642	1	0.5	365.63
				TOTAL:		1491.17
1954	3	41.5	65225	0	0.5	0.00
	4	44.9	398069	0.1	0.5	89.37
	5	54.6	25883	0.3	0.5	21.20
	6	66.4	33055	0.6	0.5	65.85
	7	70.7	47220	0.9	0.5	150.23
	8	83.2	17923	1	0.5	74.56
	9	86.7	22398	1	0.5	97.10
	10	88.9	34489	1	0.5	153.30
	11	92.2	29358	1	0.5	135.34
	12	95.0	8572	1	0.5	40.72
	13	92.1	12761	1	0.5	58.76
	14	98.5	14488	1	0.5	71.35
	15	99.3	11151	1	0.5	55.36
	16	99.3	59483	1	0.5	295.33
				TOTAL:		1308.47
1955	3	41.5	31748	0.08	0.5	5.27
	4	44.9	53673	0.22	0.5	26.51
	5	54.6	329322	0.37	0.5	332.65
	6	66.4	20954	0.85	0.5	59.13
	7	70.7	26265	1	0.5	92.85
	8	83.2	36105	1	0.5	150.20
	9	86.7	14241	1	0.5	61.73
	10	88.9	17428	1	0.5	77.47
	11	92.2	25611	1	0.5	118.07
	12	95.0	21008	1	0.5	99.79
	13	92.1	6559	1	0.5	30.20
	14	98.5	10052	1	0.5	49.51
	15	99.3	11239	1	0.5	55.80
	16	99.3	51748	1	0.5	256.93
				TOTAL:		1416.10
1956	3	41.5	30092	0.08	0.5	5.00
	4	44.9	26464	0.22	0.5	13.07
	5	54.6	43636	0.37	0.5	44.08
	6	66.4	264511	0.85	0.5	746.45
	7	70.7	16977	1	0.5	60.01
	8	83.2	20851	1	0.5	86.74
	9	86.7	28532	1	0.5	123.69
	10	88.9	11467	1	0.5	50.97
	11	92.2	13211	1	0.5	60.90
	12	95.0	19308	1	0.5	91.71
	13	92.1	16201	1	0.5	74.61
	14	98.5	5102	1	0.5	25.13
	15	99.3	7869	1	0.5	39.07
	16	99.3	42150	1	0.5	209.27
				TOTAL:		1630.70

1	2	3	4	5	6	7
1957	3	41.5	5554	0	0.5	0.00
	4	44.9	24821	0	0.5	0.00
	5	54.6	20449	0.5	0.5	27.91
	6	66.4	34649	0.6	0.5	69.02
	7	70.7	204017	1	0.5	721.20
	8	83.2	13593	1	0.5	56.55
	9	86.7	16060	1	0.5	69.62
	10	88.9	22112	1	0.5	98.29
	11	92.2	8660	1	0.5	39.92
	12	95.0	9537	1	0.5	45.30
	13	92.1	14095	1	0.5	64.91
	14	98.5	12433	1	0.5	61.23
	15	99.3	3809	1	0.5	18.91
	16	99.3	27995	1	0.5	139.00
				TOTAL:		1411.86
1958	3	41.5	4649	0.08	0.5	0.77
	4	44.9	4564	0.22	0.5	2.25
	5	54.6	17911	0.37	0.5	18.09
	6	66.4	16177	0.85	0.5	45.65
	7	70.7	27707	1	0.5	97.94
	8	83.2	157223	1	0.5	654.05
	9	86.7	11033	1	0.5	47.83
	10	88.9	12644	1	0.5	56.20
	11	92.2	17343	1	0.5	79.95
	12	95.0	6636	1	0.5	31.52
	13	92.1	7087	1	0.5	32.64
	14	98.5	10750	1	0.5	52.94
	15	99.3	9483	1	0.5	47.08
	16	99.3	25443	1	0.5	126.32
				TOTAL:		1293.25
1959	3	41.5	1619	0.08	0.5	0.27
	4	44.9	3839	0.22	0.5	1.90
	5	54.6	3763	0.37	0.5	3.80
	6	66.4	14389	0.85	0.5	40.61
	7	70.7	13096	1	0.5	46.29
	8	83.2	22047	1	0.5	91.72
	9	86.7	126308	1	0.5	547.55
	10	88.9	8841	1	0.5	39.30
	11	92.2	9744	1	0.5	44.92
	12	95.0	13068	1	0.5	62.07
	13	92.1	4799	1	0.5	22.10
	14	98.5	5384	1	0.5	26.52
	15	99.3	8596	1	0.5	42.68
	16	99.3	15205	1	0.5	75.49
				TOTAL:		1045.21
1960	3	41.5	2442	0.08	0.5	0.41
	4	44.9	1254	0.22	0.5	0.62
	5	54.6	3056	0.37	0.5	3.09
	6	66.4	2999	0.85	0.5	8.46
	7	70.7	11028	1	0.5	38.98
	8	83.2	10209	1	0.5	42.47
	9	86.7	16749	1	0.5	72.61
	10	88.9	98496	1	0.5	437.81
	11	92.2	6790	1	0.5	31.30
	12	95.0	7237	1	0.5	34.38
	13	92.1	9416	1	0.5	43.36
	14	98.5	3312	1	0.5	16.31
	15	99.3	3918	1	0.5	19.45
	16	99.3	10102	1	0.5	50.16
				TOTAL:		799.41

Continuation of Table 1.

1	2	3	4	5	6	7
1961	3	41.5	2291	0.04	0.5	0.19
	4	44.9	984	0.35	0.5	0.77
	5	54.6	911	0.68	0.5	1.69
	6	66.4	2370	0.94	0.5	7.40
	7	70.7	2355	1	0.5	8.32
	8	83.2	8601	1	0.5	35.78
	9	86.7	8109	1	0.5	35.15
	10	88.9	12529	1	0.5	55.69
	11	92.2	74015	1	0.5	341.21
	12	95.0	5056	1	0.5	24.02
	13	92.1	5030	1	0.5	23.16
	14	98.5	6686	1	0.5	32.93
	15	99.3	2327	1	0.5	11.55
	16	99.3	4117	1	0.5	20.44
				TOTAL:		598.31
1962	3	41.5	202893	0	0.5	0.00
	4	44.9	1683	0.11	0.5	0.42
	5	54.6	772	0.67	0.5	1.41
	6	66.4	746	1	0.5	2.48
	7	70.7	1901	1	0.5	6.72
	8	83.2	1847	1	0.5	7.68
	9	86.7	6833	1	0.5	29.62
	10	88.9	6524	1	0.5	29.00
	11	92.2	10658	1	0.5	49.13
	12	95.0	56966	1	0.5	270.59
	13	92.1	3892	1	0.5	17.92
	14	98.5	3913	1	0.5	19.27
	15	99.3	5171	1	0.5	25.67
	16	99.3	6834	1	0.5	33.93
				TOTAL:		493.85
1963	3	41.5	70081	0.04	0.5	5.82
	4	44.9	157564	0.03	0.5	10.61
	5	54.6	1374	0.32	0.5	1.20
	6	66.4	636	0.9	0.5	1.90
	7	70.7	575	1	0.5	2.03
	8	83.2	1450	1	0.5	6.03
	9	86.7	1480	1	0.5	6.42
	10	88.9	5334	1	0.5	23.71
	11	92.2	5128	1	0.5	23.64
	12	95.0	8091	1	0.5	38.43
	13	92.1	41507	1	0.5	191.14
	14	98.5	2940	1	0.5	14.48
	15	99.3	2862	1	0.5	14.21
	16	99.3	5918	1	0.5	29.38
				TOTAL:		369.00
1964	3	41.5	20760	0.02	0.5	0.86
	4	44.9	53282	0.06	0.5	7.18
	5	54.6	127875	0.28	0.5	97.75
	6	66.4	1134	0.32	0.5	1.20
	7	70.7	531	1	0.5	1.88
	8	83.2	462	1	0.5	1.92
	9	86.7	1078	1	0.5	4.67
	10	88.9	1188	1	0.5	5.28
	11	92.2	3596	1	0.5	16.58
	12	95.0	3559	1	0.5	16.91
	13	92.1	5355	1	0.5	24.66
	14	98.5	27193	1	0.5	133.93
	15	99.3	1796	1	0.5	8.92
	16	99.3	11413	1	0.5	56.67
				TOTAL:		378.39

1	2	3	4	5	6	7
1965	3	41.5	1959	0	0.5	0.00
	4	44.9	16807	0.34	0.5	12.83
	5	54.6	42166	0.35	0.5	40.29
	6	66.4	91146	0.76	0.5	229.98
	7	70.7	849	1	0.5	3.00
	8	83.2	443	1	0.5	1.84
	9	86.7	370	1	0.5	1.60
	10	88.9	698	1	0.5	3.10
	11	92.2	752	1	0.5	3.47
	12	95.0	2213	1	0.5	10.51
	13	92.1	2302	1	0.5	10.60
	14	98.5	3198	1	0.5	15.75
	15	99.3	16274	1	0.5	80.80
	16	99.3	4140	1	0.5	20.56
				TOTAL:		434.33
1966	3	41.5	81610	0.01	0.5	1.69
	4	44.9	860	0.15	0.5	0.29
	5	54.6	12097	1	0.5	33.02
	6	66.4	31010	0.96	0.5	98.84
	7	70.7	58137	1	0.5	205.51
	8	83.2	551	1	0.5	2.29
	9	86.7	244	1	0.5	1.06
	10	88.9	250	1	0.5	1.11
	11	92.2	425	1	0.5	1.96
	12	95.0	280	1	0.5	1.33
	13	92.1	980	1	0.5	4.51
	14	98.5	991	1	0.5	4.88
	15	99.3	1476	1	0.5	7.33
	16	99.3	7024	1	0.5	34.87
				TOTAL:		398.70
1967	3	41.5	37672	0	0.5	0.00
	4	44.9	51327	0.01	0.5	1.15
	5	54.6	492	0.23	0.5	0.31
	6	66.4	6115	1	0.5	20.30
	7	70.7	14675	1	0.5	51.88
	8	83.2	23551	1	0.5	97.97
	9	86.7	128	1	0.5	0.55
	10	88.9	79	1	0.5	0.35
	11	92.2	56	1	0.5	0.26
	12	95.0	126	1	0.5	0.60
	13	92.1	140	1	0.5	0.64
	14	98.5	214	1	0.5	1.05
	15	99.3	196	1	0.5	0.97
	16	99.3	1235	1	0.5	6.13
				TOTAL:		182.18
1968	3	41.5	1075	0	0.5	0.00
	4	44.9	19600	0	0.5	0.00
	5	54.6	14426	0.01	0.5	0.39
	6	66.4	179	0.76	0.5	0.45
	7	70.7	1420	1	0.5	5.02
	8	83.2	2346	1	0.5	9.76
	9	86.7	4602	1	0.5	19.95
	10	88.9	29	1	0.5	0.13
	11	92.2	16	1	0.5	0.07
	12	95.0	17	1	0.5	0.08
	13	92.1	31	1	0.5	0.14
	14	98.5	39	1	0.5	0.19
	15	99.3	26	1	0.5	0.13
	16	99.3	216	1	0.5	1.07
				TOTAL:		37.39

Continuation of Table 1.

1	2	3	4	5	6	7
1969	3	41.5	2275	0.62	0.5	2.93
	4	44.9	37	0.89	0.5	0.07
	5	54.6	177	0.95	0.5	0.46
	6	66.4	111	1	0.5	0.37
	7	70.7	25	1	0.5	0.09
	8	83.2	364	1	0.5	1.51
	9	86.7	791	1	0.5	3.43
	10	88.9	822	1	0.5	3.65
	11	92.2	7	1	0.5	0.03
	12	95.0	4	1	0.5	0.02
	13	92.1	7	1	0.5	0.03
	14	98.5	4	1	0.5	0.02
	15	99.3	10	1	0.5	0.05
	16	99.3	49	1	0.5	0.24
				TOTAL:		12.91
1970	3	41.5	164	0.06	0.5	0.02
	4	44.9	254	0.13	0.5	0.07
	5	54.6	25	0.31	0.5	0.02
	6	66.4	71	0.17	0.5	0.04
	7	70.7	52	1	0.5	0.18
	8	83.2	15	1	0.5	0.06
	9	86.7	205	1	0.5	0.89
	10	88.9	371	1	0.5	1.65
	11	92.2	376	1	0.5	1.73
	12	95.0	3	1	0.5	0.01
	13	92.1	1	1	0.5	0.00
	14	98.5	4	1	0.5	0.02
	15	99.3	1	1	0.5	0.00
	16	99.3	27	1	0.5	0.13
				TOTAL:		4.85
1971	3	41.5	79	0.1	0.5	0.02
	4	44.9	83	0.25	0.5	0.05
	5	54.6	50	0.6	0.5	0.08
	6	66.4	16	0.9	0.5	0.05
	7	70.7	31	1	0.5	0.11
	8	83.2	15	1	0.5	0.06
	9	86.7	4	1	0.5	0.02
	10	88.9	54	1	0.5	0.24
	11	92.2	81	1	0.5	0.37
	12	95.0	68	1	0.5	0.32
	13	92.1	0	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	1	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		1.32
1972	3	41.5	4065	0	0.5	0.00
	4	44.9	51	0.1	0.5	0.01
	5	54.6	62	0.25	0.5	0.04
	6	66.4	31	0.6	0.5	0.06
	7	70.7	10	0.9	0.5	0.03
	8	83.2	16	1	0.5	0.07
	9	86.7	3	1	0.5	0.01
	10	88.9	0	1	0.5	0.00
	11	92.2	7	1	0.5	0.03
	12	95.0	7	1	0.5	0.03
	13	92.1	9	1	0.5	0.04
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		0.33

1	2	3	4	5	6	7
1973	3	41.5	77	0.5	0.5	0.08
	4	44.9	3172	0.9	0.5	6.41
	5	54.6	12	1	0.5	0.03
	6	66.4	20	1	0.5	0.07
	7	70.7	4	1	0.5	0.01
	8	83.2	3	1	0.5	0.01
	9	86.7	1	1	0.5	0.00
	10	88.9	0	1	0.5	0.00
	11	92.2	0	1	0.5	0.00
	12	95.0	1	1	0.5	0.00
	13	92.1	1	1	0.5	0.00
	14	98.5	3	1	0.5	0.01
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		6.64
1974	3	41.5	9	0.5	0.5	0.01
	4	44.9	44	0.9	0.5	0.09
	5	54.6	2497	1	0.5	6.82
	6	66.4	4	1	0.5	0.01
	7	70.7	4	1	0.5	0.01
	8	83.2	1	1	0.5	0.00
	9	86.7	1	1	0.5	0.00
	10	88.9	1	1	0.5	0.00
	11	92.2	0	1	0.5	0.00
	12	95.0	0	1	0.5	0.00
	13	92.1	1	1	0.5	0.00
	14	98.5	1	1	0.5	0.00
	15	99.3	1	1	0.5	0.00
	16	99.3	1	1	0.5	0.00
				TOTAL:		6.97
1975	3	41.5	243	0.5	0.5	0.25
	4	44.9	7	1	0.5	0.02
	5	54.6	36	1	0.5	0.10
	6	66.4	1922	1	0.5	6.38
	7	70.7	1	1	0.5	0.00
	8	83.2	2	1	0.5	0.01
	9	86.7	1	1	0.5	0.00
	10	88.9	0	1	0.5	0.00
	11	92.2	1	1	0.5	0.00
	12	95.0	0	1	0.5	0.00
	13	92.1	0	1	0.5	0.00
	14	98.5	1	1	0.5	0.00
	15	99.3	1	1	0.5	0.00
	16	99.3	1	1	0.5	0.00
				TOTAL:		6.78
1976	3	41.5	8476	0.5	0.5	8.79
	4	44.9	179	0.9	0.5	0.36
	5	54.6	5	1	0.5	0.01
	6	66.4	22	1	0.5	0.07
	7	70.7	1371	1	0.5	4.85
	8	83.2	1	1	0.5	0.00
	9	86.7	1	1	0.5	0.00
	10	88.9	1	1	0.5	0.00
	11	92.2	0	1	0.5	0.00
	12	95.0	0	1	0.5	0.00
	13	92.1	0	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	1	1	0.5	0.00
	16	99.3	1	1	0.5	0.00
				TOTAL:		14.11

Continuation of Table 1.

1	2	3	4	5	6	7
1977	3	41.5	5629	0.73	0.5	8.53
	4	44.9	7080	0.89	0.5	14.15
	5	54.6	104	1	0.5	0.28
	6	66.4	4	1	0.5	0.01
	7	70.7	19	1	0.5	0.07
	8	83.2	1059	1	0.5	4.41
	9	86.7	1	1	0.5	0.00
	10	88.9	1	1	0.5	0.00
	11	92.2	1	1	0.5	0.00
	12	95.0	0	1	0.5	0.00
	13	92.1	0	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		27.46
1978	3	41.5	1921	0.13	0.5	0.52
	4	44.9	4641	0.9	0.5	9.38
	5	54.6	5875	1	0.5	16.04
	6	66.4	86	1	0.5	0.29
	7	70.7	4	1	0.5	0.01
	8	83.2	13	1	0.5	0.05
	9	86.7	812	1	0.5	3.52
	10	88.9	1	1	0.5	0.00
	11	92.2	1	1	0.5	0.00
	12	95.0	1	1	0.5	0.00
	13	92.1	0	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		29.82
1979	3	41.5	6690	0.1	0.5	1.39
	4	44.9	1626	0.62	0.5	2.26
	5	54.6	3881	0.95	0.5	10.07
	6	66.4	4868	1	0.5	16.16
	7	70.7	66	1	0.5	0.23
	8	83.2	3	1	0.5	0.01
	9	86.7	5	1	0.5	0.02
	10	88.9	652	1	0.5	2.90
	11	92.2	1	1	0.5	0.00
	12	95.0	1	1	0.5	0.00
	13	92.1	1	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		33.06
1980	3	41.5	3325	0.25	0.5	1.72
	4	44.9	5699	0.5	0.5	6.40
	5	54.6	1382	0.97	0.5	3.66
	6	66.4	3277	1	0.5	10.88
	7	70.7	4086	1	0.5	14.44
	8	83.2	54	1	0.5	0.22
	9	86.7	3	1	0.5	0.01
	10	88.9	4	1	0.5	0.02
	11	92.2	538	1	0.5	2.48
	12	95.0	1	1	0.5	0.00
	13	92.1	1	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		39.85

1	2	3	4	5	6	7
1981	3	41.5	4089	0.3	0.5	2.55
	4	44.9	2803	0.5	0.5	3.15
	5	54.6	4851	0.9	0.5	11.92
	6	66.4	1168	1	0.5	3.88
	7	70.7	2745	1	0.5	9.70
	8	83.2	3370	1	0.5	14.02
	9	86.7	42	1	0.5	0.18
	10	88.9	2	1	0.5	0.01
	11	92.2	4	1	0.5	0.02
	12	95.0	438	1	0.5	2.08
	13	92.1	1	1	0.5	0.00
	14	98.5	1	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		47.51
1982	3	41.5	8248	0.1	0.5	1.71
	4	44.9	3481	0.48	0.5	3.75
	5	54.6	2370	0.7	0.5	4.53
	6	66.4	4096	1	0.5	13.60
	7	70.7	985	1	0.5	3.48
	8	83.2	2321	1	0.5	9.66
	9	86.7	2824	1	0.5	12.24
	10	88.9	33	1	0.5	0.15
	11	92.2	1	1	0.5	0.00
	12	95.0	2	1	0.5	0.01
	13	92.1	368	1	0.5	1.69
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		50.83
1983	3	41.5	1024	0.1	0.5	0.21
	4	44.9	6971	0.5	0.5	7.82
	5	54.6	2923	0.69	0.5	5.51
	6	66.4	1998	0.71	0.5	4.71
	7	70.7	3467	1	0.5	12.26
	8	83.2	830	1	0.5	3.45
	9	86.7	1951	1	0.5	8.46
	10	88.9	2375	1	0.5	10.56
	11	92.2	28	1	0.5	0.13
	12	95.0	0	1	0.5	0.00
	13	92.1	2	1	0.5	0.01
	14	98.5	316	1	0.5	1.56
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		54.67
1984	3	41.5	712	0.1	0.5	0.15
	4	44.9	851	0.5	0.5	0.96
	5	54.6	5804	0.9	0.5	14.26
	6	66.4	2428	0.95	0.5	7.66
	7	70.7	1662	1	0.5	5.88
	8	83.2	2921	1	0.5	12.15
	9	86.7	702	1	0.5	3.04
	10	88.9	1636	1	0.5	7.27
	11	92.2	1976	1	0.5	9.11
	12	95.0	22	1	0.5	0.10
	13	92.1	0	1	0.5	0.00
	14	98.5	0	1	0.5	0.00
	15	99.3	264	1	0.5	1.31
	16	99.3	0	1	0.5	0.00
				TOTAL:		61.89

Continuation of Table 1.

1	2	3	4	5	6	7
1985	3	41.5	1516	0.1	0.5	0.31
	4	44.9	572	0.5	0.5	0.64
	5	54.6	683	0.9	0.5	1.68
	6	66.4	4426	1	0.5	14.69
	7	70.7	1921	1	0.5	6.79
	8	83.2	1314	1	0.5	5.47
	9	86.7	2370	1	0.5	10.27
	10	88.9	538	1	0.5	2.39
	11	92.2	1257	1	0.5	5.79
	12	95.0	1641	1	0.5	7.79
	13	92.1	19	1	0.5	0.09
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	90	1	0.5	0.45
				TOTAL:		56.38
1986	3	41.5	246737	0.1	0.5	51.20
	4	44.9	1106	0.2	0.5	0.50
	5	54.6	349	0.9	0.5	0.86
	6	66.4	435	1	0.5	1.44
	7	70.7	2610	1	0.5	9.23
	8	83.2	1109	1	0.5	4.61
	9	86.7	625	1	0.5	2.71
	10	88.9	1458	1	0.5	6.48
	11	92.2	370	1	0.5	1.71
	12	95.0	796	1	0.5	3.78
	13	92.1	951	1	0.5	4.38
	14	98.5	17	1	0.5	0.08
	15	99.3	0	1	0.5	0.00
	16	99.3	35	1	0.5	0.17
				TOTAL:		87.15
1987	3	41.5	7578	0.1	0.5	1.57
	4	44.9	207367	0.3	0.5	139.66
	5	54.6	789	0.9	0.5	1.94
	6	66.4	167	1	0.5	0.55
	7	70.7	232	1	0.5	0.82
	8	83.2	1280	1	0.5	5.32
	9	86.7	270	1	0.5	1.17
	10	88.9	154	1	0.5	0.68
	11	92.2	549	1	0.5	2.53
	12	95.0	140	1	0.5	0.67
	13	92.1	88	1	0.5	0.41
	14	98.5	95	1	0.5	0.47
	15	99.3	14	1	0.5	0.07
	16	99.3	0	1	0.5	0.00
				TOTAL:		155.87
1988	3	41.5	51586	0.1	0.5	10.70
	4	44.9	6339	0.3	0.5	4.27
	5	54.6	173837	0.9	0.5	427.12
	6	66.4	507	1	0.5	1.68
	7	70.7	111	1	0.5	0.39
	8	83.2	135	1	0.5	0.56
	9	86.7	843	1	0.5	3.65
	10	88.9	122	1	0.5	0.54
	11	92.2	46	1	0.5	0.21
	12	95.0	431	1	0.5	2.05
	13	92.1	49	1	0.5	0.23
	14	98.5	16	1	0.5	0.08
	15	99.3	18	1	0.5	0.09
	16	99.3	0	1	0.5	0.00
				TOTAL:		451.58

1	2	3	4	5	6	7
1989	3	41.5	7654	0.1	0.5	1.59
	4	44.9	43817	0.3	0.5	29.51
	5	54.6	5224	0.9	0.5	12.84
	6	66.4	144524	1	0.5	479.82
	7	70.7	349	1	0.5	1.23
	8	83.2	62	1	0.5	0.26
	9	86.7	61	1	0.5	0.26
	10	88.9	591	1	0.5	2.63
	11	92.2	24	1	0.5	0.11
	12	95.0	14	1	0.5	0.07
	13	92.1	339	1	0.5	1.56
	14	98.5	17	1	0.5	0.08
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		529.96
1990	3	41.5	6352	0.4	0.5	5.27
	4	44.9	6561	0.8	0.5	11.78
	5	54.6	37680	0.9	0.5	92.58
	6	66.4	4444	0.9	0.5	13.28
	7	70.7	121388	0.9	0.5	386.20
	8	83.2	268	1	0.5	1.11
	9	86.7	46	1	0.5	0.20
	10	88.9	46	1	0.5	0.20
	11	92.2	478	1	0.5	2.20
	12	95.0	8	1	0.5	0.04
	13	92.1	6	1	0.5	0.03
	14	98.5	289	1	0.5	1.42
	15	99.3	13	1	0.5	0.06
	16	99.3	24	1	0.5	0.12
				TOTAL:		514.51
1991	3	41.5	16397	0.1	0.5	3.40
	4	44.9	5295	0.7	0.5	8.32
	5	54.6	5622	1	0.5	15.35
	6	66.4	32322	1	0.5	107.31
	7	70.7	3724	1	0.5	13.16
	8	83.2	102383	1	0.5	425.91
	9	86.7	219	1	0.5	0.95
	10	88.9	25	1	0.5	0.11
	11	92.2	21	1	0.5	0.10
	12	95.0	389	1	0.5	1.85
	13	92.1	1	1	0.5	0.00
	14	98.5	3	1	0.5	0.01
	15	99.3	244	1	0.5	1.21
	16	99.3	5	1	0.5	0.02
				TOTAL:		577.72
1992	3	41.5	48720	0.1	0.5	10.11
	4	44.9	14035	0.2	0.5	6.30
	5	54.6	4532	0.8	0.5	9.90
	6	66.4	4826	1	0.5	16.02
	7	70.7	27683	1	0.5	97.86
	8	83.2	3124	1	0.5	13.00
	9	86.7	86094	1	0.5	373.22
	10	88.9	165	1	0.5	0.73
	11	92.2	18	1	0.5	0.08
	12	95.0	17	1	0.5	0.08
	13	92.1	329	1	0.5	1.52
	14	98.5	0	1	0.5	0.00
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		528.82

Continuation of Table 1.

1	2	3	4	5	6	7
1993	3	41.5	89097	0.01	0.5	1.85
	4	44.9	41817	0.3	0.5	28.16
	5	54.6	11773	0.8	0.5	25.71
	6	66.4	3854	1	0.5	12.80
	7	70.7	4143	1	0.5	14.65
	8	83.2	23716	1	0.5	98.66
	9	86.7	2635	1	0.5	11.42
	10	88.9	72010	1	0.5	320.08
	11	92.2	119	1	0.5	0.55
	12	95.0	9	1	0.5	0.04
	13	92.1	13	1	0.5	0.06
	14	98.5	271	1	0.5	1.33
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		515.32
1994	3	41.5	234908	0.01	0.5	4.87
	4	44.9	76423	0.3	0.5	51.47
	5	54.6	35002	0.8	0.5	76.44
	6	66.4	9325	1	0.5	30.96
	7	70.7	3237	1	0.5	11.44
	8	83.2	3532	1	0.5	14.69
	9	86.7	20138	1	0.5	87.30
	10	88.9	2096	1	0.5	9.32
	11	92.2	58182	1	0.5	268.22
	12	95.0	103	1	0.5	0.49
	13	92.1	8	1	0.5	0.04
	14	98.5	11	1	0.5	0.05
	15	99.3	233	1	0.5	1.16
	16	99.3	0	1	0.5	0.00
				TOTAL:		556.46
1995	3	41.5	263685	0	0.5	0.00
	4	44.9	201886	0.3	0.5	135.97
	5	54.6	64758	0.8	0.5	141.43
	6	66.4	26759	1	0.5	88.84
	7	70.7	6503	1	0.5	22.99
	8	83.2	2642	1	0.5	10.99
	9	86.7	2965	1	0.5	12.85
	10	88.9	16987	1	0.5	75.51
	11	92.2	1474	1	0.5	6.80
	12	95.0	44105	1	0.5	209.50
	13	92.1	62	1	0.5	0.29
	14	98.5	3	1	0.5	0.01
	15	99.3	8	1	0.5	0.04
	16	99.3	0	1	0.5	0.00
				TOTAL:		705.21
1996	3	41.5	72107	0	0.5	0.00
	4	44.9	226422	0.3	0.5	152.50
	5	54.6	170554	0.9	0.5	419.05
	6	66.4	49973	1	0.5	165.91
	7	70.7	17141	1	0.5	60.59
	8	83.2	3468	1	0.5	14.43
	9	86.7	2131	1	0.5	9.24
	10	88.9	2405	1	0.5	10.69
	11	92.2	13975	1	0.5	64.42
	12	95.0	501	1	0.5	2.38
	13	92.1	29536	1	0.5	136.01
	14	98.5	16	1	0.5	0.08
	15	99.3	0	1	0.5	0.00
	16	99.3	0	1	0.5	0.00
				TOTAL:		1035.30

1	2	3	4	5	6	7
1997	3	41.5	23144	0	0.5	0.00
	4	44.9	61745	0.3	0.5	41.59
	5	54.6	188272	0.9	0.5	462.58
	6	66.4	132255	1	0.5	439.09
	7	70.7	34319	1	0.5	121.32
	8	83.2	11002	1	0.5	45.77
	9	86.7	2031	1	0.5	8.80
	10	88.9	1781	1	0.5	7.92
	11	92.2	2002	1	0.5	9.23
	12	95.0	11416	1	0.5	54.23
	13	92.1	270	1	0.5	1.24
	14	98.5	17703	1	0.5	87.19
	15	99.3	14	1	0.5	0.07
	16	99.3	0	1	0.5	0.00
				TOTAL:		1279.02
1998	3	41.5	7582	0	0.5	0.00
	4	44.9	18712	0.3	0.5	12.60
	5	54.6	50634	0.9	0.5	124.41
	6	66.4	145425	1	0.5	482.81
	7	70.7	95395	1	0.5	337.22
	8	83.2	22507	1	0.5	93.63
	9	86.7	6457	1	0.5	27.99
	10	88.9	1187	1	0.5	5.28
	11	92.2	1348	1	0.5	6.21
	12	95.0	1423	1	0.5	6.76
	13	92.1	8988	1	0.5	41.39
	14	98.5	58	1	0.5	0.29
	15	99.3	11815	1	0.5	58.66
	16	99.3	0	1	0.5	0.00
				TOTAL:		1197.25
1999	3	41.5	72987	0	0.5	0.00
	4	44.9	5875	0.3	0.5	3.96
	5	54.6	13864	0.9	0.5	34.06
	6	66.4	40171	1	0.5	133.37
	7	70.7	108881	1	0.5	384.89
	8	83.2	70417	1	0.5	292.93
	9	86.7	15845	1	0.5	68.69
	10	88.9	4357	1	0.5	19.37
	11	92.2	630	1	0.5	2.90
	12	95.0	926	1	0.5	4.40
	13	92.1	1193	1	0.5	5.49
	14	98.5	6694	1	0.5	32.97
	15	99.3	0	1	0.5	0.00
	16	99.3	5643	1	0.5	28.02
				TOTAL:		1011.05
2000	3	41.5	25830	0	0.5	0.00
	4	44.9	61545	0.3	0.5	41.45
	5	54.6	4725	0.9	0.5	11.61
	6	66.4	10685	1	0.5	35.47
	7	70.7	30601	1	0.5	108.17
	8	83.2	78870	1	0.5	328.10
	9	86.7	49843	1	0.5	216.07
	10	88.9	10944	1	0.5	48.65
	11	92.2	2771	1	0.5	12.77
	12	95.0	408	1	0.5	1.94
	13	92.1	429	1	0.5	1.98
	14	98.5	960	1	0.5	4.73
	15	99.3	4942	1	0.5	24.54
	16	99.3	5354	1	0.5	26.58
				TOTAL:		862.06

Continuation of Table 1.

1	2	3	4	5	6	7
2001	3	41.5	16742	0	0.5	0.00
	4	44.9	21454	0.3	0.5	14.45
	5	54.6	47785	0.9	0.5	117.41
	6	66.4	3743	1	0.5	12.43
	7	70.7	8172	1	0.5	28.89
	8	83.2	22597	1	0.5	94.00
	9	86.7	55871	1	0.5	242.20
	10	88.9	33245	1	0.5	147.77
	11	92.2	7415	1	0.5	34.18
	12	95.0	1724	1	0.5	8.19
	13	92.1	201	1	0.5	0.93
	14	98.5	161	1	0.5	0.79
	15	99.3	611	1	0.5	3.03
	16	99.3	0	1	0.5	0.00
				TOTAL:		704.27

1	2	3	4	5	6	7
2002	3	41.5	244	0	0.5	0.00
	4	44.9	13463	0.3	0.5	9.07
	5	54.6	16978	0.9	0.5	41.71
	6	66.4	37178	1	0.5	123.43
	7	70.7	2863	1	0.5	10.12
	8	83.2	6145	1	0.5	25.56
	9	86.7	16707	1	0.5	72.42
	10	88.9	40328	1	0.5	179.26
	11	92.2	23925	1	0.5	110.29
	12	95.0	5700	1	0.5	27.08
	13	92.1	1265	1	0.5	5.83
	14	98.5	141	1	0.5	0.69
	15	99.3	107	1	0.5	0.53
	16	99.3	526	1	0.5	2.61
				TOTAL:		608.61

Table 2. Reproductive parameters of Norwegian spring spawning herring.

Year	Spawning stock biomass(10^3 t)	Population fecundity (10^{12}eggs)	Year-class 3 abundance (*10^6)	Survival index (per 10^6 eggs)	Survival index (per 1t SSB)	Year-class abundance	Survival conditions
1907	803.55	113.5656	10338.2	91.03284	12865.66	Strong	Favourable
1908	1494.67	188.7609	6868.6	36.38782	4595.396	Average	Favourable
1909	2949.61	357.6151	3585.7	10.0267	1215.652	Average	Moderate
1910	5282.93	662.4714	4727.2	7.135705	894.8065	Average	Moderate
1911	7294.2	919.5725	2910.4	3.164949	399.0019	Average	Moderate
1912	8288.53	1087.749	5593.8	5.142546	674.8844	Average	Moderate
1913	8651.43	1164.582	4699.4	4.035268	543.1934	Average	Moderate
1914	8612.86	1163.711	2256.4	1.93897	261.9803	Average	Unfavourable
1915	8254.71	1128.737	3005.8	2.662978	364.1315	Average	Unfavourable
1916	7842.62	1080.912	5287.9	4.892073	674.2517	Average	Moderate
1917	7464.18	1014.35	4906.3	4.83689	657.3127	Average	Moderate
1918	7148.51	977.9815	16770.7	17.14828	2346.041	Strong	Moderate
1919	6677.86	913.5187	6616.2	7.242545	990.7665	Average	Moderate
1920	5290.19	719.6705	9280.7	12.89576	1754.323	Average	Moderate
1921	4484.05	609.9729	9166	15.0269	2044.134	Average	Moderate
1922	4619.91	615.0419	14164.6	23.0303	3065.99	Strong	Favourable
1923	4864.48	635.8348	23942.7	37.65553	4921.944	Strong	Favourable
1924	5616.3	736.7086	13118.5	17.80691	2335.79	Strong	Moderate
1925	6345.56	828.076	16752.4	20.23051	2640.019	Strong	Favourable
1926	6969.93	926.929	3937.6	4.248006	564.9411	Average	Moderate
1927	8031.59	1055.86	2158.9	2.044684	268.8011	Average	Unfavourable
1928	9350.69	1224.756	2511.1	2.050286	268.547	Average	Unfavourable
1929	11026.52	1446.216	1976.8	1.366877	179.2769	Weak	Unfavourable
1930	11968.04	1582.66	11373.1	7.186066	950.2893	Strong	Moderate
1931	11946.16	1606.906	5222.6	3.250097	437.1781	Average	Moderate
1932	11130.12	1517.189	8941.8	5.893663	803.3876	Average	Moderate
1933	9933.05	1374.91	15042.5	10.94071	1514.389	Strong	Moderate
1934	8599.7	1187.83	15766	13.27295	1833.32	Strong	Moderate
1935	7248.62	1098.539	18231.8	16.5964	2515.21	Strong	Moderate
1936	6892.4	1012.191	5903.5	5.8324	856.5231	Average	Moderate
1937	6284.51	945.7016	33717	35.65289	5365.096	Strong	Favourable
1938	6040.39	933.9577	25198.7	26.98056	4171.701	Strong	Favourable
1939	6132.87	938.5382	9594.4	10.22271	1564.423	Average	Moderate
1940	6977.7	1057.505	10455.3	9.886762	1498.388	Strong	Moderate
1941	7612.99	1219.097	7453.5	6.11395	979.0503	Average	Moderate
1942	11243.05	1456.724	4607.1	3.162644	409.7731	Average	Moderate
1943	13538.88	1779.704	17566.2	9.870295	1297.463	Strong	Moderate
1944	15393.2	2022.572	14992.2	7.412442	973.9495	Strong	Moderate
1945	15832.24	2122.671	6756.2	3.182877	426.7368	Average	Moderate
1946	15328.9	2094.012	4753.4	2.269997	310.094	Average	Unfavourable
1947	14609.23	1994.008	10855.8	5.444212	743.0782	Strong	Moderate
1948	13688.96	1920.337	5413.4	2.818984	395.4574	Average	Unfavourable

Continuation of Table 2

1949	13422.85	1825.789	3594.4	1.968683	267.7822	Average	Unfavourable
1950	13973.47	1945.803	47045.8	24.17808	3366.794	Strong	Favourable
1951	12440.19	1746.491	6522.5	3.734631	524.3087	Average	Moderate
1952	11481.77	1618.8	3174.8	1.961205	276.5079	Average	Unfavourable
1953	10613.26	1491.167	3009.2	2.018016	283.5321	Average	Unfavourable
1954	9445.04	1308.472	555.4	0.424464	58.80335	Weak	Unfavourable
1955	10209.08	1416.101	464.89	0.328289	45.53691	Weak	Unfavourable
1956	11716.41	1630.696	161.9	0.099283	13.81823	Weak	Unfavourable
1957	10092.57	1411.859	244.17	0.172942	24.19304	Weak	Unfavourable
1958	9220.3	1293.251	229.05	0.177112	24.84192	Weak	Unfavourable
1959	7297.33	1045.205	20289.26	19.41175	2780.368	Strong	Moderate
1960	5769.17	799.4091	7008.12	8.766626	1214.754	Average	Moderate
1961	4192.52	598.3111	2076.01	3.469783	495.17	Average	Moderate
1962	3464.8	493.8491	195.85	0.396579	56.52563	Weak	Unfavourable
1963	2635.44	369.0037	8160.99	22.11628	3096.633	Average	Favourable
1964	2795.15	378.3946	3767.2	9.955744	1347.763	Average	Moderate
1965	3067.48	434.3335	107.48	0.24746	35.03853	Weak	Unfavourable
1966	2595.3	398.7037	227.48	0.570549	87.65075	Weak	Unfavourable
1967	1145.49	182.1776	16.37	0.089857	14.29083	Weak	Unfavourable
1968	219.03	37.39399	7.86	0.210194	35.8855	Weak	Unfavourable
1969	77.54	12.90981	406.5	31.48767	5242.456	Weak	Favourable
1970	30.72	4.850703	7.66	1.579153	249.349	Weak	Unfavourable
1971	8.23	1.323414	0.93	0.702728	113.0012	Weak	Unfavourable
1972	1.85	0.333862	24.3	72.78467	13135.14	Weak	Favourable
1973	74.4	6.643159	847.58	127.5869	11392.2	Weak	Favourable
1974	85.34	6.97487	562.94	80.70975	6596.438	Weak	Favourable
1975	91.38	6.782803	192.13	28.32605	2102.539	Weak	Favourable
1976	145.98	14.11156	668.98	47.40651	4582.683	Weak	Favourable
1977	283.51	27.45592	332.52	12.11105	1172.869	Weak	Moderate
1978	354.75	29.82165	408.94	13.71286	1152.755	Weak	Moderate
1979	385.58	33.05811	824.83	24.95091	2139.193	Weak	Favourable
1980	468.61	39.85026	102.35	2.568365	218.4119	Weak	Unfavourable
1981	502.69	47.51064	71.23	1.499243	141.6977	Weak	Unfavourable
1982	501.56	50.82519	151.56	2.981986	302.1772	Weak	Unfavourable
1983	572.712	54.67086	24673.7	451.3135	43082.21	Strong	Favourable
1984	597.396	61.88767	757.8	12.24477	1268.505	Weak	Moderate
1985	495.227	56.37529	5158.6	91.50463	10416.64	Average	Favourable
1986	414.41	87.14974	765.4	8.782585	1846.963	Weak	Moderate
1987	990.64	155.8655	635.2	4.075308	641.2016	Weak	Moderate
1988	3173.31	451.578	1639.7	3.631045	516.716	Weak	Moderate
1989	3964.74	529.959	4872	9.193164	1228.832	Average	Moderate
1990	4497.85	514.5051	8909.7	17.31703	1980.88	Average	Moderate
1991	4325.51	577.7189	23490.8	40.6613	5430.758	Strong	Favourable
1992	4583.49	528.8163	26368.5	49.86326	5752.931	Strong	Favourable
1993	4316.11	515.3171	7210.7	13.99274	1670.648	Average	Moderate
1994	4784.79	556.4556	2314.4	4.159182	483.6994	Average	Moderate
1995	5684.3	705.2148	758.2	1.075133	133.3849	Weak	Unfavourable
1996	7328.35	1035.302	7298.7	7.049829	995.9541	Average	Moderate
1997	8583.62	1279.018	2583	2.019517	300.922	Average	Unfavourable
1998	7801.11	1197.249	1674.2	1.398372	214.6105	Weak	Unfavourable
1999	7140.98	1011.054					
2000	5987.62	862.0588					
2001	5217.73	704.2744					
2002	5288	608.6118					

Table 3. Reproductive parameters of Northeast Arctic cod in 1946-2002 гг.

Year	Spawning stock biomass(10^3 t)	Population fecundity (10^{12}eggs)	Year-class 3 abundance ($*10^6$)	Survival index (per 10 eggs)	Survival index (per 1t SSB)	Year-class abundance group	Survival conditions type
1946	1112.776	603.488	468.348	0.776	420.883	Average	Unfavourable
1947	1165.059	651.316	704.908	1.082	605.041	Average	Unfavourable
1948	1019.114	558.215	1083.753	1.941	1063.427	Strong	Unfavourable
1949	729.879	389.964	1193.111	3.060	1634.670	Strong	Moderate
1950	615.339	299.996	1590.377	5.301	2584.554	Strong	Moderate
1951	568.705	255.766	641.584	2.508	1128.149	Average	Moderate
1952	520.599	208.698	272.778	1.307	523.970	Weak	Unfavourable
1953	396.417	154.179	439.602	2.851	1108.938	Average	Moderate
1954	429.694	156.078	804.781	5.156	1872.917	Average	Moderate
1955	346.919	133.077	496.824	3.733	1432.104	Average	Moderate
1956	299.823	111.118	683.690	6.153	2280.312	Average	Moderate
1957	207.840	73.689	789.653	10.716	3799.331	Average	Favourable
1958	195.377	66.760	916.842	13.733	4692.681	Strong	Favourable
1959	432.489	151.529	728.338	4.807	1684.061	Average	Moderate
1960	383.479	123.181	472.064	3.832	1231.004	Average	Moderate
1961	404.228	129.659	338.678	2.612	837.839	Weak	Moderate
1962	311.678	96.126	776.941	8.082	2492.768	Average	Moderate
1963	208.207	63.630	1582.560	24.871	7600.897	Strong	Favourable
1964	186.570	56.833	1295.416	22.793	6943.324	Strong	Favourable
1965	102.315	36.424	164.955	4.529	1612.227	Weak	Moderate
1966	120.722	42.144	112.039	2.658	928.074	Weak	Moderate
1967	129.784	46.489	197.105	4.240	1518.716	Weak	Moderate
1968	227.215	69.456	404.774	5.828	1781.458	Average	Moderate
1969	151.870	53.131	1015.319	19.110	6685.448	Strong	Favourable
1970	224.482	71.950	1818.949	25.281	8102.872	Strong	Favourable
1971	311.662	98.862	523.916	5.299	1681.039	Average	Moderate
1972	346.511	106.300	621.616	5.848	1793.929	Average	Moderate
1973	332.913	95.151	613.942	6.452	1844.151	Average	Moderate
1974	164.491	52.316	348.054	6.653	2115.946	Weak	Moderate
1975	142.028	44.250	638.490	14.429	4495.522	Average	Favourable
1976	171.238	53.008	198.489	3.745	1159.141	Weak	Moderate
1977	341.385	97.614	137.734	1.411	403.457	Weak	Unfavourable
1978	241.536	72.785	150.685	2.070	623.861	Weak	Unfavourable
1979	174.699	50.371	151.821	3.014	869.043	Weak	Moderate
1980	108.253	35.061	166.793	4.757	1540.770	Weak	Moderate
1981	166.925	46.802	397.414	8.491	2380.794	Weak	Moderate
1982	326.131	97.740	523.102	5.352	1603.963	Average	Moderate
1983	327.176	84.831	929.109	10.952	2839.783	Strong	Favourable
1984	251.077	63.723	270.605	4.247	1077.777	Weak	Moderate
1985	193.455	43.206	202.899	4.696	1048.818	Weak	Moderate
1986	170.219	39.863	172.786	4.334	1015.081	Weak	Moderate
1987	118.247	32.712	242.748	7.421	2052.889	Weak	Moderate
1988	201.850	61.101	408.093	6.679	2021.764	Average	Moderate
1989	193.794	66.264	700.256	10.568	3613.404	Average	Favourable
1990	339.048	122.928	758.583	6.171	2237.391	Average	Moderate

Continuation of Table 3

1991	672.212	185.595	516.200	2.781	767.913	Average	Moderate
1992	867.293	216.357	306.484	1.417	353.380	Weak	Unfavourable
1993	728.599	183.871	252.286	1.372	346.262	Weak	Unfavourable
1994	597.228	164.033	476.396	2.904	797.679	Average	Moderate
1995	497.714	137.328	579.155	4.217	1163.630	Average	Moderate
1996	569.105	152.536	442.602	2.902	777.716	Average	Moderate
1997	564.434	146.879	531.479	3.618	941.614	Average	Moderate
1998	385.410	109.780	454.660	4.142	1179.679	Average	Moderate
1999	253.252	72.604	278.000	3.829	1097.721	Weak	Moderate
2000	219.044	66.518	468.000	7.036	2136.557	Average	Moderate
2001	297.780	78.928	165.000	2.091	554.100	Weak	Unfavourable
2002	429.735	98.467					

Table 4. Reproductive parameters of North-east Arctic haddock.

Year	Spawning stock biomass(10^3 t)	Population fecundity (10^{12}eggs)	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)	Year-class abundance group	Survival conditions type
1950	139.640	56.895	1023.250	17.985	7327.771	Strong	Favourable
1951	106.860	31.542	120.540	3.822	1128.018	Weak	Moderate
1952	61.420	24.553	50.770	2.068	826.604	Weak	Moderate
1953	83.400	28.142	167.880	5.965	2012.950	Average	Moderate
1954	122.080	42.988	51.540	1.199	422.182	Weak	Unfavourable
1955	173.460	73.642	67.410	0.915	388.620	Weak	Unfavourable
1956	232.810	85.083	322.650	3.792	1385.894	Average	Moderate
1957	188.880	62.981	240.840	3.824	1275.095	Average	Moderate
1958	147.890	48.210	108.740	2.256	735.276	Weak	Moderate
1959	123.390	30.232	240.220	7.946	1946.835	Average	Moderate
1960	118.280	28.129	273.040	9.707	2308.421	Average	Moderate
1961	127.640	31.160	316.150	10.146	2476.888	Average	Moderate
1962	115.520	30.508	100.870	3.306	873.182	Weak	Moderate
1963	82.500	21.960	237.490	10.815	2878.667	Average	Moderate
1964	59.580	19.466	293.830	15.095	4931.688	Average	Favourable
1965	90.810	26.247	17.580	0.670	193.591	Weak	Unfavourable
1966	122.890	37.473	17.380	0.464	141.427	Weak	Unfavourable
1967	155.340	38.801	164.310	4.235	1057.744	Average	Moderate
1968	172.540	43.386	94.310	2.174	546.598	Weak	Moderate
1969	167.710	42.242	1020.080	24.148	6082.404	Strong	Favourable
1970	150.360	38.786	270.090	6.964	1796.289	Average	Moderate
1971	172.420	32.457	52.810	1.627	306.287	Weak	Moderate
1972	140.190	30.866	48.620	1.575	346.815	Weak	Moderate
1973	117.790	29.301	55.900	1.908	474.573	Weak	Moderate
1974	194.110	43.325	113.880	2.629	586.678	Weak	Moderate
1975	230.590	55.144	171.140	3.104	742.183	Average	Moderate
1976	190.810	55.151	135.430	2.456	709.764	Weak	Moderate
1977	130.130	33.650	18.820	0.559	144.625	Weak	Unfavourable
1978	97.970	20.211	6.200	0.307	63.285	Weak	Unfavourable
1979	80.290	14.430	8.300	0.575	103.375	Weak	Unfavourable
1980	74.820	12.164	4.810	0.395	64.288	Weak	Unfavourable
1981	128.060	24.752	8.370	0.338	65.360	Weak	Unfavourable
1982	106.220	21.132	256.270	12.127	2412.634	Average	Favourable
1983	61.980	13.889	524.980	37.799	8470.152	Strong	Favourable
1984	42.440	8.768	83.240	9.494	1961.357	Weak	Moderate
1985	35.900	7.402	41.550	5.613	1157.382	Weak	Moderate
1986	47.840	15.858	16.660	1.051	348.244	Weak	Unfavourable
1987	34.560	10.734	24.250	2.259	701.678	Weak	Moderate
1988	62.050	27.198	81.330	2.990	1310.717	Weak	Moderate
1989	63.580	29.296	195.280	6.666	3071.406	Average	Moderate
1990	67.300	24.174	625.830	25.889	9299.108	Strong	Favourable
1991	78.720	26.355	273.810	10.389	3478.277	Average	Moderate
1992	89.430	25.452	74.140	2.913	829.028	Weak	Moderate
1993	134.360	35.607	84.640	2.377	629.949	Weak	Moderate
1994	74.770	19.853	99.330	5.003	1328.474	Weak	Moderate
1995	95.670	32.797	43.580	1.329	455.524	Weak	Unfavourable

Continuation of Table 4

1996	136.750	49.582	179.920	3.629	1315.686	Average	Moderate
1997	132.630	44.964	57.960	1.289	437.005	Weak	Unfavourable
1998	103.070	36.234	265.190	7.319	2572.912	Average	Moderate
1999	90.820	29.357	241.000	8.209	2653.601	Average	Moderate
2000	54.350	19.856	199.000	10.022	3661.454	Average	Moderate
2001	89.720	27.386	284.000	10.370	3165.403	Average	Moderate
2002	67.450	22.444					

Table 5. Reproductive parameters of Greenland halibut of the Norwegian and Barents seas.

Year	Spawning stock biomass(10^3 t)	Population fecundity (10^{12}eggs)	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)	Year-class abundance group	Survival conditions type
1964	72.644	0.341	55.930	164.233	769.919	Strong	Favourable
1965	69.254	0.334	41.112	123.271	593.641	Strong	Favourable
1966	68.557	0.329	31.549	95.848	460.186	Average	Moderate
1967	76.709	0.362	33.550	92.561	437.367	Average	Moderate
1968	90.723	0.433	31.060	71.669	342.361	Average	Moderate
1969	116.540	0.550	26.640	48.419	228.591	Average	Unfavourable
1970	139.620	0.652	22.540	34.571	161.438	Average	Unfavourable
1971	111.283	0.514	22.100	43.021	198.593	Average	Unfavourable
1972	94.880	0.442	23.690	53.558	249.684	Average	Unfavourable
1973	95.795	0.452	20.590	45.602	214.938	Average	Unfavourable
1974	91.519	0.436	19.700	45.187	215.256	Weak	Unfavourable
1975	79.760	0.381	18.600	48.863	233.200	Weak	Unfavourable
1976	62.686	0.299	17.880	59.803	285.231	Weak	Unfavourable
1977	45.322	0.214	18.930	88.501	417.678	Weak	Moderate
1978	35.938	0.167	19.000	113.472	528.688	Weak	Favourable
1979	35.653	0.152	17.810	117.163	499.537	Weak	Favourable
1980	34.654	0.175	19.930	114.136	575.114	Weak	Favourable
1981	39.586	0.176	19.850	112.779	501.440	Weak	Favourable
1982	38.430	0.183	19.420	105.992	505.334	Weak	Moderate
1983	42.792	0.174	22.960	132.326	536.549	Average	Favourable
1984	39.254	0.162	20.710	127.625	527.590	Average	Favourable
1985	41.175	0.159	14.500	91.254	352.155	Weak	Moderate
1986	40.620	0.170	12.620	74.422	310.684	Weak	Moderate
1987	30.373	0.117	10.490	89.475	345.373	Weak	Moderate
1988	26.843	0.116	12.810	110.816	477.219	Weak	Favourable
1989	24.116	0.099	17.910	180.464	742.660	Weak	Favourable
1990	21.053	0.096	16.860	174.996	800.836	Weak	Favourable
1991	24.960	0.115	17.390	151.285	696.715	Weak	Favourable
1992	16.093	0.068	17.680	261.889	1098.614	Weak	Favourable
1993	18.115	0.066	16.280	246.475	898.703	Weak	Favourable
1994	15.671	0.065	14.080	215.218	898.475	Weak	Favourable
1995	14.210	0.060	17.890	300.049	1258.973	Weak	Favourable
1996	14.095	0.054	14.310	266.177	1015.254	Weak	Favourable
1997	15.157	0.060	15.170	253.069	1000.858	Weak	Favourable
1998	16.643	0.067	15.170	224.859	911.494	Weak	Favourable
1999	18.814	0.079	15.170	192.726	806.314	Weak	Favourable
2000	20.819	0.082					
2001	22.695	0.088					
2002	23.344	0.093					

Table 6. Weak year classes Norwegian spring spawning herring classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10□ eggs)	Survival index (per 1t SSB)
1929	1976.8	1.367	179.277
1954	555.4	0.424	58.803
1955	464.89	0.328	45.537
1956	161.9	0.099	13.818
1957	244.17	0.173	24.193
1958	229.05	0.177	24.842
1962	195.85	0.397	56.526
1965	107.48	0.247	35.039
1966	227.48	0.571	87.651
1967	16.37	0.090	14.291
1968	7.86	0.210	35.885
1969	406.5	31.488	5242.456
1970	7.66	1.579	249.349
1971	0.93	0.703	113.001
1972	24.3	72.785	13135.135
1973	847.58	127.587	11392.204
1974	562.94	80.710	6596.438
1975	192.13	28.326	2102.539
1976	668.98	47.407	4582.683
1977	332.52	12.111	1172.869
1978	408.94	13.713	1152.755
1979	824.83	24.951	2139.193
1980	102.35	2.568	218.412
1981	71.23	1.499	141.698
1982	151.56	2.982	302.177
1984	757.8	12.245	1268.505
1986	765.4	8.783	1846.963
1987	635.2	4.075	641.202
1988	1639.7	3.631	516.716
1995	758.2	1.075	133.385
1998	1674.2	1.398	214.610
N	31		
Mean	484.52	15.603	1733.489
St deviation	506.86	29.340	3260.405
Min	0.93	0.090	13.818
Max	1976.80	127.587	13135.135

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10□ eggs)	Survival index (per 1t SSB)
1909	3585.7	10.027	1215.652
1911	2910.4	3.165	399.002
1914	2256.4	1.939	261.980
1915	3005.8	2.663	364.132
1926	3937.6	4.248	564.941
1927	2158.9	2.045	268.801
1928	2511.1	2.050	268.547
1929	1976.8	1.367	179.277
1949	3594.4	1.969	267.782
1952	3174.8	1.961	276.508
1953	3009.2	2.018	283.532
1954	555.4	0.424	58.803
1955	464.89	0.328	45.537
1956	161.9	0.099	13.818
1957	244.17	0.173	24.193
1958	229.05	0.177	24.842
1961	2076.01	3.470	495.170
1962	195.85	0.397	56.526
1964	3767.2	9.956	1347.763
1965	107.48	0.247	35.039
1966	227.48	0.571	87.651
1967	16.37	0.090	14.291
1968	7.86	0.210	35.885
1969	406.5	31.488	5242.456
1970	7.66	1.579	249.349
1971	0.93	0.703	113.001
1972	24.3	72.785	13135.135
1973	847.58	127.587	11392.204
1974	562.94	80.710	6596.438
1975	192.13	28.326	2102.539
1976	668.98	47.407	4582.683
1977	332.52	12.111	1172.869
1978	408.94	13.713	1152.755
1979	824.83	24.951	2139.193
1980	102.35	2.568	218.412
1981	71.23	1.499	141.698
1982	151.56	2.982	302.177
1984	757.8	12.245	1268.505
1986	765.4	8.783	1846.963
1987	635.2	4.075	641.202
1988	1639.7	3.631	516.716

Continuation of Table 6

1994	2314.4	4.159	483.699
1995	758.2	1.075	133.385
1997	2583	2.020	300.922
1998	1674.2	1.398	214.610
N	45		
Mean	1242.34	11.897	1345.257
St deviation	1261.68	24.906	2761.509
Min	0.93	0.090	13.818
Max	3937.60	127.587	13135.135

Table 7. Average abundant year classes Norwegian spring spawning herring classified traditionally and by means of cluster analysis

Traditional classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1908	6868.6	36.387824	4595.396
1909	3585.7	10.026701	1215.652
1910	4727.2	7.1357046	894.8065
1911	2910.4	3.1649491	399.0019
1912	5593.8	5.1425457	674.8844
1913	4699.4	4.0352685	543.1934
1914	2256.4	1.9389695	261.9803
1915	3005.8	2.6629775	364.1315
1916	5287.9	4.8920726	674.2517
1917	4906.3	4.8368895	657.3127
1919	6616.2	7.2425446	990.7665
1920	9280.7	12.895763	1754.323
1921	9166	15.026897	2044.134
1926	3937.6	4.2480061	564.9411
1927	2158.9	2.0446838	268.8011
1928	2511.1	2.0502865	268.547
1931	5222.6	3.2500973	437.1781
1932	8941.8	5.8936628	803.3876
1936	5903.5	5.8323999	856.5231
1939	9594.4	10.222706	1564.423
1941	7453.5	6.1139499	979.0503
1942	4607.1	3.1626439	409.7731
1945	6756.2	3.1828767	426.7368
1946	4753.4	2.2699966	310.094
1948	5413.4	2.8189841	395.4574
1949	3594.4	1.9686827	267.7822
1951	6522.5	3.7346307	524.3087
1952	3174.8	1.9612053	276.5079
1953	3009.2	2.0180161	283.5321
1960	7008.12	8.7666258	1214.754
1961	2076.01	3.4697834	495.17
1963	8160.99	22.116284	3096.633
1964	3767.2	9.9557439	1347.763
1985	5158.6	91.504627	10416.64
1989	4872	9.1931635	1228.832
1990	8909.7	17.317031	1980.88
1993	7210.7	13.992742	1670.648
1994	2314.4	4.1591818	483.6994
1996	7298.7	7.0498286	995.9541
1997	2583	2.0195174	300.922

Cluster classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1907	10338.2	91.03284	12865.66
1908	6868.6	36.38782	4595.396
1910	4727.2	7.135705	894.8065
1912	5593.8	5.142546	674.8844
1913	4699.4	4.035268	543.1934
1916	5287.9	4.892073	674.2517
1917	4906.3	4.83689	657.3127
1919	6616.2	7.242545	990.7665
1920	9280.7	12.89576	1754.323
1921	9166	15.0269	2044.134
1930	11373.1	7.186066	950.2893
1931	5222.6	3.250097	437.1781
1932	8941.8	5.893663	803.3876
1936	5903.5	5.8324	856.5231
1939	9594.4	10.22271	1564.423
1940	10455.3	9.886762	1498.388
1941	7453.5	6.11395	979.0503
1942	4607.1	3.162644	409.7731
1945	6756.2	3.182877	426.7368
1946	4753.4	2.269997	310.094
1947	10855.8	5.444212	743.0782
1948	5413.4	2.818984	395.4574
1951	6522.5	3.734631	524.3087
1960	7008.12	8.766626	1214.754
1963	8160.99	22.11628	3096.633
1985	5158.6	91.50463	10416.64
1989	4872	9.193164	1228.832
1990	8909.7	17.31703	1980.88
1993	7210.7	13.99274	1670.648
1996	7298.7	7.049829	995.9541
N	30		
Mean	7131.86	14.25	1873.26
St dev	2101.35	22.07	2818.58
Min	4607.10	2.27	310.09
Max	11373.10	91.50	12865.66

Continuation of Table 7

N	40		
Mean	5295.46	9.14	1173.47
St dev	2226.90	14.93	1726.64
Min	2076.01	1.94	261.98
Max	9594.40	91.50	10416.64

Table 8. Strong year classes of Norwegian spring spawning herring classified traditionally and by means of cluster analysis

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1907	10338.2	91.033	12865.659
1918	16770.7	17.148	2346.041
1922	14164.6	23.030	3065.990
1923	23942.7	37.656	4921.944
1924	13118.5	17.807	2335.790
1925	16752.4	20.231	2640.019
1930	11373.1	7.186	950.289
1933	15042.5	10.941	1514.389
1934	15766	13.273	1833.320
1935	18231.8	16.596	2515.210
1937	33717	35.653	5365.096
1938	25198.7	26.981	4171.701
1940	10455.3	9.887	1498.388
1943	17566.2	9.870	1297.463
1944	14992.2	7.412	973.950
1947	10855.8	5.444	743.078
1950	47045.8	24.178	3366.794
1959	20289.26	19.412	2780.368
1983	24673.7	451.314	43082.212
1991	23490.8	40.661	5430.758
1992	26368.5	49.863	5752.931
N	21		
Mean	19531.13	44.551	5211.971
St dev	8814.09	95.200	9079.801
Min	10338.20	5.444	743.078
Max	47045.80	451.314	43082.212

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1924	13118.5	17.81	2335.79
1922	14164.6	23.03	3065.99
1944	14992.2	7.41	973.95
1933	15042.5	10.94	1514.39
1934	15766	13.27	1833.32
1925	16752.4	20.23	2640.02
1918	16770.7	17.15	2346.04
1943	17566.2	9.87	1297.46
1935	18231.8	16.60	2515.21
1959	20289.26	19.41	2780.37
1991	23490.8	40.66	5430.76
1923	23942.7	37.66	4921.94
1983	24673.7	451.31	43082.21
1938	25198.7	26.98	4171.70
1992	26368.5	49.86	5752.93
1937	33717	35.65	5365.10
1950	47045.8	24.18	3366.79
N	17		
Mean	21595.96	48.35	5493.76
St dev	8560.76	104.50	9801.16
Min	13118.50	7.41	973.95
Max	47045.80	451.31	43082.21

Table 9. Unfavourable survival conditions Norwegian spring spawning herring classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance ($*10^6$)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1914	2256.4	1.939	261.980
1915	3005.8	2.663	364.132
1927	2158.9	2.045	268.801
1928	2511.1	2.050	268.547
1929	1976.8	1.367	179.277
1946	4753.4	2.270	310.094
1948	5413.4	2.819	395.457
1949	3594.4	1.969	267.782
1952	3174.8	1.961	276.508
1953	3009.2	2.018	283.532
1954	555.4	0.424	58.803
1955	464.89	0.328	45.537
1956	161.9	0.099	13.818
1957	244.17	0.173	24.193
1958	229.05	0.177	24.842
1962	195.85	0.397	56.526
1965	107.48	0.247	35.039
1966	227.48	0.571	87.651
1967	16.37	0.090	14.291
1968	7.86	0.210	35.885
1970	7.66	1.579	249.349
1971	0.93	0.703	113.001
1980	102.35	2.568	218.412
1981	71.23	1.499	141.698
1982	151.56	2.982	302.177
1995	758.2	1.075	133.385
1997	2583	2.020	300.922
1998	1674.2	1.398	214.610
N	28		
Mean	1407.64	1.344	176.652
St deviation	1590.80	0.948	120.805
Min	0.93	0.090	13.818
Max	5413.40	2.982	395.457

Cluster classification

Year	Year-class 3 abundance ($*10^6$)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1909	3585.7	10.027	1215.652
1910	4727.2	7.136	894.806
1911	2910.4	3.165	399.002
1912	5593.8	5.143	674.884
1913	4699.4	4.035	543.193
1914	2256.4	1.939	261.980
1915	3005.8	2.663	364.132
1916	5287.9	4.892	674.252
1917	4906.3	4.837	657.313
1919	6616.2	7.243	990.767
1920	9280.7	12.896	1754.323
1921	9166	15.027	2044.134
1926	3937.6	4.248	564.941
1927	2158.9	2.045	268.801
1928	2511.1	2.050	268.547
1929	1976.8	1.367	179.277
1930	11373.1	7.186	950.289
1931	5222.6	3.250	437.178
1932	8941.8	5.894	803.388
1933	15042.5	10.941	1514.389
1934	15766	13.273	1833.320
1936	5903.5	5.832	856.523
1939	9594.4	10.223	1564.423
1940	10455.3	9.887	1498.388
1941	7453.5	6.114	979.050
1942	4607.1	3.163	409.773
1943	17566.2	9.870	1297.463
1944	14992.2	7.412	973.950
1945	6756.2	3.183	426.737
1946	4753.4	2.270	310.094
1947	10855.8	5.444	743.078
1948	5413.4	2.819	395.457
1949	3594.4	1.969	267.782
1951	6522.5	3.735	524.309
1952	3174.8	1.961	276.508
1953	3009.2	2.018	283.532
1954	555.4	0.424	58.803
1955	464.89	0.328	45.537
1956	161.9	0.099	13.818
1957	244.17	0.173	24.193
1958	229.05	0.177	24.842

Continuation of Table 9

1960	7008.12	8.767	1214.754
1961	2076.01	3.470	495.170
1962	195.85	0.397	56.526
1964	3767.2	9.956	1347.763
1965	107.48	0.247	35.039
1966	227.48	0.571	87.651
1967	16.37	0.090	14.291
1968	7.86	0.210	35.885
1970	7.66	1.579	249.349
1971	0.93	0.703	113.001
1977	332.52	12.111	1172.869
1978	408.94	13.713	1152.755
1980	102.35	2.568	218.412
1981	71.23	1.499	141.698
1982	151.56	2.982	302.177
1984	757.8	12.245	1268.505
1986	765.4	8.783	1846.963
1987	635.2	4.075	641.202
1988	1639.7	3.631	516.716
1989	4872	9.193	1228.832
1993	7210.7	13.993	1670.648
1994	2314.4	4.159	483.699
1995	758.2	1.075	133.385
1996	7298.7	7.050	995.954
1997	2583	2.020	300.922
1998	1674.2	1.398	214.610
N	67		
Mean	4332.30	4.968	659.815
St deviation	4290.76	4.165	547.527
Min	0.93	0.090	13.818
Max	17566.20	15.027	2044.134

Table 10. Moderate survival conditions Norwegian spring spawning herring classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1909	3585.7	10.027	1215.652
1910	4727.2	7.136	894.806
1911	2910.4	3.165	399.002
1912	5593.8	5.143	674.884
1913	4699.4	4.035	543.193
1916	5287.9	4.892	674.252
1917	4906.3	4.837	657.313
1918	16770.7	17.148	2346.041
1919	6616.2	7.243	990.767
1920	9280.7	12.896	1754.323
1921	9166	15.027	2044.134
1924	13118.5	17.807	2335.790
1926	3937.6	4.248	564.941
1930	11373.1	7.186	950.289
1931	5222.6	3.250	437.178
1932	8941.8	5.894	803.388
1933	15042.5	10.941	1514.389
1934	15766	13.273	1833.320
1935	18231.8	16.596	2515.210
1936	5903.5	5.832	856.523
1939	9594.4	10.223	1564.423
1940	10455.3	9.887	1498.388
1941	7453.5	6.114	979.050
1942	4607.1	3.163	409.773
1943	17566.2	9.870	1297.463
1944	14992.2	7.412	973.950
1945	6756.2	3.183	426.737
1947	10855.8	5.444	743.078
1951	6522.5	3.735	524.309
1959	20289.26	19.412	2780.368
1960	7008.12	8.767	1214.754
1961	2076.01	3.470	495.170
1964	3767.2	9.956	1347.763
1977	332.52	12.111	1172.869
1978	408.94	13.713	1152.755
1984	757.8	12.245	1268.505
1986	765.4	8.783	1846.963
1987	635.2	4.075	641.202
1988	1639.7	3.631	516.716
1989	4872	9.193	1228.832
1990	8909.7	17.317	1980.880

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1908	6868.6	36.388	4595.396
1918	16770.7	17.148	2346.041
1922	14164.6	23.030	3065.990
1923	23942.7	37.656	4921.944
1924	13118.5	17.807	2335.790
1925	16752.4	20.231	2640.019
1935	18231.8	16.596	2515.210
1937	33717	35.653	5365.096
1938	25198.7	26.981	4171.701
1950	47045.8	24.178	3366.794
1959	20289.26	19.412	2780.368
1963	8160.99	22.116	3096.633
1969	406.5	31.488	5242.456
1975	192.13	28.326	2102.539
1976	668.98	47.407	4582.683
1979	824.83	24.951	2139.193
1990	8909.7	17.317	1980.880
1991	23490.8	40.661	5430.758
1992	26368.5	49.863	5752.931
N	19		
Mean	16059.08	28.274	3601.706
St deviation	12424.61	10.361	1319.983
Min	192.13	16.596	1980.880
Max	47045.80	49.863	5752.931

Continuation of Table 10

1993	7210.7	13.993	1670.648
1994	2314.4	4.159	483.699
1996	7298.7	7.050	995.954
N	44		
Mean	7458.42	8.715	1164.083
St deviation	5233.97	4.687	628.831
Min	332.52	3.163	399.002
Max	20289.26	19.412	2780.368

Table 11. Favourable survival conditions Norwegian spring spawning herring classified traditionally and by means of cluster analysis

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1907	10338.2	91.033	12865.659
1908	6868.6	36.388	4595.396
1922	14164.6	23.030	3065.990
1923	23942.7	37.656	4921.944
1925	16752.4	20.231	2640.019
1937	33717	35.653	5365.096
1938	25198.7	26.981	4171.701
1950	47045.8	24.178	3366.794
1963	8160.99	22.116	3096.633
1969	406.5	31.488	5242.456
1972	24.3	72.785	13135.135
1973	847.58	127.587	11392.204
1974	562.94	80.710	6596.438
1975	192.13	28.326	2102.539
1976	668.98	47.407	4582.683
1979	824.83	24.951	2139.193
1983	24673.7	451.314	43082.212
1985	5158.6	91.505	10416.637
1991	23490.8	40.661	5430.758
1992	26368.5	49.863	5752.931
N	20		
Mean	13470.39	68.193	7698.121
St deviation	13603.72	94.865	9001.783
Min	24.30	20.231	2102.539
Max	47045.80	451.314	43082.212

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1907	10338.2	91.033	12865.659
1972	24.3	72.785	13135.135
1973	847.58	127.587	11392.204
1974	562.94	80.710	6596.438
1983	24673.7	451.314	43082.212
1985	5158.6	91.505	10416.637
N	6		
Mean	6934.22	152.489	16248.048
St deviation	9537.47	147.592	13356.207
Min	24.30	72.785	6596.438
Max	24673.70	451.314	43082.212

Table 12. Weak year classes of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1952	272.778	1.307	523.970
1961	338.678	2.612	837.839
1965	164.955	4.529	1612.227
1966	112.039	2.658	928.074
1967	197.105	4.240	1518.716
1974	348.054	6.653	2115.946
1976	198.489	3.745	1159.141
1977	137.734	1.411	403.457
1978	150.685	2.070	623.861
1979	151.821	3.014	869.043
1980	166.793	4.757	1540.770
1981	397.414	8.491	2380.794
1984	270.605	4.247	1077.777
1985	202.899	4.696	1048.818
1986	172.786	4.334	1015.081
1987	242.748	7.421	2052.889
1992	306.484	1.417	353.380
1993	252.286	1.372	346.262
1999	278	3.829	1097.721
2001	165	2.091	554.100
N	20		
Mean	226.37	3.745	1102.993
St deviation	79.20	2.037	600.223
Min	112.04	1.307	346.262
Max	397.41	8.491	2380.794

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1952	272.778	1.307	523.970
1961	338.678	2.612	837.839
1965	164.955	4.529	1612.227
1966	112.039	2.658	928.074
1967	197.105	4.240	1518.716
1968	404.774	5.828	1781.458
1974	348.054	6.653	2115.946
1976	198.489	3.745	1159.141
1977	137.734	1.411	403.457
1978	150.685	2.070	623.861
1979	151.821	3.014	869.043
1980	166.793	4.757	1540.770
1981	397.414	8.491	2380.794
1984	270.605	4.247	1077.777
1985	202.899	4.696	1048.818
1986	172.786	4.334	1015.081
1987	242.748	7.421	2052.889
1988	408.093	6.679	2021.764
1992	306.484	1.417	353.380
1993	252.286	1.372	346.262
1999	278	3.829	1097.721
2001	165	2.091	554.100
N	22		
Mean	242.74	3.973	1175.595
St deviation	92.10	2.078	618.508
Min	112.04	1.307	353.380
Max	408.09	8.491	2380.794

Table 13. Average abundant year classes of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1946	468.348	0.776	420.883
1947	704.908	1.082	605.041
1951	641.584	2.508	1128.149
1953	439.602	2.851	1108.938
1954	804.781	5.156	1872.917
1955	496.824	3.733	1432.104
1956	683.69	6.153	2280.312
1957	789.653	10.716	3799.331
1959	728.338	4.807	1684.061
1960	472.064	3.832	1231.004
1962	776.941	8.082	2492.768
1968	404.774	5.828	1781.458
1971	523.916	5.299	1681.039
1972	621.616	5.848	1793.929
1973	613.942	6.452	1844.151
1975	638.49	14.429	4495.522
1982	523.102	5.352	1603.963
1988	408.093	6.679	2021.764
1989	700.256	10.568	3613.404
1990	758.583	6.171	2237.391
1991	516.2	2.781	767.913
1994	476.396	2.904	797.679
1995	579.155	4.217	1163.630
1996	442.602	2.902	777.716
1997	531.479	3.618	941.614
1998	454.66	4.142	1179.679
2000	468	7.036	2136.557
N	27		
Mean	580.30	5.331	1736.775
St deviation	127.06	3.016	979.426
Min	404.77	0.776	420.883
Max	804.78	14.429	4495.522

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1946	468.348	0.776	420.883
1947	704.908	1.082	605.041
1951	641.584	2.508	1128.149
1953	439.602	2.851	1108.938
1954	804.781	5.156	1872.917
1955	496.824	3.733	1432.104
1956	683.69	6.153	2280.312
1957	789.653	10.716	3799.331
1959	728.338	4.807	1684.061
1960	472.064	3.832	1231.004
1962	776.941	8.082	2492.768
1971	523.916	5.299	1681.039
1972	621.616	5.848	1793.929
1973	613.942	6.452	1844.151
1975	638.49	14.429	4495.522
1982	523.102	5.352	1603.963
1989	700.256	10.568	3613.404
1990	758.583	6.171	2237.391
1991	516.2	2.781	767.913
1994	476.396	2.904	797.679
1995	579.155	4.217	1163.630
1996	442.602	2.902	777.716
1997	531.479	3.618	941.614
1998	454.66	4.142	1179.679
2000	468	7.036	2136.557
N	25		
Mean	594.21	5.257	1723.588
St deviation	121.53	3.125	1017.628
Min	439.60	0.776	420.883
Max	804.78	14.429	4495.522

Table 14. Strong year classes of of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1948	1083.75	1.941	1063.427
1949	1193.11	3.060	1634.670
1950	1590.38	5.301	2584.554
1958	916.84	13.733	4692.681
1963	1582.56	24.871	7600.897
1964	1295.42	22.793	6943.324
1969	1015.32	19.110	6685.448
1970	1818.95	25.281	8102.872
1983	929.11	10.952	2839.783
N	9.00		
Mean	1269.49	14.116	4683.073
St deviation	325.71	9.347	2727.709
Min	916.84	1.941	1063.427
Max	1818.95	25.281	8102.872

Cluster classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1948	1083.75	1.941	1063.427
1949	1193.11	3.060	1634.670
1950	1590.38	5.301	2584.554
1958	916.84	13.733	4692.681
1963	1582.56	24.871	7600.897
1964	1295.42	22.793	6943.324
1969	1015.32	19.110	6685.448
1970	1818.95	25.281	8102.872
1983	929.11	10.952	2839.783
N	9.00		
Mean	1269.49	14.116	4683.073
St deviation	325.71	9.347	2727.709
Min	916.84	1.941	1063.427
Max	1818.95	25.281	8102.872

Table 15. Unfavourable survival conditions of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1946	468.35	0.776	420.883
1947	704.91	1.082	605.041
1948	1083.75	1.941	1063.427
1952	272.78	1.307	523.970
1977	137.73	1.411	403.457
1978	150.69	2.070	623.861
1992	306.48	1.417	353.380
1993	252.29	1.372	346.262
2001	165.00	2.091	554.100
N	9		
Mean	393.55	1.496	543.820
St deviation	315.77	0.452	221.008
Min	9.00	0.452	221.008
Max	1083.75	2.091	1063.427

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1946	468.35	0.776	420.883
1947	704.91	1.082	605.041
1948	1083.75	1.941	1063.427
1949	1193.11	3.060	1634.670
1951	641.58	2.508	1128.149
1952	272.78	1.307	523.970
1953	439.60	2.851	1108.938
1955	496.82	3.733	1432.104
1959	728.34	4.807	1684.061
1960	472.06	3.832	1231.004
1961	338.68	2.612	837.839
1965	164.96	4.529	1612.227
1966	112.04	2.658	928.074
1967	197.11	4.240	1518.716
1976	198.49	3.745	1159.141
1977	137.73	1.411	403.457
1978	150.69	2.070	623.861
1979	151.82	3.014	869.043
1980	166.79	4.757	1540.770
1984	270.61	4.247	1077.777
1985	202.90	4.696	1048.818
1986	172.79	4.334	1015.081
1991	516.20	2.781	767.913
1992	306.48	1.417	353.380
1993	252.29	1.372	346.262
1994	476.40	2.904	797.679
1995	579.16	4.217	1163.630
1996	442.60	2.902	777.716
1997	531.48	3.618	941.614
1998	454.66	4.142	1179.679
1999	278.00	3.829	1097.721
2001	165.00	2.091	554.100
N	32		
Mean	399.01	3.046	982.711
St deviation	263.03	1.199	386.396
Min	112.04	0.776	346.262
Max	1193.11	4.807	1684.061

Table 16. Средние survival conditions of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs	Survival index (per 1t SSB)
1949	1193.111	3.060	1634.670
1950	1590.377	5.301	2584.554
1951	641.584	2.508	1128.149
1953	439.602	2.851	1108.938
1954	804.781	5.156	1872.917
1955	496.824	3.733	1432.104
1956	683.690	6.153	2280.312
1959	728.338	4.807	1684.061
1960	472.064	3.832	1231.004
1961	338.678	2.612	837.839
1962	776.941	8.082	2492.768
1965	164.955	4.529	1612.227
1966	112.039	2.658	928.074
1967	197.105	4.240	1518.716
1968	404.774	5.828	1781.458
1971	523.916	5.299	1681.039
1972	621.616	5.848	1793.929
1973	613.942	6.452	1844.151
1974	348.054	6.653	2115.946
1976	198.489	3.745	1159.141
1979	151.821	3.014	869.043
1980	166.793	4.757	1540.770
1981	397.414	8.491	2380.794
1982	523.102	5.352	1603.963
1984	270.605	4.247	1077.777
1985	202.899	4.696	1048.818
1986	172.786	4.334	1015.081
1987	242.748	7.421	2052.889
1988	408.093	6.679	2021.764
1990	758.583	6.171	2237.391
1991	516.200	2.781	767.913
1994	476.396	2.904	797.679
1995	579.155	4.217	1163.630
1996	442.602	2.902	777.716
1997	531.479	3.618	941.614
1998	454.660	4.142	1179.679
1999	278.000	3.829	1097.721
2000	468.000	7.036	2136.557
N	38		
Mean	484.006	4.735	1511.389
St deviationy	292.612	1.609	532.370
Min	112.039	2.508	767.913
Max	1590.377	8.491	2584.554

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1950	1590.377	5.301	2584.554
1954	804.781	5.156	1872.917
1956	683.690	6.153	2280.312
1962	776.941	8.082	2492.768
1968	404.774	5.828	1781.458
1971	523.916	5.299	1681.039
1972	621.616	5.848	1793.929
1973	613.942	6.452	1844.151
1974	348.054	6.653	2115.946
1981	397.414	8.491	2380.794
1982	523.102	5.352	1603.963
1987	242.748	7.421	2052.889
1988	408.093	6.679	2021.764
1990	758.583	6.171	2237.391
2000	468.000	7.036	2136.557
N	15		
Mean	611.069	6.395	2058.695
St deviation	318.622	1.021	297.296
Min	242.748	5.156	1603.963
Max	1590.377	8.491	2584.554

Table 17. Favourable survival conditions of North-east Arctic cod, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1957	789.653	10.716	3799.331
1958	916.842	13.733	4692.681
1963	1582.560	24.871	7600.897
1964	1295.416	22.793	6943.324
1969	1015.319	19.110	6685.448
1970	1818.949	25.281	8102.872
1975	638.490	14.429	4495.522
1983	929.109	10.952	2839.783
1989	700.256	10.568	3613.404
N	9		
Mean	1076.288	16.939	5419.252
St deviation	406.495	6.157	1930.269
Min	638.490	10.568	2839.783
Max	1818.949	25.281	8102.872

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1957	789.653	10.716	3799.331
1958	916.842	13.733	4692.681
1963	1582.560	24.871	7600.897
1964	1295.416	22.793	6943.324
1969	1015.319	19.110	6685.448
1970	1818.949	25.281	8102.872
1975	638.490	14.429	4495.522
1983	929.109	10.952	2839.783
1989	700.256	10.568	3613.404
N	9		
Mean	1076.288	16.939	5419.252
St deviation	406.495	6.157	1930.269
Min	638.490	10.568	2839.783
Max	1818.949	25.281	8102.872

Table 18. Weak year classes of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6^)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1951	120.540	3.822	1128.018
1952	50.770	2.068	826.604
1954	51.540	1.199	422.182
1955	67.410	0.915	388.620
1958	108.740	2.256	735.276
1962	100.870	3.306	873.182
1965	17.580	0.670	193.591
1966	17.380	0.464	141.427
1968	94.310	2.174	546.598
1971	52.810	1.627	306.287
1972	48.620	1.575	346.815
1973	55.900	1.908	474.573
1974	113.880	2.629	586.678
1976	135.430	2.456	709.764
1977	18.820	0.559	144.625
1978	6.200	0.307	63.285
1979	8.300	0.575	103.375
1980	4.810	0.395	64.288
1981	8.370	0.338	65.360
1984	83.240	9.494	1961.357
1985	41.550	5.613	1157.382
1986	16.660	1.051	348.244
1987	24.250	2.259	701.678
1988	81.330	2.990	1310.717
1992	74.140	2.913	829.028
1993	84.640	2.377	629.949
1994	99.330	5.003	1328.474
1995	43.580	1.329	455.524
1997	57.960	1.289	437.005
N	29		
Mean	58.240	2.192	595.859
St deviation	38.504	1.940	452.954
Min	4.810	0.307	63.285
Max	135.430	9.494	1961.357

Cluster classification

Year	Year-class 3 abundance (*10^6^)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1951	120.540	3.822	1128.018
1952	50.770	2.068	826.604
1953	167.880	5.965	2012.950
1954	51.540	1.199	422.182
1955	67.410	0.915	388.620
1958	108.740	2.256	735.276
1962	100.870	3.306	873.182
1965	17.580	0.670	193.591
1966	17.380	0.464	141.427
1967	164.310	4.235	1057.744
1968	94.310	2.174	546.598
1971	52.810	1.627	306.287
1972	48.620	1.575	346.815
1973	55.900	1.908	474.573
1974	113.880	2.629	586.678
1975	171.140	3.104	742.183
1976	135.430	2.456	709.764
1977	18.820	0.559	144.625
1978	6.200	0.307	63.285
1979	8.300	0.575	103.375
1980	4.810	0.395	64.288
1981	8.370	0.338	65.360
1984	83.240	9.494	1961.357
1985	41.550	5.613	1157.382
1986	16.660	1.051	348.244
1987	24.250	2.259	701.678
1988	81.330	2.990	1310.717
1989	195.280	6.666	3071.406
1992	74.140	2.913	829.028
1993	84.640	2.377	629.949
1994	99.330	5.003	1328.474
1995	43.580	1.329	455.524
1996	179.920	3.629	1315.686
1997	57.960	1.289	437.005
2000	199.000	10.022	3661.454
N	35		
Mean	79.043	2.777	832.609
St deviation	58.356	2.401	805.681
Min	4.810	0.307	63.285
Max	199.000	10.022	3661.454

Table 19. Average abundant year classes of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1953	167.88	5.965	2012.950
1956	322.65	3.792	1385.894
1957	240.84	3.824	1275.095
1959	240.22	7.946	1946.835
1960	273.04	9.707	2308.421
1961	316.15	10.146	2476.888
1963	237.49	10.815	2878.667
1964	293.83	15.095	4931.688
1967	164.31	4.235	1057.744
1970	270.09	6.964	1796.289
1975	171.14	3.104	742.183
1982	256.27	12.127	2412.634
1989	195.28	6.666	3071.406
1991	273.81	10.389	3478.277
1996	179.92	3.629	1315.686
1998	265.19	7.319	2572.912
1999	241	8.209	2653.601
2000	199	10.022	3661.454
2001	284	10.370	3165.403
N	19		
Mean	241.69	7.912	2376.001
St deviation	49.68	3.316	1034.571
Min	164.31	3.104	742.183
Max	322.65	15.095	4931.688

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1956	322.65	3.792	1385.894
1957	240.84	3.824	1275.095
1959	240.22	7.946	1946.835
1960	273.04	9.707	2308.421
1961	316.15	10.146	2476.888
1963	237.49	10.815	2878.667
1964	293.83	15.095	4931.688
1970	270.09	6.964	1796.289
1982	256.27	12.127	2412.634
1991	273.81	10.389	3478.277
1998	265.19	7.319	2572.912
1999	241	8.209	2653.601
2001	284	10.370	3165.403
N	13		
Mean	270.35	8.977	2560.200
St deviation	28.19	3.142	958.548
Min	237.49	3.792	1275.095
Max	322.65	15.095	4931.688

Table 20. Strong year classes of of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1950	1023.25	17.985	7327.771
1969	1020.08	24.148	6082.404
1983	524.98	37.799	8470.152
1990	625.83	25.889	9299.108
N	4		
Mean	798.54	26.455	7794.859
St deviation	260.92	8.288	1398.745
Min	524.98	17.985	6082.404
Max	1023.25	37.799	9299.108

Cluster classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1950	1023.25	17.985	7327.771
1969	1020.08	24.148	6082.404
1983	524.98	37.799	8470.152
1990	625.83	25.889	9299.108
N	4		
Mean	798.54	26.455	7794.859
St deviation	260.92	8.288	1398.745
Min	524.98	17.985	6082.404
Max	1023.25	37.799	9299.108

Table 21. Unfavourable survival conditions of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1954	51.54	1.199	422.182
1955	67.41	0.915	388.620
1965	17.58	0.670	193.591
1966	17.38	0.464	141.427
1977	18.82	0.559	144.625
1978	6.2	0.307	63.285
1979	8.3	0.575	103.375
1980	4.81	0.395	64.288
1981	8.37	0.338	65.360
1986	16.66	1.051	348.244
1995	43.58	1.329	455.524
1997	57.96	1.289	437.005
N	12		
Mean	26.55	0.758	235.627
St deviation	22.24	0.380	160.755
Min	4.81	0.307	63.285
Max	67.41	1.329	455.524

Cluster classification

Year	**Year-class 3 abundance ($*10^6$)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1951	120.54	3.822	1128.018
1952	50.77	2.068	826.604
1954	51.54	1.199	422.182
1955	67.41	0.915	388.620
1956	322.65	3.792	1385.894
1957	240.84	3.824	1275.095
1958	108.74	2.256	735.276
1962	100.87	3.306	873.182
1965	17.58	0.670	193.591
1966	17.38	0.464	141.427
1967	164.31	4.235	1057.744
1968	94.31	2.174	546.598
1971	52.81	1.627	306.287
1972	48.62	1.575	346.815
1973	55.9	1.908	474.573
1974	113.88	2.629	586.678
1975	171.14	3.104	742.183
1976	135.43	2.456	709.764
1977	18.82	0.559	144.625
1978	6.2	0.307	63.285
1979	8.3	0.575	103.375
1980	4.81	0.395	64.288
1981	8.37	0.338	65.360
1986	16.66	1.051	348.244
1987	24.25	2.259	701.678
1988	81.33	2.990	1310.717
1992	74.14	2.913	829.028
1993	84.64	2.377	629.949
1995	43.58	1.329	455.524
1996	179.92	3.629	1315.686
1997	57.96	1.289	437.005
N	31		
Mean	82.05	2.001	600.300
St deviation	73.80	1.205	402.735
Min	4.81	0.307	63.285
Max	322.65	4.235	1385.894

Table 22. Moderate survival conditions of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1951	120.54	3.822	1128.018
1952	50.77	2.068	826.604
1953	167.88	5.965	2012.950
1956	322.65	3.792	1385.894
1957	240.84	3.824	1275.095
1958	108.74	2.256	735.276
1959	240.22	7.946	1946.835
1960	273.04	9.707	2308.421
1961	316.15	10.146	2476.888
1962	100.87	3.306	873.182
1963	237.49	10.815	2878.667
1967	164.31	4.235	1057.744
1968	94.31	2.174	546.598
1970	270.09	6.964	1796.289
1971	52.81	1.627	306.287
1972	48.62	1.575	346.815
1973	55.9	1.908	474.573
1974	113.88	2.629	586.678
1975	171.14	3.104	742.183
1976	135.43	2.456	709.764
1984	83.24	9.494	1961.357
1985	41.55	5.613	1157.382
1987	24.25	2.259	701.678
1988	81.33	2.990	1310.717
1989	195.28	6.666	3071.406
1991	273.81	10.389	3478.277
1992	74.14	2.913	829.028
1993	84.64	2.377	629.949
1994	99.33	5.003	1328.474
1996	179.92	3.629	1315.686
1998	265.19	7.319	2572.912
1999	241	8.209	2653.601
2000	199	10.022	3661.454
2001	284	10.370	3165.403
N	34		
Mean	159.19	5.223	1536.826
St deviation	89.89	3.120	971.943
Min	24.25	1.575	306.287
Max	322.65	10.815	3661.454

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1953	167.88	5.965	2012.950
1959	240.22	7.946	1946.835
1960	273.04	9.707	2308.421
1961	316.15	10.146	2476.888
1963	237.49	10.815	2878.667
1970	270.09	6.964	1796.289
1982	256.27	12.127	2412.634
1984	83.24	9.494	1961.357
1985	41.55	5.613	1157.382
1989	195.28	6.666	3071.406
1991	273.81	10.389	3478.277
1994	99.33	5.003	1328.474
1998	265.19	7.319	2572.912
1999	241	8.209	2653.601
2000	199	10.022	3661.454
2001	284	10.370	3165.403
N	16		
Mean	215.22	8.547	2430.184
St deviation	79.41	2.121	717.314
Min	41.55	5.003	1157.382
Max	316.15	12.127	3661.454

Table 23. Favourable survival conditions of North-east Arctic haddock, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1950	1023.25	17.985	7327.771
1964	293.83	15.095	4931.688
1969	1020.08	24.148	6082.404
1982	256.27	12.127	2412.634
1983	524.98	37.799	8470.152
1990	625.83	25.889	9299.108
N	6		
Mean	624.04	22.174	6420.626
St deviation	337.74	9.278	2518.113
Min	256.27	12.127	2412.634
Max	1023.25	37.799	9299.108

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1950	1023.25	17.985	7327.771
1964	293.83	15.095	4931.688
1969	1020.08	24.148	6082.404
1983	524.98	37.799	8470.152
1990	625.83	25.889	9299.108
N	5		
Mean	697.59	24.183	7222.225
St deviation	319.38	8.794	1762.644
Min	293.83	15.095	4931.688
Max	1023.25	37.799	9299.108

Table 24. Weak year classes of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1974	19.7	45.187	215.256
1975	18.6	48.863	233.200
1976	17.88	59.803	285.231
1977	18.93	88.501	417.678
1978	19	113.472	528.688
1979	17.81	117.163	499.537
1980	19.93	114.136	575.114
1981	19.85	112.779	501.440
1982	19.42	105.992	505.334
1985	14.5	91.254	352.155
1986	12.62	74.422	310.684
1987	10.49	89.475	345.373
1988	12.81	110.816	477.219
1989	17.91	180.464	742.660
1990	16.86	174.996	800.836
1991	17.39	151.285	696.715
1992	17.68	261.889	1098.614
1993	16.28	246.475	898.703
1994	14.08	215.218	898.475
1995	17.89	300.049	1258.973
1996	14.31	266.177	1015.254
1997	15.17	253.069	1000.858
1998	15.17	224.859	911.494
1999	15.17	192.726	806.314
N	24		
Mean	16.64	151.628	640.659
St deviation	2.57	76.939	297.720
Min	10.49	45.187	215.256
Max	19.93	300.049	1258.973

Cluster classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1985	14.5	91.254	352.155
1986	12.62	74.422	310.684
1987	10.49	89.475	345.373
1988	12.81	110.816	477.219
1994	14.08	215.218	898.475
1996	14.31	266.177	1015.254
1997	15.17	253.069	1000.858
1998	15.17	224.859	911.494
1999	15.17	192.726	806.314
N	9		
Mean	13.81	168.668	679.759
St deviation	1.57	76.672	301.992
Min	10.49	74.422	310.684
Max	15.17	266.177	1015.254

Table 25. Average abundant year classes of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1966	31.549	95.848	460.186
1967	33.55	92.561	437.367
1968	31.06	71.669	342.361
1969	26.64	48.419	228.591
1970	22.54	34.571	161.438
1971	22.1	43.021	198.593
1972	23.69	53.558	249.684
1973	20.59	45.602	214.938
1983	22.96	132.326	536.549
1984	20.71	127.625	527.590
N	10		
Mean	25.54	74.520	335.730
St deviation	4.84	35.739	143.627
Min	20.59	34.571	161.438
Max	33.55	132.326	536.549

Cluster classification

Year	**Year-class 3 abundance (*10^6)**	**Survival index (per 10 eggs)**	**Survival index (per 1t SSB)**
1969	26.64	48.419	228.591
1970	22.54	34.571	161.438
1971	22.1	43.021	198.593
1972	23.69	53.558	249.684
1973	20.59	45.602	214.938
1974	19.7	45.187	215.256
1975	18.6	48.863	233.200
1976	17.88	59.803	285.231
1977	18.93	88.501	417.678
1978	19	113.472	528.688
1979	17.81	117.163	499.537
1980	19.93	114.136	575.114
1981	19.85	112.779	501.440
1982	19.42	105.992	505.334
1983	22.96	132.326	536.549
1984	20.71	127.625	527.590
1989	17.91	180.464	742.660
1990	16.86	174.996	800.836
1991	17.39	151.285	696.715
1992	17.68	261.889	1098.614
1993	16.28	246.475	898.703
1995	17.89	300.049	1258.973
N	22		
Mean	19.74	118.463	517.062
St deviation	2.54	75.677	301.728
Min	16.28	34.571	161.438
Max	26.64	300.049	1258.973

Table 26. Strong year classes of of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1964	55.93	164.233	769.919
1965	41.112	123.271	593.641
N	2		
Mean	48.52	143.752	681.780
St deviation	10.48	28.965	124.648
Min	41.11	123.271	593.641
Max	55.93	164.233	769.919

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1964	55.93	164.233	769.919
1965	41.112	123.271	593.641
1966	31.549	95.848	460.186
1967	33.55	92.561	437.367
1968	31.06	71.669	342.361
N	5		
Mean	38.64	109.516	520.695
St deviation	10.47	35.672	165.712
Min	31.06	71.669	342.361
Max	55.93	164.233	769.919

Table 27. Unfavourable survival conditions of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1969	26.64	48.419	228.591
1970	22.54	34.571	161.438
1971	22.1	43.021	198.593
1972	23.69	53.558	249.684
1973	20.59	45.602	214.938
1974	19.7	45.187	215.256
1975	18.6	48.863	233.200
1976	17.88	59.803	285.231
N	8		
Mean	21.47	47.378	223.366
St deviation	2.88	7.434	36.311
Min	17.88	34.571	161.438
Max	26.64	59.803	285.231

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1969	26.64	48.419	228.591
1970	22.54	34.571	161.438
1971	22.1	43.021	198.593
1972	23.69	53.558	249.684
1973	20.59	45.602	214.938
1974	19.7	45.187	215.256
1975	18.6	48.863	233.200
N	7		
Mean	21.98	45.603	214.528
St deviation	2.69	5.921	28.447
Min	18.60	34.571	161.438
Max	26.64	53.558	249.684

Table 28. Moderate survival conditions of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1966	31.549	95.848	460.186
1967	33.55	92.561	437.367
1968	31.06	71.669	342.361
1977	18.93	88.501	417.678
1982	19.42	105.992	505.334
1985	14.5	91.254	352.155
1986	12.62	74.422	310.684
1987	10.49	89.475	345.373
N	8		
Mean	21.51	88.715	396.392
St deviation	9.24	11.123	68.552
Min	10.49	71.669	310.684
Max	33.55	105.992	505.334

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1965	41.112	123.271	593.641
1966	31.549	95.848	460.186
1967	33.55	92.561	437.367
1968	31.06	71.669	342.361
1976	17.88	59.803	285.231
1977	18.93	88.501	417.678
1978	19	113.472	528.688
1979	17.81	117.163	499.537
1980	19.93	114.136	575.114
1981	19.85	112.779	501.440
1982	19.42	105.992	505.334
1983	22.96	132.326	536.549
1984	20.71	127.625	527.590
1985	14.5	91.254	352.155
1986	12.62	74.422	310.684
1987	10.49	89.475	345.373
1988	12.81	110.816	477.219
N	17		
Mean	21.42	101.242	452.715
St deviation	8.29	20.586	95.111
Min	10.49	59.803	285.231
Max	41.11	132.326	593.641

Table 29. Favourable survival conditions of Greenland halibut, classified traditionally and by means of cluster analysis.

Traditional classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1964	55.93	164.233	769.919
1965	41.112	123.271	593.641
1978	19	113.472	528.688
1979	17.81	117.163	499.537
1980	19.93	114.136	575.114
1981	19.85	112.779	501.440
1983	22.96	132.326	536.549
1984	20.71	127.625	527.590
1988	12.81	110.816	477.219
1989	17.91	180.464	742.660
1990	16.86	174.996	800.836
1991	17.39	151.285	696.715
1992	17.68	261.889	1098.614
1993	16.28	246.475	898.703
1994	14.08	215.218	898.475
1995	17.89	300.049	1258.973
1996	14.31	266.177	1015.254
1997	15.17	253.069	1000.858
1998	15.17	224.859	911.494
1999	15.17	192.726	806.314
N	20		
Mean	20.40	179.151	756.930
St deviation	10.21	62.007	228.284
Min	12.81	110.816	477.219
Max	55.93	300.049	1258.973

Cluster classification

Year	Year-class 3 abundance (*10^6)	Survival index (per 10 eggs)	Survival index (per 1t SSB)
1964	55.93	164.233	769.919
1989	17.91	180.464	742.660
1990	16.86	174.996	800.836
1991	17.39	151.285	696.715
1992	17.68	261.889	1098.614
1993	16.28	246.475	898.703
1994	14.08	215.218	898.475
1995	17.89	300.049	1258.973
1996	14.31	266.177	1015.254
1997	15.17	253.069	1000.858
1998	15.17	224.859	911.494
1999	15.17	192.726	806.314
N	12		
Mean	19.49	219.287	908.235
St deviation	11.56	46.995	163.123
Min	14.08	151.285	696.715
Max	55.93	300.049	1258.973

Table30. Role of population fecundity (PF) for year-class strength in four species of food fishes of the Barents and Norwegian Seas

Norwegian spring spawning h erring

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF <270 * 10^{12} eggs	23	53824.2	2340.181739	30352114.3
PF 270 - 870	23	191845	8341.083913	62588645.1
PF 870 - 1150	33	253891	7693.659697	62067591.3
PF >1550	13	137432	10571.71538	144277930

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	721973048.1	3	240657682.7	3.67531416	0.015130829	2.708191005
Inside groups	5762194789	88	65479486.24			
Total	6484167837	91				

Role of PF = 0.113 = 11.3%

North -east Arctic cod

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF <90 * 10^{12} eggs	25	13092.7	523.7098	221998.324
PF 90 - 174	17	9468.58	556.9752941	47258.8811
PF 174 - 473	11	6802.45	618.4047273	169696.548
PF >473	3	2257.01	752.3363333	96367.9136

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	180367.5725	3	60122.52417	0.39208031	0.759196396	2.78259904
Inside groups	7973803.172	52	153342.3687			
Total	8154170.744	55				

Role of PF =0.022 = 2.2 %

North -east Arctic h addock

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF <18 * 10^{12} eggs	7	703.79	100.5414286	35742.8154
PF 18 - 40	32	5184.27	162.0084375	17740.6928
PF 40 - 68	11	3197.09	290.6445455	133609.545
PF >68	2	390.06	195.03	32573.7288

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	189414.8493	3	63138.2831	1.42077506	0.248231721	2.79806045
Inside groups	2133087.544	48	44439.32383			
Total	2322502.393	51				

Role of PF = 0.082 = 8.2%

Continuation of table 30
Greenland h alibut

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF < 0.13 * 10^{12} eggs	13	201.21	15.47769231	4.86596923
PF 0.13 - 0.25	10	185.73	18.573	8.99129
PF 0.25 - 0.48	10	293.661	29.3661	146.584139
PF >0.48	3	71.28	23.76	6.2692

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1177.647569	3	392.5491897	8.53884721	0.000261396	2.901117568
Inside groups	1471.108894	32	45.97215293			
Total	2648.756463	35				

Role of PF = 0.445 = 44.5%

Table31. Role of spawning stock biomass (SSB) for year-class strength in four species of food fishes of the Barents and Norwegian Seas

Norwegian spring spawning h erring

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB < 2050 * 10³ t	23	53824.2	2340.181739	30352114
SSB 270 - 870	22	175093	7958.751364	62046859
SSB 870 - 1550	34	270643	7960.093235	62600307
SSB >1550	13	137432	10571.71538	144277930

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	716291982.6	3	238763994.2	3.6428023	0.015749042	2.708191005
Inside groups	5767875855	88	65544043.8			
Total	6484167837	91				

Роль SSB = 0.11 = 11%

North -east Arctic cod

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB < 275 * 10³ t	25	13092.7	523.7098	221998.32
SSB 275 - 465	17	9468.58	556.9752941	47258.881
SSB 465 - 940	11	6802.45	618.4047273	169696.55
SSB >940	11	6802.45	618.4047273	169696.55

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	106461.5672	3	35487.18907	0.2246491	0.878896735	2.75807821
Inside groups	9478032.826	60	157967.2138			
Total	9584494.394	63				

Роль SSB = 0.011 = 1.1 %

North -east Arctic h addock

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB < 86 * 10³ t	17	2928.34	172.2552941	32196.571
SSB 86 - 111	9	1308.5	145.3888889	13346.129
SSB 111 - 162	17	3019.82	177.6364706	57283.071
SSB >162	9	2218.55	246.5055556	91576.432

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	51447.63936	3	17149.21312	0.3624581	0.780376492	2.79806045
Inside groups	2271054.754	48	47313.64071			
Total	2322502.393	51				

Роль SSB = 0.022 = 2.2 %

Continuation of table 31
Greenland h alibut

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB < 29 * 10³ t	12	190.72	15.89333333	2.8583152
SSB 29 - 54	11	196.22	17.83818182	14.031696
SSB 54 - 104	10	293.661	29.3661	146.58414
SSB >104	3	71.28	23.76	6.2692

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1145.20238	3	381.7341265	8.1244115	0.000366064	2.901117568
Inside groups	1503.554083	32	46.9860651			
Total	2648.756463	35				

Роль SSB = 0.432 = 43.2 %

Table32. Role of survival conditions in year-class strength in four species of food fishes of the Barents and Norwegian Seas With traditional classification of survival indeces and by means of clustering

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	28	39413.78	1407.635	2530643.88
Moderate.	44	328170.55	7458.421591	27394392.21
Favourable	20	269407.85	13470.3925	185061152.2

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1721719695	2	860859847.3	16.08763479	1.08626E-06	3.098875823
Inside groups	4762448143	89	53510653.29			
Total	6484167837	91				

Role of SI in dispersion of 3-year olds = 0.256 = 25.6%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	67	290264.37	4332.30403	18410613.7
Moderate.	19	305122.49	16059.07842	154370848.3
Favourable	6	41605.32	6934.22	90963289.33

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2035575617	2	1017787809	20.36219786	5.22867E-08	3.098875823
Inside groups	4448592220	89	49984182.24			
Total	6484167837	91				

Role of SI in dispersion of 3-year olds = 0.314 = 31.4%

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	9	3541.976	393.5528889	99712.61809
Moderate.	38	18392.216	484.0056842	85621.7054
Favourable	9	9686.594	1076.288222	165237.8075

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2866564.24	2	1433282.12	14.36641556	1.03467E-05	3.171621188
Inside groups	5287606.505	53	99766.16047			
Total	8154170.744	55				

Role of SI in dispersion of 3-year olds = 0.351 = 35.1%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	32	12768.161	399.0050313	69183.21673
Moderate.	15	9166.031	611.0687333	101520.0622
Favourable	9	9686.594	1076.288222	165237.8075

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	3266307.695	2	1633153.847	17.7085882	1.28852E-06	3.171621188
Inside groups	4887863.05	53	92223.83112			
Total	8154170.744	55				

Role of SI in dispersion of 3-year olds = 0.401 = 40.1%

Continuation of table 32

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	12	318.61	26.55083333	494.8262265
Moderate.	34	5412.36	159.1870588	8080.963355
Favourable	6	3744.24	624.04	114065.1621

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1480061.704	2	740030.8518	43.04340019	1.62102E-11	3.186585218
Inside groups	842440.6896	49	17192.66713			
Total	2322502.393	51				

Role of SI in dispersion of 3-year olds = 0.637 = 63.7%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	35	2766.49	79.04257143	3405.365455
Moderate.	16	3443.54	215.22125	6305.608292
Favourable	5	3487.97	697.594	102005.0207

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1713494.625	2	856747.3126	73.42915445	5.29873E-16	3.171621188
Inside groups	618386.6328	53	11667.67232			
Total	2331881.258	55				

Role of SI in dispersion of 3-year olds = 0.735 = 73.5%

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	8	171.74	21.4675	8.318764286
Moderate.	8	172.119	21.514875	85.36893298
Favourable	20	408.022	20.4011	104.3353168

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	10.57156207	2	5.285781037	0.066117721	0.936144342	3.284924333
Inside groups	2638.184901	33	79.94499699			
Total	2648.756463	35				

Role of SI in dispersion of 5-year olds = 0.004 = 0.4%. Statistically nonsignificant.

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
Unfavourable	7	153.86	21.98	7.253766667
Moderate.	17	364.181	21.42241176	68.65888788
Favourable	12	233.84	19.48666667	133.6295152

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	36.76698997	2	18.38349498	0.232257955	0.794026474	3.284924333
Inside groups	2611.989473	33	79.15119614			
Total	2648.756463	35				

Role of SI in dispersion of 5-year olds = 0.014 = 1.4%. Statistically nonsignificant.

Table33. Role of population fecundity (PF) in year-class strength formation in four species of food fishes Of the Norwegian and Barents seas under different survival conditions. Favourable conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<280*10^12 eggs	11	50566.36	4596.94182	55937397.47
PF 280-730	5	96127.59	19225.518	59875824.82
PF 730-1500	3	75668.1	25222.7	71949845.29
PF>1500	1	47045.8	47045.8	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2573384928	3	857794976	14.55775876	7.7819E-05	3.238866952
Inside groups	942776964.6	16	58923560.3			
Total	3516161893	19				

Role of factor= 0.732=73.2%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF>30*10^12 икр	3	1434.82	478.273333	174823.8229
30-85	2	29832.3	14916.15	190419564
PF<85	1	10338.2	10338.2	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	264047235	2	132023617	2.076178064	0.271649047	9.552081792
Inside groups	190769211.7	3	63589737.2			
Total	454816446.6	5				

Role of factor = 0.581 = 58.1%*

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<60*10^12eggs	3	2949.225	983.075	108667.699
PF 60-80	5	5808.26	1161.652	255101.0879
PF>80	1	929.109	929.109	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	84162.71063	2	42081.3553	0.203991293	0.820899106	5.143249382
Inside groups	1237739.75	6	206289.958			
Total	1321902.46	8				

Role of factor=0.064=6.4%*

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<60*10^12eggs	3	2949.225	983.075	108667.699
PF 60-80	5	5808.26	1161.652	255101.0879
PF>80	1	929.109	929.109	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	84162.71063	2	42081.3553	0.203991293	0.820899106	5.143249382
Inside groups	1237739.75	6	206289.958			
Total	1321902.46	8				

Role of factor=0.064=6.4%*

Continuation of table 33

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF>33*10^12eggs	4	1700.91	425.2275	32001.28803
PF 33-50	1	1020.08	1020.08	
PF<50	1	1023.25	1023.25	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	474321.9463	2	237160.973	7.410982114	0.069063492	9.552081792
Inside groups	96003.86408	3	32001.288			
Total	570325.8104	5				

Role of factor=0.832=83.2 % *

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF>33*10^12eggs	3	1444.64	481.546667	28970.84083
PF 33-50	1	1020.08	1020.08	
PF<50	1	1023.25	1023.25	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	350078.4013	2	175039.201	6.041909575	0.142006936	19.00002644
Inside groups	57941.68167	2	28970.8408			
Total	408020.0829	4				

Role of factor=0.858=85.8%*

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.13*10^12eggs	12	190.72	15.8933333	2.858315152
PF 0.13-0.25	6	120.26	20.0433333	3.015586667
PF>0.25	2	97.042	48.521	109.786562

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1826.065058	2	913.032529	99.30237332	4.19489E-10	3.591537734
Inside groups	156.305962	17	9.19446835			
Total	1982.37102	19				

Role of factor=0.921=92.1%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.09*10^12eggs	8	125.75	15.71875	2.064183929
PF 0.09-0.22	3	52.16	17.3866667	0.275633333
PF>0.22	1	55.93	55.93	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1454.924113	2	727.462056	436.4611089	1.09561E-09	4.256492048
Inside groups	15.00055417	9	1.66672824			
Total	1469.924667	11				

Role of factor=0.989=98.9%

Table34. Role of spawning stock biomass (SSB) in year-class strength formation in four species of food fishes of the Norwegian and Barents seas under different survival conditions. Favourable conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<1150*12^3 t	10	43697.76	4369.776	61521945
SSB 1150-3500	2	15029.59	7514.795	835136
SSB 3500-10000	7	163634.7	23376.3857	41378311
SSB>10000	1	47045.8	47045.8	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2713359390	3	904453130	18.02592	2.20073E-05	3.238866952
Inside groups	802802503	16	50175156.4			
Total	3516161893	19				

Role of factor = 0.772 = 77.2%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<290*10^3 t	3	1434.82	478.273333	174823.8
SSB 290-690	2	29832.3	14916.15	1.9E+08
SSB>690	1	10338.2	10338.2	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	264047235	2	132023617	2.076178	0.271649047	9.552081792
Inside groups	190769211.7	3	63589737.2			
Total	454816446.6	5				

Role of factor = 0.581 = 58.1%*

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>170*10^3 t	2	1653.809	826.9045	71000.05
SSB 170-275	6	7103.676	1183.946	207063
SSB<275	1	929.109	929.109	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	215587.388	2	107793.694	0.584609	0.586189797	5.143249382
Inside groups	1106315.072	6	184385.845			
Total	1321902.46	8				

Role of factor=0.163=16.3%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>170*10^{3}t	2	1653.809	826.9045	71000.05
SSB 170-275	6	7103.676	1183.946	207063
SSB<275	1	929.109	929.109	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	215587.388	2	107793.694	0.584609	0.586189797	5.143249382
Inside groups	1106315.072	6	184385.845			
Total	1321902.46	8				

Role of factor=0.163=16.3%*

Continuation of table 34

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>86*10^{3}t	3	1444.64	481.546667	28970.84
SSB 86-120	1	256.27	256.27	
SSB>120	2	2043.33	1021.665	5.02445

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	512379.1043	2	256189.552	13.26337	0.032386095	9.552081792
Inside groups	57946.70612	3	19315.5687			
Total	570325.8104	5				

Role of factor=0.898=89.8%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<103*10^{3}t	3	1444.64	481.546667	28970.84
SSB 103-163	1	1023.25	1023.25	
SSB>163	1	1020.08	1020.08	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	350078.4013	2	175039.201	6.04191	0.142006936	19.00002644
Inside groups	57941.68167	2	28970.8408			
Total	408020.0829	4				

Role of factor=0.858=85.8%*

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<31*10^{3}t	12	190.72	15.8933333	2.858315
SSB 31-56	6	120.26	20.0433333	3.015587
SSB>56	2	97.042	48.521	109.7866

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1826.065058	2	913.032529	99.30237	4.19489E-10	3.591537734
Inside groups	156.305962	17	9.19446835			
Total	1982.37102	19				

Role of factor=0.921=92.1%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<22*10^{3}t.	9	142.61	15.8455556	1.950878
SSB 22-48	2	35.3	17.65	0.1352
SSB 48	1	55.93	55.93	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1454.182444	2	727.091222	415.686	1.36135E-09	4.256492048
Inside groups	15.74222222	9	1.7491358			
Total	1469.924667	11				

Role of factor=0.989=98.9%

Table35. Role of population fecundity (PF) for year-class strength in four species of food fishes Of the Norwegian and Barents seas under different survival conditions. Moderate conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<850 $*10^{12}$eggs	18	80575.79	4476.4328	14668745.97
PF 850-1300	16	145714.8	9107.1725	31001795.79
PF>1300	10	101880	10188	20611395.54

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	278060687	2	139030343	6.334321172	0.00400679	3.225679279
Inside groups	899898178	41	21948736			
Total	1177958865	43				

Role of factor= 0.236=23.6 %

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<440$*10^{12}$eggs	6	17122.03	2853.6717	13249761.36
PF 440-1500	12	240954.7	20079.555	46543832.66
PF>1500	1	47045.8	47045.8	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2200444303	2	1.1E+09	30.4438113	3.5165E-06	3.633715551
Inside groups	578230966	16	36139435			
Total	2778675269	18				

Role of factor=0.792 = 79.2%

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<84$*10^{12}$eggs	16	4184.575	261.53594	12227.3303
PF 84-220	19	10782.57	567.50363	17140.19634
PF>220	3	3425.072	1141.6907	227035.0772

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2221999.46	2	1110999.7	41.10448282	6.5219E-10	3.26741656
Inside groups	946003.643	35	27028.676			
Total	3168003.1	37				

Role of factor= 0.701=70.1 %

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<80$*10^{12}$eggs	6	2269.083	378.1805	5857.802012
PF 80-220	8	5306.571	663.32138	12240.41364
PF>220	1	1590.377	1590.377	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1306308.97	2	653154.48	68.17190474	2.802E-07	3.885290312
Inside groups	114971.906	12	9580.9921			
Total	1421280.87	14				

Role of factor= 0.919=91.9%

Continuation of table 35

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<34*10??eggs	22	3261.22	148.23727	9123.014992
PF 34-74	11	1828.49	166.22636	4518.552085
PF>74	1	322.65	322.65	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	29902.955	2	14951.478	1.957587878	0.15826528	3.304819529
Inside groups	236768.836	31	7637.7044			
Total	266671.791	33				

Role of factor=0.112=11.2%*

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<14*10??eggs	2	124.79	62.395	869.02805
PF 14-24	4	792.09	198.0225	4897.206625
PF>24	10	2526.66	252.666	1900.830004

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	61916.0064	2	30958.003	12.31947436	0.00099767	3.805567417
Inside groups	32668.118	13	2512.9322			
Total	94584.1244	15				

Role of factor=0.654=65.4%

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.27*10??eggs	5	75.96	15.192	15.26287
PF 0.27-0.39	2	65.099	32.5495	2.0020005
PF>0.39	1	31.06	31.06	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	534.52905	2	267.26453	21.19347918	0.00361641	5.786148449
Inside groups	63.0534805	5	12.610696			
Total	597.582531	7				

Role of factor=0.894=89.4%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.25*10??eggs	12	209.03	17.419167	14.86297197
PF 0.25-0.39	4	124.091	31.02275	93.72959158
PF>0.39	1	31.06	31.06	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	653.86074	2	326.93037	10.2928175	0.00178084	3.738890086
Inside groups	444.681466	14	31.762962			
Total	1098.54221	16				

Role of factor=0.595=59.5%

Table36. Role of spawning stock biomass (SSB) in year-class strength formation in four species of food fishes Of the Norwegian and Barents seas under different survival conditions. Moderate conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<6400 *10³t	19	90170.19	4745.799	15232425.6
SSB 6400-10500	16	151162.9	9447.679	33210836.4
SSB>10500	8	80081.3	10010.16	21415161.3

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	255201947	2	1.28E+08	5.53431933	0.007552908	3.231733103
Inside groups	922252336	40	23056308			
Total	1177454282	42				

Role of factor= 0.217= 21.7%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<3400 *10³t	6	17122.03	2853.672	13249761.4
SSB 3400-10600	12	240954.7	20079.56	46543832.7
SSB>10600	1	47045.8	47045.8	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2200444303	2	1.1E+09	30.4438113	3.51648E-06	3.633715551
Inside groups	578230966	16	36139435			
Total	2778675269	18				

Role of factor = 0.792 = 79.2%

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>275*10³t	16	4184.575	261.5359	12227.3303
SSB 275-930	14	8236.737	588.3384	21113.8249
SSB<930	8	5970.904	746.363	173597.661

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1494929.79	2	747464.9	15.6366558	1.40528E-05	3.26741656
Inside groups	1673073.31	35	47802.09			
Total	3168003.1	37				

Role of factor= 0.472=47.2 %

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>260*10³t	6	2269.083	378.1805	5857.80201
SSB 260-520	8	5306.571	663.3214	12240.4136
SSB<520	1	1590.377	1590.377	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1306308.97	2	653154.5	68.1719047	2.80202E-07	3.885290312
Inside groups	114971.906	12	9580.992			
Total	1421280.87	14				

Role of factor= 0.919=91.9%

Continuation of table 36

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<97*10^{3}t	14	2053.07	146.6479	8365.36814
SSB 97-164	13	2228.23	171.4023	8509.04627
SSB>164	7	1131.06	161.58	8605.39407

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	4181.08524	2	2090.543	0.24689187	0.782746653	3.304819529
Inside groups	262490.705	31	8467.442			
Total	266671.791	33				

Role of factor=0.016=1.6%*

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<69*10^{3}t	4	519.07	129.7675	6344.05409
SSB 69-97	6	1303.51	217.2517	4994.1679
SSB>97	6	1620.96	270.16	647.4832

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	47343.7066	2	23671.85	6.51421193	0.010970354	3.805567417
Inside groups	47240.4178	13	3633.878			
Total	94584.1244	15				

Role of factor=0.501=50.1%

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<57*10^{3}t	5	75.96	15.192	15.26287
SSB 57-83	2	65.099	32.5495	2.0020005
SSB>83	1	31.06	31.06	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	534.52905	2	267.2645	21.1934792	0.003616412	5.786148449
Inside groups	63.0534805	5	12.6107			
Total	597.582531	7				

Role of factor=0.894=89.4%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<54*10?t	12	209.03	17.41917	14.862972
SSB 54-83	4	124.091	31.02275	93.7295916
SSB>83	1	31.06	31.06	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	653.86074	2	326.9304	10.2928175	0.001780844	3.738890086
Inside groups	444.681466	14	31.76296			
Total	1098.54221	16				

Role of factor=0.595=59.5%

Table37. Role of population fecundity (PF) in year-class strength formation in four species of food fishes Of the Norwegian and Barents seas under different survival conditions. Unfavourable conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<880*10^{12}eggs	11	1646.97	149.724545	46884.07
PF 880-1700	14	24005.61	1714.68643	1316204
PF>1700	3	13761.2	4587.06667	847940.3

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	49052011.11	2	24526005.6	31.81003	1.3493E-07	3.385196123
Inside groups	19275373.64	25	771014.946			
Total	68327384.75	27				

Role of factor = 0.718 = 71.8%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<850*10^{12}eggs	27	60194.56	2229.42815	8657653
PF 850-1550	28	139683.3	4988.68964	16502069
PF>1550	12	90386.5	7532.20833	26373916

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	254332577	2	127166288	8.470976	0.00054476	3.140442573
Inside groups	960767927.5	64	15011998.9			
Total	1215100504	66				

Role of factor= 0.209 = 20.9%

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<140*10^{12}eggs	3	453.419	151.139667	186.0137
PF 140-775	3	831.548	277.182667	748.9066
PF>775	3	2257.009	752.336333	96367.91

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	603095.2768	2	301547.638	9.29719	0.01451932	5.143249382
Inside groups	194605.6679	6	32434.278			
Total	797700.9447	8				

Role of factor=0.756=75.6%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<88*10^{12} eggs	12	2231.177	185.931417	2318.165
PF 88-320	16	7086.864	442.929	23042.49
PF>320	4	3450.12	862.53	112815.9

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	1435095.01	2	717547.505	29.32543	1.0834E-07	3.327656373
Inside groups	709584.7089	29	24468.4382			
Total	2144679.719	31				

Role of factor=0.669=66.9%

Continuation of table 37
North -east Arctic h addock

Traditional classification
One way variance analysis
RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<29*10^{12}eggs	6	61.92	10.32	29.62412
PF 29-59	5	189.28	37.856	351.4557
PF>59	1	67.41	67.41	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	3889.145172	2	1944.57259	11.26241	0.00354939	4.256492048
Inside groups	1553.94332	9	172.660369			
Total	5443.088492	11				

Role of factor=0.714=71.4%

Cluster classification
One way variance analysis
RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<41*10^{12}eggs	20	999.88	49.994	1882.923
PF 41-79	9	1153.76	128.195556	3725.193
PF>79	2	390.06	195.03	32573.73

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	65245.41347	2	32622.7067	9.306452	0.00079639	3.340389299
Inside groups	98150.8085	28	3505.38602			
Total	163396.222	30				

Role of factor=0.399=39.9%

Greenland h alibut

Traditional classification
One way variance analysis
RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.34*10^{12}eggs	1	17.88	17.88	#ДЕЛ/0!
PF 0.34-0.48	4	82.58	20.645	4.783367
PF>0.48	3	71.28	23.76	6.2692

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	31.34285	2	15.671425	2.91415	0.14488529	5.786148449
Inside groups	26.8885	5	5.3777			
Total	58.23135	7				

Role of factor=0.538=53.8%*

Cluster classification
One way variance analysis
RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
PF<0.48*10^{12}eggs	4	82.58	20.645	4.783367
PF 0.48-0.60	2	48.74	24.37	10.3058
PF>0.60	1	22.54	22.54	

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	18.8667	2	9.43335	1.5304	0.32093129	6.944276265
Inside groups	24.6559	4	6.163975			
Total	43.5226	6				

Role of factor=0.433=43.3%*

Table38. Role of spawning stock biomass (SSB) in year-class strength formation in four species of food fishes Of the Norwegian and Barents seas under different survival conditions. Unfavourable conditions.

Norwegian spring spawning h erring

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>6700*10³t	11	1646.97	149.7245455	46884.07
SSB 6700-12500	14	24005.61	1714.686429	1316204
SSB<12500	3	13761.2	4587.066667	847940.3

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	49052011.11	2	24526005.56	31.81003	1.3493E-07	3.385196123
Inside groups	19275373.64	25	771014.9455			
Total	68327384.75	27				

Role of factor = 0.718 = 71.8%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>4600*10³t	22	36105.94	1641.179091	6500916
SSB 4600-8100	17	92285.52	5428.56	8427180
SSB<8100	28	161872.9	5781.175357	26118904

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	238535974.6	2	119267987.3	7.816331	0.00091799	3.140442573
Inside groups	976564529.8	64	15258820.78			
Total	1215100504	66				

Role of factor = 0.196 = 19.6%

North -east Arctic cod

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>625*10³t	4	726.197	181.54925	3822.98
SSB 625-940	2	558.77	279.385	1468.712
SSB<940	3	2257.009	752.3363333	96367.91

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	592027.4653	2	296013.7327	8.635447	0.01714015	5.143249382
Inside groups	205673.4794	6	34278.91323			
Total	797700.9447	8				

Role of factor=0.742=74.2%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB>465*10³t	19	5299.077	278.8987895	27568.52
SSB 465-940	10	5212.075	521.2075	73084.71
SSB>940	3	2257.009	752.3363333	96367.91

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	797948.1377	2	398974.0689	8.591354	0.00117441	3.327656373
Inside groups	1346731.581	29	46439.02003			
Total	2144679.719	31				

Role of factor= 0.372=37.2%

Continuation of table 38

North -east Arctic h addock

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<110*10^3t	6	97.13	16.18833333	208.7843
SSB 110-153	5	154.07	30.814	498.6335
SSB>153	1	67.41	67.41	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	2404.632888	2	1202.316444	3.561299	0.07254939	4.256492048
Inside groups	3038.455603	9	337.6061781			
Total	5443.088492	11				

Role of factor=0.442=44.2%

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<85*10^3t	6	186.12	31.02	875.2727
SSB 85-164	17	1159.11	68.18294118	2750.29
SSB>164	8	1198.47	149.80875	8484.551

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	55623.37073	2	27811.68537	7.225634	0.00294946	3.340389299
Inside groups	107772.8512	28	3849.030401			
Total	163396.222	30				

Role of factor=0.340=34.0%

Greenland h alibut

Traditional classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<85*10^3t	2	36.48	18.24	0.2592
SSB 85-103	3	63.98	21.32666667	4.387033
SSB>103	3	71.28	23.76	6.2692

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	36.65968333	2	18.32984167	4.248592	0.08352512	5.786148449
Inside groups	21.57166667	5	4.314333333			
Total	58.23135	7				

Role of factor=0.538=53.8%*

Cluster classification

One way variance analysis

RESULTS

Groups	*Counts*	*Sum*	*Mean*	*Dispersion*
SSB<103*10^3t	4	82.58	20.645	4.783367
SSB 103-128	2	48.74	24.37	10.3058
SSB>128	1	22.54	22.54	#ДЕЛ/0!

Source of variance	*SS*	*df*	*MS*	*F*	*P*	*F critical*
Between groups	18.8667	2	9.43335	1.5304	0.32093129	6.944276265
Inside groups	24.6559	4	6.163975			
Total	43.5226	6				

Role of factor=0.433=43.3%*