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# THIRD REPORT OF THE WORKING GROUP ON THE ESTABLISHMENT OF AN INTERNATIONAL HERRING RESEARCH SCHEME

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## A. PARTICIPATION

The Working Group met at the Fisheries Research Institute, Bergen, from 25th March - 3rd April, 1965. The following members participated:-

Mr. B. B. Parrish (Chairman)
Dr. G. Hempel (Chairman of Herring Committee)
Mr. K. Popp Madsen
Mr. O. J. Østvedt.

As announced at the last meeting of the Herring Committee, Mr. F. Devold retired from the Working Group and was replaced by Mr. O. J. Østvedt. In accordance with the recommendation at last year's annual meeting, Mr. O. Dahl had organised routine sampling of herring in the three experimental "polls" since the last meeting of the Working Group; he also gave valuable assistance to the Group during this meeting.

## B. TERMS OF REFERENCE

In accordance with the recommendation of the Herring Committee at its Annual Meeting in 1964, the main tasks of the Working Group at this meeting were as follows:-

(a) to make an appraisal of herring-sample data collected in Lindåspollen, Fjellspollen and Heiermarkspollen since the last meeting.

(b) to conduct further echo-surveys and sampling in Fjellspollen.

(c) to transfer live herring, in good condition, into a small, narrow-necked bay with a view to their establishment.

(d) to prepare plans for a detailed report for publication on the findings of the Working Group.

## C. DATA FROM SAMPLING OF HERRING FROM APRIL 1964 - MARCH 1965

In accordance with the plans drawn up at the last meeting of the Working Group (see 2nd Report of Working Group, C.M.1964, Doc.No.7) routine sampling of herring was conducted in all three polls in most months up to September 1964 (so as to complete one year's sampling), but thereafter only in the Fjellspollen. The sampling methods and procedure during the year were the same as described in the 2nd Report of the Group, sampling being done by gill-nets set by local fishermen. The samples taken in these polls, in the months following those reported in the 2nd Report are given in Table 1 (page 6 ). However, during the meeting fishing was also done by purse-seine in the Fjellspollen and the area (Nessjön) immediately outside its entrance, to provide live herring for transfer to the narrow-necked bay (Selvåg) and for additional samples.

### 1. Lindåspollen

In the 2nd Report of the Working Group, data on length, age, maturity, length/age and Vert.S. were given for the Lindåspollen herring, by month for the period November 1962-March 1964. These and the data for the period April/July 1964 are given in Tables 2 to 7 (pages 7-9 ).

The data in Table 4 show that herring in maturity stage VI and VII were present in the Lindåspollen in the months March and April in both 1963 and 1964. Also, the otolith type and V.S. data provide no evidence of the presence of substantial quantities of autumn spawners at any time during the sampling period, and it seems clear that only spring spawners have occurred in the poll in abundance during the sampling period.

The 1959 year-class contributed prominently to the samples in all months (except July 1964) throughout the sampling period (Table 3). As reported in the 2nd Report of the Working Group it was characterized by low mean V.S. (Table 6). Also, while in the early sampling period (especially in November 1962), its length-composition was bimodal (see 2nd Report), reflecting slow (low V.S.) and fast (high V.S.) growing components respectively, in the period following the 1964 spawning

season it was unimodal, only the slow-growing components being present. This is shown in Table 7, which gives the percentage length-composition of this age-group in November 1962 and for grouped months in 1963 and 1964. A similar bimodality was also present amongst the less numerous 3 and 4 year-olds (1961 and 1960 year-classes) in the months January-April 1964, whereas during the post-spawning months only the slower growing component was present.

It seems likely therefore that the faster growing components of these year-classes consisted of Atlanto-Scandian herring, which either spent their adolescent lives in this locality or were immigrant spawners and which emigrated to the open sea after the spawning season, while the slower growers were members of a more local group, comparable with that sampled by Aasen (1952) in the Lusterfjord. It is not clear to what extent these herring are confined to the Lindåspollen throughout life; however, it seems likely that they are members of a larger, local group whose distribution extends into the coastal waters in the vicinity of the Lindåspollen and an exchange of herring takes place between these areas and the Lindåspollen. Further sampling in these neighbouring areas is required to ascertain its range of distribution and movement patterns.

2. Heiermarkpollen

Most of the material collected in the Heiermarkpollen was described in the 2nd Report of the Working Group. However, additional samples were obtained in April, May, June and August 1964 bringing the total material to 1,097 herring sampled since August 1963.

The length, age and maturity stage-compositions, the mean vertebral counts and mean lengths for age are given by months for the whole sampling period for the Heiermarkspollen in Tables 8-12 (pages10-12 ).

As stated in the 2nd Report, the available data provide no clear evidence of a self-contained spring-spawning herring stock in the poll. The spawning herring observed in April were probably immigrants from outside. The samples obtained during the summer show, however, that the recovering spents (mainly of the 1961 year-class) remained in the poll at least up to September 1964. During the same time only a few young herring (2 year-olds) were sampled, indicating that during the spring and summer of 1964 no or only few immature herring migrated into the poll.

3. Fjellspollen

In its 2nd Report the Working Group established that spawning took place in Fjellspollen both in spring and autumn. At that time it was not possible, however, to conclude whether the two spawning-groups formed self-contained stocks or whether the presence of herring depended upon immigration from outside areas. In 1964 sampling was expanded to include all months in order to obtain a more complete picture of a year's cycle. The results, as shown in Tables 13-17 (pages 13-17) and in Figures 1 and 2 (pages 18-19), seem to warrant a more definite statement on the integrity of the Fjellspollen herring.

The distinction between spring and autumn spawners is based on maturity stage and otolith type. From the vertebral counts shown in Table 17 it appears that this method gives a reasonable correct split between the autumn spawners with a low vertebral count and the spring spawners having a vertebral count at least as high as that of the big Norwegian winter herring. It also appears that spring spawners were present in all months of 1964 and that they constituted the major component of the samples except for September and October.

Table 16 shows the age-composition by month of all fish sampled. It appears that fish with 3 and 4 winter-rings are the main components in January-March. In April the 4-year olds have almost disappeared and their relative importance remains on a low level during the rest of 1964.

The 3 years old spring spawners, i.e. year-class 1961, which apparently replace the 4-ringed fish are not a homogenous group. The length-distribution by month (Figure 1) indicates at least two components with different growth-rates. In January-February large 3 year-olds are present together with the 4 year-olds and both groups are replaced during March by a slower-growing component of year-class 1961. The smaller herring obviously enter the Fjellspollen to spawn, and Table 13 suggests that the spawning may even take place in early June. Though a number of 4-ringed fish and the big 5-ringed fish are found in maturity stage VI in February, it is likely that the major part emigrates from the poll to spawn outside. The data also indicate that the older and the bigger fish spawn earlier than the younger and the smaller ones, a trend which is known from the big Norwegian herring tribe.

The component of small 3-ringed fish seems to stay in the Fjellspollen after the spawning. The average length (Figure 2) increases about 4 cm during the feeding period (May-September), and in December their length is about the same as that of the fast-growing component of the same year-class almost one year earlier.

From the data presented above it is reasonable to draw the following conclusion concerning the spring-spawning herring of the Fjellspollen:-

The presence of spring-spawning herring depends upon immigration of the 3 year-olds first-time spawners from stocks outside the poll. Fast-growing members of a year-class may invade the poll in winter but leave during February-March immediately after spawning or to spawn outside the poll. They are being replaced by smaller fish, which spawn later and which remain in the poll for the rest of the year. In the following winter some of these fish may spawn a second time in the poll, but the main part of the now 4 years old herring emigrates and do not return for subsequent spawnings. The amount of spring spawners present in the poll will consequently be very much influenced by fluctuations in the strength of the year-class.

The autumn spawners have only been found in strength during the spawning season. They may dominate the samples in September-November, but in the period December-May they are scarce or altogether absent.

The percentage age-composition in the 3 years of sampling is shown below.

| Winter-rings | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | N |
|---|---|---|---|---|---|---|---|---|---|
| 1962 | 3.6 | 78.2 | 1o.9 | 5.5 | - | - | - | 1.8 | 55 |
| 1963 | 11.8 | 52.9 | 32.4 | 2.o | 1.o | - | - | - | 1o2 |
| 1964 | - | 73.4 | 23.4 | 1.6 | o.8 | o.8 | - | - | 128 |

Apparently, fish with 2 winter-rings (i.e. 3 years old) have dominated in all the three years investigated. Younger fish of small importance and fish older than 4 years of even less importance. Another important fact is that the 3 years old herring are almost as big as the 4 years old herring (average length: 29.17 cm and 3o.28 cm, respectively). The most likely interpretation of these features is that the presence of autumn spawners in the Fjellspollen is based upon immigration of recruit spawners. Due to split recruitment big 3 years old herring spawn together with small 4 years old fish and neither return for subsequent spawnings.

At the present stage of the investigation we may conclude that no self-contained stock is present in the Fjellspollen.

## D. FIELD WORK CARRIED OUT DURING THE MEETING OF THE WORKING GROUP

### (1) Echo-surveys

A number of visits were made to the Fjellspollen during the course of the meeting. The Group was fortunate in having at its disposal the 35 ft vessel "Olav" of the Aquarium in Bergen, so that regular echo-surveys could be made, with a Simrad "Skipper" echo-sounder. On four days, surveys were made over a close, criss-cross grid covering the entire length of the poll and the narrow-necked bay (Selvåg), into which it was intended to introduce live herring.

On all occasions, mid-water echo-traces were recorded, mainly in the shallower southernmost part of the poll and on the western side to the north of the entrance. However, on none of the surveys were large concentrations of herring located, the traces indicating the presence of no more than a few kilograms of fish. Within the Selvåg only two small traces were detected on the surveys made prior to the introduction of live herring.

### (2) Transfer of herring to narrow-necked bay (Selvåg), with netting barrier at entrance

Fishing in the Fjellspollen and Nessjön, just outside the entrance of Fjellspollen was done by gill-nets to provide samples, and by purse-seine to provide live herring for transfer (and additional samples). Purse-seine fishing

in Fjellspollen, using artificial lights to aggregate the fish, was done on three nights and yielded small catches, consisting of the following species:-herring, sandeel, mackerel, sprat, saithe, whiting, cod, lumpsucker and torsk. On two occasions (27/3 and 2/4) less than 1oo herring were caught, the main catch being of sandeels, but on another (31/3), about 2 hectolitres of herring, together with some sandeels were caught in the deep part of the poll just to the north of the entrance. These fish were transferred from the purse-seine into two keep-nets (each 4 x 4 x 2 m), which were towed slowly into Selvåg.

The narrowest part of the entrance to Selvåg (35 m wide and 1o-15 m deep at the centre) was then closed by small-meshed netting, weighted at the bottom and buoyed at the surface. Subsequent inspection showed that the entrance had been satisfactorily closed. It was arranged that frequent inspections of the netting should be made over the succeeding months.

The herring in the keep-nets exhibited no panic or flight reactions during the tow into the Selvåg, and on arrival were in excellent condition. They were towed to the north-west corner of the bay, where 2oo of them were tagged, 1o5 with Scottish "spaghetti" tags and 95 with "Gundersen's" internal-external sprat tags. After tagging, each herring was put back into one of the keep-nets along with the untagged fish. Close observation showed that very few scales were lost during the tagging operation and revealed no difference in behaviour between the tagged and untagged individuals.

After completing the tagging, all of the herring were released in small groups. The estimated number of tagged and untagged fish released was 1,2oo. The groups were observed swimming slowly away from the ship after release.

About 3o minutes after completing the release, an echo-survey of Selvåg was made. Two small "plume" traces were recorded close to the surface less than 2oo m from the release point.

About 1oo herring were also transferred into Selvåg following the third night's fishing on 2/4-1964.

Although the number of herring caught was much smaller than had been hoped, these experiments demonstrated that herring could be caught in the Fjellspollen and then transferred and released in the Selvåg in good condition. Also, they showed that efficient closure of the entrance could be made. In the light of these successful initial experiments, it was agreed that, if possible, the Norwegian members of the Group would arrange for a further transfer of herring to the Selvåg at a later date, a proportion of which would be tagged with the "Gundersen"tag. It was also agreed, in order to follow the fate of the transferred herring, that monthly fishing trials with gill-nets and/or purse-seine would be carried out between April and September, and frequent inspections would be made of the netting barrier at the entrance.

## E. CONCLUSIONS FROM WORK CARRIED OUT IN 1964/1965

The results of the analysis of the data collected during two full years of sampling in the selected polls and those of the field work carried out at this and earlier meetings of the Working Group, allow the following conclusions to be drawn:-

(1) None of the sites examined (Fjellspollen, Lindåspollen and Heiermarks-pollen) meet the important requirement of possessing a self-contained herring stock. Instead, it seems that, in each there is immigration and emigration of fish prior to and after the spawning season.

(2) Of the three sites, the Fjellspollen is the most accessible to the Research Institute at Bergen and meets most closely the other requirements for the site (as specified in the 1st Report of the Working Group, C.M.1963, Doc.No.121).

(3) Both spring and autumn spawners occur in the Fjellspollen. Both groups probably enter the poll as recruit spawners, prior to their respective spawning seasons. The autumn spawners appear to leave the poll immediately after first spawning, while the spring spawners remain in the poll throughout the succeeding summer and autumn and are available for sampling. However, most of them appear to leave it prior to the next spawning season and are replaced by a new group of recruit spawners.

(4) Since the stock in the Fjellspollen consists of only 2 or 3 age-groups, the abundance of fish in it depends heavily on the strength of the year-classes in the stock from which the herring in the poll are recruited. In the period of sampling, in 1962-1964, it seems that the spring-spawning stock in the Fjellspollen was maintained by two strong year-classes hatched in 1960 and 1961 (as in the Atlanto-Scandian stock), but in 1965, the abundance of fish has decreased due to the relatively weak 1962 year-class. However, even in 1965, samples of herring have been obtainable by set gill-nets in all months of sampling.

(5) Although the absence of a self-contained stock in the Fjellspollen precludes some of the investigations of herring-population dynamics as originally envisaged, the presence of spring spawners throughout the year permits others, especially those concerning annual biological cycles in the adult fish (e.g. maturation, growth, fecundity, etc.) in relation to environmental factors.

(6) The field work carried out at this meeting has shown that it is possible to catch herring in good condition in the Fjellspollen and transfer them to a small, narrow-necked bay, the entrance to which is closed by a small-meshed netting. However, before the potentialities of such an enclosed group of herring, as a basis for detailed, experimental studies can be assessed, it is necessary to sample and keep them under observation throughout the coming year, to determine if it becomes established and spawns there.

(7) The Working Group considers that it has now completed its task of determining the composition and biological properties of the herring stocks in the selected polls, with special reference to ascertaining the presence in them of self-contained herring stocks. In the light of the results obtained, the Group is not yet able to recommend to ICES the initiation of the full Fjord scheme as originally envisaged. However, it considers that the available stock of herring in the Fjellspollen, together with an enclosed group of herring in a small, netted bay would provide good facilities for many detailed biological and experimental studies which cannot be easily pursued in the open sea or in aquaria.

## F. ACKNOWLEDGEMENTS

The Working Group wishes to express its appreciation to the Director and staff of the Fisheries Research Institute in Bergen for the facilities which were made available to it during the course of this meeting, and for maintaining the routine sampling programme in the period since its last meeting. It wishes to express its thanks to Mr. O. Dahl for his efficient handling of this important part of the programme of work.

Table 1. Herring samples taken in Polls from April 1964.

| FJELLSPOLLEN | | | LINDÅSPOLLEN | | | HEIERMARKSPOLLEN | | |
|---|---|---|---|---|---|---|---|---|
| Sample No. | Date | No. of fish | Sample No. | Date | No. of fish | Sample No. | Date | No. of fish |
| 29 | 1.4.1964 | 25 | 25 | 1o.4.1964 | 7 | 15 | 18.4.1964 | 12o |
| 3o | 2.4.1964 | 43 | 26 | 2o.4.1964 | 5o | | | |
| 31 | 3.4.1964 | 42 | 27 | 22.4.1964 | 96 | | | |
| 32 | 7.4.1964 | 5o | | | | | | |
| 33 | 15.4.1964 | 68 | | | | | | |
| 34 | 6.5.1964 | 21 | 28 | 13.5.1964 | 15o | 16 | 2.5.1964 | 5o |
| 35 | 13.5.1964 | 15o | | | | | | |
| 36 | 12.6.1964 | 55 | 29 | 17.6.1964 | 16o | 17 | 2o.6.1964 | 47 |
| 37 | 19.6.1964 | 36 | | | | | | |
| 38 | 28.7.1964 | 15 | 3o | 18.7.1964 | 68 | | | |
| 39 | 31.7.1964 | 77 | | | | | | |
| 4o | 6.8.1964 | 83 | | | | 18 | 2.8.1964 | 1oo |
| 41 | 7.8.1964 | 22 | | | | | | |
| 42 | 2.9.1964 | 37 | | | | | | |
| 43 | 11.9.1964 | 25 | | | | | | |
| 44 | 17.9.1964 | 5o | | | | | | |
| 45 | 18.9.1964 | 26 | | | | | | |
| 46 | 17.1o.1964 | 13 | | | | | | |
| 47 | 3o.1o.1964 | 15 | | | | | | |
| 48 | 6.11.1964 | 2o | | | | | | |
| 49 | 7.11.1964 | 96 | | | | | | |
| 5o | 1o.11.1964 | 24 | | | | | | |
| 51 | 12.11.1964 | 27 | | | | | | |
| 52 | 4.12.1964 | 143 | | | | | | |

Table 2. Percentage length-composition by months, November 1962 - July 1964.
Lindåspollen

| Year | Month | 2o | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 3o | 31 | 32 | 33 | Mean | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | Nov. | o.6 | o.6 | 6.o | 9.5 | 7.3 | 6.3 | 8.9 | 18.9 | 23.2 | 12.9 | 4.8 | 1.1 | o.3 | o.6 | 26.8 | 349 |
| | Mar. | | 1.9 | 5.7 | 15.o | 17.o | 9.5 | 13.1 | 2o.7 | 9.5 | 3.8 | 3.8 | - | - | - | 25.7 | 53 |
| | Sept. | | | o.7 | 14.5 | 51.6 | 22.5 | 5.3 | 2.7 | 2.o | o.7 | - | - | - | - | 24.6 | 151 |
| 1963 | Oct. | | 2.8 | 2.9 | 15.7 | 2o.o | 11.5 | 12.8 | 11.5 | 8.6 | 9.9 | 4.3 | - | - | - | 25.7 | 7o |
| | Nov. | | o.8 | 3.o | 18.5 | 3o.7 | 16.9 | 12.3 | 1o.o | 1.6 | 1.5 | 1.6 | 1.5 | o.8 | - | 25.o | 13o |
| | Dec. | | | o.9 | 8.9 | 18.7 | 5.4 | 16.9 | 24.1 | 1o.7 | 6.3 | 4.5 | 3.6 | - | - | 26.5 | 112 |
| | Jan. | | o.8 | - | 21.3 | 32.o | 14.o | 11.6 | 12.3 | 2.4 | o.8 | 3.2 | 1.6 | - | - | 25.2 | 122 |
| | Feb. | | | 2.3 | 11.6 | 2o.9 | 7.o | 2.3 | 16.3 | 14.o | 7.o | 4.7 | 11.6 | 2.3 | - | 26.6 | 43 |
| | Mar. | | | | 2.7 | 9.8 | 11.6 | 8.9 | 18.7 | 17.9 | 15.2 | 8.9 | 3.6 | o.9 | 1.8 | 27.3 | 112 |
| 1964 | April | o.7 | | 1.5 | 2.9 | 25.o | 25.7 | 8.8 | 9.6 | 9.6 | 5.9 | 6.6 | 2.2 | 1.5 | - | 26.o | 136 |
| | May | | | | 6.4 | 36.9 | 4o.5 | 9.9 | 1.4 | 2.1 | 1.4 | 1.4 | - | - | - | 24.8 | 141 |
| | June | | | | 3.6 | 31.7 | 54.7 | 8.6 | 1.4 | - | - | - | - | - | - | 24.7 | 139 |
| | July | 1.9 | 15.4 | 21.2 | 5.8 | 7.7 | 21.1 | 17.3 | 5.8 | 1.9 | - | 1.9 | - | - | - | 23.9 | 52 |

Table 3. Percentage age-composition, by months. November 1962 - July 1964.
Lindåspollen
(Ages given as number of winter-rings; birthday taken as 1st January)

| Year | Month | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1o | >1o | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | Nov. | | | 3.9 | 28.5 | 4.1 | 13.4 | 17.o | 11.8 | 11.3 | 6.4 | 2.1 | 1.5 | 389 |
| | March April | | | | | 44.3 | 9.8 | 14.8 | 21.3 | 4.9 | 3.3 | 1.6 | - | 61 |
| | Sept. | | | 1.2 | 12.8 | 71.9 | 4.3 | 4.3 | 4.9 | o.6 | - | - | - | 164 |
| 1963 | Oct. | | 15.5 | 9.9 | 9.9 | 4o.8 | 5.6 | 8.5 | 5.6 | 1.4 | 2.8 | - | - | 71 |
| | Nov. | o.8 | 9.o | 23.3 | 7.5 | 5o.3 | 3.o | 1.5 | 2.2 | o.8 | o.8 | o.8 | - | 133 |
| | Dec. | - | 11.1 | 47.o | 1o.2 | 28.2 | 2.6 | o.9 | - | - | - | - | - | 117 |
| | Jan. | - | - | 36.6 | 29.3 | 11.4 | 21.9 | - | - | o.8 | - | - | - | 123 |
| | Feb. | - | - | 27.9 | 2o.9 | 25.6 | 2o.9 | 4.7 | - | - | - | - | - | 43 |
| | Mar. | - | - | 1.o | 38.1 | 23.8 | 29.5 | 1.o | 2.9 | 2.9 | 1.o | - | - | 1o5 |
| 1964 | April | | | 6.6 | 11.7 | 18.2 | 38.o | 5.8 | 1o.9 | 6.6 | o.7 | o.7 | o.7 | 137 |
| | May | | | 3.5 | 4.3 | 21.3 | 65.2 | o.7 | 3.5 | o.7 | - | o.7 | - | 141 |
| | June | | | 11.2 | 2.8 | 1o.5 | 73.4 | 1.4 | o.7 | | | | | 143 |
| | July | | | 7o.2 | 5.3 | 1o.5 | 8.8 | 1.8 | - | 1.8 | - | 1.8 | - | 57 |

Table 4. Percentage maturity composition (all age-groups combined) by months. November 1962 - July 1964.

Lindåspollen

| Year | Month | I | II | III | IV | V | VI | VII | VIII | No. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | Nov. | - | 4.4 | 29.o | 62.5 | 3.9 | - | o.2 | - | 389 |
| 1963 | March-April | - | - | - | - | - | 96.7 | 3.3 | - | 61 |
| | Sept. | - | 11.o | 84.1 | 3.7 | - | - | - | 1.2 | 164 |
| | Oct. | 12.7 | 8.5 | 5o.7 | 23.9 | 2.8 | - | - | 1.4 | 71 |
| | Nov. | 17.3 | 6.8 | 41.3 | 27.1 | 6.8 | - | - | o.7 | 133 |
| | Dec. | 7.7 | 2o.5 | 4o.2 | 27.3 | 4.3 | - | - | - | 117 |
| 1964 | Jan. | 3.3 | 37.4 | 13.o | 38.2 | 7.3 | - | - | o.8 | 123 |
| | Feb. | 2.3 | 25.6 | 16.3 | 25.6 | 3o.2 | - | - | - | 43 |
| | Mar. | - | 4.5 | 14.3 | 15.2 | 39.3 | 25.9 | o.9 | - | 112 |
| | April | - | 12.1 | o.7 | - | o.7 | 49.3 | 37.1 | - | 14o |
| | May | o.7 | 84.1 | 2.8 | - | - | 7.6 | - | 4.8 | 145 |
| | June | - | No data available | | | | | - | - | |
| | July | 5.9 | 72.1 | 22.1 | - | - | - | - | - | 68 |

Table 5. Mean lengths (cm) for age-groups by months November 1962-July 1964.

Lindåspollen

(Values in brackets for samples less than lo fish)

| Year | Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | lo | All Ages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | Nov. | - | 25.9 | 25.1 | 27.3 | 26.7 | 27.4 | 27.8 | 27.4 | 28.3 | (28.9) | 26.8 |
| 1963 | Mar. | - | - | - | 24.3 | (25.o) | (26.4) | 27.4 | (27.3) | - | - | 25.7 |
| | Sept. | - | (25.8) | 24.o | 24.4 | (25.6) | (25.8) | (27.7) | - | - | - | 24.6 |
| | Oct. | 23.o | (27.1) | (26.8) | 24.9 | (27.2) | (28.o) | (28.3) | - | - | - | 25.7 |
| | Nov. | 22.8 | 25.5 | 26.7 | 24.8 | (25.o) | (26.5) | (26.5) | - | - | - | 25.o |
| | Dec. | 23.8 | 27.2 | 29.1 | 25.6 | (26.5) | - | - | - | - | - | 26.5 |
| 1964 | Jan. | - | 23.8 | 26.3 | 26.2 | 25.4 | - | - | - | - | - | 25.2 |
| | Feb. | - | 23.6 | (27.4) | (3o.o) | (26.9) | - | - | - | - | - | 26.6 |
| | Mar. | - | - | 27.1 | 29.3 | 25.7 | - | - | - | - | - | 27.3 |
| | Apr. | - | (24.o) | 27.3 | 27.4 | 24.8 | (28.1) | 26.8 | - | - | - | 26.o |
| | May | - | (23.3) | (27.o) | 24.6 | 24.7 | - | - | - | - | - | 24.8 |
| | June | - | 25.1 | - | 24.3 | 24.7 | - | - | - | - | - | 24.7 |
| | July | - | 23.3 | - | (25.6) | - | - | - | - | - | - | 23.9 |

Figures for 1959 year-class underlined.

Table 6. Mean V.S. for age-groups, by months. November 1962-July 1964.

Lindåspollen

(No. of observations in brackets. Values not given for samples of less than 1o fish)

| Year | Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1962 | Nov. | - | 57.o9 (11) | 56.78 (1o9) | 57.13 (16) | 56.62 (52) | 56.69 (65) | 56.73 (45) | 56.7o (43) | 56.38 (26) |
| 1963 | Mar. | - | - | - | 56.96 (24) | - | - | 56.92 (12) | - | - |
| | Sept. | - | - | 56.7o (19) | 56.4o (1o7) | - | - | - | - | - |
| | Oct. | - | - | - | 56.5o (28) | - | - | - | - | - |
| | Nov. | 56.84 (13) | 57.13 (3o) | 57.oo (1o) | 56.55 (67) | - | - | - | - | - |
| | Dec. | 57.o8 (13) | 57.25 (55) | 57.25 (12) | 56.59 (32) | - | - | - | - | - |
| 1964 | Jan. | - | 57.35 (34) | 57.1o (3o) | 57.oo (13) | 56.78 (23) | - | - | - | - |
| | Feb. | - | 57.33 (12) | - | - | - | - | - | - | - |
| | March | - | - | 57.36 (11) | - | 56.46 (24) | - | - | - | - |
| | April | - | 56.9o (1o) | 56.94 (16) | 56.65 (2o) | 56.44 (55) | - | 56.62 (13) | - | - |
| | May | - | - | - | - | 56.26 (19) | - | - | - | - |
| | June | 57.27 (15) | | | 56.87 (15) | 56.64 (1o4) | | | | |
| | July | | | No V.S. readings available | | | | | | |

Values for 1959 year-class underlined.

Table 7. Length-composition of 1959 year-class. 1962-1964. (Readings to cm below).

Lindåspollen

| Length (cm) | 1962 | 1963 | | 1964 | |
|---|---|---|---|---|---|
| | Nov. | Mar.-Apr. | Sept.-Dec. | Jan.-Mar. | Apr.-July |
| 2o | o.9 | - | - | | |
| 21 | 1.8 | 4.2 | - | | |
| 22 | 19.o | 12.4 | - | | |
| 23 | 29.7 | 29.2 | 15.5 | 12.o | 1.5 |
| 24 | 12.6 | 25.o | 51.5 | 28.o | 34.8 |
| 25 | 1.8 | 8.3 | 2o.9 | 26.o | 52.2 |
| 26 | - | 8.3 | 6.1 | 6.o | 1o.o |
| 27 | 4.5 | 4.2 | 2.4 | 1o.o | o.5 |
| 28 | 1o.o | - | o.8 | 4.o | o.5 |
| 29 | 1o.8 | 4.2 | - | 2.o | o.5 |
| 3o | 7.2 | 4.2 | o.8 | 6.o | |
| 31 | 1.8 | - | 1.2 | 2.o | |
| 32 | - | - | o.8 | 2.o | |
| 33 | | | | 2.o | |
| No. of fish | 11o | 24 | 245 | 5o | 2o1 |

Table 8. Percentage length-composition by months. August 1963 - August 1964. Heiermarkspollen

| Year | Month | 2o | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 3o | 31 | 32 | 33 | 34 | 35 | Mean | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aug. | 1.5 | 16.4 | 16.4 | 41.8 | 19.4 | - | - | 1.5 | - | - | 1.5 | 1.5 | - | - | - | - | 23.2 | 67 |
| | Sept. | - | 3.1 | 6.2 | 32.3 | 32.3 | 6.2 | 1.5 | - | 4.6 | 1.5 | 7.7 | 4.6 | - | - | - | - | 24.8 | 65 |
| 1963 | Oct. | - | - | 2.8 | 41.7 | 44.4 | 5.5 | - | 2.8 | - | - | 2.8 | - | - | - | - | - | 24.7 | 36 |
| | Nov. | - | - | - | 4.7 | 31.3 | 32.2 | 15.6 | 3.4 | 1.3 | 1.3 | 5.1 | 3.4 | 1.7 | - | - | - | 25.7 | 236 |
| | Dec. | - | - | 3.o | 1o.4 | 4o.3 | 37.3 | 4.5 | 3.o | 1.5 | - | - | - | - | - | - | - | 24.7 | 67 |
| | Jan. | - | - | - | 9.7 | 24.2 | 32.2 | 24.2 | 6.5 | 1.6 | - | - | 1.6 | - | - | - | - | 25.8 | 62 |
| | Feb. | - | - | - | 1.o | 4.o | 28.o | 45.o | 17.o | 4.o | - | 1.o | - | - | - | - | - | 26.1 | 1oo |
| | March | - | - | - | - | - | 3.7 | 4.6 | 6.5 | 3o.6 | 24.1 | 25.o | 5.5 | - | - | - | - | 28.8 | 1o8 |
| 1964 | April | - | - | - | 2.5 | 5.o | 8.3 | 21.7 | 23.3 | 9.2 | 15.o | 14.2 | o,8 | - | - | - | - | 27.2 | 12o |
| | May | - | - | - | 2.o | 6.o | 2.o | 24.o | 8.o | 18.o | 2o.o | 16.o | 4.o | - | - | - | - | 27.7 | 5o |
| | June | - | - | - | - | - | 1o.6 | 17.o | 21.3 | 29.8 | 17.o | 4.3 | - | - | - | - | - | 27.4 | 47 |
| | Aug. | - | - | - | - | 1.o | 1.o | 2.o | 5.o | 13.o | 22.o | 25.o | 2o.o | 7.o | 3.o | - | 1.o | 29.7 | 1oo |



| Year | Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | No. of fish |
|---|---|---|---|---|---|---|---|---|---|
| | Aug. | - | 97.o | 3.o | - | - | - | - | 67 |
| | Sept. | - | 83.2 | 1o.8 | 3.o | 3.o | - | - | 65 |
| 1963 | Oct. | - | 97.2 | 2.8 | - | - | - | - | 36 |
| | Nov. | - | 88.9 | 11.1 | - | - | - | - | 235 |
| | Dec. | 3.o | 97.o | - | - | - | - | - | 67 |
| | Jan. | - | - | 98.4 | 1.6 | - | - | - | 62 |
| | Feb. | - | - | 1oo | - | - | - | - | 95 |
| | Mar. | - | - | 76.2 | 21.9 | 1.9 | - | - | 1o5 |
| | Apr. | - | o.8 | 91.4 | 7.8 | - | - | - | 116 |
| 1964 | May | - | 2.o | 87.o | 11.o | - | - | - | 5o |
| | June | - | 6.8 | 88.7 | 4.5 | - | - | - | 47 |
| | Aug. | - | 4.4 | 86.7 | 7.8 | - | - | 1.1 | 9o |

Table 9. Percentage age-composition by months. August 1963 - August 1964.

Heiermarkspollen

Table 1o. Percentage maturity stage composition by months. August 1963 - August 1964.

Heiermarkspollen

| Year | Maturity stage / Month | All age-groups | | | | | | | | | 2 and 3-years-old, year-class 1961 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | Fish Total | I | II | III | IV | V | VI | VII | VIII | Fish Total |
| 1963 | August | 59.4 | 37.7 | 2.9 | - | - | - | - | - | 69 | 61.2 | 38.8 | - | - | - | - | - | - | 67 |
| | September | 7o.1 | 19.5 | 3.9 | - | - | - | - | 6.5 | 72 | 81.8 | 18.2 | - | - | - | - | - | - | 66 |
| | October | 27.8 | 66.7 | 5.5 | - | - | - | - | - | 36 | 28.6 | 68.6 | 2.8 | - | - | - | - | - | 35 |
| | November | 22.6 | 54.o | 19.8 | 2.4 | 1.2 | - | - | - | 248 | 25.2 | 6o.4 | 12.6 | o.9 | o.9 | - | - | - | 222 |
| | December | 19.o | 61.8 | 16.2 | 1.5 | 1.5 | - | - | - | 68 | 16.9 | 64.6 | 16.9 | 1.6 | - | - | - | - | 65 |
| 1964 | January | - | 5o.8 | 42.6 | 6.6 | - | - | - | - | 61 | - | 51.7 | 43.3 | 5.o | - | - | - | - | 6o |
| | February | - | 28.o | 49.o | 21.o | 2.o | - | - | - | 1oo | - | 28.4 | 48.4 | 21.1 | - | - | - | - | 95 |
| | March | - | 1.o | 1.o | - | - | 94.o | 4.o | - | 1o1 | - | 9.5 | 3.1 | - | - | 73.7 | 13.7 | - | 95 |
| | April | - | 18.2 | 4.5 | - | - | 62.1 | 15.2 | - | 66 | - | 2o.o | 3.3 | - | - | 61.7 | 15.o | - | 6o |
| | May | - | 32.o | 6.o | - | - | 34.o | 28.o | - | 5o | - | 31.7 | 7.3 | - | - | 39.o | 22.o | - | 41 |
| | June | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | August | 1.o | 17.o | 78.o | 2.o | - | - | - | 2.o | 1oo | 1.2 | 17.2 | 78.o | 2.4 | - | - | - | 1.2 | 82 |

| Year | Month | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | Aug. | - | 22.9 | - | - | - |
| | Sept. | - | 23.7 | (29.9) | (3o.5) | (3o.8) |
| 1963 | Oct. | - | 23.9 | - | - | - |
| | Nov. | - | 25.1 | 31.o | - | - |
| | Dec. | - | 24.7 | - | - | - |
| | Jan. | - | - | 25.2 | - | - |
| | Feb. | - | - | 25.9 | - | - |
| | March | - | - | 28.3 | 29.8 | - |
| 1964 | April | - | - | 27.1 | (29.6) | - |
| | May | - | - | 27.6 | - | - |
| | June | - | - | 27.4 | - | - |
| | Aug. | - | - | 29.5 | - | - |

Table 11. Mean length for age by months. August 1963 - August 1964. Heiermarkspollen.

| Year | Month | 2 | 3 | 4 | Total |
|---|---|---|---|---|---|
| | Aug. | 57.16 (64) | | | 57.18 (66) |
| | Sept. | 57.32 (64) | | | 57.3o (92) |
| 1963 | Oct. | 57.26 (35) | | | 57.25 (36) |
| | Nov. | 57.15 (94) | | | 57.17 (117) |
| | Dec. | 57.19 (64) | | | 57.16 (67) |
| | Jan. | | 57.32 (31) | | 57.31 (22) |
| | Feb. | | 57.22 (94) | | 57.23 (98) |
| | March | | - | | - |
| | April | | 57.16 (1o6) | | 57.15 (12o) |
| 1964 | May | | 57.43 (4o) | | 57.32 (5o) |
| | June | | 57.28 (39) | | 57.3o (47) |
| | Aug. | | 57.12 (78) | | 57.13 (96) |

Table 12. Mean V.S. for age-groups by months. August 1963 - August 1964. Heiermarkspollen.

(Number of observations in brackets. Values are not given for samples of less than 1o fish).

Table 13. Percentage maturity composition by months.
September 1962 - December 1964.

Fjellspollen

| Year | Month | I | II | III | IV | V | VI | VII | VIII | N. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sept. | | 33.3 | 23.1 | 12.8 | 23.1 | | | 7.7 | 39 |
| 1962 | Oct. | | 5.7 | 62.9 | 17.1 | 14.3 | | | | 35 |
| | Nov. | | | 6.3 | 6.3 | 34.3 | 5o.o | | 3.1 | 32 |
| | March | | o.7 | 2.6 | 26.8 | 4o.5 | 28.1 | | 1.3 | 153 |
| | April | | 14.7 | 14.7 | 2.9 | | 61.8 | | 5.9 | 34 |
| 1963 | Sept. | 11.6 | 18.9 | 48.4 | 3.2 | 4.2 | | | 13.7 | 95 |
| | Oct. | 19.3 | 11.7 | 6.9 | 8.3 | 32.4 | 21.4 | | | 145 |
| | Jan. | | | 2.o | 56.o | 42.o | | | | 15o |
| | Feb. | | 2.8 | | 2.8 | 36.1 | 58.3 | | | 36 |
| | March | | o.7 | o.7 | | 36.6 | 61.4 | o.7 | | 153 |
| | April | | | | o.9 | | 97.4 | 1.3 | o.4 | 228 |
| 1964 | May | 1.2 | 1.2 | 2.4 | | | 8o.6 | 2.4 | 12.4 | 17o |
| | June | | | | | 1oo.o | | | | 6 |
| | July | | 1.1 | 8o.4 | 12.o | 3.3 | | | 3.3 | 92 |
| | Aug. | | 2.4 | 79.5 | 12.o | 1.2 | | | 4.8 | 83 |
| | Sept. | 1.4 | o.7 | 19.6 | 35.5 | 39.1 | 4.3 | | | 138 |
| | Oct. | | | 1o.7 | 25.o | 64.3 | | | | 28 |
| | Nov. | | 1.8 | 13.8 | 72.4 | 1o.8 | 1.2 | | | 167 |
| | Dec. | | 1.4 | o.7 | 78.3 | 19.6 | | | | 143 |

Table 14. Percentage length-composition by months. September 1962 - December 1964.

Fjellspollen

| Year | Month | 2o | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 3o | 31 | 32 | 33 | 34 | 35 | 36 | Average Size | N. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sept. | | | | | 7.5 | 7.5 | | 5.o | 17.5 | 7.5 | 17.5 | 2o.o | 17.5 | | | | | 29.65 | 4o |
| 1962 | Oct. | | | 2.7 | 2.7 | 2.7 | | | 2.7 | | 16.2 | 21.6 | 27.o | 24.3 | | | | | 3o.45 | 37 |
| | Nov. | 3.1 | | | | 3.1 | 6.2 | 9.4 | 12.5 | 6.2 | 12.5 | 15.6 | 21.9 | 6.2 | 3.1 | | | | 29.12 | 32 |
| | March | | | | | | | | | 1.3 | 11.8 | 22.2 | 27.5 | 16.3 | 15.o | 5.9 | | | 31.36 | 153 |
| | April | | | | | | | | 8.6 | 31.4 | 2o.o | 17.1 | 8.6 | 2.9 | 8.6 | | | 2.9 | 29.99 | 35 |
| 1963 | Sept. | | | 2.o | 7.o | 3.o | 1.o | 1.o | 2.o | | 5.o | 14.o | 31.o | 21.o | 12.o | 1.o | | | 3o.63 | 1oo |
| | Oct. | o.7 | 2.6 | o.7 | 9.3 | 12.6 | 5.3 | 7.9 | 7.3 | 5.3 | 11.3 | 21.2 | 6.6 | 7.3 | 1.3 | o.7 | | | 27.66 | 151 |
| | Jan. | | | | | | | | o.7 | | 2.o | 4.o | 6.o | 8.7 | 2o.7 | 36.7 | 16.o | 5.3 | 33.9o | 15o |
| | Feb. | | | 2.7 | | | | 2.7 | | 8.1 | 5.4 | 13.5 | 35.1 | 13.5 | 8.1 | 8.1 | 2.7 | | 31.56 | 37 |
| | March | | | | | | | | 2.o | 5.2 | 2o.9 | 24.2 | 22.2 | 11.8 | 7.2 | 5.2 | 1.3 | | 31.o8 | 153 |
| 1964 | April | | | | | | o.4 | 1.8 | 9.2 | 29.8 | 36.o | 19.7 | 2.6 | o.4 | | | | | 29.21 | 228 |
| | May | | 1.2 | | | | o.6 | o.6 | 8.2 | 21.6 | 36.8 | 24.o | 5.8 | 1.2 | | | | | 29.38 | 171 |
| | June | | | | | | | 1.1 | 1.1 | 9.9 | 12.1 | 28.6 | 39.6 | 5.5 | 1.1 | | 1.1 | | 3o.7o | 91 |
| | July | | | | | | | 1.1 | 1.1 | 1.1 | 11.9 | 33.7 | 39.1 | 1o.9 | | 1.1 | | | 3o.93 | 92 |
| | Aug. | | | | | | | | | 3.6 | | 1o.8 | 28.9 | 38.5 | 14.5 | 3.6 | | | 32.o7 | 83 |
| | Sept. | (< 2o) (1.4) | | | | | 6.5 | 3.6 | 5.8 | 4.3 | 13.o | 31.2 | 14.5 | 12.3 | 6.5 | o.7 | | | 3o.25 (3o.o1) | 138 |
| | Oct. | | | | | | 7.1 | 7.1 | 7.1 | 7.1 | 25.o | 14.3 | 7.1 | 1o.7 | 14.3 | | | | 29.96 | 28 |
| | Nov. | | | | | | | 2.4 | o.6 | o.6 | 1.8 | 1.8 | 5.4 | 35.3 | 4o.1 | 11.4 | o.6 | | 32.81 | 167 |
| | Dec. | | | | | | | | 1.4 | | | 2.1 | 7.o | 23.1 | 46.9 | 18.2 | 1.4 | | 33.19 | 143 |

Table 15. Average length by age and month. September 1962 - December 1964.

Fjellspollen

| Year | Month | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| | Sept. | | (25.3) | 3o.7 | (29.8) | | | | |
| 1962 | Oct. | | | 29.9 | 3o.9 | | | | |
| | Nov. | | (24.1) | 29.2 | (29.8) | | | | |
| | March | | | | 31.6 | 31.6 | (32.9) | | |
| | April | | | (28.9) | 29.6 | (3o.9) | | | |
| 1963 | Sept. | | 23.9 | 31.2 | 31.8 | (33.3) | | | |
| | Oct. | | 24.o | 28.3 | 3o.2 | | | | |
| | Jan. | | | | 33.2 | 34.3 | 33.9 | | |
| | Febr. | | | (22.3) | 31.6 | 31.6 | (32.o) | (32.3) | |
| | March | | | | 3o.2 | 32.4 | (31.7) | | (32.3) |
| | April | | | | 29.1 | (31.3) | (3o.3) | | |
| | May | | | (25.1) | 29.3 | 3o.7 | (32.3) | | |
| 1964 | June | | | (3o.2) | 3o.6 | 31.o | | | (31.3) |
| | July | | | (29.7) | 31.1 | (31.3) | | | |
| | Aug. | | | (3o.4) | 32.3 | (32.5) | (32.8) | | |
| | Sept. | (14.o) | | 29.4 | 31.5 | (31.8) | (34.3) | (3o.3) | |
| | Oct. | | (25.8) | 28.9 | 3o.7 | (33.3) | | | |
| | Nov. | | (26.3) | (29.9) | 33.1 | 33.1 | (34.o) | (34.8) | |
| | Dec. | | (27.5) | (3o.3) | 33.2 | 33.9 | (34.5) | | |

Figures in brackets are averages based on less than lo fish.

Table 16. Percentage age-composition by months. September 1962-December 1964.

Fjellspollen

| Age (winter-rings) | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8+ | Nos. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Month | | | | | | | | | | | |
| | Sept. | | 15.4 | 71.8 | 1o.3 | 2.6 | | | | | | 39 |
| 1962 | Oct. | | | 55.9 | 41.2 | 2.9 | | | | | | 34 |
| | Nov. | | 9.4 | 71.9 | 12.5 | 3.1 | | | | 3.1 | | 32 |
| | March | | | o.7 | 67.7 | 25.6 | 2.3 | | 1.5 | o.7 | 1.5 | 133 |
| | April | | | 23.3 | 5o.o | 23.3 | | | | | 3.3 | 3o |
| 1963 | Sept. | | 13.3 | 28.6 | 52.o | 6.1 | | | | | | 98 |
| | Oct. | | 3o.o | 39.3 | 28.7 | 1.3 | o.7 | | | | | 15o |
| | Jan. | | | | 29.3 | 6o.7 | 1o.o | | | | | 15o |
| | Febr. | | | 2.9 | 35.3 | 52.9 | 5.9 | 2.9 | | | | 34 |
| | March | | | | 63.3 | 32.4 | 3.6 | | o.7 | | | 139 |
| | April | | | | 96.8 | 2.7 | o.4 | | | | | 223 |
| | May | | | 1.9 | 91.o | 6.4 | o.6 | | | | | 156 |
| 1964 | June | | | 9.2 | 75.o | 14.5 | | | 1.3 | | | 76 |
| | July | | | 9.6 | 83.1 | 7.2 | | | | | | 83 |
| | Aug. | | | 1o.7 | 81.3 | 6.7 | 1.3 | | | | | 75 |
| | Sept. | 1.5 | | 62.3 | 33.8 | o.8 | o.8 | o.8 | | | | 13o |
| | Oct. | | 3.8 | 42.3 | 5o.o | 3.8 | | | | | | 26 |
| | Nov. | | 1.9 | 5.8 | 81.2 | 7.8 | 2.6 | o.6 | | | | 154 |
| | Dec. | | 1.5 | o.7 | 82.8 | 13.4 | 1.5 | | | | | 134 |

| Month | Group | 55 | 56 | 57 | 58 | 59 | 6o | Mean | N. |
|---|---|---|---|---|---|---|---|---|---|
| Sept.1962 | VIII, II-III | | 1 | 16 | 8 | | | 57.28 | 25 |
| | IV-V | 1 | 7 | 6 | | | | 56.31 | 13 |
| Oct. 1962 | II-III | | 2 | 13 | 9 | | | 57.29 | 24 |
| | IV-V | 1 | 1 | 2 | | | | | 4 |
| Nov. 1962 | III | | 1 | 1 | | | | | 2 |
| | IV-VI | 1 | 15 | 13 | 1 | | | 56.47 | 3o |
| Mar. 1963 | all mats. | 1 | 21 | 82 | 48 | | | 57.16 | 152 |
| Sept.1963 | IV-V | | | 3 | | | | | 3 |
| | I-III, VIII | | 4 | 33 | 19 | 1 | | 57.3o | 57 |
| Oct. 1963 | I-III S. | | 7 | 9 | 13 | 1 | | 57.27 | 3o |
| | I-III A. | | 9 | 7 | 3 | | | 56.68 | 19 |
| | IV-VI | 3 | 51 | 28 | 5 | | | 56.4o | 87 |
| Jan. 1964 | III-V | | 19 | 78 | 47 | 4 | | 57.24 | 148 |
| Feb. 1964 | IV-VI | | 7 | 18 | 8 | | | 57.o3 | 33 |
| March 64 | V-VI | | 2o | 74 | 42 | | | 57.16 | 136 |
| Apr. 1964 | VI | 1 | 11 | 74 | 28 | 2 | | 57.16 | 116 |
| May 1964 | I-III | 1 | 3 | 3 | | | | 56.3 | 7 |
| | VI-VIII | 2 | 12 | 9o | 53 | 3 | | 57.27 | 16o |
| June 1964 | Mat.non det. | | 12 | 57 | 22 | | | 57.11 | 91 |
| July 1964 | VIII, II-III | | 11 | 43 | 22 | 1 | | 57.17 | 77 |
| | IV-V | | 9 | 5 | | | | 56.36 | 14 |
| Aug. 1964 | VIII, II-III | | 11 | 36 | 21 | 1 | 1 | 57.21 | 7o |
| | IV-V | 1 | 7 | 3 | | | | 56.18 | 11 |
| Sept.1964 | I-III | | 4 | 2o | 6 | | | 57.o7 | 3o |
| | IV-V | 8 | 47 | 36 | 7 | 1 | | 56.45 | 99 |
| | VI | | 1 | 2 | 1 | | | - | 4 |
| Oct.1964 | III | | | 2 | 1 | | | - | 3 |
| | IV-V | 1 | 11 | 8 | 4 | | | 56.62 | 24 |
| Nov.1964 | II | | 1 | 1 | 1 | | | - | 3 |
| | III-V | | 15 | 83 | 53 | 6 | | 57.32 | 157 |
| | VI | | 2 | | | | | - | 2 |
| Dec.1964 | II | | 1 | 1 | | | | - | 2 |
| | III-V | | 13 | 65 | 51 | | | 57.29 | 129 |

Table 17. Number of vertebrae by maturity and month. Sept. 1962 - Dec. 1964.

Fjellspollen

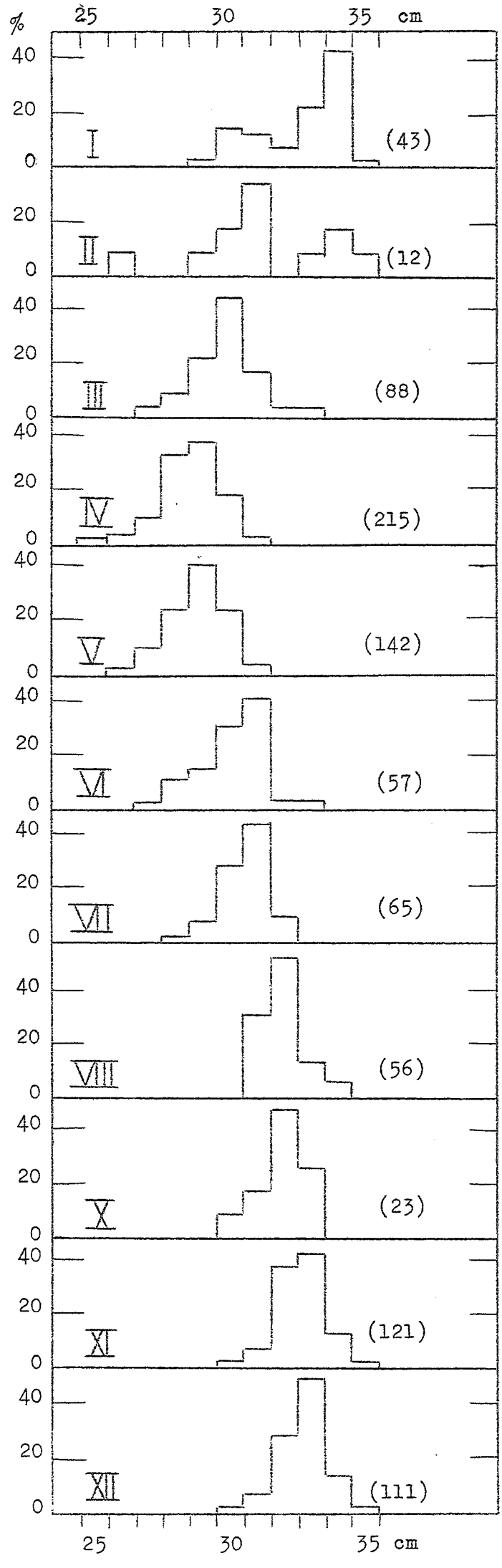


Fig. 1. Length distribution of 3 years old spring spawners by month, Fjellspollen 1964.

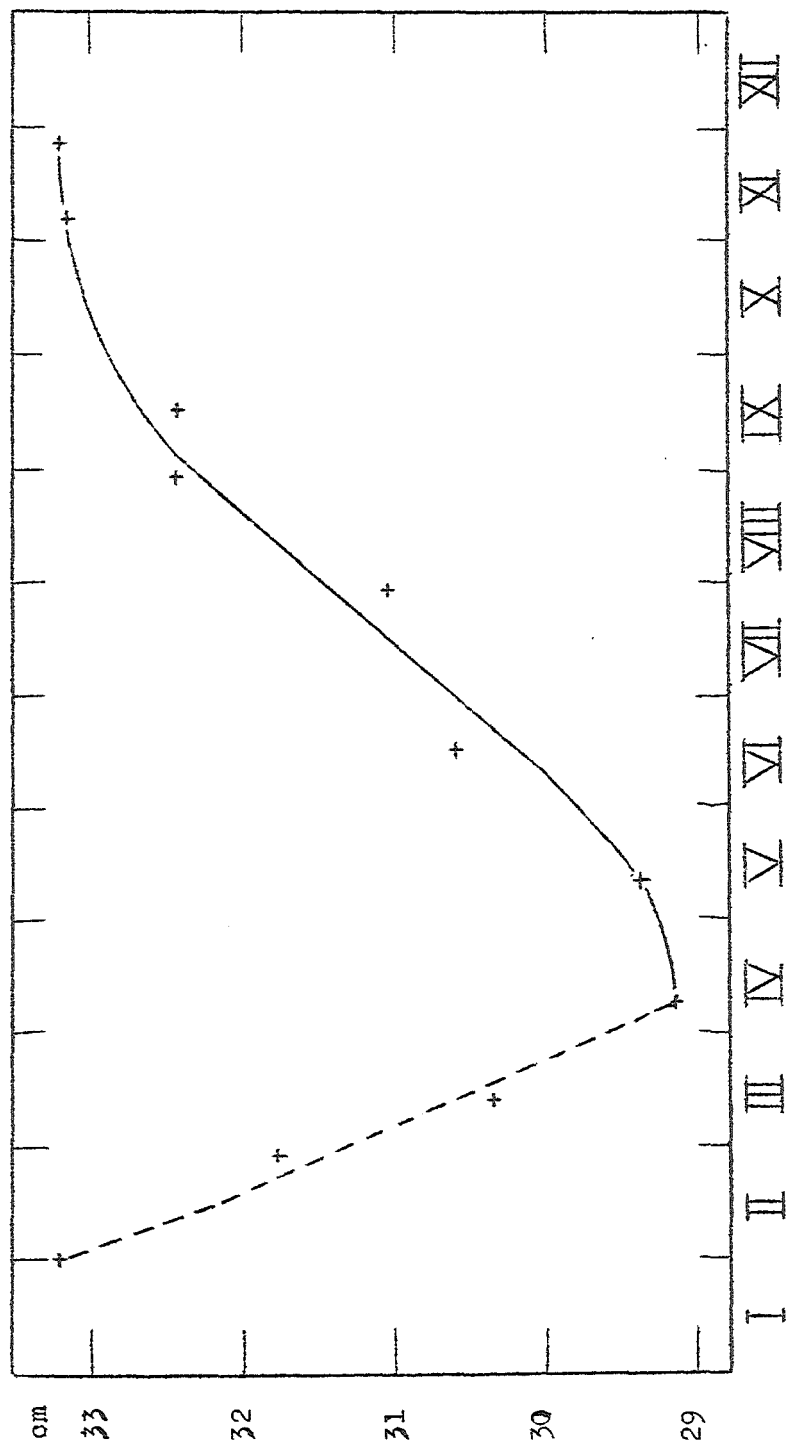


Fig. 2. Average length of 3 years old spring spawners, Fjellspollen 1964.

International Council for the
Exploration of the Sea

C.M.
Herring Committee

# INTERNATIONAL HERRING RESEARCH SCHEME

## Report on work in Fjellspollen

## April - September 1965

According to the programme set up at the working groups meeting in Bergen, March 1965, another transplation of herring to Selvåg should be undertaken.

On 14 May after several unsuccesful shots about 400 herring were caught in the northern end of the poll. However, most of the herring died and only 80 were tagged and released in Selvåg (Table 1).

### Control and sampling of the herring in Selvåg

Om 8 June the herring in Selvåg were located by a frogman and by echo-sounders. The frogman estimated the school to consist of several thousands herring. It was tried to catch the herring with purse seine, but with no success. Later in the night the herring were observed schooling near the surface and a shot with the purse seine gave a catch of 1196 herring of which 145 were tagged (Table 1). The herring were counted and released again in Selvåg (except 40 herring that were transported live to the institute in Bergen for experimental studies).

The number of fish sampled in Selvåg is shown in Table 2. Altogether 267 fish of which 44 were tagged have been recaptured, mainly with gill net. It should be noted that of the herring tagged with the "Gundersen sprat tag" only 8.4 per cent have been recaptured as compared with 18.5 per cent of the Spagetti tag and 22.0 per cent of the internal tag (Table 1).

The data on age, length and maturity of the herring transferred to Selvåg show that the herring mainly were autumn spawners ( 2 ringers). In September most of the herring were in maturity stage IV and V.

The herring in Selvåg were, however, in poor condition and fat analysis of herring taken on 15 September showed a total fat content of 13.9 per cent compared with 22.4 per cent of herring taken on 1 September in the Fjellspollen proper.

On 8 September the herring in Selvåg were again located by frogman. The transparency was very low and only 10-15 herring were observed. A week later 126 herring were taken by gill net (Table 2).

### General work in Fjellspollen

Sampling of herring have been continued as far as herring have been available, and since April ten samples consisting of 363 herring have been taken.

According to the fisherman the herring were very scarce in July and August. By the end of August the catch by gill net increased. In August-September most of the herring were in maturity stage IV and V, showing that autumn spawners had immigrated the poll.

Plankton and hydrographical observations have been taken in May and July. In May a detailed survey of the Fjellspollen was made by a group of students from the Marine Biological Laboratory , University,OSLO as a part of the practical training in a summer course held at Espegrend Biological Station. The data obtained will later on be available for the working group.

Table 1. Herring transferred to Selvåg and recaptured ( in numbers )

| No. of fish transferred to Selvåg | | | | Experiment with purse seine | | Total no. of fish sampled | |
|---|---|---|---|---|---|---|---|
| | | | | Catch | Released | | |
| Date | 2.April | 14.May | Total | 9.June | 9.June | 22.April - 15.Sept. No. | % |
| | 1200 | 80 | 1280 | 1196 | 1156 | 267 | 20.9 |
| Tag: | | | | | | | |
| Spagetti | 105 | 30 | 135 | 76 | 75 | 25 | 18.5 |
| "Gundersen" | 95 | - | 95 | 69 | 69 | 8 | 8.4 |
| Internal steel tag | - | 50 | 50 | ? | ? | 11 | 22.0 |

Table 2. Number of herring sampled in Selvåg

| Date | Gear | Total no. of fish sampled | No. of tagged fish recaptured | Spagetti tag (2/4 | 14/5 | Gundersen tag 2/4 | Internal steel tag 14/5 |
|---|---|---|---|---|---|---|---|
| 22.April | Gill net | 1 | 1 | 1 | - | | |
| 30.April | - " - | 5 | 3 | 2 | - | 1 | |
| 13.May | - " - | 9 | 1 | - | - | 1 | |
| 2.June | - " - | 40 | 2 | - | 1 | 1 | |
| 9.June | Purse seine | 12 | 1 | - | - | - | 1 |
| 17.Aug. | Gill net | 74 | 16 | 5 | 2 | - | 9 |
| 15.Sept. | - " - | 126 | 20 | 10 | 4 | 5 | 1 |
| Total | | 267 | 44 | 18 | 7 | 8 | 11 |