

Fol. 41

Farmington kopi
you log get

This paper not to be cited without prior reference to the authors

International Council for the
Exploration of the Sea

C. M. 1964
Herring Committee

No. 7
Fiskeridirektoratet
Biblioteket

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

<u>Contents</u>	Page
A. Participation	1
B. Terms of Reference	1
C. Data Collection up to April 1964:-	
1. Topography of the "polls"	1-2
2. Hydrography and plankton	2
3. Sampling of herring:-	
a) Lindåspollen	2-3
b) Fjellspollen	3-6
c) Heiamarkpollen	6
D. Technical, Legal and Social Problems	7
E. Conclusions from Work carried out in 1963/1964	7-8
F. Recommendations	8-10
Annex 1	11-12
Tables 1 - 17	13-24
Charts 1 - 3 attached	

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

A. PARTICIPATION

In accordance with the recommendation of the Council in Madrid in October 1963, the Working Group met again in Bergen from 12th to 18th April, 1964. The following members participated:-

Mr. B.B. Parrish (Chairman)
Dr. Á. Fridriksson (General Secretary of ICES)
Mr. Finn Devold
Dr. G. Hempel (Chairman of the Herring Committee)
Mr. K. Popp Madsen

Mr. O. J. Østvedt and Mr. O. Dahl of the Havforskningsinstitutt, Bergen were again co-opted to the Working Group.

B. TERMS OF REFERENCE

At the first meeting of the Working Group in 1963 three small fjords (polls) in the neighbourhood of Bergen were selected as possible sites for the establishment of the international research scheme. A general description of their physical characteristics and some information about the herring inhabiting them were given in a first report (C.M. 1963, Doc. No. 121). A number of basic requirements for the locality and fish stock were listed and the three sites were examined in the light of them.

It was evident from the results of this examination that several biological and technical problems would have to be carefully investigated before final advice could be given to the Council, as to the feasibility of the scheme. A step by step development was therefore recommended. The first step, in 1963/64 covered the following items:-

- (I) Further studies of the topographical and environmental features of the polls.
- (II) Identification of herring stocks in the polls, their size and composition and the degree of exchange with the open sea.
- (III) Seeking advice concerning the technical, legal and social problems involved in closing the mouth of a selected poll, should this prove necessary on biological grounds.

The task at the present meeting of the Working Group was to make an appraisal of the information and data collected by Norwegian workers on each of these items since the first meeting and to make further scientific observations at the selected sites. The results of this appraisal are presented below.

C. DATA COLLECTION UP TO APRIL 1964

1. Topography of the "polls"

An echo-sounding survey of all three sites and their immediate surroundings has been completed. Charts of each, of scale 1:10,000 have been prepared by Mr. O. Boström of the Directorate of Fisheries, Bergen, giving depth contours by five metres depth intervals. Small reproductions of the most relevant parts of the charts are given in Figures 1-3.

In addition to the information given in the report of the first meeting of the Group in 1963 the following relevant features of the topography of the polls, are revealed by these charts.

Fjells-pollen. The underwater topography of this poll is in the form of a U-shaped valley; the steep rocky mountains at the shore continue under water until the rather flat bottom of the fjord is reached at about 40-50 m depths. The bottom of the northern end of the poll and at least some of its deeper central parts is muddy. The sides are either rocky or, where shallow, consist of sand and gravel.

In the neighbourhood of the entrance, several sills with a sill depth of about 20 m separate the poll into a northern and southern part. The narrow entrances have a minimum depth of 2-6 m. Between the entrance of the poll and the outer skerry region there is a sheltered basin with narrow outlets and shallow arms which have gravel bottoms. This basin is a steep bowl, more than 90 m deep.

Heiemark-pollen. This poll consists of several basins, the deepest, central basin being about 116 m deep and the basins in the surrounding bays, and those outside the entrance of the inner Heiemark-pollen being 50-80 m deep with rather steep sides. Only the bays in the south-western part are shallower and less steep.

Lindås-pollen. The main topographical features of this poll were described in the first report (C.M. 1963 Doc. no. 121).

2. Hydrography and plankton

Hydrographical observations and plankton sampling have been made in all three polls and their inlets since the first meeting of the Working Group. In Fjellspollen two surveys were made, in October 1963 and January 1964, with 4 hydrographical stations inside and 1 station outside the poll (bathythermograph, surface salinity). In Heiemarkspollen, hydrographical observations and plankton hauls were made in August and November 1963 and February 1964. Additional hydrographical data were collected from this poll and its surrounding area in connection with a shellfish project. In Lindåspollen, hydrographical data were collected in November 1963 and February 1964. Some earlier data are also available. In contrast to the heavy ice cover in 1962/63 no ice was observed in 1964; therefore in February 1964 six bathythermograph stations were worked inside and one outside the poll. The results of these surveys are given in Annex I.

Additional hydrographical data and plankton samples were collected by the Working Group in Lindåspollen and Fjellspollen during the course of the Working Group meeting on 14th and 15th April, 1964.

The plankton samples were taken as surface hauls with a Clarke-Bumpus sampler and vertical hauls with a 50 cm "Juday" net. The samples taken show a very low supply of food organisms for herring in winter in the polls but high concentrations in spring and summer. In Lindåspollen phytoplankton was very abundant in April 1964. At the same time Fjellspollen showed a high abundance of copepods and their larval stages. In Heiemarkpollen a few cod eggs, in early stages of development, were caught in February 1964 and in April, cod larvae were caught in Fjellspollen and Lindåspollen. No herring larvae were caught inside these polls during the April surveys, but two specimens were taken in the outer basin of the Fjellspollen.

3. Sampling of herring

Extensive sampling of herring in the three polls, was undertaken during the year by our Norwegian colleagues, especially Mr. O. Dahl. Most of the herring were caught by local fishermen, using set gill-nets, provided by the Fisheries Institute, Bergen. In order to ensure sampling of small fish, narrow meshed nets were used together with nets of normal mesh size. A list of the samples taken during the year is given in Table 1.

For most of the samples, the following characters were examined:- length, weight, sex, maturity stage, age, scale type, otolith type and V.S. Egg samples were also taken from some ripe females in fresh condition. Results of analyses of these data, made during the meeting of the Working Group are given below.

a) Lindåspollen

Herring were sampled in the poll from September 1962 to April 1964. Twenty-four samples, totalling 1,239 herring, were taken. Sampling was interrupted from December 1962 to March 1963 due to ice, and no sampling was carried out from April to mid September 1963. Age readings were available for analysis by the Working Group from November 1962 to January 1964.

The length, age and maturity composition and the mean V.S. and lengths at age are given for the Lindåspollen samples, by month, in Tables 2-6.

The maturity data in Table 4 show clearly the presence of ripe herring in the poll during the spring spawning season in both 1963 and 1964. But there is no evidence that spawning herring were present there in autumn. The herring sampled

during the autumn months (September-November) were mostly in early maturity stages (II-IV), suggesting that the population in the poll throughout the year was spring spawning one. This is confirmed by the otolith characters of the herring sampled in the poll. These were almost entirely of the "spring" type; out of over 900 otoliths examined from this poll between November 1962 and January 1963, only 4% were characterised as "autumn" type, and these were mostly immature, 1 and 2 year-olds, sampled between November 1963 and January 1964. However, it is interesting to note that the V.S. of some of the year-classes in the samples, taken in autumn 1962 and 1963 were far lower than in open sea, spring spawning herring. This is shown in Table 6, especially for the 1959 year-class, the values for which ranged between 56.40 and 56.78, except during the spawning season, when a value more characteristic of spring spawners was obtained.

The significance of these observations in relation to the identity of the herring population in the poll is not clear. However, it is significant that the length distributions of this year-class show the presence of two distinct size groups each giving significantly different V.S. values. These compositions are shown below for the November 1962 and September 1963-January 1964 data respectively.

		Length	20	21	22	23	24	25	26	27	28	29	30	31	32	Total
No. of fish	Nov. 1962		1	2	21	32	14	2	-	5	11	12	8	2	-	110
	Sept. 1963- Jan. 1964		-	-	-	39	135	55	17	7	2	-	4	5	1	265

The mean V.S. for the smaller size-groups ranged between 56.4 and 56.6, while that for the large one, at 57.0-57.2 was fairly typical of spring spawners. It would therefore seem that this year-class was composed of two distinct groups of spring spawning herring, a relatively slow-growing group with a low vertebral count, which was the main group in the poll during the sampling period and a faster growing group, of higher vertebral count. This group was prominent during the spawning season but decreased thereafter. In this context, it is significant to note that the "Lusterfjord" herring, investigated by Aasen (1952) were relatively slow-growing spring spawning herring of low vertebral count. Although the numbers of individuals of other year-classes in the samples were small, a similar bimodal length composition is shown by the 1960 year-class (2 year-olds) in autumn 1963.

The data in Table 3 show that the herring population in the poll during autumn 1962 and throughout 1963 was composed of a fairly large number of age-groups. In November 1962 and again during the spawning season in March-April 1963, the population consisted mostly of adult fish between 3-10 years of age, amongst which the 1959 year-class predominated. However, during the following autumn and winter (October 1963-January 1964) the numbers of older fish decreased, and younger immatures increased, although the 1959 year-class remained a prominent one throughout the period. These data suggest that there was some exchange of fish with the adjacent waters during the period, especially a loss of older fish from the poll during and after the spawning season. This is also indicated by the recaptures of the fish tagged in Lindaspollen in November 1962 (see first report of Working Group), given in Table 7. These show that 8.4% of the fish recaptured were taken outside the poll, especially during March-June.

It is not clear whether the increase in the numbers of the younger age-groups in autumn 1963 was due to immigration or to their growth to catchable size inside the poll. Also, with no sampling during the summer months, it was not possible to establish whether spent herring remained there after spawning. Clearly, further sampling in the poll is needed in 1964, especially during the spawning and post-spawning period, to elucidate further the relationships and biological properties of the herring in it.

b. Fjellspollen

Material. During the period 9.9.1962 to 15.4.1964, 33 samples, comprising 1,116 herrings were secured from the Fjellspollen. The last of these samples was collected by the Working Group during a survey of the poll during the present meeting.

The sampling was distributed as follows:-

1962	September-November:	109 herring
1963	March-April; September-October:	439 "
1964	January-April:	568 "

Ice cover prevented sampling in the winter of 1962/63, while other technical difficulties caused an interruption in the programme from May to August, 1963.

Complete age and other biological data were available to the Group for the period up to January 1964. For the later material, age readings could not be carried out prior to the meeting, but all the data, not referring to age, are included in the respective tables.

Stock Composition

(i) Maturity. An outstanding feature of Fjellspollen herring is the presence of both a spring and an autumn spawning component. This is clearly evident in Table 8 which shows that spawning herring (stage VI) were caught in October-November and in February-April respectively. In October 1963 the individual samples, although small, show the following proportion of stage V and VI.

<u>Date</u>	<u>Stage V</u>	<u>Stage VI</u>	<u>n</u>
3.10	6.0%	-	(50)
10.10	33.3%	-	(9)
18.10	88.0%	-	(25)
23-25.10	34.3%	34.3%	(35)
30.10	19.0%	76.2%	(21)

In 1962 the autumn samples were even smaller. They indicate, however, that stage VI did not occur before the beginning of November and even as late as November 20th there were equal numbers of stage V and VI.

This component of the Fjellspollen herring may accordingly be stated as being a late autumn spawner and the onset of the spawning period to take place in late October and early November.

The onset of the spring spawning is indicated by Table 8 (p.18), where the figures for January to April 1964 give a reasonable picture of the development. Both in January and February the data were collected on the last day of the month and the first stage VI fish probably appeared in mid February. The main spawning probably took place at the beginning of April, which is about a month later than in the main body of open sea Norwegian spring spawners, but is similar to the recruits spawning outside Fjellspollen. The maturity compositions in 1963 suggest that spawning took place somewhat later in that year.

It is significant that in both years, no spent fish (maturity stage VII) were sampled.

(ii) Length. Table 9 (p.19) shows the total length distributions by months, while mean length for age is shown in Table 10. It is evident from these data that another outstanding feature of the Fjellspollen herring is the very large size achieved by both spring and autumn spawners. The growth rate of both is substantially higher than that of the spring spawners in the Lind&spollen and exceeds even that of the large Norwegian spring spawners.

The length distribution of the 3-years-old spring spawners in January 1964 is shown below.

cm.	29	30	31	32	33	34	35	n.
%	2.3	14.0	11.6	7.0	20.9	41.9	2.3	(43)

This clearly defined bimodal distribution is also found amongst the 3-year-olds in March 1963. A similar feature is indicated, although less clearly by the 2-year-old autumn spawners in October 1963. This could be due to a sampling bias by the gill nets used (comprising three mesh sizes), but the fact that bimodal distributions were also observed in the Lind&spollen material, collected with similar nets but covering a different size range of herring points to the presence of two different growth types. (L_1 measurements and sampling with less selective gear may clarify this interesting point).

The restricted material does not give any definite information on differences in growth rate between spring and autumn spawners. On the whole it appears, however, that age for age the spring spawners are somewhat bigger than the autumn spawners.

(iii) Age. Total age compositions by months are shown in Table 11 (p.20). A noteworthy feature is the low average age of the herring sampled, with 2 and 3-year-olds dominating. Only in one case (January 1964) were 4-year-olds present in strength and fish older than 4 were scarce in all samples. One-year-olds were also scarce, being caught only in autumn 1963.

Identification of Stocks

During the spawning seasons the mature, spawning herring can, of course, be readily distinguished as belonging to one or the other of the two main spawning components in the poll. The necessity of being able to recognize spring and autumn spawners also amongst the immature herring is self-evident and some preliminary investigations as to the discriminant power of various characters were undertaken.

(i) Vertebral counts. The vertebral counts of all fish in maturity stages IV-VI in autumn and spring respectively are summarised below:-

V.S.	55	56	57	58	59	Mean	n
Sept.-Nov.	6	74	51	6	-	56.42	(137)
Jan.-April	2	78	326	173	6	57.18	(585)

Thus there is seen to be a very definite difference in vertebral distribution and mean between the two spawning components. In Table 12 (p. 21) the vertebral counts are compiled according to maturity groups and months. These data show that except in October 1963, immature herrings in stages I-III belonged mainly to the spring spawning component according to their vertebral counts.

(ii) Scale pattern. It was not possible to distinguish spring from autumn spawners by differences in scale pattern. However, two scale types could be distinguished, both of which were distinct from the patterns known in the Atlanto-Scandian herring. One type was of a very fast-growing fish with wide summer zones and very diffuse winter rings. The other had a smaller central field and less diffuse winter rings, indicating a slower growth. Both types occurred in each of the two spawning components. It was not possible in the time available to establish whether the two scale patterns coincided with the separate modes of the bimodal length distributions mentioned above. Secondary rings occurred frequently amongst both spawning groups, in some cases making age reading difficult.

A few young specimens of Atlanto-Scandian herring, belonging to the southern spawning type, were easily recognisable in some of the samples.

(iii) Otolith type. Prior to the meeting of the Working Group otolith material, covering the main part of the sampling period was analysed at the Scottish Marine Laboratory, as to age and spawning type. In the case of the spring spawners very satisfactory results were obtained. Less than 3% of otoliths from fish in stages V and VI in March 1964 were typed as autumn spawned. However, amongst the autumn spawners - for which there was about 85% agreement between otolith type and maturity stage - there were a number of otoliths with a definite spring spawner pattern. Time did not permit a closer study of the otolith material but as the otoliths of the Fjellspollen herring, like the scales, are somewhat different from types hitherto experienced, a further examination should certainly be undertaken.

In the material from October 1963 (Table 12, p. 21) maturity stages I-III have been split on autumn and spring spawners according to otolith types. The mean vertebral numbers indicate that a fairly accurate result was obtained by this method.

(iv) Egg size. Four egg samples of autumn spawners (30th and 31st October, 1963) and 42 samples of spring spawners (March-April, 1964) were collected. They may be compared with samples taken in the skerries (Vestre Vinnesvåg) 20 miles south of Fjellspollen. As a preliminary inspection, the average diameter of eggs in some of the samples was determined. The ^{final} analysis will be based on dry weight per 100 eggs.

Comparing fish of similar size (average total length 30.6-31.5 cm), the average diameter of eggs of spring spawners taken in Fjellspollen and in Vestre Vinnesvåg were very similar: 1.42 mm - 1.44 mm. The autumn spawners, which were smaller (average total length 27.2 cm), had somewhat smaller eggs, but this difference between spring- and autumn spawners is small compared with the difference between Atlanto-Scandian spring spawners and the majority of the North Sea autumn spawners. It should be mentioned, however, that the Downs herring, spawning in November-December in the southernmost North Sea, have also big eggs which are similar to the eggs of the autumn spawners in Fjellspollen.

The available information suggests that herring are present in the Fjellspollen most of the year. Catches of herring were obtained whenever sampling was attempted and on each of the three echo-surveys carried out in November, January and during the meeting of the Working Group, herring-like traces were recorded. The local fisherman, who provided the samples, also stated that herring are found all the year round and that in May, small shoals of herring can be seen at the surface. During the spring season he caught a total of about 50 hl. and up to 2 hl. could be taken per net per night.

The question as to the degree to which the herring in the Fjellspollen are exchanged with fish from outside cannot be readily answered. However, the very restricted range of the age composition and the apparent scarcity of young and low maturity fish in spring suggests that an appreciable exchange takes place. However, the likely bias due to the selection of the gill nets and possible differences and changes in the availability of herring of different ages and maturities must be kept in mind. As a next step sampling must be undertaken during the summer period between the two spawning seasons, and preferably with different gears.

c. Heiamarkpollen

Material - 14 samples, comprising a total of 790 herring were collected from the poll between August 1963 and April 1964.

The length, age, maturity, mean vertebral counts and mean length for age by months are given for the Heiamarkpollen in Tables 13-17 (p. 22-24). The age reading for the samples secured in February and March have so far not been completed.

The samples in the period August 1963-January 1964 consisted of young immature fish mainly of the year-class 1961. The otolith typing revealed that these were almost exclusively spring spawners.

Herring in spawning condition were caught in March 1964. These fish were considerably larger than those observed during autumn and winter, having a mean length of 28.8 cm as against 25.8 cm in January and 26.1 cm in February (Table 13). This suggests that they were immigrants from outside the poll, where spawning herring also were fished in March 1964.

The maturity stage distribution shows that the young herring (year-class 1961) were still in early stages of maturity by January and will probably not reach maturity before spring 1965.

The immature herring also show a growth pattern, mean length for age and mean V.S. similar to that usually found in Atlanto-Scandian spring spawners caught along the south-west coast of Norway.

The available evidence provides no clear evidence of the existence of a self-contained spring spawning herring stock in the Heiamarkpollen. However, further sampling during the summer months is required to determine whether recovering spents remain in the pollen during the feeding season.

According to the local fishermen spawning herring have also been observed in the polls in autumn but the samples so far obtained give no indication of their presence.

It is interesting to note that in one of the small arms (Austmannevågen) connected with the main poll through a narrow entrance which can only be passed on high tide with a small boat, 19 herring were caught in September. These herring, 2- and 3-years-old (not included in the main tables) showed a remarkable content of fat and the 3-years-old had a mean length of 32.7 (11 fish) as against 29.9 (7 fish) in the main poll.

D. TECHNICAL, LEGAL AND SOCIAL PROBLEMS

The Working Group considered the technical, legal and social problems which would be likely to arise in the implementation of the full international research scheme, as originally envisaged. It was agreed that a full appraisal of these problems cannot be made until a specific choice of site has been made and the need for closing the entrance has been fully ascertained. It is evident also that, if closure of the entrance is required, provision will have to be made for the passage of vessels in and out of the poll. This could probably only be achieved efficiently, by the installation of a relatively expensive "lock" system. It is clear, however, that the legal and social problems and the costs of establishing the scheme would be greater in the more densely populated Lindås and Heiamarkpollen where there is substantial boat traffic, than in Fjellspollen, the shores of which are relatively sparsely populated. The Working Group therefore agreed that these important problems should be considered further at a later stage in the light of the results obtained from further proposed studies in the polls, especially the Fjellspollen (see Section F).

E. CONCLUSIONS FROM WORK CARRIED OUT IN 1963/64

From the data collected during the past year and reported above, the following conclusions can be drawn:-

- (i) herring were present in all three polls in all months in which sampling was carried out.
- (ii) herring in spawning condition were present in spring in all three polls and in Fjellspollen also in autumn.
- (iii) seasonal changes took place in the age and size compositions of the herring in the polls. This and irregularities in the occurrence of maturity stages, suggest that there was some exchange between the herring inside and outside the polls.
- (iv) the sizes of the populations in the polls seem to vary seasonally, but they probably exceeded 100 hl in most of the months sampled.
- (v) the biological characters of the spring spawners in the polls suggest that they were not all members of one homogeneous spawning group. The growth rates and V.S. counts, in Fjellspollen and Lindåspollen suggest that part of the populations in the polls belonged to separate, spawning groups, distinct from the main Norwegian, spring spawning population.
- (vi) the zooplankton sampling showed that, at least in spring herring food was abundant in all three polls, and the hydrographic conditions were amenable for herring.
- (vii) for a more complete appraisal of the populations of herring and their living conditions in the three polls, further sampling and observations are needed during the summer. Observations at this time should show whether there is a substantial emigration of herring after spawning. In addition, sampling of larvae and 0- and 1-group herring should show whether all early development stages occur in the polls. Hydrographic and plankton samples will also provide further information on the living conditions at this time.
- (viii) from the information available it seems that the Fjellspollen offers a number of potential advantages over the other two localities for further consideration of the research scheme. These are:-
 - (a) it is smaller than Lindåspollen and Heiamarkpollen and has a single narrow entrance.

- (b) the locality is less densely populated and there is less boat traffic in Fjellspollen than in the other polls, thereby reducing the legal and social problems which would arise should a closure of its mouth be required.
- (c) both spring and autumn spawning takes place in the poll.
- (d) the poll possesses small, narrow necked bays, suitable for isolating groups of herring for ad hoc experimental work.
- (e) it is within easy reach, by road, from Bergen.

F. RECOMMENDATIONS

In the light of the results presented above, the Working Group considers that further sampling and other experimental work is needed before the full potentialities of these polls, as sites for establishing the international research scheme, can be properly assessed. It therefore recommends the following programme of work during 1964-65, in accordance with the general lines of approach drawn up at the first meeting of the Working Group (C.M. 1963, Doc.No. 121):-

a) Sampling

- (i) In order to provide a full year's series of observations, covering all seasons, hydrographic and plankton observations and routine herring sampling should be continued in all three polls, on a monthly basis, up to September 1964. Some small-meshed gill-nets will be included in the sampling gear, to catch the younger, smaller age-groups. From September 1964 onwards, only the Fjellspollen should be sampled, special emphasis being placed on the sampling of autumn spawners before, during and after the spawning season in the period September-November, and of spring spawners during the period February-April. At these times, sampling should also be carried out in the vicinity of the Fjellspollen, especially in autumn to establish whether spawners are present outside the poll.
- (ii) The herring sampling should be along the same general lines as in 1963. In addition to observations on length, weight, sex, maturity stage, V.S. and scales and otoliths for age, racial type and l_1 determination, gonads will be collected from female herring in stages III-V, for fecundity determinations, and in stage VI for egg size measurement. For the fish in maturity stages III-V, five gonads from each cm group should be collected in summer (June-September) and in winter (December-February), respectively, and fixed in Gilson's fluid. For the fish in maturity stage VI, the ripe eggs should be preserved in 4% formalin; the sampling should cover the whole spawning season and the total size range of ripe fish. For comparison, gonads from fish in maturity stages III-V and ripe eggs from those in maturity stage VI should be collected from the main population of Norwegian spring spawners and of Icelandic spring and summer spawners.
- (iii) The following procedure for working up the herring samples should be adopted:- The sampling will be carried out by the Bergen Laboratory, where the routine observations on length, weight, sex, maturity stage and V.S. will be recorded and scales, otoliths, gonads and egg samples taken. All scales will be mounted, and the ages read at the Bergen Laboratory, but all scale samples will then be sent to the Charlottenlund Laboratory for l_1 determination; thereafter the Lind&spollen scales will be sent to the Aberdeen Laboratory. All otoliths will be sent to the Aberdeen Laboratory for mounting and reading, and those from Fjellspollen will then be sent to the Charlottenlund Laboratory and those from Heiamarkpollen to the Bergen Laboratory. All gonad samples from maturity stages III-V will be sent to the Aberdeen Laboratory and the egg samples from ripe, stage VI herring to the Hamburg Laboratory. Copies of all data sheets will be distributed from Bergen to the Charlottenlund, Hamburg and Aberdeen Laboratories.

(iv) Tagging of herring should be done by the Bergen Laboratory inside and, if possible, also in the vicinity of Fjellspollen during autumn and spring.

(v) The following hydrographic observations will also be made by the Bergen Laboratory.

(a) Records of the duration and extension of ice cover in the three polls in winter.

(b) Bathythermograph observations from stations inside and from one station outside the Fjellspollen every second month throughout the year. At each station, water samples for salinity, phosphate and oxygen will also be taken at surface and bottom. Additional measurements of surface and bottom temperatures will be made in Lindås and Heiamarkpollen as opportunities permit. Zooplankton sampling, for estimating standing crop, should be made in association with hydrographic surveys. The analysis of the invertebrate plankton should be worked up at Bergen, but fish eggs and larvae should be sent to the Hamburg Laboratory.

(vi) Larval sampling in Fjellspollen and the adjacent, outer bay (Nessjoen) should be made by the Bergen Laboratory in May and June and in December or January. Larval sampling in Lindås and Heiamarkpollen should also be made in May, if opportunities arise.

b) Possible closure of small bay in Fjellspollen

With a view to determining if a small group of herring can be established and subsequently used for experimental work in a netted arm of one of the polls, it is proposed that the following appraisal should be made by the Bergen Laboratory of a small narrow necked bay (Selvang) in the Fjellspollen for consideration by the Working Group at its next meeting.

(i) An echo-sounding survey should be made of the entrance to the bay to provide a detailed profile of the depths involved; information on the nature of the bottom at the entrance should also be obtained.

(ii) Echo-sounding should also be made in the bay itself, to provide information on depth distribution and the nature of its bottom.

(iii) Tidal changes of depth in the bay and of currents through its entrance should be made.

(iv) The technical problems involved in closing the entrance, with a double wall of small meshed netting (about 1 cm mesh size) should be examined and a plan of the best position and method of constructing the net barrier worked out.

(v) A suitable method of catching, in good condition, 20-40 hl of herring in the Fjellspollen and of transporting them to and liberating them in the bay should be worked out.

(vi) The cost of closing the bay, and keeping it closed for one or two years should be estimated.

(vii) Hydrographical observations, especially of temperature, salinity and oxygen and their stratification should be taken in the bay every second month. The quantities and stratification of zooplankton in the bay should also be determined.

(viii) The presence of fish, especially herring in the inlet should be checked by trap net or gill-net and echo-surveys.

c) Next meeting of Working Group

In order to review the proposals in the light of the further information gained during the summer, the Working Group considers it necessary for it to meet again for one day on Sunday, 27th September 1964, immediately before the next meeting of the Herring Committee.

d) Acknowledgements

In presenting this report to the Herring Committee, the Working Group wishes to draw attention to the important contribution made by members of staff at the Norwegian Research Institute in Bergen, both in the routine collection of data prior to the meeting and in providing facilities for visiting the polls and carrying out surveys of them during the meeting.

REFERENCE

- Aasen, O. 1952 "The Lusterfjord herring and its environment"
Rep. Norw. Fish. Mar. Invest., 10 (2), 63 pp.

Annex 1

Hydrographic observations in Fjellspollen, Heiamarkpollen and Lind&spollen

Fjellspollen

<u>Date</u>	<u>Stat. No.</u>	<u>Depth m</u>	<u>Temp. °C</u>	<u>Salinity ‰</u>	<u>Date</u>	<u>Stat. No.</u>	<u>Depth m</u>	<u>Temp. °C</u>	<u>Salinity ‰</u>
25.10.63	I	0	9.65	10.44	30.1.64	I	0	3.60	16.600
		10		30.650			10	6.04	32.561
		20		30.650					
	II	0	9.72	7.43		II	0	4.15	22.414
		10		31.020			5	5.5	
		20		32.770			10	6.0	
		30		32.820			20	6.2	
							25	6.1	
	III	0	9.60	11.080		III	0	3.60	11.080
		10		31.130			10	5.97	32.530
		20		32.740			20	6.02	32.759
		30		32.880			30	6.05	32.823
	IV	0	9.05	6.930	31.1.64	IV	0	2.55	19.296
		10		31.160			5	5.7	
		20		31.450			10	5.8	
30		32.840		15			5.9		
				20			6.0		
V	0	9.80	17.92		V	0	5.25	31.604?	
	10		32.120			5	5.6		
	20		32.580			10	6.0		
	30		33.250			15	6.4		
						20	6.4		
						30	6.3		
						40	6.2		
						50	6.2		

Heiamarkpollen

<u>Date</u>	<u>Stat. No.</u>	<u>Depth m</u>	<u>Temp. °C</u>	<u>Salinity ‰</u>	<u>Date</u>	<u>Stat. No.</u>	<u>Depth m</u>	<u>Temp. °C</u>	<u>Salinity ‰</u>	
13.11.63	I	0	8.75	30.190	13.11.63	V	0	8.1	29.300	
		10		9.8			(Contd.)	10	9.0	
		20		9.5				20	8.0	
		30		5.5				30	2.9	
		50		5.6				50	2.8	
	II	0	8.35	29.430		VI	0	7.85	28.91	
		10		8.8			10	8.5		
		20		8.9			20	7.5		
		30		2.8						
		50		2.6						
	III	0	7.8	29.110	12.2.64	I	0	4.5	32.080	
		10		9.5			10	5.5		
		20		9.5			20	6.5		
		30		7.12			30	6.8		
		50		3.93			50	6.9		
75		3.89								
110		3.91		-						
IV	0	7.75	28.450		II	0	3.45	30.990		
	10		8.8			10	5.4			
	20		7.0			20	5.6			
	30		2.7			30	5.7			
	50		2.5			50	5.5			

continued



Heiamarkpollen (Contd.)

<u>Date</u>	<u>Stat.</u> <u>No.</u>	<u>Depth</u> m	<u>Temp.</u> °C	<u>Salinity</u> ‰	<u>Date</u>	<u>Stat.</u> <u>No.</u>	<u>Depth</u> m	<u>Temp.</u> °C	<u>Salinity</u> ‰	
12.2.64 (Contd.)	III	0	3.80	29.80	12.2.64 (Contd.)	V	0	2.50	28.420	
		10	5.10	32.290			10	5.0		
		20	5.91	32.600			20	5.5		
		30	5.55	32.770			30	5.5		
		50	5.35	32.590			50	5.5		
		75	3.95	32.590			60	4.8		
	100	3.85	32.870							
	IV	0	0	3.55	29.330	VI	0	0	0.30	26.980
			10	4.80	10			4.5		
			20	5.20	20			5.0		
			30	5.40						
			50	5.20						

Lindøspollen

<u>Date</u>	<u>Stat.</u> <u>No.</u>	<u>Depth</u> m	<u>Temp.</u> °C	<u>Salinity</u> ‰	
29.11.63	I	0	5.50	21.00	
		20	5.3		
		30	5.0		
		50	5.0		
		60	5.0		
	II	0	0	6.45	28.410
			10	8.0	
			20	5.8	
			30	4.8	
	III	0	0	6.30	28.450
			10	7.0	
			20	7.8	
			30	4.5	
			50	4.0	
	IV	0	0	6.05	27.780
			10	7.09	28.560
			20	5.35	31.340
			30	4.36	31.380
			50	4.01	31.480
			75	3.94	31.480
	V	0	0	6.10	28.170
			10	6.8	
			20	7.5	
			30	3.7	
			40	3.5	
VI	0	0	5.85	27.450	
		10	7.0		
		20	7.5		
		30	4.0		
		40	3.5		
VII	0	0	7.95	31.060	
		10	8.0		
		20	8.0		
		30	8.7		
		50	8.2		

Table 1. Herring samples taken in the Polls, September 1962-April 1964.

<u>Serial number</u>	<u>Date</u>	<u>Number of herring</u>	<u>Serial number</u>	<u>Date</u>	<u>Number of herring</u>
<u>Fjellspollen</u>			<u>Lindåspollen (Contd.)</u>		
1	7.9.62	18	17	14.1.64	58
2	11.9.62	16	18	16.1.64	66
3	13.9.62	6	19	12.2.64	28
7	12.10.62	29	20	13.2.64	15
5	20.10.62	8	21	9.3.64	25
6	8.11.62	14	22	11.3.64	23
7	12.11.62	10	23	13.3.64	13
8	28.11.62	8	24	19.3.64	50
<hr/>			<hr/>		
9	7.3.63	103	<u>Heiamarkpollen</u>		
10	27.3.63	50	1	28.8.63	70
11	19.4.63	35	2	15.9.63	65
12	11.9.63	38	3	18.9.63	12
13	13.9.63	39	4	19.9.63	19
14	17.9.63	6	5	9.10.63	36
15	18.9.63	17	6	4.11.63	31
16	3.10.63	50	7	5.11.63	49
17	10.10.63	11	8	12.11.63	20
18	18.10.63	25	9	13.11.63	150
19	23.10.63	15	10	7.12.63	68
20	25.10.63	20	<hr/>		
21	30.10.63	21 x)	11	16.1.64	62
22	31.10.63	9 x)	12	12.2.64	100
<hr/>			13	13.3.64	58
23	31.1.64	150	14	21.3.64	50
24	29.2.64	37	<hr/>		
25	10.3.64	21 x)			
26	11.3.64	36 x)			
27	13.3.64	63 x)			
28	14.3.64	33			
29	1.4.64	25			
30	2.4.64	43			
31	3.4.64	42			
32	7.4.64	50			
33	15.4.64	68 x)			
<hr/>					
<u>Lindåspollen</u>					
1	27.9.62	13			
2	8.11.62	100			
3	10.11.62	200			
4	18.11.62	100			
<hr/>					
5	30.3.63	55			
6	7.4.63	6			
7	16.9.63	9			
8	18.9.63	6			
9	26.9.63	150			
10	25.10.63	14			
11	26.10.63	39			
12	30.10.63	18			
13	19.11.63	34			
14	21.11.63	100			
15	10.12.63	67			
16	11.12.63	50			
<hr/>					

x) Egg samples taken from some ripe females.

Table 2. Percentage length compositions by months. November 1962 - March 1964

Lind&spollen

Year	Month	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	Mean	No.
1962	Nov.	-	-	-	-	0.6	0.6	6.0	9.5	7.3	6.3	8.9	18.9	23.2	12.9	4.8	1.1	0.3	0.6	26.8	349	
	Mar.	-	-	-	-	-	1.9	5.7	15.0	17.0	9.5	13.1	20.7	9.5	3.8	3.8	-	-	-	25.7	53	
	Sept.	-	-	-	-	-	-	0.7	14.5	51.6	22.5	5.3	2.7	2.0	0.7	-	-	-	-	24.6	151	
1963	Oct.	-	-	-	-	-	2.8	2.9	15.7	20.0	11.5	12.8	11.5	8.6	9.9	4.3	-	-	-	25.7	70	
	Nov.	0.8	-	-	-	-	0.8	3.0	18.5	30.7	16.9	12.3	10.0	1.6	1.5	1.6	1.5	1.5	0.8	25.0	130	
	Dec.	-	-	-	-	-	-	0.9	8.9	18.7	5.4	16.9	24.1	10.7	6.3	4.5	3.6	-	-	26.5	112	
1964	Jan.	-	-	-	-	-	0.8	-	21.3	32.0	14.0	11.6	12.3	2.4	0.8	3.2	1.6	-	-	25.2	122	
	Febr.	-	-	-	-	-	-	2.3	11.6	20.9	7.0	2.3	16.3	14.0	7.0	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	0.9	1.8	27.3	112	

Table 3. Percentage Age Compositions by months. November 1962-January 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	10	>10	No. of herring
1962	Nov.	-	-	3.9	<u>28.5</u>	4.1	13.4	17.0	11.8	11.3	6.4	2.1	1.5	389
1963	Mar.- Apr.	-	-	-	-	<u>44.3</u>	9.8	14.8	21.3	4.9	3.3	1.6	-	61
	Sep.	-	-	1.2	12.8	<u>71.9</u>	4.3	4.3	4.9	0.6	-	-	-	164
	Oct.	-	15.5	9.9	9.9	<u>40.8</u>	5.6	8.5	5.6	1.4	2.8	-	-	71
	Nov.	0.8	9.0	23.3	7.5	<u>50.3</u>	3.0	1.5	2.2	0.8	0.8	0.8	-	133
	Dec.	-	11.1	47.0	10.2	<u>28.2</u>	2.6	0.9	-	-	-	-	-	117
1964	Jan.	-	-	36.6	29.3	11.4	<u>21.9</u>	-	-	0.8	-	-	-	123

Note:- Values for 1959 year-class underlined.

Table 4. Percentage Maturity Composition (all age-groups combined)
by months. November 1962-March 1963

Lindåspollen

Year	Month	I	II	III	IV	V	VI	VII	VIII	No.
1962	Nov.	-	4.4	29.0	62.5	3.9	-	0.2	-	389
1963	Mar.- Apr.	-	-	-	-	-	96.7	3.3	-	61
	Sep.	-	11.0	84.1	3.7	-	-	-	1.2	164
	Oct.	12.7	8.5	50.7	23.9	2.8	-	-	1.4	71
	Nov.	17.3	6.8	41.3	27.1	6.8	-	-	0.7	133
	Dec.	7.7	20.5	40.2	27.3	4.3	-	-	-	117
1964	Jan.	3.3	37.4	13.0	38.2	7.3	-	-	0.8	123
	Feb.	2.3	25.6	16.3	25.6	30.2	-	-	-	43
	Mar.	-	4.5	14.3	15.2	39.3	25.9	0.9	-	112

Table 5. Mean lengths for age groups, by months.
November 1962-January 1964.

Lind&spollen

(Values in brackets for samples of less than 10 fish)

Year	Month	1	2	3	4	5	6	7	8	9	10	>10	Total
1962	Nov.	-	25.9	<u>25.1</u>	27.3	26.7	27.4	27.8	28.4	28.3	(28.9)	-	26.8
	Mar.	-	-	-	<u>24.3</u>	(25.0)	(26.4)	27.4	(27.3)	-	-	-	25.7
	Sept.	-	(25.8)	24.0	<u>24.4</u>	(25.6)	(25.8)	(27.7)	-	-	-	-	24.6
1963	Oct.	23.0	(27.1)	(26.8)	<u>24.9</u>	(27.2)	(28.0)	(28.3)	-	-	-	-	25.7
	Nov.	22.8	25.5	26.7	<u>24.8</u>	(25.0)	(26.6)	(26.5)	-	-	-	-	25.0
	Dec.	23.8	27.2	29.1	<u>25.6</u>	(26.5)	-	-	-	-	-	-	26.5
1964	Jan.	-	23.8	26.3	26.2	<u>25.4</u>	-	-	-	-	-	-	25.2

Figures for 1959 year-class underlined.

Table 6. Mean V.S. for age groups (November 1962-January 1964)
and for alle age-groups combined (November 1962-March 1964),
by months

Lind&spollen

(Number of observations in brackets. Values not given for samples of less than 10 fish)

Year	Month	1	2	3	4	5	6	7	8	9	10	Total	
1962	Nov.	-	57.09 (11)	<u>56.78</u> (109)	57.13 (16)	56.62 (52)	56.69 (65)	56.73 (45)	56.70 (43)	56.38 (26)	-	56.72 (383)	
	Mar.	-	-	-	<u>56.96</u> (24)	-	-	56.92 (12)	-	-	-	56.93 (54)	
	Sept.	-	-	56.70 (19)	<u>56.40</u> (107)	-	-	-	-	-	-	56.39 (150)	
1963	Oct.	-	-	-	<u>56.50</u> (28)	-	-	-	-	-	-	56.74 (60)	
	Nov.	56.84 (13)	57.13 (30)	57.00 (10)	<u>56.55</u> (67)	-	-	-	-	-	-	56.76 (132)	
	Dec.	57.08 (13)	57.25 (55)	57.25 (12)	<u>56.59</u> (32)	-	-	-	-	-	-	57.03 (116)	
	Jan.	-	57.35 (34)	57.10 (30)	57.00 (13)	56.78 (23)	-	-	-	-	-	57.10 (100)	
1964	Febr.			Ages of samples not available									57.09 (43)
	Mar.			Ages of samples not available									56.87 (48)

Values for 1959 year-class underlined.

Table 7. Recaptures of herring tagged in Lindåspollen in November 1962

Number tagged = 300

Year	Month	Recaptures inside Lindåspollen	Recaptures outside Lindåspollen	Total Recaptures
1962		10	-	10
1963	Mar.	63 (59 in one catch)	3	66
	Apr.	7	2	9
	May	2	1	3
	Jun.	3	1	4
	Jul.	1	-	1
	Aug.	-	-	-
	Sep.	-	-	-
	Oct.	-	-	-
	Nov.	1	-	1
	1964	Feb.	-	1
	Totals	87	8	95

Table 8. Fjellspollen

Percentage Maturity Composition by months 7.9.1962 - 15.4.1964

Year	Month	I	II	III	IV	V	VI	VII	VIII	N.
1962	Sept.		33.3	23.1	12.8	23.1			7.7	39
	Oct.		5.7	62.9	17.1	14.3				35
	Nov.			6.3	6.3	34.3	50.0		3.1	32
1963	Mar.		0.7	2.6	26.8	40.5	28.1		1.3	153
	Apr.		14.7	14.7	2.9		61.8		5.9	34
	Sep.	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
1964	Jan.			2.0	56.0	42.0				150
	Feb.		2.8		2.8	36.1	58.3			36
	Mar.		0.7	0.7		36.6	61.4	0.7		153
	Apr.				0.9		97.4	1.3	0.4	228

Table 9. Percentage length compositions by months, 7.9.1962 to 15.4.1964

Fjellspollen

Year	Month	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	av. Size	N.
1962	Sept.					7.5	7.5		5.0	17.5	7.5	17.5	20.0	17.5					29.65	40
	Oct.			2.7	2.7	2.7			2.7		16.2	21.6	27.0	24.3					30.45	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
1963	Mar.									1.3	11.8	22.2	27.5	16.3	15.0	5.9			31.36	153
	Apr.								8.6	31.4	20.0	17.1	8.6	2.9	8.6			2.9	29.99	35
	Sept.			2.0	7.0	3.0	1.0	1.0	2.0		5.0	14.0	31.0	21.0	12.0	1.0			30.63	100
1964	Oct.	0.7	2.6	0.7	9.3	12.6	5.3	7.9	7.3	5.3	11.3	21.2	6.6	7.3	1.3	0.7			27.66	151
	Jan.								0.7		2.0	4.0	6.0	8.7	20.7	36.7	16.0	5.3	33.90	150
	Febr.			2.7				2.7		8.1	5.4	13.5	35.1	13.5	8.1	8.1	2.7		31.56	37
	Mar.								2.0	5.2	20.9	24.2	22.2	11.8	7.2	5.2	1.3		31.08	153
	Apr.						0.4	1.8	9.2	29.8	36.0	19.7	2.6	0.4					29.21	228

Table 10. Fjellspollen

Average length by age and month, 7.9.1962 to 31.1.1964

Year	Month	1	2	3	4	5
1962	Sep.	(25.3)	30.7	(29.8)	-	-
	Oct.	-	29.9	30.9	-	-
	Nov.	(24.1)	29.2	(29.8)	-	-
1963	Mar.	-	-	31.6	31.6	(32.9)
	Apr.	-	(28.9)	29.6	(30.9)	-
	Sep.	23.9	31.2	31.8	(33.3)	-
	Oct.	24.0	28.3	30.2	-	-
1964	Jan.	-	-	33.2	34.3	33.9

Figures in brackets are averages based on less than 10 fish.

Table 11. Fjellspollen

Percentage age composition by months, 7.9.1962 to 31.1.1964

Age (winter rings)		1	2	3	4	5	6	7	8	8+	Nos.
1962	Sep.	15.4	71.8	10.3	2.6	-	-	-	-	-	39
	Oct.	-	55.9	41.2	2.9	-	-	-	-	-	34
	Nov.	9.4	71.9	12.5	3.1	-	-	-	3.1	-	32
1963	Mar.	-	0.7	67.7	25.6	2.3	-	1.5	0.7	1.5	133
	Apr.	-	23.3	50.0	23.3	-	-	-	-	3.3	30
	Sep.	13.3	28.6	52.0	6.1	-	-	-	-	-	98
	Oct.	30.0	39.3	28.7	1.3	0.7	-	-	-	-	150
1964	Jan.	-	-	29.3	60.7	10.0	-	-	-	-	150

Table 12. Fjellspollen

Number of vertebrae by maturity and months, 7.9.1962 to 15.4.1964

	Group	55	56	57	58	59	Mean	N
Sep. 1962	VIII, II-III IV-V	1	1	16	8		57.28	25
			7	5		56.31	13	
Oct. 1962	II-III IV-V	1	2	13	9		57.29	24
			1	2		-	4	
Nov. 1962	III IV-VI	1	1	1	1		-	2
			15	13	1	56.47	30	
Mar. 1963	All mats.	1	21	82	48		57.16	152
Sep. 1963	IV-V I-III, VIII			3			-	3
			4	33	19	1	57.30	57
Oct. 1963 ^{x)}	I-III S. I-III A. IV-VI	3	7	9	13	1	57.27	30
			9	7	3		56.68	19
			51	28	5		56.40	87
Jan. 1964	III-V		19	78	47	4	57.24	148
Feb. 1964	IV-VI		7	18	8		57.03	33
Mar. 1964	V-VI		20	74	42		57.16	136
Apr. 1964	VI	1	11	74	28	2	57.16	116

^{x)} Stages I-III divided into spring and autumn spawners, according to otolith characters.

Spring spawners									
Year	Month	1	2	3	4	5	No. of fish		
1963	Aug.	-	97.0	3.0	-	-	67		
	Sept.	-	83.2	10.8	3.0	3.0	65		
	Oct.	-	97.2	2.8	-	-	36		
	Nov.	-	88.9	11.1	-	-	235		
	Dec.	3.0	97.0	-	-	-	67		
1964	Jan.	-	-	98.4	1.6	-	62		

Table 14. Percentage age composition by months, August 1963-January 1964

Heiamarkpollen

Table 15. Percentage maturity stage composition by months, August 1963-March 1964

Heiamarkpollen

Year	Maturity stage Month	T o t a l								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	Aug.	59.4	37.7	2.9	-	-	-	-	-	69	61.2	38.8	-	-	-	-	-	-	67
	Sept.	70.1	19.5	3.9	-	-	-	6.5	-	72	81.8	18.2	-	-	-	-	-	-	66
	Oct.	27.8	66.7	5.5	-	-	-	-	-	36	28.6	68.6	2.8	-	-	-	-	-	35
	Nov.	22.6	54.0	19.8	2.4	1.2	-	-	-	248	25.2	60.4	12.6	0.9	0.9	-	-	-	222
	Dec.	19.0	61.8	16.2	1.5	1.5	-	-	-	68	16.9	64.6	16.9	1.6	-	-	-	-	65
1964	Jan.	-	50.8	42.6	6.6	-	-	-	61	-	-	51.7	43.3	-	-	-	-	60	
	Febr.	-	28.0	49.0	21.0	2.0	-	-	100	-	-	-	-	-	-	-	-	-	
	Mar.	-	1.0	2.9	-	-	92.2	3.9	103	-	-	-	-	-	-	-	-	-	

Table 16. Heiamarkpollen

Mean V.S. for age-groups by months, August 1963 to February 1964

(Number of observations in brackets; values are not given for samples of less than 10 fish.)

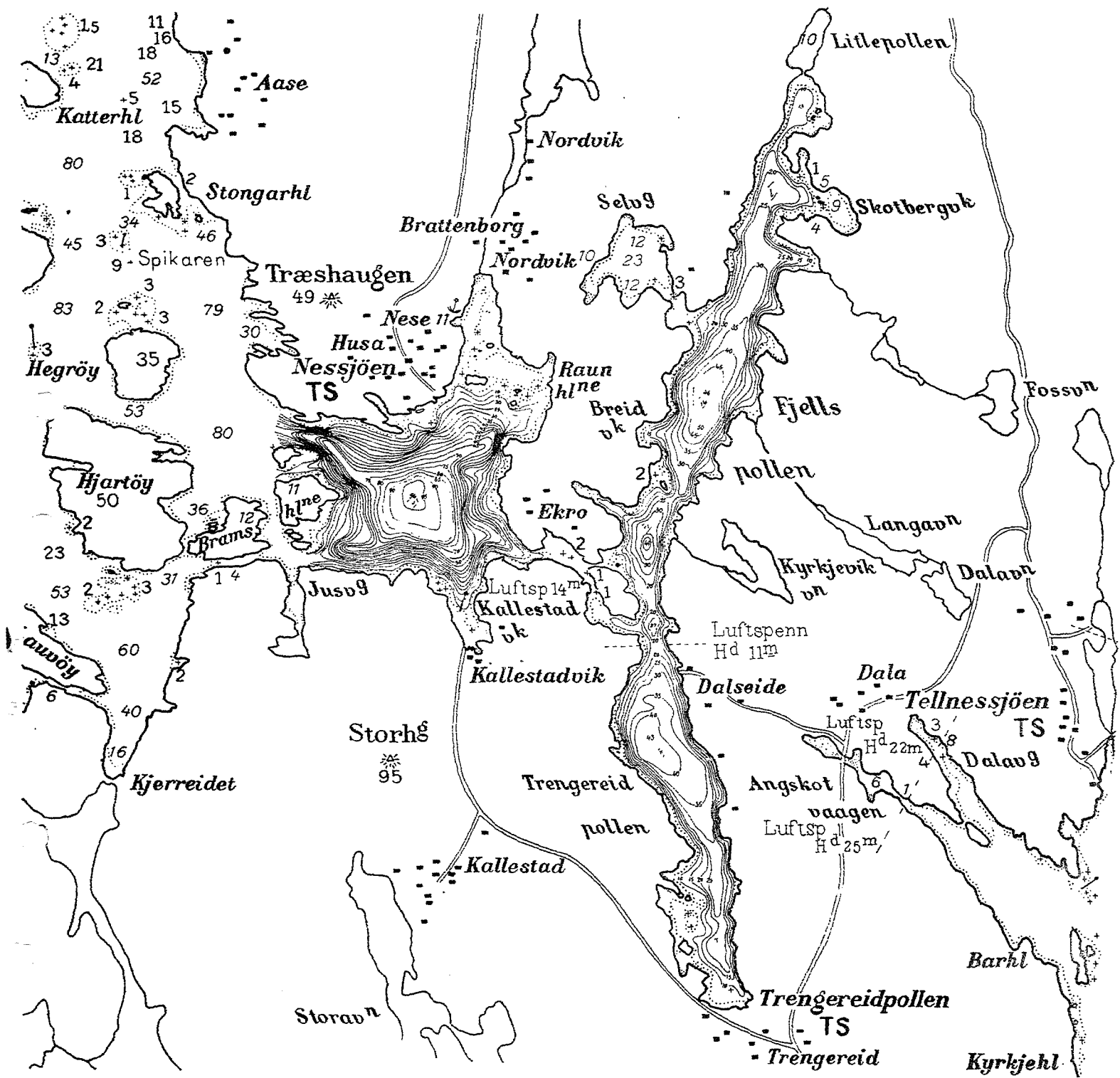
Year	Month	2	3	Total
1963	Aug.	57.16 (64)	-	57.18 (66)
	Sep.	57.32 (64)	-	57.30 (92)
	Oct.	57.26 (35)	-	57.25 (36)
	Nov.	57.15 (94)	-	57.17 (117)
	Dec.	57.19 (64)	-	57.16 (67)
1964	Jan.	-	57.32 (31)	57.31 (32)
	Feb.	-	?	57.23 ^x (98)

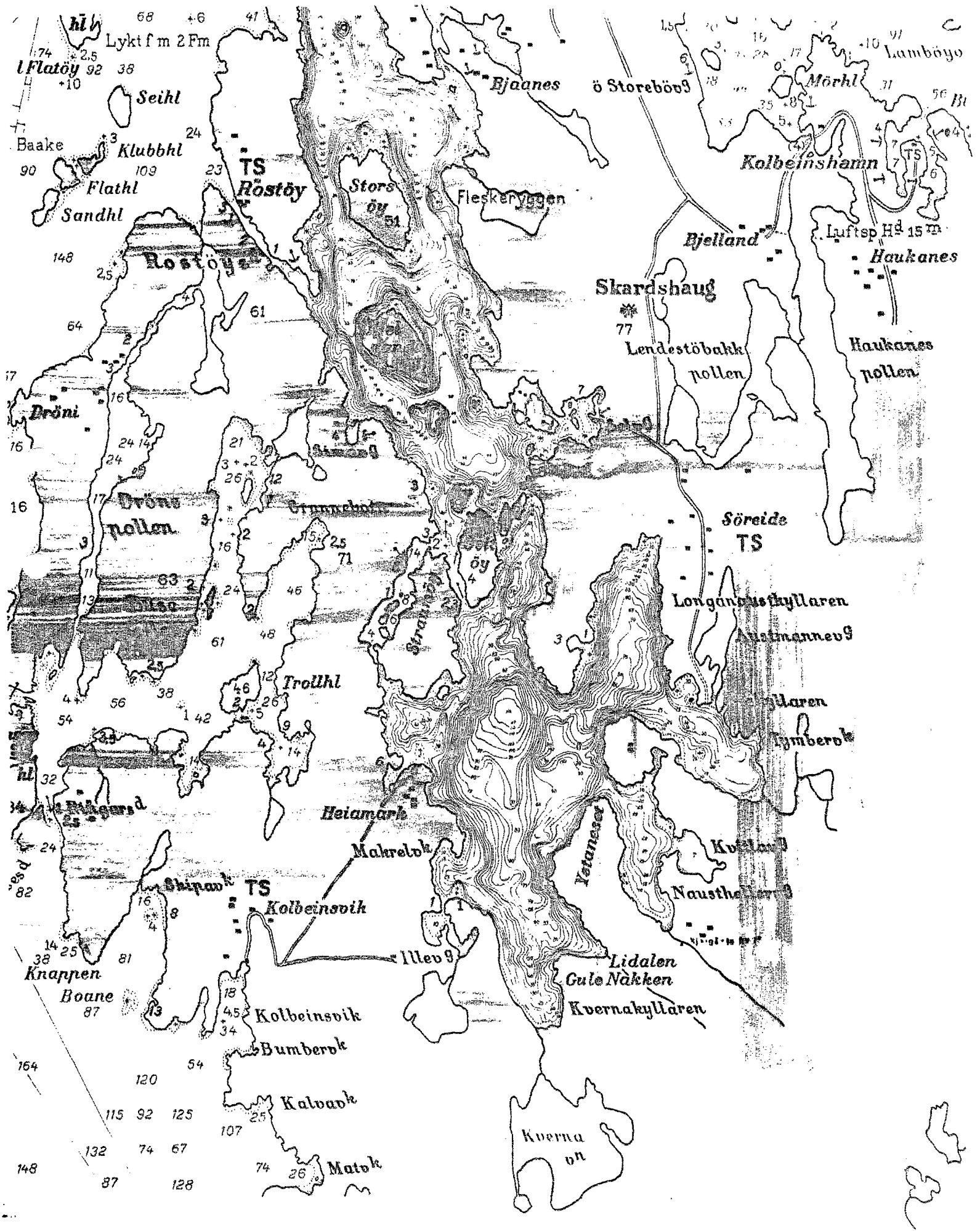
x) No age-readings.

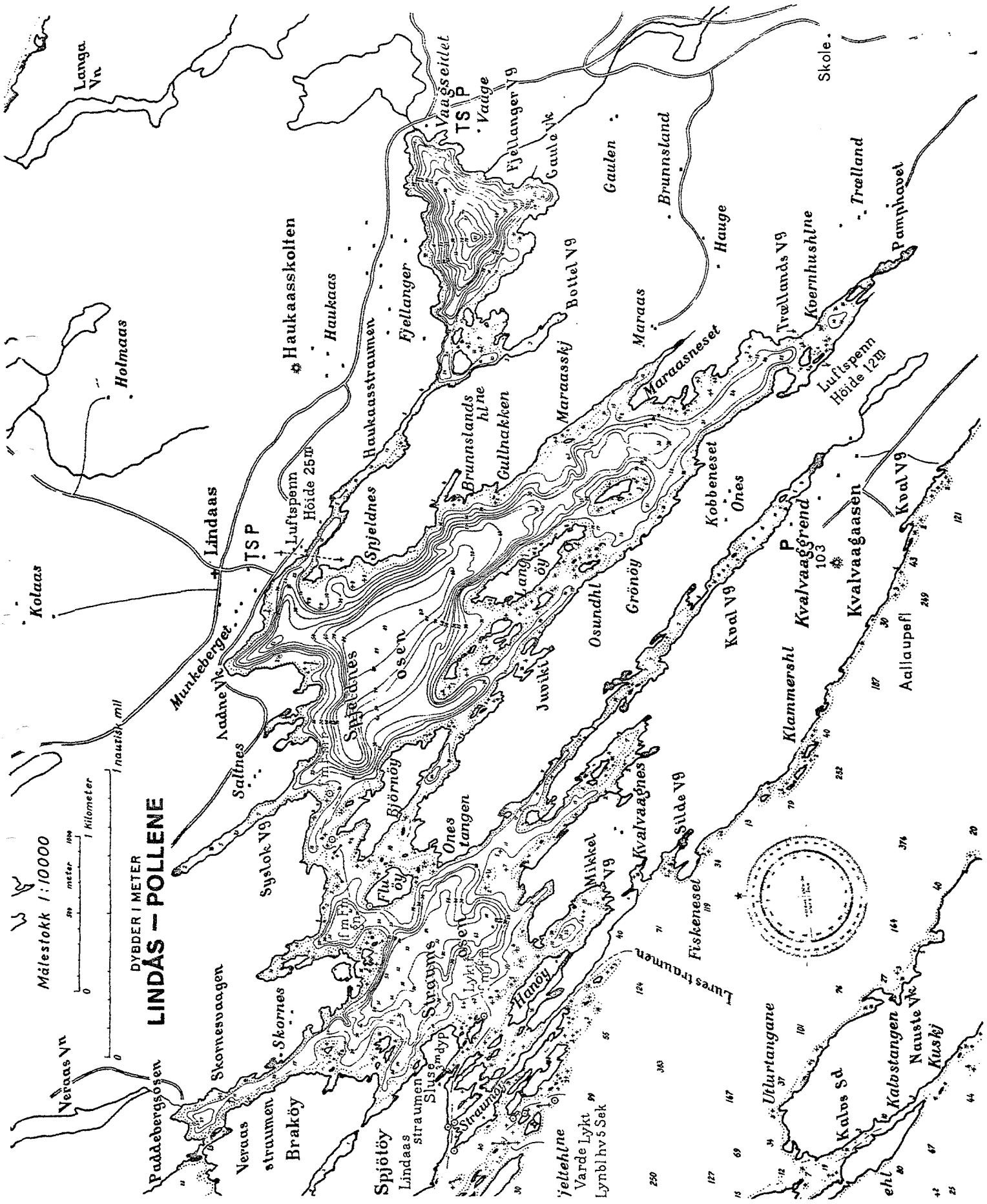
Table 17. Heiamarkpollen

Mean length for age by months, August 1963-January 1964

Year	Month	1	2	3	4	5
1963	Aug.	-	22.9	-	-	-
	Sep.	-	23.7	(29.9)	(30.5)	(30.8)
	Oct.	-	23.9	-	-	-
	Nov.	-	25.1	31.0	-	-
	Dec.	-	24.7	-	-	-
1964	Jan.	-	-	25.2	-	-







LINDÅS - POLLENE

Målestokk 1:10000

1 nautisk mil
1 kilometer

DYBDER I METER