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JOINT REPORT OF THE SCIENTISTS ATTENDING THE A C A D E M I C A N  
K N I P O V I C H - J O H A N H J O R T - Z W E Z D A - Æ G I R  
MEETING HELD AT SIGLUFJÖRÐUR ON JUNE " 23rd - 24th 1962

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Introduction.

The joint investigations started at the end of May or beginning of June (Norwegian 23rd, Icelandic 26th, Soviet 1st June). The Norwegian expedition (Johan Hjort) covered the area North of the Faroe Islands off the East and North east coast of Iceland to Jan Mayen. The Icelandic expedition ("Ægir") covered the area West, North-west and off the western North coast of Iceland. The soviet expeditions of the Pinro and Baltniro (Academician Knipovich, Zvezda, Academician Berg, Professor Mesjatsef and Professor Somov) covered the area from 60°N to 78°N between 19°E and 14°W in the north and between Iceland and Norway in the southern part of the Norwegian Sea.

Throughout the cruises, Hydrographic, Phytoplankton, zoo plankton and Herring investigations were carried out. These were completed on the 22nd of June, the day preceeding the joint meeting in Siglufjörður.

After the opening meeting the charts and the joint report was prepared in three committee which consisted of the following representatives.

HYDROGRAPHIC COMMITTEE

VI. Pakhorulov, Chairman, U.A. Vjalov, U.V. Penin, V.M. Litvin, L.A. Kruglov, O.S. Rudneva, O. Dahl, G. Sangholt, B. Halldorsson.

PLANKTON COMMITTEE

L.N. Grusov, Chairman, A.F. Timochina, Nicolaysen, Langset, G.Sv. Jónsson, Á. Þormóðsson.

HERRING COMMITTEE

O.J. Ostvedt, Chairman, G. Vestnes, Bjerke, Hoff, K.A. Ljamin, A.A. Baral, O.S. Polonsky, V.E. Platonon, J. Jakobsson.

The Icelandic and Norwegian contributions had already been prepared at a preliminary meeting at Akureyri where, as well as the respective cruise leaders, G. Berge, I. Hallgrímsson, U. Lie, L.A. Rossi and Th. Thorðardóttir were in charge of the work. The joint meeting in Siglufjörður regretted that they were unable to attend this meeting.

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At the final session the reports of the respective committees were presented and accepted. Then it was recommended that Mr. O.J. Ostvedt prepare a new joint chart of the mercator projection type. It was further recommended that the joint meeting in 1963 be held 23rd - 24rd June at Akureyri, Iceland. Mr. J. Jakobsson convened the joint meetings.

#### HYDROGRAPHY

During the joint investigations this year in the area West- and North of Iceland the ice-limit off the North-west coast was in the beginning of June observed unusually far South or only about 35 miles off the North-west coast (Cape Horn). The ice-limit west of Jan-Mayen on the other hand was further west than usual, at about 17° West.

In the Norwegian and Greenland Seas in June 1962 some displacement of warm waters in the south-eastern direction was recorded, as well as the relatively weak zone of the "polar front" to compare with the last year.

The eastern branch of the Norwegian current in 1962 in the 0-200 m and 0-500 m layers is characterized by the low heat content. The negative anomalies of the average temperature values are extremely high in comparison with the last year and somewhat lower than in 1953. Abnormalities in the 0-200 m layer in 1962 were as follows: in latitude 67° 30' N - 0.64; 69° 20' N - 0.43; 71° 10' N - 0.93; 74° 30' N - 0.95; whereas in 1953 the values of the anomalies at the latitudinal sections from 69° 20' N to the north were accordingly - 0.22, - 0.44 and - 0.75. However, in the northern part of the Sea the cooling of the 200-500 m layer in 1962 has not yet reached the cooling level of 1953, and the temperature on the section along 74° 30' N exceeds the heat deficiency by 0.25.

The heat content of the western branch of the Norwegian current this year is considerably smaller than in 1961, but is somewhat higher in the 0-200 m layer than in the cold year of 1953. The positive anomaly in the western branch of the Norwegian current was registered in the 200-500 m layer in latitude 67° 30' N - 0.90, 69° 20' N - 0.29, 71° 10' N - 0.06 and 74° 30' N - 0.46. The deviations from the average temperature in the western branch in the cold 1953 year were at the latitudinal sections from 69° 20' N to the north - 0.21, - 0.32, 0.25.

The heat conditions of the Norwegian current in the southern part of the Sea in June 1962 were abnormal in the layer from 500 m to surface. By its temperature characteristics, the western branch, though colder than in the previous year, approaches the

norm but does not reach the mean temperatures of 1953 in every observed layer. It is interesting to note that the eastern branch of the Norwegian current has at the observation period the lowest temperature as compared with the last decades.

The western branch, relatively strong this year, causes the specific peculiarities of the hydrological conditions in the mixing zone of warm and cold waters. In the Jan-Mayen region a sharp front of the north-western current was observed and it influenced the position of the  $0^{\circ}$  isotherm and of the Ice-edge in this area. The  $0^{\circ}$  isotherm was 30 miles west of Jan-Mayen. In comparison with 1961 some displacement of the  $2^{\circ}$  and  $3^{\circ}$  isotherms in the south-eastern direction was recorded between Iceland and Jan-Mayen. The heat content in the 0-200 m layer of the East-Icelandic current on the section Langanes Cape - Jan-Mayen is abnormal this year and  $0^{\circ}$  .45' lower than the heat content in 1961, and approaches the heat content of 1959.

The irvinger current waters in the north-east of Iceland are characterised throughout the entire period of observations (1954-1962) by the negative anomalies of heat content in the 0 - 50 m layer. The anomaly of this layer is -0.92. The thermies of the layer 0 - 200 m has also a lowering level, the anomaly of which forms -0.57.

In the area west of Iceland the temperature both in 100 and 20 meters was almost 1 C. lower than observed during the joint cruise in 1961. Off the north and east coast the temperature also proved to be considerably lower than observed in 1961. It should, however, be noted that the observations in 1962 took place 10 days earlier than in 1961 and repeated temperature observations indicate great fluctuations within small intervals of time, especially in the area north and east of Langanes. On the whole the temperature in 20 and 100 metres during the period 26th May - 6th June 1962 is very near the mean values during the 1950 - 1960 period as given by Stefánsson.

During the period 11. - 22. June repeated observations of temperature distribution down to 270 m (Bathy - Thermograph.) and at 4 m (Thermograph) were taken by "Johan Hjort" and "Ægir" at the North coast of Iceland between 21 W and 14 W up to 68 30 'N.

The area under observation had to be restricted according to registrations of herring for daily reports to the fishing fleet.

From 14th to 16th June the work was hampered by strong north-easterly wind during which there was an inflow of cold water in the north-eastern part of the area. This made it impossible to present a chart of the temperature distribution covering the whole period.

Summing up the temperature fluctuations in the waters of the Norwegian and Greenland Seas, we point out the weakening of

heat advection by the Atlantic current, the intensive development of the intermixture zone in the north-western area of the Norwegian Sea and the lowering of the heat content in the East-Icelandic current waters.

## P L A N K T O N

### a) Phytoplankton.

The phytoplankton studies were intended to cover the following tasks:

An indication of the quantitative distribution of the standing stock of phytoplankton, for the purpose of giving immediate information on the situation to be used in ecological studies of the herring. Thus, on R/V "Ægir" Secchi-disc readings were carried out at all stations during day time, and on R/V "Johan Hjort" the Transparency Continuous-Recorder was employed throughout the whole cruise.

Production measurements were also carried out on these vessels using the C-14 technique. Samples were taken at the standard depths, 0, 10, 20 and 30 metres. Temperature regulated incubators with artificial light were used. Furthermore, simulated in situ measurements of production were carried out on R/V "Johan Hjort".

Samples of phytoplankton for taxonomical and quantitative studies were collected on all the research vessels participating. On R/V "Johan Hjort" also samples for chlorophyll and particulate organic matter analyses were taken, for later studies.

On board the Soviet vessels Phytoplankton was collected with a Juday net of no 38 gauze which has a diameter of 37 cm.

The quantity of phytoplankton was determined visually according to the scale adopted in the institutes of Pinro and Baltiuro. The volume of the deposit was measured by the method of water displacement.

A survey of the results from the transparency and volume readings are given in the maps. Because of the different methods used the results could not be presented using common units, nor the isolines be connected for the concerning areas.

The transparency survey indicates that very high concentrations of standing stocks were present in the cold Arctic Water between Jan-Mayen, Iceland and the ice border, The maximum concentrations seemed to be in the core of the East-Icelandic Arctic Current, which by the transparency recordings could be traced down to the mixing area north of Faeroe Islands, Another productive area seemed to be located west of Iceland, south of approx. 65 30 "N.L. Also in the near vicinity of the coast North

of Iceland, two isolated places with considerable concentrations were found.

North of 65° 30' N.L. west of Iceland, and in the Atlantic and coastal waters north and east of Iceland there seemed to be rather small concentrations of phytoplankton. The Atlantic waters, north of Faeroe Islands up to Iceland, generally had a moderate to low concentration of phytoplankton.

The impression from these observations is that the phytoplankton in the cold water area was near the stage of maximum spring bloom, whereas in the Atlantic and coastal waters with low standing stocks the spring bloom seemed to have occurred at an earlier date. These assumptions are strongly supported by the state of the zooplankton in the areas (concentrations and stage-composition).

The transparency recordings have proved to show many interesting details which, from a preliminary study, seem to have significant relations to the growth and distribution of phytoplankton. These observations will later be more closely studied.

Of the two methods used it is clearly demonstrated that the transparency recordings are more easy to undertake and the observations more reliable than the Secchi-disk readings, which are affected by the time of reading, weather conditions and personal factors. The continuous recordings also show the fine structures in transparency conditions which could not have been observed by spot observations. For the further work in this field it is recommended that transparency recorders similar to that used on R/V "Johan Hjort" be installed in the participating research vessels.

On the basis of phytoplankton investigations on board the Soviet vessels it can also be stated that in view of the increased inflow of the arctic waters, an intensive "water blooming" was observed in the area of cold waters, as a result of the development of *Phaeocystis* and *Chaetoceros* sp.

The weak stratification of waters in the zone of intermixture caused a relatively weak development of "diatom blooming" (*Chaetoceros* sp. and *Thalassiosira* sp.). The summer outburst or "blooming", caused by the development of *Thizosolonia styliformis* and *Thizosolonia alata*, was observed only in the most southern areas of the Norwegian Sea. The zone of the *Peridinea* development was very limited.

The locations of the main zones of "blooming" in June 1962 were analogous to those found in May 1959.

b) Zooplankton.

The density of zooplankton in the upper 50 m layers observed is presented on special plankton charts.

A Hensen net, diameter 73 cm silk no. 3, was used on Icelandic and the Soviet vessels, while a Juday net, diameter 80 cm, silk no. 0, was used on board the Norwegian vessel.

During the cruises characteristic change in the zooplankton condition was observed. This variation was due to the change-over from winter to summer conditions, with very rapid increase of the density within a short period of time. This increase occurred when the spawning of the *Calanus finmarchicus* had taken place, and the maximum densities consisted of red Calanus of the copepodite stages II - IV.

In the cold waters north and north-east of Iceland the overwintering stock of *Calanus* dominated, while in the warm water of the Irminger Current and in the mixed waters off the north coast, spawning had obviously taken place. The high proportions of adult *Calanus* off the west coast of Iceland indicated a prespawning condition, which will soon give rise to a new generation and increase the plankton densities off the north-west coast of Iceland.

On the whole, the plankton densities observed during these cruises in Icelandic waters proved to be higher than in 1961, with the exception of the area west of Snæfellsnes and Látrabjarg on the west coast of Iceland. Contrary to previous years high densities of zooplankton were observed on the banks off the north-west coast of Iceland.

On the western part of the herring grounds off the North-Icelandic coast the plankton densities proved to be approximately twice as high as in 1961. Also in the eastern part of the north-coast herring grounds the plankton density is higher than in 1961.

The zooplankton maxima on the herring grounds off the north coast of Iceland were found to be extended further to the west and south in 1962 than in 1961.

As to the zooplankton concentrations found north of 68 N, the plankton consisted of *Chaetognatha*, *Calanus hyperboreus*, *C. finmarchicus* and *Metridia longa*, while in the other parts of the area investigated *C. finmarchicus* was overwhelmingly dominant.

As a conclusion it can be stated that favourable feeding conditions for herring are existing on the herring grounds off the north coast of Iceland. As mentioned above, the *Calanus* population in this area consists mostly of juvenile stages. In the inflowing Irminger waters off the north-west coast of Iceland a prespawning stock of *Calanus* was dominating. Thus the high concentrations of zooplankton already existing on the herring

grounds are expected to last in the near future.

It is also expected that the density of zooplankton off the eastern coast will be increasing.

On board the Soviet ships the zooplankton samples were studied by means of binoculars. The qualitative composition of zooplankton was noted:

The distribution of the plankton biomass in 1962 was almost the same as in the preceding years in the Norwegian sea. As to the quantity, the following characteristics were revealed: the biomass at the most northern sections in June 1962 was considerably lower than in the previous years. More to the south (at the sections from 72 50'N to 69 20'N), the plankton biomass was practically the same as in the preceding years. On the average, the biomass of plankton in the whole northern part of the area investigated remained in June 1962 at the level of 1960-1961 (Table 1). The biomass at the more southern sections was considerably higher. The average biomass in the area covered by the soviet ships, the whole southern part of the Norwegian Sea was considerably higher than it had been in 1958, 1960 and 1961, and approached that of 1959. In the distribution of the plankton biomass in 1962, there was observed an interchange of the poor and rich zones in accordance with the thermal regime of the Sea. The increased biomass was found in the polar and mixed waters. In the polar waters, the main mass of plankton was represented by the young of *Calanus hyperboreas*, *Metridia longa*, *Themisto juv.*, *Eukrohnia hamata*. In the mixed waters, the amount of plankton consisted mainly of *Calanus finmarchicus* of the II - IV stages and the great number of *Pseudocalanus* and *Oncaca borealis*.

In the south-western area of the Norwegian Sea, the more abundant organisms were *Temora* and the young of *Euphausiacea*. The increase of the biomass, caused by the development of *Calanus finmarchicus* of the II - IV stages, occurred also in the eastern part of the Norwegian Sea. Small biomass was registered in the central areas (less than 10 ml.).

Of the other peculiarities of the plankton development in June 1962, it is necessary to note the extremely weak development of the young of *Aglantha digitale* and the large concentrations of *Calanus finmarchicus* in the southern part of the Norwegian Sea.

H E R R I N G

The herring distribution was determined during the cruises with both vertical and horizontal acoustic ranging.

Of the west coast of Iceland the concentrations were scattered over wide areas and only in limited localities were good concentrations found. Samples of these show that approximately 50% of these were summer spawners that will presumably spawn at the south-west coast in July. Comparison of the distribution of herring off the west coast in 1961 and 1962 reveals that in 1961 the herring was found in only one locality where large shoals were recorded, but in 1962 the area of distribution was much wider (as already stated).

In the area north of the Farces and off the east coast very scattered concentrations were recorded over large areas. Off the north-east coast dense concentrations were found. Generally these were in watermasses below 3 C, extending into watermasses below 2 C. A few good shoals were recorded in this area, but as a rule the herring was present in small shoals. The herring off the north-east coast seemed to be moving westwards at considerable speed and already on June 5th dense concentrations were recorded NE of Kolbeinsey (pos. 17-18 W and 67 25' - 67 40' N).

A driftnet sample in this area showed that the shoals consisted of large herring (mean length 36.5)

Although the major part of these concentrations are most probably westward moving Norwegian spring spawners the good concentrations recorded far North-west of Kolbeinsey in Pos. 67 40' - 68' indicate that an influx of Icelandic herring had already taken place during the first week of June.

With reference to the herring distribution off the North coast in 1961 it is clear that this year the herring concentrations are found much further west than last year. During the first half of June 1961 very little herring was recorded west of 15° west but now large shoals were recorded as far west as 18° as shown on the joint chart of this report. It should further be noted that this year most of the large shoals recorded were nearer the surface than last year. Repeated observations during the period 11th - 22nd June show that the herring concentrations off the middle and eastern North-coast are now moving in an east or south-east direction and thus the main concentrations were located between 16 30 - 14 w.l. and 67 25 to 68 n.l. These repeated observations further showed that there were considerable variations in the vertical distribution of the shoals and generally it can be stated that they are now more frequently observed at greater depths than during the first 10 days in June. Throughout the first 20 days of June the main concentrations North and North-east of Iceland were observed in cold waters with temperatures below 3 C.

Only during the last days have large shoals been observed in temperatures of 4 - 5 C.

The detection of the herring concentrations in the northern part of the Norwegian Sea by means of echo-sounders when working out the sections from 78°N to 71°N did not yield good results. Records of fish, obtained at the section along 69° 20' N between 03° 30' W and 00° and east of the Greenwich meridian (at the depth of 200 - 400 m and up to the surface till 50 - 70 m), are doubtful with regard to their belonging to the herring records. At the section along 67° 30' N no herring was observed. The records of the herring shoals of diverse density obtained in the middle of June at the section along 65° 45' N, along the wedges of the East-Icelandic current, between 02 - 08 30' W and 09 30' - 11 30' W and to the south till 63° N between 02° W and 07° W.

Thus the joint investigations show that during the first half of June the main herring concentrations were located in the area off the eastern North-coast of Iceland and within the limits of the southern half of the Norwegian Sea south of 66 n.l.

EXPLANATIONS OF FIGURES

- Fig. 1. a) Temperature in 20 m and herring concentrations in the Norwegian sea.
- b) Temperature in 20 m and herring concentrations in Icelandic waters.



