

International Commission for



the Northwest Atlantic Fisheries

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ANNUAL MEETING - JUNE 1975

Report of Meeting of ICNAF Environmental Working Group

Charlottenlund, Denmark, 23-25 September 1974

Convener: E.J. Sandeman

Rapporteur: R.J. Schlitz

1. Introduction

In accordance with the recommendation of the 1974 annual meeting (1974 Report of STACRES Appendix V), an Environmental Working Group was established "to suggest a proposal aimed at determining the factors involved in the production of good and bad year-classes in some of the major fisheries of the ICNAF area".

It was further recommended that this working group should meet in Copenhagen at the time of the next ICES meeting in early October 1974.

The meeting was held in Charlottenlund Castle from September 23 to September 25, 1974.

The following persons participated:

T. D. Iles	Canada
E. J. Sandeman	Canada (Chairman)
R. W. Trites	Canada
J. R. Wilson	Canada
F. Hermann	Denmark
E. Smidt	Denmark
J. Messtorff	Federal Republic of Germany
H. W. Hill	UK
E. A. Delaney	USA
M. D. Grosslein	USA
R. J. Schlitz	USA (Rapporteur)
T. Winterfeld	USA
J. Smed	ICES

2. Agenda

The suggested Agenda circulated to all member countries of ICNAF (Circular letter 74/30, Appendix II) was discussed and after a few minor changes was adopted. The revised Agenda is here included as Appendix I to this report.

3. Review of physical environmental research programs being enacted by each country in the ICNAF area during 1974 and those planned in 1975.

To provide the group with general information on the extent of physical oceanographic work being carried out in the ICNAF area, each country reported briefly the extent of its involvement. This material is contained in Appendix II to this report.

4. Review of existing data base on file in each country

Representatives of each country present reviewed their methods of reporting physical environmental parameters and it was apparent that the five countries represented at the meeting all reported such data to their respective national data centres or ICES and that although breakdowns of the data base were not available for the meeting, information on the size of the data base with respect to particular parameters could be easily produced if required.

Specific information on the time series of the oceanographic sections used by the different countries has been included below.

5. Standardizations of oceanographic sections, stations and base periods

With the absence of representatives from several member countries of ICNAF, it was difficult to proceed very far on this matter. However, it was agreed that we should continue as far as we could and, that we should use the information we had available to make recommendations to the ICNAF Environmental Subcommittee.

A. Oceanographic sections

The Working Group recognized that it was difficult to set up criteria for sections because of our rudimentary knowledge of the manner in which environmental factors control fish production. Nevertheless it was accepted that long term monitoring of broad scale environmental conditions is desirable and important and that priority should be given to oceanographic sections with long time series, until such time as better criteria can be developed.

Subarea 1

Information contained in Document 74/82 was examined. Because of the long time series of the data and because some countries (e.g. FRG) were already working these lines, it was agreed that the working group should recommend that the standard Danish sections as outlined in Document 74/82 (Fig. 2 of this report) be considered for adoption as standard ICNAF hydrographic sections. It was noted that four of these should be considered as priority sections, and of the two lines considered as of less priority the precise positioning of the Cape Farewell section should be re-examined in the light of the USSR section which continues the Seal Island section in Subarea 2 across the Labrador Sea and position formerly occupied by weather station Bravo to Cape Farewell.

The Working Group noted the desirability of oceanographic observations on the western side of Davis Strait but felt that insufficient information was available to suggest any standard sections at the time.

Subarea 2

With the Seal Island line being worked by Canada on an annual basis since 1950 and an almost identical line being worked by several other countries (FRG, US, USSR among others) it was agreed that the Working Group should recommend the Seal Island line as a standard section. Discussion on whether the section should terminate at the edge of the continental shelf (2000 m) or whether it should be continued to Cape Farewell remained unresolved.

The Working Group was unable to recommend the adoption of any specific lines north of the Seal Island section but agreed that two sections should be considered in the area between Cape Chidley and the Seal Island section. The position of these two sections should remain undefined until the USSR sections can be examined and the locations and time series compared with FRG sections in the same area.

Subarea 3

From the information on hand, it appeared that the longest time series in this area were on sections occupied regularly by Canada (Fig. 1) and the US (Fig. 3). As several of the lines are already being occupied by other nations at least on an annual basis it was agreed to recommend that the following sections be adopted as standard oceanographic sections.

- (a) The Bonavista section from Cape Bonavista to approximately 50 N, 50 W. (Fig. 1).
- (b) The Flemish Cap section, running along the 47 N latitude line as far east as Flemish Cap to approximately 2000 m.
- (c) US Coast Guard line 3 (Fig. 3) extended into shallow water (100 m) on the Grand Bank.
- (d) US Coast Guard line 4 extended into shallow water (100 m) on the Grand Bank.
- (e) A line at the Cabot Strait or across the Laurentian Channel further southward to be chosen after examination of the Canadian, FRG and US data.

Subareas 4 and 5

Information on time series of the sections usually occupied by the different ICNAF countries was generally lacking in this area and the Working Group found it difficult to make definite recommendations. The following recommendations are made tentatively while recognizing that an input from several ICNAF countries is required before the question of standard sections can be finalized.

- (a) The Halifax section which runs perpendicularly across the Nova Scotian Shelf from Halifax apparently has been occupied on a fairly regular basis by both the USSR and Canada (Fig. 1).
- (b) Up to three more sections across the Nova Scotian Shelf. Special consideration should be given to a line running approximately south from Cape Sable.
- (c) US Coast Guard section 5 (Fig. 3) perhaps extended to link up to a Cape Sable line noted in (b) above.
- (d) US Coast Guard section 6 (Fig. 3). Although section 7 cannot be recommended as a standard section within the ICNAF area we should urge that it be occupied whenever possible because of the implications to the region further north.
- (e) There should be several sections in the Georges Bank-Gulf of Maine area.

B. Oceanographic stations

The Working Group was unable to advance further at this time. Dr. Trites agreed to examine the standard sections proposed above and to submit a proposal with regard to standard positions and depths of the oceanographic stations to the next meeting of the Working Group.

Considerable discussion was generated on the use of the data from the standard sections. While it is clear that fisheries biologists used the data in a descriptive sense for gross correlations between physical and biological phenomenon, it is also clear that no real information exists on the variability of the oceanographic sections in space and time. This is a serious lack and in an effort to gain some insight on this problem, Dr. Trites and Dr. Wilson agreed to examine the available data with respect to its variability and report back to the Working Group at the next meeting. The Working Group also agreed that as occasional transects give no information on dynamics a need exists to evaluate the optimum mix of vessel and moored buoy data acquisition systems.

C. Base periods

Though the Working Group questioned the value of using base periods, it was apparent that anomalies of oceanographic parameters would still be

used and consequently some standardization was obviously desirable. In the ICNAF Area temperature measurements represent the only time series long enough for standardization to be of much benefit. The Working Group recommended: *that MEDS should examine data time series from the ICNAF Area to determine if there are any evident periodicities and report to the next meeting of the Working Group if any useful base periods can be found.*

6. Standard ICNAF data format for exchange of physical environmental data

While recognizing that long term developments in ICNAF programs and in data formatting and exchange will eventually lead to modifications of the requirements, the Working Group agreed to a proposal which attempts to address the subject of ICNAF data management taking into account both the requirements for getting the data into the MEDS in a timely fashion for special annual analyses and the requirement for supplying data to the ICSU/IOC World Data Center System. The plan is designed to minimize duplication of effort in the handling of the data on both the national and international levels. For example, it is suggested that any ICNAF data which are supplied to the MEDS can be passed to the World Data Centers by the MEDS. This avoids the necessity of the national centers submitting duplicate shipments to the WDC's.

Attention of the group was invited to the potential of utilizing the services offered by IGOSS in providing quasi real time, telecommunicated BT and station data.

A. ICNAF data submitted to the MEDS

The MEDS will accept the following data in the following formats. It is assumed that these data will be fully processed and validated and will be supplied on 80-column punch cards or IBM Compatible magnetic tape. (note that these suggested format requirements may be amended or modified as a result of further technical discussions between MEDS and data activities of those ICNAF members who were not able to attend the meeting). All the formats described below are approved for exchange by the IOC Working Committee for International Oceanographic Data Exchange.

- (a) NANSEN Casts - the following formats can be accepted.

ICES
US NODC
OCEANS IV (Canada)

(If necessary one additional format could be negotiated and specified)

- (b) BT data - (X-BT and mechanical)

It is assumed the data will be in digital form, digitized (by the agency submitting the data) to the 1969 ICES standards for vertical resolution and accuracy, validated, and on 80-column punch cards or IBM compatible magnetic tape.

The following formats can be accepted.

US NODC compatible
CODC OCEANS IV
(Excludes ICES BT format)

Use of the format developed by the Deutsches Ozeanographisches Datenzentrum will be considered but will need to be further investigated.

- (c) STD data (Preferably digitized to the ICES "optimum" standards (1969/1970)). (Proces-Verbal de la Reunion 1970, 58th Statutory meeting Copenhagen, Sept. 28 - Oct. 7, Annex 1, Page 51, Report of the Working Group on Marine Data Management).

The same formats can be accepted as for NANSEN casts.

To insure that all data are submitted in a timely fashion to the MEDS, it is felt that a national representative must be designated and made responsible for submission of his country's data. It is recommended that, where possible, this representative be the director of the National Oceanographic Data Center (or its equivalent) or the appointed representative of the director (or in the case of certain ICES countries, the Service Hydrographique).

B. ICNAF data inventories

ROSCOP forms should be completed by the ICNAF countries for each cruise and submitted to the WDC's through national channels with a copy to the MEDS. The ROSCOP forms would cover all data collected and not just that to be submitted to the MEDS. Copies of these ROSCOP forms would not be supplied to the WDC-A by the MEDS.

From the ICNAF ROSCOP forms the MEDS will prepare a summary of the data collected for presentation at the annual ICNAF meetings. This will also provide a referral to types of data held by various labs (e.g. sub-surface currents) but not submitted to the MEDS.

It is recognized that the ROSCOP forms are already submitted to the WDC's by many ICNAF countries.

C. Broader international data exchange

Most ICNAF data would qualify (under the guidelines contained in the IOC manual on Oceanographic Data Exchange) for submission to the World Data Center System.

To facilitate this flow of the data to the WDC system the MEDS will automatically deliver a copy of the data submitted by the ICNAF countries to World Data Center-A unless otherwise instructed by the country submitting the data.

This data submission to the WDC-A by the MEDS would be effected on a semi-annual basis.

It should also be pointed out that some of the types of data collected by ICNAF, while not suitable for centralization at MEDS (e.g. Plankton data), may however be submitted to the WDC's for storage and service for all countries including ICNAF.

7. Possibility of preparing a generalized circulation model based on current state of knowledge of major features of circulation.

After considerable discussion on the uses of a general circulation model toward achieving the Working Group's general terms of reference, it was agreed that expenditure of the considerable amount of effort that would be required to build such a general circulation model of the North-west Atlantic Area would not be justified at the present time, and that, in any case, the required data base and knowledge of controlling mechanisms was not yet available. The Working Group considered that the better strategy at this time was to concentrate our major efforts on a more easily defined part of the total system. Furthermore, as a sound description of the circulation would clearly be an important part of any proposals which would be advanced towards our general terms of reference, circulation models would be considered further at this time.

8. Review of biological research programs having a direct bearing on larval and young fish production being enacted by each country in the ICNAF area during 1974 and that planned in 1975.

With most ICNAF countries submitting research reports and research plans at the annual meeting of STACRES it was considered that at this stage little would be accomplished by reviewing, in detail, plans for biological research programs except as a means of encouraging greater cooperation and coordination during 1975. With only five countries represented at the meeting and with the research plans for many countries not yet finalized the review is obviously incomplete. This is contained in Appendix III to this report.

9. Consideration of parameters likely to be of greatest importance in the production of good and poor year-classes of some of the major fisheries of the ICNAF area

This item was considered in conjunction with item 10 below.

10. Consideration of approaches to the problem

The Working Group generally agreed that a two pronged approach was desirable.

(a) The correlation approach in which emphasis is placed on predictability without necessarily understanding the causal mechanisms involved. This approach, while recognizing that fish productivity is likely to be most strongly influenced by local ocean climate, emphasizes that this climate is itself influenced and disturbed by distinct and large scale oceanological and meteorological factors. The joint study of local and large scale environmental conditions ultimately should yield information on the major linkages between small and large scale phenomena--and when coupled with fish production data, it should provide useful predictions of major fluctuations as well as some insight into mechanisms involved.

(b) The causal mechanism approach which leads to real predictability and which attempts to understand the real processes and mechanisms included in fish production. In this case, it was considered best to look at a single stock or stock complex in sufficient detail to test hypotheses about causal mechanisms and elucidate the physical and biological factors controlling year-class success.

After some discussion about suitable areas and species for study, it was agreed that we should limit our proposals to an important stock or stock complex of (i) a pelagic species (ii) a groundfish species.

(i) Pelagic species. Because the current cooperative program of herring larval surveys provided the best available data base with which to evaluate the research strategy noted in (b), and in view of the importance of the species in the area, it was agreed that herring was the best species, and Georges Bank, Gulf of Maine or Bay of Fundy the best areas where the study should be concentrated.

While the Working Group recognized that it may be desirable and necessary to further limit the scope of study to a specific stock and area they were unable at the time to do this and agreed that a meeting devoted to the production of herring in the Georges Bank-Gulf of Maine area was necessary.

(ii) Groundfish species. While it is quite evident that the cod of the 2J-3K-3L stock complex were of most importance to the Commission from the standpoint of total landings it was agreed that the wide area of coverage as well as the complexities and difficulties of study ruled out this stock as suitable for our initial efforts. Instead, it was felt that from study

of a simpler area and stock of cod, principles might be extracted which could hopefully be applied to the more complex area. For the following reasons it was felt that Flemish Cap might provide a suitable area for study:

1. Fluctuations in year class strength of both cod and redfish were regularly observed in this area.
2. The stocks of cod are discrete and confirmed as separate from those of the Grand Bank.
3. The circulation patterns are likely quite amenable to study.
4. The area is reasonably restricted in size.
5. The area is one which because of its major oceanographic features has been of interest to physical oceanographers for many years and there exists a useful historical data base of fish production and physical environmental data.

Following the above discussions and recognizing the urgency of making progress the Working Group recommended:

1. *That the next meeting of the Working Group be held prior to the 1975 annual meeting of STACRES, and that this meeting should be made up of three parts;*

(a) *Preliminary definition of a research proposal aimed at determining the factors involved in the production of good and poor year-classes in one or more of the herring stocks of the Gulf of Maine-Georges Bank-S.W. Nova Scotia area (3 days).*

(b) *Consideration of Flemish Cap as an area worthy of a special International coordinated study aimed at determining the factors involved in the production of good and poor year-classes of major groundfish stocks in the area (1 day).*

(c) *Progress on recommendations by the September 1974 Working Group meeting in the light of work continued in the interim (1 day) in particular:*

- (i) *standardization of oceanographic sections and stations*
- (ii) *standard ICNAF data formats and arrangements for exchange of data*
- (iii) *standardization of base periods for anomalies.*

To ensure the success of this meeting the Working Group emphasizes the necessity of a multidisciplinary approach and urges the participation of physical and biological oceanographers and biologists from all interested countries.

2. *That through the chairmen of the Environmental Working Group and Biological Surveys Subcommittee, the scientists involved in the larval herring program be asked to put a high priority on the analyses of the data available and documentation of their results so that the knowledge gained from these surveys can form a base upon which the Working Group can build.*

3. *That for this meeting we should attempt to gain the best possible description of the total environment of the relevant areas. To this end we should seek review papers from Dr. V. A. Bryantsev and Dr. Dean Bumpus on the physical oceanography of the Gulf of Maine-Georges Bank area, from Mr. John Colton on an overview of the total biological system of the same area and from Dr. Templeman on the oceanographic and biological features of the Flemish Cap ecosystem.*

4. *That documentation in the form of papers should be actively encouraged and that the contributions should be treated as regular ICNAF documents, with distribution prior to the meeting being a most desirable goal.*

11. Possibilities of coordination and cooperation in 1975

The Working Group noted the several cooperative or coordinated joint programs already being undertaken by ICNAF countries and the obvious need of cooperation between countries having research ships working in the same area. Because of the few countries represented at the September meeting of the Working Group and the relative uncertainty of research vessel plans in 1975, the group was unable to proceed further on this matter.

12. References

- Hermann, F., W. Lenz, and R. W. Blacker (1973). Hydrographic conditions off West Greenland in 1972. ICNAF Red Book 1973 part III: 27-32.
- Lenz, W. (1973). On the hydrography of the Southern Laurentian Channel. (ICNAF Div 3P, 4V). ICNAF Red Book 1973 part III; 33-36.

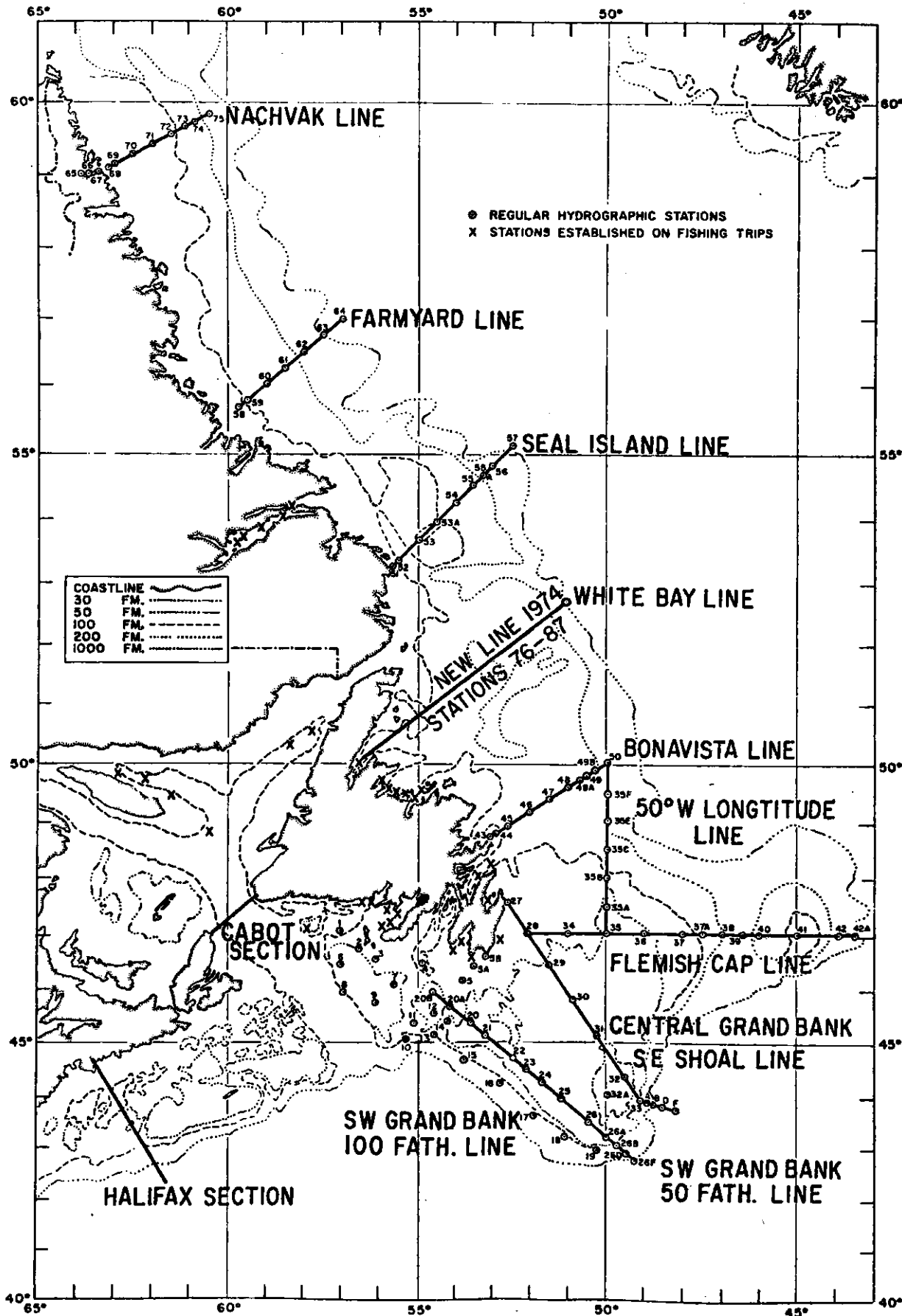


FIG. I

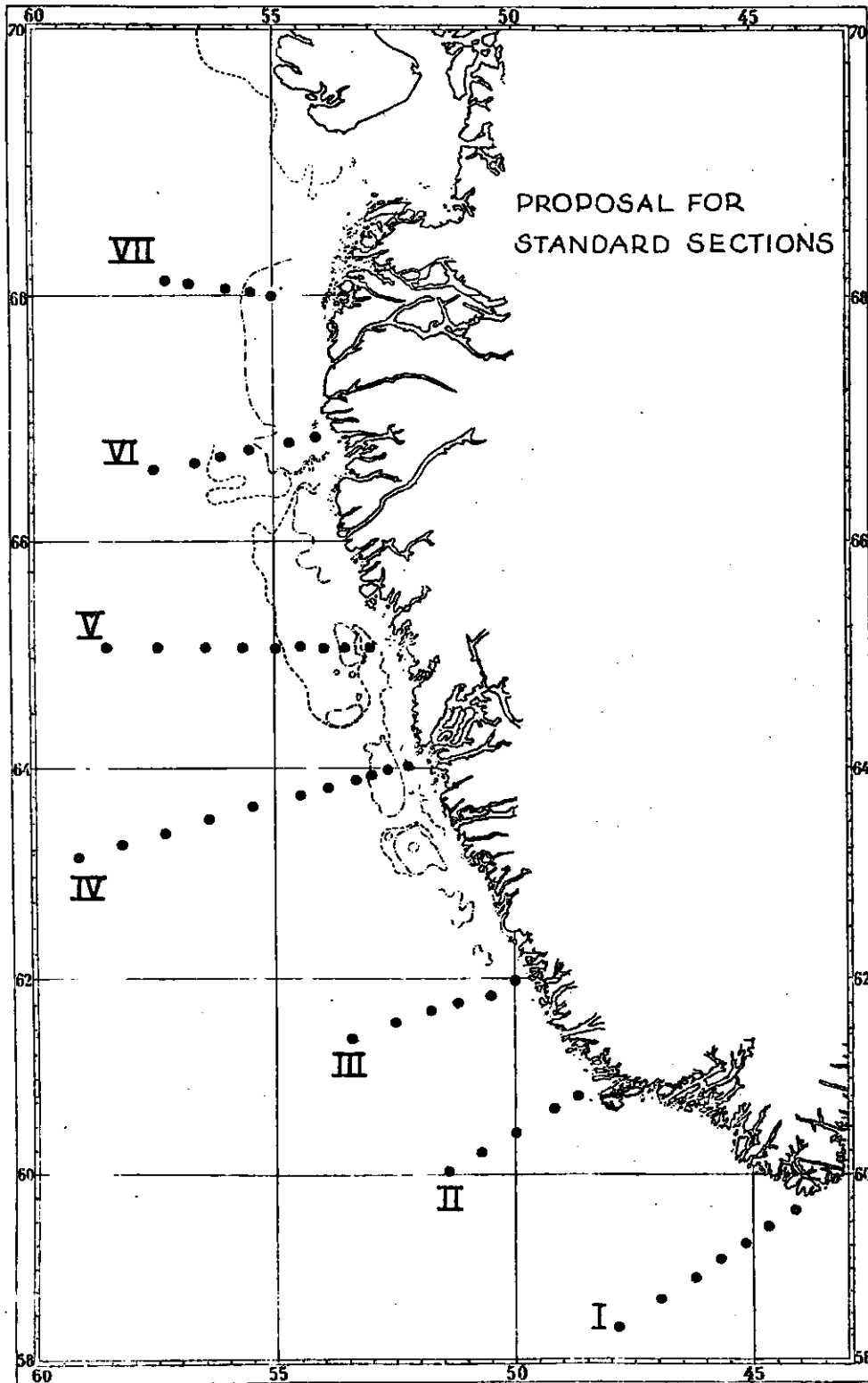


FIG. 2

UNITED STATES COAST GUARD

ATLANTIC STANDARD SECTIONS AND
OCEAN WEATHER STATION HOTEL

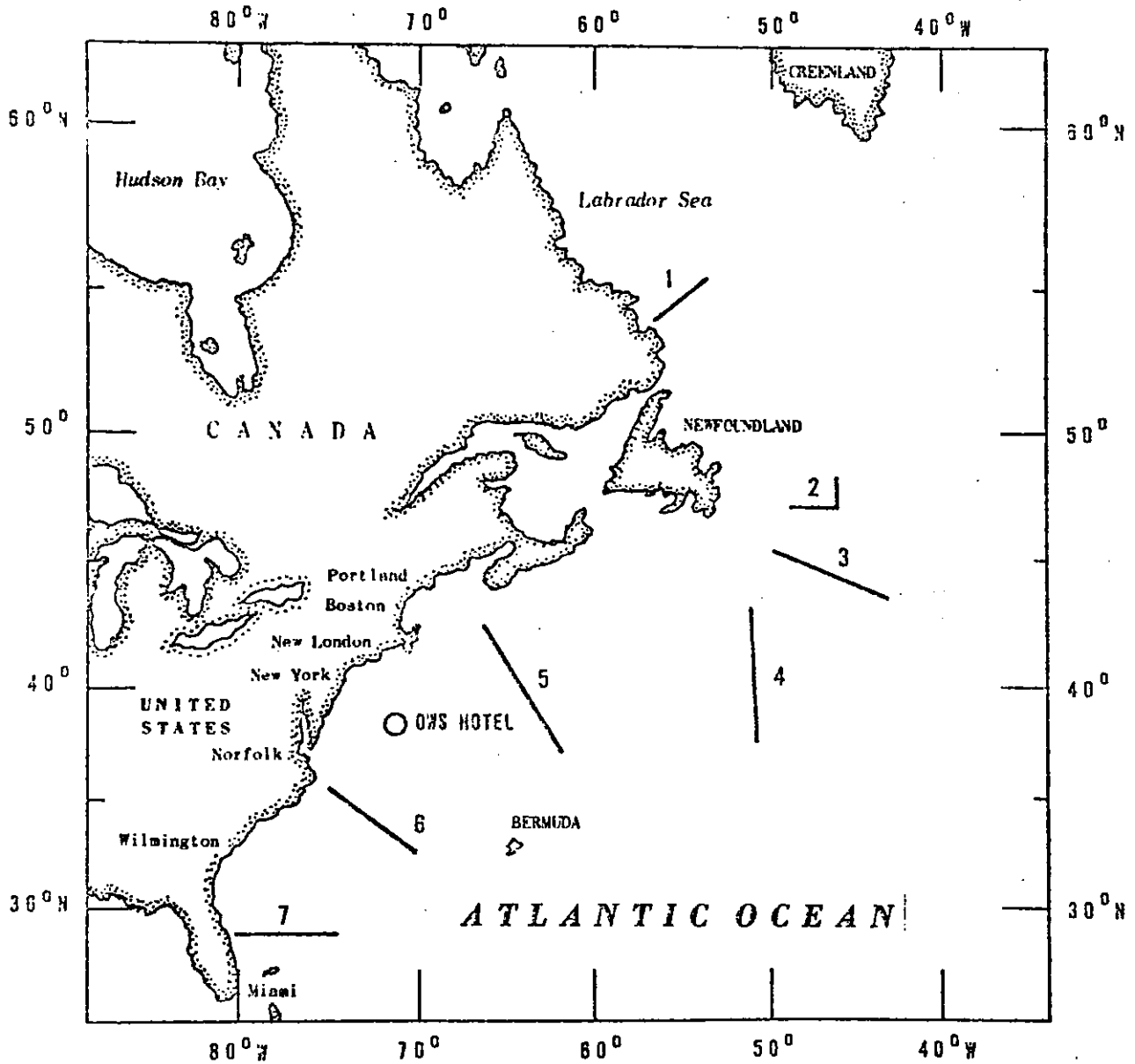


Fig. 3

APPENDIX I

Meeting of ICNAF Environmental Working Group

23-25 September 1974

Charlottenlund, Denmark

Agenda

1. Review of physical environmental research programs being enacted by each country in the ICNAF area during 1974 and that planned in 1975.
2. Review of existing data base on file in each country.
3. Standardization of hydrographic station, sections and base periods for temperature and salinity.
4. Standard ICNAF data format for exchange of physical environmental data and arrangements for exchange of data.
5. Possibility of preparing a generalized circulation model based on current state of knowledge of major features of circulation - identification of data gaps.
6. Consideration of methods to close data gaps.
7. Review of biological research programs having a direct bearing on larval and young fish production (including primary production) being enacted by each country in the ICNAF area during 1974 and that planned in 1975.
8. Consideration of the parameters likely to be of greatest importance in the production of good and poor year-classes of some of the main fisheries of the ICNAF area.
9. Consideration of approaches to the problem,
 - (a) Synoptic monitoring of large-scale phenomena (US Proposal 1)
 - (b) Intensive study of key areas (US Proposal 2)
 - (c) Very intensive study of single species (Hypothesis testing)
 - (d) Others
10. Possibilities of coordination and cooperation in 1975 and the remaining months of 1974.
11. Work to be done before next meeting.

APPENDIX II

Review of physical environmental research programs being enacted by each country in the ICNAF area during 1974 and that planned in 1975.

A. Canada (R. W. Trites)

1. The standard pattern of hydrographic stations (Fig. 1) (Seal Island line and southwards) was occupied during July and August 1974. At each station reversing thermometer measurements of temperature were made and samples of seawater for salinity determinations obtained. A BT cast was also made at each station as well as selected intermediate positions. It is planned to repeat this work in 1975.
2. The same temperature and salinity data was obtained for Station 27 except that this station was occupied approximately twice per month. It is planned to repeat this work in 1975.
3. Bottom (or other depth) reversing bottle measurements of temperature were made at each fishing station in addition to a BT cast with associated surface temperature. It is planned to repeat this work in 1975.
4. The Halifax Section is expected to be occupied seasonally during the year using an STD. It is planned to repeat this work in 1975.
5. The Cabot Section is expected to be occupied in November using an STD. It is planned to repeat this work in 1975.
6. Physical Oceanographic Survey (STD) in Gulf of St. Lawrence was carried out in April. Another survey is planned for November. It is proposed to continue with the November cruises.
7. Studies of the Currents, temperature, and salinity distributions will be undertaken in 1974 and 1975 in the deep water at the entrance to the Laurentian Channel (ICNAF area 4V₂). It is planned to acquire a one-year record of currents at the bottom and in the upper 1000 meters. Temperature and salinity surveys will be undertaken in the vicinity of these moorings.
8. For the period April 1974-March 1975 a number of groundfish and pelagic surveys are planned for Sub areas 2 and 3 as well as the Gulf of St. Lawrence, Scotian Shelf, Bay of Fundy, and Gulf of Maine. Temperature and salinity measurements are made routinely on these cruises and drift bottles and sea bed drifters released periodically.
9. Existing data from Gulf of St. Lawrence, Scotian Shelf and Gulf of Maine has been utilized as part of study of possible relationships between oceanographic processes and fish production on the Scotian Shelf and in the Gulf of Maine.
10. Hydrographic data should be available from the 200-300 Herring larval sampling stations planned for a cruise on the Nova Scotian Shelf during Oct.-Nov. 1974.

B. Denmark (F. Hermann)

Work has only been carried out in Sub area 1. The standard Danish sections in the West Greenland (Fig. 2 and ICNAF Document 74/82) area have been occupied during 1974 and every effort will be made to work them as often as possible in 1975. The middle section (IV) is the most important and this was occupied in April, May and July as well as perhaps

twice more this year. The two northernmost sections were occupied in July during the period when a cod larval survey was being carried out. This section has been worked since 1950 but correlations between larval abundance and subsequent-year-class success have not been too successful, and though good year-classes seem to be correlated with high larval abundance, good year-classes after low larval abundance have appeared often enough to cast some doubt on the adequacy of the correlation. The water temperature conditions found in the section off Fyllas Bank have been used to predict-cod-year-class strength, perhaps since this is at the northern limit of the cod distribution.

C. Federal Republic of Germany (J. Messtorff)

In Subarea 1 the Danish and German sections which were at least similar to the standard sections proposed by F. Hermann (Fig. 2) have been occupied annually since 1969, mostly in late fall.

In Subarea 2 the Seal Island section or at least part of it (Fig. 1) has been occupied annually since 1965 (except 1968) also mostly in late fall. In addition two sections further north (off Cape Chidley and about half way between the lines marked Nachvak and Farmyard in (Fig. 1) have also been worked but less frequently.

In Subarea 3 sections have only occasionally been occupied in former years with the main emphasis being placed on the Flemish Cap and Bonavista lines (Fig. 1).

In 1969 and 1972 a section across Cabot Strait was occupied in spring as well as in fall (Lenz, 1973).

In Subarea 4 sections across the Nova Scotia Shelf have been worked only occasionally but not recently (no time series).

Since FRG participates in the herring larval and young fish surveys in Subarea 5, oceanographic data from almost every station are available from both spring and fall surveys.

D. UK (H.W. Hill)

The UK research effort in 1975 will be restricted in the ICNAF Area to cod blood group sampling off West Greenland and the usual routine Continuous Plankton Recorder surveys. There will be no physical oceanography.

E. US (E.A. Delaney, M.D. Grosslein, R.J. Schlitz & T. Winterfeld)

The relevant US research effort in the ICNAF area during 1974 and 1975 can be separated into four main components: (1) regular surveys by the National Marine Fisheries Service (NMFS) and cooperating agencies, (2) cruises by the United States Coast Guard (USCG), (3) special studies by other government agencies and (4) research by private agencies.

1. In 1974 NMFS has carried out physical measurements in conjunction with its groundfish and larval herring programs. The groundfish surveys occurred in Spring and Fall from Cape Hatteras to the Nova Scotia Shelf; the larval herring surveys in December throughout the Gulf of Maine-Georges Bank area and in February on Georges Bank. In addition a small experiment was undertaken in August 1974, to determine the position of the coastal-slope water interface along the southern edge of Georges Bank.

At each of the approximately 300 randomly spaced groundfish stations an XBT and surface salinity was taken. Also along a number of cross sections STD lowerings complete with water samples were carried out as time permitted. These sections are not exactly equivalent from cruise to cruise because of the random nature of the station positions but are

nearly constant and distributed across the continental shelf at approximately 60 mile intervals and in the Gulf of Maine. In the summer of 1974 NMFS also began monthly hydrographic coverage on the shelf by Hudson Canyon in conjunction with intensive biological studies of that region.

On larval herring cruises in February and December, a minimum of surface salinity and XBT observations are taken at each station, and an STD drop with water samples is planned for as many stations as time permits.

As part of a cruise to study juvenile herring an attempt was made to determine the seaward extent of coastal water along the southern edge of Georges Bank in August 1974. Intense coverage by XBT's was used to determine the thermal structure and STD lowerings of the characteristics of coastal and slope water masses.

Finally, it should be noted that temperature profiles (XBT's) across various parts of the mid-Atlantic shelf are being monitored regularly each month on merchant vessels, and continuous plankton recorders are regularly towed across the Gulf of Maine as part of the MARMAP program. (Marine Resources Monitoring, Assessment and Prediction Program) - a coordinated effort of NMFS and cooperating national and international institutions.

The NMFS research effort in the ICNAF area during 1975 will probably be very similar to that for 1974, except that additional oceanographic studies on autumn circulation over Georges Bank are planned.

2. The USCG has continued its physical oceanographic research during International Ice Patrol activities. Portions of USCG Standard sections 1-4 have been sampled along with special sampling designed to answer questions about drift and distribution of ice.

During January and August, 1974, intensive hydrographic surveys of the New York Bight were completed to provide information on the average currents for search and rescue purposes. Both XBT and STD measurements were obtained across the continental shelf into deep water (Shelf water). The resulting density fields are being analyzed to provide an indication of the average geostrophic currents in the area.

Finally, continuous plankton tows and XBT sections are made every three weeks from Norfolk, Virginia to Ocean Weather Station Hotel, and the Cutter on station makes daily 800 meter and weekly 3000 meter Nansen casts. Sea surface temperatures (infra-red) are recorded on monthly flights along the mid-Atlantic shelf from Cape Hatteras to Cape Cod.

USCG activities in 1975 will include continuation of the spring International Ice Patrol cruises, hydrographic surveys over the New York Bight in January and from Delaware Bay to Jupiter Inlet, Florida in August, the regular transects to OWS Hotel and the daily program on station, and at least seasonal occupations of the Atlantic Standard Sections.

3. Although coordinated US efforts in offshore water within the ICNAF area have been limited, an experiment was completed in Spring 1974 to study the areas of proposed waste dumping off Hudson Canyon. Various federal agencies cooperated to determine the physical and chemical characteristics of a deep oceanic region (about 3000 m) near the seaward end of Hudson Canyon. Repetition of this experiment is not contemplated in 1975.
4. Many private research institutions and universities have oceanographic research projects within the ICNAF area, but these are largely uncoordinated. Two programs are particularly relevant to the ICNAF program. Dr. W. R. Wight of the Woods Hole Oceanographic Institution is conducting a sampling program to determine the average position of the coastal-slope water interface from Cape Hatteras to Martha's Vine Yard. A determination of the frequency that coastal water bubbles separate and the amount of coastal water lost into the slope regime is included in the goals of this experiment.

A consortium including the University of New Hampshire, M.I.T., and Nova University is conducting an experiment in Fall 1974 to determine the dynamic response of the northern Gulf of Maine to the passage of low pressure systems. Both Eulerian and Lagrangian measurements of water motion as well as density measurements will be carried out in an area east of the Isle of Shoals.

Although these and other data are collected independent of the ICNAF programs, they should be available in time through the data exchange program of the United States National Oceanographic Data Center and the Marine Environmental Data Center of Canada.

APPENDIX III

Review of Biological Research programs having a direct bearing on larval and young fish production being enacted by each country in the ICNAF area during 1974 and that planned in 1975.

A. Canada (R. W. Trites, J. R. Wilson, T.D. Iles)

1. Work is being carried out at MEDS on the vertical transport of nutrients and the relationships existing between these and the distribution and abundance of fish. Vertical velocities in the area of the Icelandic low have been determined from Ekman computations and these velocities correlate with the abundance of Cod in Sub area 1.
2. Research vessel cruises are conducted each year to all ICNAF Divisions important to the groundfish fisheries of Canada. These cruises in ICNAF Divisions 3L, 3N, 3O and 3P_g use the stratified-random method of surveying which allows minimum biomass estimates for the major groundfish species. Included in these estimates are estimates of pre-recruitment ages and these have been correlated with abundance upon entrance to the commercial fishery and used to predict contributions of various year-classes to the future fisheries in calculating total allowable catches. Relative abundance of pre-recruit ages of various year classes can be compared.
3. The surveys carried out in 1974 will be continued in 1975 and hopefully extended in coverage. The Gulf of St. Lawrence will be stratified and the system of stratified-random surveys will be used here also. An already existing stratification scheme for sub area 2 and Division 3K may be used also. With the capability of mid-water trawling and echo-integration on our research vessel, it should be possible to estimate relative abundance of 1-year-old's and maybe even 0-year-old fish of some species which will provide a greater lead time for predicting fluctuations in stock abundance and hence fisheries.
4. It is planned to start a new program aimed at elucidating the factors affecting larval distribution, abundance and survival of herring as well as the ecology of the juveniles in the southwestern Newfoundland area and Gulf of St. Lawrence. This program will be directed towards developing indices of abundance of year-class strength for prediction purposes.
5. The Canadian involvement in the ICNAF larval herring program in the Gulf of Maine-Georges Bank area will likely be continued and expanded to the Nova Scotia Shelf area where the focus will be on determining whether Banquereau Bank has a spawning area.
6. Ecology of larval fish in St. Georges Bay, Nova Scotia. An intense study of growth and survival of larvae of a succession of species in relation to food abundance, particle size, and distribution. This is an area of apparent wind-driven upwelling and the program includes a physical oceanography study.
7. Biological productivity of marine ecosystems with reference to coastal zone and continental shelf. Studies on structure and function of planktonic food chains in two particular locations are presently relevant: St. Lawrence Estuary and Southwest Nova Scotia, both areas of upwelling.
8. Correlation analysis between large scale phenomena such as temperature and freshwater runoff and subsequent fish catches in Sub areas 4 and 5.
9. An acoustic fish counting system is being employed for estimating abundance of groundfish on the Scotian Shelf and other areas and for

studying distribution patterns. This tool has considerable potential for systematic investigation of changes in distribution and concentration on a seasonal basis.

B. Denmark (F. Hermann, E. Smidt)

Denmark will be carrying out research in the West Greenland area, but plans are not completed as yet. The standard hydrographic sections will be occupied for temperature, salinity and phosphates and at each station the plankton in the 0-50 m layer will be sampled by means of an oblique tow.

C. Federal Republic of Germany (J. Messtorff)

Surveys for juvenile and larval herring in Sub area \bar{V} will be continued as will the groundfish surveys in Sub areas I and II. Observations will be similar to those made previously and will include the usual hydrographic measurements at all fishing stations as well as standard sections.

D. UK (H.W. Hill)

The UK research effort in 1975 will be restricted in the ICNAF Area to cod blood group sampling off West Greenland and the usual routine Continuous Plankton Recorder surveys.

E. U.S. (M. D. Grosslein)

In 1974 the standard MARMAP spring and fall groundfish surveys from Cape Hatteras to central Nova Scotia were again carried out, and additional monthly sampling was begun in the vicinity of Hudson Canyon. Minimum biological sampling on all groundfish cruises includes plankton hauls (with standard MARMAP Bongo nets - the same as used in ICNAF larval herring program) as well as the bottom trawl hauls. In addition to use of the trawl catch data for pre-recruit abundance indices, the plankton samples are checked for broad-scale patterns and anomalies of occurrence and distribution of ichthyoplankton in the spring and fall seasons; of particular relevance here are the autumn catches of larval herring outside the area of the ICNAF larval herring survey area, and the catches of herring larvae in March.

There were 6 cruises in 1974 directed specifically to the study of larval herring and/or spawning beds in the Gulf of Maine-Georges Bank Area. A survey of herring larvae was conducted on Georges Bank in February 1974 using standard ICNAF sampling methods to determine over-winter mortality. Inshore Gulf of Maine areas were sampled in September and October, and a special vertical distribution study of herring larvae was conducted in October over spawning sites on Jeffrey's Ledge and Georges Bank; fine mesh nets as well as standard mesh sizes were deployed in the vertical series to provide some measure of forage organisms available to the larvae. A study of 3 herring egg beds on Jeffrey's Ledge was conducted in October, using divers with SCUBA gear. In November, the final leg of the full groundfish survey was extended to fill in a gap in the ICNAF larval herring sampling program - the Gulf of Maine and western Nova Scotia section which the USSR vessel was unable to sample. The US leg of the 1974 larval herring survey is scheduled for December.

In addition to field studies of larval and juvenile fish, laboratory studies were conducted on the energy requirements and factors related to survival of fish embryos for a number of different species. Also studies continued on density-gradient sorting techniques in an effort to reduce the time and expense of sorting plankton samples.

In 1975, biological studies are expected to be similar to those for 1974, except for the following additions. A joint program by USSR, Poland and USA is being considered for applying hydroacoustic techniques and underwater trawling for juvenile stages of herring and mackerel. Also in 1975 it is hoped that the newly established and US-supported plankton sorting center in Poland will be able to begin comprehensive sorting (including invertebrates) of ICNAF plankton samples. Finally additional autumn studies on the oceanography (circulation, nutrient chemistry, and primary production) of Georges Bank are planned for 1975 but will depend on new funding in NMFS.