



FIRST DRAFT

Plans for "Cooperative Investigations of the Northern Part of  
the Eastern Central Atlantic" (CINECA)<sup>x</sup>

1. Preamble

Although the sea area of the Eastern Central Atlantic between the Straits of Gibraltar and Cape Verde is a most interesting one, both from an oceanographic and a fisheries point of view, only little is known about the living resources of this area and their environment (physical, chemical, biological). In fact, it is the most unknown area of the Northern and Central Atlantic as the waters further north have been well covered by research vessels for many years, in particular during the International Geophysical Year 1957/58, and the waters of the tropical Atlantic have been systematically studied by the ICITA expeditions, the Guinean Trawling Survey (GTS) and now by the surveys of pelagic fish resources in a number of West African countries financed by UNDP Special Fund and for which FAO is executing agency. Plans for the western part of the Central Atlantic to be explored by a "Cooperative Investigation of the Caribbean and Adjacent Regions" (CICAR) organized by IOC, have already been made.

2. The State of the Knowledge of the  
Oceanography and the Fishery Resources in the Area

During the "Symposium on the Oceanography and Fishery Resources of the Tropical Atlantic", organized by UNESCO, FAO and OAU in Abidjan in October 1966, it was recognized that a systematic study of the marine resources and their environment in the waters between Gibraltar and Cape Verde is required to supplement the knowledge which is now available for the tropical part of the Eastern Atlantic.

The International Council for the Exploration of the Sea (ICES), being aware of the intensive exploitation of the fishery resources of this area, then arranged, in collaboration with FAO, a "Symposium on the Living Resources of the African Atlantic Continental Shelf between the Straits of Gibraltar and Cape Verde" which was held in Santa Cruz de Tenerife (Canary Islands) from 25th till 28th March, 1968. During this meeting the present state of knowledge of the oceanography and the resources in the area were reviewed. The report of the Symposium and the contributions will be published shortly by ICES and FAO. The Symposium was followed (28th March - 4th April, 1968) by a meeting of the ACMRR/ICES Working Party on the Fishery Resources of the East Central and South East Atlantic.

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<sup>x</sup>) Provisional title only. The area of investigation may be defined also as "south-eastern North Atlantic".

Both the Symposium and the meeting of the Working Party provided an opportunity to identify gaps in the present knowledge and to elaborate recommendations on scientific programmes required to cope with scientific and resource management problems in the area.

These recommendations stressed the need for close international cooperation in the physical, chemical and biological studies, and were confirmed later by different bodies concerned, i.e. ACMRR (at its 5th Session in Rome, July 1968), ICES (at its 56th Statutory Meeting in Copenhagen, October 1968) and IOC (at its 9th Meeting of the IOC Bureau with the Consultative Council in Woods Hole, February 1969).

At the 1st Session of the FAO Fishery Committee for the Eastern Central Atlantic (CECAF) in Accra, March 24 - 28, 1969, serious concern was expressed at the state of certain stocks in the area. CECAF endorsed the proposal for CINECA and appointed two experts to act as contacts for this project.

Also the report on "Global Ocean Research" prepared by the Joint Working Party of ACMRR/SCOR/WMO (AGOR) on Scientific Aspects of International Ocean Research (Ponza, May 1969) pointed out the desirability to undertake research in the area between Dakar and Gibraltar.

As part of the FAO Indicative World Plan for Agricultural Development (IWP) a review of the present knowledge on the living resources of the Eastern Central Atlantic is being prepared, a preliminary draft of which is already available and which is expected to be published in late 1969.

### 3. Planning Group for Cooperative Investigations in the Area

Following the recommendations mentioned above, ICES and FAO agreed to establish an ad hoc Planning Group for CINECA, asking IOC, CECAF, SCOR and ACMRR to nominate experts to this Group.<sup>x)</sup> The members of this ad hoc Planning Group, having in mind that IOC at its 6th Session in Paris (September 1 - 12, 1969) and ICES at its 57th Statutory Meeting in Dublin (September 29 - October 8, 1969) expect to give further consideration to the plans for CINECA, decided, due to the lack of time for preparation of a more complete and detailed programme, to outline only the general scope and to draw up some preliminary proposals to be used as background for discussions.

### 4. Objectives and Programmes of CINECA

4.1 It is proposed that the Cooperative Investigations should be concerned with the following main subjects:

- (a) A systematic study of the circulation of water masses in the Eastern Central Atlantic, in particular the Canary Current and the North Equatorial Current (including the influence of meteorological effects on the inshore water masses) which could contribute to a better understanding of the oceanographic system in the whole Atlantic north of the Equator.
- (b) A study of the biomass, composition, abundance and variation of the plankton (including fish eggs and larvae surveys), with productivity estimates and investigations on the role of various organisms within the food chain.
- (c) A programme of fisheries investigations, which could lead to a better evaluation of the living resources as a basis for their rational exploitation and management.

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x) The Group started the work by correspondence. In order to facilitate contacts and until a more formal arrangement is agreed upon, FAO made available, Dr. D. Sahrhage and Dr. G. Tomczak (FAO Marine Biology and Environment Branch) to act as Technical Secretaries.

- (d) The relationship between the living resources and their environment. Particular emphasis will be given to the study of the phenomenon of upwelling, both in space and time.

4.2. The objectives of CINECA will need a large scale cooperation during several years. It is proposed to plan the work at this stage for a 3-4 year period, and it is hoped that the investigations will start in early 1971.

In the programme three major lines of activity should be considered:

(a) Preparations

- (i) Updating and reviewing of scientific and statistical information either not available at the Symposium in Santa Cruz de Tenerife or which has been published since.
- (ii) Elaboration and publication of improved sea charts and fishing charts giving better information on the nature of the sea-bed and sedimentation as well as the topography of the continental shelf area.
- (iii) Exploring the possibilities of establishing a system for more exact position finding by installing suitable stations for radio navigation, at least for some periods of CINECA.
- (iv) Arrangements for the regular and speedy publication of sea surface temperature (SST) charts, at least for the most important parts of the area where upwelling occurs during certain seasons.

(b) General Surveys

- (i) It will be necessary to coordinate, as far as possible, the relevant research programmes of the various nations in the area. There should be close international collaboration with an exchange of information on the plans for and results of survey cruises and other research activities. Whenever possible, mutual agreements should be made on the areas and periods of operation of national expeditions so that the area may be covered as widely as possible in both space and time. Furthermore, an exchange of scientific and technical personnel between the research organizations concerned could be arranged. The standardization of certain methods and items of equipment may also be required, and consideration must be given to the needs for calibrating certain types of instruments. Of particular importance is the establishment of a number of transects, normal to the coast, which should be worked at regular intervals, at least four times a year.
- (ii) For specific fisheries investigations exploratory echosurveys will be undertaken for describing the pattern of fish distribution and abundance in time and space using a combination of acoustic survey methods with various fishing techniques. Biological investigations will be made on the composition of the catches of fish and other marine animals. Some proposals for this survey are described in more detail in Annex I.

(c) Detailed Research

Whilst the research activity has to range over the whole area for a period of four years, special studies should be arranged such as a strongly coordinated multiple-ship expedition with as many ships and self-recording moored buoys or instruments as possible. Such a study might last only, say 6-8 weeks and should

extend over a limited, well selected area. Its aim would be to study the influence of the environmental factors, in particular the upwelling effect, on the composition, abundance and variation of the plankton, including fish eggs and larvae, and of the fish stocks. For this reason, not only physical and chemical observations but also biological, should be carried out. A number of detailed proposals to some aspects of the programme of CINECA are outlined in Annex I as a first basis for discussions.

#### 5. Organization of CINECA

The Cooperative Investigations should be coordinated by IOC with close collaboration between all agencies participating in CINECA. Further preparatory planning should continue to be carried out by the ad hoc Planning Group consisting of members nominated from the co-sponsoring bodies, and as soon as CINECA becomes an official programme, an International Co-ordinator and an International Co-ordinating Group should be established with overall responsibility for the organization of the survey. As in other Cooperative Investigations, a Fisheries Co-ordinator should be appointed who would be responsible to assist with the planning and execution of the fisheries aspects of CINECA.

The ACMRR/ICES Working Party on the Fisheries Resources of the East Central and South East Atlantic has made already some detailed proposals for fisheries investigations in the area, including an echo-survey (See Annex I). It is therefore suggested to start, as soon as possible, with such a survey programme to be undertaken by a number of research vessels. The next (57th) Statutory Meeting of ICES in Dublin in October 1969 may provide an opportunity for the scientists from the various countries to elaborate the programme in further detail and to obtain a first indication as to the ships' time, personnel and equipment which could be made available for CINECA.

## Detailed Proposals to some Aspects of the Programme of CINECA

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### 1. Sea Charts and Fishing Charts

The design of better sea charts and/or fishing charts, as well as the planning of the expeditions will highly depend on the possibilities of getting exact positions at sea.

### 2. Exact Positioning

As special and expensive equipment will be needed to use navigational satellites for exact positioning it is suggested that four to six mobile transmitters should be installed - at least for some periods of CINECA - which can easily be erected by a few persons in a short time. One suitable method would be the so-called "TORAN 3G", another one the "OMEGA" system. The estimated cost for a set of such "TORAN" equipment is in the order of \$150.000. The "OMEGA" system is cheaper and is covering the area although the accuracy is not as good as that of "TORAN".

### 3. Fisheries Investigations

The technique of echo-surveys with modern equipment can be used very widely to aid both the development of fisheries (by describing the pattern of distribution of fish in time and space), and the early determination of when conservation and management will become necessary.

The North African upwelling area may be split into four sectors, each with different seasons of upwelling:

	<u>Coastline</u>	<u>Season</u>	<u>Length</u>	<u>Width</u>	<u>Steaming distance</u>	
1.	Cape Verga - Dakar	Oct.-Apr.	310	125	1 500	} miles
2.	Dakar - Cap Blanc	Jan.-May	375	100	1 500	
3.	Cap Blanc - Cap Yubi	Apr.-Aug.	500	100	1 950	
4.	Cap Guir - Mazagan	May-Sept.	125	65	375	

The steaming distance is calculated assuming a grid with lines normal to the coast 30 miles apart. If 6 hauls of one hour each were made in each day, taking up 9 hours, the daily distance steamed at 8 knots would be 110 miles. The length of cruise in the first three areas would be 12-17 days; that in the fourth area would be about three or four days (but see below for the effective length, taking into account the best methods of capture).

The main species available for examination are:

Pelagic: sardines, sardinellas, horse mackerels, mackerels and anchovies;

Demersal: sparids, sciaenids, hake, mackerels, Paracubiceps, Sardinella aurita.

The pelagic fish distributions appear to be related to the temperature distributions and the bottom fish often live on the sides of canyons. All should be available for capture, for identification purposes, by midwater trawl at night and by bottom trawl in the daytime. In other words, pelagic fish are examined by night and demersal fish in the daytime.

A high powered narrow beam echo sounder, preferably also with "bottom lock" and expanded scale recorder should be used for the demersal survey in order to resolve into individuals fish close to the bottom. For pelagic fish a high resolution, high frequency ( $\geq 100$  kHz) sounder is recommended.

At night fish tend to disperse and demersal species frequently ascend from the bottom. It is therefore frequently found convenient to conduct the echo-surveying at night when the fish echoes are better resolved into individual traces and are more easily counted, and to carry out most of the fishing for sampling and identification during daytime.

Horizontally ranging sonar should be used continuously to locate areas of pelagic schools and to indicate the presence of fish too close to the surface to be recorded with a vertical echo sounder.

The upwelling system should be described during the cruises. Frequent temperature observations with a bathythermograph (or a cheap thermistor chain) are imperative - perhaps every 30-60 minutes. Nutrient and salinity observations are useful in describing upwelling processes. If analyzed automatically on board with autotechnicon methods, no time is lost.

If a survey were made once a month, 28 cruises would cover the upwelling area. This means that two ships would be employed, one from October to September, and the other from January to September. It might be worthwhile to employ a third ship on special problems of upwelling.

#### 4. SST Charts

Probably the most productive areas with regard to the fishery are the upwelling areas which, as it is known, are varying in space and time. The situation and the intensity of these areas could be shown by charts showing the temperature of the sea surface (SST charts). Attempts should be made during CINECA to draw SST charts on the basis of observations made by merchant and fishing vessels and to publish them without time lag for use by fishermen. For this purpose two different methods can be used:

- (a) The technique used by the Fleet Numerical Weather Facility in Monterey, California. It has to be proved, however, that the accuracy of this computerized method using observed temperatures and climatological values is sufficient to show enough detail of the inshore horizontal thermal structure.
- (b) The technique used by the German Hydrographic Institute which, for more than a year now, has been publishing North Sea Surface Temperature Charts. The charts are drafted on the basis of the actual observed values and published with a very short time lag.

#### 5. Multiple-ship Expedition

Hydrographical sections normal to the coast have often been made. They can give information about the extent of the upwelling zones and are, therefore, of some value, in particular if they are made at regular intervals in the same area as it is proposed by item 4.2(b). However, it has been pointed out during the Tenerife Symposium, that the mechanism of the upwelling effect can be studied only by continuously recording instruments installed either on board anchored ships or in moored buoys, a fact which has recently been proved by the expeditions of the R/V "Meteor" (April to June 1968) and the R/V "Discovery" (November to December 1968). Emphasis should be given to such continuous recordings during the proposed multiple-ship expedition for which some detailed proposals are made as follows: It is suggested that at least 8 research vessels will participate, 5 of them being research vessels with equipment for continuously recording physical and, as far as possible, chemical parameters. The other vessels should be specialized fishery research vessels.

- (a) The aims of the environmental studies: Simultaneous transects up to about 150 to 180 nm off the coast. The distance of the vessels should be 30 nm, each ship making three sections with a distance of 10 nm each. The observations should comprise: STD, XBT, optical measurements, samples for the determination of nutrients, plankton, particles,

oxygen, pH, chlorophyll, bottom samples (sediments). This first period will last one week. Simultaneous continuous measurements at at least five well chosen points to observe periodicities of the above-mentioned parameters. The measurements will be made by self-recording moored instruments and on board from the research vessels which will be anchored immediately in the vicinity of the moored buoys in order to watch over them and to complete the records of the moored instruments for chemical and biological parameters. This second period will last two weeks. The third period deals with the measurement of the current pattern. The ships will follow drifting buoys fitted with current meters in various depths, parachute drogues and other floating devices. This period will last two weeks. Finally, the measurements of the first period will be repeated.

- (b) The aims of the fisheries investigations: The fishery research vessels will combine echo-surveys with exploratory fishing and plankton investigations, in particular fish eggs and larval surveys. This programme should be supplemented by observations on board commercial fishing vessels operating in the area. Such observations could be made by students in the field of biology and by fisheries technicians to be embarked on board these vessels.

As some time will be needed for an organizational meeting of the participating scientists and for the calibration of the methods used, the whole multiple-ship expedition will need about 7 weeks. It has been suggested that the months of March to May would be most suitable for CINECA working in the area between Bathurst and Cap Blanc (13°N - 21°N).

Summary of Comments from Working Group Members:

1. Correspondence with Dr. P.G.W. Jones
2. Correspondence with Dr. C. Maurin
3. Correspondence with Prof. W.S. Wooster

1. Quotation from letter of August 6, 1969 from Dr. P.G.W. Jones:

"I approve in principle of the proposals outlined in the plan for CINECA. I have, however, one or two comments to make on some parts of this draft.

I appreciate the value of standard hydrographic sections repeated regularly through the year (page 3) but I feel that considerable care will have to be exercised when planning this part of the project. Perhaps we should first establish the degree of hydrographic variability, both in time and distance, by means of an intensive multi-ship survey. We shall then have the necessary information required to select sections and to decide on the frequency of observation to the best advantage.

I am not very happy about the division of the coastline into seasonal upwelling areas (page 1, Annex I). It has been my experience that evidence of upwelling may be found along the northwest coast of Africa between Cape Verde and Mazagan at almost any time of the year. During the period November - December the phenomenon is most active along the southern part of the coast near Cape Blanc but during the summer the area of intensive activity is much more widespread and extends northwards even as far as the Portuguese coast. The draft table suggests that no upwelling occurs between Cape Yubi and Cape Guir, which is certainly not true. I therefore feel that at the present stage of planning it would be wrong to limit echo sounding surveys to those areas and seasons listed in the table.

On page 2 of Annex I it is suggested that nutrient and salinity observations be made during the echo sounding survey. However, I do not think that cruising time will be saved by automatic analysis of the constituents. The ships will still have to stop to collect the samples. The autotechnicon procedure will merely economise on the number of analysts required on board the vessel.

I shall not be able to attend the Dublin meeting of ICES but some of my colleagues will be present who will be able to act on my behalf on matters concerning CECAF."

Quotation from Dr. Tomczak's reply of August 28, 1969:

"It is now too late to make changes to the plan which will be distributed as an ICES document in Dublin and I suggest that we add your letter, together with the comments of Prof. Wooster and Dr. Maurin, as an Appendix to the ICES document. We shall probably add another Appendix on the results of the discussions at the 6th IOC Session concerning CINECA.



Personally I am in complete agreement with your remarks concerning the standard hydrographic sections. A final decision on the sections, as well as the frequency of observations can only be made when the multi-ship survey is completed, probably not before 1972. In the meantime, it is proposed to select a few preliminary sections from which simultaneous and regular observations can be made. These observations may also be used for the proposed SST surveys.

I am very sorry that you are unable to attend the meeting in Dublin but I hope that one of your colleagues will act on your behalf for CINECA matters."

2. Quotation of a letter of July 31, 1969 from Dr. C. Maurin:

"Pour ce qui est des premiers commentaires que je ferai à son propos, ils concernent quatre points principaux:

1) Je pense qu'il serait bon de distinguer d'une manière plus précise les recherches intéressant la pêche des poissons pélagiques ou à comportement pélagique, de celles concernant les espèces benthiques. Pour les espèces à comportement pélagique je pense qu'il conviendrait d'inclure celles qui sont prises près du fond au chalut à grande ouverture verticale telles que maquereaux (Scomber colias), chinchards (Trachurus trachurus), T. mediterraneus, T. picturatus, T. trecae, Caranx rhonchus, Sardina pilchardus, Sardinella aurita, Sphyraena sphyraena etc. ...

Ces espèces pélagiques font l'objet d'une exploitation intense à l'heure actuelle. Du fait de leur biologie et de l'importance du stock il est probable qu'elles pourraient constituer dans l'avenir une importante ressource.

2) Les espèces démersales au contraire sont dès maintenant extrêmement surexploitées comme l'ont montré en particulier les recherches faites à bord de la "Thalassa" en mars-avril 1968 (Science et Pêche n° 177). Il est urgent d'envisager pour elles, dès maintenant, des mesures de protection sur le plan international. Prévoir en première urgence une étude dynamique du stock qui risquerait d'être longue, serait perdre un temps précieux.

Il est bien entendu nécessaire que pour la mise en place de mesures de conservation des poissons démersaux, les pays riverains soient consultés. Cela ne paraît conforme aux souhaits émis lors de la conférence d'Accra, comme d'ailleurs au cours du Symposium de Tenerife.

3) Pour l'établissement de cartes de pêche, en particulier les cartes de fonds chalutables, il est nécessaire de tenir compte des données déjà obtenues, ceci dans le but de gagner un temps précieux.

4) Dans la liste des espèces démersales à étudier que vous donnez dans la page 2 de l'Annexe I, vous ne mentionnez pas les Serranidés (Epinepholus, Mycteroperca et les lutjanidés (Biagramma, Parapristipoma, Orthopristis etc. ...), les crustacés (Panulirus regius, Palinurus mauritanicus, Aristeus antenatus et A. varidons, Aristeomorpha, Parapenaeus, Peneopsis, Penaeus etc.); ces espèces présentent dans ce secteur, un intérêt commercial certain.

En revanche vous parlez des Paracubiceps, espèce fort importante industriellement dans le golfe de Guinée mais pratiquement inexistante au nord du Cap Vert.

Telles sont les principales remarques que l'examen rapide de votre document m'ont permis de faire. A la vue du document en langue française, il me sera possible de faire des commentaires plus complets."

Quotation from Dr. Sahrhage's reply of August 12, 1969:

"Your comments on the draft seem to be quite adequate to us and we shall certainly take them into consideration when further extending and revising the draft.

We agree that it will be necessary to determine further the fish species which require particular attention during the Cooperative Investigation, along the lines you suggested. The reason why we did not refer in the draft specifically to the problem of over-exploitation of demersal species and of their protection is that, as you know, a Working Party on Regulatory Measures for Demersal Stocks under CECAF is expected to deal with this aspect."

3. Quotation from a letter of August 6, 1969 from Prof. W.S. Wooster

"In reference to your letter of 23 July, I have looked over the draft plans for work between Gibraltar and Dakar. I think the paper as it stands serves the useful purpose of stimulating thought about development of these investigations. Although I do not have specific recommendations for revising the paper, I have the following general comments:

1. I have never been satisfied with "northern part of the eastern central Atlantic" as a geographical designation. The word "central" is confusing because Pacific workers think of central as falling between western and eastern. Personally I prefer "southeastern north Atlantic".

2. I fail to see the reason for establishing a precise navigational system for investigations dealing with the water and the biosphere. According to M. Tomczak, LORAN coverage is adequate in the region. Only if there were a major component of geophysical and geological work would precise navigation be essential.

3. With regard to geological and geophysical investigations, there are relevant suggestions in the Ponza report. It is also worth noting that the SCOR/UNESCO/IUGS Working Group on East Atlantic Continental Margins has in mind to stimulate work in this and nearby regions.

4. I would be surprised if funds were available in the next few years to support a large-scale, formally organized, intergovernmental investigation in this region. On the other hand, I suspect that there is a significant number of individual scientists who are now interested, or could become interested, in devoting their energies to the study of this region.

5. At this stage, I think it is much more important to identify and bring together scientists who actually plan or wish to work in the region, rather than elaborating a formal structure for a project that is nothing unless it has scientific support. This may be a task for SCOR, ACMRR and ICES rather than IOC."

ORGANISATION MÉTÉOROLOGIQUE MONDIALE

S É C R É T A R I A T

Genève - Suisse

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Genève, 1 September 1969.

Dear Dr. Jackson,

Mr. Veranneman has drawn my attention to further developments concerning the plan for an International Co-operative Study of the northern part of the eastern central Atlantic. If further planning shows that the integration of a meteorological programme or meteorological advice in any form is desirable, I can assure you that WMO is willing to collaborate through its AGOR in every way with SCOR, ACMRR and other bodies concerned in the planning and co-ordination of the co-operative study.

Therefore, I am pleased to inform you that Dr. Masao Hanzawa has been appointed as contact officer for the project.

Yours sincerely,

(signed) K. Langlo  
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Professor W. Wooster, SCOR