

MITTEILUNGEN

des Komitees für wissenschaftliche
Zusammenarbeit mit Kuba

JULI 1974

BEILAGE ZU NR. 8

INFORMATIONEN DER FACHGRUPPEN

BIOLOGIE / BIOCHEMIE / CHEMIE / LANDWIRTSCHAFT
/ MEDIZIN UND PHYSIK / GEOPHYSIK

KOWIZUKU

Group of: Biology / Biochemistry / Chemistry / Agricultural Science / Medicine

PROJECT PLAN FOR 1974

Project Nr.: BioChAgM 1/74

1. Summary

Nr.	Keyword	Initiative	Supported Cub. Group	Aims	Products of work	Material	Costs	Start	End
1/74	Library of catalogues	Univ. La Habana, KOWIZUKU	Vicerectorado de Economía, Universities of La Habana, Las Villas, Oriente	provide cuban universities with informative material for planning investments for laboratory equipment	-triple collection of catalogues and price lists -coordination of collection with other european committees	catalogues	-	Jan.74	Nov.74

2. Description of Project

a) Short description: In the field of biology, biochemistry, chemistry, agricultural sciences and medicine 3 collections of catalogues on laboratory equipment, chemicals and literature shall be sent to the universities of La Habana, Las Villas and Oriente. The aim of the project is to increase the knowledge on technical details and prices of commercially available equipment for research work and thus increase the effectivity of planning the annual investments by cuban laboratories.

After an initial collection the project will continue with up to date information by the european committees. The approach to completeness shall be accomplished including the participation of other european committees in the realization of the project.

b) Origin of the Project and Cuban Interest:

The need for an economical annual plan of investments for every research laboratory and the uni-

versity as a whole is the source of high interest of cuban scientists in having available detailed information on technical data and prices of commercially available equipment in their field. Contrary to the situation in Europe the direct communication of scientists and producers of equipment is almost impossible in Cuba. The little amount of informative material in Cuban universities does not allow an allround comparison of products from different producers. The missing price lists inhibit the planification on the basis of economical criteria.

At present this problem well known to Cuban scientists can be easily reduced by the European committees but can hardly be solved by the Cubans themselves, due to difficulties we are all familiar with.

c) Supported Cuban Group: In an initial phase the "vicerectorados de economía" of the three Cuban universities shall be supplied with one tentative complete collection of catalogues and price lists. In a second phase all additionally catalogues shall be distributed on the level of interested faculties.

Die Arbeit des Komitees wächst schneller als seine Finanzkraft. Deshalb bittet das Komitee dringend um Spenden - Spenden für die Förderung der Wissenschaft in

KUBA - WO DIE WISSENSCHAFT DEM VOLKE DIENT.

Zentrale: Fakultät für Mathematik
48 Bielefeld
Postfach 8640
Konto : Commerzbank Hamburg
Kontonummer: 391 50045
Stichwort KOWIZUKU

d) Distribution of work: The KOWIZUKU starts with the collection of catalogues and makes a list of producers and their products. In collaboration with other European committees it shall be tried to increase the completeness of the collection of catalogues and the list of producers. All committees order all catalogues available. Besides the catalogues the list of producers is sent to the Cuban universities which then ask the producers again for catalogues in order to obtain as many materials as possible.

e) Capacity of the KOWIZUKU: It will be difficult to collect more than three samples of each catalogue. Completeness of material can only be obtained with regard to producers of the R.F.A. so that the help of other European committees appears to be necessary.

3. Realisation of the project in steps

Step	Product of work	Material	Costs	Start	End
1	-unsystematic collection of catalogues -list of producers and their products	catalogues	-	Jan.74	Jun.74
2	-systematic collection according to list of producers -inclusion of Cuban universities and other European Committees in the project	catalogues	-	July 74	Nov.74

Project Nr.: BioChAgM 2/74

1 Summary

Nr.	Keyword	Initiative	Supported Cuban group	Aims	Products of work	Material	Costs	Start	End
2/74	Library of data and methods	Kowizuku, various Cuban scientists	Vicerectorado de Investigaciones	Library of data and methods to support experimental research work in the field of biology, biochemistry, chemistry, agricultural science and medicine facilities to manifold material of the library on request by laboratories and other universities manifold the catalogue of the library and distribution to interested departm.	Edition and manifolding of the catalogue	1 rapid fotocopier 10.000 sheets of paper literature catalogues	2.200.- DM 800.- DM 6.000.- 800.-	Febr. 74	Nov. 75

2. Description of the Project.

a) Short description: There should be set up a library at the university of La Habana with special regard to methods and data often used in experimental biology, biochemistry, chemistry, agricultural science and medicine. In order to make available the information of the library to all interested laboratories detailed catalogues of the information present in the library are manifolded and distributed to all interested laboratories. The library is equipped with a rapid fotocopier so that information of interest can be located in the catalogue and received by every laboratory on demand as fotocopy. When this library has approached some completeness, it shall be maintained on up to date information by the university on the basis of information regularly sent by the European committees.

b) Origin of the project and Cuban interest: Several members of the KOWIZUKU, and other foreign scientists giving courses in Cuba or engaged in research work, often missed adequate literature on methods and scientific data often used in the laboratory. Information of this type in Cuban libraries is very incomplete and distributed over several libraries far away from each other. The possibilities to have photocopies of selected material are poor and time-consuming. To find articles of special interest is difficult. The libraries of the university of Las Villas and Oriente are equipped even worse. The economic blockade partially results in an information blockade and it is hardly possible for Cuban responsables of libraries to obtain sufficient up to date information on the products of worlds publishing houses. Therefore it is of high interest for Cuban scientists and those who help in the development of Cuban science to fill this gap in the sense described above.

c) Cuban group to be supported: All Cuban laboratories working in the fields covered by the library. This library may be part of the "vicerectorado de investigaciones" or be attached to another already existing library.

d) Distribution of work:

A. KOWIZUKU

- a catalogue of the necessary content of the library (fotocopies of title sheets and content of each book of interest separated with respect to special research fields);
- after this catalogue has been checked for books already present in La Habana: distribution of investments among the University of La Habana and European committees to buy the rest;
- buy a rapid fotocopier and supply it with sufficient paper;
- manifold the catalogue of literature available in the library and distribution to all interested research departments;
- steady information on new publications.

B. Cuban contribution

- information on the literature of the catalogue already available in La Habana;
- participation in the investment for new books;
- distribution of information on the library.

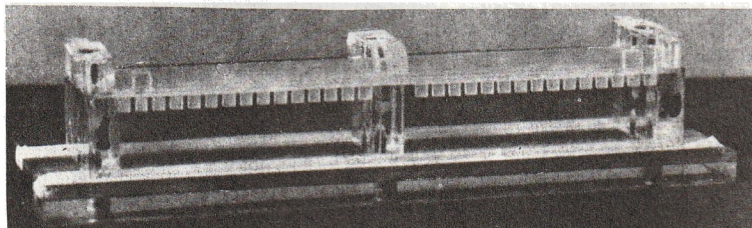
C. European committees other than KOWIZUKU

- participation on the investments.

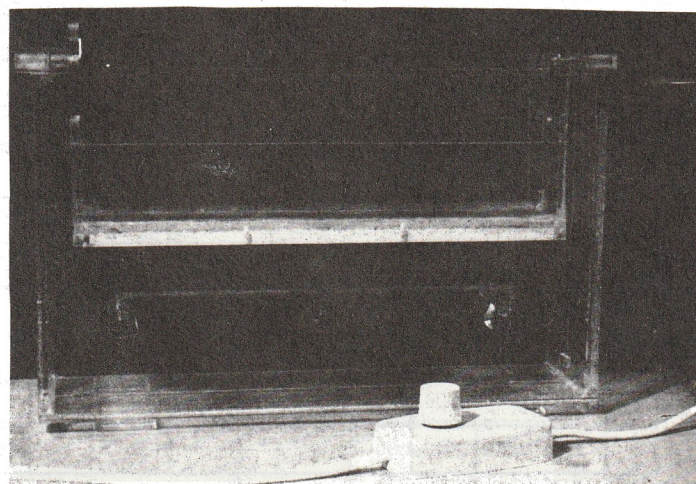
e) The capacity of the KOWIZUKU is sufficient to perform the project in the sense mentioned above.

3 Realisation of the project in steps

Step	Product of work	Material	Costs	Start	End
1	__ catalogue of necessary literatur in the library __ supply the library with a rapid fotocopier	1 rapid fotocopier 10.000 sheets of paper	2.200.-DM 800.-DM	Febr. 74	April 74
2	__ coordination of investments for books with Univer- sidad de La Habana and other European committees __ contribution of investments for books __ manifold of the catalogue	literature catalogues	3.000.-DM 500.-DM	May 74	Aug. 74
3	__ extension of the library to other research areas: __ physics, oceanography etc. __ second contribution of investment for books	literature	1.500.-DM	Sept. 74	Nov. 74
4	__ third contribution of investment for books __ steady information on new books	literature	1.500.-DM	Dec. 74	Nov. 75



Polymerization stand with 2 separation cells and a well former

Electrophoretic tank used for the
mass screening of hemoglobins.

Project Nr.: BioChAgM 3/74

1 Summary

Nr.	Keyword	Initiative	Supported Cuban group	Aims	Product of work	Material	Costs	Start	End
3/74	fotocopy service	Medical Fa- culty of University of La Haba- na, Kowizuku	All interested faculties of Cuban universities	to provide fotocopies of original articles not available in Cuba	__ fotocopies __ order sheets for fotocopies	Current contents (Life Sci- ence + Weekly sub- ject index) Current contents (Agricuilt.)	180¢ per year 120¢ per year	Jan. 74	con- tinued

2. Description of the Project:

a) **Short description:** The possibilities of the members of the KOWIZUKU to make fotocopies of literature not available in Cuba should be organized as a copy service for Cuban scientists. The service includes the subscription of the Current Contents Life Science and Agricultural Science by the KOWIZUKU and their being sent on the most rapid way to the "vicerektorado de investigaciones" of the University of La Habana in order to provide Cuban scientists with new information on their research projects as soon as possible.

b) **Origin of the project and Cuban interest:** From the beginning of its activities the KOWIZUKU has been asked for fotocopies of original articles by Cuban colleagues. However, this was performed in a rather disorganized way. The interest of Cuban scientists in using a fotocopy service in order to increase the effectivity of their research work has its origin in the fact that many journals in their libraries are incomplete or even missing and that the time between the publica-

tion of the original article and the appearance of the corresponding journal in the Cuban libraries varies from at least six months to about 1,5 years with deleterious effects on some research programs in terms of economy.

c) **Supported Cuban Group:** All Cuban research departments working in biology, biochemistry, chemistry, agricultural sciences and medicine.

d) **Distribution of work:** Subscription of CC Life Science and Agricultural Science and mailing to Cuba is done by the KOWIZUKU via the Cuban Embassy in Paris. The utilization of the fotocopy service is organized by the "vicerektorados" and faculties of Cuban universities. Other European committees shall be asked for subscription of the Current Contents to be sent to the universities of Las Villas and Oriente.

e) The capacity of the specialist group mentioned above is sufficient to perform the project. About 100 original articles of normal size can be copied per month.

3 Realisation of the project in steps

Step	Product of work	Material	Costs	Start	End
1	__ Subscription of Current Contents, mailing to Cuba __ Manifold order forms for fotocopies	Current Contents (Life Science + Weekly Sub- ject Index) CC Agriculture	180¢ 120¢	Jan 74	April 74
2	__ fotocopies on request	Fotocopies	50.-DM per month	May 74	continued

see next page for a specimen of the order form.

Comité Aleman para la
Colaboración Científica
con Cuba (KOWIZUKU)

Fakultät für Mathematik

D-48 Bielefeld

Postfach 6640

R.F.A.

Asunto: Servicio de fotocopias

Pedimos fotocopias de los trabajos originales siguientes:

Autores	Titulo	Revista	Vol.	Pág.	Año

Las fotocopias estan determinadas para:

- Ramo de Investigación: Matemáticas-Biología-Bioquímica-Química-Biomedicina-Agropecuaria-Física-Oceanografía-...^{+) otras}.....)
- Facultad:.....
- Departamento:.....
- Proyecto de investigación:.....
- Autores:.....
- Dirección completa para el envío:

Nota:

Fecha:

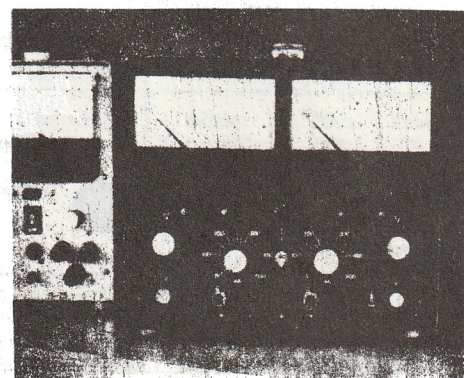
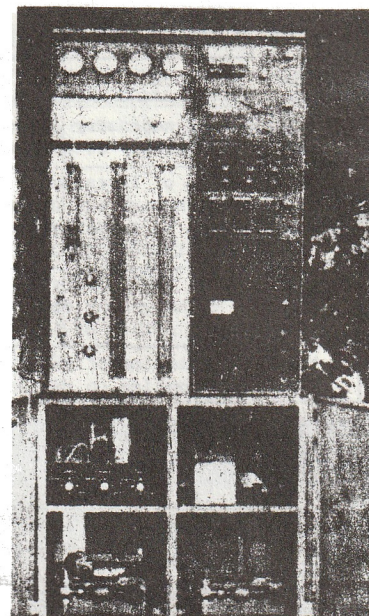
Firma:

^{+) Subrayar el ramo correspondiente}

Project Nr.: BioChAgM 4/74

1 Summary

Nr.	Keyword	Initiative	Supported Cuban group	Aims	Product of work	Material	Costs	Start	End
4/74	literature for courses on bio-chemical methods	Departamento de Genética CENIC, Kowizuku	Docents for biochemistry and similar specialities	provide Cuban scientists with material to give basic and advanced courses on biochemical methods and to enlarge their own knowledge in this field	Selected material useful for courses in: electrophoresis and isoelectric focussing; thin layer chromatography; column chromatography; gelchromatography; gas chromatography; isolation of cell structures; preparative cell culture; concentration of macromolecules; photometry; scintillationspectrometry; spectrophotometric determination of enzy-	literature from project 2/74 fotocopias of original articles bindings for the material manifold selected material	--- 500 DM ---	June 74	Nov. 74
				mes; histochemical demonstration of enzymes; qualitative and quantitative immunological determination of antigens					



Scientific instruments built in Cuba by CENIC. From Granma, official organ of the Communist Party of Cuba, January 27, 1974.

shown on page 3:

Instruments built in cooperation of La Habana University and Kowizuku. From: Heredero, L., H. Granda, J.A. Suarez Aguilar and K. Altland: An economic high speed electrophoretic screening system for hemoglobin S and other proteins. Humangenetik 21, 167-177 (1974)

2. Description of the Project

a) Short description: Informative material in the literature useful for professors to give courses on biochemical techniques should be selected according to the items mentioned above and presented together with the project 2/74 to the "Vicerectorado de Investigaciones" and "Docencia" of Cuban Universities in order to enable Cuban Scientists to give courses and enlarge their own knowledge in the field independent from visits of foreign scientists. The material should include literature on didactics and methodics, important original articles, a course handbook for students and a guide to more special literature to be found in a library presented with project 2/74.

b) Origin of the project and Cuban interest: It is a general experience of Cuban responsables for summer courses presented by foreign scientists that - with the progress of Cuban scientific development - many of these courses can now be given by advanced Cuban scientists themselves. The only major problem is that the possibilities of foreign scientists and that the accumulated experiences in a didactic and methodic sense is low due to the missing tradition in this field. On the other hand countries with a long tradition can easily supply the necessary material they are using at their own universities. The summer courses given by foreigners are expensive and the Cuban financial possibilities are rather limited. With the development of Cuban sciences there increases the interest to import more special techniques by selected invitation of

correspondingly qualified foreign scientists. However, this is only possible if the more basic knowledge can be distributed by the Cuban scientists themselves.

The aim of this project identical with a high Cuban interest is to make the performance of basic and more advanced courses independent from foreign help.

On the other hand special courses of foreign scientists are much more effective if the theoretical material presented in the literature can be studied in Cuba to some degree before the special course is started since the practical part is most important and thus could be relatively enlarged within the time limits of the course. Thus, this project together with project 2/74 should also provide the corresponding facilities for special courses.

c) Supported Cuban group: All departments using biochemical techniques and representative for them the "Vicerectorados" of the Cuban universities.

d) Distribution of work: The literature is part of project 2/74. The selection for basic and special courses is made by the specialist groups of all European committees and eventually by Cuban specialists in collaboration. Cuban universities together with the committees manifold the selected material within the needs and possibilities.

e) Capacity of the KOWIZUKU: It is not sufficient from a qualitative and quantitative point of view. Collaboration with other European committees is, therefore, indicated.

3 Realisation of the project in steps

Step	Product of work	Material	Costs	Start	End
1	rough collection of available material for each course plans for courses	-----	--	June 74	Aug. 74
2	coordination of course-contents with project BioChAgM 2/74 distribution of different courses to different committees for detailed preparation together with Cuban responsables	-----	--	Sept. 74	Sept. 74
3	special preparation of courses distributed to the Kowizuku	see 2/74	--	Oct. 74	June 75
4	manifold the courses	literature	?	Sept. 75	Nov. 75

KOWIZUKU

Group of: Physics / Geophysics

REPORT ON COMPLETED PROJECTS 1972/73

Completed Project Nr.: 1/72, project report

Project Nr.	Keyword	Initiative	Supported Cuban group	Start	End	Responsible	Product of work	Material	Costs
Ph/Geo 1/72	Rearrange the curriculum for physical oceanography, phase 1	Kowizuku	Escuela de Geografia de la Universidad de La Habana	Jan. 71	Nov. 73	Matthias Tomczak	2 summer courses 2 mimeographed manuscripts	books periodicals photo copies	4420.-DM 370.-DM 135.-DM

a) Project description

The project resulted from an offer of the Kowizuku to arrange a summer course on a subject of physical oceanography. In response to the offer, the School of Geography (Escuela de Geografia) of La Habana University asked for a course on "dynamics of ocean currents" to be held in 1971. The course has been held and has been accompanied by a mimeographed manuscript.

During the summer course it became clear that the Cuban authorities had arranged the course as part of a plan to rearrange or to establish a curriculum in physical oceanography.

As a consequence, it was planned during 1971 to incorporate, for the near future, the aid of the Kowizuku into the following aspects of the evaluation of a curriculum:

aa) Supplementing the lectures offered by the university, preparation of summer courses serving as "prototype courses" to be continued and repeated according to the cycle of lectures by Cuban professors. This has been achieved by arranging, in addition to the first summer course of 1971 "dynamics of ocean currents", another course during 1972 on "tidal theory and prediction", supported by a mimeographed manuscript and copies of relevant literature.

ab) Aid in the enlargement of the material for teaching. Several shipments of books during 1972 and 1973 served for this purpose.

ac) Discussion of the new curriculum. This discussion took place during the summer course in 1971 and 1972 and has been continued by mail, and some exchange of planning material and ideas is still taking place.

ad) Aid in improving the information possibilities of the Cuban professors of oceanography. Subscriptions of 6 oceanographic periodicals, starting in 1972, and of 3 more with the beginning of 1974, served for this purpose.

b) Origin of the project and Cuban interest

Cuban interest in establishing possibilities for studying marine sciences in general (oceanography, marine chemistry, marine biology) is extremely large. Cuba enlarged its fishing fleet tremendously with the most modern units and yielded rates of increase of its fisheries which have been considered spectacular by the Food and Agriculture Organization FAO. Although the Cuban fishing fleet has as yet regularly surpassed the annual plans, consolidation of the success is on the long run possible on the basis of scientific control and advice only. In the field of physical and chemical oceanography there exists a wide need of scientists for controlling the danger of pollution of the coastal waters occurring as a consequence of rapid industrial development, for the enlargement of the rapidly growing ports and for the establishment of navigational aids concerning data on currents, tides, waves etc. It is the aim of the Cuban oceanographic programme to educate on the long run the scientists necessary to perform these tasks within the country. At the present stage of Cuban oceanography this seems nearly impossible. Therefore a central task of the oceanographic institutes is the establishment of a curriculum which meets these necessities.

c) Participation of the Kowizuku

It has been said already that the Kowizuku participated with two "prototype courses" during the summer schools of 1971 and 1972 which have been designed in a way which makes possible a repeated presentation as a course for a semester. In view of this, mimeographed manuscripts have been prepared for both courses.

An important part of the committee's participation was the discussion of the curriculum. There are in Cuba 4 institutes working in marine sciences, 2 of which are working in research on a relatively high level while the other two are mainly responsible for teaching. Physical oceanography is taught at the Escuela de Geografía of La Habana University. This corresponds to the situation often encountered in countries of the so-called "3. World" but equally well in less advanced industrialized capitalist countries, that oceanography, which a few decades ago still was a descriptive science similar to geography, describing the oceans and their contents, is still taught as part of geography in agreement with this old concept.

Modern oceanography today has been developed on a basis of theoretical and experimental physics and is therefore related to mathematics and hydrodynamics. Oceanographic institutes in industrially developed countries are money-consuming tools for research and teaching of applied and theoretical physics similar to scientific centres of nuclear physics or electronic data handling and computing techniques. The Kowizuku thus proposed to the Cuban authorities to rearrange the education and to include especially hydrodynamics in theory and applications. An increased participation of the Cuban research institutions which partly already were working in that direction in the students' education seemed helpful.

The excellent mathematical knowledge of Cuban students of geography or oceanography proved a very good starting condition for a rearrangement of the curriculum. Already in 1971 the Cuban concept of geography as a science related to the society was developed much further than any curriculum in the same field of a capitalist university. Geography applied to the solution of social problems is impossible without mathematical knowledge, and the curriculum of geography in Cuba includes all courses in mathematics up to the level of the German Physik-Vordiplom (an examination terminating the first half of the curriculum in physics). This is equivalent to the conditions of mathematical knowledge of the curriculum of oceanography in the Federal Republic of Germany (In the FRG the curriculum of geography does not contain any lectures on mathematics).

d) Long-term cooperation

It need not be said that such a profound rearrangement of the education which even influences the definition of the basic working aims of the Cuban institutes, cannot be performed during the summer courses. The discussion of the curriculum between the Cuban scientists lasted for more than a year and resulted at the end of 1973 in a first draft of a curriculum adapted to the present possibilities of Cuba and making use of the resources of all oceanographic institutions. As long as this first draft did not exist, further summer courses could not be of any use. At present practical application of the curriculum has begun. The Cuban authorities hope to receive from 1975 on continued participation of the Kowizuku through "prototype lectures" and other activities fitted to the curriculum. Before the Cuban education in oceanography will be done by Cuba all by itself on the scientific level Cuba wants to achieve, the aid of the Kowizuku possibly will be useful for another few years.

e) Summary of the results

Following discussions with scientists sent by the Kowizuku, Cuba has in 1973 developed a new curriculum for physical oceanography. The Kowizuku initiated a discussion on the role of the 4 institutes of marine sciences in the education of physical oceanographers which led to a rearrangement of the cooperation of the institutes. During 1974 the new curriculum will be applied the first time.

The committee participated in the implementation of the education through 2 "prototype courses" for graduate students.

It helped in the enlargement of a library for the students which in 1971 consisted of about 10 books only, by sending another 30 books. As all 4 institutes of marine sciences are situated within the area of La Habana, the support of the library results at the same time in an enlargement of the information possibilities of the scientists of all 4 institutes which is additionally supported by subscription of periodicals.

f) Material support

The summer courses "dynamics of ocean currents" of 1971 (Matthias Tomczak) and "tidal theory and prediction" (Paul H. LeBlond) of 1972 were part of the project. Additional support has been given through:

fa) Mimeographed manuscripts of both courses, given in numerous copies for use by students of future courses where the subject is covered by Cuban professors.

fb) copies of additional papers serving as material for the preparation of the course by a Cuban professor; total value 135.-DM.

fc) Textbooks for an enlargement of the library for students of oceanography; total value 4.420.-DM.

fd) Subscription of 6 periodicals: Tellus, Deep-Sea Research, Journal of Geophysical Fluid Dynamics, Journal of Marine Research, Journal of Physical Oceanography, Estuarine and Coastal Marine Sciences; total value 370.-DM per year. Starting with 1974, subscription of 3 more periodicals: Journal du Conseil, Journal of Fish Biology, Crustaceana.

g) Difficulties encountered

The central problem of the initial phase of the project was the complete lack of information on the state of Cuban oceanography which could only be overcome during the summer course of 1971. Once the Cuban necessities were known, the contents of the curriculum could be presented in part as "prototype lectures" which, taking into account the high level of mathematical knowledge and the degree of general oceanographic knowledge, continued at the level of the Cuban students. It turned out impossible to overcome the lack of information before the beginning of the summer course by correspondence because of the extreme differences of the concepts of oceanography in Cuba and in federal Germany preventing understanding of each other's arguments.

With the definition of the common task to establish a completely new curriculum a new difficulty occurred because, as a consequence of the proposals of the Kowizuku, the definition of the work of the Cuban institutes and the existing distribution of the work among them should partly be discussed. The impression of the Kowizuku at the beginning of 1973 was that the critical comments on the existing organization of oceanography in Cuba - which the Kowizuku always stated in form of proposals for reorganisation - would lead to an end of the project without successful results. In early 1973 the Cuban authorities cancelled a summer course which had been defined jointly by Cuba and the Kowizuku for 1973 during the summer course of 1972. In view of the undefined situation of the curriculum the Kowizuku supported this decision; however, the project could not be regarded as successfully terminated under these circumstances.

During 1973 cooperation between the university and the institutes of marine sciences must have changed very much, possibly as a consequence of the general evaluation of the Cuban educational system and the opening of the university towards units of productive work, leading to the establishment of the first part of a curriculum which includes all

possibilities of teaching and research. An invitation for continued cooperation in 1975 through courses and other activities proves that the basis for an up-to-date education in oceanography has been laid. Thus, the project has been terminated, after a long period of delay, in its first phase. The second phase is expected to begin in 1975.

Completed Project Nr.: 2/72, project report

Project Nr.	Keyword	Initiative	Supported Cuban group	Start	End	Responsible	Product of work	Material	Costs
Ph/Geo 2/72	Computation of the circulation in Bahía de Cienfuegos	Kowizuku	Centro de Investigaciones Pesqueras CIP del Instituto Nacional de la Pesca	Oct. 71	Mar. 74	Matthias Tomczak	1 recommendation report 1 publication (in preparation)	---	---

a) Project description

Bahía de Cienfuegos is a shallow estuary of 20km length and 2-3km width, connected with the Caribbean Sea by a narrow channel. It was the aim of the project to compute the circulation within the bay in order to establish the conditions for an estimate of water renewal and the limits for the amount of industrial waste which the bay might be able to support.

The computation is done by numerically integrating the differential equations of hydrodynamics describing the motions in the ocean as a stratified medium under the control of thermo-haline forces. It is performed on a high-speed electronic computer, the topography of the bay and its climatic conditions serving as boundary conditions for the computation.

b) Origin of the project and Cuban interest

In autumn of 1969, the Centre of Fishery Studies (Centro de Investigaciones Pesqueras CIP) of the National Fisheries Institute already performed oceanographic measurements in the bay in order to obtain information on the environmental conditions for the catch of shrimp. On that occasion, a few current measurements have been performed which cannot be thought, however, as being representative for the bay as a whole since it must be expected that in a shallow bay of complicated topography the circulation displays a complicated pattern. Despite of the inadequate data CIP tried to establish a first estimate of the situation of the bay on the basis of the data. This proves the great interest of the Cuban authorities in an investigation of this kind, which becomes even more clear when considering the situation of Bahía de Cienfuegos:

Cienfuegos is a port of regional importance where several industrial plants have been built since the triumph of the revolution (among others a fertilizer plant, a thermo-electric power plant, the "Tricontinental" bulk loading sugar terminal and the second largest fishing port of Cuba which is under construction since 1971), causing an increase of industrial waste of different type (chemical, thermal etc.). On the other hand, catching of shrimp has been well developed since several decades, and there are projects of developing this into shrimp farming if water conditions assure good results on the long run. Control of environmental conditions and consideration of optimal planning well in advance are an integral part of socialist development of the national economy; scientific investigations form part of this planning.

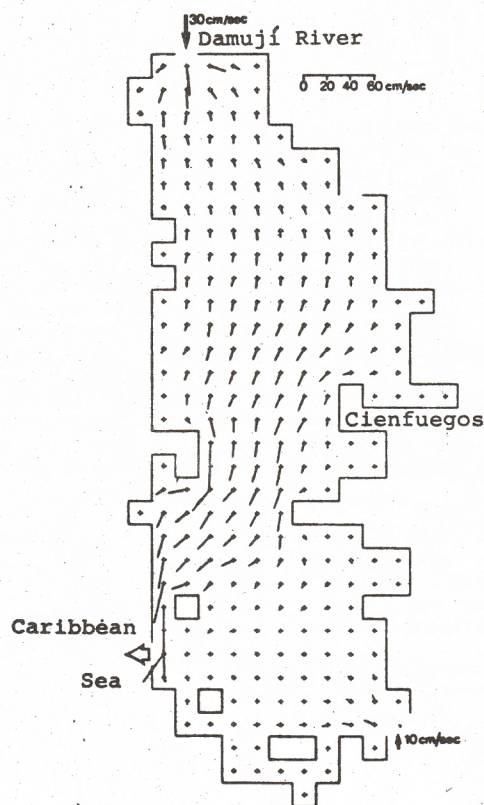
Increasing industrialisation and increased trade caused in 1973 the establishment of the Ministry of the Merchant Navy and Ports which is in charge of the intensified investigation of the environmental conditions and environment protection in the Cuban waters. It has expressed great interest in the project described here and has proposed to perform similar computations for the bays of Nuevitas and Nipe. In Bahía de Nipe the Ministry will perform during 1974/75, in cooperation with the Norwegian Development Service, current measurements, and the needs for data supplying the boundary values as well as control values for the numerical computation will be taken into account in the arrangement of the measurements.

c) Participation of the Kowizuku

The project has been envisaged during a summer course in 1971 when the problem of Bahía de Cienfuegos had been explained to a Kowizuku member during a visit to CIP. The oceanographic institutes do not have access to use of electronic computers at present, the only possibility to perform the computations was in Europe by the Kowizuku. Therefore, the project has been performed entirely by the Kowizuku.

d) Long-term cooperation

The project "Bahía de Cienfuegos" has been terminated for the moment. Continuation at a later date is possible, depending on the evaluation of the report's recommendations by the Cuban scientists and engineers and on the necessity of additional studies. Cooperation in applying numerical methods for the computation of the circulation should, on the long run, be continued by projects covering Bahía de Nuevitas, Bahía de Nipe and other estuaries of the Cuban waters.



Currents in Cienfuegos Bay according to numerical computations.

e) Summary of results

Making use of hydrographic data made available from the Centro de Investigaciones Pesqueras, the distribution of currents and density in Cienfuegos Bay has been calculated numerically on an electronic computer. Comparison of the calculated density field with observational data proves that the numerical model reproduces natural conditions well. The computed currents can therefore be regarded as realistic. The resulting distribution shows a nearly stagnant region of very slow water renewal near and around the port of Cienfuegos; in the remaining area water renewal is fairly good in the northern part during the wet season and well established in the southern part of the bay during the dry season.

Recommendations have been evaluated for establishing more uniform water renewal within the whole bay (for example by dredging passages through sills). Further computations are necessary in order to test the validity of the recommendations.

Because of the uncertainty of present oceanographic knowledge concerning the application of numerical methods in shallow water areas, the results of the project are, to a large part, of principle importance for oceanography since they demonstrate the possibilities of applying the method to shallow coastal areas.

f) Material support

The results have been reported to the Ministry of the Merchant Navy and Ports as a recommendation report. A joint publication with CIP is in preparation.

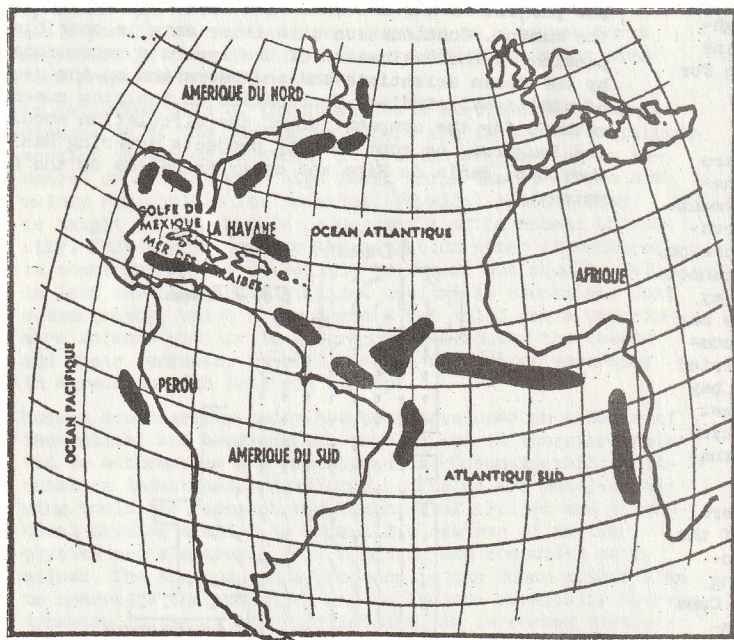
g) Difficulties encountered

Successful implementation of the project has been delayed by about 2 years. Reasons for the delay are, on one hand, the tremendous amount of programming necessary for numeri-

cally solving the hydrodynamical equations for regions of arbitrary shape which could not be tackled by the Kowizuku. Therefore, the project has been performed in cooperation with another scientist who had designed and established a programme for treating this type of problem several years ago. Other scientific work which he had to perform made a straight and rapid treatment of the problem of Cienfuegos Bay impossible.

On the other hand, that the duration of the project has not been foreseen by the Kowizuku in 1971 is a result of not estimating the problem correctly. In 1971 several results of applications of numerical methods for computing the large-scale oceanic circulation existed already, and it was estimated that their application to Bahía de Cienfuegos would not pose any specific problems. While the project was under way it turned out that expressing the processes of turbulent diffusion of momentum and mass mathematically is a much more difficult task in estuarine areas than in the open ocean. This has been recognized a central problem of oceanography since, and the German Research Society, as an example, has made it a primary task within the framework of the oceanographic works sponsored by the Society.

A large part of the project work therefore consisted in establishing the correct mathematical formulation of the problem. The time-consuming investigation of these basic problems has been tackled mainly with the aim of producing useful information on Cienfuegos Bay within a reasonable amount of time. This aim has been achieved at the beginning of 1974. The knowledge gained up to this point provides a basis for a more rapid computation of future projects in similar coastal areas; at the same time, it contributes to the basic research which is expanding internationally at the moment in that field.



Fishing grounds of the Cuban fishing fleets. From Granma, April 14, 1974.

The port of La Habana. From Granma, February 17, 1974.

