

SCOR WORKING GROUP 46 (WITH ECOR/IAHS/ACMRR/UNESCO)

RIVER INPUTS TO OCEAN SYSTEMS (RIOS)

Report of the second meeting, New Haven, USA, 24-26 March 1975

The second meeting of SCOR Working Group 46 was held at the Yale University, Geology Department, at the invitation of Professor K. K. Turekian. The following attended the meeting:

(i) Members of RIOS Working Group

D. Lal, India (SCOR) (Chairman); J.D. Burton, UK (SCOR); R. Chesselet, France (SCOR); D. Eisma, Netherlands (SCOR); F. Fournier, France (IAHS); K.K. Turekian, USA (SCOR); A. Walton, Canada (SCOR). (J.S. Alabaster, E. Eriksson, J.A. da Costa and P. Storrs could not be present.)

E.L. Hendricks, UNESCO consultant for the UNESCO/UNEP World Registry of Rivers participated on behalf of J.A. da Costa.

(ii) Invited Experts

Y. Kitano (Water Research Institute, Nagoya);
J. M. Martin (Laboratoire Geologic Dynamique, Paris)

T.F. Gaskell (SCOR Executive Committee Reporter), R.C. Griffiths (Assistant Secretary IOC) and E.D. Goldberg (Convener, SCOR ad hoc advisory panel on Biogeochemistry of Estuarine Sediments) were invited, but had been unable to attend the meeting.

On the second day of the meeting, Mr N. J. Brown of United Nations Environment Program (UNEP) joined the meeting at the invitation of the Working Group.

I. BRIEF SUMMARY OF DELIBERATIONS

The minutes of the first meeting of the Working Group, Paris, 24-27 June 1974, were approved.

The Chairman, D. Lal, presented a summary of the points made to him by members since the first meeting. The increase in global activities in the study of river-ocean processes indicated that there existed a growing awareness in the scientific community of the importance of such studies.

The Working Group received several interesting documents relevant to the purposes of RIOS: R.C. Griffiths sent reports relating to UNEP, GESAMP and POOL; K.K. Turekian presented a copy of the report of a workshop entitled Continental and Coastal Waters sponsored by the Energy Related General Research Office, Research Directorate, N.S.F.; J.D. Burton discussed a report entitled Basic properties and processes influencing the behaviours of chemical constituents in river inputs during estuarine mixing based on a paper by him to be published in a forthcoming volume Estuarine Chemistry resulting from a meeting held in London in May, 1974. E. L. Hendricks presented a summary of the deliberations of the Group of Experts on the World Register of Rivers Discharging into the Oceans. F. Fournier presented a summary of the study made on Gross Sediment Transport into the Oceans by the International Commission on Erosion and Sedimentation of the IAHS.

Ideas were exchanged on the important scientific problems with which RIOS should be concerned. The Group emphasized the need to answer the important questions posed at its first meeting:

1. How does river water and its sediment load acquire their chemical qualities in response to climatic, geological and cultural factors?
2. What transformations occur when a river meets the sea?
3. What is the ultimate flux of constituents to the open oceans via river systems?

The scientific community is currently engaged in the study of these processes for a variety of reasons. Useful data on the above questions, based on observations of natural and artificial substances in the hydrosphere, are continually becoming available. Such data would

eventually be useful for developing suitable generalized models capable of describing the physical, chemical and biological processes in the river-ocean systems and interfaces, thus advancing predictive capabilities.

However, it was felt that the present rate of developments in this field was far below that desirable and it was considered that the RIOS Working Group, being scientifically oriented, should aim at making a significant contribution to the advancement of the understanding of the influence of continents on the oceans. This, as was stated at its first meeting, was not only of great academic importance but also relevant to man with regard to problems of resources, pollution and coastal engineering.

How can RIOS promote global studies of the river-oceans system? The activities of RIOS which would make an impact would include bringing scientists together, developing scientist training programmes, encouraging studies of particular river-ocean systems, and publication and dissemination of scientific information; they would obviously require an appreciable level of funding which could at best only be met partly by SCOR. In view of this, the Group presented a detailed discussion of its aims and objectives to Mr N. J. Brown, representative of UNEP, and asked him for his views. Mr Brown responded very positively to the need to implement the ideas and work planned by RIOS. He stated that the interests of RIOS were clearly compatible with UNEP's programme of action.

Encouraged by the possibility of being supported by UNEP and realizing that support may also become available from other agencies such as UNDP for certain aspects of RIOS study related to development (e.g. harbour management, resource utilisation), the Group set out to prepare a specific plan of action for RIOS, which is recommended for execution with a high priority and urgency.

II. RECOMMENDATIONS FOR RIOS ACTIVITIES

1. RIOS action plan

It was considered that one of the most important contributions which could be made by the RIOS Group would be the active encouragement of the study of a number of major river-ocean interfaces in the world. Such studies would, over a period of time, yield substantial data on these regions thus leading eventually to comprehensive mathematical modelling of the systems in question.

Reviews of the world's river systems suggest that there is a considerable lack of data and study of several major rivers/estuaries in remote and developing areas of the world. For example, the need for data from the Congo and the Amazon, to name only two such rivers, is obvious. It is clear, however, that such information will only be forthcoming as a result of specific actions.

Firstly the data-gathering process should be encouraged in the countries in question. This can only be accomplished through trained personnel working in the various river/ocean systems and who are provided with the technical facilities needed for such studies.

Recognizing these requirements the Group believes that four specific actions should be undertaken immediately to further these objectives:

- a) Surveys of research activities in RIOS.
- b) The development of RIOS training programmes.
- c) The establishment of field stations for RIOS projects.
- d) The organization of workshops on RIOS subjects.

a) Surveys of Research Activities

A major problem for RIOS is that, because of the multi-disciplinary nature of its subject matter and the frequent use of "grey" literature as an outlet for significant data, it is difficult for workers to maintain a thorough awareness of relevant work. This is a problem for the Working Group generally in its consideration of the field, and more specifically in the identification of material and individuals for workshop contributions. It is particularly important that there should be an adequate awareness of new programmes. To ensure its effectiveness in these directions the Group considers it essential that a primary input of information on present and proposed research programmes should be obtained by correspondence and limited travel by members with responsibilities for particular regions as specified below:

Burton	UK, Australia and New Zealand
Eisma)	
Martin)	Europe, Russia and China
Fournier	Africa, S. America
Kitano	Japan
Lal	India
Turekian	USA
Walton	Canada

These members will present a summary of their findings at the workshop proposed for September 1976, in addition to presenting printed reports.

b) Training programme

The Group believes that the establishment of training programmes for scientific personnel is not one which can be specified completely at this stage since it will depend on many factors including the needs of the country involved and the background and qualifications of individuals seeking training. Nevertheless, in considering the basic objectives of the RIOS programme stated earlier, certain basic areas of needed competence can be identified within the broad fields of oceanography, environment chemistry and methodology:

- a) physical oceanography
- b) marine microbiology
- c) sedimentary geochemistry
- d) atmospheric chemistry
- e) marine chemistry
- f) organic/physical/solution chemistry
- g) isotope-chemistry/geochemistry-geochronology
- h) estuarine mathematical modelling
- i) statistics
- j) laboratory practice; viz., clean laboratories, intercalibration
- k) computer science
- l) oceanographic sensor technology

c) Field Stations

In establishing field stations it was felt by the Group that the following guidelines should be considered:

1. The location of the station should be close to the estuarine zone. Such a location is particularly advisable in view of the short-term variability of estuarine processes.
2. Facilities should be of modular construction so as to give flexibility in operations and adaptability to different areas of study.
3. Basic facilities should include: i) clean laboratories - chemical/biological
ii) living accommodations for 6-12 persons iii) general services including communication equipment.
4. Local docking facilities should be established by the host country.

The use of such facilities is not intended to exclude the more conventional use of oceanography vessels in these studies. Field stations supplement the vessels for extended study over longer periods of time. Furthermore the field stations will provide the focal points where local scientists can avail themselves of needed facilities for RIOS studies as required. Moreover, their existence will allow visiting scientists from other countries to participate in these local projects and lend their expertise to host personnel.

The group identified the following possible locations for the demonstration projects:

1. Amazon
2. A major Chinese river, e. g. Huang-Ho
3. Congo
4. Ganges

d) Workshop

Research within the RIOS concept is at a particularly critical stage of development. Substantial research programmes are few and relatively new, but there is a considerable development of work in this field within institutions that span a wide range of interests, and among workers

with very diverse backgrounds and approaches. There is need for a high-level forum in which scientists of various disciplines and from many countries, working in areas relevant to RIOS, can be brought together to exchange ideas and data, and provide an informed basis for the development of new research programmes. The Working Group proposes that workshops should be held at approximately two-yearly intervals to meet this need and to ensure a continuing exchange and review, with the first workshop ideally to be held in the United Kingdom in September 1976. This RIOS workshop should be restricted to four days of meeting, with participation by invitation only and with a ceiling of 50 participants. Working papers would be circulated before the workshop to ensure maximum opportunity for productive discussion, and invited contributions would be published. The Working Group appointed a Steering Committee consisting of Burton, Eisma and Martin to undertake the detailed organization of the workshop.

Recommendations from members of WG 46 for contributions to the workshop should reach Burton by mid 1975. The following programme was agreed:

Late June	Steering Committee to meet in Europe and formulate a proposed programme and list of participants which will be circulated to the WG 46 for their concurrence.
Early September	Steering Committee to meet with members of WG 46 who will be at the IUGG Assembly in Grenoble, to finalize a preliminary programme, with first choice and reserve list of persons for identified roles. The participation of T.F. Gaskell at this time would be most desirable.
Mid September	Invitations to go out, with deadline of 31 October 1975 for acceptance.
Early November	Reserve invitations to go out as necessary, with deadline for acceptance in early December.
Mid December	Meeting of Steering Committee in Europe to finalize programme, which will be circulated to the WG 46.

The provisional timetable for the workshop is 6 September 1976: meeting of WG; 7-10 September: workshop; 11 September: meeting of WG.

(Submission of brief summaries of papers to be presented or to be considered at the workshop would be required by 30 April 1976.)

2. Outline of Proposal to be submitted to SCOR for implementing the RIOS Action Plan

It was recommended that the above RIOS Action Plan be implemented in three phases along the lines discussed below. A draft proposal will be submitted to SCOR for appropriate action.

Phase I: Preliminary and Exploratory Phase

This phase, which should be completed between July 1975 and September 1976, will consist of two actions:

- A. Identification of ongoing research in RIOS matters
- B. Planning of workshop to be held in September 1976.

"A" will include preparation of descriptive documents on what work is currently being carried out in river-estuary-ocean processes. This would be the key to RIOS programme development as it would define the state of knowledge in this field. During the development of phase I, consideration will be given to the identification of important aspects of estuarine studies in which training programmes for scientists from developing countries will be necessary during phase III. However, should an urgent need develop for a modest pilot training programme before phase III, a separate submission will be prepared for presentation to SCOR. Under item "B" will be included meetings of the workshop Steering Committee review of documents prior to the September 1976 workshop, arrangements regarding the workshop and publication of the deliberations of the workshop.

It is estimated that the financial assistance needed for phase I will be \$10 000, including printing, for A; and \$5 000 for B.

Phase II: Workshop: United Kingdom September 1976

The phase II will be the workshop itself and subsequent publication of the proceedings.

Attendance at this meeting will be exclusively by invitation. The number of participants in the workshop will be forty-five to fifty, including the RIOS Working Group members and accredited observers. The duration of the workshop will be 4 days; SCOR WG 46 will meet on two days, one day before and one day after the workshop.

It is planned to publish the proceedings of the workshop.

Expenses towards transportation and per diem for 45 to 50 scientists will amount to about \$50 000. A sum of \$30 000 may be required for the publication of the workshop proceedings.

Phase III: Demonstration Projects

Phase III, which will immediately follow the September 1976 workshop, would be planned for a duration of 5 years and will consist of the following:

- A. Establishment of field stations
 - 1. Survey of potential sites
 - 2. Building of three facilities
- B. Training programme
- C. Visiting scientists programme
- D. Workshops

The establishment and maintenance of three field stations is estimated to cost about \$300 000 per year. The training programme is designed for training six scientists annually and will cost about \$75 000 per year. The visits of scientists from developed countries to the field stations will cost about \$25 000 per year. The total expenditure amounts to \$2 000 000 for five years.

Two workshops will be convened during phase III; this will need a total sum of about \$200 000.

The three phases involve financial support of about 2.3 million dollars over six years in addition to the costs of meetings of WG 46.

Phase I	\$15 000	July 1975 to September 1976
Phase II	\$80 000	September 1976 to mid 1977
Phase III	\$2 200 000	October 1976 to October 1981
Total	<u>\$2 295 000</u>	

It was strongly recommended that the above RIOS Action Plan be implemented and that support to the extent of 2.3 million dollars be requested from UNEP/UNDP and other organizations, through SCOR. The first such request to be in respect of phases I and II only.

III. OTHER RECOMMENDATIONS AND SUGGESTIONS ON ITEMS PERTAINING TO RIOS MATTERS

The WG noted the report of the Group of Experts on the World Register of Rivers Discharging into the Ocean, presented by E.L. Hendricks, and that of IAHS on sedimentation, presented by F. Fournier. The global data presented and envisaged in these reports constitutes an important source of information for RIOS, and it is important that the existence of any other data of this kind be known to the Group. The Group urges the establishment of the proposed world wide river sampling network and commends such an action. The importance of knowledge of individual chemical components transported by suspended matter in addition to that in dissolved form was stressed. Proposals made by WG 46 for training and the establishment of field stations could help to extend measurement capabilities on a global scale. The Group was informed of the creation by SCOR of two ad hoc advisory panels:

- 1) Biogeochemistry of Estuarine Sediments
- 2) Coastal Lagoons

In noting these recent developments the members were particularly interested in the terms of reference for these ad hoc panels. For matters relating to the biogeochemistry of estuarine sediments the Group recognized an overlap in the nature of the needed scientific information with that already recognized as essential to the broader concepts embraced by the RIOS programme. RIOS cannot disregard biogeochemical processes governing or affecting transfer across the river-ocean interface. On the other hand, the Group does not consider it within its purview to examine

closely the detrimental effects to life in the coastal zone due to man's intervention. The Group hopes that the major effort of the ad hoc panel on Biogeochemistry of Estuarine Sediments would supplement the more process-oriented approach of RIOS with one aimed primarily at detrimental man-induced, perturbation of the coastal eco-system.

The WG had been asked to comment on a proposal for an IBP Handbook on Estuarine Chemical Methods. While generally sympathetic to the idea of such a handbook, the Group felt that considerable caution was necessary in specifying recommended procedures for such variable environments, and that at this stage critical reviews of various areas would be more valuable than the specification of detailed methods. The need for more evaluation and intercomparison was recognized. The workshop proposed by the Group should provide an improved basis for assessing this question.

SCOR was requested to seek active participation of scientists from the USSR and the People's Republic of China in future deliberations of WG 46, bearing in mind the importance of river-ocean systems in these countries.

The meeting adjourned on the evening of 26 March with a warm vote of thanks to K. K. Turekian for the excellent arrangements made for the meeting and to Mr R. C. Griffiths and Mr G.E. Hemmen for their valuable help and guidance.