

# The Aral Sea Basin

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## Preface

There is no doubt that changes to the Aral Sea and a large adjacent region constitute one of the most extreme cases of environmental degradation of the twentieth century. Very large withdrawals of water from the sea's influents, the Syr and Amu Dar'ya, primarily for agricultural purposes, have brought about catastrophic alteration to the form and function of this water-body. As a result, from its position prior to 1960 as the fourth largest lake in the world (according to surface area), the Aral Sea has already diminished in size by about half, its volume shrunk by two-thirds, level dropped by more than 16 metres, and salinity increased more than threefold. Although the pace of the sea's recession has slowed in recent years, it continues unabated.

Environmental impacts include the extinction of endemic species and collapse of the lake fishery, the exposure of vast salt-covered tracts of the former bed of the lake, a significant decrease in the productivity of surrounding crop and pasture lands following the deposition there of wind-blown salts and dust from the exposed bed, the degradation of key terrestrial ecosystems and loss of important habitat, and a change for the worse in the already severely continental climate of the region. This by no means exhausts the list of profoundly negative environmental (and social) impacts brought about by the present, anthropogenically induced regression of the Aral Sea. Indeed, the Project on Critical Environmental Zones identified the Aral Sea as the only one of nine regions examined throughout the world in which '...the wealth or well being of the region's population (was) clearly declining as a result of adverse environmental changes (Meyer, W.B. and B.L. Turner, 'The Earth Transformed: Trends, Trajectories, and Patterns', 302–317 in R.J. Johnston *et al.*, **Geographies of Global Change** (Blackwell: Oxford, 1995)).

A central question, of course, is what can be done to slow the rate of change and ameliorate in the near term those impacts that are the most devastating to the local populace and, in the more distant future, at least partially restore the former ecology of the sea and near Aral region. A consideration of this question, and especially its corollary—what research is needed to resolve the problems—was the core reason why the Scientific and Environmental Affairs Division of NATO (North Atlantic Treaty Organization), in collaboration with Glavgidromet (The Main Administration for Hydrometeorology of Uzbekistan) decided to sponsor an Advanced Research Workshop (ARW) to address these critical issues.

Initial planning was undertaken by one of us (P. Micklin), who has long had an interest and involvement in water resource management in Central Asia, and Dr V. Chub, Director of Glavgidromet. The Workshop was held May 2–5, 1994, in Tashkent, Uzbekistan, and was attended by 81 representatives from a wide variety of countries and organizations both within the Aral Sea Basin and elsewhere. A full, comprehensive and valuable series of papers were presented that provoked intense and sometimes heated debate. The papers included in the present volume represent the more important contributions delivered.

A final session considered the overall aims of the Workshop and the extent to which these had been achieved. A Workshop summary was prepared by a small drafting committee (including the editors of this volume) along with recommendations for further research on critical Aral Sea region issues. These were discussed and approved at a concluding plenary session and are reproduced below.

Several thanks are in order. First, to the Division of Scientific and Environmental Affairs of NATO and its Administrator, Dr L. Veiga da cunha, for providing the funding for the Workshop and for keeping the editors' 'feet-to-the-fire' until editing of these proceedings was completed. Secondly, to Miss Sandra Lawson, Adelaide, for turning our untidy manuscript into camera-ready copy so promptly and meticulously. And thirdly, to our hosts in Tashkent who were generous to a fault, hospitable far beyond the expected, and to whom we hope these proceedings will be of some value and interest. We dedicate these to them.

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January 1996

## **Meeting Summary and Recommendations for Future Research Efforts**

The workshop, sponsored by the North Atlantic Treaty Organization, was held at Glavgidromet, The Main Administration for Hydrometeorology, in Tashkent, Uzbekistan. Glavgidromet was responsible for local arrangements. Dr Philip Micklin, Professor Geography, Western Michigan University, Kalamazoo, Michigan, USA, and Dr Victor Chub, Director of Glavgidromet, were codirectors of the ARW.

One of the purposes of the workshop was to discuss critical scientific issues related to the drastic environmental changes that have occurred in the Aral Sea basin over the past 34 years, chiefly related to the desiccation of the sea itself, and to identify the key research needs related to these. A second goal was to stimulate collaborative research on these subjects among scientists in the new states formed from the former USSR and between these scientists and those from NATO countries.

There were 35 official participants in the ARW from 10 countries (4 NATO, 5 Cooperation Partners, 1 from Australia). Additionally, 46 observers attended the meeting, representing a variety of national organizations, several businesses, and a number of international organizations (NATO, WMO, UNESCO, UNEP). Seventeen speakers from 8 countries (4 NATO, 4 CP, and 1 Australia) gave key-note lectures in either Russian or English. Simultaneous translation into English and Russian was provided. A large number of other participants and observers had the opportunity to comment and/or give brief summaries of their scientific work during the discussions following the formal reports. Copies of formal reports were provided to all participants; revised versions of these will be published by Springer-Verlag.

Speakers and participants in the workshop noted that in the period 1975–1991 in the former USSR much attention was devoted to scientific studies related to the problems which have arisen as a result of environmental changes associated with the drying of the Aral Sea and its main contributory causes. After the breakup of the USSR, the newly independent states of Central Asia (Kazakhstan, Uzbekistan, Kyrgyzstan, Tadjikistan, and Turkmenistan) created the Interstate Council on the Aral Sea Issues to take responsibility for the funding and coordination of research on the Aral Sea crisis and for formulation and implementation of remedial actions. International organizations such as The World Bank, WMO, UNESCO, NATO, UNDP, WHO, and UNEP in recent years have also evinced great interest in helping alleviate the Aral Crisis.

The main recommendations for further scientific work follow. They were formulated by a three person subcommittee, discussed and extensively expanded and revised at the final plenary session of the conference, and put into final form by Dr Philip Micklin (USA) and Dr William D. Williams (Australia).

## **Recommendations for Further Scientific Research**

### ***I. Hydrologic processes and phenomena***

- (1) Studies of the hydrologic effects of the environmental changes in the basin of the Aral Sea.
- (2) Assessment of micro, meso, and macro scale climatic change owing to desiccation of the Aral Seas.
- (3) Identification and evaluation of the intensity and range of salt/dust transfer from the dried bottom of the Aral Sea.
- (4) Computer modelling of key hydrodynamic processes in the Aral Sea.
- (5) More intense investigation of groundwater and its role in the water balance of the Aral Sea basin and sea proper.
- (6) Study of the water balances and hydrology of the Large and Small Aral seas as separate water-bodies.
- (7) Determination of the minimum amount of surface and groundwater that needs to be reserved (from consumptive and polluting uses) for ecological sustainability in the Aral Sea basin.

### ***II. Ecosystems and their changes***

- (1) Continued investigation of biotic (floral and faunal) changes in the Aral Sea and deltas of the Amu and Syr Dar'ya brought about by drying of the Aral Sea with better integration of studies of different aspects of the region's ecology and stress on the employment of contemporary methods of understanding ecosystem dynamics in a holistic framework.
- (2) Development of computer models of ecosystem changes as a means of integrating and understanding the dynamics of very complicated systems.
- (3) Attention to issues of biodiversity and endangered species loss, particularly in the deltas of the Amu and Syr Dar'ya.
- (4) Investigation of how best to use the potential resources of the Aral Sea(s) as they are presently constituted and will be in the coming years; of particular interest in this connection is the possibility of using the Aral Sea(s) for aquacultural purposes, either in an extensive or intensive form.

### ***III. Agricultural production and management***

- (1) Studies of land tenure and use in the Aral Sea basin and how these relate to water use and ecological degradation here.
- (2) Investigation of the extent and nature of water use in the Aral Sea basin and of means effectively to implement water-saving technologies, particularly in irrigated agriculture.
- (3) Evaluation of presently non-utilized and under-utilized sources of water to augment currently fully or over-utilized sources.



**IV. *Medical, health, social, economic, cultural, and demographic issues***

- (1) Studies of demographic dynamics in the Aral Sea basin, of how these relate to environmental and other regional problems, and of means of alleviation.
- (2) Investigations of the economic structure of the Aral Sea region and of means for its improvement.
- (3) Study of the medical and health situation in the Aral Sea region and of means for its improvement.
- (4) Investigation of the legal structure in the Aral Sea basin, both within nations and among nations, and its relationship to ameliorating the most serious environmental problems.
- (5) Studies devoted to developing effective means to monitor the health of human populations in the Aral Sea region.

**V. *Toxic contaminants* (biocides, metals, other organic and inorganic compounds)**

- (1) More intensive study and monitoring of toxic contaminants, including their sources, amounts, environmental pathways, persistence and biological effects, and sinks in the Aral Sea region.
- (2) Development of less harmful substitutes for toxic contaminants and alternative means of controlling pest species of plants and animals.

**VI. *Application of modern technologies***

- (1) Studies and monitoring of hydrology, landscape and ecosystem change, irrigation, and of other appropriate subjects in the Aral Sea basin employing contemporary computerized and remote sensing (e.g. satellite) technologies for data gathering, analysis, organization, and storage; of particular importance is the development of a GIS (Geographic Information System) for critical parts of the region.
- (2) Investigations should be undertaken to determine the optimal means for introducing modern technologies on a broad scale into the Aral Sea basin and for training local scientists and technicians in their use.

## CONTENTS

	Page
<b>Preface</b> .....	iii
<b>Part I: Overview of the Aral Problem</b>	
Micklin, P.P., 'Introductory Remarks on the Aral Issue' .....	3
Ivanov, Y.N., V.E. Chub, O.I. Subbotina, G.A. Tolkacheva and R.V. Toryannikova, 'Review of the Scientific and Environmental Issues of the Aral Sea Basin' .....	9
<b>Part II: The Aral Sea</b>	
Bortnik, V.N., 'Changes in the Water-Level and Hydrological Balance of the Aral Sea' .....	25
Aladin, N.V., I.S. Plotnikov, M.I. Orlova, A.A. Filippov, A.O. Smurov, D.D. Pirulin, O.M. Rusakova and L.V. Zhakova, 'Changes in the Form and Biota of the Aral Sea Over Time' .....	33
Williams, W.D., 'The Aral Sea: A Limnological Perspective' .....	57
<b>Part III: Ecological Changes Around the Aral Sea</b>	
Novikova, N.M., 'Current Changes in the Vegetation of the Amu Dar'ya Delta' .....	69
Keyser, D., 'The Ecological Restoration of Delta Areas of the Aral Sea' .....	79
Kurochkina, L.Ya. and G.B. Makulbekova, 'Ecosystem Changes in the Northern (Kazakhstan) Area of the Former Aral Sea (Priaralie)' .....	87
<b>Part IV: Climatic and Hydrologic Changes Around the Aral Sea</b>	
Razakov, R.M. and K.A. Kosnazarov, 'Dust and Salt Transfer from the Exposed Bed of the Aral Sea and Measures to Decrease its Environmental Impact' .....	95
Kamalov, S.K. 'Climatic and Ecological Effects of the Environmental Changes in the Aral Sea Zone on Karakalpakstan' .....	103

### **Part V: Water Management Issues**

Dukhovnyy, V.A. 'The Problem of Water Resources Management in Central Asia with Regard to the Aral Sea Situation' .....	109
Chembarisov, E.I., 'Hydrochemistry of River, Collector and Drainage Waters in the Aral Sea Basin' .....	115
Schroeder, R.A., 'Transferability of Environmental Assessments in the Salton Sea Basin, California, and Other Irrigated Areas in the Western United States to the Aral Sea Basin, Uzbekistan' .....	121

### **Part VI: Contemporary Technologies for Studying the Aral Problem**

Ptichnikov, A. 'Environmental and Landscape Changes in the Aral Sea Region as Detected from Remote Sensing' .....	141
Ressler, R., 'Monitoring of Recent Area and Volume Changes of the Aral Sea and Development of an Optimized Land and Water Use Model for the Amu Dar'ya Delta' .....	149
Sehmi, N.S. and S.A. Pieyns, 'Water Resources Monitoring in the Aral Sea Basin' .....	161
Williams, J.B., 'Real-time Monitoring of the Changing Environment of the Aral Sea Region: the Role for Low-cost, Local Reception of Satellite Data' .....	167
Zakarin, E.A., 'Problems of Space and Satellite Monitoring of the Aral Sea Basin' .....	175
<b>Subject Index</b> .....	181