

WATER QUALITY DATA REQUIREMENTS OF THE GEMS/WATER PROGRAMME FOR EAST ASIA AND PACIFIC REGION

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Abstract. GEMS/Water is a UNEP Programme that has been operational since the late 1970s. Its main objective is the compilation of a global water quality database for use by UN and other international agencies, universities and NGOs and the assessment of water quality at the global or large-scale regional levels. Water quality data is provided by National governments from their water quality monitoring programmes. Presently more than 100 countries participate in GEMS/Water. Within the Asian region there are 16 participating countries that report data from 229 stations. In 2001 Mongolia became the newest participating country. If GEMS/Water is to fulfill its mandate of providing accurate assessments of the status of water quality in the East Asia/Pacific region, it is essential that all countries in the region participate in the Programme and that data from a much greater number of monitoring stations becomes available.

HISTORICAL PERSPECTIVE

Reversing the damage already created by human activities will be complicated and expensive. It will require accurate knowledge as to the state of our water resources and proper monitoring, surveillance and analysis programmes can only obtain this. In 1977 the United Nations Environment Programme (UNEP) initiated a global programme on freshwater quality monitoring, known as GEMS/Water, in co-operation with three other United Nations agencies: WHO, UNESCO and WMO. GEMS/Water is the only UN system-wide programme addressing freshwater quality monitoring at both global and regional levels. It provides information not only for making “snapshots” of existing water quality, but also for providing information for effectively managing these resources.

The GEMS/Water programme addresses global freshwater quality issues through a global network of monitoring stations located in rivers, lakes, reservoirs and groundwaters. At its inception, GEMS/Water monitoring stations were designated at specific locations: points of water abstraction for public supply, important fishing and recreational areas, points of abstraction for agricultural uses,

river confluences and where rivers discharge into lakes or oceans, and where international boundaries are crossed. By the end of 1996, >1 million data points had been stored in the GEMS/Water database, located at Environment Canada's National Water Research Institute in Burlington, Ontario, from >500 stations in about 70 countries. By 2001 these numbers had significantly increased – there are currently more than 100 countries participating in the Programme, providing data from more than 800 stations. The total number of data entries now exceeds 1.6 million (Table 1) and this number continually increases, as GEMS/Water is a living database.

GEMS/Water initially focused on the collection of data for about 50 different water quality descriptors: e.g., pH, dissolved oxygen, BOD, faecal coliforms, phosphates, nitrates and DOC as well as trace contaminants, heavy metals and toxic organic substances. Analytical quality control exercises were conducted for within-laboratory use as well as for interlaboratory comparison studies. As state-of-the-art analytical techniques become more widely available, the quality and scope of parameters is increasing in the database so that presently data for more than 100 parameters is compiled.

The GEMS/Water programme was reviewed in 1990 by a panel of experts who concluded that emphasis should be shifted from the monitoring of data to the interpretation of data and to the assessment of water quality issues and trends. Some monitoring stations were subsequently modified and new ones added in accordance with the purpose of the underlying assessments. Four monitoring aspects were to be emphasized:

1. Baseline monitoring stations - located in areas where no direct sources of pollutants are likely to be found. These are used not only to establish background levels for essential water quality indicators, but also to determine whether trace contaminants are reaching remote water bodies through atmospheric transport and deposition.
2. Impact stations – located at sites in which there is at least one major use of the water such as drinking water supply, irrigation or wildlife populations.
3. Trend monitoring stations - are intended to provide information on human impacts on water quality. They are primarily located in large river basins that show responses in a moderate time frame to pollution fluxes and changes in land-use.
4. Global river flux monitoring stations - to determine the fluxes of organic and inorganic trace contaminants to the continent/ocean interfaces, as well as water constituents contributing to large-scale geochemical cycles. The latter includes substances containing carbon, nitrogen, phosphorus and sulphur.

The Global Runoff Data Centre (GRDC), a WMO centre located in Koblenz, Germany, does the collection of hydrological data for the rivers monitored in the GEMS/Water Programme.

GEMS/WATER IN THE EAST ASIA-PACIFIC REGION

There are currently 16 countries in the Asian region participating in the GEMS/Water Programme (Table 2). In 2001, Mongolia became a participating country but there are currently no data records in GEMS/Water as transfer of information is in progress. In addition to these Asian countries, Australia and New Zealand are also participating countries.

In order for GEMS/Water to provide effective water quality assessments for the East Asia-Pacific region, it will be necessary to increase the number of participating countries and the number of stations from which water quality data is reported. In addition, UNEP and other UN agencies wish to be able to identify water quality “hotspots” and emerging issues in the world. In order to do this, good quality data is required from a statistically representative number of stations from this very large and geographically diverse region. Furthermore, it is essential that the data be transferred to GEMS/Water with a minimal time delay, which in these days of electronic communication should not be very difficult. However, at the present time, the lag time in data transfers is anywhere from a few months to several years. Clearly this will not permit the identification of emerging issues or hotspots, a key UNEP objective.

Table 1. Number of data entries by parameter group in the GEMS/Water database for WHO designated regions: Africa, the Americas, Eastern Mediterranean, Europe, South East Asia and the Western Pacific.

Region	Phys/Chem	Major Ions	Metals	Nutrients	Organic Contaminants	Micro-Biology	Date Range
AFRA	2021	3916	967	1914	4	339	1978 – 1998
AMRA	33168	35226	31249	27157	3545	9384	1978 – 1999
EMRA	12257	14897	10054	8413	366	2963	1978 - 2000
EURA	112814	119061	126778	98685	11944	18968	1978 – 2000
SEAA	73186	96100	20088	53626	267	13859	1978 – 1999
WPRA	57314	39880	46627	68879	6537	9553	1978 – 2000
Total	290760	309080	235763	258674	22663	55066	1978 - 2000

Note: totals do not add up to 1.6 million as these are only representative parameters.

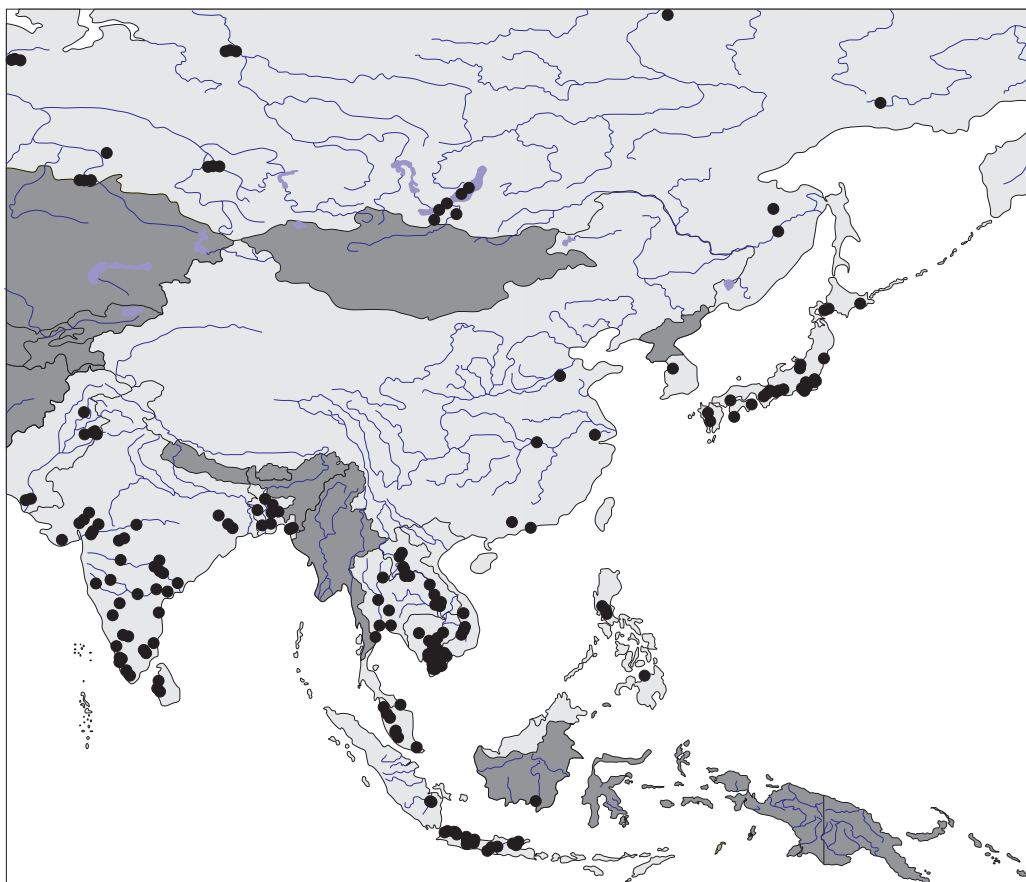


Fig. 1. Distribution of GEMS/Water stations (black dots) in Asia.

Table 2 Asian countries participating in GEMS/Water and the number of monitoring stations per country and the their record periods.

Country	No. of Stations	Record Period
Bangladesh	9	1979 - 1995
Cambodia	5	1993 - 1995
China	4	1980 - 1996
Hong Kong	1	1979 - 1999
India	42	1978 - 1999
Indonesia	22	1979 - 1994
Japan	27	1979 - 1999
Korea	1	1982 - 2000
Laos	15	1985 - 1996
Malaysia	7	1987 - 1996
Pakistan	7	1979 - 2000
Philippines	4	1979 - 1999
Russia	23*	1980 - 1999
Sri Lanka	3	1979 - 1980
Thailand	7	1978 - 1993
Vietnam	52	1985 - 1995

* Total number of stations for Russia is 42, which includes not Asian regions.

Other problems in compiling a global water quality database are that many countries do not use the same analytical techniques, do not have the most up to-date equipment and also may not have the appropriate level of technical expertise. In order to help participating countries with these problems, GEMS/Water offers a modular training course. The course is composed of modules beginning with how to collect water samples and their analysis through to data base formation and the statistical analysis and presentation of data. In addition, a QA/QC exercise for participating laboratories is also offered, which allows a laboratory to assess the quality of their results relative to other laboratories in the world.

CONCLUDING REMARKS

A sustainable supply of good quality freshwater will remain a basic need for human survival and well-being. The activities of the GEMS/Water

Programme are directed at achieving this objective. GEMS/Water provides a means to collect, compile and analyze the relevant data so as to provide the needed information and knowledge to help us manage and use our finite and sensitive freshwater resources in a sustainable manner.

For the East Asia-Pacific region there is currently not full country participation in GEMS/Water and this is an important issue that needs to be addressed. In addition, data from a

greater number of stations that is made available in a timely manner is required to allow GEMS/Water to undertake more effective assessments of water quality in this extremely large region. In order for GEMS/Water to be able to address these problems, a strong international commitment by countries in the region is essential.

For more information on the GEMS/Water Programme, its products and accomplishments see the web site at www.cciw.ca/gems.