Integrated monitoring and assessment systems (IMAS)

P7

Project Leader: Dr Sunil Tennakoon

The role of Project P7 is to produce software tools and guidelines that enable users to design water-quality monitoring plans for their fresh and estuarine waters — plans that are both technically sound and economically feasible.

Project summary

National guidelines exist for deciding on desirable quality for fresh, estuarine and marine waters and for monitoring their condition. The guidelines recognise that some of the hardest things to do in monitoring are to set appropriate objectives for the monitoring program, to choose appropriate indicators and sampling patterns to reveal condition, to balance the preferred intensity of sampling against the resources available, and to analyse and interpret the data. Project P7 sets out to bridge the gap between the ideals of the national guidelines and the realities of local situations and capabilities.

The Integrated monitoring and assessment systems (IMAS) will consist of

- monitoring design guidelines — a suite of linked software tools to help users identify monitoring objectives, develop monitoring hypotheses to focus the monitoring program, build conceptual models, select appropriate core and supplementary indicators, and optimise the sampling program by making auditable trade-offs between cost and statistical robustness;
- data interpretation and assessment methods — software tools for statistical analysis, embedded in decision support system technology, that provide guidance on data preparation, type of analysis, interpretation and reporting protocols for a wide range of end users. The aim is to encourage the use of techniques for data interpretation and assessment which are consistent with study design. The types of data, and the quantity, quality and methods of statistical analysis will affect the recommendations and conclusions derived from the monitoring program.

IMAS will be user-friendly and applicable in regional, state or national water monitoring and assessment programs for freshwater and estuarine systems. They will allow users to combine data from various sources, choose and apply appropriate analysis techniques, manage time-series data, make defensible decisions and report water quality information in manners appropriate for a range of audiences.

Users are expected to include staff of natural resource management agencies, CMAs and consulting firms, who decide on policy and strategy, and/or give technical advice to others, and/or are directly involved in monitoring and assessment.

Nine individual components are planned for IMAS:

- Objective setter — a structured approach to help users identify their management objectives and drivers, to create specific monitoring objectives.
- Conceptual model library — a monitoring conceptual model is a series of working hypotheses that identify the relationships between the site activity and its expected outcome; users will be able to search the library and retrieve from it.
- Indicator selection tool — strategies for choosing core and supplementary indicators for local and regional assessment; suggested methods for collecting and analysing selected indicators; help in selecting physical, chemical and biological indicators based on the monitoring program's objectives and particular context; checkable records of the usefulness of previously chosen indicators.
- Monitoring plan optimiser — users will be able to input objectives and indicators generated from other IMAS tools and produce a design, via a transparent process, that is optimal in terms of statistical power, time, and constraints of cost for the various elements of monitoring programs, such as laboratory costs, QA/QC costs, salaries, etc.

- A guide to techniques for combining data and information from different sources — by combining information of various types it may be possible to infer a causative link between management actions and ecosystem response; available techniques include Multiple Lines and Levels of Evidence (MLLE) and Bayesian Belief Networks (BBN).
- GIS interpretation techniques and tools — utility software that will underpin other products and link to the reporting guidelines; it will consist of a library of algorithms and plug-ins.
- A guide for reporting on monitoring outputs — the elements necessary for meaningful reporting about monitoring programs to various audiences, including visualisation techniques and reporting protocols.
- Water-quality guideline setting and library — a percentile-based statistical software tool for setting local or regional water quality guidelines and testing compliance against these guidelines. The routines within the software are based on the approach described in the National Water Quality Guidelines. The tool allows uncertainty or confidence limits of the estimated guidelines to be calculated as well. This tool consists of a library of guideline values from different sources and has the capacity to store derived local guidelines with associated meta-data.
- Common time-series data analysis techniques — guidance for selecting and implementing existing methods for common calculations based on time series data such as estimated constituent loads of streams, trend detection or pattern recognition, with illustrative case studies. The methods will primarily be those used in other eWater products and those in common usage by eWater partners.

Key achievements 2006

- Completion of the IMAS product development plan.
- Preliminary work on the regional guidelines tool, beta version.

2007–2008 key deliverables

- Single web-based one-stop shop for monitoring and assessment tools.
- Version 1 beta-tested monitoring plan decision-support system, including:
  - a monitoring objective builder,
  - an indicator selection tool.
- Version 1 regional water quality guidelines tool.
- Beta-version of time series data manager (e.g. trends or pattern analysis, loads estimation).

The project team

Project leader Dr Sunil Tennakoon is employed as a Principal Scientist at Freshwater and Marine Sciences with the Queensland EPA. He is responsible for designing and developing computerised decision support systems for water management and provides assistance for catchment hydrology modelling. Sunil has been involved in a number of water quantity and quality-management research projects in several countries.

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The P7 team also comprises staff of these eWater partner organisations: Monash University, The University of Newcastle, The University of Melbourne, University of Canberra, SA Department of Water Land and Biodiversity Conservation, NSW Department of Natural Resources, Queensland Department of Natural Resources and Water, Environment ACT, Victoria Department of Sustainability and Environment, CSIRO Land and Water, EPA Victoria, Sydney Catchment Authority, Gippsland and Southern Rural Water.