MONITORING PROGRAMS AND ENVIRONMENTAL RESEARCH: CAN THEY COMPLEMENT EACH OTHER?

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Abstract
Monitoring programs, although focused in scope and space, can initiate dedicated environmental research of extensive general scope. Careful analyses of the monitoring results are the first step in identifying general environmental questions worth pursuing, complementing and broadening the monitoring studies.
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Regular monitoring programs aim at supervising the influence of anthropogenic discharges on the marine environment and as a warning system to protect the environment. Compared to basic research, monitoring is more specific and adapted to the particular environmental risk posed by a specific activity, limited in space and scope. In Israel, discharge of industrial and municipal treated effluents into the sea is regulated by a strict permit system granted by an inter-ministerial committee. Monitoring of the composition of pollutants in the effluents and monitoring of the marine environment at the discharge area are among the requirements for receiving a discharge permit. Therefore, while environmental research suffers from decreasing financial support, monitoring programs are required by law and continue to be funded.

However, even in specific monitoring programs one can find interesting and unexpected findings that can be translated into scientific questions worthy of dedicated research. For example, three "hot spots" of total mercury concentration in the sediments were recognized along the Israeli Mediterranean coast within the framework of different monitoring programs: 1.the northern part of Haifa bay, opposite a chlor- alkali plant, 2. the southern part of Haifa Bay, opposite the Qishon estuary and 3. the marine disposal site of excess sewage sludge at the southern part of the coast [1-2]. The scientific question raised was why does mercury accumulate in fish and benthic fauna from Haifa Bay and not in fish and benthic fauna from the sewage sludge disposal area, even tough the total mercury concentration in the sediments at all sites are similar (Table 1). A dedicated research on mercury speciation found that ca. 90% of the mercury at the sewage sludge disposal site was bonded to humic matter via sulfur or bonded directly to sulfide in the mineral phase and therefore unavailable to methylation and not bioavailable.

Tab. 1. Mercury at three locations along the Israeli Mediterranean coast.

Site	Source	Hg sediment $\mu g\ g^{-1}$ dry wt	Hg species	Environmental effect
Northern Haifa Bay 3-12 m water depth	Electrochemical industry	ca. 0.25	Probably Hg^0 and Hg_{inorg}^{+2}	Elevated concentrations in sediments, fish and benthos
Qishon estuary 10-12 m water depth	Unknown	ca. 0.25	Unknown	Elevated concentrations in sediments and fish
Sewage sludge disposal site ca. 38 m water depth	Sewage sludge from municipal sewage treatment plant	0.005-1.4 average of 0.26	Associated with organic matter and sulfides	Elevated concentration in sediments

An additional example is chromium anomaly found during regular monitoring at the southern Mediterranean coast of Israel. Chromium concentrations are higher than expected in the sediments along a narrow stripe at ca. 15 m depth and are associated with high concentrations of Fe, Mn, and to a lesser extent Zn. The scientific question that cannot be answered at this stage is what is the source of chromium? Is it natural or anthropogenic? The question has ramifications into the use of sediment quality criteria in the area.

These two examples, out of many others show that monitoring programs, although focused in scope and space, can initiate dedicated environmental research of extensive general scope. Careful analyses of the monitoring results are the first step in identifying general environmental questions worth pursuing, complementing and broadening the monitoring studies.

References

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