

Introduction

With the signing of the Settlement Agreement between Public Utilities and environmental groups in 1980, the Hudson River assumed a unique role as an example of an environment that can be protected and restored when dedicated, concerned citizens work together with commercial interests to resolve conflicts in a fair and equitable way. As the Settlement Agreement ends in 1990, the world will be watching the renegotiation process and its outcome may well point the way to similar agreements the world over.

Research in the Hudson Estuary changed drastically after the settlement. During the controversial decade that preceded the settlement, most of the research was aimed at gathering data to answer specific questions that would aid in predicting the effects of new power plants on the environment and the organisms that depend on that environment. While the data were gathered using the most rigorous methods, state of the art equipment, and the finest analytical techniques, scientists are justifiably disappointed to find that the increase in our understanding of the Hudson ecosystem, and estuarine ecosystems in general, has not been commensurate with the amount of data gathered during the monumental efforts that collectively have been called the Hudson River Ecological Study.

Does this mean that the Hudson River Ecological Study was a badly designed program? Under the circumstances, no. It was designed with the paramount goal of answering specific questions. For example, a large part of the conflict centered on the effects of entrainment of fish larvae. Power plants use tremendous quantities of cooling water and when this water comes from a tidal estuary, it carries with it vast numbers of larvae of fish and invertebrates. Immediately this raises questions of the ability of the larvae to survive entrainment, of the numbers of larvae actually entrained, of the effect of mortality caused by the power plants, and of what measures can be taken to protect the larvae from the power plants. Answering such

questions was enormously difficult and costly, and the data had to be collected in ways that would stand intense scrutiny in the courts. The program had to be designed to give precise answers to specific questions of what goes on at specific sites in this river. There simply was no time for broad general studies that would not promise immediate, useful results. As a consequence we have vast quantities of specific data showing what goes on in the river, but we still have little understanding of why it happens in this way.

After the settlement, the emphasis of Utility-sponsored research changed to studies aimed at evaluating the steps being taken to mitigate the effects of the power plants, focusing on such questions as the effectiveness of the release of hatchery raised striped bass fingerlings, and the advantages of different intake and screen designs. But again, the approach is directed at answering questions of what rather than why.

This volume is the published proceedings of the Seventh Symposium on Hudson River Ecology organized by the Hudson River Environmental Society. It presents a selection of estuarine research studies that have been conducted on the Hudson ecosystem, mostly since 1980, and it is a follow-up on a similar conference held in 1981. The 1981 conference brought together a number of biologists who were directly involved in the Hudson River Ecological Study. The resulting published proceedings were focused on fishery studies, since fisheries played a key role and were highly emphasized in the study. The present volume is much less limited in its scope and reflects the broader perspective of research that is being conducted today. Some of the research presented here was funded by the Hudson River Foundation for Science and Research that was established as part of the Settlement Agreement. Some was funded by the utilities as part of their monitoring programs, and the rest was supported by various other agencies and organizations. The fact that more different institutions are supporting research on the Hudson River is as encouraging as the expanded breadth of topics represented. We take both as indications that scientists are now finding it possible to pursue more basic types of research; research aimed at developing a fundamental understanding of how estuarine systems work as well as research aimed at answering specific immediate questions.

Like the previous volume *Fisheries Research in the Hudson River*, this symposium provides a sampling of current projects in the Hudson Estuary. Several of the papers deal with physical and chemical ecology with a strong emphasis on long-term trends and predictability, which is in itself an indication of the maturing of our approach to

further understanding of the basics of the system. This is followed by a series of papers on fisheries methods including reviews of quality control and indices, and statistical approaches that are being applied to Hudson River data.

A few of the papers deal with individual species with emphasis on trends and long-term studies, but there are also several surveys that deal with the complete fish fauna instead of a few key species. Certainly this is a reflection of the recognition that estuaries are complex integrated systems and the whole is much more than the sum of its parts. Another indication of the systems approach is the paper on energetics and the lower food web of the river.

Finally, we have included a paper dealing with the restoration of the tidal marshes in the vicinity of Croton Bay, giving us hope that sections of the river can be returned to something near their natural state.

Together these papers provide a cross section of estuarine research as it is being practiced in the Hudson River. They indicate that the trend in estuarine research in general is toward more fundamental research directed toward clarifying the mechanisms of the estuary. A part of this trend is that a wider variety of investigations is being conducted by a greater diversity of specialists. We hope this trend continues.

Basic research is often characterized as uneconomical because it so frequently leads to dead ends or just to more questions instead of to answers that are immediately useful. In fact the opposite is true. The history of environmental impact studies has clearly demonstrated that in our haste to answer immediate questions for specific projects, we have overlooked the larger goal of really understanding the ecosystem. Consequently we have to gather the same kinds of data over again for the next project. If the articles in this book are any indication, the future will see much more emphasis on fundamental principles.