

PROGRESS TOWARDS IMPLEMENTATION OF
THE TIDAL POTOMAC RIVER
LIVING RESOURCES MONITORING PLAN
OCTOBER 1991

Prepared by
Claire Buchanan, Ph.D.

Report 91-10

October 1991

The Interstate Commission on the Potomac River Basin
6110 Executive Boulevard, Suite 300
Rockville, Maryland 20852

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INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

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PURPOSE OF THE PLAN

The original purpose of the tidal Potomac River Living Resources Monitoring Plan (PRLRMP) was to create a framework for an integrated monitoring program by coordinating the ongoing monitoring programs of various state and local agencies. Additional programs were proposed where there was need. The plan was intended to serve as a prototype for integrating living resources monitoring programs in Chesapeake Bay sub-basins.

A second purpose of the PRLRMP is to encourage researchers and managers to explore large-scale and long-term trends in the Potomac River's biota, and relationships between living resources, habitat, and water quality.

SUMMARY 1991

- o The Interstate Commission on the Potomac River Basin (ICPRB) has designed and written a biological data entry program for Potomac species, compiled a bibliography of references for Potomac biota, and located most of the actual data sets. It has begun to obtain copies of these data sets, computerize data sets where necessary, and form large, integrated databases for key species and functional groups (identified in the PRLRMP). Ultimately, ICPRB and others will be able to use these databases to determine status and trends of key species/functional groups in the tidal Potomac River, and identify relationships between living resources, water quality and habitat.
- o The Metropolitan Washington Council of Governments (MWCOG) and the Potomac Research Center at George Mason University are repositories for hard copies of historical and contemporary living resources data from the tidal Potomac River.
- o SAV, zooplankton, phytoplankton and benthos continue to be monitored by a number of institutions although the Maryland zooplankton program has been jeopardized by budget cuts. Initial efforts to relate the status and trends of these biological groups with water quality and habitat in Chesapeake Bay have yielded promising results.

- o Monitoring of largemouth bass by Maryland DNR indicates the bass populations have closely tracked the resurgence and recent decline of SAV in the DC area.
- o Maryland DNR monitoring programs for river herring and blue crab have not been expanded to include the tidal Potomac. Bay anchovy are still not monitored by Maryland or Virginia although they are a recorded bycatch of the Adult Striped Bass Survey in the Potomac.
- o More quantitative sampling methods of oyster surveys in the Potomac have not been implemented. A good spatset such as occurred this year is the incentive to expand spatial coverage of the survey upriver to Mathias Point from time to time.
- o At this time, the only ongoing monitoring for ichthyoplankton in the tidal Potomac is that done in the Gunston Cove Ecosystem Monitoring Program. Funding for a budget request to the Living Resources Subcommittee to analyze 7 years of archived ichthyoplankton samples is doubtful for FY92.
- o Recommendations proposing new programs for monitoring ichthyoplankton, water quality of nearshore sites and oyster beds, and water column respiration have not been implemented. However, steps have been taken to initiate some of these recommendations.
- o The continued absence of rigorous monitoring programs for many finfish and shellfish in the tidal Potomac undermines, if not negates, the objectives of the PRLRMP, the Chesapeake Bay Living Resources Monitoring Plan, and the Chesapeake Bay Agreement.
- o ICPRB intends to more aggressively pursue the objectives of the PRLRMP, and will unilaterally begin to experiment with existing biological, habitat and water quality data to determine if relationships between living resources and their environment can be made for the tidal Potomac. A small advisory group will be invited to guide and to peer review this ICPRB effort.

BACKGROUND

The Interstate Commission on the Potomac River Basin (ICPRB) initiated the effort to put together a Potomac River Living Resources Monitoring Plan (PRLRMP) for the tidal portion of the river. The original draft of the plan, prepared by Roland Fulton III, was made an addendum to the Chesapeake Bay Living Resources Monitoring Plan (Agreement Commitment Report) in July 1988. A task force composed of scientists and managers working on the Potomac River estuary was established in late 1988 to evaluate

and improve the draft PRLRMP and discuss how the plan would be implemented. The task force members were:

Chairperson:

Michael Hirshfield, formerly of the Maryland Department of Natural Resources and presently with the Chesapeake Bay Foundation, Annapolis, MD

Managerial Work Group Members:

Meosotis Curtis, formerly of the Washington Metropolitan Council of Governments

Hamid Karimi, District of Columbia Environmental Control Division

Carlton Haywood, Interstate Commission on the Potomac River Basin

Michael Haire, Maryland Department of the Environment

Elaine Schaeffer, Fairfax County

Scientific Work Group Members:

Bruce Barber, Virginia Institute of Marine Science

Virginia Carter, United States Geological Survey

Meosotis Curtis, formerly of the Metropolitan Washington Council of Governments

Steve Edmondson, formerly of the District of Columbia Environmental Control Division

A. F. Holland, formerly of Versar, Inc.

Edward Houde, University of Maryland

Fred Jacobs, Coastal Environmental Services

R. Christian Jones, George Mason University

Phil Jones, Maryland Department of Natural Resources

Donald P. Kelso, George Mason University

Bobby Lewis, formerly of George Mason University

Robert E. Magnien, Maryland Department of the Environment

Bob Nyman, University of Maryland

Kevin G. Sellner, The Academy of Natural Sciences

The final draft of the PRLRMP, prepared by Claire Buchanan, was submitted to the Joint Living Resources/Monitoring Subcommittee Work Group and the Living Resources Subcommittee of the Chesapeake Bay Program in June 1989.

Some of the plan's recommendations were initiated at once in 1989; others required action on the part of the Chesapeake Bay Program or state and federal agencies before they could be implemented. The plan identifies several tasks for the Interstate Commission on the Potomac River Basin (ICPRB). Furthermore, ICPRB is tracking implementation of PRLRMP recommendations by other agencies. This is the third ICPRB report on progress towards implementation of the Potomac River Living Resources Monitoring Plan.

Relationship to the Chesapeake Bay Living Resources Monitoring Plan (CBLRMP)

The Chesapeake Bay Living Resources Monitoring Plan (CBLRMP) identifies three major objectives for monitoring in that plan:

- I. document the current status of living resources and their habitats,
- II. track the abundance and distribution of living resources and the quality of their habitats over time, and
- III. examine correlations and relationships between water quality, habitat quality, and the abundance, distribution and integrity of living resources populations.

As a subset of the CBLRMP, the Potomac plan endorses these objectives for monitoring programs even though its component programs vary in their immediate purposes. For example, some Potomac monitoring programs aim at determining status and trends whereas others attempt to correlate water and habitat quality with living resources. A well designed monitoring program, however, can eventually contribute to all three objectives. The PRLRMP therefore attempts to complement rather than interfere with the immediate objectives of its component programs.

Another goal of the Chesapeake Bay Plan beyond the immediate commitment to develop a living resources monitoring plan was to fully integrate living resources and water quality monitoring. The ongoing plankton monitoring programs on the Potomac River are integrated with water quality monitoring in the sense that sampling for both is done simultaneously, in the same locations. PRLRMP task force members concluded that simultaneous monitoring is less important for the juvenile and adult stages of longer-lived organisms such as fish or macrobenthic invertebrates since their responses for the most part reflect the integrated effects of environmental conditions or fishing pressure encountered over much longer time spans. However, long-term water quality monitoring in the habitats of these organisms is vital and should be designed to answer living resources questions.

"Species of Interest" in the tidal Potomac River

A "top down" approach was used as the PRLRMP evolved, first identifying the species of interest (also called "target species" in the CBLRMP) and then using a conceptual food chain model to identify the habitats and groups of organisms of critical importance to these species. The species of interest in the tidal Potomac River were identified as:

striped bass
 clupeids (river herring)
 large mouth bass
 bay anchovy
 oyster
 blue crab

Habitats and groups of organisms directly influencing the success of these species are:

submerged aquatic vegetation (SAV)
 benthos
 zooplankton
 phytoplankton

The "species of interest" list was not meant to include all important living resource species, and the "habitats and groups of organisms" list does not imply which ecosystem components should **not** be monitored. The lists represent a compromise between information needs and budgetary constraints. The task force felt that monitoring programs focused on the selected "species of interest" and ecosystem components will provide enough information to accomplish the three major objectives of monitoring (see above). The programs should also, as a by-product, yield much information on other species whose habitats strongly overlap those of the selected species.

REVIEW OF ORIGINAL RECOMMENDATIONS AND DISCUSSION OF PROGRESS TOWARDS IMPLEMENTATION

The original 15 PRLRMP recommendations can be grouped into three categories: those encouraging modifications to existing programs, those proposing new monitoring programs, and those addressing data management and information needs. Each of the original recommendations is restated below and progress towards implementation is discussed.

Recommendations for Modifications to Existing Programs

"RECOMMENDATION 2. New or expanded stock assessment programs for juvenile and adult finfish in the Potomac mainstem are needed to comprehensively monitor large-mouth bass and bay anchovy (resident species), and river herring (anadromous species), all of which have been designated PRLRMP species of interest. These studies would complement four ongoing projects monitoring finfish in several tidal freshwater tributaries and just below the fall-line. Expanding the large-mouth bass project would also allow objective evaluations of different SAV communities as fish habitats."

River herring, bay anchovy, and large-mouth bass continue to be monitored in three of the four original projects

monitoring juvenile and adult finfish in tidal freshwater tributaries and just below the fall-line in the Potomac:

Gunston Cove Ecosystem Monitoring Project (Fairfax
County/George Mason University)
District of Columbia Fisheries Monitoring Program
Maryland DNR Large-mouth Bass Study

The Maryland DNR Small Tributaries Monitoring Program is changing emphasis and has discontinued sampling in Mattawoman Creek.

The Gunston Cove and District of Columbia projects shore seine monthly from March to November/December to assess juvenile fish abundance. In addition, the Gunston Cove project does monthly bottom trawls, and the District has an intensive gill net study from February to late spring targeting anadromous fish.

Maryland DNR has conducted a Largemouth Bass Study in the tidal Potomac River for several years to track radio tagged bass, monitor bass tournaments, and collect population data by electroshocking and seining. Largemouth bass are a piscivorous species resident in the tidal freshwater river. Populations boomed in the Washington, D. C. area with the return of submerged aquatic vegetation (SAV) in the mid 80's, indirectly supporting the opinion that SAV communities are important habitat for fish. The bass then moved with the SAV beds as they expanded downstream. Sampling sites in the Washington area that experienced a drop in SAV densities in the last 4 years have also shown decreases in bass numbers. Electroshocking and seining efforts were temporarily halted in 1991 and will resume in 1992. Tagging and monitoring of fish caught and released during bass fishing tournaments was done in 1991 and will be continued next year. The radio tracking study is finished. A report ("Statewide fisheries survey and management, study V: investigations of largemouth bass populations inhabiting Maryland's tidal waters", 180 pp.) is available. (Principle Investigator: Leon Fewlass, DNR)

River herring and bay anchovy are still not monitored in the mainstem Potomac below the District of Columbia. The sparse river herring (blueback, alewife) were once important anadromous spawners whose young were the dominant pelagic prey species. Bay anchovy is presently a dominant species in the estuarine river and a key intermediate between plankton and piscivorous fish. Juvenile herring are regularly surveyed by Maryland Department of Natural Resources (DNR) in six locations around the bay but the program has not been expanded to include the Potomac River. Bay anchovy are not formally surveyed by Maryland or Virginia.

In the Potomac mainstem, the long standing Maryland Estuarine Juvenile Finfish Survey in summer (shore haul seine) and the Maryland Striped Bass Assessment (gill net) during the spawning season appear to provide adequate estimates of striped bass abundances. The Juvenile Finfish survey is conducted at 8 permanent and 5 auxiliary Potomac stations three times each summer. The Striped Bass Assessment survey is conducted in the Potomac from early April to late May with multipanel drift gill net set at randomly chosen stations between Maryland Point and Indian Head. The programs have not been considered useful in assessing many other species since these species differ from striped bass in habitat use and gear vulnerability. However, the numbers of juvenile herring caught in the Juvenile Finfish Survey are recorded, and bay anchovy are a recorded bycatch in the Maryland Adult Striped Bass Survey.

"RECOMMENDATION 5. The Maryland DNR annual oyster bar survey and Virginia's shellstring spatfall survey need to be expanded upriver. Emphasis needs to be put on introducing more quantitative sampling methods for oyster bars."

To date, Virginia is still monitoring shellstring spatfall at six stations in the lower Potomac River (and will continue to do so) but cannot expand upriver because of budgetary reductions. Virginia is exploring the possibility of using the cost effective Leslie analysis technique to better quantify oyster stocks when adequate harvest and effort records exist (e.g. James River). Roger Mann, Eric Barth and Bruce Barber have requested funding (\$25,000) from CBSAC in the past to do an analysis of the Potomac River in collaboration with A. C. Carpenter of the Potomac River Fisheries Commission, but have been turned down. If funded, such an analysis would be a good opportunity to calibrate this inexpensive technique with the costly, labor intensive quantitative sampling program presently being sponsored by Maryland.

The Fisheries Management Plan for Oysters, written by a Living Resources Subcommittee workgroup, mentions improving the annual oyster surveys (Actions 1.1.1 and 1.1.2) and continuing research on the relationship between adult oyster density and recruitment (Actions 2.1.3, 2.1.4, and 2.1.5). Implementing these actions would address this PRLRMP recommendation. Maryland DNR still uses the statistically imprecise dredge method for sampling oyster bars in its annual survey. Expansion of the annual oyster bar survey upstream is instigated by a good spatset. A good spatset was experienced this year (1991) and the survey may extend as far as Mathias Point this fall.

Several workshops have been held in the last two years to address problems in oyster ecology and management in Chesapeake Bay:

- o A workshop on "Research needs for rehabilitating the American oyster industry" was convened at the College of William and Mary, VIMS on September 7-8, 1989, with the objective of developing a regional approach to the problem of oyster recovery. Specific objectives included: 1) a synopsis of the current status of oyster production, disease prevalence, and ongoing research efforts in the various states, 2) development of a coherent regional research plan encompassing all components of the envisioned process, and 3) definition and prioritization of present research needs within this plan. (Report is in "A Plan Addressing the Restoration of the American Oyster Industry", publication VSG-90-02 available from Virginia Sea Grant, University of Virginia, Charlottesville, VA 22901.)
- o A workshop on "Restoration of the American Oyster Industry" was held in Annapolis, Md. on December 5-6, 1989, to discuss the social, political, economic and marketing issues that should be considered in any effort to restore or rehabilitate the American oyster industry. (Report is in "A Plan Addressing the Restoration of the American Oyster Industry", publication VSG-90-02 available from Virginia Sea Grant, University of Virginia, Charlottesville, VA 22901.)
- o A Shellfish Monitoring Workshop was held at Horn Point Laboratory on November 6 and 7, 1990 to discuss Maryland and Virginia sampling methods, existing spatfall and bar monitoring programs in the Bay, and implementation of the 1989 Fisheries Management Plan for Chesapeake Bay Oysters. (Report is available from Dr. Roger Newell, Horn Point Environmental Laboratories, CEES, University of Maryland, Cambridge, Maryland 21613)

A conference on "The Oyster: Ecology and Management" will be held in Annapolis, Maryland on October 30-31, 1991. It will focus on bringing together resource managers and oyster researchers to exchange information and to explore new ideas for restoring the U. S. oyster industry. Presentations will build on previous efforts and will include summaries of recent meetings and brief updates on the status of oyster stocks around the country. The objectives are to identify remaining gaps in our knowledge and needs for future research, and to suggest innovative management approaches and inventive strategies to help bring back the oyster industry. Contact Tidewater Fisheries, Maryland Department of Natural Resources, Tawes State Office Bldg., Annapolis, MD. for more information.

"RECOMMENDATION 7. A fisheries-independent monitoring program for blue crab should be started [in the Potomac]. We endorse the efforts of CBSAC and the Chesapeake Bay Program to continue the development of a Bay-wide crab survey and urge that such a survey be incorporated into the Bay-wide monitoring activities."

The Fisheries Management Plan for Blue Crab (Living Resources Subcommittee, 1989) calls for a Bay wide, fisheries independent summer survey (Action 3.1) which would incorporate the ongoing Maryland summer trawl survey for blue crabs (Maryland Blue Crab Monitoring Program). Presumably, Potomac stations would be included. This aspect of the plan has not been implemented yet. The Maryland summer trawl survey included 21 stations in small creeks in the lower Potomac River estuary from 1977 to 1986, but these stations were abandoned because of time and effort limitations and low counts at most of the stations. Recreational crabbing, however, indicates a significant crab population inhabits the Potomac estuary and suggests that the summer trawl survey did not sample the appropriate crab habitats.

Several Potomac sites are sampled as part of the tagging program and the winter dredge survey of juveniles and males in the ongoing Maryland Blue Crab Monitoring Program, done by DNR and University of Maryland. The University of Maryland is responsible for sampling the Potomac sites.

"RECOMMENDATION 8. We endorse the CBLRMP plans to continue documenting SAV distributions with annual aerial surveys and suggest that an aerial survey of tidal wetlands be done in conjunction with the SAV survey. Ground-truthing of aerial surveys of SAVs should receive high priority. We recommend that the SAV group of the Chesapeake Bay Living Resources Subcommittee designate an institution(s) to manage the SAV data."

The U.S. Geological Survey (Virginia Carter and Nancy Rybicki) have monitored the abundance and distribution of submerged aquatic vegetation (SAV) in the tidal Potomac River from 1978-89. From 1989 to 1991, the Metropolitan Washington Council of Governments (MWWOG), in conjunction with the U.S.G.S., aerially photographed and ground-truthed SAV distribution in the upper Potomac as part of an Hydrilla control program sponsored by the Army Corps of Engineers, Maryland, Virginia and the District. This project will probably end this year. The 1991 report will be available shortly from MWWOG (Project director: Giselle Bernstein, 202-962-3345).

The annual Bay SAV Survey photographs, ground-truths and maps SAV in the entire Potomac estuary, and incorporates ground-truthing done by the U.S.G.S., MWWOG, and others. The Chesapeake Bay SAV survey results are published annually

and are available from the Chesapeake Bay Program Office (1-800-523-2281). The Submerged Aquatic Vegetation Policy (1989) recommends continuing the annual surveys at least through 1995.

An indepth technical synthesis of water quality factors controlling SAV distribution and abundance is almost finished and will be available in early 1992 from the Chesapeake Bay Program Office (1-800-523-2281). Near-shore and mid-channel sites were compared for four major areas including the tidal, freshwater Potomac. The indepth technical synthesis greatly enhanced the ability of the program to attract regular funding sources and garnered long-term support for the program from diverse agencies. SAV is now generally recognized as a good indicator of Bay "health". The SAV workgroup of the Chesapeake Bay Program Living Resources Subcommittee is overseeing management of the SAV survey. (SAV Workgroup chair: Linda Hurley, U. S. Fish and Wildlife Service, Annapolis, MD)

A biennial aerial survey of tidal wetlands could easily be instituted in conjunction with the SAV survey in the future if mapping scales are 1:24000 and funding is available for the extra flight time. The Wetlands Inventory and Mapping Workgroup is presently evaluating survey approaches for tidal wetlands.

"RECOMMENDATION 10. Slight differences in methodologies between the various plankton monitoring programs in the Potomac River can easily be corrected. Monitoring of plankton and benthos (other than oyster) in the lower estuary near the recurring anoxic region is relatively sparse, and projects focusing on this region of the river should be encouraged."

The Gunston Cove Project and the District of Columbia Zooplankton Monitoring Project have made slight modifications to their sampling methods, and data from those projects are now directly comparable with zooplankton data from the Maryland Chesapeake Bay Monitoring Program.

The Maryland Chesapeake Bay Monitoring Program intended to drop its zooplankton component beginning in 1992 because of budget constraints. Maryland Department of the Environment submitted a budget request to the Chesapeake Bay Program Living Resources Subcommittee to fund the program for FY 1992. Strong support for continuing zooplankton monitoring in Chesapeake Bay has come from a zooplankton monitoring workshop held September 23-24, 1991, in Easton, Maryland. The workshop demonstrated the potential usefulness of zooplankton monitoring data to managers of water quality and fisheries in evaluating progress towards restoring and maintaining the Chesapeake Bay. A final report on the workshop will be available in mid November.

Recommendations Proposing New Monitoring Programs

"RECOMMENDATION 3. An intensive monitoring program for egg and larval stages of anadromous fish is tentatively proposed; actual recommendations for such a program should wait until after an ichthyoplankton workshop which has been proposed for mid 1989."

Dr. Edward Houde (University of Maryland) convened a workshop with the support of Maryland DNR to discuss "Ichthyoplankton Monitoring and Research in the Chesapeake Bay" with a relatively small group of fish biologists and managers on 5 December, 1989. The proceedings were published in April 1990 and are available from the EPA Chesapeake Bay Program (1-800-523-2281). Workshop participants discussed the uses of ichthyoplankton monitoring and research in 1) assessing fish resources, 2) detecting trends in abundance, 3) linking trends to water quality or habitat criteria, and 4) gaining understanding of early life dynamics that can be related to recruitment variability. The workshop concluded that ". . . it is not certain that the benefits to fishery management of [monitoring anadromous ichthyoplankton] would be greater than those derived from abundance monitoring of later life stages . . . the present monitoring schedule and efforts in the Bay are not adequate to survey the spawning areas and times of anadromous fish . . . intensive monitoring of anadromous ichthyoplankton in selected spawning areas might define the environmental conditions that led to the eventual juvenile year-class abundances".

Two recent programs in the Potomac River have intensively monitor anadromous ichthyoplankton in small tributary spawning areas. One of these programs will continue in 1992, the other is being shut down:

- o The ichthyoplankton component of the ongoing Gunston Cove Ecosystem Monitoring Program, George Mason University, monitors one spawning area of striped bass, white perch, and herring in the Potomac Estuary. Weekly sampling for anadromous ichthyoplankton begins in March, and sampling at longer intervals is done during the summer in order to monitor resident species ichthyoplankton. Up to nine years of data from the physical/chemical, zooplankton, SAV and juvenile/adult fish components of this ecosystem program permit some assessments of the relationships between water quality and habitat and ichthyoplankton survival. A George Mason University graduate student (S. Blumenshine) is presently looking at white perch Y-O-Y and juvenile feeding habits as they are influenced by zooplankton spatial and temporal distributions. (Principle Investigators: Don Kelso and R. Christian Jones, George Mason University, Fairfax, VA)

- o The Small Tributary Monitoring Project (DNR) in Mattawoman Creek was expanded from two to seven stations in the 1990 and 1991 field seasons and anadromous species ichthyoplankton were monitored at four stations twice a week from March through June. This project will not be continued in 1992 in Mattawoman Creek. A final report will be published by DNR in mid 1992. (Principle Investigators: Jim Uphoff, DNR; Lenwood Hall, Wye Research and Education Center)

"RECOMMENDATION 4. We recommend that archived samples of the Maryland Chesapeake Bay Plankton Monitoring Program (MDE) from 1985 to the present be analyzed for ichthyoplankton. These samples will provide the basis of an ichthyoplankton monitoring program for resident species (primarily bay anchovy, a PRLRMP species of interest) in the mainstem Potomac River and will complement two existing ichthyoplankton monitoring programs in Potomac tributaries. We further recommend that a monitoring program specifically targeted at resident ichthyoplankton be added to the Plankton Monitoring Program."

The ichthyoplankton workshop (see recommendation 3) noted that ". . . monitoring of fish eggs and larvae for species that are abundant, widely distributed, and have a protracted spawning season may provide useful information in the context of present Chesapeake Bay monitoring efforts." The workshop participants then recommended that ". . . selected, archived plankton samples from the Bay [Plankton] Monitoring Program be examined and analyzed for ichthyoplankton to determine if the sampling design is adequate to evaluate abundances and spatio-temporal distributions of selected species", namely bay anchovy, naked goby, hogchoker and perhaps a few other species. "Results of this proposed evaluation should be incorporated into any decision on whether to include ichthyoplankton in future monitoring activities."

The Interstate Commission on the Potomac River Basin (ICPRB) has submitted a proposal to the Living Resources Subcommittee for FY92 funding to initiate this effort. Funding for this project through the Living Resources Subcommittee looks doubtful at this time. In the mean while, the Maryland Zooplankton Monitoring Component will continue to incidentally collect but not sort or identify ichthyoplankton.

At this time, the only ongoing monitoring for resident ichthyoplankton in the tidal Potomac is that done in the Gunston Cove Ecosystem Monitoring Program.

"RECOMMENDATION 6. A new, intensive water quality monitoring program on cross-channel transects that intersect three oyster bars is recommended in order to document differences in offshore and nearshore, or bar, environments."

It is still not feasible at this time for MDE to implement this recommendation. Continuous samplers would need to be deployed since these instruments measure at intervals frequent enough to record the relatively short-term anoxic/hypoxic events in shallow waters.

"RECOMMENDATION 9. A water quality monitoring program for nearshore sites, with and without SAVs, is highly recommended for the entire tidal Potomac and important tributaries. The possibility of initiating a volunteer program to accomplish this is being explored by a number of groups and should be encouraged."

The SAV technical synthesis (see recommendation 8) establishes regional ambient habitat requirements for SAV in the Bay. These criteria are being used to determine restoration goals for water quality parameters and SAV acreage in the Bay, including the tidal Potomac. Some monitoring of nearshore sites with and without SAV will be necessary in order to track success of the restoration program. The details of this monitoring effort are not worked out as of yet. (SAV Workgroup chair: Linda Hurley, U. S. Fish and Wildlife Service, Annapolis, MD)

In the James and Patuxent Rivers, Citizens Monitoring Programs organized by the Alliance for the Chesapeake have produced reliable long-term data for temperature, dissolved oxygen, secchi depth and several nutrients, collected weekly from nearshore sites. This program has expanded to include the York, Rappahannock, and Elizabeth Rivers and several eastern shore tributaries in Virginia, the Conestoga River in Pennsylvania, the four Maryland "Targeted Watershed" tributaries, and a small tributary (Nomini Creek, VA) of the tidal Potomac. At this time, no efforts are focused on nearshore water quality monitoring in the tidal Potomac mainstem.

Through grants from the Virginia Environmental Endowment and Virginia Water Control Board, the Alliance has developed a data entry program for water quality variables that allows citizens to computerized the data and run simple statistical analysis. Virginia citizens groups will be sending data diskettes to the Virginia Water Control Board annually for use in 305B reports. The data will also be presented in annual reports by the Alliance. For more information, contact Ms. Marcie Judd in Richmond (804-775-0951) or Ms. Kathy Ellett in Baltimore (301-377-6270).

"RECOMMENDATION 11. We tentatively endorse efforts presently being made to initiate water column respiration studies (i.e. short-term oxygen consumption over time) by the Maryland Chesapeake Bay Water Quality Monitoring Program and others in mesohaline regions typified by hypoxia or anoxia. This should

provide a good index for tracking improvements in the bay's pelagic habitats as nutrients are reduced. A workshop to review the proposed study methods and to ensure that they are adequate for monitoring purposes is presently needed."

There has been no action as of yet on the part of the Bay community to organize a workshop to discuss this proposal. Considering the funding shortages that are forecast for 1991, this project will probably be shelved for the time being.

Recommendations Addressing Data Management and Information Needs

"RECOMMENDATION 1. It is critical at this stage in the Potomac River Living Resources Monitoring Program (and in the Bay community as a whole) that fish biologists and estuarine ecologists working on other parts of the food chain clearly state their views on the factors controlling fish populations in the Potomac River, in order to identify those trophic components or water quality parameters needing monitoring. In particular, differing perspectives on the relative roles of climatic variation, overfishing, and water quality (nutrients, contaminants, impediments) need to be clearly articulated and, to the extent possible, resolved."

This difficult yet critical task for the Bay community is ongoing in research and management groups although formal discussion - and resolution - of the problems are rare. The newly released second edition of "Habitat Requirements for Chesapeake Bay Living Resources", June 1991 (available from the U. S. Fish and Wildlife, Chesapeake Bay Programs, 301-224-2732) reviews much of what is known about Chesapeake Bay populations of several important fish species and factors controlling these populations are discussed, sometimes in great detail. Also, an ichthyoplankton workshop held on December 5, 1989, discussed and reported on ichthyoplankton monitoring and research as a means to gain understanding of early life dynamics that can be related to recruitment variability, among other things ("Ichthyoplankton Monitoring and Research on the Chesapeake Bay", available from the EPA Chesapeake Bay Program, Annapolis, MD, 1-800-523-2281).

"RECOMMENDATION 12. The feasibility of maintaining one, or more, repositories for hard copies of historical and contemporary living resources data from the Potomac River should be explored very soon. The Metropolitan Washington Council of Governments (MWCOG) and the proposed Potomac Research Center at George Mason University are two possible repositories. Accessibility to the public, both in terms of geographic location and ease in obtaining or viewing the data, is an important requirement. We recommend bolstering efforts to assemble hard copy collections of Potomac living resources monitoring data and to establishing repository(ies)."

The Interstate Commission on the Potomac River Basin (ICPRB) initiated discussions in 1989 with both George Mason University (GMU) and MWCOG concerning the establishment of repositories of data hardcopies at these locations. In a February 22, 1990 meeting at ICPRB, the details of establishing the repositories and cooperatively updating them were worked out. George Mason University has placed their repository in the campus library system and will integrate the bibliography of Potomac River living resources data (see below) into their computer system. The MWCOG repository has been incorporated into their inhouse library system. ICPRB has passed on more than 100 hard copies of various Potomac biological data sets and reports to GMU and MWCOG.

As they are completed, ICPRB will also make available to COG, George Mason and any interested parties large, integrated databases for key species or groups. These databases are the products of ongoing efforts by ICPRB to locate and computerize historical data sets, merge them with contemporary data sets if methods were comparable, and create large, integrated databases with which to do trend analyses for the tidal Potomac River (see below).

"RECOMMENDATION 13. We endorse the developing computerized data bank for living resources at the EPA Chesapeake Bay Liaison Office (CBLO) Computer Center in Annapolis, MD., and recommend that efforts be made to enter all of the Potomac's living resources data into computer databases."

ICPRB has focused much effort in the last two years towards implementing this recommendation. It has designed and written a biological data entry program for Potomac species, compiled a bibliography of references for Potomac biota, located most of the actual data sets, and begun to obtain copies of these data sets, computerize data sets where necessary, and form large, integrated databases for key species and functional groups (identified in the PRLRMP). Ultimately, ICPRB and others will be able to use these databases to determine status and trends of key species/functional groups in the tidal Potomac River, and identify possible relationships between living resources, water quality and habitat.

Computer Data Entry Program. The DBASE data entry program was designed to facilitate the entry and storage of biological data in computer formats compatible with the CBLO biological databases. Much historical data resides on paper; contemporary data are going on paper or on various incompatible computer formats. Comparisons of the data are consequently difficult to make even though disparate data sets are often comparable. The CBPO has recognized the need for a computerized data bank in which the data is entered in

a standardized format and made available to researchers and living resources managers, and it is developing such a data bank. Unfortunately, only a few large monitoring programs presently submit data to the CBPO data bank. The biological data entry program designed by ICPRB is intended to allow smaller organizations such as research groups, citizens groups and local agencies to generate databases in forms directly comparable to each other and to the evolving CBLO databases.

Master lists of fish, benthos, zooplankton, phytoplankton, and SAV species found in the Potomac estuary were compiled by ICPRB from a number of sources and are a feature of the ICPRB data entry program. Researchers can quickly select species from these master lists to create computer files (e.g. for individual cruises or sample sets) that are format compatible with the CBLO databases. Sources for the species master lists include the "Environmental Atlas of the Potomac Estuary", the Gunston Cove Ecosystem Monitoring Program, District of Columbia fish surveys, "Index and Field Identification Guide to the Fishes of the District of Columbia", "Field Guide to the Submerged Aquatic Vegetation of Chesapeake Bay", the National Water Quality Network surveys (1958 - 1968), and the Chesapeake Bay Program species lists. These master lists can easily be updated or customized by individual researchers.

Since the National Oceanographic and Atmospheric Administration's NODC coding system for species is being used by the EPA Chesapeake Bay Program, species in the master lists are tagged with the appropriate NODC codes whenever possible. Approximately 700 species, resident in the Potomac estuary, were found not to have NODC codes. ICPRB is working with the U. S. Geological Survey and NOAA to get codes assigned to these species.

Preliminary versions of the data entry program were demonstrated to representatives from MWCOG, DCECD, George Mason University, and Computer Services Corporation (CSC), and at the Tidal Freshwater Ecosystems Symposium of the Virginia Academy of Sciences meetings at George Mason University (May 25, 1990). Valuable insights and suggestions were received and incorporated into the program. The final version 1.0 is available from ICPRB (no charge).

Bibliography and Location of Data Sets. Two critical prerequisites to entering all of the tidal Potomac living resources data onto computers and creating large, integrated databases was to identify and then locate all the data sets. Many of the data sets are poorly circulated, not readily available, or still in the form of raw data. ICPRB has compiled a bibliography of unpublished data sheets, reports, summaries, symposia, books and other references for biological data for the tidal Potomac River. A preliminary

bibliography was compiled from the ICPRB library system, the University of Maryland Chesapeake Bay Laboratory library system, the Chesapeake Bay Environmental Data Directory, the Smithsonian Institution Library and miscellaneous bibliographies. On November 16, 1989, MWCOG convened a meeting of the Potomac River Monitoring Committee and ICPRB's efforts were discussed with the group. PRMC members subsequently helped ICPRB obtain some data sets. In early 1990, ICPRB searched the University of Maryland's CDrom literature search system and incorporated references to Potomac biota into the bibliography. The bibliography is available in printed form or on computer diskette from ICPRB. ICPRB, GMU and MWCOG intend to jointly update this bibliography regularly.

In addition to the bibliography, ICPRB has assembled a list of historical and contemporary biological data sets for the tidal Potomac. Included in the list is information concerning sampling methods, sampling locations, dates, computer format (if computerized), and where the data is located. Comparable sets are being obtained by ICPRB with the intention of merging them into larger databases. Missing are some historical data sets that are lost or destroyed.

Data Entry of Historical and Contemporary Data Sets. ICPRB has identified contemporary and historical data sets that are not entered into computer data files and are encouraging the organizations responsible for the data to 1) enter it in computer formats compatible with the SAS format used at the Chesapeake Bay Computer Center, according to the computer center's guidelines, or 2) use the data entry program available from ICPRB. Some historical data sets (e.g. monthly phytoplankton counts of samples collected by the National Water Quality Network between 1958 and 1968) have been entered in abbreviated forms in STORET or other computer databases. Other historical data sets will need to be entered by ICPRB if the data proves to be valuable enough to include in the large databases needed for trend analyses.

Ongoing efforts to obtain computerized data sets and actual data sheets of uncomputerized biological data from the tidal Potomac have resulted in a fairly complete collection for zooplankton. ICPRB should have an integrated database for tidal Potomac zooplankton from the following data sets by December 1991:

- Maryland Chesapeake Bay Zooplankton Monitoring Program
(1984-present)
- Gunston Cove Ecosystem Monitoring Program (1984-present)
- District of Columbia Zooplankton Monitoring Program
(1984-present; intermittent)
- USGS Potomac Estuary Study (1985-1987)

Distict of Columbia (1982-1983)
 Maryland Department of Natural Resources (1981-1982)
 USGS Potomac Estuary Study (1981)
 PEPCO at Morgantown (1974-1979)
 VEPCO at Possum Point (1977-1978)
 Maryland Department of Natural Resources (1977)
 Maryland Department of Natural Resources (1976-1977)
 Maryland Department of Natural Resources (1973-1974)
 Anadromous Alosids Project (1967-1968)
 Chesapeake Bay Institute (1965-1966)

Work has begun on obtaining and computerizing the phytoplankton data sets. ICPRB will make these databases available to the management and scientific communities as they are completed.

"RECOMMENDATION 14. Plans should be made now for analyzing and interpreting the Potomac River living resources monitoring data in order that thoughtful, effective management policies can be formulated soon and predictive models of the system can be updated. ICPRB should continue the task of designing and performing basic, or first-step, status and trend analyses for merged data sets of Potomac living resources. Increasing the availability of these analyses will hopefully stimulate analyses of "relationships between water quality, habitat quality and the abundance, distribution and integrity of living resources populations" (objective III of the Chesapeake Bay Living Resources Monitoring Plan)."

The integrated databases being created by ICPRB (see #13 above) will enhance the availability of significant biological data sets to researchers and managers. Many of the rapid bioassessment and bioindicator tools that either exist, or are being developed for use in the Chesapeake Bay region, can easily be applied to the integrated databases. For example, the zooplankton monitoring workshop (September 23-24, 1991, Easton, MD) identified zooplankton bioindicator tools useful in evaluating food availability for larval fish and water quality. We intend to apply these techniques to the integrated zooplankton database early in FY 1992. ICPRB will continue to review the literature in order to evaluate other statistical and analytical methods presently used on biological data from estuarine systems, and to select the ones most appropriate for the Potomac River biological data sets.

RECOMMENDATION 15. "The Potomac River Living Resources Monitoring Task Force will be dissolved when this report is complete. We suggest that ICPRB and MWCOG schedule at least an annual, formal meeting to exchange information on new developments and to review living resources monitoring activities of the Potomac River."

MWCOG convened a meeting of the Potomac Regional Monitoring Committee (PRMC) on November 16, 1989. The group discussed various living resources monitoring programs in the Potomac and recommendations of the Potomac River Living Resources Monitoring Plan.

WHERE DO WE GO FROM HERE?

Progress towards implementation is most evident in recommendations addressing data management needs and in recommendations proposing modifications to existing programs for SAV and zooplankton. Progress is minimal or lacking in all of the recommendations proposing expanded or improved finfish and shellfish surveys, and in recommendations to initiate ichthyoplankton monitoring, water quality monitoring at nearshore and oyster bed sites, and water column respiration monitoring programs. In most cases, fiscal constraints have prevented programs from expanding their scope. Other factors also play a role in limiting some programs. For example, the focus of monitoring programs relating living resources with habitat and water quality is frequently very different from the focus of programs designed to estimate allowable harvests of commercially or recreationally valuable fish. Also, Maryland DNR is sometimes reluctant to expand monitoring programs into the Potomac where fisheries are regulated by the Potomac River Fisheries Commission.

For whatever reason(s), the Potomac River still lacks the rigorous monitoring programs for oysters, blue crab, river herring, bay anchovy, and ichthyoplankton that are needed to link living resources with water/habitat quality. Absent also is a good understanding of the water and habitat quality in shallow, nearshore zones and the oyster reefs, both of which support large biological communities in the tidal Potomac River. The living resources goal statement of the Chesapeake Bay Agreement (1987) recognizes that the "productivity, diversity and abundance of living resources are the best ultimate measures of the Chesapeake Bay's condition." Clearly stated in the Agreement is the intention to "monitor populations of commercially, recreationally, and ecologically valuable species to ensure sustained, viable stocks". The Agreement notes that "to be successful, these actions must be carried out in an integrated and coordinated manner across the whole Bay system." This goal of the Agreement is further clarified in the Chesapeake Bay Living Resources Monitoring Plan, which states three objectives for living resources monitoring: determine status, determine trends, and identify "relationships between water quality, habitat quality, and the abundance, distribution and integrity of living resources populations". The continued absence of rigorous monitoring programs for many finfish and shellfish in the tidal Potomac undermines, if not negates, these objectives.

The Interstate Commission on the Potomac River Basin (ICPRB) feels that many of the recommendations can be partially or fully

implemented despite the lack of monitoring programs for key finfish and shellfish. Historical and contemporary data sets for zooplankton, phytoplankton, benthos, and SAV in the tidal Potomac are comparable in many cases and can be used to create large, integrated databases. Continuing efforts to relate these ecological significant groups to water quality and to higher trophic levels in the Chesapeake Bay are producing sensitive indicators of Bay "health". Efforts such as the ongoing Adult Striped Bass Survey, the Maryland Estuarine Juvenile Finfish Survey, and the District of Columbia fish surveys, and the earlier Anadromous Alosids Project (Virginia) typically have a wealth of bycatch data that has not been used to their fullest extent and may produce statistics on other ecologically valuable species. Comparisons of historical crab size records (e.g. the 10 year Morgantown study) with present day size frequencies may indicate if increased fishing pressure is reducing the average size of the crab population. Analyses of the archived MDE ichthyoplankton samples will determine if an ichthyoplankton monitoring program in the Potomac is warranted. Possibilities such as these can be explored while momentum gathers to initiate rigorous monitoring programs in the Potomac and elsewhere in the Chesapeake Bay.

ICPRB intends to more aggressively pursue the objectives of the Potomac River Living Resources Monitoring Plan while continuing to encourage government agencies in Maryland, Virginia and the District of Columbia to implement and maintain the monitoring programs recommended in the Plan. ICPRB will unilaterally begin to experiment with existing biological, habitat and water quality data to determine if relationships between living resources and their environment can be made for the tidal Potomac. If relationships surface and are found scientifically sound, it may be easier to implement all of the Plan recommendations. A small advisory group will be invited to guide and to peer review this ICPRB effort.