Final Report for
Chesapeake Bay Program Grant No. X-003457-01
Fiscal year 1989

PROGRESS TOWARDS IMPLEMENTATION OF THE POTOMAC LIVING RESOURCES MONITORING PLAN

Prepared by
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INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

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POTOMAC RIVER LIVING RESOURCES MONITORING PLAN

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The Potomac River Living Resources Monitoring Plan (PRLRMP) was drafted in order to coordinate existing programs of county, state, federal, and other agencies into an integrated living resources monitoring program for the tidal Potomac River, and to propose additional programs where needed. It is also intended to serve as a model for integrating living resources monitoring programs in the Chesapeake Bay area. A task force composed of scientists and managers working on the Potomac River was established in late 1988 for the purpose of evaluating and improving the draft PRLRMP and discussing how the plan would be implemented. After six months of meetings and draft reviews by the task force, the final PRLRMP was submitted to the Joint Living Resources/Monitoring Subcommittee Work Group and the Living Resources Subcommittee of the Chesapeake Bay Program in June 1989. The PRLRMP is included here as an appendix. See the acknowledgements in the PRLRMP for a list of the task force members.

Some of the plan's recommendations can be initiated at once; others require action on the part of the Chesapeake Bay Program or state and federal agencies before they can be implemented. The plan identifies several tasks for the Interstate Commission on the Potomac River Basin (ICPRB). Furthermore, ICPRB is tracking and coordinating implementation of PRLRMP recommendations by other agencies. This is the first progress report on implementation of the PRLRMP. In the following discussion, each of the 15 PRLRMP recommendations is restated, with a description of current status as described by the listed contact person.

PROGRESS TOWARDS IMPLEMENTATION OF RECOMMENDATIONS

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.

Contact: Dr. Michael Hirshfield (Maryland DNR)

No action has been taken as of yet.

Recommendation 2. New or expanded stock assessment programs for juvenile and adult finfish in the Potomac mainstem are needed to comprehensively monitor largemouth 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.

Contact: Dr. Robert Bachman (Maryland DNR, Freshwater Fisheries)

The Maryland DNR Largemouth Bass Study is tracking 10 - 15 radio tagged bass, monitoring bass tournaments, and electrofishing and seining to collect population data in the freshwater tidal Potomac River. Work to date indicates this fishery is holding up under intense fishing pressure. However, reproduction appears to be an important limiting factor in the area and new regulations will be enacted in 1990 for the 1 March to 15 June period to protect male bass as they guard their nests and are especially vulnerable to fishing. Dr. Bachman is working within Maryland DNR to expand the Largemouth Bass Study.

Contact: Mr. Dale Weinrich (Maryland DNR, Fisheries Division, Maryland Juvenile Herring Survey)

Juvenile herring are regularly surveyed in several locations around the bay but not in the Potomac River. Dr. Michael Hirshfield has indicated he will work

within Maryland DNR to have stations in the Potomac added to the survey.

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.

Contact: Dr. Michael Hirshfield (Maryland DNR, Chesapeake Bay Research and Monitoring)

Dr. Hirshfield is working with Dr. Edward Houde (University of Maryland) to set up this workshop in the fall of 1989. The workshop will follow a special session of the Estuarine Research Foundation meetings (8-12 October, 1989, Baltimore) entitled "Estuarine Fish Population Dynamics: Recruitment, Habitat and Fishing Mortality" and is scheduled to take place in mid November.

Recommendation 4. We recommend that archived samples of the Maryland Chesapeake Bay Plankton Monitoring Program (MDE) from 1984 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.

Contact: Dr. Robert Magnien (Maryland Department of the Environment, Chesapeake Bay and Special Projects)

The Plankton Component of the MDE Chesapeake Bay Project could not implement this recommendation without further justification since the prime concern of MDE is water quality. If 1) justification for the study could be developed, 2) an agency or organization responsible for using the data from year to year is identified, and 3) a clear statement of the objectives and expectations is drawn up, the Chesapeake Bay Project could conceivably add this study to the Plankton Component. The study could feasibly be a cooperative venture with Maryland DNR. Dr. Magnien is very interested in initiating efforts to quantify the relationships

between fish and the "lower organisms" in the Chesapeake Bay. The planktivorous, planktonic fish larvae are an obvious link between the two groups.

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.

The Living Resources Subcommittee (Fisheries Management Plans Workgroup) of the Chesapeake Bay Program has recently completed the FMP for Chesapeake Bay oysters. Several actions (to be taken) are identified in the FMP which appear to indirectly address this PRLRMP recommendation:

Actions 1.1.1 and 1.1.2. Maryland and Virginia will establish catch limits and will open and close harvest areas on a rotating basis to control harvesting pressure. Decisions will be based on analysis of the oyster population structure as determined in improved annual surveys.

Actions 2.1.3, 2.1.4, and 2.1.5. Maryland and Virginia will continue oyster repletion programs, will attempt to reconstruct buried oyster bars, and will continue research on the relationship between adult oyster density and recruitment.

Furthermore, the FMP identifies several data and informational needs which have bearing on this PRLRMP recommendation:

1. Evaluation of production from seed plantings in low salinity areas.

2. Determine factors affecting abundance, survival and growth of larvae and juveniles.

3. Determine natural and fishing mortality rates.

4. Define stock/recruitment relationship.

The possibility of introducing a hardier, more disease resistant oyster species into the bay is also being actively debated by the bay community, and decisions regarding this proposed introduction will affect future FMPs for oysters.

Dr. Bruce Barber (VIMS), a member of the scientific workgroup that shaped the PRLRMP, made many valuable suggestions and comments about the future needs of the

Virginia and Maryland oyster programs which were incorporated into this PRLRMP recommendation. Future contacts will be listed in later progress reports.

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.

Contact: Dr. Robert Magnien (Maryland Department of the Environment, Chesapeake Bay and Special Projects)

It is not feasible at this time for MDE to implement this recommendation. Dr. Magnien suggested that one approach to identifying anoxic or hypoxic events in shallow waters is to measure water quality at midchannel stations and then use hydrodynamic models to determine shallow water oxygen levels. Alternatively, continuous samplers could be deployed. These instruments measure at intervals frequent enough to record the relatively short-term anoxic/hypoxic events in shallow waters.

Contact: Ms. Linda Hurley (U. S. Fish and Wildlife Service, Chesapeake Bay Estuary Program)

Unless SAV are involved, this project should probably not be included in the various SAV and nearshore/ offshore studies underway in the bay region.

Recommendation 7. A fisheries-independent monitoring program for blue crab should be started. 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.

Contact: Mr. Jim Casey (Maryland DNR, Maryland Blue Crab Monitoring Program)

Summer trawl surveys for blue crabs included 21 stations in small creeks in the lower Potomac River estuary from 1977 to 1986, but were stopped in 1986 because of 1) time and effort limitations and 2) low (mostly zero) counts at most of the stations being sampled. Recreational crabbing indicates a significant crab population inhabits the Potomac estuary. In the present DNR/University of Maryland Cooperative Blue Crab Management Plan Study, several Potomac sites are sampled as part of the tagging program and the winter dredge survey of juveniles and males. The University of Maryland is responsible for sampling the Potomac

sites. The recently completed Fisheries Management Plan for Blue Crab (Living Resources Subcommittee) calls for a summer survey (Action 3.1) and designated crab sanctuaries (Action 5.2). It is still uncertain if Potomac sites will be included in future summer surveys, or if Potomac crab sanctuaries will be established.

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.

Contacts: Linda Hurley (U. S. Fish and Wildlife Service, Chesapeake Bay Estuary Program)
Richard Batiuk (U. S. Environmental Protection Agency, Chesapeake Bay Liaison Office)

A regularly funded monitoring program for SAV beds will hopefully be implemented in 2 - 3 years. An indepth technical synthesis of the existing data is being done now and should greatly enhance the ability of the program to attract regular funding sources. Ms. Hurley agreed that designating an institution(s) to manage the SAV data and ensure rapid data analyses and synthesis in the future would also help the program. 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.

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.

Contact: Ms. Linda Hurley (U. S. Fish and Wildlife Service, Chesapeake Bay Estuary Program)

The tidal freshwater Potomac River is one of four areas where water quality is being monitored by members of the SAV workgroup at nearshore sites with and without SAVs. Although there are no immediate plans to expand this particular program (V. Carter & N. Rybicki, U.S.G.S.), it can hopefully be expanded in the future.

Contact: Ms. Kathy Ellett (Citizens Monitoring Program, Alliance for the Chesapeake Bay)

As of now, there appears to be no interest in adding Potomac River sites to the citizens water quality monitoring program, but there could very well be in the future. The new Maryland co-ordinator is Gayla Campbell.

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.

Contact: Mr. Hamid Karimi (District of Columbia Environmental Control Division, Water Hygiene Branch)

Mr. Karimi has indicated his willingness to compare the surface horizontal tow method used by his group and the depth-integrated sampling methods used by other groups studying zooplankton in the Potomac River. These comparisons are presently being done.

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.

Contact: Dr. Robert Magnien (Maryland Department of the Environment, Chesapeake Bay and Special Projects)

No action so far.

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 Council of Governments (COG) 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 repositor(ies).

Action by ICPRB: ICPRB has initiated discussions with both George Mason University and Metropolitan Council of Governments concerning the establishment of repositories of data hardcopies at these locations. The commission has also begun collecting hardcopies of Potomac biological data sets that are not already held at GMU or COG, and intend to place them in these repositories as they become operational.

Contact: Mr. Jim Shell (Metropolitan Washington Council of Government)

Details of the COG repository are presently being worked out and this repository will be officially established by the end of the year. Mr. Shell would like to see it expanded eventually to included biological data from above the fall line.

Recommendation 13. We endorse the developing computerized data bank for living resources at the 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.

Action by ICPRB: ICPRB is identifying contemporary and historical data sets that have never been entered into computer data files and either 1) encouraging the organizations responsible for the data to enter it in computer formats compatible with the SAS format used at Chesapeake Bay Computer Center, according to the computer center's guidelines, or 2) seeking ways to have historical data computerized. ICPRB has contacted COG and the District of Columbia Environmental Control Division (DCECD), both of which have uncomputerized, contemporary biological data, and the Chesapeake Bay Computer Center, and is helping to coordinate a meeting on October 4 to discuss data entry formats, quality assurance procedures, and the specific needs of each organization.

Contact: Mr. Jim Shell and Shiela Myers (Metropolitan Washington Council of Governments)

COG is presently cataloging the biological data they have amassed. They will be hosting the October 4 meeting. On November 16, 1989, COG will convene a meeting of the Potomac River Monitoring Committee to discuss the PRLRM Plan (see discussion of recommendation 15 below).

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).

Action by ICPRB: ICPRB has indicated its interest in participating in a Bay Program workgroup to develop an Index of Biological Integrity (IBI) for the Potomac estuary and its tributaries. It is reviewing the literature in order to evaluate statistic and analytic methods presently used on biological data from estuarine systems and to select the ones most appropriate for the Potomac River estuary. It has also begun to assemble a collection of historical and contemporary biological data sets in order to evaluate 1) the feasibility of merging them into an integrated database, and 2) their value as a complementary or contrasting study if they cannot be included in the integrated database.

Contact: Mr. Jim Shell (Metropolitan Washington Council of Government)

Mr. Shell has indicated COG strong interest in participating in this task.

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

Contact: Mr. Jim Shell (Metropolitan Washington Council of Government)

COG will convene a meeting of the Potomac Regional Monitoring Committee (PRMC) on November 16. Included in the agenda is discussion of various living resources monitoring programs in the Potomac and recommendations of the Potomac River Living Resources Monitoring Plan.

Action by ICPRB: ICPRB is working with COG to identify items that need to be addressed at the meeting and/or should receive high priority.

Appendix

ACKNOWLEDGEMENTS

The Interstate Commission on the Potomac River Basin initiated this effort to put together a Potomac River Living Resources Monitoring Plan. Drafts of the plan were prepared by Roland Fulton III and Claire Buchanan in 1988 and early 1989, and were discussed and edited by the Potomac River Living Resources Monitoring Task Force, chaired by Michael Hirshfield of the Maryland Department of Natural Resources.

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, Versar
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, George Mason University
Robert E. Magnien, Maryland Department of the Environment
Bob Nyman, University of Maryland
Kevin G. Sellner, The Academy of Natural Sciences

INTRODUCTION

The Potomac River is an integral part of the Chesapeake Bay ecosystem and has a long history of monitoring and research on its living resources. The river can thus function as a model to explore strategies for monitoring and restoring the Bay's living resources.

The tidal Potomac River Living Resources Monitoring Plan (PRLRMP) coordinates the ongoing monitoring programs of various state and local agencies, and creates a framework for an integrated monitoring program for living resources in the Potomac River. The program will ultimately monitor large-scale and long-term trends in the Potomac River's living resources, and explore the relationships between living resources, habitat, and water quality. The PRLRMP program's objectives are intended to complement rather than interfere with those of its component programs even though some of the latter were designed to detect the impact of point sources of pollutants or other disturbances.

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

The Chesapeake Bay Program came out with the Living Resources Monitoring Plan in July of 1988. The Potomac River plan differs from the Bay plan in several respects. First, the recommendations are made in the context of existing monitoring programs in the Potomac River which are in some cases more comprehensive than those presently operating in some other areas of the Bay. Only a few new monitoring programs are proposed. Second, the recommendations are more specific about sampling locations, sampling times, and parameters to be measured than is the developing Bay plan since most of the PRLRMP program will consist of ongoing monitoring programs. Third, the PRLRMP plan focuses on groups believed to be significant components of food chains supporting certain representative fish populations. Not included are important species such as hard and soft shell clams, waterfowl and other birds that the Chesapeake Bay Program has identified "target", or representative, species.

The executive summary of the 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.

We have incorporated these objectives into the Potomac plan. We recognize that individual monitoring programs vary in their immediate purposes; some aim at determining only 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 executive summary of the CBLRMP goes on to state "a goal beyond the immediate commitment to develop a living resources monitoring plan is the full integration of living resources and water quality monitoring . . . ultimately, there will be a Chesapeake Bay Monitoring Program that will include both water quality and living resources components." The ongoing plankton monitoring programs on the Potomac River (i.e. the Maryland Department of the Environment [MDE], Fairfax County/George Mason University [FC/GMU], and the District of Columbia Environmental Control Division [DCECD]) are integrated with water quality monitoring in the sense that sampling for both is done simultaneously, in the same locations. 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.

Approach to plan development

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 were identified as:

Striped bass

This fish is a top predator, anadromous, and highly valued by sports and commercial fishermen. Commercial and recreational harvests of the Chesapeake Bay striped bass stock ages 7 years and younger are currently prohibited on the Atlantic Coast from Maine to North Carolina due to poor recruitment in key spawning rivers in Chesapeake Bay.

River herring (blueback, alewife)

These fish are important anadromous fish which spawn in freshwater, tidal sections of the river and which have substantially declined in recent years. Young-of-the-year river herring and the other alosids were once dominant pelagic prey species in freshwater and upper estuarine nursery areas.

Large-mouth bass

This piscivorous species is a representative resident of the freshwater tidal river, and appears to be responding positively to the return of submerged aquatic vegetation (SAV).

Bay anchovy

This species has a cosmopolitan distribution in the estuarine portion of the Chesapeake Bay. It is ecologically important, being the most abundant fish species in the estuarine river and a key intermediate between plankton and piscivorous fish; it would be directly affected by the major water quality problems in the lower river (e.g. anoxia and eutrophication); and a substantial part of its population is resident in the Potomac River for much or all of their life cycle.

White perch, yellow perch, catfish, eels, menhaden, shad and other species are also ecologically important and valued as sports and/or commercial finfish. However, the habitats of these species overlap strongly with those of the selected species of interest. Monitoring programs focused on the species of interest should, as a by-product, yield much useful information on these and other species and provide an adequate index of the "health" of the system.

Oysters

Diseases (MSX and Dermo) are presently decimating the commercially valued oyster bars in the Chesapeake Bay and its subestuaries, although expanding anoxic and hypoxic zones may play a role. Overfishing may also contribute significantly to recent declines in oyster stocks (draft Fisheries Management Plan, March 29, 1989).

Blue crab

The blue crab is one of the few species that supports a healthy commercial fishery at present and it is currently the most important income-producing resource in the Bay.

A conceptual food chain model identifies the following habitats and groups of organisms as critically important to the selected species of interest in the Potomac River (presented in no particular order of importance):

Submerged aquatic vegetation (SAV)

Benthos

Zooplankton [micro- (>44um), meso- (>202um)]

Phytoplankton

This list is not meant to include all "important" species, nor is it meant to imply what other ecosystem components should not be monitored. It is meant to represent a compromise between completeness of information and budgetary constraints. The purpose of this plan is to provide an ongoing assessment of the Potomac River living resources, and it is felt that these ecosystem components will provide the basic data needed to do just that.

FINDINGS AND RECOMMENDATIONS

The Task Force appointed to design a Potomac River Living Resources Monitoring Plan has drawn up the following list of findings and recommendations. This monitoring plan is a component of the evolving bay-wide monitoring plan. The recommendations proposed by the PRLRMP Task Force require formal endorsement and/or action by the Chesapeake Bay Living Resources and Monitoring Subcommittees if they are to be considered part of the Bay-wide monitoring plan. Actual implementation will require action by appropriate committees and/or agencies.

Findings:

1. Monitoring efforts directed at examining relationships between water quality, habitat quality and living resources (CBLRMP objective III) need not conflict with monitoring programs aimed solely at determining status and trends (CBLRMP objectives I and II). A well designed, long-term monitoring program will eventually contribute to all three objectives, despite the original purpose of the program.

2. Plankton and water quality monitoring should be done simultaneously. Long term water quality monitoring in the habitats of longer-lived organisms is vital, but need not be done simultaneously with monitoring of these organisms (e.g. adult fish, benthos, SAV).

3. Species of interest in the tidal Potomac River are:
   striped bass
   clupeids (river herring)
   large mouth bass
   bay anchovy
   oyster
   blue crab

4. Habitats and groups of organisms directly influencing the success of these species are:
   submerged aquatic vegetation (SAV)
   benthos
   zooplankton [micro- and macro-]
   phytoplankton

5. Other important species, or species of interest, can be added to the present list in the future as appropriate.

Recommendations:

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.

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.

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.

4. We recommend that archived samples of the Maryland Chesapeake Bay Plankton Monitoring Program (MDE) from 1984 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.

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.

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.

7. A fisheries-independent monitoring program for blue crab should be started. 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.

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.

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.

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.

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.

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 Council of Governments (COG) 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 repositor(ies).

13. We endorse the developing computerized data bank for living resources at the 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.

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).

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

DISCUSSION OF MONITORING PROGRAM COMPONENTS

The ongoing monitoring programs that comprise the PRLRMP program are outlined in the Table 1. These projects and the proposed monitoring projects are discussed below.

Finfish

Factors controlling finfish populations. Opinion varies tremendously on what factors control finfish populations in the Chesapeake Bay. As a result, agreement is lacking on what actions need to be taken in order to restore fish populations. 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 try to come to a consensus on which factors can control fish populations, in order to identify those trophic components or water quality parameters needing monitoring. In particular, the relative roles of climatic variation, overfishing, and water quality (nutrients, contaminants, impediments) need to be clearly articulated and, to the extent possible, resolved. A workshop composed of fish biologists and estuarine ecologists is needed to accomplish this task and to insure adequate consideration of the critical factors in future monitoring.

Juvenile and adult stock assessments. Four ongoing programs monitor juvenile and adult finfish in Potomac freshwater tributaries and just below the fall-line: the Fairfax County/George Mason University Gunston Cove Project, the District of Columbia Fisheries Monitoring Project, the Maryland DNR Small Tributaries Monitoring Program in Mattawoman Creek and the Maryland DNR Large-mouth Bass Study. Shore haul seines are used in all of the studies, and bottom trawls are also done in Gunston Cove. Of the four finfish that were designated species of interest in the PRLRMP, only large-mouth bass inhabits these sites on a long-term basis. River herring and striped bass are transients and bay anchovy are incidental. In the mainstem Potomac River, the long standing Juvenile Index Survey during the 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 programs are not considered useful in assessing many other species since these species differ from striped bass in habitat use and gear vulnerability. The bay anchovy is not monitored in the mainstem at this time.

New or expanded programs for bay anchovy and river herring are needed in the tidal mainstem and tributaries to complement these tributary studies and more adequately assess these populations. For example, the existing Maryland Striped Bass Stock Assessment could be expanded to

include pound or gill nets targeted at adult river herring and positioned near favored spawning areas upriver of Indian Head (e.g. Mattawoman Creek, Gunston Cove, Piscataway Creek, Broad Creek). And, if the pilot Chesapeake Bay Mainstem and Tributary Trawl Program finds that large-scale trawl surveys are a useful, fisheries-independent tool for characterizing juvenile finfish populations, sampling locations established along the entire Potomac would provide the needed data on juvenile river herring and bay anchovy. Young-of-the-year river herring appear to favor salinities below 2 ppt before they leave the river, and consequently are found in the mainstem and tributaries above Maryland Point and in the midriver tributaries, from July to October. Summer populations of juvenile and adult bay anchovy are found throughout the tidal river system below Broad Creek. The drawback of this pilot trawl study is that implementation of an actual monitoring program is several years away. The Maryland DNR presently conducts a Juvenile Herring Survey each year in four eastern shore rivers, the head of the Chesapeake Bay, and the Patuxent River. Expanding this program to include the head of the Potomac River may be a feasible option to waiting for the trawl study to be completed.

Expanding the Large-mouth Bass Study would generate more accurate estimates of bass abundance and allow objective evaluations of different SAV communities as habitats. Maryland DNR presently monitors juveniles at a few locations in the tidal freshwater Potomac River, is tracking radio-tagged individuals, and is monitoring catches at local bass tournaments. The bass population has recently been growing and popular opinion attributes this growth to the concurrent return of SAV, although this is undocumented.

Ichthyoplankton. Ichthyoplankton are presently surveyed at least biweekly in two Potomac tributaries: Gunston Cove (FC/GMU) and Mattawoman Creek (Small Tributaries Monitoring Project, Maryland DNR). Larvae of the two anadromous PRLRMP species of interest - the striped bass and river herring - are found in these collections. We propose a new program for high-frequency monitoring of additional spawning and nursery habitats of anadromous fish (i.e. tributaries) to examine relationships of the critical egg and larval stages with water and habitat quality. The coordination of spring surveys of spawning stocks, this ichthyoplankton monitoring program, and the summer juvenile surveys would permit relative estimates of survivorship during all freshwater stages of these fish to determine if exceptionally high mortality occurs at a particular life stage. Analyses of the water and habitat quality coincident with these life stages may indicate what factors, other than fishing, are causing high mortality. Although clearly aimed at a level III objective of the CBLRMP (see above), the program would also document the status and trends of ichthyoplankton, an

important but frequently overlooked component of the plankton community. Monitoring several tributaries in addition to Gunston Cove and Mattawoman Creek is suggested. Smith and Possum Points represent prime spawning and nursery areas for striped bass while Piscataway and Broad Creeks are major spawning sites for the river herring.

Actual recommendations for this intensive monitoring program for eggs and larvae of anadromous fish should wait until after an ichthyoplankton workshop which should be held in mid 1989. This workshop has been proposed by a number of individuals to evaluate the uses of data from ichthyoplankton monitoring.

Fish eggs and larvae in the Potomac mainstem have been collected monthly in zooplankton tows for the Maryland Chesapeake Bay Plankton Monitoring Program (MDE) since 1984, but the ichthyoplankton data have not been regularly compiled from the archived samples. Although slightly larger plankton nets with larger mesh sizes are normally used to collect fish eggs and larvae, ichthyoplankton data from these archived samples are acceptable because of the long tow lengths that were done. The archived samples therefore provide the basis of an ichthyoplankton monitoring program for many resident species, and primarily bay anchovy, for the last 6 years. Future ichthyoplankton sampling in the mainstem Potomac, using the correct nets, could be inexpensively achieved by piggybacking onto the MDE cruises. The PRLRMP Task Force recommends that an ichthyoplankton program in the Potomac mainstem be officially established in order to document the status and trends of ichthyoplankton as important components of the plankton. Ichthyoplankton should be collected biweekly, between March and September.

Oysters

Emphasis could be placed on expanding and improving the fall surveys of oyster bars presently conducted by the Maryland DNR (Maryland Oyster Spat and Condition Index Program). Fall surveys provide data on over-summer (disease) mortality, spatfall, condition, size, and containment burden but are presently hampered by inadequate dredge sampling methods which provide, at best, relative catch-per-unit-effort abundance estimates. Brian Rothschild of CBL is working on developing more quantitative methods for sampling oyster bars and the feasibility of using these methods in the fall surveys will be reviewed.

Presently, spring bar surveys are conducted only in Virginia tributaries of the Chesapeake Bay. Spring bar surveys provide information on overwinter mortality, including harvesting pressure, and probably do not need to be initiated in the Potomac because similar data are

collected by the Potomac River Fisheries Commission, i.e. harvest and effort data for each bar.

Water quality measurements made during the annual oyster bar surveys are insufficient to assess the relationship of water quality with population status and trends. Large differences in water quality exist between midchannel and nearshore in the lower estuary, and frequent water quality sampling along cross-channel transects is needed to establish what the oyster bar habitat is like. An intensive water quality monitoring program is recommended for three of the Potomac's oyster bars. These bars should be spaced along the zone of the estuary that have supported producing oyster bars and if possible should be adjacent to existing water quality monitoring stations. Bars fitting these requirements are the Cedar Point Bar (below Morgantown), Ragged Point Bar, and Cornfield Harbor Bar (near Point Lookout). The Ragged Point Bar is also adjacent to a recommended plankton and benthos monitoring station.

The Virginia Institute of Marine Sciences (VIMS) presently monitors spatfall on shellstrings at Cornfield Harbor Bar, Jones Shore Bar, Thicket Point Bar, Hog Island Bar, and Great Neck Bar in the lower Potomac. Weekly surveys of spatfall on shellstrings are done from June through early October, and could easily be co-coordinated with the proposed intensive water quality monitoring described above. Since planktonic larvae drift long distances before settling, this spatfall monitoring program could be expanded to include bars further up in the estuary in order to accurately assess the timing and relative success of oyster recruitment. Spatfall in the Potomac is presently poor except for near the mouth of the river, and oyster shell planted in this area in the summer is used as a source of seed for planting on bars further up the river where historically viable oyster populations were wholly or partially destroyed by Hurricane Agnes in 1972. Although spatfall on shellstrings generally correlates with that on bottom cultch, recruitment on bottom cultch is reduced by fouling or post-settlement mortality. Monitoring data on water quality (e.g. extent of anoxic zone) will help to identify the causes of poor spatfall in the upper estuary.

Blue Crab

Reproduction and larval recruitment of blue crab appear to be vigorous; however, adult mortality due to fishing pressure is increasing throughout the Chesapeake Bay as other fisheries decline. It is recommended that a fishery-independent monitoring program for the blue crab be started as soon as possible. The program should be part of the developing Bay-wide blue crab survey since there is presently no crab monitoring program in the Potomac River.

We urge VMRC and DNR to finalize the blue crab FMP and implement it as soon as possible.

Submerged Aquatic Vegetation

The current aerial SAV survey (Chesapeake Bay Program) provides data on distribution and percent cover. Priority should be placed on maintaining annual aerial surveys of SAV in the Potomac River in order to maintain an archive of data for analysis of long-term trends, even if digitization and interpretation of the data is conducted only periodically. The U.S.G.S. and others have done intensive, annual ground surveys of the Potomac SAV populations since 1978, but these programs ceased in 1988. Efforts to continue ground-truthing in the Potomac should have high priority although intensive, comprehensive surveys could effectively be done at intervals of up to 3 - 5 years. Alternatively, several representative sites could be intensively surveyed every year. We recommend that the SAV group of the Chesapeake Bay Living Resources Subcommittee designate an institution(s) to manage the SAV data, i.e. take responsibility for overseeing the data analyses and ensuring rapid processing of the data, coordinating ground-truthing efforts, making the data and data analyses readily available to interested parties and the public.

A biennial aerial survey of tidal wetlands could easily be instituted in conjunction with the SAV survey in the future if wetlands are designated an important habitat to PRLRMP species of interest. In anticipation of expanding the PRLRMP to include species directly dependent upon tidal wetlands, we urge that aerial surveys of these habitats be piggybacked onto the present SAV survey and the photographs be archived until future funding permits their analysis.

Ambient water quality standards for SAV are presently being developed by the Chesapeake Bay SAV Workgroup. As of now, there is no program that documents long term trends in nearshore water quality, in or out of the SAV beds. Instigating a water quality monitoring program to do this should receive high priority, and the possibility of setting up such a monitoring program has been proposed to the Citizens Monitoring Program by the Interstate Commission on the Potomac River Basin. Furthermore, the National Fish and Wildlife Service (contact, Linda Hurley) is attempting to organize a coordinated SAV/water quality study in the Potomac River. We strongly endorse both of these efforts.

Plankton and Benthos

All of the benthos and plankton monitoring stations are at or near existing water quality stations of the Potomac Regional Monitoring Committee (PRMC) which samples biweekly or monthly. Plankton monitoring is fully co-coordinated

with the PRMC. Benthic samples are collected 10 times annually (DNR/MDE) or just annually (DCECD, FC/GMU), and are not coordinated with water quality sampling although sediment parameters are measured. The designated stations provide good coverage of the freshwater and transition zones. Plankton and benthos sampling in the lower, mesohaline zone is relatively sparse, and efforts to continue the short-lived biological monitoring program of the U.S.G.S. (1985-1987) over the recurring anoxic region would be worthwhile.

There appears to be no need to co-ordinate the benthos and plankton monitoring programs in time and space. The short-lived plankton, especially phytoplankton, respond very quickly to changes in water quality and are sampled simultaneously with water quality samples. Simultaneous sampling is less important for long-lived benthic organisms whose responses reflect the integrated effects of environmental conditions encountered over much longer time periods. Previous studies indicate that benthic responses are related as closely to broad-scale water quality as to local water quality measurements.

Many of the slight differences between the various zooplankton monitoring programs can easily be rectified by using different net mesh sizes. The DCECD has indicated its willingness to directly compare their method of shallow, horizontal zooplankton tows with whole column vertical tows, the method used in other monitoring programs.

Biological Oxygen Demand

In an attempt to provide information on fish and shellfish habitat quality, water column respiration (i.e. short-term oxygen consumption over time) should be initiated in the Maryland Chesapeake Bay Water Quality Monitoring Program and other on-going programs in mesohaline regions typified by hypoxia or anoxia. This kind of data is especially critical since fish and shellfish physiologists feel that short exposure to <2 mg oxygen/liter will a) harm larvae, juvenile or adult stocks, and b) reduce habitat size to effectively stress populations. For example, there is some indication that oyster larvae exhibit a negative geotactic response in hypoxic waters and actively swim at 9% oxygen saturation (i.e. do not settle to the bottom). Adult oysters have considerable anaerobic capacity, but under prolonged conditions of hypoxia, will eventually loose weight and die. Although obviously aimed at a level III CBLRMP objective (see above), long-term monitoring of this kind would also provide a good index for tracking improvements in the bay's pelagic habitats as nutrients are reduced. A workshop is needed to resolve the issue of which methods are best suited for determining water column respiration.

Data management

A central facility, or repository, capable of managing and housing an entire collection of living resources monitoring data from the Potomac River is presently nonexistent. Most living resources monitoring programs produce summary data reports, frequently at irregular intervals, which are poorly circulated. Hard copies or computer files of the data can usually be obtained only by contacting the individuals or programs conducting the work. The feasibility of maintaining one, or more, designated repositories for hard copies (e.g. annual reports, printouts) of historical and contemporary living resources monitoring data from the Potomac River should be explored very soon since thorough analysis of the status and trends of Potomac living resources, and of their responses to water quality parameters, depends upon a complete collection of the data.

The Metropolitan Council of Governments (COG) would be a logical location for such a repository since they already maintain the computerized water quality database for the Potomac Regional Monitoring Committee and hard copies of the companion biological data from 1984 to present. They also have designated funds in their upcoming fiscal year to expand their collection of hard copies of living resources data (personal communication, Meosotis Curtis). However, the COG data collection is not readily available, and accessibility to the public, both in terms of geographic location and ease in obtaining or viewing the data, is an important requirement of a data repository. The proposed Potomac Research Center at George Mason University in Fairfax, VA is another possible repository.

We recommend bolstering efforts to assemble hard copy collections of Potomac living resources data, regardless of whether the repository issue is resolved. ICPRB is willing to compile a list of contemporary and historical living resources data for the tidal Potomac River, using existing monitoring directories, and to begin collecting hard copies of the data. ICPRB is willing to act as a temporary repository for the hard copies until permanent repositories are designated.

Comprehensive analyses of living resources and habitat quality ultimately depend upon computerized data banks. A computerized data bank is needed for Potomac living resources in which the data is entered in a standardized format and made available to researchers and living resources managers. Such a data bank is being developed for the entire Chesapeake Bay and its tributaries at a central data management facility located at the Chesapeake Bay Liaison Office (CBLO) of the U.S. Environmental Protection

Agency, in Annapolis, MD. Unfortunately, few living resources monitoring programs presently submit data in the required computerized form to CBLO. We recommend that efforts be made to enter all of the Potomac's living resources data into computerized databases, whether at the CBLO or at the individual monitoring agency. If a separate data bank is created (by an agency housing a hard copy repository of the data, for example) it should be compatible with the CBLO Bay-wide database.

It is intended that a directory of available living resources data and ongoing living resources monitoring programs on the Potomac River be published on a frequent basis and distributed to interested parties. Responsibility for assembling and distributing this directory could be given to an organization housing a Potomac data repository or one with a direct interest in the Potomac River.

Data analysis

At this time, a coordinated plan for analyzing and interpreting Potomac living resources monitoring data as a whole is completely lacking. Such a plan is needed now in order to fully utilize existing data in the ongoing development of well thought out, effective management policies for living resources in the Potomac River. Results of multi-variable analyses are vital to improving modeling efforts to predict the consequences of management actions as well as toxic loading or catastrophic events. Data analysis is presently done in a selective or piecemeal fashion by investigators with specific interests.

Methods that will be used in first-step analyses of incoming data sets of the coordinated PRLRMP monitoring programs need to be chosen now, and the underlying assumptions identified. Then, actual data collection procedures need to be evaluated to determine if the assumptions are met, and if more or different data would yield better assessments. ICPRB has begun this task and is designing a strategy of basic, or first-step, analyses which can be regularly performed on the merged data sets of Potomac living resources. These analyses will accomplish two of the three monitoring objectives set down by the CBLRMP, i.e. determine status (I) and trends (II). The Commission is also willing to take on the responsibility of doing the analyses since this task fits with the mission of ICPRB. This should not precluded others from taking on these tasks; it only provides for at least one agency to do the analyses.

The third objective of the CBLRMP (i.e. examine relationships between water quality, habitat quality, and the abundance, distribution and integrity of living resources populations) requires more than a strategy of

basic, regularly performed analyses. It might best be accomplished by researchers and living resources managers with specific hypotheses and interests. Identifying the relationships depends, of course, on knowing what trends exist in the living resources, and increasing the availability of trend analyses results will hopefully stimulate this kind of analyses.

The Potomac River Living Resources Monitoring Task Force will be dissolved when this report is complete. We suggest that some formal, periodic meeting is needed to exchange information on new developments and to consider future living resources monitoring needs of the Potomac River. Monitoring efforts on the Potomac River's living resources will increase as the presently evolving Chesapeake Bay programs are instituted, and coordination with this and other new programs is critical to preserving a viable PRLRMP Plan. The organizations best suited at this time to arrange these meetings are COG and the Interstate Commission on the Potomac River Basin although future meetings could be hosted elsewhere (e.g. the proposed Potomac Research Center at George Mason University, CBLO in Annapolis, MD).

TABLE 1. CURRENT BIOLOGICAL MONITORING PROGRAMS ON THE TIDAL POTOMAC RIVER

Key for recommended changes:

A. Minor change (such as coordination among programs or changes in methodology) that should not require substantial increases in funding or personnel.
B. Major change that probably would require increased funding or personnel.

PROGRAM	STATIONS	SAMPLE FREQUENCY	VARIABLES MEASURED	RECOMMENDED CHANGES
ZOOPLANKTON & PHYTOPLANKTON MONITORING				
Maryland (MDE)	Indian Head (XEA 6596) Maryland Point (XDA 1177) Ragged Point (XBE 9541)	Zooplankton-monthly Phytoplankton-monthly Oct-Mar, twice monthly Apr-Sept	Phytoplankton cell counts Chlorophyll-a In vivo Fluorescence Primary productivity Microzooplankton (>44um) Mesozooplankton (>202um)	B.(1) Monitor water column respiration, if Bay program selects measure other than BOD.
Fairfax County/GMU	15 Sta. in Gunston Cove, Dogue Creek, Potomac River, (near POH 232 & XFB 1433)	Monthly Mar-Nov Twice monthly June-Sept.	Phytoplankton cell counts Chlorophyll-a Primary productivity Zooplankton (>73um) Ichthyoplankton (>333um)	A.(1) Sample >44um microzooplankton and >202um mesozooplankton.
District of Columbia (DCECD)	Key Bridge (PMS 10) Naval Research Lab (PMS 37) Pennsylvania Ave. on Anacostia R. Phytoplankton also sampled at 9 other stations on Potomac and Anacostia Rivers.	Monthly	Phytoplankton cell counts Zooplankton (>80um) -surface tows only	A.(1) Sample >44um microzooplankton and >202um mesozooplankton. (2) Plankton sampling should collect integrated vertical samples of water column unless vertical stratification of plankton is shown to be insignificant. B.(1) Monitor primary productivity. (2) Increase temporal frequency of sampling to correspond with Maryland at 3 main stations.
BENTHOS MONITORING				
Maryland (DNR/MDE)	1 Station tidal fresh 7 Stations transition 8 Stations lower estuary	10 times annually	Benthos enumeration & biomass. Associated sediment & water quality variables	A.(1) Coordinate methods for sampling and analysis with other benthic monitoring programs.

CURRENT BIOLOGICAL MONITORING PROGRAMS ON THE TIDAL POTOMAC RIVER

PROGRAM	STATIONS	SAMPLE FREQUENCY	VARIABLES MEASURED	RECOMMENDED CHANGES
BENTHOS MONITORING (CONT.)				
Fairfax County/GMU	15 Stations, Gunston Cove area	Annually	Benthos enumeration	A.(1) Coordinate methods for sampling and analysis with other benthic monitoring programs.
District of Columbia (DCECD)	13 stations, free-flowing tributaries	Periodically	Benthos enumeration	A.(1) Coordinate methods for sampling and analysis with other benthic monitoring programs.
INTENSIVE MONITORING OF FISH LARVAL STAGES				
Fairfax Co./ GMU	Plankton nets, at 18 stations in Gunston Cove, Dogue Creek, Potomac River	Biweekly Apr.-Aug.	Ichthyoplankton (>333 micron) I.D. and counts, eggs, incidential larvae & adults.	
Maryland Small Tributary Monitoring Program (DNR)	Drift nets at two sta. in Mattawoman Creek	Weekly - biweekly, 1 April - 1 June	Anadromous species ichthyoplankton I.D. & counts, eggs.	
FISHERIES MONITORING				
Maryland Adult Striped Bass Survey	Drift gill nets placed between Maryland Point (XDA 1177) and Indian Head (XEA 6596)	Daily, early Apr-late May	Spawning stocks of striped bass	B.(1) Institute pound or gill net sampling targeted at spawning Clupeids, 3 times weekly during Apr-May. Stations: Mattawoman Creek, Gunston Cove, Piscataway Creek, Broad Creek. B.(2) Develop or expand programs to assess adult stocks of Bay anchovy.
Maryland Estuarine Juvenile Finfish Survey (DNR)	Beach haul seine samples 5 stations in lower estuary 5 stations in transition 3 stations in tidal fresh	Monthly Jul-Sept.	Juvenile indices for striped bass, white perch, river herrings.	

CURRENT BIOLOGICAL MONITORING PROGRAMS ON THE TIDAL POTOMAC RIVER

PROGRAM	STATIONS	SAMPLE FREQUENCY	VARIABLES MEASURED	RECOMMENDED CHANGES
FISHERIES MONITORING (CONT.)				
Maryland Small Tributaries Monitoring Prog.	Seine hauls 6 sta. Mattawoman Creek	2-3X monthly, Apr.-June	Juvenile indices	
MD Large-mouth Bass Study (DNR)	Several stations Upper Tidal Potomac	Monthly	Abundance	
Fairfax County/ Geo. Mason	Gunston Cove Area 1. Bottom trawl-5 stations 2. Beach haul seine-4 stations	Monthly Mar.-Nov.	Fish abundance, species composition.	
District of Columbia (DCECD)	Several stations on Potomac & Anacostia Riv. within D.C. boundaries. 1. Gill net 2. Shore haul seine	1. Feb.-late summer 2-3 times weekly in spring 2. Monthly Mar.-Dec.	1. Spawning stocks of anadromous fish. 2. Juvenile indices	
Potomac River Fisheries Comm		Annually	Commercial Fisheries Landings	
Oyster Bar Survey (DNR)	Key Oyster Bars	Annually, in fall.	Oyster size, condition, disease prevalence, mortality, spatfall, contaminant burden.	A.(1) Improve sampling method(s).
Virginia Shell-string Spatfall Survey	6 stations near mouth of Potomac River	Weekly, June-early October	Spatfall on shellstrings	B.(1) Institute additonal surveys on Ragged Point Bar and Cedar Point Bar.

CURRENT BIOLOGICAL MONITORING PROGRAMS ON THE TIDAL POTOMAC RIVER

PROGRAM	STATIONS	SAMPLE FREQUENCY	VARIABLES MEASURED	RECOMMENDED CHANGES
AQUATIC VEGETATATION MONITORING				
Chesapeake Bay Aerial SAV Survey	Tidal River	Annually	Percent Cover	B.(1) Ground-truthing every 3-5 years. (2) Institute biennial aerial survey of tidal wetlands, in conjunction with aerial SAV survey.
U.S.G.S. (program will cease after 1988)	1. Freshwater Tidal River - Shoreline Survey 2. 172 transects (DC-301 bridge)	1. Annually 2. 1-2 times annually	1. Percent Cover 2. Species composition, biomass	
Citizens Monitoring	Rappahanock & Patuxent Rivers	Weekly	A suite of physical & chemical parameters, & biological observations & measurements.	B.(1) Expand present program to include the Potomac River.
DATA MANAGEMENT				
CBLO Computer Center				B.(1) Establish centralized living resources data bank at CBLO Computer Center, Annapolis, MD.

POTOMAC RIVER LIVING RESOURCES MONITORING PLAN

PURPOSE

The tidal Potomac River Living Resources Monitoring Plan (PRLRMP) is an addendum to the Chesapeake Bay Living Resources Monitoring Plan (Agreement Commitment Report, July 1988). Its purpose is to assemble an integrated living resources monitoring program for the Potomac River from existing programs, and to propose additional programs where needed. It is intended to serve as a prototype of a Bay-wide integrated monitoring program for living resources.