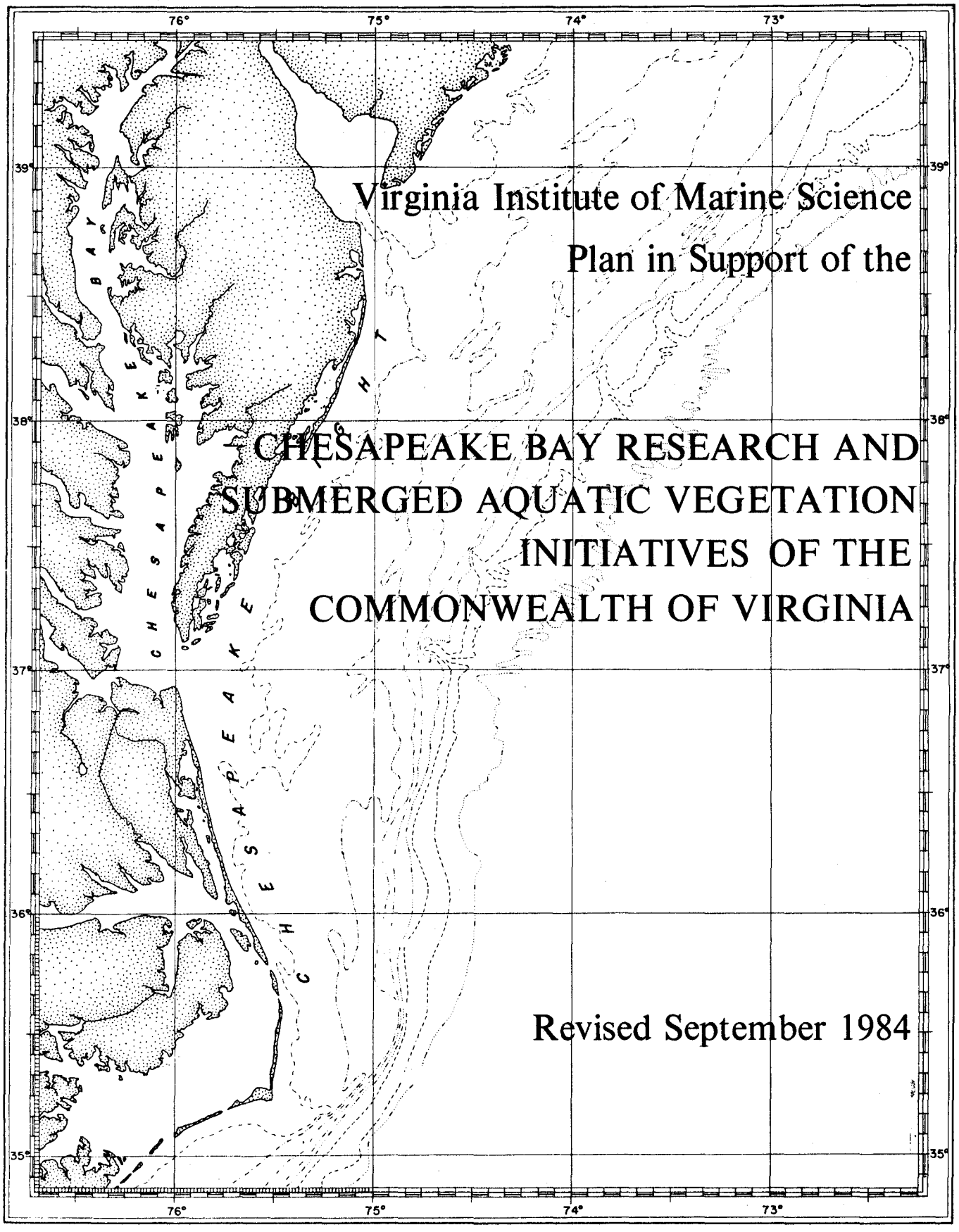
1984

Virginia Institute of Marine Science Plan in Support of the Chesapeake Bay Research and Submerged Aquatic Vegetation Initiatives of the Commonwealth of Virginia

Virginia Institute of Marine Science



Virginia Institute of Marine Science

Plan in Support of the

CHESAPEAKE BAY RESEARCH AND SUBMERGED AQUATIC VEGETATION INITIATIVES OF THE COMMONWEALTH OF VIRGINIA

Revised September 1984

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OVERVIEW

The General Assembly acted upon and enlarged the Governor's initiatives by appropriating $13.3 million (1984-86 Biennium) for Virginia's Chesapeake Bay Plan. The Virginia Institute of Marine Science (VIMS) received $1.7 million of that amount to address issues dealing with Bay management and $150,000 to re-establish Submerged Aquatic Vegetation (SAV). The 1984-86 Appropriation Act described three studies to be conducted:

1. River Circulation Studies for Revitalization of James River Seed Oyster Industry;

2. Biological Studies of Factors Causing Decline in Virginia's Oysters and Critical Finfish Populations; and

3. Chemical Poisons in Virginia's Tidal Waters.

The impetuses for these studies is 1) the Joint Legislative Audit and Review Committee (JLARC) report on Virginia Fisheries (House Document #2, 1984), 2) Senate Bill #167 (1984 Session) and 3) the discovery of very high concentrations of toxic organic compounds in the Elizabeth River.

From a scientific viewpoint, research on the revitalization of the James River seed oyster industry is highly interdisciplinary. Therefore, the research programs can best redescribed as:

1. Revitalization of the James River Seed Oyster Industry - Biological and River Circulation Studies;

2. Factors affecting recruitment of Virginia's Critical Finfish Population - Biological Studies; and

3. Chemical Poisons in Virginia's Tidal Waters.

Revitalization of the oyster industry in Virginia will depend upon increasing the potential yield of the James River seed beds which, since the end of the 1950's, have experienced declining trends in recruitment. The reasons for the decline are not clear. Our studies are addressing the potential causes of reduced recruitment and how the oyster larvae are transported by water currents. These findings will be of particular importance in identification of optimum locations for brood stocks and/or locations where additional replenishment efforts would increase yield. Equally important, our studies will identify those factors over which man has little or no managerial control but which must be identified to lessen the chance of useless and costly managerial actions being initiated. Specifically, we will investigate:

1. Composition and Distribution of Brood Stocks (Project 1);

2. Effects of Predators and Fouling on Spat Strike and Survival (Project 2);

3. Impacts of Chlorinated Sewage on Oyster Spat Fall and Spat Survival (Project 3); and,

4. Mechanisms of Water Circulation in the Lower James River/Hampton Roads as a means of Predicting the

Transport Pathways of Oyster Larvae and/or Dissolved Pollutants (Projects 4 A-D).

The goal of our work is to provide Virginia's management agencies with an evaluation as to which brood stocks need protection and/or enhancement, where additional substrate could be best placed to enhance seed oyster yield, and to delineate the influence of chlorinated sewage on oyster production. Further, our effort will provide managers with information on the factors contributing to poor survival of oyster spat. It is estimated that this component of the Research Plan will cost $899,687 (Exhibit 1).

For the research components dealing with recruitment of Virginia's critical finfish, we are conducting two research projects:

1. Development of Models Relating Environmental Variations with Strength of Recruitment of Virginia Populations of Spot and Summer Flounder (Project 5); and,

2. Investigation of Viability of Striped Bass Eggs on the Pamunkey River Spawning Grounds, with Observations on the Occurrence and Possible Effects of Acid Runoff in the Spawning Grounds (Project 6).

The estimated cost for this research plan component is $214,323 (Exhibit 2).

The goals of this effort will be to provide the Virginia Marine Resources Commission (VMRC) with predictions of finfish recruitment in support of their Fisheries Management Plans.

The last component of our research program emerged from studies conducted by VIMS in the first phase of the EPA/Bay program which disclosed that the Elizabeth River contained very high concentrations of organic compounds called polynuclear aromatic hydrocarbons (PAH). Although these compounds are the major organic pollutants in the Chesapeake Bay proper, the primary source in the Elizabeth River is creosote in the Southern Branch. Biological collections and analyses of organisms from the river have revealed blatant impacts in the areas with highest concentrations. Finfish exhibit fin rot, tissue lesions, liver damage, suppression of the immune system, and in some cases blindness due to cataracts.

Our specific research will focus on the derivative compounds, or metabolites, of the PAH which have been shown to be more toxic than the parent PAH. Thus, the goal of our studies is to determine the fate and effects of PAH and their metabolites in the sediments, water, and biota of the Elizabeth River (Project 7). The analytical systems to be established will also allow us to examine many industrial compounds (non-PAH) which cannot now be deciphered.

The second area of this research component concerning toxic chemicals in Virginia's water will be the establishment of an Early Warning System for Pollutants in Seafood (Project 8). The two main classes of compounds of concern are synthetic organics, pesticides and polychlorinated biphenyls (PCB). With implementation of this broad spectrum screening procedure, our goal is to circumvent for the future the devastation experienced by the seafood industry when Kepone was introduced into the James River.

Exhibit 3 details the funding requirement of $585,990 for these projects.

Finally, as part of the Governor's initiatives, $150,000 (Exhibit 4) has been provided to reestablish Submerged Aquatic Vegetation in selected regions which have experienced widespread decline (Project 9).

Our overall objective for the SAV initiative is to replant eelgrass in selected areas in the lower Bay, using whole plants, and to investigate the effects of submarine light, dissolved nutrients and fouling on eelgrass growth. By combining *in situ* monitoring of transplant sites and by conducting laboratory microcosm experiments, we expect to better understand those factors affecting the growth and survival of the transplanted eelgrass and establish minimum water quality requirements for eelgrass growth and survival. We will also investigate the feasibility of using naturally produced seeds for re-establishing SAV in selected lower Bay habitats in the hope of minimizing the overall time required for such efforts.

The Initiative Funds, as summarized below, are augmented by $575,935 from the Institute's biennium core research program thereby allowing increased concentration on these particularly critical research areas (Exhibit 5). In addition, private sector funding sources will contribute approximately $165,000 during the first year of the biennium.

Research Components	FY 84/85	FY 85/86	Biennium
James River Oyster Seed Beds	$393,976	$ 505,711	$ 899,687
Finfish	91,770	122,553	214,323
Chemical Poisons	214,254	371,736	585,990
Submerged Aquatic Vegetation	75,000	75,000	150,000
	$775,000	$1,075,000	$1,850,000

Project 1

Composition and Distribution of Brood stocks

Objectives:

1. Examine male/female ratios among several potential adult brood stocks in the lower James River, and describe the distribution and abundance of adult oysters.

Project Description:

Location of the brood stock, producing the larvae that set on the seed beds of the James River, is important for understanding the dynamics of spat set and distribution. We aim to describe the gametogenic condition of oysters from beds at approximately 6 locations in the lower James River. Previous histological sections, prepared monthly since 1951, will be examined for abundance and distribution of adult oysters by sex. Possible trends and changes will be examined by comparison with newly-collected samples.

This is the first step in our effort to identify the sources of larvae recruited to the seed beds and to determine any differences in gamete production by oysters from different areas of the river.

Data will be analyzed to determine the proportion of male and female oysters on each bed at each sampling time, and the spatial/temporal distribution of sexually active oysters within the lower James River.

A closely related study, funded separately by VIMS is examining the genetic make up of oyster brood stocks in the James to determine whether one or several subpopulations are dominant contributors to the annual stocks; and, therefore, should be favored in any management schemes.

Anticipated Results:

We will provide information to management agencies on the location of important adult oyster brood stocks in the lower James River. This will provide data on stocks that need protection and enhancement.

Project 2

Effects of Predators, and Fouling, on Spat Strike and Survival

Objectives:

1. Identify seasonal abundance of predators of oyster spat in the field and examine their selection of prey under laboratory conditions.

2. Identify seasonal abundance of fouling organisms and oyster spat on clean and natural cultch, and determine in the laboratory whether fouling impedes spatfall.

3. Determine the impact of blue-green algae, living within oyster shell, on spatfall and spat.

Project Description:

Four stations have been established in the area of Wreck Shoal, and clean oyster shell have been spread over the bottom. These shell, and natural cultch, are being collected at two-week intervals between June and November and then at monthly intervals. The shell and cultch samples are collected by divers using suction samplers.

The samples will be examined in the laboratory for occurrence of spat, predators, and fouling organisms. Abundance and size frequency counts will be made. The data will be examined for correlations between spat abundance and growth, predator abundance, and fouling organisms. These will be related to spatial and temporal differences.

Randomly collected samples of recently introduced oyster shell and naturally occurring shells from the James River will be examined twice monthly. Numbers of spat and macro-fouling organisms will be quantified. These shells will be held in filtered flow-through systems to which predators will be added (the flatworm Stylochus, mud snail Odostomia, mud crab, and blue crab). Controls will be maintained. A set will also be held in wire cages in the James, along with uncaged controls. This is expected to evaluate possible damage by larger predators.

Endolithic blue-green algae live inside oyster shell, just below the surface of the shell. Shells with and without the algae will be used to obtain a set, then evaluated weekly similarly to the predator/fouling studies.

Anticipated Results:

The seasonal occurrence of predators and fouling organisms will be reported to VMRC, the agency responsible for placement of cultch, together with an evaluation of their effect on spat mortality. Such information should be useful in 1) site selection for placement of cultch, and 2) time of placement of the cultch in the river.

Project 3

Impacts of Chlorinated Sewage on Oyster Spatfall and Spat Survival

Objectives:

Determine the impact of chlorinated sewage on oyster spatfall and spat in the James River.

Project Description:

The effects of chlorination and dechlorination are being studied in the laboratory using graded series of dilutions of chlorinated and dechlorinated sewage stocks. Five dilutions will be tested ranging from 1% to 20%. VIMS physical oceanographers will determine the distance from the outfall at which the dilutions occur. A field study to monitor spatfall and fouling organisms is being conducted. Plates are located at selected sites, which are expected to include levels of sewage comparable to the dilutions mentioned above. Weekly counts are being made of spat and other invertebrates to determine whether the tested dilutions of chlorinated sewage are impacting survival of James River seed oysters.

Anticipated Results:

Since the use of chlorine in sewage treatment began at approximately the same time as appearance in Virginia of the devastating oyster disease MSX, it is not clear whether the sharp decline in oyster setting 25 years ago was caused by one or both of these factors. The results of this study will assist state agencies by identifying allowable chlorine levels in sewage effluents and by providing information as to the causes of the historical decline in oyster spatfall after the late 1950's.

Project 4

Determinations of the Mechanisms of Water Circulation in the Lower James River/Hampton Roads as a means of Predicting the Transport Pathways of Oyster Larvae and/or Dissolved Pollutants

Approach:

Oyster larvae remain in the water column for a period of 10 to 30 days during which time they are entrained in complex circulation patterns. The initial step in successful recruitment depends upon a large number of larvae being over a favorable hard substrate at the time when the larvae must attach for permanent residence. The paths of water mass movement from the spawning stock to ultimate setting is thus crucial. The problem is made even more complex by the fact that oyster larvae can adjust their vertical position in the water column. Past VIMS studies on river circulation and on patterns of oyster spat settlement suggest that it will be possible to provide reasonable estimates of larval movement by integration of past field and mathematical modelling work with certain new field observations.

The purpose of the integrated approach is to test our existing working hypothesis regarding how oyster larvae are retained within the system. The information base so derived will also allow us to address the movements of materials from point source discharge. Finally, from this improved understanding of the details of circulation we will be able to provide a better assessment of the degree to which channel modifications or lateral boundary geometry changes may impact the seed oyster beds.

Working Hypothesis:

Water masses in the lower James River and Hampton Roads recirculate in such a pattern that the upriver sections of the seed bed areas are likely the prime brood stock areas while the downriver sections are most likely to receive the strongest strike. Moreover, the distribution of oyster larvae is influenced by fortnightly variations in the vertical salinity structure and meso-scale circulations induced by converging water masses.

In order to attain our objectives we must understand the movement of water in the three spatial dimensions and be able to trace these movements through time. Tools with sufficient resolution are not available to resolve the problem with a single stroke. Accordingly we plan four projects which when integrated will provide the estimates sought. In the first case we will examine the movement of water masses in the horizontal plane. The second case addresses the variability of the water density (salinity) structure in the vertical plane. In both of these cases we can interface the field observations with existing numerical hydrodynamic models and then use the models as a means for interpreting the system. The third case addresses smaller scale motions which are recognized as being potentially important to the concentration (or in some cases dispersion) of oyster larvae. Although these scales are not incorporated into any mathematical models our interpretation of the model results must incorporate these findings. The fourth case addresses the microcirculation and sedimentation processes occurring on one of the most important seed rocks, Wreck Shoal.

This project will broaden our understanding of how oyster rocks are influenced by sedimentation and thereby assist in identifying additional areas for shell replenishment.

Anticipated Results:

Based upon the integrated results of Projects 4 A, B, and C, we will provide refined estimates of larval transport and estimates of the sphere of influence of sewage treatment plants. From these estimates we will provide recommendations as to those areas most favorable for brood stocks and those areas favorable for establishing additional substrate for seed oysters.

From our study on sedimentation processes on Wreck Shoal we will develop bottom selection criteria for additional areas for shell replenishment.

The enhanced understanding of the river circulation will enable us to offer markedly improved estimates of potential impacts arising from proposed modifications in channels or shore boundaries.

Project 4A

Horizontal Circulation and Characterization of Larval Movement and Retention

Objective:

To determine first order estimate of larval transport pathways, larval retention and pathways of movement of point source discharges.

Project Description:

Past studies in the James River Hydraulic Model in Vicksburg have traced dye movements from the seed bed rocks, and from the principal sewage treatment plant (STP) outfalls in the lower James River/Hampton Roads area. In addition some dye studies have been conducted in the field in conjunction with STP outfall siting. As well there have been limited studies using drogues (devices which move with the water mass) in the Hampton Roads area. These results are being incorporated into the more general framework of a numerical hydrodynamic model so that larval releases (or pollutants) may be simulated for a variety of conditions such as neap/spring tides and variable freshwater inflow. This model provides information on the circulation patterns in the horizontal plane.

After calibration of the model using previous results of the hydraulic model and field results, the numerical model runs will indicate the gross pathways of water movement in the horizontal plane and will thus serve to trace larval or pollutant releases. These results will provide the first estimates as to which seed bed areas

would offer best larval retention and, therefore, warrant consideration for brood stock enhancement. As well, these results will identify candidate areas where additional substrate might be created to increase the yield of seed oysters.

When coupled with the first phase results of projects 4B and 4C (described below) these model results will be used to determine additional dye and drogued buoy release locations and field sampling strategies for investigating larval densities.

Anticipated Results:

In the first year, maps showing a first order estimate of water movements in the horizontal plane will be prepared, and initial estimates will be made concerning the optimum location for brood stock and additional substrate for seed oysters. These estimates will be crude since they will not include the effects of variations in vertical salinity structure or the effects of mesoscale circulation.

Project 4B

Role of Mesoscale Circulation in Larval Transport

Objectives:

1. To identify the location and character of the principal water mass convergence zones' (fronts) likely to affect larval (and dissolved pollutant) transport processes.

2. To determine whether the formation and dissipation of 'fronts' play a significant role in oyster larval transport processes.

Project Description:

The seed oyster beds are located on the shallow margins of the channel and on the flanks of the river. During the tidal cycle water masses tend to converge over these areas and materials in the water column tend to become concentrated. Our work is concentrated on two types of frontal zones. In the first case attention is being focused on those features associated with depth changes parallel to the channel axis. The second class of features are those associated with shoreline irregularities. The particular case in point is a convergence zone documented by VIMS off of Newport News Point. During flood tides, surface waters in the channel and on Hampton Flats converge and plunge. Of importance to larval processes is the fact that the Small Boat Harbor STP outfall is located within the sphere of influence of the convergence. Thus oyster larvae may be stirred in a mixing zone with STP effluent.

During the first year we will utilize existing and new aerial photography to identify the principal zones of interest. Also we are conducting preliminary field investigations to define the behavior of the convergence zones. Particular emphasis will be placed at Newport News Point and at the vicinity of Wreck Shoal, one of the most important seed bed areas.

The work completed in 1984-85 will be the foundation for interdisciplinary efforts in the 1985 oyster spawning season (July-Sept.) to document the distribution of larval and toxic pollutants in the vicinity of fronts. With respect to toxics we expect to find enhanced surface layer concentrations since the consequence process skims the surface film. These surface slick or foam zones, in fact, are the principal surface manifestation of fronts.

Anticipated Results:

In the first year we will identify and report upon the principal convergence zones in the lower James - Hampton Roads area. In addition we will report the results of our preliminary surveys at Newport News Point and Wreck Shoals.

In the second year we will report the results as to the role the fronts play in larval transport processes.

Project 4C

Role of Temporal Variations in Gravitational Circulation

Objectives:

1. To document the fortnightly variation in gravitational circulation as well as salinity gradients, and to ascertain the importance of other scales.

2. To infer the role temporal variations in gravitational circulation plays in larval transport.

Project Description:

The classical view of estuarine circulation in systems like the James River is that of a net downriver transport in the less saline upper layer and net upriver transport in the bottom saltier water. Oyster larvae, having the ability for vertical migration, can thus be affected by this circulation. Recent works at VIMS and other institutions have demonstrated that the classical 'steady state' gravitational circulation in a partially-mixed estuary is not steady at all, rather it is highly variable. In particular our studies have shown a fortnightly breakdown in vertical salinity gradient. Of importance to the problem of larvae transport is the observations that the intensity of oyster strike also appears to exhibit a fortnightly variation. It was also observed that the classical two layer circulation of upstream transport near the bottom and downstream transport near the surface were frequently interrupted by wind and

other meteorological events. It is not known if these random occurrences of interruption play a role in larvae transport.

During the summer of 1983 an extensive survey was conducted to investigate the fortnightly variation in salinity structure. The data are being reduced for analysis, and the results will serve to guide future sampling strategy. The actual strength of gravitational circulation (currents) were not measured, but the Initiative funding will provide the instrumentation for this phase. Accordingly the gravitational circulation in a river transect near James River Bridge will be studied in detail. Since this is a transect at the downstream limit of seed oyster beds, it is important to know the distribution of net transport through the transect. This will be measured during various seasons with particular emphasis on summer. Current meters will be deployed at five stations across the river. Current velocities will be measured at several depths for a period of at least one month. Concurrently, temperatures and salinities will also be measured at each station. The data will be analyzed for gravitational circulation. The spatial (lateral) as well as temporal variability will be studied. Correlation between vertical stratification and strength of circulation will be investigated. Insight gained from these studies will be incorporated in an existing two-dimensional (vertical and longitudinal) mathematical model to simulate the observed hydrodynamic behavior of the model and then investigate alternate conditions. Particular emphasis will be placed on the variability of the circulation in response to varying forcing functions, i.e. tide, freshwater runoff and wind events.

Anticipated Results:

In the first year a data report on fortnightly salinity variations will be issued. These results will be corporated into the mathematical model to test the sensitivity of the model.

In the second year the results of the field observations on temporal variability of gravitational circulation will be reported. As well the interpretations derived from the mathematical models will be completed.

Project 4D

Micro-circulation and Sedimentation Processes at Wreck Shoal

Objective:

To determine the sedimentation processes on oyster rocks and formulate criteria for judging site suitability for shell plantings.

Project Description:

Sedimentation processes on oyster rocks are very poorly documented or understood. In addition to being located within a zone of relatively high natural sedimentation the oysters themselves produce very large volumes of sediments as fecal materials. How are the oyster rocks maintained in this environment of deposition? This project is intended to provide answers to this question. Wreck Shoal, one of the most important seed rock areas, has been selected for the study. The significance of the project rests on the fact that if additional replenishment areas are needed, we must have a better understanding of oyster rock sedimentation. With such understanding we will be able to evaluate the risk of planting shell at various sites.

In the first year of the project the historical patterns of sedimentation are being determined. In addition the detailed bathymetry, oyster and sediment distributions have been mapped. Current meters have been installed to decipher the micro-circulation.

During the second year detailed studies will be conducted on the sediment transport processes. This will include the evaluation of

sedimentation rates in areas of different surface roughness and sediment types.

Anticipated Results:

In the first year we will report on the historical depositional patterns and on the modern distribution of oysters and sediments. Additional reports will address the micro-circulation.

In the second year we will report on the results of sediment transport processes studies and formulation of a more general morphodynamic model of oyster rock sedimentation.

Project 5

Development of Models Relating Environmental Variations With Strength of Recruitment of Virginia's Populations of Spot and Summer Flounder

Objectives:

Identify natural environmental variables (e.g. wind transport, temperature) affecting fluctuations in juvenile abundance of summer flounder, weakfish, spot and striped bass.

Project Description:

Juvenile abundance data from the ongoing VIMS 30-year juvenile fish monitoring program are being used as estimates of recruitment. Interannual fluctuations in recruitment will be examined conceptually based upon the life cycle and corresponding environmental forces/responses of the shelf fall spawning species (summer flounder and spot). The "model" will be that developed last year for the croaker, another fall shelf spawner, using shelf wind fields and subsequent winter temperatures. From this study realistic recruitment indices and an understanding of why they fluctuate can be developed. These indices can be tested, not only for stock recruitment, but also as indicators of subsequent commercial catch using cross correlation analyses. We will initiate weakfish and striped bass data bases.

Anticipated Results:

Models of spot and summer flounder recruitment will be completed and delivered to VMRC within the biennial period to be used in

development of Fishery Management Plans. Juvenile data bases for striped bass and weakfish will be assembled and proofed during that same period for later model development.

Project 6

Investigation of the Viability of Striped Bass Eggs on the Pamunkey River Spawning Grounds With Observations on the Occurrence and Possible Effects of Acid Runoff in Spawning Grounds

Objectives:

1. Estimate striped bass egg production and larval abundance on the Pamunkey River spawning grounds in spring months.

2. Calculate female biomass required to produce observed egg production as an estimate of spawning stock size.

3. Measure vitality of eggs on the spawning grounds.

4. Document pH changes during weather-related increases in runoff and determine effects on survival of eggs and larvae.

Project Description:

Striped bass spawning stock size, from estimates of egg production and larval abundance, will be calculated for the Pamunkey River spawning grounds. The spawning grounds have been divided into 3-mile segments and will be sampled with 60 cm bongo samplers equipped with 333μ mesh nets. Ancillary environmental data will be measured. Egg production will be calculated using standard methods and female biomass calculations from the literature.

Egg vitality will be measured on shipboard using established criteria. Eggs will be collected using a 1-m Hansen egg net equipped with a 202μ mesh net and collecting jar. Examinations will be made

twice weekly. Special attention will be given to obtaining estimates of vitality before and after storm events to ascertain whether increases in acidity have an impact upon survival and normal development of eggs.

Anticipated Results:

Data obtained on egg and larval abundance will be compared with previous years data (1980, 1983, 1984) for estimates of interannual variation. Calculations of biomass (spawning stock size) will be performed for 1984-1986, information important in development of Fishery Management Plans. We will observe and document whether or not pulses of acidity occur in this drainage basin after storm events and, if so, what effect lowered pH has on survival of eggs and larvae.

We will provide documentation on levels of interannual variability and initiate the data base to provide information on trends in egg production and viability necessary for development and operation of a Virginia Fisheries Management Plan for striped bass.

We will provide documentation of the potential effects of reduced pH in the waters of the spawning grounds of the Pamunkey River.

Project 7

Chemical Poisons in Virginia's Tidal Waters, Fate and Effect of Polynuclear Aromatic Hydrocarbons

Objectives:

The initiative funding will allow us to correct the current problem which exists with respect to detecting metabolites of polynuclear aromatic hydrocarbon compounds. We intend to couple or interface microbore high performance liquid chromatography (HPLC) with a quadruple mass spectrometer (MS) which has the capability of electron impact as well as both positive and negative chemical ionization. The milder separation conditions of HPLC should allow us to separate and identify many of the metabolites. There is an added advantage of a HPLC-MS system. It will allow us to look at many industrial compounds which are not PAH but are too polar for conventional analyses. This will be of great importance and assistance in the pilot toxics monitoring strategy initiative of the Water Control Board. Also the initiative monies will allow us to replace aged equipment (HPLC and GC's).

Project Description:

The first task is to set up the instrumentation, particularly the HPLC-MS system. Then experimentation will proceed to determine the optimum operating conditions for chemical ionization and establish the time for the cyrogenic pump to reach saturation. Then we will test the HPLC-MS with standards (PAH, azaarenes, nitroaromatics, hydroxy PAH) and evaluate the responses with different solvents and positive

and negative ions. Once this is done we will utilize the system to determine the compounds in:

1. Sediments from the Elizabeth River
2. Water and suspended matter from the Elizabeth River
3. Interstitial fluids from the Elizabeth River
4. The biota from the Elizabeth River including the following organs of fish:

    A. Liver
    B. Musculature
    C. Kidney
    D. Bile
    E. Eyes

In addition, we will be working closely with the Water Control Board by utilizing the technology for their toxics strategy initiative and will transfer the data and technology to them and the Division of Consolidated Laboratory Services as appropriate.

Anticipated Results:

One of the products which will result from this effort will be the development of an analytical methodology for polar and labile organic compounds in sediments, water and tissues. It will be documented and available to other laboratories for their use.

We will utilize the methodologies to be developed by analzing samples from the Elizabeth River and nearby areas. Therefore another product will be the determination of the concentrations of toxic PAH

metabolites in the biota of Elizabe h River and Hampton Roads. These data will be transferred to the Water Control Board and State Health Departments for their use in evaluating the potential threat, if any, to consumers of the seafood from the area as well as evaluating the health of the marine and estuarine organisms therein. This will be important in the considerations of port development and/or clean-up of the contaminated portions of the river.

This will lead to our better being able to advise the management agencies of the Commonwealth on the impacts, present and future, of the severe pollution of the Elizabeth River.

Project 8

Early Warning System for Pollutants in Seafood

Objectives:

The objective of this portion of the research initiative is to integrate and supplement elements of on-going monitoring and research studies to produce a comprehensive monitoring program for toxic organic chemicals in Virginia seafood. We anticipate that in addition to providing the first comprehensive study of possible toxic organics in Virginia seafood, this study should provide valuable background information for the James River seed bed study. High residues of toxic organic chemicals are known to effect spawning success of many aquatic animals. A comparison of residues found in James River oysters to those from other areas and with known toxic levels should allow an estimate of the likely impact of these chemicals on oyster reproduction in the James River.

Project Description:

The elements shown in Table I are being included to form the program.

Anticipated Results:

The integration of these programs will provide for a comprehensive study of existing levels of PAH, pesticides, and PCBs in major Virginia seafood items. The results should provide the information necessary to identify any problem species and/or areas and lead to the design of a standardized monitoring program. Such a program will help ensure that Virginia's seafood remains a strong viable and wholesome resource.

Table I

Study	Description	Status
PAH levels in Virginia oysters and clams	Quantitative PAH levels in oysters from the James, York & Rapp. rivers & clams from the James	Cooperative State Agency Program - for 84-85
Kepone levels in James oysters	Monitoring Kepone	State Health Department - regular programs
Other pesticides and PCBs in oysters	Establish baseline	New - this initiative
Kepone levels in James River fishes	Monitoring Kepone	State Water Control Board-VIMS regular programs
Other pesticides and PCBs in James, York & Rapp. fishes	Establish baseline	New - this initiative
PAH levels in sediments from the James, York & Rapp. rivers	Expand baseline	Ongoing - State Water Control Board, VIMS tributary monitoring
Uptake of PAH from sediments & solution by oysters & depuration	Determine bioavailability	Cooperative State Agency - for 84-85
Effects of PAH on fishes	Determine effects on biota	Ongoing and with new studies from this initiative

Project 9

Reestablishment of Submerged Aquatic Vegetation

Objectives:

1. Eelgrass will be planted in the fall of 1984 and 1985 at sites in the Potomac, Rappahannock, Piankatank and York rivers.

2. The feasibility will be determined for using seeds vs. whole plants for revegetating denuded areas and these planting sites monitored for physical (e.g. light) and biological (e.g. growth and epiphytic colonization) parameters.

3. Examine the effects of light, nutrients and epiphyte fouling on eelgrass growth in the laboratory.

Research Plan:

Our research plan is divided among transplanting, monitoring and laboratory microcosm experiments. The direction of the first two (planting and monitoring) will be highly dependent on results gained from the first year's work.

Methods of planting and locations may remain similar depending upon success of the first year's planting. If first year test experiments with seeds are successful, our plan would shift to planting all sites with seeds rather than whole plants. Seeds may be a better alternative to transplanting because of the overall greater potential number of plants that could be established with a minimal

amount of time. Monitoring may be reduced or the emphasis shifted, depending on the data produced from the previous year.

The laboratory microcosm experiments will address the role and interactive effects of nutrients, light and grazing on both macrophyte growth and survival and specifically the degree to which epiphytic fouling is controlled by these environmental variables. Light, nutrients and epiphyte growth are being experimentally examined because previous research has indicated these variables to be among the most important in determining the ultimate fate and survival of submerged aquatic vegetation.

Anticipated Results:

1. Approximately 26 acres of eelgrass will be planted within the tributaries of the lower Chesapeake Bay.

2. Criteria will be provided that will guide management decisions on SAV habitat restoration.

Exhibit 1

Virginia Institute of Marine Science

Revitalization of the James River Seed Oyster Industry

	Project							
Initiative Funding	1	2	3	4A	4B	4C	4D	TOTAL
1984-85	$ 1,000	$ 83,652	$29,592	$ 38,033	$111,400	$119,109	$11,190	$ 393,976
1985-86	-0-	113,049	39,519	47,646	130,060	153,923	21,514	505,711
	$ 1,000	$196,701	$69,111	$ 85,679	$241,460	$273,032	$32,704	$ 899,687
Core Research Funding								
1984-85	$14,655	$ 12,200	$ -0-	$ 21,531	$ 20,132	$ 24,319	$ 2,114	$ 94,951
1985-86[1]	-0-	12,200	-0-	21,531	20,132	24,319	2,114	80,296
	$14,655	$ 24,400	$ -0-	$ 43,062	$ 40,264	$ 48,638	$ 4,228	$ 175,247
Grand Total	$15,655	$221,101	$69,111	$128,741	$281,724	$321,670	$36,932	$1,074,934

[1] FY 86 core research support is an estimate, based on the achievements of the FY 85 initiative and core research effort.

Exhibit 2

Virginia Institute of Marine Science

Factors Effecting Recruitment of

Virginia's Critical Finfish Population

	Project		
Initiative Funding	5	6	TOTAL
1984-85	$ 67,595	$24,175	$ 91,770
1985-86	90,270	32,283	122,553
	$157,865	$56,458	$214,323
Core Research Funding			
1984-85	$ 36,800	$ -0-	$ 36,800
1985-86[1]	36,800	-0-	36,800
	$ 73,600	$ -0-	$ 73,600
Grand Total	$231,465	$56,458	$287,923

[1] FY 86 core research support is an estimate, based on the achievements of the FY 85 initiative and core research effort.

Exhibit 3

Virginia Institute of Marine Science

Chemical Poisons in Virginia's Tidal Waters

	Project		
Initiative Funding	7	8	TOTAL
1984-85	$172,254	$ 42,000	$214,254
1985-86	329,736	42,000	371,736
	$501,990	$ 84,000	$585,990
Core Research Funding			
1984-85	$ 78,104	$ 36,540	$114,644
1985-86[1]	78,104	36,540	114,644
	$156,208	$ 73,080	$229,288
Grand Total	$658,198	$157,080	$815,278

[1] FY 86 core research support is an estimate, based on the achievements of the FY 85 initiative and core research effort.

Exhibit 4

Virginia Institute of Marine Science

Submerged Aquatic Vegetation

Initiative Funding	
1984-85	$ 75,000
1985-86	75,000
	$150,000
Core Research Funding	
1984-85	$ 48,900
1985-86[1]	48,900
	$ 97,800
Grand Total	$247,800

[1] FY 86 core research support is an estimate, based on the achievements of the FY 85 initiative and core research effort.

Exhibit 5

Virginia Institute of Marine Science

Budget Summary

Research Components

Initiative Funding	FY 84/85	FY 85/86	Biennium
James River Oyster Seed Beds	$ 393,976	$ 505,711	$ 899,687
Finfish	91,770	122,553	214,323
Chemical Poisons	214,254	371,736	585,990
Submerged Aquatic Vegetation	75,000	75,000	150,000
	$ 775,000	$1,075,000	$1,850,000

Core Research Funding

James River Oyster Seed Beds	$ 94,951	$ 80,296	$ 175,247
Finfish	36,800	36,800	73,600
Chemical Poisons	114,644	114,644	229,288
Submerged Aquatic Vegetation	48,900	48,900	97,800
	$ 295,295	$ 280,640[1]	$ 575,935
Grand Total	$1,070,295	$1,355,640	$2,425,935

[1] FY 86 core research support is an estimate, based on the achievements of the FY 85 initiative and core research effort.