Chesapeake Bay Living Resources 1998

Chesapeake Bay Program

Living Resources Subcommittee Annual Report

November 1999

LIVING RESOURCES SUBCOMMITTEE

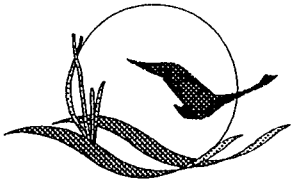
*"The productivity, diversity and abundance of living resources are the best ultimate measures of the Chesapeake Bay's condition. These living resources are the main focus of the restoration and protection effort." –**1987 Chesapeake Bay Agreement***

The Living Resources Subcommittee (LRSc) is committed to the restoration, enhancement, protection and management of the living resources of the Chesapeake Bay. Living resources include fish, shellfish, birds and waterfowl, as well as the submerged aquatic vegetation (SAV), wetlands, and other shoreline and riverine systems important to water quality and fish and wildlife habitats. In cooperation with Bay Program partners, the LRSc supports the restoration of streams, wetlands, Bay grasses (SAV) and aquatic reefs, and the opening of stream blockages for migratory fish passage. The subcommittee also guides the development of Chesapeake Bay-specific fish management plans. LRSc-directed policies and projects have enhanced fish and shellfish populations, helped improve water quality and increased wildlife habitat in the Chesapeake Bay watershed. Ongoing biological monitoring and ecosystem modeling programs contribute significantly to the understanding of the Chesapeake Bay's living resources and their relationships with each other, as well as the land and water.

Eleven workgroups and the Chesapeake Bay Stock Assessment Committee, a joint committee with the National Oceanic and Atmospheric Administration (NOAA), support the LRSc. Workgroups include the Aquatic Reef Habitat; Ecosystem Indicators; Ecosystem Modeling; Exotic Species; Fish Passage; Fisheries Management; Habitat Restoration; Living Resources Monitoring (a joint workgroup with the Monitoring Subcommittee); Submerged Aquatic Vegetation (SAV; also a joint workgroup with the Monitoring Subcommittee); Waterfowl and Other Waterbirds; and Wetlands.

Chesapeake Bay Living Resources 1998

Living Resources Subcommittee Annual Report



Prepared by the Living Resources Subcommittee
Chesapeake Bay Program

November 1999

Printed on recycled paper by the U.S. Environmental Protection Agency for the Chesapeake Bay Program

TABLE OF CONTENTS

Figures

Maps

Tables

EXECUTIVE SUMMARY

The Living Resources Subcommittee (LRSc) of the Chesapeake Bay Program is committed to the restoration, enhancement, protection and management of the living resources of the Chesapeake Bay. The LRSc's workgroups include Aquatic Reef Habitat; Ecosystem Indicators; Ecosystem Modeling; Exotic Species; Fish Passage; Fisheries Management; Habitat Restoration; Living Resources Monitoring (a joint workgroup with the Monitoring Subcommittee); Submerged Aquatic Vegetation (also a joint workgroup with the Monitoring Subcommittee); Waterfowl and other Waterbirds; and Wetlands. This report summarizes each workgroup's achievements in 1998 and articulates their respective priorities for the coming year.

In 1998 the Wetlands Workgroup completed further action items from Directive 97-2, *Wetlands Protection and Restoration Goals*. It selected the Chickahominy watershed in Virginia as the final pilot test site for the Wetlands Initiative Program and published a draft report of those results in the fall. The workgroup also developed a template for the states to use in developing their respective net-gain wetlands restoration strategies, and supported funding the National Wetlands Inventory to finalize the mapping of the Chesapeake Bay Watershed.

The Virginia Institute of Marine Science (VIMS) continued its SAV monitoring survey, with the help of funding from CBP and other partners, and found about 8 percent less SAV than was mapped in 1997–a total of approximately 63,500 acres, or 56 percent of the Interim Restoration Goal. Virginia and Maryland began to implement the regulations and law that each passed to protect SAV from certain fisheries activities, and CBP partners continued to work on several SAV planting projects and initiated several new ones. The *Chesapeake Bay SAV Water Quality and Habitat-Based Requirements and Restoration Targets: A Second Technical Synthesis*, which revises the 1992 technical survey, was drafted and is expected to be completed and published in 1999.

Oyster reef restoration made significant progress in 1998, with reefs constructed in the Great Wicomico and Elizabeth rivers. Spat set improvements were particularly noticeable in Virginia's reconstructed reefs, although spat set in Maryland was one of the lowest ever recorded, which may be due to significant freshwater flows during spring. However, Maryland deployed more than 1.7 million hatchery oysters in new reefs near Cambridge, on the Choptank River.

By the end of 1998 the Fisheries Management Workgroup had completed a total of 15 Fishery Management Plans that encompass 20 species and more than 260 commitments. The workgroup monitored the status and trends of each species and updated fishery statistics; evaluated several FMPs; completed the *1998 Chesapeake Bay and Atlantic Coast Tautog FMP*, which the Executive Council approved, and drafted a habitat document, *A Guide for Assessing Human Activities in the Chesapeake Bay Watershed to Protect Fish and Shellfish Habitat*.

The Fish Passage Workgroup reports that since the program began, nearly 70 projects have been completed throughout Maryland, Virginia, and Pennsylvania, opening a total of 523.5 miles of spawning habitat to anadromous fish. The vertical slot ladder at Virginia's largest project, Bosher's Dam in Richmond, also was finished, which opens 137.6 miles of the mainstem James River to Lynchburg, and 200 miles of major tributary habitat. The states, along with USFWS and the Pamunkey Tribal Government, produced and stocked 33.42 million American shad larvae and

fingerlings in Chesapeake Bay tributaries.

The Exotic Species Workgroup convened the Ad Hoc Panel on Non-Indigenous Oysters to review the results of field experiments with non-indigenous oysters that VIMS conducted in 1997, and reviewed VIMS's proposals for continuing its experiments with triploid Pacific oysters. The workgroup also finalized two position statements, one dealing with Atlantic sturgeon and the other dealing with subspecies and non-native stocks. The LRSc approved both.

Biologists from the Waterfowl Workgroup continued to collect data on waterfowl concentrations during the Midwinter Waterfowl Survey, and the CBP provided new funding for late-winter concentration surveys.

The Monitoring Workgroup provided more biological monitoring data for inclusion in the Chesapeake Information Management System (CIMS), and now has an expanded list of data sets available on the CIMS web site. At a July workshop members identified and discussed the apparent decline in seasonal abundances and in the diversity of large mesozooplankton in the brackish waters of the Bay and its tributaries. The workgroup continued to upgrade and enhance a computer program to calculate zooplankton indicators from CIMS and to present them graphically. Workgroup members continued to develop the Chesapeake Basinwide Monitoring Strategy. New GIS products and support included aggregating a basinwide data layer of small watersheds; updating fish passage databases; producing a map of potential tautog habitat; developing protocols for habitat restoration targeting; and creating a wide variety of maps for living resources documents and presentations.

The Chesapeake Bay Stock Assessment Committee (CBSAC) prepared the *1998 Blue Crab Advisory Report* based on updated data through the 1997-98 winter dredge survey, in which it concluded that the blue crab stock is fully exploited. CBSAC will update the report every May. CBSAC also continued its recreational survey project, designed in 1996, to focus on the results of recreational harvesting in the Chesapeake Bay and in particular to provide preliminary estimates of crab populations.

The Ecosystem Process Modeling Workgroup continued to develop simulation models that conceive the Bay as an ecosystem. They used water quality models to characterize the responses of Virginia tributaries to nutrient loadings, and integrated these results in the Virginia Tributaries Technical Synthesis Workshop, held at VIMS in March. Workgroup members also assisted in reviewing and revising SAV habitat requirements; developed fish energetics models for several key species, including striped bass and menhaden; and developed a bioenergetics model for blue crabs.

WETLANDS

The Chesapeake Bay watershed consists of 64,000 square miles of landscape that drains into the Bay through a network of freshwater and tidal rivers and streams. The watershed contains nearly 1.5 million acres of wetlands, which link the land and water and perform functions that are vital to the health of the Bay and its surrounding landscape. Bay wetlands help control flooding and erosion, provide wildlife habitat and improve water quality.

Population growth and development are degrading the number and efficiency of tidal and nontidal wetlands throughout the watershed. The Wetlands Workgroup is committed to protecting and restoring wetlands within the Bay watershed. These commitments are set forth in the *1989 Chesapeake Bay Wetlands Policy and Implementation Plan* and in Directive 97-2, *Wetlands Protection and Restoration Goals.* To meet their goals, the workgroup plans to develop and deliver tools, such as the Wetlands Initiative Program (see below), to Bay Program Partners and local communities to help protect and restore their resources.

In 1998 the Wetlands Workgroup focused on implementing Directive 97-2, which recommits not only to a no-net-loss wetlands goal but also to achieving long-term net gains in wetlands acreage and function. The workgroup focused on three of the five goals in the directive: establishing a status-and-trends strategy to evaluate wetland loss and gain every five years, completing the National Wetlands Inventory (NWI) mapping of the entire watershed and helping states develop jurisdiction-specific strategies for achieving net gain goals. The workgroup also continued to test and develop the Wetlands Initiative Program.

1998 Accomplishments

Wetlands Initiative Program

This program began in 1997 and focuses on giving local governments and communities a planning tool to help them combine wetland protection and restoration with other land use management strategies. The initiative is based on a three-step protocol that identifies the location of wetlands in a community and evaluates their functions based on adjacent land use and surrounding features. This year the Chickahominy watershed in Virginia was selected as the final pilot test site. Based on the *Chesapeake Bay Wetlands Initiative*, a draft report completed in November 1997, the initiative protocol used in the Virginia pilot was refined from previous versions and included modifications to address restoration targeting. A second report of the results from the Chickahominy watershed was drafted this fall. The final *Chesapeake Bay Wetlands Initiative* will be available in 1999.

State Strategies

The workgroup developed a template to assist the states in developing their own net gain wetlands restoration strategy. The template discussed setting a goal for wetland resources; developing an assessment program and inventory of wetland resources; evaluating existing and necessary protection mechanisms; addressing strategy development and implementation plans; and monitoring strategy progress. The template also included a glossary to ensure the states are using the same definitions within their plans, and a wetlands acreage tracking form that suggests a minimum data set

for accounting wetland losses and gains from programmatic and natural changes. All three states and the District of Columbia presented their strategies or status reports at the 1998 Executive Council meeting.

Status and Trends

The purpose of developing a status-and-trends strategy is to track wetland losses and gains in the landscape with greater efficiency than the NWI currently accomplishes. The workgroup determined that satellite imagery could best address these needs, balancing cost with accuracy. This and other options from different workgroups were presented at a workshop, where attendees selected and forwarded their recommendations to the Implementation Committee (IC) for review. The CBP also cooperated with the National Institute for Environmental Renewal to prepare a technical analysis of these recommendations.

The workgroup supported funding for the NWI to finalize mapping of the Chesapeake Bay watershed. This included 21 USGS quadrangle maps in Virginia and 71 in New York. When this effort is complete, the entire watershed will be mapped under NWI, and the workgroup will have established the baseline for future status-and-trends analyses.

1999 Wetland Workgroup Priorities

1. Forward a wetlands net gain goal to the IC.
2. Complete and distribute the *Chesapeake Bay Wetlands Initiative* to local communities.
3. Integrate the Wetland Workgroup's efforts with those of other Living Resource workgroups. Issues include habitat restoration targeting, restoring habitat and communicating a watershed approach toward resource management.

BAY GRASSES OR SUBMERGED AQUATIC VEGETATION (SAV)

Bay grasses grow in shallow water regions of the Chesapeake Bay and are ecologically important to the Bay's living resources. These underwater grasses provide food for waterfowl and habitat for fish, crabs and invertebrates. They also filter suspended sediments and oxygenate the surrounding water and substrate. To grow, Bay grasses require that sufficient levels of light reach their underwater leaves. Sedimentation and algae combine to reduce these levels.

About 13 species of Bay grasses once covered more than 400,000 acres of the Bay. The CBP is working to restore Bay grasses to historical levels of acreage, abundance and species diversity. In 1993 the Chesapeake Executive Council agreed to an interim goal of restoring 114,000 acres of Bay grasses Baywide by 2005.

The SAV Workgroup implements the Bay Program's SAV policy by promoting the monitoring, protection and restoration of the Bay's underwater grasses and related research and outreach. In 1998 workgroup members continued funding and conducting Baywide aerial surveys of Bay grass coverage. Workgroup members also took important new steps to protect SAV from the effects of fisheries harvests; planted SAV and continued refining methods to grow SAV and target planting sites; continued to refine existing SAV habitat requirements and develop new requirements; and conducted education and outreach on SAV.

1998 Accomplishments

SAV Monitoring

In 1998 VIMS continued this important survey, using funds from the CBP and several of its partners. The survey found about 8 percent less SAV than was mapped in 1997, totaling about 63,500 acres, or 56 percent of the interim restoration goal. From 1997 to 1998 SAV area increased 3 percent in the upper Bay, decreased 14 percent in the mid-Bay zone and decreased 5 percent in the lower Bay zone. The 1998 survey documented SAV in some rivers that had not been surveyed recently, including the Chickahominy River, which is a tributary of the James River. U.S. Fish and Wildlife Service (US FWS) continued to coordinate volunteer ground truthing through the SAV Hunt, with help from the Chesapeake Bay Foundation and the National Aquarium in Baltimore in conducting several training workshops (see below). Citizens surveyed SAV on 72 different USGS quadrangle maps. Maryland DNR documented expanding beds of water chestnut (*Trapa natans*) in the Bird and Sassafras rivers, and the SAV Workgroup discussed possible control measures. DNR had planned to harvest the plants mechanically, but they died back before the harvester was available.

For more information on SAV, see the following web sites:

- VIMS SAV survey results: http://www.vims.edu/bio/sav/
- Chesapeake Bay Program SAV page: http://www.chesapeakebay.net/facts/sav.htm
- Maryland DNR SAV page (includes SAV key): http://www.dnr.state.md.us/Bay/sav/
- U.S. Fish & Wildlife Service, Chesapeake Bay Field Office SAV page: http://www.fws.gov/r5cbfo/CBSAV.HTM

USGS, SAV/wetlands research:
http://www.rvares.er.usgs.gov/nrp/proj.bib/sav/wethome.htm

SAV Protection

Important new steps were taken toward this CBP goal in 1998. Virginia and Maryland began to implement the regulations and law that each passed to protect SAV from certain fisheries activities. Virginia took two actions in 1998. In January 1998 VMRC regulations closed existing SAV beds in Chincoteague Bay and a 200-meter buffer to clam and crab dredging. House Joint Resolution 283 was passed in April 1998, which requested that the Virginia Delegation to the Chesapeake Bay Commission develop improved protection guidelines for Virginia SAV. In Maryland, Senate Bill 398 was passed, prohibiting the use of a hydraulic clam dredge in SAV beds in Maryland's coastal bays or its portion of the Chesapeake Bay. Maryland DNR appointed a task force of citizens, watermen, researchers and managers who worked to achieve consensus recommendations on where lines should be drawn to close SAV beds to clamming. Lines in several areas have been approved and published, and the others will be published soon.

The following web pages contain relevant information:

- MD SB 398: http://mlis.state.md.us/1998rs/billfile/sb0398.htm
- VMRC dredging regulations: http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+4VAC20-1000
- VA HJR 283: http://leg1.state.va.us/cgi-bin/legp504.EXE?981+sum+hj283
- VIMS reports on SAV damage: http://www.vims.edu/bio/sav/savreports.html

SAV Restoration

CBP partners continued to work on current SAV planting projects and began several new ones in 1998. VIMS continued its projects at several Virginia locations, and the Alliance for the Chesapeake Bay (ACB) and NOAA's projects progressed in the St. Mary's and Patuxent rivers. New projects included the "Bay Grasses in Classes" project, begun by Maryland DNR and the CBF, which shows schools how to grow wild celery in the classroom from seed, then plant it in suitable nearby sites. They plan to raise about 100,000 plants at 60 schools to plant in May 1999. Through its Bay Grass Restoration Partnership, Maryland DNR worked with citizens to plant 2,000 SAV shoots in each of the following locations: Wye River, Harness Creek (South River) and Stoney Creek (Patapsco River). ACB has a contract with the Department of Defense (DoD) to monitor SAV habitat requirements and restore SAV at a number of DoD facilities Baywide, and US FWS did pilot SAV planting projects in the Magothy and South rivers. SAV restoration sites were mapped in GIS, and Maryland DNR completed a GIS-based targeting tool that will be used to choose sites for SAV planting.

SAV Research

A group of SAV researchers and managers completed a draft in 1998 of the new document, *Chesapeake Bay SAV Water Quality and Habitat-Based Requirements and Restoration Targets: A Second Technical Synthesis.* This is a revision of the document with a similar title published in 1992 that laid out water quality habitat requirements and restoration targets for SAV growth in the

Chesapeake Bay. The revision develops a new integrated light requirement and accounts for variations in tidal range, which affect where plants can grow. The draft was sent out for peer review, and should be completed and published in 1999. Research was begun on the effects of wave exposure on SAV, and on using laboratory-reared plants for SAV planting to minimize field harvesting. Research on relationships between environmental variables and species of SAV found in tidal fresh to oligohaline waters also began in 1998.

SAV Education and Outreach

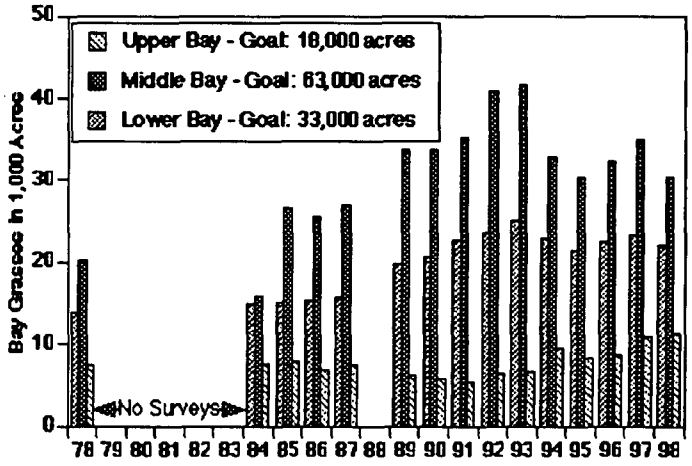
Working with CBP communications staff, the SAV Workgroup drafted a new brochure, *Underwater Bay Grasses Are Good for Wildlife and People,* which the CBP published and distributed in March 1998, with 10,000 copies printed. Several SAV items were added to the web pages of CBP partners, including an innovative SAV identification key on the Maryland DNR web page (see address above), reports on SAV scarring caused by fisheries activities, and a compendium of the latest SAV field observations on the VIMS web page. About 130 adults and 120 middle school students participated in the "SAV Hunt," coordinated by US FWS. Two groups gave SAV Hunt training workshops with US FWS assistance: 103 citizens participated in six workshops offered by CBF, and 30 NAIB staff and citizens attended two NAIB workshops (see above, under monitoring). The Bay Grasses in Classes program will train 60 teachers and teach approximately 2,400 students about Bay grass issues in the Chesapeake Bay.

Bay Grasses in Classes: Students grow wild celery in the classroom and transplant seedlings to Bay waters

1999 SAV Workgroup Priorities

1. Continue annual surveys of SAV distribution and abundance and using the results to promote SAV protection.
2. Continue SAV restoration and related targeting projects.
3. Continue research on SAV/water quality/living resource linkages and SAV protection issues.
4. Continue outreach and education efforts about SAV.
5. Finish and distribute products of several other ongoing workgroup projects, including an SAV planting guidance document; guidance for SAV ground truthing (to be posted on US FWS CBFO web page in 1999); and a white paper on possible causes of the SAV declines in Tangier Sound.

Acres of Bay Grasses: Changes by Zone



GOAL: The interim goal is to restore Bay grasses to all areas where they were mapped from 1971 to 1990.
STATUS: Total acreage in the upper zone of the Bay increased in 1996, 1997 and 1998. Total acreage in the lower and middle Bay increased in 1996 and 1997, then decreased in 1998.

OYSTER REEF RESTORATION

Oyster reefs play an important ecological role in the Chesapeake Bay by providing essential habitat for the Bay's oysters, as well as for finfish and crabs. Historically, reefs of densely packed individual oysters created a hard surface over many acres of Bay bottom and formed a three-dimensional habitat for Bay creatures. In recent years reef acreage has been lost to harvest pressure, oyster diseases and pollution. Harvesting techniques have reduced many three-dimensional reefs to flat surfaces.

The *Aquatic Reef Habitat Plan* establishes specific goals to rebuild and restore reefs as habitat for the oyster and other reef community species. The plan commits Bay Program signatories "to enhancing, protecting and restoring benthic reefs as ecological systems to benefit the oyster resource and the diverse ecological community associated with Chesapeake Bay structured reefs." Approximately 5,000 acres each in Maryland and Virginia, and 1,000 acres in the Potomac River, must be designated as oyster reef habitat by the year 2000. Oyster reef habitat will be created within these designated areas.

The Aquatic Reef Habitat Workgroup directs the enhancement, protection and restoration of oyster reefs. The workgroup continues to grapple with questions concerning the designation of oyster reef habitat in the Chesapeake Bay and the Potomac River and is making significant progress toward the year 2000 goal. Funded projects focus on reef restoration and creation, as well as the ecological evaluation of created reefs.

1998 Accomplishments

Reef Restoration Progress

Reef restoration progressed significantly in 1998. In Virginia, a second reef was constructed in the Great Wicomico River, and a reef was constructed in the Western Branch of the Elizabeth River. Considerable improvements in the status of the oyster resource, especially spat set, were observed in association with most of Virginia's reconstructed reefs. More large, presumably disease-tolerant oysters were transplanted from Tangier Sound to reefs in the Piankatank and Great Wicomico rivers. Spat set improved substantially in these rivers after large oysters were placed on the constructed reefs. Citizen volunteers continued to make impressive efforts in the lower Chesapeake Bay area to grow hatchery produced, disease-tolerant oysters and to place them on reefs in the Lynnhaven and Elizabeth rivers. Spat set improved more than 20-fold in both of these rivers after these broodstock oysters were placed on the reefs. Maryland constructed reefs in 1998 in an area near Cambridge on the Choptank River and deployed more than 1.7 million hatchery oysters.

Reef Ecology Studies

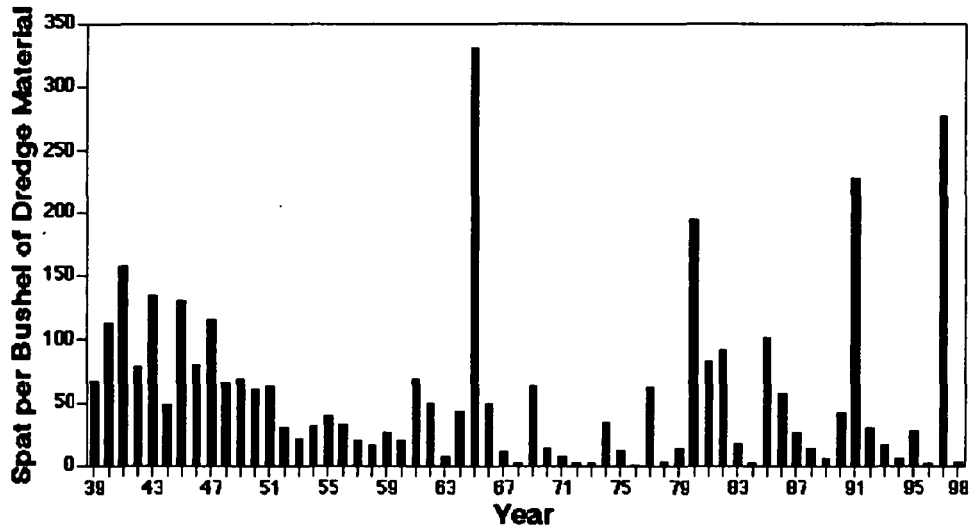
Ecological studies of Virginia's constructed reefs show that other animals, including crabs, recreational finfish and clams, also are benefitting from three-dimensional oyster reef creation. Three-dimensional reefs provide substantial benefits for oysters compared with hard substrate. Monitoring efforts associated with the Virginia reef projects have suggested three important ecological functions

of the three-dimensional reef structure for the oyster. First, they provide the best configuration for positioning oysters to maximize fertilization success in the Bay's tidal system. Second, the three-dimensional structure provides juvenile protection from predation, which results in higher survival than occurs when oyster live on the bottom. Third, oysters appear to grow faster on the reef structure than on the bottom.

Oyster Spat Set and Harvest Update

Spat set in Maryland in 1998 was one of the lowest on record (declining from 277 to 4). Spat set in Virginia improved in the James River and was very good in the vicinity of several of the reef restoration sites. Significant freshwater flows during the spring contributed to the low spat sets observed in Maryland and in the lower salinity areas of Virginia. A late summer and fall drought resulted in higher salinities, which could increase the likelihood of significant disease mortality in 1999. Oyster harvests in the Chesapeake Bay remained low in 1997-98, with Virginia harvesting less than 20,000 bushels, down slightly from last year, and Maryland harvesting more than 250,000 bushels, a substantial increase over last year's 140,000 bushels.

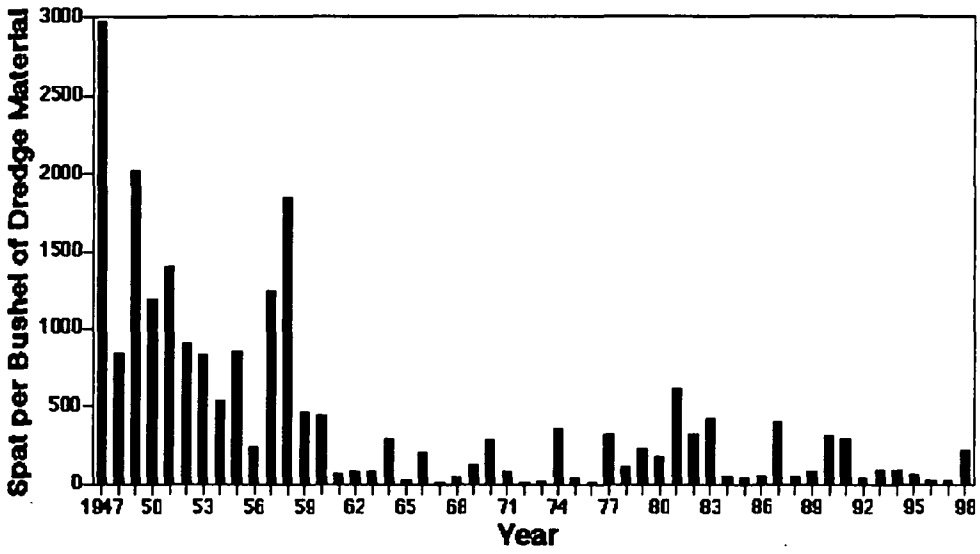
Maryland Oyster Spat



Chesapeake Bay Program Reef Restoration Sites

Map shows reef construction through 1998

Virginia Oyster Spat



1999 Aquatic Reef Habitat Workgroup Priorities

1. Construct two reefs in the Mobjack Bay, one reef in the York River and two reefs in the Lafayette River in Virginia.
2. Continue reef restoration efforts in the Severn and Choptank rivers in Maryland.

FISHERIES MANAGEMENT

Chesapeake Bay Fishery Management Plans (FMPs) are developed to provide compatible, coordinated management for the conservation and wise use of the Bay's fishery resources. To be effective, Chesapeake Bay FMPs must consider the biological, economic and sociological factors of each resource.

1998 Accomplishments

The Fisheries Management Workgroup continued to develop, implement and revise Baywide FMPs. To date, the workgroup has completed 15 FMPs, encompassing 20 species and more than 260 commitments. In 1998 the workgroup monitored the status and trends of each species under its direction; updated fishery statistics; coordinated management actions among the Bay jurisdictions, the coastal commission and the council; and tracked progress toward implementing management recommendations. In accordance with the FMP Review Schedule, the workgroup reevaluated the *1990 Bluefish FMP*, the *1991 Atlantic Croaker and Spot FMP*, and the *1994 Chesapeake Bay and Atlantic Coast King and Spanish Mackerel FMP* and made recommendations for improved implementation. The workgroup also completed a draft habitat document, *A Guide for Assessing Human Activities in the Chesapeake Bay Watershed to Protect Fish and Shellfish Habitat*, and finished the *1998 Chesapeake Bay and Atlantic Coast Tautog FMP*.

Because fishery management is a dynamic process, new information must be incorporated into FMPs and management measures should be adjusted to reflect the current status of a particular fish stock. Some changes to the plans can be made by developing amendments. An amendment to the *1989 Alosid FMP* was adopted in 1998. The Principals' Staff Committee of the CBP was given the authority to sign "minor" amendments in order to facilitate their implementation. The FMP Workgroup developed criteria outlining what constitutes a major and minor amendment.

Approved Chesapeake Bay Program Fishery Management Plans

Alosids (Shad and Herring)
American Eel
Atlantic Croaker and Spot
Black Drum
Black Sea Bass
Blue Crab
Bluefish
Horseshoe Crab
Oysters
Red Drum
Spanish and King Mackerel
Striped Bass
Summer Flounder
Weakfish and Spotted Seatrout
Tautog

Tautog

Although the largest proportion of the tautog fishery takes place in the Exclusive Economic Zone (or EEZ–3 miles to 200 miles offshore), the Chesapeake Bay serves as an important nursery and feeding ground for young tautog. Concerns about localized over-fishing, especially in the New England area, led to the development of a federal FMP and state compliance issues. As a result, the Chesapeake Bay jurisdictions developed the *1998 Chesapeake Bay and Atlantic Coast Tautog FMP*, which the Executive Council approved. In conjunction with the coastal management measures, the Bay plan will begin to reduce exploitation levels, rebuild the spawning stock and promote uniform management recommendations between state and federal agencies. The CBP will continue its commitments to restore water quality and consider the specific habitat needs of tautog. Habitat needs include the restoration of SAV, oyster reefs and wetlands.

Atlantic Croaker/Spot

The workgroup reviewed the *1991 Atlantic Croaker and Spot FMP* and decided that its goals and objectives continue to be appropriate for managing the resource. The plan protects young croaker up to age one, encourages more research, promotes the use of bycatch reduction devices and continues monitoring efforts. Currently, there are no coastal requirements for managing the stocks. A quantitative assessment of the croaker stock along the Atlantic coast is scheduled to begin in 1999, which may result in an amendment to the 1991 plan in the year 2000.

American Shad

The CBP's Executive Council adopted Amendment #1 to the *1989 Chesapeake Bay Alosid FMP*. The amendment continues the moratorium on harvesting shad and confirms the incorporation of shad restoration targets into the revised FMP. The revised plan is scheduled to be completed in 1999. To date, the goal and objectives of the 1989 plan have been revised. Management strategies, actions to address restoration efforts and habitat recommendations also will be developed. The revised FMP also will include actions that address the compliance issues defined by the Atlantic States Marine Fisheries Commission (ASMFC). One of the ASMFC's major recommendations is to close the ocean-intercept fishery over the next five years.

Atlantic Sturgeon

A restoration plan for Atlantic sturgeon in the Chesapeake Bay is scheduled to be developed. A biological background section already has been drafted. The process was interrupted when the National Marine Fisheries Service proposed that sturgeon be added to the list of the Endangered Species Act, which would have affected the ability to implement a restoration plan. Ultimately sturgeon was not added to the list and is currently protected by state laws under the *Atlantic States Marine Fisheries Commission FMP*. There is a prohibition on the harvest of sturgeon from all Atlantic coast jurisdictions.

Blue Crabs

The blue crab fishery is the most valuable commercial fishery and an important recreational fishery in the Chesapeake Bay. The blue crab also plays important ecological roles as a benthic predator and prey for many finfish species. The *1998 Chesapeake Bay Blue Crab Advisory Report*, completed by the Technical Subcommittee of the Chesapeake Bay Stock Assessment Committee,

determined that the blue crab stock is fully exploited and that the spawning stock biomass is below the average (1968-1997). This indicates that the portion of the spawning stock that is harvested has increased in recent years. New legislative activities concerning blue crabs include a recreational crabbing license (beginning in 1999), coastal bay crabbing limits, limited entry for all commercial fisheries and an apprenticeship program for people who wish to enter the fishery. The limited entry bill will cap crabbing effort at the 1996 level. The Blue Crab Target Setting Task Force completed a final report that developed a hierarchy of target levels to address sustainability, efficiency and recovery scenarios. These recommendations concerning the appropriate levels of abundance and fishing mortality will be considered for incorporation into the management plan. Estimating the status of the blue crab stock continues to be difficult because a crab's age cannot be determined, and because of their complex life cycle and variations in their availability to the survey gears.

Bluefish

The workgroup thoroughly reviewed the *1990 Chesapeake Bay Bluefish FMP* and decided that its goals and objectives remain appropriate for managing the bluefish resource. However, significant changes have occurred in the status of the stock and what is necessary for appropriate target levels. The most recent coastal stock assessment has determined that bluefish are overfished and at a low level of abundance (based on 1977-97 data). The assessment indicates that fishing mortality rates were high in 1987 and 1991 and have steadily decreased since then. Some adjustments to the current management measures are necessary to continue to lower fishing mortality and rebuild the stock. As a result, an amendment will be developed for the bluefish FMP in 1999.

Horseshoe Crabs

The Atlantic States Marine Fisheries Commission adopted an interstate horseshoe crab management plan in October 1998. The plan was developed to respond to a significant increase in horseshoe crab harvest and the potential effects this harvest would have on migratory shorebirds, which use the crab's eggs as an important food source. The monitoring components provide an ambitious 1999 work schedule, which will begin to yield the necessary information to make more effective management decisions. As a result of increased harvest, Maryland, Delaware and New Jersey implemented additional regulations to reduce fishing effort. Maryland implemented a commercial quota, seasonal restrictions and gear restrictions. A regional workshop is planned in early 1999 to evaluate and review each state's spawning survey and recommend a standard methodology that is statistically robust and comparable from state to state. Maryland will be reviewing the *1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab FMP* in 1999.

Spanish and King Mackerel

King and Spanish mackerel are found in large numbers primarily along the southern part of the Atlantic coast and Gulf of Mexico. Management efforts in the southern region have been successful in rebuilding the Atlantic migratory stocks of both king and Spanish mackerel and have resulted in an increase in both species in the Chesapeake Bay region. In order to continue the efforts by the south Atlantic states, the jurisdictions of the Chesapeake Bay adopted a king and Spanish mackerel management plan in 1994. During the fall of 1998 the plan was reviewed to determine the effectiveness of current management strategies. The goals and objectives of the plan continue to be appropriate for managing the resource. The plan will be updated and a habitat section completed in 1999.

Striped Bass

The striped bass stock remained at high levels of abundance, and the fish are being exploited at a sustainable level. Management measures have been successful in maintaining fishing mortality at or below target levels since the fishery reopened in 1990. Spawning stock biomass should continue to remain stable under the current levels of exploitation. Record high recruitment from the 1993 and 1996 year classes are contributing to the adult stock. Results of the 1998 Maryland juvenile survey indicated that recruitment was slightly above the target period (1959-1972) average of 12.

A draft amendment has been developed for the *1989 Chesapeake Bay Striped Bass FMP*. The amendment updates the current status of the stock, adopts the Atlantic States Marine Fisheries Amendment #5, which sets guidelines for establishing management measures, and provides an expanded habitat section that is specific to the Chesapeake Bay. The recent concern about striped bass health and its trophic implications will be included in the habitat update. The amendment is scheduled for adoption in 1999.

1999 FMP Workgroup Priorities

1. Continue to implement adopted FMPs. Conduct complete reviews of the *1991 American Eel FMP*, the *1994 Horseshoe Crab FMP*, the *1994 Oyster FMP* and the *1997 Blue Crab FMP*.
2. Integrate fishery management into Bay processes, especially for American shad.
3. Begin to consider multispecies management.

FISH PASSAGE

Anadromous fish, such as American and hickory shad, blueback herring and alewives, spend most of their lives at sea but must migrate to spawn in freshwater tributaries. More than 2,500 blockages, such as dams, culverts and weirs in the large rivers and small streams of the Chesapeake Bay watershed, prevent migratory fish from reaching historic spawning grounds. As a result, the natural reproduction of these valuable species remains low. Currently, stocking programs conducted by basin states, the US FWS and the Pamunkey Indians help resupply the shad population of the Chesapeake Bay. The Bay Program is committed to opening blockages in tributaries so that anadromous fish can reach freshwater spawning grounds. Fish passage goals established in 1993 directed Bay Program signatories to open 725 stream miles by 1998 and 1,356 miles by 2003.

The Fish Passage Workgroup oversees the implementation of fish passage development at blockages throughout the watershed. This includes construction, reconfiguration and/or demolition, whenever necessary, to help restore migratory fish access to historic spawning habitat upstream. In 1998 there was significant progress in opening stream miles, but when added to the previous year's accomplishments, it still fell about 210 miles short of the five-year mileage goal set by the Executive Council. Some of this shortfall is made up in stream miles that were reopened but are not yet accessible to migratory fish because of downstream blockages. These miles eventually will convert to anadromous fish usage and contribute toward Bay Program goals.

1998 Accomplishments

Fish Passage Update

Since the beginning of this program nearly 70 fish passage projects have been completed, opening a total of 523.5 miles of spawning habitat to anadromous fish. An additional 121.5 miles were reopened but are not yet accessible due to downstream blockages. In 1998 Bay jurisdictions completed two fish ladders, two highway culvert replacements and eight dam removals. Also, seven prior blockages, some of which were targeted for passage or removal, were destroyed by natural forces.

In Virginia, a Denil fish ladder was completed at Harvel Dam, which opened 5.7 miles of the Appomattox River up to the city of Petersburg. Virginia's largest project, a vertical slot ladder at Bosher Dam in Richmond, also was completed, opening 137.6 miles of the mainstem James River to Lynchburg, as well as about 200 miles of major tributary habitat, including the lower Rivanna. Maryland reported four weir collapses and a culvert replacement in the Patuxent watershed (25.6 miles, including 1.2 miles for resident fish only); a destroyed weir and another culvert project in the Potomac watershed (19.3 miles); deterioration of an overflow section of the Cypress Branch Dam on the Chester River (10 miles); and a collapsed dam on Octoraro Creek in the lower Susquehanna watershed (2.3 miles for resident fish). The Pennsylvania Fish and Boat Commission actively promotes dam removals and completed eight such projects in 1998. All were in historic herring habitat of the Susquehanna watershed (for example, the Conestoga River, the Little Conestoga and Lititz Run), but because downstream blockages remain in place, the 34.8 miles gained are currently available only for resident fish movements.

Alosid Restocking

Stocking efforts and a moratorium on shad fishing in the Chesapeake Bay have helped to increase the number of shad returning to spawning waters. In spite of an unusually high flow spring season, which reduced fish-passage effectiveness, shad returns to the Susquehanna River amounted to more than 46,000 fish passed at Conowingo Dam, of which more than 6,000 passed into spawning water above Safe Harbor Dam. The wild component of the shad population at Conowingo was 71 percent, continuing a four-year increasing trend in natural production.

Pennsylvania, Maryland, Virginia, the US FWS and the Pamunkey Tribal Government worked together to produce and stock 33.42 million American shad larvae and fingerlings in Bay tributaries–a modern record. This included 11.76 million stocked in the Susquehanna River in Pennsylvania; a total of 1.82 million stocked in the Patuxent, Choptank and Potomac rivers in Maryland; and a total of 19.84 million stocked in the James and York river systems in Virginia. Maryland DNR also stocked 11.5 million cultured hickory shad in the Patuxent, Choptank and Tuckahoe rivers. All fish were distinctively marked with tetracycline, and Maryland fingerlings also received coded wire tags.

In the Susquehanna River, more than 4,600 adult shad and 1,100 adult blueback herring collected at the Conowingo West fish lift were stocked above the fourth mainstem blockage at York Haven. An additional 3,600 bluebacks were stocked in Conestoga Creek. Virginia stocked more than 5,000 adult blueback herring from the Chickahominy River to the James River above Richmond.

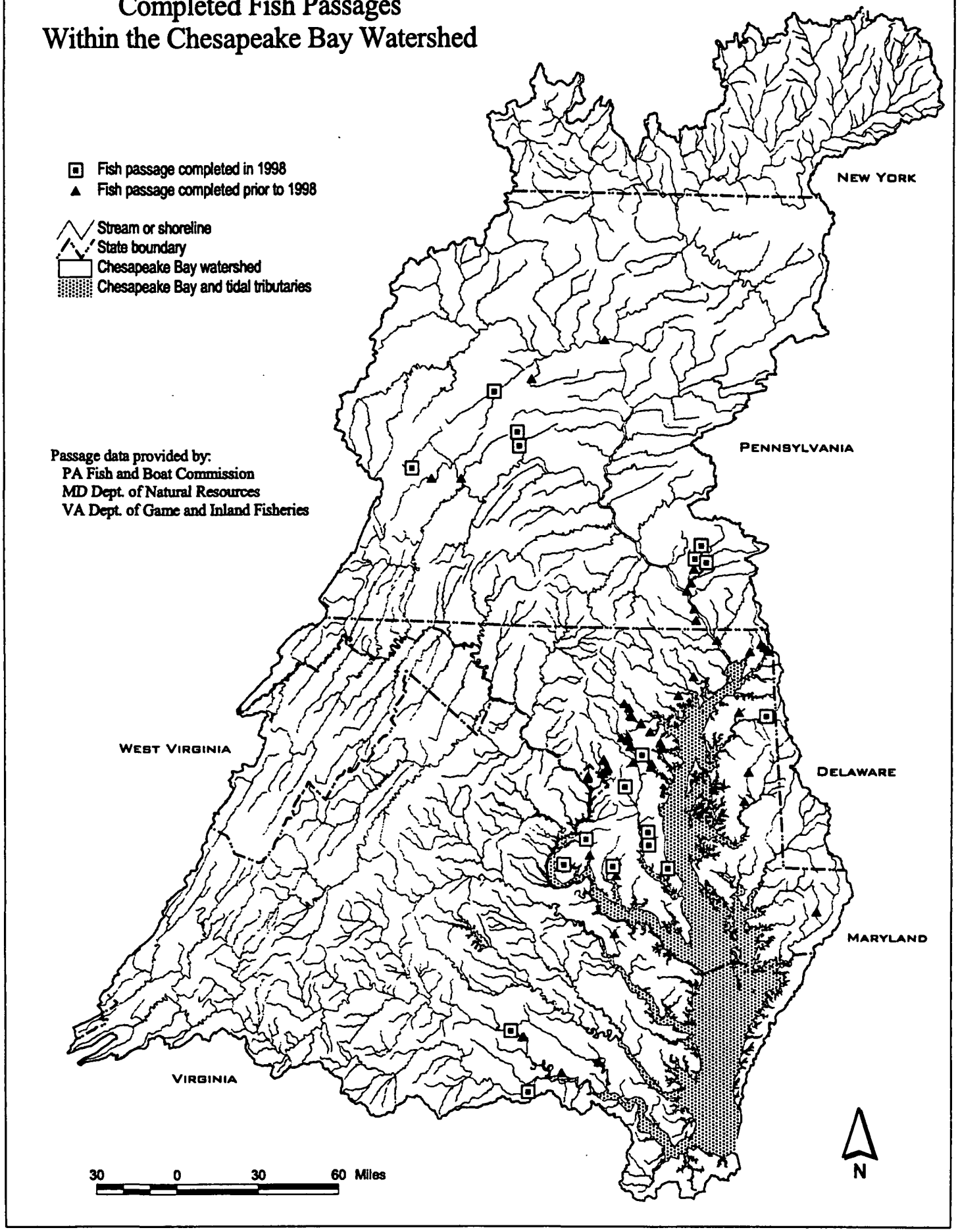
1999 Fish Passage Workgroup Priorities

1. The single largest gain in reopened stream miles counting toward Bay Program goals will occur in 1999. A 500,000 shad vertical slot fish ladder at York Haven Dam on the Susquehanna River will open more than 400 miles of mainstem and major tributaries to migratory fish. When this is complete, numerous stream miles previously classified as inaccessible to anadromous fish in PA will become fully accessible.
2. The long-awaited labyrinth weir fishway at Little Falls Dam on the Potomac River (10 miles) also is scheduled for construction, as are numerous fishway, notch and removal projects in Maryland and Pennsylvania. Cumulative Bay watershed tributary miles reopened to migratory fish toward the 2003 goal will exceed 1,000 by the end of 1999.
3. Fish passage design should be completed for the Abutment Dam at Petersburg, VA. Construction likely will be scheduled for 2000. This project will open 121 miles of the Appomattox River.
4. A Corps of Engineers feasibility study for removal of the Embrey Dam on the Rappahannock River (71 miles) is under way, as are smaller fish passage negotiations such as those for Wilsons Mill Dam on Deer Creek (MD), and the Pierce Mill Dam in the District of Columbia.

For more information on fish passage, see the Bay Program web site (www.chesapeakebay.net). An image of an animated map of streams opened to anadromous fish and projected openings can be viewed at:

http://www.chesapeakebay.net/bayprogram/data/gis/gallery/fishpass.gif.

Completed Fish Passages Within the Chesapeake Bay Watershed



HABITAT RESTORATION

The Habitat Objectives and Restoration Workgroup (HORW) develops and maintains guidelines for the protection of water quality and habitat conditions necessary to support the living resources found in the Chesapeake Bay watershed. The workgroup accomplished several important tasks in 1998 that contributed to the fulfillment of the Bay Program's *Chesapeake Bay Habitat Restoration: A Framework for Action.* Most important, it completed another year of implementing projects within each of the CBP's jurisdictions that are specifically designed to restore habitat within the watershed.

Chesapeake Bay restoration has begun to address nonpoint sources of excess nutrients and sediments. The diffuse nature of these contributions highlights the difficult task at hand. Nonpoint source contributions do not travel through pipes to our waterways but circulate through the thousands of miles of streams, creeks and rivers to the Chesapeake Bay. We must manage these pathways effectively in order to reduce nutrient and sediment inputs and to improve habitat for living resources. Effective management requires that we assess watershed conditions at the small scale. It also means that we must target areas where the implementation of stream, wetland and riparian forest restoration projects, agricultural best management practices and stormwater retrofits can provide the greatest reduction in nutrient and sediment input and at the same time improve habitat for living resources.

The CBP's *Chesapeake Bay Habitat Restoration* lists freshwater tributaries as one of four habitat areas targeted for restoration efforts. In addition to opening migratory fish blockages and restoring nontidal wetlands, preservation and restoration of upstream habitat are Bay Program priorities. The 1996 Chesapeake Executive Council's *Adoption Statement on Riparian Forest Buffers* reinforces the Bay Program's commitment to stream restoration. The goal of this statement is to restore forest buffers on 2,010 miles of stream and shoreline in the watershed by the year 2010. Restoration projects are good examples of local, state and federal government agencies partnering with local nonprofit organizations.

1998 Accomplishments

Habitat Restoration Projects Completed and Funded

In 1998 six previously funded implementation projects were completed and six new habitat restoration proposals were selected for funding. The six completed projects resulted in the restoration of 206 acres of wetlands; 50 acres of riparian forest; 200 linear feet of streams; the expansion of a fish hatchery for American shad; and the restoration of 10 acres of neotropical songbird habitat. The six projects selected for funding will result in the restoration of more than 550 acres of wetlands and 12 miles of riparian forest buffers.

Seventy signs were distributed to previous grant recipients for posting on completed project sites. Grant recipients are required by grant condition to post these signs in a publicly visible location whenever possible.

The workgroup also has been working with CBP staff to develop a tracking data base for all the habitat restoration projects that the workgroup funds. The development of this data base has been completed **(through what years?)**, and projects continue to be updated as grant recipients submit information.

Habitat Restoration Targeting

The workgroup developed the Broadscale Ecological Strategy for Targeting (BEST). BEST is a GIS-based system for mapping Baywide habitat conditions, which will allow for:

- Gross-scale designation of priority areas for habitat restoration and protection across the entire Bay watershed;
- Evaluation of proposed habitat restoration projects in terms of their potential benefits for multiple living resources targeted by the CBP;
- Identification of data gaps most critical to the assessment of habitat quality;
- Integration of conservation and restoration initiatives throughout the Bay watershed, including CBP independent projects; and
- Compilation of available Baywide habitat data and best professional judgment in a comprehensive, consistent, accessible and spatially explicit format.

BEST was developed to fulfill the requirements of Executive Council Directive 94-3, *Framework for Habitat Restoration*, which charges the HORW with targeting expenditures of Bay Program funds for habitat restoration to maximize the benefits of available funding, and to progress toward meeting existing habitat goals. Mapping based on the BEST methodology has been completed in several select Bay areas. It is hoped that this approach can be used to target the FFY 2001 Chesapeake Bay Program Habitat Restoration Projects Challenge Grants.

In order to begin immediately targeting habitat restoration projects in FFY 2000, the HORW is using the Clean Water Action Plan Unified Watershed Assessment priority watersheds identified by Virginia, Maryland, Pennsylvania and the District of Columbia. Proposed restoration projects occurring in priority watersheds will be rated higher than those proposed elsewhere in the watershed.

Citizen's Resources Guide to Habitat Restoration

The workgroup completed *Better Backyard: A Citizen's Resource Guide to Beneficial Landscaping and Habitat Restoration in the Chesapeake Bay Watershed.* This document will be made available to the public by March 1999.

1999 Habitat Objectives and Restoration Workgroup Priorities

1. Release another request for proposals soliciting projects from all CBP jurisdictions for advancing the *Framework* and conduct meetings in each jurisdiction to discuss the RFP with prospective applicants.
2. Complete the mapping of targeted habitat restoration sites and use these maps for allocating habitat restoration funding.
3. Reconvene the special ad hoc team to write an implementation plan for the beneficial use of dredge material in the Chesapeake Bay and begin to implement demonstration projects in Maryland and Virginia.

EXOTIC SPECIES

Exotic aquatic species, or non-indigenous species, are so-called because they are not native to the Chesapeake Bay watershed. Exotic species may be introduced intentionally to the Bay watershed, as in the case of certain sportfish, or they may be introduced unintentionally, through the discharge of ballast water or by escaping from aquaculture facilities. Exotics may threaten the Bay's ecosystem by transmitting disease, competing with native species, or through other ecological pathways. The *Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species*, adopted in 1993, aims to minimize the economic and ecological risks associated with the first-time introduction of exotic aquatic species to the Bay watershed. A 1996 implementation plan recommends identifying and monitoring exotic aquatic species in the watershed. Few regulatory controls currently exist to prevent the introduction of non-indigenous species, making education the best method for controlling the introduction of new exotics.

The Exotic Species Workgroup (ESWG) implements the Chesapeake Bay regional policy that guides the intentional introduction of exotic species. The workgroup also addresses strategies for preventing and controlling accidental introductions.

1998 Accomplishments

Exotic Oyster Species

The Ad Hoc Panel on Non-Indigenous Oysters met to review the results of field experiments with non-indigenous oysters that VIMS conducted in 1997. The panel also reviewed VIMS's proposals for continuing its experiments with triploid Pacific oysters (*Crassostrea gigas*) and initiating experiments with triploids of *C. ariakensis*, an Asian species (formerly *C. rivularis*). The panel's final charge was to consider how to determine what constitutes acceptable risk in conducting field experiments with non-native species.

Genetic testing of the triploid *C. gigas* during field experiments revealed increasing rates of reversion to a mosaic state (a mixture of diploid and triploid cells) over time. Shortly before the Ad Hoc Panel meeting, one *C. gigas* was found with haploid gametes, which indicated possible reproductive viability. Given the unexpected reversions and the appearance of haploid cells, the panel recommended immediate termination of field trials with *C. gigas*. VIMS had already undertaken this action. The experiments yielded sufficient information to show that *C. gigas* did not perform favorably in the Chesapeake Bay environment relative to the native oyster. The panel approved VIMS's proposal for field testing *C. ariakensis* during 1998 and 1999, with increased frequency of ploidy testing, given the unexpected reversion rates seen in *C. gigas*.

Rather than attempt to develop a quantitative measure of acceptable risk, the panel approved a plan of action to be followed if haploid gametes are found in any non-native species being tested. This involves immediately notifying the chair of the Ad-Hoc Panel and appropriate officials within the state, who will then meet to review the evidence and determine the appropriate management response.

Stocking of Non-Indigenous Subspecies or Stocks of Native Species

The Policy and Implementation Plan for Non-Indigenous Species only addresses the introduction of *species* that are not native to the Chesapeake Bay watershed. The issue of how to deal with potential introductions of *subspecies* or stocks from outside the watershed arose because of a proposal to stock hatchery-raised Atlantic sturgeon of Hudson River origin into the Chesapeake Bay. The Exotic Species Workgroup finalized two position statements in 1998, one dealing specifically with Atlantic sturgeon and the other addressing the general issue of subspecies and non-native stocks. The LRSc approved these position statements.

The workgroup approved the introduction of Hudson River-origin Atlantic sturgeon for several reasons: the abundance of the native Chesapeake Bay sturgeon stock is extremely low, genetic differences between the two stocks are thought to be minor and juveniles of the Hudson River stock already occur naturally in the Bay. The workgroup recommended that any future stocking proceed according to the Atlantic States Marine Fisheries Commission's Atlantic Sturgeon Stocking Protocol.

Regarding the question of when a subspecies or stock should be considered an exotic species for first-time introduction to the Chesapeake Bay watershed, the position statement indicates that recognized subspecies that are non-indigenous should be subject to the ESWG's review, and introduction of non-indigenous stocks should not require routine review by the ESWG, with the possible exception of threatened or endangered species or species that have been extirpated from the watershed.

1999 Exotic Species Workgroup Priorities

1. Focus on control strategies. A Controls Task Group has been established, which will identify existing control programs and needs, and coordinate and develop regional control plans. One of their priorities is to coordinate development of a Baywide strategy for zebra mussel control.
2. Investigate the benefits to the Chesapeake Bay region of developing a federal Aquatic Nuisance Species Management Plan. The purpose of the federal plans is to identify management practices that reduce threats from aquatic nuisance species. Federal funds are provided to implement the plans.
3. Increase outreach and educational activities. Identify needs, prioritize and develop informational materials such as flyers and web pages.

WATERFOWL AND OTHER WATERBIRDS

The Chesapeake Bay is home to more than 50 species of migratory waterbirds, including two raptor species, bald eagles and osprey. More than half of these birds are present only during the winter months. After the wintering populations depart for northern breeding grounds, populations of native waterfowl, such as wood ducks and black ducks, in addition to large populations of exotic or non-native waterfowl, such as mute swans, resident Canada geese and mallards, breed in the Chesapeake Bay watershed. The raptor species and many thousands of colonial waterbirds, including herons, egrets, cormorants, gulls and terns, also depend on the rich fishery and predator-free nest sites to raise their young.

The Waterfowl and Other Waterbirds Workgroup is a loose confederation of biologists from state and federal agencies involved in the waterfowl management of the Chesapeake Bay region, working toward implementing the Chesapeake Bay Waterfowl Policy and Management Plan. Their last meeting took place in October 1997, when members met to discuss research needs in the mid-Atlantic region and to familiarize researchers from Ducks Unlimited with those needs.

1998 Accomplishments

Waterfowl Concentration Database and Atlas

Biologists from all three states continue to collect data on the location and numbers of waterfowl concentrations during the Midwinter Waterfowl Survey. In 1998 the CBP provided $22,000 for late-winter concentration surveys, where information has been lacking. Only a small part of the survey was flown in 1998. The mild winter resulted in an early spring migration, and the workgroup thought the survey would not be productive. The survey is planned for March 1999. The data will help protect habitats used by waterbirds in late winter, which may differ from early winter distribution.

Waterfowl Indicators

The subcommittee developed and reviewed a new, simplified indicator that includes 20 species or species groups. Final review has not been scheduled.

Gillnet Bycatch of Birds

The U.S. Fish and Wildlife Service has begun a new project to assess the mortality of birds caught in anchored gillnets from the coast of Virginia through New Jersey. The project is relevant to Chesapeake Bay waterbirds, which leave the Bay and pass through gillnetted areas as they migrate up the coast. Fishermen also have proposed that monofilament gillnets be allowed in the Bay.

Invasive Species

Several workgroup members are working on a variety of projects related to invasive species. Mute swans, resident Canada geese, *phragmites* and nutria are invasive species that severely degrade waterfowl habitat in the Bay.

1999 Waterfowl Workgroup Priorities

1. Expand the workgroup and begin to implement the recommendations of the Reevaluation Team, which completed its review in October 1997.
2. Maintain concentrations and trends databases and continue to collect geo-referenced data on waterbird distributions.
3. Expand understanding of breeding waterfowl distribution and determine habitat use by mallards and black ducks.
4. Identify habitat restoration sites important for waterfowl.
5. Reduce degradation of coastal wetlands from exotic species such as *phragmites*, nutria, resident Canada geese, and mute swans.
6. Determine the impact of fisheries bycatch on waterbirds.
7. Seek to better integrate water bird needs with fisheries management.
8. Publish the waterfowl status and trends report on the Internet.

BIOLOGICAL MONITORING AND GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The Living Resources Monitoring Workgroup is a joint workgroup of the Living Resources and Monitoring subcommittees that focuses on creating, maintaining and updating biological and living resources monitoring databases, reporting monitoring results and maintaining the CBP zooplankton monitoring program. The workgroup is currently assisting CBP efforts to implement a Basinwide Monitoring Strategy and also has assisted several efforts to develop biological indicators of Bay health.

More than 3,000 species of plants and animals inhabit the Chesapeake Bay region. To better assess the status of Bay resources, the CBP has integrated and enhanced state biological monitoring programs since 1984. Aerial surveys track Bay grass coverage. Phytoplankton and zooplankton monitoring programs are piggy-backed onto the CBP water-quality monitoring program. The states have monitored benthos, bacteria, shellfish and finfish and commercial landings for decades. Other state surveys also monitor habitat coverages, such as oyster bars and wetlands. Numerous waterfowl and songbird surveys are conducted throughout the United States, and the Bay Program uses some of these data.

The *Living Resources Monitoring Plan* directs the development of a Baywide monitoring program for species that are important to the commercial, recreational and ecological health of the Chesapeake Bay. The *Monitoring Plan* recommends establishing long-term, Baywide monitoring of the Bay's plant and animal resources. Analysis of these data sets is essential to understand fully how humans are affecting the Chesapeake Bay ecosystem. It is crucial to the Bay Program's protection and restoration efforts.

1998 Accomplishments

Databases

In 1998 the database manager continued to upload a variety of biological monitoring data into relational database structures and load them on an Internet server linked to the Chesapeake Information Management System (CIMS). Computer programs were written that allow Internet users to query the benthos, zooplankton and phytoplankton databases on-line, and selectively downloaded parts of these huge databases. The following data sets are now available from the CIMS web site (http://www.chesapeakebay.net/bayprogram/infobase/lr/lrsctop.htm) in uniform databases, with documentation:

- Phytoplankton taxonomic counts
- Picoplankton taxonomic counts
- Primary productivity (C^{14})
- Vertical and horizontal *in situ* fluorescence
- Microzooplankton taxonomic counts
- Mesozooplankton taxonomic counts
- Mesozooplankton measured and estimated biomass
- Gelatinous zooplankton (jellyfish) measured biovolume

- Benthos taxonomic counts
- Benthos measured biomass

Other data are available through links to the CIMS server, including:

- CBP SAV aerial surveys
- Virginia fish surveys
- Chesapeake Bay Ocean Data Acquisition System (ODAS) project
- National Marine Fisheries Statistics

Zooplankton Monitoring Programs

In 1998 the principal investigators and state program managers implemented changes in the Maryland and Virginia zooplankton monitoring programs to improve the compatibility of data among states and to strengthen the overall utility of the monitoring data. The importance of the zooplankton monitoring results in assessing the health of the Bay food web became increasingly apparent this year during a July workshop and at other public forums. Seasonal abundances and the diversity of the large mesozooplankton–which serve as food for many forage species in the Bay–continued to decline for unclear reasons in the brackish waters of the Bay and its tributaries. Meanwhile, the smaller microzooplankton continued to flourish, indicating the continued dominance of bacteria and microorganisms as consumers of the Bay's productivity. Comb jellyfish, predators of zooplankton and larval fish, also remained exceptionally abundant in the middle Bay. By contrast, freshwater mesozooplankton increased in some tributaries in response to high spring flows, which have greatly expanded their habitat. These increases supply larvae of anadromous fish (striped bass, white perch, herring and shad) with sufficient food levels in spring and summer.

Indicators

Significant steps were taken this year in assessing the quality of the zooplankton and phytoplankton data and their usefulness in generating indicators of Bay health. Monitoring program staffs in Maryland and Virginia performed counts on a set of "split" samples, to determine if species identifications and sorting methods in different laboratories produced comparable results. Long-vested method differences were quantified and resolved where possible, and irreconcilable differences were documented. Analysts can now confidently generate Baywide plankton indicators from the data.

Work continued on upgrading and enhancing a computer program to calculate zooplankton indicators from the CIMS databases and to present the indicators graphically. Another computer program, which calculates benthic metrics and the Benthic Index of Biological Integrity and classifies benthic habitat conditions, is nearly complete. Tables of the indicators that these computer programs produce will soon be available on the CIMS web site.

Trophic Changes Workshop

The CBP Scientific and Technical Advisory Committee (STAC) sponsored a workshop in July 1998 to evaluate and interpret recent trends in living resources monitoring results from Chesapeake Bay open water habitats. The workshop provided a forum for a diverse group of scientists and managers to synthesize the monitoring information and brainstorm about why the trends are occurring, whether they can be related to each other and whether they are adversely affecting

productivity in open water habitats. A workshop report is currently being reviewed. Although not anticipated in the Monitoring Workgroup's 1998 workplan, the Trophic Changes workshop helped initiate a major priority for 1999: more analysis and interpretation of living resources monitoring results.

Chesapeake Basinwide Monitoring Strategy

Members of the workgroup were involved this year in developing a programwide monitoring strategy to better support CBP subcommittee and workgroup activities. The strategy is nearly complete. LRSc workgroups and teams have identified data gaps and recommend changes to improve and optimize the current monitoring systems. They have explored potential ways to link or integrate different monitoring program results to enhance the data's usefulness and to better answer management questions.

1999 Living Resources Monitoring Workgroup Priorities

1. Continue to create, maintain and update biological databases and enhance their accessibility and usefulness.
2. Maintain and enhance the Zooplankton Monitoring Program.
3. Encourage analysis, integration and interpretation of biological monitoring results.

New GIS Products and Support

Base Data

A basinwide data layer of small (11-digit) watersheds was aggregated from data provided by each state. Through this effort a high-resolution Chesapeake Bay watershed boundary data layer was created. Onsite help was provided to Maryland DNR's Oxford Lab to complete a Maryland Bay Bottom Survey data layer.

Fish Passage

Fish passage databases were updated to reflect changes due to opening or onsite inspection of blockages. The historic (1970s) ranges of alosids in Maryland were digitized from maps and reports. Working with the Fish Passage Workgroup chairman, correct fish passage mileage was established.

Fishery Management Plans

A map of potential tautog habitat was produced for the *Chesapeake Bay and Atlantic Coast Tautog FMP*.

Habitat Restoration

Protocols for habitat restoration targeting were developed, and prototype analyses were begun. Clean Water Action Plan (CWAP) Unified Watershed Assessment priority watersheds were digitized for use with the habitat restoration targeting effort. In conjunction with the new project

tracking database, a data layer of CBP-funded habitat restoration sites was created. Breeding Bird Atlas data were digitized from the Maryland, Delaware and West Virginia state atlases.

Living Resources

A large variety of maps were created for Living Resources documents and presentations. Technical support was given to Bay Program subcommittees and partners that included analysis and maps for the Nutrient Areas of Concern Workshop and Virginia Tributary Strategy meetings. A GIS program was written to allow CBP data managers to add geographic attributes required for CIMS compliance to existing data tables

Reefs

Locations of new reef sites in the Bay were added to the database, and maps showing these locations were updated. A more complete data layer of historic oyster grounds in Maryland was obtained.

SAV

SAV bed delineation data for 1997 was obtained from the Virginia Institute of Marine Science. An SAV restoration site data layer was created. Working with the monitoring staff, SAV light attenuation habitat requirement maps were produced.

Web Site Additions

Maps used for the Virginia Tributary Strategies were placed on the CBP GIS web site for viewing and downloading. An animated map of fish passage progress showing streams opened and expected to be opened was added to the CBP web site.

Wetlands

National Wetland Inventory (NWI) data for 13 quads in Virginia were funded and processed.

1999 GIS Priorities

1. Acquire 33 more NWI quads in Virginia.
2. Map potential habitat for six fish species in conjunction with data from *Habitat Requirements for Chesapeake Bay Living Resources* and other sources to define and map Priority Living Resource Areas within the Chesapeake Bay and its tributaries.
3. Use the habitat restoration targeting protocols to prototype analysis and mapping of selected Unified Watershed Assessment priority watersheds. Further refine the habitat restoration protocols based on results and comments from workgroups.
4. Add living resources data to the interactive mapping program *Bay Atlas* on the Chesapeake Bay Program's GIS web site so that Bay Program partners and the public can map and download living resources and other data online.
5. Provide LRSc and its workgroups with data analysis and mapping as needed.

THE CHESAPEAKE BAY STOCK ASSESSMENT COMMITTEE

The Chesapeake Bay Stock Assessment Committee (CBSAC) was established in 1985 by the NOAA National Marine Fisheries Service. Its purpose was to develop a Baywide cooperative program for assessing the fishery resources of the Chesapeake Bay. Each year the committee funds Bay-area fisheries research to improve the regional information required for stock assessments.

The *1987 Chesapeake Bay Agreement* called for the development of a compatible Baywide stock assessment program and pledged "to develop, adopt and begin to implement a Baywide plan for the assessment of commercially, recreationally and ecologically selected valuable species." Accordingly, CBSAC developed the Chesapeake Bay Stock Assessment Plan and now assesses Baywide fishery resources and identifies data needs for stock assessment models. The CBSAC's recommendations include ways to collect catch, effort and biological data from commercial and recreational landings, in addition to long-term surveys for estimating the relative abundance of important species in all regions of the Bay and its tributaries. CBSAC supports studies that are designed to estimate the relative influence of fishing mortality, natural mortality and habitat modification on patterns of trends in abundance.

CBSAC's Technical Subcommittee addresses issues related to specific stock assessment needs and provides the committee with scientific advice.

1998 Accomplishments

Blue Crab Advisory Report

The CBSAC Technical Subcommittee prepared an advisory report based on updated data through the end of the 1997-98 winter dredge survey. The report was patterned after the National Marine Fisheries Services/Northeast Fisheries Science Center's advisory reports. In it, CBSAC concluded that the Baywide blue crab stock is fully exploited. Over the past three years the abundance of juvenile crabs has been average; harvestable biomass and spawning stock biomass are below the 1968-97 time series average; and the average annual fishing mortality rate, calculated from four different surveys, did not exceed the threshold fishing mortality rate. CBSAC developed the threshold fishing mortality rate in the 1997 crab stock assessment, based on life history characteristics. With its assumption that crabs can live for as long as eight years, the report is considered risk-averse (preventive of a crisis instead of reactive to one). The report also found that annual fishing mortality rates generally have risen since 1991. The report advised that the crab regulations Maryland and Virginia put into place in the past few years be maintained, emphasizing that fishing mortality rates should not be allowed to increase.

The advisory report will be updated each May, with the latest fishery-independent survey data and harvest statistics. Four fishery-independent surveys were used in the 1998 report, including the only Baywide blue crab survey–the winter dredge survey–which was developed through CBSAC and has been funded by NCBO since 1990.

Alosid Monitoring Workshop

In recent years there has been evidence that American shad may be increasing in the

Chesapeake Bay. However, in the absence of a shad fishery, it is difficult to monitor the recovery of shad within Bay tributaries. Despite the efforts to restore blocked anadromous fish runs and to replenish depleted stocks, no coordinated monitoring strategy exists to evaluate the results of these efforts. CBSAC sponsored two workshops, in November 1997 and June 1998, to determine if current monitoring efforts are adequate to provide long-term data on alosids for stock assessment, fishery management and evaluation of Baywide restoration efforts.

The workshops provided a forum for:

- the presentation of monitoring efforts from each of the Bay's jurisdictions;
- interactions among Bay jurisdictions to foster collaborative methods;
- dialogue among researchers and managers regarding information needs and research directions for alosid monitoring; and
- the evaluation of current alosid monitoring efforts.

The workshop participants made several commitments. They agreed to develop a Baywide data exchange web site within two years, to validate the juvenile surveys, and to hold a Baywide meeting every other year, beginning in 1999, to continue the dialogue among Bay jurisdictions.

Funded Projects

The blue crab winter dredge survey has been funded by NCBO through CBSAC since 1989 to provide a consistent Baywide survey of blue crabs. It yields indices of abundance, size composition and other important biological data for assessments of this important resource. These data are the most important time series available for the blue crab stock. They are essential for assessing the stock and for providing managers with an early forecast of the upcoming crab fishing season. The survey results were used in preparing the *1998 Blue Crab Advisory Report.*

Current blue crab stock analyses are hampered by a lack of knowledge about the magnitude of the recreational fishery within the Bay. In 1996 CBSAC funded the design of a recreational survey to provide a sound statistical framework for estimating catch, effort and biological characteristics of blue crabs taken by recreational harvesters in the Chesapeake Bay. The recreational survey project was continued through 1998 to evaluate the design and to provide preliminary estimates of crab populations.

Knowing the age structure of an exploited population is an essential component of fisheries management. The inability to determine the age of blue crabs accurately has curtailed management decisions and hampered justification of management actions. Using biochemical techniques, scientists are isolating a lipoprotein complex called lipofuscin, a fluorescence pigment obtained from crab eye stalks or brain tissue, which provides a method of determining the age of blue crabs.

1998 Status of Fishery Stocks Important to the Chesapeake Bay

Species	Trend	Description Phase
1. Striped Bass	Stable/Improving	Restored
2. Atlantic Croaker*	Improving	Historically high levels
3. Spot	Stable	Appear healthy, moderate abundance
4. Catfish* (r)	Stable	Appear healthy
5. White Perch* (r)	Stable	Recent indices above average
6. Black Drum*	Unknown	Appear healthy, abundance variable
7. Weakfish	Improving	Moderate abundance, recovery underway
8. Yellow Perch* (r)	Improving	Indices above previous lows since 1993
9. Blue Crab (r)	Declining	Slightly below long-term average abundance
10. Softshell Clam* (r)	Stable	Depleted, abundance dependent on water temperature
11. Atlantic Menhaden	Declining	Concern over recent poor recruitment
12. Spotted Seatrout*	Unknown	Recent indications of reduced abundance
13. Summer Flounder	Improving	Overfished, medium abundance, recovery underway
14. American Eel*	Declining	Recent indications of low abundance

* No formal stock assessment exists

r: resident to Chesapeake Bay

15. Hard Clam	Declining	Recent signs of decreased abundance
16. Horseshoe Crab*	Declining	Recent indications of low abundance
17. Hickory Shad	Improving	Moderate abundance, approaching historic numbers in some rivers
18. Red Drum	Declining	Overfished, recovery plan adopted
19. Bluefish	Improving	Overfished, low abundance
20. Black Sea Bass	Stable	Overfished, low abundance, recovery plan adopted
21. Tautog	Stable	Overfished, recovery plan adopted
22. Alewife and Blueback Herring	Unknown	Low abundance
23. American Oyster (r)	Improving	Severely depleted, recovery underway
24. American Shad	Improving	Very depressed abundance (Bay moratorium)
25. Atlantic Sturgeon	Unknown	40-year moratorium in place
26. Shortnose Sturgeon	Unknown	Endangered

* No formal stock assessment exists r: resident to Chesapeake Bay

1999 CBSAC Priorities

In 1997 CBSAC began to review the plans and priorities of its research program. Through 1998 it continued to develop a five-year plan to set research priorities by reviewing specific species research recommendations. Although the blue crab stock is still considered the committee's highest priority, committee members also have discussed developing a multispecies program that could include a Baywide monitoring plan.

CBSAC recommends the following specific projects, in addition to the multispecies program:

1. Continue the blue crab aging studies.
2. Continue the winter dredge survey.
3 Initiate the next blue crab stock assessment.
4. Initiate a pilot recreational fishing survey.

ECOSYSTEM PROCESS MODELING

Modeling has become an integral part of the Chesapeake Bay Program's management efforts, particularly since the *1993 Chesapeake Bay Agreement* adopted the Strategy for the Restoration and Protection of Ecologically Valuable Species. One of its seven recommendations was that the CBP pursue "a program to develop simulation models of the Chesapeake ecosystem." Under Directive 97-1, the Chesapeake Executive Council reinforced their commitment "to continue efforts to refine our monitoring and modeling of the Bay and its watershed, to assure the most accurate measures of progress." A wide range of modeling approaches is being used to simulate various processes, populations and communities in the Chesapeake Bay and its tributaries. Bottom-up control in the Bay is represented principally by nutrient management, which is one of the Modeling Subcommittee's central focuses. However, linking management actions to living resources has been problematic.

Recently the CBP has emphasized recognizing the importance of the complex interactions and synergistic responses of human activities to estuarine resources. One of the program's major objectives is to understand the linkages among the trophic levels. This has begun with links between water quality and lower ecosystem processes. To achieve this goal, the CBP is reviewing a suite of models for higher trophic levels, coupled directly or indirectly.

In 1998 the ecosystem process modelers continued to develop simulation models that conceive the Bay as an ecosystem. The Scientific and Technical Advisory Committee's review last year concluded that, "the project is highly relevant to the CBP and LRSc goals and objectives." The project currently involves a coordinated effort that begins to link water quality conditions to living resource responses on an objective, quantitative basis.

1998 Accomplishments

Benthos/Pelagic Modeling

The CBP used models in support of Virginia's Tributary Strategy Process. In particular, they used water quality models to characterize the Virginia tributaries' responses to nutrient loadings. Results of this targeted effort were integrated into the Virginia Tributaries Technical Synthesis Workshop, which was held in March at VIMS. Other studies included investigating responses of various biological communities to direct and indirect effects of low dissolved oxygen conditions. Box models continue to better explain the complex physical, chemical and biological processes in the Patuxent River. Investigators used their models to characterize water quality.

SAV Modeling

Several members of the modeling team were instrumental in reviewing and revising the SAV habitat requirements. They also worked closely with the Modeling Subcommittee to ensure that SAV components were successfully included in the Chesapeake Bay Environmental Model Package. A chapter of the *Chesapeake Bay Submerged Aquatic Vegetation Water Quality and Habitat-Based Requirements and Restoration Targets: A Second Technical Synthesis Report* is devoted to their work, "Water Quality Effects on Light Available for Submersed Plants in Chesapeake Bay: Epiphyte Contribution to PAR Attenuation."

Bioenergetics Modeling

Fish energetics models were developed this year for striped bass, bluefish, weakfish, Bay anchovy, menhaden, spot and white perch. These models use food and habitat information to predict the potential production of single fish. Investigators continue to work on multiple species. The models are being combined to incorporate ecological feedbacks associated with top-down control by fish of their prey. A bioenergetics model for blue crabs also was developed.

1999 Ecosystem Process Modeling Workgroup Priorities

Unfortunately, funding within the Living Resources and Modeling Subcommittee budgets was not approved for this fiscal year. As a result, investigators will complete their assigned tasks as outlined in their long-term workplan, with completion scheduled for the spring. In the meantime, the Ecosystem Modeling Workgroup will reorganize its members and develop a list of management and scientific questions relating to linkages between nutrient controls and higher trophic levels, which models could be used to answer in the future. This effort supports the LRSc's theme for fiscal year 2000 concerning Ecosystem Management and Fisheries Management.

NEW PUBLICATIONS

New Documents
1998 Catfish Populations in Chesapeake Bay
1998 Chesapeake Bay and Atlantic Coast Tautog Fishery Management Plan
Guidelines for Developing and Revising Fishery Management Plans
The 1998 Chesapeake Bay Basin Species List

Recent Bay Program Initiatives
Directive 98-1, *Chesapeake Bay Program Education Initiative*
Directive 98-2, *Chesapeake 2000*
Directive 98-3, *Accelerating Bay Restoration through Implementation of Innovative Technologies*
Directive 98-4, *Interstate Animal Waste Distribution and Use Technology*

Brochures, Fact Sheets and Adoption Statements
1998 Community Watershed Initiative
Federal Agencies' Chesapeake Ecosystem Unified Plan
A Snapshot of the Chesapeake Bay: How Is It Doing?
June 1998 Fact Sheet on Bay Grasses

Other Popular Documents
Better Backyard: A Citizens' Resource Guide to Beneficial Landscaping and Habitat Restoration in the Chesapeake Bay Watershed (also on the web at www.chesapeakebay.net/facts/better.htm)

Hot Hits on the Chesapeake Bay Program Web Site
Bay Journal by the Alliance for the Chesapeake Bay, monthly editions and back issues
New Chesapeake Bay Program web site, site map
New Chesapeake Executive Council web page

LIVING RESOURCES SUBCOMMITTEE
1998

Chair: *Carolyn V. Watson*, Maryland Department of Natural Resources
Coordinator: *Mike Fritz*, US Environmental Protection Agency, Chesapeake Bay Program Office

Workgroup Chairs

Aquatic Reef: *James Wesson*, Virginia Marine Resources Commission
Chesapeake Bay Stock Assessment: *Derek Orner*, National Oceanic and Atmospheric Administration
Ecosystem Modeling: *Arthur Butt*, Virginia Department of Environmental Quality
Ecosystem Indicators: *Steve Jordan*, Maryland Department of Natural Resources
Exotic Species: *Anne Richards*, University of Maryland, Chesapeake Biological Laboratory
Fisheries Management Plans: *Eric Schwab, Co-chair*, Maryland Department of Natural Resources; *Jack Travelstead, Co-chair*, Maryland DNR; *Nancy Butowski, Assistant Chair*, Maryland Department of Natural Resources
Fish Passage: *Richard St. Pierre*, U.S. Fish & Wildlife Service
Habitat Restoration: *Frank Dawson*, Maryland Department of Natural Resources
Living Resources Monitoring: *Claire Buchanan*, Interstate Commission for the Potomac River Basin
Submerged Aquatic Vegetation: *Peter Bergstrom*, U.S. Fish & Wildlife Service
Waterfowl and Waterbirds: *Doug Forsell*, U.S. Fish & Wildlife Service
Wetlands: *Carl Hershner*, Virginia Institute of Marine Science

THE CHESAPEAKE BAY PROGRAM

The Chesapeake Bay Program is a regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the U.S. Environmental Protection Agency (EPA), which represents the federal government; and participating citizen advisory groups.

Since its inception, the Chesapeake Bay Program's highest priority has been to restore the Bay's living resources–its finfish, shellfish, Bay grasses, and other aquatic life and wildlife. Because water quality improvements are essential to living resource restoration, the *1987 Chesapeake Bay Agreement* set a goal to reduce the nutrients nitrogen and phosphorus entering the Bay by 40 percent by the year 2000. In the 1992 Amendments to the *Chesapeake Bay Agreement*, partners agreed to maintain the 40 percent goal beyond the year 2000 and to attack nutrients at their source–upstream in the tributaries. The Chesapeake Executive Council, comprised of the governors of Maryland, Pennsylvania and Virginia; the mayor of Washington, D.C.; the EPA administrator; and the chair of the Chesapeake Bay Commission, continues to guide the restoration with directives and policies that address habitat restoration; toxic pollution prevention and point source and agricultural nonpoint source nutrient pollution reductions. Bay Program initiatives encourage the watershed's 1,650 local governments to address land use management, growth and development, stream corridor protection and infrastructure improvements.

Nutrient pollution reductions are achieved through voluntary agricultural management practices, urban nutrient management strategies and nitrogen-reducing technologies for wastewater treatment plants. Habitat restoration efforts focus on reestablishing Bay grasses, protecting and planting riparian forest buffers, opening fish passages, creating and restoring aquatic reefs and Baywide management of fish stocks. Toxic contaminants are declining in many parts of the Bay since regional action plans have been established and a voluntary industrial pollution prevention program was implemented. Other improvements include fisheries and habitat restoration, recovery of Bay grasses, nutrient and toxics reductions and significant advances in estuarine science.