CHESAPEAKE BAY OYSTER RESTORATION, MANAGEMENT & RESEARCH

OVERSIGHT FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

OF THE

COMMITTEE ON RESOURCES
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C O N T E N T S

OVERSIGHT HEARING ON CHESAPEAKE BAY OYSTER RESTORATION, MANAGEMENT AND RESEARCH

Monday, October 22, 2001
U.S. House of Representatives
Subcommittee on Fisheries Conservation, Wildlife and Oceans
Committee on Resources
Annapolis, Maryland

The Subcommittee met, pursuant to call, at 10 a.m., in Environmental Matters Committee Room, Lowe House Office Building, Annapolis, Maryland, Hon. Wayne Gilchrest [Chairman of the Subcommittee] presiding.

Mr. GILCHREST. The hearing will come to order. I want to welcome everyone for coming this morning. We look forward to the witnesses and the information we will gather to make some continuing understanding of man's impact on a number of ecosystems. This morning we will deal pretty closely with the Chesapeake Bay and Watershed, and how we have made progress in recent decades to understand the nature of the ecosystem, human impacts on that ecosystem, positive or negative, whether we are restoring habitat or fragmenting habitat, whether we are cleaning habitat or polluting habitat, whether we are reinvigorating the species or overharvesting the species. These are all very carefully difficult and complex issues that we take extremely serious so that future generations will be able to live in a more pristine, understood, habitable ecosystem.

These are very difficult times for all of us pending the difficult issues in the Middle East, our virtual war with the stain of madness that inflicts a tiny fraction of the human population, the difficulties now in the United States with biowarfare, but we appreciate all your steady, calm and deliberate efforts to be here today.

The Congress, as Mr. Underwood will attest, is orderly, calm, still functioning, but as in other arenas you have a few people that will say otherwise, but basically this Government, this Administration, is functioning as well as it can be, and we appreciate all the efforts of all of you coming here today to continue life as usual. We appreciate the Administration and the Congress and the troops and the people of this country.

So, today we will discuss, I think, efforts that will be implemented, and have been implemented, on a very timely, efficient, expedited scale, so that if there is any identifiable John Smith's rel-

atives still living in the Mid-Atlantic region, in the not too distant future they can take a canoe or a sailboat—we will stay away from the motorized craft because they cause turbidity on the shoreline, and we know what that does—sail up the Chesapeake Bay and, in a very pleasant way, maneuver their craft around the fully functioning oyster reefs.

At this point, I would like to yield to the gentleman from Guam, Mr. Underwood, for a few words.

STATEMENT OF THE HON. ROBERT UNDERWOOD, A DELEGATE TO CONGRESS FROM GUAM

Mr. UNDERWOOD. Thank you, Mr. Chairman, and I, too, echo your remarks and endorse your statement. I am remaining engaged in being normal. I daresay that we might be the only House subcommittee doing business today, and I guess it is testimony to the fact that you as a schoolteacher going directly into politics and me essentially following the same route, me as a schoolteacher going into politics—other people know better, but I do want to congratulate you for having this hearing and for continuing the work of the subcommittee. Thank you, and good morning to all of you. It is a pleasure to join you here in Annapolis today to learn more about the status of oyster research and restoration in the Chesapeake Bay. In fact, I hope that we will get a chance to taste the fruits of those efforts later on this afternoon.

I applaud you for the dedicated interest that you have shown in scheduling field hearings to allow the members of this subcommittee opportunities to be exposed more directly to the important fish and wildlife issues that come before the committee. I am certain that such experiences will help make us more insightful legislators as we grapple with a number of authorization and reauthorization issues.

I regret that my schedule prevented me from attending the subcommittee field hearing held earlier this year at the Blackwater National Wildlife Refuge near Cambridge. I understand that this hearing was a very informative session concerning the local impacts caused by the refuge system's operation and maintenance budget backlog. I am sorry that I missed that. I hope to sit down with you, Mr. Chairman, to discuss how we might be able to get you and other members of the subcommittee out to Guam and the Western Pacific, to learn more about the unique ocean and coastal resource issues that define that region. I want you to know that the staff is also pushing for that, on both sides of the aisle.

[Laughter.]

We, too, have problems with invasive species and, believe me, as much as you dislike your furry friend, the nutria, just wait until you meet a brown tree snake up close and personal.

Let me close by saying that the efforts made since the early 1980's to restore the Chesapeake Bay have been guided by a remarkable commitment by the Federal Government and the affected States and communities that span across the entire Chesapeake Bay Watershed. And if any one factor can be used as a benchmark to judge the success of those efforts, oysters would be a good keystone species.

In that regard, I look forward to hearing from today's witnesses to learn more about what is being done to restore the oyster population and, by association, to restore the health of the Chesapeake Bay. Thank you.

[The prepared statement of Mr. Underwood follows:]

Statement of Hon. Robert A. Underwood, a Delegate to Congress from Guam

Thank you, and good morning Mr. Chairman. It is a pleasure to be able to join you in Annapolis today to learn more about the status of oyster research and restoration in the Chesapeake Bay. In fact, I hope that we get a chance to taste the fruits of those efforts later this afternoon at lunch.

More seriously, I applaud you for the dedicated interest you have shown in scheduling field hearings to allow the members of this subcommittee opportunities to be exposed more directly to the important fish and wildlife issues that come before us. I am certain that such experiences will help make us more insightful legislators in the future.

I sincerely regret that my schedule prevented me from attending the subcommittee's field hearing held earlier this year at the Blackwater National Wildlife Refuge near Cambridge, Maryland. I understand that this hearing was a very informative session concerning the local impacts caused by the Refuge System's operations and maintenance budget backlog. I am sorry that I missed it.

I hope soon to sit down with you to discuss how we might be able to get you and the other members of the subcommittee out to Guam and the Western Pacific Ocean to learn more about the unique ocean and coastal resource issues that define that region. We, too, have problems with invasive species. And believe me, as much as you dislike your furry friend, the Nutria, just wait until you meet a Brown Tree Snake up close and personal.

Let me close by saying that efforts made since the early 1980s to restore the Chesapeake Bay have been guided by a remarkable commitment by the Federal Government and the affected States and communities that span across the entire Chesapeake Bay watershed. And if any one factor can be used as a benchmark to judge the success of those efforts, oysters would be a good keystone species. In that regard, I look forward to hearing from today's witnesses to learn more about what's being done to restore the oyster population, and by association, to restore the health of Chesapeake Bay.

Thank you.

Mr. GILCHREST. Thank you, Mr. Underwood. Mr. Underwood said that we should trade visits to each other's districts. So, Mr. Underwood comes to Annapolis and we will eventually get to Guam. That is a fairly balanced mutual beneficial relationship.

I would like to introduce now a good friend, Mr. George Owings, who represents Southern Maryland extremely well. I first met George when I had the idea as a schoolteacher to run for Congress back in 1988, and at some of the interesting debates between our then opponent, Mr. Dyson, George would often give me some advice in breaks between the debate, which was always appreciated. Mr. Owings.

Mr. OWINGS. Thank you, Mr. Chairman. Ladies and gentlemen, I am here today as a member of the Environmental Matters Committee, the group who are sitting now representing Chairman John Hurst and the entire committee. Congressman, I would like to thank you very much for the invitation. I have a special interest in this as Eric Schwaab, Tom Grasso, and some of you know, I am the Chairman of the Subcommittee on Agriculture, Environment and Natural Resources on this committee, and so I have a keen interest in that. In fact, Mr. Chairman, it was because of your leadership in this very room that steps were taken to ensure that the charge you were leading on Bay dumping had a satisfactory ending

to it, at least to this point in time. And so, again, I would like to thank you on behalf of the Chairman and the Committee for the kind invitation to join you.

Mr. GILCHREST. Thank you, Mr. Owings.

Our first panel is Mr. Scott Gudes, Acting Under Secretary for Oceans and Atmospheric Administration for NOAA, U.S. Department of Commerce; Mr. Eric Schwaab, Director, Maryland Department of Natural Resources, Fisheries Service; and Col. David Hansen, District Engineer, Norfolk District, Army Corps of Engineers. Gentlemen, welcome this morning. Mr. Gudes, you may begin.

STATEMENT OF MR. SCOTT B. GUDES, ACTING UNDER SECRETARY FOR OCEANS AND ATMOSPHERE, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. GUDES. Thank you, Chairman Gilchrest, Congressman Underwood, Chairman Owings. On behalf of Secretary Don Evans and the 12.5 thousand men and women at your NOAA, I would like to thank you for this opportunity to testify today on oyster restoration, Marine Protected Areas and, of course, the Chesapeake Bay.

As I have said to this committee before, the Chesapeake Bay is the nation's largest estuary. It is the backyard for NOAA Headquarters. It is something that is quite special to us. We have some 3,000 of our 12,500 employees at NOAA work in Maryland, and so this is something we take very seriously and this is actually quite an honor to be here in the State House.

I have personally been able to be involved in restoration efforts around the Bay, including oyster restoration, and have a strong personal commitment to this issue we are talking about today.

These are, of course, State-managed fisheries, and I am pleased to be here with Eric Schwaab and the Department of Natural Resources. At NOAA, we are in the mode of working with Maryland and Virginia and assisting the States with oyster restoration and disease. The fact that NOAA does not directly manage fisheries in the Chesapeake Bay, I think, gives our Chesapeake Bay office and agency a role as a nonbiased advocate for overall sustainability of Bay fishery resources, including oysters.

We are concerned about the loss of oyster stocks in the Bay. In the mid-1950's, the Bay produced some 34 million pounds per year, and the harvest at that time actually was fairly even between Maryland and Virginia. Last year the harvest was only 2.5 million pounds, with only about 6 percent in Virginia.

The Chesapeake Bay Foundation has noted that we are at something like 2 percent of historical levels—and you were talking about John Smith before—historical levels of oysters overall in the Bay.

Oysteries provide habitat and structure for other shellfish, for crabs, for finfish. They are a natural filtering machine removing plankton, sediment and improving water quality. In fact, a mature oyster can filter as much as 60 gallons of water per day.

NOAA has worked aggressively to get to the root of many of the factors on declining oyster levels—overfishing, alteration and degradation of habitat, and disease, MSX and Dermo. Let me speak to habitat first.

Habitat loss or alteration continues to be a significant problem, and our goals are centered around, one, meeting the Chesapeake 2000 goal to restore oysters to 10 times their current biomass by 2010, and, two, furthering the science of restoration techniques.

The handout I have provided and the chart up here indicates location where our oyster restoration activities have focused. This chart shows oyster reserves, oyster sanctuaries, harvest bars, bar cleaning and hatcheries.

We have worked closely with the Oyster Recovery Partnership I know you will hear from later today, and many partners in the Bay to re-establish oyster beds with clean shell and spat, recondition oyster bars coated by sediment, and to field test disease-resistant strains oysters. Just last week, some people from my office, Dr. Becky Alley, our head of Legislative Affairs, Mary Beth Nethercut, and a lot of the folks who are here from the Chesapeake Bay office worked with you to do an oyster recovery project in the Chester River. A significant effort has gone into increasing the production of spat-on-shell young oysters and placing them on reconditioned bars.

To date, through NOAA and partner-funding, more than 25 bars, representing over 380 acres, have been reconditioned and seeded with 70 million oysters. We have supported research on the optimal design and shape of oyster beds, and NOAA has provided vessel support and scuba divers for restoration. Of course, our Community-Based Restoration Program, which leverages 5-to-1 in private funds, is actively involved. The Restoration Center in our Fishery Services provided some $350,000 for these efforts and, as you know, our slogan is "Restoration is habitat-forming".

As the committee knows, we are developing multiple species ecosystem models for the Chesapeake Bay that will provide insights into the interactions of fish and shellfish populations, habitat, and loss to disease, and we are using NOAA hydrographic expertise—John Rayfield, who is up there in front, and you and the committee and the Congressmen have shown so much leadership in this area—we are using that same sort of technology to identify bottom substrate for oyster planting and restoration.

Let me talk a little about diseases. Diseases represent one of the threats to oyster populations in the Chesapeake Bay. The MSX parasite, which thrives in high salinity waters, arrived in the 1950's, and Dermo, which can tolerate lower salinity, arrived later.

NOAA has been supporting oyster disease research since 1989, at about $1.5 to $2 million per year, and since 1995 this program has been administered through the Sea Grant program at both VIMS and at University of Maryland. Through research and input from our constituents, the program has developed oyster strains that are more disease-resistant. Next year, the Sea Grant programs of those two States will be holding a Shellfish Summit in Washington, D.C., with resources managers and Federal officials and State officials and others, to discuss disease and restoration efforts.

Now let me talk a little bit about Marine Protected Areas. One such approach that the summit will no doubt discuss are long-term conservation measures for habitat and protected areas. This could include measures similar to those used by State managers for oyster and crab management.

This general issue of Marine Protected Areas, or MPAs, as we say, I think is not well understood. An MPA can be any number of protective measures that are about some level of protection for marine and coastal environment. For example, at NOAA, we maintain 13 national marine sanctuaries. In most parts of these sanctuaries, fishing is allowed. These are MPAs. We operate 25 national estuarine research reserves. The Virginia NERS has four sites along the York River, and in Maryland you have three sites around the State, including Jug Bay near Washington, D.C., on the Patuxent. These are also MPAs. Fisheries conservation measures could also be called MPAs. The fact is that MPAs come in all shapes and sizes.

We are currently working with the Department of Interior to develop an inventory of Federal, State and local MPAs around the nation, and we are in the process of putting together an MPA Advisory Committee. And Dr. Susan Roberts, of the National Academy of Sciences I know will be talking about this in the second panel.

In the Bay, we are working with State partners to create elevated 3-dimensional oyster reefs in areas set aside for non-harvest brood stock. These oyster sanctuaries are closed, and oyster reserves are closed for some time for oyster harvesting.

This is a good example, Mr. Chairman, members of the committee, of a win-win. These sanctuaries and reserves restore oysters. They are also open to commercial and recreational fishing. These should be excellent sites for striped bass, sea trout, and other finfish.

Good management of MPAs, of course, requires science and management and, at the national level, we are working on that. Our ecosystem management approach here in the Bay, working with partners like the State of Maryland, DNR should look at the potential effectiveness of various sizes and locations for reserves and sanctuaries.

In conclusion, Mr. Chairman, as often happens when I get a chance to talk in front of your committee, I am passionate about these issues and I exceed my 5 minutes. Let me just say that we take this issue very seriously. We strongly support the efforts of the two States to restore oysters in the Bay, as you say, for all the reasons, and while I think this is very affordable, I think if you take a look at the success with striped bass, where NOAA, the States along the Atlantic Coast and Maryland showed the leadership, in the mid-1980's we thought striped bass were gone, they have recovered. So, I think that is possible, that is doable, that is the goal with oysters as well. Thank you.

[The prepared statement of Mr. Gudes follows:]

Statement of Scott B. Gudes, Acting Under Secretary for Oceans and Atmosphere, Deputy Under Secretary for Oceans and Atmosphere, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Thank you, Mr. Chairman and members of the Subcommittee, for inviting me to today's hearing. I am Scott Gudes, Acting Administrator of NOAA and Deputy Under Secretary for Oceans and Atmosphere in the Department of Commerce. I am happy to be here today to discuss oyster restoration in the Chesapeake Bay, and the role of Marine Protected Areas in marine resource management. Both are essential elements of the many excellent efforts underway in the Bay to restore this valuable ecosystem.

I have been asked to testify about the National Oceanic and Atmospheric Administration's (NOAA) involvement in oyster restoration, oyster disease research, and the role Marine Protected Areas (MPAs) can play in the ongoing oyster recovery efforts. I would like to begin by providing a brief history of the oyster fishery in the Chesapeake Bay. This background is necessary to put NOAA's contributions, and the efforts of the many partners who are also committed to restoring the Bay's oyster population, into context.

Changes in the abundance of oysters over the last three centuries mirror the larger transformations that have occurred in the Chesapeake Bay. Since the mid–1800s, the amount of oysters harvested in the Bay has declined to less than two percent of prior levels, resulting in a significant economic impact and broad ecological consequences. Healthy oyster reefs are an efficient filtering systems and oyster larvae are an important food source for many species. Oyster reefs also serve as habitat for crabs, mussels, clams, finfish, and many invertebrates that are important food items for higher predators, including commercially and recreationally important species. As the NOAA Chesapeake Bay Office (NCBO) shifts its focus from a single or multi-species fishery management, to an ecosystem-based approach, the important ecosystem functions of oysters are being further recognized.

Additionally, oyster population and harvest data are key elements in ecosystem modeling efforts for the Bay. The important ecological functions of oyster habitats are being described, and recommendations for their use and protection will be provided in the Fishery Ecosystem Plan (FEP) currently under development by NOAA and its partners. Working with other Bay partners, NOAA is helping to identify specific areas where certain types of activities should be controlled in order to protect reef structure, permit oyster reproduction and growth, and allow spat set.

While estimates of the historical amount of oyster bottom range from 400,000 acres to less than 220,000 acres, only a relatively small amount of viable oyster bottom exists in the Bay today. The dramatic decline in the oyster population and oyster habitat has occurred in a number of fairly distinct phases, a result of a number of factors. Overfishing (including the habitat destruction associated with certain fishing gears and methods), disease, pollution, and siltation have devastated what was once the Chesapeake Bay's most lucrative fishery. Loss of the physical structure provided by oyster reefs, and the extensive biotic communities that existed within and around them, has had marked effects on the overall Bay health and ecology. The economic and social impacts on local communities and watermen dependent upon oysters have been no less dramatic.

Prior to 1865, oyster harvest remained plentiful, but modest. Most of the harvest was conducted by hand-tonging, a relatively inefficient harvest method that did not significantly alter the physical structure of the reefs. In 1865, oyster dredges were legalized and harvest numbers skyrocketed. Dredges harvested more efficiently and made areas that had previously been difficult to harvest with hand tongs more accessible. After the advent of the dredge, harvests peaked at over 15 million bushels in 1887. Scraping by these dredges resulted in the flattening of raised oyster reef structure and served to reduce the overall benefits of this structure (e.g., aggregated oyster spawning stock, 3-dimensional fish habitat, and elevation off the silty bottom).

In the 1950s, hydraulic-powered hand tongs, with the ability to remove large clumps of oysters from reef structures, further increased the efficiency of the fishery. The more efficient gear kept the fishery viable, with harvest levels in a near steady-state of about 4–5 million bushels per year, but prevented the long-term sustainability of the fishery. Recent harvest levels represent historic lows and have remained fairly constant over the last three to four years, averaging about 300,000 bushels annually in Maryland and 22,000 bushels annually in Virginia.

The effects of high levels of fishing and associated habitat destruction were compounded by the onset of two oyster diseases, Dermo and MSX. Dermo (Perkinsus marinus), a natural parasite in Atlantic estuaries, has been in the Bay since the late 1950s. It is most prevalent and infective at high salinities, killing oysters at an age just before they reach marketable size (age 2 to 3 years). Another identified oyster disease, MSX (Haplosporidium nelsoni), was introduced to the Bay, possibly through the importation of oysters from other areas. It is less understood than Dermo and kills very young oysters in high salinity waters.

While a number of localized populations of Bay oysters display some resistance to disease onset and mortality (large, market-sized oysters in areas of high disease prevalence suggest some traits of disease resistance), we do not yet have a long-term solution or answer to how to combat these diseases beyond managing around them. Recent efforts to conduct genetic crosses to create a disease-resistant strain of oysters have shown some early promise. However, even if the strain is highly successful, it would be many years until it could make up a significant component of the

genetic pool of the Bay-wide oyster stock. The bulk of oyster restoration efforts today focus on re-establishing historic reefs through the placement of shell and young oysters. One of the more promising approaches is the creation of 3-dimensional reefs that extend significantly off the floor of the Bay and are thought to be more conducive to healthy and productive oyster populations.

OYSTER DISEASE

In an effort to address the ongoing oyster disease problem, NOAA has supported an Oyster Disease Research Program (ODRP) since 1989. Between the start of the program and 1999, NOAA invested $1.5 million per year, and increased funding to $2 million in 2000. Administered by NOAA Sea Grant since 1995, this program has focused primarily on mid–Atlantic oyster disease problems, such as the parasites Dermo and MSX, as well as juvenile oyster disease and summer mortality syndrome.

The combination of these disease factors have led to the decline of both the mid–Atlantic and Pacific oyster industries. The ODRP has been guided by an Advisory Committee, as well as an ongoing process of constituent involvement through a series of workshops and scientific meetings that have resulted in recommendations for research. The results of the ODRP were summarized in a 1998 publication entitled, "Restoring Oysters to U.S. Coastal Waters," and on a web page (www.mdsg.umd.edu/oysters/disease/index). Sea Grant also has supported a Gulf Oyster Industry Program at $1 million per year for the past three years to work on restoring and improving the Gulf oyster industry. These programs have provided new technology, improved oyster stocks, and scientific information that are being used by state managers and the oyster industry. Several significant accomplishments made by the ODRP include:

- Development of disease resistant oyster strains that are about 10 times more resistant than native wild stocks to both Dermo and MSX.
- Development of disease models incorporating environmental, biological and hydrographic information to allow better management of the oyster industry. These models are being used by managers in some states to predict the annual severity of disease for oyster harvesters.
- Improved understanding of the disease mechanisms and virulence that impact oyster survival. We have learned that there are several levels of virulence depending upon the species of Dermo. There are currently 3 species of Dermo.
- Improved diagnostics for identification and quantification of oyster diseases. We now have diagnostic techniques that can detect a single parasite cell in 30 grams of oyster tissue. This level of detection improves our ability to assure disease free status for oysters that may be moved around the bay in commercial oyster operations.
- A recent breakthrough in producing tetraploid American Oysters (Crassostria virginica) has been made, allowing assured production of triploid oysters. Triploid oysters maintain higher meat quality during summer months, thus extending the market season. Triploid oysters are also sterile, thus removing the threat of genetic alterations of wild stocks from oysters placed in the bay for aquaculture or enhancement.
- Improved communications between scientists, managers, industry, and the general public on oyster issues in the United States. Oyster issues are being discussed in many educational contexts including K–12 education, as well public fora.

ODRP managers realize that the overall goal is to restore oysters in coastal waters, both for industry and the important ecological roles that they play in water quality and ecology. In fiscal year 1901, researchers began to apply the technology developed for diagnostics and improved disease- resistant stocks to field applications. Disease-resistant oysters created through the ODRP are being placed on restoration oyster reefs and compared to non-resistant stocks to determine if any differences exist in survivability. Disease diagnostic tools with greater sensitivity are also being used in at least two projects to study disease transmission and severity.

Additionally, the National Sea Grant Program, through the Virginia and Maryland state Sea Grant Programs, is planning a major oyster summit meeting for Fall 2002 in Washington, D.C. Participants will include scientists, resource managers, NGO's and interested governmental officials. We will use the opportunity to discuss the status of both oyster disease research and ongoing restoration efforts, and how we can improve future coordination of these two important activities.

OYSTER RESTORATION

Oyster restoration seeks to reestablish or duplicate the functional, high-quality, hard bottom habitat that once existed throughout much of the Chesapeake Bay. It typically involves uncovering existing shell or distributing new shell in formerly productive areas, then seeding the bottom with spat (young oysters) or adult broodstock. In some areas, enough oyster larvae are produced naturally to allow sites to recolonize via natural spat set. In the long-term, truly restoring oysters and oyster reef habitat involves restoring or mimicking the hard substrate produced by living oysters. Through restoration, we are "jumpstarting" the natural system. The long-term goal is to restore a sustainable oyster population that will provide multiple ecological benefits, as well as support a viable commercial fishery.

The 1999 Chesapeake Bay Oyster Restoration Consensus Report outlined a number of ideas to facilitate oyster restoration. The three key concepts within the document are: (1) the importance of three-dimensional reef habitat for oysters and the resulting community of organisms that utilize them; (2) the necessity for reef sanctuary areas to preserve and protect broodstocks for replenishment of nearby harvestable areas nearby; and (3) the importance of changing the current practice of moving potentially disease-infected seed from areas of high infection to those areas with low or no disease presence. Independently, these suggestions will require significant changes in current management practices and resource commitments.

Numerous Federal, state, and local government agencies, as well as public and private non-profit organizations are involved in oyster restoration efforts. NOAA's current efforts in oyster restoration are centered around two principal themes: progress toward the Chesapeake 2000 goal to restore oysters to 10-times their current biomass by 2010, and furthering science through development of innovative restoration techniques and strategies. To this end, NOAA has dedicated funds to increase oyster substrate and rear young spat oysters for placement on natural or restored bottom areas. Projects range from large-scale production to relatively small-scale endeavors.

Significant funding has been targeted toward increasing the capacity and efficiency of hatchery-based restoration efforts, where immense quantities of spat-on-shell (young oysters set on old oyster shell) are produced for placement on recreated oyster shell mounds. No less significant are modest amounts of funding provided through NOAA's Community–Based Restoration Program for "oyster gardening" programs that encourage citizen and school groups to grow young oysters for up to one year, before planting them on restored reefs. Oyster restoration is also being furthered through the funding of applied research and cooperative partnerships. For example, alternative substrate studies are underway to address the critical issues of limited availability of shell substrate. Additionally, older, disease-resistant oysters are being moved to sanctuary areas in proximity to commercial oyster beds, where oysters are aggregated and protected, in hopes of improving chances for strong natural spat sets.

NOAA staff, through the Chesapeake Bay Office, Restoration Center, Coastal Zone Management Program, and other programs have been integrally involved in restoration planning, coordination, and cooperation among all the entities in each state to further NOAA goals to restore both the ecological function and habitat value of oyster reefs. Staff have provided extensive monitoring assistance to the states and other entities involved in oyster restoration, through diving services, boat support, and labor during critical phases of the rearing, nursery and planting stages of oyster restoration. In cooperative projects, NOAA divers provide monitoring and assessment expertise to validate project results. NOAA ship-based charting technology is also being utilized to locate suitable bottom substrate types to help identify appropriate planting areas.

Oyster Recovery Partnership

In Maryland waters, NOAA is working closely with the Oyster Recovery Partnership (ORP), and has provided over $1.6 million to ORP for oyster recovery efforts since 1999. The ORP is the leading regional organization initiating, coordinating, and managing oyster restoration efforts in Maryland waters of the Chesapeake Bay. ORP has representation from many interest groups, including significant involvement from commercial watermen. While ORP's focus has been on restoring oyster habitat and oysters for harvesting, the program is working with NOAA to employ strategies to further the science of oyster restoration. This includes: the first broad-scale field testing of potentially disease-resistant oyster strains; leveraging ORP funds with those available for oyster sanctuary and reserve sites to implement co-located reserves and sanctuaries with commercial harvest sites; and experimenting

with methods to recondition existing non-viable oyster bars that had been smothered by sediment.

While one emphasis of ORP is directed at restoring harvestable oyster bottom, a significant proportion of the funding from fiscal year 1901 has been directed at increasing production capabilities of spat-on-shell. Hatchery production of young oysters at the University of Maryland's Horn Point Hatchery is needed in Maryland waters where predictable spatfall does not occur in all areas. The hatchery product is often the limiting factor in restoration efforts. ORP mechanized the grow-out process by incorporating state-of-the-art stainless steel containers, boom trucks, and forklifts. This has allowing bulk handling of shell and spat, and has resulted in excess of 100 million spat-on-shell being produced this year alone.

Community–Based Restoration Program

NOAA's Community–Based Restoration Program (CRP) has provided funding to communities in 10 states for oyster restoration, including Atlantic and Pacific coast states, as well as to states bordering the Gulf of Mexico. To date, 26 oyster restoration projects have been funded with nearly $1 million in CRP funds, which are leveraged at the local level between one and five times. The bulk of oyster restoration funding has been focused in the Chesapeake Bay, where NOAA Restoration Center staff has provided close to $350,000 to groups in Maryland and Virginia, including the Chesapeake Bay Foundation, the Virginia Marine Resources Commission, Chesapeake Appreciation Inc., Assateague Coastal Trust, and others. This will translate to more than $1 million in oyster restoration efforts once volunteer labor and local contributions are included. NOAA staff work closely with communities to aid in project development and implementation. Projects often are monitored and maintained by communities, promoting stewardship and a heightened appreciation for a healthy environment.

Coastal Zone Management Program

In fiscal year 1999 and fiscal year 1900, NOAA's Coastal Zone Management Program provided the Virginia Department of Environmental Quality $500,000 each year to fund comprehensive restoration planning for oyster sanctuary reefs on the Rappahannock River.

The success of the oyster recovery efforts in the Chesapeake Bay will rely on the continued support of existing research and restoration efforts, as well as the careful coordination of the many partners participating in this effort. The progressive approaches being pursued in the Bay, such as the use of oyster reserves and sanctuaries in conjunction with commercial harvest areas, reflects the willingness of the Bay partners to work together to take an ecosystem approach to oyster recovery. This approach also provides an example of the concepts supported under Marine Protected Areas.

MARINE PROTECTED AREAS

What are Marine Protected Areas?

Before describing the role of Marine Protected Areas in the Chesapeake Bay, I would like to provide some background on MPAs in general and on NOAA's recent efforts in using them for the long-term conservation and management of marine resources. While the term Marine Protected Area has been used for over two decades, the concept of using MPAs for fishery management has been around for centuries. The term is generally used to describe marine areas given some sort of special protection. Today, there are many different types of Marine Protected Areas, or MPAs in use around the world for different purposes.

MPAs come in different shapes, sizes, and management characteristics, and have been established for different purposes, with varying types of protection and uses. They range from areas with no consumptive uses, such as Edmonds Underwater Park in Washington State (set aside as an underwater park visited by scuba divers), to multiple-use areas, such as those found in the Florida Keys National Marine Sanctuary. In the United States, MPAs may include national marine sanctuaries, fisheries management zones, national seashores, the marine areas of national parks and national monuments, critical habitats, national wildlife refuges, national estuarine research reserves, state conservation areas, state reserves, and privately owned and managed areas.

There are many different types of MPAs to serve as many purposes. They are managed by a variety of different groups at federal, state, and local levels. Unfortunately, there is currently no inventory of the existing U.S. MPAs. NOAA and the Department of the Interior are presently working to develop an inventory of existing

MPAs to help us all better understand how to best use these MPAs as marine resource management tools.

How are Marine Protected Areas Used?

MPAs are an important tool for fishery management today, with examples including area and seasonal fishing closures for protection of spawning grounds, or fishing closures for restoration of essential habitat and depleted spawning stocks. Several regional Fisheries Management Councils, such as the South Atlantic, Pacific, and Western Pacific are currently in stages of proposal, design, or review of Marine Protected Areas for management of their regionally important commercial and recreational species.

Other types of MPAs may also provide biodiversity protection and conservation of sensitive habitats and endangered species, or provide recreational and educational opportunities to the public. MPAs designed to increase and protect biodiversity and those sites designed for fishery enhancement purposes are not mutually exclusive. The success of either type of MPA is based on the enhancement and protection of a healthy marine ecosystem. MPAs can be unique tools in the marine resource management toolbox, because they shift the emphasis of marine resource management from the traditional focus on a single species to protection of a specific area or habitat that can often help meet multiple goals and objectives. Our science and experience indicate that MPAs can be useful tools to help manage, protect and sustain the Nation's valuable marine resources, as well as the people and economies that depend on them. How best to use MPAs in combination with other management tools to meet these goals is a major challenge for ocean stewardship.

Clearly, MPAs by themselves are not a "silver bullet" to marine management. MPAs are an additional tool for marine resource management that place an emphasis on spatial parameters, but cannot be successful if used in isolation. Their use and design requires a consideration of such factors as oceanographic regimes, sources of pollution, or how fishing effort affects ecosystem processes inside and outside the protected area. The design, placement, and implementation of an MPA need to be considered within the context of a variety parameters, that include socio-economic considerations of the affected fishing community, in order to form an integrated ecosystem approach for marine resource management. MPAs are best used in combination with, and to complement, other management tools.

What is the Federal Role in MPAs?

The federal MPA initiative is a collaborative effort between NOAA and the Department of the Interior that seeks to partner with other Federal, state and territorial agencies and other stakeholder groups to help provide information, tools and services to build a framework for a comprehensive and coordinated system of MPAs in our Nation's waters. The initiative grew out of Executive Order 13158 (May 2000) on Marine Protected Areas and received further endorsement when Secretary Evans announced that the Bush Administration had decided to retain the Order. The Order does not create any new authority to establish MPAs, rather it establishes a mechanism to improve their effectiveness and "to harmonize commercial and recreational activity with conservation." The initiative is designed to understand the effectiveness of the collection of existing marine protected sites in each region; increase coordination and effectiveness among the assortment of existing sites to better meet increasing demands; and help local, state, Federal, and tribal entities most effectively use MPAs under existing statutory authority to meet their goals. To address these challenges, NOAA is working with government and non-government partners to:

- build an inventory and assessment of existing sites within U.S. waters;
- provide a sound scientific foundation and tools for MPA design, management and evaluation under existing statutory authority;
- develop and maintain a website at http://mpa.gov to provide access to information on MPAs;
- provide an open, equitable and meaningful process to engage user groups and the American public on MPAs through stakeholder workshops and an MPA Federal Advisory Committee.

NOAAs fiscal year 1902 budget request included $3 million to help implement these efforts. I would like to thank Chairman Gilchrest and other members of the Committee for their leadership and support of Marine Protected Areas.

MPAs in the Chesapeake Bay

There are many examples of MPAs in the Chesapeake Bay, including two National Estuarine Research Reserves in Maryland and Virginia. These Reserves are federal-state partnerships between NOAA and the Maryland Department of Natural Resources, and NOAA and Virginia Institute of Marine Science. The Maryland Re-

serve has three sites or components throughout the upper Bay. The Virginia Reserve protects four components on the York River. Both Reserves include estuarine habitats that function as living laboratories for research and educational activities. The sites are also part of a nation-wide system, helping to monitor water quality in estuaries around the Nation, and conduct educational workshops for resource managers in the area. Both reserves also conduct regionally specific activities that are aimed towards improving the management and condition of Chesapeake Bay. These and other sites have shown us how valuable different types of MPAs can be to help sustain these valuable resources.

Various forms of MPA concepts are currently in use in the Chesapeake Bay, though typically known by different terms. NOAA is doing work in conjunction with the Bay partners to create elevated, three-dimensional reefs, in areas throughout the Bay that are set aside as non-harvest broodstock "reserve" or "sanctuary" areas. Historical harvest areas surrounding these restored, elevated sanctuary sites are also being restored to clean the existing surface shells of sediment and re-plant with oysters destined for future harvest. Many of the newly restored harvest areas will be adaptively managed to control the future harvest to a certain percentage of the standing stock, as well as to permit only certain gear types in certain areas. The long-term goal is to restore both the harvest and non-harvest areas to allow the oyster populations to be self-sustaining, while maintaining a viable commercial fishery. Although the oyster reserves and sanctuaries are closed to oyster harvest, they are open and available for all other uses, especially for fishermen who flock to these areas because of the higher densities of finfish species. These multi-agency efforts provide an excellent example of using ecosystem-based research and management to design and use MPAs as a management tool.

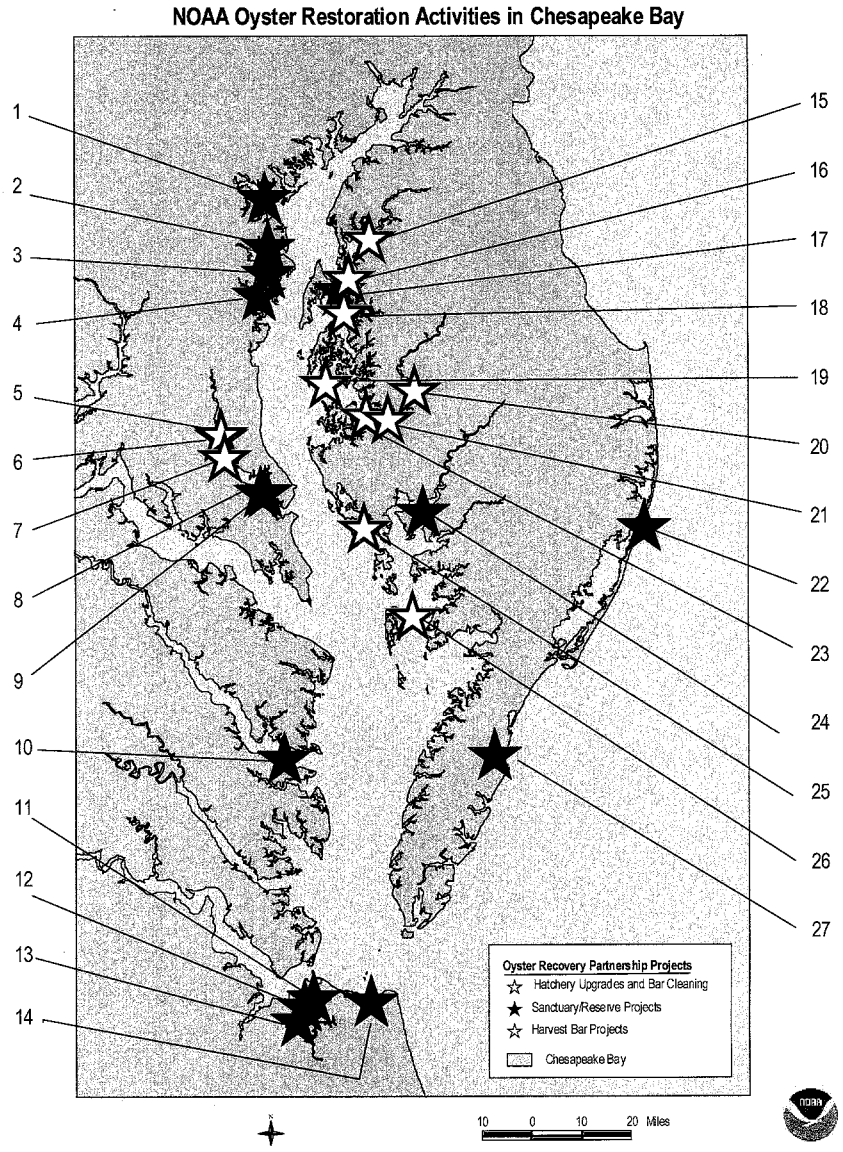
Similarly, the Commonwealth of Virginia has established seasonal closures along the deep channels of the southern Bay for blue crabs to provide protection during the crabs' annual summer migration. While both commercial and recreational crabbing are prohibited in these corridors during these migration periods, all other commercial and recreational activities remain open. The benefits provided by this deep water sanctuary to crabs are still under investigation; however, the intent behind this effort resembles the MPA concepts of identifying areas that are critical to health of the blue crab population and providing the necessary protection. Those areas identified as providing important benefits to multiple species should be carefully evaluated by the Bay partners and considered as potential sites for future MPAs as part of the suite of efforts being undertaken to help restore the Chesapeake Bay's economic productivity and ecosystem integrity.

I want to reemphasize that MPAs have been used successfully in fisheries management for decades and have played an important role in the recovery of many important commercial and recreational species, such as New England groundfish and scallops. The success of MPAs relies upon the support of the entire community that is dependent upon the resources and benefits provided by the Bay. Therefore, I cannot emphasize enough the importance of total community involvement in any MPA process that may take place in the Bay.

I would like to reiterate NOAA's commitment to oyster restoration in the Bay. The restoration of a healthy, sustainable oyster population will require continued oyster disease research, including selection and propagation of disease resistant oyster strains. Until such time as we are better able to control disease in the oyster population, we need to continue the innovative restoration work that allows us to mange around these diseases. This restoration works provides the foundation for a projected ten-fold increase in population that we, as part of the Bay community, are committed to attaining by 2010.

Mr. Chairman, this concludes my testimony. Again, I appreciate the opportunity to share with you and the other members of the Committee NOAA's efforts in the Chesapeake Bay and am prepared to respond to questions.

[Attachments to Mr. Gudes statement follow:]


NOAA Oyster Restoration Activities in Chesapeake Bay
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Oyster Recovery Partnership Projects
Hatchery Upgrades and Bar Cleaning
Sanctuary/Reserve Projects
Harvest Bar Projects
Chesapeake Bay
10 0 10 20 Miles

NOAA Oyster Restoration Activities in Chesapeake Bay

1. **Fort Carroll Education-based Oyster Reef**
(Living Classrooms Foundation)
FY98--$35K
2 Acres (36,000 bushels shell)
2 million spat-on-shell

2. **Magothy River-Chestneck Shoal**
(Oyster Recovery Partnership)
FY00--$20K
shelled by DNR
1.2 million spat-on-shell

3. **Severn River-Weems Creek**
(Oyster Recovery Partnership)
FY00--$25K
shelled by DNR
1.5 million spat-on-shell

4. **South River-Glebe Bay**
(Oyster Recovery Partnership)
FY00--$25K
shelled by DNR
1.5 million spat-on-shell

5. **Patuxent River-Elbow Bar**
(Oyster Recovery Partnership)
FY01
Bar Cleaning

6. **Patuxent River-Teague Bar**
(Oyster Recovery Partnership)
FY01
Bar Cleaning

7. **Patuxent River-Broadneck Bar**
(Oyster Recovery Partnership)
FY01
Bar Cleaning

8. **Patuxent River- Neals Addition Oyster Reef**
(Chesapeake Bay Foundation)
FY01--$30K
2 Acres (shelled bottom present)
300,000 citizen gardener oysters

9. **Patuxent River Oyster Reef**
(Chesapeake Bay Foundation)
FY99--$17K
1 Acre (10,000 bushels shell)
200,000 citizen gardener oysters

10. **Rappahannock River Oyster Restoration (CZM/VA DEQ)**
(Virginia Marine Resources Commission)
FY99--$500K; FY00--$500K
9 Acres reefs, 300 Acres harvest bars
(3 million bushels shell)
Natural recolonization

11. **Lafayette River Oyster Reef**
(Virginia Marine Resources Commission)
FY99--$15K
1 Acre (50,000 bushels shell)
150,000 citizen gardener oysters

12. **Elizabeth River-Craney Island Oyster Reef**
(Virginia Marine Resources Commission)
FY99--$34K
1 Acre (81,000 bushels shell)
40,000 citizen gardener oysters

13. **West Branch Elizabeth River Oyster Reef**
(Virginia Marine Resources Commission)
FY97--$40K
1 Acre (60,000 bushels shell)
150,000 citizen gardener oysters

14. **Lynnhaven River**
(City of Virginia Beach)
FY01--$50K
2 Acres (40,000 bushels shell)
Citizen oyster gardeners at a later date

15. **Chester River-Emory Hollow**
(Oyster Recovery Partnership)
FY00
Bottom reconditioned via bar cleaning
4.6 million spat-on-shell

16. **Chester River-Blunts Bar**
(Oyster Recovery Partnership)
FY00
12 Acres (88,000 bushels shell)
11.5 million spat-on-shell

17. **Wetlands & Shoreline at Horseheads Wetlands Center**
(Wildfowl Trust of North America & CBF)
FY01--$155K
0.5 Acres (4 tons concrete; 1,000 bushels shell)
20,000 citizen gardener oysters

18. **Eastern Bay-Bugby Bar**
(Oyster Recovery Partnership)
6 Acres (45,000 bushels shell)
6 million spat-on-shell

19. **Choptank River-France Bar**
(Oyster Recovery Partnership)
FY99
20 Acres (129,000 bushels shell)
20 million spat-on-shell

20. **Choptank River-Sandy Hill**
(Oyster Recovery Partnership)
FY01
Bar Cleaning

21. **Oyster Habitat in Coastal Bays**
(Assateague Coastal Trust)
FY99--$10K
0.8 Acres (30,000 bushels shell)
1.2 million citizen gardener oysters

22. **Choptank River-Bolinbroke Sands**
(Oyster Recovery Partnership)
FY00
15 Acres (57,000 bushels shell)
15.5 million spat-on-shell

23. **Hatchery Production Upgrades**
(Oyster Recovery Partnership)
FY01
Stainless steel setting baskets,
shell washer, setting tanks
Boom trucks, forklifts, bobcats, vessel upgrades

24. **Nanticoke River Oyster Reef**
(Chesapeake Bay Foundation)
FY00--$88K
1.2 Acres (110 tons limestone marl; 5,000 bushels shell)
100,000 citizen gardener oysters

25. **Honga River**
(Oyster Recovery Partnership)
FY01
Bar Cleaning

26. **Tangier Sound-Terrapin Sands**
(Oyster Recovery Partnership)
FY99
5 Acres (38,000 bushels shell)
4 million spat-on-shell

27. **Oyster Reef & SAV in Coastal Bays**
(Virginia Marine Resources Commission)
FY01--$26K
2 Acres (40,000 bushels shell)
Natural re-colonization

For those not specifically noted above, Oyster Recovery Partnership projects completed as part of a broad, multi-year cooperative agreement with NOAA, totaling $435K in FY99, $396K in FY00, and $805K in FY01.

Mr. GILCHREST. Thank you, Mr. Gudes.
Mr. Schwaab.

STATEMENT OF ERIC C. SCHWAAB, DIRECTOR, MARYLAND DEPARTMENT OF NATURAL RESOURCES, FISHERIES SERVICE

Mr. SCHWAAB. Thank you, Mr. Chairman. I appreciate the opportunity to speak before you today on this important issue. I have provided written testimony which details at great length our restoration efforts. I will just try to simply hit some of the high points. I would like to try to leave you with three take-home points.

The first is that we have decades of effort underway to maintain oyster stocks, and an oyster fishery, with some success primarily at maintaining. But it is clear that we now need to change the game to restore oysters to their former status.

In changing that game, the second point I want to make is that we are now moving into a substantial new phase in our restoration effort, and that phase is supported by the new Bay Agreement goal that you heard spoken of a moment ago. It has a substantial focus on the creation of a network of oyster sanctuaries. And it is bolstered by the Governor's commitment of new funds to stand behind our efforts to restore this oyster habitat and this resource to its former glory.

And then, finally, I would like to just emphasize that we need to continue to build on the substantial partnerships that have been created over the years to not only protect and enhance the Bay, but specifically to focus on oysters, and I will just provide to you a little bit of detail on each of those points.

As I mentioned a moment ago, Maryland's DNR Oyster Program has a long history of oyster restoration work. It primarily has consisted of two main components. The first is a repletion program that focuses on continuing and enhancing economic benefits realized from a substantial oyster fishery. This has been underway for decades, sustaining a modest but variable commercial harvest despite the habitat and disease limitations that you have already heard about.

But more recently we have initiated a Restoration Program that focused on improving the ecological benefits derived from a substantially increased oyster population. This seeks to substantially restore oyster populations to recapture those ecological benefits provided by new habitat that filters water, that provides resources for other fish, and that, again, as you mentioned, brings back the kind of Bay that existed when Captain John Smith sailed up the Bay so many hundreds of years ago.

To help realize this aggressive new goal—and this goal, as you heard mentioned, speaks to a tenfold increase in oysters in the Bay by the year 2010, over a 1994 base period. To help demonstrate Maryland's commitment and to jump-start this effort, Gov. Glendenning, in 2000, announced his intention to commit $25 million in new oyster restoration funds over the next 10 years.

Just a little bit specifically about the Oyster Sanctuary Program. Oyster sanctuaries are areas closed to harvest. These sanctuaries complement the formerly mentioned repletion program by permanently protecting select oyster populations and reef communities.

Five years ago there were only three sanctuaries in the Maryland portion of the Bay. Today there are 24, with many more planned. Active habitat restoration is another important aspect of this sanctuary initiative. It is not enough to simply identify these areas and walk away from them. Substantial restoration projects have got to be completed to bring about the full benefits that these new sanctuaries can realize.

A network of successful oyster sanctuaries will help sustain and restore oyster population and a restored oystery fishery. By rebuilding select oyster reefs and permanently protecting them, again, will serve as source areas for oyster larvae to increase and provide for natural reproduction throughout the Bay. They will restore important water quality benefits to the Bay, and they will provide important reef habitat for all aspects of the Chesapeake Bay ecosystem, including crabs and finfish.

Moving on to the partnership, to help realize the challenging effort that has been put forth in front of us, we have established in the Bay region a comprehensive Oyster Management Plan Initiative, and we are trying in Maryland to build on a long-standing Oyster Roundtable Partnership initiative.

The partners in the Chesapeake Bay are currently developing a comprehensive oyster plan to coordinate and provide guidance for restoring and maintaining the valuable ecological services provided by oyster reefs, and to develop a sustainable and rebuilt fishery over the long-term. The plan is scheduled for completion in January 2002.

Restoration of Maryland's oyster resources for both ecological and economic benefits has also been guided a Maryland level Oyster Roundtable Action Plan which is currently being updated.

With respect to these partnerships, the important thing to remember is that to achieve our ultimate restoration goal for oysters and more broadly for the Chesapeake Bay, the Maryland DNR must work very closely with many oyster restoration partners, many of whom you will hear from here today, including the Maryland Watermen's Association, the Chesapeake Bay Foundation, the Oystery Recovery Partnership, the Corps of Engineers, NOAA, the EPA, Maryland citizens and private industry. Only by aggressively working together will we ultimately be able to achieve these oyster restoration goals.

I would be happy to field any questions on more specific aspects of our program the committee would have. Thank you.

[The prepared statement of Mr. Schwaab follows:]

Statement of Eric C. Schwaab, Director, Fisheries Service, Maryland Department of Natural Resources

Decline of Oysters in the Chesapeake Bay

The demise of oyster reefs and the collapse of the oyster fishery in the Chesapeake Bay has been well documented. Removal of oysters and shell, and the failure to return this material to the Bay in the last decades of the 19th century led to the severe loss of oyster reef habitat. This loss, in combination with the burial of shell due to high sediment inputs from land erosion led to a rapid decline in habitat suitable for oyster larval settlement, exacerbating the effects of over harvesting of adult oysters. The introduction of Haplosporidium nelsoni (the causative agent of MSX disease) in the 1950s and subsequent epizootic events by MSX and the indigenous parasite Perkinus marinus (which causes Dermo disease) have further exacerbated the decline in oysters in Chesapeake Bay and impeded restoration efforts.

Maryland DNR's Oyster Restoration Program

Maryland DNB's Oyster Program consist of two main components: 1) a restoration program focused on improving the ecological benefits derived from a substantially increased oyster population; and 2) a repletion program focused on continuing and enhancing the economic benefits realized from a sustainable oyster fishery. The latter effort has been underway for decades, sustaining a modest but variable commercial harvest despite the habitat and disease limitations previously noted. The former is a more recent initiative, seeking to substantially restore oyster populations so as to recapture the ecological benefits provided by a greatly increased oyster population. The new Chesapeake Bay Agreement calls for a tenfold increase in oyster population in the Bay by the year 2010 compared against a 1994 base year.

To help realize this aggressive new goal, in 2000 Governor Glendening announced his intention to commit $25 million to oyster restoration over the next ten years. The following resources and management techniques are applied to both programs to achieve the ecological and economic objectives of the oyster restoration program.

Shell Planting - Shell plantings consist of "dredged shells" from a large scale dredging program in the upper Chesapeake Bay, and "fresh shells" that come from shucking houses that process oysters. Dredged shells are placed in higher salinity areas where natural oyster reproduction occurs to produce new oysters for the Bay (seed oysters). Some of these young oysters are then transplanted for stocking in lower salinity zones where disease impacts are less severe. These transplanted oysters then grow to market size, at which point they are targeted for commercial harvest. By placing over 2.5 million bushels annually, the dredge shell program produces a yearly gain in oyster habitat in the Bay of over 800 acres per year. Approximately 80% of the current commercial harvest comes from dredge shell areas and seed oyster plantings.

Fresh shells from shucking houses have three major uses. They are used in hatcheries as cultch for the production of hatchery raised oysters. Hatchery oysters are usually disease free and are planted to restore populations in low salinity restoration zones where concerns for the moving of oyster diseases prevent the use of natural oysters. Secondly, fresh shells are planted on harvest bars for rehabilitation and fishery enhancement. Lastly, a small amount of fresh shells are used for sanctuary projects.

Seed Oyster Planting - Seed oysters obtained through the shell program are planted around the Bay. Seed oysters are targeted to areas with low natural spatfall and good survival. On average, about 300,000 bushels of seed are planted annually in harvestable areas. In 1998, after an excellent spat set in 1997, about 1 billion seed oysters were planted. Seed oysters boost harvest and contribute to the Bay's ecology. Seed plantings sustain the fishery in areas of low reproduction such as the upper Bay and Chester River. Some seed oysters have been planted in sanctuary areas.

The dredged shell and seed planting costs about $1.5 million each year and this investment sustains a harvest with an average dockside value of $7 million. Of that $ 1.5 million investment, approximately half comes from the industry via commercial license fees and a per bushel tax paid on harvested oysters.

Oyster Sanctuary Program - Oyster sanctuaries are areas closed to harvest. These sanctuaries complement the repletion program by permanently protecting select oyster populations and reef communities. Five years ago there were only three sanctuaries in Maryland. Today there are 24 sanctuaries with many more planned. Active habitat .restoration is underway or planned for most of these sanctuaries. Sanctuaries protect oyster populations and the reef communities they support.

A network of successful oyster sanctuaries is being developed to help sustain a restored Chesapeake Bay oyster population. It is believed that by rebuilding select oyster reefs and permanently protecting them, they will serve as source areas for oyster larvae to increase and provide for natural reproduction throughout the Day. In addition, oyster in sanctuaries will help filter bay water and provide important reef habitat for the Chesapeake Bay ecosystem.

As a result of the Governor's new commitment of funds, the Department expects to spend approximately $1.5 million in the current fiscal year and $2 million per year for the next nine years to rebuild oyster habitat. Most of this work will occur in areas pennanently designated as sanctuaries. This work is further expected to be complemented by federal efforts under the auspices of the Army Corps of Engineers and numerous non-profit organization initiatives.

Oyster Hatchery Production - Seed oysters are produced by DNR and by the University of Maryland hatchery. Larvae are set under controlled conditions on shell placed in tanks. Resulting seed are planted to support restoration projects. Shells come from DNR's fresh shell program. The DNR and University of Maryland hatcheries combined can produce approximately 80 to 100 million spat annually.

Oyster Reef Habitat Construction - For 40 years the State of Maryland has used dredged oyster shell to improve oyster habitat and produce more oysters for their ecological and economic benefits. Clean oyster shell is the preferred setting substrate for oyster larvae, but four decades of dredging has resulted in a limited supply of available oyster shell. Efforts are ongoing to identify alternatives to dredged oyster shell to be used for oyster habitat restoration activities.

One alternative is the cleaning of in situ shell that has been silted over. Increased siltation rates and low oyster productivity has led to many bars being silted under a layer of tine silt and mud. Permit applications have been submitted to research the benefits of excavating buried shell to the surface to once again provide suitable habitat for oysters.

Another alternative to preserving the dwindling supply of dredged oyster shell is to use alternative substrate materials. Permit applications have been submitted to examine the use of alternative materials such as recycled concrete, stone or brick to construct habitat in oyster sanctuaries, either as an area to catch setting larvae or as the core of a reef which is then coated with a layer of oyster shell. Seed oysters could then be planted at these sites in low setting areas, while natural spat set would be expected at sites in high setting areas.

The excavation of shell and use of alternative materials will not only benefit oysters, but also numerous fish and benthic organisms.

Comprehensive Oyster Management Plan and Maryland Oyster Roundtable - As previously mentioned, the new Bay Agreement calls for a tenfold increase in oyster population in the Bay by the year 2010 compared against a 1994 base year. The partners of the Chesapeake Bay are currently developing a Comprehensive Oyster Plan to coordinate and provide guidance for restoring and maintaining the valuable ecological services provided by oyster reefs, and develop a sustainable oyster fishery. This Plan is scheduled for completion in January 2002.

Restoration of Maryland's oyster resources for both ecological and economic benefits has been guided by the Maryland Oyster Roundtable Action Plan of 1993. The Oyster Roundtable Steering Committee is currently developing an Action Plan for 2002 - 2007 that will build upon the original Action Plan of 1993 and establish the forum and framework for implementing the Comprehensive Oyster Management Plan.

To achieve our ultimate restoration goal the MD DNR works very closely with many oyster restoration partners, including the Maryland Watermen's Association, the Chesapeake Bay Foundation, the Oyster Recovery Partnership, the Corps of Engineers, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency, Maryland citizens and private industry. Only by aggressively working together can we achieve our goals.

Mr. GILCHREST. Thank you very much, Mr. Schwaab.

Col. Hansen, good morning, welcome.

STATEMENT OF COLONEL DAVID HANSEN, DISTRICT ENGINEER, NORFOLK DISTRICT, U.S. ARMY CORPS OF ENGINEERS

Col. HANSEN. Good morning, Mr. Chairman and members of the subcommittee. I am Col. David Hansen, of the United States Army Corps of Engineers, and I command the Norfolk Engineer District. Accompanying me today is Lt. Col. Scott Flanigan, from the Baltimore Engineer District, but most importantly, I have brought along our two project managers, Ms. Claire O'Neal from Baltimore, and Mr. Doug Martin from Norfolk.

Sir, we are here representing the Honorable Mike Parker, Assistant Secretary of the Army for Civil Works, the Army and the Corps of Engineers on this most important collaborative effort.

I appreciate the opportunity to inform you of the Corps' activities in support of the Chesapeake Bay oyster restoration efforts. I am very proud of the work that the Baltimore and Norfolk Districts have accomplished to date, and look forward to seeing more positive results from our completed projects and from the new projects as they come on-line.

The Corps' involvement in oyster restoration began in 1995 when Congress appropriated $500,000 to carry out a project to improve the Bay's oyster population. This project was a direct response to the precipitous decline of the Chesapeake oyster harvests which had fallen to one-eighth of the harvest from a decade earlier and to less than 2 percent from the late 1800's' harvest. Not only has this decline hurt the regional water-based economy, but it has also depleted the Chesapeake Bay of natural filtering organisms and the aquatic habitat structure on which numerous marine animals thrive.

The authorization for the Corps' oyster restoration program comes from Section 704(b) of the Water Resources Development Act of 1986. Originally, the authorization was limited to $5 million and the Maryland portion of the Chesapeake Bay, but in subsequent WRDA, specifically 1996, the area was expanded to the Virginia watershed, and the Federal funding limit was raised to $20 million. In keeping with other Civil Works projects, the authority requires cost-sharing, with non-Federal sponsors providing 25 percent of the project costs.

The first project in this program was developed with Congress' initial appropriation and then funded for construction through the Corps' Civil Works budget process at a total cost of $3.3 million, of which $2.5 million was Federal. The plan for this first project was the result of coordination among many project partners: the Maryland Department of Natural Resources, other Federal and State resources agencies, watermen, the Chesapeake Bay Foundation, the academic community, interested citizens, as well as many non-profit groups such as the Oyster Recovery Partnership.

The plan called for the creation of new oyster bars, rehabilitation of non-productive bars, development of new seed bars, and planting of young oysters from the State hatcheries, as well as follow-on project monitoring. For this project, the Maryland DNR acted as the non-Federal sponsor, providing the 25-percent cost share.

This restoration project identified six tributaries in Maryland for oyster bar development, three on the Western Shore and three on the Eastern Shore. In addition, two areas of the Eastern Shore, Kidges Strait and Eastern Bay, were planned for seed bar development. Over the past 5 years, the Corps and Maryland DNR have placed over 700,000 bushels of shell and millions of seed oysters in these rivers to create new oyster bars.

In conjunction with the University of Maryland, the Corps has documented the ecological success of the oyster bars, including an underwater video, which demonstrates the value of the oyster bar habitat for other aquatic species, such as blue crabs and rockfish. This monitoring has provided important information that is being used by the Corps, the State agencies, and the scientific community to design ongoing and future projects.

Building on the success of this first project, the Corps has moved out, thanks to Congress' Fiscal Year 2001 $3-million appropriation, on what we call our Phase II projects for this program. The Phase II projects include an estimated $2.6 million of construction in the Tangier-Pocomoke Sound region of Virginia which the Norfolk District is leading, with the Commonwealth of Virginia as its project sponsor. This construction of 150 acres of oyster reefs is scheduled

to start in the Spring of 2002. similarly, the Baltimore District is developing a Phase II project in Maryland which will continue to develop on their Phase I activities beginning in the late Spring of 2002.

Meanwhile, the Corps in concert with a committee of Federal, State, local, non-profit, and industry representatives is developing a long-term master plan to meet the oyster habitat goal of the 2000 Chesapeake Bay Agreement. This goal calls for a tenfold increase in oyster biomass by the year 2010. This long-term master plan is expected to lead to the next wave of projects in the coming years.

In addition to the two phases of the Section 704(b) project, we have used our authority under Section 510 of WRDA 1996 to fund a $1.2 million oyster restoration project in the lower Rappahannock River. This project involved the creation of more than 170 acres of oyster reefs over the past 2 years, with the Commonwealth of Virginia as its non-Federal sponsor.

Over the past 6 years, the Army Corps of Engineers has enjoyed working with the numerous project sponsors in the Chesapeake Bay oyster restoration effort. We are committed to continuing this partnership in the upcoming years. We also appreciate the tremendous support that Congress has bestowed upon the Corps' oyster restoration program. We thank you for this. We look forward to the year 2010, when the Corps and our project partners can celebrate meeting the tenfold goal for oyster restoration, and maybe then we will be able to eat a few on the half-shell.

Thank you for your support, and for allowing us the opportunity to discuss this incredibly important restoration program.

[The prepared statement of Col. Hansen follows:]

Statement of Colonel David Hansen, District Engineer, Norfolk District, U.S. Army Corps of Engineers, Department of the Army

Mr. Chairman and Members of the Subcommittee:

I am Colonel David Hansen, District Engineer, Norfolk District. With me today, is Lieutenant Colonel Scott Flanigan, Deputy District Engineer, Baltimore District. We are here today representing the Honorable Mike Parker, Assistant Secretary of the Army for Civil Works. I am pleased to represent the Army and the Corps of Engineers on this important matter.

I appreciate the opportunity to inform you of the Corps' activities in support of the Chesapeake Bay oyster restoration efforts. I am very proud of the work that the Baltimore and Norfolk Districts have accomplished to date in seven rivers in the Chesapeake Bay region. I am looking forward to seeing more positive results as our completed projects continue to provide their benefits, and as new projects come on line in support of oyster restoration.

The Corps' involvement in oyster restoration began in 1995 when Congress directed us to carry out a project to improve the Bay's oyster population and appropriated $500,000 to initiate that project. The project was a response to the precipitous decline in the oyster harvests in the Chesapeake Bay. The harvests in the mid–1990's were only 1/8 of the harvest from a decade earlier and less than 2 percent of what it was 100 years earlier [see attached graphs]. The decline in the oyster fishery has been attributed to overfishing, sedimentation, pollution, and disease. Not only has this decline hurt the regional water-based economy, but it has also depleted the Chesapeake Bay of natural filtering organisms and the aquatic habitat structure on which numerous marine animals thrive. As we have learned over the past few years, oyster restoration is critically important to the marine ecosystem of the Chesapeake Bay, particularly in major tributaries such as the Lynnhaven, James, Rappahannock, Potomac, Patuxent, Choptank, and Chester Rivers.

Section 704(b), WRDA 1986 (Chesapeake Bay Oyster Restoration)

The authorization for the Corps' oyster restoration program comes from section 704(b) of the Water Resources Development Act (WRDA) of 1986. This language au-

thorized the Corps to implement projects that provide alternative or beneficially modified habitats for indigenous fish and wildlife, including man-made reefs. Originally, the authorization was limited to $5 million and the Maryland portion of the Chesapeake Bay, but in subsequent WRDA's (section 505 of WRDA 1996 and section 342 of WRDA 2000), the areal extent was expanded to the Virginia watershed, and the Federal funding limit was raised to $20 million. In keeping with other Civil Works projects, this authority requires cost sharing, with non–Federal sponsors providing 25 percent of the project costs.

The first project in this program was developed with Congress' initial appropriation and then funded for construction through the Corps' Civil Works budget process in fiscal years 1996–2000, at a total cost of $3.3 million ($2.5 million of Federal funds). The plan for this first project was the result of coordination among many project partners; the Maryland Department of Natural Resources (DNR), other Federal and state resource agencies, Maryland watermen, the Chesapeake Bay Foundation, the academic community, interested citizens, as well as non-profit groups such as the Oyster Recovery Partnership. The plan called for creation of new oyster bars, rehabilitation of non-productive bars, development of new seed bars, and planting of young oysters from the State hatcheries, as well as follow-on project monitoring. In turn, the State of Maryland upgraded its hatcheries to provide a sufficient supply of healthy seed oysters. For this project, the Maryland DNR acted as the non–Federal sponsor, providing the 25-percent cost share.

This restoration project identified six tributaries in the Maryland portion of the Chesapeake Bay for oyster bar development. These tributaries were the Severn, Magothy, and Patuxent Rivers on the Western Shore, and the Chester, Choptank, and Nanticoke Rivers on the Eastern Shore of the Chesapeake Bay. In addition, two areas of the Eastern Shore, Kedges Strait and Eastern Bay, were planned for seed bar development. Over the past five years, the Corps and Maryland DNR have placed over 700,000 bushels of shell and millions of seed oysters in these rivers to create new oyster bars.

In conjunction with the University of Maryland, we have documented the ecological success of the oyster bars, including an underwater video, which demonstrates the value of the oyster bar habitat for other Chesapeake Bay aquatic species, such as blue crabs and rockfish. This monitoring has provided important information that is being used by the Corps, the state agencies, and the scientific community to design ongoing and future projects.

Building on the success of this first project, the Corps has moved out, thanks to Congress' fiscal year 01 $3-million appropriation, on what we call our Phase II projects for the oyster restoration program. The Phase II projects include an estimated $2.55 million of construction in the Tangier–Pocomoke Sound region of Virginia that the Corps' Norfolk District is leading. In September 2001, the Assistant Secretary of the Army for Civil Works and the Commonwealth of Virginia executed a project cooperation agreement to initiate this project. Construction of 8 acres of 3-dimensional and 150 acres of 2-dimensional oyster reefs is scheduled to start in the spring of 2002. Similarly, the Corps' Baltimore District is developing a Phase II project in Maryland which will continue the previous Phase I activities in the six tributaries over the next two years. Phase II Maryland construction activities are expected to start in the late spring of 2002.

Meanwhile, the Corps in concert with a committee of Federal, state, local, nonprofit, and industry representatives is developing a long-term master plan to meet the oyster habitat goal of the 2000 Chesapeake Bay Agreement. This goal calls for a 10-fold increase in oyster biomass by the year 2010. This goal emanated from the June 1999 multi-state scientific consensus document that is the basis for our project's amended authorization in WRDA 2000. This long-term master plan is expected to lead to the next wave of projects in future years.

Section 510, WRDA 1996 (Chesapeake Bay Environmental Restoration and Protection Program)

In addition to the two phases of the section 704(b) project, we have used our authority under section 510 of WRDA 1996 (the Chesapeake Bay Environmental Restoration and Protection Program) in Virginia to fund a $1.2-million oyster restoration project in the lower Rappahannock River. This project involved the creation of more than 170 acres of oyster reefs over the past two years. Similar to the section 704(b) project, the lower Rappahannock effort was cost-shared 75–25, with the Commonwealth of Virginia picking up the non–Federal share.

Summary

Over the past six years, the Army Corps of Engineers has enjoyed working with the numerous project partners in the Chesapeake Bay oyster restoration effort, par-

ticularly the state agencies in Maryland and Virginia. We are committed to continuing this partnership in the upcoming years. We appreciate your support for the Corps' oyster restoration program. We look forward to the year 2010, when the coalition of local, state, Federal, academic, non-profit, and industry groups can celebrate meeting the 10-fold goal for oyster restoration, and maybe even eat a few on the half-shell.

Thank you for your support and for allowing me the opportunity to discuss this incredible restoration program.

[An attachment to Col. Hansen's statement follows:]

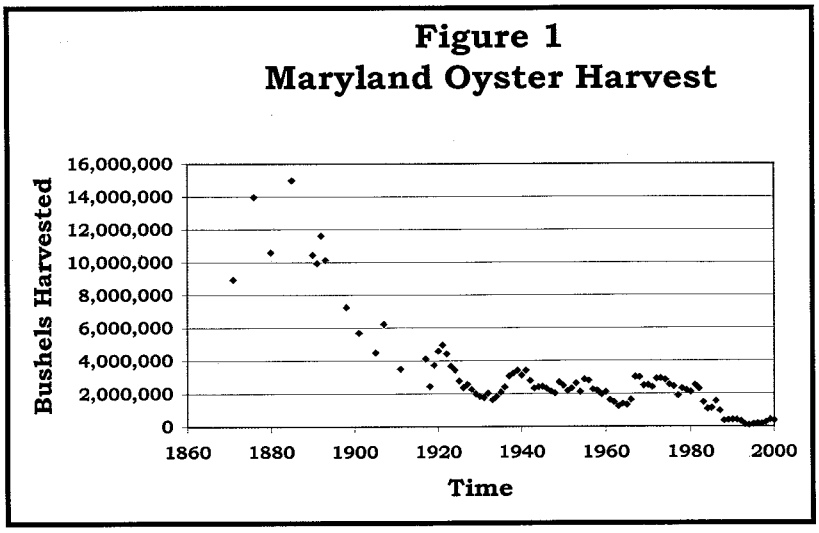
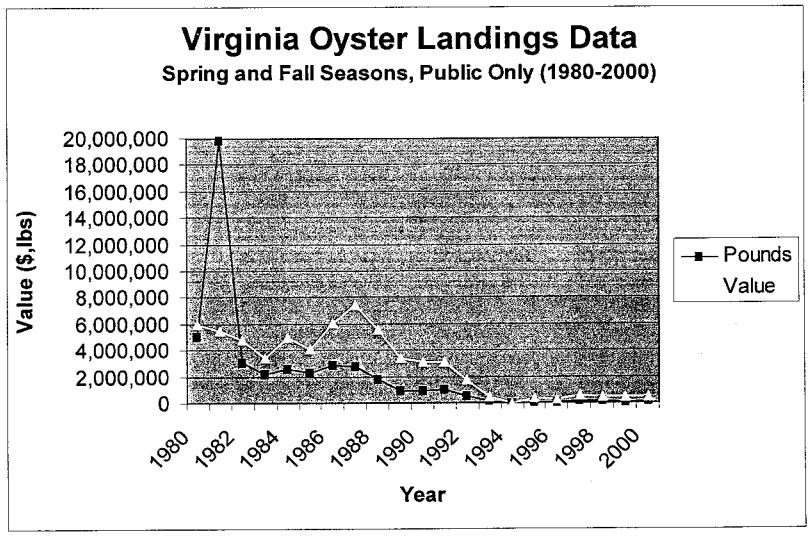


Figure 1
Maryland Oyster Harvest
Bushels Harvested
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1860
1880
1900
1920
1940
1960
1980
2000
Time


Virginia Oyster Landings Data
Spring and Fall Seasons, Public Only (1980-2000)
Value ($,lbs)
20,000,000
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Year
Pounds
Value

Mr. GILCHREST. Thank you very much, Col. Hansen.

The oyster reefs that the Corps has been developing over the last couple of years and with in the next couple of year time frame, are these oyster reefs to be sanctuaries in whole, or are some of them to be sanctuaries? What is the status of that?

Col. HANSEN. Sir, we have had a discussion of that over the last couple of days in response to being requested to appear today. We currently are not clear, and I say this because the WRDA authorization does not clearly specify the mix of whether or not we are executing our construction for the sole purpose of creating protected sanctuaries. And there is a myriad of opinions with regards to whether or not they should or should not be restricted in total, or whether or not there should be a degree of harvest capability for the watermen's concern and the continued economic development.

Mr. GILCHREST. Is the Corps a part of this partnership that we are talking about in the restoration project of 10 percent by the year 2010?

Col. HANSEN. Yes, sir, we are the reef construction agency.

Mr. GILCHREST. So, the Corps, though, as far as some of your restoration projects that come out of WRDA are concerned, whether it is the areas around Tangier Sound and Pocomoke Sound and some of the other places that you have mentioned, does the Corps need authorization from Congress to place them in a particular status, or does the Corps have the discretion within this network to make that decision?

Col. HANSEN. Sir, if Congress wished these reefs to be protected sanctuaries, they would have to clarify the language to designate each site.

Mr. GILCHREST. So, right now the status of what the Corps is doing as far as this partnership in the recovery project, it would be necessary, or it would be better, based on your opinion, if Congress clarified what you were to do with these oyster reef projects, whether sanctuary in whole or in part?

Col. HANSEN. In my opinion, I believe Congress—it would be necessary for Congress to designate that requirement.

Mr. GILCHREST. Mr. Gudes, the area that you are working in as far as recovery projects, I would assume there is some little overlap. Is there any overlap in the oyster sanctuaries that the Corps has specifically mentioned, and the oyster reef projects you are working on? Is there any overlap at all, and does no one need clear signals from Washington to work—I would assume that all of this is also working in partnership with the State of Maryland and Virginia, and Maryland and Virginia, their DNRs, would have a specific recommendation as to what oyster reef projects would be sanctuaries even though there are Federal dollars involved.

Mr. GUDES. Yes. Well, one of the frustrating and great things about the Federal Government is that most agencies have different appropriations, different authorization acts, and what is guidance in what agency. I know, for example, in NOAA we have an awful lot of guidance, as you know, Mr. Chairman, in terms of appropriations.

My understanding is, first of all, there is some overlap in some areas. I know the Colonel was talking about the Rappahannock area I didn't mention, I think, in my oral testimony, but through

the Coastal Zone Management Program, we have been working with the State of Virginia and VIMS in terms of some oyster restoration in that area.

It is my understanding that we really do do all aspects of oyster restoration and do try to pivot off of what the two States and the universities in the Sea Grant programs want us to be working on, and so I think you would find NOAA efforts in all those categories I talked about, Community-Based Restoration or Sea Grant, in all aspects of the oyster restoration efforts. And when I say that I mean sanctuaries, reserves, which are closed for some period of time, as well as harvest areas.

Mr. GILCHREST. NOAA doesn't need any authorization in any aspect of the Resources Committee, the Commerce Committee, their counterparts in appropriations, to give you clear language to make a determination as to whether something needs to be protected as a sanctuary, or something needs to be fished shortly after it is restored.

Mr. GUDES. I think this may go back to just the Organic Acts that we work on, but we have, I think, sufficient flexibility to really respond under the appropriations language or authorization language that we have. I think that is fair, and if the State of Maryland DNR or other partners in the case of the projects we do here want to create additional reserves or sanctuaries within the programs that we have, I think we have the flexibility to do that.

Mr. GILCHREST. Thank you.

Mr. GUDES. My staff says that is correct.

Mr. GILCHREST. Mr. Schwaab, since you are working with these two Federal agencies and probably a myriad of other Federal, State and in the private sector, in your effort to restore, in this particular goal, certainly habitat and then the oysters themselves to a level of 10 percent of what the historic levels were by 2010, do you feel that the State of Maryland has good communication with all those in the partnership? Is there anything that you would recommend that we help clear up to make your job a little bit easier as to what areas you would like to see as sanctuaries and what areas you would like to see as part sanctuaries?

Mr. SCHWAAB. Yes, sir. The discrepancy between the harvestable areas and the closed areas, first of all, is that we firmly believe that to reach that tenfold increase goal, which is the overarching goal, we must all together meet that subservient strategy of restoring 10 percent of the historically productive oyster grounds as essentially a sanctuary network throughout the Bay.

To answer directly your question, we feel that we have made substantial progress—and I mentioned the Baywide Comprehensive Oyster Management Plan which is being developed in concert by all of the partners, and we feel like that is the most important tool to keep everybody on the same page to identify the appropriate areas for restoration and the appropriate areas that need to be set aside as sanctuaries into perpetuity, and as long as we remain on the course that we are on now, which has all the partners sitting around the table developing that single Comprehensive Oyster Management Plan, that we do have the kind of communication and the kind of cooperation that is going to be required to get there. As long as we remain on that course, we are on that course now,

we expect to have a draft of that plan completed by soon after the first of the year, and we think we are on the right track in achieving what it is I think you are seeking.

Mr. GILCHREST. Thank you. We just want to make sure that—there is a fairly large effort that has been ongoing, and we are trying to fine-tune it so that we become one fine green machine here, that there is no missteps or no misunderstandings, that everybody feels clear about what their role is, and we can accomplish this ambitious task.

Col. Hansen, I would assume that under a lot of programs that the Corps helps facilitate, they usually need, in some respect, a local sponsor. So, I would guess that—we will certainly check into this—that with or without clear definitive congressional language, that if the local sponsor wanted this to be a part sanctuary or a full sanctuary, that that would be pretty much all the Corps would be required to have to comply with that.

Col. HANSEN. Yes, sir, that is correct, and that was the gist of my answer. We have a lot of Bay partners, with a lot of moving in the right direction, and we are all swimming in the same direction. It is just some are still using the breaststroke, some are using the backstroke, some are using the crawl, and we will get synchronized very shortly. It is committee hearings like this that help focus our attention, so we understand what that stroke will be.

Mr. GILCHREST. Thank you very much. I guess it is difficult to change somebody's favorite fishing stroke, or swimming stroke, but at least we will figure out how to point them in all the same direction. Thank you all very much.

I yield now to my good friend, Mr. Underwood.

Mr. UNDERWOOD. Thank you, Mr. Chairman. Thank you for your testimonies this morning. Mr. Gudes, you mentioned a number of times in your testimony about Marine Protected Areas, and the role that they are playing in this effort.

Would you tell me the committee what is the status of the appointment process to create the Marine Protected Areas Advisory Council on the national level, and are we going ahead with that, and when do we expect the members of the new panel to be named?

Mr. GUDES. The Secretary approved moving forward in his decision, I want to say, in the April-March time frame. We went back out for additional nominations. That process actually was extended in September because of all the events, and closed at least September 30th. And our goal is to have a panel appointed by, I believe, the first of the year.

Mr. UNDERWOOD. Maybe, Mr. Schwaab, you could enlighten us as to how important is the MPA in your effort?

Mr. SCHWAAB. We believe the sanctuary network—specific to the oyster restoration initiative, we believe this backbone of a sanctuary network is absolutely critical to moving to that next phase. Now, the oyster sanctuaries, as we described them, are certainly one type of Marine Protected Area. They are open to many other types of uses, including recreational fishing, but they are closed to harvest of oysters and they are closed to the types of damaging gear that in some cases comes along with the harvest of oysters

that we believe partly led to the decline 100 years ago in the resource.

Mr. UNDERWOOD. You mention in your testimony that Governor Glendenning has earmarked $25 million for the purpose of oyster restoration. Would you characterize whether the effort is—you know, this would be tough choices, but I am just trying to get a sense of what is the general direction of the State. Would you characterize it more as directed toward restoring the number of harvestable oysters, or would it be more toward the direction of the ecological benefits of having a healthy oyster population?

Mr. SCHWAAB. The latter, sir. As I mentioned, we had decades of, and continue to operate what we call a Repletion Program, which involves shell and seed management for the purpose of maintaining and enhancing the fishery. While that has been modestly successful, it certainly has not returned oyster populations to the level that we need to reach to achieve the kind of Bay restoration goals that we want.

So, the bulk of the new commitment from the Governor, the vast majority of that money will be directed specifically to restoration practices in these newly designated oyster sanctuaries, and that will involve all sorts of things, from restoration of existing oyster bars through simply—you know, we are working experimentally with some cleaning processes to basically large-scale construction of what you might view as a 3-dimensional oyster reef, areas that are then seeded with young oysters in some cases, all of those kind of things, and some which are very expensive, will go into, again, the effort specifically to restore a self-sustaining network of oyster reefs that represent 10 percent of the historically productive oyster bottom.

Now, we think there will be many ancillary benefits from that Corps network that will be of benefit to the fishery by providing reproductive potential that will have effect on surrounding areas, and we expect to continue to maintain that at historic levels, efforts directed at sustaining the fishery, but this new money will be largely for the restoration initiative.

Mr. UNDERWOOD. This question would be for all three of you in terms of your own experience with this particular issue. What is the most currently significant factor limiting the recovery of the oyster population? I know that a number of items have been suggested, ranging from water quality to habitat degradation to disease or overharvesting.

Mr. GUDES. I think if you take a look at what has happened to oyster populations in the last 40 years, disease has been the major change. It is the major challenge, I think, when you are able to—I think the Virginia numbers show that even greater because of higher salinities in MSX, and it is a challenge when you can get the oysters out there, to be able to bring them to maturity.

The other side I have done, as I said, I have done some of these projects myself up on the Magothy River, for example, which is an historic area of oyster. The Bay's ecology has changed, and it is higher levels of fresh water to where oysters don't naturally occur in those areas now, and so you can put the oysters out there, but the chances of them spawning and reproducing are not as great. The flip side is they are not as vulnerable to MSX, for example, be-

cause of the lower salinity levels. But I would say that the disease is still the greatest problem.

Mr. SCHWAAB. I would certainly concur in recent years. We believe, however, that poor habitat and the low status of the stock, the low numbers of oysters out there are certainly impeding their ability to naturally hopefully overcome with time some of those disease limitations, but clearly the immediate limiting factor is disease, and we need to find many ways to work around that or to position oysters to work around that.

Col. HANSEN. Sir, the Corps of Engineers is founded as a construction agency. We work deliberately toward supporting the Administration and the wills of Congress to promote environmentally sustainable development, and I would say that commitment of Federal and sponsor dollars, concerted effort and a mindset all channeled in the same direction for this single purpose would be the largest thing to overcome, and we are moving that way as we speak.

Mr. UNDERWOOD. These diseases which are MSX and Dermo, are these diseases considered invasive species themselves, or how did they get into the Chesapeake Bay?

Mr. SCHWAAB. Nobody knows with certainty. It is believed that Dermo is a long-standing and naturally-occurring disease, but that MSX was possibly brought here to the Bay with some non-native oysters decades ago.

Mr. UNDERWOOD. Well, that expands our invasive species inquiry, Mr. Chairman, a little bit more.

[Laughter.]

Mr. UNDERWOOD. Well, that is all I have, Mr. Chairman. I am also more interested in how Pocohontas saw the Chesapeake Bay than John Smith. I thought I would just let you know for the record.

[Laughter.]

Mr. GILCHREST. I think the last panel is going to talk about Pocohontas. Thank you, Mr. Underwood.

Mr. Owings.

Mr. OWINGS. Mr. Chairman, I didn't have any particular questions, save the fact that Congressman Underwood was talking about invasive species, an area that will attest to the fact that last session we addressed that. There are some 27, I believe, in the back bays that we find some 27 species of crab, the Japanese green crab and a few other species, that have worked their way down here, and we are fearful that can work its way into the oyster population are some of the things we are fighting now. We have addressed that issue, at least we are attempting to address that issue, unless I am mistaken.

Mr. SCHWAAB. There are certainly many different invasive species, including some of the crab species that Delegate Owings mentioned, particularly in the coastal bays that are of concern, and that continues to be a very important avenue of pursuit in protecting and restoring this ecosystem.

Mr. GILCHREST. Thank you, Mr. Owings. Just a follow-up question, Mr. Schwaab. With your ability to communicate a whole range of issues with all the users of the Bay, but in particular with this issue of oyster restoration, oyster reefs, oyster sanctuaries, are the

commercial watermen fully engaged in the discussion of these issues, as well as recreational fishermen, recreational boaters, and other users of the Bay, as we move along with developing what used to be only a few oyster sanctuaries, which are a growing number of oyster sanctuaries, which will continue to be even more sanctuaries throughout the Chesapeake Bay?

Mr. SCHWAAB. Yes, sir. Our Roundtable Steering Committee here in Maryland that I mentioned, which coordinates the Maryland specific restoration efforts, includes representation from the industry, and specifically watermen.

One of the very positive things that we have seen recently is strong support from the commercial fishing community for the establishment of this network of oyster sanctuaries. They are beginning, we believe, to recognize that not only would the establishment of a sanctuary network be important in its own right, but that it ultimately will lead to the kinds of ancillary benefits increasing reproductive potential that I mentioned, that will help sustain their industry for the long-term.

Mr. GILCHREST. Somebody told me one time—and I am not sure who it was, but it was either somebody in the State or perhaps NOAA—that if you could restore the oysters using sanctuaries and reefs by 2010 to about 10 percent of historic levels, then those sanctuaries could remain sanctuaries, but because of the increased spat and the increased potential for productivity and the increased size of the oysters on the oyster reefs, because they are not being harvested so they are growing out, that the number of oysters that could be harvested would be many more, maybe even double, than what it is today, without touching the sanctuaries, almost like a large endowment where you don't use the principal, but you just harvest the interest. Is that likely?

Mr. SCHWAAB. We believe that could certainly be the case and, in fact, not only would we expect to not touch the principal, but we would expect to remove only a portion of the interest so that the principal would continue to grow as well because we believe that the 2010 tenfold increase goal may only put us part-way to where we ultimately need to be, and we need to position—we like to say we need to position the oysters to do the heavy lifting themselves. If we can get the kind of base population established that we are after by 2010, then the sky is the limit from there.

Mr. GILCHREST. Just one last question. We are talking about sanctuaries, and in some form they are called Marine Protected Areas, and I know that NOAA is involved in a pilot project in the Chesapeake Bay dealing with an ecosystem approach to managing the fisheries. And I wondered how connected the oyster program and the oyster network is with maybe producing some type of pilot project or precedent for Marine Protected Areas that could be implemented in other areas, and the Oyster Roundtable Group moving toward the goal of 2010, what discussions they have with the other pilot project that is in the Bay dealing with the ecosystem approach, and if they are connected in an ecosystem approach, do you look at oyster restoration from a perspective of corridors from as far up the Bay as you can produce oysters or oysters will grow, down through to the mouth of the Bay, are these sanctuaries being thought of as connected?

Mr. SCHWAAB. As you mentioned, in the Chesapeake Bay, we have probably underway the first development of a comprehensive fisheries ecosystem plan. That plan involves, at this point, sort of characterization of many aspects of the Chesapeake Bay ecosystem, and there are specifically habitat sections of which the oyster sanctuary network, and more broadly the oyster populations, would be an important part, to from the habitat section to things like removals and all of the aspects of management, multi-species interactions at the finfish level, you know, all sorts of interactions of that type.

I think that that project is still very much in its formative stages. I think it is going to be a process that we will continue to learn, as the plan is developed, what the ultimate management implications are. Does it deal specifically with, for example, this sanctuary network? I don't think it is at that level yet.

Just one comment about the whole concept of Marine Protected Areas. Obviously, we have spoken a lot about them in the context of oyster sanctuaries, and they are very important in this to protect habitat from gear impacts, to protect, we think, some base level of spawning stock. There are many other reasons for which you might establish a Marine Protected Area, ranging from again some those types of uses for protection of stock to research areas. We are looking very hard at establishing a Marine Protected Area down in the coastal bays primarily for the purposes of establishing baselines in an unfished population so that we can compare natural mortality with fishing-related mortality.

So, one of the things I think we need to continue to grapple with as we look down the Marine Protected Area road is, what are we protecting? What are we establishing the MPA for? What is its ultimate objective? And that will help to inform the design of the specific area and its specific limitations.

Mr. GILCHREST. Thank you.

Mr. GUDES. I don't know about the corridors, Mr. Chairman. I do think, on the general MPA issue, this is probably a good example where, as I said in my statement, MPAs are all sorts of different protection measures. We have been talking about MPAs. These are all State MPAs, State of Maryland or Virginia MPAs, and it is probably an important point to make about the whole issue and process, and part of the issue of getting an inventory is about understanding what the various States in the United States are doing in terms of MPAs.

On the issue of the ecosystem, I think that it is probably very difficult to look at all the dynamics of the Chesapeake Bay without doing that, without looking at the full context of runoff and all the aspects that relate to finfish and the environment. Oysters are a major part of that.

I mentioned in my opening statement how much the water quality of the Chesapeake Bay historically relates back to oyster populations. I don't have the exact number, but when John Smith was here, I think the Bay filtered water through every three or 4 days largely because of the size of the oyster population of the Bay now. It is about once per year because of how few oysters there are in the Bay. So that relates back to the whole issue of what does the ecosystem look like, what is the quality of the water, and it is about habitat. That is why it was difficult to answer your question

before, Congressman Underwood, when you said is it disease or is it habitat. They all relate. And bringing back oysters and bringing back the Bay to a better state require really looking at all these aspects. It is not just about the Chesapeake Bay. When we talk about stellar sea-lions in front of your committee, and North Pacific groundfish, the same sort of issues, increasingly it is about an ecosystem approach. And there are a lot of people in our agency and the Fishery Service, the National Ocean Service, our research components, who are more and more looking at that.

Mr. GILCHREST. Thank you very much. Gentlemen, thank you very much for your testimony this morning. I look forward to continuing working with you.

Mr. UNDERWOOD. In our field hearing in Guam.

Mr. GILCHREST. In our field hearing in Guam, to look at brown tree snakes. I wonder if we can eat brown tree snakes, a source of protein.

[Laughter.]

Mr. GILCHREST. Our second panel, Dr. Mark Luckenbach, Virginia Institute of Marine Science, Wachapreague Lab; Dr. Susan Roberts, National Academy of Sciences, Ocean Studies Board; and Mr. Tom Grasso, Director, U.S. Marine Conservation Program, World Wildlife Fund. Welcome this morning.

Dr. Luckenbach, you may begin, sir.

STATEMENT OF DR. MARK LUCKENBACH, VIRGINIA INSTITUTE OF MARINE SCIENCE, WACHAPREAGUE LAB

Mr. LUCKENBACH. Thank you, Mr. Chairman, for the opportunity to address you today. As requested, my written and oral comments will address recent progress in oyster restoration, the role of disease research, and the potential value of Marine Protected Areas in this process.

In January 1999, I had the pleasure to host a group of academic and Government scientists from the Chesapeake region as they met at the Virginia Institute of Marine Science's Eastern Shore Laboratory to chart a scientifically sound course for restoring oyster populations in Chesapeake Bay. The group's report, which I will refer to henceforth as the Consensus Plan, provides guidelines based upon the best available science at the time for restoring ecologically-functional native oyster populations to Chesapeake Bay and for establishing a sustainable fishery.

The need for this scientific consensus was driven at the time by a perceived failure of conventional management approaches to stem the decline in fisheries landings and enhance the declining resource. The Plan emphasized two criteria for restoring oyster populations.

The first was the establishment of permanent sanctuaries which were highlighted as essential to rebuilding self-sustaining oyster populations. The two most critical elements in establishing sanctuaries were identified as the need to provide complex, 3-dimensional structures as the basis for reefs, and to restrict harvest on these reefs in perpetuity.

Secondly, the Consensus Plan recommended strongly against the management practices that were going on at the time of moving diseased oysters around the Bay's waters. The Plan's strategy for

supporting a sustainable fishery envisioned that the development of disease-tolerant oysters in reef sanctuaries would in time supply new recruits to surrounding harvest areas, and it was this Consensus Plan that first recommended an intermediate goal of restoring and protecting 10 percent of the formally productive oyster bars in the Bay as sanctuaries.

My comments regarding implementation of this plan are going to really have more relevance to Virginia, since I am from Virginia, but many of the points I think are also relevant to the Maryland portion as well.

First, the good news. In the last few years, there really has been a general recognition of the key elements of this Plan both by management agencies and by the general public, and you have already heard today as well how this is being incorporated into the recent Chesapeake Bay Agreement Plan.

In Virginia, the Fisheries Management Agency, the MRC, has attempted since 1999 to follow the strategy outlined in the Plan. In 1999, Governor Gilmore established the Oyster Heritage Program that formally recognized the ecological role of oyster reefs, the need for large-scale efforts to reconstruct this reef habitat, and the need for involvement by other State agencies and other stakeholders, namely, that this was more than just a fisheries issue, and it had only been a fisheries issue in Virginia prior to that.

Under the auspices of this program, there have been more resources within the State of Virginia devoted to establishing reef sanctuaries and, as well, to restoring harvest areas. At present, there are over 30 reef sanctuary sites that have been established in Virginia waters. There is a figure in my written testimony that indicates the locations of these. Ten more such sanctuaries are planned for 2002.

Over the past few years, both the monies and the shell resources in Virginia have been allocated roughly equally, in equal proportions, for the construction of sanctuary and harvest areas. An attempt is being made to co-locate these harvest and sanctuary areas at least in close proximity to one another so that the spawn from the sanctuaries, as you have been hearing about today, can help populate the harvest areas.

As I will discuss in a little more detail in just a moment, we have very little detailed information about how these sanctuary reefs are developing. The data that we do have for the lower part of the Bay indicate that oyster populations are slowly, but progressively becoming established, and that if we continue to limit harvest, at least harvest pressure on these reefs, viable reefs will likely develop on most, but not necessarily all, of these locations.

Also, as you have heard today, the diseases Dermo and MSX remain widespread and they continue to cause significant mortalities on the sanctuaries and elsewhere.

A real important point here, I think, is that the presence of these diseases is slowing the process, but it is not eliminating the development of oyster populations on these reef sanctuaries. In the absence of harvest pressure—and that is about all we can do much about, that and rebuild habitat, we can't do a whole lot in the short-term about diseases—in the absence of harvest pressure, via-

ble oyster populations can, and do, develop on reef sanctuaries even in the presence of diseases.

On the disease front, there is, however, some positive news. Selectively bred, highly disease-tolerant oyster seed stocks have been developed in recent years, in part with partnerships from NOAA and the States, and some of these oysters that have been bred have been planted onto both sanctuary and harvest areas in both Maryland and Virginia.

It is really too early, I believe, to evaluate the effectiveness of this stocking because the intent is not to see how well they survive, but whether or not these oysters will reproduce and that their genes will become incorporated into the wild populations, particularly those disease-resistant genes.

More good news is that within the past year, molecular genetics tools have been developed—again, with NOAA Oyster Disease Research money—that will permit us to track the incorporation of these disease-resistant genes from selectively bred oyster strains into wild populations in the field. This is a powerful tool, but this technique is going to need to be applied widely and over many years to evaluate how these desirable characteristics from these selectively bred stocks are being incorporated into wild stocks. It can't happen overnight, it is going to take several oyster generations.

I would like to conclude by pointing out three areas that I think are important needs for the continued success of oyster restoration in Chesapeake Bay. The first is that oyster shells, which are the preferred substrate for building reef bases for sanctuaries are in short supply. Both Maryland and Virginia dredge these buried shells, and these shells are limited in their supply and, in some cases, dredging may have undesirable consequences.

Consequently, alternative substrates for building reef sanctuary bases are required to reach even our currently defined goals. There are several alternative substrates out there that are suitable for oyster settlement that have been identified, but further research is urgently needed to optimize these substrates for reef construction.

Second point, we are spending literally millions of dollars, and many more have been allocated for the construction of reef sanctuaries. A nearly inconsequential level of funding is being devoted to monitoring and assessing of these efforts. Funding, I believe, is urgently needed to monitor these restoration projects, track their success, and provide data to support adaptive management of the process. For the vast majority of reef sanctuaries constructed in recent years, we have little useful information about the detailed development of oyster populations in associated communities.

Again, we are spending millions of dollars and devoting millions of bushels of valuable shell to undertake these restoration projects in an environment of pretty considerable scientific uncertainty, and we are devoting less than 1 percent of these expenditures to assess how well we are doing.

Ecological restoration is a pretty daunting task. In this country, we have undertaken some big ones of those in recent years—the restoration of the everglades perhaps being a good example. We are going to need to be guided by science as we do this, and we are

going to need to learn along the way. We don't know all the necessary steps.

Finally, restoration of ecologically-functional oyster reefs in a sustainable fishery, oyster fishery, will require a long-term sustained effort. You have heard that from other speakers today. It took us a century to decimate this resource, it will likely take a few decades to restore it.

The greatest threat, I believe, to the success of this restoration effort could be impatience by resource managers and others, if we let it happen. If we are expecting the diseases to go away, we will be disappointed. If we are expecting that oyster harvest will rise dramatically in the short-term, we will be disappointed. If we are expecting that the ecological benefits we have heard about, such as improved water quality and increased fish production will be evident overnight, we will also be disappointed.

The risk that I see is that this disappointment could lead to an abandonment of the sanctuary strategy and a return to the strategy of "Let us harvest them quick, before the disease kills them", or, worse yet, an imprudent haste to introduce an exotic species.

I suggest that the designation of Marine Protected status for reef sanctuaries, as has been discussed here today, provides a valuable management tool for State-Federal partnerships that could help us achieve this level of protection and long-term commitment. Thank you.

[The prepared statement of Dr. Luckenbach follows:]

Statement of Mark W. Luckenbach, Director, Eastern Shore Laboratory, Virginia Institute of Marine Science, College of William and Mary

Synopsis of Scientific Workgroup on Oyster Restoration

On January 18, 1999 a group of academic and government scientists from the Chesapeake Region met at the Virginia Institute of Marine Science's Eastern Shore Laboratory to chart a scientifically sound course for restoring oyster populations in Chesapeake Bay. The group's report[1] (henceforth referred to as the Plan) provides guidelines based upon the best available science for restoring ecologically-functional native oyster populations to Chesapeake Bay and establishing a sustainable oyster fishery.

The need for this scientific consensus was driven by the failure of conventional management approaches to stem the decline in fisheries landings and enhance the declining resource. The Plan emphasized two essential criteria for restoring oyster populations.

(1) The establishment of permanent reef sanctuaries was highlighted as essential to rebuilding self-sustaining populations and supporting fisheries in areas outside of the sanctuaries. The Plan pointed out that proper site selection for these sanctuaries was a crucial element, noting that they needed to be located in sites that historically supported productive oyster populations. Further, the Plan identified the need to provide complex, 3-dimensional structure as a base for these reefs, in contrast to low-relief plantings often conducted in harvest areas. The rationale provided for maintaining the sanctuary status of these reefs included the rebuilding of viable oyster populations, the promotion of the evolution of disease resistance in oyster populations and the broader ecological role of reef habitats. Importantly, the sanctuary reefs were viewed as a means to enhance recruitment of oysters to adjacent harvest areas.

(2) Proper disease management was considered an essential feature of achieving the restoration goals outlined in the Plan. The primary emphasis of the Plan in this regard was to recommend against the movement of diseased oysters within the Bay's waters.

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[1] "Chesapeake Bay Oyster Restoration: Consensus of a Meeting of Scientific Experts" Chesapeake Research Consortium, June 1999

The strategy for supporting a sustainable fishery envisioned by the Plan involved the development of disease-tolerant oysters in the reef sanctuaries (both by natural selection and breeding programs) that would then supply new oyster recruits to surrounding harvest areas. While admitting that the required size and number of sanctuaries to achieve this goal was unknown at the present time, the Plan recommended an intermediate goal of restoring and protecting 10% of the formerly productive oyster bars in the Bay as sanctuaries.

Progress in Implementing the Plan

My comments regarding implementation are most relevant to the Virginia portion of the Chesapeake Bay, but many of them may apply to the Maryland portion as well. First, there has been a general recognition of the key elements of the Plan by management agencies. In Virginia, the Virginia Marine Resources Commission (VMRC) is the lead agency charged with fisheries and marine resources management. While the VMRC had engaged in some aspects of this strategy to restore reef habitat beginning in 1993, since 1999 they have largely attempted to follow the strategy outlined in the Plan in their restoration efforts. In 1999, Virginia Governor Gilmore established the Oyster Heritage Program that formally recognized (i) the ecological role of oyster reefs, (ii) the need for large-scale efforts to reconstruct reef habitat, (iii) the need for involvement by other state agencies and stakeholders. Under the auspices of this program, the VMRC has had more resources and been more effective in establishing reef sanctuaries. At the present time there have been over 30 oyster reef sanctuary sites established in Virginia (see Figure below). The VMRC has been allocating available resources (both monies and shell) in roughly equal proportions to construct both sanctuary and harvest areas. Because of the greater cost of constructing the 3-dimensional bases in the sanctuaries this is resulting in approximately a 90:10 proportion (based on area) of restored harvest area to sanctuary. Further, an attempt is being made to locate sanctuary and harvest areas in close proximity to one another; however, there is a large element of opportunism in the site selection, with shell planting often being dictated by proximity to shell supplies.

Little information is available on the development of oysters and associated estuarine communities on the sanctuary reefs; that which is available points to considerable variation between sites. Low to moderate levels of oyster recruitment have been observed at most sites, likely the result of low abundances of natural oyster brood stock throughout much of the Bay. Nevertheless, in most of the lower part of the Bay oyster populations are slowly, but progressively becoming established on the reefs.

Diseases, especially Dermo (caused by the protozoan parasite Perkinsus marinus), remain widespread in natural oyster populations throughout most areas of the Bay. Both Dermo and MSX (caused by Haplosporidium nelsoni) result in significant mortalities of oysters on the sanctuaries and elsewhere. Importantly, the presence of these diseases is slowing, but not eliminating the development of oyster populations on the sanctuary reefs. In the absence of harvest pressure viable oyster populations can and do develop on reef sanctuaries, even in the presence of disease. In the upper portion of the Bay, where recruitment of wild oysters can be especially limiting, Maryland has employed hatcheries to produce large quantities of disease-free oyster seed that has been planted onto both sanctuary and harvest areas. The available data indicate that disease transmission to these stocks has been relatively low. This suggests that if they are protected from harvest they may lead to the development of viable populations.

The Plan recognized the potential of selectively-bred oyster strains for stocking onto sanctuary reef as a means of increasing oyster resistance to endemic diseases. In the two years since the Plan a large number of selected stocks have been placed on sanctuary reefs. Selection of disease-resistant, or more appropriately disease-tolerant, oyster stocks has proceeded in recent years, largely with the support of NOAA's Oyster Disease Research Program (ODRP). Under this program and with additional support from cooperating universities, the Cooperative Regional Oyster Breeding (CROSBreed) Program has successfully developed selected lines of native oysters that exhibit a high degree of disease tolerance. In Maryland these stocks are being propagated in a state-run hatchery and used in their stocking program. Also, these stocks have been distributed to interested private shellfish hatcheries and are being utilized in private aquaculture. In addition, private citizen and NGO's are purchasing these oyster seed, growing them to sufficient size and planting them on the sanctuary reefs. Though it is too early to evaluate the effectiveness of this stocking, its intent is that these oysters will reproduce, and their disease tolerance will be incorporated into the population.

Recently, with support from ODRP, molecular genetic tools have been developed that will permit us to track the incorporation of genes from these selectively-bred oyster strains into wild populations in the field. These techniques do not involve genetically modified oysters, rather they merely permit us to follow how resistant oyster strains are getting incorporated into populations in the Bay. These techniques will need to be employed widely and over many years to evaluate how desirable characters of the selectively-bred stocks are introgressing (becoming incorporated into) wild stock.

Further Needs

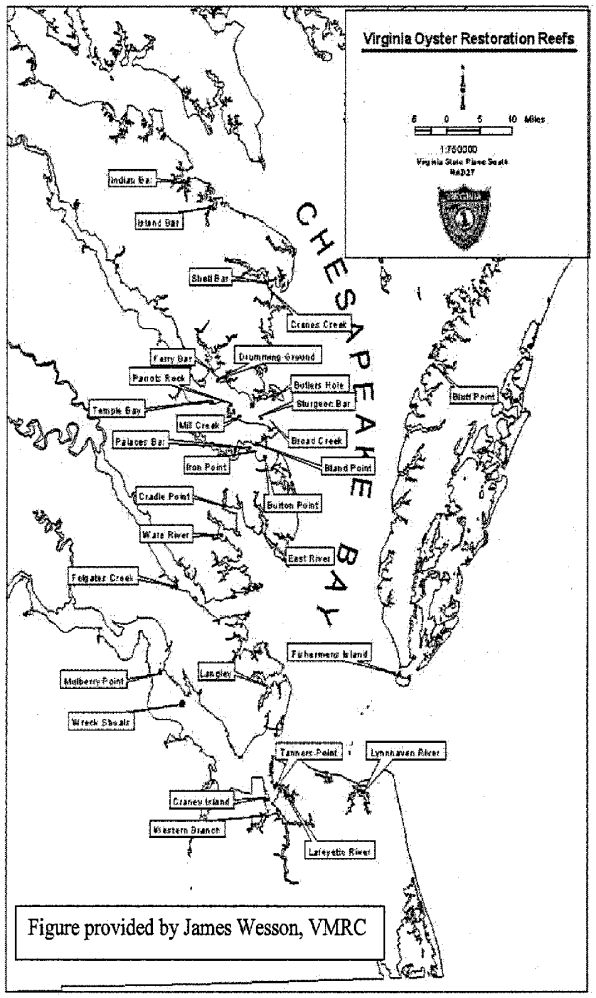
Oyster shell, the preferred substrate for building the bases of sanctuary reefs and settlement material in harvest areas, is in short supply. Few freshly shucked shells are available and both Maryland and Virginia dredge buried shell to use in restoration. These buried shells are, however, limited in their supply and in some cases the dredging may have undesirable consequences—for instance, disrupting shad spawning grounds. Consequently, alternative substrates for building sanctuary reef bases will certainly be required to reach currently defined restoration goals. Several alternative substrates that are suitable for oyster settlement have been identified, but further research is urgently needed to optimize these substrates for reef construction.

While millions of dollars have been allocated for the construction of reef sanctuaries in recent years, a nearly inconsequential level of funding is being devoted to monitoring and assessment of these efforts. Funding is urgently needed to monitor these restoration projects, track their success and provide needed data to support adaptive management. For the vast majority of the sanctuary reefs constructed in recent years, we have little useful information about the development of oyster populations and associated reef communities. This is not simply a matter of academic interests. We are spending millions of dollars and devoting millions of bushels of limited shell resources to undertake restoration in an environment of considerable uncertainty and we are devoting less than 1% of these expenditures to assess how we are doing and learn how to do it better. At best, this is a risky course; I rather suspect that it is foolhardy.

Finally, restoration of ecologically-functional oyster reefs and an oyster population capable of supporting sustainable fisheries will require a long-term, sustained effort. It took us a century to decimate this resource; it will likely take a few decades to properly restore it. Along the way there is certain to be a mix of successes and failures with individual projects. As argued above, we need to be in a position to learn from these mistakes and improve our efforts as we proceed. The greatest threat to the success of this restoration will be impatience by resource managers and decision makers. If we are expecting the diseases to go away, we will be disappointed. If we are expecting that oyster harvests will rise dramatically in the short-term, we will be disappointed. If we are expecting that ecological benefits, such as improved water quality and increased fish production, will be evident overnight, we will also be disappointed. The risk is that this disappointment will lead to an abandonment of the sanctuaries and a return to strategy of "harvest them quick before the disease kills them" or worse, an imprudent haste to introduce an exotic species. The designation of marine protected status for sanctuary oyster reefs could provide a valuable management tool to achieve the level of protection from harvest that will be crucial to the development of viable, disease-tolerant oyster populations.

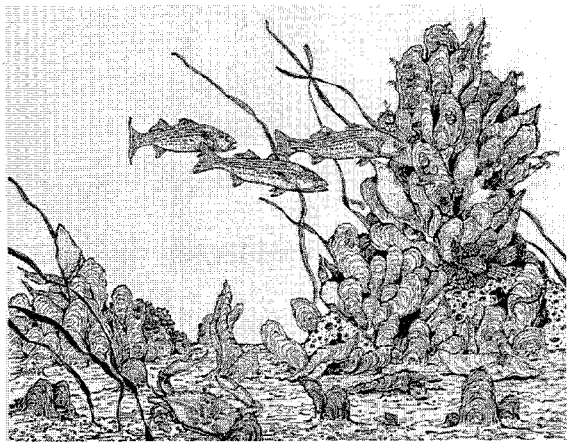
Ecological restoration is a daunting challenge, but one this nation has undertaken on some impressive scales in recent years. The Everglades and the Grand Canyon are among the most high profile examples, but restoration of a keystone species and a sustainable oyster fishery in Chesapeake Bay would rank as no less of an achievement. As with those and many other restoration projects, our success will be dependent upon ensuring that the best available science guides our efforts and that these efforts are sustained in the face of exploitation pressures. Marine protected areas could provide an avenue for establishing state-federal partnerships in this endeavor.

[Attachments to Dr. Luckenbach's statement follow:]


Virginia Oyster Restoration Reefs
CHESAPEAKE BAY
Figure provided by James Wesson, VMRC

Chesapeake Bay Oyster Restoration

Consensus of a Meeting of Scientific Experts
Virginia Institute of Marine Science
Wachapreague, Virginia



"The abundance of oysters is incredible. There are whole banks of them so that the ships must avoid them. They surpass those in England by far in size, indeed they are four times as large."

Francis Louis Michel
after a visit to Virginia in 1701

Chesapeake Research Consortium
June 1999

Executive Summary

A small group of oyster experts from Maryland, Virginia and North Carolina met at the Virginia Institute of Marine Science Eastern Shore Laboratory, Wachapreague, VA on January 18, 1999 to recommend measures to restore and protect the oyster resource of the Chesapeake Bay.

Restoration Philosophy

- The goal for Chesapeake Bay oyster restoration should be to restore and manage oyster populations for their ecological value in such a way that a sustainable fishery can exist while maintaining the essential ecosystem functions of oyster reefs.

Protection Philosophy

- The oyster fishery should be managed regionally based on stock assessments.
- Proper disease management means minimizing, or even prohibiting, movement of infected oysters.

Essential Components of Oyster Restoration Efforts

- Three-dimensional reefs, standing substantially above the bottom, are essential for oyster reproductive success, for predator protection and to create habitat for other organisms.
- Permanent reef sanctuaries permit the long-term growth and protection of large oysters that provide increased fecundity and may lead to development of disease resistant oysters.
- For success, both components, three dimensional reefs as permanent sanctuaries, are necessary; neither component alone will be sufficient.

Reef Siting and Design

- Sanctuary reefs must be placed on hard bottom in areas of natural spatset. Three-dimensional structure equal to at least one-half the water depth is recommended.
- Adult oysters may need to be added to reefs to "jumpstart" recruitment.
- Oyster shell is a limiting resource in all areas and availability may affect recruitment around reefs.

Goals

- Long-term goals are to set aside and restore 10% of historic productive oyster reef acreage for its habitat and ecological value and to restore a sustainable public fishery that would not require additional public monies.
- Short-term goals are to increase spatset, increase the number of adult oysters and to increase habitat and fish utilization of that habitat in tributaries where reef sanctuaries have been established.
- Intermediate goals (4-8 years) are to demonstrate the effectiveness of reef sanctuaries in selected tributaries in Maryland and Virginia.

The Consensus

Restoration Philosophy

Overfishing in the late 1800s and early 1900s reduced Chesapeake Bay market oyster landings from a peak of about 24 million bushels in 1887 to a more-or-less steady state of about 5 million bushels by 1930. This high harvest pressure also mined the oyster reefs themselves, greatly reducing the reef habitat in the Bay. In the last four decades two protozoan diseases (MSX disease caused by *Haplosporidium nelsoni* and Dermo disease caused by *Perkinsus marinus*) have combined to further reduce oyster populations throughout Chesapeake Bay to about 1% of historical levels.

Restoration and proper management of oyster populations in the Chesapeake Bay are critical, but we must move away from the concept of restoring and managing oysters strictly to support an industry. The primary impetus for oyster restoration should be because their filter-feeding lifestyle is an important ecological component in the Bay ecosystem and because their reef-building nature provides valuable habitat for oysters themselves and for other organisms. Oysters can improve water quality because they consume phytoplankton that contribute to anoxia in bottom waters and they also reduce suspended particulate matter, thereby improving water clarity and light penetration critical for aquatic plants. Oyster reefs support a diverse macrofaunal community that provides shelter and food for crabs and fish. An increase in oyster reefs will increase habitat and food for other important species in the Bay.

The restoration philosophy must be to restore and manage oyster populations for their ecological value, but in such a way that a sustainable fishery can exist. The restoration philosophy must not be to manage oysters just to support a fishery. Oysters should be managed on a regional basis with regional quotas established for a fishing season based on stock assessments.

Essential Components of Any Restoration Effort

1. Permanent Reef Sanctuaries

There are really two parts to this component—reefs and permanent sanctuaries. It is clear from historical documents that three-dimensional oyster reefs were a dominant feature of the Chesapeake Bay when colonists arrived in the New World. Oyster reefs provide aggregations of oysters that maximize reproductive success and the resulting structure enhances recruitment and growth of young oysters and provides protection from predators. In Chesapeake Bay, oyster densities are currently so low at most historical reef sites that reproductive success is likely low. Further, the lack of reef structures results in sub-optimal habitat for oyster growth and survival. Three-dimensional reefs are critical for reproductive success, predator protection and, of course, for the habitat they provide for other estuarine fauna.

Permanent sanctuaries are critical for a number of reasons. Permanent sanctuaries will allow for the development and protection of large oysters. It is well documented that fecundity in oysters increases exponentially with length. Thus, a small number of very large oysters can produce many more eggs than a large number of small oysters. In addition, large oysters in disease-endemic areas have a demonstrated ability to survive diseases, a characteristic that is, at least in part, inherited by their offspring. Natural disease resistance has not developed in Chesapeake Bay for two reasons. First, there has been historically a large unselected gene pool in low salinity that diluted any selected gene pool. Second, the fishery harvested all the large oysters that were surviving in disease-endemic areas and that may have been disease resistant. We cannot guarantee that disease resistant oysters will become widespread in the Bay with the protection of large oysters, but certainly disease resistance will never become widespread without the protection of large oysters.

Reef sanctuaries are also critical for habitat and ecological value. The reef structure provides important habitat for myriad organisms that contribute to the overall health of the Bay and provide food for recreationally and commercially important fish and shellfish species. In short, reef sanctuaries contribute to ecosystem restoration. Large oysters may be important for the structural integrity of a reef and it has been documented that a range of oyster sizes, including large individuals, is important for the ecological role of reefs (e.g. nesting sites for small fishes). Reefs must be considered "ecological sanctuaries." Harvesting must not be allowed on reef sanctuaries or the community of organisms important for reef structure and function will never fully develop.

Thus, the combination of restored three-dimensional reefs and permanent sanctuaries is critical to the success of oyster restoration. Restored reefs where harvesting is allowed will be unsuccessful as will sanctuaries alone. It is the combination of the two concepts that is important.

Areas around reef sanctuaries can be managed for harvest. Shells planted around reefs to catch spat can be harvested eventually in place or the small oysters can be moved to other areas for growout and harvest. However, a long-term goal should be to create a sustainable regional fishery and thereby reduce the necessity to move oysters. Properly placed reef sanctuaries will likely reduce or eliminate the need to move oysters for harvest because the reefs will be a source of larvae that will settle on local harvestable beds.

2. Proper Disease Management

One of the basic tenets of disease management is that infected organisms should not be moved into areas where the disease is not present or is present at lower levels. Much of the spread of Dermo throughout the Bay resulted from moving infected oysters. Managers argue that because Dermo is now present throughout the Bay it doesn't hurt to move infected seed oysters into low salinity because the disease is already there. However, the historical distribution of Dermo was restricted to the lower Bay and the mouths of major tributaries. Prior to the severe droughts of the late 1980s Dermo was not present in most Maryland tributaries and there is reason to expect that if rainfall patterns return to normal Dermo will eventually return to its historical range. It is well documented that Dermo is not pathogenic below about 12 ppt, so managers argue that it doesn't make any difference if infected seed oysters are moved to salinities below that level. However, if a drought occurs Dermo will multiply rapidly, kill oysters and spread to other oysters, thereby perpetuating the disease in the area.

At the very least, a policy must be established against moving any infected oysters into salinities lower than where they set or into areas where disease levels are low. However, there was strong sentiment among most committee members that infected oysters should not be moved at all.

Issues

There are many other issues involved with the successful implementation of a reconstructed oyster reef sanctuary program. Issues that the committee felt were important are discussed briefly below.

1. Reef Siting

Reef sanctuaries should be placed in areas that historically supported productive oyster bars if there has been no subsequent change in hydrography or sedimentation patterns. To be self-sustaining they must be placed on stable, hard bottom and in areas where natural spatset occurs. If reefs are to be a source of spat for shell plantings, and for sustainability of the reef itself then salinity, flow regime and basin morphology will be important considerations. Hydrodynamic models or drifter studies will be useful in determining fate of larvae from any proposed reef site.

2. Reef Design Criteria

A reef is defined here as a three-dimensionally-complex biogenic structure that rises substantially from the seafloor. Verticality is critical and reefs should have sufficient vertical relief that recruitment and growth of the reef will outpace sedimentation. Substantial three-dimensional structure equal to at least one-half the water depth is recommended. Historically, some reefs may have broken the surface at low water and the goal should be to reproduce historical reefs to the best of our ability.

The core of the reef may be composed of any substrate that will provide stability to the vertical structure. There should be a veneer of oyster shell or other suitable substrate for spat settlement. The veneer must have a three-dimensional matrix sufficient to allow spat settlement and provide protection for the spat from predators.

Optimal size of reef sanctuaries has not been determined and will likely be dictated by funding constraints. In Virginia, reefs as small as one acre have substantially increased spat set in the surrounding area. An archipelago of small reefs may be more effective than a single large reef.

3. Reef Protection

It is critical that reef sanctuaries be protected from poaching. They should be sited such that enforcement of the sanctuary will be feasible. Community awareness can be important for enforcement so reefs should be sited, if possible, in areas where community oversight can develop.

4. Broodstock Supplementation on Reefs

It will probably be important to add adult oysters to some restored reefs to enhance recruitment to the reef and to the surrounding area. Large natural oysters can be harvested and aggregated on reefs to enhance fertilization success. This strategy worked successfully in Virginia where large, but scattered, oysters from Tangier Sound were aggregated on a reef in the Great Wicomico River. Spatset on and around the reef increased dramatically the following year. If natural recruitment is low then it may be necessary to add adults to a reef in high density to "jumpstart' recruitment.

Where possible and when available, progeny from genetically selected oysters could be stocked on reefs. There are a number of programs underway to select oysters for a variety of traits including growth in low salinity, fast growth, or disease resistance. These strains will require evaluation for their effectiveness for use on reef sanctuaries.

5. Shellplants Around Reefs

An important component of the restoration strategy will be to plant shell around reef sanctuaries to enhance spatset, although the need for shell planting will likely be site specific. Good quality oyster shell is a limiting resource for spatset around reefs in all areas. Shallow buried and fossil shell are currently available, but more emphasis needs to be placed on returning harvested shell to the Bay. After spatfall, the shell could be left in place for future harvest or it could be moved to other areas to develop sanctuaries or for future harvest. The oysters moved to other areas would contribute ecological value until they were harvested. However, as stated above, a long-term goal is to use reef sanctuaries to provide a sustainable regional source of spat to reduce or eliminate the need to move seed oysters.

Siting of shellplants will be important to maximize spatset. Circulation models may help determine current patterns and where best to plant shell.

Restoration Goal

The long-term restoration goal should be to construct and protect a sufficient number of reef sanctuaries bay-wide such that 1) habitat and ecological function will be restored, 2) water quality will improve and anoxia will decrease, and 3) a sustainable fishery can exist with no addition of public funds. In lieu of specific data on the required sanctuary area necessary to meet this goal, we recommend that 10% of traditional oyster bar acreage in formerly high-yielding harvest locations be set aside and restored as permanent sanctuaries. As additional data become available it may be possible to refine this estimate.

The short-term goal will be to increase spatset, increase the number of adult oysters, and increase habitat and fish utilization of that habitat in specific tributaries where reef sanctuaries have been constructed.

Over the next four to eight years the intermediate goal should be to demonstrate effectiveness of reef sanctuaries for ecological improvement in one or two selected tributaries in each state. The tributaries will have to be monitored to evaluate success, using criteria listed above under short-term goals.

Committee Members:

Eugene Burreson, Virginia Institute of Marine Science, Chair

Grant Gross, Chesapeake Research Consortium

Victor Kennedy, University of Maryland Center for Environmental Science

Mark Luckenbach, Virginia Institute of Marine Science

Roger Mann, Virginia Institute of Marine Science

Don Meritt, University of Maryland Center for Environmental Science

Roger Newell, University of Maryland Center for Environmental Science

Kennedy Paynter, Jr., University of Maryland

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Mr. GILCHREST. Thank you, Dr. Luckenbach.
Dr. Roberts.

STATEMENT OF DR. SUSAN ROBERTS, NATIONAL ACADEMY OF SCIENCES, OCEAN STUDIES BOARD

Ms. ROBERTS. Good morning, Mr. Chairman and members of the subcommittee. Thank you for this opportunity to speak to you about Marine Protected Areas. I am a Senior Program Officer at the Ocean Studies Board at the National Academies. I served as the Study Director for the Academy's Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States, and this committee issued a report that was published last year called Marine Protected Areas: Tools for Sustaining Ocean Ecosystems.

This study evolved from a convergence of interests in the concept of using specially designed management for the conservation of living marine resources, and particularly a new interest in ecosystem-based management. Primary funding for the study was provided by NOAA's National Marine Fishery Service and the National Marine Sanctuary Program. Additional funding was provided by the Fish and Wildlife and National Park Services.

We assembled a committee of 13 volunteer experts chaired by one of Maryland's eminent marine scientists, Ed Houde, who works at the University of Maryland's Solomons campus, and my testimony provides a very brief overview of the findings. My written testimony provides additional detail, and if you want the whole story, I recommend that you read the whole report.

Marine protected areas are not new to resource management, but there has been a plethora of terms that have been used to describe this management approach—closed areas, reserves and sanctuaries, just to name a few.

Marine protected area is used as an umbrella term to describe a discrete geographic area that has been designated for the conservation of marine and coastal resources. This approach recognizes the patchiness of marine habitats. The apparent uniformity of surface waters disguises much of the diversity that lies beneath. Because of this patchiness, it is possible, and often desirable, to tailor management to the specific requirements of a given site.

The NRC Committee endorsed the use of MPAs as a valuable tool to complement conventional management of marine resources, but they recognize that MPAs are not a magic bullet. They will not miraculously solve all our marine management problems. They need to be used in concert with other forms of marine resource management. However, this approach is valuable for conserving habitat, biological communities, ecosystem services, and supporting commercial fisheries, particularly for relatively sedentary species. Some of the speakers earlier this morning mentioned a lot of these potential values of using Marine Protected Areas. But the focus of today's hearing is an example of the sedentary species. In fact, the oyster is about as sedentary as a critter can get, literally cementing itself into place as it grows to maturity.

The committee's report suggested that the oyster sanctuaries can be expected to contribute to the resources of the Chesapeake Bay in at least three ways. First, the sanctuaries will help rebuild the

oyster fishery. Sanctuaries allow a mature community of oysters to develop. These older, mature oysters are premium spawners that will help seed populations in surrounding areas that are open to harvest.

Second, the reefs built by the oysters not only provide habitat for oysters, but also for many of the other small animals that live in and among the oysters. The biological community of the reef also provides food and shelter for many other fish that are popular, such as striped bass and the blue crab.

Third, oysters provide what scientists call "ecosystem services". They make a major contribution to the overall health of the ecosystem. With the depletion of oysters from the Bay due to fishing, loss of habitat, and disease, and the phenomenal ability of oysters to filter and clarify the water, oysters consume microscopic, but abundant algae, and without the oysters, these algae sediment and deplete the bottom waters of the Bay of oxygen, and that has impacts on the rest of the fisheries. Restoring the oysters will help to restore the quality of the Chesapeake Bay's scenic waters.

In summary, I want to emphasize that MPAs are envisioned to play a role in the ecosystem on a scale larger than their boundaries, and I want to mention that we don't really see MPAs as being parks. I don't think the analogy to a park is really relevant, because we see MPAs as really a resource management tool that will have benefits for the Bay in its entirety, so that people, when they want to see an oyster, are not going to have to go to a sanctuary to see an oyster. But it is really intended to help to restore the health of the waters as a whole.

Thank you for inviting me to testify. I would be happy to answer any questions that the committee might have.

[The prepared statement of Dr. Roberts follows:]

Statement of Dr. Susan Roberts, Ocean Studies Board Division on Earth and Life Studies, National Academy of Sciences

Good morning Mr. Chairman and members of the Subcommittee. Thank you for this opportunity to speak to you about Marine Protected Areas. My name is Susan Roberts and I am a Senior Program Officer with the Ocean Studies Board at the National Academies. I served as the study director for the National Research Council's Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States, which was conducted under the oversight of the NBC's Ocean Studies Board. As you know, the National Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, and was chartered by Congress in 1863 to advise the government on matters of science and technology.

This study evolved from a confluence of interests in the timely and controversial topic of setting aside areas in the marine realm. for the conservation of living marine resources. Primary funding was supplied by the National Oceanic and Atmospheric Administration through the National Marine Fisheries Service and National Marine Sanctuaries Program, with additional funds from the Department of the Interior through the Fish and Wildlife and National Park Services. We assembled a committee of 13 volunteer experts who spent 2 years gathering data, convening 4 meetings around the country with scientists, managers, and stakeholders, and deliberating on the value of using Marine Protected Areas (MPAs) as a management tool for both sustaining marine fisheries and conserving marine biodiversily. The report was released, complete with conclusions and recommendations, in November, 2000 and published by the National Academy Press in May, 2001. My testimony today provides an overview of the findings of that study. My written testimony provides additional detail. Copies of the published report are available upon request.

RECOGNIZING THE LIMITS

In the past, it seemed that the seas were so vast that they could not be harmed by human deeds and therefore needed no protection. However, it is now clear that coastal management and policy must address human impacts such as overfishing, habitat destruction, drainage of wetlands, and pollution that disrupt marine ecosystems and threaten the long-term productivity of the seas.

Advances in oceanography have demonstrated that the sea is not a uniform, limitless expanse, but a patchwork of habitats and water masses occurring at scales that render them vulnerable to disturbance and depletion. The patchiness of the ocean is well known. by fishermen who do not cast their nets randomly but seek out areas where fish are abundant. Overfishing has become more of a problem as increases in technology and fishing capacity have placed increased pressure on our native fish populations. Destruction of fish habitat as the result of dredging, wetland drainage, pollution, and ocean mining also contributes to the depletion of valuable marine species. With the continued growth in the demand for seafood and other marine resources, it has become not only more difficult, but also more critical to achieve sustainability in the use of living marine resources. These concerns have stimulated interest in and debate about the value and utility of approaches to marine resource management that provide more spatially defined methods for protecting vulnerable ocean habitats and conserving marine species, especially marine reserves and protected areas. Based on evidence from existing marine area closures in both temperate and tropical regions, marine reserves and protected areas can be effective tools for addressing conservation needs as part of integrated coastal and marine area management.

There have been numerous attempts to develop terms and definitions to encompass the array of applications of MPAs in marine conservation. The committee defined a simplified list of terms for the various types of protected areas, listed here in order of increasing level of protection:

- Marine Protected Area-a discrete geographic area that has been designated to enhance the conservation of marine and coastal resources and is managed by an integrated plan that includes MPA-wide restrictions on some activities such as oil and gas extraction and higher levels of protection on delimited zones, designated as fishery and ecological reserves within the MPA (see below). Examples include the Florida Keys National Marine Sanctuary and marine areas in the National Park system, such as Glacier Bay.
- Marine Reserve—a zone in which some or all of the biological resources are protected from removal or disturbance. This includes reserves established to protect threatened or endangered species and the more specific categories of fishery and ecological reserves described below.
- Fishery Reserve-a zone that precludes fishing activity on some or all species to protect critical habitat, rebuild stocks (long-term, but not necessarily permanent, closure), provide insurance against overfishing, or enhance fishery yield. Examples include Closed Areas I and II on Georges Bank, implemented to protect groundfish.
- Ecological Reserve-a zone that protects all living marine resources through prohibitions on fishing and the removal or disturbance of any living or non-living marine resource, except as necessary for monitoring or research to evaluate reserve effectiveness. Access and recreational activities may be restricted to prevent damage to the resources. Other terms that have been used to describe this type of reserve include "no-take" zones and fully-protected areas. The Western Sambos Reserve in the Florida Keys National Marine Sanctuary provides an example of this type of zoning.

MANAGING MARINE RESOURCES

Management of living marine resources presents numerous challenges. The conventional approach typically involves management on a species-by-species basis with efforts focused on understanding population-level dynamics. For example, most fisheries target one or a few species; hence, managers and researchers have concentrated their efforts on understanding the population dynamics and effects of fishing on a species-by-species basis. Although this approach seems less complex, it does not resolve the difficulties of either managing multiple stocks or accurately assessing the status of marine species. This is compounded by the relative inaccessibility of many ocean habitats, the prohibitive expense of comprehensive surveys, and the complex dynamics and spatial heterogeneity of marine ecosystems. In addition, the species-specific approach may fail to address changes that affect productivity throughout the ecosystem. These changes may include natural fluctuations in ocean conditions (such as water temperature), nutrient over-enrichment from agricultural

run-off and other types of pollution, habitat loss from coastal development and destructive fishing practices, bycatch of non-target species, and changes in the composition of biological communities after removal of either a predator or a prey species.

In addition to challenges presented by nature, management must also address challenges presented by social, economic, and institutional structures. Regulatory agencies are charged with the difficult but important task of balancing the needs of current users with those of future users of the resource as well as the long-term interests of the general public. Regulatory actions intended to maintain productivity often affect the livelihoods of the users and the stability of coastal communities, generating pressure to continue unsustainable levels of resource use to avoid short-term economic dislocation. Finally, responsibility for regulating activities in marine areas, extending from estuarine watersheds to the deep ocean, is fragmented among a daunting number of local, state, federal, and international entities. This complexity in jurisdictional responsibility often places a major barrier to developing coordinated policies for managing ocean resources across political boundaries. Although the protected area concept, with its emphasis on management of spaces rather than species, is not new and has been used frequently on land, there has been less support and few interagency efforts to institute protected areas as a major marine management measure. Increased use of MPA-based approaches will shift the focus from agency-specific problem management to interagency cooperation and will facilitate the implementation of marine policies that recognize the spatial heterogeneity of marine habitats and the need to preserve the structure of marine ecosystems.

CONCLUSIONS AND RECOMMENDATIONS

MPA DESIGN

There are multiple goals for establishing MPAs, such as conserving biodiversity, improving fishery management, protecting ecosystem integrity, preserving cultural heritage, providing educational and recreational opportunities, and establishing sites for scientific research. To promote biodiversity, the siting criteria for an MPA or reserve may include habitat representation and heterogeneity, species diversity, biogeographic representation, presence of vulnerable habitats or threatened species, and ecosystem functioning. To improve fishery management, site choice may depend on the locale of stocks that are overfished to provide insurance against stock collapse or to protect spawning and nursery habitat. Alternatively, a site may be selected to reduce bycatch of nontarget species or juveniles of exploited species. Ranking and prioritizing these objectives may be guided by local conservation needs and/or regional goals for establishing a network of MPAs. Conflicting objectives may require negotiation, trade-offs, and consideration of social and economic impacts.

Effective implementation of marine reserves and protected areas will depend on resolving these conflicting objectives through participation by the community of stakeholders in developing the management plan. Federal and state agencies will need to provide resources, expertise, and coordination to integrate individual MPAs into the broader framework for coastal and marine resource management. Additionally, the needs and concerns of affected communities must be evaluated and considered when choosing sites for marine reserves and protected areas. Stakeholders should be encouraged to participate in the process by employing their expertise as well as considering their concerns.

The task of designing a MPA should follow four sequential steps: (1) evaluate conservation needs at both local and regional levels, (2) define the objectives and goals for establishing the MPA, (3) describe the key biological and oceanic features of the region, and (4) identify and choose one or more sites that have the highest potential for implementation. At the end of the process, the draft management plan should specify the location, size, and zoning regulations for the proposed MPA. Each of these parameters is described in more detail below.

Location

The success of MPAs depends on the quality of management in the surrounding waters. Therefore, the choice of sites for MPAs should be integrated into an overall plan for marine area management that optimizes the level of protection afforded to the marine ecosystem as a whole. In coastal areas specifically, MPAs will be most effective if sites are chosen in the broader context of coastal zone management, with MPAs serving as critical components of an overall conservation strategy. Management should emphasize spatially oriented conservation strategies that consider the heterogeneous distribution of resources and habitats. Often a single MPA will be insufficient to meet the multiple needs of a region and it will be necessary to establish

a network of MPAs and reserves, an array of sites chosen for their complementarity and ability to sustain each other. Site identification should attempt to maximize potential benefits, minimize socioeconomic conflicts, and exclude areas where pollution or commercial development have caused problems so severe that they would override any protective benefit from the reserve.

Size

The optimal size of marine reserves and protected areas should be determined for each location by evaluating the conservation needs and goals, quality and amount of critical habitat, levels of resource use, efficacy of other management tools, and characteristics of the species or biological communities requiring protection. In many cases, specific attributes of the locale (saltmarsh habitat, spawning and nursery grounds, special features such as coral reefs, seamounts, or hydrothermal vents) will determine the size of an effective reserve. In other cases, the dispersal patterns of species targeted for protection, as well as the level of exploitation, should be considered in deciding how much area to enclose within a reserve. To achieve the marine management goals described above will require establishing reserves in a much greater fraction of U.S. territorial waters than the current level of less than 1%. Proposals to designate 20% of the ocean as marine reserves have focused debate on how much closed area will be needed to conserve living marine resources. For sedentary species, protecting 20% of the population will help conserve the stock's reproductive capacity and may roughly correlate with protecting 20% of that species' habitat in a reserve. However, the optimal amount of reserve area required to meet a given management goal may be higher or lower depending on the characteristics of the location and its resident species. Size optimization generally will require adjustments to the original management plan based on reserve performance, as determined through research and monitoring. Hence, the first priority for implementing reserve sites should be to include valuable and vulnerable areas rather than to achieve a percentage goal for any given region.

Zones and Networks

Zoning should be used as a mechanism for designating sites within an MPA to provide the level of protection appropriate for each management goal. In many instances, multiple management goals will be included in an MPA plan and zoning can be used to accomplish some of these goals. These zones may include "ecological reserves" to protect biodiversity and provide undisturbed areas for research, "fishery reserves" to restore and protect fish stocks, and "habitat restoration areas" to facilitate recovery of damaged seabeds. Frequently, an MPA is established initially to protect a site from threats associated with large-scale activities such as gravel mining, oil drilling, and dredge spoil disposal. Under these MPA-wide restrictions, there is an opportunity to resolve other conflicting uses of marine resources through zoning of areas within the MPA. Networking should be considered in both zoning and siting of MPAs to ensure long-term stability of the resident populations.

MONITORING AND RESEARCH

The performance of marine reserves should be evaluated through regular monitoring and periodic assessments to measure progress toward management goals and to facilitate refinements in the design and implementation of reserves. Marine reserves should be planned such that boundaries and regulations can be adapted to improve performance and meet changes in management goals. There are three tasks that should be included in a well-designed monitoring program: (1) assess management effectiveness; (2) measure long-term trends in ecosystem properties; and (3) evaluate economic impacts, community attitudes and involvement, and compliance.

Research in marine reserves is required to further our understanding of how closed areas can be most effectively used in fisheries and marine resource management. Reserves present unique opportunities for research on the structure, functioning, and variability of marine ecosystems that will provide valuable information for improving the management of marine resources. Whenever possible, management actions should be planned to facilitate rigorous examination of the hypotheses concerning marine reserve design and implementation. Research in reserves could provide estimates for important parameters in fishery models such as natural mortality rates and dispersal properties of larval, juvenile, and adult fish. Other research programs could test marine reserve design principles such as connectivity or the effect of reserve size on recovery of exploited species. Modeling studies are needed both to generate hypotheses and to analyze outcomes for different reserve designs and applications.

INSTITUTIONAL STRUCTURES

Integration of management across the array of federal and state agencies will be needed to develop a national system of MPAs that effectively and efficiently conserves marine resources and provides equitable representation for the diversity of groups with interests in the sea. The executive order issued by the White House on May 26, 2000, initiates this process through its directive to NOAH (Department of Commerce) to establish a Marine Protected Area Center in cooperation with the Department of the Interior. The goal of the MPA Center shall be "to develop a framework for a national system of MPAs, and to provide Federal, State, territorial, tribal, and local governments with the information, technologies, and strategies to support the system." Implementation of a national system of MPAs should be used to:

- improve regional coordination among marine management agencies;
- develop an inventory of existing MPA sites; and
- ensure adequate regulatory authority and funds for enforcement, research, and monitoring.

Effective enforcement of MPAs will be necessary to obtain cooperation from affected user groups and to realize the potential economic and ecological benefits. Also, coordination among agencies with different jurisdictions will improve the representation of on-site and off-site user groups so that the general public's cultural and conservation values, as well as commercial and recreational activities, receive consideration. Under current management approaches, these interests are often addressed by different agencies independently of each other and may result in short-term policies that are inconsistent with the nation's long-term goals.

CONCLUSION

What are the consequences of not developing a national system of marine reserves and protected areas? Are conventional management strategies sufficient to ensure that our descendents will enjoy the benefits of the diversity and abundance of ocean life? Although it may seem less disruptive to rely on the familiar, conventional management tools, there are costs associated with maintaining a status quo that does not meet conservation goals. Hence, our relative inexperience in using marine reserves to manage living resources should not serve as an argument against their use. Rather, it argues that implementation of reserves should be incremental and adaptive, through the design of areas that will not only conserve marine resources, but also will help us learn how to manage marine species more effectively. The dual realities that the earth's resources are limited and that demands made on marine resources are increasing, will require some compromise among users to secure greater benefits for the community as a whole. Properly designed and managed marine reserves and protected areas offer the potential for minimizing short-term sacrifice by current users of the sea and maximizing the long-term health and productivity of the marine environment.

Thank you for inviting me to testify. I would be happy to answer any questions the committee might have.

Mr. GILCHREST. Thank you very much, Dr. Roberts.

Mr. Grasso.

STATEMENT OF TOM GRASSO, DIRECTOR, U.S. MARINE CONSERVATION PROGRAM, WORLD WILDLIFE FUND

Mr. GRASSO. Thank you, Mr. Chairman, Representative Underwood and Delegate Owings. It is indeed a pleasure to be here today both before the subcommittee before which I have appeared and follow closely, as well as being in this room. It has been a number of years since I have been here, but this has certainly been the site of a number of very lively discussions and debates about things from oysters to chickens to industrial pollution. It is great to be back here. It is a bit of a deja vu for me, but I am glad to be here, particularly today, to talk about the opportunity to use Marine Protected Areas or marine reserves to protect and restore the oyster population of the Chesapeake Bay. WWF, in fact, has a very particular interest in this issue, and 2 years ago partnered with the

Chesapeake Bay Foundation and the Department of Natural Resources to fund a research oyster reef site off Tolly Point at the mouth of the Severn River, and I look forward to hearing from my former colleagues, CBF, as to how those reef research projects are doing.

In addition, we think that Marine Protected Areas provide opportunities beyond just oysters in the Chesapeake Bay to promote restoration of valuable commercial fisheries. So, what I would like to do today, very briefly for you, is outline a report and guide that we produced just over a year ago entitled "Fully Protected Marine Reserves: A Guide", and what it essentially does is establish a working process for community-based fisheries management, State level managers, fishers, and other stakeholders, to follow in developing a marine reserve, and then it also gives some examples from around the world of where marine reserves have worked.

First, let me outline for you briefly what we see six basic functions of marine reserves are. And when I say marine reserves, today I am referring to those Marine Protected Areas that are considered fully protected, meaning off-limits to any fishing or any other extractive activities.

1) Fully protected reserves can enhance the production of offspring which can restock fishing grounds.

2) Reserves can allow spillover of adults and juveniles into fishing grounds.

3) Reserves can provide a refuge for vulnerable species.

4) Reserves can prevent habitat damage from destructive fishing practices such as dynamite fishing and other types of extractive activities.

5) Fully protected reserves can promote development of natural biological communities, which are different from communities in fishing grounds.

6) Fully protected reserves can facilitate recovery from catastrophic human and natural disturbances.

With those basic functions outlined in our report, we then thought it was important to provide some examples of where we have seen reserves work, and why, and I am going to highlight a few of those for you, particularly pertaining to the restoration of fisheries abundance and improvements in fish stock capacities in marine reserves as compared to outside of marine reserves.

For example—and I will start with some of the older ones—in the Bahamas, a marine reserve that was created some 36 years ago, which is a tropical seagrass meadow, the average density of the adult queen conch in that region was 15 times higher in the reserve than outside the reserve.

In a reserve in South Africa known as the De Hoop Marine Reserve, after only 2 years, experimental catch per effort increased by up to fivefold from six out of ten of the most commercially important species.

In the Dutch Antilles, in the Saba Marine Park, after only 4 years, in the no-take zone the biomass of target species was over twice that in the fishing grounds.

On the West Coast of the United States, in Shady Cove, in the San Juan Islands in Washington State, after 7 years, lingcod were nearly three times more abundant in the reserve than outside.

In the Edmonds Underwater Park in Washington, after 27 years, the number of rockfish eggs and larvae originating from within the park is 55 times greater than outside.

And then, lastly, in the Anacapa Island, in the Channel Islands of California, densities of the commercially exploited red sea urchin were nine times higher in the reserve than in nearby fished areas.

The reason I mention these is that one of the critical aspects of designing, establishing and implementing the marine reserves are the people you have involved. As we heard from Dr. Roberts, it is important to have the science behind you, but we believe it is equally important to have the right people involved in designing this, and by that I mean the people who are using that area for fishing and other activities. In our experience, we found—and particularly in the dry Tortugas where there has just recently been established a fully protected marine reserve—fishermen play a very important role in this process. I am sorry I haven't seen Larry Simms here yet, but I know the expertise of fishermen in a region can be a very valuable asset when you are designing a marine reserve because the benefits can accrue to those fishermen as well as other stakeholders. Without them, you won't have an effective reserve because you won't have buy-in from those stakeholders.

So, if I can leave the committee with one piece of advice, if you will, it would be to have the broadest, most involved process in establishing marine reserves because, in the long-run, that is what is going to end up with the best result, and an implemented marine reserve that is productive for all those involved. Thank you.

[The prepared statement of Mr. Grasso follows:]

Statement of Thomas V. Grasso, U.S. Director for Marine Conservation, World Wildlife Fund

Good morning, and thank you Mr. Chairman- My name is Thomas V. Grasso and I am the U.S. Director for Marine Conservation at the World Wildlife Fund. Established in 1961, the World Wildlife Fund, with offices or representatives in more than 60 countries around the world, seeks to meet today's complex conservation challenges by identifying problems, crafting solutions, and helping local communities draw up conservation plans which they themselves can implement to protect the environment for future generations. Since its founding, WWF has helped establish, fund or manage more than 500 parks and reserves worldwide, effectively safeguarding hundreds of species and millions of acres of wildlife habitat. In the last decade, WWF has increasingly turned its attention to the myriad challenges we face in protecting the biological diversity of the world's oceans.

I am pleased to testify today before the Subcommittee on Oceans and Fisheries regarding the use of Marine Protected Areas and regions for the conservation and restoration of economically and ecologically valuable marine species. WWF is also keenly interested in today's discussion regarding oyster sanctuaries in the Chesapeake bay which we believe can contribute to the restoration of the historic economic and ecological value of this classic Chesapeake species. Today, my testimony will outline why establishing fully-protected marine reserves and Marine Protected Areas should be used as tools for conserving the world's ocean biological diversity; describe the improvements in fishery abundance and economic opportunities that result from the establishment of fully protected marine reserves; and lastly, articulate a process for establishing marine reserves that incorporate these many functions and values.

Wildlife in the sea is diverse, exciting, good to eat and provides a myriad of services to humanity, many of which we can barely even comprehend. However, human activities now pose serious threats to the oceans' biodiversity and their capacity to support productive fisheries, recreation, water purification and other services we take for granted. Traditional fisheries management, alone, is not equipped to deal with these many challenges.

WWF believes we need new approaches'to better manage the oceans. A growing number of people now believe there is a way to conserve marine biodiversity, restore dwindling fish stocks, promote sustainable tourism and safeguard ecosystem integrity. All of this can be achieved by instituting fully protected reserves: that is, areas completely closed to fishing and all other types of exploitation or harmful use. Such reserves would offer additional protections to those currently provided by most Marine Protected Areas (MPAs). At the moment MPAs cover less that half a percent of the world's oceans, few protect very much and 71 % appear to have no active management (Kellecher et al. 1995). For example, a 1997 assessment pointed out that, of Canada's 110 MPAs, 72 provided no protection to species or habitats (Wallace 1997)—Another 1997 report suggests that, although California has more than 100 MPAs, less than one fifth of one percent of their combined area is protected from fishing, and little of that is effectively enforced, (McArdle 1997).

Marine reserves have enjoyed a great increase in attention over the last few years. A decade ago they sounded like a good idea, but now we have the research to show that they really do work—People who pioneered reserves, the fishers who gave up sections of their fishing grounds in the hope of better times ahead, are beginning to reap benefits from their foresight. To better understand these benefits, several years ago, WWF embarked on an effort to research the successes of marine reserves around the world. The news is very encouraging and I'd like to share some of these successes with you today. Marine reserves provide a number of important benefits or functions. According to WWF's recently published report, entitled "Fully-protected marine reserves: a guide," the authors, Callum Roberts and Julie Hawkins, Describe the potential uses of these reserves as follows:

(1) Fully protected reserves enhance the production of offspring which can restock fishing grounds

Protecting or creating a "reserve" in a marine environment will allow many individual species in that area to live longer and grow larger. Bigger animals produce many times more eggs than smaller ones. For example one ten-kilogram red snapper (Cu ijanus campechanus) produces over twenty times more eggs at a single spawning than then one-kilogram snappers. Big fish may also spawn more frequently than small. On the Pacific coral reefs of Guam, half kilogram goatfish reproduce four to five times more often than goat fish half this size, and produce 100 times more eggs over a year. Therefore, a few very large animals are more valuable as egg producers than many smaller ones. In addition to increases in average body size, marine reserves will also result in increased egg production relative to fishing grounds. Some animals, especially those that are attached to the bottom or those having limited powers of movement (e.g. oysters, clams or abalones), can only reproduce successfully at high population densities. Fertilization rates decrease, as they get farther apart, and fewer offsprings are produced. By increasing population densities, reserves can greatly increase the number of young spawned. Many of these eggs and larvae produced by fish in fully-protected reserves will drift into fishing grounds and help restock the fishery.

(2) Fully protected reserves allow spillover of adults and juveniles into fishing grounds

As the number and biomass (body weight) of individual species within reserves increases, they will start to emigrate out of reserves and into fishing grounds. Thus, a proportion of the fish which once received protection in reserves do eventually become available for fishers to catch. This, together with their ability to provide eggs and larvae to fishing grounds, provides the basis for fully protected reserves to be economically beneficial to fishers. This, in turn, can help compensate for the short-term loss that fishers may experience in the early years after reserves are established.

(3) Fully protected reserves provide a refuge for vulnerable species

Some species are particularly vulnerable to fishing and may be unable to persist even in areas where fishing pressure is quite light. If this is the case no-take zones offer a critical refuge. For example, barndoor skate (Dipturus laevis) have been driven to the edge of extinction by trawl fishing on continental shelves of the eastem United States and Canada, even though they have never been directly targeted by fishers (Casey & Myers 1998). Their large body size means they are caught as by-catch, and their low reproductive rates mean they cannot persist in areas that are trawled. There are similar concerns for several species of rockfish (Sebastes spp.) in the Pacific (Yaklavich 1998). Since fishing gear is not selective, rare species will continue to be caught as long as fishing continues. Protecting vulnerable species is a key benefit of fully protected reserves.

(4) Fully-protected reserves prevent habitat damage

Many forms of fishing can damage the marine environment in some way and impacts vary from minor and localized to large-scale and devastating. Just as reserves provide refuge to species from fishing, they also provide a respite from damage to their habitats. This respite will allow time for the process of recovery and will ultimately lead to restoration of biodiversity within the area.

(5) Fully protected reserves promote development of natural biological communities, which are different from communities in fishing grounds

Fully-protected reserves have offered remarkable insights into how human activity has transformed marine ecosystems. For example, protection of rocky shores in Chile led to a change from communities dominated by mussels to ones dominated by barnacles. This shift was facilitated by the recovery of loco (Concholepas concholepas), a predatory snail, which had been overexploited before protection (Castilla & Duran 1985). Reserves create conditions that are different from surrounding fished areas. These healthier conditions promote development of different community structures, and enhance regional biodiversity. In other words, marine reserves facilitate increases in diversity at the 'seascape' level.

(6) Fully-protected reserves facilitate recovery from catastrophic human and natural disturbances

There is growing evidence that human impacts and stresses undermine the capacity of ecosystems to recover from major disturbances. When intact, fully functioning ecosystems rebound more quickly from catastrophes like storms or oil spills, than places where animals and plants are affected by other stresses. For example Connell (1997) reviewed studies of recovery of coral reefs from major disturbances and found that healthy reefs are resilient and recover relatively quickly. However, reefs sufferings from multiple stresses showed little or no recovery. The reasons are simple. Healthy ecosystems tend to support larger populations of plants and animals that produce at higher rates. This means that disturbances are less likely to completely eliminate populations, and so recovery will be faster. Fully protected reserves help maintain populations at higher levels, so promoting recovery from disturbance. They also help reduce levels of stress from other human activities.

Lastly, Mr. Chairman, WWF believes that the process through which marine reserves are established is as important as the science that goes into the map or chart that is drawn around proposed area. WWF's experience in the process that established the Tortugas reserve suggests that involving commercial and recreational fisherman as well as other stakeholders is critical to the long-term success of a marine reserve. Attached to my testimony is a copy of a chart that appears in the Roberts/Hawkins report outlining a series of case studies of marine reserves that have resulted in improved fishery abundance and the subsequent economic value to local commercial and recreational fishing and ecotourism industries. I will highlight just a few for you. These case studies illustrate that fishermen have a legitimate stake in the design, establishment and implementation of marine reserves. As the Committee considers marine reserves, WWF would strongly encourage the most inclusive process to ensure all interested stakeholders are considered.

In summary, fully protected reserves can: protect exploited populations, enhancing production of offsprings which help restock fishing grounds; supplement fisheries through spillover of adults and juveniles into fishing grounds; provide a refuge from fishing for vulnerable species; prevent habitat damage and promote habitat recovery; maintain biodiversity by promoting development of natural biological communities that are different from those in fishing grounds; and facilitate ecosystem recovery after major human or natural disturbances. Indeed, a process that includes interested stakeholders from the outset will allow marine reserves to perform these functions for many years to come. Thank you Mr. Chairman.

[An attachment to Mr. Grasso's statement follows:]

Table 1: Examples of the effects of reserves that offer protection from fishing, drawn from experiences in many parts of the world and from many different habitats.

Reserve name and location	Years of protection	Habitat type	Effects reported
Leigh Marine Reserve, New Zealand	21	Warm-temperate rocky reef	The most common predatory fish *Pagrus auratus* was 6 times more common in the reserve than outside, while the spiny lobster *Jasus edwardsii* was 1.6 times more abundant, and had a bigger carapace (a part of their horny outer skeleton: average size = 110mm in reserve, 94mm outside). In 18 years, sea urchin densities declined from 4.9m² to 1.4m² in the reserve while urchin cover rose from 14% to 40% in unprotected areas (Babcock 1999).
Tawharanui Marine Park, New Zealand	14	Temperate rocky reef	The most common predatory fish *Pagrus auratus* was 9 times more common in the reserve than outside, while the spiny lobster *Jasus edwardsii* was 3.7 times more abundant, with a carapace about 16mm bigger (Babcock 1999).
Mayotte Island, Indian Ocean	3	Coral reef	Total numbers of species present did not differ between protected and unprotected areas, however most large carnivores were more diverse and abundant in the reserve. The mean biomass of commercial species was 202g/m² in the reserve compared to 79g/m² outside (Letourneur 1996).
Looe Key, Florida, USA	2	Coral reef	15 species that were targets of spear fishers increased in abundance after spearfishing was banned: snappers by 93%, grunts by 439% (Clark et al. 1989).
Cousin Island, Seychelles	15+	Coral reef	Groupers, emperors and snappers were more abundant and diverse within the reserve than in fished sites (Jennings 1998).
Sainte Anne, Seychelles	11	Coral reef	Despite the fact that a few families retain fishing rights and poaching is fairly common in this reserve, the diversity of target species and total fish biomass was higher than in heavily fished areas. The biomass of prey did not increase when predators were removed by fishing (Jennings et al.1995, Jennings et al. 1996).
Merritt Island Wildlife Refuge Florida, USA	28	Sub-tropical estuary	Experimental catch per unit effort (the amount caught for every unit of fishing effort) was 2.6 times greater in the reserve for all game fish combined, 2.4 times for spotted sea trout *(Cynoscion nebulosus)*, 6.3 times for red drum *(Sciaenops ocellata)*, 12.8 for black drum *(Pogonius cromis)*, 5.3 for snook *(Centropomus undecimalis)* and 2.6 for striped mullet *(Mugil cephalus)*. Fish in the refuge were larger and more abundant, and anglers were preferentially targeting the reserve boundary (Johnson et al. 1999).
Kisite Marine National Park, Kenya	5	Coral reef	Snappers, emperors and groupers were more abundant in the park and appear to be spilling over into fishing grounds. Protection did not affect species number or diversity (Watson et al. 1996).

Excerpted from *Fully-Protected Marine Reserves: A Guide*, by Callum M. Roberts and Julie P. Hawkins. World Wildlife Fund, 2000.

Reserve name and location	Years of protection	Habitat type	Effects reported
Punta El Lacho, Chile	2	Temperate rocky intertidal	The commercially important marine snail, the Loco *(Concholepas concholepas)*, increased in density from 5 to 14 times and doubled in body size following protection (Castilla & Duran 1985).
Barbados Marine Reserve	11	Coral reef	Large, trapable fish were approximately twice as abundant in the protected area, and 18 of 24 species were bigger (Rakitin & Kramer 1996, Chapman & Kramer 1999).
Exuma Cays Land and Sea Park, Bahamas	36	Tropical seagrass meadow	The average density of adult queen conch *(Strombus gigas)* was 15 times higher in the reserve, and late stage larval densities were 4-17 times higher (Stoner & Ray 1996).
Exuma Cays Land and Sea Park, Bahamas	10	Coral reef	The reproductive output of Nassau grouper *(Epinephelus striatus)* was 6 times greater in the reserve (Sluka et al. 1997).
Hawaii Marine Life Conservation Districts	not reported	Coral reef	Fishes were 63% more abundant in areas protected from fishing (Grigg 1994).
De Hoop Marine Reserve, South Africa	2	Warm-temperate rocky reef	Experimental catch per unit effort increased by up to five-fold for 6 out of 10 of the most commercially important species (Bennett & Attwood 1991).
Saba Marine Park, Saba, Netherlands Antilles	4	Coral reef	In the no-take zone the biomass of target species was over twice that in fishing grounds (Polunin & Roberts 1993).
Hol Chan Marine Reserve, Belize	4	Coral reef	Biomass of target species in the reserve was on average almost double that in fishing grounds, while in certain parts of the reserve it was ten times greater (Polunin & Roberts 1993, Roberts & Polunin 1994).
Anse Chastanet Reserve, St. Lucia	2	Coral reef	Total biomass of commercially important species was more than double that in fishing grounds and the reserve contained three easily caught species found nowhere else (Roberts & Hawkins 1997).
Ras Mohammed Marine Park, Egypt	15	Coral reef	Mean biomass of fish was 1.2 times greater on protected reefs, while differences for seven target species were much greater. Individuals of the lunartail grouper *(Variola louti)* were three times larger in the reserve (Roberts & Polunin 1993a, 1993b).
Kisite Marine National Park and Mpunguti Marine National Reserve, Kenya	Kisite 20 Mpunguti 0 (open to fishing using traditional methods	Coral reef	Abundances of key commercial species (groupers, snappers and emperors) were up to 10 times higher in the fully-protected Kisite Marine National Park compared to the fished Mpunguti reserve. Furthermore, keystone species such as triggerfish (a predator of urchins) were also more abundant in the Kisite Park, while their urchin prey were much more abundant in the fished Mpunguti reserve (Watson & Ormond 1994).

Reserve name and location	Years of protection	Habitat type	Effects reported
Three Kenyan Marine Parks: Malindi, Watamu, Kisite	Malindi 24 Watamu 20 Kisite 19	Coral reef	Reserves helped to support regional diversity by protecting species that were unable to persist in fished areas. Of the 110 species recorded on protected reefs, 52 were not found in fished areas (McClanahan 1994).
South Lagoon Marine Park New Caledonia	5	Coral reef	Within protected areas the species richness of fish populations increased by 67%, density by 160%, and biomass by 246%, but the average size of most species did not increase (Wantiez et al. 1997).
Banyuls-Cerbere Marine Reserve, France	6	Warm-temperate rocky reef	18 target species were bigger in reserves (Bell 1983).
Shady Cove, San Juan Islands, Washington, USA	7	Temperate rocky reef	Lingcod *(Ophiodon elongatus)* were nearly three times more abundant in the reserve (Palsson & Pacunski 1995).
Edmonds Underwater Park, Washington, USA	27	Temperate rocky reef	The number of rockfish eggs and larvae originating from within the park is 55 times greater than outside. For lingcod *(Ophiodon elongatus)* the figure is 20 times as many (Palsson & Pacunski 1995).
Anacapa Island, Channel Islands, California, USA	20	Warm-temperate rocky reef	Densities of the commercially exploited red sea urchin *(Strongylocentrotus franciscanus)* were 9 times higher in the reserve than in nearby fished areas (Gary Davis quoted in Fujita 1998).
Tsitsikamma National Park, South Africa	22	Rocky reef	Of three species studied, one was 4 times more abundant in the reserve and another 13 times more. Bream, *Petrus rupestris*, were on average twice as large when protected. The biggest individuals for all species were found in the reserve and maximum sizes in fished areas were depressed. (Buxton & Smale 1989).
Sumilon Island Reserve, The Philippines	10	Coral reef	Eighteen months after fishing was resumed in the reserve, catch per unit effort fell by a half, and the total yield of fish was 54% less, despite a greater area available for fishing (Alcala & Russ 1990).
Apo Island Reserve, The Philippines	6	Coral reef	The biomass of large predators increased 8-fold in the reserve. In fishing grounds mean density and species richness of large predators also increased (Russ & Alcala 1996 a,b).
Kyoto Precture Closure, Japan	4	Temperate sand and mud bottom	The proportion of large male snow crabs *(Chionoecetes opilio)* rose by 32% in the closed area (Yamasaki & Kuwahara 1990).
Maria Island Reserve, Tasmania	6	Temperate rocky reef	The densities of rock lobster *(Jasus rubra)* and bastard trumpeter fish *(Latridopsis forsteri)* increased by 1 and 2 orders of magnitude respectively within the reserve. The numbers of species also increased for fish, invertebrates and algae, as did the densities of fish larger than 33cm (Edgar & Barrett 1999).

Mr. GILCHREST. Thank you very much, Tom—words of wisdom and good advice. And your comment about Larry Simms today, I think, was very appropriate. He may be on the last panel.

I would just like to say at this point, in case I forget when the last panel comes up here and Larry doesn't attend, that I have worked with Larry Simms for a long time, and he has, in my judgment, the right heart and the right mind for this issue in a very comprehensive way, and he has always acted with a great deal of credibility, and has been professional in his input as the basic leader of Maryland's watermen, has always been positive and crucial for these activities. I am happy that you mentioned him, Tom, and your advice also to bring in all the stakeholders is important to make this a successful adventure.

I would like to make a comment, though—sort of a comment/question. We are talking about sanctuaries, Marine Protected Areas. The comment part of this is that we, as people, have our suburbs, towns, cities. We have our areas where we live, raise our children, find shelter, sustenance, and so on. And it only seems reasonable to have those same areas set aside for wildlife, and we do have wildlife sanctuaries, wildlife refuges, national parks, and so on. But I think this is the time frame for renewed—and I say renewed because people have been discussing these issues for hundreds of years—a renewed effort to understand the need for whatever we want to call this—water refuge, Marine Protected Area, sanctuary—set aside for wildlife, for species. And I think we will probably go a long way in achieving that.

Dr. Roberts, in your effort to understand the importance of Marine Protected Areas, but in this particular incident, for sanctuary for marine species, in particular oysters, in identifying those areas that would be most suitable for an oyster reef and an oyster sanctuary and all of the positive spinoffs that that would create, in your efforts, have you at least in part focused on the land around those tributaries for their positive or negative contribution to the nutrients in that particular tidal basin, tidal estuary? And I know, Dr. Luckenbach, you mentioned how difficult it is to understand, from a scientific perspective, and monitor all this, and we don't expect oysters to explode all of a sudden, the marine environment to all of a sudden go back near to the way it was 500 years ago.

I will say, though, along the Sasfras River where I live, if you looked at the river 20 years ago in certain areas, it was fairly devoid of abundant, diverse marine resources, marine life. But if you look at the Sasfras River today, especially if you went paddling today, or Wednesday, you could see six feet down easily, right to the bottom. A lot of grass has come back. Spawning of rockfish and little tidal ponds and so on. You wouldn't have seen that 20 years ago. But the change of the land use practices has fundamentally changed and restored the characteristic of that marine ecosystem.

If you go through on a Sunday, though, in July, you won't see down six inches because of the turbidity of just large numbers of recreational boaters. So, just two quick comments, or I guess questions.

Do you look at the land use around the tributaries where the oyster reefs are going to go, and how much is the oyster reef protected? We know we are not going to harvest those oysters, but

have you looked at the recreational use around those young oyster reefs?

Ms. ROBERTS. I think there are two answers to your question, and one is that the committee did consider that and recommended that at least for the initial siting of an oyster sanctuary, that you should consider what the environment around it is like, and that would certainly include the land and what types of influences are going to be coming into the sanctuary. So, you would not want to put a sanctuary in an area where you have some sort of upstream source of pollution or turbidity that you are not going to be able to solve because that would obviously compromise the success of that sanctuary.

But the other side of the issue is that I think one of the problems that we have had in the marine environment is that we don't always recognize what we have. We don't always see it as being a piece of property that we want to protect.

And one thing that I think can help with the establishment of Marine Protected Areas is that people recognize it and say, "This is something valuable and we want to protect it now". And then there is more interest, I think, from the land-based side, in doing something about reducing the effects of pollution.

And so I think Marine Protected Areas can give the community a sense of ownership over the areas in the water that then builds the stewardship to take care of them.

Mr. GILCHREST. Thank you. Dr. Luckenbach.

Mr. LUCKENBACH. I can speak to each of those questions, I think. Certainly, in Virginia, the efforts and where we place reefs has certainly involved looking at environmental characteristics. And I think one of the more interesting examples of that, though, that points out it is not always upstream or exactly in the watershed, it relates to the oyster reefs at the mouth of the Rappahannock River. We have been installing some there in the last few years, and we will be putting more.

It turns out that near the mouth of the Rappahannock River, we expect to be able to put and sustain some oyster reefs on the south shore, but not the north shore, and that actually has nothing to do with land use immediately on the northern shore of the Rappahannock River near the mouth, it has got to do with the fact that we know from our hydrographic studies that low dissolved oxygen water comes in from the main stem of the Bay, and can slosh frequently up onto the banks of the north shore and will kill oysters in that area. So, although there is one small planting that is going on there now, our expectations are that that is not going to be a good location.

As to your second question about whether or not these sites are being used by other individuals and recreational fishermen, I can say they are being used so much that even our experiments on the reefs sometimes are hampered by all the fishing gear that is tangled up in them. And most of them that I have worked on now for a dozen years, maybe 10 years, have all become known to the recreational fishermen as good fishing spots.

Mr. GILCHREST. So, is that harmful to the development of the oyster reef, or is it neutral? Does it enhance it?

Mr. LUCKENBACH. We don't know, on balance. I don't think at this point that we have enough—I wouldn't expect that they are moving so many fish that it is harmful in that sense, but for the few that run their boats aground on the reefs, I don't think it is harmful. I think most of it is probably positive in the sense of bringing public support to the idea.

Mr. GILCHREST. That is good. Is there any indication right now, Dr. Luckenbach, or anybody, I suppose, that if you are going to restore the oysters to the Chesapeake Bay, you have a 10 percent goal of historic proportions, what will 10 percent do for the Bay? And I am not sure, is it 10 percent of what was there 300 years ago, 50 years ago? What does the 10 percent actually mean? And what does that 10 percent mean as far as the actual restoration of the oysters as a mechanism that purified water?

Mr. LUCKENBACH. Very good question, and the answer is that in details we don't know the answer to that. Certainly, the 10 percent that came out of our scientific consensus meeting was—we recognized that that was an intermediate goal.

At the time, there was one study that we were referring to—it was a modeling study—that indicated that if we had just a 10 percent, at that point, I believe, reduction in harvest of oysters in the Bay, that we would see differences in the system—increased light penetration, increased growth of submerged aquatic vegetation.

In trying to assess where this might be successful and, as you say, where we might see water quality improvements, it is really important to realize that this is going to happen a piece at a time, and it is not going to be Baywide, for example, that we see these examples, but on tributary-by-tributary basis. And one of the things that I think is going to be exceedingly important along the way is that we—we all have this big, grand metric out there, "What can I do for the whole Bay"—we need to develop some success criteria for individual projects. How much does this particular reef need to get us in order to be successful? We don't have that yet.

Mr. GILCHREST. Thank you. Dr. Roberts? Now, you don't have to answer, if you don't want to.

Ms. ROBERTS. It would be a tough one for me to answer because we didn't specifically look at the oysters in Chesapeake Bay but, in general, I guess I would like to reiterate what I said at the end of my testimony, the long-term goal—and I would like to back what Dr. Luckenbach said, this is a long-term goal, this isn't something we are going to see in the short-term.

It is not just to have restoration—if you have restoration of 10 percent in the actual sanctuaries, that that is going to contribute to the rest of the Bay as well. You are going to see recovery of the oyster beds in other areas, so that the actual improvements are going to be seen beyond just areas in the sanctuary. So, I think that is the long-term goal.

Mr. GILCHREST. Thank you. Tom?

Mr. GRASSO. I was just going to say, Mr. Chairman, your question is an important one, you have to know what the baseline is so you understand what you are measuring. And I am sure our colleagues from the Chesapeake Bay Foundation can give a specific answer as to 10 percent of what, but at this point just the state

of the oyster population, 10 percent of anything would be better than nothing.

Mr. GILCHREST. Thank you. Mr. Underwood.

Mr. UNDERWOOD. Thank you very much, Mr. Chairman, and thank you for your testimony this morning, and thank you for your remarks, Mr. Grasso, on keeping stakeholders in line. We recently had a problem with PCBs in the waters in an area of a military dump site in Guam. And one of the things that I think was overlooked was actually consulting the fishermen. Sometimes when we get fishermen involved in it, sometimes we think they are contributing to the depletion of resources rather than active participants in the maintenance of resources. And I think, given large levels of cooperation, we can see that come to pass.

I am interested, Dr. Luckenbach, in your comment about evaluation, and in there you mentioned—I think you used a figure that we are spending less than 1 percent on evaluating the nature of the projects that we are engaged in. It also brings to mind the comment by the Chairman about 10 percent, and trying to figure out exactly what is the benchmark where we are going. Then you mention in your own testimony about a kind of scientific—well, see, now, I don't know whether this is a scientific consensus or a consensus by scientists, and that is really a neat distinction, I think, to make. So, the question is, is that 10 percent just a consensus goal that was arrived at because we sat around and we anticipated that this perhaps is achievable, perhaps it is better than nothing, or was it based on anything that would approach something that is peer-driven research?

Mr. LUCKENBACH. I think a combination of each of those. Certainly, we discussed higher levels, and we realized realistically they weren't achievable. It didn't make a lot of sense to set goals that weren't achievable. We had some limited evidence, not from the entire Bay, but from the individual tributaries, that small, but concentrated sanctuaries, with high densities of food stock oysters on them made noticeable differences in the surrounding areas, particularly the Great Wicomoco River in Virginia had been a small experiment in that, as it were, that did lend a little bit of reality to our estimate of 10 percent, but very much I think it was, as you said, a belief that that was an achievable goal. Anything larger, as Mr. Schwaab said in the first panel, it is beyond our doing anyway. The oysters are going to have to do the heavy-lifting on this.

Mr. UNDERWOOD. And what about the—what is the source of the fact that we are not putting as much resources into evaluating our efforts, can any of you speak to that? Maybe it is more appropriate for you, Dr. Roberts.

Ms. ROBERTS. I would second that. The committee felt it was very important to have ongoing monitoring and research, and there are several reasons for that. One is that to get continuing support for the implementation of the sanctuaries, it is very important to see how they are functioning. Are you making progress towards your goals? You can't do that without having ongoing monitoring.

And the second is that I think the sanctuaries themselves provide a very valuable tool for research. We need to understand more about how the oyster reefs work, and also how the whole concept of having a marine reserve or marine sanctuary is going to func-

tion. Did we put them in the right place? Did we make them the right size? How many of them do we need? This all going to take further research. So, I think that it is extremely important to have continuing monitoring and research.

Mr. GRASSO. I would agree with that. It is very important to have scientific research continue once the marine reserves are established. And I also think, again, it provides a role for the fishermen in the area as well. They are the ones that are out there on a daily basis working for a living, and they can oftentimes provide very useful information to the scientists and researchers, what they are seeing out there as well, and are sometimes some of the first people who see problems that may be emerging and can come up with suggested ways of dealing with them. So, again, going back to the stakeholder process, it is something that continues even after the marine reserve has been established.

Mr. UNDERWOOD. Thank you. Dr. Luckenbach, you mentioned in your testimony about alternative materials, substrate materials, to rebuild oyster reefs, since we don't have a lot of oyster shells. What environmental factors are considered in that process, and what kind of alternative materials should we be looking at?

Mr. LUCKENBACH. Well, we are, in fact, both looking at and using a range of other materials, including ground concrete, mined limestone morel, and we have done experimentation with stabilized coal combustion byproducts, basically, coal ash or the cinders that would be in cinderblocks. Certainly, for any new or exotic material like the coal ash, it is important initially to do all of the proper environmental chemistry to ensure that we are not putting something in the waters that would be harmful. I think we have managed to get over most of those hurdles and, in fact, we know that we have a number of materials, and the most obvious one is there is a lot of concrete out there that is available, and some of it is being used as reef bases. What we have also learned in recent years is when you put material out on the bottom of the Bay, the difference between getting a living, functioning oyster reef there or not getting one at all may be due to very subtle differences in the size and the shape of the materials that you put out. Oysters will settle all over everything. We have all found a beer bottle or something in the Bay with oysters settled on it, but they surprisingly don't survive very well if they don't have exactly the right type of refuge from predation, the right type of elevation, the right type of environment in the face of low-dissolved oxygen. And we have seen just extremely striking differences.

What we need to do now is focus in literally on the real engineering thing, exactly how big do we have to break that concrete up, and exactly what sizes. We are narrowing in on it, but we have got a ways to go.

Mr. UNDERWOOD. I am very heartened by that because I don't want people to think that they are contributing to oyster beds by throwing beer bottles into the water, or dumping cars into the water, or any of these other things which sometimes I fear—you know, sometimes we will hear various businesses say that they are going to contribute with these artificial reefs.

In your statement, also, you mentioned that viable oyster populations have been re-established even in the presence of Dermo and

MSX. Why is this? Are these populations genetically different, or is an increased survival rate attributed to environmental factors in those areas that you are studying?

Mr. LUCKENBACH. Very good question. The most striking case of this is our series of experimental reefs that we placed right at the mouth of Chesapeake Bay, in Fisherman's Island National Wildlife Refuge. That is an area that has the highest incidence of disease that I can find anywhere in the Chesapeake Bay. One hundred percent of the oysters that have been through a summer are infected with Dermo, and MSX every few years comes in and kills quite a few of them.

The why it is is that, for one, Dermo has actually always been with us, and we can't do a lot about it. We can't slowly and progressively build some disease-resistant animals. What we did and the why it is is we provided a reasonable substrate in the right configuration, some good protection from predation, and we did the only other thing you can do. There has been zero harvesting on those reefs. And many, many oysters have died from disease. And I don't want to minimize the importance of disease. When these diseases come in and hit an oyster bed or oyster reef, they kill enough of them that there is clearly no longer in many cases commercially viable quantities of oysters on those reefs, but there are always oysters left. It never kills 100 percent of them. And it is those ones that it didn't kill that are so important because they are the ones that spawn the next year. So, the ones in particular that I was talking about are reefs that have been out there for six and 7 years now, and they have six- and 7-year-old oysters on them, and every year some oysters have died from disease. But it is so critical to leave the ones there that are disease-tolerant—not completely disease-resistant, but they are disease-tolerant—and the population is gradually becoming more disease-resistant, but that is what I attribute it to. In the end, all we can do in the short-term, is put out materials and manage the harvest.

Mr. UNDERWOOD. In your estimation, are we spending enough resources on trying to deal with the diseases themselves as opposed to the whole issue of finding an appropriate habitat?

Mr. LUCKENBACH. No one has had for some time now the Oyster Disease Research Program, and I think they have made some very good advances. And there is not one of my colleagues that would tell you they couldn't make more if they had more money. You know, at some point, there is a limit to that.

I do believe that we have—as well, we have spent some money of State, Federal and private, on evaluating new materials for habitat. I think we need to do more in the latter, more importantly there, because that is something we can do. Diseases we can do a little bit, but they are out there and it is part of the environment.

We can improve the habitat that we put out and, very importantly, we need, as we have said earlier, we need to improve the monitoring that we are doing, not just come back a year later and say are there oysters on there or not. We need to be able to look closely so we can do adaptive management, and we can add a little more substrate, and we need to add oysters in a place that we haven't, brood stocks where we haven't added them. We need to understand the circulation patterns so we know why larvae aren't

coming back to that reef. It is that type of follow up on the actual sanctuaries that I believe is grossly underfunded right now.

Mr. UNDERWOOD. Dr. Roberts, on the MPAs, when you were evaluating the MPAs, did you also evaluate the institutional and the administrative framework of forming these MPAs as opposed to just the scientific evaluation, and if you made any kind of evaluation about them, could you share some of your findings?

Ms. ROBERTS. We talked about it quite a lot, as I think people recognize that it is not just the science that is important for establishing an MPA, you have to have the framework to put it together. And I think that the lesson we learned, when we went to the Florida Keys to hold one meeting, and I believe there was something like 20 different agencies involved in establishing just that one National Marine Sanctuary, and that is kind of a lesson learned in that this is not a simple task to bring all these agencies together.

To put a positive spin on that, though, I think it is a very good thing that in looking at an MPA where you are talking about local waters, State waters, and Federal waters, is that you do bring all of those groups together to talk about the implementation of the area. You know you cannot manage it without having all the players at the table. That includes all the agencies involved. It includes all the stakeholders. We know that you can't leave any stakeholders out because they are going to be very unhappy and cause trouble later down the road. Also, we know that if you bring the stakeholders in, they can help you. I think that was clear in what happened at the Tortugas. They brought people in who understood the fisheries in that area, what sites really needed to be protected, what areas may be more resilient and could withstand some fishing pressure.

So, the committee recommended that when you decide that you need a Marine Protected Area to meet your marine conservation goals, that the first step is to make sure you bring all of the relevant players to the table, and that is going to include all of the agencies involved.

Mr. UNDERWOOD. I think those insights are very critical because sometimes the tendency is in the fact of having to involve 20 agencies or 20 groups, the tendency would be, well, let us streamline it and give authority to one agency, and that necessarily won't yield the most desirable result and probably get a lot of resentment.

Just a last question to Mr. Grasso. I know that you mentioned a number of MPAs around the world, and one of the issues that I am very much interested in is coral reef restoration, and I know there are a number of areas in the world are having extreme difficulty with that. So, would it be your recommendation that there be greater use of MPAs in areas that are recognized as kind of biological hotspots, as in the Philippines and Indonesia?

Mr. GRASSO. Absolutely. We think that particularly given the number of threats facing coral reefs around the world, that marine reserves or Marine Protected Areas can play a vital role, in particular places where we are beginning to look at perhaps those reefs that are not being affected by climate change, but may provide the type of biological diversity functions and benefits that would otherwise be decimated by other threats, we think a focused

effort with these marine reserves and MPAs in those areas that are perhaps immune to climate change might in the long-run promote biological diversity that we may otherwise lose. So, there are a number of strategic approaches to dealing with threats to coral reefs and marine reserves can plan a very important role in that.

Mr. UNDERWOOD. Thank you, and sorry to bring up coral reefs, but maybe with enough climate change we will be talking about coral reefs in the Chesapeake.

[Laughter.]

Mr. GILCHREST. We will take coral reefs there. We have our own coral reefs in the oyster reefs. Thank you, Mr. Underwood. Mr. Owings.

Mr. OWINGS. Thank you, Mr. Chairman. Very quickly, Dr. Luckenbach, I was surprised that you mentioned oyster shell itself as a primary, very successful place to spat when we recreate these beds. That is not the question. And Congressman Underwood made a very good point. With 20 agencies involved—and this is the question—which we couldn't expect there to be one focal point for informational purposes.

I guess my question is this. The Bay has been fouled by man. It is man's responsibility to now clean, whether it is runoff, accidental spills such as happened, as we all know, up at Chalk Point, the daily dumping of boats discharging into the water and what have you.

I guess what I am trying to find out is if there is one place where we could go where the scientific information would correspond. We are well aware of the work done specifically with oysters down at CBL, Chesapeake Biological Lab, is historic, and it is ongoing as we speak, through all the individual capacities where research is done, gains that we have made in the Oyster Recovery Program at the State level, all of the agreements that we have had down through time, Maryland, our sister State and D.C., seems to me that we are losing ground. Tom, you won't agree with this, I know, but it seems to me that we are losing ground instead of gaining ground, and that is a sad commentary for all of our efforts. We are still dealing with migratory birds, so it is a whole host of natural resources that we try to deal with. I wish you could convince me that we are not losing ground, that in fact we are gaining ground.

Mr. LUCKENBACH. Well, the NGOs, including the Bay Program, have probably expressed similar opinion in recent years, that we are gaining ground in some areas and losing in others, and certainly Congressman Gilchrest gave examples of one near his home where there have been some clear improvements.

You did ask at the beginning of one place to go for information or where almost, I took it to be, is there a clearinghouse for the scientific information. Indeed, it is not all there, but I would suggest that the Chesapeake Bay Programs Office is, in fact, a good place for that. The Chesapeake Bay Program is a Federal-State partnership, and does maintain databases. Some of them get up there really on real-time, and a lot of effort particularly has been made in recent years to make the very informative Websites and real-time data available on there. And so I think that is an example of something in terms of sharing information that is working extremely well.

Mr. OWINGS. Thank you, Mr. Chairman. Mr. Chairman, I want to beg your leave. I have got a briefing at the nuclear power plant for security purposes at Calvert, so I would like to thank you very much for your kind hospitality today. I will certainly be reporting to the Chairman of the Committee.

Mr. GILCHREST. Thank you, Mr. Owings. And that is an excellent question. Very often information like the environment is fragmented, and we will work with you and the Chairman of the Committee and the Committee, certainly, to, as we move through this enormous undertaking but important endeavor, we will make sure that that flow of information is efficient and timely. Thank you, Mr. Owings.

Mr. OWINGS. Thank you again, sir.

Mr. GILCHREST. I just had one sort of follow-up question dealing with what Mr. Underwood raised as far as MSX and Dermo and can you develop a disease-resistant oyster, and also a follow-up question to that is, I understand, that Virginia is or has introduced an experimental Japanese oyster. What is the status of that project? Maryland, I think, has yet approved of that, and I know that the introduction of the Japanese oysters are sterile. Can we count on the fact that there won't be any reversal of that while they are in the water—and that is a loaded question—but as far as the disease-resistant oysters, is there any sense that—and we know that one or both of these diseases have been in the Bay for a long time or, if not, since the beginning of time, and there wasn't any evidence of its difficulty with oyster reproduction and oyster health until maybe 60, 70 years ago, or at least until this—I was going to say this century—the previous century, the 20th Century. Is there any inkling of understanding whether or not the disease-resistant oyster is disease-resistant because of its size, its age, or its volume, where it might be located?

Mr. LUCKENBACH. I will certainly tackle the first part of that, the native oyster disease, first. Absolutely, we can breed highly disease-tolerant oysters. In fact, going back quite a few years before I was even in the field, an MSX-resistant oyster was bred actually in Delaware Bay. It turned out that it was highly susceptible to Dermo and it grew very slowly. Primarily with funding from NOAA for about 12 years now, we at the Virginia Institute of Marine Science and University of Maryland, in partnership with the University of Delaware and Rutgers University have been involved in a selective breeding program that has resulted in an oyster, at least one and probably two strains of oysters, that is highly resistant to MSX. It is quite resistant to Dermo. Dermo is a slow, sort of infectious disease, and eventually they can get Dermo. And it is rapid-growing. We developed that oyster with aqua-culture in mind. In order to sustain it, you have to keep breeding it in a hatchery.

The notion of being able to use that in restoration is somewhat of a newer one. As low as oyster stocks are in the Bay, if we took and threw these few of them out that we have, of course, they would just get overwhelmed by the wild stocks. That is why we have been ramping-up production of these disease-tolerant animals, and we have developed, as I mentioned in my testimony, a genetic tool that will let us try to track over several oyster generations

whether or not the genes from these oysters get incorporated into the wider broad population. A part of that, is part of your question, is oysters that are resistant to diseases, particular diseases, seem to be so for the same reason that some humans might be to a particular disease—that is, their immune system is just able to fight it off. They have to have a good immune system and they have to be healthy. So, some of the increased impact of Dermo is probably due to unhealthy oyster populations and unhealthy individuals.

The other question that you asked, which I am sure the day will come when the subcommittee will probably hold hearings on exotic oyster species, I would assume, related to the work in Virginia with a non-native oyster. In fact, the Virginia Institute of Marine Science has been doing experimental work with two different exotic oyster species, one often called the "Japanese" or "Pacific" oyster species, which we found, frankly, not to grow very well in the Bay, and then over the last three or 4 years, 5 years perhaps, with the Southern Asian oyster that, working in short-term experiments with sterile individuals, we found actually performed and grew very well in the Chesapeake Bay.

Over the past 2 years, the Virginia Marine Resources Commission, the Fisheries Management Agency, has permitted limited small trials with sterile triploid animals by our industry. It is unclear at this time whether or not they would be willing to permit the large use of sterile triploids. It is the general feeling, I believe, of the Virginia Institute of Marine Science and the scientific community, that a large-scale introduction or use of sterile triploid animals in aquaculture right now would entail significant risk of an unintended introduction of reproductively capable animals, either by the reversion that you spoke of or by mistakes that occur in a hatchery. And at this time, there certainly aren't any plans by the Virginia Institute of Marine Science—which would not be the organization that would actually introduce them—to either do such an introduction or to support a large-scale introduction of either reproductively capable animals or of sterile ones without an extremely high bar on biosecurity set to ensure that there would be no accidental release.

Mr. GILCHREST. Is there a difference in the spat from an oyster—how long do oysters live if you didn't harvest them?

Mr. LUCKENBACH. Some can certainly live as long as 50 years.

Mr. GILCHREST. Is there a difference between oyster spat from an oyster that is 30 years old and an oyster that is 3 years old, as far as its ability to reproduce, its ability to be resistant to disease, those kinds of things?

Mr. LUCKENBACH. A very good question. An oyster that maybe not just because it is 30 years old, but if it is 30 years old and it has lived those 30 years in an area of the Bay that has MSX and Dermo, then that means that adult was resistant to MSX and Dermo. What we find is that if the parents were resistant to MSX, the offspring are very resistant. If the parents were resistant to Dermo, the offspring are more resistant than average, but not necessarily completely.

Mr. GILCHREST. So then a volume such as a large oyster reef with old or aging or much older—certainly older than three or 4 years—oysters would have a pretty pronounced effect on those oys-

ters to begin to show great resistance to both diseases, and is there any correlation to that and the way that the oyster reefs and the reproduction levels used to be 100 or 150 years ago?

Mr. LUCKENBACH. Absolutely, yes. I think you just hit it on the head right there.

Mr. GILCHREST. So there is some need for, then, sufficient areas to be put in sanctuaries so this type of disease-resistant oyster can happen after we sort of kick-start it, over a period of time.

Just a quick question about Japanese oysters. Is the experiment with Japanese oysters for the purpose of providing a harvestable oyster for commercial activity, or for its introduction to the benefit to the marine ecosystem and water quality, or both?

Mr. LUCKENBACH. Well, first of all, just for clarification, we actually are no longer experimenting with what is commonly called the Japanese oyster. We are working with the Southern Asian oyster.

Mr. GILCHREST. Southern Asian oyster.

Mr. LUCKENBACH. The press, I think, has called it the Asian oyster. Our experiments, I think, are fairly—are just to gain the knowledge. There are those that have suggested that its application could be in either one of those lines that you propose. I think the scientific consensus would be that the most prudent use, if any, would be in a very controlled aquaculture setting that would increase harvest, and not that we yet know enough to think that we could dump another oyster in and try to restore what we used to have.

Mr. GILCHREST. Thank you, Dr. Luckenbach. Any other comment, Dr. Roberts, Mr. Grasso?

Mr. GRASSO. I would just add, Mr. Chairman, that our experiences with non-native species and their interaction with native marine species is one that suggests that we have to be very careful in proceeding down the road, of using non-native species of oysters in the Bay, and the tale of North Atlantic salmon and the impact of farmed Atlantic salmon on the wild stocks of North Atlantic salmon should be a cautionary tale for those of us on the Chesapeake Bay, when it comes to oysters and trying to breed disease-resistant oysters.

Mr. GILCHREST. Thank you. Mr. Underwood?

Mr. UNDERWOOD. No questions.

Mr. GILCHREST. Dr. Luckenbach, Dr. Roberts, Mr. Grasso, thank you very much for your testimony. It has been very helpful here this morning, and we hope to continue to carry on our dialogue with all three of you. Thank you very much.

Mr. GILCHREST. Our third panel this morning is Mr. Charles Frentz, Oyster Recovery Project; Mr. Sherman Baynard, Past Chairman, Maryland Coastal Conservation Association; Mr. Mike Hirshfield, Vice President of Resource Protection, Chesapeake Bay Foundation; Ms. Karen Oertel, President, Harris Crab House, and Mr. Larry Simms, or perhaps a representative of Mr. Larry Simms, or perhaps not.

Welcome, ladies and gentlemen, to the hearing this afternoon. We look forward to your testimony and your input on how we can proceed in this most important endeavor with this project.

Mr. Frentz, you may begin, sir.

STATEMENT OF MR. CHARLES FRENTZ, OYSTER RECOVERY PROJECT

Mr. FRENTZ. Thank you, Mr. Chairman. I am Charlie Frentz, the Executive Director of the Oyster Recovery Partnership. We are the nonprofit organization you keep hearing about today. We are basically the organization where "the rubber meets the road". We are the ones that implement a lot of these scientific and environmental programs you have been hearing about this morning.

There are a lot of questions that I would like to answer for the panel, so instead of having prepared remarks, I think I would like to try to embellish some of the comments of some of the other panelists for you, and clarify some of the issues involved with what is actually happening out in the Maryland waters of the Chesapeake Bay.

Mr. GILCHREST. That would be wonderful, Mr. Frentz. We will make sure that your testimony is included in the record.

Mr. FRENTZ. The Partnership works with everybody involved in the process, from the Federal agencies to the local agencies, State agencies. We also work closely with a lot of the foundations and the public at-large.

A lot of the projects that we do are very large in scope. The philosophy of the Oyster Recovery Partnership is to take these oyster resources to a different level as far as restoration is concerned. We wear two hats, one is an environmental hat and one is certainly to bring back the oysters for the watermen in the area. And if I don't get in too much trouble, I will even try to speak on behalf of Larry Simms and the watermen. There are no watermen representative here, but Larry is one of our board members, and I am intimate with his philosophies and statements as to the watermen's concerns and issues with oysters. I know that is going to get me in a lot of trouble, but I will try to, anyway.

We have got two hats. One of them is certainly for the sanctuaries which could be considered an MPA, and we are not just haphazardly picking these sites anymore. On Monday, Mr. Chairman, you saw a little bit of the Partnership's work over on Kent Narrows, and before we did that planting on Monday, we actually put out about half-a-million oysters onto a sanctuary that we produced last year from the Chesapeake Bay Trust.

This took us about a year to put this sanctuary in place. We had public hearings. We talked to all the watermen involved. We talked to the scientific community and got their technical advice. We worked closely with Maryland's Department of Natural Resources, from the permit process, using their experience as to where other sanctuaries had gone. We picked the site selection through some of the new technologies being brought to bear by NOAA and the Oxford Lab under Maryland's Department of Natural Resources, with side scan sonar and bathymetry. So, we don't haphazardly go out and pick any of these sites anymore, we actually go in and take a side scan sonar of historic areas, use the experience of the watermen as to where these sites, using their experience—

Mr. GILCHREST. Where is that site that you just—

Mr. FRENTZ. This site is in Eastern Bay that we put in last year. So, with all of this technology to bear, the experience of the watermen and folks from the Department of Natural Resources, we

identified areas that would have the best chance of survival around all these disease pressures and the ecological pressures throughout in the Chesapeake Bay.

Last year, the Partnership had a record 38 million disease-free oysters that we put out into five areas. As part of that process and the grants that we had with NOAA, we actually had some scientific experiments wrapped around our actual implementation of these oysters. We took four strains, two local strains, one called "cross-breed" which Mark talked about before that is being developed by VIMS, University of Maryland and Rutgers, and the strain from the Gulf waters called "France". We took these four strains and placed them in two different areas in the Chesapeake Bay, in the high salinity areas in Tangier Sound, and in the lower salinities in the Choptank River, and we put them side-to-side at 1 million oysters per acre density. We did a 5-acre site in Tangier Sound and about a 20-acre site in the Choptank. So, this organization implements all of the aspects, all the expertise, all the experience that can come to bear, and is actually putting these things out in the water.

This year, we put 55 million disease-free oysters at 16 sites, ten were sanctuaries and 6 of them were these managed reserves that I would like to get into a little bit later. These oyster sanctuaries, again, we picked the site selections, but we don't haphazardly just put the oysters in the water either.

With the advice and counsel of everyone, we go out and, in some instances, actually bar clean these sites where we will try to get the oyster shells that are under the sediment up out of the water column. We will then go in and spend a lot of money, sometimes leverage money from the Army Corps, sometimes Foundation money, sometimes NOAA money, to make a 3- to 6-inch shell base above that reclaimed oyster shell. And we do all of that before we put on a layer of these disease-free oysters that are baby oysters set on spat-on-shell. Most of this work is done in the hatchery by the University of Maryland at their Center for Environmental Science near Cambridge.

All of this work is done—the sites themselves are picked around disease pressures, but in the case of sanctuaries we know the diseases are going to impact them, so the monitoring money that you were hearing about, all of the programs we have now, does institute some of these monitoring monies. We will not put anything out in the water that we are not going to monitor in the future. It does us no good to just haphazardly throw something out in the Chesapeake Bay and hope that something good is going to come out of it.

In fact, Dr. Ken Painter is in the audience here. He is taking the lead for guidelines for monitoring and guidelines for what success actually means on sanctuaries, and these reserves that I would like to talk about now.

The Partnership put about—

Mr. GILCHREST. Reserves and sanctuaries are the same thing.

Mr. FRENTZ. They are not. However, if I could get into the watermen's viewpoint on some of these issues, the watermen have taken a 180-degree turnaround about what their opinion is on sanctuaries. They do see them as a benefit to their harvestable

areas. And the monies that the Oyster Recovery Partnership is spending on what is called a "managed reserve" has also taken a major change.

We go in and pick these sites with the experienced watermen and the Department. We go in and pick areas where there historic areas where they had a proliferation of oysters. We will go in and bar clean them. We may put a base of 3 inches of additional oyster shell on top of that, and then put the spat-on-shell on top of that area, the same type of thing that we are doing with the sanctuaries.

The sanctuaries will have a density of about 2 million oysters per acre. The sanctuaries will have a much larger base to start with, to try to create a reef structure. The object of the managed harvestable reserves is such that we know they are eventually going to come in and take these animals—catch these animals for harvest. So, we don't spend as much money on the base of an operation in a managed reserve. However, the watermen have done something that is very, very unusual.

In the last year, through Larry Simms' help and the Maryland Watermen's Association, they have agreed to close these areas for three to 5 years. They will be monitored for disease pressure and grow-out. They have also agreed not to take anything but a 4-inch or larger oyster off of these managed reserves. And this is a very important point to make. They are actually contributing largely to this tenfold increase we have all been talking about. These managed reserve areas will be the size of 5-to-100 acres, where sanctuaries, we are trying to create sanctuaries of a minimum of 1 acre to 5 acres. So, the managed reserves are actually a mini-closed sanctuary for a while.

They have also agreed not to take all of the oysters off of these managed reserves, they are only going to take a percentage, in agreement with Maryland's Department of Natural Resources and the Partnership. So, these will be self-sustaining harvestable areas—in essence, many reserves—also helping to propagate additional oysters in the water as a sanctuary does.

This is a major change in philosophy for the watermen in the Maryland waters of the Chesapeake Bay. So, this oyster that Mark was talking about is an animal that we looked at and have been discussing for a couple of years. The Partnership would like to make it very clear we have not given up on our local oyster. We think that we can work around these disease pressures. We do believe that we can manage the harvest with the watermen. We do believe that we can site-select sanctuaries in areas where they will grow and create these reef structures that we need.

The Partnership does something else. There are a lot of questions about is the public involved. Last year, we had over 12,000 volunteer hours involved with our process, helping us. We work with all of the Foundations, like the Chesapeake Bay Foundation. I see my yellow light.

One thing I would like you to know that we do do, we have logistically upgraded our entire program. We now have stainless steel containers, Mr. Chairman, I think you saw on Monday. We are able to put tens of millions of oysters into proper areas in the

Chesapeake Bay to try to make a real difference out there. I will end my comments at that point. Thank you, Mr. Chairman.

[The prepared statement of Mr. Frentz follows:]

Statement of Charles S. Frentz, Executive Director, Chesapeake Appreciation, Inc. doing business as Oyster Recovery Partnership

Introduction

Thank you, Mr. Chairman, and members of the Subcommittee for allowing me to present testimony at today's hearing. I am Charlie Frentz, Executive Director of the Oyster Recovery Partnership (the Partnership). It is my pleasure to be here today to discuss the work of the Partnership in restoring viable oyster populations to the Chesapeake Bay. I am aware of the testimony of several other presenters this morning, so to ensure brevity and a minimum of redundancy regarding the historical and scientific factors related to current oyster resources, I will direct my remarks specifically to the current impact of our efforts and the future goals of the organization.

The Oyster Recovery Partnership and its Mission

The Partnership is a 501(c)(3) nonprofit organization formed in 1994 by the Oyster Roundtable to oversee and manage oyster restoration projects in the Maryland waters of the Chesapeake Bay. The Oyster Roundtable represents a consensus of scientists, environmentalists, watermen, private industry, local and state government and the public. These prominent industry representatives identified the critical need to restore sustainable oyster populations in the Chesapeake Bay and mandated the Partnership to develop and implement restoration strategies.

The Partnership's Game Plan

Over the last year, we have matured into an extremely professional organization with a no nonsense business approach to restoration. Last year, the Partnership planted a record 38 million disease free spat on shell (baby oysters averaging the size of a thumbnail) at four major sites in the Choptank River, Eastern Bay and Tangier Sound. Our 2000 program exceeded the organization's previous six years of effort.

This year, the Partnership planted over 55 million disease free oysters at sixteen major managed reserve and sanctuary sites throughout the Bay (see addendum). We also helped our partners move or plant an additional seven million oysters.

Our game plan is simple, although the challenge is enormous. Create large, self sustaining sanctuaries and managed harvest areas on historic oyster producing sites that have the best chance to survive and propagate despite the extensive disease, harvest, environmental and demographic pressures affecting the ecology of the Bay.

Our Partners

Our strength and success is derived from the tremendous expertise and support we garner from our many partners. The University of Maryland's Center for Environmental Science (CES) produces the millions of disease free oysters for our projects. Maryland's Department of Natural Resources has partnered with us on several plantings and provides public hearing, permitting and technical support at all levels. Watermen and industry business render field and logistical expertise. The environmental community, local associations and several scientific advisory committees provide technical support. Community associations are actively involved in our plantings and hundreds of volunteers work with our staff.

The Partnership now has financial and management support from a wide range of interest groups spearheaded by dedicated Congressional funding managed by NOAA. Congressional funding and NOAA expertise has exponentially increased the Partnership's ability to upgrade spat on shell production in association with Maryland's CES. This high level of support has substantially upgraded the organization's ability to logistically handle multiple major planting operations. We can't emphasize enough the tremendous assets NOAA brings to oyster restoration through professional management and hands on field expertise.

We also have direct funding and leveraged support from a wide range of supporters such as the Chesapeake Bay Trust, the National Fish and Wildlife Foundation, the Army Corps of Engineers, the Campbell Foundation for the Environment, the Chesapeake Bay Foundation, the Environmental Protection Agency, and over a dozen regional associations, commissions, community groups and corporations.

MPA's, Sanctuaries and Managed Harvest Reserves

Our bottom line job is to develop, implement and manage oyster restoration projects that have the best chance of making a discernable impact on the Chesa-

peake Bay. The Partnership's program involves two distinct oyster restoration processes that address the ecological, economical and political interests of all our partners. These restoration projects have many similarities to the Marine Protected Areas being addressed at this hearing.

Sanctuaries: The Partnership has targeted the development of oyster sanctuaries ranging in size from one acre to five acres to create an area able to provide self sustaining reef structures. These sites are chosen through a detailed process of public and private meetings identifying the best available sites. Criteria for site selection address a variety of factors including probability of creating a viable living reef structure, disease pressures, natural recruitment potential, sites in proximity to commercial and leased bars but buffered from harvest areas, and areas in closed parts of the Bay seeking oyster communities for their filter feeding and water clarity advantages.

Tremendous effort is placed on areas with solid substrate. These areas are usually embellished with a three to six inch plus layer of cultch before planting disease free oysters at a density of 2 million oysters per acre. This level of effort has proven to be necessary for the development of a viable reef structure creating a diverse benthic community.

Well-developed structures of this size in protected and buffered areas will have a much better chance of withstanding the impact of storms, environmental stresses and inadvertent harvest.

Managed Harvest Reserves: The Partnership's mission to help bring back the health of the Chesapeake Bay also includes efforts to revive the commercial harvest of watermen that is so important to the economy, culture and history of Maryland.

Restoration design for commercial harvest areas have evolved as temporary closed reserves for a period of three to five years, with subsequent closures required after partial harvest of the restored bar. Multiple managed areas are being developed with a minimum five to one hundred acres on historic oyster bars that have the best chance of withstanding current disease pressures. These areas also have the potential for natural recruitment.

The watermen's experience and consent is a strong component of site selection, together with public hearings, Maryland DNR oversight and scientific and technical advise. Managed harvest bars are prepared through a combination of bar cleaning to recoup and place existing shell, barging in and laying additional shell bases of three inches for sites needing added bottom preparation and spat on shell plantings at densities of one million per acre.

These bars will be monitored during closure periods for disease pressures and grow out. Commercial watermen have agreed to allow these animals to reach four inches before harvest. A predetermined percentage of harvested oysters will be allowed before each site is again closed.

This technique has several distinct benefits in comparison to the current put and take commercial harvest practices in the Bay. Taking only four-inch oysters turns these structures into long-term self-sustaining oyster bars performing the additional function as natural recruitment areas. Watermen also recognize the substantial increased market value of a four inch oyster compared to the legal industry standard three inch catch.

Bar Cleaning, Seed Bars and Alternative Core Materials

To maximize the regions ability to recoup finite supplies of mined oyster shell, the Partnership has worked with NOAA to institute bar cleaning projects. This program involves the identification of outstanding areas for restoration that have large deposits of shell under layers of sentiment.

These sites have been identified through a combination of new side scan sonar and bathymetry technologies developed and in use by NOAA with the support of Maryland's DNR at the Sarbanes Laboratory in Oxford, Maryland.

Bar Cleaning: This Partnership initiative, supported by NOAA funding, is a cost effective management tool to prepare the widest range of viable historically productive oyster bars. This technique was used very successfully in year 2001 for managed harvest areas, potential seed bars and several sanctuaries.

Regional watermen and their vessels have been subcontracted through management oversight by the Maryland Waterman's Association to use a variety of techniques and gear types to properly retrieve and place sediment covered shell. An added bonus of this program has been the retrieval of scattered mature oyster brood stock usually deeply imbedded in heavy sediment. These animals are then returned to their resident bar in densities the scientific community deems could have tremendous natural recruitment for the area.

In addition, some of the mature oysters, between four and twelve inches, have been transferred to the CES hatchery as brood stock. Spat on shell from these ani-

mals will be placed back on their specific bar in hopes the progeny produced will be more tolerant to the local disease pressures.

Seed Bars: NOAA support of the Partnership's seed bar restoration program has worked with watermen to identify and restore large potential bars for the natural recruitment and transfer of oyster seed at targeted areas of the Bay. Management around disease pressures and the new bar cleaning techniques are vital factors in determining the best possible sites.

Alternative Core Materials: Concentrated efforts by the Partnership, Maryland's Department of Natural Resources and the Chesapeake Bay Foundation are currently experimenting and acquiring alternative core materials to complement our restorations programs to offset questionable future supplies of cultch needed to build up natural oyster bars and sanctuaries.

Conclusions and the Future

The coordinated efforts by our many partners is beginning to the show promise of making a discernable difference in helping to bring back the health of the Chesapeake Bay through oyster restoration. Our new site identification, planting and bar cleaning techniques, acquisition and use of new technologies and the logistical upgrading of the Partnership's field operations are on the right track. The Partnership can make exponential increases in our program if we:

- Continue to use the experience and counsel of our many partners and leverage their support of our efforts.
- Continue to upgrade the logistical ability of the Partnership to produce and plant substantial increases in disease free spat on shell at viable restoration sites.
- Acquire and use state-of-the-art scientific equipment and experienced techniques to promote cost effective program management.
- Continuously promote improvement and alternative choices in acknowledgement of the evolving dynamics of the ecology of the Bay.

Thank you, Mr. Chairman, for this opportunity to give an overview of the work and progress of the Oyster Recovery Partnership. I would be pleased to answer any questions from you or your subcommittee.

Mr. GILCHREST. Thank you very much, Mr. Frentz.

Mr. Baynard.

STATEMENT OF SHERMAN BAYNARD, PAST CHAIRMAN, MARYLAND COASTAL CONSERVATION ASSOCIATION

Mr. BAYNARD. Good morning, Chairman Gilchrest and Congressman Underwood. My name is Sherman Baynard, and I am here today on behalf of the Coastal Conservation Association. Mr. Chairman, I would like to insert my full statement for the record, and make a couple of comments.

CCA is a national organization with some 80,000 members on the Atlantic and Gulf Coasts who are concerned about the conservation of marine resources. Today I would like to address the costs and benefits of using Marine Protected Areas to help recover oysters in the Chesapeake Bay.

Although fishermen have long supported use of time and area closures to protect fish spawning aggregations or juvenile fish populations, CCA's membership and most of the recreational sector are deeply troubled by the rhetoric being used by some organizations to promote Marine Protected Areas.

The recreational fishing experience depends on two essential ingredients, access to places to fish and availability of fish at those places. For a number of years, the recreational sector has invested heavily in both ingredients. Recreational fishing taxes have contributed millions of dollars through the Wallop-Breaux program and much of this has been spent to improve angler access to places to fish.

Additionally, recreational fishermen have led the fight to conserve America's marine fisheries. Striped bass, weakfish, redfish, and Atlantic shad are all recovering as a result of the efforts of recreational fishermen.

We have worked alongside, and inside, the existing State and Federal fishery management systems using all of the traditional fishery management tools—size limits, creel limits, quotas, seasons and, where appropriate, area closures—to recover our fishery resources from past periods of overexploitation.

Before I get to the use of MPAs in the oyster program, let me provide you with some suggestions about how to establish some parameters for the use of MPAs.

First and foremost, Congress needs to define the term. Everybody today has a different definition of an MPA. After we define the types of MPAs, we need to develop a specific process that must be used before one can be put into place in any marine environment.

Let me suggest some parameters that ought to be discussed in defining the various types of MPAs. Terminology shouldn't be vague. Terms like "marine parks", "marine sanctuaries", or "marine reserves" convey widely different messages to different audiences.

Any MPA should specify up front the activities that will be allowed and those that will not. For our purposes, it should explain exactly what forms of fishing will be allowed and what forms will be prohibited.

Any MPA should specify a purpose that can be supported scientifically. While closed areas may produce more fish at a given location, they may not allow more fish to be harvested from the same ecosystem.

Any MPA should specify its duration—is a closed area to be temporary or permanent.

The process ought to include scientifically valid biological objectives to be achieved through the use of MPA. A finding should be required that less draconian measures will not achieve the biological objectives. Lastly, there should be a Sunset provision to remove the restrictions when the biological objectives have been met.

Now let me address the issue of MPAs in oyster restoration and management. Millions of dollars have been spent to restore oyster populations in the Chesapeake Bay without significant success. Much of the money has come from Federal and State taxpayers who support these programs for three reasons—oyster restoration provides for economic development of the industry, improved water quality in the Bay, and the natural inclination to return the Bay to its full abundance. We support all of these reasons for oyster restoration.

The present problems with oysters in the Chesapeake Bay result from disease, water quality and over-harvesting. The most effective immediate action we could take to improve water quality would be to reduce the removal of menhaden within the Chesapeake Bay.

Finally, the possibility of establishing closed areas to rebuild oyster populations should be examined. Temporary MPAs have proven successful in rebuilding scallop populations in New England, but those areas were closed only to bottom-trawling and dredging, while all other forms of fishing were allowed to continue.

From what we have heard, however, the MPAs being discussed for the Chesapeake Bay do not follow the New England model. We are opposed to the use of MPAs to restore oysters if they would prohibit fishing that has no impact on the recovery of the oysters or the water quality of the Chesapeake Bay. We see no benefit to a marine wilderness in the Chesapeake Bay. Thank you for the opportunity to testify, and I will be happy to answer questions.

[The prepared statement of Mr. Baynard follows:]

Statement of Sherman Baynard, Coastal Conservation Association

Good Morning, Chairman Gilchrest and members of the Subcommittee. My name is Sherman Baynard and I am here today on behalf of the Coastal Conservation Association ("CCA"). CCA is a national organization with some 80,000 members on the Atlantic and Gulf coasts who are concerned about the conservation of marine resources. Today I'd like to address the costs and benefits of using Marine Protected Areas (MPAs) to help recover oysters in the Chesapeake Bay. Frankly, we believe that many of the potential benefits of MPAs have been overblown and many of the negative consequences have been overlooked.

Although fishermen have long supported use of time and area closures to protect fish spawning aggregations or juvenile fish populations, CCA's membership and most of the recreational sector are deeply troubled by the rhetoric being used by some organizations to promote Marine Protected Areas. Statements like 25% of the mid–Atlantic ought to be declared off-limits to fishing and 5% of the marine coastal waters ought to be set aside as ocean wilderness areas have rung the alarm bell in the recreational sector.

The recreational fishing experience depends on two essential ingredients—access to places to fish and availability of fish at those places. For a number of years the recreational sector has invested heavily in both ingredients. Recreational fishing taxes have contributed millions of dollars through the Wallop–Breaux program and much of this has been spent to improve angler access to places to fish. Additionally, recreational fishermen have led the fight to conserve America's marine fisheries—striped bass, weakfish, redfish, and Atlantic shad are all recovering as a result of the efforts of recreational fishermen. We have worked alongside, and inside, the existing State and Federal fishery management systems using all of the traditional fishery management tools - size limits, creel limits, quotas, seasons, and, where appropriate, area closures—to recover our fishery resources from past periods of overexploitation.

The explosion in recreational fishing for these species has more than proved the point that sound conservation coupled with improved opportunities to fish will benefit our coastal economy. To cite just one example, today there is more economic contribution to the Maryland economy from fishing for striped bass than ever before. Expanding angler access is something the recreational sector, local, state and federal officials have been trying to encourage for twenty years. MPAs are unpopular because anglers believe they will be used to restrict their access to the fishery resources and thus deny them the benefit of their Wallop-Breaux taxes and their conservation efforts. Before 1 get to the use of MPAs in the oyster program let me provide you with some suggestions about how to establish some parameters for the use of MPAs.

First and foremost Congress needs to define the term. An MPA is defined in Executive Order 13158 to be "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." Under this definition, MPAs will include areas where oil drilling is prohibited, areas where sewage outfalls are prohibited, areas where some fishing is prohibited, areas where all fishing is prohibited, and areas where skin diving is prohibited. In practice, however, it seems that the current effort to establish

MPAs is focussed almost exclusively on fishing. Some groups have claimed that 20% of the fishable area in the US ought to be designated as a Marine Protected Area while others now argue for a 5% designation as ocean wildernesses.

Let me suggest some parameters that ought to be discussed in defining the various types of MPAs

1. Terminology shouldn't be vague - terms like marine parks, marine sanctuaries, or marine reserves convey. widely different messages to different audiences.

2. Any MPA should specify up front the activities that will be allowed and those that will not - for our purposes, it should explain exactly what forms of fishing will be allowed and what forms will be prohibited.
3. Any MPA should specify a purpose that can be supported scientifically - while closed areas may produce more fish at a given location, they may not allow more fish to be harvested from the same ecosytem.
4. Any MPA should specify its duration - is a closed area to be temporary or permanent.

If we. intend MPAs to be permanent wilderness areas, where no activity other than research can take place, then let's say so. If we intend MPAs to be nothing more than traditional time and area fishery closures, then let's say so. But, let's not continue to have this open ended discussion about something we have failed to define.

After we define the types of MPAs, let's develop a specific process that must be used before one can be put into place in any marine environment. The process ought to include scientifically valid biological objectives to be achieved through the use of the MPA. A finding should be required that less draconian measures will not achieve the biological objectives. Lastly, there should be a sunset provision to remove the restrictions when the biological objectives have been met.

Now let me address the issue of MPAs in oyster restoration and management.

Millions of dollars has been spent to restore oyster populations in Chesapeake Bay without significant success. Much of the money has come from federal and state taxpayers who support these programs for three reasons. Oyster restoration provides for economic development of the industry, improved water quality in the Bay and the natural inclination to return the Bay to its full abundance. We support all of these reasons for oyster restoration.

The present problems with oysters in Chesapeake Bay result from disease, poor water quality and over harvesting. There are a number of studies being done by the States of Maryland and Virginia on the disease issue. Work at VIMS developing new strains of disease resistant oysters looks promising but so much work in this area over the years has looked promising without producing any results that it is difficult to be optimistic.

The issue of water quality is on the minds of anyone who lives in the Chesapeake Bay watershed. The pollutant inputs from urban areas and agriculture have been well documented, but much less is known of how the Bay responds to increased pollutant loads. There is no doubt that restoring oyster populations would help restore the Bay's water quality, but an even faster way to improve water quality would be to stop harvesting menhaden on an industrial scale. A five-year moratorium on the harvest of menhaden for fish meal and oil would have an immediate and quantifiable impact on water quality.

There is also the issue of over-harvesting. The States of Maryland and Virginia could easily limit the harvest of oysters and Congress could provide relief funds to the industry to sustain them while the oysters recovered. The key is funding assistance to the industry while the stocks are allowed to recover.

Finally, the possibility of establishing closed areas to rebuild oyster populations should be examined. Temporary MPAs have proven successful in rebuilding scallop populations in New England, but those areas were closed only to bottom trawling and dredging, while all other forms of fishing were allowed to continue.

From what we have heard, however, the MPAs being discussed for Chesapeake Bay do not follow the New England model. We are opposed to the use of MPAs to restore oysters if they would prohibit fishing that has no impact on the recovery of the oysters or the water quality of the Chesapeake Bay.

Recreational fishermen are ready to conserve and are doing so everyday. This is a community that supports size limits and seasons to protect spawning fish; bag limits to reduce over-harvest and even limited closed areas when fishing effort needs to be reduced. We have endorsed measures like barbless hooks and complete catch-and-release when they are necessary to rebuild a stock. But, it is simply unacceptable to exclude recreational fishermen from an area without demonstration that recreational activity is having a negative effect on the resource.

Thank you for the opportunity to testify. I would be pleased to answer any questions.

Mr. GILCHREST. Thank you, Mr. Baynard.

Mr. Hirshfield.

STATEMENT OF DR. MICHAEL F. HIRSHFIELD, VICE PRESIDENT OF RESOURCE PROTECTION, CHESAPEAKE BAY FOUNDATION

Mr. HIRSHFIELD. Thank you, Mr. Chairman and Congressman Underwood. Again, as someone coming late in the panel, I think I will depart not just from my written remarks, but also from my written prepared oral remarks, and just comment on a few of the things that I have heard today, and the very few things that haven't already been said.

I am Mike Hirshfield. I am Vice President for Resource Protection at the Chesapeake Bay Foundation. We are a region-wide, non-profit environmental education and advocacy organization, partnering with just about everybody that has already been up here, and those that are here now, in restoring the Chesapeake and restoring oysters to the Chesapeake.

I was struck by Congressman Underwood's comments about Pocohontas. We have a tendency to date the understanding of the Chesapeake Bay with the arrival of Captain John Smith and the European colonists. In fact, what we know is that the Native Americans who lived here at that time were living off the interest of that endowment of the American oysters. They were living quite well. If you go to any of the oyster shells, you can see the size of the oysters that were consumed at an average Indian village, and they are quite large. They would definitely be two- or three-bite oysters.

It was the arrival of the European settlers that, in fact, started the consumption of that endowment, eating into the principal and, in fact, it could be argued that the first real invasive species that hit the Chesapeake Bay was the arrival of the New England fishing fleet that had pretty much wiped out their oyster beds and proceeded to show up in the Chesapeake Bay in the latter part of the 19th Century. That is what began the whole-scale mining of the Chesapeake Bay oyster reefs, and it really is a mining analogy that you have to think of when you think of what happened to the oyster reefs of the Chesapeake in the 19th Century. We removed all of that shell, all of that habitat, and we are suffering the lack of it even today.

It is also important to take a little bit of time for perspective on oyster restoration. I, like many of my colleagues here in the room, have been engaged in Chesapeake Bay restoration activities for quite some time, and I can tell you that only 10 years ago there were very serious conversations all around the region about the concept of a restored Chesapeake Bay without oysters. Could we have, could we talk about, could we talk about a saved Bay without oysters, because the future was seen to be that bleak.

I am just delighted that the experiments of the 1990's that started looking at rebuilding oyster reefs, setting aside sanctuaries, got us out of what had been a fairly sterile series of debates about what to do about the oysters. The management tools that people were talking about were the traditional ones. Think about everything you can do to restrict effort and, when all else fails, goes to a moratorium.

When the community realized that that would not work and started playing around with actually rebuilding reefs, that was the breakthrough. And Dr. Luckenbach did not take very much per-

sonal credit for his effort, and Ken Painter and Rich Tachas, who are also here, were part of that group of ten scientists who—it was a consensus of scientists, but if you have ever seen ten scientists in a room, getting that is a pretty amazing thing. This document that they produced in 1999 did aim not just the scientific community, but the management community all in the same direction for restoring oysters to the Chesapeake. It is at the core of the WRDA—it is at the core of the Corps' authorization. It is referenced in the WRDA authorization. This is the blueprint that Chesapeake Bay oyster restoration is following.

I also put out—I am not going to go into our picture of what it is going to take, but I put out a bunch of these "Restoring Chesapeake Gold" brochures that we put together on behalf of the community. I hope a few of them made it up to you guys.

A couple of other things. The public is really enthusiastic about oyster restoration. A couple of examples. The Hampton Roads Rotary Club folks have raised over $100,000 of private money to put toward oyster restoration in the Hampton Roads area and, as a result of that, four new sanctuary reefs have been established.

Similarly, there are hundreds of families and thousands of school children all over the Chesapeake Bay, who are growing oysters off of their docks, not eating them—which is pretty remarkable—and taking them out and putting them out onto those sanctuary reefs to help jump-start the reproduction that we are looking for. This is a way that people on the land are connecting themselves to the water, and we are seeing a lot of additional enthusiasm about what is it going to take to keep that water quality healthy, a question you were asking earlier.

I really would like to thank this committee for holding this hearing. In my mind, Marine Protected Areas with careful definition, careful thought about their goals that they are being established for are an extremely valuable tool. I haven't actually heard about proposals to close Chesapeake Bay area oyster reefs to fishing, although I have to say I identify a little bit with a couple of the scientists who said maybe one that was set aside so that we could see what a truly intact, pristine system would look like might be worth talking about.

It is an experiment. It is a great experiment that we are heading for, with a lot of enthusiasm, a lot of scientific backing, but if we knew all the answers it wouldn't be an experiment, and the challenge that we have got—imagine if those coral reefs that we are so proud of in the South Pacific had all been knocked down 100 years ago before there really was a mature science of oceanography, what we would be trying to guess we would do to put them back together to restore them. I am very, very confident that when we are successful in restoring oysters to the Chesapeake through this nicely, brilliantly simple scheme of small area for sanctuaries, large area for managed harvest reserves around them, that we are going to see good things happen to the Bay that we haven't even guessed yet. Thank you very much.

[The prepared statement of Mr. Hirshfield follows:]

Statement of Michael F. Hirshfield, Ph.D., Vice President of Resource Protection, Chesapeake Bay Foundation

Good morning. On behalf of the Chesapeake Bay Foundation (CBF), I would like to thank Subcommittee Chairman Wayne T. Gilchrest and the other members of the Subcommittee for this opportunity to present testimony on the use of Marine Protected Areas as a management tool in oyster restoration.

Before I speak about this important subject, let me introduce myself. My name is Michael Hirshfield. I am the Vice President of Resource Protection at CBF, which has its headquarters here in Annapolis, Maryland and offices in Virginia and Pennsylvania. CBF is a member-supported, non-profit environmental education and advocacy organization with over 90,000 members throughout the Bay watershed and nationwide. Our mission is to Save the Bay-to restore and protect the Chesapeake Bay and its watershed.

Marine protected areas have emerged as powerful tools for fisheries managers to restore not only the health of our natural resources but also the strength of the fishing industry.

On the Chesapeake Bay, Marine Protected Areas are essential tools in our effort to restore a keystone species and what was once our most valuable commercial fishery: oysters.

In the 17th Century, when Europeans first entered the tidewaters of what would become Virginia, they found a Bay teaming with so many oysters that the Native Americans had named it "Tschiswapeki" meaning Great Shellfish Bay. By the 19th Century, oysters were such a valuable fishery that watermen dubbed them "Chesapeake Gold." At the end of the 20th Century, overharvesting, disease and pollution had nearly eradicated the oyster, reducing their population by more than 99 percent.

The loss of oysters has hurt both the ecology and economy of the Bay. Oysters are essential to the bay as water filters, and were once capable of straining tremendous quantities of algae and sediment from the water every day. Their reefs once served as habitat for multitudes of other organisms, from shrimp and crabs to striped bass and other commercially and recreationally important species of fish. Watermen lost their most valuable fishery and have been forced to shift their fishing effort to blue crabs, jeopardizing the Bay's other top fishery in the process.

The Chesapeake Bay Foundation, the largest non-profit conservation organization dedicated to Saving the Bay, has set a goal of increasing the Bay's oyster population tenfold. Achieving that goal by 2010 is now the Baywide standard, agreed to by the governors of Virginia, Maryland, and Pennsylvania and the mayor of Washington D.C.

In 1999, the Bay's scientific community reached consensus on the best way to achieve that goal, drafting a strategy to jump-start the natural machinery that sustained the Bay's oysters for thousands of years. Their strategy was brilliant in its simplicity: Rebuild oyster reefs, stock the reefs with healthy oysters, and set aside the restored reefs and small portions of adjacent oyster grounds as protected areas. These areas then provide a continuous, long-term supply of healthy oysters to other oyster grounds managed for the benefit of the fishing industry throughout the Bay. Additionally, this jump-starting of oysters will allow the Bay's other natural components, such as underwater grasses that depend on clearer water for their survival, to take over and sustain themselves.

These oyster sanctuaries accomplish four key tasks:

First, they create an enduring source of young, genetically strong oysters for years to come. When first spawned, juvenile oysters are free-swimming and can be carried from their home reefs by tides and currents to nearby reefs where they settle and grow. Hence, strategically locating sanctuaries in areas surrounded by harvest areas creates a net increase in the number of oysters available for harvest. The strategy calls for setting approximately 10 percent of the Bay's traditional oyster grounds as sanctuaries.

Second, sanctuaries allow oysters to grow large and old enough to maximize their reproductive capacity. In oyster reproduction, size matters. Large oysters produce exponentially more eggs than small oysters. Thus, even small areas with large mature oysters can produce a sufficient supply of offspring to supply a large area used by the fishing industry.

Third, sanctuaries are essential to the battle against disease. Large oysters in disease-endemic areas have a demonstrated ability to survive diseases, a characteristic that may be inherited by offspring. We currently remove too many large, potentially disease-resistant oysters from the population, and lose some of the oysters' natural resistance to diseases in the process. Programs to collect large oysters and con-

centrate them on high=quality habitat in sanctuaries are an important part of the restoration strategy.

Fourth, sanctuaries create habitat for a wide range of organisms including the Bay's most commercially and recreationally valuable fish. In 1998, more than 60 percent of the Bay's commercial catch was in species that rely, at least in part, on oyster reefs for habitat. That translated to $37 million worth of total dockside value in Maryland and $20 million in Virginia. Oyster bars are great fishing spots and a key target for the nearly 5 million recreational fishing trips on the Chesapeake Bay each year.

This sanctuary approach is already showing success on the Chesapeake Bay. On the oyster grounds of Virginia's Great Wicomico River, for example, oyster restoration pioneer Dr. James Wesson of the Virginia Marine Resources Comm ission (VMRC) built a three-dimensional sanctuary reef in 1996.

Before building the reef, spat settlement (the number of juvenile oysters that settle on a square meter of each oyster reef) on nearby natural oyster grounds was well below 200 juveniles per square meter, indicating little likelihood that oyster populations would rebound naturally.

Working with the Chesapeake Bay Foundation and others, Dr. Wesson stocked the reef with hearty oysters bought from watermen. One year later spat settlement leapt to nearly 1,200 spat per square meter-a 600-percent increase. More importantly, spat sets on all nearby bars (up to 6 miles away) increased by as much as 400 percent - many of these areas were used as "seed beds" by the oyster industry that following year.

Another example, and one that demonstrates the public's support for Marine Protected Areas, is found in the heart of Hampton Roads Harbor, in Virginia. Since 1998, the Rotary Clubs of Norfolk and Portsmouth, VA have sponsored an annual fundraiser to raise money for oyster sanctuary reefs in the Elizabeth River. In the past four years, the Rotarians have helped to raise more than $100,000 in private matching funds used, resulting in the construction of four new sanctuary reefs in the Elizabeth and Lafayette Rivers. The reefs are now being restored by students and volunteers and managed by the VMRC. The reefs have dramatically increased the number of oysters in these two urban rivers and are becoming popular fishing places for the ' recreational anglers and commercial crabbers.

While we can't expect success rates like this all the time in all parts of the Bay, we can expect that sanctuaries will ultimately benefit not only the Chesapeake's ecology, but also the economy for those who depend on a restored oyster population.

Thank you again for this opportunity to showcase oyster sanctuary reefs as an example of Marine Protected Areas in the Chesapeake Bay.

Mr. GILCHREST. Thank you very much, Mr. Hirshfield.

Ms. Oertel.

STATEMENT OF KAREN OERTEL, PRESIDENT, HARRIS CRAB HOUSE

Ms. OERTEL. Thank you, Mr. Chairman, for asking me. I do want to say that Congressman Gilchrest had asked if I would address the Oyster Recovery Partnership, and I had asked you to allow Charlie to do it because he is the most knowledgeable. We hired Charlie about 2 years ago as the Director, and he has made a phenomenal difference with what we have been doing, very knowledgeable about what we have been doing and have coordinated a lot of efforts. So, thank you for allowing him to do that.

I asked you to allow me to address the processing industry side, which is what I am part of. So, as it has Harris Crab House here, it probably should say W.H. Harris Seafood. Harris Crab House is my other business that we started in an effort 20 years ago to stabilize our situation.

I am a member of the processing industry and, with that, we process oysters. We buy directly from the watermen and are connected with them. We have been in the industry since 1947, which means in December we will be entering our 55th year in this indus-

try. We are a family-owned industry. We process the oysters, we handle crabs. We buy directly from the local watermen, and I am going to put a whole new twist on what you have just heard. I think you are going to hear some things that you have not heard today, although I certainly agree with a lot, and almost entirely with what you have heard today.

We not only buy oyster product from people within—our oystermen within our own States, but we buy from ten additional States in an effort to supply the products that are used by our customer base that we have that is on a national level.

Yes, we are earning a living, but while we are doing that we are providing approximately 60 jobs within our plant, and we are also purchasing from watermen that affects about 300 watermen in the Chesapeake Bay region.

W.H. Harris Seafood has played an important role, an intricate part in stabilizing this industry in Maryland and its economy. We have always worked within the State in its quest to understand the problems of this industry, and have tried to help solve them.

We are one of the few that actually still are involved in a private oyster agricultural project in the Chesapeake Bay. Currently, I serve on the Oyster Roundtable, and I am serving on the Steering Committee of this group which guides some of the things that we are doing there, and I also serve with the Oyster Recovery Partnership and I am on the Executive Board of that, guiding the directions of many of the things that we do there.

Other owners of this firm serve on crab committees. We serve on the SAB committees. We are out in the State in every direction that we can with our concerns over the environmental issues and the economic issues of the oyster industry in the Bay.

We fully understand that each group that is testifying here today has important issues, and I am just going to make an attempt to give you a few from the processing industry.

Disease is one of the most important issues that we deal with. MSX and Dermo have succeeded in devastating most of the native oysters in the Chesapeake Bay. Oysters are living only in the upper part of the Bay regions in numbers. This is where we see most of the oystermen actually harvesting over the last few years.

Areas where watermen are currently able to work and find live product are primarily above the Chesapeake Bay on the northern side, in waters of lower salinity. Seed grounds are primarily found in the lower part of the Bay, south of the Bay, although some are found north of the Bay, very small areas around Parsons Island and a couple of others.

Of these areas, the Eastern Bay is widely affected by disease and has oysters that are stressed for the most part. If shucked for market, the yield per pint has been averaging only about 4 pints a bushel, which means that we can't make a profit on that oyster, we actually lose.

The Chesapeake River oyster which is currently being harvested by watermen, that is in the northern part, is producing a little better than 5 pints per bushel, allowing for a margin of profit in the marketplace. This is important for you to know as it sets the stage for our industry and its ability for the processors to make a profit and remain in this industry.

We use oysters from other States which we process that allows for a better yield per bushel, as much as 6 pints, allowing for a better profit. The Chesapeake Bay oyster that is purchased from local watermen is used primarily for rawbar shell oysters which allows us to have a market for the local watermen product and a reasonable profit.

What this means is that the watermen must sell us an oyster that is for rawbar market. It has to have a nice cup shell, it has to be clean of muscles, and there has to be a full measure in the container at our dock.

The problems that we see in the Chesapeake Bay that affect this industry, we must find a way to control and manage disease, that has been said. We must look at and explore new innovative ways to reach our goals in the Chesapeake Bay. Maryland laws and regulations do not allow for Maryland to be competitive in the market because we are not allowed to have private aquaculture, which adds additional stress to the processors in Maryland. We have only a 6-month industry in Maryland, while other States are able to meet the market demands year-round because of the private industry that they encourage.

The old wive's tale of eating an oyster in months of R, that are in the months with an R in it, has long since gone. Refrigeration put an R in every month, and allowing oysters to be consumed year round, and the public demands this of us.

Public versus private aquaculture of oysters—because Maryland does not encourage private aquaculture, it puts Maryland at a disadvantage to compete and to hold a place in the market. This does not allow for Maryland to meet U.S. demands for product in the worldwide market which we don't even address.

One hundred fifty years of regulations and laws that does not encourage an active private aquaculture of oysters in the Bay in the Maryland waters has failed to provide both economically and environmentally for the future of the Bay.

Issues that we have is lack of lease grounds. Good quality lease grounds. Larry Simms and I are currently working, talking, discussing a project that could allow watermen to be involved in this, creating a situation where we could have a co-op, allow for oysters to be taken off some private grounds, watermen growing it. That has not worked out yet, but we are starting to work on those ideas.

Lack of good seed to the private oyster grower. We can receive naturally-grown seed only after the public industry has obtained all that they need. Regulations set the bar too high to allow a good count of seed to be purchased by the private oyster industry.

Lack of hatchery seed that is produced. These are not available, period, to the private industry. Even if some of the seed was made available for private bottom or water column aquaculture, it will be difficult to encourage anyone to be brave enough to invest the capital with the threat of the diseases and its devastating effects on our oyster. We do grow oysters in the Magothy on private lease grounds, but they are in the best of what is available on hard grounds, and they allow for a reasonable survival rate. We put as much as $50,000 at times on those grounds.

Regulations. Can I have another few moments, there are a couple of things you have got to hear.

Mr. GILCHREST. Okay.

Ms. OERTEL. Thank you. Regulations on a national level from FDA that will require additional investment in the processing industry to meet their demands for a better, safer product for the consumer are at our doorstep.

I have an insert that will be in my packet that you will be picking up that is listed No. 1, and it will prove what is getting ready to happen to us.

How does this affect the Maryland processor? We currently depend on oysters from other States to survive and stay in business. Even if Maryland is not under that 60 percent goal that FDA is going to be looking at, guys, we purchase oysters from other States and actually process them.

Let me tell you what is going to—we will not be making—we are looking at about a $3 million investment in our industry in order to put the machinery in that will process the oyster under FDA regulations, that will allow us to compete in this country. We are not going to be making that investment because we have to depend on other States, we can't depend on Maryland.

We need to depend on Maryland to encourage this investment. We see oyster leases—and there is a fact sheet that you are going to have that will give you some facts that have come from the fisheries with DNR, on harvesting that has been going on since about 1975 to date, so you can see some numbers there. I would ask you to look at those.

There are restraints that we need. These are restraints that—well, I have lost my thought there. But, anyhow, the bottom line in this is that it is too much money for us to look at putting into an industry that has severe problems here in Maryland.

Facts about processors remain in Maryland. Information from interstate shellfish certified shippers lists. There are only about 30 of us currently listed as SP, shellfish processors, that are in Maryland. You could be a major processor with a building, a corporation like I have, or you can have a little truck that is on the road and be shucking them somewhere. We are one of the large processors. There are currently about seven of our size that are left in the State of Maryland. One of them is owned by a lady that is 80 years old, or more. There is no one in her family involved in that business. And when she becomes unable to run that business, it will cease to exist. Queen Anne County is already looking at purchasing that property as a museum for the water industry.

We also have another processor that will be going out of business December 31, 2001, unless something happens that miraculously will change his situation. Actually, I put $50,000 in his business last year to operate for the 2000-2001 season, or he wouldn't have opened his doors. He had exhausted all of his financial possibilities to even stay in business, and he is currently looking at what he will be doing January 1st, other than the seafood processing industry.

There is another one that we have been dealing with since my father's time. This is a family industry. We have been in it a long time. He is in such a financial crisis that he will be short-lived in this industry unless something turns around for him.

My receivables run in the neighborhood of $800,000. I have got news for you. They have eaten my oyster. I have nothing to get back. I could have one individual that would go up on our industry and not pay me, and I have worked an entire year or have created a situation that seriously jeopardizes my industry.

We are stressed to our limits right now. The effect on the watermen, the jobs and the economy that is produced by this industry is in serious trouble, but why do we stay? We care. We have a commitment to the watermen, to this industry, to the economy, and to the environment, but we are good business people and make no mistakes about this, we will not remain if we cannot continue a reasonable profit.

This is the first time I have ever made this statement publicly about my industry. We will not see our business forced into bankruptcy. We will be reorganizing into a more viable business, or sell the waterfront property that we currently own. These options would be of serious consequence to the watermen depending on a processor in our area. Selling it as a processing business with the problems we face doesn't seem to be an option. Who would want to buy it? Who would really want to take on the problems that we are currently dealing with here?

Losing the processing industry in Maryland has other consequences. The loss of the shell that is used in the processing industry for growing both seed and establishing these habitat areas and these sanctuaries that you are talking about is imperative to this industry, and that shell comes from the processing industry.

We just returned from Ireland, and one of the things that I brought back from the oyster industry—that is what we did. One of the things that I brought back from there was their lack of conch, their lack of oystershell. They have to use substrate of all different kinds. They use muscles. That is what they are growing their oyster with. It is known that an oyster is one of the best things—shell is one of the best things we can put in there.

A conclusion? It is with great regret that someday this family will be forced to leave this industry, but if we do not aggressively consider change in how we think and act in this industry, we will see our future—this will be what happens in our future. Things that we can do. All groups continue to work together, and we are doing that to provide for the opportunities that remain economically sound in this industry, while providing for the environment.

Address the change in the regulations and policies that limit our ability to compete nationwide in this industry. And there is Attachment 3 that you are going to see, look at it. These are issues presented by the DNR in conversations with legislators and industry. We have actually tried to come up with a couple of regulations last year, regulation changes that would allow for seed product to go out to agriculturists, private aquaculture. We were unsuccessful entirely on one. It was pulled out of committee. It would have been the best. But the second part of it was that we did get one bill through to grow some seed in some containers for private aquaculture use, if you wanted to grow it but, unfortunately, they set us off of the areas where seed actually grows. So, there is concern if you went to put a container in to try to grow seed oysters, you

are not in the best areas to do it, and certainly would not have a good return on your time.

You need to provide and encourage oyster aquaculture and farming in the Bay, both on a private and a public level. Increase your hatcheries' ability to provide seed oysters in a farming pursuit. Horn Point, increase production. Piney Point, upgrade the facility allowing for higher production, and private hatcheries, encourage them in the State and in Virginia. Use and increase the sanctuary and the recovery area plantings of oysters in the Bay currently being organized by the Oyster Recovery Partnership. Embrace the importance of the shell conch that is used in production of oysters, and enhance the ability to be able to supply the shell for this purpose.

Maintain and improve the fossil shell operation, its dredging operation. It is very important to what we are doing in Virginia and Maryland. Use an alternative substrate, and wouldn't it have been interesting, out of something so horrible which happened at the Pentagon, that that substrate could be used for something so good in the Chesapeake Bay.

Continue to use scientists to find an oyster that will have disease resistance in a natural product, and use all methods available to put it in the water. Consider the approach of VIMS with the nonnative oyster that we are currently studying. Encourage Maryland to do some of the studies under the VIMS regulations that are currently there. Maryland is not doing it. Maryland needs to be actively involved in this.

Provide funding to recreate habitat areas and oyster reefs, and put grasses back in the Bay and protect these. Know the history of this Bay. There is a good book to read. It was put out by John Brooks. It is called The Oyster. You want to know what happened. Read it. The writing was on the wall in the late 1800's. The prediction was made what was going to happen to the Chesapeake Bay. It is there.

Those knowledgeable of the situation in the Bay both environmentally and economically acknowledge that the oyster restoration must be undertaken on a large scale if we are to expect to restore the habitat areas, improve the quality of waters in the Bay, and provide for the economics which are so important to this region.

We have already succeeded in producing results in these efforts, but we must undertake this on a larger scale. I thank you for your time, and I am sorry I went over.

[The prepared statement of Ms. Oertel follows:]

Statement of Karen Oertel, Owner/Partner, W. H. Harris Seafood Inc.

Our family has owned and operated W. H. Harris Seafood Inc. for 54 years. We process Oysters, handle Crabs, buying from local watermen and purchasing product both oysters and crabs from 10 other states in the effort to supply these products to our customer base. Yes earning a living while providing 60 jobs yearly within the plant, while purchasing waterman's product which can affect as many 300 watermen in the Chesapeake Bay region. W. H. Harris Seafood has played an important role, an intricate part in stabilizing this industry in Maryland and it's economy.

We have always worked within this state in it's quest to understand the problems of this industry and have tried to help solve them. We are one of a few that actually is still involved in private oyster aquaculture in the Chesapeake Bay. Currently I serve on the Oyster Round Table, serving on the Steering Committee of this group. You should here from someone today, which explains what we do. I also serve on

the Oyster Recovery Partnership Board and I am on the Executive Committee of this group. Again you should hear testimony from someone here today. Other, owners of our firm serve on various other committees within the state to assist in solving the issues of this industry in the Chesapeake Bay. Crab Committees SAV (grasses), etc. We work with groups nationally that are involved with other issues that affect this industry on a national level as well.

We fully understand that each group that is testifying here today has important issues. I will make an attempt in the time allowed to present the issues of the processing industry. Past, Present and it's Future as we see it.

Disease is the most serious issue, MXS and Dermo have succeeded in devastating most of the native oysters in the Chesapeake Bay. Oysters are living only in the upper bay regions. Areas where waterman are currently able to work and find live product are north of the Chesapeake Bay Bridge in waters of lower salinity. Seed—grounds. are primarily found in the lower Bay south of the bridge although some are found north of bridge also. Of these areas Eastern Bay is widely affected by disease and has a oyster that is stressed for most part. If shucked for market the yield per pint has been averaging only 4 pints per bushel which means in the market place we can not make a profit on this oyster. The Chester River oysters and other bar at this northern level are producing a little better that 5 pints per bushel. Allowing for a marginal profit in the market place. This is important for you to know, as it sets the stage for our industry and it's ability for processors to make a profit and remain in this industry. We use oysters from other states which we process that allows for a better yield per bushel, as must as 6 pints per bushel, allowing for a better profit. The Chesapeake Bay oyster that we purchase from local watermen are used primarily for Raw Bar Shell Oysters which allows us to have a market for the local watermen product and a reasonable profit. What this means to the waterman is that this shell product must be an oyster that is acceptable for the Raw Bar market. The product must be a cup shell, clean of mussels and a full measure must be presented at the dock when we are buying from them.

PROBLEMS WE SEE IN THE CHESAPEAKE BAY THAT AFFECT THIS INDUSTRY

1. We must find a way to control or manage disease in the Chesapeake Bay if we want to retain the economics of this industry. All of this is while establishing habitat areas that provide for the Bay environmentally.
2. We must look at and explore new innovative ways to reach our goals in the Chesapeake Bay.
3. Maryland Laws and Regulations do not allow for Maryland to be competitive in the market place. This adds additional stress on the processors in Maryland.

a. We have only a 6 month industry in Maryland while other states are able to meet market demands year round. They encourage a private growing industry which allows for a year round supply. The old wives tail of eating an oyster in months with an R is it is long since gone. Refrigeration put an R in every month allowing oysters to be consumed year round.

b. Public vs Private Aquaculture of oysters. Because Maryland does not encourage the private aquaculture it puts Maryland at a disadvantage to compete and hold a place in the market. This allowing for Maryland to meet US demands for the product and to market into the world wide market which we do not do now. 150 years of regulations and laws that does not encourage an active private aquaculture of oysters in the Bay has failed to provide both economically and environmentally for the future of the bay.

Issues:

1. Lack of leased grounds.
2. Good quality leased grounds
3. Lack of good seed to the private oyster grower. We can receive naturally grow seed only after the public industry has obtained all they need. Regulations set the bar to high to allow a good count of seed to be purchased by the private industry.
4. Lack of hatchery produced seed. These are not available to the private industry. Even if some of this seed was made available today for private bottom or water column aquaculture it will be difficult to encourage anyone to be brave enough to invest capital in it with the threat of disease and it's devastating affects on the oyster. We do grow oysters in the Magothy on private leased grounds but they are in the best water available on some hard bottom grounds where the oysters has a reasonable survival rate. We have seen them grow to harvest able size and harvested in the out of season times to meet market demands. We have also lost product from industrial spills, disease and poaching. Currently

we have approximately a fifty thousand dollar investment on these grounds. They can be alive and thriving this week and gone the next.

5. Regulations on a national level form FDA that will require additional investment in the

processing industry to meet their demands for a better safer product for the consumer. See 1 attached insert. How does this affect Maryland Processors? We currently depend on oysters from other states in order to survive and stay in business. Even if Maryland is not under the 60% goal of FDA we shuck other states oysters and will be required to make approximately a three million dollar investment for machinery to do the post harvest treatment. We will not be making this investment depending on other states. We need to depend on Maryland to encourage this investment. See oyster lease facts 2. These are our restraints that need to be recognized. This list was developed by the Department of Natural Resources.

FACTS ABOUT PROCESSORS REMAINING IN MARYLAND

Information from Interstate Certified Shellfish Shippers List October 1, 2001

There are currently 30 licenses in Maryland that allow for shellfish processing in Maryland. This can be a major processor like us a person or firm that has a truck and processes on a minimal or extremely limited bases. Of the 30 current license holders there are only 7 large processors. We are one of them. Of the 7 remaining 1 is owned by an individual that is well in her 80's. No other family member is involved. When she becomes physically unable to continue to operate this business will cease to operate. Queen Annes County is already considering buying this operation for a museum.. Another processor that is located on the lower western shore has had financial difficulties for several years and will be remaining in the processing industry only thru Dec. 31, 2001. He remained in operation in the 2001 season because we loaned him $50,000 to open the 2000–2001 season. This because we recognize the importance to the waterman in that area and he had exhausted all other financial alternatives. The third processor located on the lower eastern shore has serious financial difficulties and is also in serious trouble. This leaves 4 processors remaining. This industry is stressed to it's limits. The affect on the waterman, jobs and the economy that is produced by this industry is in serious trouble. Why do we stay? Caring, comment to something we believe in the economy and the environment But we are good business people and make no mistake, we will not remain if we cannot continue to maintain a reasonable profit. We will not see our business forced into bankruptcy. We will reorganize into a more viable business or sell the waterfront property we currently own. These options would be of serious consequences to the watermen depending on a processor in this area. Selling it as a processing business with the problems we face is not an option. Who would want to take on the problems we currently face.

Losing the processing industry in Maryland has other consequences. The loss of the shell that is used in the process of growing seed both on the bottom and in the in our hatcheries will have grave results in our ability to produce a seed oyster. The shell is a intricate part of revitalizing the bay's oyster.

CONCLUSION

It is with great regret that someday this family will be forced to leave this industry. But if we do not aggressively consider change in how we think and act in this industry we see this in our future.

THINGS WE CAN DO;

1. All groups continue to work together to provide for the opportunities to remain economically sound in this industry while providing for the environment.

2. Address and change regulations and policy which limit our ability to compete nationwide in this industry. See attachment 3. These are issues presented by the DNR in conversations with legislators and industry.

3. Provide and encourage farming (aquaculture) in the bay both on a public and private level.

4. Increase hatcheries ability to provide seed oysters in our farming pursuit.

a. Horn Point - increase production

b. Piney Point- upgrade facility allowing for higher production

c. Private hatcheries. Encourage this but this will occur only when aquaculture is encourage on both a public and private level. On public and private leased grounds.

5. Use and increase the sanctuary and recovery area plantings of oysters in the bay currently being organized by the Oyster Recovery Partnership.

6. Embrace the importance of the shell culte product in the reproduction of seed oysters. Enhance our ability of being able to supply the shell for this purpose.

7. Maintain and improve Langenfelders fossil shell operation to produce shell used in the effort to grow oysters in the bay.

8. Continue to use scientist to find a oyster that will have disease resistance in our natural product and use all methods available to put it in the bay. Open experimental trials of the non native oyster the Areakanas in Maryland waters. Use the VIMS approach for control to assure the safest trial possible is used.

This allows Maryland to have invaluable information both on the oysters it's prospects and its problems that it could produce. Consider putting it in the bay if test prove to have a positive affect.

9. Provide funding to recreate habit areas produced by oyster reefs and put grassed in the bay. Protect these. These two things will substain the very life of the bay providing sanctuary, the food chain for all species.

10. Know our History. Read the oyster by John Brooks about the Bay and use it to determine our future.

Those knowledgeable of this situation in the bay both environmentally and economically acknowledge that the oyster restoration must be undertaken on a large scale if we expect to restore habitat areas, improve the quality of the waters in the bay land provide for the economics which are so important to this region. We have already succeeded in producing results in our efforts but this must be undertaken on a even larger scale.

Mr. GILCHREST. Thank you, Ms. Oertel, and your testimony has been very compelling. I would guess that probably more than half the people in this room have read the book that you describe, by that early scientist over 100 years ago, who predicted what we are now trying to deal with. When you read that book, it seems like somebody from Johns Hopkins wrote it about a month ago.

Ms. OERTEL. I agree with you.

Mr. GILCHREST. It was very timely. And you bring up some compelling perspectives on oyster recovery in the Bay, and I would like to ask Mr. Frentz, I know you didn't come to testify today about aquaculture, or private oyster harvesting, or those kinds of programs. But if we are looking at the overall recovery effort of the Chesapeake Bay, would you say, or have you discussed, or do you care to discuss the issue of privatizing or making a co-op with oyster recovery? Is that a piece of it, a part of it?

Mr. FRENTZ. It is certainly a process we have looked at, and forgive the passion of Karen, we have a hard time keeping her down to 5 minutes at our board meetings, too. But she is correct. There are a lot of things that we need to look at, and aquaculture is one of them. There are an awful lot of leaseholders in the State of Maryland, especially in the area in the Nanocoke River. These folks basically have no access to any oyster spat. The Partnership planted 55 million oysters this year, but it is really a drop in the bucket. It is still something we are trying to give Mother Nature a jumpstart on.

These folks would like to have access to oyster spat to put on the grounds that they are working, and I would like to see co-ops occur.

Mr. GILCHREST. What has to change in order for them to have access to oyster spat?

Mr. FRENTZ. Well, logistically, the Partnership, especially with some grants from NOAA, has basically quadrupled what the University was able to do, but it is not enough. We probably need to look at private enterprise, a public-private partnership. If there could be some funding with that, another hatchery would not be out of the scheme of things. There are a number of private people I have talked to that may want to take that on.

Karen was also right to tell you that the disease pressures are such that it is a tough thing for you to decide to get into the business if your oysters are not going to live. So, we have turned a corner, Mr. Chairman. We have got a long way to go. Certainly, the Oyster Recovery Partnership has gotten everybody out of their comfortable box. We are doing things a lot differently than we have in the past.

Mr. GILCHREST. Would you say, Mr. Frentz, that there is a consensus about aquaculture, or is it still a pretty vitriolic difference of opinion, whether it is the commercial watermen, the State management regime, the private sector, the public sector, is there the beginnings of a consensus for some leaseholding to occur?

Mr. FRENTZ. Well, the Partnership does have a few aquaculture projects in the field. Our difficulty is proving that they can make a profit and that it is a viable operation for them. Karen can back a lot of folks here, their experience in aquaculture has not worked very well.

Mr. GILCHREST. Is that because of disease?

Mr. FRENTZ. There is a tremendous impact on aquaculture in Maryland because of the nutrient loads. Just the cleaning of these aquaculture facilities, the bags that they put out in the upper water columns. It is a very—it is a heck of a lot of time and effort that needs to be put to bear by these watermen or aquacultures that may want to get involved in the process. You throw in the diseases after they do all this good work and they finally get an animal, and in the higher salinities MSX will kill the young oysters quickly, and the Dermo takes over just as these animals are basically getting to market size, about 3 inches. So, you do all that work and it is very labor-intensive and you can't get your oysters to market, it is a very difficult scenario for you.

So, there are suggestions on some public-private partnerships. There are still a few folks out there that would like to do aquaculture, but I think they are going to need some help from all of us to get the ball rolling.

Mr. GILCHREST. Thank you.

Ms. OERTEL. Just to address the No. 3 that I related to that you need to read is oyster leasing issues. It was in coordination with DNR, myself, and two legislators, in an interest to try to find a solution or to create some aquacultural initiative in Maryland. We have been unsuccessful thus far, but I think that it gives you some of the problems that we deal with, if you would read that. Certainly, the area where lease grounds are located, they are marginal, nonproductive, mud-ridden, near in small tributaries where runoff and silting is prevalent, and they don't—I mean, you can put oysters on a bottom that is muddy and they suck down to China. We have done that. It doesn't work.

Mr. FRENTZ. Mr. Chairman, last year I did ask for some NOAA funds, substantial funds, and basically was turned down because the way the aquaculture initiatives are set up, from a Federal funding point of view, it only addresses very small aquacultural projects. We were turned down because I basically asked to start up a new hatchery, a watermen aquacultural co-op type of situation, to develop the resources to allow these aquacultures to have

access to oyster seed, and it was turned down flat basically because I was not a small operation looking to do this on a small scale.

Mr. GILCHREST. You were turned down by NOAA?

Mr. FRENTZ. It was of the—Rich, can you help me out—

Mr. GILCHREST. I think to some extent we are crossing the line between—

Mr. FRENTZ. U.S. Department of Agriculture. National Sea Grant Aquacultural Initiative, according to Rich.

Mr. GILCHREST. They turned you down because you were too big?

Mr. FRENTZ. Too big. I actually asked for an overall operation to jump-start the entire industry here, and it was basically predicated on smaller areas.

Mr. GILCHREST. So you had specific locations that were suitable, unlike what Ms. Oertel was talking about, where the areas that were, I guess, agreed upon for aquaculture for oysters were not suitable based on their location and some of the problems from sediment, things like that?

Mr. FRENTZ. I won't claim that I had a suitable site picked out, Mr. Chairman.

Mr. GILCHREST. We will follow up and certainly work with you on that issue, and work with NMFS, Seagrant, USDA, and anybody else that might help us pull together some pilot project.

Mr. GILCHREST. I think that would be very helpful for a jump-start because it is just very difficult for a private enterprise to take such an exposure when we happen to find the success out there for them.

I would like to comment also about a lot of the discussion that we had today about the flexibility that the Partnership has to basically get out of the box and do these things, and the outstanding rapport we have with NOAA. And if I can make a subtle request of your committee—

Mr. GILCHREST. You can make a subtle, or latent, or right on the—it won't be very subtle if you speak into the mike.

Mr. FRENTZ. I guess I have never been accused of being subtle, so I will just ask. When you write the language for these MPAs, if you give such specific guidelines and you box-in the Army Corps or NOAA or some of the other folks that we work with, and you don't allow us that flexibility or that adaptive management or whatever term you want to use, this will put us into a complete bind because the dynamics of the Bay are evolving. There is no question that without flexibility, without using the best science that is coming in to bear, if you map out a strategy that is so narrow, you won't allow us to have success bringing back the health of the Bay.

Mr. GILCHREST. Well, that was one of the reasons I posed that question to the Corps of Engineers, so that they had—we have worked for many years with the Corps of Engineers on just innumerable projects with different perspectives on goals and policies and things like that. We just wanted to make sure that the Corps was clear in its mission to restore the oysters, and actually the staff showed me the language in which the Corps was given that responsibility. And looking at the language, I think it was pretty clear to me that the Corps had some flexibility to work with the Partnership to do what was best. We don't want to lock anybody

into a very narrow frame of reference. And after serving in Washington for a few years, all the brains in the nation don't reside there. So, we want to come up with full partnerships.

I just had another question, actually, about Marine Protected Areas, and whatever we want to call them—sanctuaries. It seemed to me that a number of people today on this panel—Mr. Hirshfield talked about the endowment with the principal in which we can harvest the interest, but the principal will be fundamentally sound for generations to come, and that from Dr. Luckenbach mentioning apparently that the older they are, they have lived that long, they are going to be resistant, so that we would think, I would assume, areas of the Bay where you could have those old oysters putting out spat that are resistant to these diseases, and that maybe some of the sanctuaries, some of the Marine Protected Areas, could be, in the beginning at least, considered to be permanent. These are sanctuaries that we will draw upon gradually, but they will give us this solid group of old world oysters—when I say old world, what used to be here a couple hundred years ago. Do we need to permanently set aside a reasonable number of sanctuaries that will be permanently protected?

Mr. HIRSHFIELD. My understanding of the consensus is that is what people are expecting to come out of this. I don't think there is any expectation that after ten or twenty years of building back some of the oyster reefs of the Chesapeake Bay, that the intent is to go back in and knock them all down. There are still ongoing questions of what the appropriate fraction of the bottom that should be a set-aside should be, and those discussions will continue, but I think everybody understands the concept of maintaining the principal, and that is part of the 90-10 breakdown of the protected area. Ten percent set-aside as not just old and disease-resistant, but old and really big and making lots and lots of baby oysters, not just a few oysters that a 3-year-old might make, plus the 90 percent of the managed area, that is the managed reserve that is designed to live off that interest. So, that is the core of the concept, and the only wrinkle in that is making sure you get the right areas so that you actually are getting that interest spread outside of the true sanctuary.

Mr. GILCHREST. Thank you. Mr. Baynard?

Mr. BAYNARD. I think the public perceives that that would be the case, that a sanctuary is just as described, it would be permanent. In the case of oyster restoration, I don't think the public would be willing to commit the resources, time and effort to accomplish this without that understanding. If it were to be opened back up for general consumption in some form, I just don't think that you could get this commitment that is needed to accomplish what we want.

Mr. FRENTZ. Mr. Chairman, there is no intention of breaking these sanctuaries down, they are inviolate. To expand on that, from some of these progeny that are coming out, the watermen helped the Partnership clean two sanctuaries in the Patuxent River, one called Teague and Elbow Bar, Elbow Bar being a sanctuary area that the Chesapeake Bay Foundation has been interested in for several years. And when they cleaned those bars, they acquired some large, mature oysters that were impacted into the mud, which nobody thought was there. They figured it was devoid of oysters.

We took those oysters and we placed a lot of them on a certain area in close proximity to each other because the scientific community tell us that is the best way for them to recruit. We took some of those oysters and we have given them to Dr. Don Merritt at the University of Maryland Center for Environmental Science, and he will take those oysters and he will breed those oysters and the spat-on-shell that comes from them will go back to that specific bar. And although we don't have all the answers, it makes good sense, common sense, to me, to take the animals that were living there and take the animals that are produced from those mature oysters and put them right back onto that bar. Something said that those animals could live there. It wasn't rocket science for me to put them right back where they were in the first place, and we have done this in 16 different places in the Bay this year.

Now, we will monitor these things. We will take a look at it. And, again, what we are all trying to do is get out of the box, think a little bit differently, use the best science we have got, impact this from a larger logistical point of view to get as many oysters out of the water as we can. We could use some common sense out there as we are trying to bring back the Bay.

Ms. OERTEL. One of the things from the Oyster Roundtable that we realize needs to be in place, and we hope will be in the new plan that we are developing, has to do with the sanctuary and recovery areas and the fines, the control of those areas if someone gets on them. We know that a slap on the wrist, a minimal fine is not going to stop anyone. We have got to get serious about our law enforcement and our courts with what we are going to do, and I think we all realize that. Perhaps a loss of a license for a period of time will start to make an impact. I don't know what direction that is going in, but we realize that that has to be in place in order to protect these areas.

Mr. GILCHREST. Thank you very much. Mr. Underwood.

Mr. UNDERWOOD. Thank you, Mr. Chairman, and thank you for your testimonies this afternoon. It was very compelling testimony, as the Chairman has noted, Ms. Oertel.

I guess many of the issues that have been raised pertain to State regulations. Some deal more appropriately, I guess, with what I am trying to understand here, which is the Federal end of it. I am trying to receive some sense of guidance from your testimonies. In particular, I am very interested in Mr. Baynard's testimony in which I believe you mentioned several times that there was a lack of clarity about MPAs, and that that lack of clarity has led perhaps to, in some ways, restricting the use by people for recreational purposes. I am trying to juxtapose that with Mr. Frentz' testimony when talking about regulations which seem to argue for more flexibility in order to be able to develop sanctuaries and protected areas in a more collaborative way.

What is the basic issue that you are trying to get across, Mr. Baynard, and am I characterizing your testimony appropriately?

Mr. BAYNARD. The major issue is communications and understanding. CCA isn't opposed to the concept of MPAs. What we are concerned about is losing our access and ability to utilize the public resource. We have laid out criteria that we feel needs to be addressed. In the case of the Chesapeake Bay and the oyster sanc-

tuaries, again, this brings in the issue of defining an MPA, and the broad use and what people view it as.

We want to be assured—and I think, in general, we have been—but we want to be assured up front that in supporting the concept of an oyster sanctuary and in other terms, of an MPA, that the recreational sector is not going to be denied access into those areas to enjoy recreational fishing.

Many times, Government has good intentions that get sidetracked and adversely affect large portions of the citizenry perhaps unintentionally, and we just feel that these are issues that need to be brought forward in the beginning, not at the end.

Mr. UNDERWOOD. Well, I guess that is part of the structure that at least the Congress has tried to develop in terms of making sure that stakeholders are consulted, that sometimes it appears a little confusing, and perhaps it may put out of focus one or two groups of stakeholders, and I think the process is inevitably filled with some sense of uncertainty in terms of what the final outcome is—that is, your sense of—you are certainly not arguing that the decisions be pushed up, are you? You are just arguing for more clarity in terms?

Mr. BAYNARD. We are arguing for more clarity. Again, it may well be designed that there will be no restrictions in the case of Chesapeake Bay, but we want that known in the front portion of this process. If restrictions become necessary, all we are asking is that there be scientific basis for those restrictions, that there be quantitative measurements for the benefit of it, and that if recreational angling is having a negative impact on these resources and other traditional methods aren't able to be utilized to address those, that once those problems and issues have been answered and addressed, that we have recourse to gain access back to these areas.

Mr. UNDERWOOD. Well, thank you for your testimonies again, and hopefully 1 day, Mr. Hirshfield, we will get back to those really big oysters that we can eat with a regular size fork.

Mr. HIRSHFIELD. Navigation hazards in the Chesapeake Bay. You have to watch your sailboat.

[Laughter.]

Mr. UNDERWOOD. We eat with a regular size fork so that Ms. Oertel's business will boom. Thank you very much.

Mr. GILCHREST. Thank you, Mr. Underwood. I will just close with a last—I guess, a last comment or question. Each of you up there knows the complexity and the difficulty that lies ahead not only with oyster restoration, but with the best that we can understand from an engineering perspective, the mechanics of the ecosystem within this watershed. And it is not just about oysters. In fact, Mr. Baynard, I think you made a comment about menhaden, which is a part of the filtering system, and then we talked about phytoplankton and then zooplankton, then the worms at the bottom in the mud, and then the interactions between prey and predator species, and the moratorium on rockfish, and all of these things are enormously complex, but I would assume and hope that as we move forward, that each interest group, whether it is the Oyster Recovery Project or recreational fishermen or commercial fishermen or private sector business or the Chesapeake Bay Foun-

dation or NOAA or whoever, or the scientists that come in and give us the best available data that they have at that particular time, that we certainly broaden as far as we can our frame of reference on the issue so we don't let small particulars interrupt or slow down the progress.

In the area of recreational fishing, for example—there are a lot of other examples we could give here. There are a lot more recreational fishermen here today than there were 20 years ago, and they come from all over, not just Maryland—Delaware, Pennsylvania, New Jersey, New York, North Carolina, West Virginia, Ohio, from out West—and we see more and more pressure from the recreational boating community, the recreational fishing community. We want to make the Bay as accessible and as available to all these people as possible, and we want them to enjoy a vibrant, productive, pristine, clean Chesapeake Bay. To do that takes an enormous effort.

Each county on the Bay has a dozen or dozens of little tidal basins, tidal ponds, that are craving for more SAVs, that are now beginning to spawn rockfish within the last few years, that didn't 20 years ago. What we see, though, is more and more people—I have seen it myself—going into the tidal ponds with hand-held nets, catching fish with children on a wonderful, warm Saturday afternoon, wading in waist-deep water, while some of the other things in that region, like eagles or osprey or blue heron, go wanting for the fish that are scooped up in a small tidal pond that might be ten acres.

Now, you want the kids to go in there and learn about the ecosystem. You want them to catch fish. But the pressure on the Bay comes from a rather large group of citizens whose population continues to increase in the area which we recreate in, like the tidal basins or the Bay, doesn't increase.

So, this is an issue that takes rigorous critical mental exercise, and it is not going to be over next year or 10 years. Every generation has to take the responsibility to deal as effectively as they can with this issue. And Mr. Underwood and myself and Mr. Owings certainly has to listen to each of you and absorb your information so that we can put in place a type of legislation that helps each of you expand the people that you represent into this critical area of the Bay.

And I want to thank all of you for coming. Whenever we have hearings and each of you gives testimony from a different perspective, from different interest groups—and I want to tell you that Mr. Underwood is a good listener, an intelligent member of this committee, and our staffs on both sides will take this information and do the best we can for all of you. Thank you all very much.

The hearing is adjourned.

[Whereupon, at 1:25 p.m., the subcommittee was adjourned.]

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