EFFORTS TO INTRODUCE NON-NATIVE OYSTER SPECIES TO THE CHESAPEAKE BAY AND THE NATIONAL RESEARCH COUNCIL'S REPORT TITLED "NON-NATIVE OYSTERS IN THE CHESAPEAKE BAY"

OVERSIGHT FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

OF THE

COMMITTEE ON RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTH CONGRESS

FIRST SESSION

Tuesday, October 14, 2003, in Annapolis, Maryland

Serial No. 108-67

Printed for the use of the Committee on Resources

Available via the World Wide Web: http://www.access.gpo.gov/congress/house
or
Committee address: http://resourcescommittee.house.gov

U.S. GOVERNMENT PRINTING OFFICE

89-844 PS WASHINGTON : 2004

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

COMMITTEE ON RESOURCES

RICHARD W. POMBO, California, *Chairman*
NICK J. RAHALL II, West Virginia, *Ranking Democrat Member*

Don Young, Alaska
W.J. "Billy" Tauzin, Louisiana
Jim Saxton, New Jersey
Elton Gallegly, California
John J. Duncan, Jr., Tennessee
Wayne T. Gilchrest, Maryland
Ken Calvert, California
Scott McInnis, Colorado
Barbara Cubin, Wyoming
George Radanovich, California
Walter B. Jones, Jr., North Carolina
Chris Cannon, Utah
John E. Peterson, Pennsylvania
Jim Gibbons, Nevada,
Vice Chairman
Mark E. Souder, Indiana
Greg Walden, Oregon
Thomas G. Tancredo, Colorado
J.D. Hayworth, Arizona
Tom Osborne, Nebraska
Jeff Flake, Arizona
Dennis R. Rehberg, Montana
Rick Renzi, Arizona
Tom Cole, Oklahoma
Stevan Pearce, New Mexico
Rob Bishop, Utah
Devin Nunes, California
Randy Neugebauer, Texas

Dale E. Kildee, Michigan
Eni F.H. Faleomavaega, American Samoa
Neil Abercrombie, Hawaii
Solomon P. Ortiz, Texas
Frank Pallone, Jr., New Jersey
Calvin M. Dooley, California
Donna M. Christensen, Virgin Islands
Ron Kind, Wisconsin
Jay Inslee, Washington
Grace F. Napolitano, California
Tom Udall, New Mexico
Mark Udall, Colorado
Aníbal Acevedo-Vilá, Puerto Rico
Brad Carson, Oklahoma
Raúl M. Grijalva, Arizona
Dennis A. Cardoza, California
Madeleine Z. Bordallo, Guam
George Miller, California
Edward J. Markey, Massachusetts
Rubén Hinojosa, Texas
Ciro D. Rodriguez, Texas
Joe Baca, California
Betty McCollum, Minnesota

Steven J. Ding, *Chief of Staff*
Lisa Pittman, *Chief Counsel*
James H. Zoia, *Democrat Staff Director*
Jeffrey P. Petrich, *Democrat Chief Counsel*

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

WAYNE T. GILCHREST, Maryland, *Chairman*
FRANK PALLONE, JR., New Jersey, *Ranking Democrat Member*

Don Young, Alaska
W.J. "Billy" Tauzin, Louisiana
Jim Saxton, New Jersey
Mark E. Souder, Indiana
Walter B. Jones, Jr., North Carolina
Randy Neugebauer, Texas
Richard W. Pombo, California, *ex officio*

Eni F.H. Faleomavaega, American Samoa
Neil Abercrombie, Hawaii
Solomon P. Ortiz, Texas
Ron Kind, Wisconsin
Madeleine Z. Bordallo, Guam
Nick J. Rahall II, West Virginia, *ex officio*

C O N T E N T S

OVERSIGHT FIELD HEARING ON THE EFFORTS TO INTRODUCE NON-NATIVE OYSTER SPECIES TO THE CHESAPEAKE BAY AND THE NATIONAL RESEARCH COUNCIL'S REPORT TITLED "NON-NATIVE OYSTERS IN THE CHESAPEAKE BAY"

Tuesday, October 14, 2003
U.S. House of Representatives
Subcommittee on Fisheries Conservation, Wildlife and Oceans
Committee on Resources
Annapolis, Maryland

The Subcommittee met, pursuant to call, at 11:05 a.m., in the Joint Legislative Hearing Room, Maryland House of Delegates, Annapolis, Maryland, Hon. Wayne T. Gilchrest (Chairman of the Subcommittee) presiding.

Present: Representative Gilchrest.

Also Present: Adelaide C. Eckardt, Maryland Delegate.

STATEMENT OF THE HONORABLE WAYNE T. GILCHREST, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MARYLAND

Mr. GILCHREST. Good morning, everyone. The Subcommittee on Fisheries Conservation, Wildlife and Oceans of the Resources Committee will come to order.

I want to thank all of you for coming this morning. We look forward to an informative exchange of information where we can all learn about the different aspects of the Chesapeake Bay ecosystem, the potential for oyster recovery of the native species, and what may happen with a myriad of possibilities for introduction of the Asian oyster.

And we look forward to the panel of witnesses from the scientific community, the public service community in the form of State officials and the Corps of Engineers, and those men and women who make their living on the Bay. I would like to welcome all of our witnesses and members of the Maryland General Assembly at today's hearing.

As native oysters have declined, the introduction of non-native oysters into the Chesapeake Bay has been tested, contested and debated for many years.

This hearing is a part of the ongoing and in-depth discussions I know all of you continue to have. I hope to learn much about each of your areas of expertise today and to get an update on the progress of both native oyster recovery and non-native oyster recovery, aquaculture and in-water testing.

As most of you know, I have always strongly supported efforts to recover the native oyster population in the Bay. It is crucial to the well-being of the entire Bay ecosystem. It is also important to the livelihood of our Maryland watermen, our restaurants, our shucking houses, and our coastal towns and fishing villages.

I have not taken a position on the introduction of non-native oysters into the Bay, but am concerned about the potential impact this may have on a fragile and troubled and, to a large extent, degraded ecosystem. Concerns include the impact this introduction may have on long-standing efforts to restore the native oyster.

One of the goals of the Chesapeake 2000 agreements is to increase native oyster populations tenfold by 2010. Federal and State budgets are tight, and competition for funds between oyster programs could be counterproductive for both efforts. I also know that Maryland and Virginia oyster fisheries have dramatically declined, and this has been a bitter blow for our oyster industry and our Bay culture.

Like all of us, I would like to see the abundance of oysters in the Bay reach historic proportions. As a European visitor, Francis Louis Michel, described: "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."

This statement was made in 1701, and 300 years later we must use these words to inspire our oyster restoration efforts however we decide to proceed. And if we proceed methodically, and we are well informed and we understand the nature of our responsibility, perhaps in this room 300 years from now people will be blessing us for making the right decision.

Maryland and Virginia are both heavily invested in the restoration of the Bay oysters and are now looking to non-natives to help restore the fishery. However, the billion dollar price tag associated with invasive aquatic species across the Nation gives us pause and causes us to examine these activities in the Chesapeake Bay in a national precedent-setting context.

In March, we introduced the National Aquatic Invasive Species Act of 2003, H.R. 1080, which reauthorizes the National Aquatic Species Act. It proposes a screening program at the Federal level and grant support for State screening programs prior to the introduction of non-native aquatic species.

This legislation is intended to help our Nation prevent the economic and environmental damage we are now experiencing as a result of the intentional and unintentional introduction of a relatively small number of species. And we need only look at Maryland, whether it is nutria or snakehead, to understand the potential damage of non-native species which actually have become invasives.

Given that the Chesapeake Bay programs have applied a formal screening process for the introduction of the Suminoe oyster, its

experience can be of valuable assistance to such introductions elsewhere. Maryland, Virginia and the Chesapeake Bay program, the Oyster Recovery Partnership, Federal agencies and their partners are all to be commended for their dedication to the health of the Chesapeake Bay and its oysters. They have, to date, been a model for the rest of the Nation in precautionary and cooperative management of a valuable and shared resource.

We are pleased that we have a good representative mix of experts here today to present all sides of this historic debate, and, as always, all input is important. Together we may be able to chart a course that will recover Chesapeake Bay oysters and provide an abundant resource for everyone to enjoy and help in this most important endeavor to restore the Chesapeake Bay ecosystem upon which future generations can be blessed.

At this point I want to thank the first panel and your expertise that we will share this morning. We have Dr. James Anderson, Professor, University of Rhode Island, Kingston, Co-Chair of the National Research Council Committee on Non-native Oysters in the Chesapeake Bay; Dr. Robert Whitlatch, Professor, University of Connecticut, Groton, member of the National Research Council Committee on Non-native Oysters in the Chesapeake Bay; Dr. Frederick Kern, III, Acting Chief, Coastal Resource Health Branch, National Centers for Coastal Ocean Science, NOAA; Dr. Don Boesch, President, University of Maryland's Center for Environmental Science; and Dr. Standish K. Allen, Jr., Professor of Virginia Institute of Marine Sciences.

Gentlemen, thank you for coming this morning. We will begin with Dr. James Anderson.

[The prepared statement of Mr. Gilchrest follows:]

Statement of The Honorable Wayne T. Gilchrest, a Representative in Congress from the State of Maryland

I would like to welcome all of our witnesses to today's hearing. As native oysters have declined, the introduction of non-native oysters into the Chesapeake Bay has been tested, contested, and debated for many years. This hearing is just a part of the on-going and in-depth discussions I know all of you continue to have and I hope to learn much about each of your areas of expertise and to get an update on the progress of both native oyster recovery and non-native oyster aquaculture and in-water testing.

As most of you know, I have always strongly supported efforts to recover the native oyster populations. It is crucial to the well-being of the entire Chesapeake Bay ecosystem. It is also important to the livelihoods of our Maryland watermen, our restaurants, our shucking houses, and our coastal towns.

I have not taken a position on the introduction of non-native oysters into the Bay, and am extremely concerned about the potential impact that this may have on a fragile and troubled ecosystem and the environmental and economic impact of our declining native oyster. My concerns are shared, I know, and they include the impact that this introduction may have on our long-standing efforts to restore the native oyster. One of the goals of the Chesapeake 2000 agreement is to increase native oyster populations tenfold by 2010. Federal and state budgets are tight and competition for funds between oyster programs could be counterproductive for both efforts.

I also know that the Maryland and Virginia oyster fishery has declined dramatically and that this has been a bitter blow for our oyster industry and our Bay culture. Like all of us, I would like to see the abundance of oysters in the Bay reach historic proportions as a French visitor to the area said: "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." This was 1701 and 300 years later, we must use these words to inspire our oyster restoration efforts, however we decide to proceed.

Maryland and Virginia are both heavily invested in the restoration of our native oyster and are now looking to non-natives to help restore this fishery. The billion dollar price tag associated with invasive, aquatic species across the nation should give us pause and cause us to examine activities in the Chesapeake Bay in a national, precedent-setting context. I introduced the National Aquatic Invasive Species Act, H.R. 1080, which reauthorizes the National Aquatic Species Act and would, among many other things, provide authority for federal agencies and support for states to conduct screening programs prior to the introduction of such species. This language is in response to growing concern that invasive, non-native species are crippling local infrastructure, native fisheries, and budgets. The nation is watching the Chesapeake Bay, with one of the only formal processes similar to such a screening process, as it cautiously moves in this direction.

Maryland, Virginia, the Chesapeake Bay Program, the Oyster Recovery Partnership, Federal agencies, and their partners are all to be commended for their dedication to the health of the Chesapeake Bay and its oysters. They stand as a model for the rest of nation in precautionary and collaborative management of a valuable and shared resources. I am pleased that we have a good representative mix of the experts here today to present all sides of this historic debate. As always, everyone's view is important and together we may be able to chart a course that will recover Cheapeake Bay oysters and provide an abundant resource for the future for everyone to enjoy.

I look forward to hearing from all of our witnesses and I am sure this debate will continue even after today's hearing.

STATEMENT OF DR. JAMES L. ANDERSON, PROFESSOR, UNIVERSITY OF RHODE ISLAND, KINGSTON, CO-CHAIR OF NATIONAL RESEARCH COUNCIL COMMITTEE ON NON-NATIVE OYSTERS IN THE CHESAPEAKE BAY

Dr. ANDERSON. Thank you. My job is to give an extremely brief summary of the NRC report on Non-native Oysters in the Chesapeake Bay.

As everyone in this rooms knows, oyster stock in the Chesapeake Bay has declined dramatically to less than 1 percent of its levels in the 19th century. Fishing pressure and habitat degradation from agriculture, industrial and residential pollution, deforestation, and oyster reef destruction have contributed to the decline.

But in recent decades the diseases MSX and Dermo have been identified as the core reasons for further decline, and it should be noted that MSX is caused by a parasite that was introduced to the East Coast from Asia.

Fisheries management efforts and various restoration programs have not been successful in restoring the oyster stock to date. The loss of the oyster has been devastating to the oyster industry and dependent communities, and those that remain in the oyster processing sector now depend on oysters brought from the Gulf of Mexico region and other areas for their economic survival. Furthermore, the loss of oysters has contributed to the decline in water quality and clarity.

The introduction of the non-native *ariakensis* oyster from Asia has been proposed as a solution to these difficult problems. Indications are that it may grow well in the Chesapeake Bay. It is known to be resistant to MSX and Dermo. This proposal is not without precedent. For example, in France, the nonindigenous—I mean the indigenous—European flat oyster was devastated by a nonindigenous disease, and now the French industry is primarily dependent upon the non-native Pacific cupped oyster, *C. gigas*. In addition, non-native *C. gigas* and the Eastern oyster are both harvested in

the Pacific Northwest. And, in fact, *C. gigas* is the dominant species harvested in the State of Washington.

Our committee was asked to assess the existing research on oysters and other introduced species to determine if there is sufficient information to analyze the ecological and socioeconomic risks associated with the following three management options: One, to not introduce non-native oyster *C. ariakensis* at all; two, to allow for open water aquaculture of non-native infertile oysters; or, three, the introduction of reproductive non-native *C. ariakensis* oysters.

The study revealed that, despite the positive result of some oyster introductions, some extremely negative consequences have been observed as well. A major risk of introducing non-native oysters comes from pathogens, such as MSX, or the introduction of other animals or plants that may be attached to the oysters. In Australia and New Zealand, introduced non-native oysters have displaced native oysters.

We concluded that there are shortcomings and gaps in the basic research on the biology of *C. ariakensis* and the scientific community's understanding of the ecological consequences of introducing *C. ariakensis*. Economic and cultural research is also lacking, and the institutional and regulatory framework currently is inadequate to monitor and oversee non-native oyster introductions. Given these limitations, a formal risk analysis was not possible.

However, in the judgment of the committee, option two, aquaculture of non-native sterile oysters represents an appropriate interim step that possesses less risk to the Chesapeake Bay and its dependent communities than either options one or three. However, limits and controls on the aquaculture practices must be implemented to minimize the risk of introducing pathogens and/or reproductive non-native oysters during the transitional phase. Option two may provide limited benefit to parts of the oyster industry, and it provides decisionmakers with added information required to make future decisions.

Moreover, this option allows more time for innovative, science-based efforts to restore the native populations. Option 1, not allowing any introduction, fails to address industry concerns and will not result in proved understanding of the ramifications of non-native oysters. It may also increase the risk of rogue or uncontrolled introductions.

Option 3, the direct introduction of non-native oysters, is not advised given the limited knowledge of the biology of *C. ariakensis* and potential irreversible consequences.

The committee cautions the decisionmakers that there is no quick fix to the Chesapeake Bay, and that all of these solutions will take time. I would like to thank you for the opportunity to testify and would be glad to answer any questions.

[The prepared joint statement of Dr. Anderson and Dr. Whitlatch follows:]

Joint Statement of James L. Anderson, Ph.D., Co-Chair of the Committee on Nonnative Oysters in the Chesapeake Bay, Ocean Studies Board, National Research Council, The National Academies, and Professor, Department of Environmental and Natural Resource Economics, University of Rhode Island, Kingston; and Robert Whitlatch, Ph.D., Member, Committee on Nonnative Oysters in the Chesapeake Bay, Ocean Studies Board, National Research Council, The National Academies, and Professor, Department of Marine Science, University of Connecticut, Groton

Good morning Mr. Chairman and members of the Subcommittee. Thank you for this opportunity to speak to you about the proposed introduction of the nonnative oyster Crassostrea ariakensis. Our names are James Anderson from the University of Rhode Island and Robert Whitlatch from the University of Connecticut and we are members of the committee that recently released the report Nonnative Oysters in the Chesapeake Bay, the culmination of a study conducted with the oversight of the NRC'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.

The oyster stock in the Chesapeake Bay has declined dramatically. Harvest is now about one percent of what it was at the end of the 19th century. Fishing pressure and habitat degradation resulting from agricultural, industrial and residential pollution, deforestation, and oyster reef destruction have contributed to the decline. In recent decades, however, the diseases MSX and Dermo have been identified as the core reasons for further decline. It should be noted that MSX is caused by a parasite that was introduced to the East Coast from Asia. Fisheries management efforts and various restoration programs have not been successful in restoring the oyster stock to date. The loss of the oyster has been devastating to the oyster industry and its dependent communities. Those that remain in the Chesapeake oyster-processing sector now rely on oysters that are brought in from the Gulf of Mexico region and other areas for their economic survival. Furthermore, the loss of oysters has contributed to declines in water quality and clarity.

The introduction of the non-native Suminoe oyster, or Crassostrea ariakensis, from Asia has been proposed as a solution to these difficult problems. Indications are that it may grow well in the Chesapeake and it is known to be resistant to MSX and Dermo. This proposal is not without precedent. For example, in France the indigenous European flat oyster was devastated by disease and now the French industry is based primarily on the non-native Pacific cupped oyster, or C. gigas, which was initially imported from Japan. In addition, non-native C. gigas and the eastern oyster C. virginica, are both harvested in the Pacific Northwest. In fact, C. gigas is now the dominant species harvested in Washington State.

Our committee was asked to assess the existing research on oysters and other introduced species to determine if there is sufficient information to analyze ecological and socioeconomic risks associated with the following three management options: one, not introducing non-native *C. ariakensis* oysters at all; two, open-water aquaculture of non-native, infertile oysters; or three, the introduction of non-native reproductive, oysters.

Our study revealed that, despite the positive results of some oyster introductions, some extremely negative consequences have been observed as well. A major risk of introducing a non-native oyster comes from pathogens, such as MSX, or the introduction of other animals or plants that may be attached to oysters. And in Australia and New Zealand, introduced non-native oysters displaced native oysters.

We concluded that there are shortcomings and gaps in the basic research on the biology of *C. ariakensis* and in the scientific community's understanding of the ecological consequences of introducing *C. ariakensis* into the Chesapeake Bay. Economic and cultural research is also lacking with relation to introduction of *C. ariakensis*, including evaluation of production and management systems. In addition, the institutional and regulatory framework is currently inadequate to monitor and oversee non-native oyster introductions. Given these limitations, a formal risk assessment is not possible.

In the judgment of the committee, option two, aquaculture of non-native sterile oysters, represents an appropriate interim step that possesses less risk to the Chesapeake Bay and its dependent communities than either options one or three. However, limits and controls on aquaculture practices must be implemented to minimize the risk of introducing pathogens or reproductive non-native oysters during this transitional phase. Option two may provide limited benefit to parts of the oyster industry and it provides decision makers with the added information required to

make future decisions. Moreover, this option allows more time for innovative, science-based efforts to restore native oyster populations. On the other hand, option one, not allowing any introduction, fails to address industry concerns and will not result in improved understanding of the ramifications of non-native introductions. It may also increase the risk of rogue or uncontrolled introductions. Option three, or the direct introduction of reproductive non-native oysters, is not advised given the limited knowledge base on *C. ariakensis* and the potential for irreversible consequences of introducing a reproductive non-native oyster into the Chesapeake Bay.

The committee cautions decision makers and observers that it is unlikely that there exists any "quick fix" to the Chesapeake oyster situation. It is also unrealistic to expect that the oyster industry and the Chesapeake Bay water quality could ever be fully returned to conditions found in the past. It must be remembered that the many problems in the Chesapeake Bay, including the plight of the oyster, have been the result of more than a century of fishery, land use, and environmental mismanagement by both the public and private sectors. However, continued commitment to responsible management and research could ultimately yield significant benefits to the Bay economy, as well as its environment and cultural heritage.

Thank you for the opportunity to testify. We would be happy to take any questions the Committee might have.

Mr. GILCHREST. Thank you very much, Dr. Anderson. Dr. Whitlatch.

STATEMENT OF DR. ROBERT B. WHITLATCH, PROFESSOR, UNIVERSITY OF CONNECTICUT, GROTON, MEMBER OF THE NATIONAL RESEARCH COUNCIL COMMITTEE ON NON-NATIVE OYSTERS IN THE CHESAPEAKE BAY

Dr. WHITLATCH. Thank you. I would like to briefly reiterate several points that my colleague has made and that have been articulated also in the committee report.

It is well recognized that environmental and economic issues related to the introduction of non-native oysters in the Chesapeake Bay are fraught with considerable uncertainty. Since the potential risk and benefits of introducing a species are difficult to quantify, it is not surprising that various interest groups differ in the value of deliberately introducing a species.

I think we all agree, however, that once a species is introduced in an uncontrolled manner it is virtually impossible to control its spread. Marine ecosystems have few natural boundaries which reduce the movement of species, and the species which may be desirable in one location may not be desirable in other locations.

I live in the State of Connecticut, where our oyster industry is doing quite well, thank you. We are concerned that this is not a regional issue, but should be viewed as a national issue. Obviously the concerns about Chesapeake Bay are important, but we should view this in a more national means.

The committee's recommendation to adopt what we think is a well reasoned, but conservative approach to the issue of the introduction; namely, introducing using reproductively sterile individuals in limited field trails, is an important recommendation because it allows two things, one of which we can gain information on the biology of the species and how it potentially interacts with the Chesapeake Bay ecosystem. And using this approach also provides the opportunity for further development of integrated science-based approaches to the restoration of native oyster populations in the Bay.

Well, what can Congress do? Firstly, in order to accomplish the goal that is one of our recommendations, is that we need to establish a long-term commitment of resources in order to study the species and how it will interact with the Bay ecosystem. Funds need to be provided to the science community and to resource managers so the appropriate information can be obtained to better understand how the species will interact with the Bay ecosystem.

This is not simply a recommendation from a research scientist to say give us more money to do research. But as my colleague stated, the disease problem, one of the disease problems in the Bay right now was due to introduction of a non-native parasite, and there are many other examples in the world where non-native species have been affected by native parasites and also non-native parasites.

The second recommendation is there needs to be established appropriate biosecurity protocol procedures in order to ensure that any studies that use a species in the Bay minimize the risk of establishment of wild populations of the non-native species.

These resources are needed not only to educate the science community in terms of trying to understand how to deal with the species, but also to educate watermen and other individuals that are working with the species in the Bay in order to establish appropriate biosecurity protocols in order to ensure minimizing the potential of the species in the Bay.

Thank you—not in order to minimize the potential of the species in the Bay, I am sorry, in order to minimize the potential spread of the species in an uncontrolled manner in the Bay.

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

Next is Dr. Frederick Kern, III. Thank you, sir.

STATEMENT OF DR. FREDERICK G. KERN, III, ACTING CHIEF, COASTAL RESOURCE HEALTH BRANCH, NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. KERN. Thank you, Chairman Gilchrest. My name is Fred Kern, and I am a Research Fishery Biologist at the NOAA Cooperative Laboratory in Oxford, Maryland. I must point out it is located in one gem of a Congressional District.

Mr. GILCHREST. Can you say that again, sir?

Dr. KERN. It is located in one gem of a Congressional District.

Mr. GILCHREST. Oh. Thank you.

Dr. KERN. Most recently the Chesapeake Bay Program panel, ad hoc panel, reviewed the findings of the NRC report and reported to the Chesapeake Bay Program and to the Norfolk District of the Army Corps of Engineers on how the NRC recommendations would affect the current permit of the Virginia Seafood Council to carry out its experimental test of triploid *Suminoe C. ariakensis* oysters.

My comments today address NOAA's role of native oyster restoration and the NOAA perspective on the NRC report. On native oyster restoration, restoring the oyster populations in the Chesapeake Bay is a long-term venture. It is a job of immense scope.

Historic oyster grounds in the Chesapeake Bay once encompassed over 400,000 acres. Recent bottom surveys of certain parts of the Bay suggest that oyster habitat is severely degraded across all but the smallest fraction of those historic acres. Although oyster

disease and habitat degradation are the biggest impediments to oyster restoration, other factors associated with human activities and land use, such as high sediment rates, poor water quality, increased frequency and severity of freshets, are also involved.

In the last 2 or 3 years, some large scale efforts have been initiated that already have begun to show signs of success, especially in areas of moderate salinity regimes.

NOAA currently supports the native oyster research and restoration work, totaling more than $4 million annually. Restoration work is focused on increasing oyster substrate and rearing spat for placement on rehabilitated bottom habitat.

On regional policy on the non-native species, the NRC report identified the lack of specific authorities to control non-native species introductions as a major inadequacy in the existing regulatory frameworks.

Most States in the U.S. require a permit to introduce a non-native species, but have no specific guidelines, procedures, or penalties associated with intentional introductions. To respond to the need for regional coordination on non-native species introduction, the Chesapeake Bay Program developed the policy in 1993 amongst the participating States and cooperative units. Under this policy proposed new introductions must be submitted for review by the ad hoc panel comprised of representatives from State and Federal agencies as well as scientific experts.

Since 1997, this ad hoc panel has reviewed several proposals and permits submitted by the State of Virginia. Most of these permits were approved, providing specific biosecurity requirements that were incorporated into the projects.

Regarding NOAA support for non-native oyster research, NOAA Sea Grant Office and several State sea grant programs have funded research on the biological and ecological characteristics of *C. gigas* and *C. ariakensis*. The National Sea Grant Program continues to fund long-term genetic programs to develop more resistant *C. virginica* oysters.

Recognizing the current need for better scientific data on *C. ariakensis*, NOAA has responded by directing 1.4 million toward research on the species in Fiscal Years 2002 and 2003.

On the National Research Council report, last year NOAA joined several other agencies and institutions in sponsoring the study of non-native oyster issues by the NRC. In conducting the study, the NRC synthesized the available data from research and case studies of non-native oyster introductions around the globe. This synthesis represents the most comprehensive review of non-native oyster introductions and the consequences to date.

Dr. Anderson identified the three options in which they were reviewed and their choice of option number two, conduct open water aquaculture of triploid nonindigenous oysters to continue the needed research to answer the questions that were raised in their report.

The NRC study also calls attention to several important misconceptions regarding the introduction of *C. ariakensis*. The NRC found little scientific support for these myths that have shaped public discourse on this subject. I won't go into the five myths, but they should be reviewed.

At the present time, NOAA believes that the following steps are necessary and appropriate for moving forward in an informed decision on *ariakensis*:

One, develop a highly focused, short-term research plan that will answer the key biological and ecological questions identified by the NRC panel.

Two, develop biosecurity protocols for all in-water deployments of triploid *C. ariakensis*.

Three, clarify the proposal by Maryland and Virginia to introduce reproductive diploid *C. ariakensis*.

And, four, perform a full risk assessment and alternative analysis.

Thank you for allowing me the opportunity.

[The prepared statement of Dr. Kern follows:]

Statement of Frederick G. Kern, III, Acting Chief, Coastal Resource Health Branch, Center for Coastal Environmental Health and Biomolecular Research, National Centers for Coastal Ocean Science, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to testify on recent efforts to introduce non-native oyster species to the Chesapeake Bay and on the National Research Council's report entitled "Non-native oysters in the Chesapeake Bay." My name is Fred Kern, and I am a Research Fishery Biologist at the NOAA Cooperative Laboratory in Oxford, Maryland, and have been associated with the laboratory for more than 35 years. My research speciality addresses shellfish diseases, and I have represented NOAA on a variety of committees and panels that address issues of introducing non-native organisms. I have chaired the Chesapeake Bay Program's (CBP) ad hoc panels that review proposals by the Program's partners to introduce non-native oysters to the open waters of Chesapeake Bay.

Most recently the panel reviewed the findings of the National Research Council's (NRC) report, "Non-native oysters in the Chesapeake Bay," and reported to the Bay Program and the Norfolk District of the Army Corps of Engineers on how the NRC's recommendations would affect the current permit for the Virginia Seafood Council to carry out its experimental test of triploid Suminoe (C. ariakensis) oysters in the Chesapeake Bay. My comments today address NOAA's role in native oyster restoration and NOAA perspectives on the NRC's report.

Native Oyster Restoration

Restoring the native oyster population in the Chesapeake Bay is a long-term venture. It is also a job of immense scope. Historic oyster grounds in the Chesapeake Bay once encompassed over 450,000 acres. Recent bottom surveys in certain parts of the Bay suggest that oyster habitat is severely degraded across all but the smallest fraction of those historic acres.

The Chesapeake 2000 Agreement sets the goal of a tenfold increase in native oysters by 2010, relative to a 1994 baseline. It has been estimated that 15,000 acres must be restored to reach this goal. Although oyster diseases and habitat degradation are the biggest impediments to oyster restoration, other factors associated with human activities and land use—such as high sedimentation rates, poor water quality, and increased frequency and severity of freshets—are involved as well.

Contemporary restoration efforts began in the 1990s with small projects that were experimental in nature. While this work provided significant advancements in our understanding of how to restore oyster habitat and "jump start" oyster populations by seeding rehabilitated bottom with hatchery spat, the scope and geographic scale of the work was insignificant relative to the large areas of degraded oyster habitat in need of rehabilitation. In the last two to three years some large-scale efforts have been initiated that are already beginning to show signs of success, especially in areas with a moderate salinity regime.

NOAA currently supports native oyster research and restoration work totaling more than $4M annually (Table 1). Restoration work is focused on increasing oyster substrate and rearing spat for placement on rehabilitated bottom habitat. These objectives are furthered through funding of applied research and development of cooperative partnerships among federal agencies, state agencies, research institutions, and non-profit groups. Significant funding has also been directed toward increasing

the capacity and efficiency of hatchery production. Complementary oyster disease research funding continues to address disease vector mechanisms and management strategies, including the development of potentially disease-resistant strains of native oysters. Through cooperative projects, NOAA divers provide monitoring and assessment expertise to validate project results, and NOAA ship-based charting technology assists in identifying bottom substrate types and appropriate project sites.

Regional Policy on Non-Native Species

Most states in the U.S. require a permit to introduce a non-native species, but have no specific guidelines, procedures, or penalties associated with intentional introductions. To respond to the need for regional coordination on non-native species introductions the Chesapeake Bay Program developed the "Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species" in 1993. Although this policy is non-binding, it was approved and signed by the Governors of Virginia, Maryland, Pennsylvania, Delaware and West Virginia, the Mayor of the District of Columbia, the Administrator of EPA (representing the EPA as well as other federal agency partners) and the Commissioner of the Chesapeake Bay Commission. Under this policy, proposed introductions must be submitted for review by an ad hoc panel comprised of representatives from the state and federal agencies as well as scientific experts. Since 1997, this ad hoc panel has reviewed several proposals submitted by the State of Virginia (see attachment).

NOAA Support for Non-native Oyster Research

The NOAA National Sea Grant Office and several state Sea Grant programs have funded research on the biological and ecological characteristics of *C. gigas* and *C. ariakensis*. National Sea Grant continues to fund a long-term genetic research program to develop a more resistant C. virginica oyster.

Recognizing the current need for better scientific data on *C. ariakensis*, NOAA responded by directing $1.4M toward research on this species in Fiscal Years 2002 and 2003 (Table 1). For example, three research projects in FY03 were funded through NOAA's Sea Grant Oyster Disease Research Program. However, this Request for Proposals has a two-year funding cycle, and the next anticipated RFP cycle would be in 2005.

National Research Council Report

Last year, NOAA joined several other agencies and institutions in sponsoring a study of non-native oyster issues by the National Research Council (NRC). In conducting its study, the NRC synthesized available data from research and case studies of non-native oyster introductions around the globe. This synthesis represents the most comprehensive review of non-native oyster introductions and their consequences to date (more specific conclusions attached). I would like to highlight some of the study's findings.

The NRC panel focused its study on three options:

- Option 1: Prohibit introduction of non-native oysters.
- Option 2: Conduct open water aquaculture of triploid non-native oysters.
- Option 3: Introduce reproductive diploid oysters.

The panel recommended Option 2 as an interim measure that could provide some immediate relief for certain segments of the oyster industry, as well as a way to safely study this species' biology within Chesapeake Bay in order to obtain the scientific data required for a risk assessment. Option 1 was not recommended because of the risk of a possible rogue introduction, which might be more likely if government agencies are perceived as taking no action to address the industry's plight. Option 3 was not recommended because "the irreversibility of introducing a reproductive non-native oyster and the high level of uncertainty with regard to potential ecological hazards make Option 3 an imprudent course of action."

The adequacy of the existing regulatory frameworks to address non-native oyster introduction also was addressed at length in Chapter 8 of the NRC report. With respect to federal authority, the applicability of federal consistency provisions of the Coastal Zone Management Act (CZMA) will not apply unless there is both an application to issue a federal license or permit and an enforceable policy concerning the introduction of non-native species into state waters included in an affected state's federally-approved Coastal Management Program.

The NRC study also calls attention to several important misconceptions regarding introduction of *C. ariakensis*: "In evaluating the scientific evidence bearing on the potential risks and benefits of introducing a non-native oyster into the Chesapeake Bay, the committee finds relatively little scientific support for many of the common assumptions that have shaped public discourse on this issue." The report identifies five such "myths."

- Myth I: Declines in the oyster fishery and water quality can be quickly reversed.
- Myth II: Oyster restoration, whether native or non-native, will dramatically improve water quality in Chesapeake Bay.
- Myth III: Restoration of native oyster populations has been tried and will not work.
- Myth IV: Crassostrea ariakensis will rapidly populate the Bay, increasing oyster landings and improving water quality.
- Myth V: Aquaculture of triploid Crassostrea ariakensis will solve the economic problems of a devastated fishery and restore the ecological services once provided by the native oyster.

NOAA endorses the NRC report and its recommendations. We find the report to be of the highest scientific caliber. NOAA also concurs with the NRC's conclusion that there is not adequate scientific information about Crassostrea ariakensis to support a full risk assessment at this time. As the Nation's ocean and coastal science agency, NOAA is committed to supporting the research needed to better inform this important decision.

Next Steps

At the present time, NOAA believes the following steps are necessary and appropriate for moving forward to achieve an informed decision on *C. ariakensis*. The first three steps can be taken simultaneously; however, NOAA believes the fourth step is dependent upon completion of the first three.

1. Develop a highly focused, short-term research plan that will answer the key biological and ecological questions identified by the NRC panel. NOAA has recommended that the Scientific and Technical Advisory Committee (STAC) of the Bay Program develop this plan. STAC has indicated willingness to undertake this task. With adequate resources, STAC could produce the research plan over the course of a few months. NOAA stands ready to coordinate the implementation of this plan across multiple academic institutions and research facilities as soon as it is completed.
2. Develop biosecurity protocols for all in-water deployments of triploid *C. ariakensis*, including both research and industry aquaculture. As recommended by the NRC panel, these protocols should be patterned after the Hazard Analysis Critical Control Point (HACCP) approach currently used in the field of food safety, and should include the ten points listed in the NRC report. We have begun working with our federal agency partners and NOAA's national and state Sea Grant programs to facilitate the formation of a panel of national experts on the topic of biosecurity to accomplish this step.
3. Clarify the proposal by Maryland and Virginia to introduce reproductive diploid *C. ariakensis*.
4. Perform a full risk assessment and alternatives analysis. The federal and state agencies involved (ACOE, NOAA, EPA, USFWS, MD, and VA) have agreed to cooperate in preparing an Environmental Impact Statement (EIS) to address the States' joint proposal. NOAA looks forward to serving as a Cooperating Agency on this EIS. We suggest this effort move forward by initially addressing the alternatives, with comprehensive risk assessment to follow at a later date when sufficient scientific information becomes available.

This concludes my testimony. I would like to thank the Chairman and the Members of the Subcommittee for giving me the opportunity to testify today. I would be happy to answer any questions you may have.

Table 1. NOAA funding for oyster restoration and research in Chesapeake Bay (values are thousands of dollars).

Activity	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
NATIVE OYSTER RESTORATION												
Restoration: MD & VA (NOAA Chesapeake Bay Office)				20		26		435	396	805	1900	1880
Restoration: VA (NOS/OCRM CZM Program)							220	535	500			
Community-based Restoration Projects (NMFS/Habitat Restoration Center)						40	51	51	138	261	232	320
Baywide Stock Assessment (NOAA Chesapeake Bay Office CBSAC)		60	68	77	12				50	50	55	
Oyster Disease Research Program (NOAA Sea Grant, natl. prog. since FY95)	1500	1500	1500[1]	1500[1]	1500[1]	1500[1]	1500[1]	1500[1]	1500[1]	2000[1]	2000[1]	2000[1]
TOTAL	**1500**	**1560**	**1568**	**1597**	**1512**	**1566**	**1771**	**2521**	**2584**	**3116**	**4187**	**4200**
NON-NATIVE OYSTER RESEARCH												
National Research Council Study (NOAA Chesapeake Bay Office)											50	
C. ariakensis Pathogen Studies: VA (NOAA Chesapeake Bay Office: CBSAC)											75	
VIMS Hatchery Support: VA (NOAA Chesapeake Bay Office)											7	8
Biosecurity & Monitoring for VSC Project: VA (NOAA Chesapeake Bay Office)												943
C. ariakensis Research: MD & VA (NOAA Sea Grant: ODRP)												277[2]

[1] National program, with only a portion of funding going to Chesapeake Bay research projects.
[2] This $277,000 is part of the $2.0M for the national Oyster Disease Research Program

Mr. GILCHREST. Thank you, Dr. Kern. Dr. Boesch.

STATEMENT OF DR. DONALD F. BOESCH, PRESIDENT, UNIVERSITY OF MARYLAND CENTER FOR ENVIRONMENTAL SCIENCE

Dr. BOESCH. Chairman Gilchrest, thank you for the opportunity to address you today on the important issue of the Chesapeake Bay and oysters, the very species for which this great estuary was named.

I head the University of Maryland Center for Environmental Science, an organization that has developed science for living resource management for 78 years now. We have worked on oyster biology and conservation from the very start. In fact, science has mingled with oyster management for even longer periods of time, going back into the 19th century with Professor Brooks at Johns Hopkins. Unfortunately, had the science findings and recommendations of our ancestor scientists been heeded we might not be here today.

But here we are. We are faced with this well-considered recommendation of the National Research Council panel. My colleagues and I stand ready to work with the State and Federal agencies and the stakeholders in addressing the questions raised by the NRC report in a careful and credible way.

The University of Maryland Center for Environmental Science has been at the forefront of efforts to restore populations and habitat of the native eastern oyster since 1994. Dr. Kern referred to the NOAA sponsorship of those efforts. Our scientists developed the scientific theory behind the key element of the Maryland Oyster Roundtable action plan, which designates oyster recovery areas into which the importation of diseased oysters is restricted and in which active rebuilding of reefs is pursued.

Scientists for the Maryland Department of National Resources and watermen have learned much in the process, leading to

management approaches that avoid worsening the spread of the Dermo disease, establish permanent oyster sanctuaries and seed oyster reserves in which harvest is eventually allowed.

These efforts have been locally successful in areas in which the other oyster disease, MSX, does not occur. In this regard, we are more fortunate than in Virginia in that we have extensive areas of low salinity habitat in Maryland, which is only threatened by MSX in occasional dry years. Rates of acquisition of Dermo disease by disease free young oysters planted on fresh shell beds are greatly reduced compared to other areas in which oyster production is supplemented by repletion of naturally occurring, but disease carrying oysters. The growth rates on these restored oyster bars have ranged from an inch to an inch-and-a-half per year. The oysters grow vertically, providing home to substantially greater populations of associated animals.

The accompanying photograph, which I have attached to my testimony, shows 5-year-old oysters in the Chester River, growing in the Chester River from a reef restored by the Army Corps of Engineers in 1997 and 1998. What you will see is a dense colony of oysters, each five or more inches long, at a density of 100 to 400 per square meter.

The efforts to restore the native oysters, Eastern oysters, have been successful, as I said, only on a local scale. Disease mortality at high salinities remains a problem, and the scale of the restoration effort to date has been modest compared to the scale of the problem. The successes that we have realized, however, would have not been possible without the greatly expanded production of disease-free spat at the Center's oyster culture facility at our Horn Point Laboratory. We have doubled the production each year, with over 150 million spat-on-shell produced in 2003.

The just opening Aquaculture and Restoration Ecology Laboratory, which we hope, Congressman, you will visit soon, it is just about to open, at Horn Point, which is also located in the First Congressional District, will greatly increase our capacity as we work together with the Oyster Recovery Partnership, an amazing organization that does all of the heavy lifting, both literally and figuratively, and the Maryland Department of Natural Resources, the Corps of Engineers, and NOAA. The new laboratory facility also has unique quarantine facilities that will allow our scientists to work on oyster diseases in non-native oyster species under near natural conditions without the risk of accidental introduction.

The previous speakers have commented on scientific and management issues related to the *Suminoe* oysters as addressed in the NRC report. I will not say much more about that, other than to indicate that my colleagues and I are committed to responsible and probing research on the key questions identified in the NRC report under appropriate levels of biosecurity.

Working together with Dr. Allen and his colleagues at Virginia Institute of Marine Science, we have already begun some of this research, and look forward to working with responsible agencies and scientists throughout the region as the challenging questions of introduction is addressed.

Thank you.

[The prepared statement of Dr. Boesch follows:]

Statement of Donald F. Boesch, Ph.D., President, University of Maryland Center for Environmental Science, Cambridge, Maryland

Chairman Gilchrest and members of the Subcommittee, thank you for the opportunity to address you today on the important issue of the Chesapeake Bay and oysters—the very species for which this great estuary was named.

I head the University of Maryland Center for Environmental Science, an organization that has developed science for living resource management for 78 years now. We have worked on oyster biology and conservation from the very start—in fact, science has mixed with oyster management even before that extending to the days of Professor Brooks at Johns Hopkins University. Unfortunately, had all of the scientific findings and recommendations been heeded we would not be in the predicament we are today. But here we are, with a fresh set of well-considered recommendations from the National Research Council. My colleagues and I stand ready to work with state and federal agencies and the stakeholders in addressing the questions raised in the NRC report in a careful and credible way.

The University of Maryland Center for Environmental Science has been at the forefront of efforts to restore populations and habitats of the native Eastern Oyster since 1994. Our scientists developed the scientific theory behind the key element of the Maryland Oyster Roundtable action plan, which designates Oyster Recovery Areas into which the importation of diseased oysters is restricted and in which active rebuilding of reefs is pursued. Scientists, the Maryland Department of Natural Resources, and watermen have learned much in the process, leading to management approaches that avoid worsening the spread of the Dermo disease, establish permanent oyster sanctuaries, and seed oyster reserves in which harvest is eventually allowed.

These efforts have been locally successful in areas in which the other oyster disease, MSX, does not occur. In this regard we are more fortunate than in Virginia in that we have extensive areas of low-salinity habitat, which is only threatened by MSX during occasional dry years. Rates of acquisition of Dermo disease by disease-free young oysters planted on fresh shell beds are greatly reduced compared to other areas in which oyster production is supplemented by repletion of naturally occurring, but disease-carrying seed oysters. Growth rates on these restored oyster bars range from an inch to an inch-and-a-half per year. The oysters grow vertically producing the complex structure of a natural reef, providing home to substantially greater populations of associated animals. The accompanying photograph shows five-year-old oysters from a reef restored by the Army Corps of Engineers in 1997 and 1998. What you see is a dense colony of five-year-old oysters, each five or more inches long and at a density of 100 to 400 per square meter.

The efforts to restore native Eastern Oysters have been successful on only a local scale at this point. Disease mortality at higher salinities remains a problem and the scale of the restoration effort has to date been modest. The successes that have been realized, however, would have not been possible without the greatly expanded production of disease-free spat by the Center's oyster culture facility at our Horn Point Laboratory. We have doubled production each year, with over 150 million spat-on-shell produced in 2003. The just opening Aquaculture and Restoration Ecology Laboratory at Horn Point will greatly increase our capacity as we work together with the Oyster Recovery Partnership—an amazing organization that does all the heavy lifting, both literally and figuratively—and the Department of Natural Resources, Corps of Engineers and NOAA. The new laboratory facility also has unique quarantine facilities that will allow our scientists to work on oyster diseases and non-native oyster species under near-natural conditions without the risk of accidental introductions.

The previous speakers have commented on scientific and management issues related to the Suminoe oyster. I will not say much more other than to indicate that my colleagues and I are committed to responsible and probing research on the key questions identified in the NRC report. We have already begun some of this research and look forward to working with the responsible agencies and scientists in other states as the challenging question of introduction is addressed.

Mr. GILCHREST. Thank you, Dr. Boesch. Dr. Allen.

STATEMENT OF DR. STANDISH K. ALLEN, JR., PROFESSOR, VIRGINIA INSTITUTE OF MARINE SCIENCE

Dr. ALLEN. Good morning. I would like to move forward with this from this NRC report. So my testimony focuses on the scope of use

of these so-called sterile or triploid *ariakensis* in the Chesapeake Bay. That is, within the recommendation to deploy diploids only by the NRC report, there is a wide scope of possible activity with varying levels of attendant risk. In general, the more valuable the information sought for research or aquaculture, the larger the risk, even using triploids. At the current level of risk aversion in the community, that is, extremely risk averse, the level of useful information is potentially low for both research and aquaculture.

Full assessment of the biological and ecological characters of *C. ariakensis*.

Mr. GILCHREST. I am sorry, Dr. Allen, I don't mean to interrupt, but I just want to make sure I understood your last statement.

The recommendation from NRC, which I think is number two, you are saying would not be very helpful in understanding this—the process of using *ariakensis* in the Chesapeake Bay and its ramifications?

Dr. ALLEN. My thesis is that there is a tremendous range of things that we can do under this particular recommendation, and I intend to amplify that range. I am saying that if we limit the range extraordinarily through restrictions on trials, then the information we are capable of gaining are consequently limited, and the information we can gain from it. Let me try to expand.

Mr. GILCHREST. Thank you.

Dr. ALLEN. Clearly the biological and ecological characters of C. ariakensis are difficult to evaluate. It is made all of the more difficult by the Catch-22 of intentional introductions, which is that you can't know the true impact of an introduction until you have actually made it, and you can't make an introduction until you can predict the environmental impact.

In the case of shellfish introductions of the past, a full evaluation, at least an ecological one, was absent. Introduction was primarily based on economic considerations. For the most part, and as reviewed by the NRC report, these introductions became economically important and generally ecological innocuous. But we are in a different era now, one more cognizant of the downside of introduced and non-native species. We are also in a different era of technology vis-a-vis shellfish genetics, which allows us to take an intermediate course between no introduction and complete introduction. That intermediate course invokes the use of triploids as a tool for ecological and economic evaluation of non-native introduction so that it is not irreversible.

In my testimony, written testimony, I summarize the major research recommendations by NRC and suggested approaches for their empirical determination. More than half of the issues that need attention can be addressed by using sterile progeny in the field as a proxy for diploids.

Answers to research and other categories requires some aspect of reproductive biology to be fully operational, such as reproductive output in various environments or recruitment dynamics. Some research can be limited to laboratory work, with the rather large caveat that lab studies cannot always be extrapolated to relevance in the field. Some research, like evaluation of population genetics, is completely doable in the lab.

The NRC report clearly indicates that adoption of a careful approach to open water triploid aquaculture should be considered an interim action to provide researchers an opportunity to obtain critical data on non-native oysters for risk assessment. I am not sure that the report envisioned the full potential of triploid experiments for this purpose.

It seems to me that they framed the recommendation for open water aquaculture on, quote, the inclusion of parallel ecological experiments designed to generate information critical to evaluating the risks that triploids won't lead to diploid population, unquote.

More directed ecological research, not necessarily resembling or associated with commercial aquaculture, is possible; that is, there is a range of experiments that could be designed using triploids that have no relationship to how triploids may be grown in commercial aquaculture.

Envision an experiment designed to test the ecological function of *C. ariakensis* reefs, for example. Hatchery production of culch could be produced and placed into one or more estuaries with or without *C. virginica* interspersed and community structure examined over the course of several years. New year classes of triploids could be, quote-unquote, recruited to the reef by subsequent hatchery spawns and deployment, all of the while obviating colonization, or at least decreasing its risk to diminutive levels for the sake of gaining the information.

Such creative experiments using triploid, not diploid, *C. ariakensis* could be enormously instructive. While research with triploids is highly promising as an alternative to diploid studies, it is not risk free. At the present time, however, it is my opinion that the regulatory environment is too risk averse to entertain anything other than highly restrictive trials.

As in research, there is a tremendous opportunity to learn of the economic potential of aquaculture by a slightly less risk averse environment. For example, deployment on-bottom with triploids that could be dredged at market size would yield information on the viability of this species to standard practices in use for *C. virginica*. It would yield information on the hardiness of this species for fisheries use, anticipating the possibility of a diploid introduction for fisheries purposes. On-bottom trials could indicate the feasibility of extensive repletion aquaculture, already practiced by the State of Maryland, of triploids. More interestingly, trials of this sort, carefully integrated with scientists, could yield fishery, aquaculture and ecological data simultaneously, but not without some risk.

Currently VIMS is embarked on a unique collaboration with the industry, the Army Corps of Engineers, Virginia's Center of Innovative Technology, and the Virginia Marine Resources Commission in a comprehensive trial of about 1 million triploid *C. ariakensis*.

In short, scientific evaluation of reproduction, disease incidence, reversion, comparative growth and economic impact have been coupled with the commercial scale trials of triploids. I have suggested some avenues of integrated research above. It would be helpful to encourage such programs as well as finding mechanisms to enable interstate collaboration among Virginia, Maryland and North Carolina, by providing resources and allowing reasonable levels of risk.

Thank you very much.

[The prepared statement of Dr. Allen follows:]

Statement of Standish K. Allen, Jr., Director, Aquaculture Genetics and Breeding Technology Center, Professor of Marine Science, Virginia Institute of Marine Science, College of William and Mary

Thesis of this Testimony

Recently the National Research Council (NRC) of the National Academy of Sciences released their report "Non-native Oysters in the Chesapeake Bay." In it was a thorough analysis of existing data for *C. ariakensis* and recommendations for specific research needs. The report also evaluated three management options for *C. ariakensis* given the breadth and quality of existing research on this species. The three options were: (1) no use of non-native oysters; (2) open water aquaculture of triploid oysters; and (3) introduction of reproductive diploid oysters.

Of these three choices, the report concluded that "[T]he risks of proceeding with triploid aquaculture in a responsible manner, using best management practices, are low relative to some of the risks posed under the other management options."

They went on to indicate that contained aquaculture of triploid *C. ariakensis* provided an opportunity to further evaluate the risk of introducing non-natives by serving as a proxy for the reproductive form of the oyster. Contained aquaculture of triploids also allows exploration of the potential for extensive triploid-based aquaculture.

My testimony focuses on the scope of use for triploid *C. ariakensis* in the Chesapeake Bay. That is, within the recommendation to deploy triploids only, there is a wide scope of possible activity with varying levels of attendant risks. In general, the more valuable the information sought for research or aquaculture, the larger the risks, even using triploids. At the current level of risk aversion in the community (i.e., extremely risk averse), the level of useful information is potentially low for both research and aquaculture.

Statement of conflict of interest

I share co-authorship of a patent on tetraploid technology obtained in my previous appointment at Rutgers University. The patent was obtained because of the broad utility of tetraploids in shellfish aquaculture and before its application to the current situation (i.e., before the development and application of tetraploidy to *C. ariakensis*) in Chesapeake Bay.

Brief background on triploidy in C. ariakensis

Field research on the Asian (Suminoe) oyster, *C. ariakensis*, began in 1998 at the Virginia Institute of Marine Science (VIMS) in response to a resolution from the Virginia Legislature to initiate investigations on alternative species. All field trials have employed sterile triploids. Initial research indicated promising performance in *C. ariakensis* in a variety of salinities for growth and disease resistance (Calvo et al., 2001). Research on this species is still ongoing at VIMS. With harvests of C. virginica at record lows, there is intense pressure to submit to the introduction of this non-native species. VIMS, and specifically the Aquaculture Genetics and Breeding Technology Center (ABC), has been working on options for the use of *C. ariakensis* in a non-reproductive form: We have developed the technology for creating 100% sterile triploids in anticipation *C. ariakensis* might be useful in research, grown in commercial aquaculture, or both.

Triploid aquaculture is enabled by the development of tetraploid oysters (Guo and Allen 1994b). Tetraploids have four sets of chromosomes. Since the complement of chromosomes in a tetraploid is divisible by two, which is essentially what meiosis accomplishes during gamete formation, tetraploids are fertile. Moreover, gametes produced from tetraploids contain two sets of chromosomes. (Normal reproduction in diploids yields gametes with a single set of chromosomes.) Therefore, one highly efficient method of making triploid oysters is to breed tetraploids with diploids in the hatchery (Guo et al. 1996). Triploids created in this way are referred to as genetic triploids. The major manifestation of triploidy in oysters is the disruption of normal reproductive physiology, rendering triploids functionally sterile (Allen, 1986; Allen and Downing, 1990; Guo and Allen, 1994a; Erskine, 2003).

Despite the effectiveness of creating triploids using tetraploids, the process is not perfect. There are three aspects of the biology of triploids that engender some risk for establishing reproductive populations.

Fertility—Triploids produce gametes but are generally considered sterile

Reproductive potential of triploid Crassostrea gigas has been studied extensively for a number of reasons, ranging from documentation of their sterility for commer-

cial purposes (Allen and Downing, 1990) to estimation of their reproductive capacity for population control (Guo and Allen, 1994a). Estimation of reproductive likelihood in triploid oysters was not quite as simple as the case for fish (cf. Allen et al., 1986). Triploid Pacific oysters do, in fact, make significant numbers of eggs and sperm (Allen and Downing, 1990). However, it is fair to say—based on the principals of meiosis generally and the information we have specifically from Pacific oysters—that triploidy will be similarly effective as a reproductive control measure for *C. ariakensis*.

Our analysis of reproductive potential of triploid Pacific oyster revealed that although gametes from triploids were fully capable of fertilization, aneuploid progeny resulted (Guo and Allen, 1994a). When triploids were crossed with themselves, the ploidy of resulting embryos was 2.88n on average, that is, hypotriploid. Survival of fertilized eggs to metamorphosis and settlement was only about 0.0085%. More recent data showed that triploid males are about 1000-fold less fecund than diploid males; triploid females about 20 times less fecund. So, although triploid oysters are not sterile in terms of gamete production, their reproductive potential is extremely low, by all practical measures, 0.

Fidelity"100%" triploids

Until recently, the production of spawns of 100% triploids seemed all but impossible. This is because the state of the art for making triploids involved an induction procedure in which the newly fertilized egg is poisoned with an antibiotic, usually cytochalasin B (CB), to cause the failure of cytokinesis during the elimination of the second polar body (PB2) (Allen et al., 1989). The chromosome contained in the polar body contributes the third chromosome set to the embryo. Because the treatment (whether CB or anything else) has to be coordinated with the elimination of the second polar body and because PB2 elimination in a population of newly fertilized eggs is subject to inherent variation, some eggs escape treatment and remain diploid. This imprecision gives rise to broods of oysters with varying proportions of triploids. For perfect biological containment, pure triploid populations are necessary.

In summer of 1993, Dr. Ximing Guo and I were successful in creating the first viable tetraploid bivalves, specifically C. gigas (Guo and Allen, 1994b). Tetraploids, crossed to diploids, are very effective in producing large numbers of pure triploids. Fecundity of tetraploid females seems relatively high, only slightly lower than diploids (Guo et al., 1996). Fecundity of males is sufficient to fertilize about 50 million eggs with a single 2-3" male. Survival of 4n x 2n crosses (both reciprocals) in the larval stage were at least as high as the diploid controls, and two orders of magnitude higher than triploids produced by standard induction procedures. These initial data indicate that it is feasible to create 100% triploids using a tetraploid breeding population.

Since this work on C. gigas, subsequent work at VIMS has shown that the production of triploids is not exactly 100%. In a 2000 year class of "100%" triploids for industry trials in Virginia, 4 diploid (normally reproductive) oysters were found among about 3400 examined (0.12%). Two spawns in 2003 indicated 4 diploids among 3000 (0.13%) and 2 diploids among 3004 examined (0.07%). Thus as a general rule, we can say that "100%" triploid spawns to date are actually about 99.9% triploid. While this is still very good, say, compared to induced triploids, it is not perfect. Furthermore, when even a very low probability of diploid occurrence is multiplied by large numbers of oysters—e.g., 1,000,00 or 100,000,000—substantial numbers of normal diploids can obtain (see below).

Proportion of diploids among triploids	Number of triploids deployed	Expected number of diploids
0.1%	10,000	10
0.1%	1,000,000	1000
0.1%	10,000,000	10,000
0.1%	100,000,000	100,000

Stability—reversion and mosaics

Certified triploid C, gigas were deployed in Delaware and Chesapeake Bays in 1993. After about 9 months of exposure, we found a relatively high proportion of mosaics—that is, oysters with both diploid and triploid cells in the somatic tissue—among our triploid oysters. The occurrence of mosaics themselves is not particularly surprising since the triploid induction process (then based on induction) effectively

poisons newly dividing embryos. Abnormal progeny, such as mosaic individuals with two cell types, might be expected as a matter of course.

The surprising result was that the frequency of mosaics in several triploid populations increased over time, suggesting that some triploids have a tendency to lose chromosome sets. We have called this process reversion.

The classic definition of mosaicism is the presence of two or more cell types in the same organism. In our case, it is the presence of triploid and some other cell type(s) within the same oyster. This other cell type is generally diploid, although (i) whether or not the "diploid" cells contain balanced sets of chromosomes is unknown; (ii) there can be more than one other cell type, as has been recently found in our lab among tetraploid oysters; and (iii) some mosaic conditions, like that found in the gonad of triploids, is natural because of the process of meiosis. The presence of mosaics among triploid populations is generally unappreciated for two major reasons. First, it requires some level of sophistication in ploidy analysis, for example, flow cytometry (FCM), to find mosaics. With FCM, the frequency distribution histograms of mosaics appear as distinct ploidy types, usually triploid and something else. The second reason mosaics have gone unnoticed is that they generally occur in very low frequency (e.g., 5%), although if sample size is large enough they always seem to be found.

In recent evaluations of populations of triploids, both induced and genetic, shows that the process of reversion is quite slow, taking a year or so to begin affecting the population (Zhou, 2002). The process is progressive, however, such that populations of triploids left for longer periods of time produce more and more mosaics. The frequency of mosaics ranges from 2-5% in the first year, perhaps reaching about 10% by year three. The frequency of reversion in genetic triploids is about 1/3 that of induced triploids. The salient risk in the process of reversion is whether or not the "unstable" triploids will eventually yield reproducing oysters. To date, there has been no evidence that normal reproduction occurs in mosaics. This risk is especially low in animals less than, or equal to, typical market size (3") (Chandler et al, 1999).

Application of triploidy to recommendations by the National Research Council report

Application to research

Full assessment of the biological and ecological characters of *C. ariakensis* for the purpose of evaluating the risk of introduction is clearly a difficult task. It is made all the more difficult by the Catch-22 of intentional introductions: You can't know the true impact of an introduction until you have actually made it; you can't make an introduction until you can predict the environmental impact. In the case of shellfish introductions of the past, a full evaluation—at least an ecological one—was absent. Introduction was primarily based on economic considerations. For the most part, and as reviewed in the NRC report, these introductions became economically important and generally ecologically innocuous.

But we are in a different era now, one more cognizant of the downside of introduced and non-native species. We are also in a different era of technology, vis a vis shellfish genetics, which allows us to take an intermediate course between "no introduction" and "complete introduction." That intermediate course invokes the use of triploids as a tool for ecological and economic evaluation of non-native introduction before it is irreversible.

The table below summarizes the major research recommendations made by NRC and suggested approaches for their empirical determination. More than half of the issues that need attention can be addressed by using sterile (triploid) progeny in the field as a proxy for diploids. Answers to research in other categories require some aspect of reproductive biology to be fully operational, such as reproductive output in various environments or recruitment dynamics. Other research can be limited to laboratory work, with the rather large caveat that lab studies cannot always be extrapolated to relevance in the field. And some research, like evaluation of population genetics of the species, is completely doable in the lab.

Category	Research Recommendation	How, where accomplished
Biology		
	Effects of temperature, salinity	Triploids in field
	Growth rate	Triploids in field
	Reproductive cycle	Laboratory*
		Triploids in field
	Larval behavior	Laboratory
	Settlement patterns	Laboratory*
	Settlement in different hydrodynamic regimes	Impossible
	Size specific post settlement mortality	Triploids in field
	Susceptibility to parasites	Triploids in field
	Susceptibility to pathogens	Triploids in field
	Susceptibility to predators	Triploids in field
Category	**Research Recommendation**	**How, where accomplished**
Ecology		
	Interspecific competition	Laboratory
		Triploids in field
	Reef building capacity	Triploids in field
Genetic, phenotypic diversity		
	Geographic population structure	Laboratory
	Phenotype	Triploids in field
	Biology of other related species	Laboratory§
	Integrated response to environmental change	Triploids in field
Larval dispersion		
	Circulation model of Chesapeake Bay	Laboratory
Economic, social impacts		
	Public versus private	Process too dynamic
	Economic, socio-cultural study	Process too dynamic
	Economic feasibility	Triploids in field
	Model of impacts	Process too dynamic
Management options		
	(1) Prohibit non-natives	—
	(2) Open water triploid	
	Susceptibility to *Bonamia*	Laboratory,
		Triploids in field
	3n biology – fertility, fidelity, fertility	Triploids in field
	Model triploid reproductive potential	Triploids in field
	(3) Diploid introduction	
	Survival and reproduction	See Biology above
	Reproduction	See Biology above
	Reef building capacity	See Ecology above
	Marketability	Triploids in field

* – research can be accomplished in lab, but extrapolation to relevance in the field is difficult.

§ – author does not agree with this recommendation, unless it is limited to literature search, not empirical studies.

The NRC report clearly indicated that adoption of a careful approach to open water triploid aquaculture should be considered an interim action to provide researchers an opportunity to obtain critical data on non-native oysters for risk assessment. I'm not sure that the report envisioned the full potential of triploid experiments for this purpose. It seems to me that they framed the recommendation for open water aquaculture on the "inclusion of parallel ecological experiments designed to generate information critical to evaluating the risk that triploid aqua-

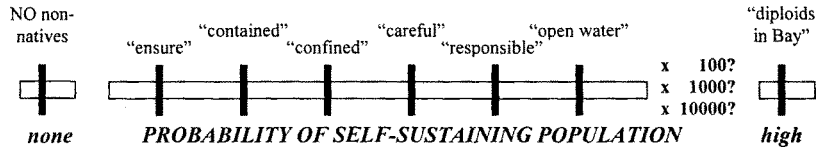
culture will eventually produce a diploid population." More directed ecological research, not necessarily resembling or associated with commercial aquaculture, is possible. That is, there is a range of experiments that could be designed using triploids that have no relationship to how triploids may be grown in commercial aquaculture.

Envision an experiment designed to test the ecological function of a *C. ariakensis* reef, for example. Hatchery produced spat on cultch could be produced and placed into one or more estuaries, with or without C. virginica interspersed, and community structure examined over the course of several years. New year classes of triploids could be "recruited" to the reef by subsequent hatchery spawns and deployment, all the while obviating colonization, or at least decreasing its risk to diminutive levels for the sake of gaining the information. Such creative experiments using triploid, not diploid, *C. ariakensis* could be enormously instructive.

While research with triploids is highly promising as an alternative to diploid studies, it is not risk free. (The risk of reproduction among triploids was briefly discussed above.) At the present time, however, it is my opinion that the regulatory environment is too risk averse to entertain anything other than highly restrictive trials. Perhaps that stems in part from the NSC report's admonition that "stringent regulations will be necessary to ensure that aquaculture of triploid *C. ariakensis* does not result in the establishment of a self-reproducing population..." Ensure is a powerful word.

Application to aquaculture

In fact, the NRC report used a number of descriptors to describe the scope of aquaculture recommended by the panel: they include "ensure," "contained," "confined," "careful," "responsible," and "open water." Depending on interpretation, these terms could entail different levels of risk (see below). How do we define that level? What is reasonable? What is acceptable?



For the industry aquaculture trials recently approved in Virginia, the level of permissibility has been to "ensure"—ensure that aquaculture does not result in a self-sustaining population. In addition to the conditions placed on the growers themselves, which includes double containment of oysters, bonding, and additional investments, there has been a host of other conditions placed on the trial that can only be satisfied with stringent sampling regimes accomplished by researchers, in this case VIMS. At this phase in the evolution of *C. ariakensis* trials, these provisions seem appropriate. However, it is probably unreasonable to think that this level of restriction on aquaculture can yield meaningful economic data, other than marketing information. That is to say, the expense to growers for raising oysters greatly exceeds what might be expected with lesser restriction. With highly restrictive aquaculture, it will be impossible to show economies of scale that would accrue if there were, for example, no restrictions. In short, it will be difficult to realize the considerable economic potential of this species.

No one expects "no restrictions," for the time being, but there seem to have been some expectations in the NRC report for limited success in aquaculture. They listed some of the benefits of open water aquaculture as determining viability of aquaculture, aquaculture employment, and retention of fishery benefits to the Bay. So, which of the descriptors (i.e., what levels of risk) apply to these expectations and how open water can open water aquaculture be?

As in research, there are tremendous opportunities to learn of the economic potential of aquaculture by a slightly less risk averse environment. For example, deployment on-bottom with triploids that could be dredged at market size would yield information on the viability of this species to standard practices in use for C. virginica. It would yield information on the heartiness of this species for fisheries use, anticipating the possibility of a diploid introduction for fisheries purposes. After all, there is a general assumption that the introduction of this oyster will provide a similar fishery to C. virginica. On bottom trials could indicate the feasibility of extensive, repletion aquaculture—already practiced by the State of Maryland—of triploids. An on-bottom trial might yield information on density dependent growth. More interestingly, trials of this sort, carefully (Is this what the NRC report meant

by this word?) integrated with scientists, could yield fishery, aquaculture and ecological data simultaneously—but not without some risk.

The "H-bomb" effect

It seems that one of the tacit assumptions among those who enthusiastically oppose non-native trials is what I call the "H-bomb view" of risk. There seems to be a feeling that any reproduction at all stemming from open water aquaculture is the "big one," the final consequence. But in fact, reproduction episodes stemming from triploid trials (or for that matter, open water triploid aquaculture) will be much more gradual and are not necessarily cataclysmic. What might happen if there was some reproduction as a consequence of research or commercial aquaculture?

For one thing, recruitment likely would be severely hampered by impediments to colonization (the NRC reports calls it "barriers to successful introduction") such as, water quality, lack of substrate, sedimentation, habitat loss, and suitability of *C. ariakensis* to Chesapeake Bay. If populations did establish, what is likely to be their size, considering that triploids were used and security was breached by a potentially very small number of individuals? Would not the very process of "escape" give rise to research opportunities? Are reproduction episodes truly un-eradicable? Could eradication be favored with careful placement of these trials in specific estuaries? If eradication was "ensured," could small populations of diploids be used to gather data?

Integration of research and commercial trials

I bring up these issues because the need to understand the risks and benefits—for fisheries and aquaculture—probably is going to involve the need for more aggressive trials yielding critical data in a timely fashion. Perhaps it is time to pay serious attention to well-integrated programs.

Currently, VIMS is embarked on a unique collaboration with the industry, the Army Corps of Engineers, Virginia's Center for Innovative Technology and the Virginia Marine Resources Commission in a comprehensive trial of about 1,000,000 triploid *C. ariakensis*. In short, scientific evaluation of reproduction, disease incidence, reversion, comparative growth (with triploid C. virginica), and economic potential have been coupled with the commercial scale trials of triploids. I have suggested some other avenues of "integrated" research above. It would be helpful to encourage such programs, as well as finding mechanisms to enable interstate collaboration among Virginia, Maryland and North Carolina, by providing resources and allowing reasonable levels of risk.

References

Allen, Jr., S.K. 1986. Gametogenesis in three species of triploid shellfish: Mya arenaria, Crassostrea gigas, and C. virginica. In K. Tiews (ed.) Selection, Hybridization and Genetic Engineering in Aquaculture, Proceedings of a World Symposium, Schriften der Bundesforschungsanstalt fur Fischerei Hamburg Band 18/19, Berlin.

Allen, Jr., S.K., Downing, S.L., and Chew, K.K. 1989. Hatchery Manual for Producing Triploid Oysters. University of Washington Press, 27 pp.

Allen, S.K., Jr., and S.L. Downing. 1990. Performance of triploid Pacific oysters, Crassostrea gigas: gametogenesis. Can. J. Fish. Aquat. Sci. 47: 1213-1222.

Calvo, G.W., M.W. Luckenbach, S.K. Allen, Jr., and E.M. Burreson. 2001. Comparative field study of Crassostrea ariakensis (Thunberg, 1793) and Crassostrea virginica (Gmelin, 1791) in relation to salinity in Virginia. J. Shellfish. Res. 20: 221-229.

Chandler, W., A. Howe and S.K. Allen Jr. 1999. Mosaicism of somatic and gametic tissues in *Crassostrea gigas* and *C. ariakensis*. J. Shellfish Res., 18: 29 (abstract).

Erskine, A.J. 2003. Gametogenesis in genetic triploid *C. ariakensis*. M.S. Thesis, Virginia Institute of Marine Science, 129 pp.

Guo, X. and S.K. Allen, Jr. 1994a. Reproductive potential and genetics of triploid Pacific oysters, Crassostrea gigas. Biol. Bull. 187: 309-318.

Guo, X. and S.K. Allen, Jr. 1994b. Viable tetraploid in the Pacific oyster (Crassostrea gigas Thunberg) produced by inhibiting PB I in eggs from triploids. Mol. Mar. Biol. Biotechnol. 3: 42-50.

Guo, X., G.A. DeBrosse, and S.K. Allen, Jr. 1996. All-triploid Pacific oysters (Crassostrea gigas Thunberg) produced by mating tetraploids and diploids. Aquaculture 142: 149-161.

Zhou, M. 2002. Chromosome set instability in 1-2 year old triploid Crassostrea ariakensis in multiple environments. M.S. Thesis, Virginia Institute of Marine Science, 69 pp.'

Mr. GILCHREST. Thank you, Dr. Allen. In your proposal, your scope of research, based on the National Research Council's recommendations, do you have a timeframe for understanding some of the critical questions as far as pathogens are concerned, and whether or not these *ariakensis* will become invasive?

Dr. ALLEN. Regarding the pathogen issue, we have conformed to a series of protocols that have been recommended by the International Council for the Exploration of the Seas, which is designed specifically to minimize or reduce as much as humanly possible the introduction of diseases from outside the area.

Mr. GILCHREST. So that can be done before the triploids are actually put in the water?

Dr. ALLEN. That has already been done, Mr. Gilchrest. We have practiced that in order to get the animals presently in the field.

Regarding the other issue, that is the $64 million question, is what level of risk can we accept without allowing the ultimate introduction of this animal by accident? And, at present, we are relying on models that been produced by members of our faculty at VIMS, Dr. Luckenbach and Dr. Mann, to evaluate the likelihood that reproduction may be a by-product of some of these triploid trials.

We are basically applying every tool that we have at our disposal to minimize these risks and still gain the information. I think that is the point, is we can't gain the information risklessly.

Mr. GILCHREST. But at this point, so that I understand, VIMS is moving forward with *ariakensis* to continue to use the triploid to evaluate its impact on whether or not it will be invasive and to see if it is, in fact, compatible with the Chesapeake Bay ecosystem and that you are not recommending a diploid introduction?

Dr. ALLEN. VIMS's official policy on this issue, which was issued almost 2 years ago, is that at this time we do not support a diploid introduction, but that triploid aquaculture, carefully designed to gather information, can be fostered with the use of biosecurity. It is basically parallel to what the NRC report said.

Mr. GILCHREST. Is your goal, then, to refine a triploid introduction to be solely used for aquaculture, or is part of your goal to see whether or not *ariakensis* can be compatible with the ecosystem so eventually the diploid oysters would be introduced?

Dr. ALLEN. The goal of the current research that we are embarked on is to develop this triploid aquaculture idea to its fullest potential and reduce the risk as much as possible. I don't think it is for one institute or another to say unilaterally that this is a good thing for introduction.

We have already said that diploids are not appropriate at this time, and we would, I am sure, join in the research to evaluate that, given the appropriate resources. But our goal right now is specifically to try to focus on the industry problem of lack of resources and to provide an alternative while not making an introduction at the same time, which is a big task, but we are making some progress in that way.

Mr. GILCHREST. So at this point you are not involved in research determining whether *ariakensis* as a diploid introduction would be invasive?

Dr. ALLEN. My lab personally is not. But the other members of VIMS, particularly Mark Luckenbach, who directs the Eastern Shore lab, has been working in that arena as well. But it is basically a question of limitation of resources. We are applying precious State funds to do what work is available at the present time.

Mr. GILCHREST. Do you have a timeframe for when your research will have some final conclusions so that *ariakensis* triploid aquaculture can go full steam ahead in Virginia?

Dr. ALLEN. I don't believe that we are setting any deadlines for ourselves. We are just trying to iterate the improvements in the sterile technology to try to make it as safe as possible. There is sort of two levels that we are working from here.

One is the level of trying to make the technology perfect, which is, you know, kind of hard to do, and the other is the level of risk that we are allowed to take in implementing the technology. And I think it is my overall thesis that that level of risk tolerance is very low right now, and there is somewhere to meet in the middle that could yield greater information and more productive economic evaluations for the industry.

Mr. GILCHREST. I see. Thank you.

Dr. Boesch, are you involved in similar research projects specific to triploid for aquaculture use only? Are you involved in any research that deals with the potential introduction of diploid *ariakensis* into the Maryland waters of the Chesapeake Bay?

Dr. BOESCH. Yes, Mr. Gilchrest. We, until very recently, the Maryland State policy was very risk averse, to use Dr. Allen's term, about *ariakensis* research, and that has changed of late. And we have now initiated several projects, one working very closely with Dr. Allen, which is essentially an extension of work they are doing there with the industry of outplanting—not outplanting, but in controlled devices planting sterile triploids into Maryland waters.

Our scientists have, like Dr. Allen indicated, have gone through a process of getting an agreement and permit authority to do this work. In addition to that, we are staging, we are able to do laboratory work on diploid animals in a biosecure environment to answer some questions regarding their reproductive biology, and also with a new research project just underway, to understand the degree to which some important predators of oysters, of the native oyster, might be a controlling factor on the Suminoe oyster as well.

That is done in the controlled environment in the laboratory. We have just been—had a meeting with the Department of Natural Resources to look at the NRC report recommendations concerning the questions one would have to address, you know, to make that decision, and we have been exchanging ideas with the Department about the priorities of that research, emphasizing the key issues that would make or break a decision. What are the adverse, potentially adverse consequences? Addressing some of the potential of the non-native oyster, not only in aquaculture but in ecological restoration, using these criteria to prioritize the work and discuss with them how that research can be done.

But you have to understand that our work, in contrast to Dr. Allen's, is just beginning on Suminoe oysters, because of this change of policy that I referred to.

Mr. GILCHREST. So you feel that the University of Maryland is a little bit behind VIMS in understanding *ariakensis* as far as the aquaculture is concerned, the introduction of triploids versus diploid is concerned?

Dr. BOESCH. They have been working on this issue for longer than we have for sure. So they have more experience.

Mr. GILCHREST. Do you feel that your relationship with the Department of Natural Resources and the State of Maryland, which will ultimately to a large extent make this decision, triploid versus diploid, is integrated well, you have a good relationship with the State as far as what priorities are concerned?

Dr. BOESCH. I think we do. As I indicated, we have recently, just as of last week, had some dialog with them about the priorities, and our role with the University is to be supportive in working with the departments, the State departments, but also to be independent in the conduct of research and in the conclusions and recommendations that we draw from that research. So I think there is a good understanding of that.

But to foster that relationship, and to also use our resources wisely, for example, the Department has come to us and offered help to support our new research facility of the oyster culture facilities and so on, put some of their resources into that so we can jointly work on not only the questions of Suminoe oyster introduction or aquaculture, but also, and very importantly, advance the state of knowledge that we have been able to gain on the reestablishment or rehabilitation of native oyster populations.

Mr. GILCHREST. Is there any feeling that research on non-native oysters is taking money away from research on native oysters, and is there in your judgment some real possibility that in the future native oysters, *virginica*, can be disease resistant?

Dr. BOESCH. On the first question, I would say that is a general concern that I have heard voiced, that the great attention on the Suminoe oyster will consume all of the resources so we will not advance our understanding, scientific understanding, and also our restoration activities on native oysters.

So far that hasn't happened. I think we have to guard against it, and I think the NRC report has a firm recommendation on that, to continue to work on native oyster disease issues and restoration.

With respect to the second question, our center, in cooperation and collaboration with Dr. Allen and folks at VIMS and our colleagues at Rutgers University, have for several years now been engaged in extending Dr. Allen's work on disease resistant strains of—strains of native oysters that are resistant to either MSX or Dermo or both, and we are continuing to advance that research.

And we have been particularly engaged in working with Dr. Allen and using some of those disease resistant oysters, native oysters in various outplantings and field trails in various parts of Maryland with mixed success. They can do reasonably well under management situations in which they are challenged primarily with Dermo. But if there is heavy MSX infection, there is a bit greater survival but it is still pretty severe. But it is still a work in process. And I think Dr. Allen, I am sure, this is sort of his life's work, and we are still optimistic about that line of research.

Mr. GILCHREST. Now, I am not asking for a deadline, but is there a timeframe upon which the potential for understanding a particular strain of *virginica* to be resistant to MSX and Dermo, and under what context might that be? For example, do native oysters seem to do a lot better when they are on reefs close to the surface as opposed to oyster bars? Do they do better the larger they are when they are in the process of reproduction? And a timeframe for when we might see some progress where we actually have oyster reefs with native oysters in large numbers in the Chesapeake Bay?

Dr. BOESCH. Disease resistant? We are still working with disease resistant strains. If it is OK, Dr. Allen is the expert on this. I am not.

Dr. ALLEN. We are basically trying to find an oyster that will work. I mean, that is why we left the wild oyster in favor of an oyster that has been selectively bred to become disease resistant in hopes that that oyster will be more successful in recruiting its young to the system than the wild oyster is, which by the way is not very successful at doing that. The non-native oyster represents simply another alternative in that possible selection of candidates for this particular purpose.

Mr. GILCHREST. Can a non-native oyster and the native oyster interbreed?

Dr. ALLEN. They can fertilize each other, but they don't form viable progeny. So there is—but, by the way, if they could, we would be embarked on a program now to hybridize the two of them and improve our native oyster by bringing in some of the effective genes that the non-native oyster seems to have. And that is an approach that is standard aquacultural selection techniques. But I think it is important to realize here that, whether it is the non-native oyster or it is a selectively bred native oyster on this very slow course of selective breeding, they are both two artificial solutions over and above what we have already been used to.

In other words, we are replacing the wild oyster with an entirely artificial oyster one way or the other. So as to a timeframe, which was your original question, you have got to realize that the process of selective breeding can yield an improvement between 5 and 10 percent per generation over and above the last. And you can understand that that is a relatively slow progress for the native oyster selection; whereas, the non-native starts with a level of disease resistance that we only wished our oysters had.

And so, you know, the race between these two, the non-native has already won, and we are dealing with this issue of whether it is a wise choice or not. The race that we are doing for the native oyster is one to try to make it effective before we make it moot.

Mr. GILCHREST. Dr. Anderson, would you agree with the statement that the non-native oyster, *ariakensis*, the Asian oyster, after some period of study, as a result of the near elimination of the native species, would be an appropriate course to take after some of the issues are vetted as far as pathogens and some idea of invasive, that a diploid *ariakensis* would be an appropriate action course to take for Virginia and Maryland?

Dr. ANDERSON. Well, first of all, I would like to say that there is no doubt that these institutions can do the research to get the

information to improve our ability to make the decision as to how extensively we use either sterile or nonsterile oysters, *ariakensis*.

However, I think basically it is a value judgment when it comes to that point. You get more and more information, but at some point you decide, do you want this oyster in the Bay? And you may be able to say, well, we can put it in the Bay without disease. We can put it in the Bay so there is no introduction of, shall we say, hitchhikers or other species, and we can, you know, more or less manage it.

But the final decision really starts to be a value judgment. Do you really want a new oyster in the Bay?

Mr. GILCHREST. Dr. Whitlatch, can you tell us whether or not—you said you were from Connecticut?

Dr. WHITLATCH. Yes.

Mr. GILCHREST. I suppose the oyster industry up there is the Long Island Sound.

Dr. WHITLATCH. Yes, it is.

Mr. GILCHREST. And you seemed to say that you had some concern with the introduction of *ariakensis* in the Chesapeake Bay because it might pose a regional problem, including Long Island Sound?

Dr. WHITLATCH. I think that, if the Suminoe oyster becomes reproductively viable in the Chesapeake Bay, it is only a matter of time before it will spread to other estuaries along the East Coast, and so while we look at this as initially a regional issue; you know, what is the well-being of the oyster industry in the Chesapeake Bay, I think this should be viewed more as a national issue.

The species has all of the life history attributes of what we would think an invasive species should have. It grows fast, it has high reproduction, it has a number of modes of being dispersed, both naturally and by humans, and so it is, as I said, a matter of time before the species has a strong potential of being found throughout other parts of the Northeast region.

Mr. GILCHREST. I guess this question would be to anybody. Where did this Asian oyster come from? Where has it been introduced before? Has it been successful? Has it—I think I read somewhere last night, it was in somebody's testimony, perhaps it was in NRC, that the introduction into—or someone said it here this morning—the introduction into Australia and New Zealand has been not successful.

Was that the introduction of *ariakensis*, or was that the *C. gigas*?

Dr. WHITLATCH. The *ariakensis* was used in research purposes in Oregon, at the Oregon State University Marine Laboratory, in the mid-1970's as a potential new aquaculture species. There were several attempts to introduce the species into several embayments in Oregon, and to this date there are no wild populations. It has notsuccessfully reproduced in those embayments.

Dr. WHITLATCH. The general wisdom is that the temperatures in that environment are too cold for it to reproduce. There were oysters from that same stock that were introduced that were brought in from China to Oregon that were then brought into France. And, for again, for research purposes. However, the species became—was very vulnerable to a parasite and it was not—has no longer been considered for aquaculture purposes.

Mr. GILCHREST. So that was *ariakensis*?

Dr. WHITLATCH. Yes.

Mr. GILCHREST. And that was introduced in Oregon but the water temperature wasn't compatible—

Dr. WHITLATCH. Yes.

Mr. GILCHREST.—in France, but they had a problem with parasites that it wasn't compatible with. But at this point, does it appear, based on the last few years of research, that *ariakensis* is compatible with the temperature and the parasites in the Chesapeake Bay or don't we know that yet?

Dr. WHITLATCH. Limited. There has been a lot of laboratory studies done on its temperature salinity requirements and in the Bay. And it looks, to date, using that laboratory information, that it could survive and reproduce in most of the salinities and temperature regimes in which the native oyster exists.

Mr. GILCHREST. Do you have a native oyster in the Long Island Sound?

Dr. WHITLATCH. Yes, *C. virginica*.

Mr. GILCHREST. Oh. So it is the same.

Dr. WHITLATCH. Same species, yes.

Mr. GILCHREST. And you don't have MSX and Dermo up there?

Dr. WHITLATCH. We do have those problems, but not to the same degree that Virginia and Maryland have.

Mr. GILCHREST. Why is that?

Dr. WHITLATCH. That is an excellent question. I don't know the answer to that.

Mr. GILCHREST. So it is not—I am sure that the Long Island Sound is as—what is the salinity?

Dr. WHITLATCH. It is more like Virginia's salinity.

Mr. GILCHREST. And the MSX and Dermo is not?

Dr. WHITLATCH. There are problems. We have had outbreaks in the past, but for some reason, they have not persisted at the same degree of intensity as you have them in the State of Virginia and Maryland.

Mr. GILCHREST. Is your oyster industry mainly aquaculture?

Dr. WHITLATCH. It is virtually all aquaculture. It is leased bottom aquaculture relying on natural set of the spat fall. The spat are collected on shell culch, and then moved to leased tracts of land where they are cultured until they are ready to market.

Mr. GILCHREST. Dr. Allen, will Virginia—and maybe this is more appropriate for the next panel. And Dr. Boesch as well. The kind of oyster industry in Connecticut, I would assume is vastly different than the oyster industry in the Chesapeake Bay, both Virginia and Maryland. So are there—is there a process that we would have to go through if we chose to a greater extent to use aquaculture? Is there a potential for that to be successful in Virginia and Maryland the way it is in Connecticut?

Dr. ALLEN. My opinion here is that aquaculture is the way in which the Chesapeake Bay will realize resource in the immediate future, in the mid-future, maybe not in the long-term future, depending on revitalization of natural stocks, and if aquaculture were to be given a shot here in Chesapeake Bay, you need an oyster, of course, and that is why the people are attracted to the non-native. But you also need a regulatory environment that enables that. It

is more—it is closer to that enablement in Virginia because of the history of leased bottoms there than it is to Maryland. But even there we need more regulatory authority and mechanisms to allow the farming of the Bay in a way that they do it in many other parts of the world very successfully.

Mr. GILCHREST. Thank you.

Dr. Boesch.

Dr. BOESCH. I would agree, in fact, every, I believe every successful oyster commercial production aquaculture, production around the world is based on aquaculture of some sort. It could be of the type that Dr. Whitlatch mentioned where there is a natural spat set in some areas, and then the shell of the oysters are removed before they are grown out. That occurs in Connecticut. It occurs in some sort of combination in the very successful oyster industry in Louisiana. Many parts of the world.

Other parts of the world supplement the natural recruitment, which sometimes there is none, with hatchery production and then they are grown out in the field, either on racks or on bottom. So those opportunities exist, and I think they have to be part of the solution as we deal with trying to increase the commercial output potential of the native oyster as well as we move forward.

We need some innovation in terms of how we manage that into the future. And there are traditional obstacles, you know, policy obstacles that prevent that as Dr. Allen indicated.

Mr. GILCHREST. Thank you. Dr. Kern, *virginica* in the Long Island Sound, vervus *virginica* in the Chesapeake Bay, do you have any idea why one is more resistant to MSX and Dermo than the other? Is it that the strain of those diseases is weaker in Long Island Sound? And can, as Dr. Allen suggested, it is not a question of—well, Dr. Allen probably didn't suggest this. I might ask this question. Can you mate Long Island Sound *virginica* with the Chesapeake Bay native oysters? Has that already been done? Does that show any promise to resistance?

Dr. KERN. There have been a number of studies that have looked at various resistances, specifically to *perkinsus*. There are different races, the Gulf Coast races of *C. virginica*. You have to realize that until the Chesapeake Bay interruption I guess that *C. virginica* is the temperate coral reef system for the United States. It extends from Maine to Mexico. When we lose oysters, we don't just necessarily lose oysters, we lose all of the organisms associated with an oyster reef. And there has been a great deal of movement of oyster seed back and forth through hatcheries and exchange of materials.

So the various oysters strains are there, but there is not a lot of difference between the two. There are areas in New England when MSX was probably introduced through the movement of seed oysters or what have you that suffered severe mortalities. But due to the fact that they are hatchery-based aquaculture private industry for the most part, they can basically control their stocks, remove them, replace them, start all over again, put them on their own bottoms and remove them. We are talking about a paradigm shift here in Maryland to be able to go from a natural production of oysters and harvesting to a hatchery-based aquaculture system. I mean, you are talking apples and oranges here when you are

talking—you are comparing the two. And that is what is going on in New England and Connecticut and even Maine and the Gulf Coast. It is—they are much more oriented toward aquaculture.

Mr. GILCHREST. So you are saying that there is a—the paradigm for the Chesapeake Bay at this point, and I guess this would be a good question for the next panel, is hatchery produced vs. harvesting wild produced oysters. And is that an inevitable shift?

Dr. KERN. I have a sign in my office that says it is the ecosystem, stupid. And I want to go back to that point where it is the fact that the oysters in Chesapeake Bay are facing a system that did not exist 300 years ago. The nutrient loads, the siltation loads, everything else that is going on on top of that produced a system which is not conducive to producing oysters. I don't care whether it is *ariakensis* or *C. virginica*. They have to have adequate substrates in order to settle. They have to have water clean enough to be able to filter so they don't drown in their own pseudo feces. They have to have a quality of shell structure to be able to settle on.

You get away, around all that, by putting them in trays in aquaculture systems and growing them out in the laboratory and putting them overboard. But at what cost? I mean, you are increasing the overall handling and everything else. There is a—the system has to be able to pay for itself. It hasn't been adapted in Chesapeake Bay. But I, just on an off note, that if *ariakensis* diploids are trying to find a place in the Choptank River where they used to be, they would have a difficult time finding the oyster bed that is not choked with siltation.

Mr. GILCHREST. So there is a great deal more work that needs to be done prior to a thriving oyster population filtering the Bay in a few days. And that is an understanding of the ecosystem, based on human activity and how the Bay has been degraded over a century or more. Are those—well, I could keep asking this panel questions. I think I will close with this question though and ask any one of you that wants to ask it or answer it, in this paradigm shift in the State of Maryland, wild oyster harvest vs. hatchery raised oysters, are we at a fork in the road, do you think, that we have one or the other? Can there be a mix of that in the Chesapeake Bay, and if it is all hatchery raised, what are the benefits to the other organisms in the ecosystem versus the benefits of natural oyster reefs?

Dr. BOESCH. I may be foolish enough to try to answer that question. I think the answer if you gave me those three choices, it is probably a mixture. For example, the production that we have had from the hatchery at Horn Point this year, given the kind of mortality you see after the spat are planted, would actually still yield more harvestable oysters in 2 years, 2 to 3 years than we are able to harvest for the last several years for the whole State. So the potential of producing viable commercial culture of oysters if the economics are right, you know, your cost has to be, as Dr. Kern has indicated, the cost has to be less than the value of the commodity is there.

Having said that, hatchery production is not going to, in and of itself, replenish the natural environment or natural habitat of oysters. It can help. It can help by jump-starting the process, by creating an oyster reef, creating the structure. But the success of

that over the long time is going to be dependent upon the natural recruitment from surviving oysters. And so we will have good years when we have good recruitment and we will have bad years and in the future because the oysters are sort of at the margin of where they were historically in terms of size of their population. The other very important thing that Dr. Kern indicated is the limitation of available habitat. You asked whether we can restore oysters so they can again filter the Bay in 3 days.

I think the answer to that is clearly not in your and my lifetime. The oysters that once existed in the Chesapeake when Europeans arrived here, those reefs took thousands of years to develop. Thousands of years to develop. They were very extensive physically. They were very extensive vertically. And those were destroyed by our wanton harvest strategies, initially. Removed not only oysters, but removed the very habitat, the coral reefs of the east coast, as Dr. Kern indicated in the process. If this Suminoe oyster or engineered oyster, native oyster is successful, it is not going to rebuild that structure, that habitat the organism themselves create overnight. It is going to take similarly centuries to do that.

Mr. GILCHREST. Dr. Allen.

Dr. ALLEN. Thank you. I would like to reiterate that the course of commercially based hatchery produced aquaculture and restoration are not mutually exclusive. They actually go quite well hand in hand. And there is no reason why you can't have a viable industry based on aquaculture that has been built by entrepreneurial dollars as well as having a publicly focused restoration program at the same time. It is a question of whether or not the aquaculture operations can be made commercially viable, which I think it is clear it can't be with the native oyster the way it is, wild, so it is either going to be a selectively bred one or an alternative one, either as a diploid or a triploid. It doesn't matter. But they are not mutually exclusive.

Mr. GILCHREST. Dr. Anderson.

Dr. ANDERSON. I would just like to say, I think ultimately the Bay has to—the oysterman industry has to manage sort of as a portfolio and I would like to back up with—

Mr. GILCHREST. What industry did you say was a portfolio?

Dr. ANDERSON. The oyster industry. Basically you have to look at the technologies as a portfolio of options, and one should not preclude the others, and I think a lot can be learned from aquaculture in terms of disease resistance for enhancement or re-establishment of the native. But it can work the other way. And the other thing, it is not really an either/or. There is a continuum in aquaculture. And in Connecticut, most of their oysters come from a wild set and there are wild harvesters that get a lot of those seed oysters to be put on the sites and then there is very minimal aquaculture there. There are not big racks floating all over Connecticut. You can ski over the oyster sites and things like that. So on the other hand, there could be all kinds of racks and gear in the water and intensive hatchery stuff. And I think you really have to look at the solution as a portfolio. It is not like one goes and the other stays.

Mr. GILCHREST. I see. Thank you very much. I guess this definitely will either be a question or a comment. You don't have to answer it. Dr. Boesch said that the development of oyster reefs in

the Chesapeake Bay happened over thousands of years and created a bay that John Smith knew. If we move, and it is likely I suppose that we will, to a different genetic—an oyster that is, to some extent, non-native or genetically altered by us so that it is disease resistant and a fairly flourishing, we hope, economically viable hatchery-raised aquaculture industry in the Chesapeake Bay which offers some ecosystem help to water quality, if—I suppose the next question I would have, do we give up on trying to fully restore the Chesapeake Bay, and do we say because of human population, it can never be what it was in the past, or is another possibility an oyster reef corridor in the Bay for the purpose of the ecosystem for filtering water for home for other organisms which can be the principle upon which the rest of the aquaculture industry can draw the interest from?

So is there any thought in this process of creating corridors from the mouth of the Bay up to the Susquehanna River for the purpose of, you know, just reconnecting this ecosystem?

Dr. BOESCH. Well, a few years ago, scientists from research institutions throughout the Bay region, including mine as well as VIMS, got together to assess the prospects of oyster restoration. We weren't at that time talking about the Suminoe oysters. The native oysters. And out of that, and some thought by a lot of people came this concept. I wouldn't characterize it as a corridor, but a sort of constellation, if you will, of sanctuaries, an oyster sanctuary which would be built and managed and never be harvested. But that would produce offspring, you know, would produce a genetic selection naturally, and also help reseed the other areas. And then around that would be essential reserves which would be managed oyster areas which would be harvested.

So that may be something close to the concept that you mention. It wouldn't necessarily, you know, extend down the length of the Bay. But it would be located in certain, you know, well-managed areas in which there is again a constellation of a sanctuary and then reserve areas that are managed for harvest.

Mr. GILCHREST. So that is an ongoing process right now.

Dr. BOESCH. That is a recommendation. And—

Mr. GILCHREST. Is that a recommendation to the Chesapeake Bay program or a recommendation to—

Dr. BOESCH. We named this the Chesapeake Bay Research Consortium, which is a consortium of the research institutions at the request, actually of the then-secretaries of natural resources of Maryland and Virginia.

Mr. GILCHREST. Has that recommendation been acted upon?

Dr. BOESCH. Well, in some ways it has, because in Maryland's program we have gone—it hasn't been the same way geographically. But in Maryland—has since then, in its oyster recovery program, designated sanctuaries. You know, in fact, with Congressional support, these sanctuaries have been developed and then we have these other areas which we are replenishing with disease-free hatchery produced seed oysters, but the intent of which is that those will ultimately be available for harvest. In fact, there was a strategy that is based upon if we see the disease incidence grow so that we expect mortality of those oysters, then they will be open

to harvest at that time, so the oysters can be removed before they succumb.

So there are lots of approaches like that that are essentially managing with nature that allow you to preserve some bits of the earth for their biodiversity values and instructional values and the like, while at the same time, managing other parts of the environment in consort with that.

Mr. GILCHREST. Thank you very much.

Dr. Allen.

Dr. ALLEN. Well, if I understand your question correctly, I think what I heard you say is can we give up on the other Bay cleanup efforts and establish this oyster corridor.

Mr. GILCHREST. No. I don't think I meant to say give up on any clean up efforts.

Dr. ALLEN. Good.

Mr. GILCHREST. That includes what we do on the land. That includes what we receive from Ohio, from power plants.

Dr. ALLEN. But, you know, certainly the NRC report made the point that you know it isn't just oysters that are going to make a significant improvement. It is the overall, all the issues put together and, you know, corridor or no corridor, all the other cleanup has to go or the Bay is dead, of course.

Mr. GILCHREST. I think that everything has to be integrated and instead of making priorities, that we are now going to take a look at aquaculture and triploid oysters, and we put all our efforts into that or somebody puts all their efforts into diploid oysters, I don't think this would be worthy of those of us in public service or in scientific institutions because of the full array of issues, whether it is more construction, more impervious surfaces, more air deposition, more commercial recreational fishing, agriculture, power boats in shallow fragile estuaries, the full range of issues, I think, need to—I don't think we have the benefit of picking or choosing what we are going to prioritize. I guess it is time now that we looked at this in the big picture and understand the details of the big picture.

Well, gentlemen, thank you very much. This has been very informative. Our next panel is Colonel Yvonne J. Prettyman-Beck, District Engineer, Norfolk District, U.S. Army Corps of Engineers. Welcome Colonel; Ms. Rebecca Hanmer, Director, Chesapeake Bay Program Office, U.S. Environmental Protection Agency; Honorable Mr. C—I should say Dr. Ronald Franks. Dr. Franks, Secretary, Maryland Department of Natural Resources. Welcome Ron; Dr. James A. Wesson, Department Head, Conservation Replenishment Department, Virginia Marine Resource Commission

Mr. GILCHREST. Thank you all very much for coming this afternoon. We look forward to your testimony. It is 12:30. I guess we have been going for about an hour and 15 minutes or so. So I think what I will do I will announce at the end of this panel, unless I see a different opinion, we will take a 10-minute break at the end of this panel just to pace the hearing. Thank you all very much for coming. We look forward to your testimony on this fascinating and critical issue. Colonel Prettyman-Beck, you may go first, ma'am.

STATEMENT OF COLONEL YVONNE J. PRETTYMAN-BECK, DISTRICT ENGINEER, NORFOLK DISTRICT, U.S. ARMY CORPS OF ENGINEERS

Colonel PRETTYMAN-BECK. Yes, sir. Mr. Chairman and members of the Subcommittee, I am currently District Engineer for the U.S. Army Corps of Engineers, Norfolk District. With me today is Christina Coarreale, Claire O'Neill and Jeff Lorenz of the Baltimore Engineer District, and Peter Kube and Doug Martin of the Norfolk District. We are here today representing the Honorable John Paul Whitley, Assistant Secretary of the Army for Civil Work. We are very proud of the restoration work we have accomplished to date, as well as our future plans. My objective during this testimony will be to provide you with an overview of the Chesapeake Bay native oyster recovery program and a brief assessment of the proposed introduction of non-native oyster species to the Chesapeake Bay and its tributaries.

A copy of the Corps of Engineers October 2001 testimony has been provided as an exhibit. As previously testified, our planned formulation is based on coordination and consultation among many project partners and stakeholders, Federal and State resource agencies, watermen, Chesapeake Bay Foundation, academics, community-interested citizens, as well as nonprofit groups, such as the Oyster Recovery Partnership, Virginia Seafood Council, Lynnhaven 2007 and others. The plan includes the creation of new oyster reefs, rehabilitation of non-productive reefs, development of seed-producing reefs, planting of disease tolerant seed oysters and follow-on project monitoring. Subsequent to the Corp's 2001 testimony, the Norfolk District has completed the Tangier/Pocemoke Sound project in Virginia waters. This involved the construction of 158 acres of oyster reefs and the seeding of 30 million disease tolerant spat on shell.

Total cost for construction seeding and monitoring in the Virginia portion of the project area to date is $2.9 million. We are currently monitoring the project site to determine sustainability of the young oysters and to determine if changes in the management of the newly created reefs are necessary. Future projects planned within the Commonwealth of Virginia include the Great Wicomico and the Piankatank and Lynnhaven Rivers. Additionally, the Baltimore District has been funding oyster restoration at a cost of approximately $1 million a year for 2002 and 2003.

Our focus in Maryland is mostly toward the development of sanctuaries. In addition, the Baltimore District has directed funding toward harvest reserves that will allow limited harvest. During 2002, 95 acres of shell and 35 million spat were planted in the Choptank and Patuxent Rivers. In 2003, 85 acres and 120 million spat were also planted. Future projects planned within the State of Maryland include the Chester and Choptank Rivers. We are currently developing a master plan for the Chesapeake Bay oyster restoration programs. The draft plan is scheduled to be completed in Fiscal Year 2004 with approval in Fiscal Year 2005.

The purpose of the master plan will be to guide future development in the Bay, provide a focus for policy and decisionmaking and to map the way for oyster restoration of the Chesapeake Bay. My assessment of the Chesapeake Bay native oyster recovery program

is positive. Data collected from monitoring and analysis of this data indicates the native oyster restoration is working. We are seeing historical record-setting spat set on new constructed reefs seeded with disease tolerant oyster seed. We are also seeing increases in the survivability of young oysters that indicates the new breeds of native oysters are increasing their disease tolerance, representing the beginning metrics for success.

My testimony will now focus on the non-native Suminoe oyster, *C. ariakensis*. In the spring of 2002, the Virginia Seafood Council applied for a permit under section 10 of the rivers and harvest and section 404 of the Clean Water Act to introduce a million non-native triploid sterile Asian oysters into the waters of the Chesapeake Bay and the ocean. After a thorough multi-agency evaluation of the proposal, which resulted in major changes to the project, a permit was issued to the Virginia Seafood Council in the spring of 2003. The permit contains 15 rigorous conditions that minimize the risk of accidental release of a reproducing population of non-native oysters.

The oysters are now in the water and are being raised by eight experienced seafood growers using a variety of aquaculture grow-out methods. During the permit evaluation process, the Corps agreed with other Federal, State and private agencies, that an environmental impact statement to evaluate the impacts of future large-scaled introductions of Asian oysters into the Bay would be needed. The State of Maryland and Commonwealth of Virginia have proposed to introduce and establish a reproducing self-sustaining population of non-native oysters into the Chesapeake Bay to improve the ecological health of the Bay and revitalize the oyster industry.

Opinions vary with regard to the idea of introducing Asian oysters in the Bay. At one end of the spectrum are those who are opposed to any introduction of non-native species based on history of unintended and sometime disastrous consequences associated with introductions of other non-native species over the years. This group believes the obvious safe choice is not to allow the Asian oyster to be introduced but to continue and augment native oyster restoration efforts. At the other end are those who believe the Asian oyster is the last best chance for not only reviving the commercial oyster industry in the Chesapeake but for also restoring the Bay's historic water quality.

To this group, introduction of reproductive Asian oysters is the obvious answer for both the economic and environmental reasons. And every day of delay, while additional studies are conducted, represents another wasted opportunity. Right now, we simply do not know what the long-term effects of introducing reproductive Asian oysters in the Bay would be. This was the conclusion of the recently released National Academy of Sciences report, which was to recommend for additional study. The report indicated proposals to offset the decline of native oysters in the Chesapeake Bay by introducing a reproductive population of oysters from Asia should be delayed until more is known about the potential environmental risk.

In the meantime, carefully regulated aquaculture of sterile Asian oysters could help the industry and generate information necessary

for assessing the risks of future large-scale introductions. The NAS report and Federal Agency Committee of the Chesapeake Bay program has validated the approach the Corps has taken to date by its authorization of restricted control aquaculture project designed to not only help an ailing oyster industry, but to generate valuable scientific research to help answer future questions. In summary, the Corps of Engineers, with the help of our sponsors, Federal, State and local agencies and many stakeholders is committed to aggressively restoring the native oyster to the Chesapeake Bay per existing Congressional authority and funding.

Mr. Chairman, on behalf of the U.S. Army Corps of Engineers, we would like to thank you and the Committee and Congress for this opportunity to speak on this important issue.

Mr. GILCHREST. Thank you very much, Colonel Prettyman-Beck.

[The prepared statement of Colonel Prettyman-Beck follows:]

Statement of Colonel Yvonne Prettyman-Beck, District Engineer, Norfolk District, U.S. Army Corps of Engineers

Mr. Chairman and Members of the Subcommittee: I am Colonel Yvonne Prettyman-Beck, District Engineer, Norfolk District. With me today is Ms. Christina E. Correale, Chief, Operations Division, Baltimore District. We are here today representing the Honorable John Paul Woodley, 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 restoration work that the Baltimore and Norfolk Districts have accomplished to date in waters of the Chesapeake Bay and its tributary rivers. 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.

My objective during this testimony is to provide you with an assessment of the Chesapeake Bay Native Oyster Recovery Program starting with a summary of the last testimony given to this body, a report on actions conducted by the Corps and others since that testimony was given, and plans for the next time frame. I will also present a brief overview of another facet of the program that involves the proposed introduction of a non-native oyster species to the Chesapeake Bay and its tributaries.

On 22 October, 2001, my predecessor, Colonel David Hansen, District Engineer of the Norfolk District, and LTC Scott Flanigan, Deputy District Engineer of the Baltimore District, provided this Subcommittee testimony on the Chesapeake Bay Native Oyster Recovery Program. A copy of that testimony is provided to you as an exhibit.

In 1995 Congress directed the U.S. Army Corps of Engineers to improve the Chesapeake Bay's native oyster population and appropriated funds to initiate a project. Congress directed this action due to the rapid decline in the Bay's native oyster population that had reached a level of less than 2% of what it was 100 years earlier. In addition, oyster harvests in the mid-1990's were only 1/8 of the harvest of a decade earlier. The precipitous decline is attributed to over harvesting, sedimentation, pollution, and disease. Not only has the region's water-based economy been impacted, but the Chesapeake Bay has been depleted of natural filtering organisms that are critical to the sustenance of a healthy and vibrant marine ecosystem, particularly in the major tributaries such as the Potomac, Rappahannock, Patuxent, Choptank, Chester, Lynnhaven, Great Wicomico, and James Rivers.

The Corps authorization for the current native oyster restoration program is included in Section 704(b) of WRDA 1986 (Chesapeake Bay Oyster Restoration), as amended. Originally the authorization was limited to the Maryland portion of the Chesapeake Bay, but was later modified to include the Virginia watershed. The Federal funding authorization limit is currently $20 million. Cost sharing is required under the program, with the non-Federal sponsors providing 25 percent of the project costs. The sponsors may meet their cost sharing responsibilities through in-kind services. The program's non-Federal sponsors are the Maryland Department of Natural Resources and the Virginia Marine Resources Commission

As previously testified, the Chesapeake Bay Oyster Recovery Program was formulated based on coordination and consultation among many project partners and stakeholders, Federal and State resource agencies, watermen, the Chesapeake Bay Foundation, the academic community, interested citizens, as well as non-profit groups such as Oyster Recovery Partnership, VA Seafood Council, Lynnhaven 2007, etc. The oyster restoration plan includes the creation of new oyster reefs, rehabilitation of non-productive reefs, development of seed-producing reefs, planting of disease tolerant seed oysters, and follow-on project monitoring. The use of disease tolerant strains of the native oyster such as DEBY and CROSBreed will be used.

Subsequent to the Corps October 2001 testimony, the Norfolk District completed the Tangier/Pocomoke Sound project in Virginia waters. This involved the construction of 158 acres of oyster reefs and the seeding of 30 million disease tolerant spat on shell. This is the largest single seeding to date for ecosystem restoration within the Commonwealth of Virginia. Total cost for construction, seeding, and monitoring in the Virginia portion of the project area to date is $2.9 million. We are currently monitoring these sites to determine sustainability of the young oysters and to determine if changes in management of newly created reefs are necessary.

The next restoration area within the Commonwealth of Virginia is located in the Great Wicomico River, a tributary on the west side of the Chesapeake Bay. The scope of work for this project includes the construction of new reefs and the seeding of the new and existing reefs with 5-million disease tolerant large adult brood stock oysters. These reefs will become "breeder reefs" producing hundreds of millions of disease tolerant spat-on-shell oysters that will be used for seeding future projects within the Chesapeake Bay. The decision document has been approved and the Project Cooperation Agreement is now being coordinated with the Commonwealth of Virginia. We anticipate the start of reef construction and oyster seeding during the spring/summer of 2004. The cost of the Great Wicomico River project is currently estimated at $2.4 million.

Future projects planned within the Commonwealth of Virginia include the Painkatank and Lynnhaven Rivers. We are currently coordinating project scopes of work with the sponsor, VIMS, Chesapeake Bay Foundation, Lynnhaven 2007, and others.

Since the October 2001 testimony the Baltimore District has been funding oyster restoration at a cost of approximately one million dollars a year for 2002 and 2003. Our focus in the Maryland portion of the project area is mostly towards the development of sanctuaries. In addition, the Baltimore District has directed funding towards harvest reserves that will allow limited harvest. During 2002, the total area planted with shell was 95 acres. This included 15 acres of sanctuary and 60 acres of harvest reserves in the Choptank River and 5 acres of sanctuary and 15 acres of harvest reserve in the Patuxent River. During 2002, the total spat planted was 35 million. In 2003 the area planted with shell totaled 85 acres. This area included 20 acres of sanctuary and 15 acres of harvest reserves in the Chester River, and 35 acres of sanctuary and 15 acres of harvest reserve in the Choptank River. The total spat planted in 2003 was 120 million. The Maryland Department of Natural Resources is our local cost-sharing sponsor and is doing similar activities to the extent of $350,000 per year.

Our plans for future activities, in the Maryland portion of the project area, will be to pursue restoration opportunities throughout the bay with our focus being the Chester and Choptank Rivers to help meet the oyster habitat goal of the 2000 Chesapeake Bay Agreement (which calls for a 10-fold increase in oyster biomass by the year 2010). Previous project activities have been in the Chester, Choptank, Severn, Magothy, and Patuxent Rivers, and the Smith Island area.

We are currently developing a Master Plan for the Chesapeake Bay Oyster Restoration Program. The draft plan will be completed in FY-04 with approval in FY-05. The purpose of the master plan will be to guide future development of oyster restoration efforts in the Bay, provide a focus for policy and decisionmaking, and to map the way for oyster restoration of the Chesapeake Bay.

My assessment of the Chesapeake Bay Native Oyster Recovery Program is positive. Data collected from monitoring and analysis of this program indicates that native oyster restoration is working. We are seeing historical record-setting spat set on new constructed reefs seeded with disease-tolerant oyster seed. We are also seeing increases in the survivability of young oysters that indicates the new breeds of native oysters are increasing their disease tolerance. These are the beginning metrics for success.

My testimony will now focus on the non-native Suminoe oyster, Crassostrea ariakensis.

In the Spring of 2002, the Virginia Seafood Council applied for a permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act,

to introduce a million, non-native, triploid, (sterile) Asian Oysters (Crassostrea ariakensis) into the waters of the Chesapeake Bay and the Ocean. After a thorough multiagency evaluation of the proposal, which resulted in some major changes to the project, a permit was issued to the Virginia Seafood Council, in the Spring of 2003 authorizing the deployment. The permit contains 15 rigorous conditions that minimize the risk of an accidental release of a reproducing population of non-native oysters. The oysters are now in the water and are being raised by 8 experienced seafood growers using a variety of aquaculture grow-out methods.

During the permit evaluation process, the Corps agreed with other Federal, state and private agencies to prepare an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to evaluate the impacts of future large-scale introductions of Asian oysters into the Bay. The State of Maryland and Commonwealth of Virginia have proposed to introduce and establish a reproducing, self-sustaining population of non-native oysters into the Chesapeake Bay to improve the ecological health of the Bay and to revitalize the oyster industry.

Opinions vary with regard to the idea of introducing Asian oysters into the Chesapeake Bay. At one end of the spectrum are those who are opposed to any introduction of non-native species, based on the history of unintended, and sometimes disastrous consequences associated with introductions of other non-native species over the years. This group believes the obvious safe choice is to not allow the Asian oyster to be introduced, but to continue and augment native oyster restoration efforts. At the other end are those who believe that the Asian oyster is the last best chance for not only reviving the commercial oyster industry in the Chesapeake, but also for restoring the Bay's historic water quality. To this group, introduction of reproductive Asian oysters is the obvious answer for both economic and environmental reasons, and every day of delay while additional studies are conducted represents another wasted opportunity.

The Chesapeake Bay is an economic and ecological asset of national importance. Decisions affecting the Bay are too important to be made precipitously. Right now we simply do not know what the long-term effect of introducing reproductive Asian oysters into the Bay would be. This was the conclusion of the recently released study of the National Academies of Science (NAS) and their recommendation was for additional study. The report indicated that proposals to offset the decline of native oysters in the Chesapeake Bay by introducing a reproductive population of oysters from Asia should be delayed until more is known about the potential environmental risks. In the meantime, carefully regulated aquaculture of sterile Asian oysters could help the oyster industry and generate information necessary for assessing the risks of future large-scale introductions. The NAS report and the Federal Agencies Committee of the Chesapeake Bay Program has validated the approach the Corps has taken to date by its authorization of a strictly controlled aquaculture project designed to not only help an ailing oyster industry but generate valuable scientific research to help answer future questions. The National Academies of Science recommended that additional study is needed before a decision is made whether or not to introduce reproductive Asian oysters into the Bay.

In closing, the Corps of Engineers, with the help of our sponsors, federal, state and local agencies, and many stakeholders, is committed to aggressively restoring the native oyster to the Chesapeake Bay per existing Congressional authority and funding.

Mr. Chairman, on behalf of the Corps of Engineers, I would like to thank you, the Committee and Congress for the opportunity to testify today on these important issues.

Mr. GILCHREST. Ms. Hanmer.

STATEMENT OF REBECCA HANMER, DIRECTOR, CHESAPEAKE BAY PROGRAM OFFICE, U.S. ENVIRONMENTAL PROTECTION AGENCY

Ms. HANMER. Thank you. Good morning. My name is Rebecca Hanmer, and I am director of the EPA's Chesapeake Bay Program Office. I appreciate the opportunity to appear before you today and I have with me Mike Fritz, who is our Living Resources Program Coordinator. In our Chesapeake Bay program master plan, which is the Chesapeake 2000 agreement, the Executive Council made a commitment to achieve at a minimum, a tenfold increase in native

oysters in the Chesapeake Bay by 2010. This commitment is focused on native oysters and is a keystone of our program. Thanks to increased funding from the Congress, the Army Corps of Engineers, and NOAA, collaborating with Maryland and Virginia, we are now implementing restoration projects that are orders of magnitude larger than the earlier pilot projects. We have a long way to go. But we believe we are making progress and should continue to accelerate native oyster restoration efforts.

In the Chesapeake Bay program, our framework for considering introduction of non-native oysters is the Chesapeake Bay policy for the introduction of non-indigenous aquatic species adopted by the Chesapeake Executive Council in 1993. It says, in part, it shall be the policy of the jurisdictions in the Chesapeake Bay basin to oppose the first-time introduction of any non-indigenous aquatic species unless environmental and economic evaluations are conducted, and that risks are acceptably low. This policy was motivated by our experience with other intentionally introduced species which turned out to be very harmful.

EPA, like other Federal agencies, also has obligations under the 1999 Presidential Executive Order 13112 regarding invasive species. Specifically we may not authorize fund or carry out actions that we believe are likely to cause or promote introduction or spread of invasive species unless we have determined that the benefits of such actions clearly outweigh the potential harm.

As you know, Mr. Chairman, the EPA joined with others to support a study by the National Resource Council, and we received an excellent report. As the NRC points out, there is no quick fix, no silver bullet and no shortcut, not for the oyster industry or for water quality restoration. We agree with the management option that was chosen by the report. We agree with the conclusion that it is currently not predictable—possible to predict the effect of introducing reproductive *C. ariakensis* on the ecology of Chesapeake Bay and that the irreversibility of introducing a reproductive nonnative oyster and the high level of uncertainty with regard to potential ecological hazards makes an imprudent course of action.

EPA has joined with other Bay program partners and the Corps of Engineers to support preparation of a full environmental impact statement before any deployment of reproductively capable *C. ariakensis* into bay waters. A strong scientific analysis is a necessary precondition for sound decisionmaking and will be vital to a strong environmental impact statement.

The adequacy of existing regulatory frameworks for non-native oysters introduction was also addressed in the NRC report, including applicability of Clean Water Act sections 404 and 402, which are subject to the purview of EPA. These and other potential areas of Federal and State jurisdictions will be evaluated during the development of the environmental impact statement. We also look forward to the environmental impact statement as a mechanism for evaluating alternatives including importantly native oyster aquaculture as an alternative that has received too little attention to date.

In closing, Mr. Chairman, I want to comment on the importance of the Chesapeake Bay program as an institution. The NRC report suggested that the Bay program's precautionary approach to intro-

duction of non-native species could serve as a model for elsewhere in the country. The 1993 policy, the report says, is consistent with the precautionary approach to non-native introductions in its requirement for environmental and economic evaluations to be conducted in order to assure that risks associated with first-time introductions are acceptably low. It illustrates a clean list approach to introductions which the NRC committee generally recommends for all levels of decisionmaking about non-native introductions.

Mr. Chairman, we will continue to pursue a precautionary approach with our partners as we move forward with careful study of contained *C. ariakensis* aquaculture until the evaluation review and risk limitation requirements of our Bay policy are met. EPA believes that the Chesapeake Bay program partners should oppose the introduction of non-native oysters in the Chesapeake Bay beyond what is currently being done on an experimental basis.

Meanwhile we look forward to collaborating with our partners on an environmental impact statement to continue the evaluation of the benefits, risks and consequences of and alternatives to non-native oyster introduction. We appreciate the opportunity to testify and I will be happy to answer any questions that you have.

Mr. GILCHREST. Thank you very much, Ms. Hanmer.

[The prepared statement of Rebecca Hanmer follows:]

Statement of Rebecca Hanmer, Director, Chesapeake Bay Program Office, U.S. Environmental Protection Agency

Good morning and thank you, Mr. Chairman. My name is Rebecca Hanmer. I am the Director of the Environmental Protection Agency's (EPA's) Chesapeake Bay Program Office. I appreciate the opportunity to be here today to discuss efforts to introduce non-native oyster species to the Chesapeake Bay and the National Research Council's (NRC's) report titled "Non-native Oysters in the Chesapeake Bay."

In the Chesapeake 2000 agreement, the Chesapeake Executive Council made the following commitment: "By 2010, achieve, at a minimum, a tenfold increase in native oysters in the Chesapeake Bay, based upon a 1994 baseline." This commitment is focused on native oysters. While our collective effort to develop and implement a Chesapeake Bay Program comprehensive bay-wide oyster management plan is behind schedule, we have a draft plan, the principal guidelines of which are being implemented by Federal and State agencies engaged in native oyster restoration. Our oyster restoration initiative is now emerging from a phase of experimentation and pilot project, and is entering a phase of accelerated implementation with an adaptive management approach. Thanks to increasing funding from the Congress, the Army Corps of Engineers, in collaboration with Maryland and Virginia, is now engaging in the implementation of restoration projects that are orders of magnitude larger than the earlier pilot projects. We have a long way to go, but we believe we should stay the course.

In the Chesapeake Bay Program, our framework for the consideration of the introduction of non-native oysters is another document signed by the Chesapeake Executive Council, the 1993: "Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species." The Chesapeake Bay Program's policy is simply stated as follows:

> "It shall be the policy of the Jurisdictions in the Chesapeake Bay basin to oppose the first-time introduction of any non-indigenous aquatic species into the unconfined waters of the Chesapeake Bay and its tributaries for any reason unless environmental and economic evaluations are conducted and reviewed in order to ensure that risks associated with the first-time introduction are acceptably low."

The establishment of this policy was motivated by our experience with other intentionally introduced species, including nutria and mute swans, which are among the six most harmful aquatic species in the region for which we are very near completion of basin-wide control plans.

EPA also has obligations under Executive Order 13112 regarding Invasive Species (February 3, 1999). Specifically, we may not authorize, fund, or carry out actions that we believe are likely to cause or promote the introduction or spread of invasive

species in the United States or elsewhere unless we have determined, and made public our determination, that the benefits of such actions clearly outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with these actions.

As you know, Mr. Chairman, in the interest of obtaining an independent, objective and expert assessment of the risks and potential benefits of the introduction of non-native oysters, EPA joined with others to support a study by the National Research Council. We received an excellent report and I submit it for the record as part of my written testimony.

The NRC report identifies five commonly held "unrealistic expectations and common misconceptions" also called "myths," which I believe we should keep in mind. I would summarize the useful messages derived from those myths as follows: There is no quick fix, no silver bullet, no shortcut, not for the oyster industry and not for water quality restoration. And native oyster restoration is not an exercise in futility, we should continue our aggressive pursuit of new technologies, good stock, and new methods, always remembering that this will be a long-term project.

The report also provides conclusions with respect to the three options the study committee was asked to evaluate.

- Option 1. Status quo, no introduction of non-native oysters. The report emphasizes the risk that a prohibition on any activity with non-native oysters could lead to a harmful illegal release. I suggest that it may be important to proactively educate members of the oyster industry that oyster restoration is going to be a long-term project with any species, while developing economic alternatives for watermen and others in the industry (e.g., engagement in restoration).
- Option 2. Open water aquaculture of triploid oysters. The report concludes that "contained aquaculture of triploid *C. ariakensis* provides an opportunity to research the potential effects of extensive triploid-based aquaculture or introduction of reproductive non-native oysters on the ecology of the Bay and offers some additional economic opportunities for the oyster industry and the watermen." The report supports the track we are currently following, although it may be necessary to define acceptable project size limits and continually improve the nature of the strict control protocols as we proceed.
- Option 3. Introduction of reproductive diploid oysters. The report concludes that "it is not possible to predict if a controlled introduction of reproductive *C. ariakensis* will improve, further degrade, or have no impact on either the oyster fishery or the ecology of Chesapeake Bay." And says: "In sum, the irreversibility of introducing a reproductive non-native oyster and the high level of uncertainty with regard to potential ecological hazards make Option 3 an imprudent course of action." I agree with that conclusion.

The Chesapeake Bay Program partners are vitally engaged on this issue. Under the terms of a joint agreement, the partners agreed to undertake an Environmental Impact Statement (EIS) prior to any decision to go ahead with Option 3. That process has now begun.

The Bay Program prides itself on its reliance on sound science to guide all our activities. That is why we called for and helped underwrite the cost of the National Research Council's study. Similarly, we have asked our Scientific and Technical Advisory Committee to establish a panel of experts to develop the research plan. A strong scientific analysis is a necessary pre-condition for sound decision making and will be vital to a strong EIS.

The adequacy of existing regulatory frameworks to address non-native oyster introduction also was addressed at length in Chapter 8 of the NRC report. With respect to federal authority, the applicability of Clean Water Act Sections 404 and 402 are subject to the purview of the EPA. The critical issue with respect to Section 404 jurisdiction is whether an introduction would involve the discharge of dredged or fill material. Appropriately, the Army Corps of Engineers asserted 404 jurisdiction over the Virginia Seafood Council proposal because the proposal clearly involved the in-water discharge of dead shell material (i.e, fill) to establish a hard substrate on which to place some of the experimental oysters. What is less clear is whether introduction of oysters without the discharge of dead shell material would involve a discharge of fill material at all. Similar to the Army Corps of Engineers, EPA would need to see the details of a specific proposal before the applicability of Section 404 could be determined. For purposes of interagency consistency, we have asked the Corps to consult with EPA before they make any project-specific determination in this regard.

In closing, Mr. Chairman, I want to comment on the importance of the Chesapeake Bay Program as an institution with important potential in the consideration of this issue. The NRC report also suggested that Chesapeake Bay Program's 1993

policy, and the ad hoc advisory panel review process under that policy, could serve as a model for elsewhere in the country. "The 1993 policy," the report says, "is consistent with a precautionary approach to non-native introductions, e.g., in its requirement that environmental and economic evaluations be conducted in order to ensure that risks associated with first-time introductions are acceptably low." "Also" the report continues, "the 1993 policy illustrates a 'clean list' approach to introductions, an approach which the committee generally recommends for all levels of decision-making about non-native introductions as contrasted with the 'dirty list' approach. Under the 1993 policy, and many State laws, introductions of non-native species are prohibited unless specifically approved. Utilizing a clean list is a key step in implementing a precautionary approach."

Mr. Chairman, we will continue to pursue a precautionary approach with our partners in the Chesapeake Bay Program as we move forward with careful oversight and study of contained aquaculture, as supported by the NRC report. Based on the numerous findings and policy and research recommendations of the NRC report, it is clear that we still have work to do to fulfill the evaluation, review, and risk minimization requirements of the 1993 Chesapeake Bay Program policy. Therefore, in keeping with the 1993 policy, we conclude that until those requirements are met, Chesapeake Bay Program partners should oppose the introduction of non-native oysters in Chesapeake Bay beyond what is currently being done on an experimental basis. Meanwhile, in order to meet the evaluation and review requirements, we look forward to collaborating with our partners on an Environmental Impact Statement to continue the evaluation of the benefits, risks and consequences of—and alternatives to—non-native introduction. We are all committed to working together, which will serve the partnership of the Chesapeake Bay Program well in the EIS process.

Mr. GILCHREST. Delegate Eckardt just walked in. I don't know if, Addie, you want to come up to the dais and ask questions. We have this and one more panel left, but you are welcome to come up. Dr. Franks. Welcome.

STATEMENT OF HON. C. RONALD FRANKS, SECRETARY, MARYLAND DEPARTMENT OF NATURAL RESOURCES

Mr. FRANKS. Thank you, Mr. Chairman. Thank you for inviting me to testify on this critical issue facing the State of Maryland, Virginia and the Chesapeake Bay. Oysters have been a keystone species here for as long as we have documented history of the Bay and today, restoration of an oyster population in the Bay is a top priority for the Department of Natural Resources and Governor Ehrlich. Restoration of oysters, restoration of bay grasses and the reduction of nutrients are the three critical activities comprising the cornerstone of Maryland's Bay restoration efforts.

Today, I would like to provide you with a brief overview of Maryland's past and continuing efforts to restore native oysters, and why we believe it is time to evaluate the introduction of a second oyster species that should be part of our bay restoration efforts. The importance, both ecologically and economically, of restoring a viable population of oysters to the Chesapeake Bay, cannot be overstated. Nevertheless, if we are to take this road, it must be done in a responsible and timely manner.

Environment. Oysters provide specific ecological benefits for the Bay. When abundant they provide the Bay's foundation linking other species together and enriching the ecosystem. A healthy population of oysters is to the Chesapeake Bay as healthy trees to our landscape. Without these essential components that filter pollutants and ensure healthy habitat for other living things, their respective ecosystems cannot fully function and these benefits critical to other living communities are lost.

The end result is a fundamental change in the ecosystem. And I will underline that. Which today for the Bay means an ecosystem dominated by algae and bacteria, rather than by oysters and bay grasses. The result, degraded water quality, clarity and habitat. Today, Maryland's oyster industry is economically extinct. The Chesapeake Bay is no longer considered a viable source of oysters for the national or even local market. These financial realities impact harvesters processors, shippers, restaurants and family businesses.

The oysters we eat in Maryland today are being imported from the Gulf Coast to meet the local market demand. We expect this year's harvest to fall below last year's 53,000-bushel low, and we are seeing watermen continue to drop out of the fishery.

In 1999, there were 2,520 harvesters. In 2004, we estimate that less than 200 will harvest oysters today. Over the past 12 to 15 years, many restoration initiatives have been undertaken based upon a recommendation from scientists and environmentalists. The aquatic reef habitat restoration plan was implemented in 1993 to set aside thousands of acres of bottom habitat for rehabilitation as oyster reef sanctuaries.

The Maryland Oyster Roundtable of 1993, that still exists today, recommended shell and seed plantings, hatchery development, fish, management and sanctuary creation to reverse the decline. The 1999 scientific consensus document that was written by Maryland, Virginia and other marine scientists supported these and other recommendations. It served as the scientific voice and foundation of the 2000 Chesapeake Bay agreements which made a commitment to restore oysters to 10 times their 1994 level by 2010.

Yet, in spite of this tremendous commitment to oyster restoration, the bi-state efforts under the Chesapeake Bay program have not increased numbers or the biomass of oysters in the Chesapeake Bay. Actually, as measured by the oyster biomass index, the levels are below the all-time low baseline of 1994. Every opportunity currently known has been attempted or made available to increase the biomass of *C. virginica*, but so far we have been unsuccessful. In fact, 8 million State and Federal dollars will be spent in Fiscal Year 2004 on Chesapeake Bay oyster restoration. And, since 1994, a total of nearly $41 million has been spent in Maryland alone with no measurable Bay-wide success.

When considering the future of the native oyster population and the efforts to restore it, we must be realistic and base our strategy on what we know. There are no cures for the diseases MSX and Dermo that are killing the native oyster population. The areas where disease becomes entrenched never sees the disease abate, and the oyster beds never improve to pre-disease levels. The best science has been applied to restoration with less than positive outcomes.

Most scientists agree that it will take many decades to make any real progress in restoring native oysters to the Chesapeake Bay if it can be done at all. Everyone, scientists government, watermen, citizens, does agree that the Bay needs an oyster that can survive and multiply. The only question is if it will be our native oyster or an introduced species. *C. ariakensis* is a current—is in a proposal that is on the table to potentially introduce in oyster, the Oregon

strain of the oyster to the Chesapeake Bay. Here is where that proposal stands.

In July, 2003, Virginia's DNR Secretary and I submitted a request to the U.S. Army Corps of Engineers in Norfolk to coordinate the evaluation and the introduction of this second species of oysters to the Bay through the preparation of environmental impact statement. Since that time, both departments have been working with the Corps to do the preparatory work necessary for this comprehensive and extensive public review of our proposal.

A formal planning meeting is scheduled to convene tomorrow, Thursday, that will include the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, NOAA, and representatives from Virginia and Maryland to begin the process of preparing an EIS. Preparation of this EIS will be aided by the recently issued National Academy of Sciences report, including the funding of a specific research directed to the questions and uncertainties identified therein.

A central function of the EIS will be to analyze the risk of unknown or unanticipated consequences to introducing a non-native oyster in the Chesapeake Bay. The Commonwealth of Virginia has already begun research and experimentation with this non-native species which has been raised in Oregon waters for the last 30 years. Results of the Virginia experiments to date indicate this species is resistant to diseases decimating the Bay's native oysters and can adapt very readily to the Chesapeake Bay ecosystem. And it has the potential to thrive here.

There is some question on the part of the Corps as to whether we have the legal jurisdiction to conduct an EIS on *C. ariakensis*, recognizing that Maryland, and hopefully Virginia, is willing to conduct a State EIS that include the same parameters as the Federal EIS process. Mr. Chairman, a common goal has brought us here today and we, like you, have one priority, and that is the restoration of the Chesapeake Bay. And while we, like you, understand that true Chesapeake restoration is an ecosystem approach that relies on several components, including nutrient reduction and bay grass restoration, we are fully focusing today on the oyster.

We estimate the cost of the EIS and non-native research to be approximately $3 million over the next 12 to 18 months, and we believe there is urgency in completing it. Congress has recognized the need funding the Bay restoration programs and has directed Federal agencies to assist us. We are very appreciative of the support we have received to date and ask that judgment be held until all the science is in.

We invite our Federal agencies to partner with us in completing a full unbiased assessment of the risks involved and the benefits to be gained. Again, thank you for the opportunity to appear. We look forward to a full and informative public dialog on our proposal and a balanced decision that will serve our environment and our citizens resulting in a healthy productive Chesapeake Bay. Thank you very much, Mr. Chairman.

Mr. GILCHREST. Thank you, Dr. Franks.

[The prepared statement of Ronald Franks follows:]

Statement of The Honorable C. Ronald Franks, Secretary, Maryland Department of Natural Resources

On behalf of the Department of Natural Resources, the Governor, and the State of Maryland, thank you for the opportunity to testify today and for your interest in the Chesapeake Bay.

The Chesapeake Bay oyster is the cornerstone of the Bay's ecology and water quality, serving as the Bay's main filtration system and rich habitat for many other species. Tragically, the Bay's oyster population has been decimated by disease, which has crippled the Bay's ability to filter nutrients entering its waters through watershed runoff and waste-water treatment discharges. As a result, restoring the Bay's oyster population is an essential element of the Ehrlich Administration's plan to improve the quality of the Bay's waters. While the ecological and economic importance of oysters cannot be overstated, attempts to overcome diseases, such as Dermo and MSX, continue to fail. At this time an alternative, disease-resistant oyster, such as the Crassostrea ariakensis, is the only viable option for scientists and policymakers to effectively and efficiently restore the Bay's oyster population.

OYSTER HISTORY SINCE THE 1900s

The history of oysters in Chesapeake Bay is closely tied to our national efforts to conserve and manage natural resources. During the decade of the 1910s, the state took action to reverse the decline in oyster harvesting: Maryland conducted experimental seed and shell plantings and took regulatory action that would eventually form the backbone of oyster management in Maryland.

During the 1920s, just as the harvest declines were being reversed, a typhoid outbreak in the major population centers of Chicago, New York and Washington, that was attributed to oysters, received a lot of negative publicity and resulted in oyster sales crashing. During this period, the oyster market was also undergoing a long-term, gradual shift from a mass-market dietary staple to more of a luxury food item. Additionally, the Chesapeake Biological Laboratory was established, and two major engineering projects affecting the hydrology of the Upper Chesapeake Bay were completed: Conowingo Dam and the conversion of the Chesapeake & Delaware Canal to a water-level shipping route.

During the 1930s, oyster harvests were affected by the Great Depression and by competition from cheaper seafood brought about by improved transportation and refrigeration. As the nation emerged from the Depression, oyster harvests in Chesapeake Bay climbed to their highest point in almost 20 years.

During the 1940s and World War II, a large number of watermen left their boats for U.S. military service. Oyster harvests declined, but the Chesapeake Bay remained the dominant source of oysters in the United States.

During the 1950s, the oyster parasite Dermo was discovered in Maryland. Also, a series of hurricanes caused considerable damage that severely depressed oyster reproduction.

During the 1960s, Maryland began large-scale planting of old shell, and harvests increased to the highest since the 1930s in spite of oyster disease outbreaks.

During the 1970s, a series of natural catastrophes and changes in the industry set the stage for a tailspin from which oyster abundance and the oyster harvest have yet to recover. As a result of more than half-a-decade of reduced salinities, a nearly complete spat-set failure occurred during this decade. The Virginia oyster industry declined sharply as a result of disease, which, in turn, increased harvesting pressure in Maryland to meet the demand for oysters.

During the 1980s, several years of low rainfall allowed oyster diseases to return with a vengeance, and MSX and Dermo both became chronic infections on most oyster bars in the state. The mid-1980s were a pivotal point for the oyster. In 1987, the Maryland oyster harvest declined to below one million bushels, the lowest harvest since the mid-nineteenth century, and in 1988, harvests plummeted even further—by more than 60 percent from 1987 levels to 363,000 bushels. The dockside value fell from $16 million in 1987 to $7 million in 1988. Since 1988, oysters have continued their decline with far fewer bushels harvested in the years thereafter. An Executive Order in 1985 established the Maryland Bay Cabinet to coordinate Bay recovery programs to improve water quality and Bay health.

In the 1990s, the oyster harvest declined to a 150-year low in spite of a series of record high spat falls. The mortality of mature oysters approached 90 percent, which severely reduced the benefits that the record spat falls provided. We also saw the creation and signing of the Chesapeake 2000 Agreement, which established new goals for the reduction of nutrients and restoration of oysters and Bay grasses. The price tag for restoration of the Bay is now estimated at $18.7 billion, with Maryland's portion being $6.8 billion.

PRESENT DAY: DEFINING THE PROBLEM

It is clear that we are at a pivotal point in Bay restoration efforts, particularly the restoration of the Bay through an abundant population of self-reproducing oysters. In spite of a massive effort and expenditures of tens of millions of state and federal dollars to restore native oyster populations, populations are now one-half of what they were in 1994, a reference year for rebuilding oyster populations. The oyster diseases Dermo and MSX are a dominant influence, and unless they are substantially controlled—and no evidence suggests that they can be—the trend and the outlook for the native oyster is bleak. There is little reason for optimism and even less evidence that we are making any progress in defeating these oyster diseases.

A look at the historical data reveals a crucial trend. Oyster harvests remained between 2 million and 4 million bushels from 1920 to 1982, thereby showing the ability of the Chesapeake Bay to support an abundant population in balance with a significant fishery.

However, that is not now the case. As a result of more than 15 years of disease pressure, Maryland has a record-low oyster population estimated to be less than 1 percent of historic levels. MSX and Dermo have expanded in range and prevalence, reaching record-high levels farther up the Bay and tributaries, depending on the year. In 2002, the average oyster-mortality rate for Maryland was 58 percent, and many areas experiencing 80- to 100-percent mortality. The typical mortality rate without disease pressure is 10 percent or less. This difference is vital and critical to our restoration efforts. Oyster survival is key to establishing an abundant oyster population in the Bay.

One problem is the intense disease conditions that prevent the sporadic natural sets of young oysters from realizing their potential to sustain the population for the long term. As the spat grow to become larger oysters, diseases kill them by the ages of 3 to 4 years, thereby mitigating their ecologic and economic benefits. Unlike spat or young oysters, larger and older oysters produce more brood, filter more water, and create more valuable hard-bottom habitat critical to the growth of oyster bars. Conversely, low mortality rates allow successive year classes, or spat sets, to live many years and to develop abundant populations upon the oyster bars.

Against this background and history, the Commonwealth of Virginia began research and experimentation with the non-native species Crassostrea ariakensis, which has been raised in Oregon waters for the last 30 years but was originally from Southeast Asia. Results of the Virginia experiments to date indicate that this species of oyster is resistant to the diseases decimating the native oysters, can adapt very readily to the Chesapeake Bay, and has the potential to thrive in the Chesapeake Bay.

The decline of the oyster makes it all the more imperative to recall its ecological and economic importance:

• Ecological Importance

Oysters provide specific ecological benefits for the Bay, but these benefits have declined to insignificance due to the loss of oysters. Only by restoring an abundant population can we restore these ecological functions.

Oyster populations are a keystone species when they are in abundance, linking other species together and enriching the Bay's ecology. A healthy population of oysters is to the Chesapeake Bay as healthy trees are to a forest. Without these essential components, the respective ecosystems do not fully function, and the benefits that extend to, and are critical to, other living communities in the ecosystems are minimal to nonexistent. The ultimate result is a fundamental change in the ecosystem. The Bay's ecosystem today is dominated by algae and bacteria rather than by oysters and SAV, resulting in degraded water quality and poor water clarity.

Oysters create hard-bottom habitat that is essential to many sessile, attached organisms such as mussels, barnacles, bryozoans, and anemones, which filter the water and provide food for larger animals. The hard, shelly habitat is also important for many small organisms, such as mud crabs, blennies, gobys, and worms, that require the niches provided by the shells and oyster clumps. These organisms attract larger organisms, such as blue crabs and commercial and recreational fin fish, illustrating that oyster reefs are an important component of the Bay's food web.

Oysters and other filter feeders eat algae and sequester silt, clearing the water. They remove algae, eat it, and convert it to biomass, reducing nutrients in the water column. Nutrient enrichment and algae blooms are two of the Bay's major problems that were especially prevalent this year. By clearing the water and reducing nutrients, oysters, when in great abundance, could help Bay underwater grasses.

It has been estimated by leading oyster scientists that the once-abundant pre-1870 oyster population required only about 3 days to filter a volume of water equivalent to the Bay's volume. By 1988, that changed to 325 days; today, our remnant population requires an estimated 700 days.

Scientists generally agree that it will take decades, if it can be done at all, to increase the number of C. virginica to ecological significance.

• Economic Issues

The oyster industry is economically extinct, impacting harvesters, processors, shippers, restaurants, and family businesses. Oysters are being imported into Maryland by processors and restaurants from the Gulf Coast and the West Coast to meet the local market demand. Chesapeake Bay is no longer considered a viable source of oysters for the national market.

DNR expects the harvest to fall below last year's 53,000 bushels and oystermen to continue dropping out of the fishery. In 1999, there were 2,520 harvesters, followed by 915 in 2002 and 437 in 2003. For 2004, it is estimated that less than 200 will harvest oysters. Maryland processors have already suffered and will continue to decline. There were 58 in 1974, they fell to 20 in 1990, and only a handful are left now.

OUTLOOK FOR NATIVE OYSTERS & RESTORATION

The long-term goal of the Chesapeake Bay Program to restore an abundant and a healthy Chesapeake Bay oyster population is essential. Attaining a self-sustaining oyster population is necessary to provide ecological benefits significant enough to reach the water-quality improvement goals prescribed for the Chesapeake Bay, as well as to improve the Bay's fishery.

Restoration efforts must address the entire Bay and not just the improvement of a few sites, or even many sites. Restoration is not repeatedly restocking these sites time and time again to replenish failed efforts. None of the efforts address the disease solution because there is no cure. Maryland does not have the luxury to hope that the native oyster will recover or that they should be given more time to recover, or that even larger-scale efforts should be undertaken. The Bay's future is dependent on a robust oyster population, and the risk is too great to base the entire Bay restoration strategy on a idea that is significantly contingent on the re-emergence of the native oyster.

When considering the future of the native oyster population and the efforts to restore it, we must be realistic and base our strategy on what we know. There is no cure for the diseases MSX and Dermo that are killing the native oyster population. The areas where disease becomes entrenched never see the disease abate, and the oyster beds never improve to pre-disease levels. The best science has been applied to restoration with less than positive outcomes. Scientists generally agree that it will take decades to make progress in restoring oysters, but even they have doubts if it can be done within decades, if at all. Everyone does agree that the Bay needs an oyster that can survive and multiply. The issue is whether it is to be the native oyster or a second oyster species.

The oyster population, its ecological contributions, and the fishery are at record-low levels, and only a dramatic change can improve the situation. Oyster populations will continue to decline for at least 4 years due to recent low spat sets, continued mortality, and the expectation that mortality will occur in the future. The high rainfall in 2003 lowered salinity and will deter disease and improve survival, but stocks are so low and recent sets so poor that any large-scale significant increase in stocks will not occur. If a strong set occurs in the summer of 2004, it will take about 3 years for the set to grow, but even a strong 2004 year class may not produce any significant change because MSX and Dermo can easily impact those oysters as it did the strong year classes of 1985, 1986, 1991, and 1997.

The oyster's demise in the Bay is similar to what has happened in other East Coast areas. The Delaware Bay has experienced only a remnant oyster population and fishery since the 1940s, and MSX and Dermo have spread north and south along the Atlantic coast. Around the world where oyster diseases have impacted native stocks, there have been no cases where the situation has reversed.

NATIVE OYSTER RESTORATION EFFORTS

During the past 12 to 15 years, many restoration initiatives have been undertaken that were based upon recommendations from scientists and environmentalists. The Aquatic Reef Habitat Restoration Plan was implemented in 1993 to set aside thousands of acres of bottom habitat for rehabilitation as oyster reef sanctuaries. The Maryland Oyster Roundtable of 1993, which still exists today, recommended shell and seed plantings, hatchery development, fishery management, and sanctuary creation to reverse the decline.

The 1999 Scientific Consensus document that was written by Maryland, Virginia and other marine scientists supported these and other recommendations. It served as the scientific voice and foundation of the 2000 Chesapeake Bay Agreement, which made a commitment to restore oysters to 10 times the 1994 levels by 2010.

Progress towards the 2010 oyster goal is measured by an oyster biomass index that is calculated by scientists using data from DNR's annual Fall Oyster Survey. Biomass is a measure of living oysters in the Bay. For Maryland, the biomass index has declined 70 percent during the last few years, and it is now below the previous all-time-low baseline of 1994. In spite of the tremendous commitment to oyster restoration, the Bi-state efforts under the Chesapeake Bay Program have not increased the number or biomass of oysters in the Chesapeake Bay.

The native restoration program costs have exceeded tens of millions of dollars. Maryland and federal dollars will total about $8 million for Fiscal Year 2004. A few years earlier, it ranged between $4 million and $5 million annually. Every opportunity currently known has been attempted or made available to increase the biomass of C. virginica, but so far, we have been unsuccessful.

Restoration efforts have and continue to include:

- Establishing a network of sanctuary and reserve areas where oysters are protected from harvest in order to protect brood stock, maintain ecological function, and "jumpstart" recovery;
- Planting shell for habitat and setting of young oysters;
- Cleaning silted bars;
- Planting natural seed oysters on old and new shell habitat; and
- Planting potentially resistant strains of hatchery-reared, disease-free oysters.

Some of the major initiatives of the native oyster restoration include:

1. Sanctuaries and Reserve Areas

Sanctuaries, or non-harvest areas, are the foundation of the restoration initiative. They are designed to protect brood, deliver ecological benefits, and yield recovery in non-sanctuary areas as oysters spread through larval dispersal. Reserve areas are also designated for these purposes, but they are also opened for periodic, limited harvest; then the area is closed again to achieve the ecological benefits. Together with reserve areas, they allow scientists to monitor oysters that are free from harvesting pressure and to evaluate their experiments and the concept of controlled harvesting as a recovery method. Maryland presently has 29 sanctuary areas, ranging in size from entire tributaries, such as the Severn River, down to about 10 acres, and 4 major reserve areas.

To date, some sanctuaries have received good natural sets of spat on planted shells, indicating a strong start for the restored sites. Other sanctuaries in lower setting areas were planted with hatchery seed, and these populations too have experienced good initial growth and survival. Unfortunately, most of these sanctuaries were impacted over time by the diseases and have suffered high oyster-mortality rates in both the planted seed and natural oysters. The net total of the oyster populations have not increased under a sanctuary strategy: They have decreased.

2. Hatchery Seed Oysters

Hatchery seed oysters are a key component of the restoration program for sanctuaries and reserves. The seed oysters that are disease free when they leave the hatchery are planted to stock restoration sites. At times, natural spat set occurs to populate a site, but hatchery seed is the dominant source of oysters for restoration sites. Seed plantings in lower salinity areas, which are also low-disease areas, have survived and grown well, while the hatchery seed placed in higher-disease areas have been infected and essentially lost to disease. In 2003, Maryland planted more than 100 million hatchery seed compared to less than 15 million about 5 years ago. To achieve the ultimate goal of restoring the Bay, hundreds of billions of oysters are needed. This requires oysters to successfully reproduce and survive in the wild in all areas of the Bay.

3. Habitat

Habitat improvement has been the foundation of oyster restoration for more than 100 years. Oysters need clean habitat on which to set and grow. Habitat improves a spat set, so in an effort to increase the spat set and the overall oyster population survival, shell plantings have been made in restoration areas. However, spat-setting areas are also disease-prone areas, and we are seeing high mortality rates in the third and fourth years. The habitat strategy does not address disease; therefore, habitat initiatives are helpful but not the answer for total oyster restoration.

Currently, about 100 acres of habitat are shelled each year for restoration goals compared to less than 20 just a few years ago. Thousands of acres still need improvement.

A variation on the habitat theme was the construction of 3-D habitat in the form of large shell piles to elevate oysters in the water column, thereby encouraging a healthier stock. The theory was that such habitat would aid restoration, but thus far, the diseases also impact these oysters, showing that 3-D habitat alone is not

a viable solution. Another variation was using non-shell materials. They have been planted on restoration sites, but they do not attract spat as effectively as shell. Even if they equaled or surpassed shells, disease would undermine the populations.

4. Harvest Control

Reducing or ceasing harvest has been recommended and reviewed as a viable method to restore Bay wide stocks. Sanctuaries are a form of harvest reduction, as are limitations on the harvesting season, the daily bushel limit, and the gear that is used. During the past 10 years, though sanctuaries have increased, we have not seen improvement in oyster abundance in closed areas that have been off limits to harvesting. In wide areas of the Bay, including most of Virginia's and Maryland's waters, there has been a de facto moratorium on harvesting due to disease impacts, yet oysters have not recovered in the absence of a fishery. One could conclude that harvesting is not the cause of the problem and therefore not the solution.

A method related to controlling harvest that was implemented and monitored was to buy back large oysters harvested by watermen and replant the oysters in sanctuaries to encourage these disease survivors to produce better progeny for the Bay. The buyback oysters that were purchased and returned to the waters were themselves highly infected, and they quickly died.

EFFORTS TO CONSIDER AND INTRODUCE A NON-NATIVE OYSTER

Due to the lack of ecologically and economically significant results and the inability of current strategies to mitigate and address the diseases, a new approach must be considered to restore the entire Bay—the solution must enable oysters not only to survive but also to reproduce successfully and thrive. Hundreds of billions of oysters are required to help restore the Bay.

Maryland is currently reviewing a proposal to introduce a second oyster species, the Oregon strain of the oyster Crassostrea ariakensis (C. ariakensis) to the Chesapeake Bay.

This oyster, also known as the Asian Oyster, has been in U.S. waters since 1957 and was imported again in 1972 to Oregon for aquaculture and has since been under evaluation in Virginia and North Carolina. The current West Coast brood stocks are in their fifth generation since the original stocks were imported. Our proposal would use only the Oregon strains of *C. ariakensis*. The ICES protocols have been met, and the introduction of diseases, viruses, or pathogens from outside the United States has already been addressed and minimized in accordance with the NAS recommendation. To date, no significant mortalities due to diseases or other causes were noted during the sustained commercial production on more than 100 acres of beds in Oregon.

Its environmental requirements are much like our native oyster, indicating it is a good candidate for consideration to restock the Bay. Results from Virginia show that the Crassostrea ariakensis is not infected by MSX, but is by Dermo. However, it survives well even though it has Dermo. Mortality rates are extremely low, as the native oyster was before disease appeared in the Bay. The *C. ariakensis* filters water a little less efficiently than a same-sized native oyster, but because it grows twice as fast and given its expected longer life span, the population would still filter more water than the native population. Tests in Virginia also confirm that native spat will set upon the shells of *C. ariakensis* and grow, indicating that large populations of *C. ariakensis* could provide the needed clean, hard-bottom habitat to assist native oyster populations.

In July, 2003, the Secretaries of Virginia's and Maryland's Departments of Natural Resources submitted a request to the U.S. Army Corps of Engineers in Norfolk, Virginia, to coordinate the evaluation of an introduction of this second species of oyster to the Bay by preparing an Environmental Impact Statement (EIS). Since that time, both Departments have been working with the Corps to do the preparatory work necessary for this comprehensive and extensive public review of our proposal.

A formal planning meeting will convene October 15 and 16, 2003, with the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Virginia, and Maryland to begin the process of preparing an EIS for public review and comment. Preparation of this EIS will be aided by the recently issued report by the National Academy of Sciences, including the funding of specific research directed at the questions and uncertainties identified in the NAS report. DNR would like to complete the EIS in 12 to 18 months, an ambitious but doable time frame

POTENTIAL EFFECTS OF INTRODUCING A NON-NATIVE OYSTER

A central feature of the Environmental Impact Statement to be developed is to analyze the risk of unknown or unanticipated consequences in introducing a non-

native oyster in the Chesapeake Bay. Many of the potential effects are not currently known and will be addressed in the EIS, including:

- Where will the *C. ariakensis* grow in the Bay, and how might the oyster affect other resident species, especially the native Eastern oyster?
- Will *C. ariakensis* provide ecosystem services to the Bay similar to those provided by the native oyster?
- Will *C. ariakensis* become a nuisance species, which would result in negative impacts on the Bay ecosystem?
- What are the chances of the non-native oyster dispersing to regions outside the Bay?
- If an illegal introduction of *C. ariakensis* occurs, is there an increased concern that disease agents or other species that may be attached to the oysters would be introduced into the Bay?

The NAS report that will be discussed shortly includes discussion on each of these questions and on possible economic and social effects. A table included in the NAS report assesses the short-term (1-5 years) potential outcomes for biological and social factors likely to be affected by selection of three options presented in the report, a caveat being that there are uncertainties associated with each outcome.

Using ICES protocols, the NAS report identifies positive and negative factors (see chart below) associated with a large, managed diploid (reproducing) introduction of *C. ariakensis*. These initial assessments will be a point of reference as the EIS is prepared.

Positive Factors	Negative Factors
• Increased water quality and clarity	• Disease introduction
• Reef structures and ecological services	• Susceptibility to pathogens and parasites
• Traditional fishery	• Competition with other species
• Fishery and Aquaculture employment	• Dispersal beyond the Bay
• Tourism, recreation, and sports fishery	• Genetic interactions
• Watermen's communities & culture	• Environmental political impacts
• Fishery political impacts	• Restoration efforts
• Viability of aquaculture	• Impact of rogue introductions

REGULATORY ISSUES SURROUNDING THE INTRODUCTION OF A NON-NATIVE OYSTER

The primary concern regarding the introduction of a non-native oyster is that it could be considered an invasive species. The National Invasive Species Act of 1996, which governs the introduction of non-native species through ballast water, defines "aquatic nuisance species" as a "nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aqua cultural or recreational activities dependent on such waters." 16 U.S.C. 4702 (1). Ultimately, the EIS will address this issue in detail, but evidence is not available to conclude that *C. ariakensis* would be an invasive species:

1. No harmful effects have been observed after more than 30 years of *C. ariakensis* being in Oregon waters. Oyster stocks have been tracked and raised from brood stock, which were imported to Oregon from Ariake Bay, Japan, in 1969-71. No other imports have been recorded since then.
2. No diseases have been reported in these stocks since their importation to Oregon or in studies conducted by Virginia. No natural spawning occurs in these stocks due to high (near full sea water) salinities in the region. No setting occurs in larvae from these stocks at 35 ppt (full-strength sea water). The oyster requires moderate (15-20 ppt) salinities and high temperatures (>60 F) for successful spawning and larval survival.
3. From East Coast field studies and other sources, *C. ariakensis* eats algae, which is overabundant and a serious problem in the Chesapeake Bay. *C. ariakensis* provides hard-shell habitat, which the Bay has lost by the thousands of acres and which many organisms need. *C. ariakensis* provides habitat for native oyster spat as documented in Virginia studies.

To virtually eliminate foreign disease risks, oysters will NOT be brought from Asia but from Oregon stocks. Virginia Institute of Marine Sciences brood stock and would be the parentage for large-scale introductions to the Bay.

NATIONAL ACADEMY OF SCIENCES (NAS) REPORT

On August 14, 2003, the Committee on Non-native Oysters in the Chesapeake Bay, Ocean Studies Board, and National Research Council of the National Academy

of Sciences released the prepublication version of their report on Non-native Oysters in Chesapeake Bay.

The Academy was asked to examine the ecological and socioeconomic risks and benefits of open-water aquaculture and the direct introduction of the non-native oyster Crassostrea ariakensis in the Chesapeake Bay. The report reviews how *C. ariakensis* might affect the ecology of the Bay, including effects on native species, water quality, habitat, and the spread of human and oyster diseases and possible effects on recovery of the native oyster. The Committee assessed whether the breadth and quality of existing research on oysters and other introduced species is sufficient to support risk assessments of three management options: 1) no use of non-native oysters; 2) open water aquaculture of triploid (non-reproducing) oysters; and 3) introduction of reproductive diploid oysters. Where current knowledge was considered inadequate, the committee recommended additional research priorities.

In brief terms, the executive summary of the report states that, because relatively little is known about *C. ariakensis*, it is difficult for scientists and resource managers to decide whether this oyster has the potential to help or hurt conditions in the Chesapeake Bay, either for the industry or the ecosystem. Hence, opinions range from the hope that this oyster will revive a threatened industry and restore some of the filtering capacity of the original oyster population to the fear that it will be an invader that outgrows the commercial demand for oysters and upsets the ecology of the Bay. The report addresses a wide range of issues and concludes, given the present state of knowledge, that they are currently unable to predict the long-term impacts of this oyster if it is introduced to the Bay.

Even though the Committee rejected the option of "no use of non-native oysters," they warned that there is a risk of a rogue introduction. The report further concluded, "Our review of the case studies clearly indicates that greater ecological or economic harm typically arises from organisms that are inadvertently introduced with the foreign oyster."

The NAS report sums up the situation we face: "...nevertheless, a decision must be reached about whether or not to proceed with the use of the non-native oyster despite uncertainty in the type and magnitude of the potential risks involved." It will only be through an Environmental Impact Statement that a final decision will be made and that the risks will be weighted against the benefits.

DNR appreciates the advice and guidance offered by the NAS report and will be utilizing that guidance in determining research priorities and in preparing the Environmental Impact Statement. We have already begun, in cooperation with the University of Maryland and Virginia research institutions, to prioritize the needed research and have identified funds to begin this research.

CONGRESSIONAL ACTION NEEDED

One issue examined in the NAS report dealt with "the regulatory framework for managing proposed introductions" and local, national, and international jurisdiction. The report points out that "...EPA does not consider 'a non-native organism' a 'pollutant' for NPDES permitting purposes, and that the U.S. Army Corps of Engineers approval is required only if an introduction involves structures or fill."

We are uncertain why jurisdiction should be a matter of concern or needs to be further debated. The states will, as indicated in the joint letter to the Norfolk District of the Corps, prepare a full EIS in accordance with federal guidelines and in cooperation with the federal agencies, including consideration of possible impacts beyond the Chesapeake Bay. We will conform to the ICES protocols regarding introductions of non-native species to minimize the introduction of any "hitchhikers." Furthermore, we will be inviting the Atlantic States Marine Fisheries Commission to be the interstate forum where interstate interests can be addressed as we proceed with the EIS.

CONCLUSION

Our priority is the restoration of the entire Chesapeake Bay. That restoration has many facets because the Chesapeake Bay is important in so many ways. Maryland's comprehensive approach to restoring the Bay includes: nutrient reduction, SAV restoration, and oyster restoration. The Oyster is the cornerstone of Maryland's restoration strategy because it is an absolutely essential element of the Bay's ecology.

While Maryland will continue native oyster restoration efforts, the catastrophic levels of this specie demand that we consider alternative efforts. Our only alternative is whether the naturalized Oregon strain of *C. ariakensis* should be introduced into the Chesapeake Bay. To that end, it will take full cooperation and support of the federal government to ensure that all necessary steps are taken to ensure the decision process is comprehensive and expeditious.

The key decision points we will be focusing on are:

1. Will an introduction cause harm to the ecology of the Bay;
2. Are there ecological and economic benefits to be derived from an introduction;
3. Will introduction interfere with efforts to recover the native oyster; and,
4. If introduced in Chesapeake Bay, will there be impacts on other coastal areas outside of Chesapeake Bay?

We estimate the costs of the EIS and non-native research to be approximately $3 million over the next 12 to 18 months. A longer-term research program may be required to investigate whether different strains of C.a. brought in from outside the U.S. would be a feasible alternative.

We also believe there is some urgency. While the outlook for the native oyster from both an ecological and economic perspective is bleak, it will take time to do the EIS and conduct the necessary research. Nevertheless, time is of the essence, and it is our hope that the EIS can be completed within a 12 to 18 month time frame. The situation is urgent and we are prepared to assist in a way deemed necessary—to protect the health of the Chesapeake Bay.

Thank you for the opportunity to explain our rationale and need for a decision on oysters. We look forward to a full and informative public dialogue on our proposal and a balanced decision that furthers the restoration of Chesapeake Bay.

Mr. GILCHREST. Dr. Franks.

Mr. FRANKS. Yes, sir.

Mr. GILCHREST. As Maryland moves along to consider the Asian oyster *ariakensis*, as part of a solution to the restoration of water quality in the Chesapeake Bay, and I think it is my understanding that Maryland, more so than Virginia, at this time is considering the introduction of diploid as opposed to triploid oysters; is that correct?

Mr. FRANKS. We are after the EIS. If it shows that it is possible to do that with minimal risk.

Mr. GILCHREST. And Dr.—so Dr. Wesson, oh, I am sorry. I missed—OK. Let me hold off on the questions until Dr. Wesson is done. Thank you.

Mr. FRANKS. Yes, sir.

STATEMENT OF JAMES A. WESSON, DEPARTMENT HEAD, CONSERVATION REPLENISHMENT DEPARTMENT, VIRGINIA MARINE RESOURCE COMMISSION

Dr. WESSON. Thank you, Mr. Chairman, for allowing the Commission to testify today. Everybody has mentioned the keystone value of the oyster to the Chesapeake Bay. But they are also extremely important to the health of the Commonwealth, and they provided livelihoods for untold numbers of Virginians, especially in the rural and the Bay shore communities.

In the 1890's, because of their significant economic value, the Commonwealth actually set aside more than 200,000 acres of bay bottom for public use. But all the rest of the acreage was made available for private leasing, and we have had an aquaculture industry in continuous use for more than a hundred years. Oyster production in Virginia declined dramatically around the turn of the century into the early 1920's as it did in Maryland before we knew that the shells were so valuable to the oyster, and we had to put them back overboard.

But once the public and the private industry began returning shells back to the Bay, from the 1920's to the 1950's, the oyster production was actually increasing in Virginia's part of the Bay. In the late 1950's, as we have all heard, that was when the disease was introduced to the Delaware and Chesapeake Bays, there was

a rapid and sustained decline in oyster production and population levels to the lowest point that now exist in Virginia. The newly introduced disease MSX, in combination with the native disease Dermo, have almost totally decimated the oyster industry and reduced the current populations in Virginia to less than a half a percent of what it was just 45 years ago.

The small oyster processing industry that remains in the Commonwealth survives almost exclusively on the processing of imported oyster shell stock. The industry remains at a competitive disadvantage in the marketplace due to the cost of importation and more shucking houses close with each passing year. In the late 1950's, there were 400 shucking houses in Virginia, and currently there are less than 15 that actually have any significant shucking activity at all.

The Virginia Institute of Marine Science, along with the Virginia Marine Resources Commission, have implemented countless strategies, research products and restoration programs to combat the disease-induced decline in the oyster population since the 1950's. The private oyster industry has invested and lost millions of dollars using various strategies to grow oysters within the disease-dominated conditions in the Bay.

Private investment has mostly been suspended because of the inherent risks and losses. State restoration activities have continued throughout the decline and have included the best science and management strategies that were available at any given time. The oyster restoration effort has been especially ambitious since the early 1990's with the combination of 3-D oyster reef restoration projects, the setting aside of large acreages of sanctuaries, the strict control of the wild harvest, and the implementation of quantitative statistically sound oyster monitoring programs. The 3-D oyster reef restoration and sanctuary program that was implemented at the VMRC has become the model for Bay-wide restoration efforts. The 3-D sites that we have built, they duplicate the conditions that the oysters were in before harvesting began, and we have found that the reefs improve the juvenile spat, juvenile survival and spat set because they protect the oysters from predation.

The oysters on the reefs grow faster which increases the fecundity, and we know that on the reefs we have improved their fertilization rates because the oysters are close to one another. The broodstock oyster population on these reefs have either been allowed to develop naturally, or in many cases, have been augmented with the best genetic stocks that we had at the time. And since we have begun this work, it has become the Bay-wide consensus that the restoration of the 3-D reefs and the establishment of sanctuaries is throughout the Bay is the best way to achieve the 2000 tenfold increase in the native oyster population goal by 2010.

And there has been a significant influx of the State, Federal and private monies to rebuild these reefs in Virginia and, in fact, we have built more than 70 of these reefs in the Commonwealth throughout the Bay, and there has been a significant outlay of money and effort to build these reefs, and we have not seen any increase in oyster populations associated with this effort, nor have there been any increase in oyster harvests.

In fact, since we began this work in 1993, the population of oysters are actually only 40 percent of where we began. Oyster disease still dominates the survival and can be seen from the minor results on the restored reefs. Once we build the reefs, we get a large spat set. We see the populations grow quickly. But within 2 to 3 years, the number of large oysters has returned to the levels that we see throughout other parts that we haven't restored in the local areas. There has been all sorts of research efforts to understand the diseases and to selectively breed tolerant oysters and we have been working on this for more than 40 years, and there has been some progress in disease tolerance, but the risks still remain too great for any significant private investment.

To date, the selective genetic improvement of disease tolerance did not appear to transfer into the wild populations. And Virginia began this work on considering the non-native oyster in the late 1980's. It has not been a new process for us. We have been slow and deliberate in the efforts that we have done through private industry and research institutions and the government entities.

We filed an international protocol for testing of non-native aquatic species and all the, as you have heard, all the broodstock has been quarantined throughout these projects. The tests have been—we started off with actually the Pacific oyster, and found very quickly that they didn't like the Bay very much and, actually, the industry is not very interested in using them because of the taste.

But in the mid 1990's, with the results that we have seen with the second oyster, the *ariakensis* that we are talking about now that have been done, the research the Virginia Seafood Council petitioned the Commission to do some industry trials, and the results on those trials have been excellent, whether we have worked in low middle or high salinity areas and that the oysters grew fast.

They had a very similar taste to the Chesapeake Bay oysters, and we didn't see any problems with diseases in them in all the areas that they were tested. These projects have grown as we started with 600 oysters, then we went to 6,000—600 oysters per site, and about 6,000 oysters, and then we went to 60,000 oysters in the second project, and now we are into the project that we have been hearing about today where we are testing a million oysters, but you still have to keep in mind that the million oysters are still not even one week's worth of material for a moderately large shucking house in Virginia.

VMRC is currently monitoring the project closely and all future requests that would come to VMRC for regulatory approval also must be approved through the Corps of Engineers. We are in the process of completing the environmental impact statement or beginning that process. And VMRC will be an active participant. It is critically important to the survival of the beleaguered industry to move this process as quickly as possible.

Congress can be instrumental to the success of these efforts by fully funding the process to allow the projects to occur simultaneously and quickly. Currently, nearly all the important functions of oyster and Chesapeake Bay area are either lost or severely diminished. Oysters are critically important to filter the Bay's waters as we heard to provide this complex habitat for the oyster as well as other species, and to provide sustainable economically viable

product for the historic industry. All available resources that the Congress can possibly bring to bear on this effort would be immensely important to the citizens of the Commonwealth of Virginia.

Mr. GILCHREST. Thank you, Dr. Wesson.

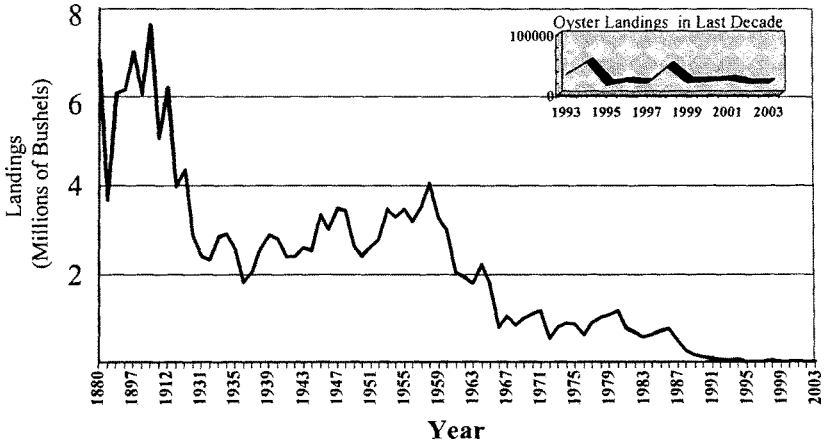
[The prepared statement of James Wesson follows:]

Statement of James A. Wesson, Ph.D., The Virginia Marine Resources Commission, Division of Fisheries Management, Department of Conservation and Replenishment

Oysters are keystone contributors to the ecological health of the Chesapeake Bay and barrier island/lagoon system of Virginia. They also have been extremely important to the health of the economy of the Commonwealth, as they have provided livelihoods for untold numbers of Virginians, especially in rural, bayshore communities. In the 1890s, because of the significant economic value, the Commonwealth of Virginia surveyed and set aside more than 200,000 acres of oyster ground for public use. The remaining areas of bay bottom are available for private lease and have been in continuous use for private oyster production, for more than a century.

Oyster production in Virginia has declined dramatically, since the turn of the century, owing to several factors. From 1880 through the 1920's, the decline in harvest was directly related to harvesting activities. The value of the harvested shell, as a building commodity on land, resulted in lost reef volume, as the reef shells were not returned to the bay. These activities resulted in a significant decline in oyster populations. Oyster restoration began when the Commission of Fisheries (currently the Virginia Marine Resources Commission) and the private oyster industry in Virginia started returning harvested shells to the oyster "rocks" or reefs in the late 1920's. At that time, the value of the shell as a building material had declined, due to the availability of quarry stone and a better highway transportation system to the bayshore communities. As shells were returned to the oyster rocks, oyster production actually increased significantly between the late 1920's and the late 1950's. Oyster management and private oyster husbandry maintained and increased oyster production and Virginia became a worldwide leader in oyster production.

Virginia Oyster Landings (1880 - 2002)

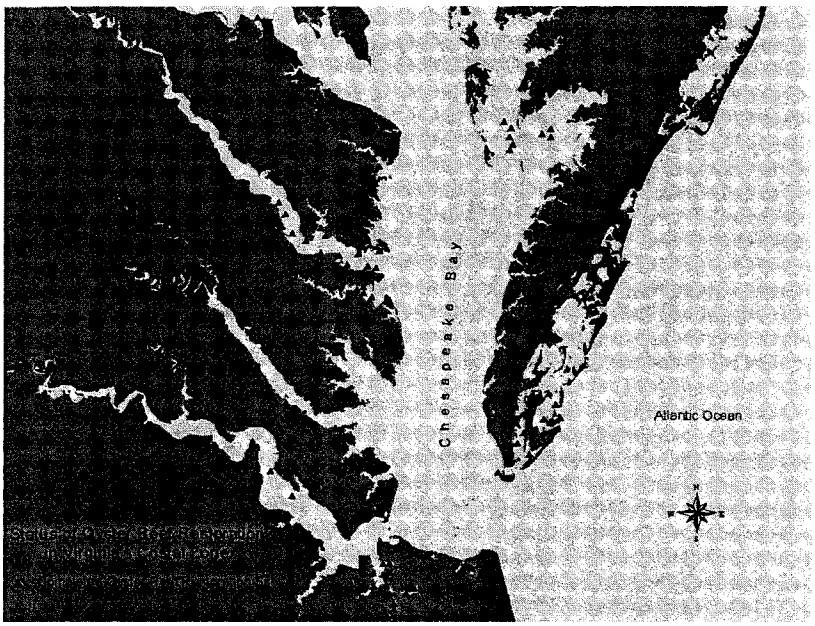


In the late 1950's, a new oyster disease was introduced to the Delaware and Chesapeake Bays, and this disease caused a rapid, and sustained decline in oyster production and population levels to the lowest point that currently exists in Virginia's waters. The newly introduced disease called MSX, in combination with the native disease called DERMO, have totally decimated the oyster industry and have reduced current population levels of oysters in Virginia to less than one half of one percent of levels only 45 years ago. The small oyster processing industry that

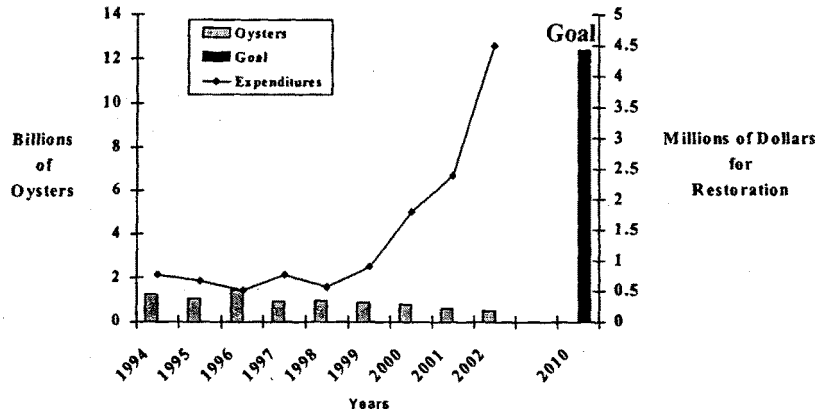
remains in the Commonwealth survives almost exclusively from the processing of imported oyster shellstock. The industry remains at a competitive disadvantage in the marketplace, due to the costs of importation, and more oyster shucking houses close with each passing year. There were more than 400 shucking houses in Virginia in the late 1950's, while currently no more than 15 still continue any significant amount of shucking activity.

The Virginia Marine Resources Commission (VMRC) and the Virginia Institute of Marine Science (VIMS) have implemented countless strategies, research projects, and restoration programs to combat the disease-induced decline in oyster populations since the 1950's. The private oyster industry has invested and lost many millions of dollars, using various strategies to grow oysters within the disease-dominated conditions in the Bay. Private investment has mostly been suspended because of the inherent risks and losses. State restoration activities have continued throughout the decline and have included the best science and management strategies that were available at any given time. The oyster restoration effort has been especially ambitious since the early 1990s, with a combination of 3-dimensional (3-D) oyster reef reconstruction projects, the setting aside of large acreages of sanctuary areas, the strict control of wild oyster harvest, and the implementation of a quantitative, statistically sound oyster-monitoring program.

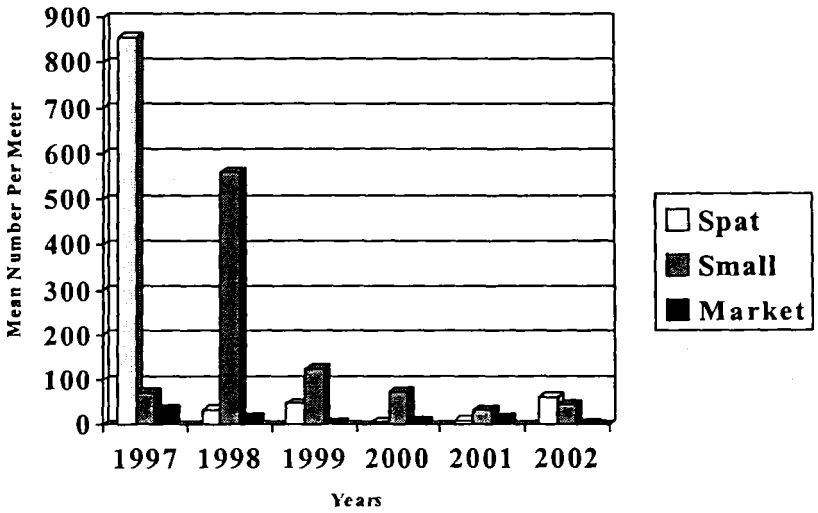
The 3-D oyster reef restoration and sanctuary program implemented by VMRC has become the model for baywide oyster restoration efforts. These 3-D reef restoration sites duplicate oysters reefs that were observed prior to any significant harvesting activities. These constructed reefs improve juvenile oyster survival (resulting in improved spatset), allow oysters to grow faster (resulting in improved fecundity or reproductive capacity), and physically position oysters in the most optimal configuration for spawning success (resulting from improved fertilization rates). Broodstock oyster populations on these reefs have been allowed either to develop naturally, or, in many cases, have been augmented with genetically selected oyster broodstock. Since there has been baywide consensus that the restoration of 3-D reef structures and the establishment of oyster sanctuaries throughout the Bay is the best way to achieve the Chesapeake Bay 2002 goal of a 10-fold increase in native oyster populations by 2010, there has been an extremely significant influx of State, federal and private monies to rebuild these reefs in Virginia. Since 1993, more than 70 of these reefs have been constructed throughout the Bay. The significant outlay of money and effort to rebuild oyster reefs has not increased oyster populations in the Bay or provided any increase in the associated and direly needed oyster harvest in the Commonwealth. Since the reef restoration effort began in 1993, the standing stock of oysters in Virginia's portion of the Bay has actually decreased by almost 60 percent. Oyster diseases still dominate oyster survival, as can be seen from the monitoring results from all of the restored reefs.



Virginia's Progress Towards the 10-fold Oyster Goal



Typical 3-D Reef Survey
1997 - 2001



Newly-constructed reefs are rapidly populated by oysters, and the oysters grow very fast for the first one to 2 years, but most oysters, even on the ideally constructed reefs, succumb to disease within 2 to 4 years. The very expensive, constructed, 3-D reefs lose their value as clean, oyster habitat, as the oysters die off on the reefs, and quickly return to the background population levels of the surrounding, unrestored areas.

Significant efforts by research institutions, such as the Virginia Institute of Marine Science, have been made to understand oyster diseases and selectively breed disease tolerant native oysters. After more than forty years, MSX is still poorly understood, especially its method of transmission from oyster to oyster, and there is no dependable selected strain of genetically improved, disease tolerant oysters that can sustain a commercial aquaculture industry in Virginia. Some progress has been made in disease "tolerance", but the risks remain too great to entice significant private investment. To date, the selected, genetic improvement in disease tolerance does not appear to transfer into wild populations of oysters.

In the late 1980s, Virginia began discussing a non-native oyster introduction, as possibly the only strategy to counteract the impacts of disease on native oyster populations and as a way to save the associated, valuable industry. The process of considering a non-native introduction has been slow and deliberate, with much input from private industry, research institutions, and governmental entities. International protocols for the testing of non-native aquatic species have been followed during this time period. Introduced broodstock has been quarantined during all projects, and only sterilized oysters have been tested in the waters of the Commonwealth. The earliest tests were always conducted under research protocols by VIMS. The Pacific oyster (Crassostrea gigas), the most widely used and introduced oyster in the world, has been tested and found not acceptable in the Chesapeake Bay, in both performance and industry acceptance. In the late 1990s, another closely related and similar looking species called the Suminoe or Chinese oyster (Crassostrea ariakensis) was tested in Virginia's portion of the Chesapeake Bay and coastal bays. Research results were very good, with this oyster exhibiting significant resistance to disease and exceptional growth rates, at a number of sites. Taste tests for the oyster were also very positive.

Based on these results, the Virginia Seafood Council petitioned the Virginia Marine Resources Commission in 1999 to allow industry tests with the Suminoe oysters using very controlled methods. The first tests involved a direct, "on-bottom" comparison between the Suminoe oyster and the native oyster at 6 locations. All of the

oysters were triploid (sterile) and contained within bags and cages. In low, mid, and high salinity areas, *C. ariakensis* grew to market size faster than the native oysters (most of the native oysters never reached market size), with most of the oysters reaching market size in one year or less.

Only 600 oysters were grown at each of the six sites in this project, and the results were so positive that a second, larger growout project was requested in 2000. In the second Virginia Seafood Council trial, 60,000 triploid (sterile) oysters were deployed by various methods at 10 sites throughout Virginia's portion of the Bay and coastal bays. This test was designed specifically to evaluate market acceptance of the new oysters by the industry participants. Growth rates were exceptional again. There was no evidence of any significant mortality, and the consumers found the oyster very acceptable as a food product. With the poor condition of our native oyster in the Bay, bushels often shuck less than 5 pints of oyster meat. In the winter, local oysters can shuck up to 10 pints per bushel. The Suminoe oyster consistently shucked more than 12 to 13 pints per bushel, so the attractiveness to the industry cannot be overstated.

Concurrent with the exceptional results with the non-native oyster were the disappointing results with the native oyster. Imported shellstock from the northeast and Maryland has been unavailable because of poor oyster survival. Competition in Virginia markets from west coast oyster imports is much more severe than previously, as local Bay shellstock has become unavailable and many long-held accounts have been lost by the local industry. Processors from the Gulf Coast States have become more competitive, as they have been processing more oysters locally and taking markets away from the Chesapeake Bay industry. The processors in Virginia's portion of the Bay must import shellstock, with all of the attendant transportation costs, and compete with oyster producers nationwide. The combination of the dire situation of a continued lack of local shellstock and the impressive results with the non-native oyster trials have resulted in a desperate situation for the remaining industry and its need to move this project along as quickly as possible.

The Virginia Seafood Council has continued with requests to test *C. ariakensis* with a proposal to use 1,000,000 triploid oysters in the current project. This appears to be a large project; however, this quantity of oysters is used by one moderately large shucking house in a single week. This project, now underway, triggered the review process that has led to this hearing and triggered the National Academy of Sciences study that was completed this summer. An exhaustive State and federal review has resulted in significant modifications to the originally proposed project. The Virginia Seafood Council has been persistent in moving this project forward and has made modifications and coped with the associated delays. The National Academy of Sciences review has supported the conservative direction of the studies using the sterile triploid, non-native oyster that have been approved by VMRC and other federal agencies.

The VMRC is monitoring the current project closely. All future project requests will require VMRC regulatory approval, as well as approval from the Army Corps of Engineers. The process of completing an Environmental Impact Statement (EIS) is beginning, and VMRC will be an active participant in that effort. It is critically important to the survival of the beleaguered oyster industry to move this process as quickly as possible. Congress can be instrumental to the success of these efforts, by fully funding the EIS process, to allow all of the projects to occur simultaneously and quickly. It is also important that non-native oyster species be exempted from House Bill 1080, the National Aquatic Invasive Species Act, so that no unnecessary regulatory hurdles are added to the process.

Currently, nearly all the important functions of the oyster in the Chesapeake Bay are either lost or severely diminished. Oysters are critically important in their ability to filter the Bay's waters, to provide a complex habitat for other species in the Bay, and to provide a sustainable, economically viable product for an historic industry. All available resources that Congress can apply to this effort are immensely important to the citizens of the Commonwealth of Virginia.

Mr. GILCHREST. Dr. Wesson, Virginia's goal as far as *ariakensis* is concerned, now I know that it is complicated. There is myriad of multiple things to do. Is the essence at this point though the goal of the State of Virginia with *ariakensis* to continue working with triploid oysters over a certain timeframe before considering the introduction of diploid oysters in Virginia waters?

Dr. WESSON. Yes, sir. That is the current state that we are in. Where all the projects that have been considered this far have been with triploids and none have come before the Commission as a request to do triploids to date.

Mr. GILCHREST. Are you going to have, or has there been, a discussion on a timeframe for experimentation research with diploids, or is it all dealing right now with triploids?

Dr. WESSON. Well, some of the research is going on with triploids in quarantine. But all the end water testing that we are considering right now is with triploids, and there is really not a time schedule that has been set up per se, but the clock is ticking on the industry if we have any hope that they will be able to survive through the effort. So there is a sense of urgency.

As the industry has seen their ability to compete in the marketplace where now the west coast oysters are in our marketplace almost everywhere. The Gulf industry has become much more active in marketing their own product rather than sending it to the Chesapeake Bay for us to shuck. And the ability for the industry in Virginia and Maryland to compete will only depend on the availability of local shell stock.

Mr. GILCHREST. Now, are you looking at local shell stock being triploid? Do you see in a year or two, in 10 years that triploid oyster being replaced with diploid? Do you think the oyster industry in Virginia can be saved with triploid *ariakensis*?

Dr. WESSON. It is impossible to know at this point. It is very hard to imagine that no other industry in the world has been—had a hand tied behind its back and told that you can only use sterile oysters and compete in a world marketplace. So, if you would ask the industry, I think they are certainly willing and able to bring their own financial resources to bear to move triploid aquaculture along as fast as possible. But for our Bay, we have always had an industry that is built on a shucking product. And because of that, the costs are set by the rest of the world whatever the costs are in the Gulf or what the costs are on the west coast.

And in order for these facilities to survive, they are going to have to have a product that they can shuck at a cost that is competitive. And a part of that can be made up by the fact that the triploid *ariakensis* is much meatier or fatter and that for the Virginia oyster, right now if you shuck a Virginia oyster, you get four to five pints per bushel production.

In the wintertime, when they are really fat, you might get up to 8 to 10. With the triploid *ariakensis*, we have seen regularly 13 pints, 12 or 13 pints of meat per bushel. Now, when you have that combination of the very meaty nature of the oyster, then you can have some slack in the amount of production that you have to have and it makes triploid aquaculture seem to be possible.

Mr. GILCHREST. Did you bring some samples for us to taste?

Dr. WESSON. Unfortunately, our samples have run out. The product now has been separated between the last one we had 2 years ago. The oysters were big, and they are gone. You wouldn't want to eat them as big as they are now, the few that are left.

Mr. GILCHREST. I would like to try one of those big ones.

Dr. WESSON. The new ones have just gone out.

Mr. GILCHREST. Thank you.

Dr. Franks, how would you categorize Maryland's approach to this issue? Similar to what Virginia is doing? Virginia, if I can paraphrase, is looking, at least in the immediate future, the timeframe of the next few years, dealing with making triploid the priority, and Maryland is looking to make the diploid the priority; and, if we are, is it for traditional wild harvest, is it for hatchery-raised, farm-raised aquaculture, or a combination of the two?

Mr. FRANKS. It is a combination of the two, Mr. Congressman.

I think right now we are looking at some triploid possibilities that exist currently. They are not large scale, but they might offer a little bit of relief to the oyster industry that has been devastated so heavily. But the primary point of focus for us is conducting a thorough and complete EIS to see whether or not it is possible to introduce a self-reproducing oyster without further detriment to the Chesapeake Bay.

That is the long-term direction that we are taking. We just want to be sure that we are not going to introduce something that will be harmful to us. If that is the case and if the EIS supports that, then I think we are going to move ahead very vigorously in introducing a diploid oyster.

Mr. GILCHREST. Do you have a timeframe for the EIS?

Mr. FRANKS. The EIS, I have heard some very interesting timeframes, all of the way from a year to 10 years. We are trying to do with the most frugal use of time that we can, without being reckless. We want to be thorough and complete, but we don't want to just establish a time that has historically been accepted as a time that it takes to do that kind of a project.

We want to know exactly what needs to be done. We want to do it in as frugal a timeframe as we can, because we consider the situation that exists in Maryland, and I will say in Virginia as well, to be an emergency situation, a situation where our oyster population has been reduced to a level that it no longer is a filter for the Bay.

If you combine that with the fact—and I don't want to introduce another subject, but if you combine that with the fact that menhaden are not or as populated in the Bay as they once were or filtering ability is dramatically changing, and we do not want to become an algal system where algae dominates and not oysters dominate. So we are moving ahead with all of the haste that is possible, without being reckless.

Mr. GILCHREST. Thank you.

As you move ahead with an EIS, do you see this EIS being conducted solely by the State of Maryland? Do you see the State of Maryland, through this EIS, partnering with other Federal agencies, the Chesapeake Bay program; and, in the end, do you see the necessity for a permit being issued before diploid oysters are introduced?

Mr. FRANKS. Well, let's take the EIS process first. It was our original intention to partner with Virginia, and they agreed, and we sent the appropriate letter to the Corps of Engineers in Norfolk. They—and I can let them answer for themselves—evidently did not feel that they had jurisdiction.

Mr. GILCHREST. The Corps of Engineers?

Mr. FRANKS. The Corps of Engineers felt that they did not have jurisdiction. Recognizing that, we came to a point where we had to make a decision. So from that point we decided that Maryland, and hopefully in partnership with Virginia, would move ahead with a State EIS following the exact same guidelines you would follow if you did a Federal EIS.

We have invited all of the appropriate agencies to be partners with us, to look over our shoulder, to be there to ask questions, to make sure that the EIS meets the criteria that we have set for it. So at that point, we have taken it on ourselves in Maryland, and hopefully with Virginia, to move ahead with a State EIS with Federal partners.

Mr. GILCHREST. And this would be an EIS for the introduction of diploids?

Mr. FRANKS. Correct.

Mr. GILCHREST. OK. I have some other questions, but I will yield to, if she has any questions, Delegate Eckart for the panel.

Ms. ECKART. Thank you very much. I appreciate the opportunity to be here with you. I had a welfare reform update, so that is where I was. So I just wanted to commend you not only for your work in this area but I think for the fact that we all appreciate the urgency of what we are about.

I guess my comment—I guess my question would be, you certainly—for Dr. Wesson, you have worked on this for a long time in Virginia; and, as I understood your testimony, you said that, in fact, you have not seen a significant impact of the non-native oysters in your waters. Is that correct? Did I hear that clearly or not?

Dr. WESSON. You are talking about non-natives then?

Ms. ECKART. The *ariakensis*.

Dr. WESSON. The non-native tests that we have done thus far have been highly controlled, everything in cages, sterile oysters. So, no, we have not seen any impact on anything else because they have all been retrieved.

Ms. ECKART. OK. But the other efforts that you have made in restoring your oyster population have not been beneficial or productive. That you have—I thought I heard you say you continued to see a decline in the population despite efforts to turn that around?

Dr. WESSON. That is correct. As we have spent more money, the numbers have actually gone down.

Ms. ECKART. That is what thought I heard. I think we are all concerned about the impact of our efforts, that we want to make sure that we do make a good investment, a good return on our dollar; and I would hope, Mr. Secretary Franks, that we would move forward with the EIS study and, as you said, be deliberative with that but not careless or reckless.

So I appreciate those efforts. I look forward to hearing more.

Mr. GILCHREST. Thank you, Ms. Eckart.

Ms. Hanmer, Dr. Wesson and Secretary Franks—and Dr. Wesson and Secretary Franks, if I misconstrued your earlier statement by paraphrasing it wrong as far as the tenfold increase program for native oysters, please correct me.

Ms. Hanmer, it appears that Dr. Wesson and Secretary Franks have alluded to the fact that the process and the policy and the

program to increase the native oysters tenfold by 2010 has not been successful at all. Would you agree with that assessment? And, as a result of that, if you agree, based on the 1993 policy, would you also agree with Virginia, but especially Maryland, that we should move forward with *ariakensis*?

Ms. HANMER. First, I can't say that the efforts to date to restore—that there is universal agreement, obviously, on the success or nonsuccess of the efforts to date. If you look at the broad picture and count the numbers, I have no reason to disagree with the numbers that Dr. Wesson has given you or Dr. Franks has given you. Those are the numbers. If you talk to other people in smaller operations, they say, well, we are beginning to learn a lot more at the individual technique basis. Things are becoming more successful. So I don't think that it is appropriate at this time to say that we want to pull the plug on the native oyster restoration program. I think it is just beginning to show us what we can do.

As I mentioned in my prepared testimony, I also think that evaluation of native oysters aquaculture—and this is not universally shared, so I will say it is EPA's opinion that evaluation of native oyster aquaculture does have a place in the native oyster restoration program and should be looked at in a more concerted manner than it has to date.

Mr. GILCHREST. Now, you say the evaluation of native oyster aquaculture?

Ms. HANMER. Yes. As you heard the description of the native oyster restoration activities to date, that has not been a focus. I am suggesting that we could focus more attention on native oyster aquaculture as a part of a host of approaches that the last panel discussed. So perhaps we have been too narrow in our discussion of what we mean by native oyster restoration.

The second part of your question was, would we abandon the precautionary approach? And the answer is no. I think that—I don't want to make a hackneyed saying, but, you know, act in haste, repent in leisure is actually—

Mr. GILCHREST. Say that again.

Ms. HANMER. Act in haste, repent in leisure has certainly been the history of some of our activities where agencies have introduced non-native species.

I just wrote a grant request just the other day for money to try to eliminate zebra mussels in a quarry in Virginia. So the issue of getting rid of invasive species is very serious, and that is why we think that it is extremely important to approach the deliberate introduction of a possibly invasive species with great care. That is why we are committed to the environmental impact statement and to working kind of cooperatively with our Bay program partners on the research.

Mr. GILCHREST. Would you want to be a part of the Maryland EIS process? And are you a part of the Maryland EIS process?

Ms. HANMER. Yes. The U.S. Environmental Protection Agency championed the idea of the development of an environmental impact statement.

Mr. GILCHREST. Now, the development of an environmental impact statement on the introduction of diploid oysters?

Ms. HANMER. On the introduction of non-native oysters generally—generally.

Mr. GILCHREST. If you do an—I apologize for interrupting. But if you do an EIS statement and you are in support of an EIS statement of the introduction generally of non-native oysters, does that specifically mean diploid oysters and then *ariakensis*?

Ms. HANMER. It means reproductively capable oysters; and under certain circumstances, triploid oysters introduction could be—also produce a reproducing population in the Bay.

Mr. GILCHREST. What is the status now with that as far as you, Maryland and Virginia are concerned?

Ms. HANMER. The status is this spring the—we went through the ad hoc panel process of our Chesapeake Bay panel policy, and the Federal agencies got together with Virginia and Maryland in connection with working on our recommendations for the research proposals, the research marketing proposals in Virginia. So that in the context of working out conditions for the permit that was issued to the Virginia Seafood Council by the Norfolk District this spring, a number of safeguards were built into that permit at the instigation of the Federal agencies like our own Fish and Wildlife Service, National Marine Fisheries Service. So we reached agreement on the types of precautionary practices that should be associated with the current research on triploid oysters.

As the years progressed, there may be proposals for a much larger scale triploid oyster aquaculture. Depending on how those proposals are framed and also how the safeguards are carried out, those could introduce a reproducing population, and therefore we will have to subject those to the same kind of review as diploid oysters.

It is a question of time. The general scientific agreement was that, over time, triploid oyster populations placed in the Bay could, over time, if not controlled, become reproducing diploid populations. That is why we don't make as fine a distinction.

So the issue is, do we have to introduce a non-native species in the Bay in order to have both a naturally viable oyster population and an economically viable oyster population? That is the question we see at the heart of the environmental impact statement.

Mr. GILCHREST. So, EPA is or isn't a part of that EIS?

Ms. HANMER. At the time we proposed the environmental impact statement, it was clear that there was a Section 404 jurisdiction. We were in Virginia, we were talking about a particular situation, and, in that context, then it was clear Federal jurisdiction and therefore an environmental impact statement under the Federal jurisdiction.

A question has since been raised whether all—whether any and all methods of introducing diploid oysters would also be subject to Section 404. And that has been a question.

Mr. GILCHREST. That hasn't been answered yet?

Ms. HANMER. It depends on exactly what the method is.

Mr. GILCHREST. So Section 404 applies to triploid introduction to aquaculture?

Ms. HANMER. It would apply to any method that could be viewed as the discharge of fill material. So if you use a method that could

be defined as fill material, then Section 404 of the Clean Water Act would apply. In the meantime, however, I think—

Mr. GILCHREST. But you are not sure whether it applies to the introduction of diploids?

Ms. HANMER. It is a—it could apply to the introduction of diploids. It depends on how it is done. Whether shell are used, whether shell are placed on the bottom, whether shell are placed on a reef would be one of the considerations.

Mr. GILCHREST. So Section 404 doesn't apply to the spat, it only applies to the shell?

Ms. HANMER. Possibly, yes.

Mr. GILCHREST. Colonel Prettyman-Beck, do you have a comment on the Federal role in the EIS based on the Clean Water Act?

Colonel PRETTYMAN-BECK. Well, sir—

Mr. GILCHREST. Now you issued a permit, it is my understanding, to—I don't want to use the word allow, but to enable Virginia to pursue the triploid research they are doing right now, correct?

Colonel PRETTYMAN-BECK. That is correct, sir. Virginia Seafood Council back in, I believe, April of this year. With the issuance of that particular permit, we put very stringent conditions upon that permit pending the release of the National Academy of Science's report. Those particular conditions were, if there was anything that came out of that report that was recommended or would change the avenue or the information we gave to Virginia Seafood Council, that we would make those changes. But when the report was released we did not have to modify or make any particular changes because everything was consistent with the way that we issued that particular permit.

With regards to the EIS, Congress has to authorize and appropriate us as a Federal agent to conduct the EIS. We are standing ready, if approved and appropriated, to be a lead member in that particular study.

Back prior to the permit process, or when this was ongoing, it is my understanding—and I just came on board in the past 2 months—but it is my understanding the Federal Committees Group that Ms. Hanmer has mentioned all met and decided that an EIS was the way to go.

Mr. GILCHREST. The EIS was the way to go for?

Colonel PRETTYMAN-BECK. For additional study in terms of whether or not the outcome would be to introduce additional triploid oysters, the *C. ariakensis* or just do additional study for that.

Mr. GILCHREST. Was there discussion about an EIS on diploids?

Colonel PRETTYMAN-BECK. Sir, I was not there, so I would have to defer to someone who was at that particular meeting and discussion.

Mr. GILCHREST. I guess what I am trying to pull together here in my mind so I understand this, the Corps of Engineers issued permits for Virginia to pursue this research with the triploid *ariakensis*. That is not now, or is it, an EIS? That is just research on triploids?

Dr. WESSON. They permitted the structures themselves to do the project.

Mr. GILCHREST. Now, in your mind, Secretary Franks, you made a comment that the State of Maryland, while the Feds looked over your shoulder, would pursue its own EIS as far as understanding the ramifications of the introduction of *ariakensis* diploids.

Mr. FRANKS. Yes, sir.

Mr. GILCHREST. And as far as EPA and the Corps of Engineers, you don't yet know the status of your regulatory jurisdiction in that EIS?

Ms. HANMER. We would participate with the environmental impact statement development process, whether it was termed as a Federal environmental impact statement under the lead of the Corps of Engineers, because the jurisdiction was clear, whether it was a Federal EIS because the Corps was authorized to do it, or whether or not it is an environmental impact statement carried out cooperatively by Maryland and Virginia, in which case I would characterize it as an environmental impact statement carried out cooperatively under the aegis of the Chesapeake Bay program.

That would be one way to do it, to bring all of the agencies together.

Mr. GILCHREST. Now, given that statement, Ms. Hanmer or Colonel Prettyman-Beck, is there—is it clear or unclear who has the authority to introduce non-native oysters in the form of diploids to the Chesapeake Bay? Who has the authority to issue that permit?

Colonel PRETTYMAN-BECK. The State of Maryland.

Mr. GILCHREST. The State of Maryland can do it without EPA and the Corps?

Ms. HANMER. There is a way—the discussion has been that there is a way in which the oyster could be introduced, spat with no shell, simply off the back of the boat, that might not conform to the regulatory definition of fill under Section 404. EPA's position is that we really need to look at the details.

And, of course, we also have been asked whether or not Section 402, which is the discharge of pollutants from a point source, might be applicable. Unfortunately, our answer would have to be the same, and that is these are very—these are considerations that are based on a set of facts. We would need to see the specific proposal for how the work was to be done in order to determine whether 404 or 402 jurisdiction applied in a case like that.

In almost all cases I can envision, our opinion would be that Section 404 would apply. In other words, that the introduction would be subject to 404 as a discharge or fill material.

Mr. GILCHREST. I have no doubt in my mind, based on my relationship with Secretary Franks and the State of Maryland and also the past history of Virginia, that there will—that there would be no problem with full cooperation between the Bay program, the Corps of Engineers and any research understanding of *ariakensis*.

I would like, Secretary Franks, just—I think I asked this—I asked a question earlier, in which you said, or you made—I asked a question about whether we were pursuing diploids for traditional harvest, hatchery raised or a combination of the two and you made a comment that it would be a combination of the two.

If and when Maryland and then subsequently, I am sure, Virginia pursues *ariakensis*, whether it is in aquaculture with triploids or whether it is in introduction with the diploids Bay-

wide, do you envision us continuing to work on the tenfold increase of native oysters? Would we continue to do that in the form of creating sanctuaries around the Bay or would the program of increasing the native oysters by tenfold with sanctuaries be abandoned?

Mr. FRANKS. No, it would not be abandoned. We see, if the EIS goes as we think it should go and will go, that we will be able to introduce—

Mr. GILCHREST. Or hope goes.

Mr. FRANKS. Or hope goes. We will be able to introduce reproducing diploid *ariakensis*. We see them as self-limiting, as far as their spread is concerned; and we see a symbiotic relationship between the *ariakensis* as well as *virginicus* in the Bay—*virginicus* having a home where they are less affected by the diseases which have ravished them over the years.

We would certainly hope that both of them would thrive in their particular area, as conditions allowed. We do not see one replacing the other.

Mr. GILCHREST. The gentleman from Connecticut seemed to raise some concern about the introduction of *ariakensis* in the Chesapeake Bay in which he said it would be inevitable before they were—became a part of their ecosystem. Is there anything you can say—and maybe, Dr. Wesson, you might comment on this—to allay the fears of—I think it was Dr. Whitlatch that made that comment?

Mr. FRANKS. I am not an expert in their spread, so I am going to move this microphone over here and hope that he can answer that question.

Dr. WESSON. Well, one thing to keep in mind is, when he was talking about the Connecticut industry thriving, you have got to keep it in perspective. The thriving Connecticut industry has moved itself to a half-shell, high-end, market-type oyster; and the quantities of oysters that they produce are not acceptable to us in the Chesapeake Bay. They are just too small.

We used to buy oysters in Virginia to shuck from the Northeast, Connecticut, New Jersey. Now they are so expensive because of the problems they have with diseases and growing oysters and all of the effort they have to put into growing the oyster out, they are only imported to our processing facilities now for half-shell product; and then most of them don't even mess with those.

There is no way—you have to know that if a reproducing animal is introduced in the Chesapeake Bay that it has the likelihood that it will move farther, both accidentally and because that industry, if they see us making progress, is going to be interested in having it in their waters just so they have oysters to produce again.

Mr. GILCHREST. Can you tell us the difference between *virginica* and *ariakensis* as far as its growth rate, its size, its marketability, its taste, is concerned?

Dr. WESSON. Well, again, the work that has been done to date has been done with oysters that have been grown in intensive aquaculture situations where they have been allowed to grow in floats, which is the optimum place for either our oyster or that oyster; and in all cases *ariakensis* outgrows, in those aquaculture facilities, the *virginica*. They are much faster, much more meat,

they don't die from diseases, which a lot of the same oysters, side by side of our oyster, would have died from.

On the bottom, in the limited amount of work that we have done in some controlled tests, it is not as obvious, the growth rate differences between the two species, because it is—they are not in the optimal place for them to grow in a tray. That is some of the work that we need to do very quickly, to evaluate how they do on the bottom.

Mr. GILCHREST. Would there be any difference in the growth rate between a triploid and a diploid?

Dr. WESSON. We don't know that yet. We certainly suspect that there would be differences between triploids and diploids.

Triploids generally grow throughout the summer, where diploids do not, because diploids are putting body effort into reproducing. So the triploids are used in other places in the United States, so that they are fat in the summer, because they don't put any effort into reproduction, so they grow faster. They are meatier through the summer.

So you would not imagine that a triploid would not grow faster than a diploid.

Mr. GILCHREST. Where in the U.S. are there *ariakensis* right now that are successful in being harvested both in the wild form and aquaculture?

Dr. WESSON. In the United States, they are not being used. That is one of the unique things about using them in the Bay in some ways.

But as they were tested in the West Coast, as was mentioned earlier, they do not do as well with their husbandry methods that they have that are very, very successful on the West Coast of doing 5 and 6 million bushels of oysters per year, as the workhorse that they have in the Pacific oysters.

It is just a better aquaculture species for them, likes cold water, likes clean water. But that oyster did not like living in the Chesapeake Bay, where we have more turbid water and warmer water. So that oyster was really not available to us as a product, unless we used it on our coastal bays or had some applicability.

Mr. GILCHREST. I see.

Ms. Hanmer, you made some—in your testimony, you made reference to something called the precautionary approach as far as pursuing—specifically as far as pursuing this policy of introducing either triploid or diploid oysters. Can you give us some specifics as to what the precautionary approach is, and are there general scientific parameters to this concept that you would like to see used in an EIS?

Ms. HANMER. I think that the essential difference—and I am not an invasive species expert, so I will describe it as a political scientist understands it. That is, that you do a lot of studying up front, and the burden of proof is shifted so that in the precautionary approach you assume that the introduction of a nonindigenous aquatic species could cause a problem and the burden of proof is to demonstrate that the risks will be minimized and are acceptable.

Mr. GILCHREST. I see.

Ms. HANMER. Whereas the other way around would be to say that studies would be done of certain species, and they would only be controlled after they were lifted. That is the opposite approach.

Mr. GILCHREST. I guess maybe my last question would be to Colonel Prettyman-Beck. Is the Army Corps positive—do you have a positive perspective on the restoration of native oyster? It seems that Maryland and, to some extent, Virginia are fairly pessimistic about restoration of native oysters.

Would you care to comment? Does the Corps have a—is the Corps positive about some day restoring the native oysters in a tenfold capacity by 2010?

Colonel PRETTYMAN-BECK. The first part of that question I could say absolutely yes, sir. Tenfold capacity in 2010, not quite sure.

As you—as I stated earlier in my testimony, on the Virginia side, we recently, in the year 2000, have implemented restoration—native restoration projects within the Commonwealth of Virginia and in coordination with VIMS, who will be analyzing, looking at the data that is coming in, will provide us feedback so that we can produce that in a public forum.

Our Baltimore District has been doing this for a longer period, I believe since 1997; and we have been informed that there has been some positive results in terms of the native oyster program which we are executing. So we feel positive with that particular program and would recommend that that program continue.

Mr. GILCHREST. Thank you very much.

Ms. Eckart, any further questions?

Ms. ECKART. No.

Mr. GILCHREST. Dr. Wesson, Secretary Franks, Ms. Hanmer, and Colonel Prettyman-Beck, thank you all for your testimony. We look forward to continuing to work on this issue with all of you.

The Subcommittee will now take a 10-minute recess.

[Recess.]

Mr. GILCHREST. The hearing will come to order.

We appreciate the patience of the last panel. Mr. Goldsborough said it is always nice to have the last word.

We have today Mr. Larry Simns, President of Maryland Watermen's Association. Welcome, Larry. Ms. Frances Porter, the Executive Director, Virginia Seafood Council. Welcome. And Mr. Bill Goldsborough, Senior Fisheries Scientist, Chesapeake Bay Foundation. Thank you all for coming and attending.

Mr. GILCHREST. We will start with Mr. Larry Simns.

STATEMENT OF LARRY SIMNS, PRESIDENT, MARYLAND WATERMEN'S ASSOCIATION

Mr. SIMNS. Thank you for this opportunity to testify before the committee. My name is Larry Simns. I am President of the Maryland Watermen's Association, and my testimony today relates to the issue on introduction of non-native oyster species to the Chesapeake Bay.

Millions of dollars have been spent over the past 50 years trying to figure out a way to get around the two parasites that have attacked the Chesapeake Bay oyster resource, MSX and Dermo. Today, in a waterman's humble opinion, we are no closer to solving

that problem of how to grow more oysters in the wild than we were when we started.

If we are going to come close to reaching a tenfold increase in oysters in the Bay by the year 2010, as set forth in the Chesapeake Bay agreement in 2000, the only chance we have is to bring in an oyster that disease is not going to kill. Five years of that time frame have already gone by, and we have made no progress.

The *ariakensis* oyster is not an exotic species. It has been in this country for over 40 years, being bred in hatcheries in the USA and raised in Oregon waters. No adverse effects have been determined in placing it with and/or growing it with other species, such the problems found with the introduction of *gigas*.

We need to be cautious, working with closed systems studies, and we need Congress to help us get moving on these studies. We need funding to start and then to continue the studies that will either prove or disprove the potential effects of the introduction of the *ariakensis* oyster into the Maryland portion of the Chesapeake Bay.

This oyster would not only help the industry but, as oysters are filter feeders, an abundance of healthy oysters would help clean the Bay waters. Septic system runoff is a big problem in the Bay right now, along with sewage treatment plant overflows, development and population growth. Left in the state it is now, without assistance, the Bay dead zones will become larger and larger until the Chesapeake Bay is nonproductive.

It is imperative that Federal funds become available to bring sewer treatment plans up to grade. As long as we continue to have overflows and sewage spills that load waterways with nutrients, we cannot expect to have a healthy Bay. Good water is essential to reproduction of our resources; and no matter what steps we take to help the oyster stocks recover, without a healthy environment they will not prosper.

The studies anticipated would work with the diploid and the triploid *ariakensis* oyster, the *ariakensis* which are treated so as to be unable to reproduce. However, we need to have an oyster that is capable of reproducing in the wild, as no amount of hatcheries will be able to take the place of natural oyster reproduction.

At first glance, we know the *ariakensis* tastes as good and looks much like our *virginica*. It grows fast, and MSX and Dermo doesn't kill them before they grow to market size. Also, to date no harm has been shown to exist in areas where it is being grown.

We are not saying we want to give up on our *virginica* oyster. In some areas they will continue to grow and prosper but not in the numbers to sustain the oyster industry or to be an effective tool in cleaning the water, both of which are equally important.

I will use this picture that was presented to you earlier of the successful—and you heard a lot of about successes of the *virginica*. But I want to caution you on those successes. That is a very narrow view at certain areas. We are fortunate that the Congressman and myself are living in an area that oysters *virginica* will grow and prosper, and that is the Chester River area. That is where this picture was taken.

They have lived for 5 years, and they have grown to lengths of 6 to 8 inches. If you put that same effort in the lower Choptank River or the lower portion of the Chesapeake Bay or the 90 percent

of the Bay that has diseases in it that kill the oysters, they wouldn't be there. They would be small shells that died before they reached maturity.

I heard all of the testimony here, and everybody has got blinders on. They are looking at a specific area or their specific expertise. They are not looking at the broad range. We heard the gentleman from Connecticut—the scientist from Connecticut saying that aquaculture was the way to go because they had oysters, and the disease didn't seem to bother them that much, only at certain times.

I would invite those aquaculturists and that scientist to come to Maryland and try to have an aquaculture culture product here with *virginica*. He will fail like all of our other aquaculturists have. Because no matter who grows it, whether Mother Nature is growing it or man is growing it, the disease wipes it out.

So we have to be very careful when you listen to all of those success stories that you put them in the right context. They are not in the Chesapeake Bay. They work where they are. But they won't work here.

So we need to focus our *virginica* studies or efforts to restore the oysters back in areas that we know they grow. That is what we are doing with the ORP. With other parts of the Bay, every time we try, it is not successful. So I just need to point that out.

Just want to point out—I will speed up here a little bit—in France, when they lost their native species, which was the flat oyster, we took a trip over there and talked to the scientists and the bureaucrats and the oyster growers. And I asked them one question. I said, when the disease, which was MSX, came in and wiped your oysters out, how long did it take you to introduce a non-native species, which is the Japanese oysters? They said 2; and I said, 2 years? They said, no, 2 months; and they was up and running that year and producing oysters. Right now, they have a full-blown industry of non-native oysters.

We went to Ireland, same thing. When they lost their native oysters, and they are—99 percent of their oysters produced in Ireland are non-native oysters. They only produce 5,000 bushels of their native oysters.

So we have to look at these things. The West Coast right now, the oysters that they produce, they have got 50 percent of their market or better in the whole country, are non-native species. So we have to put this in perspective; and what we want to do is speed these studies up to find out, to disprove or prove this oyster so we can get on with it.

Because we don't have time. Forget the industry, if you would for a minute, for just thinking of—we don't have time for the environment to wait to see if the scientists will come up with a *virginica* that will live here.

In my lifetime alone, I have seen 5,000 licensed oystermen go down to less than 200 right today. I have seen harvests of 5 million bushels go down to 50,000 bushels last year. That tells me we have gone past the time of waiting and looking. We need to do something drastic now. If it is proved that this oyster is terrible and is harmful, then we don't want to do it. But we need to find that answer out. We need to do it within a year. We don't need to wait

5 years, 3 years. We need to do it within a year. There is no reason with the knowledge that we have today that we can't do that.

Thank you for this opportunity.

Mr. GILCHREST. Thank you, Mr. Simns.

[The prepared statement of Mr. Simns follows:]

Statement of Larry Simns, President, Maryland Watermen's Association

My name is Larry Simns, President of the Maryland Watermen's Association and my testimony today relates to the issue of introduction of a non-native oyster species to the Chesapeake Bay.

Millions of dollars have been spent over the past fifty years trying to figure out a way to get around the two parasites that have attacked the Chesapeake Bay oyster resource—MSX and Dermo. Today, we are no closer to solving the problem of how to grow more oysters in the wild than we were when we started.

If we are going to come close to reaching a tenfold increase in oysters in the Bay by 2010, as set forth in the Chesapeake Bay Agreement in 2000, the only chance we have is to bring in an oyster that diseases are not going to kill. Five years of that time frame have already gone by and we have made no progress.

The Ariakensis oyster is not an exotic species. It has been in this country for over forty years being bred in hatcheries in the U.S.A. and raised in Oregon waters. No adverse effects have been determined in placing it with and/or growing it with other species, such as the problems found with the introduction of Gigas.

We need to be cautious, working with closed system studies, and we need Congress to help us get moving on these studies. We need funding to start and then to continue the studies that will either prove or disprove potential effects of the introduction of the Ariakensis oyster into the Maryland portion of Chesapeake Bay.

This oyster would not only help the industry but, as oysters are filter feeders, an abundance of healthy oysters would help clean the Bay waters. Septic system runoff is a big problem in the Bay right now, along with sewage treatment plant overflows, development, and population growth. Left in the state it is now, without assistance, the Bay dead zones will become larger and larger until the Chesapeake Bay is non-productive.

It is imperative that federal funds become available to bring sewage treatment plants up to grade. As long as we continue to have overflows and sewage spills that load the waterways with nutrients, we cannot expect to have a healthy Bay. Good water is essential to reproduction of our resources and no matter what steps we take to help the oyster stocks recover, without a healthy environment they will not prosper.

The studies anticipated would work with the diploid and triploid Ariakensis oyster, which are treated so as to be unable to reproduce. However, we need to have an oyster that is capable of reproducing in the wild, as no amount of hatcheries will be able to take the place of natural oyster reproduction.

At first glance, we know that the Ariakensis tastes as good and looks much like our Virginica. It grows fast, and MSX and Dermo doesn't kill them before they grow to market size. Also, to date no harm has been shown to exist in areas where it is being grown.

We are not saying we want to give up on our Virginica oyster—in some areas they will continue to grow and prosper but not in numbers to sustain the oyster industry, or to be an effective tool in cleaning the water. Both of which are equally important.

We do need the studies but we all know that scientists can study data for many years and still not come to a conclusion. Time is crucial to the livelihoods of our watermen, dealers, shuckers and packers. Maryland is all but out of the oyster business and now is the time to look to the future. Maybe Ariakensis is the future, but we will not know that for sure until funding is in place and the studies are done. The one thing that we don't need is for this issue to get bogged down in scientific studies and bureaucratic jargon that could delay the introduction of this oyster.

In France they were able to get a non-native oyster species introduced in only two months. The West Coast was not far behind that time frame. With the right funding level and the right people in place, Maryland should move ahead in working with the diploid and triploid species. We need to determine the environmental impact of introducing this non-native oyster into the Chesapeake Bay, with a time frame of no more than one year of study before actual introduction of the Ariakensis oyster into Chesapeake Bay.

Mr. GILCHREST. Ms. Frances Porter. Welcome.

STATEMENT OF FRANCES PORTER, EXECUTIVE DIRECTOR, VIRGINIA SEAFOOD COUNCIL

Ms. PORTER. Mr. Chairman, I am Frances Porter of the Virginia Seafood Council. The Seafood Council is a trade association, nonprofit and incorporated, which represents the interests of the commercial fishing industry in Virginia; and I appreciate the opportunity to be here to represent the industry today.

The Seafood Council is a strong advocate for a clean and healthy Chesapeake Bay. Membership in the Seafood Council includes packers, processors, shippers, harvesters and aquaculturists.

Dr. Franks and Dr. Wesson have done a thorough job of using my script today and leaving me not a lot to say that hasn't already been said. But I would like to try to put a face on the industry, the oyster industry in Virginia.

You asked, Representative Gilchrest, earlier if someone had sampled or if you could sample an oyster. I had the opportunity, just 10 days ago, to shuck and cook and eat four *ariakensis* about this size. No, I beg your pardon, two. It was adequate for a meal, a very substantial meal, very tasty, very tender. So that is a face to this *ariakensis*.

Then if I could have with me today one of the second or third generation oyster packers from Virginia, they would say to you in a very impassioned way how this industry continues in a downward spiral. They would give you numbers that would say, from a high in the mid-1980's of a million bushels a year, they are down in 2002 to less than 20,000 bushels.

I am going to try to tell you how Virginia is working to restore the oyster industry. The Virginia Seafood Council approached the State Legislature in 1990 to seek help with the industry, at that time primarily with restoration of the native oyster, though we had already been engaged with VIMS in research on the *gigas* oysters.

Since 1990, private industry and the State of Virginia has spent millions of dollars in restoration efforts, but the return of the native oyster is not happening. Oysters survive one or two summers, but then they become victims of the disease, and they just cannot reach market size.

In 1995, the Virginia State Legislature mandated that VIMS, and I quote, begin the process of seeking approvals in conformance with State, Federal and international laws and protocols for the in-water testing of oyster species not native to Virginia waters. And at that time, we really geared up the process. The Seafood Council helped to secure funds for VIMS to hire world-class geneticist, Dr. Allen, and to build their aquaculture genetics and breeding technology center.

Today, Virginia is on a parallel track to restore an oyster industry with three resources: the native oyster, the aquaculture triploid *ariakensis*, and eventually the diploid *ariakensis*.

Virginia has not abandoned native restoration, nor does it have any intention to do that. We continue to plant shells, move seeds, work the beds. But the process is stalled, and the industry is dying. The oyster industry has great value to the Commonwealth in its economic impact, as a part of the heritage and culture of the State and, most important, its ecological action in filtering the Bay.

It seems so simple. If the native oyster cannot overcome the forces of the diseases in the Bay, then we need to find a species that can. We believe we have found that in the *ariakensis*, and so we are seeking permission to grow it in the Chesapeake Bay. But it seems to me that all around us there is great focus on the risk of introducing the oyster, with inadequate focus on the benefits of introducing a non-native oyster.

You are aware that we have had two generally successful projects in 2000 and 2001 with small numbers of the oysters. From those projects we learned that it is disease-resistant, that it grows rapidly, that it tastes real good, and that it is marketable. We also know theoretically that it is filtering the Bay.

We know these things about the *ariakensis* now, so we need to have them in quantities sufficient to have an impact on a faltering industry. This fall we have put close to a million *ariakensis* in the Bay, operating under a permit issued by the Virginia Marine Resources Commission and the United States Army Corps of Engineers. The permit includes numerous conditions that were requested by State and Federal agencies and environmental organizations.

The Seafood Council is appreciative of the National Academy study and believes it has opened the door for more aggressive support for contained aquaculture or *ariakensis*, and we anticipate in Virginia proceeding aggressively with larger and larger projects of contained triploids until we create a significant impact on the packing and processing industry.

The State of Virginia and the Seafood Council support the environmental impact statement; and I, like you, don't know exactly where that stands today. But the Seafood Council in the last 2 weeks has effectively lobbied our United States Senators. We have met with both of them. We believe that the money has been appropriated. We know it has been placed in the budget for the Corps of Engineers to proceed rapidly with the EIS.

Now I may be a little behind the times in understanding what that situation is now. But perhaps the most important thing I can tell you today is how the Virginia Seafood Council in its pilot projects has consistently and precisely followed all of the laws, regulations, protocols and conditions to safely conduct the grow-outs. The Virginia Seafood Council has no desire to proceed with any non-native introductions outside existing guidelines and legal constraints. Rather, we would favor modifying and improving the guidelines.

There is very little time left to salvage this important industry. Only about 20 processing houses remain in Virginia, and so much of the infrastructure has been lost. Inadequate resource will force the closure of more shucking houses in the very near future.

So VFC requests the rapid completion of the EIS and any additional research deemed necessary, and I will be most appreciative if you can help to solve the mystery of how to move forward with the EIS. When that is completed, the Virginia Seafood Council will request permission to grow more non-natives and eventually in the open waters of the Commonwealth even as a self-sustaining stock.

Mr. GILCHREST. Thank you very much.

[The prepared statement of Ms. Porter follows:]

Statement of Frances W. Porter, Executive Director, Virginia Seafood Council

The Virginia Seafood Council is a trade association, non-profit and incorporated, which represents the interests of the commercial fishing industry in Virginia. VSC membership includes packers, processors, shippers, harvesters, and aquaculturists of seafood.

Virginia Seafood Council, recognizing the stead and drastic decline in Virginia oyster harvest, approached the Virginia State Legislature in 1990 to seek help for the restoration of a native oyster population in Chesapeake Bay. That beginning has resulted in innovative attempts to restore native oyster populations while also pursuing the newest and best technologies of a non-native resource.

With restoration of the native oyster stalled, the State Legislature passed a resolution in 1995 mandating that the Virginia Institute of Marine Science "begin the process of seeking approvals in conformance with State, Federal and International laws and protocols for the in-water testing of oyster species not native to Virginia waters."

Today, Virginia is on a parallel track to restore the oyster industry with three different resources—the native C. *virginica*, the triploid C. *ariakensis*, and the diploid C. *ariakensis*. Virginia has not abandoned, and has no plan to abandon, the native oyster. In fact, she continues to aggressively plant shells, move seeds and work existing beds.

The oyster industry has great value to the Commonwealth. First, it has significant impact on the state's economy. That economic impact now comes from oysters brought in for shucking from the Gulf Coast, Maryland, Delaware and New Jersey, most of whom are also experiencing declining resources.

Next, the oyster industry is valued for its heritage and tradition; people come to Virginia to eat Virginia seafood, including the famous Virginia oyster. There is an important cultural tradition in harvesting and shucking the oyster and sharing the stories of great oyster reefs rising above the surface of creeks and rivers in colonial times.

Third, the oyster industry is very, very important to the health of the Bay. It is an integral part of the Bay's ecosystem and is constantly filtering the Bay of nutrients and sediments. Basically, Virginia has not benefitted from the ecological action of a healthy oyster population in the past ten years.

As the Virginia Seafood Council worked with the Legislature, we helped to secure funds to bring a world-class geneticist to the staff of the Virginia Institute of Marine Science and to secure funds to build the Aquaculture Genetics and Breeding Technology facility at VIMS.

It is the genius of VIMS that has brought us to the threshold of a new commercial oyster industry in Virginia. It has been a tedious road and Virginia is keenly aware that its project with triploid C. *ariakensis* is under very close scrutiny from many State and Federal agencies, environmental oversight organizations and individuals.

The science of the project is best explained by the scientists, who will probably precede me with testimony during the hearing.

Virginia Seafood Council has been aware for more than fifteen years of the national and international protocols related to non-native species introductions. Virginia has proceeded cautiously and meticulously with its non-native project. Seafood Council members selected to be growers of the C. *ariakensis* have been versed in the necessity to follow every known rule regarding non-natives and to follow precisely a11 the conditions of the Virginia Marine Commission/U.S. Army Corps of Engineers permit.

In 2000 and 2001, Virginia Marine Resources Commission permitted the Council highly controlled introductions of C. *ariakensis*. Valuable information has been learned. This non-native species is disease resistant, grows rapidly and is flavorful. We also know, theoretically, that it benefits the Bay with its filter-feeding habits. Marketable, healthy, rapid growth, disease resistant able to filter the Bay—an excellent combination.

With his knowledge available, the next step is to introduce large enough quantities of C. *ariakensis* to make a significant impact on a faltering industry.

The 2003 "Economic Analysis and Pilot-scale Field trials of triploid C. *ariakensis* Aquaculture" proposed the introduction of 1,000,000 oysters in the spring of 2003. Some delays were experienced as the scientists worked to produce a million oysters with a diploid rate of no more than one in one thousand. That was accomplished in the summer and 800,000 oysters have been placed in the water between September 29 and October 9. Two growers experienced extensive damage on September 18 from hurricane Isabel and were unable to participate in this year's field trials.

Virginia Seafood Council is appreciative of the National Academies' study. The Academies have opened the door for more aggressive support for contained aquaculture of triploid C. *ariakensis*. We anticipate proceeding aggressively with much larger quantities of triploids in containment to create a significant economic impact on the Virginia oyster industry.

At the same time, the Commonwealth of Virginia supports the Environmental Impact Statement and has joined the State of Maryland in triggering the study. Virginia Seafood Council had effectively lobbied the Virginia Congressional delegation to release up to $500,000 to the U.S. Army Corps of Engineers this month to fund the EIS.

It is important to note that Virginia Seafood Council, in its pilot projects, has consistently and precisely followed all laws, regulations and conditions to safely conduct the grow outs. VSC has no desire to proceed with any non-native introductions outside existing guidelines and legal constraints.

It is also important to note that Virginia oyster growers and processors have very little time left to salvage an important industry. With only 21 processing houses now operating in Virginia, much of the infrastructure has been lost and inadequate resources will force the closing of more shucking houses in the near future.

Virginia Seafood Council requests rapid completion of the Environmental Impact Statement and any additional research deemed necessary. Completion of these projects should culminate with the permission to grow non-native *Crassostrea ariakensis* in the open waters of the Commonwealth as a self-sustaining stock.

Mr. GILCHREST. Mr. Goldsborough.

STATEMENT OF WILLIAM J. GOLDSBOROUGH, SENIOR SCIENTIST, CHESAPEAKE BAY FOUNDATION

Mr. GOLDSBOROUGH. Thank you, Mr. Chairman, for the opportunity to address the Subcommittee on this important issue. My name is Bill Goldsborough. I am a scientist on the staff of the Chesapeake Bay Foundation, a nonprofit conservation organization.

As an environmental organization that supports oyster restoration, CBF is confronted with quite a dilemma on this issue. If the Asian oysters hold the promise that some believe it does, it could dramatically help the Bay ecosystem as well as the commercial oysters fishery.

Native oyster stocks in the Bay are at about 1 percent of what they were historically, and the Bay suffers for lack of a dominant filter feeder and a building block for rich reef communities. The oyster fishery, well, it was the most valuable fishery in the Bay for over a hundred years and as recently as 1980 contributed over half of the Nation's production of oysters. Now, as has been said, it is suffering dramatically.

However—and this is the flip side of our dilemma—as a non-native species, the Asian oyster also has potential to cause ecological havoc in the Chesapeake Bay and Atlantic Coast waters. The introduction of exotic species into new environments is second only to habitat loss as a contributor to species depletion and extinction.

It has been estimated that exotic species that become invasive cost the United States $137 billion annually, more than earthquakes, floods and fires combined—not to suggest that this issue necessarily is in that kind of a category but to put a perspective on the abstract issue of these potential impacts that have been discussed. It is a real issue that has to be considered.

This serious dilemma is compounded by the fact that very little is known about the Asian oyster, even in its native waters. Thus, we have the National Research Council report—study and report—which we fully supported from the beginning; and I am happy that

there is consensus across the Chesapeake Bay community in support of that work.

In CBF's view, the NRC report offers a responsible road map to oyster restoration in the Chesapeake Bay. In our view, the primary message in that report was that more needs to be known about this oyster.

I chose one brief quote to make that point from the report: Quote, it is impossible, given the present state of knowledge, to predict whether the Asian oyster will be a boon or an ecological disaster. Unquote.

The report goes on to list a sequence of priority areas of research that might address this problem of lack of information and allow us to make more responsible public policy decisions in the future. Addressing these information needs by the development and the implementation of a research plan is, in our view, the number one priority before us now.

CBF strongly recommends that the Scientific and Statistical Advisory Committee of the Chesapeake Bay program be tasked with developing this research plan. In our view, they are the most qualified and appropriate body for doing this. We have written the Chesapeake Bay program in support of this action.

Another key finding of the NRC report is that the regulatory framework applicable to marine introductions is, quote, a patchwork with significant gaps. I think this is quite clear from the fact that nobody seems to know where we stand with an EIS now and who would have authority over it. There is a lack of Federal jurisdiction over marine introductions, which is an astounding thing to realize. Many of us did not realize that until recent deliberations on this issue.

The nonbinding nature of the regional review processes also seems to hamper the ability to get hold of this issue.

So CBF supports establishing the appropriate mix of increased Federal and/or regional authority over marine introductions, would defer to the NRC report for more detail on what those options might be and for a variety of other people with various expertise to contribute to that deliberation.

But I would note that the NRC report did mention the Chesapeake Bay program in particular as appropriate for increased authority on this matter with respect to the Chesapeake Bay, and I would support that. But I would also want to note that the Atlantic States Marine Fisheries Commission should be considered as a possible vehicle, because it is a way that other coastal States could bring their views to bear on this issue; and they do have various concerns and interests at stake as well.

I would also note that the NRC report has a very important chapter entitled Unrealistic Expectations and Common Misconceptions. I won't go into the details of that but would refer folks to that.

The basic message is that there are no quick fixes for either the Chesapeake or the oyster fishery embodied in either the native or the Asian oyster. Progress in reversing long-term declines in oyster populations will take a long time. It took a long time to get where we are now, and there are a lot of stressors out there.

As to whether or not we approach oyster restoration with native or non-native oysters, CBF's view is that native oyster restoration continues to have promise if it is funded sufficiently for a sustained period of time.

With respect to non-native oysters, CBF believes that, at some point in the future, the Asian oyster might be judged appropriate for use in Chesapeake Bay, but in the near term it should only be used in controlled aquaculture using sterile oysters, and this is the view point that is reflected in the NRC report.

I do also want to point out that—and I was happy to hear both Dr. Boesch and Secretary Franks mention this—the Chesapeake Research Consortium in 1999 put forth a document which I can provide a copy of—I was not able to find an electronic copy to submit—which basically provides a consensus of scientific experts on a road map or formula for oyster restoration in the Bay. In our view, this is still scientifically supported and is beginning to show positive results in the record spat sets around sanctuary reefs in Virginia and the modest disease levels found on harvest reserves in Maryland. It is our view that, to fully evaluate and investigate the potential for the native oyster, we need to scale up these approaches. It is a matter of scale.

You noted that Colonel Prettyman-Beck from the Corps of Engineers described one initial effort to do this with their Tangier Sound/Pokemoke Sound Project. We need more of that. We need to scale up these strategies that seem to be showing some success.

The CRC reports basic principles of permanent reef sanctuaries combined with proper disease management can show some success in the long term, in our view, if support is sustained for their application.

I also want to say that the Bay Foundation supports a collaborative, federally led environmental impact statement. I say "federally led" because there are implications for the whole coast, indeed for the whole country. We are bringing in an oyster to the Atlantic Ocean that is not there now potentially. So whether it—or where the Federal jurisdiction should be, I am not sure. I am hearing that EPA may be interested in taking on that jurisdiction, if the interpretation supports it; and we would support that.

In the short term, though, this seems like the most viable approach is for the authorization language that Ms. Porter referred to to pass through Congress authorizing the Corps of Engineers and funding the Corps of Engineers to undertake that process; and we fully support that.

Beyond the questions of whether the Asian oysters' life history would be compatible with the Chesapeake system, I just want to leave you with this one thought. Nobody knows how it would respond to the low-dissolved oxygen conditions prevalent in Chesapeake Bay in the summer due to massive nutrient pollution. The Chesapeake dead zone, where water commonly is completely devoid of oxygen and no fish or shellfish can live, expanded to be 150 miles long in 2003, the largest such habitat depletion on record. No attempt to rehabilitate the biota of the Bay will be fully successful until steps are taken to stem the nutrient pollution from sewage effluent, agriculture runoff and atmospheric inputs.

Now, one final note, Mr. Chairman, to answer the question in the letter about testifying at this hearing. It was asked whether or not there are any recommendations on Congressional action on this issue. I noted one already, that the authorization language for the Corps of Engineers be passed. It is enclosed in the Senate version of the energy and water appropriations bill, which as of last week, I understand, was in conference committee. I don't know the status today, so we would support quick passage of that authorization language.

Also, funding to support the research recommendations by the NRC studies is important; and again, in our view, that should be begun with a stack committee under the Bay program developing a research plan. Funding for that could come through the authorization for an EIS through the Corps of Engineers, but it appears that the next cycle for that mechanism will take too long.

In the short term, we recommend consideration of the NOAA Chesapeake Bay studies program as a logical funding vehicle. This program is designed to support mission-oriented fishery research.

On a somewhat longer timeframe, Federal legislation will clearly be needed to fill the gaps in oversight for marine introduction. Several options for that are mentioned in the NRC report.

I will also just mention that native oyster restoration programs again must be expanded. Congress has stepped up as a key partner in this endeavor over the last 3 years. We are in the third year of a 10-year program which grew from the CRC report, the formula for restoration; and it is way premature to judge that effort, I would offer. But I suggest that, given the feedback so far, that the stage is set for a very appropriate scaling up of native oyster restoration; and Congress can play a key role in supporting that effort.

Finally, again, nutrient pollution. We will not get anywhere with restoring Chesapeake Bay biota if we don't address that problem on a large scale as well.

Thank you, Mr. Chairman.

Mr. GILCHREST. Thank you, Dr. Goldsborough.

[The prepared statement of Dr. Goldsborough follows:]

Statement of William J. Goldsborough, Senior Scientist, Chesapeake Bay Foundation

Thank you, Mr. Chairman and Members of the Subcommittee, for the opportunity to address you on an issue of critical importance to the future of Chesapeake Bay: the potential introduce of non-native oysters. My name is Bill Goldsborough. I am a staff scientist and director of the fisheries program for the Chesapeake Bay Foundation (CBF). CBF is a private, non-profit conservation organization dedicated to saving the Chesapeake Bay. We have been ardent advocates for oyster restoration as a key element of Bay restoration since the mid-1980s, and I have served on several oyster management committees in both Maryland and Virginia during that time. I also serve as Chairman of the Habitat Committee of the Atlantic States Marine Fisheries Commission (ASMFC), which co-sponsored a workshop on the use of Asian oysters in Chesapeake Bay in May of 2002.

As an environmental organization that supports oyster restoration, CBF is confronted with quite a dilemma with the proposed introduction of the non-native Asian oyster into Chesapeake Bay. If the Asian oyster (Crassostrea ariakensis) holds the promise that some believe it does, it could dramatically help the Bay ecosystem as well as the commercial oyster fishery. With the Bay's native oyster stocks at about 1% of their historic abundance, the Bay suffers from the lack of a dominant filter feeder and a building block for rich reef communities. The oyster fishery was the most valuable fishery in Chesapeake Bay for over 100 years and as recently as 1980 contributed half the nation's production of oysters.

However, as a non-native species, the Asian oyster also has the potential to cause ecological havoc in Chesapeake Bay and Atlantic coast waters. The introduction of exotic species into new environments is second only to habitat loss as a contributor to species depletion and extinction. It has been estimated that exotic species that become invasive cost the United States $137 billion annually— more than earthquakes, floods and fires combined.

This serious dilemma is compounded by the fact that very little is known about the Asian oyster, even in its native waters. Fundamental aspects of life history, such as its reproductive ecology, are very poorly understood. Given this reality, a broad consensus was reached among agencies, institutions and oyster interests in this region almost two years ago that an independent, technical assessment of the issue was needed, and the National Research Council (NRC) study was commissioned.

National Research Council Report

CBF believes that the NRC report, "Non-native Oysters in the Chesapeake Bay," released in August 2003, offers a responsible roadmap for oyster restoration. Its recommendations mirror the approach embodied in CBF's position statement on non-native oysters first released in December 2001 (updated version attached). The report clearly indicates that more needs to be known about the Asian oyster:

> "It is impossible, given the present state of knowledge, to predict whether the [Asian] oyster will be a boon or an ecological disaster [if introduced to Chesapeake Bay]..."

It goes on to provide a detailed listing of priority areas of research to develop the information necessary for making responsible public policy decisions about how to utilize the Asian oyster. Addressing these information needs through the development and implementation of a research plan is the single most important action now before us. CBF strongly recommends the Scientific and Statistical Advisory Committee (STAC) of the Chesapeake Bay Program (CBP) as the most qualified and appropriate body for developing a research plan based on the NRC recommendations. CBF has written the CBP (attached) in support of this action, and at its last meeting STAC indicated a willingness to make this a priority. Additional funding will be necessary to support this research.

Another key finding of the NRC report is that the regulatory framework applicable to this issue is a "patchwork with significant gaps." Most noteworthy are the lack of federal jurisdiction and the non-binding nature of regional review processes under some circumstances. CBF supports action to address these weaknesses by identifying and establishing the appropriate mix of increased federal and/or regional authority over marine introductions. The ASMFC should be evaluated as a possible avenue for binding deliberation among coastal states for any marine introduction that has implications for multiple states.

The NRC report also perfectly characterizes the ultimate source of political contention regarding the Asian oyster in a section entitled, "Unrealistic Expectations and Common Misconceptions." The basic message is that there are no quick fixes for either the Chesapeake or the oyster fishery embodied in either the native or the Asian oyster.

> "Progress on reversing the long-term declines in oyster populations and water quality will be achieved only when unrealistic expectations for a quick fix are replaced with a long-term commitment to systematic approaches for addressing the Bay's complex, multi-dimensional problems."

It goes on to describe the "myths" that native oyster restoration will not work and that the Asian oyster will rapidly populate the Bay.

Native vs. Non-native Oysters

CBF believes that native oyster restoration continues to have promise if it is funded sufficiently for a sustained period of time. This sentiment is echoed in the NRC report:

> "Although restoration efforts have made limited progress in establishing sustainable oyster populations, there remains some optimism that a more comprehensive management approach will ultimately achieve recovery of the oyster resource."

In 1999 the Chesapeake Research Consortium (CRC) convened a meeting of the Chesapeake area's top oyster scientists and charged them with developing a formula for native oyster restoration based on the best available science. Their report (CRC 1999) remains a viable, if unfulfilled, guide for oyster restoration. This consensus document played a major role in convincing Congress to expand the Federal funding for oyster restoration in 2000. And in the same year the CBP, based in part on the same scientific consensus, adopted a ten-year commitment to expand native oyster stocks tenfold. We are only in the third year of that initiative. In fact, record

reproduction around sanctuary reefs in Virginia and modest disease levels in harvest reserve areas in Maryland are measures of success that suggest these strategies should be applied on a larger scale. The CRC report's basic principles of permanent reef sanctuaries combined with proper disease management continue to be supported by science, and large scale plans for applying them have been proposed (Allen, et al. 2003).

In CBF's view, the Asian oyster may, at some point in the future, be judged appropriate for use in Chesapeake Bay, but in the near term should only be used in controlled aquaculture using sterile oysters until its biology and the risks of its introduction are much better understood. This viewpoint is consistent with a key conclusion of the NRC report:

> "[Contained aquaculture of sterile Asian oysters] ... should be considered a short term or interim action that provides an opportunity for researchers to obtain critical biological and ecological information on the non-native oyster required for risk assessment ... [and] allows for more management flexibility in the future depending on the status of the native oyster and the success of restoration efforts."

CBF supports the development of a collaborative, federally-led Environmental Impact Statement (EIS) to thoroughly assess the risks and benefits of introducing Asian oysters to the Chesapeake Bay and Atlantic Ocean. The EIS should incorporate the research plan developed by STAC (see above) and should fully evaluate the available alternatives for native oyster restoration. Authorization and funding for the Army Corps of Engineers (ACE) to take on the lead role in an EIS should be a high priority.

The information about the Asian oyster that has ignited so much interest from the oyster industry is that field trials have shown that it grows faster and survives better than the native oyster under some circumstances. This knowledge tells us that the Asian oyster could possibly be a good aquaculture animal, but it is a huge leap of faith to assume that it would also reproduce, multiply effectively, and establish substantial wild stocks in Chesapeake Bay. Beyond the questions of whether its life history would be compatible with the Bay system, no one knows how it would respond to the low dissolved oxygen conditions prevalent in Chesapeake Bay in the summer due to massive nutrient pollution. The Chesapeake "dead zone," where water commonly is completely devoid of oxygen and no fish or shellfish can live, expanded to be 150 miles long in 2003, the largest such habitat depletion on record. No attempt to rehabilitate the biota of the Bay will be fully successful until steps are taken to stem the nutrient pollution from sewage effluent, agricultural runoff and atmospheric inputs.

Congressional Action

Congress has been a key player in oyster restoration and must continue to be engaged if restoration goals are to be met. The deliberations about introducing the Asian oyster into Chesapeake Bay have highlighted several ways that Congress can assist:

1. Statutory authorization and appropriations for the ACE to conduct an EIS are needed. Language currently in the Senate version of the Energy and Water Appropriations bill should be adopted into the final version of the bill. While this language is sufficient to start the process, subsequent years' appropriations should stand alone and not be co-mingled with native oyster restoration funding.
2. Funding to support the research recommended by the NRC study and described in the proposed STAC research plan is urgently needed. Such funding could be part of the EIS appropriation for the ACE, however, the next cycle for that statutory mechanism will not provide the needed funds soon enough. CBF recommends consideration of the NOAA Chesapeake Bay Studies program as a logical funding vehicle. This program is designed to support mission-oriented fishery research.
3. On a somewhat longer time frame, federal legislation will probably be needed to fill the gaps in oversight for marine introductions. As identified in the NRC report, two possibilities are, amending existing legislation, such as the Lacey Act or the Invasive Species Act, and vesting authority in a regional body, such as ASMFC or CBP.
4. Funding for native oyster restoration programs should be expanded. The potential for restoration success is embodied in larger scale application of certain approaches now showing promise. NOAA and ACE are both important partners through which federal funding for native oyster restoration is dedicated.
5. Congress should seek ways to address nutrient pollution in the Chesapeake watershed as an integral part of programs to restore the Bay's biota. The Bay's

dead zone represents severe habitat loss for oysters, blue crabs and finfish. State-federal cooperation in funding sewage treatment plant upgrades should be the first priority.

Thank you for the opportunity to address the Subcommittee on this important issue.

References

Chesapeake Research Consortium, 1999. "Chesapeake Bay Oyster Restoration: Consensus of a Meeting of Scientific Experts."

Allen, S.K., R. Brumbaugh, & D. Schulte, 2003. "Terraforming the Chesapeake." Virginia Marine Resource Bulletin, Volume 5, Number 1.

NOTE: The following attachments to Mr. Goldsborough's statement have been retained in the Committee's official files.

- Chesapeake Bay Foundation Position Statement On The Use of Non-native Oysters in Chesapeake Bay, August 2003.
- Letter from Theresa Pierno (CBF) to Rebecca Hanmer (CBP), September 12, 2003.

Mr. GILCHREST. Dr. Goldsborough, do you agree—does the Chesapeake Bay Foundation agree with the program now under way in Virginia as far as the *ariakensis* oysters are concerned?

Mr. GOLDSBOROUGH. Yes, in a word. Given the biosecurity safeguards that have been applied—and I would note that we have been involved monitoring the non-native research that has gone on in Virginia during the last 10 years, started with the Pacific oyster, and so we have been involved in those deliberations. Each step of the way we have ended up supporting the research that was undertaken. That includes the latest proposal by the Seafood Council with those safeguards, and I would—

Mr. GILCHREST. Do you see *ariakensis* being—do you see the Asian oyster as being a definite part of the oyster industry in the Chesapeake Bay?

Mr. GOLDSBOROUGH. I think it is premature to say a definite part. We simply don't know enough about it; and that, again, is the primary recommendation from the NRC report.

Mr. GILCHREST. I guess as far as the triploid fish hatchery aquaculture part of this is concerned, is it likely that the—in your mind, that *ariakensis* will be or can be a significant part of the economy of the aquaculture in the Chesapeake Bay.

Mr. GOLDSBOROUGH. I don't think you can say that it would at this time. I think all you can say is that it would be a very small part. Because the contained, small-scale aquaculture using triploids that is suggested as a possible interim action in that report simply would not be a major part of the industry. I am sure it would be important for many folks, and I think we ought to go somewhat down that road and look at that a little bit further as long as we are able to minimize risk while we learn more about that animal and its prospects and its life history and while we attempt further scaling up of the native oyster restoration work.

Mr. GILCHREST. Are you still positive about the restoration of disease-resistant native oysters in the Bay?

In the context of that question, I think it was Dr. Allen who said earlier, and he can tell me if I paraphrase his comment wrong, that it is not a matter of *ariakensis* or native oysters. It is a matter of we are genetically altering, if I can use that correctly, that term correctly, we basically to some extent, from a layman's perspective,

we have given up on the native oysters, and we are now looking for genetically altered native oysters.

Mr. GOLDSBOROUGH. I do think that is a fair characterization. I think it is a useful perspective to put on all this.

Mr. GILCHREST. So are you optimistic to increasing tenfold the genetically altered native oysters?

Mr. GOLDSBOROUGH. I believe it is possible. And I believe, and I think most folks that were involved in that commitment believe, that that restoration on that 10-year timeframe would not be linear. It would come slow at first, and it would increase in rate later during the 10-year period by virtue of biological multipliers kicking in. You do see some application of that strategy, particularly in Virginia, and some results from it and in several of the tributaries where they are getting record spat sets around the sanctuary reefs.

Mr. GILCHREST. Ms. Porter, how do you see the triploid oyster being used in Virginia and in the context of aquaculture? Do you see that as the very beginnings of the restoration of the oyster industry so that eventually it would move to diploid oysters being used for aquaculture or diploid oysters being used in the traditional wild harvest way?

Ms. PORTER. Well, I certainly see great promise for the oyster industry with the *ariakensis* oyster. It will be very difficult in the aquaculture setting to grow a million bushels a year. It would be a very long time before we could reach that goal. Not that that has been defined as a goal, but that is where we were in the mid-80's.

I really don't know about the diploid. We are cautious about the diploid. Certainly, the processors are anxious to find a product that will be plentiful in the Bay; and it would seem that a diploid in the wild would be—if in fact it is adaptable to the Bay, that it would be the best way to get the greatest number. But we are still very much on an aquaculture triploid track until we know the risk and the benefits.

Mr. GILCHREST. Do you think Virginia is moving more in the direction that Connecticut—Connecticut apparently is almost exclusively hatchery-raised oysters in Long Island Sound; and they changed that some I don't know, several decades ago. Is Virginia moving in that direction, more toward an industry that relies on hatchery-raised aquaculture type business, as opposed to the traditional wild harvest?

Ms. PORTER. I believe that—yes, I believe that we are moving in that direction. That is not particularly good news for the traditional watermen, and they are not supportive of that. It would be relatively good news for the packinghouses.

Mr. GILCHREST. Would that be the—similarly to what they do in Connecticut where the—where someone would lease a certain area, a certain bottom and that would be their area for raising oysters?

Ms. PORTER. Well, there are many private growers in Virginia leasing bottom today, yes.

Mr. GILCHREST. Mr. Simns, what direction do you see Maryland watermen going in as far as the oyster industry is concerned? Do you envision aquaculture becoming a small part of the industry? Do you see us moving in that direction, especially if we introduce *ariakensis*?

Mr. SIMNS. If we had an oyster that would live, whether it is *ariakensis* or hybrid generic or one that is disease-resistant, you would see almost overnight—the 10,000 acres that is leasable today in the State of Maryland, you would see a good portion of that being leased and being worked and jump into production. The reason it is not being used is because you can't afford to invest your money and put seed out there and it is going to die. If we were—

Let's use the *ariakensis*, for example. What we see is both would come up together. The aquacultures and the public rock system would come together, especially if we—the diploid were to reproduce on its own.

And just a clarification about Connecticut. Connecticut, the major part of their oyster, if I am correct, is not produced in hatcheries. It is produced in the wild and harvested by the oystermen and sold to the—or planted on the leaseholder's bottom. So it is a wild aquaculturist type of thing. They do have some hatchery-based oysters, but I can tell you that there is not—

Mr. GILCHREST. Is the wild harvest sold?

Mr. SIMNS. The leaseholders hire the local watermen, and sometimes they are also using harvest gear to go on the public seed bottom and harvest the seed and put it on their lease bottom. So it is a combination.

Mr. GILCHREST. It is a collaborative effort between the wild harvest and the hatcheries.

Mr. SIMNS. Right. And the same thing in the Gulf of Mexico. When those—they get their seed, well, they have a natural-producing seed on their lease bottom, but they also get their seed off of State bottom. They are allowed to harvest it and put it on their bottom. So almost anyplace where the aquaculture are surviving it is subsidized somewhat by the State because they are allowed to use the public rock to subsidize the seed.

There is not too many areas that I know of that get their total production from hatcheries. They actually get a lot of it from the natural reproduction. I mean, there might be some people that do just depend on hatchery-raised seed. But if you look at the bulk of the oysters coming out of the Gulf of Mexico, most of them are naturally reproduced, but they are grown on private tracts of bottom. There is not a whole lot of difference from growing it aquaculturally on a large tract of bottom that you, as an individual, own or a company owns, versus the State owned it and it being harvested. The only difference is that they rotate.

We could do the same thing. That is what we see coming in the State of Maryland. We are experimenting with on the reserves. You heard a little bit about the reserve part.

What we are doing is we are cleaning these bars off and the same way they do in Connecticut. They go in, and they take every existing oyster off of it, because it has diseases in it. They take all the big oysters off, all the little oysters. They take them all ashore. They shuck what they can. They leave it on the shell pile until it dies and it cleans itself up before they put the shells back in the water. They leave them there about a year or so. So there is no disease on that bar.

Then when you plant your disease-free oysters there, whether they come out of the hatchery or they come from somewhere else,

it has a better opportunity of growing to maturity before it catches disease.

Now, this is just a plain waterman's example. It is not scientific. But we are doing the same thing with the ORP and the reserve areas. We go in. We hire the watermen to clean these areas off. We catch all the existing oysters on the area and take them to another place. Then we go down and plant shells or hatchery seeds, and we are seeing good results of that.

But I have to remind you that these areas we are seeing good results are areas that we have the least amount of problem with disease. In areas that we have tried to where disease is pretty heavy, the oysters will go longer without catching the disease because you cleaned it off, but eventually they get it. So the success in Connecticut has been because they cleaned the bars off and they plant either natural seed or hatchery seed.

In Maryland, we see the same thing happening. If we start rotating our bars where we have cleaned them down to, you know, after you harvest them, get all of your harvestable out, then you go in and clean up all the existing oysters and get the disease away from there before you plant anything else back. They seem to last longer before they catch the disease, which gives them time to mature and be harvested again.

Leaving them lay there for long periods of time until they die, in the watermen's perspective—and the scientists would disagree with me—we think you are harboring disease, and you have got a place that is infested with disease, and it keeps the disease there. We think, although there is places for sanctuaries that we should experiment with, we feel that sanctuaries is probably going to be where the disease comes from if you leave them there and don't ever harvest them.

Mr. GILCHREST. So you are saying that sanctuaries might not be a good idea because there is not enough rotation.

Mr. SIMNS. Yeah, and that is a debatable issue. I don't want to say that sanctuaries aren't good, because there are some other things that they might produce of oysters that are more resistant to the disease.

Mr. GILCHREST. Would sanctuaries be OK for diploids?

Mr. SIMNS. Yes, I think so.

Mr. GILCHREST. Do you have an opinion of oyster bar versus oyster reef?

Mr. SIMNS. Well, it is not a lot of difference. You know, you heard testimony that Chester Bay doesn't have enough reefs to support an oyster system. Well, it does. We don't have as many as they had in the 1800's, probably, because a lot of them silted over; and the upper Bay is no longer productive because it is too fresh water. But there is a lots of oyster bars or oyster reefs in the Chesapeake Bay. They don't have many oysters on them now, but the substrate is there, and they could be, you know, put back to life.

In fact, that is what we are doing at ORP. We are putting oysters in places that is not producing many oysters. We are taking off what few oysters are there, and then we put shells back down and put seed oyster on top of them, and that works.

What I see, whether it is *ariakensis* or *virginica*—I would love for it to be *virginica*, but I don't see that happening over 100

percent of the Bay. What I see is how an aquaculture industry that both uses triploids and diploids—because they will use triploids because in the summertime they will have a good marketable oyster when the season is out because the triploid doesn't reproduce and in the summertime when the other oysters are reproducing they are not a very good oyster to sell. So they will use triploids for specific times of year when the season is closed to sell. They will use diploids so they don't have to continually be buying oysters from a hatcher.

Mr. GILCHREST. So you do see Maryland moving toward—

Mr. SIMNS. I see it being parallel. I don't see it doing more. Because in my life history again, when we had 10,000 acres of oyster bottom as leaseholders, I would say in my lifetime over 50 percent of them are very productive.

Mr. GILCHREST. Would the Maryland Watermen's Association be receptive to similar ideas that Virginia has as far as—not only as far as aquaculture is concerned, but as far as the process Virginia is following pursuing first the triploid process and then, later on down the road, diploids? Or do you feel that the Watermen's Association thinks that that interim step of dealing specifically with triploids is not necessary?

Mr. SIMNS. Well, I think there is a short—I think in their mind that should be a shorter time span than what I was saying, because I am not going to live long enough or the rest of my people I represent.

Mr. GILCHREST. We should have this done in 40 or 50 years.

Mr. SIMNS. Yeah. That is what I am talking about.

Mr. GILCHREST. So you will still be around.

Mr. SIMNS. I am not going to live long enough to see the diploid being enough production out there to keep my people alive.

Mr. GILCHREST. On that issue, if we find that the diploid is suitable and does not become invasive and does not become an environmental catastrophe, what is your sense of a realistic timeframe for diploids revitalizing the oyster industry and becoming an important, positive aspect in restoring the ecology of the Bay? Is it 5 years, 10 years, decades?

Mr. SIMNS. If we were allowed today to both use the diploid and the triploid, then I would say in 5 years time we would see definite improvement. Because we wouldn't want to harvest the triploid right away, even when it reached maturity, because we want to let it reproduce once at least so that it is helping spread. You wouldn't want to go in there and harvest it all.

Mr. GILCHREST. Would you need sanctuaries in the beginning?

Mr. SIMNS. I think we would need sanctuaries. I am talking about with the *ariakensis* because you are not worried about the disease. I think that you should have places in each area of the Bay where you have some sanctuaries for reproduction purposes, and then you should have your harvestable areas. And I wouldn't just say harvestable area like we see it today. I would say that you should have what we are talking about in the reserve.

What we are doing in the reserves is, when we put those oysters there, we don't open them up to harvest right away. We wait until pretty close to 50 percent of them are four inches or longer, and we also put a bigger size limit on them so that we are getting two

for the price of one. You know, you take a three-inch oyster and let it go to four, you get two bushels for one.

So that is what our strategy is on the reserve areas with *virginica*.

On the *ariakensis*, because it grows faster you might not need to do that. But I still would say I think you have got to do different with the *virginica* than you do with *ariakensis* because you don't have the disease to worry about. So you might just be able to have sanctuaries for reproduction purposes and then open areas and then your leaseholders, also.

The other thing about having the leaseholders is, if you allow them to do diploids too, then you have got another influx of reproducing oysters in there, that they are not just going to reproduce on the lease bottom, they are going to reproduce all over the Bay. So I think if we work that altogether, then I see us really doing—really doing well.

I think the other thing is, if we had the *ariakensis*, then we could take our resources that we are spending on *virginica* now and hopefully get more resources for that. But you would concentrate that money into areas that you know the *virginica* is going to have a better chance of living and not spread it all over the Bay doing little experiments where you know they are going to die. Because what you are doing right now with the little bit of money we have, half of it gets spent in areas that we know they are going to die.

So you know if you put all your efforts, say, in Chester River to upper Choptank River in the upper Bay and kept that just for *virginica*, you could have a specialized oyster that people would be willing to pay a whole lot more money for because it is a local specialized oyster; and you could have the *ariakensis* in the other 90 percent of the Bay for the shucking business and for the countrywide market.

But in other countries, in Ireland, for instance, they produce 5,000 bushels of their native oysters, and they get a premium price for them, and they spend a lot of money to have them there. They have a co-op that works on that, and then the rest of the oysters are sold to the rest of the world.

Mr. GILCHREST. Well, that is an interesting idea.

Mr. SIMNS. So we are looking at this thing not from a narrow perspective, keeping everything like it is. We are looking at the future of expanding it so everybody is included and so that we really have a viable industry from all aspects of it.

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

Just a couple of more quick questions. I know everybody's probably ready to go have dinner since you skipped lunch.

Mr. Goldsborough, in this research that has been done for *ariakensis* or triploids/diploids, the native oysters, and based on your understanding as a scientist, these kinds of incidents that have happened around the world, whether it is Oregon, France, New Zealand or whatever, can you give us some—I am going to focus as a pessimist for a second. I want to leave this hearing, though, as an optimist. Is there some understanding of the type of havoc that an invasive oyster could cause in the Chesapeake Bay? Can you give us some examples of that? And how do we go about

finding out whether those examples that you are going to give us will actually happen, and how long might that research take?

Mr. GOLDSBOROUGH. Well, on the last point, I would have to defer to some of the scientific community as to how long it would take. I believe the Co-Chair of the NRC report suggested on the order of 5 years, but I can't verify that, not being a research scientist. But you have put your finger on the million dollar question, no doubt about it. The experience worldwide have been varied, and in some cases imported oysters have become invasive and others not.

Mr. GILCHREST. Now could you explain for us "they have become invasive"? Now an oyster doesn't move. So what kind of invasive havoc is—give us some possibilities that could happen in the Chesapeake Bay.

Mr. GOLDSBOROUGH. Well, what that means is, as a new organism to a local ecosystem, it has not evolved within that system with a series of checks and balances. It comes in and as those things get sorted out it does not have limiting factors to control its growth and distribution. So it goes wild, and the end result is you see plenty of terrestrial examples like fragmites. You end up with a monoculture that does not have anywhere near the habitat value of the native ecosystem, so the possibility is that it overruns native organisms and communities. And I must say—

Mr. GILCHREST. So would a zebra mussel in the Great Lakes be an example of that—

Mr. GOLDSBOROUGH. Yes.

Mr. GILCHREST.—or would that be beyond the parameters of what could happen here?

Mr. GOLDSBOROUGH. I don't think that we can say that it is beyond the parameters now. And this is quite a dilemma, no doubt about it. Because who wouldn't like to see more oysters in the Bay filtering the water? But there are downsides that we have to factor into this as well, and the main thing about it is that it is unpredictable and probably irreversible.

Mr. GILCHREST. I see. Thank you.

I think what we hope to—I guess the next step as far as the Congress is concerned is to collaborate in a very rigorous way with the scientists, with the industry, with the other Federal agencies, certainly with the State agencies to move along in as harmonious a fashion and with all deliberate speed that is reasonable under the circumstances.

Now that is easier said than done. But I think all of us, if we can agree with an opening statement that we want to restore the Chesapeake Bay—and one of the ways to do that is to restore the oyster population, not forgetting, like Larry said in the beginning, septic tanks, air deposition, construction, development, agriculture, probates in sensitive shallow areas, overharvesting. So all of these things I think we need to collaborate together on. I would hope that, as we continue to pursue this, that each of us that has a certain area of interest become as responsible and as knowledgeable as we can to move along.

I don't have any other questions, I don't think, at this particular point. If any of you want to make a closing comment or a recommendation to us, we are open for that.

Larry.

Mr. SIMNS. Yeah, if I may.

One thing I would like to—

Mr. GILCHREST. Larry gave me some good recommendations in a shopping plaza in Chestertown a couple of days ago. So I still remembered those, Larry.

Mr. SIMNS. One thing I would like to point out, and what Bill is talking about, you know, if we were to be fortunate enough to have a catastrophe that we had a bloom of these oysters in the Chesapeake Bay, there is one predator out there that that oyster would have a hard time keeping up with, and that is the Maryland watermen. We would keep that stock down so that they didn't overrun. So that is one thing I would like to see us have, a problem of too many oysters.

Somebody said, what will happen if the oyster gets so big that, you know, it is not good for market? Well, I can tell you we would develop a market for it, because Campbell soup would love to have an oyster to grind up and make oyster chowder out of. So I don't think the problem of an overabundance of oysters is going to be a problem like the zebra mussel is because the zebra mussel doesn't have a predator of a Maryland watermen and the oystermen—the oyster does. So keep that in mind.

Mr. GILCHREST. Well, Larry, you are sitting next to somebody from Virginia. So now she's going to say something about the Virginia watermen.

Mr. SIMNS. Well, Virginia, too. We will take care of the overabundance.

But I would just say that time is of the essence, and certainly we don't want to do anything wrong here. We don't want to do anything that we can't turn around. So we need to be cautious. But I don't think that being cautious means we have got to take 5 years to find out. Because if you put the money and the effort you can find out in a year what you can find out in 5 years. We found out in 50 years that we haven't been able to get a disease-free oyster yet that will work in the wild. So I don't want to wait 50 years to find out whether this oyster is going to work or not.

And thank you.

Mr. GILCHREST. Thank you very much, Larry.

Mr. Goldsborough.

Mr. GOLDSBOROUGH. Thank you for the opportunity for a final comment, Mr. Chairman.

I guess I would just refer to science and say that I would certainly support conducting the science as expeditiously as possible and get the answers we need. No question about it.

But I would note that the history of oyster management, starting with Dr. William Brooks, who was mentioned earlier in the late 19th century, all the way through some of the recent committees during the last decade that were mentioned, during that history, in virtually every case, science has in one way or another been compromised. So I guess my final comment is, let's just not let the science be compromised this time and let's see what it can do. I think the NRC report is a big foundation for that, the CRC document I mentioned is another, and the science that we have yet to

conduct in the next couple of years pursuant to the NRC report as well.

Mr. GILCHREST. Thank you very much.

Ms. Porter, you have the last word.

Ms. PORTER. I don't have a last word. I guess more than anything I would encourage you to do whatever you can to get this EIS on track and under way.

Mr. GILCHREST. All right. Well, thank you very much, Mr. Goldsborough, Ms. Porter and Mr. Larry Simns. We appreciate your testimony. It has been very enlightening.

This hearing is adjourned.

[Whereupon, at 2:52 p.m., the Subcommittee was adjourned.]

○