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RESEARCH BEING CONDUCTED IN NATIONAL MARINE SANCTUARIES

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

OF THE

COMMITTEE ON RESOURCES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTH CONGRESS

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OVERSIGHT HEARING ON RESEARCH BEING CONDUCTED IN NATIONAL MARINE SANCTUARIES

TUESDAY, SEPTEMBER 29, 1998

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS, COMMITTEE ON RESOURCES, *Washington, DC.*

The Subcommittee met, pursuant to notice, at 10:06 a.m., in room 1334, Longworth House Office Building, Hon. Jim Saxton (chairman of the Subcommittee) presiding.

Mr. SAXTON. Good morning. The Subcommittee on Fisheries Conservation, Wildlife and Oceans will come to order.

STATEMENT OF HON. JIM SAXTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. SAXTON. The National Marine Sanctuaries Act of 1972 authorizes the designation of areas in the marine environment with nationally significant aesthetic, ecological, historical, or recreational values as National Marine Sanctuaries.

The primary objective of this law is to protect marine resources, such as coral reefs, sunken historical vessels or unique habitats, while facilitating all compatible public and private uses of those resources. An active research program is a vital component of the overall conservation and management programs of these sanctuaries.

Twelve National Marine Sanctuaries have been designated on the Atlantic, Pacific, and Gulf Coasts, in Hawaii, and in Guam. One additional area in the Great Lakes is an active candidate for designation.

Section 309 of the Sanctuaries Act directed the Secretary to conduct research, monitoring, evaluation and education necessary to carry out the purposes and policies of the Act. These policies and purposes include comprehensive and coordinated coordination conservation and management of the sanctuaries; enhancement of public understanding and appreciation of the marine environment; and, to the extent compatible with resource protection, facilitation of public and private uses of sanctuaries.

Limited funds have led NOAA to rely on outside groups to conduct the bulk of the research that is being done in sanctuaries. Coordination between researchers and resource managers has been very productive, as is evident by the number of outside researchers working in sanctuaries. The research has provided invaluable information about fish, corals, marine mammals, habitats, and cultural resources located in the sanctuaries.

Today we will hear from two groups, the National Geographic Society and the Cambrian Foundation, which have had particularly fruitful research partnerships with the sanctuary program, and we will receive an overview of research in sanctuaries from NOAA.

I look forward to these witnesses.

[The prepared statement of Mr. Saxton follows:]

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Twelve National Marine Sanctuaries have been designated on the Atlantic, Pacific and Gulf coasts, in Hawaii and in Guam. One additional area in the Great Lakes is an active candidate for designation.

Section 309 of the Sanctuaries Act directed the Secretary to conduct research, monitoring, evaluation and education necessary to carry out the purposes and policies of the Act. These policies and purposes include comprehensive and coordinated conservation and management of the sanctuaries; enhancement of public understanding and appreciation of the marine environment; and, to the extent compatible with resource protection, facilitation of public and private use of sanctuaries. Limited funds have led NOAA to rely on outside groups to conduct the bulk of the research that is being done in the sanctuaries. Coordination between researchers and resource managers has been very productive, as is evident by the number of outside researchers working in sanctuaries. This research has provided invaluable information about the fish, corals, marine mammals, habitats, and cultural resources located in the sanctuaries.

Today we will hear from two groups—the National Geographic Society and the Cambrian Foundation—which have had particularly fruitful research partnerships with the sanctuary program, and we will receive an overview of research in sanctuaries from NOAA.

I look forward to the witnesses testimony.

Mr. SAXTON. Before I recognize my friend, the gentleman from California, let me just observe that our witnesses today are quite notable. Dr. Sylvia Earle is with us today. Dr. Earle has become well-known—extremely well-known, I might add—and we are particularly honored to have Dr. Earle with us this morning.

While we were talking just prior to the hearing, we talked about issues that we deal with, with regard to the ocean on an ongoing basis, the subject of non point source pollution, which is well-known to us here; the subject of making sure that we preserve coastal areas because they are so immensely important to the ocean environment; and, of course, the marine sanctuaries program, which we are formally here to discuss today.

So welcome, Dr. Earle. We appreciate very much that you have given of your time to us, and we look forward to hearing from you this morning, along with our other witnesses, of course.

Mr. Farr, the gentleman from California, for whatever statement he may wish to make.

STATEMENT OF HON. SAM FARR, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. FARR. Thank you very much, Mr. Chairman. I appreciate your having this hearing today, and also with Mr. Gilchrest here.

These are the three real strong advocates of good ocean policy. And I appreciate the opportunity to speak with these distinguished witnesses.

I just want to welcome to this hearing room Dr. Earle. I got to know Dr. Earle in 1992 when we inaugurated the National Marine Sanctuary in Monterey. Monterey Bay National Marine Sanctuary is the largest of our 12 sanctuaries, and the phenomenon of this sanctuary is an underwater canyon called the Monterey Bay Canyon, which is about 12,000 or 13,000 feet deep. It is essentially the Grand Canyon under the sea, right next to the shore.

And Dr. Earle's new role with the National Geographic is to be Explorer-in-Residence of the Oceans. What a great title. I think we ought to refer to her as Ms. Neptune of the Modern Era. When we had the National Conference on the Oceans in Monterey, Dr. Earle and I went to Portugal.

And I think what was so amazing about that opportunity to be on a dais in Portugal was that she was conducting an interview with Jacques Cousteau's son who was underwater in the ocean in Monterey conducting a live, interactive dialogue with students who were onstage in Lisbon, Portugal.

That technology of bringing scientists and students together in real life situations is something that no other science—I mean, if you think about it, we have not yet done that with space travel. We sort of have timed, set-up interviews, but this opportunity to have science and discovery and the inquisitive mind to be linked in real time in real laboratories was really exciting. And I think our Committee is blessed with the opportunity to have jurisdiction on those issues.

So thank you, Mr. Chairman.

Mr. SAXTON. Thank you. Mr. Gilchrest, the gentlemen from Kennedyville, on Maryland's Eastern Shore.

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

Mr. GILCHREST. Thank you, Mr. Chairman. I thank Sam for that introduction to our witnesses. Those words ring true. I have to go to another hearing that started at 10 a.m. that deals with another issue on the oceans, and that is interdicting illegal migrants and drugs.

So it is a slightly different dimension, although I want to thank all of our witnesses this morning for their dedication to service in this most extraordinary undertaking, which is to help us to understand the virtual mechanics of creation and how those natural processes need to be sustained, now more than ever, in order for future generations to have the same prosperity and the same basic blessings of freedom and liberty that we have now.

And that is going to happen when we understand how we manage the quickly diminishing natural resources while we are all collectively marooned on this infinitesimal blue and white speck in the midst of an infinite hostile environment called the universe. We've got no place else to go. So as these resources become diminished and the population increases, threats and divisive, volatile conflicts are bound to explode. So we, together, as astronauts on

this little spacecraft, some of those things that we learned in elementary school have to be revised in our consciousness.

So it's through your efforts to educate the public and elected officials as to the importance of these things, the vital importance of sustaining, and then somehow, restoring our natural resources, will be very, very important. I apologize, I would like to stay here rather than talk to the Coast Guard about interdicting drugs. But that's also important.

And I would have missed this opportunity if it were not for the gentleman from New Jersey insisting that I come down here.

[Laughter.]

And Jim, I am going to take a couple of these things, if it's all right, since they have some interesting things on the inside. Thank you.

Mr. SAXTON. Thank you very much, Mr. Gilchrest.

Welcome to all of our witnesses this morning. Let me try to frame at least how I see us proceeding this morning, and perhaps frame the issues. In a very nice article about Dr. Earle, Roger Rosenblatt writes, when speaking of the oceans, "it defines and characterizes," he says, "the Earth, one flowing body of water with different names and climates and covering almost 75 percent of the planet. The oceans encompass 97 percent by volume of all the Earth's living space. Nearly half the world's population lives within 60 miles."

And then he goes on in another paragraph to talk about Dr. Earle and the book that she has authored, " 'Sea Change,' " and he says, "In her book, 'Sea Change,' and before legislators and others in power, Dr. Earle argues that the oceans give us a 4 billion-year-old legacy, the living history of the world, and that we are blithely squandering our inheritance."

I wanted to say that because I take every opportunity to try to convey to the public the importance of the issues that we deal with, many of which are often taken for granted.

Dr. Earle, welcome. We look forward to your perspective this morning, and the time is yours.

STATEMENT OF SYLVIA A. EARLE, EXPLORER-IN-RESIDENCE, NATIONAL GEOGRAPHIC SOCIETY

Dr. EARLE. Thank you, Mr. Chairman, members of the Committee, staff, and those who are here to watch the action take place. Yes, I am here as the Explorer-in-Residence of the National Geographic, but I am here in part as an ambassador for the fish and the other creatures out there who don't have a voice of their own.

I am also here in my capacity as a businesswoman. I am the founder and currently the chairman of Deep Ocean Exploration and Research, and founder of another small company and a member of several corporate boards. This has given me a perspective of the importance of protecting the assets, that a sound economy depends on a sound environment.

And Roger Rosenblatt was right, you know. We are squandering the assets. And the sooner that we, as a nation, can face up to the importance of taking care of those assets, taking care of the systems that are at the heart and soul of certainly the environment,

but just as convincingly, the heart and soul of our economy, the better off our future looks.

But I am here primarily today in my capacity as director of the Sustainable Seas Expeditions, a private-public partnership that is aimed at exploring and conducting research in this nation's 12 national marine sanctuaries, those young, but promising, counterparts of the National Parks; and to develop, in cooperation with the National Geographic and with others, a vigorous program of research and exploration, of public outreach and education.

The primary partner in the research and exploration aspects, and other aspects as well, of the Sustainable Seas Expeditions is NOAA, the agency within the Department of Commerce with oversight of the marine sanctuaries.

But as well, the U.S. Navy has come on board with a commitment for ship time, and we are exploring other avenues of collaboration with the Navy; with NASA; with the Department of Transportation; the EPA; and private institutions, including the Monterey Bay Aquarium Research Institute and the Monterey Bay Aquarium; Woodshole Oceanographic Institution; Harbor Branch Oceanographic Institution; Mote Marine Laboratory; the Center for Marine Conservation; the Jason Foundation; the New England Aquarium; and others.

It's amazing. It seems that this whole idea of coordinating an expedition to explore our own aquatic backyard is serving as a kind of lightning rod, a powerful catalyst that appears to be unleashing pent up interest in ocean research and exploration with an underlying mission; and that is to establish a solid, factual base to support what common sense should tell us is in the nation's economic and environmental best interests, the protection of those natural productive ecosystems such as those now embraced in the 12 national marine sanctuaries.

We can be, and we are, in fact, extremely effective at extracting and consuming the ocean's living wealth, but we know very little about how to restore depleted species and damaged systems, other than to protect the source, that essence of what is now embodied in the sanctuary program.

But one problem in achieving protection for the nation's ocean assets is that old bugaboo, funding; and $12 million or now, even $14 million to service 12 marine sanctuaries embracing some 18,000 square miles is a fraction of what is required to do justice to the issues at hand.

I'm mindful that as important as the little Sojourner was in exploring that other planet, Mars, at a cost of $25 million, what a similar commitment would do for the marine sanctuary program. Twenty-five million dollars would take care of about 2 years of funding for our sanctuary program at its present level.

The Sustainable Seas Expeditions were conceived when I was here in Washington serving as the chief scientist of NOAA in the early 1990's. At the time, I guess I had a wake-up call, a serious one, when I was asked to go with then Secretary of Commerce Mosbacher and about 100 U.S. businessmen and Congressmen to go over to the Persian Gulf to look at the aftermath of the Gulf War.

Most of the people on board were there to look at restoring the economy of that war-torn country. What really impressed me was the way that we human beings—one in particular in this case, Saddam Hussein—was able to bring about the collapse of what many regard as the cradle of human civilization and turn it almost overnight into a graveyard.

I was also impressed by the reaction of the businessmen, those hard-headed number-crunchers, and the Congressmen, also hard-headed number crunchers, thinking about what it takes to restore the economy. It got right back to the business of clean air, clean water, a place to live, the resources that are at the heart and soul of having a restoration or a continuation of a sound economy.

Well, back home here in Washington, I certainly became inspired to do whatever I could to do what can be done at this point in history to protect the nation's underwater assets. But I was struck—and I have been, I guess most of my professional life—about our lack of access to the sea; how our inability to get much below 100 feet where divers conveniently can go, does limit our capability.

I was also struck by the fact—am still—about the lack of awareness that people seem to have about the existence of the marine sanctuary program or that this country has jurisdiction over an area underwater that exceeds the amount that is above water, that is, that which is embraced within the exclusive economic zone, the EEZ, that extends from the coastline out to 200 miles.

The lack of knowledge about the oceans really inspired the expedition and the need to do something. Again, Saddam Hussein can do something negative as one person that affects the planet as a whole. Maybe individuals can take action themselves to make a difference in a positive sense, I reasoned.

And thus, was launched the concept here, something that is in parallel, I think, comparable in some ways to the Lewis and Clark Expedition over two centuries ago, where the idea of going out to explore the American West so that we could better understand how the Nation could take responsibility for that vast area. We have an equally vast, a greater area that now awaits us a few feet off the shore.

And with new technologies that have been developed in recent years, including one that we want to adapt for this Sustainable Seas Expedition, the little deep worker. It is capable of going down to 2,000 feet and is so simple to operate that even scientists can get in and take off and explore on their own.

We have enlisted the aid of the marine sanctuary program and the research coordinator, Dr. Steven Giddings, and his staff and the managers of the sanctuary program, to help develop a program of research and exploration that will extend over the next 5 years, with initial funding from the Richard and Rhoda Goldman Foundation. Five million dollars has been set aside and channeled through the National Geographic Society to get us on our way.

But other funding is building, so that in the several months, the 5 months since the expeditions were launched, funding that essentially has doubled our capacity to do what we set out to do when the program was launched back in April now seems possible.

We have assembled a technical advisory committee for science and another one for education that will help to guide us along the

way. A call for collaboration that was issued in early August resulted in more than 60 proposals that came by the end of August, the first week, actually, in September, of people from around the country associated with many scientific institutions who were inspired to do what they can using funding sources that they are coming up with to work with us to explore our own aquatic backyard through the sanctuary program.

We want to leverage private funds to go even further than this. Our success will be measured by our ability to think of new ways to work together, to share talent and equipment, breaking down the institutional barriers and building on the discoveries as they come about.

We really need your assistance in helping us to achieve our goals by encouraging public agencies to match the funds that we are raising on our own and the resources that we are deriving from private initiatives. We need you to encourage the development of new ways to accomplish individual program objectives through joint ventures. And certainly, we need your leadership to inspire involvement of the public in this new era of ocean exploration.

Many of our current ocean problems, such as storm water pollution—I attended a conference yesterday in Long Beach, largely attended by, as far as Federal agencies are concerned, representatives from the Environmental Protection Agency. But there were a lot of private institutions there as well looking at non point sources of pollution that ultimately flow into the sea.

It is hard to get our arms around these issues, but this is our charge at this point in history, as never before. We not only have the opportunity, but the obligation to act, to do what we can to protect the resources so important to all of us.

You know, right now there are several pieces of legislation that are pending that have passed the House, passed the Senate, and are in conference, but are in danger of being allowed to slip by unless quickly some action is taken.

The Coral Reef bill is a great opportunity for support of ocean exploration and research. The Clean Water Initiative relates to the business I was up to yesterday with the storm water, but it is much more all-embracing than that. And certainly, the Oceans Act that is now in conference. If we can get behind these important pieces of legislation and push them over the edge, we will have accomplished a great deal during this Year of the Oceans, to get behind what it takes to do in other ways what the Sustainable Seas Expeditions is all about.

We are embarking on a new program of exploration, public education, research that can lead to better conservation. And at the same time, with this building of a better kind of partnership between public agencies and private institutions, we can change how we protect the ocean and strengthen the National Marine Sanctuaries program. These expeditions can act as they already have shown some capacity for doing, as a catalyst to be the public and private sector to work together in ways that can accomplish more than Federal funds alone can achieve.

I really, with my whole heart, look forward to working with you in any way that I can to inspire a sea change of attitude about the way we look after our oceans.

[The prepared statement of Ms. Earle may be found at end of hearing.]

Dr. EARLE. And Mr. Chairman, I brought a short video clip with me that was prepared by the National Geographic that describes the Sustainable Seas Expeditions, and I would like, if possible, to share that with you and members of the Committee at this time.

Mr. SAXTON. Thank you very much. Obviously, we are all prepared for that, and we look forward to seeing it.

Dr. EARLE. Thank you.

[Video.]

Mr. SAXTON. Thank you.

In the film, we got a glimpse of the role of NOAA, and here, I suspect, to tell us about that and some other things, is Dr. Nancy Foster. Dr. Foster, the floor is yours.

STATEMENT OF NANCY FOSTER, ASSISTANT ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. FOSTER. Good morning. I am Nancy Foster, as you said. I am the Assistant Administrator for the National Ocean Service, and I want to tell you that I am not sure which is worse, following Sylvia or following a National Geographic video.

[Laughter.]

But here I am. First, what I would like to do is talk a little bit about research partnerships in the National Marine Sanctuary program and why they are important to us. These kinds of partnerships are indispensable to us as we go about doing our business, and I think it is particularly relevant that we are highlighting them at this point in time, as Sylvia said, the Year of the Ocean, coming so closely on the heels of the National Ocean Conference.

One of the key elements that the President spoke of was the exploration of the ocean using advanced underwater technology, which is exactly what our Sustainable Seas Expedition is going to do. And you certainly know, as well as I do, that this kind of knowledge about the ocean is only going to be gained today through the types of public and private partnerships that you are hearing about.

Partnerships are critical to us in several ways. One, they allow us to do things that we could never possibly do with appropriated dollars alone. They help us get the scientific information that we need to understand these complex marine ecosystems, and they also help provide the technical capabilities that we need in order to manage them effectively.

But in addition to this, they also help us strengthen public awareness of the critical importance of this kind of research to the long-term conservation of these resources that the public is so concerned about.

We need scientific information to make sound decisions, to implement our field operations, and also to evaluate the effectiveness of the management strategies that we are employing at the present time.

Now, I can't emphasize strongly enough that a program like ours can never do what needs to be done on its own. And that's where the value of partnerships really stands out. And we've just done something that hopefully will help us be a much more effective

partner. We are completing, for the first time, a National Marine Sanctuary Research Plan, and this is going to strengthen our ability to attract cooperation and, hopefully, resources from the myriad of other NOAA programs that are relevant to the sanctuary program.

Now, one very important component of this research plan is monitoring. We are going to be establishing a nationwide systemwide strategy setting up criteria and standards for not only data quality, but also data comparability. And we are excited about this, because our newly established National Ocean Service Science Office is working with the sanctuary program to develop this monitoring strategy. We want to make sure that what we do in sanctuaries is compatible with the other monitoring programs that we have, both in NOS and in NOAA, things like monitoring for harmful algal blooms and our national status and trends program.

I couldn't speak here without mentioning one of our special projects in the sanctuary program. You are going to be hearing from our friends in the Cambrian Foundation about the cooperative effort surrounding our Monitor Project. I think it's fair to say that no other sanctuary epitomizes partnerships in the way that this one does. And it's no exaggeration for me to say that since the very beginning back in the 70's when this sanctuary was formed, we would never have been able to protect this special ship, were it not for partnerships, people willing to help us.

And today, I think I can safely say that we would have very little chance of saving this ship were it not for special partners like the Cambrian Foundation and the U.S. Navy, the Mariner's Museum in Norfolk, and just countless other folks who have given time and resources and energy to the ship.

So, in conclusion, I would just say that NOAA has long recognized the value of research partnerships, and we look forward to the coming year when we are implementing this research plan and establishing new partnerships and creative partnerships. Thank you.

[The prepared statement of Ms. Foster may be found at end of hearing.]

Mr. SAXTON. Thank you very much.

We are going to move right along now to Terrence Tysall, who has been doing some work deeply below the sea, from what we hear.

STATEMENT OF TERRENCE TYSALL, PRESIDENT, CAMBRIAN FOUNDATION

Mr. TYSALL. Well, deep is certainly a relative term, and sitting at this table, I don't think I can use that particular term. But gentlemen and ladies, everyone involved, I appreciate, first of all, the opportunity to come up here and speak. I am really resentful of the opportunity to speak behind these two heavy-hitters. I feel like a lead in band for a big concert or something; it's kind of sad, but I will do my best.

One of the things that Representative Gilchrest mentioned earlier and has been echoed by Dr. Earle and Dr. Foster consistently is cooperation. I am not going to beat the horse, but it is absolutely essential. The existence of the Cambrian Foundation is based on it.

What we do, the analogy that we repeatedly use in our tours across the country to speak to people, is the story from our youths about Stone Soup. I pretty much hop from place to place with my rock, which is the only asset that I have, and I take this stone and I go to village to village or from sanctuary to sanctuary and try to get people motivated to work together.

The underlying motivation of this for me personally is the fact that as a young man growing up in school, I was struck with a lot of the 1950's movies, the International Geophysical Year in 1955, and they promised us by the time that I was going to get old that we would have communities on the bottom of the sea and I would be a marine biologist and we'd be doing these wonderful things. And it's kind of sad. I grew up and supposedly there was nothing left to explore. I didn't quite have the grades to do some of it, and the next thing I know, there is no funding for research and things like that.

So what we decided to do was take the bull by the horns, so to speak, and realize that things can be done. Obviously, a scientific point of view is absolutely essential in any of these things, but it's the whole thing of developing a partnership. I learned a great lesson from the explorer that went before all of us, and that is Jacques Cousteau. Mr. Cousteau obviously went out there; he never claimed to be a highly degreed individual, but he was an explorer and he brought the scientists along.

So, in our short 4-year existence, really, following in his footsteps, we've done work in Belize, been the first people to journey to the bottom of the Blue Hole of Belize, which is about 410 feet on scuba, to get data and collect things that you plain cannot do with submersibles; to explore caves and get information on our sea level changes over the millennia.

So what we've tried to do with situations like the Monitor is take that selfish interest of hey, we'd like to go see this wonderful thing that NOAA is protecting for us and protect it. And constantly, what we heard was we don't have the funding, we can't do it. And so it started as almost a grass roots thing with the Monitor Marine Sanctuary manager, Mr. John Broadwater. We said fine, John, you have needs that you need; how can we help? And it's almost a scientific lend-lease. They give us the ability to dive and to work in these places and we try to give them as much usable data as possible.

Because we can sit and complain about problems, and we can point them out, which is our American birthright, it seems lately, that here is a problem, here is a problem. I'd like to do that, but I'd also like to help everybody solve them.

So what I would like to do very briefly is I want to show a 5-minute video. I will narrate over the top of it. It's going to show some of our ideas working on the U.S.S. Monitor. For those of you that don't know, the Monitor is obviously a Union Civil War ironclad, quite pivotal in the Civil War, sunk actually on the first day of 1862. And she sits at 240 feet, which causes a snicker, because as they say, effective work by scuba divers can't be done past 100. So we'll see if we can show some difference.

Now obviously, on this video you saw the Cambrian Foundation. No way, shape or form us taking credit for this whole thing; we are a partner.

[Video.]

I appreciate it. Thank you.

[The prepared statement of Mr. Tysall may be found at end of hearing.]

Mr. SAXTON. Well, thank you very much, all three. Let me start with a rather broad, general question and then any of you can respond to it that wish to. My experience with ocean management and trying to make progress to alleviate ocean mismanagement has, as you might guess, been primarily on the East Coast of the United States, for obvious reasons.

Every year for the last 14 years, 500 or 600 of my friends get together at a lobster bake and we have a great time. This year, individual after individual who attended the function came to me and said, look at that ocean, isn't it beautiful. It looks as blue as if we were in the Caribbean somewhere.

And when I heard that, I thought back to the summers of 1987 and 1988 when people didn't come and say, look at the beautiful ocean. They said, let me out of here, I don't want to be near it, because they were afraid. There were algaeblooms, there was medical waste, there were dolphins floating up out of the ocean onto the beaches. And it was, in the Northeast, at least, not a very pleasant set of circumstances.

And so we began, here in this room and in one down the hall, at least, we began to look at how we could solve some of these problems. And I guess I want to make two points. The first point is that we did so, because the public said they would not put up with anymore of the kinds of circumstances that existed.

And the second point is that, in spite of the fact that we can brag about what we did, we did all the easy stuff first. We dealt with point sources of pollution, basically. We stopped dumping New York and North Jersey sludge in the ocean. We stopped all the chemical dumping in the ocean. We stopped all the offshore wood burning. We made garbage barges put nets over the barges. We passed a law to require that medical waste be tracked from cradle to grave, so to speak. And we took care of all the things that we could kind of get our arms around.

And the second point I guess I want to make is that now we still have the most difficult part of the job ahead of us because the pollution that is getting to the ocean today gets there because of our everyday lives, not because of some inexpensive way of disposing of medical waste or garbage that is falling off of barges or burning wood offshore or dumping chemicals in the ocean or dumping sludge in the ocean. It comes from a very different source.

So the second point I would like you to address is, I believe we were successful in dealing with many of the point sources in the East Coast, because the public said you've got to do something and there was great public sentiment to do something, so we set out to do that something and it dealt with the easier part of the problem.

So the question is how can we work together as partners, which is what we've talked about here a lot today, to mobilize public sen-

timent so that we can take care of the more difficult of these issues.

Dr. EARLE. Well, that's an easy question. Do you want to go first.

Dr. FOSTER. No, you can go.

Dr. EARLE. The key to solving this really tough problem is in letting people know that there is a problem, in identifying the nature of the issues. And this goes back to establishing the baseline information that is required to show the changes over time.

Unfortunately, we did not start a monitoring program back when we were kids that would give us before and after consequences of our increasing population and increasing pressures on the ocean, increasing contamination of the water system, land and sea.

But we can retrieve through archival sources some information and we can start right now with an increasingly effective system of baseline monitoring, establishing underwater observatories, if you will. And it seems that the National Marine Sanctuaries are a logical place to really emphasize such monitoring.

Of course, some of this has been going on through NOAA and other agencies, the EPA. Some of it has been undertaken in terms of individual scientific projects. But I think that we are looking now at an opportunity to pull things together, both in terms of developing the knowledge base, a starting point, a new starting point, so that 5 years, 15, 50, 500 years from now, we can look back to this era as a time when we seriously began to assess the state of the oceans from the inside out, using, of course, the new modern techniques that NASA has provided from overview surveillance, but coupling that with underwater observations and instruments that we place specifically in areas where we want to get good, solid information, and link it all together with some consistent means of establishing assessment.

That's what Dr. Foster was referring to in her remarks. And we are so fortunate to have Dr. Foster as the person who is really working with us with the Sustainable Seas Expedition, the liaison for NOAA, as one who was once the head of the National Marine Sanctuary program and is certainly well acquainted with the issues.

I think, if I can just take another moment, that this needs to be coupled further with not just what we are putting into the ocean, but also assessment of what we are taking out.

It is the combination of how we are affecting the ecosystems of the sea as a whole through the chemical changes that are taking place by our actions on land and the awareness that what we see now, although it has improved—you are absolutely right, Mr. Chairman, it has improved in the last few years through actions that have been taken, which is good news.

The scary news is that, despite those positive things, there is this profound ignorance of the nature of the oceans as a whole, plus the awareness that our numbers are increasing in the very areas that are going to have the most impact on the coastline and the offshore areas beyond.

But we need to understand what we are doing to the ocean wildlife, that which makes the oceans resilient and capable of dealing with the changes that we are imposing through pollution and other issues. We are destabilizing the ability of the sea to recover as it

historically has been able to, both by what we are putting in, but also by what we are taking out.

Mr. SAXTON. Dr. Foster.

Dr. FOSTER. Yes, just a couple of thoughts. Over the past year, going out and trying to meet with constituents, I've been impressed with how sophisticated the public has become. And one of the first questions that they always say, or one of the first points they make is why can't you guys in the Federal Government get your act together? You know, get your act together and then come and talk to me, because I think they are tired of having the same conversation with so many agencies.

And I think that's one thing that we've really been working on the past 2 or 3 years, and I think that will make a difference, because it strengthens the involvement and the work that leads toward resolution of these issues.

The other thing that I think is critical is that we work on a new dialogue, if you will, with the public, a new way of involving them. The government is so comfortable doing business the way we've always done it. I decide what the issue is, I write a paper, I give it to you, you review it, and then I do whatever.

And we are trying to convince people that we are serious about getting them involved from the very beginning, having them help you design possible activities and then hold them accountable, as well as the government agencies, for going away from the table and seeing that something happens. I think people respond very well to that getting involved with us.

Mr. SAXTON. Thank you. Mr. Tysall, do you have——

Mr. TYSALL. Absolutely. I think everyone mentioned a key word here, and that is awareness. The big thing that we are talking about here is obviously lots of research programs and funding for these research programs.

But in our personal existence with the Cambrian Foundation, if we don't get the word out, if we don't get this awareness to the general public, to our people that make our very existence possible, they don't know what's going on. And I think there's a big gulf, a separation between the academic community, the government, and the regular folks.

And I'm not sitting here saying I'm a representative of the working joe or anything, but I know what it's like. I know the fact—and this is certainly not to cast stones—but in 1990, we were not allowed to conduct activities on the Monitor. It was forbidden by the government. They said, oh, you cannot, you don't have the ability to do that.

Well, it took a lot of head banging to get this to happen. Now, what's neat is we can put all that stupidity behind us from other people that let that happen and it's over and done with. We can get down and get to work.

And every member of a Cambrian Foundation team are people who are taking time out of their days, that are literally risking their lives here, guys. We are talking people that don't have the pressure hull of a submersible to rely on, that all these dissolved gases and all these dangerous conditions face them every time they go down on the Monitor.

And no one is asking for a hero's welcome, but these are people that take time away from their jobs at Disney World in Florida, take time away from their dive shops in Virginia, take time away from their job at Boeing out in Seattle, or people from Canada, Mexico, Great Britain. All these people that take time, take vacation time to come out and help make sure that this particular piece of history, or in the case of the monk seal study, this information gets done.

And we are not playing pseudo-scientist. We just want to help the scientists get the data. And it's important and it doesn't lessen anybody's role. And it's really neat, because it's that whole thing of blending. Because as we all know, we can all get so much more done working together rather than pulling apart.

Dr. EARLE. Mr. Chairman, if I might add a bit to this. One of the reasons that I think the partnership with the National Geographic is so important in this respect is the power of that institution to communicate to the public at large, as well as, of course, to the scientific community, a part of the public at large.

But consider that the magazine that published a great overview article about the marine sanctuaries last March reaches millions of people. There is a project in the works now to look at Monterey for a television program, which will reach, maybe before its lifetime comes to an end, hundreds of millions of people.

I am producing a book in collaboration with—well, through the National Geographic that will published next year that will reach yet another audience. The magazine, the lectures, the many avenues that that institution has really provides an amplifier to all of this in terms of a bridge to the general public.

Just as in the early days of the National Park Service and the whole idea of protection was greatly helped by the influence of the National Geographic, through the many articles and meetings and other ways of communicating to the public, so now is there an opportunity for ocean care and the National Marine Sanctuary program to gain a boost from the input of organizations, in this case, very notably, the National Geographic Society.

The Center for Marine Conservation is another example of a private membership organization that's been around for 25 years devoted to ocean conservation, but a major part of their program has been to communicate with the general public and to arouse their support for the National Marine Sanctuary program and all that embraces.

I think there are many opportunities here, but it takes the leadership of the Federal Government that has the jurisdiction over these areas to provide the backbone that will then be joined by these various private partners.

Mr. SAXTON. Thank you. Mr. Farr.

Mr. FARR. Thank you, Mr. Chairman. I am very intrigued by your analogy to the Lewis and Clark Expedition, and I was thinking on your comment about sound economy depends on sound environment. That California, with 32 million people and sort of a nation-state economy, has done something about understanding its environment.

Every city, county in the State is required to have an analysis of the hazardous hazard zones, flood and earthquake and other

kinds. They have done an analysis of all the historic buildings that are in their jurisdiction, analysis of all the open space. We have really gone down to micromanaging and identifying every river, valley, mountain, watershed system, which then allows us to attack the problem of nonpoint source.

But then when we get into the oceans, your analogy is that we are not there. I mean, we were further along 200 years ago preparing for the Lewis and Clark Expedition than we are today. I wonder, it would be interesting to see what the Federal dollars committed to the Lewis and Clark Expedition would be today, if we had to make the same type of monetary commitment to exploration. I am sure it would exceed the amount that you requested.

One of the things that I want to ask you about is identifying this need. I mean, when Lewis and Clark went out thinking of exploring that land, nobody invented jeeps or snowmobiles or video cameras or GPS systems or appropriate clothing. They didn't have any Zodiac rafts to go down those rivers.

I mean, what are the types of equipment that we need to do this exploration, to thoroughly make it user-friendly and not just stationed. I know that the titanium subs are so expensive, we can't do it. But are there less than those types of vehicles that could be available in every marine sanctuary?

You know, we don't even have the equipment. We don't even have the jeep that the National Park Service or the Forest Service has, or the truck, to explore what we have responsibility for, to access it. What are those kinds of equipment that we need to have, if you had that list?

Dr. EARLE. Well, thank you for that question.

[Laughter.]

Yes, we are really fortunate to have come along when new equipment has given us access as never before, but it's a tease. It just gives us a taste of what the potential really is. In August, I had an opportunity to spend a week in Aquarius, our underwater counterpart of the Space Station, sitting down in the Florida Keys in 60 feet of water with five colleagues.

And our mission was to try to do what people take for granted they can do when they go out in the forest or in the desert. We spent a week exploring and monitoring the area and looking at places that Dr. Steve Giddings had established 4 years before as baseline transects, places that were documented with video cameras to then go back and see what it was like 4 years later. And we'll go back again in the future, presumably, to those same places, something that we ought to be replicating in many parts of the ocean. But here, at least, is a starting point in this one site.

But it's the only site, not only in this country, but in the world where there is an underwater laboratory, a working underwater laboratory where scientists can go and spend the kind of time that we take for granted we can apply when we go visit any part of the land. I mean, we had a day and night living underwater, sometimes as much as 10 hours a day that we could actually go out in the sea.

But people do that all the time in the desert or in the forest or, if you want to go visit New York, you expect to be able to walk the

streets and not just take 20-minute excursions a few feet from your hotel or your car. But in the ocean, we are really constrained.

Now, my colleague here from the Cambrian Foundation has described some really great techniques for taking individual divers down, but these are systems available to not everybody.

Mr. FARR. We need systems like that in place where scientists are going to be attracted to go, and I presume that the marine sanctuaries and other areas are—you know the spots that you would like to go into. But we can't make them accessible, or you have to make it by reservation, you have to have funding. It seems to me to go in the ocean is about like having to climb Mt. Everest. You have to put together an incredible financing and scheduling of materiel and money.

If we had enough money for research in this research account, what I'm trying to say is, $25 million doesn't seem to me like even a drop in the bucket.

Dr. EARLE. It's frustrating. I wouldn't take a penny away from what we are investing in space technology or the space research, the program as a whole. I just wish there were equal numbers of pennies applied to ocean technology, ocean research.

Mr. FARR. Well, what are the essentials? I'm just trying to see what we basically need. Do you have a list, if you had your shopping list of just equipment needs?

Dr. EARLE. Absolutely. Where might I begin? The possibilities range from establishing a network of underwater observatories. There is already a national plan developing along these lines through the National Underwater Research Program, in working with institutions such as the Monterey Bay Aquarium Research Institute, and Rutgers University, to build on existing work that has been invested already.

But some of these can be done with remotely operated systems. Some are best accomplished with the human presence. I think the combination is very much in order. We have one deep diving submersible now in operation for this country, the Alvin. I mean, there are other submersibles, but this is for scientific research.

There are a few that can go to 1,000 feet, some that can be leased for access somewhat deeper. But we just lost the Sea Cliff, this nation's only vehicle, operated by the Navy in this case, for access to about half the ocean's depth. It's being delivered to Woods Hole and possibly may be in a sense merged with the Alvin to give us deeper access.

But it's like having one jeep for all of North America or rather, for the oceans of the world. In all of the world, there are four other manned submersibles capable of going to half the ocean's depth, one in France, two in Russia, one in Japan. One remotely operated vehicle, developed by Japan, has the capability of going to the deepest part of the sea, and it did so this year, down to seven miles.

Where are we, as a nation? We have our eyes focused on the heavens above and we should, but at the same time, what about the depths below? Why aren't we there in the leadership role of applying the technology that we have in hand, and use it for understanding our ocean, our life support system.

You know, it governs climate, weather. It takes care of so much that is vital to our survival, and yet we are hampered by our ignorance of this vast inner space. So there are institutions such as Woods Hole, such as MIT, such as private companies that are investing in the development of offshore resources, in terms of the research institutions, of exploring and understanding. But where is the national commitment to couple with this?

Mr. FARR. You know, we didn't get into space by private investment.

Dr. EARLE. That's right.

Mr. FARR. And we shouldn't get into the national oceans, the international oceans and depend just entirely on private investment. I think there is a role here for the Federal Government.

And let me just segue to Nancy Foster. There are two things I wanted to ask you, Nancy. What has the administration done in bringing those requests to Congress; and two, what is the status of those funds, those deliverables that the President gave at the Monterey conference?

One of the things, just in light of this discussion, he promised out of $225 million that he was going to commit, $194 of that is committed to three ships. Those are surface vehicles, not underwater vehicles. I mean, in your role, is NOAA bringing to the attention of the Congress the things that Dr. Earle talked about. I don't see those requests coming to Congress.

Dr. FOSTER. Well, I have to admit we have not done a very good job of this in the past. It has not been a budget priority. I think we are seeing some changes in that. I think that one big boost was the National Ocean Conference, because the President and Vice President actually made commitments. I think that it's possible that you will see some improvement in the 2000 budget. Could I also—go ahead.

Mr. FARR. I mean, the deliverables were made last June. Some of those were not dependent on—I thought they were like, things we could do now.

Dr. FOSTER. There are some things that we could do now, and we are doing some things. In 1999, there will be some slight shifts in focus in some of the existing budget that will get things underway. So there are two categories of things: the things that we can begin now and the things that will be dependent upon future budgets.

Mr. FARR. Well, on behalf, I hope, of the consent of the Chair, but could you deliver to the Committee the promises made and promises kept list.

Dr. FOSTER. Yes, I could, I think.

Mr. FARR. Thank you.

Dr. FOSTER. Could I also just add one thing to what Sylvia was saying about equipment. You know, it is even more basic than what she was talking about. We, in the sanctuary program, and NOAA in general, actually have difficulties getting those surface platforms that you were talking about. I mean, getting access to the sites that we manage. So it goes from basic all the way to sophisticated.

Mr. FARR. Terrence, what is the motivation for the Cambrian Foundation or Institute to do the exploration? And is it only for the Monitor, or do you have other?

Mr. TYSALL. Absolutely not. Mr. Farr, it's simple, speaking on the basic end of the table. But in the situation with the Monitor, there is a situation down there and there is a timetable. And this timetable is not going to wait on government bureaucracy; it's not going to wait on the fact that this defense or this election or whatever. The fact is that the oceans were there and they're going to deteriorate that wreck.

Now that's not pointing fingers, because none of us can control that. But the fact is, it's a personal involvement in this case that started this whole thing, because you get down there and you see this——

Mr. FARR. But does your money depend on matching from any other, like Federal? Is it seed money, or is it just, we're going to do this, no conditions?

Mr. TYSALL. I certainly hope this doesn't undermine our credibility with this group, but the Cambrian Foundation paid its first salary this year of $853 to buy me health insurance, and that was it. And the reason this is, is because on one of our other projects trying to work with the Naval Historical Center, I was bitten by a bug in the Solomon's and nearly kicked.

So we are in a situation where this needs to be done, and we are willing. And I'm not trying to come across like oh, this self-sacrificing group. But literally, these are people paying their own way. I mean, how would we all feel if the Monitor protection—you know, everybody says, each member of the general public could pay two cents or something.

Well, I've got 40 or 50 people that are each paying $1,000, plus losing time away from their jobs, and then on top of that, risking their lives. And please, the Cambrian Foundation isn't about that; it's about that cooperation.

But there are a lot of people like us out there. And we are talking about $25 million. I could make the Cambrian Foundation operate indefinitely on a million dollar endowment. But we can take what we have, to give you an idea of NOAA—and please, this is not denigrating the National Oceanic Administration at all—but they were asked to put a team on the U.S.S. Monitor, and there was very little funding available.

And NOAA, that is supposed to be the icon of ocean exploration for our country, wasn't even able to have the divers trained. They had to approach outside civilian sources, which we donated. We donated all that training.

Mr. SAXTON. Let me try to focus on this general issue that we have been discussing here, Mr. Farr and our witnesses, relative to the commitment that the U.S. Government has in being a good partner, or the lack of it.

Let me make a couple of observations. First, let me say that this institution—and I am glad you're here, Dr. Earle, because I think that the National Geographic Society, and you, in particular, and people in the past like the Cousteau Foundation, et cetera, provide an invaluable service. And I am going to tell you why.

We, in this institution, reflect in a very general, and in a very specific, sense the desires and aspirations and goals of the American people. Over time, that happens. And unfortunately, it is my observation and my opinion that in spite of the serious nature of the issues we are discussing, it is my opinion that by and large today, on a scale in prioritizing our American desires and needs and aspirations and goals, the subject that we are talking about, at least as reflected by this institution and by this administration and the previous administration, are not very high on that set of priority goals.

Example: The Republicans took control—and I am a Republican, as you know—the Republicans took control of the House and reorganized in such a way that we used to have a committee that dealt with coastal and ocean issues. And we had 50 people employed doing that in the House.

Today, it is this Subcommittee and five people, at least on the Republican side, and another three or four on the other side. That doesn't speak very well for us, unless we are reflecting the goals and desires and aspirations of the American people.

With regard to the administration, even more specifically—and I won't go into the whole diatribe—but I am today writing a letter to the chairman of the Subcommittee on Commerce, State, Justice, State and Judiciary, which happens to also handle funding for NOAA, trying to make the case that the administration failed to request adequate funds for Fiscal Year 1999 to meet the ongoing needs of OAR and NOAA and other research programs; and suggesting that it's critical that NOAA receive at least $15 million next Fiscal Year for OAR's acquisition and data line and stating that this is not an increase over Fiscal Year 1998, it is just level funding.

And so we have an administration and a Congress that I believe generally do reflect the desires and goals and needs, et cetera, of the American people, and we are not doing much to meet the goals that you have said today—and I believe also—are very important goals.

And it was for reasons such as those that a few months ago, I prevailed upon a very cooperative NOAA to help us name the National Estuary and Research Reserve in New Jersey as the Jacques Cousteau to try to focus the Jacques Cousteau NERR, to try to focus public attention on these issues. And why we spend so much time—I think Mr. Farr is a hero in these matters—trying to draw public attention.

And I have made this little speech here today because I want you to know how much we appreciate the National Geographic Society's efforts, and ask you if it's possible to double them or triple them, because we need the public support to carry out the mission that you, all three of you, have so ably described this morning.

If you'd like to respond, that's fine, but I just needed to get that off my chest.

Dr. EARLE. Mr. Chairman, I would like to respond that I absolutely agree with your analysis and hope that the National Geographic Society will come through with thunderous support in response to what is increasing an obvious need.

And I see, everywhere I go around the country—and I do travel both here and abroad quite a lot—there is a change of attitude and I think an increasing excitement and awareness of the importance of the ocean.

Coupled with, I would say, the assignment that some of us here are taking on to try to work with the public at large to promote from outside, as well as from within, to support you, there needs to be—and I am very pleased to be in the presence of the leadership from within government to give people hope that their concerns are not falling on deaf ears.

There needs to be a balance, of course. And some of it sometimes has to be taken almost on faith from the government side to show that courageous leadership, to step forward sometimes even in the absence of a clear-cut mandate because you know it's the right thing to do, because in your lifetime you have seen the need grow for the importance of protecting the assets.

And I really champion your championship and yours, Sam Farr, for these issues, and for others. Some of your colleagues are outstanding stars, heroes in this cause. I just hope that we can work together to raise a groundswell at this critical point in history.

This is the time, as I think never before, and arguably never again, an opportune moment here at the beginning of a new millennium, to pull things together and make a difference.

Mr. FARR. Dr. Earle, I was very impressed with your sense that you have had an incredible opportunity to see things that most people on this planet have never seen or experienced, and you feel that because of that opportunity you have an obligation to do this work.

It seems to me that those of us on this Committee know of that opportunity because we are here today and we have done something about it by having an oceans bill that Chairman Saxton authored and I co-sponsored. We got it through this House with some amendments that we had to take, because politics is the art of compromise, and we had to compromise on some things that we needed to compromise on.

But the Senate has done the same and we are now at a point where we have just a few weeks left and the obligation that the institution has is to get a bill to the President. And everybody in this room that's listening to this needs to bring some pressure on the Senate and the House. This institution has got to respond, because we can't just take it down to the goal line and not walk over it. So I would appreciate that.

And I want to reflect on Chairman's Saxton. We are the sum total of the politics of America. If National Geographic has the ability to put it out there—but you are not talking to everybody here, because you probably wouldn't be following this hearing if there weren't interest—you have this obligation to make this a political issue, not partisan issue, political issue, that it will be brought to the lawmakers of our States and the lawmakers of our nation so that they will obligate—we are the responsibility for deciding what money the Federal Government spends.

The President proposes, but we dispose. And we can add more money if we think it's the right thing to do. But we won't do it unless we hear from the American public that this frontier, this ocean, this water planet needs to understand itself better.

I think we get it, we just have not put it into political terms that we want our politicians to get it also and to respond more than just a few people sitting on this Committee, but that the whole elected body would make it as important as going into outer space.

The President made that commitment, but it's not going to get the kind of attention that John F. Kennedy's statement got about going into space. But once the President had made that commitment back in the 1960's, as you pointed out, there was follow-through. And unfortunately, so far we have had the commitment, but not the followthrough.

You might want to reflect on that, because you've noticed it very well on how much follow-through there was to the space program versus how disjointed the followthrough has been on the ocean. And I think that brings in Dr. Foster's role too, because that follow-through is, at least for the administration, is partly in her camp.

Dr. EARLE. If I could comment on that with a resounding yes. What you say is right on target, absolutely. We have the opportunity and maybe, again, the obligation to do in the next century for the oceans what in the present century has been done for aviation, for aerospace, for what goes skyward.

It's not either/or; we need to do both. But we certainly need to couple our reach skyward with our reach inward. The frustrating thing, and at the same time a very positive thing, is that in the last 25 years we have learned more about the oceans than during all preceding human history, in parallel with the development of technology that has given us the kind of access that we are now beginning to enjoy.

That is, among other things, I think the most important thing that it's revealed to us, the magnitude of our ignorance and how important continued investment in exploration and the tools for exploration really is.

That's why this is such a critical point in time, how even a modest investment in the ocean is bound to pay big dividends, how by supporting ships that we need to get to where we have to go on the surface, by supporting the development of technologies that will take us either with remotely operated systems or with plates of little submersibles comparable to the spacecraft that we take aloft, or places to stay underwater. The Aquarius is one example.

But look at what we are doing, the huge investment we are making to go perch in space or to establish an outpost on Mars. Why not, at the same time that we go aloft, are we not putting equal weight at least—perhaps there's even a case to be made for a greater kind of importance in investing what goes into the depths.

Mr. FARR. Why have we not done that? Why has space gotten all of the commitment? Has it been the equipment manufacturers, because it's a big budget item and they can design equipment to go into space? What has pushed us? People don't know much about space because very few people ever will be there. All we do is look at it. We know a little bit about the ocean; we can touch it, get in it and vacation. But why is the energy put into space that hasn't been there for the ocean?

Dr. EARLE. I think that is the ultimate mystery of the sea. Nancy has just suggested that Star Trek has probably had something to do with the fascination with the skies above.

Mr. FARR. Well, before Star Trek, there was Lloyd Bridges.

Dr. EARLE. Well, this is true. And there is Cousteau and others. I mean, you can give a flip answer to it. I had an occasion to have a nice leisurely lunch once with Claire Booth Luce and we discussed this problem. And she sort of pushed back from the table and looked at the puffy white clouds over that blue ocean in Hawaii and she said, well, you know, my dear, Heaven is in that direction, and you know what's down there.

[Laughter.]

But there are some more substantive responses, and some of it goes back to the beginnings of NOAA. NOAA was never mandated to develop technology the way NASA was. And of course, NASA and NOAA are very different kinds of agencies, although at the time that NOAA was formed in 1970, there was talk of the Ocean and Atmospheric Agency being something of a wet NASA.

It was never to be. It is within the Department of Commerce, and I can make a case for that being legitimate. But it has really constrained the agency for being a worthy sort of parallel agency to the space agency that it is sometimes likened to.

Part of it does relate to the lack of a mandate within what NOAA is to really further the development of new technology, the engineering that could be and should be, must be supported if we are to gain access to the sea that is anything like our access to the skies above.

We need not only systems so simple that scientists can use them, but so simple that Senators and everybody, little kids, have access to the sea. And in fact, we have seen through private initiative, the development of passenger submarines that little kids and grandparents, businessmen, anyone can get in and at least gain access to the ocean without getting wet.

And that's a good thing, it's a step in the right direction. But it is far short of what we really need to accomplish the needs that are at hand.

Mr. FARR. But is there more pressure, lobbying pressure, because we do the basic research for equipment under the NASA scenario? And then the equipment manufacturers come to the Hill and lobby for that? I mean, nobody comes in here and lobbies me except for, you know, some vessels. But nobody lobbies me for an undersea vehicle.

Dr. EARLE. Well, stand by.

[Laughter.]

Mr. TYSALL. What would your address be, Mr. Farr?

Mr. FARR. No, I mean, you do, in discussions like this, but there's no Lockheed or General Motors out there or Pratt Whitney or any of those companies that lobby much for ocean vehicles.

When you think about it, on ecotourism and all our people living along the coast, do you know that the No. 1 tourist attraction in America is the Los Angeles beaches?

Mr. SAXTON. New Jersey.

[Laughter.]

Mr. FARR. There's more people in L.A. You can have them all in New Jersey, if you want.

Mr. SAXTON. We in New York.

Mr. FARR. But it doesn't take rocket science to say if people want to go right there to the water's edge, what kind of business there would be to want to rent a car to drive it right into the ocean and have a rental car system that would have a vehicle that you could drive around under the sea. I mean, that may happen in our lifetime. Somebody is going to make a lot of money on that, but there's nobody in here lobbying that we do the research to do that.

Dr. EARLE. I think part of the problem stems from the fact that we are terrestrial, air-breathing creatures and it seems that the ocean is an inhospitable place for us. Again, I think in the last 25 years, we have seen a growing change of attitude. But it has yet to get to the point where people are as inspired with the concept of being able to go out into the sea as they are about going up into the sky.

And yet, I think part of the reason people are maybe reluctant to undertake that is because when they go to the beach, at least in the last few years, they have seen things like the hypodermic needles on the Jersey Shore. And people don't want to dive in places where they know sewers are flowing.

We have to turn things around in parallel to showing why it's important to get out and see the oceans from the inside out, to make those connections. But I am encouraged, because those people who are entering the sea, either as swimmers, as snorkelers, as divers, are a growing constituency and a growing voice, growing Ambassadors for the creatures out there and for the state of the oceans as a whole.

I think we have the message loud and clear from all of you that this is an important mission for us to come back and let these voices be heard, so that you will have the support you need to really follow through with the leadership and be able to inspire others to follow your lead.

Mr. SAXTON. Dr. Earle and Dr. Foster and Mr. Tysall, we are unfortunately running out of time. I know that we could stay here and have a productive conversation for quite some time longer about these and many other related subjects.

But I want to thank you for coming here to be with us today. We will look forward to a long and continuing partnership with each of you. Thank you very much.

[Whereupon, at 11:38 a.m., the Subcommittee adjourned subject to the call of the Chair.]

[Additional material submitted for the record follows.]

STATEMENT OF DR. SYLVIA A. EARLE, EXPLORER-IN-RESIDENCE, NATIONAL GEOGRAPHIC SOCIETY

Good morning. I am Dr. Sylvia Earle, Explorer-in Residence at the National Geographic Society and currently Project Director for the Society's *Sustainable Seas Expeditions.* Thank you Mr. Chairman, and members of the Subcommittee, for this opportunity to testify on the work the National Geographic is doing with NOAA and many other partners in promoting the importance of the oceans and one of our most precious marine resources, the national marine sanctuaries.

The *Sustainable Seas Expeditions* were conceived while I was chief scientist for NOAA in the early 1990s. At that time, I was able experience first hand just how terrible one man's impact can be on the ocean as a witness to Sadam Hussein's ecoterrorism in the Persian Gulf. The experience of witnessing destruction of this ecosystem magnified, in my mind, the importance of the United State's investment in protecting its most special marine areas for the future. However, despite the fact the marine sanctuaries were established over 25 years ago, I was surprised on joining NOAA by our lack of information about the state of their health and the absence of tools to undertake the job of marine protection. While these marine protected areas were acknowledged to be critically important to policies governing the conservation of coastal marine resources, their effective management was crippled by our lack of knowledge about the nature of the environment below about 100 feet. Even in shallow water, limited diving time severely compromised the ability of observers to gain insights about underwater systems comparable to those that we take for granted on land. About 20 minutes is the maximum duration of a normal dive at 100 feet.

I was also struck by the fact that many people were totally unaware of these young but promising underwater counterparts of the National Parks. In addition, many are still not aware that the United States has jurisdiction over an aquatic realm from the coastline to the edge of the Exclusive Economic Zone, 200 miles seaward, that is larger than the land area of the United States.

This lack of knowledge about the oceans provided the inspiration to conduct an exploration of the marine sanctuaries in the same spirit that President Jefferson launched the Lewis and Clark Expedition over two centuries ago. It was the inspiration from this well-known chapter in American history that grew into a five-year, multi-million dollar initiative, the *Sustainable Seas Expeditions,* funded by the Richard & Rhoda Goldman Fund and launched by the National Geographic Society in April 1998. Working in close collaboration with marine sanctuary managers and other scientists, the *Sustainable Seas Expeditions* team plans to use innovative submersible technology to undertake the first sustained exploration of sanctuary sites to depths of 2,000 feet—to photodocument the natural history of each sanctuary's plants and animals and to establish permanent marine monitoring field stations within the sanctuary system. These objectives are critical to the development of more adequate marine conservation protocols. I have attached a schedule and list of preliminary goals we hope to accomplish through our program.

Another part of the inspiration for this program was the National Geographic Society's history applying private support to the creation of new conservation policies. Without private support from individuals and institutions early in the development of the National Park Service, most notably from the National Geographic Society, that program may have remained small or perhaps disappeared altogether. A similar opportunity now exists for the Society to help foster an ocean ethic and enhance support the care and stewardship of the sea comparable to its efforts for precious land resources in the early days of the National Park Service. The Society recognized the pivotal role private institutions could play in nurturing the young but vulnerable conservation and protection goals of the national marine sanctuaries program—and hence the birth of the *Sustainable Seas Expeditions.*

In just five months since the *Expeditions* were launched, the program has acted as a catalyst for support for the national marine sanctuaries that heretofore has not been possible. NOAA has provided the cornerstone of support for the *Expeditions* through the NOAA fleet and its scientific and technical staff. Institutions at every level, from Federal to non-profit, from academic to commercial, have come forward to add their support, recognizing the importance of the need for more information on the oceans and the strength that can be achieved through private-public partnership. As you can see in our blue ribbon Technical Advisory Committee for the Expeditions, some of our nation's finest experts are participating with the Society and NOAA in an unprecedented manner with the goal to increase the understanding of marine sanctuaries and develop new policies for their protection. Within weeks of its issuance, a call for collaboration resulted in the beginning of a national research

program that previously seemed impossible given the limits of Federal funding. And we are seeing a similar response from the education community.

Although the *Sustainable Seas Expeditions* is only in the first half of its first year, we feel that we are on the brink of developing a new way of doing business not just at the non-profit level, but at a national level. We hope to leverage private funds to accomplish national objectives. Our success will be measured by our ability to think of new ways of working together, sharing talent and equipment, breaking down institutional barriers and building on new discoveries. We ask for your assistance in helping us achieve our goals by encouraging public agencies to match our funds and resources with their own. We need you to encourage the development of new ways to accomplish individual program objectives through joint ventures. We also need your leadership to inspire involvement of the public in a new era of exploration of the oceans. Many of our current ocean problems, such as storm water pollution, for example, cannot easily be solved by a single agency. The solution to many of these complex problems requires the combined will of an informed public. That knowledge begins with understanding the vital link between ocean health and human health and the importance of protecting one in order to protect the other.

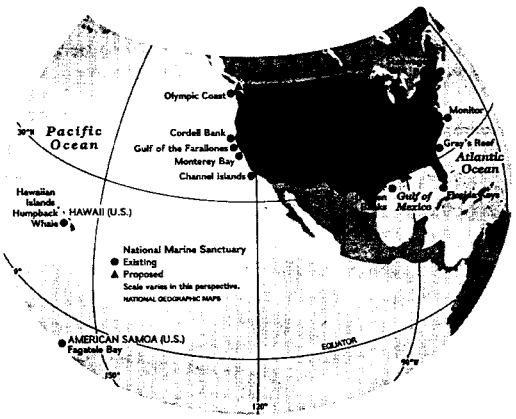
In conclusion, the *Sustainable Seas Expeditions* is embarking on a new program of exploration of the ocean and public education that can lead to better ocean conservation. At the same time, it is building a new public-private partnership that can change how we protect our ocean and strengthen the national marine sanctuaries program. These expeditions can act as a catalyst to allow the public and private sector to work together in ways that accomplish more than Federal funds can alone achieve. I look forward to working with you to develop the means to strengthen our project, this new partnership and the need to better protect our ocean.

I would be pleased to answer any questions you may have.

Probing the Depths of Nation's Watery Sanctuaries

The world's oceans are critically threatened by overfishing, pollution, disease and encroaching humanity. To protect vital pockets of U.S. coasts, the government has created 12 marine sanctuaries. Each site in this living gallery of kelp forests, canyons, coral gardens and tide pools is a laboratory for the restoration of marine ecosystems.

The National Marine Sanctuary System was created in 1972, exactly a century after the first U.S. National Park was designated. The system is managed by the National Oceanic and Atmospheric Administration (NOAA). In all, the 12 units of the system take in some 18,000 square miles.



Working with sanctuary managers and other scientists, **Sustainable Seas Expeditions** will use submersibles to make the first sustained deep-water exploration and photodocumentation of each of the 12 sanctuaries. The project will also create the first permanent marine field stations within the sanctuary system.

An intensive campaign will be launched by **Sustainable Seas Expeditions** and the National Geographic Society to raise regional and national awareness of the marine sanctuaries. The campaign will use the images gathered during the exploration and documentation of the sites.

(OVER)

SANCTUARIES (PAGE 2)

Sustainable Seas Expeditions will unfold in three phases.

Phase I: April 1998 to December 1999

Each sanctuary will be explored at depths of up to 2,000 feet to provide the first photodocumentation of the plants, animals and habitats that make these sites significant.

The sanctuaries and the specific projects in the first phase are:

Stellwagen Bank

Taking in 842 square miles of Massachusetts Bay, Stellwagen Bank begins 25 miles east of Boston and three miles north of Cape Cod. Sanctuary staff work with the area's lucrative whale-watching industry and others to protect marine life. But large vessels, which must cross sanctuary waters to reach Boston, still pose a threat to migrating whales.

Sustainable Seas Expeditions will use submersibles as "blinds" to make primary ecological observations of the deep rock reefs common to this sanctuary. The data will be used for habitat management.

Channel Islands

Creatures as tiny as tentacled green anemones and as massive as blue whales thrive in the rich broth of this sanctuary's waters, a blend of warm southern and cold northern currents. The islands are key nesting sites for endangered brown pelicans. More than 20 kinds of sharks roam the waters, drawn by one of the world's outstanding concentrations of sea lions.

Sustainable Seas Expeditions will undertake deep reef surveys at Anacapa Cove, a no-take zone, to gather baseline data for designing other refuges in the sanctuary and for assessing the effects of refuges on fish populations. Deep reef habitats will be photodocumented for the first time and a study will be made of rockfish.

Monterey Bay

The largest marine sanctuary, Monterey Bay holds the nation's greatest diversity of marine life and habitat as well as one of its largest ocean canyons, which cuts more than two miles deep.

Sustainable Seas Expeditions will use the Big Creek Reserve to test habitat mapping and to document comparative fish populations, particularly rockfish.

(MORE)

SANCTUARIES (PAGE 3)

Farallon Islands

This wildlife refuge off San Francisco hosts the largest concentration of breeding seabirds in the continental U.S. Elephant seals, nearly wiped out by 19th-century hunters, also thrive here.

Sustainable Seas Expeditions will begin a long-term investigation of white shark behavior.

Olympic Coast

Rough offshore waters host thousands of vessels engaged in Pacific Rim trade. Sanctuary staff promote shipping safety and practice oil-spill response to keep the waters pristine along this stretch of the Pacific Northwest coast.

Sustainable Seas Expeditions will conduct comparative baseline surveys at depths of 600 feet to characterize deep sea floors in areas known to be trawled frequently and in areas with little or no trawling.

Hawaii

Hawaii's humpback whale sanctuary is the only site dedicated to one species. Nearly two-thirds of the estimated 8,000 North Pacific humpbacks mate and calve here, their only U.S. breeding ground.

Sustainable Seas Expeditions will explore and document the deep channels between Maui, Lanai and Kona, in areas where humpbacks concentrate in winter months. No direct observation ever has been made below 100 feet in most of this region or of the whales in this habitat.

Flower Garden

Beneath the surface a hundred miles off the Texas-Louisiana coast two salt domes rise from the ocean floor and bristle with coral — the northernmost coral reef on the continental shelf. This is Flower Garden Banks, where for a few nights associated with the full moon each August the coral equivalent of Mardi Gras occurs: a riotous release of billions of gametes in a mass spawn that looks like an inverted confetti storm. By gathering gametes from the spawn, nurturing them and transplanting the larvae onto clay tiles, scientists hope to replenish damaged reefs worldwide.

Sustainable Seas Expeditions will study and photograph the annual mass coral spawning and correlate spawning data with surveys to depths of 100 feet.

(OVER)

The Florida Keys

The 3,696 square miles of Florida Keys sanctuary is the world's third largest barrier reef. Many ills plague this site: choking algae fed by waste, coral disease, overfishing and breakage from contact with people.

Sustainable Seas Expeditions will explore and document the underwater communities in preparation for the designation of the Dry Tortugas region as the sanctuary's second ecological reserve in January 2000. The information will be used in selecting the best site for the reserve.

Monitor

Monitor was the first national marine sanctuary, put in place in 1975 around the wreck of a Civil War ironclad vessel which lies in 230 feet of water off Cape Hatteras, N.C. **Sustainable Seas Expeditions** will map the deteriorating Monitor and it will bring engineers, salvage experts and archaeologists to the wreck to help NOAA develop a conservation plan.

Gray's Reef

A 23-square-mile reserve 20 miles off the coast of Georgia, Gray's Reef is a feeding and resting place for sea turtles after trips ashore for nesting.

Sustainable Seas Expeditions will begin a long-term sea turtle study by photodocumenting behavior and habitats. Daily movements of turtles will be tracked, including foraging and diving behavior, in preparation for monitoring migration and identifying migration pathways.

Cordell Bank

A region of astonishing productivity, Cordell Bank, off the northern California coast, surrounds a four-by-nine-mile granite seamount on the very edge of the continental shelf, 20 miles offshore.

Sustainable Seas Expeditions will use submersibles to give marine scientists the first opportunity to explore the sanctuary. Starting at 80 feet and going as deep as possible, the explorations will photodocument the bank and its species.

Fagatele Bay

To date no one has dived deeper than 40 feet in this sanctuary off American Samoa. **Sustainable Seas Expeditions** will explore and photodocument the Fagatele Bay sea floor for the first time.

(MORE)

SANCTUARIES (PAGE 5)

Phase II: January 2000 to December 2002

Sustainable Seas Expeditions in the second phase will expand the characterization of habitats, focusing on large animals such as whales, sharks, rays and turtles, and compare habitat requirements among sanctuaries.

The California coast sanctuaries will be used to collect data on the schooling behavior and movements of highly migratory sharks and pelagic rays. Submersibles, coupled with Crittercam and sonic technology, will be used to identify, observe and track individuals. Using technology developed for the National Geographic Society, Crittercam is a camera which is attached harmlessly to an animal such as a whale in order to photograph behavior.

Pacific sanctuaries will be used for novel exploration and research to document migratory behavior of endangered or threatened animals such as blue, gray, humpback and right whales, their critical habitats, and the role of human disturbance on whale behavior (including whale watch boats and divers). Crittercam and satellite tracking will be used to document elephant seal migration patterns and habitat use, and Crittercam will monitor California sea lion foraging.

In the Florida Keys and Flower Garden, **Sustainable Seas Expeditions** will document and compare the timing and behavior of species involved in mass coral spawning.

Sea turtles will be studied in Gray's Reef, the Florida Keys and Flower Garden.

Phase III: January 2002 to April 2003

Sustainable Seas Expeditions will shift focus in this phase from exploration and data gathering to data analysis and interpretation.

A major campaign will focus on public outreach and education.

An international workshop will convene at the National Geographic Society to disseminate and review the project findings and to discuss how the information may be used in future policy.

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4/98

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STATEMENT OF DR. NANCY FOSTER, ASSISTANT ADMINISTRATOR FOR OCEAN SERVICES AND COASTAL ZONE MANAGEMENT, NATIONAL OCEANIC AND ATMOSPRERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Good morning. I am Dr. Nancy Foster, Assistant Administrator for Ocean Services and Coastal Zone Management at the National Oceanic and Atmospheric Administration (NOAA). Thank you Mr. Chairman, and members of the Subcommittee, for this opportunity to testify on public/private research partnerships in NOAA's National Marine Sanctuaries. Research partnerships play an indispensable role in helping advance NOAA's coastal stewardship mission to conserve, protect, and enhance the biodiversity, ecological integrity, and cultural legacy of our Nation's valuable marine protected areas.

It is fitting that we highlight these essential partnerships in this, the International Year of the Ocean, especially in light of the major initiatives announced at the National Ocean Conference in June at Monterey, California by President Clinton. One of the most important elements is to explore the oceans, the last U.S. frontier, and better understand how to protect marine resources. Much of this knowledge will be gained through public/private research partnerships such as the ones you will hear about today.

This hearing also coincides with the efforts of the National Ocean Service to redefine itself to strengthen the effectiveness of NOAA's coastal stewardship mission, enhance research support within NOAA for coastal management, and build better linkages among NOAA's coastal programs. A key element in this process has been improving NOAA's understanding of our unique areas of management responsibility, including our 12 National Marine Sanctuaries. Fundamental to this effort is our commitment to foster partnerships that ensure balanced participation and allow us to leverage NOAA's technical expertise with the diverse strengths available from outside the Federal Government. These partnerships not only help provide the additional scientific data and technical capabilities vital to improving our understanding and management of these complex marine ecosystems, but they also help build the public's awareness of the critical importance of conducting this research. Strong partnerships are vital to enabling the Sanctuary program to provide the superior marine resource management required to sustain these special areas for future generations.

Today, I would like to summarize the importance of research to the National Marine Sanctuary program and the role partnerships play in conducting that research. This hearing comes in the might of one of the most successful years in the National Marine Sanctuary programs 26 year history, much of which is due to the strong internal and external partnerships that NOAA has participated in. I think it most appropriate that you hear about these productive collaborations directly from your other witnesses, Dr. Sylvia Earle and Mr. Terrence Tysall. NOAA is very fortunate to have the National Geographic Society and the Cambrian Foundation as partners. Rather than discuss in detail specific partnerships, Mr. Chairman, I would like to submit for the record, attached with my written statement, a summary of the public/private research partnerships currently under way in our 12 National Marine Sanctuaries.

As trustees for the Nation's system of marine protected areas, NOAA needs the support of the private sector, academia, industry and others to help manage and protect these unique public resources. A critical component of this support is to provide NOAA with the high quality research needed to make sound management decisions, implement effective field operations, and to evaluate the effectiveness of NOAA's management strategies on our Nation's valuable natural and cultural marine resources. Our Sanctuaries are natural laboratories in which we can test, refine, prove and implement the linkages between scientific theories and management practices. Many of the lessons learned can be applied outside of the Sanctuaries. Because of their exceptional significance and their irreplaceable value to the nation, it is imperative that the Sanctuaries be able to draw upon high quality research expertise and facilities.

Although NOAA is the Nation's premiere scientific agency for ocean (and atmospheric) research, we also recognize our limitations. At times, it seems that the questions that need answers are as boundless as the oceans themselves. It will not surprise anyone on this Subcommittee that more resources are needed to fully address these challenges. This is where the value of partnerships truly stands out. An abundance of knowledge, skills, expertise, creativity, and resources is available in this country, whether it be from Federal, state, academic, private or other institutions that NOAA can collaborate with to help accomplish its mission. Strong, well-focused partnerships help NOAA address needs beyond available resources.

The National Marine Sanctuary program's role in public/private partnerships includes identifying areas and gaps where partnerships can best address outstanding needs, seeking the appropriate partners to address those needs, and bringing sufficient resources to the table to adequately support NOAA's commitment to the partnership effort. In the past, NOAA has developed partnerships in areas as diverse as the Sanctuaries themselves. A few examples are multi-lingual education at the Channel Islands Sanctuary, fish resource inventories in the Florida Keys, and even a benefit concert by the popular country band "Little Texas" to raise funds for monitoring activities at the Flower Gardens Sanctuary.

Partnerships are expected to play an important, well-defined role in the first-ever comprehensive National Marine Sanctuary Research Plan currently under development. The Research Plan will ensure that all National Marine Sanctuaries have the capability to effectively coordinate site-specific planning and research, identify and address priority research areas relevant to important management issues, and direct NOAA and external resources to where the most critical needs exist.

Also, the Plan will encourage development of partnerships to implement cross-cutting scientific projects involving multiple sites that cut across regions. We also expect to establish clear criteria for data quality and management for monitoring and other research programs, and make information produced through Sanctuary sponsored research programs widely accessible and user friendly.

Some of the key goals of the Plan are to fully understand the nature of the many threats to our nation's valued marine resources and ecosystems by monitoring the condition of protected resources and tracking natural and human-induced changes. NOAA expects to enhance its capabilities to better respond to resource damage incidents and restore marine habitats important to those communities that rely on healthy, vibrant marine resources.

In conclusion, NOAA has long recognized the value of public/private partnerships that enhance research efforts needed in the National Marine Sanctuaries. The two exciting partnerships that will be highlighted this morning demonstrate the National Marine Sanctuary Program's unique ability to find willing partners, leverage appropriated dollars and realize significant benefits. The development of a system-wide Research Plan will provide the guidelines needed to ensure that future partnerships are focused where most needed. I look forward to working with you next year, Mr. Chairman, to update the Subcommittee regarding our progress in developing new partnerships under the Research Plan, when your Subcommittee begins to consider reauthorization of the National Marine Sanctuaries Act.

Thank you for the opportunity to discuss research partnerships in NOAA's National Marine Sanctuaries. I would be pleased to answer any questions you may have.

SUMMARY OF NATIONAL MARINE SANCTUARY PUBLIC-PRIVATE PARTNERSHIPS

SEPTEMBER 1998

Stellwagen Bank NMS, MA

University of Connecticut
Ivar Babb/Peter Auster, NURC-NAGL

One of the key research partners for this sanctuary; provides considerable support for sanctuary research and education. Leads critical habitat research program at SBNMS, which is on the cutting-edge of providing and understanding the important role habitats play in sustaining marine resources. The Center is also assisting the sanctuary with understanding the acoustic environment, and the effects of human-generated sound on the marine mammals that return to this critical habitat every year. UCONN, through the NURC-NAGL, provides us with access to advanced underwater technologies such as ROVs and manned submersibles, essential to conducting effective research in a sanctuary generally too deep to allow safe diving.

Woods Hole Oceanographic Institution
Porter Hoagland, Marine Policy Center

Marine Policy Center provides significant support in a number of areas related to understanding the socioeconomic implications of sanctuary management. Conducted a study of the economics of whale watching at SBNMS (one of the 10 top whale watching sites in the world according to World Wildlife Fund), developed an inventory of existing marine protected areas in the Gulf of Maine (a project that is part of our activities associated with the Gulf of Maine Council on the Marine Envi-

ronment), and has agreed to provide socioeconomic analysis for our upcoming management plan review.

Massachusetts Institute of Technology
Dr. Jim Bellingham, AUV Program

Collaborative work, in cooperation with NURC-NAGL, deploying MIT's Autonomous Underwater Vehicle (AUV) Odyssey to field test its capabilities to map the sanctuary seabed. Have collaborated on a number of other proposals which did not receive funding.

Dr. Judith Kildow, Department of Ocean Engineering

Graduate students, under the direction of Dr. Kildow, produced an environmental monitoring program for the sanctuary, which is being used both to help the sanctuary formulate monitoring priorities and to assist the NMS program to develop a national program-wide monitoring initiative.

University of North Carolina at Wilmington (UNCW)
Dr. Larry Cahoon

Dr. Cahoon is a participant in our habitat research team and leads an effort, funded largely by NURC-NAGL, to shed light on changes to seabed production in areas where considerable fishing activity occurs. UNCW has participated in at least three sanctuary research cruises, focusing on demersal zooplankton and seabed productivity.

Harbor Branch Foundation
Tim Askew, Operations Manager

Through NURC-NGL, cutting-edge technologies in submersible and ROV systems have been deployed and yielded considerable information regarding seabed processes in the Sanctuary. Harbor Branch's Vessels SEA DIVER and EDWIN LINK have been platforms for critical research in the Sanctuary, supporting both ROVs and manned submersible CLELIA, such as a lobster habitat research project funded by NURC-NAGL.

Monitor NMS, NC

The Mariners' Museum
Claudia Pennington, Director

The Mariners' Museum is this sanctuary's key partner. Through a long-term memorandum of understanding, the museum serves as principal museum for sanctuary education programs, curation of the Monitor Collection of artifacts and documents, and artifact conservation. The museum is currently preparing a conservation and exhibit facility for the conservation, curation and interpretation of large components to be recovered from the Monitor. The museum is also working with NOAA for the development of the USS Monitor Research Center, to be located at the museum.

National Undersea Research Center/University of North Carolina at Wilmington (NURC/UNCW)
Lance Horn or Doug Kesling, Operations

One of the key research partners for this sanctuary, NURC/UNCW provides essential support for sanctuary deepwater research and training. During the most recent on-site research expeditions, NURC/UNCW provided dive training support, decompression chamber and operators, dive equipment and research divers. Because of the unique relationship between NOAA's National Ocean Service and the National Undersea Research Program, NURC's services are available to this sanctuary at a fraction of the estimated cost of obtaining equivalent services from an outside contractor.

Cambrian Foundation
Terrence Tysall, President

This private, nonprofit foundation is dedicated to conducting deepwater diving research projects. The foundation has committed resources for long-term research at the Monitor sanctuary. The foundation, which conducted NOAA-permitted private research at the sanctuary for several years, participated as a full partner in NOAA's 1998 Monitor Expedition. The foundation provided training, equipment and research divers for the expedition, absorbing a large portion of the associated costs.

U.S. Navy, Naval Sea Systems Command (NAVSEA)
CDR Christopher Murray, Commanding Officer
Mobile Diving and Salvage Unit Two (MDSU Two)

MDSU Two provided essential personnel and equipment for the highly successful 1998 Monitor Expedition. Using a Navy-leased vessel as a research platform, Navy and NOAA divers worked together for the recovery of the Monitor's propeller, hull plates and other artifacts, as well as for the recovery of data required for the next phase of on-site stabilization and research.

Oceaneering Technologies
A division of Oceaneering International
Leonard Whitlock, Engineer

Oceaneering holds a NAVSEA contract for support of Navy ocean research and salvage. In 1997, Oceaneering provided, at no cost to the government, a preliminary assessment and recovery plan for the preservation of the Monitor's hull and the recovery of major hull components.

Gray's Reef NMS, GA

Skidaway Institute of Oceanography, Savannah, GA
Dr. Herb Windom, Acting Director

The Gray's Reef National Marine Sanctuary program offices are located on the campus of the Skidaway Institute of Oceanography (SkIO). Under Joint Project Authority of the Department of Commerce, SkIO and Gray's Reef have entered into a long-term agreement to collaborate on research, conservation and educational activities. Through this agreement SkIO provides access and use of all its facilities including research vessels, Distance Learning Center and marine operations equipment. SkIO also provides staff and research faculty support for all facets of sanctuary research and educational programs.

National Undersea Research Center at the University of North Carolina / Wilmington (UNCW) Wilmington, NC
Tom Potts, Assistant Science Director

The Center at UNCW has provided considerable support for Gray's Reef over the past 4-5 years in establishing monitoring programs, providing research coordination and training of staff and volunteer divers. UNCW has conducted extensive surveys of the sanctuary using their ROVs to provide video confirmation of reef features identified with side scan sonar surveys. They have provided training to staff for Nitrox diving certification and have visited sanctuary offices on two different occasions to provide week long dive certification training for volunteer divers from local universities. Tom Potts serves in a part-time capacity as the sanctuary's Research Coordinator and has ensured that the sanctuary research needs receive priority in the NURC annual call for proposals from the scientific community.

University of Georgia, Athens GA
Dr. Erv Garrison

For four years Dr. Garrison has been providing time and scientific equipment to Gray's Reef to explore the paleoenvironmental conditions of the sanctuary. His work includes extensive diving and survey of a portion of the reef that has significant fossil resources. He has also conducted sub-bottom surveys of the reef and adjacent areas to explore ancient drowned riverbeds and has been participating in media events and stories relating to the work at the sanctuary.

Georgia Southern University, Statesboro GA
Dr. Jim Henry

Dr. Henry has been directly involved with the sanctuary program at Gray's Reef since its inception. He has conducted a variety of geological studies of the reef and continues to contribute to the sanctuary program by providing advisory services, review of documents and support for geophysical surveys. He has also encouraged other GSU faculty to focus their work where feasible in the sanctuary and this has resulted in support for GRNMS loggerhead sea turtle studies, reef fish and invertebrate monitoring and paleoenvironmental sediment characterization.

Marine Resources Research Institute, Charleston SC
Dr. Jack McGovern

Through support from the National Marine Fisheries Services, MRRI has conducted five years of reef fish assessment surveys in the sanctuary. Their efforts under the MARMAP program have provided the most reliable scientific data for the sanctuary on the status of targeted recreational fish species.

Florida Keys NMS, FL

Florida Institute of Oceanography, St. Petersburg
Dr. John Ogden (813-553-1100.

Since 1992 FIO has worked with the sanctuary on providing the best available science for use in management decisions. FIO implemented the SEAKEYS program which

- established long-term automated physical oceanographic monitoring stations along the reef tract,
- monitored coral change over a 4 year period, and
- quantified hydrological linkage between Florida Bay and the sanctuary.

As part of SEAKEYS, two educational posters were produced to graphically show linkages in the ecosystem. Last year, FIO was awarded a $200K monitoring grant to look at the effects of the no-take zones on the coral community. Dr. Ogden is leveraging that money to get private funding to enhance the study to investigate the replenishment potential of marine reserves.

National Undersea Research Center at the University of North Carolina-Wilmington (NURC/UNCW),
Bob Wicklund, Director; Dr. Steven Miller, Science Director

For the past seven years, NURC/UNCW has operated the world's most active and productive coral reef research program involving both a day-boat program and a saturation mission program. The sanctuary and NURC work hand-in-hand on science planning, permitting, and logistics. It is essentially the research arm of the sanctuary. (A good indicator of our cooperation together is that NURC RFP for research now lists investigating the effect of the no-take zones as a major funding priority.) NURC manages our Level I contract to Ogden and conducts a yearly rapid assessment of the no-take zones.

Mote Marine Lab, Sarasota and Pigeon Key
Dr. Kumar Mahadevan, Director; Dr. Erich Mueller, Pigeon Key Marine Research Center director

The Pigeon Key lab has been operating in the sanctuary for the past three years and focuses on cutting edge coral reef restoration techniques, coral disease research, and investigating the cause and effect of episodic events in the sanctuary. Mote will be funding two post-doctoral fellows to assist with the science coming out of the SSE initiative.

Flower Garden Banks NMS, TX/LA

Gulf of Mexico Foundation—Flower Gardens Fund
Dr. Quenton Dokken, Director

Provides financial and in-kind support for research and education at the Sanctuary. Has been instrumental in initiating partnerships with business and industry, including Mobil, Shell, Oryx, and BP Exploration. Annually provides financial assistance to graduate students conducting a variety of work in the Sanctuary. Sponsors the annual Education Workshop & Field Excursion for classroom teachers and informal educators.

Channel Islands NMS, Santa Barbara, CA
University of California, Santa Barbara (UCSB)

Channel Islands National Marine Sanctuary (CINMS) has partnered with UCSB scientists to study the impacts of El Niño storm runoff on the marine environment—specifically in the Santa Barbara Channel and the sanctuary. Since early February, El Niño generated storms have resulted in nearly two-thirds of the Santa Barbara Channel being inundated with freshwater, terrestrial sediments, agricultural runoff and other debris. The runoff creates a visible pattern of nutrient rich brown sediment plumes which, in turn, produces green marine algal blooms.

Southern California Coastal Water Research Project (SCCWRP)

CINMS has partnered with the Southern California Coastal Water Research Project (SCCWRP) and 54 organizations, including international and volunteer organizations, to participate in a regional marine monitoring survey of the Southern California Bight, referred to as the Bight '98 Project. The project includes the measurement of a variety of indicators at roughly 300 sites between Point Conception and just south of the Mexican Border. The indicators measured will include benthic invertebrate assemblages, sediment contaminant concentrations, sediment toxicity, demersal fish assemblages, demersal fish gross pathology, demersal fish bioacummulation, dissolved oxygen, temperature, salinity, transmissivity and marine debris.

The overall goal of Bight '98 is to assess the condition of the bottom environment and the health of the biological resources in the SCB. To accomplish this goal, Bight '98 will focus on four objectives: (1) estimate the extent and magnitude of ecological change in the SCB, (2) compare condition among selected geographic regions of the

SCB, (3) assess the relationship between biological responses and contaminant exposure, and (4) describe historical trends at selected sites.

Monterey Bay NMS, CA

Monterey Bay Aquarium Research Institute (MBARI)
Marcia McNutt, President

MBARI and MBNMS share facilities and scientific expertise to achieve their missions. MBARI is providing the large training tanks for submersible training for the Sustainable Seas Expeditions. They provide satellite images and buoy data related to oceanographic monitoring, and have recently completed a sea floor map that is so detailed that potential ship wrecks can be located. The MBNMS has provided MBARI scientists ship time on the R/V McArthur for El Nińo studies and we have worked closely together on the cause and effects of toxic algal blooms. MBARI has a representative on the MBNMS Research Activities Panel. This panel advises the Sanctuary on research issues while providing a forum for collaboration between 22 research institutions in the Monterey Bay region. In the future, MBARI and MBNMS are planning for a combined postdoctoral position. The position would be funded by MBARI and the post doc would be located at the MBNMS office, working on a joint project of interest.

MBNS Research Activity Panel (RAP)
Dr. Greg Cailliet

Working under the auspices of the Sanctuary Advisory Council, the RAP is composed of 22 representatives—14 from private and university marine research institutions. The RAP meets nine times per year to advise the MBNMS on research and scientific issues, as well as to coordinate research, logistics (such as shiptime) and funding issues among the various institutions represented. This group of research talent helps the sanctuary develop action plans for difficult resource management issues, for instance on the issues of White Shark chumming, or diver impacts on kelp beds. Also, the sanctuary gains significant knowledge about the region's biological resources due to the active research conducted by the RAP members.

Moss Landing Marine Laboratories
Dr. Don Croll, University of California at Santa Cruz
Critical Marine Mammal Habitats Study

Starting 1995, the sanctuary has directed resources to studying the critical habitats of large cetaceans (whales) in the sanctuary. While the sanctuary region has long been known for its diversity of marine cetaceans, little was known about what brings so many large mammals to the specific locations in the Sanctuary. This study by researchers at the University of California, Santa Cruz assessed sea floor topography, oceanic currents and the distribution of prey to explain recent unusual phenomena of coastal congregations of whales.

Moss Landing Marine Laboratories
Monterey Bay EMS BeachCOMBERS
Dr. James Harvey

The MBNMS Beach Coastal and Ocean, Mammal and Bird, Education and Research Surveys (COMBERS) program began two years ago with only partial funding by the MBNMS. The program was created through the recruitment of volunteer beach walkers to collect standardized scientific data on beached and dead marine birds and mammals. The goal of the study is to create a database of information from which environmental "events" (El Nińos, Red Tides, Oil Spills, etc.) within the sanctuary can be evaluated for ecological significance. The program has responded to oil spills, found tagged animals from throughout the Pacific, detected toxic algal blooms, provided data related to impacts of gill net fishing on birds, and saved a drowning citizen.

California State University Monterey Bay
Dr. Rikk Kvitek
MBNMS Site Characterization

One of the first research projects conducted by various research universities and partially funded by the sanctuary is known as the "MBNMS Site Characterization." While the area encompassed by the sanctuary has become world renown for its cutting edge marine research, little had been done to synthesize and abstract the available environmental information. The sanctuary site characterization is an encyclopedia of information about the sanctuary environs (which includes a 10,000 record bibliography), and is served out over the internet to the general public. Individual chapters were donated by academic experts from numerous disciplines. The sanc-

tuary site characterization has become a educational tool for resource managers, scientists, teachers and students at all levels of education.

Gulf of the Farallones NMS, CA
Cordell Bank NMS, CA

The Marine Mammal Center (MMC)
Dr. Francis Gulland

MMC provides early detection and tracking of mortality events in the sanctuary as part of the five-year old BeachWatch program. Also educates the public about how to best coexist with wildlife and reduce disturbance and taking of seal pups as part of the sanctuary's SEALS program.

Farallones Marine Sanctuary Association (FMSA)
Maria Brown

FMSA provide educational opportunities, information exchange with the public—particularly school children—volunteer coordination, and data housing. Partner in both the BeachWatch and SEALS programs.

Olympic Coast NMS, WA

University of Washington (UW)
Dr. Julia Parrish.

In addition to OCNMS helping Dr. Parrish's seabird research with logistical support, Dr. Parrish is a key player for OCNMS as the Research Representative on the Sanctuary Advisory Council. Dr. Barbara Hickey. Aboard NOAA ship *McARTHUR,* conducted physical oceanographic investigations along the shelf and canyons of OCNMS.

Dr. Rita Homer and Jim Postel.

Mr. Postel and Dr. Homer have taken advantage of OCNMS's offer of ship time to conduct investigations for marine biotoxins and phytoplankton species off the Olympic coast. Dr. Megan Dethier Dr. Dethier has helped OCNMS establish intertidal transects for monitoring long-term trends in nearshore communities.

California State University Monterey Bay (CSUMB)
Dr. Rikk Kvitek

Dr. Kvitek and his dive team have been key players in establishing subtidal transects for sanctuary baseline data, video habitat characterization, and for monitoring long-term trends of nearshore communities.

University of California Santa Cruz (UCSC)
Michael Kenner

UCSC's dive team has helped the sanctuary establish baseline data for subtidal habitat characterization and to monitor long term trends in sea otter habitats.

Oregon State University
Dr. Carl Schoch

Dr. Schoch has been instrumental in establishing on-site inventories of geomorphological characterizations of shoreline into GIS with links to biological communities, that OCNMS and other agencies are using for resource inventories.

Ecoscan Resource Data (ECI)
Bob VanWagenen

ECI has flown annual aerial surveys for OCNMS and other resource agencies to monitor long-term trends in kelp canopy cover and digitize into GIS.

Coastal Maritime Archeology Resources (CMAR)
Mark Norder

CMAR volunteer divers conduct survey work for historical shipwrecks off the Olympic coast while OCNMS provides logistical and vessel support.

Hawaiian Islands Humpback Whale NMS, HI

University of Hawaii, West Hawaii
Dr. Joe Mobely

The university recently completed a sanctuary sponsored aerial surveys of humpback whales (and other cetacean) populations in Hawaii. This is important since the sanctuary has limited data on where the humpback whales reside or how many are actually here. Some of the highlights of the just completed study include:

- Estimated—2-3000 humpbacks
- Sperm whales—more than expected in Hawaiian waters

- Fin whales—second recorded siting.
- Distribution of humpbacks has not changed over the past 10 years, even though boat and vessel traffic has increased in areas such as Maui.

Fagatele Bay NMS, AS

University of Guam Marine Laboratory
Dr. Charles Birkeland

FBNMS has a research partnership with the University of Guam Marine Laboratory that extends back to 1988. Under the direction of Dr. Birkeland, we have a biological resource survey approximately every three years. This database is one of the oldest longitudinal studies of a Pacific coral reef. The survey has documented changes in the coral and fish populations with the recovery from the crown-of-thorns starfish infestation of 1978, and represents a significant management tool.

PRIVATE RESEARCH EXPEDITIONS ON THE USS MONITOR CONDUCTED BY THE CAMBRIAN FOUNDATION

29 September 1998

Terrence N. Tysall, Founder and President

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1.0 Introduction

> **Cambrian (kam' bre an) adj.** ***A period of the Paleozoic era occurring from 500 million to 600 million years ago. It is believed that life was wholly confined to the water during this period.***

The Cambrian Foundation is a private not for profit research organization. It was founded in 1994 for the purposes of conducting scientific research on, educating the public in regards to and preserving and exploring the aquatic realm. The Foundation became a member-based organization in January 1997.

2.0 Current Projects

2.1 The *USS Monitor* Survey.

The Cambrian Foundation has been conducting research operations in the Monitor National Marine Sanctuary since 1994. The 1997 expedition achieved the greatest success yet on the *Monitor*. A quote from the *Monitor* Sanctuary Manager says it all, "The Cambrian Foundation dive team has gathered more usable data in one week than NOAA has since it began overseeing the site." The repeated success led to the most ambitious expedition in the sanctuary's history in 1998.

2.2 The Great Blue Hole Geologic Survey.

This expedition was another of which all the team members paid a great deal of the expenses to participate. The chief scientist on the expedition, Dr. Robert Dill, summed it up best by saying, "The Cambrian Foundation's expedition could very well be the most significant geologic research done in the last fifty years." It was because of the success of this project the Cambrian Foundation received it's first world wide television exposure through the SeaTek program on the Learning Channel.

2.3 The Solomon Islands National Museum project.

Foundation members are currently striving to improve the existing museum facilities on the island of Guadalcanal so that the Islanders are better able to preserve their unique culture, one of the oldest on earth, as well as the one of a kind natural history and maritime resources of the region. Other goals of this project are the creation of a submerged cultural resources management team comprised entirely of Solomon Islanders. It is also the wish of the Cambrian Foundation to assist the Naval Historical Center in protecting the historic World War II relics of the region.

2.4 The *SS City of Ainsworth* project.

A Cambrian Foundation dive team was the first to reach the wreck, one of Canada's most historic shipwrecks, in Kootenay Lake, British Columbia. Designated an Underwater Heritage Site in 1990, the wreck had never before been visited by free swimming divers.

2.5 The Miskito Indian project.

We continue to involve ourselves with Sub Ocean Safety organization in their mission to protect indigenous peoples around the world from unsafe greed oriented diving practices that result in an epidemic of decompression illness the world over.

2.6 The Trident project.

This ambitious endevor will put two aquanauts on the sea floor for an entire year in an attempt to create a permanent human pressence in the sea.

3.0 USS Monitor Historical Background

Ironclad ships had been built before by navies in Europe and the East, but never before had two met in battle. The *Virginia* was an adapted wooden ship, originally, the *USS Merrimack*. She was constructed in this manner out of necessity for time and money. The Union had started construction on an ironclad ship, the *USS Galena*, of similar design. However, when it was apparent that the Confederates would have their ironclad ship ready before the Union's, they started on a revolutionary project that would produce a ship that would influence all warship design in the future.

On March 8, 1862, the *CSS Virginia* (formally the *USS Merrimack*) steamed down the Elizabeth River to Hampton Roads where five large union ships were in blockade, the *USS Cumberland, USS Congress, USS Minnesota, USS Roanoke* and *USS St. Lawrence*. At the end of this day, two Union ships, the *USS Cumberland* and *USS Congress*, were sunk, and the *USS Minnesota* was grounded and severely damaged. For fear of grounding themselves in the darkness of night, the *Virginia* pulled back to the safety of the Elizabeth River and Sewell's Point, where a battery of Confederate guns were placed. They planned to continue the battle the next day and the *Minnesota* should be easily taken before continuing the attack on the *USS Roanoke* and *USS St. Lawrence*.

What the Confederates did not know was that the *USS Monitor* had arrived in the darkness and had taken up along side of the *Minnesota* to protect her. Unlike the *Virginia*, which was a modified wooden ship, the *Monitor* was a specially designed ironclad ship, designed by a Swedish-American engineer and inventor, John Ericsson, and was a marvel of ingenuity. She weighed 776 tons, was 172 feet long and 41 feet wide, drafted 11 feet 4 inches, had a 12 inch freeboard and carried a 360 degree rotating turret that housed only two 11 inch Dahlgren guns.

On the morning of March 9, 1862, the *Virginia* headed out to continue the battle that had begun the day before. Before she could get close to the *Minnesota*, however, the *Monitor* moved up and engaged the *Virginia*. The battle lasted for approximately 4 hours and at times the two ships fired upon each other at point blank range. At one point, the *Virginia* ran aground, but the *Monitor* could not finish her. Later in the battle, the *Virginia* put a shot into the pilothouse of the *Monitor* and blinded her captain, Lieutenant John L. Worden. The *Monitor*, it's captain wounded, steamed away from the battle. The Confederates believed that the *Monitor* was retreating. Lieutenant Samuel Dana Greene, the executive officer, assumed command with these instructions from the captain, "Gentleman, I leave it with you. Do what you think is best. I cannot see, but do not mind me. Save the *Minnesota* if you can." After attending to the captain, Greene turned the ship around to resume the battle. By the time this was accomplished, the *Virginia* had decided to return to Norfolk for repairs, and the Union believed that the *Virginia* was abandoning the fight. Both sides considered the battle to be a victory despite the fact that no other ships were taken or sunk, and the blockade was still intact.

The irony of this battle was that the *Monitor* was not supposed to be there that day, and had she not arrived, the Confederates would have surely sunk the remaining ships and broken the blockade. Had this happened, the British and French, who were observing the battle, might have sided with the Confederates and this probably would have changed the outcome of the war.

The two ships would not meet again in battle, and in fact, neither ship would see their first birthday. On May 11, 1862, after the fall of Norfolk to the Union, the *Virginia* had no place to run. She was run ashore by her captain, Josiah Tattnall who replaced the wounded Buchanan, and set ablaze to prevent the Union from capturing her. Captain Tattnall reported to the Confederate Secretary of the Navy, Stephen R. Mallory, "The *Virginia* no longer exists." On December 31, 1862,

the *USS Monitor* sank in a storm, 16.1 miles south-southeast of Cape Hatteras, North Carolina while being towed by the *USS Rhode Island*. She was on her way to Beaufort, North Carolina to assist with the blockade there. The scene of man after man plunging to their deaths into the raging sea while trying to reach lifeboats caused a few of the crew to freeze on the top of her turret in terror. Boats from the *Rhode Island* continually risked their lives evacuating the crew from the ill-fated ironclad. The men lined the *Rhode Island's* rail to look for their ship, her lights alternately appearing and disappearing behind the monstrous waves. Finally, near one in the morning, her lights disappeared forever. Acting assistant paymaster William F. Keeler wrote, "The *Monitor* is no more."

The *Monitor* was discovered in 1973 in 230/240 feet of water, and on January 30, 1975, the site was designated as the nation's first marine sanctuary under Title III of the Marine Sanctuaries, Research, and Protection Act of 1972.

4.0 Site Description

The Monitor National Marine Sanctuary encompasses a vertical water column from the surface to the seabed and extending horizontally one nautical mile in diameter 16.1 nm SSE of Hatteras Light, North Carolina. The Monitor lies in 230 to 240 feet of water at coordinates 35° 00.121' N and 75° 24.375' W. The Monitor National Marine Sanctuary can be one of the most difficult research environments on the planet. The extreme depth of the site is merely one concern. Other environmental conditions include water temperatures ranging from 40°F to 75°F throughout the year and highly unpredictable currents. Currents can range from zero to several knots, with the prevailing direction of the current from the NE. The operational area and it's conditions can be best summarized by referring to the area's historical name, "The Graveyard of the Atlantic."

5.0 Synopsis of 1998 Diving Operations

For the past 4 years (including this year), the Cambrian Foundation has put together scientific expeditions to the Monitor. These expeditions are typically one week in duration. However, this year we also participated in a one month long, historical joint effort with NOAA (National Oceanic and Atmospheric Administration), the US Navy and NURC at UNCW (National Undersea Research Center at the University of North Carolina at Wilmington). This was the first time a civilian organization was allowed to dive along side the Navy and NOAA divers off of their vessels.

During phase I of this project, the Navy, NOAA and the Cambrian Foundation were diving from the *Kellie Chouest*, a leased DSRV support vessel, 300 feet long, on a four point mooring directly over the *Monitor*. Phase II was conducted by NOAA, NURC and the Cambrian Foundation utilizing the NOAA vessel *Ferrell*, a 140 foot vessel anchored within about one quarter mile of the *Monitor*, and the 54 foot UNCW research vessel, *Cape Fear*. The overall objectives for this project were to collect data for an engineering study for stabilization and selective recovery efforts and to map, photograph, video and recover small artifacts that might be destroyed during the stabilization. Our objectives for both phases were to train some of the NOAA and NURC divers, to provide qualified personnel to the NOAA team, to help NOAA validate this new style of diving (untethered deep scuba diving) and to act as diving supervisors for the NOAA/NURC/Cambrian Foundation team.

The Navy's operation was separate from ours and was similar to how NOAA divers had conducted operations in the past. Their divers were lowered down over the port side of the *Kellie Chouest*, two at a time on a stage (a large, metal basket that can hold two standing divers), where they would step off the stage right next to the wreck and walk over to it. Their helmets were tied to the surface with an umbilical that contained a communications cable, a hot water line for their suits, a "pneumo" tube for determining depth and their gas supply line. Their longest bottom time was 37 minutes, and they consumed about 1000 cubic feet of bottom mix (heliox 14/86) on each dive. Also, they were doing surface decompression or "Sur-D" diving. This means that after about one hour of in water decompression, at their 40 foot stop, they would be quickly removed from the water, stripped from their gear and hurried into the chamber, where they would spend another hour and one half. In

order to accomplish this type of diving, the Navy had at least 16 divers on the surface for two bottom divers – hoist operator, umbilical line tenders, gas supply technicians, communications operator, safety diver and tenders, chamber operator and tender and a dive supervisor. They spent the majority of their time working on the removal and recovery of the prop and shaft, but they also recovered two deck plates and a support beam.

In contrast, during phase I, our teams were lowered on the DSRV platform or did a giant stride into the water where they swam over to a downline that was affixed to the stern of the *Kellie Chouest*. During phase II, we did liveboat operations off the *Cape Fear* and used a downline attached to a large norwegian ball. The divers would swim down this line to near the wreck and then over to it. Being untethered, we were able to travel the entire length and width of the wreck to collect our data and artifacts. Our bottom times ranged from 15 to 40 minutes with between one and two and one half-hours of in water decompression utilizing EAN36 and O_2. The divers would consume around 150 cubic feet of bottom mix (trimix 18/50). Support for our bottom divers (we could have up to 10 in the water at one time) required 6 other personnel – two in water support divers, one standby diver, one safety diver, a chase boat operator and the dive supervisor. The support divers were diving air on their backs and would each carry one stage cylinder of EAN36 and one of O_2. The standby diver also had air on his back and two stage cylinders and was located in the chase boat (an Avon or Zodiac inflatable) while the safety diver was on deck with trimix on his back and two stage cylinders. We were able to place several markers, take engineering measurements and recover some small artifacts.

All of our separate diving expeditions on the *Monitor* require a permit from NOAA. There are two kinds of permits that NOAA can issue, a research permit or a special use permit. With the special use permit, divers are allowed to view the wreck, however, they can make no physical contact. A research permit is issued only after submitting a plan for the research activities to be done on site. NOAA and the North Carolina government must approve the permits. Terrence Tysall, president of the Cambrian Foundation, has held a research permit for four years that has allowed team members to dive the *Monitor*. John Broadwater, the Monitor National Marine Sanctuary manager for NOAA, assists each team. Over the last two years, the teams have placed and surveyed station markers to help track movement and deterioration of the wreck. The teams have also searched for and brought up artifacts while documenting the wreck with still photographs and video. And lastly, members have been involved in cleaning the wreck of garbage that had either drifted into the wreck or been left over materials from previous expeditions like PVC measuring tubes and measuring tape.

When entering a National Marine Sanctuary, boats are not allowed to anchor. There is, however, a subsurface marker buoy floating and attached near the wreck. An additional downline was placed closer to the wreck, attached to a large anchor in the sand near the turret. The boat captain motored to near the buoys and estimated the current. Each day, a crewmember snorkeled or dove to the new buoy and attached a 100-foot line with a large Norwegian ball on one end and 30 pounds of weight near the other end. The weight carried the line down the buoy line and brought this line parallel to the main buoy line. The divers used this line during their ascent. The divers all had to be completely suited up, with mask, fins, doubles and stage cylinders. At a prearranged signal, the divers went over both sides of the boat, one after another, like paratroopers leaving an airplane. The divers drifted into the buoy line while descending and pulled themselves down that line hand over hand to the bottom. Most of the divers were using trimix on the bottom. The Cambrian Foundation core dive team typically used bottom mixes with higher than normal ENDs on the *Monitor* as training for more demanding expeditions that the Foundation conducts. Bottom times were typically 25 to 30 minutes, which when using EANx and/or O_2 for decompression, had the divers out of the water in 100 to 120 minutes of run time.

Ascents were made up the buoy line to the separate float ball line that had been attached. When the last diver had reached this line, it was unhooked, and the divers drifted with this float as a reference. The boat simply followed the float and picked up the divers as they came to the surface.

The permit allows for no more than 12 divers on the wreck at one time, however, we rarely put more than 10 in the water at a time. On each of the last two expeditions, the conditions on the first day have not been favorable to dive the *Monitor* and we have done a tune up dive on a nearby wreck. In 1997, the sea conditions were exceptionally rough all week but we had good visibility and current conditions on the bottom. However, this year, we had more favorable sea conditions, but the visibility on the bottom was usually around 10 feet. Last year twenty-four station markers were placed and secured, and measurements between these points were obtained. We attempted to verify some of these measurements again this year. This survey data is invaluable in tracking the deterioration of the wreck and greatly assists divers in retrieval of artifacts. When artifacts are found, they must be located where they are on a site map and are usually drawn and photographed prior to retrieval. Determining direction and distance from two or more separate station markers, an artifact can be triangulated to its exact location. Some of the artifacts recovered on these expeditions were a broken lid to a small container, the top of a broken glass bottle, an intact glass bottle of hair restorative, a brass rifle stock butt and the officer's head (toilet). The head is significant because it was the first below waterline marine flush toilet. Excellent digital video of the current state of the wreck and the location of the station markers was obtained in 1997, however, because of the poor visibility this year, we did not get any good video or still photographs Lastly, a tremendous amount of trash was removed from the wreck last year. This consisted of nets, long line fishing line, soft drink cans, a coffee mug, an old shoe, PVC pipe and fiberglass measuring tape.

The work that we have been able to do on the *Monitor* has been very rewarding - knowing that certain artifacts have been preserved and can now be seen by people that would not have had the opportunity before. We hope that our work will continue on the *Monitor*, working with NOAA on larger scale projects as well as on smaller expeditions designed for our members.

6.0 Curriculum Vitae

Terrence N. Tysall

Education:

Currently majoring in Biological Oceanography specializing in marine mammal behavior and Aquatic Exploration at Goddard College

Relevant Employment:

1985 – 1990	US Navy active duty and reserve - stationed at RTC San Diego, CA, Fleet Anti-Submarine Warfare Training Center Pacific, Naval Special Warfare Center/Basic Underwater Demolition/Seal Training, Seal Team 5 TAD
1988	Marine mammal handler and trainer for ZooVet Busch Gardens, Tampa, FL
1988 – 1991	Special projects coordinator, diving safety officer and marine mammal trainer for the Dolphin Research Center, Grassy Key, FL
1991 – 1992	Instructor and Manager Dan's Scuba, Clearwater, FL
1992 – 1994	Director of Technical Instruction Hal Watts Mr. Scuba, Orlando, FL
1994 – 1996	Owner Orlando Diving Center, Orlando, FL
1994 -	Founder and President of the Cambrian Foundation, Winter Park, FL

Scientific Expeditions:

1989	MRDF/US Navy Vital Capacity Habitat Study
1990	MRDF/US Navy Vital Capacity Habitat Study
	MRDF/ US Navy Doppler Habitat Study
1991	Gulf Coast Speleology Survey University South Florida
	Wakula Springs SIO2 Project Florida State University Diving Program
1992	Die Polder Survey Florida Speleological Researchers
	Yucatan Cave Survey
	Gulf Offshore Speleology Survey University South Florida
	Deep Wreck Survey Palm Beach County
	Apopka Springs Survey Project
1993	Key Caulker Speleological Survey
	Andrea Doria Project
	USS Monitor Expedition
	Yucatan Survey Project
1994	Yucatan Survey Project
	USS Monitor Expedition
1995	Key Caulker/Great Blue Hole Exploration
	SS Edmund Fitgerald Expedition
	USS Monitor Expedition
	USS Atlanta Expedition
1996	USS Monitor Expedition
	Nemesis Survey Project
1997	Solomon Islands Project
	Great Blue Hole of Belize
	USS Monitor Expedition
	Yucatan Exploration Project
	SS City of Ainsworth Project
1998	Solomon Islands Project
	USS Monitor Expeditions
	Monk Seal Forage Study

Diving History:

24 years diving experience
5000+ logged dives / 5000+ hours
2000+ Cave or Cavern dives
530 ffw deepest wreck dive
600 fsw deepest open water dive
485 fsw deepest cave dive

Diving Certifications:

1974 – 84	Initial diving experience with 110 logged dives
1984	NASDS/SSI Open Water
	NASDS/SSI Night Diver
	NASDS/SSI Advanced Open Water
	NASDS/SSI Deep Diver
	NASDS/SSI Rescue Diver
	NASDS/SSI Underwater Navigation
	NASDS/SSI Equipment Specialist
	NSS-CDS/NACD Cavern
	NSS-CDS/NACD Basic Cave
1985	SSI Wreck Diver
	US Navy Scuba
	US Navy LAR V
	US Navy MK 16
1989	IANTD Nitrox
	IANTD Deep Air
	IANTD Advanced Deep Air
	IANTD Technical Deep Air
	IANTD Technical Nitrox
1990	IANTD/Deep Inc. Trimix

Professional Diving Certifications:

1987	US Navy Scuba Instructor
	LAR V Instructor
	US Navy Dive Supervisor
1988	SSI Dive Control Specialist
	SSI Assistant Instructor
	SSI Open Water Instructor
	SSI Advanced Open Water Instructor
	SSI Specialty Instructor
	Deep
	Night
	Cavern
	Navigator
	SSI Dive Control Specialist Instructor
	PSA Deep Instructor
	IANTD Nitrox Instructor
1989	Red Cross Lifesaving Instructor
1990	Aquanaut MRDF
1992	NSS-CDS Cavern Instructor
	NACD Cavern Instructor
	IANTD Deep Air Instructor
	IANTD Advanced Deep Air Instructor
	IANTD Technical Nitrox Instructor
	IANTD Technical Deep Air Instructor
	IANTD Trimix Instructor
	IANTD Overhead Environment Instructor

	IANTD Cave Instructor
	NACD Cave Instructor
1993	NSS-CDS Full Cave Instructor
	NSS-CDS Instructor Sponsor
	NACD Instructor Trainer
	IANTD Instructor Trainer
	DAN Instructor Trainer
	SSI Instructor Trainer/Evaluator
	NAUI Instructor Trainer
1994	TDI Extended Range Instructor
	TDI Trimix Instructor
	TDI Instructor Trainer
1997	TDI Rebreather Instructor Trainer

Affiliations and Awards

Scuba Schools International
National Association of Scuba Diving Schools
International Association of Nitrox and Technical Divers
Technical Diving International
Professional Scuba Association
US Deep Diving Team, Florida Director
National Association of Underwater Instructors, Technical Advisory Board
Divers Alert Network, Research Advisor
National Speleological Society Cave Diving Section, Training Committee
National Association of Cave Diving, Training Committee
Florida Speleological Researchers, Director
League of the New Worlds, Board of Advisors
Deep Tech Magazine, Board of Advisors
Cambrian Foundation, Founder and President

Abe Davis Award
International Cave Diving Safety Award
NACD Wakula Awards