BEYOND THE FREEDOM OF THE SEAS: OCEAN POLICY FOR THE THIRD MILLENNIUM

FOURTH ANNUAL
ROGER REVELLE COMMEMORATIVE LECTURE

National Academy of Sciences Auditorium
Washington, DC

5:00 pm

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Sponsored By:
The National Science Foundation
The Office of Naval Research
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WELCOME

Dear Lecture Participant:

On behalf of the Ocean Studies Board (OSB) of the National Academies, I would like to welcome you to the Fourth Annual Roger Revelle Commemorative Lecture.

For almost half a century, Roger Revelle was a leader in the field of oceanography. Revelle trained as a geologist at Pomona College and at U.C. Berkeley. Then, in 1936, he received his Ph.D. in oceanography from the Scripps Institution of Oceanography. As a young naval officer, he helped persuade the Navy to create the Office of Naval Research (ONR) to support basic research in oceanography and was the first head of ONR's geophysics branch. Revelle served for twelve years as the director of Scripps (1950-1961, 1963-1964), where he built up a fleet of research ships and initiated a decade of expeditions to the deep Pacific that challenged existing geological theory.

Revelle's early work on the carbon cycle suggested that the sea could not absorb all the carbon dioxide released from burning fossil fuels. He facilitated the first continuous measurements of atmospheric carbon dioxide, leading to a long-term record that makes present-day discussions and research on global warming possible and very valuable. Revelle kept the issue of increasing carbon dioxide levels before the public and spearheaded efforts to investigate the mechanisms and consequences of climate change.

DR. ROGER REVELLE
(1909 – 1991)

Revelle was a proponent of daring programs, like Mohole and the International Indian Ocean Expedition. This expedition addressed fundamental scientific questions and pioneered international cooperation. In 1960, Revelle left Scripps for critical posts as science advisor to the Department of the Interior (1961-1963) and as the first director of the Center for Population Studies at Harvard (1964-1976). Revelle applied his knowledge of geophysics, ocean resources, and population dynamics to the world's most vexing problems: poverty, malnutrition, security, and education.

In 1957, Revelle became a member of the National Academy of Sciences (NAS) to which he devoted many hours of volunteer service. He served as a member of the Ocean Studies Board, the Board on Atmospheric Sciences and Climate, and many other committees. He also chaired a number of influential Academy studies on subjects ranging from the environmental effects of radiation to the study of sea-level change.

This lecture was created by the Ocean Studies Board in honor of Dr. Roger Revelle to highlight the important links between ocean sciences and public policy.

I hope you enjoy the lecture.

Nancy Rabalais
Chair, Ocean Studies Board

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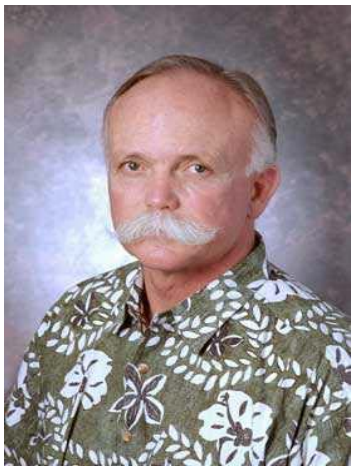

Michael K. Orbach is Professor of Marine Affairs and Policy, and Director of the Duke University Marine Laboratory and the Coastal Environmental Management Program in the School of the Environment at Duke University. He holds a BA in Economics from the University of California at Irvine, and an MA and Ph.D. in Cultural Anthropology from the University of California at San Diego. During the years of 1976-79, he held the critical position of Social Anthropologist and Social Science Advisor for the National Oceanic and Atmospheric Administration in Washington, D.C. From 1979-82, he was Associate Director of the Center for Coastal Marine Studies at the University of California at Santa Cruz. In 1983-93, he joined the Department of Sociology and Anthropology and became a Professor of Anthropology while occupying the position of Senior Scientist with the Institute for Coastal and Marine Resources at East Carolina University. In 1993, Dr. Orbach joined Duke, with offices at the Duke Marine Laboratory in Beaufort, North Carolina.

Dr. Orbach has performed research and set policy in coastal and marine issues across the U.S. and in Mexico, Central America, the Caribbean, Alaska and the Pacific. He has also published widely on social science and policy in coastal and marine environments. His many impressive honors, awards, and appointments include:

Scientific and Statistical Committee, Pacific Fisheries Management Council (1979-82); North Carolina Marine Fisheries Commission (Governor's appointments, one republican, one democrat, 1985-95; Vice-chair, 1994-95); Chair, North Carolina Ocean Affairs Council (Governor's appointments, one republican, one democrat, 1985-93); Technical/Management Committee, Albemarle-Pamlico Estuarine Study (EPA National Estuary Program, 1985-1995); National Advisory Committee, National Coastal Resources Institute (1985-1995); Praxis Award (with J. Johnson), Washington Association of Practicing Anthropologists (1991); Founding Board Member, Partnership for the Sounds (1992-present); National Research Council Committees on 1) Reducing Porpoise Mortality from Tuna Fishing (1989-92); 2) the National Sea Grant College Program (1994); 3) Science and Policy in the Coastal Ocean (1995); 4) Individual Fishing Quotas (1997-1999); President, The Coastal Society (1995-98); Advisory/Selection Committee, Pew Charitable Trusts Marine Conservation Scholars Program (1996-99); Ocean Studies Board, National Research Council (1997-1999); Founding Board Member, North Carolina Shore and Beach Preservation Association (1997-present); National

Board of Directors, Surfrider Foundation (2001-present); Science Advisory Committee, U.S. Commission on Ocean Policy, 2001-present.

Introduction

I had the great fortune to know and to work with Roger Revelle. I did not work with him on science, but rather on issues of the relationship between science and policy-making, and on the educational process through which ocean professionals of the future should be trained. For all of his grounding in natural science, Roger was a "big thinker" in many areas including those I mention. In this lecture, I will build on Roger's ideas, but also, with a great deal of humility, point to what I perceive to be the their boundedness in the time in which Roger lived and worked.

My general thesis in this talk is that it is time to "enclose" the world ocean. I use the term "ocean" in the singular to emphasize the connectedness of all of the world's major saltwater bodies, with each other and with the land and the atmosphere as well. The term "enclose" is taken from the ocean policy literature, and refers generally to the trend towards the treatment of more and more of the ocean and its resources as sovereign resources, within the ownership or control of one or a group of nations, or even specific private interests. In the most general sense, to "enclose" the ocean is to exert control over access and use rights and privileges throughout the world ocean, in particular what is now referred to as the "high seas", the area more than 200-nautical miles from shore. Such enclosure must necessarily include changes in our cultural perceptions of appropriate behavior towards ocean space and resources in all parts of the world ocean, including such concepts as the "precautionary principle"[1] and our perception of ocean resources along the commerce-recreation-aesthetics continuum.

This thesis is, of course, controversial. I will argue that throughout human history we have progressed from lower to higher densities of human use of terrestrial, ocean, and atmospheric space, and that as that density of use has increased governance institutions have been developed to control human behavior towards various ends, ends based on human perceptions and values. Most terrestrial space and resources, for example, were in the past "open access, common pool", owned by no one and used by all (Ostrom, 1990; McCay and Acheson, 1987). As densities of use increased, governance institutions – including restricted access and private property rights – developed to create order in that use, and to channel its costs and benefits (McCay, 1998; Coastal States Organization, 1990). Such incursions to the "open access, common pool" notion are now occurring in the ocean, and in the atmosphere, creating significant changes in what McCay has termed the "culture of the commons"-- the human beliefs, values and preferences that determine the nature of our governance institutions (McCay, 1998). It is this history and progression I will characterize, with a prognosis for ocean space and resources in particular.

In doing so, I am clearly expressing my own thoughts and opinions as well as "scientific" facts and information. That, of course, is the nature of governance institutions. Science is but one input to the process of governance, the latter of which at its core is an exercise in the development and application of human values. It is our "human values" regarding the world ocean to which I now turn.

[1] The "precautionary principle", or "precautionary approach", generally refers to the extent to which we exercise caution in human behavior that affects ocean resources (MacDonald, 1995).

Human Governance Institutions

My own perspective on the ocean is one of a human ecologist. That is, when I view the ocean I view it through the lenses of the people who live, work, or recreate in or near the ocean. I also use the lenses of those who are not in close proximity to the ocean at all, but who are aware of and concerned with the ocean and its resources. These may include everyone from seafood consumers, to viewers of documentary specials concerning the ocean, to members of environmental groups in the Midwest who may never see a whale or seal in their natural habitats, but who regularly send their money to support groups working in the interests of people who care about those creatures. When we develop governance institutions, it is the human ecology with which we are dealing (Orbach, 1995).

From this vantage point one thing is entirely clear: For most of the world's human population, the ocean is 'out of sight, out of mind'. Not only do most humans not live or work on or in the ocean, but it is in fact an extremely hostile environment for humans. It is too salty to drink or to irrigate crops. Its density both smothers us if we are immersed in it and crushes us if we go too deep without elaborate protection. Its waves bash us on beaches and in boats, and its biochemical characteristics foul and corrode our machines and structures. Even though an increasing number of us live or work near the ocean, it is still not an "intimate environment" for most humans (Revelle, 1969; Orbach, 1982).

This factor maters precisely because humans develop governance institutions for those spaces and resources about which they care most, and with which they are the most intimately involved. This is why the most complete set of governance institutions evolved first for humans in relation to terrestrial, as opposed to ocean and atmospheric, spaces and resources. Those are the spaces and resources for which we first developed dense use.

Governance on Land and Ocean

In the earliest days of human society most terrestrial space was "open access, common pool" – owned or controlled by no one. After the Neolithic Revolution around 10-14,000 BP (Before Present), and especially with the aggregation of human populations into cities around 3-5,000 BP and the subsequent growth of major centers of "civilization" centered in what are now Greece, China, Mexico, Peru and North Africa, human terrestrial governance institutions grew exponentially in number and complexity. One of the most important of these is the notion of "private property", under which space and resources may be held, and their use dictated, exclusively by certain individuals or groups of individuals. The last 10,000 years of human history have seen the complete 'carving up' of terrestrial space and resources into "property", some of which is held in trust for aggregates of people under institutions called "governments", under the general term "public trust". Our cultural understandings regarding this "property" have been codified over time through "natural", Roman Civil, and English Common "Law" (Coastal States Organization, 1990; McCay, 1998).

Not so with the ocean. With few exceptions, until the late 1700s nation states did not even claim exclusive governance authority over any portion of the ocean (Eckert, 1979; Wilder, 1998). The exceptions were societies that depended heavily on ocean resources and were in the position to exert some form of control over the use of those resources. In the age of low technology this was not very common, and the reach of such societies did not extend very far

from shore. Even if a state claimed 'territory' or control over ocean resources, it was difficult if not impossible to enforce such claims. The areas in which such claims were most in evidence were in smaller, more enclosed, ocean areas such as the Mediterranean or North Seas, or in smaller, more remote insular areas such as the Pacific Islands (Johannes, 1982).

Thus, for the first millenium A.D. humans made small incursions into ocean space and nibbled at the ocean's resources, but did not have the technological ability to do more than that. In fact, as Roger points out in his 1969 *Scientific American* article (Revelle, 1969), during this period sea monsters regularly appeared on charts, and dire prognoses made for those who ventured too far towards the "ends of the earth". And, because they were not needed except in isolated cases, ocean governance institutions were virtually non-existent.

Emergence of the "Freedom of the Seas"

Long before fishing developed as a significant ocean use, merchant and military shipping were prominent (Revelle, 1969; Wenk, 1972). During the first half of the second millenium attempts were made by many countries and coalitions of countries to assert control over shipping. Beginning around the midpoint of the second millennium, large-scale attempts were made to 'carve up' the ocean in terms of shipping access. Under the Treaty of Tordesillas in 1494, Spain and Portugal made an attempt to divide up the world ocean between their two countries (Hollick, 1981; Wilder, 1998). This, of course, was far from being both universally agreed-upon by ocean-adjacent or ocean-using nations, and not even vaguely enforceable by the two countries themselves.

It was exactly this inability of any nation or group of nations to actually control ocean use or access that led, in 1609, to the treatise by the Dutchman Hugo de Grotius titled, *Mare Liberium*, or "freedom of the seas" (Wilder, 1998). Under the commonly accepted doctrine that developed pursuant to this treatise, the world ocean remained "open access, common pool", with no nation or group of nations controlling use or access. This system was presumably for the good of all nations, but was a bit disingenuous – they certainly would have controlled it if they could have! Combined with this doctrine was the notion of the ocean as a source of inexhaustible resources, the use of which need not be restricted. This also created, in essence, the exact opposite of the "precautionary principle".

This remained generally the situation until the late 1700s, when the new United States of America declared a three-mile Territorial Sea off its shores, the term "Territorial Sea" meaning the portion of the ocean that nation states have the right to treat as they do their land areas, with all the attendant rights and responsibilities (Wilder, 1998). Soon all ocean-adjacent nations had followed suit, and the first phase of the "ocean enclosure" movement, out to three miles, was complete.

In retrospect, one remarkable aspect of this declaration was that it did NOT include the notion of the use or allocation of ocean space and resources as private property outside of the public institutional domain. Rather, the declaration preserved both the notions of open access to all citizens of the state or nation and the idea that the resources of the ocean in that three-mile strip were "common pool", "owned" by all of the people of a given political entity and held in trust for them by their government. This is the critical notion of "public trust" space and

resources, as noted above. So, even though the three miles of the ocean was "enclosed", it was in the "public trust", not the private property, domain.[2]

Also remarkably, this three-mile limit remained in effect in the U.S. as the main ocean "enclosure" until 1945, when President Truman issued a Presidential Proclamation claiming the resources of the Outer Continental Shelf adjacent to our shore for the U.S. This Proclamation, later codified in the Outer Continental Shelf Lands Act of 1953, had the effect of extending the U.S. jurisdiction over certain ocean resources much farther than the traditional three miles, to the outer limit of the continental shelf. It was, however, not a "territorial" zone, but a resource control zone. That is, neither the Proclamation nor the Act extended the sovereign territory of the U.S., only its control over the use of certain space and resources for extractive purposes (Cicin-Sain and Knecht, 2000).

Two more major steps bring us to our current formal "enclosure" situation. The first was the passage by the U.S. Congress of the Magnuson Fishery Conservation and Management Act (now the Magnuson-Stevens Act, or M-SFCMA) of 1976. The M-SFCMA extended the jurisdiction of the U.S. over fishery resources to 200 miles. Most ocean-adjacent nations followed suit soon thereafter.[3] Then, in 1983, in part in reaction to the then-recently completed United Nations Law of the Sea Convention, President Ronald Reagan, again by Presidential Proclamation, declared a 200-mile Exclusive Economic Zone (EEZ) off the U.S. shores. This Proclamation – which has still not been codified by the U.S. Congress – has essentially turned a continental shelf and fishery resource jurisdictional system into an exclusive access system for all ocean and shelf resources within 200 nautical miles, including the water column itself. Again, most ocean-adjacent nations followed (and in some cases, led) suit (Cicin-Sain and Knecht, 2000)(Figure 1).

Thus, by the end of the second millenium the "ocean enclosure" movement had reached 200 miles out to sea, and farther in cases of continental shelves that exceeded that distance. To fully understand the context of this situation, however, we must recount a parallel and somewhat broader international discussion regarding ocean spaces and resources that began in the early 1900s.

Ocean Space and Resources in the Broader Perspective

Although merchant and military shipping had dominated ocean access discussions for most of the second millenium, in the latter part of that millenium extractive ocean uses became much more prominent. Ocean fisheries and offshore oil and gas, in particular, grew quickly in the wake of the industrial revolution of the 1800s, and by World War I extractive uses of the ocean had achieved the beginnings of their current – in some cases devastating – status. The technological advances of World War II completed this advance, and by the 1990s, for example, world ocean fish catches had leveled off in the face of ever-increasing fishing effort (Stone, 1997)(Figures 2,3). Offshore oil and gas, the other major extractive ocean use, continues to rise (Figure 4) as does world ocean shipping (Figure 5). Much of the demand for these resources, and the time lag in developing governance institutions regarding their use, was driven by the

[2] There are minor exceptions to this, having to do mostly with sessile resources such as shellfish and insular resources (McCay, 1998; Johannes, 1982).

[3] Certain nations had attempted to claim "extended" fisheries jurisdiction for many years, but it was the action of the U.S. government through the Magnuson Act that prompted the 'ripening' of the 200-mile fishery jurisdiction as commonly-accepted international law.

increasingly rapid increase in world human population (Figure 6) and the ubiquitous notion of the inexhaustibility of ocean resources (Huxley, 1883; Safina, 1998).

It was also clear, especially in the face of the "open access, common pool" character of ocean resources, that these issues had significant international dimensions. Not only are many of the resources of the ocean themselves mobile across national boundaries, but the human users themselves (fishermen, oil and gas activities, shipping) crossed those boundaries with increasing regularity as extractive technology (steam and diesel power, steel ships, radar, sonar, synthetic fibers, deep-sea engineering) developed. First with the League of Nations early in the 1900s; through the Treaty of Paris in the 1930s; the three United Nations Law of the Sea Conventions (UNCLOS) beginning in 1958; and finally in broader environmental discussions beginning in Stockholm in 1972 and continuing through Rio de Janeiro, Kyoto and Johannesburg, attempts have been made to further develop human governance institutions for ocean space and resources (Cicin-Sain and Knecht, 2000; Johannesburg Summit, 2002; Hollick, 1981;).

These discussions have all had a curious dimension, owing to the culturally defined "open access, common pool" nature of ocean space and resources. Humans have always treated ocean space and resources differently from terrestrial resources. From time to time "scientific" justifications have been given for this circumstance – for example, that many of the resources are mobile – but these "scientific" justifications ring a bit hollow when exposed to scrutiny. Many terrestrial resources, for example, are (or were) also mobile – often highly migratory. Because of the density and intimacy of the use of terrestrial resources humans developed the notion of "property" on land (including many "natural" resources such as forests and water), and governance institutions developed accordingly. There are, of course, categories of terrestrial or avian resources that under our governance institutions are formally called "wildlife", which generally are not subject to private property access (Bean, 1983). However, virtually all of the terrestrial space and resources have been divided up into "property" of either the private or public trust variety. This is opposed to the ocean, where even under the 200-mile EEZs some 60% of the ocean and its resources are "high-seas" and thus principally "open-access, common-pool". Because the density of human use of the ocean had not reached a high enough state, and because most people had not been exposed to life or conditions on or in the ocean, the "freedom of the seas" doctrine was allowed to remain.

One aspect of this distinction between land and sea became focused in the idea of ocean space and resources as the "Common Heritage of Mankind", a phrase coined by Arvid Pardo, the United Nations (UN) Ambassador from Malta, in a speech to the UN in 1967. That phrase, and a companion phrase, "the New International Economic Order", became common parlance in the third UNCLOS Convention (UNCLOS III) between 1973 and 1982 (Hollick, 1981; Wilder, 1998). These two phrases perpetuated the idea of ocean space and resources as different from the terrestrial; in particular, that they are and should remain "common pool", if not "open access". Significantly, however, they also advanced the notion that the governance of ocean space and resources should be institutionalized for the benefit of all humankind, not only those in ocean-adjacent nations or with ocean exploitation capability. More particularly, the idea was advanced that the benefits of ocean resources should be directed to those humans most in need of them on some sort of social equity basis, rather than simply to those with the ability to exploit them. This discussion remains prominent today, as evidenced recently in Johannesburg at the United Nations World Summit on Sustainable Development (Johannesburg Summit, 2002).

Throughout the UNCLOS III discussions, which lasted from 1973 until 1982, questions of the state of, and access to, ocean space and resources were debated hotly. In every arena from ocean science research, to fisheries, to merchant and military navigation, to issues of territorial

claims, questions of who should have access to which of the ocean's spaces and resources, under what conditions, were the central focus. In general, the "200 mile" rule was observed; this was the boundary to which nation-state claims would be limited. The area beyond 200 miles – the "high seas" – was an area in which there was a call for international cooperation, but no mandatory compliance except that exerted by nation-sates on their own citizens, perhaps through treaty arrangements among two or more nation-states (Hollick, 1981).

The one exception to this was the discussion of ocean mining. In this case, those supporting the Common Heritage of Mankind/NIEO made an effort to both extend the notion of resource control beyond 200 miles and to ensure the benefits of the exploitation of ocean minerals for the good of all humankind, not only those with exploitation capacity. This effort was only partly successful, with a very loose system of governance only now beginning to be developed for ocean minerals around principles somewhat different from those proposed in the 1982 UNCLOS Convention (International Seabed Authority, 2000). The attempt to construct ocean governance around the Common Heritage of Mankind principle, as evidenced in the UNCLOS ocean minerals discussions, was perhaps ahead of its time.

Who Owns the Ocean

As referenced above, some 60% of the ocean space lies outside of the 200 mile EEZ of individual nation-states. Within 200 miles there are three different states of governance. The first is the "Territorial Sea", now out to 12 miles (again, in the U.S., by Presidential Proclamation), within which the ocean is treated as sovereign territory of the adjacent nation as is the land (customs authority, etc.). The second is the area from 12-200 miles, which is officially classed as "Exclusive Economic Zone", within which access to resources is controlled by the adjacent nation.[4] The third governance situation involves resources that are migratory, meaning either common pool resources such as migratory fish or ships registered to individual nation-states that cross international boundaries in their travels. In the case of migratory fish stocks the governing institution is the Convention on Straddling Stocks, which places the burden for cooperation in conservation for such stocks in the hands of nations within whose jurisdiction the fish occur, or whose fishermen take them either within or outside of any national jurisdiction (Burke, 1994; Balton, 1996). In the case of shipping, the 1996 Protocol for the London Convention places a similar burden in the hands of the nations of registry of the ships, again either within or outside of national jurisdiction (Van Dyke, 2000).

Thus, in summary: 1) Shoreline to 12 miles, Territorial Sea; 2) 12-200 miles, Exclusive Economic Zone; 3) Outside of 200 miles, High Seas; and 4) Special provisions for migratory resources and shipping.

My basic argument is that all of human history evidences the division of space and resources into either public trust or private property as the density of use increases. This has clearly happened on land, and it is now also happening with the ocean. The main reasons we have not divided the entire ocean space and resources into either jurisdictions or property of some sort are essentially the same reasons that underlay the original "freedom of the seas" doctrine – that we are either:

[4] Since at least the 1930s there has been discussion of some form of "contiguous zone" adjacent to formal territorial or resource control zones within which some less formal controls are appropriate, but this phenomenon is not well-established.

1) ignorant of;
2) uncaring towards; or
3) perceive that it is either too costly or not possible to monitor or control

ocean space and resources beyond 200 miles.

It is useful in this regard to review the history of marine fisheries policy and management in the U.S. Until 1976 there was no effective federal management of marine fisheries. Virtually all management, with the exception of international treaties, was done by the individual states within 3 miles of their shorelines. There were various coordination mechanisms such as the Interstate Marine Fisheries Commissions initiated in the 1940s, but the basic management authority existed in individual states and their respective jurisdictions. And, until the advent of the Alaska Salmon Limited Entry system in the early 1970s, the management of marine fisheries had operated under an open-access principle. The Magnuson-Stevens Act created for the first time a uniform, authoritative marine fishery policy and management presence, and included a provision for the development of "limited access" systems. As of 2002, most of the major U.S. marine fisheries are under some form of limited access system. Some of these systems, termed generally "Individual Fisherman Quota" (IFQ) systems, create a form of property right of access to a certain portion of the fish harvest. These IFQ systems are controversial, in large measure because they introduce both the notions of restricted access and property rights to ocean spaces and resources (NRC, 1998). However, I submit that they are becoming ubiquitous for exactly the same reasons that terrestrial space and resources eventually came under some form of private property (Christy, 1996) -- increased density of human use.

The question is: *Should* ocean resources be different from the terrestrial -- in particular in the areas of access and property rights[5] -- and if so in what ways?

Are Ocean and Terrestrial Space and Resources Different From One Another, Such That Their Governance Systems Must Also Be Different?

I would suggest that there are three basic reasons that might be given to answer to this question in the affirmative. The first is that ocean space and resources are intrinsically different from the terrestrial. The second is that practical aspects of dealing with ocean space and resources justify, and perhaps require, a governance system different from those on land. The third is what I will call the "Cultural Preference Rule": That humans simply *believe* that ocean space and resources *should* be treated differently from those of the land, ideally for reasons that we can articulate clearly. Let us consider these three possibilities.

Are Ocean Space and Resources Intrinsically Different?

In the 1969 *Scientific American* articles in a special issue of that magazine focused on the ocean, Roger Revelle and his colleagues enumerated the distinctive features of ocean space and resources: Depth, density, fluidity, salinity, viscosity, organismal metabolism and mobility. The authors were not – with the exception of Roger himself – as concerned with the implications of these characteristics for human governance as they were for their exploration as science. That

[5] There is an important discussion regarding the difference between the concept of a "right" and the concept of a "privilege" (NRC, 1998). I use the terms "right" for simplicity here, although "privilege" may be the more appropriate term in many instances.

was the *forte* of Roger, Willard Bascom, John Issacs, Walter Munk, and the other contributors to that work. They were *explorers* of the ocean realm. They delighted in exploring and presenting the wondrous feature of the ocean. And, they were generally concerned with the use of science in exploitation of ocean resources.

Why would, however, these characteristics lead us to govern human behavior differently in the ocean realm? The atmosphere, also, has characteristics different from the land, and we have developed governance institutions for activities such as aircraft, radio transmission, satellites, air space and air pollution that mimic in principle governance institutions for terrestrial space and resources (Torres, 2001; Weiner, 1999a).

Take, for instance, migratory resources such as terrestrial and avian wildlife. In both cases – similar to ocean resources – the populations themselves are mobile across jurisdictional (including national) boundaries. For many of them we created a specific category with specific legal standing – *wildlife*. In the case of most if not all of these resources, we have developed a subsidiary cultural rule, translated into law, that allocates these resources to recreational, as opposed to commercial, harvest. For those resources that remain the realm of commerce, we have applied the notions of private property and developed appropriate governance institutions. For those we consider *wildlife*, we also develop elaborate governance institutions, including rules of access, and many of these institutions are robust across national boundaries (Bean, 1983; Holt and Lee, 1978). Why should we not do the same for ocean resources, throughout ocean space?

My conclusion, then, is that ocean resources are not *intrinsically* different from terrestrial or avian resources *from a governance point of view*.

Do Ocean Space and Resources Have Practical Management Conditions or Constraints?

It is certainly true that 100, or even 50 years ago technology and management systems did not exist to monitor ocean fish harvests, or the movements of merchant or military ships. It is also true that even now there may be humans who perceive the ocean and its resources to be 'inexhaustible'. I submit that neither of these circumstances is true today.

In the current era of computers, satellites and remote sensing technology there is no *technological* reason that we cannot monitor the movements of, if not detailed behavior aboard, every boat and ship in the sea. There are, of course, economic factors and issues of confidentiality and privacy involved, but no more so than on the land or in the air.[6] Although the ocean remains a difficulty biophysical space for humans to deal with, for the purposes of monitoring major ocean uses the technology is clearly available, as is the underpinning of a legal framework for their governance (Weiner, 1999b).

It is just as clear that the resources of the ocean are not inexhaustible. Obviously, oil and gas are non-renewable resources, and the main renewable ocean resource of which humans have taken advantage – fish – are clearly not inexhaustible based on the record of the last century of exploitation. This record is one of overfishing one fish stock only to proceed on to another, where the same record is repeated (Botsford et al, 1997; Garcia and Newton, 1994; Pauley et al,

[6] Secrecy among marine fishermen (Acheson, 1981) has generally been viewed as a culturally specific phenomenon that must be respected by governance institutions. The question, however, is given that they are harvesting a public trust resource for private purposes, why *should* they be allowed any more secrecy in their activities than timber harvesters or water users who are using public trust resources?

1998). I would like to believe that since the ubiquitous international passage of national fishery legislation in the 1970s we have begun to change that approach, but the record is still not clear.

So, the resources of the ocean are not inexhaustible and it is technologically possible to monitor – and control – human behavior in the major extractive or impacting (e.g., pollution from ships) ocean uses with sufficient resources applied to that end. The issue is not one of science or technology, but of political will.

The Cultural Preference Rule

Just as humans have developed special governance institutions for such categories of resources as wildlife (and, in the case of the U.S., even more particular institutions when concerning marine mammals), we could decide that ocean space and resources simply deserve (read "humans would prefer them") to be treated differently. In the governance sense, this is a premise of the Common Heritage of Mankind approach – that all humankind *should* share in some equitable way in the use of ocean resources in a way they do not with terrestrial resources, largely because of the existence of the pervasive notion of 'private property' on land which to a certain extent subverts equitable public purpose. There are, of course, overarching political, social and economic philosophies regarding this question, the discussion of which has reached across the millennia.

In a more practical vein, though, it may simply be a matter of *deciding*. The current discussion of the concept of Marine Protected Areas (MPA) is an example of this. In one sense the MPA discussion involves the best way to conserve or protect specific ocean resources or ecosystems, but in a larger sense the question is simply *how do we prefer to treat ocean space and resources?* This is akin to the questions that John Muir and Teddy Roosevelt asked about terrestrial resources -- these questions led to the establishment of the U.S. National Park system. Conservation, yes, but also aesthetics, existence value, perceptions of individual and societal well-being and all of the other concepts that have emerged as we have developed governance institutions for our cities, farms, forests rivers and wildlife (Miller et al, 1987). Why should we not ask these very same questions of ocean spaces and resources?

My own conclusion from this brief exploration of these issues is that ocean space and resources are not significantly different from the terrestrial and atmospheric *from the point of view of functionally appropriate governance institutions.* It is our own *cultural assumptions* that lead us to treat them differently.

The Future of Ocean Governance

In the end, the art may be not so much in coming up with specific answers as it is in simply asking the right questions. To those who maintain that complete freedom of navigation is important to commerce and the military – and thus the need for the continued "freedom of the seas" – I would point out that Marco Polo, Julius Ceasar and Hannibal probably said the same thing about *terrestrial* space and resources in their times. To those who point out that the application of current governance principles of terrestrial space and resources to the conservation of those resources, including access restrictions and property rights, has not been successful – witness large-scale deforestation and pollution – I would say that it is not the principles themselves that are at fault, but their application and implementation. And, "freedom of the

seas" in the sense that we currently treat our "high seas" is not the *application* of principle, but the *absence* of principle.

To lead us into the third millenium of ocean governance, I thus suggest three proactive principles upon which to proceed:

1) The enclosure of the world ocean. By this I do not mean that all ocean space and resources should become "privatized", but that a comprehensive system of governance institutions should be developed on the presumption that ocean space and resources are not different from those of the land or air except to the degree that we decide they *should* be. Just as they came to be considered on land and in the air, access and property rights and privileges should be considered for the ocean. The ocean is simply the newest area where the density of human use and exploitation capacity has become high enough to require a comprehensive governance framework using these concepts. Perhaps the model is the International Seabed Authority developed under UNCLOS for ocean minerals; perhaps it is the European Community's Common Fisheries Policy (European Union, 2002). Whatever the model, comprehensive governance – including monitoring, sanctions and enforcement by appropriate authorities – should be our goal.

2) The "precautionary principle" should become ubiquitous in all ocean governance. One of the most damaging effects of the long tenure of the "freedom of the seas" concept has been the *defacto* notion that governance rules were not needed because of humans' inability to cause significant detrimental effects on the ocean – the inexhaustibility hypothesis. The ocean's resources are clearly *not* inexhaustible and many, such as fisheries and coastal water quality, are clearly being used in a non-sustainable way. The adoption of a "precautionary principle" (Macdonald, 1995; Mangel et al, 1996) would be of significant assistance in correcting this misperception in areas such as ocean fishery management (Ecosystems Principles Advisory Panel, 1999; Hewison, 1996).

3) We should *reexamine* our overall cultural framework regarding ocean space and ocean resources, in particular as it regards aesthetic and non-consumptive dimensions. What portion of the world ocean should have the same status as Yosemite or Yellowstone? Paraphrasing Dr. Sylvia Earle's question, why are tuna, billfish and sharks not the lions, tigers and bears of the ocean, deserving of the same status as their terrestrial wildlife counterparts as specially protected elements of our planet (Earle, 1995)? How should we treat the 'environment' of the albatross, which is the world ocean itself (Safina, 2002)? The fact that we have not thought of ocean space and resources in this way is both and error of omission and commission. The error of *omission* is that ocean spaces and resources have been 'out of sight, out of mind' when they no longer need to be. The error of *commission* is that the doctrine of "freedom of the seas" has remained so long as our principal tenant of ocean governance (Van Dyke, 2000). We must develop, as I once termed it, a new "ocean ethos" (Borgese, 1998; Orbach, 1982).

This leads me back to Roger Revelle. Roger was very cautious about the "enclosure" of the oceans, in part because of concerns over freedom of scientific research and in part because he was a product of the culture of his time, a culture that valued highly the exact freedom and openness that have always been part of the appeal of the oceans. In the 1969 *Scientific American* article, for example, he wrote, "…the organization of human society into national states, which works, however imperfectly, on the land, is not well suited to the optimization of the sea," and that "The areas adjacent to the coasts in which coastal states exercise certain exclusive rights shall be as small as feasible…" (Revelle, 1969, p-65). That article was written a decade before

most nations (led by the U.S. – at first for fishery resources by the Fishery Conservation and Management Act of 1976 and later for all ocean resources by President Reagan's Exclusive Economic Zone Proclamation in 1983) extended their resource control zones to 200 miles, both of which were "authorized" under the 1982 Law of the Sea (LOS) Convention (Cicin-Sain and Knecht, 2000). Roger also wrote that,

> "The freedom of scientific research shall be kept inviolate. The exclusive rights granted to the coastal states shall not include the right to interfere with scientific research, provided that the coastal state is given prior notification of the plan to conduct the research, has full opportunity to participate in it and has access to all the data obtained and samples collected, and provided that the research does not deleteriously affect marine resources or other uses of the sea" (Revelle, 1969, p-65).

In this sentiment Roger was both prescient and recalcitrant; the principles he expoused were generally incorporated into the LOS Convention, although clearly under the exclusive authority of the "coastal states" (Hollick, 1981). Science is a 'use' of the ocean, subject to the same principles of fairness and equity as other uses.

Roger clearly viewed the ocean as a special environment; special because of its vastness, its beauty, its intrigue, and its importance both to humans in the use of its spaces and resources and in the biogeochemical processes of the planet. Whether his conservatism regarding the application of terrestrial governance to the ocean was warranted is something we will have to test as we experiment with new and different governance systems for ocean space and resources. We should go into this venture with an open mind, clear objectives, and with all the resources of technology, the social and natural sciences, and the history of the first two millennia available to us as we make the necessarily human value decisions governing human behavior and the world ocean.

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Previous Lectures

2001 *Ocean Exploration*

Dr. Marcia K. McNutt
President and CEO
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Abstract: The ocean is essential to life on Earth: it is Earth's largest living space and contains most of its biomass. The ocean moderates climate to keep Earth habitable, recycles our wastes, and provides an inexpensive source of protein to feed the global population. Yet 95% of the ocean remains unknown and unexplored. Now, thanks to a number of technological innovations, we have the tools necessary to undertake a systematic exploration of the ocean. Autonomous vehicles can be programmed to execute precise underwater surveys lasting up to weeks without pause. Remotely operated vehicles equipped with physical, chemical, and biological sensors function as our eyes, ears, noses, and hands in the deep sea. New data management systems permit the systematic archiving of information, allowing subsequent generations of researchers around the world to answer questions not contemplated at the time the data were collected.

Much has been learned about the oceans through traditional research programs. But research is different from exploration. While research attempts to find answers, exploration inevitably uncovers new questions. Ocean exploration brings great, but often unpredictable, rewards: cures for diseases from novel biological compounds, untapped mineral, energy, and biological resources, new insight into how the ocean functions, geological and biological vistas of unsurpassed beauty, and renewed appreciation for mankind's maritime past. The time is ripe to launch a major, international program of ocean exploration with all the benefits it will bring.

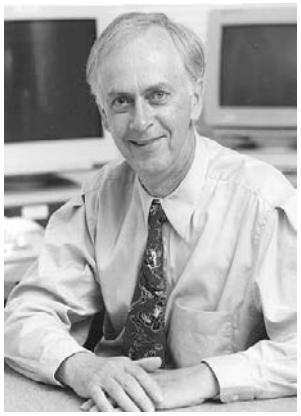
2000 *The Oceans and Human Health: The Discovery and Development of Marine-Derived Drugs*

Dr. Shirley A. Pomponi
Director, Division of Biomedical Marine Research
Harbor Branch Oceanographic Institution

Abstract: The oceans are a rich source of both biological and chemical diversity. During the past two decades, thousands of novel, marine-derived biochemicals have been identified. Many have the potential for development as new pharmaceuticals to treat diseases such as cancer and drug-resistant infections. The challenges facing continued discovery are both technical, such as developing new tools to explore habitats and collect and test organisms never before studied, as well as political, such as complying with regulations related to the rights of a country to its natural resources. Successful discovery and development of marine-derived pharmaceuticals will depend on our ability to address a number of questions. What organism produces the "bioactive" compound, and why? Can we apply this knowledge to our rapidly increasing understanding of the human genome and human disease processes? Are there viable alternatives to harvesting for sustainable use of marine natural resources for drug development? And finally, what constitutes a fair and equitable sharing of revenues resulting from commercialization of marine resources, as mandated by the U.N. Convention on Biological Diversity? Addressing these questions will require the collaboration of marine and biomedical scientists and the cooperation of industry and government.

1999 *Contemplating Action: Storing Carbon Dioxide in the Ocean*

Abstract: Concerns about global climate change suggest that we should level off, or even decrease, atmospheric carbon dioxide. Recent advances in ocean science hint at the possibility of taking active steps to achieve this. Experiments have shown that it is possible to inject carbon dioxide directly into the deep ocean, where it forms a solid gas hydrate. Other options have also been explored, such as fertilizing seawater to speed up the growth of microscopic plants that consume carbon dioxide. If we want to hold carbon dioxide levels steady, large interventions will be necessary. Is this even possible? And would there be unforeseen environmental consequences? Forty-two years after Roger Revelle's analysis of "the greenhouse" problem, society may be ready to take action through active use of the enormous buffering capacity of the ocean.



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