

Historical Perspectives

G. Carleton Ray and Frank M. Potter, Jr.

(born 1928 and 1932)

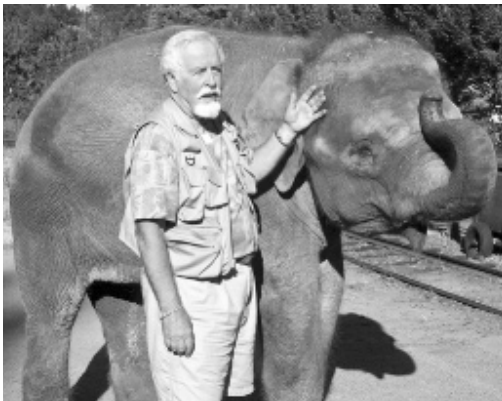
G. Carleton Ray, Ph.D., has focused most of his nearly 60-year career on a crossdisciplinary approach to coastal marine research and conservation from an ecosystem perspective. Ray completed his B.S. from Yale University in 1950, his M.S. from the University of California, Berkeley, in 1952, and his doctorate from Columbia University in 1960; all of his degrees were in the discipline of Zoology. He studied herpetology, ichthyology, the central roles of natural history, and physiological ecology, and he has engaged in research and conservation in polar, temperate, and tropical environments, as well as in marine mammal acoustics, coastal and estuarine ecology, biogeography, biodiversity, and conservation science. Ray helped to establish the Bahamas National Trust and the world's first land-and-sea park in the Exuma Cays. He served on the initial Committee of Scientific Advisors of the Marine Mammal Commission. Ray chaired the Marine Steering Committee of the International Union for Conservation of Nature and Natural Resources (IUCN) in the mid-1970s, which was the first major international effort in marine conservation. He also took part in early development of the concept of Biosphere Reserves for UNESCO's Man and the Biosphere Programme (MAB). As a result, Ray served on the U.S. MAB's first Biosphere Reserve Directorate and the Coastal



G. Carleton Ray (Photo courtesy of John Anderson)

Marine Ecosystems Directorate. More recently, he helped initiate the marine portion of the IUBS/SCOPE/UNESCO *Diversitas Programme*, while serving on the U.S. National Committee for the International Union of Biological Sciences. In addition to being active in governmental and nongovernmental organizations, as well as local, national, and international policy, Ray worked to inform members of the general public about coastal-marine natural history and conservation policy via papers, books, radio, and television appearances. He has authored/co-authored more than 300 scientific and conservation papers and reports, popular articles, and several books.

Frank M. Potter, Jr. graduated with his A.B. from Hamilton College in 1954 and obtained his Juris Doctorate from the University of Chicago Law School in 1957. Potter spent his career focused on issues related to understanding and protecting our natural environment and natural resources (including the U.S. National Marine Sanctuary Program), as well as by being involved in energy policy issues for the U.S. Much of Potter's career revolved around politics and policy. He founded the Environmental Clearinghouse in Washington, DC, in 1968 and later held staff positions on two House Committees and served as Executive Director of a Senate-sponsored conference on



Frank M. Potter, Jr., and Chendra

international environmental issues. In addition to his Congressional subcommittee work related to the Marine Mammal Protection Act, Potter was responsible for organizing and staffing the first House subcommittee with comprehensive jurisdiction over energy policy. He developed studies, hearings, and legislation on national long-range energy policy, requiring and producing effective cooperation with Executive Branch agencies within Administrations with widely differing policy objectives. He proposed and supervised a complete reorganization of the House Committee on Energy and Commerce. This reorganization involved restructuring and focusing new systems of quality control for one of the largest staffs in Congress. Included in this process was the creation of an experimental, and ultimately adopted, system for gathering, organizing, and disseminating information to the Members and staff. Potter also developed a series of workshops and seminars related to enhancing the use of foresight within the executive and legislative branches of state and federal governments. Elements of this process were subsequently incorporated within processes of Congress, the National Security Council, and the White House. Potter has authored numerous reports and remains active in environmental stewardship.

The Making of the Marine Mammal Protection Act of 1972

G. Carleton Ray and Frank M. Potter, Jr.

E-mail: cr@virginia.edu and fpotter@mac.com

Preamble

The 1960s was a critical time for the flowering of the world's environmental concerns, particularly in the United States. At the end of that definitive decade, the Marine Mammal Protection Act was near the top of the political agenda in Washington politics. Frank Potter¹ was in the right place to help the Congress assert a leading role to establish the Act, and Carleton Ray,² Kenneth Norris,³ and William Schevill⁴ were in positions to make scientific information available to lawmakers. All this came about through serendipitous circumstances, which this paper is intended to explain.

First, we outline the major attributes of the Act as signed into law in 1972, thus becoming a major contributor to the emergence of national wildlife law. We then provide a zeitgeist for the Act, contrasting scientific efforts to develop an international, scientific Marine Mammal Program with urgent social concerns for marine mammals. In this context, some members of Congress were seeking new solutions for conservation and management; neither emotive appeals nor traditional management advanced that goal.

It is not our purpose to review the marine mammal science of the time, nor to examine legal or social complexities. Nor do we analyze the several thousand pages of testimony on marine mammals placed before Congress, nor examine the later activities of the Marine Mammal Commission (Hofman, 2009). Rather, we are primarily concerned with how ecological science became entrained into the MMPA's language, despite considerable controversy, with concluding reflections on the Act's influential, and sometimes unintended, consequences.

Unfortunately, we have lost major contributors to this history, notably Ken Norris and Bill Schevill, who participated in all these endeavors, and also those who joined Ray in attempts by the Marine Mammal Council⁵ to develop the Marine Mammal Program. Fortunately, records of our activities, as well as Congressional hearings and historical writings, are preserved in the Smithsonian Institution Archives (Record Unit 7227) and are freely available to scholars. This paper is based on that archival material, and on personal notes and recollections, to present a living history in the making of the Marine Mammal Protection Act.

Setting the Stage

The Marine Mammal Protection Act (MMPA) (Public Law 92-522) passed, despite sometimes-contentious testimony, without significant opposition or debate by both the House of Representatives and the Senate and was signed into law on 21 October 1972. It joined a number of laws enacted during the late 1960s and early 1970s in response to environmental issues that caught public attention.⁶ At the time, marine mammals, more than any other group of animals, had aroused public awareness and protest, which, in turn, forced Congress to act. The MMPA took a bold step and broke new ground in the process:

- It called for a moratorium on the taking and importation of marine mammals and marine mammal products, except under permit.⁷
- It required a science-based ecosystem approach for conservation and management.
- It established the concept of *optimum sustainable population* (OSP) for marine mammals as significant functioning elements of ecosystems and placed *ecosystem health* as a first priority.
- It adopted a *precautionary approach* by shifting the burden of proof to the user, thereby restricting human intervention where such actions might otherwise disadvantageously affect species or populations of marine mammals.
- It established a Marine Mammal Commission and a Committee of Scientific Advisors on Marine Mammals to review activities of, and make recommendations to, agencies responsible for marine mammal management, and would then report results directly to Congress.

Four general features of the Act are particularly significant. First, the Act bridged science and management⁸ in order to force consideration of new ecosystem-based approaches toward conservation and utilization of marine mammals, thereby directly confronting failed, or at best inadequate, past conservation and management practices. Second, it designated marine mammals as *wild-life* (see discussion below) rather than resources for the taking. Third, it opened conservation and management practices to public scrutiny and full accountability (the Freedom of Information Act did not yet exist). Fourth, and most important,

in a political atmosphere charged with emotion, it brought scientists and policymakers together to formulate marine mammal policy. Unexpectedly, it compromised various states' conservation and management plans involving marine mammals. The MMPA became the principal law for guiding marine mammal conservation and management policy, and one in which the public became directly involved. As such, it exemplifies a nexus among the potentially conflicting cultures of science, management, users, and the public.

Two major factors permitted this significant and unprecedented step to be taken: (1) recognition by Congress of the need for better science to guide management and (2) the political power of the U.S. public. The oceans were rising in importance for resources, economics, and public participation. A *marine revolution* was intensifying nations' needs to exploit energy and fishery resources, increase maritime transport, secure national defense, initiate environmental education, and accommodate recreation (Ray, 1970). For the first time in human history, the invention of SCUBA (Self-Contained Underwater Breathing Apparatus) allowed large numbers of the public to observe marine life directly in the natural environment. Also, new ways of thinking about systems science were emerging. The International Geophysical Year (IGY, 1957-1958) inspired the International Biological Program (IBP, 1962-1974), which included large-scale regional programs. Concurrently, marine mammal science was maturing after World War II, in particular regarding research on natural history, acoustics, cognition, and diving physiology.

Perhaps the essential element with regard to the MMPA is to be found in the realization within portions of scientific and regulatory communities that fundamental changes were required to revise resource management approaches that no longer seemed to work as they had been designed. This was coupled with a willingness on the part of legislators and legislative staffs to seek new ways to approach these challenges. The creation of a cabinet-level Department of the Environment was being considered to unify environmental responsibilities that were spread throughout a host of state and federal agencies; one example was a split in marine mammal authority between the Departments of Interior and Commerce. Public pressure forced legislators to gather all the information they could on marine mammals, the better to address the scientific, conservation, and management issues that had surfaced. By 1971, 42 different, often repetitive and redundant, marine mammal bills had been introduced in Congress—36 in the House and the rest in the Senate—more than on any other environmental issue of the time, according to Congressional records.

In short, the MMPA was intended to shift the traditional focus of marine mammal management from using or managing species for the convenience and benefit of its human managers to the health and integrity of ecosystems on which its constituent species depend. Inherent in that shift was the unspoken premise that a “hands-off” policy was preferable unless existing conditions dictated otherwise—that is, adoption of the *precautionary principle*. This principle has deep historical roots, but more recently arose from the “Rio Declaration” of the 1992 “Earth Summit,” that scientific uncertainty should not preclude measures to protect the environment—that is, the user should bear the burden of proof. Other features of the Act were less clear. For example *optimum* (as in OSP) may imply multiple, possibly conflicting values or variables that may be taken into consideration when determining a desired sustainable population level. Furthermore, a *healthy* ecosystem can be difficult to define, although ecologists have suggested vigor, resilience, persistence, and ecological organization as indicators. However, it would not have been appropriate for the Act to give explicit definitions and “marching orders.” Such legislation as the MMPA is intended to set a framework on which agencies could act and courts interpret.

The *intent* of the MMPA, as opposed to the letter of the law, was to raise the discussion, as well as the application, from past reductionist approaches to conservation and management of marine mammals to taking account of what was then becoming known of the dependency of species on ecosystem function and condition. Specific directives in legislation are almost always complex, vague, or worse, and the MMPA that passed Congress contained some of those attributes. Nevertheless, the Act represented “a major departure from the regulatory scheme it replaced” (Bean & Rowland, 1997) as it was purposefully intended as a sharp break from simplistic terms and models for single-species management, notoriously maximum sustainable yield (MSY), which in its purest form “focuses solely on the effects of a given harvest level on the ability of the stock to replenish itself” (Bean & Rowland, 1997).

Zeitgeist for the Ensuing Debate

The MMPA's legislative initiatives were directly relevant to the continuing evolution of wildlife law. Roman law set the precedent; *ferae naturae* were regarded as property of no one, like the air or oceans (Blumm & Ritchie, 2005). Yet wild animals could become the property of anyone who captured or killed them, except in the case of a private landowner who had “the exclusive right to reduce to possession the wildlife on his property” (Bean &

Rowland, 1997). As this form of law evolved and as royal lands expanded, only kings and royalty, or those people with franchises, were allowed to hunt or fish. By the time of the American Revolution, the British King and Parliament had complete authority to determine what rights others might have on the taking of wildlife in terms of a *public trust*. After the American Revolution, the people themselves became "sovereign," with a growing desire to utilize and protect natural resources, which often conflicted with private property rights (Caspersen, 1996). A seminal U.S. case, *Martin vs. Waddell* in 1842, concerned property rights over oyster beds in New Jersey; the final ruling resulted in the people's power to hold navigable waters and the soils under them (the benthos) for their common use, and thus was born the U.S. version of "public trust" under state jurisdiction (McCay, 1998). It was not until the Lacey Act (1910) that federal wildlife regulation, with its central mandate to prohibit interstate transport of any wild animals or birds killed in violation of state law, was enabled through power over interstate commerce to aid enforcement of state game laws (Anderson, 1995). Until the 1960s, only migratory birds fell under federal law by virtue of the Migratory Bird Treaty Act (1918). The Endangered Species Preservation Act (1966) and the Endangered Species Conservation Act (1969) signaled renewed interest in a federal presence in wildlife preservation. By this time, federal constitutional authority had come to reside in three sources: (1) treaty-making power, (2) property power, and (3) commerce power. Under the Constitution, those powers provided support for precedence of federal law over state law, and wildlife law became recognized as distinct from environmental or natural resource law (Bean & Rowland, 1997).

Wildlife law was finally becoming established at almost exactly the time of the MMPA's development. The intense debate that ensued was predominated by three contrasting perspectives (Bean & Rowland, 1997). First, some scientists and traditionalists thought that marine mammals provided important commercial and food resources that could be used sustainably, given proper regulation and management. Second, other scientists and conservationists thought the first priority should be conserving the ecological roles played by marine mammals in their ecosystems. Third, still others stressed marine mammal intelligence, especially that of cetaceans, and argued that marine mammals should be placed off limits for any human use. Unanimity on these widely different perspectives was difficult to achieve. Instead, Congress was faced with forging a compromise among the seemingly irreconcilable views of traditional managers, environmentalists, protectionists, and the scientific community.

The 1960s was also a transformational period for *environmentalism*, which began to influence both law and society (Coglianese, 2001). A wide array of organizations dedicated to protecting the earth and its living inhabitants represented a rising tide of environmental awareness, which was being translated into law (Caspersen, 1996). Graham (1999) summed it up this way: "In 1965 the environment was not a leading issue. Five years later it was the national problem Americans said they worried about most, second only to crime. Earth Day 1970, celebrated just as that crescendo in public concern was reaching its peak, became the lasting symbol of past frustrations and future hopes."

This social zeitgeist was reflected in particular by concern for the exploitation and depletion of marine mammals; some species even appeared to be on the brink of extinction (e.g., manatees, large whales). A host of nongovernmental organizations (NGOs) were formed, dedicated to the cause of halting marine mammal exploitation, but with diverse, conflicting sets of values and objectives and too often lacking in scientific understanding (see testimony below). Various groups mounted protest campaigns against whaling, the clubbing of seals, dolphins caught in tuna purse-seine nets, and capturing and maintaining marine mammals in inadequate public display facilities. An extreme "protectionist" fringe was whipping itself into a froth, calling for a complete halt to the taking of any marine mammals (*taking* being translated as any form of killing, capture, harassment, public display, or even research). Marine mammals were joined in a "perfect storm" about whether they were to be managed for human use in the context of their (often degraded) ecosystems, or on ethical and moral grounds to be placed under complete protection. This conflict became apparent in testimony before Congress (see discussion below), which was typified by insufficient agreement among scientists, managers, industries, and the public about what conservation was all about. But despite extremes of opinion, the conservation issues were the same. Responsible government agencies struggled with quotas for commercial and traditional users (whalers, fishermen, sealers, Native Americans, and the public) while acknowledging that long-term sustainability of valued species was not being attained. Furthermore, the problem of jurisdiction arose as to ownership of, or responsibility for, transboundary species among states or in the open ocean.

The International Whaling Commission (IWC) came under particularly harsh attack for its perceived failure to stop excessive commercial taking and depletion of virtually all species and populations of great whales. Its creation was "an achievement of considerable statesmanship," but even so, it had little power to implement, enforce,

and monitor whaling activities (Gambell, 1999). Although the IWC had completely protected certain (already depleted) species, designated whale sanctuaries, and set limits and seasons, the ugly fact was that the whaling industry continued to dominate IWC deliberations. Controversy raged within the IWC itself over quotas (Smith, 1983; Burns, 1997; Gambell, 1999). In 1961, the IWC appointed a special committee of three (later to become four) experts in population dynamics, its members chosen from countries not then engaged in pelagic whaling in the Antarctic, to conduct an independent analysis of whale stocks and to make appropriate recommendations to the IWC. The committee brought newly developed mathematical methods and techniques, originally designed for fisheries assessment, into the analysis of whale stocks—that is, MSY, defined as the maximum level at which a natural resource can be routinely exploited without long-term depletion. In 1963, the IWC committed to a drastic reduction in quotas and to rigorous analysis of catch data and biological information to determine the level of yield that whale stocks could sustain (Gambell, 1999). In the 1970s, the IWC adopted a “new management procedure” that divided species into *initial management stocks*, *sustained management stocks*, and *protection stocks*, all gauged by how near or far the stocks were from MSY levels. These commitments did little to resolve the situation, either socially or scientifically, and whaling continued at high levels. Increasingly, it became apparent that fisheries-oriented population dynamics models were inappropriate for whales. Finally, in 1982, under increased international public pressure, the IWC set a pause in commercial whaling. But what was most obviously needed was a better understanding of whales in the oceans, as well as a *new* management procedure.

Other marine mammals were also of concern. Manatees (*Trichechus manatus*) were depleted in Florida and elsewhere, and several species of small cetaceans that venture into brackish and fresh waters near human settlements were under threat from urbanization and development. Alarming numbers of porpoises were victims of fishery practices of Pacific tuna purse-seine fleets, which sought out large schools of porpoises, as many as 1,500 in number, that frequently occurred above schools of yellowfin tuna. Catching the tuna involved deploying a seine around the school, then drawing the seine in and inadvertently capturing dolphins that, unless released, would become entangled and drown. Some estimates of annual dolphin mortality were up to 200,000 annually for the eastern tropical Pacific Ocean alone. The future of the U.S. tuna industry was at stake as were dolphin populations (Gosliner, 1999).

Pinnipeds raised similar concerns. Pacific walrus (*Odobenus rosmarus divergens*), traditionally taken chiefly by Alaska and Russian Natives for ivory, food, and hides (Krupnik, 1993), were unprotected by federal law. The State of Alaska had taken action to regulate the Native subsistence take of walrus but did not curtail this activity as aggressively as some thought necessary. For polar bears (*Ursus maritimus*), concerns were widely expressed about U.S. trophy hunting. A popular technique was to find the bears by airplane and drive the exhausted animals to a place where another plane had left the hunter—scarcely sportsmanlike but certainly effective if the chief objective was a bearskin. No federal law regulated this activity at that time; only Alaska had any jurisdiction and then only to the offshore three-mile limit.

The strongest, or at least loudest, concerns arose from those who opposed the taking of northern fur seals (*Callorhinus ursinus*) on the Pribilof Islands, Alaska, and on the Commander Islands of Russia, an activity with a long history (Roppel, 1984; Scheffer et al., 1984). Harvest of fur seals was managed under the International Convention for the Conservation of North Pacific Fur Seals of 1911 (Fur Seal Convention), a binding international agreement between the United States, the USSR, Canada, and Japan, restricting the taking of fur seals to land-based operations, and also providing protection for sea otters (*Enhydra lutra*). This Convention proved to be a success story, stopping pelagic sealing and allowing the fur seals to recover dramatically to high population numbers. The sea otters, too, recovered in much of their historic range. Nevertheless, taking fur seals for the fur trade was strongly contested. Most scientists and wildlife managers thought that abolishing the Convention would mean a return to pelagic sealing (killing fur seals at sea), resulting in the same high losses that had almost destroyed the species in earlier years. Similarly, the annual harvest of harp seals (*Pagophilus groenlandicus*) in the Canadian North Atlantic, over which the United States had no jurisdiction or legitimate voice, met with strong opposition by protectionists concerned with killing seal pups. Both fur seals and harp seal pups were taken by clubbing the young for the fashion world. Both industries took immediate defensive action. Newspaper reports, accompanied by photographs, triggered public protests. For fur seals, the issue was straightforward as the taking was purely commercial. But for harp seals, the issue was more complex as sealing was also part of the maritime culture of Canada and other North Atlantic nations since some meat is also used.

These events and concerns, often expressed in impassioned letters to Congress from concerned constituents (and voters), created an environment

that, to Congressional eyes, seemed compelling: *Do Something! Now!* While many scientists might have agreed with that conclusion, scientific and social solutions diverged.

The Proposed U.S. Marine Mammal Program

As momentum for protecting marine mammals increased during the 1960s, marine mammalogists were independently advancing their studies, largely immune from the controversy. Of more consuming interest to them were shifts occurring along biological, theoretical, technological, and logistical pathways. Systems science was emerging out of a law of ecology that "we can never do merely one thing" (Hardin, 1972, p. 38). Satellites that could view whole swaths of Earth and computers capable of analyzing large regional datasets were being developed. Thus, for the first time, real-world, real-time peeks at whole regional ecosystems and their dynamics at multiple scales became conceptually possible. This was an exciting period for science, and marine mammals were not isolated from these developments; more and more, scientific interest became focused on their place in nature.

At the same time, oceanaria and aquaria were being expanded to the delight of the public, while also providing unique opportunities for research. The First International Symposium on Cetacean Research, held in Washington, DC, in 1963, brought together scientists; agency representatives; and others involved in research, conservation, management, and the display of cetaceans (whales, dolphins, and porpoises). The results were published three years later (Norris, 1966). In his preface, Norris noted that "whaling had become dependent on science . . . public oceanariums have focused both public and scientific attention on the remarkable attributes of the smaller odontocete [toothed] cetaceans . . . civilized society has become scientifically minded . . . [and] marine mammals have emerged as intriguing subjects from a variety of new and unexpected viewpoints." A number of research efforts and summary volumes of the knowledge of the time followed this conference, including Ridgway (1972), covering basic biological and medical knowledge of the time.

These activities inevitably led to new associations of researchers concerned about marine mammal associations with their native environments. The seminal work of Schevill and William A. Watkins on dolphin vocalizations led Ray to invite them to the New York Aquarium to look into pinniped vocalization (Schevill et al., 1963). Norris and Ray were drawn together by common interests in herpetology and fishes as well as marine mammals, Norris as curator of Marineland of the Pacific and Ray as curator at the New York Zoological Society's (now the Wildlife Conservation Society)

New York Aquarium. Soon, thoughts among Schevill, Norris, and Ray evolved about developing a programmatic approach for marine mammal research, thinking we might learn a whole lot more through the integration of disciplines.

Coincidentally, in 1962, the International Biological Programme (IBP) had initiated a decade-long research program dedicated to ecosystem-based research, emphasizing global *biomes*,⁹ the U.S. portion of which was intended to be supported by the National Science Foundation (NSF).¹⁰ While marine mammals hardly comprise a biome, we concluded that they emphatically are important players. We even thought, contrary to traditional oceanography of the time, that marine mammals and other predators might exert top-down influences, even controls, on coastal and marine ecosystem structure and function. Thus, with the cautious approval of Schevill and Norris, Ray contacted the U.S. National Committee of IBP (US/IBP), which, it turned out, thought well of our intent. Internationally, we were to work with Professor Max Dunbar of McGill University, Canada, who was the Director of the Marine Productivity (PM) component of IBP. Max expressed enthusiasm and, as a result, marine mammals tentatively became an IBP initiative, pending submission of a formal proposal satisfactory for funding by NSF.

We soon found, much to our surprise, that an IBP Marine Mammal Working Group (IBP/MMWG) already existed and had proposed that IBP could serve communicative and coordinative functions among the several groups worldwide that were concerned with marine mammals¹¹—a tall order, totally dependent on grant success! Clearly, IBP offered the best current opportunity for national and international scientific marine mammal endeavors; hence, Dunbar asked Ray to coordinate the MMWG (Table 1). By November 1968, we three, joined by Charles O. Handley, Jr.,¹² had developed a brief concept proposal for IBP review at national and international levels, portions of which are worth quoting:

Current research on marine mammals in the fields of systematics, behavior, physiology, acoustics, and anatomy is urgently in need of expansion and integration so that an intelligent approach to this major resource may develop on a national and international level. The IBP offers the best opportunity to gather together research-oriented mammalogists into a comprehensive, international, and non-political program. The U.S. program will initially establish a Marine Mammal Coordinating Council to integrate existing programs and to encourage new programs. It will aid to develop a Marine Mammal Study

Table 1. IBP International Marine Mammal Working Group

Membership	
Dr. Anelio Aguayo L. Departamento de Oceanologia Universidad de Chile Vina del Mar, Chile	Dr. Richard M. Laws British Antarctic Survey Monks Wood Experimental Station Huntingdon, England
Dr. J. L. Bannister Western Australian Museum Perth, Australia	Dr. Arthur W. Mansfield Arctic Unit Fisheries Research Board of Canada Ste. Anne de Bellevue, Quebec
Dr. Peter B. Best Division of Sea Fisheries Cape Town, South Africa	Dr. Masaharu Nishiwaki Ocean Research Institute University of Tokyo Tokyo, Japan
Dr. M. C. Crawley Department of Zoology University of Canterbury Christchurch, New Zealand	Dr. G. Carleton Ray, <i>Coordinator</i> Department of Pathobiology The Johns Hopkins University Baltimore, Maryland
Dr. H. Dean Fisher Department of Zoology University of British Columbia Vancouver, BC, Canada	Dr. Vladimir Sokolov Institute of Evolutionary Animal Morphology and Ecology USSR Academy of Sciences Moscow, USSR
Dr. John A Gulland, <i>Observer</i> UN Food and Agriculture Organization Rome, Italy	Dr. Willem L. van Utrecht Zoologisch Laboratorium der Universiteit Amsterdam, The Netherlands
Dr. Sidney J. Holt, <i>Observer</i> Office of Oceanography UNESCO Paris, France	Dr. Raul Vaz-Ferreira Departamento de Zoologia Vertebrados Universidad de la Republica Montevideo, Uruguay
Dr. Åge Jonsgård Institutt for Marin Biologi A&C Oslo, Norway	

Center for specimens and data sorting at the Smithsonian Institution . . . and it will cooperate closely with several other phases of the US/IBP (phenology, human adaptability, biogeography of the sea, conservation of ecosystems, etc.). . . . Most of the studies of marine productivity have been focused on the base of the trophic structure, but most of the exploitation has been at the top. . . . This exploitation has been for the most part biologically blind, with the result that population after population has been depleted. . . . The avoidance of duplication of these past mistakes requires not only good intentions, but also sound information about a fauna within its ecosystem, the knowledge of which lags a century behind that of terrestrial mammals.

The US/IBP Coordinating Committee agreed to this approach. Max Dunbar also encouraged us to examine marine mammals within the system in which they live by, "placing stress on the interrelationships between these species, their ecosystems, and the effects of and on man" (pers. comm., 1971).

The inclusion of marine mammal research within the IBP having been secured, the second order of business was formulation of a US/IBP "Council" (Table 2) for program development. Soon thereafter, on 1 March 1971, the IBP Marine Mammal Program came into existence with an NSF planning grant of \$67,000, allowing for support of the Council, a newsletter, encouragement of individual research programs, promotion of a Marine Mammal Study Center, office functions, and hiring of an Executive Secretary. Suzanne Contos (née Montgomery)¹³ became our Executive

Secretary and lost no time in producing the *Marine Mammal Newsletter*, No. 1, in April 1971, presenting the US/IBP organization and purpose to a long list of U.S. marine mammalogists, and encouraging them to join in:

It is important to recognize the unique characteristics of the US/IBP and of the Integrated Research Projects, which are at its core. The IBP focuses on intensive study of large-scale systems or problems, larger than any studied comprehensively before. It uses a coordinated, multi-nation interdisciplinary approach and emphasizes the changing inter-relationships between man and his environment. Thus, central management is vital in

the development of the IBP program, and it is for this purpose that this initial grant has been awarded.

A few ideas soon germinated, and some tentative proposals arrived. But then a noteworthy interruption occurred.

The Whale Problem

During the 1960s, conservationists had become outraged by the lack of progress by the International Whaling Commission for controlling whaling, and they were not the only ones. Various agencies (notably the U.S. Department of the Interior) and some scientists thought that members of the IWC Scientific Committee, as well as its critics,

Table 2. US/IBP Marine Mammal Council (*Marine Mammal Newsletter*, No. 1, April 1971)

Executive Committee	
Dr. G. Carleton Ray, Program Director Department of Pathobiology The Johns Hopkins University Baltimore, Maryland	
Dr. Kenneth S. Norris The Oceanic Institute Oahu, Hawaii	
Mr. William E. Schevill Woods Hole Oceanographic Institution Woods Hole, Massachusetts	
Dr. Charles O. Handley, Jr. Division of Mammals National Museum of Natural History The Smithsonian Institution Washington, DC	
Dr. George A. Bartholomew, Jr. Department of Zoology University of California Los Angeles, California	Dr. Francis H. Fay Arctic Health Research Institute University of Alaska Fairbanks, Alaska
Mr. John J. Burns Alaska Department of Fish & Game Nome, Alaska	Mr. Karl W. Kenyon Bureau of Sport Fisheries & Wildlife Sand Point Naval Air Station Seattle, Washington
Dr. William C. Cummings Naval Undersea Research and Development Center San Diego, California	Dr. Clayton E. Ray Department of Paleobiology National Museum of Natural History Smithsonian Institution Washington, DC
Mr. William E. Evans Naval Undersea Research and Development Center San Diego, California	Mrs. Suzanne M. Contos Executive Secretary

should meet openly together. Thus, the idea for a global gathering on the issue of whaling arose. On 24 November 1970, U.S. Secretary of the Interior Walter J. Hickel announced, as he placed eight commercially sought-after species on the U.S. Endangered Species List, that an international meeting of leading cetologists would be called to consider the plight of the great whales. The organizers, as well as agencies and other donors, agreed to the U.S. position that we would take no stand at this time whether marine mammals should or should not be utilized, as this is a decision for society at large. And, as scientists, we agreed that utilization cannot be based on the state of ignorance that now persists. Soon after receiving NSF support, our nascent

US/IBP became overwhelmingly engaged in organizing and managing The International Conference on the Biology of Whales, 10-12 June 1971, at Skyland, Shenandoah National Park, Virginia. This so-called "Skyland Conference" was supported by a number of agencies and conservation organizations.¹⁴ Thirty-four participants and observers from ten countries participated; Russian cetologists were invited but did not attend (Figures 1 & 2).

One major focus of that meeting, and a major *cause célèbre* of fisheries management of the time, was the concept of *maximum sustainable yield* (MSY), adopted, quite inappropriately its critics thought, for whales by the IWC (see above). Oceanographers, notably Max Dunbar, saw

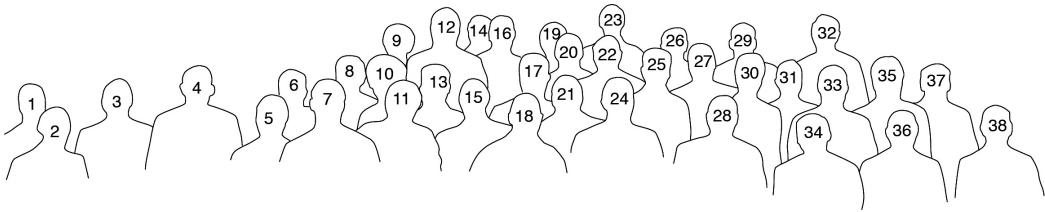


Figure 1. Participants of the Skyland Conference: (1) Douglas G. Chapman, U.S.; (2) Dale W. Rice, U.S.; (3) Clyde Jones; (4) Scott McVay, U.S.; (5) Victor B. Scheffer, U.S.; (6) not identified; (7) Raúl Vaz-Ferreira, Uruguay; (8) Yoshio Fukuda, Japan; (9) Roger S. Payne, U.S.; (10) not identified; (11) Edward D. Mitchell, Canada; (12) Peter B. Best, South Africa; (13) Seiji Ohsumi, Japan; (14) not identified; (15) William H. Dawbin, Australia; (16) Charles O. Handley, Jr., U.S. (Observer); (17) Tadayoshi Ichihara, Japan; (18) K. Radway Allen, Canada; (19) Robert L. Brownell, U.S. (Observer); (20) J. A. Gulland, FAO; (21) not identified; (22) Willem L. van Utrecht, The Netherlands; (23) not identified; (24) Richard M. Laws, UK; (25) Ray Gambell, UK; (26) Sidney G. Brown, UK; (27) Åge Jonsgård, Norway; (28) Kenneth S. Norris, U.S.; (29) William E. Schevill, U.S.; (30) L. K. Boerema, FAO; (31) Max J. Dunbar, Canada; (32) J. L. Bannister, Australia; (33) J. L. McHugh, U.S.; (34) Masaharu Nishiwaki, Japan; (35) Anelio Aguayo L., Chile; (36) Takeyuki Doi, Japan; (37) Colin W. Holloway, IUCN; (38) Hideo Omura, Japan. Participants not pictured: William E. Evans, U.S.; Sidney J. Holt, FAO; Karl W. Kenyon, U.S. Observers not pictured: U.S. Department of the Interior—Curtis Bohlen, Frank Witmore, Earl Baysinger, John Sayre; Smithsonian Institution—Michael Huxley; New York Zoological Society—James Oliver; US/IBP—William Milstead; NOAA—George Y. Harry, Jr.; NSF—George Llano; Environmental Defense Fund—Roderick A. Cameron; CEQ—Lee Talbot; IUCN—Harold Coolidge; University of California, Berkeley—Edwin R. Lewis; Marine Technological Society—Robert Niblock. Photograph by G. Carleton Ray



Figure 2. Skyland Conference Management, Marine Mammal Council: William E. Schevill, Kenneth S. Norris, and G. Carleton Ray. Suzanne M. Contos went missing while herding participants. Photograph by a willing photographer (not identified), who borrowed Ray's camera for the purpose.

influences that were omitted from the MSY logistic equation—for example, the effects of climate change—and naturalists scratched their heads about the natural-history basis for recruitment for which MSY seemed to make little sense at all; the eminent proponent of the r -K continuum, ecologist R. K. Pianka (1970) (see “Reflections” below) dubbed MSY a “much overused logistic equation.” Thus, the primary objective of the conference was to define what was known and not known about whale biology, ecology, and numbers, notably with relevance to whales as members of healthy ecosystems, so that scientists and managers could agree on what was needed to place the management of whaling on a more sound footing. The participants recognized that it was not entirely reasonable to scold the IWC alone for not saving whales from depletion as some accomplishments had been achieved under challenging circumstances (see above).

Major conference recommendations (Schevill, 1974) may be summed up as follows¹³: (1) stocks that were already depleted and/or protected should be allowed to recover to at least the estimated level of MSY; (2) an International Observer Scheme should be adopted; (3) the “blue whale unit” should be abandoned, and each species and/or population stock should be managed separately; (4) more knowledge is needed for effective management, including from new technology (e.g., radio-telemetry), requiring a quantum jump in personnel and facilities on a far broader front; (5) population analysis should be decoupled from dependence on catch data; (6) natural history is poorly known, especially trophic relationships, hydrography, and environmental relationships,

which, if better known, would make possible the use of whales as indicators of environmental quality; (7) noncommercial species also should be considered; (8) stock identification is a major prerequisite for rational exploitation but is poorly developed for cetaceans; (9) optimum stock levels contribute significantly to humans needs as well as for allowing cetaceans to fulfill their roles in the ecosystem; and (10) all nonmember nations engaged in or entering whaling operations should immediately join the IWC and adhere to its regulations, and all member countries should take all possible steps to bring this about and seek universal adherence to its recommendations. These recommendations by no means represent the entire and often subtle inferences resulting from the conference. Nor, in today's world, would they be considered satisfactory, due in large part to the fact that cetacean science was overwhelmingly devoted to “stock” rather than “population” assessments and hardly at all to behavior or ecology. Nor was human use of whales for food (or other commercial uses) seriously challenged, perhaps due to the participants' reluctance to address social/political issues.

The resulting volume (Schevill, 1974) did not appear until three years after the Conference, but it told the overriding story that despite the data that population dynamicists had accumulated, the exploitation of whales rested on much assumption and guesswork, indicating a pressing need for research on natural history and ecology, food-web energetics, oceanographic relationships, and the like. As Bartholomew (1974) put it for the northern fur seal, “the primary reasons for the successful manipulation of this species are not to be found in the remarkable insights by the persons who do the managing, nor in the complexities of the operations associated with their utilization. Rather, the reasons for success are functions of the biology of this particular species.” The conference's unique contribution, at least in our opinion as Conference organizers, was that conservation and management of great whales must be based on the paramount consideration that each species' natural history and its relationship to habitat and ecosystem function must become better known and explicitly incorporated into management models, absent which population (stock) numbers become meaningless. This conclusion caught the attention of Congress only six months in advance of House hearings.

Program Resumption

Following the Skyland Conference, the US/IBP Marine Mammal Program development resumed. In November 1971, the Council held its second meeting, following which, with the US/IBP's and

Max Dunbar's encouragement and with NSF's approval in principle, we submitted a proposed program of research to NSF's Office of Ecosystem Analysis, dated January 1972 and titled, "Marine Mammals: The Biological Basis of Productivity and Conservation." Both the NSF panel and its *ad hoc* reviewers gave high marks to the program framework and conceptual basis, but it was felt that the program required additional integration of individual projects, with a stronger relationship to ecosystem research. We were also informed that our proposal was to be shifted to NSF's Office of Biological Oceanography for funding consideration. Meanwhile, we had received rumblings that we were engineering a global focus for our own work. Norris put it this way in a letter to one colleague: "We are attempting to cut a hunk out of a very large national budget for marine mammal work . . . because we thought it ought to be done

[and as] the only organized group . . . we will be quite relieved if some responsible government body can take over some of the tasks that have been thrown at us."

In May 1972, NSF approved a second planning grant of \$64,900 for 12 months effective to October 1973 to give us time to develop an improved proposal. At Handley's invitation, our office was moved to the Smithsonian Institution, Division of Mammals, and Suzanne was promoted to Program Administrator with the considerable task of seeing that we all toe¹⁶ the line. On 26 September 1972, we submitted our revised proposal to NSF (Tables 3 & 4). Less than a month and a half later, the Program Director of Biological Oceanography informed Ray by telephone that its panel advised not to fund the program; one comment (origin unknown) was that "marine mammals are insignificant to their ecosystems."

Table 3. Objectives of the US/IBP Marine Mammal Program (NSF Proposal, September 1972)

This program seeks, within a brief period of time, to mobilize and orient a broad segment of marine mammal research towards the basic science and technology necessary for the wise conservation and management of marine mammals within their ecosystems. It is our strong belief that, in the future, the wise management of marine mammal resources must provide for the protection of the ecosystem in which the animal lives. Therefore, our study of marine mammals includes a comprehension of the animal's system and the relationship of the species to this system. We seek to isolate and study a series of key questions on important marine mammals that may have wide application. We hope to provide new tools of an intellectual and informational sort, as well as actual tools such as tracking devices, tags, and data packs. Specific aims are:

- A. To carry out basic research on certain crucial areas on an integrated, sub-program basis.
- B. To coordinate these efforts by use of the tools and methods of population dynamics and ecosystem description and modeling.
- C. To communicate information through the scientific community and especially from the basic scientist to the manager and decision-maker both on a national and international level.

Within the program, research will be focused on three aspects of marine mammalogy: the numbers, distribution, and dynamics of the species themselves; the processes by which they relate to the environment in which they live; and their relationships to the total system. Specific areas of research include:

Species – Individuals and/or Populations

- Systematics and evolutionary biology
- Spatial and seasonal distribution and numbers
- Social structure and reproductive behavior
- Age, growth, and sexual composition of herds
- Energetics, food habits, utilization of food, and caloric budgets
- Parasites, disease, and contaminants
- Physiology of thermoregulation and reproduction

Environment

- Trophic relationships
 - Physical and chemical relationships
 - Contributions of marine mammals to their ecosystems
 - Modeling
 - Processing of data and evolution of research objectives with the aid of a program-wide modeling effort on the levels of population dynamics, process studies, and ecosystem description
 - Validation and simplification of models
 - Conversion of models into a form applicable to regional management
-

Table 4. Marine Mammal Program (as approved by the U.S. and International IBP and submitted to NSF, September 1972)**Central Management***Program Director:* G. Carleton Ray*Co-Program Director:* William E. Schevill*Program Administrator:* Suzanne Contos**Sub-Program A: California Current System¹⁷***Coordinator:* Kenneth S. Norris

Project A-1: Trophic Relationships of the Año Nuevo Island Pinnipeds in the California Current System

Investigators: William T. Doyle, Burney J. Le Boeuf, Roger L. Gentry, John S. Pearce, Gary B. Griggs, and Richard W. Pierce

Project A-2: Distribution, Movements, and Abundance of Delphinid Cetaceans in the California Current System

Investigators: William E. Evans, C. Scott Johnson, William F. Perrin, George B. Anderson, Douglas J. Wilcox, Dale W. Rice, Izadore Barrett, Donald R. Patten, and Giles W. Mead

Project A-3: Systematics, Distribution, and Ecological Implications of Marine Mammal Helminth Parasites on the California Coast

Investigator: Murray D. Daily

Project A-4: Biology of Large Whales: Acoustic Investigations

Investigators: William C. Cummings, James F. Fish, and Paul O. ThompsonProject A-5: Proposal to Study the Coastal Harbor Seal, *Phoca vitulina r.*: Populations of Willapa Bay and Gray Harbor, Washington*Investigators:* Douglas G. Chapman and Terrell C. Newby

Project A-6: Radiotracking of Large Whales by Satellite

Investigators: Robert Goodman and Kenneth S. Norris

Project A-7: Geographic, Trophic, and Phylogenetic Relationships of Environmental Toxicant in Marine Mammals

Investigators: Donald R. Buhler, Bruce R. Mate, and James M. Witt**Sub-Program B: Marine Mammals of the Bering Sea***Coordinator:* G. Carleton Ray

Project B-1: Population Parameters and Distribution of the Pacific Walrus

Investigators: Samuel J. Harbo and Francis H. Fay

Project B-2: The Role of Social Behavior in the Productivity of the Walrus

Investigators: Peter C. Lent, Francis H. Fay, and Edward H. Miller

Project B-3: Distribution and Productivity of Walrus Food Species in the Bering Sea

Investigators: C. Peter McRoy, Sam W. Stoker, and George J. Mueller

Project B-4: Nutrition, Assimilation Efficiency and Metabolic Function of the Pacific Walrus

Investigators: G. Carleton Ray and Steven D. Sult

Project B-5: The Energy Budget of the Pacific Walrus

Investigators: Douglas Wartzok and G. Carleton Ray

Project B-6: Studies of Walrus Movements and Feeding Behavior by Radio-Telemetry

Investigators: G. Carleton Ray and Douglas Wartzok

Project B-7: Manned Undersea Support Activities

Investigator: G. Carleton Ray

Sub-Program C: Great Whales

Coordinator: William E. Schevill

Project C-1: Aerial Survey of Gray Whale Migration

Investigators: Kenneth S. Norris, Thomas P. Dohl, and Kenneth Balcomb

Project C-2: Age-Specific Tagging and Laser Branding

Investigators: Kenneth S. Norris, Thomas P. Dohl, and R. Keith Farrell

Project C-3: Mass Tagging and Tracking of Whales

Investigators: William E. Schevill, William A. Watkins, William E. Evans, G. Carleton Ray, and Hugh Martin

Sub-Program D: Process, Population, and Ecosystem Modeling

Coordinators: Douglas G. Chapman and Gerald J. Paulik

Project D-1: Process, Population, and Ecosystem Modeling

Investigators: Douglas G. Chapman and Gerald J. Paulik

Sub-Program E: Marine Mammal Study Center

Coordinator: Charles O. Handley, Jr.

Summary Budget – Year 1 (Calendar Year 1973)

Central Management	\$102,753
California Current Sub-Program	564,047
Bering Sea Sub-Program	225,618
Great Whales Sub-Program	108,526
Modeling Sub-Program	137,146
Marine Mammal Study Center	103,548
Total	\$1,241,638*

* Program expected to endure for three years. Year 2 budget expected to decline to about \$980,000; Year 3 to increase to about \$1,100,000.

The *Marine Mammal Council Newsletter*, No. 7, of March 1973 carried NSF's views:

There does not yet exist the critical mass of basic data necessary to support an integrated research program on marine mammals. . . . Therefore, the NSF Office of Biological Oceanography has decided not to fund the proposed Integrated Research Program of the U.S. IBP Marine Mammal Program. . . . [I]n the experience of the NSF, large integrated programs must be based upon a critical mass of basic information. . . . [T]he study of marine mammals has not yet reached its critical level, and thus could be better accomplished through a number of relatively small grants for the innovative development of improved research methods.

On the contrary, the philosophy of the Council was that only through integration of existing effort could further studies emerge and a critical mass of data be obtained. Some investigators were forced to seek other funds. On the bright side, the Marine Mammal Study Center was established at the Smithsonian's initiative with James G. Mead as its

director. The Council chose to disband, more than ever convinced that the conservation and management of marine mammals must become truly systemic and based on natural history and ecology.

Social Concerns and Perceptions

While our IBP Marine Mammal Program was endeavoring to become a reality, the plight of marine mammals was becoming ever more perceived as urgent by the public at large, with the appearance of books, articles, newspaper accounts, etc., many of them flavored by much emotional mythology. Some publications offered historical and scientific facts—notably Alpers (1961), who wonderfully described cetaceans' historical relationships with humans—but other concurrent books and papers created strong misconceptions in the public psyche. Anecdote and emotion began to contaminate scientific knowledge. Two examples will suffice: the dolphin's "big brain" and whale "song."

Since the earliest days of keeping porpoises and dolphins in aquaria, and especially since the opening of Marine Studios in 1938, the world's first oceanarium (later to become Marineland of

Florida; Wood, 1973), cetacean intelligence had become obvious to all who worked with them. John Lilly's controversial *Man and Dolphin* (1961) and *The Mind of the Dolphin* (1967) carried this notion to extremes by presenting one species, the bottlenose dolphin (*Tursiops truncatus*) as possessing superior intelligence among mammals, equal to, or perhaps surpassing, humans. Lilly was an innovative neurophysiologist who had been impressed by one dolphin's imitation of his voice. His purpose became to talk with dolphins, and his logic went like this (Lilly, 1961): the "first thing we must look for in any species with which we may try to communicate is a brain comparable in size and complexity to the human brain. . . . Having found such a species, we should attempt to determine whether its members have an intraspecific language. . . . Next we should determine whether individuals of the nonhuman species can be taught a human language." By this logic, Lilly proceeded to eliminate chimpanzees with smaller brains than humans because "no interspecies communication has been achieved with primates having smaller brains than man's," or species with larger brains than ours (e.g., elephants) because "the mental processes may turn out to be too alien for us to understand and we would not be able to establish communication." It must be acknowledged that, without proof one way or the other, most scientists did not necessarily reject Lilly's conjectures. Alpers (1961) commented, "A caution is needed here, lest such behavior be considered proof of intelligence: repetition which in part would be labeled 'parrot-fashion' does not necessarily become something else when it suddenly occurs, or appears to occur, in a large-brained aquatic mammal." Wood (1973) summed it up this way: "Lilly's depiction of the porpoise as a highly intelligent creature with a potential for human speech has remained essentially speculative, lacking supporting evidence. It nevertheless has had an immense appeal to people in every intellectual stratum, including those who otherwise have little interest in animals. The fascination of this idea may be akin to what we feel at the thought of someday establishing communication with an intelligent race from another planet." Cognitive scientists now understand that comparing intelligences by means of brain size among species sheds little light on their cognitive capacity. In fact, the dolphin brain is peculiar among mammals and is highly developed for acoustics (Ridgway, 1986). Thus, brain size alone may be a poor indicator of intelligence.

Whale song, contrary to the "big-brain" hypothesis, had a scientific basis in those days as other highly loquacious animals (e.g., insects, frogs, and birds) were known to sing, according to strict behavioral criteria involving reproduction,

territoriality, or other behaviors. Shortly after World War II, marine mammal sound became a high-priority subject for investigation, supported in particular by the U.S. Office of Naval Research, primarily due to the discovery that dolphins possess "sonar." That some sounds might also have social significance was another possible interpretation. So when Payne & McVay (1971) portrayed the remarkable sequence of sounds of the humpback whale (*Megaptera novaeangliae*) as "songs," as in the title of their seminal paper, the public's immediate attention was drawn to human-like qualities. Strengthening their case, the authors assumed that whales slamming their tails on the water's surface, finning, and jumping was "playful behavior." Insufficient attention was drawn to the paper's caveat: "Until there is further evidence, we can only guess what function the remarkable series of vocalizations serves." Of course, the authors guessed correctly, but it was some time after their publication before true "song" was demonstrated for any cetacean. It might be worthy to note that true "song" had been verified earlier for the bearded seal (*Erignathus barbatus*; Ray et al., 1969), with confirmation that males were doing the singing during the mating season and that their testes were undergoing spermatogenesis.

One cannot overemphasize the appeal of "big brain" and "song" as they were being unabashedly portrayed in the press and before legislators (see testimony below) to focus attention on marine mammals as animals "like us." To scientists, the use of simplistic correlations seemed disingenuous (i.e., are sharks, pythons, or sea turtles less worthy because they have little brains and don't sing?). Norris commented to a leading conservationist, "[T]he brain-nervous system thing is personal cant . . . a chaotic level of emotional bias and pseudoscience." Teleological thinking appears to be a common phenomenon in the workings of the human mind; as Culotta (2009) put it, "If you think that an agent is responsible for some mysterious event, it's a short step to thinking that the agent has a mind like your own." Nevertheless, the assumption of intelligence and whether dolphins deserve to be kept "captive" in aquaria continues to this day. In asking, "Are dolphins too smart for captivity?" (Grimm, 2011), one also needs to consider how else might we find the answer, other than through controlled experiments in holding facilities?

MMPA: The Drafting and Hearings Process

Concurrent with efforts to develop the US/IBP Marine Mammal Program, we had heard rumblings of a "marine mammal protection act" being developed by Congress, but we hardly expected

to be drawn into the action. In May 1971, the House Committee on Merchant Marine and Fisheries, Subcommittee on Fisheries and Wildlife Conservation, hired Potter to be responsible for the drafting, analyzing, and processing of environmental legislation. The first task given to him by Chairman John D. Dingell (D, MI) was to put together a bill to deal with the nation's responsibilities for managing marine mammals in areas under its jurisdiction. In 1968, Potter had created the nonprofit Environmental Clearinghouse to provide independent research data and analysis on environmental issues for members of Congress, many of whom lacked any direct access to such information. Ray was an invited charter member of the Committee of Scientific Advisors to the Clearinghouse. Accordingly, Potter asked Ray to enlist some of his colleagues to help draft the bill on marine mammals. Norris and Schevill agreed. Many hours of discussion ensued over the next several months, during which Potter grilled we three mercilessly on possible solutions to the issues before the Congress. Inevitably, we reflected back on the concepts that had emerged from our attempts to develop the IBP Marine Mammal Program. At the heart of the matter was a new management regime that would connect mammals functionally to their environments. MSY was not an option. Together, we dredged up a fisheries term of the 1930s, *optimum yield*, used to express economic benefit. Our intent was to displace economics with *ecosystem health* to suggest environmental relationships. Other related thoughts also emerged, notably application of the *precautionary principle*. Thereby, accountability became an issue; what was needed was something like an "ombudsman" to oversee progress on how the Act was applied, which evolved into a "commission."

These ideas, which emerged from extended discussion and from conversations with colleagues, were reported to Rep. Dingell, who agreed to them in principle. It was this that proved most remarkable to we three scientists—that Rep. Dingell and his colleagues in Congress were driven more by rational, scientific thought than by emotive appeals, and that they were open to something new and more effective, albeit controversial, than traditionally embedded management procedures. By September of that year, Potter and staff of the House Legislative Counsel had drafted a bill titled the Marine Mammal Protection Act (HR 10420), sponsored by Congressmen Glenn Anderson (D, CA), Thomas Pelly (R, WA), and several other members of Congress. Several days of hearings ensued in both houses of Congress. Four days of hearings held in 1971 by the House Committee on Merchant Marine and Fisheries in September were most comprehensive and are summarized here

(U.S. House of Representatives, 1971). Witnesses included representatives of state and federal agencies, potentially affected industries, scientists from relevant disciplines, and passionate individuals echoing the public's feeling that *Something Must Be Done*. The MMPA bill was not the only one; other versions were also under consideration, ranging from simple paragraph-long bills to the one that became the MMPA's most substantial challenge, the protectionist bill called the Ocean Mammal Protection Act (OMPA, HR 6554). The differences between them are striking in both substance and intended execution (Box 1).

The Senate Commerce Committee held its own hearings on several similar bills in February and March 1972 (U.S. Senate, 1972), running essentially the same gamut as those in the House. Senator Ernest Hollings (D, SC), Chairman of the Committee, had sponsored S. 3112, incorporating the House version of the MMPA. Senate hearings covered more or less the same territory as those in the House, although considerably more time was devoted to state/federal relationships, a subject of intense concern to Senator Ted Stevens (D, AK). Ken Norris, on our behalf, as well as several other scientists, testified as to the state of current research and management of species of concern to the Committee (seals, porpoises, whales, manatees, and sea otters). The Committee reported its bill to the full Senate in June, and it passed the Senate in July.

The House Hearings

On 9 September 1971, Rep. Edward A. Garmatz (D, MD), Chairman of the parent Committee on Merchant Marine and Fisheries, opened the first day of the House hearings, remarking that never in 24 years in Congress had he experienced the volume of mail that he had on the question of marine mammals, which he identified as "an extremely complex subject." Rep. Dingell then provided a short introduction, stating that the Subcommittee "approaches the subject of marine mammal protection with open minds and no preconceptions as to the best way to deal with the problems which these animals confront. . . . [O]ur research efforts to learn more of these animals has been, to put it charitably, very limited." Rep. Dingell also had inserted into the hearing record an extensive and detailed memorandum by the Subcommittee's Counsel (Potter), summing up the various bills under review by the Committee:

There are many bills presently pending before the Committee which deal with some or all species of marine mammals. Some provide research authority only, some deal with only certain types of marine mammals,

Box 1. Two kinds of bills (*Marine Mammal Newsletter*, No. 4, February 1972)***The Anderson-Pelly Bill: Marine Mammal Protection Act (H.R. 10420)***

The MMPA outlines a management/conservation program with built-in provisions for international cooperation and a transparent method of operation that provides for constant public scrutiny of its administration.

Findings—The Anderson-Pelly bill concludes that certain species and population stocks are in danger as a result of man's activities and that they should "not be permitted to diminish beyond the point at which they contribute effectively to the health and stability of the ecosystem of which they are a part." Secondly, they may be managed by the yardstick of "optimum sustainable yield" and all depleted stocks should be replenished to that point. The bill also maintains that marine mammals are "resources of great international significance, esthetic and recreational, as well as economic," and that they should be managed consistently within the ecosystem concept. Additionally, the bill finds that both our state of knowledge of these species and the international treaty arrangements designed to protect them are inadequate.

Procedure—H.R. 10420 would forbid the taking of any marine mammals by vessels or by persons under U.S. jurisdiction anywhere in the world and the taking of these animals by anyone in waters or lands under U.S. jurisdiction except in accordance with a permit or international agreement. The burden of proof would rest on the exploiter or whoever wishes to take an animal. Applications for permits would be subject to public review. Stiff fines would be established for violation of this act, including possible seizure of vessels. Responsibility for setting limits and quotas would be vested in the Department of Commerce (cetaceans and all pinnipeds except walruses) and the Department of the Interior (all other marine mammals), with the assumption that such responsibility would be transferred to the Department of Natural Resources, when and if such an agency is established.

To oversee the entire program, the bill would set up a three-member Marine Mammal Commission, assisted by a nine-member Committee of Scientific Advisors. The Commission's recommendations would be transmitted to the Departments of Commerce, Interior, and State, and all reports and recommendations would be a matter of public record. An annual report would also be submitted to Congress. Further, all recommendations made by the Scientific Committee and not followed by the Commission would be transmitted both to the appropriate agencies and to Congress.

The bill would make an exception for the taking of marine mammals under "native rights" but only for subsistence purposes and in accordance with traditional customs and shall not be done in a wasteful manner, not including species protected under the Endangered Species Conservation Act of 1969. The bill calls for additional international agreements covering marine mammals and charges the State Department to "seek the convening of an international ministerial meeting on marine mammals before July 1, 1973" for this purpose. It also sets up research programs under the Commerce and Interior Departments. Exclusive state control of any species of marine mammals is pre-empted, but federal and state agencies may enter into cooperative arrangements and states are permitted to enact stricter regulations than existing federal law.

The Harris-Pryor Bill: Ocean Mammal Protection Act (H.R. 6554)

This bill represents a protectionist approach to marine mammal conservation, which gives little consideration to the ecosystem.

Findings—"The Congress finds that ocean mammals are being ruthlessly pursued, harassed, or killed, both at sea and on land by hunters of many nations of the world. The Congress further finds that many ocean mammals will become rare, if not extinct, unless steps are taken to stop their slaughter." The bill further states that it should be the public policy of the United States to "protect all ocean mammals from harassment or slaughter" and that the U.S. should negotiate to obtain "a worldwide ban on the further slaughter of ocean mammals."

Procedures—The bill would prohibit the taking or possession of any marine mammal except by native tribes for their own uses and, under a permit system, for medical and scientific research and for certain zoos. Enforcement and penalties are similar to those of H.R. 10420. Under the bill, the North Pacific Fur Seal Convention, signed in 1957, would be terminated in 1976 and the State Department would be instructed to begin negotiations with all parties to the Convention to work out an international agreement to ban all killing of North Pacific fur seals, both at sea and on land. The Pribilof Islands would then be designated a National Seal Rookery Preserve and Bird Sanctuary under the Interior Department. Omitted from the bill is any provision for support of scientific research, the enjoiner for the State Department to seek an international ministerial meeting on marine mammals, any provision for using existing scientific expertise, such as would be inherent in a publicly administered Marine Mammal Commission, or any mention of the ecosystem.

some are directed at the humane or inhumane methods of taking. Mr. Pryor (D., AR) has introduced, with some 100 cosponsors, a bill which would impose an absolute ban upon the taking of all such marine mammals, and Mr. Anderson and several others have introduced an alternative that would impose such a ban, but would permit the Secretary of the Interior to issue permits for the taking of marine mammals, after full public review. . . . In preparing for these hearings, I have read a vast amount of information on ocean mammals, and have interviewed a number of people who seemed to be knowledgeable on the subject: conservationists, government officials, scientists and others. While this material is, of course, available to anyone who wishes to see it, its bulk precludes general distribution. I thought it might be helpful to the Committee if I were to identify some of the critical issues that may emerge during the course of the hearings on this subject, and to supply background information that may put these issues into somewhat clearer perspective. . . . Barring better and more information, it would therefore appear to be wise to adopt a cautious attitude towards the exploitation of marine mammals. This approach was strongly endorsed at the recent international conference on the biology of whales; one of the scientific working groups stated clearly that those who wish to use a given species or population stock of animals should carry the burden of demonstrating that the rate of killing would not endanger that species or stock.

Potter next provided detailed information on the issues concerning marine mammals then before Congress, also noting that, in order to enhance the scientific basis of conservation and management, a Marine Mammal Commission (MMC) would be appointed by the President, with a Committee of Scientific Advisors, consisting of nine scientists "knowledgeable in marine ecology and marine mammal affairs . . . with the advice of the National Science Foundation, National Academy of Sciences, and Smithsonian Institution." Thus, not only would the MMC report directly to the President, but also its findings, recommendations, and agency responses would be matters of public record, and uniquely, if the agencies chose to disregard these recommendations, they were required to specify why they did so. This concept of agency accountability, open to the public, had never before, to our knowledge, been included in U.S. legislation.

The remainder of the first day and the following three days were devoted to testimony from state and federal agencies, professional wildlife societies, business interests, scientists, NGOs, and the public. Government agencies were largely in support of the MMPA bill; some were impartial and divested authority to other agencies. Not surprisingly, some agencies were justifiably concerned about how transfers of authority under the Act might play out in practice, while others seemed more protective of their "turf."

The Council on Environmental Quality (CEQ) had great interest in passage of the MMPA. A statement by Russell Train, Chairman, read by Dr. Lee Talbot, Senior Scientist of the CEQ, was largely restricted to

what we consider to be the most important aspects of the act. . . . America has led the world in the development of the principles and practice of scientific wildlife management. . . . [M]anagement techniques required to assure the survival of a species may range from provision of total protection through culling or harvest. . . . [T]he rigid policy of total protection . . . represents a reversion away from scientific conservation and management. . . . The provisions of the act recognize the need to base effective management on "adequate scientific information," which in some cases does not now exist. . . . [Living resources should be recognized as] integral parts of ecosystems . . . [that] contribute to the stability and health of our environment.

The CEQ's testimony then cited the Fur Seal Convention of 1911 (and by inference, the U.S. Fur Seal Act, 1966) as "one of the few successful examples of international management of a living marine resource" and recommended that its authority should be extended. The CEQ also endorsed the creation of a Department of Natural Resources to achieve better coordination among agencies. Finally, the CEQ strongly promoted an independent "citizen commission" with access to the best scientific expertise to make appropriate recommendations to the federal government and hinted that it should host that commission.

That the responsibility for management of marine mammals fell to multiple departments and agencies was also of concern. All cetaceans and pinnipeds except walrus fell under the management authority of the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). The Department objected to the implied transfer of authority to the proposed MMC,¹⁸ the blanket ban on take, cumbersome permit procedures, the abrogation of the Fur Seal Convention

proposed by protectionists, and of individual states' loss of conservation and management programs.

Walrus, sea otters, manatees, and polar bears, on the other hand, fell under the management authority of the Department of the Interior, which also objected to the creation of a Marine Mammal Commission.¹⁹ Detailed testimony by the Interior's Bureau of Sport Fisheries and Wildlife (BSFW, forerunner to today's Fish and Wildlife Service) noted the "unprecedented, worldwide expression of concern over the plight of marine mammals . . . [which] speaks well for the possibility of increasingly mature and responsible environmental husbandry." The BSFW was "not opposed to complete protection in those cases where such action is warranted. . . . [However to] let Mother Nature have her way would be grossly irresponsible and would greatly decrease the likelihood of the survival of these animals. . . . Marine mammals should be conserved and managed to achieve the optimum ecological, esthetic, and economic benefits to mankind. We support legislation that will achieve this objective." In this manner, the BSFW expressed doubts about the benefits of a moratorium. The BSFW was at the time in the process of preparing draft legislation to gain relief from "the locked-in situation which we now face wherein we can deal only with species at the point of endangerment. . . . If we wait until a point of actual endangerment we are working against tremendous odds whereas if we can recognize that an animal is in a bad plight sometime in advance of that final day, we stand a far better chance of doing whatever needs to be done to preserve it." The Interior witness agreed with problems relating to dual authority (between it and Commerce) over marine mammals and suggested that this would be "resolved if the Department of Natural Resources should come into being."

As marine mammals cross into international waters, the Department of State is involved. The Department pointed out that the United States traditionally seeks agreement with other nations and that a total ban on take of fur seals, for example, "might well lead to a situation directly opposite to that proposed"—that is, a renewal of pelagic sealing. State brought up the example of the Convention on Fishing and Conservation of the Living Resources of the High Seas, adopted by the United Nations Conference on Law of the Sea (1958), in which Article 2 states, "conservation of the living resources of the high seas means the aggregation of the measures rendering possible the optimum sustainable population yield from those resources as to secure a maximum supply of food and other marine products . . . for the benefit of man." State concluded that the findings of the

proposed MMPA provided an excellent basis for international agreements.

The State of Alaska's delegation testified that marine mammals that entered waters within the three-mile boundary fell under the authority of the states. The State shared "a commitment to early action designed to gather full information about ocean mammals and the programs which will insure the existence and enhancement of each separate species . . . to identify the precise species of ocean animals which are endangered [and] to create conservation and management programs which solve the problems which brought the species to an endangered status. . . . [The] "theme" of your final legislation . . . should be the gathering of adequate information for the coming years. . . . HR 10420 offers a framework which is responsible and practical . . . in creating a cooperative State-Federal program." A letter from Alaska Governor William E. Egan strongly supported the delegation's views: "No state has a larger stake in the wise conservation of the many species of marine mammals for the benefit of future generations of Americans. . . . [T]he State of Alaska opposes any bill which would depart from sound resource management principles, of which the international fur seal agreement is an excellent example, in favor of a general and indiscriminate ban on the taking of marine mammals which would apply to endangered species as well as those which clearly are not. This statement also explains our continued opposition to any extension of federal jurisdiction over resident species of marine mammals."

This last statement caught the State of Alaska in a shaky argument. One member of the delegation expanded on it: "The Constitution of the State of Alaska states that fish, forests, wildlife, grasslands and other renewable resources belonging to the state shall be utilized, developed, and maintained on the sustainable yield principle subject to preferences among beneficial uses. . . . [W]e feel that as written, House bill 10420 would assert Federal jurisdiction over populations which are, in fact, resident in the State of Alaska." This touched on the controversial issue of whether federal jurisdiction in wildlife law takes precedence over state law (see previous discussion). Alaska's Attorney General's Office intervened: "What we are saying is that [marine mammals] are linked to a certain land mass, that is the State of Alaska. They do not to any great extent migrate away to the high seas." To which Rep. Dingell replied, "Well, of course, I appreciate that. . . . While I think the Federal Government would be pretty helpless to try to protect on an exclusive basis the marine mammals in the State of Alaska's territorial waters, it certainly takes a partnership, and it seems to me that it takes a Federal preemption as far as the protective laws

are concerned.” As Alaska’s delegation could not cite any marine mammal that was exclusively restricted to state waters, it was implied that federal authority was upheld.

Professional wildlife organizations also testified on this and other matters. The International Association of Game & Fish Commissioners (IAGFC) supported Alaska’s position: “We feel rather strongly that those animals that are found along the coastline, within the 3-mile limit, the boundaries of the State, should be retained under the protection of the respective states. . . . Federal assumption of responsibility for resident wildlife is an unnecessary duplication and invasion of existing State programs.” However, their testimony also endorsed state-federal “cooperative programs.” This somewhat ambivalent position amplified that the issue of state-federal jurisdiction was far from being resolved.

The Wildlife Management Institute (WMI) had this to say: “[I]n this day of rapidly expanding human population, and the accompanying alienation and impairment of natural habitat, plus the mounting demand resulting from more people, it is necessary and desirable to deliberately manage some animals. . . . [M]anagement of a wildlife population runs full scale from the outright prohibition of taking to controlled harvest . . . [and] should be based on the judgment of persons qualified by training and experience to evaluate the many biological factors that must be taken into account. . . . [W]e cannot accept the risks inherent in ‘hands off’ preservation.” The WMI went on to describe the elements of a “constructive program for marine mammals,” noting that “the goal should not be solely to restore species or stocks so that they may be managed on a sustained yield basis” but, rather, “in terms of the capability of their habitat to support them and of society to accept their presence.” The WMI opposed the creation of a commission as being “wastefully expensive and of little value,” although they were supportive of a Scientific Advisory Committee under some government agency.

Two commercial groups spoke up. The American Tunaboat Association declared, “In great measure, the success of the U.S. tuna fleet in meeting the challenge offered by every other tuna producer in the world that sells frozen tuna in the free market of the United States can be attributed to the fact that the U.S. fishermen and the porpoise have been learning how to live together in accomplishing the task of capturing the tunas.” Lengthy questioning focused on how, or whether, fishermen and porpoises (dolphins in this case) actually “live together” when porpoise kill in fishermen’s nets was estimated to be in the tens, if not hundreds, of thousands.

A joint statement by several organizations speaking for the fur industry acknowledged problems facing fur seals such as pollution, habitat, and the recurrence of pelagic sealing should the Fur Seal Convention be abrogated: “We recognize that the continued existence of the fur industry depends upon the enforcement of conservation measures on a worldwide scale. . . . We are opposed to the overutilization of any species of wildlife that threatens that species with extinction. . . . We strongly favor H.R. 10420. It is an enlightened proposal the provisions of which spring from an application of common sense rather than emotion.” Entered into the record was an agreement on aims and practices negotiated by the International Fur Trade Federation with the IUCN and the World Wildlife Fund (WWF).

Marine mammal scientists had direct interests in the consequences of the Act—and could have contributed a great deal to the hearings—but only a few testified before the Subcommittee for various reasons.²⁰ At the end of the second day, three offered views on various species without taking a stand on either bill. Judson Vandever of the Hopkins Marine Station, Stanford University, testified on behalf of southern sea otters, and of deaths and disease from speeding boats, abalone fishermen, and pollution. Daniel Hartman of the Paradise Point Nature Center, New Hampshire, brought up the issue of speeding boats injuring and even killing Florida manatees. Theodore Walker of Scripps Institution of Oceanography, went on record against killing of any cetacean, even any marine mammal.

Due to our involvement with the drafting process, we (Ray, Norris, and Schevill) were to participate on the morning of the fourth day, September 23. Ray presented our joint statement endorsing HR 10420:

We must observe that the overwhelming thrust of our civilization is still toward the exploitation of resources. Such exploitation has led to the rise of the environmental consciousness felt so widely today. One form of this has been protectionism, so easy for the uncritical to endorse in principle, yet so narrow a method. . . . Neither the extreme exploitative nor the protectionism point of view gives sufficient attention to the interdependency between animals and their environment. What is needed is a system of flexible management, based on a continual scientific reappraisal of the ecological health of populations. . . . The concept of “sustainable yield” is important and it is clear that such a yield must not be calculated merely in economic terms. . . . [W]hat is considered “optimum”

from the point of view of economic yield may not be optimum in terms of a species population in its environment. . . . [W]hether we like it or not, humans have intervened in the natural world to such an extent that there is no backing away from management on a global scale, or else grave consequences will surely beset us. . . . The question is not “Shall we manage?” but “How can we manage in such a way that natural systems are not disrupted?”

With reference to the bill’s key word “optimum,” we used “yield” only to refer to takings, but otherwise used “population” when referring to marine mammals generally or in an ecological context. We also endorsed a “highly visible” Marine Mammal Commission, and referred to the conclusions of the International Conference on the Biology of Whales (see above), which had already been entered into the record. We concluded our prepared statement with

[W]e are in a real sense hoist on the petard of our own humanness in this ‘exploiter’ vs. the ‘conserver’ confrontation. Judgments on ‘humane’ methods as well as management for human needs are both homocentric. What we ask is a different view—that we see and study populations within systems and use, as well as appreciate and enjoy them, on that basis.

Questioning followed our presentation. Norris was asked by Congressman Pelly, “I take it you are a little skeptical about the love affair between the fishermen and the porpoises?”

Norris responded, “That was the tuna fishermen’s statement, not mine, I assure you. I think that is a very rocky love affair at best. . . . The need has been for the tuna industry to be more open and to be more cooperative with the scientists who have been attempting to solve this problem for some time.”

Rep. Anderson observed, “You see, this is also where the number of porpoises is apparent. If we could take a certain number of porpoises in a proportion to the total number of porpoises without endangering them, that is one answer.” The response was classical Norris-Schevill counterpoint.

Norris: “There has not been an opportunity to find out. The governmental program . . . is very small and lodged in very few individuals.”

Shevill: “I have heard repeatedly that on these fishing grounds the porpoises are no longer as numerous. This does not give you numbers, but it seems to me this does give us a hint that the mortality is excessive.”

Norris: “I have heard the same story as you have and that is that the school size is reducing and that they are very much more difficult to approach and to find.”

Shevill: “Kind of sounds like overfishing.”

Other representatives asked our thoughts on “protectionists” who advocated absolute bans or moratoriums on killing (harvest/taking). We responded that this is a difficult question to answer because we are speaking on two levels: moral, esthetic, and social values vs. scientific information. Rep. Kyros (D, ME) replied, “I think this is the crux of the difference between the Harris-Pryor bill and the bill filed by my colleague, Mr. Anderson. Where can the animals be taken scientifically, putting social and moral reasons aside?”

Norris said, “I think one of our feelings about the protectionist attitude is that, indeed, protection is one of the tools of management. This means we have to judge and gauge the effects we have had on these animals, and this means some kind of management. It does not mean locking them up and not looking at them and studying them. It means understanding them.” Our position was that simplistic protection was insufficient and that management simply means conservation in which we *do* something constructive rather than merely serving the delusion that we are doing something by doing nothing.

The remainder of the testimony illustrated that NGOs were divided into management and protectionist camps. The National Wildlife Federation opposed complete protection by law of all ocean animals, advocating the need for science-based management and maintenance of habitat, and “not on the basis of emotional, philosophical or moral judgments.” The Federation opposed creation of a Committee of Scientific Advisors as “excessive bureaucratic layering.” The American Humane Association supported management: “Any marine mammal legislation which proposes protection only without management is categorically untenable,” to which the Izaak Walton League of America (IWLA) agreed:

[W]e joined many of our colleague organizations in opposing what we believe is an ill-advised demand for a total and absolute ban on the taking of marine mammals under any circumstances. The result has been that the League is included on a list circulated by one organization involved in this problem and entitled “Assassins Unlimited.” . . . [T]he League has learned from sometimes painful experience that a total ban on the taking of animals is no guarantee that a species will survive or do well. . . . [T]he proposed Marine Mammal Commission and the Committee of Scientific Advisors will be most important in determining what should be done on a species by species basis. . . . [T]he legislation specifically states that its purpose is to protect

and enhance the status of marine mammals as resources vital to the ecological integrity of the sea and man's environment.

Other NGOs promoted an emotive, protectionist alternative. The World Federation for the Protection of Animals stated that beneath widespread public outcries against killing marine mammals is a "precious thread of sentiment" for which the Pryor-Harris bill might actually be "too far ahead of its time . . . until public opinion and science can make [stopping killing] irresistible." The Fund for Animals, a national anti-cruelty society based in New York City, asserted, "It does not matter how many of an animal or sea mammal there is. What really matters is the total immorality and senselessness of taking any such creatures for such a frivolous purpose" (e.g., killing seals for fur). The World Federation for the Protection of Animals observed that "There is a tide in the affairs of men, and as far as our relationship with wild animals is concerned, the flood is upon us. . . . Hear our plea, that the murder of ocean animals, no matter how useful, be legally and morally banned."

The strongest opposition to the Anderson bill came from the Friends of Animals (FOA), which opposed it as a "management bill" that would set up a "new and expensive bureaucracy." The FOA said the government had two arguments for fur seals: (1) either it has to kill seals because of a treaty or (2) kill seals because it is good conservation. The FOA cited the research of John Lilly (see earlier discussion) in defense of strong emotional bonds with dolphins that if broken, "the dolphins first appeared distressed and then, in some cases, they died. In fact, they literally committed suicide." The FOA proposed that ocean mammals should be "left alone . . . neither harassed, killed, managed, nor harvested." With regard to the porpoise-tuna issue, the FOA would simply have preferred to shut down the tuna purse-seine fleet altogether.²¹ They also claimed that radio-telemetry research and underwater TV of Weddell seals (*Leptonychotes weddelli*) in Antarctica was "aimed at eventual seal hunting in the Antarctic." Their complex and misleading, ethical/moral argument prompted Rep. Goodling (R, PA) to cite an FOA letter, written by its Washington Coordinator, Lewis Regenstein, to the Pennsylvania Game Commission News: "Let us tell it like it is. Hunters are not only paranoid, they are miserable cowards."

Captive marine mammals elicited complex, morally and ethically directed discussions in which several statements stand out. The Humane Society of the U.S. said, "It is time, gentlemen, that the citizens of this Nation and the peoples of the world, reevaluate the rationale upon which we

base our right to destroy other life forms." The Sea Mammal Motivational Institute added, "The sea mammal in captivity is a pathetic victim of human greed and cruelty, disguised as entertainment." The International Society for the Protection of Animals sought middle ground: "We feel H.R. 10420 is worthy of consideration after certain changes have been made. . . . No. 1, an import restriction on all products derived from marine mammals, No. 2, the section which provides an exception for the taking of marine mammals 'which occurs as an incident to commercial fishing operations.'" Similarly, the National Audubon Society testified, "The fur seal harvest has been brought into question by widespread concern about the humaneness of slaughtering the animals by clubbing them. . . . The basic philosophic and moral question, we think, is not whether a bullet or a club or some other weapon is more humane, but whether it is moral to kill animals for the sake merely of catering to man's vanity." The Society for Animal Protective Legislation (SAPL) raised the issue of cetacean humanity (see previous discussion) by requesting that "Songs of Humpback Whales" (Payne & McVay, 1971) be inserted into the record, and added, "Dr. Schevill, who gave testimony this morning, has also recorded the whale songs and other sounds . . . but the work of Roger Payne is probably the most advanced in this area." (Schevill withheld response.) The SAPL proceeded, "Clearly the dearth of scientific literature on the living mammals of the oceans makes all theories purely speculative but . . . we are dealing with animals some of whom may be at least as intelligent as man." This lengthy testimony also covered the morality of wearing furs, Greek mythology regarding porpoises, whaling, and much else and concluded with a statement with which we might have agreed: "We need to get away from establishment attitudes."

A consultant for Friends of the Earth concluded the testimony, endorsing the Ocean Mammal Protection Act, while urging "a really comprehensive study of marine ecosystems, and the role of marine mammals in these systems." Their testimony continued, "There is no merit in attempting to apply the so-called lessons of terrestrial wildlife management to the incomparably more complex marine environment. . . . The dramatic deterioration of the marine environment makes this kind of study critically important. . . . We hope that the ethic embodied in the Pryor bill will not be absent from the legislation reported out by the committee. Marine mammals are obviously among the most highly evolved and intelligent of living beings. This should not be ignored."

While these hearings were underway, some interested parties submitted op-ed pieces to

express their views. The FOA's Regenstein (1971) warned that "Unless drastic and immediate action is taken, several of the larger species of whales will soon be reduced in numbers to a point at which their extinction will become inevitable. . . . Eventually, if the present whale hunting continues most other whales, including the porpoises and the dolphins, may also disappear." Regenstein continued, "[W]hales, like humans, nurse their young, bear calves every two years, cry in agony when wounded, and sing so beautifully that a [Hovannes] symphony has been inspired." Relationships with humans are "friendly," and so close that "native peoples have violently resisted efforts of scientists to obtain dolphin specimens. . . . [T]he blue whale is so closely related to man that it has a nearly identical body temperature and a remarkably similar brain, eye, and circulatory system." He also implied that the New York Zoological Society was suspect because it consulted with the TV program *Animal World*. The IWC was accused of policies that "have led to the virtual extinction of several species of whale; its present actions will soon wipe out most of these that remain." The U.S. Department of State was accused of "utter and malicious nonsense" in pursuing international cooperation for conservation of marine mammals on the high seas, not acknowledging that this was the only tool available under international law. More constructively, Regenstein suggests, while endorsing OMPA, "that the U.S take the lead in protecting these unique and awe-inspiring creatures," which, in fact, the MMPA intended.

The attacks on the MMPA bill continued. The *Baltimore Sunday Sun* (19 December 1971) reported that "an avalanche of mail had been sent to Congress and an "environmental feud" between the "gun people" and the "ecology people . . . could, some conservationists fear, irreparably polarize the entire environmental movement." The Anderson bill was dubbed a "sell-out." And, the report noted, supporters of the Harris bill claim that "anyone backing the [MMPA] bill must have ulterior motives. . . . Dr. Ray, for example, had agreed to support the bill in exchange for the promise of a \$30,000 a year job the bill would create."

This caused The Rachel Carson Trust (*The Washington Post*, 7 December 1971) to observe, "the surprisingly one-sided coverage of this [MMPA] issue" and that "your readers deserve to know that the preponderance of responsible, established conservation organizations and wildlife specialists feel keenly that the Anderson bill . . . was in fact by far the stronger and effective of the bills considered . . . and that the irresponsible publicity campaign by those favoring the Harris-Pryor bill has done great damage to the cause of ocean mammals."

Rep. Dingell added (*Baltimore Morning Sun*, 1 January 1972),

The article carried in *The Sunday Sun* . . . may have left a wholly inaccurate picture in the minds of your readers. . . . The only opposition to the bill came from a small, highly vocal and, to my mind, irresponsible group of individuals, sometimes termed "protectionists," whose basic position seems to be that man should leave all animals alone. They appear to oppose all forms of wildlife management, in blatant disregard of the fact that man has already seriously upset the balance of nature, and that leaving the animals alone may well be more damaging to the animals themselves as well as to the natural ecosystems upon which those animals depend.

Another FOA letter to *The Washington Post* (31 May 1972) titled "A Last Chance for Ocean Mammals" pointed to loopholes in total protection:

[T]he bill is primarily oriented towards vested interest groups which profit from killing and sale of marine mammals and their products. . . . Dr. Carleton Ray, a marine "biologist" from the Smithsonian, who is expected to head or participate in the Marine Mammal Commission set up by the bill, opposes a cessation of the killing of marine mammals and lobbied vigorously against a strong bill. . . . Ironically, if [this] bill is not significantly strengthened before it is passed, it may indeed be too late. For we will have lost what is perhaps our last chance to halt the slaughter, suffering, and eventual extinction that man is visiting upon these unique, intelligent, and highly-evolved creatures of the sea.

The letter singled out the fur seal industry and "other significant factors" such as Sen. Hollings' desire to protect his home state's Fouke Fur Company (processor of fur seal pelts), as well as Sen. Stevens opposition to measures to protect ocean mammals from "a big industry in Alaska."

Sen. Ernest Hollings (D, SC) responded (*The Washington Post*, 7 June 1972), "It is unfortunate that *The Washington Post* has allowed its editorial page to be used to propagandize half truths and misstatements of fact. . . . What is of concern to me is the attack on this bill as perpetuating and legitimizing the present slaughter of marine mammals, when the opposite is true." Sen. Ted Stevens commented (same issue),

It is completely beyond my comprehension why you give space on your editorial page to people who make a business of raising money to argue for causes that they create. . . . That “big industry” in Alaska that your article mentions is some 50,000 to 55,000 individual Alaska natives who harvest ocean mammals primarily for food. . . . I consider this recent article part of your consistent vendetta against Alaska and Alaskans and another instance in which your editorial board has been mesmerized by these witch doctors who don’t understand the difference between protection and prohibition.

Ray added (same issue), “Yesterday’s article presented an alarmingly biased and erroneous statement concerning proposed legislation now under consideration. . . . The issue resolves itself down to ‘management’ of individual species within their ecosystems. This is a concern that is vastly misunderstood by those protectionist groups which believe that ‘protection’ of marine mammals is attained by merely opposing the ‘slaughter.’” The letter quoted Dr. Steven Muller, President of The Johns Hopkins University (to faculty and students, 1972): “Passion in the service of reason can lead to the utmost in human achievement. Reason in the service of passion can lead to the torment of men and women by each other.”

The Post’s editorial (same issue) attempted to see both sides: “How the bill looks depends on where you stand. . . . [It is] a common and legitimate debate akin to those raging over civil rights, taxation, and the war. . . . We regret that the architects of the ‘mainstream’ position feel so defensive about criticism from their flanks. . . . Creative compromise is, after all, an assertive legislative act. Those who manage to gather their forces under large umbrellas should not be so nervous about the few who choose to stay out in the rain.”

After the hearings wound down, Potter and the staff of the House Legislative Counsel prepared the draft of the final version of the Marine Mammal Protection Act, which the House readily passed and handed over to the Senate. The House-Senate conference committee filed its report on 2 October 1972, substituting “population” for “yield” as in “optimum sustainable population.” This version became Public Law 92-522 and was signed by President Nixon only slightly more than a year from the date of the first hearings in the House—the legislative equivalent of a 100-yard dash, as well as a great credit to Congress, particularly Rep. Dingell and Sen. Hollings, for recognizing the need for a sound scientific basis for conservation and management. Misrepresentation and excessive emotion had backfired.

Reflections

The history of the MMPA provides lessons for present-day management. For those of us involved in research, the lesson is that science could provide a roadmap for conservation and management, with the caveat that science *per se* does not make the final decisions. If one thing can be said about the development of the MMPA and its aftermath, it is that the MMPA process was replete with serendipity, surprise, a touch of hubris, and some naïveté. The serendipity was the temporal coincidence of the emergence of a marine mammal science program, together with a rising tide of public concern regarding marine mammals and the environment. The surprise was the heated nature of the debate and that some extreme views inhibited shared views among the scientific and management communities and NGOs. The hubris was the conviction that science would drive the debate; the naïveté was that it did not.

The Marine Mammal Commission website (www.mmc.gov) summarizes the MMPA as follows:

The Marine Mammal Protection Act was enacted in 1972 in partial response to growing concerns among scientists and the general public that certain species and populations of marine mammals were in danger of extinction or depletion as a result of human activities. The Act set forth a national policy to prevent marine mammal species and population stocks from diminishing, as a result of human activities, beyond the point at which they cease to be significant functioning elements of the ecosystems of which they are a part.

The Act was the first legislation anywhere in the world to mandate an ecosystem approach to marine resource management. In the Act, Congress directed that the primary objective of marine mammal management should be to maintain the health and stability of the marine ecosystem and, when consistent with that primary objective, to obtain and maintain optimum sustainable populations of marine mammals. The ecosystem approach has been incorporated in other U.S. statutes such as the Magnuson–Stevens Fishery Conservation and Management Act, in legislation in other countries, and in international agreements such as the Convention for the Conservation of Antarctic Marine Living Resources.

The Act includes a general moratorium on the taking and importing of marine mammals, which is subject to a number of

exceptions. The Act also established the Marine Mammal Commission and provides the authority under which the Commission operates.

The *ecosystem approach* was not any one person's or organization's invention but arose from a widespread perception of the time that narrowly based mechanisms dispersed among multiple agencies were not working sufficiently toward long-term solutions for marine mammal conservation and management. Species-ecosystem (including human) relationships were at the heart of the matter, in some respects following practices already in place for terrestrial management (e.g., Wagner, 1969). The classic, NSF-supported, half-century-old Hubbard Brook ecosystem study is an outstanding example (Likens & Bormann, 1974): "Legislation which ignores the biosphere perspective or the complexity of the landscape mosaic is ultimately naïve. . . . Management 'solutions' that consider rivers or lakes as entities, in isolation from their watersheds and airsheds are sheer folly." No less a folly is it to consider marine mammals as entities apart from their ecosystems.

Ecosystem management was not the only suggestion of the times. The notion of a Department of Natural Resources had also reverberated around the executive and legislative branches of the federal government for years. It was an excellent but impossible dream as many branches of government feared the uncertain changes that might ensue. For some agencies, these changes would inevitably involve losses of budget, manpower, turf, and prestige. The idea made too much sense ever to be realized, absent a massive reconstruction of the executive branch. Furthermore, more legislative specificity would probably not have been possible, and was almost certainly a bad idea, as it would have involved a degree of micromanagement by Congress that would have been beyond its capabilities. However, it is worth noting that many nations have established such comprehensive departments of government.

On a more personal level, at about the time of the hearings, the Wildlife Management Institute invited Ray to present his views on "managing marine environments." Ray invited Norris and Schevill to participate, but Schevill declined. What emerged was Ray & Norris (1972). Here's a bit of pure Norris:

Is managing the ocean like managing the land? It is not and the differences between the two endeavors are crucial. . . . The sea is . . . a bouillabaisse of animals and plants, of uncountable microscopic organisms, of nutrients, of degradation products of life,

of inorganic contributions from land, from chemical precipitation, and of dust from the atmosphere. Its "winds," which are the ocean currents, move at all levels from the surface to the deepest sea where water generally creeps northward from the Antarctic Convergence. With them move nutrients and life. With them move clouds of reproductive products and of larvae, so that no part of the sea is ever free of the replenishing supply of life suited to it, save those places where man has so altered the conditions of life that occupancy is not possible.

We continued:

It seems true that the maximum or optimum-sustainable-yield method of dealing with single species is an unspoken way of managing within the unseen and unknown constraints of an ecosystem. . . . We learn, to our consternation, that natural populations are themselves equilibria, and that their levels respond to forces we scarcely understand. . . . Nature, we learn, is far more complicated than management on a species level; population dynamics studies directed at single, harvested species tell us little about the ecosystem of which those species are a part. . . . [Our concern] is with a strategy which leaves basic resources in good shape, and which protects the aesthetic values that serve to make our world more livable. . . . [T]he basic determinants of management strategy must lie with those who attempt to understand marine ecosystems.

It is within that philosophy, spawned by our history, that OSP arose.

Progress Toward OSP

Almost immediately following the appointment of the members of the Marine Mammal Commission, and soon thereafter of the Committee of Scientific Advisors (CSA), the MMPA's central concept, *optimum sustainable population* (OSP), became the key element of a management philosophy that reflected a sea change in the way that marine mammal management was intended to be carried out in the future. OSP was defined in the MMPA as "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the optimum carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element." It is to be noted that the letter of the law can be interpreted in quite different ways. Nevertheless, despite Congress's clear intent, the Act's language understandably gave scientists, managers, affected industries, the environmental community, and the

MMC intellectual heartburn. What Congress was calling for, in uncertain legalese, was a shift away from the simplistic, narrowly based logistic equations of population dynamics, most particularly MSY, which was then widely considered a failure. Larkin (1977), in his entertaining review of MSY, made poetic fun with it:

Here lies the concept, MSY.
It advocated yields too high.
And didn't spell out how to slice the pie.
We bury it with the best of wishes,
Especially on behalf of fishes.
We don't know what will take its place,
But hope it's as good for the human race.

But despite MSY's perceived failure, a shift to another paradigm was, admittedly, risky, futuristic, and unknown territory. Several attempts were made to rectify this situation. Following a court decision regarding the tuna-dolphin controversy, the National Marine Fisheries Service (NMFS) held a workshop (Southwest Fisheries Center, 1976) that defined OSP as "a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity." *Maximum net productivity* was defined as "the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and/or growth less losses due to natural mortality." The conclusion was that *maximum net productivity levels* (MNPLs) were "between 50 and 70% of their [i.e., dolphin] carrying capacity and that 60% of the estimated carrying capacity would be a prudent approximation when available information is insufficient to determine the MNPL." These

definitions had long-lasting effects on implementation of the MMPA, which came to be applied to other species (Hofman, 2009).

The NMFS workshop employed the language of population dynamics and did not consider ecosystem aspects. Therefore, a second workshop (MMC, 1976) considered "ways to identify and characterize marine mammal responses to ecosystem variables" and concluded, not surprisingly, that the Act does not "provide a basis for determining the optimum level with reference to readily available, objective, biological criteria . . . [as] it includes certain features which are potentially inconsistent and certain other features which call for subjective value judgments that are not amenable to quantification." Thus, the MMC (1976) suggested four sets of empirical indicators that "reflect the general relationship between any given population and its environment . . . with most of the individual items having rather obvious implications as to the overall condition of the population" (Box 2). The report thereby concludes, "For present purposes, it will be useful to define the optimum sustainable population as a range of population levels within the upper limit being the average carrying capacity of the habitat (K) and the lower limit at the MSY level," which they suggest might be at 50 to 70% of K. Arguably, this is the identical conclusion of the previous one and is no more "quantifiable" than the flawed MSY concept that the Act suggests that OSP replace as it adds an unknowable and dynamic dimension of "average carrying capacity." Furthermore, the criteria that MMC (1976) identified are entirely oriented toward biological responses to ecological effects, omitting the reverse—that is, the effects that marine mammals might exert on food webs, energetics, or other environmental variables. The two-way street of species-environment connectivity is missed. MSY remains the central concept.

Box 2. Indicators of the relationship of marine mammals and their ecosystems (MMC, 1976)

Behavioral Responses

1. Antagonistic displacement behavior or schooling behavior
2. Time spent searching for food or tending and feeding young
3. Shifts in dietary components observed in food-habit studies

Effects Evident in Individuals

4. Physical condition, including growth rates
5. Incidence of disease and parasitism

Reproductive Effects

6. Population aspects
7. Annual reproductive rates of mature females

Population Aspects

8. Age structure
9. Survival rates, particularly of young age classes
10. Occupancy of marginal range
11. Rate of change of population size
12. Changes in abundance of preferred foods or other indicators of habitat effects

Concurrently, the CEQ, in cooperation with other conservation and scientific institutions, sponsored studies reported in Holt & Talbot (1978), the conclusions of which may be summed up as follows: (1) Ecosystems should be maintained at desirable states to maximize consumptive and nonconsumptive variables, ensure present and future options, and minimize adverse effects; (2) Management decisions should include a safety factor to allow for limited knowledge [the precautionary principle]; (3) Conservation measures should be applied to avoid wasteful resource use; and (4) Monitoring, analysis, and assessment should precede use of wildlife, and the results should be made available to the public. These principles were widely regarded and agree generally with the intent and substance of the MMPA in calling for a shift in management perspective, but are even more generalized and non-operational. It is interesting to note that no less than two further attempts have since been made to establish principles for ecosystem conservation and management (Mangel & Hofman, 1999; Meffe et al., 1999), lacking, however, specificity about applications.

The Marine Mammal Commission subsequently funded consultants to further investigate OSP. The first of these (Botkin & Sobel, 1977) acknowledged the ambiguity of MMPA language. For example, "productivity" as used in the Act's definition of OSP may be ecologically defined as the rate of change of numbers or biomass per unit of time. However, the Act fails to differentiate net vs. gross productivity, the latter being almost impossible to measure or predict. The Act allows various interpretations that populations are to be maintained either at intermediate or very high levels, in neither case necessarily ecologically optimal. In Botkin and Sobel's view, paucity of data on life history and ecological relationships obliges biologists to adopt deterministic models, such as MSY, although, they say, probabilistic models might be better. Furthermore a "healthy" ecosystem may be defined by rates of recycling, energy flows, environmental change, ecosystem persistence and recurrence, and states where carrying capacity for certain populations are within some estimated range. But, as change is a primary ecosystem characteristic, deterministic models are sure to fail. These problems led them to conclude that a better way to view populations within ecosystems is in terms of "states of 'equilibrium' conditions . . . directed toward 'persistence' and 'recurrence.'" There was little disagreement with the theory expressed in the report, but the Commission was disappointed that it did not provide an operational definition of OSP that moved beyond traditional single-species management.

The Commission's second funded study (Fowler et al., 1980) was an attempt to define OSP

for marine mammals, specifically "in the context of their ecosystem." The authors lost no time reiterating that "health and stability of the marine ecosystem is unclear and . . . 'optimum sustainable population' is vague." To their credit, the report does deal with the status and applicability of current knowledge of ecosystems, particularly with regard to ecological function, such as trophic relationships, information about diets, transfers of materials and energy, and the roles of behavior and evolutionary factors, all of which had been pursued for terrestrial wildlife management for some time. Furthermore, Fowler et al. note that species' density-dependence usually involves resources that have been modified by social, physiological, and behavioral factors. This leads to the conclusion that the MNPL level (see above), should be raised for most species from the 50 to 70% to close to K (on the r-K continuum; Pianka, 1970). But it does not necessarily follow that that all marine mammals are alike. In fact, variability among marine mammal natural histories suggests that marine mammals vary considerably from r- to K-selected (Ray, 1981). Nevertheless, Fowler et al. (1980) capture a systems approach as well as the precautionary principle in their principal finding: "Research along both [population and ecological] lines will enhance our progress in understanding both levels. . . . As we progress toward greater and greater levels of indirect perception, we must depend upon our abilities to synthesize our information into a conceptual framework . . . [in which] emergent properties of ecosystems, which are as yet undiscovered, may become apparent. . . . [W]e need to act conservatively in accordance with our ignorance." A shift in research emphasis is made explicit, but once again, no fully operational definition of OSP was achieved, nor perhaps could it have been.

A substantial hindrance for reaching operational definitions for OSP seems to be that the approaches of population dynamics are quantifiable, whereas ecosystem "health" is not, and the more the first is emphasized, the more OSP comes to resemble MSY. Due to this dilemma and so as not to be held hostage to an incapability to set levels of take, a new quantifiable approach arose. A complex issue regarding incidental take of marine mammals by fisheries (Hofman, 2009), led to amendments to the MMPA in 1994 directing the Secretary of Commerce (NMFS), with advice from the MMC, to prepare status reports for all marine mammal stocks, to include, among other things, an assessment of *potential biological removal* (PBR; Wade, 1998; Taylor et al., 2000). PBR is calculated as the product of (1) the minimum population estimate of the stock, (2) one-half the maximum theoretical or estimated net productivity rate of the stock at a

small population size, and (3) a recovery factor of between 0.1 and 1.0. This innovation released takings from compliance with OSP, however defined, and resolved the problem of incidental take in a quantitative and understandable way. However, minimum *population of the stock*—a *non sequitur*—is known with any degree of accuracy only for a small minority of marine mammals. *Maximum net productivity rate* is highly variable year to year as it is dependent on carrying capacity, behavior, hysteresis of density-dependent population responses, and alterations in habitat quantity and quality, and the *recovery factor* is judgmental. In other words, PBR is an exercise in Delphic guesswork. Should the species exist as a metapopulation, which we may assume to be the case for most species until and unless proven otherwise, all bets are off. To its credit, PBR is precautionary and pragmatic, but ecosystem- or habitat-oriented it is not.

More recently, Robards et al. (2009) provided thoughtful commentary on both OSP and PBR. They note that both the NMFS and FWS adopted the definition of OSP proposed by the Southwest Fisheries Center (1976). Both agencies also accepted that the MNPL would be between 50 and 70% of *K* and that 60% should be used if available data are insufficient to estimate it. Thus, both agencies acknowledge that PBR is useful as a default for assessing appropriate harvest level—for example, in the case of subsistence take of Pacific walrus. Nevertheless, in doing so, Robards et al. (2009) observe that the “primacy of population assessment becomes institutionalized over other potential management goals, such as habitat,” and further that PBR “does not by itself foster a precautionary ecosystem-based approach [as] large-scale environmental changes are expected to increase natural mortality.” They suggest a “fresh approach” of ecosystem-based management (EBM), requiring an interdisciplinary focus, avoiding habitat degradation, minimizing risks of irreversible ecosystem changes, obtaining and maintaining long-term socioeconomic benefits, generating knowledge of ecosystem processes, and utilizing robust precautionary measures. By inference, their suggestion of EBM implies that “the best scientific evidence available today is not the same as envisioned when the MMPA was first drafted”—true for the quality and quantity of science, but wrong for the intent of the Act. That is, adoption of an ecosystem approach is not necessarily information-dependent.

The result of the search for an operational definition of OSP, as related to ecosystem health, remains challenging to this day. A principal reason is that mutual relationships and feedback among species and their environments, albeit critical for

conservation and management, are insufficiently known, such that predictive power is limited at best. Grappling with this dilemma clearly requires a significant shift toward systemic thinking and acting. Which is, in fact, what has been happening during the last decade—for example, ecosystem-based fisheries management (Pikitch et al., 2004); the systemic relationships among whales, whaling, and ocean ecosystems (Estes et al., 2006); a systemic approach to management (Fowler, 2009); and attempts to place marine mammals within their “seascapes” (Campagna et al., 2008; Ray et al., 2010). True, these are not prescriptive studies. Nevertheless, they do suggest new research and management agendas that have been too long in coming.

In sum, the MMPA’s promotion of ecosystem concepts was an early precursor to EBM, which McLeod & Leslie (2009) define as “an integrated approach to management that considers the entire ecosystem, including humans [which] differs from current approaches that usually focus on single species, sector, activity or concern.” Chan et al. (2009) add that EBM was “born from management disasters caused by narrow species- or issue-specific decision-making [and] represents a profound shift in natural resource management.” In fact, EBM has now been incorporated into the official ocean policy of the U.S. Government by virtue of directives of the Bush and Obama Administrations. Its attainment will be less constrained by information (or its lack) than by a willingness to do so.

Conclusion

In large part, controversies over the provisions of the MMPA resulted from its visionary aspects, which are difficult to implement (Kellert, 1999). In a slightly different context, Holling & Chambers (1973) observed, “It is attempting and safe academic device to approach any problem from a traditional viewpoint. . . . But even if an ideal interdisciplinary research activity could be mobilized to produce a better mousetrap, no one would beat a path to its door. . . . We need to find directions towards solutions and not the Utopian solutions themselves.” Discussions on Antarctic living marine resources provide an example. In 1978, agencies of the U.S. Government were arguing among themselves to develop a negotiating position to govern living resource uses of the Southern Ocean (Antarctic). All U.S. agencies proposed basing negotiations on MSY. Each of the Antarctic Treaty Parties also carried MSY as the central tenant (Hofman, 2009). The Marine Mammal Commission and the Council on Environmental Quality, with a significant assist at the negotiations by a presentation

by Richard M. Laws (UK), persuaded the group that single-species management did not make sense, although advocating such a position was almost heresy then. Eventually, the MMPA's precautionary ecosystem approach won the day and was finally incorporated into the Convention on the Conservation of Antarctic Marine Living Resources at a diplomatic conference in 1980, and entered into force in 1982 (Kimball, 1999). Even so, the notion of *ecosystem health* raises difficult visions (Mangel & Hofman, 1999). A fisherman might conclude that more fish is the indicator, a scientist that resilience is the principle, or a conservationist that biodiversity value takes precedence. To make matters even more complex, the MMPA hearings bear witness to Kellert's (2005) contention that "sustainable fisheries conservation will never be achieved lacking fundamental shifts in human values and ethics" (see also Kellert, 1996).

On reflection, the Act was, and is, far from perfect. In fact, some might say it is naïve in adopting an approach and certain conditions that were either too far ahead of the times and/or impractical in the first place. Some reasons may be found in tendencies to respond to crisis and dependence on public concerns for evolving policy. Referring to changes in public attitudes toward environmental affairs from the 1960s (see previous discussion) to now, Graham (1999) observed,

A generation later, the political and economic ground has shifted. . . . The public's sense of crisis has been replaced with enduring support for improving pollution control and conservation, but also with a frequent reluctance to pay the public costs of increased protection or to change everyday habits. . . . Many aspects of national policy are, in practice, becoming customized by state, locality, industry, or facility. The simple structure of uniform standards and deadlines of the 1970s is evolving into a complex web of requirements and negotiated agreements tailored to suit particular situations.

Changing circumstances also involve unintended consequences. Soon after the Act passed, complex sets of biological, economic, and political factors resulted in a "dazzling array of distinctions never contemplated by the original drafters" (Bean & Rowland, 1997) with regard to incidental take of various species of marine mammals by fisheries. Some of these proved to be intractable and far beyond any technological fix. The result has been increasing exceptions by means of waivers or reduced regulations rather than of true solutions. Another unintended consequence

concerns state-federal collaboration, jurisdictions, and ownership. Whereas the MMPA, as written, contained provisions to develop state-federal management collaboration, anti-management pressures from protectionists and constitutional conflicts over subsistence rights (for Alaska specifically) substantially hindered implementation of such partnerships. With regard to the high seas, all marine mammal species are covered in one way or another under international conventions or agreements, such as the Law of the Sea, the International Whaling Convention, and Convention for the Conservation of Antarctic Marine Living Resources, but most of these agreements are nonbinding. To rectify this situation, in 1972, the MMPA called for an international ministerial meeting on marine mammals to be held before 1 July 1973 to negotiate a binding international convention for the protection and conservation of all marine mammals, but no meeting took place and no global convention exists. Yet another unintended consequence affected scientists directly. The Act sought to provide permits for scientific, educational, and other purposes in an expeditious manner. Nevertheless, permitting turned out to be excessively sluggish within the responsible agencies. Additionally, after the MMPA was passed, some funding agencies, such as the NSF, tended to "pass the buck."

Clearly, impediments remain, and it is our belief that the role of scientists is more important than ever in transforming toward "effective communication of science in environmental controversies" (Groffman et al., 2010) and particularly in urging what the MMPA intended, namely an ecosystem-based approach for seeking solutions to real-world situations. Scientists are confronted by the fact that "social science research has shown that technical knowledge is only loosely connected to collective decisions and to individual references" (Nisbet et al., 2010). Better framing of policy debates is suggested to form "an interpretative storyline that communicates what is at stake" (Groffman et al., 2010). This involves "engagement" by ecologists and others who "should understand that the relationship between science and policy can be highly context dependent and is not simply about transmitting scientific knowledge" (Pace et al., 2010). Complex cultural differences also come into play. Snow (1960) first called attention to the lack of communication between two cultures: (1) science and (2) the humanities. Now, environmental policy decisions involve no less than four (Nisbet et al., 2010): (1) environmental science, (2) philosophy and religion, (3) the social sciences, and (4) creative arts and professions, all of which may have different meanings and consequences for policymakers, managers, and the public.

The full intent of the MMPA has yet to be reached. OSP in the context of ecosystem health remains the goal, especially given global scenarios of rapidly changing ecological and social conditions. As scientists, managers, and policymakers are faced with solving environmental problems, science-based NGOs might serve as environmental ombudsmen to keep the rest of us committed to innovation. No more urgent environmental example—even surpassing climate change—could be found than today’s attacks upon biological diversity, including marine mammals. Establishing the connection of species to biological communities and maintaining environmental health and resiliency are crucial. The MMPA was an attempt at a systems-level approach, portions of which remain relevant, and other portions perhaps best forgotten. Who can say where we might have been had the MMPA not been passed in the first place? That OSP remains unfulfilled should not deter us, although at one point of the debate, Norris and Ray agreed, “We should have stuck with lizards.”

Acknowledgments

We are indebted to Bob Hofman, formerly the Marine Mammal Commission’s Scientific Program Director, for his review and suggestions concerning a draft of this article. Suzanne Contos (néé Montgomery), formally Program Administrator of the Marine Mammal Council and Special Assistant to the Executive Director of the Marine Mammal Commission, provided advice, leadership, and assistance during almost the entire history presented here, and also reviewed a draft. Michael Pace and Jerry McCormick-Ray, both of the Department of Environmental Sciences, University of Virginia, gave their advice during the early drafting process. Most of all, we thank Bill Schevill and Ken Norris for the memories, good times, humor, enduring wisdom, and philosophy; we are not likely to see their equals any time soon. We only hope that we’ve got it right through them. Finally, we thank Clayton E. Ray, then Curator of Paleontology, when at the closure of the IBP Marine Mammal Program he suggested that all our records be preserved in the Smithsonian Archives (Record Unit 7229).

For purposes of brevity, it has been necessary to choose examples of testimony and other items of history for this review. Any errors of fact or omission or commission are the sole responsibility of the authors.

Endnotes

- ¹ At the time, Counsel, Subcommittee on Fisheries and Wildlife Conservation, Committee on Merchant Marine and Fisheries, U.S. House of Representatives.
- ² At the time, Associate Professor, The Johns Hopkins University, and Program Director, Marine Mammal Council, Smithsonian Institution. Currently Research Professor, University of Virginia.
- ³ Then of the Oceanic Institute, Hawaii, later of the University of California, Santa Cruz.
- ⁴ Then of the Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.
- ⁵ Not to be confused with the Marine Mammal Commission, which came later.
- ⁶ Land and Water Conservation Act, 1965; Fur Seal Act, 1966; Endangered Species Preservation Act, 1966; Wild and Scenic Rivers Act, 1968; Endangered Species Conservation Act, 1969; National Environmental Policy Act, 1969; Clean Air Act, 1970; Clean Water Act, 1972; Marine Protection, Research and Sanctuaries Act, 1972; and the Coastal Zone Management Act, 1972. Others followed such as the Endangered Species Act, 1973, and the Fisheries Conservation and Management Act, 1976.
- ⁷ Waivers for incidental take by commercial fishing are included under strict conditions; conditions of the Act did not apply to take by Alaska Natives for subsistence purposes; and international agreements with regard to marine mammals remained applicable.
- ⁸ *Management* is used collectively herein to include all conservation, preservation, protection, regulatory activities, etc., depending on context.
- ⁹ US/IBP large-scale programs: Aerobiology, Arid Lands, Coniferous Forests, Desert, Eastern Deciduous Forest, Grassland, Human Adaptability, Tundra, Tropical Forest, and Upwelling. The International Programme was organized into sections on Productivity Terrestrial, Production Processes, Conservation Terrestrial, Productivity Freshwater, Productivity Marine, Human Adaptability, and Use & Management.
- ¹⁰ United States’ participation was facilitated by the National Academy of Sciences (www.nationalacademies.org/archives/International_Biological_Program.html).
- ¹¹ International Commission for Northwest Atlantic Fisheries (ICNAF); International Commission for Exploration of the Sea (ICES); North Pacific Fur Seal Commission (NPFC); Sealing Commission of the Northeast Atlantic

- (SCNA), IWC; and Scientific Committee on Antarctic Research (SCAR).
- ¹² Curator of Mammals, Smithsonian National Museum of Natural History.
 - ¹³ Until May 2011, Special Assistant to the Deputy Director, Marine Mammal Commission.
 - ¹⁴ US/IBP (\$2,000), Smithsonian Institution (\$2,500), National Science Foundation (\$5,000), New York Zoological Society (\$5,000), NOAA (\$2,500), U.S. Department of the Interior (\$2,500), U.S. World Wildlife Fund (\$3,500), National Audubon Society (\$2,500), Environmental Defense Fund (\$2,500), and the National Wildlife Federation (\$500), for a grand total of \$28,500, administered by the Conservation Foundation of Washington, DC (an offspring of the New York Zoological Society). **Note:** Through the frugally efficient administration of Suzanne Contos, total expenses proved to be \$22,396.11, leaving a balance of \$6,103.89 for publication and other costs.
 - ¹⁵ This is a digest. The recommendation of Working Groups are too lengthy to quote; see Schevill (1974).
 - ¹⁶ Confusion reigns about whether this should be "tow the line."
 - ¹⁷ Smithsonian Archives records for this subprogram are incomplete. Thus, the authors apologize to the following for not including their names: Michael A. Cyr, Keith R. Farrell, Clifford H. Fiscus, John D. Hall, Stephen J. Leatherwood, C. Victor Morejohn, Daniel K. Odell, Sigmund T. Rich, and William A. Walker.
 - ¹⁸ In later Senate testimony, the Department of Commerce representative stated that the Marine Mammal Commission, if established, should be "of limited duration with a provision for statutory extension . . . [and only for] . . . the short-term goal of reviewing existing policies and practices." The representative also suggested elimination of OSP.
 - ¹⁹ In later Senate testimony, the Department of Interior representative said, "Although we support and make extensive use of advisory commissions, we feel that their role should be advisory and that the advisee should have discretion in appointing their members and determining their duties and structure."
 - ²⁰ One reason was distance from Washington, DC. At other hearings in other states, more appeared. Others testified before the Senate. Nevertheless, scientists' views were not especially well-represented.
 - ²¹ At the time, there also was a long-standing pole and line tuna fleet that did not take marine mammals.

Literature Cited

- Alpers, A. (1961). *Dolphins: The myth and the mammal*. Boston: Houghton Mifflin.
- Anderson, R. S. (1995). The Lacey Act: America's premier weapon in the fight against unlawful wildlife trafficking. *Public Land Law Review*, 16, 27-85.
- Bartholomew, G. A. (1974). The relationship of the natural history of whales to their management. In W. E. Schevill (Ed.), *The whale problem* (pp. 294-304). Cambridge, MA: Harvard University Press.
- Bean, M. J., & Rowland, M. J. (1997). *The evolution of national wildlife law*. Westport, CT: Praeger.
- Blumm, M. C., & Ritchie, L. (2005). The pioneer spirit and the public trust: The American rule of capture and state ownership of wildlife. *Environmental Law*, 50, 101-147.
- Botkin, D. B., & Sobel, M. J. (1977). *Optimum sustainable marine mammal populations*. Unpublished report prepared for the Marine Mammal Commission. 126 pp.
- Burns, W. C. (1997). The International Whaling Commission and the future of cetaceans: Problems and prospects. *Colorado Journal of International Environmental Law and Policy*, 8, 31-88.
- Campagna, C., Sanderson, E. W., Coppolillo, P. B., Falabella, V., Piola, A. R., Strindberg, S., & Croxall, J. P. (2008). A species approach to marine ecosystem conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 17, S122-S147. <http://dx.doi.org/10.1002/aqc.918>
- Caspersen, A. R. C. (1996). The public trust doctrine and the impossibility of "takings" by wildlife. *Environmental Affairs*, 23, 357-391.
- Chan, K. M. A., Gregr, E. J., & Klain, S. (2009). A critical course change. *Science*, 325(5946), 1342-1343. <http://dx.doi.org/10.1126/science.1178100>
- Coglianese, C. (2001). Social movements, law, and society: The institutionalization of the environmental movement. *University of Pennsylvania Law Review*, 150, 85-118. <http://dx.doi.org/10.2307/3312913>
- Culotta, E. (2009). On the origin of religion. *Science*, 326, 784-787. http://dx.doi.org/10.1126/science.326_784
- Estes, J. A., DeMaster, D. P., Doak, D. F., Williams, T. M., & Brownell, R. L., Jr. (2006). *Whales, whaling, and ocean ecosystems*. Berkeley: University of California Press.
- Fowler, W. T., Bunderson, W. T., Cherry, M. B., Ryel, R. J., & Steele, B. B. (1980). *Comparative population dynamics of large mammals: A search for management criteria* (Final Report to the U.S. Marine Mammal Commission in fulfillment of Contract No. MM7aCO13; U.S. Department of Commerce, National Technical Information Service PB80-178627). Washington, DC: U.S. Department of Commerce. 320 pp.
- Gambell, R. (1999). The International Whaling Commission and the contemporary whaling debate. In J. R. Twiss, Jr. & R. R. Reeves (Eds.), *Conservation and management of marine mammals* (pp. 179-198). Washington, DC: Smithsonian Institution Press.

- Gosliner, M. J. (1999). The tuna-dolphin controversy. In J. R. Twiss, Jr. & R. R. Reeves (Eds.), *Conservation and management of marine mammals* (pp. 120-155). Washington, DC: Smithsonian Institution Press.
- Graham, M. (1999). *The morning after Earth Day: Practical environmental politics*. Washington, DC: Brookings Institution Press.
- Grimm, D. (2011). Are dolphins too smart for captivity? *Science*, 332, 526-529. <http://dx.doi.org/10.1126/science.332.6029.526>
- Groffman, P. M., Stylinski, C., Nisbet, M. C., Duarte, C. M., Jordan, R., Burgin, A., . . . Coloso, J. (2010). Restarting the conversation: Challenges at the interface between ecology and society. *Frontiers in Ecology and the Environment*, 8, 284-291. <http://dx.doi.org/10.1890/090160>
- Hardin, G. (1972). *Exploring new ethics for survival: What the hedgehog knows*. New York: Viking Press. 38 pp.
- Hofman, R. J. (2009). The continuing legacies of the Marine Mammal Commission and its Committee of Scientific Advisors on Marine Mammals. *Aquatic Mammals*, 35(1), 94-129. <http://dx.doi.org/10.1578/AM.35.1.2009.94>
- Holling, C. S., & Chambers, A. D. (1973). Resource science: The nurture of an infant. *BioScience*, 23, 13-20. <http://dx.doi.org/10.2307/1296362>
- Holt, S. J., & Talbot, L. M. (1978). New principles for the conservation of wild living resources. *Wildlife Monographs*, 59, 5-33.
- Kellert, S. R. (1996). *The value of life*. Washington, DC: Island Press.
- Kellert, S. R. (1999). *American perceptions of marine mammals and their management*. New Haven, CT: Yale University, School of Forestry and Environmental Studies, The Humane Society of the United States. 286 pp.
- Kellert, S. R. (2005). Perspectives on an ethic toward the sea. In P. W. Barnes & J. P. Thomas (Eds.), *Benthic habitats and the effects of fishing* (pp. 703-711). Bethesda, MD: American Fisheries Society.
- Kimball, L. A. (1999). The Antarctic treaty system. In J. R. Twiss, Jr. & R. R. Reeves (Eds.), *Conservation and management of marine mammals* (pp. 199-223). Washington, DC: Smithsonian Institution Press.
- Krupnik, I. (1993). *Arctic adaptations: Native whalers and reindeer herders of Northern Eurasia*. Hanover, NH, and London: University Press of New England.
- Larkin, P. A. (1977). An epitaph for the concept of maximum sustainable yield. *Transactions of the American Fisheries Society*, 10, 1-11. [http://dx.doi.org/10.1577/1548-8659\(1977\)106<1:AEFTCO>2.0.CO;2](http://dx.doi.org/10.1577/1548-8659(1977)106<1:AEFTCO>2.0.CO;2)
- Likens, G. E., & Bormann, F. H. (1974). Linkages between terrestrial and aquatic systems. *BioScience*, 24, 447-456.
- Lilly, J. C. (1961). *Man and dolphin: Adventures of a new scientific frontier*. Garden City, NY: Doubleday.
- Lilly, J. C. (1967). *The mind of the dolphin: A nonhuman intelligence* (1st ed.). Garden City, NY: Doubleday.
- Mangel, M., & Hofman, R. J. (1999). Patterns, processes, and ecosystems. In J. R. Twiss, Jr. & R. R. Reeves (Eds.), *Conservation and management of marine mammals* (pp. 87-98). Washington, DC: Smithsonian Institution Press.
- Marine Mammal Commission (MMC). (1976). *The concept of optimum sustainable population*. Unpublished report. 23 pp.
- McCay, B. J. (1998). *Oyster wars and the public trust: Property, law, and ecology in New Jersey history*. Tucson: University of Arizona Press.
- McLeod, K., & Leslie, H. (2009). *Ecosystem-based management for the oceans*. Washington, DC: Island Press.
- Meffe, G. K., Perrin, W. F., & Dayton, P. K. (1999). Marine mammal conservation: Guiding principles and their implementation. In J. R. Twiss, Jr. & R. R. Reeves (Eds.), *Conservation and management of marine mammals* (pp. 437-454). Washington, DC: Smithsonian Institution Press.
- Nisbet, M. C., Hixon, M. A., Moore, K. D., & Nelson, M. (2010). Four cultures: New synergies for engaging society on climate change. *Frontiers in Ecology and the Environment*, 8, 329-331. <http://dx.doi.org/10.1890/1540-9295-8.6.329>
- Norris, K. S. (Ed.). (1966). *Whales, dolphins, and porpoises*. Berkeley and Los Angeles: University of California Press.
- Pace, M. L., Hampton, S. E., Limburg, K. E., Bennett, E. M., Cook, E. M., Davis, A. E., . . . Strayer, D. L. (2010). Communicating with the public: Opportunities and rewards for individual ecologists. *Frontiers in Ecology and the Environment*, 8, 292-298. <http://dx.doi.org/10.1890/090168>
- Payne, R. S., & McVay, S. (1971). Songs of humpback whales. *Science*, 173, 585-597. <http://dx.doi.org/10.1126/science.173.3997.585>
- Pianka, E. R. (1970). *r* and *K* selection. *The American Naturalist*, 104, 592-597. <http://dx.doi.org/10.1086/282697>
- Pikitch, E. K., Doukakis, P., Fluharty, D., Heneman, B., Link, J., Livingston, P. A., . . . Sainsbury, K. J. (2004). Ecosystem-based fisheries management. *Science*, 305, 346-347.
- Ray, C. (1970). Ecology, law, and the "marine revolution." *Biological Conservation*, 3(1), 7-17. [http://dx.doi.org/10.1016/0006-3207\(70\)90051-0](http://dx.doi.org/10.1016/0006-3207(70)90051-0)
- Ray, G. C. (1981). The role of large organisms. In A. R. Longhurst (Ed.), *Analysis of marine ecosystems* (pp. 397-413). New York: Academic Press.
- Ray, G. C., & Norris, K. S. (1972). Managing marine environments. In *Transactions of the Thirty-Seventh North American Wildlife and Natural Resources Conference* (pp. 190-200).
- Ray, G. C., Overland, J. A., & Hufford, G. L. (2010). Seascape as an organizing principle for evaluating walrus and seal sea-ice habitat in Beringia. *Geophysical Research Letters*, 37, L20504. <http://dx.doi.org/10.1029/2010GL044452>, 2010

- Ray, C., Watkins, W. A., & Burns, J. J. (1969). The underwater song of *Erignathus* (bearded seal). *Zoologica*, 54(2), 79-83 + plates I-III & phonograph record.
- Regenstein, L. (1971, Winter). The whales near extinction. *Defenders of Wildlife News*, 390-395.
- Ridgway, S. (Ed.). (1972). *Mammals of the sea: Biology and medicine*. Springfield, IL: Charles C. Thomas Publisher.
- Ridgway, S. (1986). Physiological observations on dolphin brains. In R. Schusterman, J. A. Thomas, & F. G. Woods (Eds.), *Dolphin cognition and behavior: A comparative approach* (pp. 31-60). Mahwah, NJ: Lawrence Erlbaum Associates.
- Robards, M., Burns, J. J., Meek, C. L., & Watson, A. (2009). Limitations of an optimum sustainable population or potential biological removal approach for conserving marine mammals: Pacific walrus case study. *Journal of Environmental Management*, 91, 57-66. <http://dx.doi.org/10.1016/j.jenvman.2009.08.016>
- Roppel, A. Y. (1984). *Management of northern fur seals on the Pribilof Islands, Alaska: 1786-1981* (NOAA Technical Report NMFS-4). Washington, DC: U.S. Department of Commerce. 26 pp.
- Scheffer, V. B., Fiscus, C. H., & Todd, E. I. (1984). *History of scientific study and management of the Alaskan fur seal, Callorhinus ursinus* (NOAA Technical Report NMFS SSRF-780). Washington, DC: U.S. Department of Commerce. 70 pp.
- Schevill, W. E. (Ed.). (1974). *The whale problem*. Cambridge, MA: Harvard University Press.
- Schevill, W. E., Watkins, W. A., & Ray, C. (1963). Underwater sounds of pinnipeds. *Science*, 141, 50-53. <http://dx.doi.org/10.1126/science.141.3575.50>
- Smith, G. (1983). The International Whaling Commission: An analysis of the past and reflections on the future. *Natural Resources Lawyer*, 16, 543-567.
- Southwest Fisheries Center. (1976). *Report of the workshop on stock assessment of porpoises involved in the Eastern Tropical Pacific yellowfin tuna industry* (SWFC Administrative Report LJ-76-29). La Jolla, CA: Southwest Fisheries Center.
- Snow, C. P. (1960). *The two cultures*. Cambridge, UK: Cambridge University Press.
- Taylor, B. L., Wade, P. R., & DeMaster, D. P. (2000). Incorporating uncertainty into management models for marine mammals. *Conservation Biology*, 14, 1243-1252. <http://dx.doi.org/10.1046/j.1523-1739.2000.99409.x>
- U.S. House of Representatives. (1971). *Hearings before the Subcommittee on Fisheries and Wildlife Conservation of the Committee on Merchant Marine and Fisheries* (Serial No. 92-10). Washington, DC: U.S. House of Representatives, Ninety-Second Congress, First Session. 593 pp.
- U.S. Senate (1972). *Hearings before the Subcommittee on Oceans and Atmosphere of the Committee on Commerce* (Serial No. 92-56). Washington, DC: U.S. Senate, Ninety-Second Congress, Second Session. 844 pp.
- Wade, P. R. (1988). Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Marine Mammal Science*, 14, 1-37. <http://dx.doi.org/10.1111/j.1748-7692.1998.tb00688.x>
- Wagner, F. H. (1969). Ecosystem concepts in fish and game management. In G. VanDyne (Ed.), *Ecosystem concept in natural resource management* (pp. 259-307). New York: Academic Press.
- Wood, F. G. (1973). *Marine mammals and man: The Navy's porpoises and sea lions*. Washington & New York: Robert B. Luce, Inc.