
**SOCIAL SCIENCE PERSPECTIVES
ON MANAGING CONFLICTS
BETWEEN MARINE MAMMALS
AND FISHERIES**

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*Proceedings from a Conference on Management of
Sea Otters and Shellfish Fisheries in California
Held at Arroyo Grande, California, January 9-11, 1981*

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INTRODUCTION: EXPLORING CONFLICTS
BETWEEN MARINE MAMMALS AND FISHERIES

What priority should be given to the protection of marine mammals versus to the commercial and recreational utilization of fisheries? Answers to this question are increasingly becoming contentious in countries around the world, and are particularly evident in the United States. Marine mammals/fisheries interactions along America's coasts have become the object of conflict and public concern. Marine mammals, after all, are the symbols, in many respects, of man's attachment to and fascination with the sea. These are the animals which can be likened to man by their attributes and behavior (such as the intelligence and communicative skills of porpoises, or the nurturing behavior of sea otter females toward their young). These are also the mammals whose capabilities and behavior can be viewed as transcending man. The mammoth whales who traverse huge distances linking different regions of our water planet are perhaps the best example of man's fascination with marine mammals as they represent the embodiment of mystery and adventure, of strength and grace.

Fisheries, on the other hand, represent other values which are also considered important by man. Utilization of fisheries, for some, means making food resources available to a protein-needy world. To others, it means recreational enjoyment and interaction with the natural environment--experiences which assume increasing importance in technologically advanced societies such as the United States. To many, fishing--whether commercial, subsistence, or recreational--represents a way of life; a special way of life which involves unique aspects of freedom and independence, of adventure, and in some ways, of man's ability to prevail over nature, but with due care and respect.

When do marine mammals and fisheries interactions become conflictual? Throughout time, of course, marine mammals and fishery stocks have interacted naturally in the marine environment as predator and prey, with marine mammals at the top of the food chain. While the relationship between marine mammals and fisheries obviously involves conflict (i.e., one consumes the other), marine mammal/fisheries interactions only become conflictual or problematic when man develops a stake over either resource.

Most instances of marine mammal/fisheries conflicts can be grouped into two major categories. The first concerns situations in which marine mammals and fishery resources of value to man occupy the same marine environment. In these cases, man and marine mammal compete with each other for the same fishery stocks. A prominent example of this type of competition is the conflict between sea lions and harbor seals and salmon fishing along the Pacific coast--whereby the mammals typically steal or partially consume the fish in the nets, often leaving unmarketable carcasses for the frustrated fishermen.

The second major category concerns marine mammal/fishery interactions which affect or interfere with fishing operations, sometimes referred to as incidental take. Prominent examples include the tuna/porpoise case, whereby porpoises which are used to locate schools of tuna drown in the purse seiners' nets, and cases where sea lions and seals become entangled in gill nets during fishing operations.

In addition to these two categories, other cases of conflicts over marine mammals exists. These situations, however, do not entail direct interactions between marine mammals and fisheries. Marine mammals themselves can become the object of controversy; conflict here revolves around the question of whether the marine mammals should be viewed as usable resources. The most widely publicized cases in this category are perhaps the killing of dolphins by the Japanese as a method of preserving fishery resources for human harvest, and the conflict over whether the endangered bowhead whale should continue to be used for traditional subsistence purposes by Alaskan Eskimos.

The case of the southern sea otter in California represents a prime example of all of these different types of conflicts. As a resource, the sea otter has alternatively been hunted ruthlessly and then protected completely. Throughout much of the twentieth century, the sea otter has competed with man for valuable shellfish resources, and has generally prevailed in this competition. More recently, the sea otter has come into conflict with the development of other valuable marine resources, such as oil and gas. Some groups maintain, also, that fishing operations (primarily gill netting in northern California) may pose a problem to the safety of sea otters. Most of all perhaps, the sea otter/shellfish fisheries controversy in California has involved a clash of values and has engendered intense conflict among groups holding fundamentally different philosophical views on who should get what, and on who has what rights.

Incorporating all of these different elements, the sea otter/shellfish fisheries controversy in California can be fruitfully used as a case study to better understand the nature of marine mammals/fisheries interactions in general. This volume thus brings together a collection of original interdisciplinary papers and comments presented at the conference on MANAGEMENT OF SEA OTTERS AND SHELLFISH FISHERIES IN CALIFORNIA: POLICY ISSUES AND MANAGEMENT ALTERNATIVES, held at Arroyo Grande, California, on January 9-11, 1981. While focused specifically on the sea otter case, these interdisciplinary social science perspectives explore the complex web of philosophical, historical, economic, social, political, and administrative issues which generally underlie conflicts between marine mammals and fisheries.

Sea Otters, Shellfish Fisheries, and Man: Epic and Drama

If one were to approach the sea otter case in California from a literary tradition, one could properly view it as a story of epic and drama. The sea otter has had a dramatic, fascinating, and, in fact, epic history--a history of abundance all along the Pacific Coast, hunting by men from all over the world, near extinction, and then dramatic recovery. The otter story has also been and continues to be a story of conflict--conflict over the shellfish it consumes (the abalone, Pismo clams, sea urchins, and other shellfish, that are also sought after by man); conflict over the oil development which threatens its survival; as well as conflict between different agencies of government which differ on its management.

To understand the fascinating, dramatic, and conflictual story of the interaction among man, sea otters, and shellfish fisheries over time, several facts about the biology and behavior of the sea otter must first be explained: the quality of its fur, the nature of its metabolism, its role as a "keystone" species, and its "cuddly quotient."

The sea otter possesses one of the most beautiful furs in the world; as one nineteenth century captain put it, "Next to a beautiful woman and a lovely infant, a sea otter's skin is the finest natural object in the world." The metabolism of the sea otter is also highly distinctive. Unlike most marine mammals, the sea otter lacks a protective layer of blubber which could protect it against chill waters. The lack of such an insulating mechanism means two things. First, to maintain itself, the otter must consume enormous quantities of food: on the average, the equivalent of nearly a quarter of its body weight a day. Second, lacking the blubber, otters must depend on their thick air-filled fur for insulation. Should the otter's fur become contaminated with oil (in the event of oil spills), the fur would lose its insulating qualities, resulting in overexposure and death.

The sea otter is also thought to be a "keystone species," one which significantly structures the nearshore marine environment. This means that when otters are present, different kinds of marine life prevail than when otters are not present. Presence of sea otters has been associated with significant reductions in shellfish resources (most notably abalone, clams, and sea urchins, which represent the favorite food items for otters), regrowth of kelp forests, and an attendant increase in finfish resources which are attracted by the luxuriant kelp habitat.

Finally, the grace, beauty, and human-like behavior of the otters exert great appeal for many, not only in terms of what Michael Orbach calls the "cuddly quotient" in this volume (the very common "Oh, aren't they cute!" public reaction), but also because of the otters' unique characteristics. The sea otter is a tool-using animal; as it

lies on its back nesting on the kelp, it utilizes rocks to break open clams or other shellfish. Sea otter females are also very devoted to their young, in a manner, as Victor Scheffer observes, unequalled among nonprimate animals.

Prior to the eighteenth century, sea otters inhabited the Pacific Ocean all the way from Baja California in Mexico, up the whole Pacific Coast through the Aleutian, Commander, and Kurile Islands, to Japan. Because of the value that became attached to its fur, the sea otter, according to a number of observers, was partially responsible for the commercial opening of the Pacific Coast. In the eighteenth century, once its luxurious pelt was discovered, the sea otter became the prized fur of the Imperial Chinese and was thus hunted ruthlessly for over one hundred and seventy years by hunters from all over the world. The Russians, Spanish, British, and Americans all took part in the fur trade of the eighteenth and nineteenth centuries. By the beginning of the twentieth century, this prized species had been almost decimated. In 1900, in California, sea otters were thought to be extinct.

In 1911, however, a small remnant population was discovered along the Big Sur Coast in northern California. The animal became protected and soon began to expand both in terms of numbers and range. The California otters now number around 1,800 and range from Santa Cruz in the north to Pismo Beach in the south.*

The dramatic recovery of the otter in the twentieth century, while applauded by some, soon became embroiled in conflict with others. As the range of the otter expanded between 1910 and 1980, so did the population of California and the pressures of this population on coastal resources. California's population grew from about two million people in 1910 to twenty-four million in 1980. In many areas of the coast, while the otters were absent, shellfish resources grew and became exploited by many Californians for commercial and recreational purposes. In the 1950s, as the range of the sea otter expanded south beyond the pristine coastal areas near Big Sur, conflicts with shellfish fisheries became apparent.

A review of the history of this conflict over the last thirty years suggests that this has been a very bitter, and occasionally explosive conflict--one in which the major parties to the controversy (sea otter protectionists, and commercial and recreational fishing interests) have typically held antagonistic and largely irreconcilable positions. Differences among these groups have been rooted not only

*A map depicting the sea otter range in California may be found on p. 200 of this volume. Sea otters are much more numerous in Alaska where there is an estimated population of 120,000 to 125,000 animals.

in economic and social factors, but in deeply held philosophical orientations as well. Sea otter protection groups have tended to view those who fished as greedy rapists of the marine environment, interested only in their short-term economic gain. Divers, on the other hand, have often viewed sea otter protectionists as members of an elitist class who care more about the rights and fate of animals than about the rights and fate of humans.

These parties have pursued their differences in the political arena--albeit at different levels and with differential rates of success. Protection groups--well connected to national and international constituencies--proved highly effective in providing federal level protection for the sea otter, both through the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Commercial and recreational groups, on the other hand, less organized and less politically cohesive, engaged in much more ad hoc and sporadic political action directed mainly at local and state levels of government. Conflict among these groups continued until the early 1980s, their positions experiencing little change over time.

Addressing Marine Resource Conflicts

The management framework that governs the use and protection of marine resources, however, is ill equipped to reconcile conflicts such as this one. Different marine resources are managed separately by a complex and fragmented array of agencies at all levels of government--including local, state, federal, and, on occasion, international--each pursuing different legislative mandates and each responsive to different political constituencies. In the case at hand, sea otters were under the management authority of the California Department of Fish and Game until 1972 when this authority was transferred to a federal agency, the U.S. Fish and Wildlife Service, under the provisions of the Marine Mammal Protection Act. Since 1977, the sea otter has been protected further by federal law through the Endangered Species Act. Management of shellfish fisheries, on the other hand, has continued under the jurisdiction of the California Department of Fish and Game. Offshore oil exploration, development and production operations, in turn, are managed by a yet different set of state and federal agencies--most prominently the Bureau of Land Management, the Minerals Management Service, and the California State Lands Commission (depending on their distance offshore).

While conflicts involving a single marine use can generally be accommodated (more or less successfully) within the existing management framework, conflicts which involve interactions among several marine uses (such as the present case) can often fall "between the cracks"; i.e., no government agency or group has authority or responsibility for addressing and mediating the conflict. A common result is delay or inaction, and more often than not, resource conflicts

among different user groups become supplemented by conflicts between different agencies as well as conflicts between different levels of government. California's effort to regain control over sea otter management after the enactment of the Marine Mammal Protection Act represents a prime example of such intergovernmental conflict or tension. Relevant examples of inter-agency or interdepartmental tension may be found in current differences of opinion between the U.S. Fish and Wildlife Service and the Bureau of Land Management over the potential impacts of increasing offshore oil exploration and exploitation in areas of the California coast which are occupied by sea otters.

All of these different types of conflicts over marine resources (among interest groups, intergovernmental, and inter-agency) are typically focused around regional issues and are manifested at a regional level. The sea otter controversy in California, for example, currently concerns primarily the central and southern California areas. Such conflicts, however, can seldom be fully addressed and ultimately resolved by regional actors alone. Instead, their eventual resolution must involve the full array of multiple private and public actors located at other levels (state, federal, and occasionally, international). Unfortunately, under the current segmented and sectorally oriented management regime, there are no readily available mechanisms for catalyzing the attention of this wide array of actors. Effective mechanisms that promote public/private interface, and intergovernmental and inter-agency cooperation have yet to be fully developed.

In the absence of effective conflict management mechanisms, the University, in our view, can play a useful role in addressing marine conflicts such as the sea otter/shellfish fisheries controversy. The University can perform an important public service function in this arena in at least three respects. First, the University can apply its collective knowledge resources to better understand the complex nature of marine issues. As we discussed above, marine conflicts such as the sea otter/shellfish fisheries case involve biological, historical, philosophical, economic, social, political, and administrative dimensions which must be properly understood in order for effective policy solutions to emerge. As a repository of multidisciplinary talent, the collective knowledge resources of the University can be catalyzed to better understand what is at stake in these issues--from a scientific, as well as from a human impact and policy perspectives.

Second, the University can facilitate conflict resolution by providing a neutral meeting ground for groups holding divergent points of view on specific marine issues, and by fostering interchange of information and opinion among government agencies, academia, special interests and the general public. While no doubt individuals associated with a University may hold specific value positions, as an institution, the University is generally considered to be neutral on public policy debates, having no specific stake in the outcome of

conflictual issues. Given this neutral stance, the University is in a key position to catalyze attention on conflictual marine problems and to promote balanced discussion formats which involve the full array of private and public interests. The University, moreover, is in a position to identify and include in discussions the interests of groups who are potentially, rather than actually, affected by specific decisions--such as the rights and interests of future generations.

Third, the University can play an important role in this area by educating and involving the general public. Marine conflicts, after all, involve debates over common property resources, which should properly concern all citizens. The general public, however, has not generally been well informed about nor involved in these disputes. Increasing public understanding and awareness of marine policies is, in our view, a proper University function which may, in the long run, contribute significantly to wise conservation and equitable management of America's common property marine resources.

The Regional Forum on the Sea Otter/Shellfish Fisheries Conflict

Our Regional Forum on MANAGEMENT OF SEA OTTERS AND SHELLFISH FISHERIES IN CALIFORNIA: POLICY ISSUES AND MANAGEMENT ALTERNATIVES had three major purposes: (1) to discuss the issues involved in this controversy from a multidisciplinary perspective, with an emphasis on social science and humanities contributions (in contrast to previous discussions which had largely been centered solely on biological perspectives); (2) to bring together public and private groups found at local, state, federal, and international levels and to provide a neutral meeting ground for the expression of their divergent views; and (3) to inform and educate the general public.

The two-day meeting, held on January 9-11, 1981 in Arroyo Grande, California, brought together approximately 50 speakers and 250 conference participants--representing a wide variety of disciplinary, agency, and interest group perspectives.

During the first day of the forum, four panel sessions were held focusing on different aspects of the interaction among sea otters, shellfish fisheries and humans over time: BACKGROUND AND HISTORY, PHILOSOPHICAL AND SOCIAL ISSUES, ECONOMIC COSTS AND BENEFITS, AND LEGAL AND ADMINISTRATIVE ISSUES. The papers in this volume represent the full texts of the presentations made at these panels. In addition to these paper presentations, each panel was composed of 6 to 10 panelists representing divergent agency and interest group perspectives from all sides of the political spectrum. Comments made by the panelists have been transcribed and are included in the volume following the papers in each panel. (*Biographical information on conference participants is available in Appendix II.*)

Presentations made at the first panel, BACKGROUND AND HISTORY, briefly reviewed the status of biological research on sea otters and shellfish fisheries, and analyzed the historical interactions among humans, sea otters, shellfish fisheries and other aspects of the ecosystem.

Scientific understanding of the biology, behavior, and ecology of a species represents a first prerequisite to formulating a sound management regime. While the forum was primarily concerned with exploring the sea otter/shellfish fisheries controversy from the perspectives of the social sciences, two brief presentations on the state of biologically oriented research on sea otters and shellfish fisheries were made at the outset of the conference by Charles Woodhouse, Jr., a marine mammalogist, and by Robert Hardy, Fred Wendell, and John DeMartini (all biologists). *(For readers interested in the biological aspects, the full texts of these presentations are available in APPENDIX I: BIOLOGICAL BACKGROUND.)*

Reviewing the state of the art of biological research on the sea otter, Woodhouse finds that while adequate data are available on the behavior, systematics, zoogeography, diet and habitat requirements of sea otters, information on ecological processes at the population and community level is scant. For example, we know little about how and why the size of the population is growing or declining, its internal dynamics (how different parts of the population relate to one another), and the dynamics of range occupation (how and why does the range contract or expand). These gaps in scientific knowledge have important management implications. Insufficient scientific data on these questions makes definition of Optimum Sustainable Population (as required by the Marine Mammal Protection Act) very difficult. Moreover, it complicates prediction of the potential success of management efforts such as translocation (establishing other colonies of otters) or zonal management (containment of sea otters within a specified zone).

Robert Hardy, Fred Wendell, and John DeMartini discuss the status of and management practices concerning shellfish fisheries actually or potentially affected by sea otters: the red abalone, Pismo clam, sea urchin, Dungeness crab, rock crab, and lobster fisheries. Their paper reviews scientific evidence on the effects of sea otter predation on shellfish stocks. The authors conclude with a plea for formulating a management regime for sea otters which allows for the continued utilization of shellfish fisheries by both commercial and recreational harvesters.

In contrast to the modern Western belief that man has dominion over nature, American Indians are often thought of as prudent conservationists who lived in harmonious balance with their natural environment. This presumed harmony is touted by conservationists as an example of how modern man, too, could co-exist in a "balanced

community" with shellfish fisheries and sea otters. Phillip Walker, a physical anthropologist, reviews the archaeological evidence found in Indian middens on the relationship among Indians, sea otters, and shellfish. His findings raise questions about the presumed "harmonious balance," and suggest that the available archaeological evidence indicates that as their populations grew, Indians, too, intensified their exploitation of marine animals. Questions of continued survival, not environmental concerns, are the motivating factors which have guided man's actions throughout time, Walker concludes.

Tracing the relationship among humans, sea otters, and shellfish through to the twentieth century, John Talbott, a historian, describes the causes and consequences of the fur trade of the eighteenth century. Talbott recounts how the attractiveness of the sea otter became widely known through the journals of the explorer Captain James Cook in his Pacific voyages, and how sea otter pelts became a major exchange vehicle for obtaining tea and textiles from the Chinese. The lucrative fur trade with Canton was conducted primarily by Russian and American ships which hunted for sea otters on the Pacific Coast, at first using expert Aleut Indian hunters, and later on, with firearms.

Establishing a precise historical record and estimating the number of sea otters that existed prior to the fur trade as well as the number that were actually taken during the fur trade (information which is relevant to current efforts to determine Optimum Sustainable Population), however, is extremely difficult, Talbott explains. Particularly because Yankee hunting of sea otters was illegal under the Spanish and Mexican rule of the West Coast, the few hunting records that exist are very fragmentary and make it very difficult to establish overall mortality rates. One figure that provides some indication of the extent of the hunt is the number of pelts taken in 1811, 9,356 skins, which represents the highest annual number recorded. By 1840, the overexploitation of sea otters brought the fur trade to a halt, and the sea otter came dangerously close to becoming extinct.

In the twentieth century, the sea otter in California became protected by international, federal, and state actions,* and slowly began making a comeback. In her comments in Panel 1, Margaret Owings, President of the Friends of the Sea Otter, traces the development of this organization, founded in 1968, to protect the historical rights of these native species to live along the shore, to extend their range, and to forage upon the natural foods that were there long

* A discussion of these laws is available in the paper by Cicin-Sain paper, Part 4, p.195.

before they were shared with man. The sea otter is an aesthetic resource, Owings contends, "It is nothing that is eaten in restaurants, worn on backs, or shipped to Japan in boxes, but it has a drawing power unequalled in California, and it will last as long as man will let it last and must let it last."

It doesn't matter that the "sea otters were there first," however, fishing groups contend. Contemporary Californians have become accustomed to utilizing and enjoying the shellfish resources that grew abundant during the absence of the sea otter. And, the continued expansion of the sea otter, Thorn Smith, an ex-commercial diver points out, precludes this enjoyment. Sea otters, Smith maintains, act as "Shiva, the destroyer, annihilating underwater stocks of shellfish."

This clash of values--Does it matter "Who was there first?" "Who should prevail?" "What values are at stake, and how do we decide which values should prevail?"--was the subject of considerable debate in Panels 2 and 3, SOCIAL AND PHILOSOPHICAL ISSUES, AND ECONOMIC COSTS AND BENEFITS. In Panel 2, Ernest Partridge, a philosopher, raises a number of the moral issues which underlie the controversy. Partridge suggests the need to shift our attitudes from a less anthropocentric view to a more holistic perspective. Calling for a moral point of view based on an ecological perspective, Partridge urges us to follow Aldo Leopold's land ethic, by which nature is regarded "not as a commodity, but as a community" of which man is a part. Describing what he terms the "moral paradox," Partridge suggests that human beings, in order to be healthy and fulfilled, need to care for things beyond their immediate concerns. This need for self-transcendent concern and the moral paradox are discussed in the context of an ecological point of view, and Partridge asserts that a self-transcending concern for the welfare of wild species and their habitats enriches the quality of moral life.

Partridge concludes with a plea for protecting nature, not only for the sake of nature, but for man's wellbeing as well. "One must wonder," he concludes, "if this generation can at one time be exploiters and destroyers of the natural community and at the same time [be] good neighbors in the social community... A world unsafe for sea otters is a world less safe for human beings and for human moral ideals."

Using a comparative framework, Michael K. Orbach (a cultural anthropologist) locates the interaction of sea otters and humans within the broader context of man/mammal relationships. Orbach discusses how and why humans relate to different kinds of mammals, how these relationships vary according to culture, and what management implications flow from these cultural relationships.

In contemporary American society, Orbach suggests, humans view wild mammals (such as tigers, lions and bears) with awe, fright, admiration, and sometimes with disdain. Domestic mammals (such as dog, cats, cows, horses), on the other hand, are anthropomorphized--given human attributes--as nurturers (cows), or as companions (dogs, cats). Man's relationship with these mammals tends to be instrumental or utilitarian. Marine mammals (such as whales, porpoises, sea otters), in turn, inspire a mystical presence engendered partially by the power and mystery of the ocean itself, partly by their social behavior and communication patterns, and partly because these animals, in many respects, closely resemble man.

Management practices (in the form of laws and policies) reflect, Orbach maintains, these cultural relationships between man and mammals. Hunting and other wildlife-related laws and policies reflect the cultural importance of hunting to American society, while at the same time attempting to foster rational conservation and management of wild mammals. Domestic mammals are the least protected by law and policy, but their numbers are generally sufficiently large, and the cultural relationship is sufficiently utilitarian for the domestic mammal-man relationship (with some help from humane animal legislation and practice) to be largely self-regulating. The essentially protective laws which govern marine mammals reflect our cultural preferences toward these mammals; this cultural relationship is clearly special among all of those between man and other mammals. At the same time, however, special allowances for the hunting of these marine mammals (in economic hardship cases and for subsistence purposes) also reflect our cultural biases as hunters, gatherers, and economic beings, as well as conservationists and preservationists.

In the discussion in Panel 3, ECONOMIC COSTS AND BENEFITS, Maynard Silva (a political scientist) describes how and why a wide range of societal interests are actually (or potentially) affected by current management of the sea otter. Silva points out that although it is extremely difficult to arrive at a precise calculus of who loses and who benefits, and to place a dollar value on these costs and benefits, it is important to at least hypothesize about what potential costs and benefits may ensue from management measures. Directly related to the survival of sea otters, Silva maintains, are several intrinsic values --the moral value of conservation, the value of retaining environmental complexity, the enhancement of the aesthetic aspects of the California coastline, and the psychological aspect of knowing that prized animals such as the sea otters "are there." Affected negatively by the protection of the sea otter are commercial shellfish fisheries; most prominently, fisheries for abalone and sea urchins. Other shellfish fisheries, lobster, various crabs, rock scallops, and squid, may be affected negatively in the future as the sea otter reoccupies its former range. On the other hand, it is conceivable that as the sea otter expands, if regrowth of kelp occurs, that commercial finfish fisheries will expand. The welfare of industries associated

with commercial fisheries (e.g., processors, chandlers, boat builders) will, of course, be similarly affected as particular fisheries expand or contract. In terms of recreational fisheries, some losses can be anticipated for recreational shellfish fishermen and for those who provide them with services. Conversely, recreational finfish fishermen and their suppliers may experience gains from revitalized kelp beds.

Sea otter expansion may also be a boon to tourism in coastal communities, generating benefits such as the purchase of accommodations, meals, fuel, tours, and souvenirs. Moreover, sea otter expansion can be expected to benefit the kelp harvesting industry in California, through the regrowth of kelp beds.

On the negative side, if development of some outer continental shelf hydrocarbon reserves is deemed incompatible with protection of the southern sea otter, then the value of these foregone resources should be considered as a cost of southern sea otter protection. Finally, Silva concludes, some consideration should be given to the impact that protection of the southern sea otter may have on the U.S. balance of trade; e.g., in potential increases in imports of shellfish to offset declining domestic production, or, conversely, in potential increases in exports of kelp products or of finfish resources.

In contrast to the broad cost/benefit framework employed by Silva, Suzanne Holt, an economist, explores economic costs and benefits associated with sea otter expansion and the attendant decline in the recreational clam fishery in the context of one coastal community, Pismo Beach, California--the site of recent sea otter occupation. Using survey data, Holt discusses similarities and differences in the recreational and spending behavior of clammers and other types of tourists in this community. She finds that, contrary to popularly held images, the exhaustion of the clam fishery by sea otters has not resulted in a significant loss of revenue to the Pismo Beach economy for a variety of reasons--e.g., visits by clammers account for a relatively small proportion of all tourist visits to Pismo Beach; most clamming trips are multipurpose; surveyed clammers reported that they would be likely to return to Pismo Beach notwithstanding the decline in the clam fishery; other attractions of the area (such as offroad vehicle use on the beach) continue to draw tourists.

Discussions in Panel 4, LEGAL AND ADMINISTRATIVE ISSUES, centered on analyzing the complexity of the legal and administrative framework for managing marine mammals and fisheries, and on reviewing alternative management options. In his paper, "Legal Perspectives on the Sea Otter Conflict," Edwin M. ("Rip") Smith (an attorney), reviews the Marine Mammal Protection Act and the Endangered Species Act as they structure the options available in the management of sea otters.

Smith finds that conflicts between federal and state agencies regarding a management approach for the California sea otter population are a product of drastically different priority structures. While the state seeks to jointly manage marine mammals and fisheries, federal law affords very clear priorities to two classes of wildlife populations, marine mammals and threatened or endangered species. Since the sea otter falls within these protected categories, the constitutional requirement of the supremacy of federal law severely restricts the strategies available to California. These priorities similarly restrict all federal activity which may pose jeopardy to threatened or endangered species. The realization of California's interests in otter management, Smith concludes, will require some adaptation of federal priorities before the state may balance the maintenance of fisheries against the conservation of either marine mammals or threatened or endangered species.

My paper, "The Management Framework," reviews, in some detail, the administrative history of sea otter management, first, under state control (from 1911 to 1972), and later under federal control (from 1972 to present). The various conflicts which have characterized sea otter management over time are analyzed--i.e., the scientific debates, the conflicts among diverse interest groups, and the inter-agency and intergovernmental conflicts. The state/federal management framework that governs the use of related uses of the marine environment (shellfish fisheries and oil and gas operations) is also described, although in more cursory terms. The review of the management history and framework reveals that the sectorally oriented management regime for marine resources (whereby each use is managed separately by different agencies), typically results in conflict; as different agencies pursue their legitimately mandated goals and actions, these often come into conflict with the legitimately mandated missions of other agencies.

This paper also reviews the positions of major parties to the controversy on four major management alternatives for sea otter management--total preservation (allowing for unlimited expansion of the sea otter range), zonal management (artificially constraining the sea otters within a specific zone), translocation (moving sea otters to another location), and collection for scientific purposes or public display (such as in aquaria). A set of criteria for evaluating alternative management options is posited. Among the questions that should be asked of any management scheme are: Does it protect the animal, as required by the Marine Mammal Protection Act? What socioeconomic groups does it affect, and to what extent? Is it technologically feasible (do we have sufficient scientific knowledge to carry it out)? Is it feasible from an administrative standpoint (can it be carried out given existing organizational arrangements or will changes in agency operations need to take place)? Will it be possible to enforce? and finally, How much will it cost, and who should properly bear the administrative cost burden? These evaluative criteria served as a basis for discussion of alternative management options in a series of workshop meetings during the second day of the forum.

During the second day of the forum, a public comment session and concurrent discussion workshops took place. The public comment session provided members of the audience with an opportunity to make brief presentations on the issues, to give position statements on behalf of a group, or to state individual opinions. Summaries of the twenty-two presentations which were made during this session may be found in the PUBLIC PARTICIPATION SESSION in this volume.

Following the public comment session, eighteen concurrent discussion workshops (composed of ten to fifteen participants each) met to further consider the issues posed in the papers and by the panelists and public. Approximately two hundred individuals participated in these five-hour discussion sessions.

Conference participants were pre-assigned to specific workshops to insure that each workshop served as a microcosm of the variety of experiences present at the conference; state and federal agency personnel, interest group members, academics, and members of the general public were represented in each discussion group. Workshop participants were asked to focus their discussions on a detailed set of questions prepared by the forum staff (*available on p. 268 of this volume*).

The first set of questions raised the broad philosophical concerns involved in this issue, focusing on the values at stake in the controversy and on the possibilities for reconciling opposing viewpoints. Among the questions discussed were: "What are the rights and role of humans versus the rights and role of animals?" "What specific values are at stake in this controversy?" "Are these values reconcilable, or does this case represent a zero sum situation whereby one group's gain inevitable represents another group's loss?" "How do we balance current and future interests?" "Do we have a responsibility for ensuring certain options for future generations?" and "If so, what types of options?" A second set of questions raised more specific and practically oriented management issues. Participants were asked to focus discussion on the current management regime and to evaluate the feasibility of various management options, such as unlimited range expansion, zonal management, and translocation.

Each discussion group was assisted by a trained Facilitator--a neutral moderator skilled in group processes whose function was to promote orderly and reasoned discussion; a Reporter whose function was to keep notes and record the "sense of the group" on the questions posed; and a Resource Person, someone with considerable substantive background, to assist the Facilitator on substantive points. Following the five-hour workshop sessions, group facilitators and the forum staff met to synthesize the results of the various workshops. These issues were then summarized in a concluding plenary session.

According to many of the evaluative letters which we received following the forum,* the workshop discussions proved to be one of the most rewarding aspects of the two-day meeting. This was the first time, we were told, that many had a chance to view "the enemy" face to face, and to find that s/he didn't have two heads, after all. The workshops, in fact, were intended to be process oriented--beginning a new process of dialogue among contending groups--rather than outcome oriented--arriving at particular solutions to the problem. In this respect, we believe that the workshops proved effective in identifying potential areas of agreement and disagreement, and in clarifying the issues. We attribute the success of these workshop sessions to several factors: the extensive preparatory work made in advance of the conference both in terms of training workshop Facilitators and in the preparation of background material (in the form of maps, and other documentary information) and of very specific questions to structure the discussions; the skill of the Facilitators (who came from the ranks of experienced groups such as the League of Women Voters); and the enthusiasm and involvement of the audience in this intensive discussion effort.

From a substantive perspective, with the benefit of hindsight, we feel that it is unfortunate that we allocated only a short period of time for synthesizing the results of the workshops (one and one-half hours). No doubt we were unable to capture fully the complexity and subtleties in interpretation which surfaced in different workshop sessions. The summary of the plenary session nevertheless, provides a broad overview of the major topics and points brought up during the workshop discussions.

We hope that the interdisciplinary social science perspectives presented in the papers in this volume--emanating from anthropology, history, philosophy, economics, political science, and law, and the spirited discussion among the diverse public and private groups present at the forum, will provide fresh insights and novel perspectives for future public policy deliberations on managing conflicts between marine mammals and fisheries.

Biliana Cicin-Sain
Santa Barbara, California
March 10, 1982

*Evaluative letters and media reports on the conference are on file with the California Council for the Humanities, San Francisco office.

1 SEA OTTERS, SHELLFISH FISHERIES, AND MAN: BACKGROUND AND HISTORY

Moderator

*Charles D. Woodhouse, Jr.,
Santa Barbara Museum
of Natural History*

CALIFORNIA INDIANS, SEA OTTERS, AND SHELLFISH:
THE PREHISTORIC RECORD

Phillip L. Walker
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INTRODUCTION

The purpose of this paper is to discuss how the ecological relationships between prehistoric California Indians, sea otters, and shellfish changed through time. Although the archaeological evidence regarding these relationships is limited, it is possible to identify some of the important cultural and ecological variables that influenced the prehistoric human exploitation of sea otters and shellfish. By describing the causes of instability and change in the marine ecosystem California Indians exploited, I hope to provide insights into the complex set of factors that threaten the survival of modern sea otters and shellfish populations.

In summarizing the prehistoric record, I begin by speculating about the ecology of California's sea otters and shellfish populations before they were harvested by humans. Next I discuss the evidence for instability in the prehistoric coastal ecosystem, placing special emphasis on the effects that the hunting and gathering activities of the Indians had on the populations of sea otters and shellfish they harvested. Finally, this information is used to help reconcile some of the divergent views people have about the best way to insure the long-term co-existence of sea otters and a viable shellfish fishery.

PREHISTORIC ECOLOGY AND ENVIRONMENTAL CHANGE

Before sea otters were hunted by humans, the size and distribution of their population was probably not determined by the effects of predators but instead by the abundance of the animals they eat. From field studies we know that non-human predators have a relatively minor effect on modern otters. They are occasionally killed by white sharks, killer whales and bald eagles, but these attacks are rare (Orr, 1959; Kenyon, 1969; Estes and Smith, 1973; Ames and Morejohn, 1981). Humans are the only predators with a proven capacity to limit sea otter populations.

The effects competitors have on the sea otter's food supply are largely unknown. Although seals, sea lions, starfish, and a variety of other marine animals eat some of the same foods as otters, many

biologists suspect that the influence of these food competitors is very limited (Woodhouse, et al., 1976). Early in their evolution sea otters may have competed for shellfish with otter-like seals (King, 1964, p. 130; Mitchell, 1966). Since the extinction of these creatures several million years ago, man has been the sea otter's most significant food competitor.

Abalone, sea urchins, and rock crabs--the California sea otter's favorite prey--thrive in kelp beds in rocky areas with extensive crevices. Prehistoric sea otters, like their modern descendants, were no doubt attracted by the abundance of food provided by this productive habitat. California sea otters are quite flexible in their food preferences: when their preferred foods are in short supply, they readily change their foraging strategy and begin to feed more intensively on alternative foods such as kelp crabs, turban snails, and mussels (Ebert, 1968; Vandevere, 1969; Woodhouse, et al., 1976). Sea otters have an important effect on the structure of ecological relationships within the kelp bed community. Recent studies suggest that they help maintain kelp beds through their predation on sea urchins and other herbivorous invertebrates that eat kelp. In the absence of otters, these herbivores can become so abundant that they destroy kelp beds by overgrazing them (McLean, 1961; Mann, 1973; Palmisano, 1974; Estes, et al., 1978; and Duggins, 1980).

The ability of California sea otters to survive without the food and protection provided by kelp is demonstrated by their recent expansion into habitats with sandy bottoms where they feed on Pismo clams (Miller, et al., 1975). These areas have a low biological productivity in comparison to kelp beds and do not provide enough food to sustain a dense otter population. This is suggested by variation in the rate at which otters have reoccupied different parts of their prehistoric range. When the expanding population moved into areas with sandy bottoms, their spreading rate was faster than when they migrated over more productive areas with rocky bottoms (Calif. Dept. of Fish and Game, 1976; Woodhouse, et al., 1976).

The prehistoric distribution and abundance of California sea otters undoubtedly varied due to fluctuations in oceanographic conditions that caused periodic perturbations in the distribution and productivity of kelp beds. Studies of temperature sensitive marine organisms preserved in ancient deep sea sediments indicate that, during the past 8,000 years, ocean temperatures off the coast of southern California have frequently exceeded the limits that the southern California kelp species, Macrocystis pyrifera, can tolerate (Figure 1) (Pisias, 1978). Warm water conditions like these are known to cause modern kelp beds to slough off and die (North, 1971, p. 12). This would significantly reduce the abundance of shellfish and other invertebrates sea otters eat. The diminished food supply would in turn reduce the size of local otter populations either through increased mortality rates associated with starvation (Kenyon, 1969), or by forcing animals to migrate to new areas in search of food.

The prehistoric abundance of sea otters and shellfish would also be affected by changes in the geology of California's coastline. Heavy winter storms can destroy kelp beds by moving sand into areas that formerly had rocky bottoms (Calif. Dept. of Fish and Game, 1976). On the Channel Islands, erosion of sand into the ocean after forest fires would have the same effect (Johnson, 1980, pp. 115-16). In either case the result would be the same--a dramatic decrease in the abundance of sea otters and the invertebrates they eat.

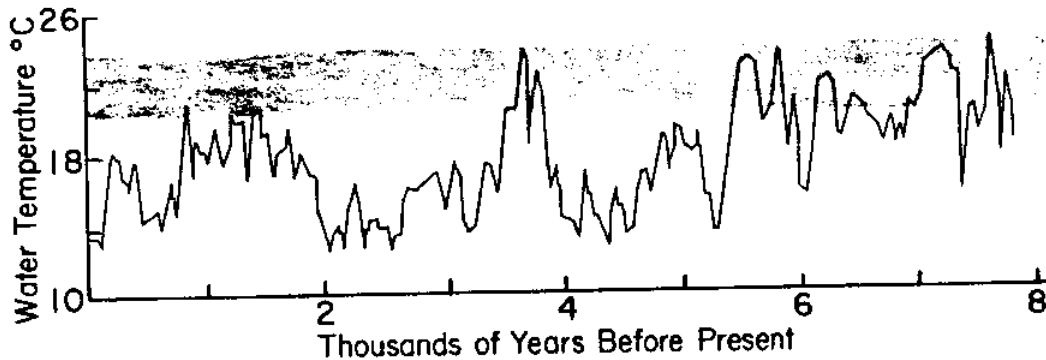


Figure 1

VARIATION IN ESTIMATED MEAN FEBRUARY SEA SURFACE TEMPERATURE
OFF SOUTHERN CALIFORNIA DURING THE PAST 8,000 YEARS

The grey band marks the range of temperatures in which the southern California kelp species, Macrocystis pyrifera, begins to exhibit symptoms of temperature damage and die (North, 1971, p. 12).

Source: Data from Pisias, 1978.

PREHISTORIC HUMANS, SEA OTTERS AND SHELLFISH

When the first people arrived in California more than 10,000 years ago, the balance of the coastal ecosystem slowly began to change in response to the presence of these new predators. The earliest California Indians probably had little effect on the marine environment simply because their population was small and oriented toward hunting and gathering on the land. This is suggested by spear points and other stone implements left at campsites which appear adapted for hunting large land mammals and waterfowl (Wallace, 1978, pp. 25-27). These Indians no doubt exploited marine mammals, fish and shellfish to some extent but we lack evidence of this, perhaps because the rising sea level since the end of the Pleistocene period has flooded the coastal sites they occupied.

As California's Indian population grew, people began to build villages on the coast and more intensively exploit marine resources. People on Santa Rosa Island were hunting sea mammals, catching fish, and collecting a large number of red abalone as early as 6,750 years ago (Orr, 1968, pp. 96-99). By the time the first Spanish explorers arrived in California, Indians living along the Santa Barbara Channel had developed a maritime oriented economy based on fishing, sea mammal hunting, and shellfish collecting, that supported villages with more than 1,000 inhabitants (Landberg, 1965).

Little is known about the effect California Indian food gathering activities had on the abundance of shellfish and sea mammals. In some places--along the central coast, for example--the human population was never very large and the rugged coastal cliffs made exploiting the nearshore environment difficult. Indians living in these areas probably had little effect on the abundance of marine animals they harvested. Along the Santa Barbara Channel, in contrast, a dense Indian population lived in permanent coastal villages situated to take advantage of the abundant food supply provided by kelp beds and estuaries. The garbage middens left by the Chumash Indians who lived in this area contain impressive quantities of sea mammal and shellfish remains (Lyon, 1937; Landberg, 1965; Walker, 1976; Walker and Craig, 1978). From the archaeological evidence it is clear that these Indians intensively exploited the kelp bed habitat, killed a considerable number of otters, and competed with otters over some of their favorite invertebrate prey.

Intensive shellfish collecting by the Chumash appears to have caused a deterioration in the abundance of certain easily harvested species. Steven Botkin (1980) studied California mussel (Mytilus californianus) and little-neck clam (Protothaca staminea) shells from a Chumash village site at Malibu and found a gradual reversal in the relative abundance of these species through time. In the earliest levels of the midden, the quantity of mussels is three times greater than that of clams. Through time the abundance of clams increases until in the later levels of the site clams are eight times more abundant than mussels.

Botkin believes that the first people who lived at the village preferred mussels because they can be collected with less effort than clams. Little-neck clams live in the gravel of the intertidal zone. According to ethnographic accounts, the Chumash collected clams by standing ankle deep in water, digging their feet into the sand or gravel to locate the shellfish, and then reaching down to capture them by hand (Harrington, 1913). After they are harvested, mussels are very slow to recolonize an area. Hewett (1935) found that the recolonization process was far from complete more than two and one-half years after he collected all of the mussels growing on a rock in a Monterey Bay mussel colony. From this ecological and ethnographic evidence, Botkin hypothesized that the increase in the relative abundance of little-neck clams in the upper levels of the Malibu site was not caused by changes

in the environment or the dietary preferences of the Chumash but instead was a result of a decline in the availability of mussels due to the effects of heavy human predation.

There is evidence that the intensified exploitation of little-neck clams during the later occupancy of the Malibu site led to a decrease in the average size of clams in the local population. Measurements of the hinges of little-neck clams from the midden show that there was a gradual decrease from the bottom to the top of the midden in the average size of the clams the Indians harvested (Figure 2). This led Botkin to conclude that, because of intensified harvesting of clams through time, "more of the prey population was being consumed than could be replaced by natural increases in the yearly growth rate of surviving individuals" (1980, p. 135).

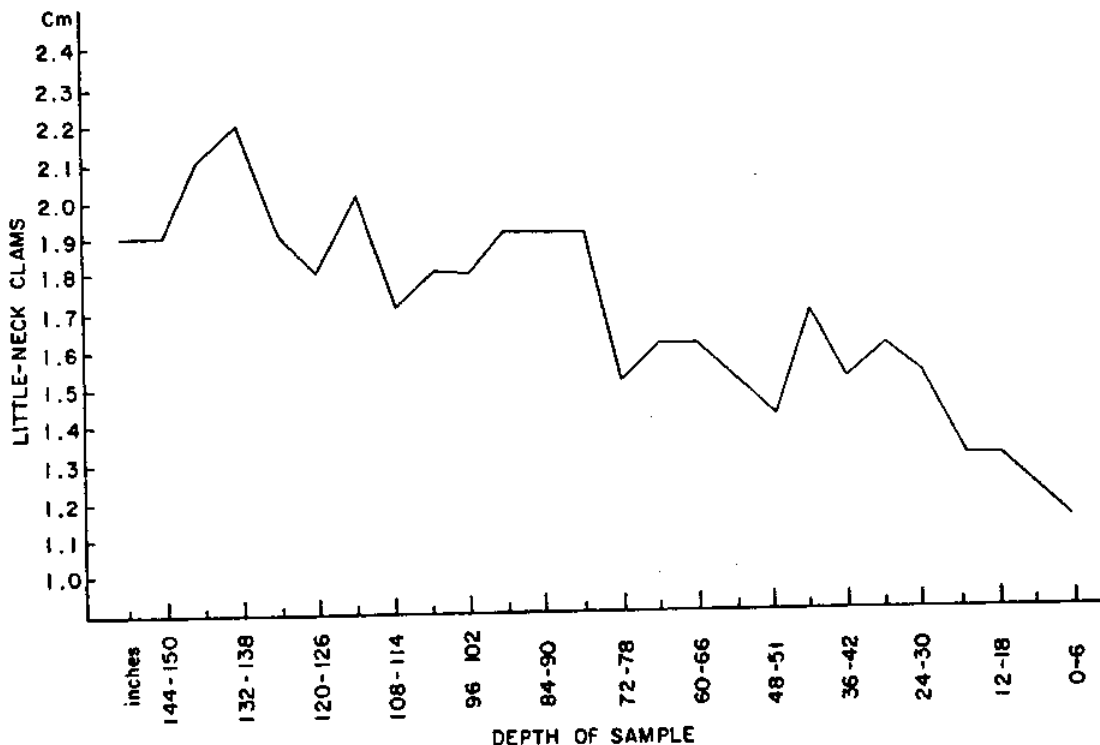


Figure 2

THE AVERAGE WIDTH OF LITTLE-NECK CLAM HINGES PLOTTED AGAINST THE DEPTH OF MIDDEN SAMPLES TAKEN FROM THE SITE OF THE INDIAN VILLAGE AT MALIBU

SOURCE: Data from Botkin, 1980.

The popular view of prehistoric American Indians as "prudent predators" who wisely managed the animals they exploited, has recently been challenged by several authors (Martin and Wright, 1967; Simenstad, et al., 1978). Simenstad, Estes, and Kenyon (1978) argue that local "overexploitation" of sea otters by prehistoric Aleutian Islanders caused a disruption of the kelp bed ecosystem and a destruction of the rich fauna of fish, birds and marine mammals the kelp beds once supported. According to their interpretation of archaeological evidence, aboriginal Aleuts disturbed the kelp bed community by killing so many sea otters that they minimized or eliminated its keystone maintenance role in the kelp bed ecosystem.

Consistent with predictions based on observations of modern kelp beds with and without sea otters, they found that "the abundance of sea otter bones through the midden strata were directly related to the abundance of marine fish and seals, and inversely related to the abundance of sea urchins and limpets" (Simenstad, et al., 1978, p. 410). These changes in abundance were interpreted as evidence that the removal of sea otters from kelp beds through intense human predation resulted in an expansion of the sea urchin population that formerly had been kept in check by the otters. The super-abundant sea urchins in turn are presumed to have destroyed the kelp beds by overgrazing them.

Otter hunting by Indians may have influenced the distribution and abundance of prehistoric sea otters in southern California. I have analyzed faunal remains from a number of sites in the Santa Barbara Channel area and have found that sea otter bones are much more common in San Miguel Island middens than in sites on the mainland coast. Perhaps overzealous otter hunting by Indians from the large Chumash villages on the mainland coast reduced the size of the local otter population. An alternative explanation is that San Miguel Island's favorable exposure to nutrient rich water upwelling from the California current made its coastline a particularly productive sea otter habitat.

Sea otter bones are very abundant in an archaeological midden (SMI-525) located above the modern San Miguel Island sea mammal rookery at Point Bennett (Walker and Craig, 1978). Apparently this site functioned as a camp for prehistoric otter hunters. The frequency of otter bones varies from the bottom to the top of the midden in a manner comparable to the Aleut site reported by Simenstad, Estes and Kenyon (1978). The invertebrate remains from this site have not been studied to determine how the abundance of sea urchins and other kelp eating animals varies relative to that of sea otters. Although overexploitation of sea otters by the Indians is a plausible explanation for the low frequency of otter bones in some of the levels of this midden, variation in oceanographic conditions, geology of the coastline, food preferences of the Indians, or economic activities performed at the site may also be involved.

The growth of a network of intertribal trading relationships during the late prehistoric period increased the demands coastal groups placed on the marine mammals and shellfish in their territories. To participate in this expanded system for exchanging resources, Indians with access to marine resources would need to harvest more shellfish and sea mammals than they could use locally. The practice of trading marine shells from the coast to the interior is ancient. As early as 6600 B.C., Olivella biplicata shell beads were collected on the central coast and transported 250 miles inland to Nevada (Heizer, 1978). Intertribal trading was particularly intense after A.D. 1000. By this time Indians in southern California were trading Olivella shell beads and whole abalone shells across the Colorado desert to Pueblo Indians in the southwest. The archaeological evidence of trade in marine resources is reinforced by numerous ethnographic accounts of intertribal trade in shell beads, dried fish, and mollusk meats (Sample, 1950; Davis, 1961; Heizer, 1978).

These expanded intertribal economic interactions may have stimulated prehistoric fur traders to kill more sea otters. We know from ethnographic accounts that California Indians killed otters primarily for their fur and not for their meat. Otter pelts were highly prized as trade items and were used to manufacture bed covers, arrow quivers, and clothing (Woodhouse, et al., 1976). The Chumash on Santa Rosa Island reportedly hunted otters and traded them to the mainland. In exchange they received seeds, minerals, and other resources they needed (King, 1971).

In some societies, rules governing the possession of sea otter pelts may have influenced the number of otters killed. Indians living in northern California considered otter skin capes a status symbol and restricted their ownership to wealthy people of the social elite (Kroeber and Barrett, 1950; Foster, 1947). Common people were punished if they hunted sea otters and were required to give otters that washed up on the beach to members of the upper class.

From the archaeological distribution of sea otter bones it is clear that they were hunted all along the California coast (Woodhouse, et al., 1976). Considering their frequency in archaeological deposits, there is remarkably little reference to sea otter hunting in the ethnographic literature. This has led some people to conclude that California Indians lacked either the ability or motivation to kill a substantial number of otters (Fisher, 1940; Ogden, 1941). One explanation for the apparent inconsistency between the archaeological and ethnographic records is that most of the ethnographic information on California Indians was collected in the late nineteenth and early twentieth centuries from missionized Indians. This was after their traditional hunting and gathering activities had been greatly disrupted by several generations of contact with whites and the California sea otter population was nearly extinct (Woodhouse, et al., 1976).

CONFLICTING INTERPRETATIONS OF THE ARCHAEOLOGICAL RECORD

Archaeological evidence has been used to support contrasting opinions about the best way to manage California's sea otters and shellfish fisheries. On one side of the controversy, people believe that if sea otters are allowed to reoccupy their former range unimpeded by human intervention, they will reduce the abalone and Pismo clam populations in these areas to levels no longer useful for commercial or recreational purposes. On the other side of the controversy, people believe that sea otters are capable of establishing a harmonious relationship with the shellfish they eat. They point to the impressive number of abalone shells in coastal archaeological middens as evidence that sea otters and large shellfish populations can co-exist (Rashkin, 1972; Howard, 1974; Woolfenden, 1979, pp. 73-76). This archaeological evidence leads them to conclude that Indians, sea otters and abalones lived in a "balanced community" and that it is simplistic to blame the decline of modern shellfish populations on the expansion of sea otters.

Daniel Miller of the California Department of Fish and Game believes that the abundance of abalone shells in Indian middens does not necessarily indicate that there were dense populations of exposed abalones in aboriginal times. He notes that "a few abalones taken by each of several Indians during low tide at the rate now being harvested by shorepickers in the sea otter's range can yield a respectable pile of abalone of several generations." He points out that "abalones are transported by the force of large storm swells from the subtidal zone into and occasionally above the intertidal zone. This source of abalones could account for many large shells found in Indian middens" (Miller, 1974, p. 6).

Sylvia Broadbent, an archaeologist, has criticized Miller's assertion that "there can be virtually no commercial and sports harvest of abalones, sea urchins, red and rock crabs, Pismo clams, and possibly spiny lobsters where sea otters are regularly foraging" (Miller, 1974, p. 8), as "historically absurd," considering the archaeological record. She notes that "the amount of abalone shell in Indian coastal middens from Humboldt to San Diego counties is simply fantastic...especially on the Monterey Peninsula and in the San Luis Obispo and Santa Barbara areas" (Woolfenden, 1979, p. 74). From the abundance of shellfish remains in these middens she concludes that before European-inspired cataclysmic hunting of the otters, "the Indians flourished, the otters flourished, and so did abalones, sea urchins, crabs, mussels, chitons, oysters, clams, and so on and so forth" (Woolfenden, 1979, p. 76).

Donald M. Howard, president of the Monterey County Archaeological Society, also rejects Miller's contention that Indians were unable to harvest large numbers of abalone in competition with otters. He presents archaeological evidence from a large midden on the south end of Carmel Bay to refute the idea that a substantial number of abalone in

Indian middens were collected on the beach after storms:

...neatly formed whale rib wedges used to pry off abalone are found with large shells, showing that the Indians selectively removed abalone. Characteristic Indian wedge scars found on the shell margins attest to this use of wedges. Giant keyhole limpet shells also bear wedge scars. Several Indian skulls found at the Carmel site had fused ear orifices, an ailment of some modern skin divers, indicating that some Indians may have regularly obtained large abalone by free diving.

He adds that "We must conclude from an analysis of these valuable sites that otter predation did not prevent the Indians from obtaining, with wedges, impressive numbers of large abalone. Yet, Indian, otter, and abalone were once a balanced community. These aborigines did not misuse their resources" (Howard, 1974).

In my opinion, the use of archaeological data in this controversy has not been convincing. The association of sea otter bones and shellfish remains in a midden does not necessarily mean that large populations of these animals lived together in the same habitat. Only a few of the reports of California sea otter remains in archaeological middens provide information on the quantity of bones recovered (Woodhouse, et al., 1976). Without additional quantitative evidence it is premature to speculate about the size of the prehistoric California sea otter population. We know that a considerable number of otters were harvested by the Indians but the role this human predation had in limiting the size of the otter population is unclear.

The lack of accurate information on the amount of time involved in the accumulation of most of these archaeological sites limits the conclusions that can be made about the co-existence of sea otters and shellfish. Archaeological middens often consist of food remains and other refuse deposited over hundreds or even thousands of years of human occupation. During this amount of time, substantial fluctuations in the abundance of animals in a nearshore community could occur due to changes in oceanographic conditions, or the effects of human predation. The presence of quantities of large abalone shells and sea otter bones in a site that may have accumulated over a long period of time is not convincing evidence that large numbers of sea otters and mature abalone actually co-existed in a stable relationship with prehistoric humans. Alternative explanations exist that cannot be rejected without information on the stratigraphic relationships of the faunal remains. It is possible, for example, that the abalone were from a part of the midden deposited during a period when otter hunting by Indians had reduced the local population to the point that large abalone were available for harvesting.

CONCLUSION

The prehistoric record is so fragmentary that we will never be able to completely reconstruct how the ecological relationships between sea otters, shellfish, and humans changed through time. A tremendous amount of evidence has been lost through the destruction of coastal archaeological sites by construction projects and urban development (Hogan, 1981). Some information has also been lost by archaeologists. In the past they generally concentrated on recovery and analysis of artifacts and often failed to keep adequate records of the animal remains they excavated. Another impediment to reconstructing man's relationship to the prehistoric marine ecosystem is that the relationship between the animal remains found in archaeological middens and the biological populations these animals came from is often unclear. Archaeological faunal remains reflect not only the local environment, but also the cultural preferences and technological capabilities of the people who produced them as well as the skewing effects of differential preservation.

The archaeological evidence we do have indicates that California Indians gradually intensified their exploitation of marine animals. In the beginning, when their population was small, they probably had little effect on the abundance and distribution of sea otters and shellfish. Through time the demands placed on the marine environment increased in response to the rapidly growing Indian population's food requirements and the development of intertribal economic relationships that facilitated redistribution of marine resources. Late in the prehistoric period, human predation probably caused a deterioration in the abundance of sea otters and shellfish in coastal areas with dense Indian populations.

It is popular to blame the rapidly accelerating destruction of the earth's resources on the modern Western belief that man has dominion over nature (White, 1967; Dubois, 1967; Smith, 1976). Some people believe that this world view explains modern man's tendency to treat plants and animals as commodities to be managed for maximum short-term profit with little regard for the long-term consequences of his actions. Prehistoric American Indians and other non-Western people, in contrast, are said to have lived in a "stable" or "balanced" relationship with the plants and animals they exploited because they attributed spiritual significance to and considered themselves submerged in the natural world.

From archaeological evidence it is clear that prehistoric man's ideology did not always prevent him from overexploiting the environment. Regardless of differences in world views, human behavior has always been motivated by a fundamental concern for continued survival. As Daniel Guthrie has written:

The Indian's actions toward nature were, and are, identical to those of modern man. What concern for the environment there

was existed for the expressed purpose of guaranteeing human survival. A true reverence for nature, where nonhuman organisms are given a right to survival equal to that of man, has never been part of man's emotional makeup. Man shares with all other animals a basic lack of concern about his effect on his surroundings...Man's attitude toward the environment has not changed in the millennia since his evolution from lower animals. Only his population size and the sophistication of his technology are different (Guthrie, 1971, p. 722).

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1. SEA OTTERS, SHELLFISH FISHERIES AND MAN: BACKGROUND AND HISTORY

DISCUSSION

JOHN TALBOTT, PROFESSOR OF HISTORY, UNIVERSITY OF CALIFORNIA
AT SANTA BARBARA

Comments on the Historical Record. William Sturgis, who was an early nineteenth century Boston sea captain, had this to say about the furry animals that Chuck Woodhouse will be showing us on our Sunday tour: "Next to a beautiful woman and a lovely infant, a sea otter's skin is the finest natural object in the world." Captain Sturgis certainly didn't have in mind what Mike Orbach calls "the cuddly quotient," the "ah, look at that cute little so and so" factor. Sturgis was thinking of what sea otter pelts brought in the China market, and that the price they fetched in the China trade was what brought sea otters near extinction. I want to say something about why sea otters were hunted, how and by whom they were hunted (and I'm referring now to Europeans, not to the Indians, largely), and what some of the consequences of hunting them were.

It is generally thought that Western Europeans hunted sea otters because otter fur was irresistably beautiful and luxurious and therefore much sought after. That, in fact, isn't the whole story. News of the sea otter came to the men who would make their fortunes from it by way of the printed word. The journal of Captain James Cook's third Pacific voyage, which was a best seller in its day, mentions the otter in the course of discussing landfalls on the northwest coast of North America. Nowhere, probably, is the link between exploration and commercial exploitation of discovery more clear than in the case of Cook's journals and adventures in fur trading that followed from them.

Certain of Captain Cook's readers were not interested mainly in tales of adventure and descriptions of far-off places. They had sufficient adventures of their own. The Yankee traders bent on exploiting the trade with China, a trade that promised to be lucrative beyond anyone's wildest dreams, faced a major obstacle. They knew what they wanted from the Chinese: tea and textiles they could sell back home and abroad. But what could they get the Chinese to buy? What could they bring with them that was at once easily transportable and valuable enough to pay the expense of the long voyage between Boston and Canton? What commodity could provide the where-with-all to pay for the Chinese cargo? That's where the sea otter came in. Its fur was eminently transportable, it was something that wealthy Chinese

wanted badly enough that they were willing to pay very high prices. Trading for sea otter pelts on the western coast of North America offered the promise of making a fortune in the port of Canton, the only Chinese port where foreigners were allowed to exchange sea otter pelts.

Boston men dominated the American sea otter trade. In 1796, a ship out of Boston called, appropriately enough, the Otter, became the first American vessel to anchor in California waters. Spain, of course, ruled California then, and all the Otter's cargo, including its otter skins, was contraband. In 1801, only six years after the Otter dropped anchor, 16 ships visited the California coast, all but two of them from Boston. In the early years of the trade, traders dealt with Indian hunters, and prices paid these hunters varied greatly. On Queen Charlotte's Island, 200 chisels, actually short links of strap iron, brought 200 skins (which leads me to conclude that, perhaps, that's where the expression "chiseler" came from). At Nutka Sound, however, one skin was worth 10 chisels, or six square inches of sheet copper. Soon the Boston captains, therefore, had metal workers aboard making tools to order. One of the shrewdest of these captains was William Sturgis, who had such an admiring eye for sea otter pelts. On one of his early voyages, Sturgis noted that the Indians used ermine pelts for currency. So he bought 5,000 ermine pelts at the Leipzig Trade Fair for 30 cents apiece. He then traded them on the Pacific Coast against 560 otter skins worth \$50 apiece in Canton. That comes out to a 48-dollar-and-50-cent profit on each dollar and a half invested.

Bartering with Indian hunters soon gave way to a new system, one that appears to have been devised by the Russians, who dealt in furs along both sides of the Bering Strait and down the northwest coast of North America. In 1804, Captain Joseph O'Kane, commanding the vessel O'Kane (which he didn't own, but which was named after him anyway), out of Boston, arranged with Alexander Boronoff, the Russian factor at Newarchangel or Sitka in the Aleutians, to borrow 150 Aleut Indians. The deal they made was that Boronoff would supply the Aleut hunters and O'Kane would supply the transport, and both would split the profits. The Russians and Americans cooperated against the sea otter. The first cruise turned out to be very profitable, indeed, yielding 1,100 pelts for trade in China, worth more than \$50,000, which was an enormous sum during that time. This system worked so well that it dominated the next decade until 1814.

The Aleuts carried aboard the Russian and American ships were expert hunters. They went after the sea otters in their badarkas or kayaks, wooden framed small boats made water-tight by means of seal or sea lion skins which were stretched over them. Until the introduction of firearms into the hunt, they carried a supply of arrows loosely fitted to a wooden shaft and hurled from a kind of wooden launcher. To catch each arrowhead was a line several fathoms long that was used

to retrieve the otter and bring it to the boat. Some Aleuts attached their lines to inflated bladders, apparently, which allowed them to retrieve their arrowheads when they missed and to mark the course of the submerged animal. The Aleuts went out in hunting parties of five to ten badarkas and their methods were simple. Forming a circle around an otter, some member of the party put an arrow into it, and when the wounded animal dove under the water, the badarkas covered the area where it might reappear. As soon as it did, a shout would frighten it into submerging once again before it gathered sufficient air. Repeated dives would drive the animal to exhaustion and finishing it off would be an easy matter. Cruder methods of hunting otters included spreading nets on kelp beds, setting various kinds of snares, and the simple expedient of clubbing them to death.

Establishing a precise historical record and estimating the number of sea otters that existed before the great fur trade began, as well as the numbers that were taken in the trade, is extremely difficult. Hunting records, for a variety of reasons, are quite incomplete. For one thing, Yankee hunting of sea otters in the Spanish and Mexican era was illegal, and no captain in his right mind kept an accurate set of books. When the Mexican authorities came on board, no one was more surprised than the captain of the vessel itself, to discover a hold full of sea otter skins. From what little we do know, though, it would appear that the most active period of sea otter hunting was already over by about 1850. In 1811, 9,356 skins were taken, the highest annual number recorded. The O'Kane, in 1803, took 1,800 skins in five months; in 1806 to 1810, 4,819; in 1810 to 1811, 3,952. In 1816, the Russians established in Fort Ross were bringing in about 2,000 otter skins annually. But all these records are extremely fragmentary.

As the hunting went on, it moved southward along the California coast. In the 1830s, hunters in the Santa Barbara Channel were commenting on the abundance of otters. By then, guns were in use, for specific mention of them is made in 1836. On Santa Rosa Island, one gunman and two helpers were taking thirty otters a week by shooting them from the land. This change from spears to guns no doubt greatly accelerated the decline in the sea otter population. The Mexican government did have a conservation policy. Sea otter pups were not to be killed, and hunting licenses were required. But, this was a government whose ability to enforce its writ was limited indeed, and its rules were widely ignored.

The high value of a sea otter's pelt in the Canton market put a low value on the sea otter's life. Because the trade was so lucrative, everybody who could outfit a ship wanted into the action, and the first half of the nineteenth century therefore brought a steady decline in profits. Several competitors elbowed each other for position: The Hudson's Bay Company, long established in the fur business; the Northwest Fur Company, American fur traders who had come

over land from St. Louis; and the Russians. Quickly the sea otter became too scarce and too expensive to continue as an important medium of exchange in the China trade. Between 1821 and 1830, the Yankee vessels actually engaged in trade annually, dwindled from thirteen to two. "By 1837," as Samuel Elliott Morrison has put it, "the old northwest fur trade on which Boston had thrived for forty years was a thing of the past." And by 1840, the sea otter, on whom that fur trade was largely based, had itself come dangerously near to becoming a creature of the past.

DON SINIFF, PROFESSOR OF ECOLOGY AND BEHAVIORAL BIOLOGY, UNIVERSITY OF MINNESOTA, AND FORMER COMMISSIONER, U.S. MARINE MAMMAL COMMISSION

A very interesting discussion of the history, and Chuck Woodhouse's summary of the biology of the otter in California have provided some interesting background, I think, from which we can launch this workshop.

A few observations about the biology. In our experience, contrasting the Alaska populations and California populations, a couple of items come to mind--one is the relatively narrow range of the otter along the coast of California compared to that of the Alaska population. I think this is something that has an impact upon the dynamics of the population that we often tend to forget. Recently, a colleague of mine, Dr. Eberhart, looked at range expansion in terms of area of coast and found that it is similar to growth patterns in the population. He found, in fact, the same type of growth curve fits both conditions, and this would indicate, I guess, that the habitat we're looking at in California is relatively uniform. One very important aspect of the biology of the otter in California that I think will come up in our deliberations is some estimate of mortality, which is going to be needed to make determinations.

Woodhouse talked about data gaps, and I think that's one item that we need to consider. In my view we're going to need some rather firm estimates (by sex and age category) both in the center of the range and at the extremes, in order to make some of the determinations that are needed.

On the historic record, it's my feeling that the historic record is valuable in several aspects, not necessarily because it's going to help us directly solve the problem of locating otters in terms of transplants, but primarily in looking at what past ecosystems were like with reference to mortality patterns and general densities. We all know that the coast of California has changed a great deal over the years, but still these historic determinations may help in trying to understand some of the best locations where we can expect good survival of otters, and some of the locations where we might not expect

very good survival. I think probably the ecosystems have not changed too much in that regard. Also, I think the paper by Dr. Walker indicates that some of the data on rates of decline may be useful in trying to interpret past population levels. I'm not sure we've looked at that data to the degree that we should have.

MARGARET OWINGS, PRESIDENT, FRIENDS OF THE SEA OTTER

Because of the limited time, I've selected some points of history on the otter harvest and the abalone harvest, of which man is the binding of these two elements. Needless to say, we agonize over the fur traders' slaughter of otters--we consider it a black chapter in history. I've been living within sight of the otters for the last 24 years; they're in the kelp below our house in Big Sur. My husband and I purchased Grimes Point unaware of its early history. Grimes Point was so named because of Elia Grimes, who was the captain of a contraband vessel, The Eagle, which traded and hunted and slaughtered otters during the first quarter of the 1800s. In 1833, Captain John Cooper, on his vessel, The Rover, was associated with Grimes in the otter trade. He kept a log book, which one can read, and it lists, among other things, hundreds upon hundreds of otter skins and otter tails. When he wrote that he was going to keep his twelve boats hunting in this state, he said "until there is not an otter left on California." He also commented that whereas he had taken seven hundred otters between San Francisco and Monterey, his last trip brought him only 32. "As things appear," he wrote, "I do not think we will be able to get any more than 600 skins in all the coast." This small number of living otters, of which he spoke in such a disparaging way, is one-third of our entire population of the sea otter today.

Fifty years ago the Monterey Herald reported the first day of the abalone season: "Monterey's abalone fishermen who went out for the first time this season hit their stride yesterday and brought in 1,000 dozen abalones to Municipal Wharf." The year before, over 3.4 million pounds of abalone were harvested. The abalone population couldn't take the stress, so after a period in which the Japanese hard-hat divers, using hand-pumped compressors, had stripped the area north of Carmel River, that area was closed to commercial divers. In 1936, the abalone industry had moved its processing plants from Monterey to Morro Bay because the abalone harvest around Monterey had petered out. They left behind them berms and dikes of abalone shells you've all been familiar with. This is an early picture, [Showing Photo] and this is just a detail of miles of abalone shells which are actually the contemporary middens of our times, similar to those that Dr. Walker spoke about. All one can say is that they tell their own silent story of man's relationship with them.

On November 19, 1963, the California Senate Fact-finding Committee on Natural Resources met in San Luis Obispo for a hearing, at the request of the Morro Bay abalone divers. The subject was the effect of the sea otter on the abalone resource, quite similar in a way to what we have here today. Thirty otters had been counted that day south of the San Luis Obispo County line. Eighty people attended this hearing and I was among them. Most people took an active part. A representative of the California Department of Fish and Game took the position that sea otters had not seriously depleted the abalone harvest. He backed the statements with charts and poundage reports. "You will notice," he said, "that in the year 1961, when sea otters were present, the catch was over a million and one-half pounds, by far the largest in any year in the past 10 years." The commercial abalone divers testified with some emotion that their catch was decreasing, that they've seen otters dislodging abalones from rocks under the water, that it was unfair to have the measurement of their abalones regulated when the sea otters took any size abalone, and that unless something was done about the otter, they would take it into their own hands, and the otters would become fair game. Fish and Game, on the other hand, pointed out that one-half of the fishermen's abalone catch was in violation of the law either in size or the location from which they were taken, that the number of licensed abalone fishermen, which was 27 in 1937 had grown to 505 in 1963, that the number of otters counted at the time of this hearing was markedly smaller than the year before, and that considerable shooting of otters was going on. One diver remarked, with some agitation, "It's mighty hard to shoot an otter from a rocking boat!"

In 1967, California State Senate Concurrent Resolution Number 74 asked for a sea otter/abalone advisory committee. Two scientists, Dr. Kenneth Norris and Dr. Aryan Roest, one commercial abalone man, Chuck Sites, one sportsman, Councilman Chuck Henry, and myself as a conservation-minded citizen were appointed. Issues directed by the legislature to address were again, not unlike those that we are discussing today in this forum, though I'll reserve further comment on them. Following these meetings, Fish and Game commenced a five-year research program on the abalone and otter. This seemed like an excellent idea, but for those of us on the sidelines, it appeared that the research focused on the depletion of the abalone resource and the food habits of the otter. There was, from our point of view, very little study of the biology and population dynamics of the otter.

In 1968, we founded the Friends of the Sea Otter because as the issue was heating up, the otter needed a friend. Dr. James Mattison and I put the trust together and the official count of otters at that time was 567. This was eight fewer otters than ten years before. From 1968 until today, we, and an ever-growing body of supporters, have been unswerving in our single-minded objective--to see that the otter gets equal time in arriving at solutions to the complex problems of man and the sea. The threat of oil-spills and offshore oil

drilling, the growing depletion of the shellfisheries, the problems of the Pismo clams (In the early 1900s, the bag limit was 200, in 1948, it was ten, and today, apparently, I think, it is three or four.), toxic pollution and the need for sanctuaries for our marine life are foremost among these problems. Public enthusiasm for the otters was heightened by the knowledge of its return from near extinction--the return of the native turned the otter's presence into a moral issue, one might even say a moral resource. Yes, we are the people who feel that otters have a right: the right to live along the shore, the right to extend their range, the right to forage upon the natural foods that were there long before they were shared with man. As for the socioeconomic impact of the otters about which Dr. Cicin-Sain wrote; the otters, we feel, are an aesthetic resource not only visibly, but in their productive role in the kelp community, in their part in society. Without any question in our mind, they represent an aesthetic resource that is lasting, viable, and has economic value. The sea otter is nothing that is eaten in restaurants, worn on backs, or shipped to Japan in boxes, but it has a drawing power unequalled in California and it will last as long as man will let it last and must let it last.

THORN SMITH, GENERAL COUNSEL'S OFFICE, NATIONAL MARINE FISHERIES
SERVICE, WASHINGTON, D.C.

As Dr. Woodhouse pointed out, I am currently an attorney with NOAA, The National Oceanic and Atmospheric Administration, I give legal advice to the National Marine Fisheries Service, particularly on their living marine resource plans.

I'd like to first of all make the point that I am appearing today as a private individual and the views that I express here this morning or any other time during the symposium, are entirely mine, and do not, in any way, shape or form represent the views of the National Marine Fisheries Service nor the Department of Commerce. My reason for being here is that I, too, have been involved in the sea otter/shellfish conflict for many years--I was a commercial diver, working out of Morro Bay primarily, from 1965 to 1975. I continued diving while I was in law school during the summers and made my most recent commercial dive in 1979 off San Miguel Island. Consequently, I am still fairly well in touch with what's going on under water. I'm going to try to give you a feeling for the view of an individual who has been involved on the other end of the controversy. I really want to assure you, though, that I am very much concerned about sea otters and about other marine mammals, just as I know most of the other divers are.

I think it is really wonderful that the sponsors of this symposium have provided us with a forum, hopefully a neutral forum, where we can reason together. In my view, besides giving my personal view, I think we have some very tough management decisions to make. I think

we should make them soon, and I think we're inevitably going to have to make them on the basis of incomplete knowledge, which is usually the case, unfortunately, in any marine resource conflict resolution. I'm very hopeful that we can do this in a spirit of compromise and that these proceedings will propel us in that direction. I thought that the papers were excellent--they make a substantial contribution to our understanding of these problems and issues. Rather than repeat them specifically, though, I thought it might be more helpful if I tried to share with you some of my experiences as a commercial diver, and tell you about a few of the things I've learned and a very few of the issues I've considered.

I started diving in 1965, immediately after college--I did it intentionally because I'm a diving freak, a diving addict, and there's nothing I'd rather do. I've always been completely fascinated by things biological and the marine world. It was the best way to get involved, I felt. I was told very early by other older and more experienced divers that I had better start paying attention to the sea otter and shellfish fishery problem. The otters at that time had moved far enough south that they had eliminated Beckett's Reef, which was our primary abalone diving area in that part of California. We were up around San Simeon at that time and very frankly, I didn't believe the stories of the older divers--I said, "You've got to be kidding, I've watched these animals from the beach and they're delightful." They couldn't possibly be causing any trouble at the bottom of the ocean! After I'd been diving for two years, I was working in an area which we called Red Rock, off Cambria. The otters were just north of us and the bottom there is characterized by very large piles of boulders. These boulders had all sorts of nooks and crannies and there were abalones who would hide in these nooks and crannies and if I spent an entire day working on one of these rock piles I might get three to four dozen abalone. At that time, I think we were being paid \$12, \$14, or \$15 a dozen. Because of the weather, we could really only work half of the time, so you can see that none of us were getting very wealthy in the process. We experienced some bad weather and I was working on a rock pile which I hadn't finished, went back about three days later and this time the otters had come down and worked the area themselves. It was my first experience seeing what the otters actually do to shellfish on the bottom. Frankly, I was shocked. It looked to me as though a blacksmith had gone through and simply smashed every shellfish he could find, and then afterwards, had turned over great numbers of boulders and removed the juveniles from the bottom. It was one thing for me to see the adult abalones and urchins and other animals being destroyed, but when I realized the extent to which the otters turn over boulders and take the juveniles as well, I really became upset. Naturally, as a diver, I could see the handwriting on the wall, so I became somewhat active in attempts to call the situation to the attention of the California Department of Fish and Game, which eventually did listen to us and did in good faith attempt to control the sea otter.

I continued diving, as I said, for a period of ten years, essentially moving south as the otters moved south, so I have had quite a bit of experience with them. I'd like to tell you a few of the things I learned first-hand, things which are hard to understand unless you've spent substantial time under water. I want to reiterate that I am interested in, fascinated by, concerned about marine mammals. I enjoy watching them greatly. I'm entirely sympathetic with the former plight of the otter. However, the difference between appearance and reality is very great. It's one thing to look at otters from the beach or from a boat--they're very anthropomorphic, they're entertaining, they take care of their babies, they look very innocent and quite delightful. Under water it's something like Shiva, the Destroyer. They virtually annihilate the underwater stocks of shellfish. It is entirely clear to me that there can be no co-existence of otters and commercial shellfish fisheries within the same area. One of the things that made me realize what a formidable adversary and a wonderful animal the otter is was an experience I had at Monterey Bay. I was salmon trolling and pulled into the harbor one night. We had just dropped the anchor and there was an otter right next to us. He had an old coke bottle on his chest and what appeared to be a rock scallop, and he was beating on the bottle with his rock scallop and broke the scallop open and ate it. After he was through he dropped the shell, lay there for a minute, picked the coke bottle up and looked into it, shook it, and a little octopus popped out! And he gobbled it!

In the course of my diving, I learned a number of things--it occurred to me after two or three years of diving that really one of the most interesting marine mammals was man! Man fills the same ecological niche that otters fill, but in my view, man does it more efficiently. We are able and we do manage for sustained long term yields of shellfish populations. In the abalone industry we have quite a number of management measures, including size limits, depth limits, area closures, seasons, and now a limited entry program. These have all been enacted by the state of California, and the idea, of course, is to see if there's a reproductive stock so that we can go back year after year and remove a certain portion of that stock for commercial purposes. An illustration of the ecological niche argument which has been raised is the urchin and kelp issue. I am sure you are all aware urchins tend to attack kelp beds, and to eat the holdfasts at the bottom of the kelp; the kelp then is often carried away rapidly during the first storm of the fall. It's been maintained that otters would stop the urchins from doing this. Of course, now we have the very successful urchin fishery doing this as well, and we don't really need the otters for that purpose. The nearshore marine environment is a terrific engine of productivity. It goes through annual cycles in which these kelp grazing animals grow very rapidly. I would not be prepared to say how much these animals would be worth if we manage them in a more rational manner, but I would say that it would be a very great deal.

I have found that divers are very extraordinary people who work in a very surrealistic world. They have particular individual qualities which are necessary for survival in that environment. I found them to be very intelligent in a practical way, independent and self-sufficient and not surprisingly, I found that very, very many of them are strong environmentalists, and are increasingly well informed and sophisticated on environmental matters. They understand that their livelihood is dependent upon a viable habitat. The nature and quality of the diving experience is something which I think should be considered: it is surreal, superreal, I don't know how else to describe it. Making a dive is like taking a trip on a time machine, one could say, confronted with a sense of mesozoic life forms that I find absolutely fascinating. Oddly enough, men can, I think, learn to feel at home in the sea. I think there are certain instincts (I don't know if they are residual or what) but they make you understand what's going on somehow, if you've been down there for awhile.

I found that divers form very remarkable communities but they are very vulnerable, just as the sea otter is, in the sense that they are entirely dependent upon shellfish. When the industry collapsed in Morro Bay there were very severe socioeconomic impacts. There were personal tragedies which were directly related to the collapse of the industry. Divers don't easily learn to adapt to other lines of work --they can't use their diving equipment in other industries, they can't sell it, but what's more important, they don't want to. I think it's important for us to keep in mind that we are managing people, as well as shellfish and otters. The sooner we learn to regard divers and fishermen as valuable living marine resources, the sooner we'll be able to make rational decisions in conflicts like this one. My personal conclusions are that I, at least, have learned to regard man as a marine mammal, as a valuable living marine resource. I feel that there are a whole range of values associated with commercial shellfish diving as a human activity. Otters and shellfish fisheries simply don't mix, and I'm very hopeful that we will reach a solution which, to me, would appear to have to be in the nature of a compromise.

JAMES A. ESTES, WILDLIFE BIOLOGIST, DENVER WILDLIFE RESEARCH CENTER,
SANTA CRUZ FIELD STATION, U.S. FISH AND WILDLIFE SERVICE

I'll try to restrict my comments largely to biological issues because those are the ones that I've had the most experience with. I'm really not qualified to comment on social or economic issues and I don't really care to make any public statement on philosophical or moral issues. First of all, I'd like to simply state that the importance of oil and the development of oil along the coast of California has probably been the principal motivating factor in categorizing or listing the California population of sea otters as a threatened population. It was mentioned by Chuck Woodhouse that there have been studies demonstrating that oil increases the metabolic rate of sea

otters. I think there's great concern by most of us involved with the otter that a large oil spill would be catastrophic, or potentially catastrophic, to the present population.

Don Siniff mentioned his view that it would be important to learn more about natural mortality in the sea otter population in California. I think most of us who have looked at the data that are available feel that it's very likely that natural mortality is limiting the present growth of the population. I would simply like to express the view that I think this is going to be an exceedingly difficult task. I recognize its importance, but I'm not particularly optimistic that studies oriented toward identifying specific causes of mortality are going to be particularly fruitful.

I'd also like to point out that it was mentioned that the population of sea otters in California has been growing at the rate of about five per cent per year. It's not at all clear, looking at the evidence, the data that has been gathered over the last five or ten years, that the population has increased in numbers noticeably during that period of time. It is true that the population has expanded its range, but it's not at all clear that it has increased in size: in fact, it's very unlikely in my view that, at least over the last five years, the population has increased at a rate as high as five per cent per year.

Dr. Walker spoke of the relationship between man and sea otters and mentioned that perhaps over the past 10,000 to 15,000 years there has been an association between aboriginal people and sea otters along the coast of California. I think, in looking at the history of sea otters along the coast of California, it's important to recognize that the species of sea otters that we recognize today probably has been here for one to two million years and that their very close ancestors have been here three to five million years. In considering the evolution of various forms of marine organisms, I think it is important to recognize this fact.

There's much that one could say about the ecological relationships associated with sea otters. The issues are complicated, so I would like to merely point out two or three specific points. It is generally agreed that sea urchins along the coast of California and, in fact, over much of the world, are devastating herbivores. They are capable, under some circumstances, of eliminating the standing stock of plant material and natural marine ecosystems. This is clearly the case in many areas along the California coast. It is also clear that sea urchins have limited kelp beds along the California coast, and that the mortality of sea urchins, for various reasons, has resulted in enhancement of the kelp beds. I think there can be little doubt that sea otters have a very devastating and dramatic limiting impact on sea urchin populations. The extent to which this interaction is applicable along the coast of California is unclear. We have along

this coast a very heterogeneous sort of ecosystem which behaves very differently in different locations, and consequently, it's simply not possible to put forth a simple model explaining the behavior of this system.

In conclusion, I'd like to give you my view of the role of biology in dealing with certain problems related to management of natural resources. It's my view that people, in looking for advances, or looking back at the advances made in engineering, physics, chemistry and mathematics, perhaps expect a bit too much from biologists in developing predictive models by which we can understand and manage the behavior of natural populations and ecosystems. I think most people engaged in research today are looking at populations and ecosystems from the perspective of trying to understand the processes acting within these systems, but not necessarily to achieve an ability to predict precisely the behavior of these systems. It's my view that this situation is going to prevail--it's just the way biology is.

RICHARD BURGE, DIRECTOR, POINT WHITNEY SHELLFISH LABORATORY,
WASHINGTON DEPARTMENT OF FISHERIES

The statement that Thorn Smith made in the middle of his talk was quite interesting to me because he admitted something that I have never admitted to many people. I moved to Morro Bay in 1969 to take over studies of the abalone, and at the time I moved there I began hearing from many people the effect the sea otters had on abalone and other resources. I didn't believe it either! Thorn mentioned that he was there when sea otters went to Beckett's Reef. I was there when sea otters were leaving Cambria, and moving on to the Point Estero bed. I know many fine biologists, including Earl Ebert and Mel Odemar, who talked about the depletion of abalones. It was infeasible to me that this could occur when diving on the very rich abalone beds at Point Estero and seeing the thousands of abalones that occupied that area. Obviously, otters fed on some abalones and some sea urchins, but I could not believe that they could have the impact that they do.

In the years before the otters moved into sandy beaches and rocky habitats, in San Luis Obispo County, the Department of Fish and Game initiated surveys at Pismo Beach, Point Estero and other areas such as Diablo Canyon to study shellfish for the purposes of improving management strategies for various species. Surveys were initiated at Pismo Beach in the early 1930s and at Point Estero in about the mid 1960s. These surveys included beach transects and diving transects to count abalones, to count Pismo clams, to develop population estimates, and to also study the life history and ecology of these animals. These surveys and the information that came from them allowed us to improve our management of these species. In subsequent years, they also provided a baseline to study the effects that sea otters had on

shellfish. What I'd like to review in this very short period of time is the depletion rate that sea otters have had on various shellfish species.

The surveys at Point Estero were initiated in 1964, and otters entered that area about 1969, providing about five years of baseline data. These surveys show that when otters entered that area, they first fed on sea urchins, taking a few abalones, but it took three to four years before they depleted abalone beds to a level that made fishing no longer commercially feasible. The depletion rate was about 90 per cent through 1978. The abalones that remained were growing in crevices and under rocks, generally out of the reach of both sea otters and man, and only available to a biologist who is inspecting the bottom. John DeMartini mentioned the depletion rate of sea urchins using data from Sue Benech's studies. Sea urchin counts conducted at Point Estero, at Diablo Canyon, and at other areas have given very similar results. At Point Estero, sea urchins were never fished, and then they were only fished for a year or so in the Point Buchon to Pecho Rock area before the otters entered that area. Sea urchins are not cryptic animals like abalones. They live on a hard substrate and many are recruited in shallow crevices, or under the spine canopy of an adult, meaning that almost all of them are available to a predator, and for this reason the depletion rate is much higher than it is for abalones.

Dan Miller, of the California Department of Fish and Game, began talking about depletion of Pismo clams in Monterey Bay in the late 1960s and early 1970s and at that time many of us didn't believe the sea otters could raft off sandy beaches or take Pismo clams because they were in sand. Otters began feeding on Atascadero Beach just north of Morro Bay in 1970-71, but at the same time, we had the finest set of Pismo clams that we had seen on that beach in 30 years. Probably quite foolishly, we closed that beach to allow for survival of those clams. The move may have been foolish, but the data that we received from it was quite valuable for understanding Pismo clams and sea otters. On the beach, we found that Pismo clams rarely grew above 60 mm or about 2 inches in length, and almost all of them had been taken by the time they reached 80 mm, or about 3 $\frac{1}{4}$ inches. This compares quite favorably with the data that Dr. Walker presented on sizes of average Pismo clams from kitchen middens. His chart indicated that prehistoric man began taking Pismo clams at about 1.9 cm and towards the end of their period, that size was reduced to about 1.3 cm. This is just below the size at which sea otters began feeding on Pismo clams. When we re-opened Atascadero Beach, we estimated that, using normal survival rates and growth rates, there should have been about 400,000 Pismo clams available to fishermen; however, we knew better because we had been conducting surveys. We continued to census the beach as it opened and we found no one that took a legal size Pismo from that beach.

The otters, of course, have more recently moved on to the Pismo beaches. The charts that John DeMartini presented on the effects that otters have had there show a number of things. First of all, through knowledge of recruitment we know that the recruitment and populations of Pismos are somewhat cyclic, just as they are for many other shellfish, Dungeness crab possibly the most notable. During the late 1960s and early 1970s, recruitment rates were quite low on the beach, and this was reflected in some of the earlier data presented on catch effort for 1975 and 1976, when the catch was ranging between two and five clams per individual. This was, by the way, quite similar to the catch on Monterey Beach, just prior to that time. However, some very good sets of young clams occurred in the early 1970s and we closed a number of the beaches again to protect the small clams from sport clamming activity and other damage that might occur, so that they could attain legal size. Just prior to the arrival of sea otters on the Pismo beaches, the catch had increased to four to eight clams per individual. This was probably some of the better clamming at that beach we had seen in eight to ten years or more, and then we saw the decline on each individual beach as the otters moved south and fed on those beaches for a period of a few months to a year. A general depletion rate of Pismo above 3 inches or so is very close to 100 per cent. Clammers on beaches in Monterey Bay and on Atascadero Beach averaged 0 to 4 clams per 100 clammers, in comparison to averages of 2 to 800 per 100 clammers prior to the arrival of the sea otters.

2 PHILOSOPHICAL AND SOCIAL ISSUES

Moderator

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SEA OTTERS AS A MORAL RESOURCE

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INTRODUCTION

Should the sea otters be allowed to extend their range without restriction, despite the likelihood of severe impacts of that expansion upon the shellfisheries in California? Or should some areas of the California coast be kept off-limits to the otters and thus made safe for abalone, crab and clams? Don't ask me, I'm just a philosopher. I do not have a simple, definitive answer. But then, no one else does either; not the fishermen, the ecologists, the Friends of the Sea Otter, or anyone else. All of these, philosophers included, offer ingredients to a decision, for any decision must entail a mix of benefits and costs. There is no simple recipe for a solution. Whatever the eventual policy decision regarding the sea otter - shellfish controversy, something of value must be sacrificed, perhaps a sizeable portion of the sea otters' range and with it a margin of assurance of their security and survival. Perhaps we will have to relinquish an economically viable shellfish industry, or at least tolerate a diminution of this resource and a rise in the consumer cost of shellfish. What shall be our policy? It depends upon how we decide to balance the gains and losses. And they are gains and losses of many types and varieties of values: economic values, political values, recreational values, aesthetic values, scientific values and, yes, moral values. Regarding the assessment of most of the values just listed, I defer to my colleagues at this conference. Concerning the final item on the list, "moral values," I claim some degree of professional interest. And so, I offer not a solution of the controversy, but rather an ingredient toward a solution--some evaluative considerations to keep in mind as we balance out the plusses and minuses of the various competing policy alternatives.

But perhaps I understate the task of this paper. For I will not simply be adding a few more items to the debate, I will propose that the issues be viewed from a perspective radically different from that which most of us, as products of Western civilization, are accustomed to. I will suggest that we not ask directly, "What management policy is in the best interests of human beings?" but rather, "What policy best protects and respects the value and integrity of the life community of which human beings are a part?" Perhaps it is from this second point of view, what I will call "the ecological perspective" or "the eco-system point of view," that the greatest value of sea otters and other such economically "valueless" (even costly) species can be understood, appreciated and realized -- by and for human beings. Such "useless" creatures, I will suggest, are of most value to us when, paradoxically, they and

their habitats are valued for themselves; when, that is, we assume an ecological perspective rather than an anthropocentric point of view.

The task and structure of this essay can now be set forth. To begin, I will describe, in turn, the anthropocentric and the ecosystemic approaches to evaluating natural resources, species and habitats. I will then offer some empirical arguments in support of the ecosystemic view. Following that I will suggest that human beings are psychologically so constituted that, in order to be healthy and fulfilled, they need to care for things beyond themselves--things beyond their immediate concerns, neighborhoods and lifetimes. From this and other considerations, it follows that a personal life exclusively directed to the search for self-satisfaction is self-defeating.

These considerations of moral psychology which I call, in turn, the need for self-transcendent concern and the moral paradox will be joined with the ecological point of view to yield the conclusion that a self-transcending concern for the welfare of wild species and their habitats enriches the quality of moral life; that persons with genuine reverence and respect for wild creatures and their habitats will, through this concern, enjoy greater fulfillment in their own lives and be better neighbors to each other.¹

ANTHROPOCENTRISM

Anthropocentrism, the view that man's needs and interests are of supreme and even exclusive value and importance in nature so dominates the thinking of most people in our culture that it is virtually pre-conscious--an unexamined presupposition of most popular reflections, feeling and utilization policies regarding wild nature. Anthropocentrism, or "human chauvinism" as Richard and Val Routley call it (Routley, 1979; pp. 36-59) has both a religious and a secular foundation. The religious theme is set rather explicitly in a famous verse in Genesis (I:26) in which the Lord is recorded to have said: "[Let man] have dominion . . . over all the earth, and over every creeping thing that creeps on the earth." And then, that famous injunction, "be fruitful and multiply and fill the earth and subdue it. . ." (Genesis I:28).

¹ In this paper I have condensed and summarized much of the content of a university course. Thus I will, of necessity, make brief, abstract, and sometimes dogmatic statements with only a promise that my arguments have been presented elsewhere in greater detail. I invite the reader to examine works cited in these notes and references and to explore further this sketch of an environmental ethic; that is, this attempt to articulate and justify a policy of responsible conduct toward "useless" nature.

Recently, many historians (notably Lynn White, Jr.) (White, 1967, p. 3167) have focused upon those verses as typifying the Western religious approach to man's place in nature. By this account, nature was created for mankind's benefit, and it is his role to be the master of nature. The Lord created the earth as a garden and habitat for man, and man is given little restriction regarding his use of it. Moreover, there is little acknowledgment of the limits of mankind's capacity to wisely manage the earth exclusively for its own use.

The rationale and justification of the secular approach are somewhat different, yet they lead to essentially the same conclusion. By this account, life has recently evolved to include a self-conscious, rational, deliberative, personal species--homo sapiens. Some species have sentient lives; that is, they are capable of feeling and, most significant, morally speaking, of feeling pain. Most species, however, are neither sentient nor conscious. That they are alive or not "matters" not a bit, say, to an insect, to a tree, and perhaps very little to a hummingbird. These species haven't the mental (which is to say the neural) capacity to "care." Life matters most, if not exclusively, to the one species we know that can contemplate the past, present and future of its own life and act rationally and deliberately to affect the condition of that life. Again, that singular species, is, of course, the human species. Nature, according to this point of view, matters, has value, has significance, only if there is a species to whom it can have significance. It follows, then, that values in nature are almost exclusively human values. The only possible qualification to this rule would be the value of avoiding cruelty to non-human sentient species--the so-called "higher animals." Except for that proviso, that sole personal and rational species, homo sapiens, has acquired with its capacities the privilege, even the right, to do with nature what it pleases. So we come, at length, to the same conclusion as that of theological anthropocentrism: nature exists for mankind's advantage and use. What counts exclusively is humanity--its aspirations, its desires, its interests--with possibly the minor qualification that, as moral agents, human beings should not be wantonly cruel to animals that have the capacity to suffer.

Does this anthropocentric position offer no safety or security for the sea otters and their habitat? Well, perhaps it does--at least for the short term. After all, sea otters are adorable and cute. And so long as we feel that way about them--so long, that is, as they entertain and delight us--then we may take some trouble to keep them around. But, again, we will do so on account of what they do for us. But if that is the reason we protect the sea otters, then their safety is hostage to our taste and modes of entertainment. But tastes and attitudes change, as do our moral fashions. From a similar perspective, the California Condor or the celebrated Tennessee Snail Darter² (neither of which is adorable at any stage of life), would gain not an iota of protection.

² The snail darter (percina tanasi) is, of course, the endangered fish that effectively delayed construction of the Tellico Dam in Tennessee.

But what attitude toward nature renders the world safe for the California Condor and the Snail Darter as well as the Sea Otter? (Apparently that attitude has some hold on us since we do, in fact, have laws protecting even ugly endangered species.) Is there an attitude toward nature that does not require an "aw gawsh!" response, or other such simple-minded projections for us to care enough to take some trouble and expense to protect a "useless" species? I rather doubt that the uncompromising human chauvinist will offer us much warrant for protecting a species that can not be readily shown to be useful, entertaining, or of some other direct value to human beings. And so if other human values compete and conflict, say, with the integrity of the sea otters' habitat, the "aw gawsh!" factor might readily be over-ridden and the sea otters' tenure be placed in great peril.

THE ECOLOGICAL PERSPECTIVE

How, then, shall we answer the human chauvinist? There are several strategies for rebuttal, but many of them will have little appeal to the modern frame of mind. For example, one might attempt to defend the primitive believe in animism or perhaps pan-psychism. (This approach, after all, is not unheard of these days. Recall The Secret Life of Plants [Tompkins and Bird, 1973].) Both positions hold that nature is alive and sentient. A more promising answer to anthropocentrism, I think, would be to attempt to dissolve the hard conceptual line that we customarily draw between human beings and "nature," and to challenge the implicit assumption that we can somehow physically, organically, and even psychologically, detach the fate of mankind from the fate of nature. We might even challenge the notion that such a view of the man-nature relationship is productive of scientific or moral insight. Perhaps there is a better way of viewing the natural order and man's place in it. But in what sense "better"? An example from the history of astronomy might clarify my point.

Before the days of Copernicus it was, of course, possible to plot the positions of the planets and to forecast the concurrence of eclipses and other celestial events, even with the assumption that the earth was the center of the solar system. But, as most students of the history of science are aware, the geocentric view required the positing of an array of complicated theoretical entities (such as "epicycles") which "adjusted" the theoretical model to permit moderately accurate predictions. For this system to "work," for it to "fit" the observed data, the theoretical scaffolding had to become quite complicated and unwieldy, and was overburdened with otherwise useless ("ad hoc") assumptions and theoretical concepts. "Suppose instead," Copernicus asked, "we just assume that all the planets, earth included, are satellites of the sun. What then becomes of our capacity to make predictions and the conceptual equipment required to do so?" What happens is that we make better predictions and do so with but a fraction of the theoretical baggage and the computational fussing. We do not, for instance, need to assume that

one insignificant speck of heavy elements (the earth) stands still while all the rest of creation moves about it. Assume further that the very concept of motion itself, and the variables that define it (namely time and space), are themselves functions of the place and circumstance of observation, then still more heretofore intractable physical problems fall within our conceptual reach and into theoretical place. The stage is set for yet another scientific revolution. Enter Albert Einstein.

Is there, analogously, a better point of view regarding man's function in nature (an empirical-scientific question) and man's responsibility toward nature (a moral question) that similarly simplifies the task of the scientist and the moral philosopher, and which brings insoluble problems and paradoxes within the range of resolution? Perhaps such a transformation of perspective is available: the ecological point of view.

Let us propose, then, that nature not be regarded as humanity's personal playground, garden or supermarket, of use and value only as mankind regards it as such (however wisely and far-seeingly he may "manage" it). What do we gain scientifically from such a point of view? What do we gain morally? I suggest that we gain so much in our understanding of our physical, biotic and, yes, of our moral "place" that simplicity and clarity themselves strongly recommend this new, holistic, integrated point of view.

The ecological point of view is, first of all, holistic; it focuses upon the "all-ness" of nature. The anthropocentric perspective tends to be particularistic; it focuses upon the eachness of things. To the "human chauvinist" (and perhaps especially the theologically-oriented chauvinist), nature is a museum of discrete specimens, or, to mix the metaphor, a vending machine with separate and distinct trinkets which can be had as whim and inclination require (and with an implicit understanding that there is a vendor on call, ever ready to restock the machine). Extracting an item from the machine affects no other part of the machine. The act of purchase is a discrete, disparate, isolated event. Returning to our original simile, the specimens in "museum earth" are viewed, contemplated, and perhaps admired separately and in sequence, like pearls on a string. But they remain securely in place, as the spectator leaves the museum door and returns to his resident world of personal concerns and "human interests."

The ecologist does not view things this way. Rather than tallying up each part to sum up an aggregate collection, the ecologist understands that a view of the whole illuminates his knowledge of the parts. Species have a function, a niche, in the life community. Particular organisms are not specimens in museum earth, they are conduits of energy flows and nutrient cycles. We cannot, says the ecologist, know what an organism is or what a species is, unless we know, additionally, what it does. Knowledge of the organism does not end with the outer membrane. The whole informs the part. Unity in system, equilibrium and stability in

and through complexity and diversity--these are the themes and principles of the ecological point of view.

By examining the whole, we discover functions of the whole that are basic to ecological science: that diversity enhances stability, that established systems tend toward equilibrium, that life communities are complex cybernetic systems with negative feedback mechanisms serving to restore stability following externally caused disruptions. Both ecological and molecular biology reveal, in macro and micro perspective, unimaginable degrees of complexity and suggest, beyond the shores of our knowledge, an unfathomable sea of fact, hypothesis, data, theory, law, function, diversity, structure that are and will forever be beyond our understanding and control. The biologist well knows that he is dealing with an order of nature that can encode, in the microscopic space of a cell nucleus, more information than is contained in a library. He is privileged to study the structure of life communities and organisms that have evolved over billions of years and through an infinitude of discrete "experiments" of selective evolution (Commoner, 1971, pp. 42-43).

Both biologist and philosopher know that it is practically and logically impossible to know all there is to know, even generally and abstractly, about life communities. It is practically impossible because there is simply too much to be known. Furthermore, biotic omniscience is logically impossible for the simple but interesting reason that we, the knowers, are integral parts of the known. Thus our very knowledge of the life community, and of our part in that community, alters our own knowledge. We can no more encompass all knowledge of ecology than we can catch our own shadow or stand at the end of the rainbow. And if we cannot fully understand, then it follows that we cannot completely manage and control. Knowing this, the life scientist is both epistemically humble and technologically conservative. He is understandably reluctant to reach blindly into the life machine and blithely pull out and discard random parts.

I write here of the science of ecology; specifically, of the mode of knowledge characteristic of that science, of the structure that the science displays as the ecologist gathers, interprets, and integrates his data, as he defines and clarifies his concepts, and as he formulates his laws, principles and theories. But how do we move from a scientific to a moral point of view? We move with great difficulty and caution, for here we encounter perhaps the most formidable problems of contemporary critical ethics; namely, the question of the logical bearing of facts upon values and the problem of moral justification. If I even begin an attempt to explain these difficult and technical issues, we shall never return to the topic of this paper. So I will reluctantly set these considerations aside and move to a series of suggestions as to how the ecologist might inform the moralist. (I have attempted the difficult and technically exacting task of assessing the cogency of these suggestions elsewhere.) (Partridge, 1981b 1981c).

My argument in support of the ecological perspective upon the moral question of man's responsibility to nature will include the following elements: First, I will argue for the value, to human beings, of biotic diversity. Next, I will examine the contention that human beings have a genetic need for natural environments (I have coined this theory "bio-humanism"). Then I will indicate that the direct experience of wild nature is an intrinsic good. Following that, I will suggest that, in comparison to the anthropocentric view, the ecological perspective has considerable advantages of theoretical coherence and scope of application. My discussion then turns to considerations of moral psychology, wherein I argue that human beings have a fundamental need to care for things outside themselves and that this need is suitably met, and human life enriched, by a transcending concern for the well-being of natural species, habitats and ecosystems. The paper concludes with an application of these considerations to the issue of the management of the sea otter.

THE CASE FOR BIOTIC DIVERSITY

Granted that sea otters are cute, adorable and enjoyable to watch. Surely we should protect them. But why need we protect their habitat as well? Why not put them in zoos, where we can enjoy their antics close up. And if we appreciate their company so much, let's domesticate them and have them as pets. (And if they don't adapt at once to being pets, we can, if patient, breed pet-qualities into them.) This way we both keep the sea otters and also utilize the California coastal waters for shellfishing and other uses that might be incompatible with the unmanaged presence of wild sea otters.

Let's expand the question. If, as "Global 2000" (the report of the President's Council on Environmental Quality) warns us, we are about to lose 20% of all species in the next twenty years, then so what? Isn't there such a thing as "enough species"? Why this insistence upon a diversity of life forms? Why must we have as many species as possible? Aren't there enough now? Perhaps even more than enough? Why not settle for enough?

I have neither the space nor the scientific expertise to give these questions the attention that they deserve. Most members of this panel are far better qualified to speak on the value of ecosystemic diversity and complexity. Let it suffice, then, for me to repeat some of the more common arguments for biotic diversity.

The ecologist tells us that the more complex and diverse an ecosystem, the more stable it is. This rule, by the way, is strangely contrary to our experience with artificial systems such as machines. In this latter case, we find that the more complex a machine, the more that can go wrong with it and the more difficult and expensive it is to replace it. Why the difference? As I understand it, biotic stability is accom-

plished through redundancy and through complex feedback control systems. The more diverse the ecosystem, the larger the pool of resources available to fulfill disrupted functions (niches) of the system or to check a sudden growth of the population of a component species once a predator is removed, or a new food source is introduced into the system.

I will leave it to the experts to explain and to validate the rule that diversity increases stability. Suffice it to say that I accept their rule. And given this rule, it follows that if we value ecosystemic stability as an end, we should likewise value ecosystemic diversity as a means.

But there are further reasons to value the diversity and the consequent stability of an ecosystem. For instance, being more stable, a diverse ecosystem, and in any case an established natural ecosystem, is self-regulating. Artificially simplified ecosystems, on the other hand, are more likely to require management, especially if these systems have significant energy and nutrient imports directed to particular artificial (e.g., economic) benefits. The paradigm case, of course, is that of agriculture, and especially of intensive, mechanized agriculture.

Unquestionably, if we are to maintain a civilized mode of existence, large portions of the earth's surface must be domesticated and managed, and that means that these regions must be biotically simplified. It is even desirable to do so, once we grant that the civilized condition is desirable. (It would simply make no sense to value civilization and, at the same time, deny any value to agriculture and urbanization.) Thus we arrive at what I call the "fail safe argument" for leaving appreciable portions of the planet in a wild state. A natural ecosystem that has endured in a moderately stable condition over millions of years with only slow increments of evolutionary change, is not likely suddenly to go awry. An ecosystem that is managed, even intelligently, knowledgeably and competently, for what must be rather short-term objectives, is always in some danger of "becoming unstuck." To avoid biotic "unraveling" of artificial ecosystems requires constant study, attention, monitoring, forecasting -- in short, management. When we significantly interfere in nature, we have the responsibility of asking "and then what?" (as Garrett Hardin so eloquently reminds us) (Hardin, 1977, 1980). A linear increase in particular interventions leads to an exponential increase in long-term consequences. And, in fact, our interventions are themselves increasing exponentially. Thus we are constantly being surprised, too often unpleasantly, as we encounter the unintended and unexpected "by-products" of our management of nature. In stark contrast to this, natural systems, left alone, are quite capable of self-regulation. They do quite well without our interventions.

There is an additional argument for allowing significant portions of nature to remain undisturbed. The more we interfere with nature, the more human effort and attention is required to manage it, and that means time, effort, attention, and concern that might otherwise be devoted to

aesthetic creation and enjoyment, to philosophical contemplation, to the expansion and enrichment of friendships, to the advancement of scientific and human knowledge--just to mention part of the inventory of enjoyments and fulfillments that enrich human life. And if we neglect to assume the management of the artificial interventions that we have undertaken, or if we thoughtlessly leave to future generations an unfair burden of managerial responsibility, then eventually, through managerial neglect or simple incapacity to cope with accumulating difficulties, nature will become "unstuck" and the price may be very grave indeed.

If our attempts to domesticate nature through mechanized agriculture occasionally fail (due, for example, to the ravaging of a monoculture by an uncontrolled bacterium or insect pest), we may have desperate need to return to the storehouse of nature to find alternative means of sustenance. We should not burn the bridges back to our aboriginal sources of food and other necessities. And nature supplies more than physical nourishment. In the section that follows I will suggest that nature nourishes our emotions, our temperament, our minds, and our souls as well. The wellsprings of these human goods should be kept safe, lest our civilized enjoyments fail us.

The "fail-safe" argument for the preservation of natural habitats yields clear moral implications. These implications become apparent as we ask, "What general public attitudes and habits are most likely to result in policies that will be more protective and less exploitative of wild ecosystems?" Surely this would be an attitude of respect and reverence toward nature and a frame of mind which, to borrow Aldo Leopold's terms, regarded nature as a community rather than a commodity, and man as a citizen of this life community rather than a master. This precisely describes ecological morality, or "the land ethic."

"BIO-HUMANISM": THE ARGUMENT OF "GENETIC NEED"

Why preserve wild nature and the wild creatures therein? One intriguing answer to this question has been proposed by a number of biologists, geneticists, ecologists and ethologists. They plausibly suggest that our need for nature has a genetic base. We need, in short, the environment in which we developed as a species. A prominent defender of this hypothesis of "bio-humanism" is the botanist, High Iltis. He writes:

. . . Every basic adaptation of the human body, be it the ear, the eye, the brain, yes, even our psyche, demands for proper functioning access to an environment similar, at least, to the one in which these structures evolved through natural selection over the past 100 million years. . . . [L]ike the need for love, the need for nature, the need for its diversity and beauty, has a genetic basis. We cannot reject nature from our

lives because we cannot change our genes [Emphasis in the original] (Iltis, 1967, p. 887).

It follows from the bio-humanist hypothesis that a destruction of the natural environment diminishes man's legacy and estate by depriving him of places of refuge, fulfillment, "re-creation" (in the literal sense of that abused word). Such destruction, writes Paul Shepard, is "an amputation of man." (Shepard, 1969, p. 4). To be healthy and fulfilled, we cannot be totally detached from that which nurtured us. The sack of skin that encloses the human organism does not contain all of "human nature." Thus, in a significant sense, the human organism is the natural world which created it. Nature which nourished us as a species sustains us still. There may be more truth than poetry in the worn metaphor, "Mother Nature."

Could we survive in an entirely artificial environment? On a planet wholly domesticated, with every last vestige of wilderness crowded out? Perhaps we could. However, it would be a much diminished life. Or so the bio-humanist would argue.

Thy hypothesis of bio-humanism will be difficult either to confirm or refute because of the persistent and recalcitrant difficulty of separating and isolating the respective roles of heredity and environment--"nature and nurture"--in determining behavior and taste. And yet it is urgent that we attempt to determine just how much we need to be in the presence of wild nature. In the meantime, the very plausibility of the bio-humanist hypothesis mandates caution and conservatism with regard to our policies of exploitation and development. If, at length, we conclude that mankind can manage quite well without wilderness, there will be time enough to dismantle it, if that is what we choose to do. However, if we eventually discover that mankind has a deep need to be in the presence of the kind of natural species, landscapes and ecosystems that produced him, we may arrive at the realization too late to reclaim and enjoy our precious natural legacy.

If, as Iltis and others suggest, we have a genetically-coded need for nature, then an encounter with nature should evoke feelings of unity, of harmony, and of affirmation of nature. That it does so is abundantly clear in the received historical record of religion, art and literature. After all, was it not in the wilderness that Moses, Gautama Buddha, Jesus and other great figures in the world religions found their enlightenment and their mission? Manifestations of the message of nature evoked in art and literature are plentiful. One need only think of Beethoven's Pastoral Symphony or Debussy's La Mer, the poetry of Wordsworth or Gary Snyder, the landscapes of Turner or Cezanne, the essays of Emerson, Thoreau or Muir, and of Aldo Leopold, Joseph Wood Krutch and Edward Abbey in our own time.

Candor requires acknowledgement of a contrary trend. As historian Roderick Nash reports, the early colonists in North America regarded the

wilderness as dreadful, alien, satanic (Nash, 1973). Even today, those who live in remote and less civilized regions such as Tanzania and southern Utah, are bewildered by the trouble and expense that Europeans and southern Californians will tolerate just to be in the presence of their "useless" wilderness. Such outlanders are inclined to preserve wilderness only if obliged to do so by an oppressive foreign power, such as the Department of the Interior, or if convinced that there is economic benefit to be gained by attracting the wilderness-craving tourists (Nash, 1979). But this affirmation of nature, this evocation of feelings of wonder, harmony, unity, reverence, is available to most of us. When we imperil the sea otter by restricting its range and threaten its habitat with development and marine pollution, we diminish the possibility of such experiences. To lose such opportunities, I submit, would be grievous and irredeemable.

THE ARGUMENT FROM COGNITIVE ADEQUACY

The essential message that the biologist and the ecologist has for the moral philosopher is that man evolved from, and remains a member of, the natural community. Man is a natural being and thus remains subject to nature's laws. This is so whether or not we are aware of this dependence or desire it. We have long believed that this was not so; that mankind was of a special and separate order from nature. Recently, while we have acknowledged our natural origins, we have allowed ourselves to believe that with our remarkable growth in scientific knowledge and technical power we could declare our independence from the life community. The hard facts seem to indicate that we can not, and that we will continue to believe otherwise at our great peril.

Ecological science also recommends, by example, the holistic point of view--a perspective effectively and productively employed by the ecologist in his work. However, the moral philosopher need not learn of this approach from the ecologist, since most moral philosophers have long recognized that morality makes no sense when viewed reductively; that is to say, a rational code of morality is not to be comprehended simply by summing up the separate tastes, preferences, desires and wills of each member of the community.³ On the contrary, most moral philosophers have learned that if morality is to be understood and justified at

³ This realization has been "general" among philosophers, but not universal. Recently, the logical positivists and some existentialists have attempted just such a reductive and atomistic approach to ethics, with a resulting denial by these philosophers of objective and rational grounds for moral judgments. I have discussed these "non-cognitivist" approaches to ethics and their relevance to environmental ethics in my paper, "Environmental Ethics: Obstacles and Opportunities" (Partridge, 1981c).

all, it must be viewed in the context of the system of the community, of the role of the institution of morality in that community, and of the agent's understanding of his function in that community. In short, morality, moral principle, moral instruction, are intelligible only when human conduct is viewed holistically, systemically, contextually, from the point of view of an integrated community of persons. This point has been persuasively argued in the past by such social contract theorists as Thomas Hobbes, John Locke, Jean Jacques Rousseau, it has been reiterated in the present by game theorists and systems analysts (as in the case of the celebrated "prisoner's dilemma" and Garrett Hardin's splendid paper "The Tragedy of the Commons") and active philosophers such as Kurt Baier, Michael Scriven, and John Rawls. Time forbids explication and elaboration of this contention that contemporary moral philosophers are, in general, favorably inclined to think holistically and systematically about moral communities (of persons). Suffice it to say that a moral philosopher interested in deriving norms of conduct toward nature (that is to say, an environmental ethic) should find it relatively easy to adopt the ecologist's preferred mode of holistic and systemic thinking. The moral philosopher is used to such modes of thought in his examination, articulation and justification of social norms. Articulating an ecological ethic should present little difficulty to the moral philosopher. He faces his greatest challenge as he attempts to justify such an ethic. Then he must face, and take account of, some significant differences between social communities and life communities. We will return to this point near the close of the paper.

Earlier I described how, at certain pivotal moments in the history of science, radical reconstructions of theory and redefinitions of concepts have accomplished "cognitive breakthroughs"--resolutions of previously insoluble puzzles and contradictions, extensions of the range of prediction and explanation, and a simplification of the logical and conceptual structure of the science. Such revolutions in scientific thought were accomplished by Copernicus in astronomy, Galileo, Newton and Einstein in physics, Darwin in biology, and Freud in psychology. In a similar manner, the holistic, systems-oriented perspective of the ecologist displays significant cognitive advantages over a particularistic reductive approach to the life sciences.

Does moral understanding undergo similar transformations of structure and extensions of scope in the course of its development? The history of ethical thought would seem to indicate that it does. But even more startling are recent investigations by the psychologist Lawrence Kohlberg that indicate that a series of transformations occur in each person in the course of the growth and development of his moral perception and cognition (Kohlberg, 1973, 1971; Muson, 1979). Kohlberg described moral growth as a progression, through a series of six distinct "stages," toward greater "cognitive adequacy." As in the case of the theoretical scientist, the child, in the course of his moral development, finds himself faced with a series of unresolved puzzles and contradictions ("cognitive dissonance"). He then gropes for a new theoretical

structure that will realign and thus resolve these puzzles and contradictions by assimilating them into a more coherent system of thought with a larger scope of application.

A reflection upon first, the history of scientific revolutions, second, the apparent scientific advantages of the holistic, systemic perspective of the ecologist, and finally, Kohlberg's studies of the psychology of moral development yields the suggestion that the ecosystemic perspective might offer a better mode of viewing our moral responsibilities toward nature--"better," that is, than the traditional and prevalent anthropocentric view. If this is so--if, in fact, an ecologically oriented morality constitutes an advancement in moral thinking over the man-centered view--then previously insoluble puzzles and contradictions might "fall into place" in the new structure, thus "harmonizing" previous "cognitive dissonance." Let's see if this is the case.

Anthropocentrism proclaims our capacity, even our "right," to manage the natural estate exclusively for human advantage and use. The ecological moralist denies both the capacity and the right to do this. Support for the ecological moralist's view is found in the accumulating, dreadful account of the cost of our careless exploitation of nature: uncontrolled population growth, resource depletion, species extinction, and a widespread poisoning of the biosphere through casual dumping of the refuse of our industrial civilization. Awareness of all this should create a "dissonance" in the world-view of the human chauvinist. For, if man is so wise, powerful and capable of managing his private planet, all this should not be happening to him.

Anthropocentrism also creates a "moral dissonance" which might well be resolved through the ecosystemic view. While massive exploitation of nature might seem to serve the interests of people we care about, such as our contemporary neighbors and our children, even such "altruistic" solicitude for the welfare of immediate and contemporary others may be felt to be inconsistent with a "natural" and intuitive regard and admiration for natural landscapes and species that one seems to have despite one's anthropocentrism. (Promptings, perhaps, of "bio-humanistic impulses"?) Thus one might somehow feel a measure of discomfort about the casual destruction in a few years time of species and habitats that had evolved and endured over millions of years. But in what moral terms does the human chauvinist articulate, much more defend, a case for restraining such biotic destruction and exploitation? Moral concepts such as "rights," "duties," "justice," "responsibility," emerge from the evaluation of persons and their communities. But they seem strained and inappropriate when applied to nature. There even appears to be some difficulty in extending the concept of "rights" to apply to future generations which, after all, do not exist now when we are making decisions that will significantly affect the quality of their lives in the future (Partridge, 1981a, 1976). In short, in the realm of ethics, the anthropocentric view just does not seem to do the cognitive work that we want it to do. It leaves us with just too many puzzles and paradoxes.

Somehow it seems inadequate to say that we should protect the sea otters simply for the sake of the enjoyment we gain by having them around, even less to argue for their protection in terms of the economic value they realize by promoting tourism. Somehow these points in "defense" of the otters seem rather crass and morally irrelevant. Something essential seems to be missing from this "defense."

I suggest that there is a basic inconsistency between a factual membership in a community and a moral mastery thereof that cannot be psychologically sustained. Thus the sort of anthropocentric arrogance that leads us casually to eradicate species of millions of years of development will "feed back" to affect our attitudes and behavior toward members of our own species and toward our own habitat. The self-seeking frame of mind that leads to and manifests a willingness to shred and destroy ecosystems of countless ages of standing, and which even urges an active participation in such destruction, is not a frame of mind that is well designed to promote moral qualities that one might prefer to find in one's neighbors--such qualities as mutual respect, restraint, humility, and loyalty to one's community.

ARGUMENTS FROM MORAL PSYCHOLOGY

"Self Transcendence"

So far I have argued for the advantage of viewing our species and our responsibilities from an ecological perspective and against the anthropocentric point of view. I have also attempted to give empirical indications as to why we should value natural areas and preserve biotic complexity and diversity. The remainder of my remarks will focus upon moral psychology.

After a remarkably extended period of oversight and neglect, moral philosophers are once again adopting a psychological perspective and examining the perennial issues of good and bad, right and wrong, obligations and rights, etc., in such psychological terms as needs, fulfillments, moral sentiments (Rawls, 1971), motives, habits, capacities to comprehend and obey moral maxims, problem-solving abilities, moral educability, etc. Many philosophers (and I include myself) believe that apart from these psychological considerations, attempts to solve ethical questions are pointless and unavailing. And yet, by bringing these considerations into moral contemplation and controversy, we complicate these moral issues enormously. Be that as it may, this focus of attention on human sentiments, needs, motives, habits, capacities and fulfillments is indispensable to moral philosophy.

My discussion of the application of moral psychology to an ecological ethic will focus on basically two themes: First of all, the need for self-transcendent concern, and second, what has been called "the moral paradox"--an observation, reiterated throughout the history of religious and philosophical ethics, that one's self-interest is best

served by not seeking one's self-interest. Through these psychological considerations we may find that, viewed in the full systemic context, an operative, ecologically-oriented moral policy toward nature--a policy that regards the "interests of nature" in addition to, and perhaps even prior to, immediate human concerns--is a policy that is ultimately most fulfilling of human aspiration and most deserving of human loyalty.

Let us approach the consideration of moral psychology by confronting the ecological moralist with an artificially difficult case. Let us, for the sake of argument, concede to the opponents of the Friends of the Sea Otter the larger part of their position. Assume that the otters will be quite safe in their present habitat and thus need not expand their range. Concede that unmanaged sea otters and a commercially and recreationally viable shellfish population cannot co-exist. Grant that an abundance of shellfish is well worth having for reasons of commerce and recreation and sufficiently valuable to give presumptive warrant to reserve large areas of the coastal waters for shellfishing. And finally, assume that live sea otters are of no economic value.⁴

And so we are left with this essential question: Can we argue for the safety and security of the sea otters, and, much more, for the security and preservation of their habitats, with no better reasons than we would argue for the security and preservation of "non-adorable" and even ugly species such as the California Condor, the snail darter and the furbish lousewort? That, I think, becomes the crucial question.

I think that we can argue this. Let's formulate our question in an apparently paradoxical format: "Do we need to need species that we do not need?" Assume a constant sense to that word "need" and the answer is clearly "No." It is a simple logical truth that we do not need what we do not need. End of question. But assign different senses to the word "need," (as I believe we appropriately can) and we might get this paraphrase: "Is human life enriched by caring for things that are of no apparent use to human beings?" This is our question. I suggest that the answer is "Yes." Furthermore, I suggest that a life bereft of "useless things" is not an enviable life. How shall we argue this? We shall argue it by looking deeply into the logic and psychology of motivation and "need." We will find, I think, that fundamental to the human condition is a need to care for things outside of oneself--what I have elsewhere called "the need for self-transcending concern" (Partridge, 1981a).

⁴ Of course, dead sea otters, more specifically their pelts, are extremely valuable. We just do not permit the collecting of sea otter pelts because we feel that the otters are more valuable alive in their habitat than on milady's shoulders. Why? Well that's the very point in question in this conference and in this paper.

In another work I have presented the following characterization of "self transcendence": "By claiming that there is a basic human need for 'self transcendence,' I am proposing that as a result of the psychodevelopmental sources of the self and the fundamental dynamics of social experience, well-functioning human beings identify with, and seek to further, the well-being, preservation, and endurance of communities, locations, causes, artifacts, institutions, ideals, etc., which are outside themselves and which they hope will flourish beyond their own lifetimes. . . ." Thus we cannot regard our decisions and the values which we hold to be restricted to and isolated within ourselves.

This claim has a reverse side to it; namely, that individuals who lack a sense of self transcendence are acutely impoverished in that they lack significant, fundamental, and widespread capacities and features of human moral and social experience. Such individuals are said to be alienated, both from themselves and from their communities. If such individuals lack concern for self-transcending projects and ideals because of a total absorption with themselves, they are said to be narcissistic personalities.

"Self transcendence" describes a class of feelings which give rise to a variety of activities. It is no small ingredient in the production of great works of art and literature, in the choice of careers in public service, education, scientific research, and so forth. In all this variety, however, there is a central, generic motive; namely, for the self to be part of, to favorably affect, and to value for itself the well-being and endurance of something that is not oneself (Partridge, 1981a).

Elsewhere I have presented several arguments in defense of the claim that healthy human beings need self-transcendent concerns. In one of these, the argument of "import transference," I point out that if an institution, place, organization, person or principle is important to a certain individual, that individual will regard that thing as intrinsically valuable; i.e., as worthwhile in and of itself. He will care for its fate (an appropriate word for this caring may be "love") even beyond the term of his own lifetime. Thus, John Passmore writes:

When men act for the sake of a future they will not live to see, it is for the most part out of love for persons, places, and forms of activity, a cherishing of them, nothing more grandiose. It is indeed self-contradictory to say: 'I love him or her or that place or that institution or that activity, but I don't care what happens to it after my death.' To love is, amongst other things, to care about the future of what we love. . . . This is most obvious when we love our wife, our children, our grand-children. But it is also true in the case of our more impersonal lives: our love for places, institutions and forms of activity (Passmore, 1974, p. 88).

The Paradox of Morality

If, as I have urged, self transcendence is vital to the human condition, then surely its absence should be seen to exact a high price in the life quality of those who are devoid of self-transcendent interests and concerns. And here, I think, we find clear clinical evidence to support the claim that self-transcendent concern is essential to psychological health and well-being. In psychiatric and sociological literature a lack of active personal interest and involvement in external concerns and causes is called "alienation," a common and apparently increasing phenomenon in contemporary life.

A lack of self transcending interest, concern and involvement, in short a lack of valuing of external things in and for themselves, is defined as alienation. When value is turned inward and focused directly and exclusively upon oneself and upon one's image of oneself, this is called narcissism. Narcissism is not only widespread in our present culture, it is even recommended and celebrated by such "pop philosophers" as Ayn Rand, Robert Ringer, Richard Dyer and Werner Ehrhardt. It has political expression in libertarianism and is reflected in that label often used to characterize the decade of the 70's: "the me generation." In his splendid book, The Culture of Narcissism, Christopher Lasch indicates that Narcissism is not a desirable condition--to say the least of it. The narcissist, he writes "impoverishes his personal life and reinforces the 'subjective experience of emptiness' . . . his fear of emotional dependence, together with his manipulative, exploitative approach to personal relations, makes these relations bland, superficial, and deeply unsatisfying" (Lasch, 1978, pp. 39-40; Kernberg, 1975).

And so the narcissist is "looking out for number one." The alienated person is incapable of making attachments beyond himself--of having self-transcending concern for other persons, places, institutions or principles. Neither mode of life is to be envied.

Then what is the answer? How is one to find satisfaction in one's life? Paradoxically, one is to find it by renouncing the direct and deliberate search for personal satisfaction. Satisfaction and fulfillment are attained by valuing things other than oneself not for the gratification that these others bring us but for themselves. Happiness is found by reaching out, in admiration, reverence and love, rather than through self-serving calculation. This is the paradox of morality. The paradox is expressed in religious literature, as when Jesus says: "Whosoever will save his life shall lose it, and whosoever shall lose his life for my sake shall find it" (Matthew 16:25). The paradox is also set forth by moral philosophers from Aristotle, through Hobbes and Butler, on to Kurt Baier, Michael Scriven, John Rawls and many others in our own time.

The paradox is sometimes expressed, in a more restricted sense, as "the paradox of hedonism" (pleasure-seeking). Here is philosopher Joel Feinberg's formulation of the hedonic paradox:

An exclusive desire for happiness is the surest way to prevent happiness from coming into being. Happiness has a way of "sneaking up" on persons when they are preoccupied with other things; but when persons deliberately and single-mindedly set off in pursuit of happiness, it vanishes utterly from sight and cannot be captured. This is the famous "paradox of hedonism": the single-minded pursuit of happiness is necessarily self-defeating, for the way to get happiness is to forget it; then perhaps it will come to you. If you aim exclusively at pleasure, then pleasure will never come. To derive satisfaction, one must ordinarily first desire something other than satisfaction, and then find the means to get what one desires (Feinberg, 1965, p. 533).

It then follows that deliberate attempts to directly maximize enjoyments, say through legislation, education and policy-making, can be not just unavailing; even worse, they may be self-defeating. A clear example of such a policy paradox appears in attempts to manage natural landscapes and seascapes, or "useless" natural objects and species. Thus, for example, when faced with the question of "managing" sea otters and shellfisheries, if we ask, "Well, just what good are sea otters to us anyway?"--"good" in the economic sense, or even good in the aesthetic sense of the delight that they offer to us, we may be systematically excluding from consideration their greatest value. For it may be the case that, paradoxically, sea otters are valuable "to us" precisely to the degree that they are valued and admired not for our sake and gratification but for themselves--for what they are. And to value sea otters for what they are, one must also value the habitat and ecosystem in which they evolved and which sustains them. It makes neither ecological nor moral sense to have regard and concern for the wild otters and not for their natural habitat as well. We value the natural habitats and ecosystems for what they are: independent of us, complex, diverse, self-regulating, and with a long history of evolution and duration. To the degree that we "lose" our self-awareness in the contemplation of the wild, and thus cast aside the impudent question, "But what good is all this to us?"--to that degree we gain the fullest advantages of visiting wild places or even simply knowing that they exist, free, undisturbed and wild.

Like musical talent and athletic skill, other-regarding, self-transcendent interest and concern are enhanced and strengthened through application. I do not feel, as many have charged, that to love nature more, one must love mankind less (albeit there are, to be sure, abundant examples of misanthropic nature-lovers). A capacity for love is not some kind of depletable psychic resource. Quite the contrary. I suspect that a callous indifference to the value of the diverse and complex order of life forms in natural ecosystems, and to their long histories of evolution and maintenance, does not leave one with a greater capacity

for love, altruistic solicitude and moral responsibility toward humanity. Rather, I think that such insensitivity to natural values is contagious and that it can spread to contaminate our moral stance toward fellow human beings. Rather than leaving a larger store of love available for humanity, an indifference to natural history, order and sustenance adversely affects our human relationships. Such self-regarding callousness, reflected in disregard and destruction of nature for immediate economic gain, sets a pattern of behavior that can contaminate the value and integrity of communal life. In short, I would suggest that a study of moral psychology will teach us that ecological morality is complementary to, rather than in competition with, social morality. Other things equal, I believe that I would rather have for a neighbor a friend of the sea otters than someone who is utterly indifferent to the fate of these creatures.

THE MORAL POINT OF VIEW

To this point, I have been discussing the paradox of morality from the perspective of the individual. But perhaps a stronger justification of altruism comes, not from the point of view of the moral agent, but from the point of view of the system--of the community. To "look out for number one" by calculating a maximization of "payoffs" for oneself, or, alternatively, to apply values exclusively in terms of one's own conduct, is to take what moral philosophers call the perspective of "the moral agent." On the other hand, to look toward the maximization of goods for the entire community, or to apply moral rules for each with regard for the optimum function of these rules in regulating the whole, is to adopt the perspective of "the moral spectator," or, more directly, "the moral point of view." The points of view of the agent and the spectator are notoriously in conflict. This conflict and the attempt to resolve it give immediate rise to the necessity for moral deliberation and to moral philosophy.

It can be readily demonstrated, I believe, that life in a community of persons assuming and acting in accordance with the point of view of the moral spectator is to be preferred to life in a community of persons each acting from the point of view of individual agents, however rational. Two paradigms readily illustrate this contention.

First, there is the celebrated case of "the tragedy of the commons," so vividly and effectively presented by Garrett Hardin (1968). To simplify and generalize Hardin's point: there are numerous circumstances in human communal life in which uncoordinated, self-seeking activity by each member of a community destroys the resource base and thereby the community. To use Hardin's initial example, herdsmen utilizing an overstocked common pasture will, by adding to their personal flock (a decision of the moral agent), degrade the common resource and thus the wealth of all others (a harmful act from the point of view of the moral spectator). Of course, the same decision on the part of the others

(i.e., the decision to increase their own flocks) harms the interests of the first herdsman. And yet, given the lack of communal rules of management or procedures of rule enforcement (i.e., no effective moral or legal restraints on range use) the rational decision is to add to one's personal flock. (After all, the pasture will be ruined in any case due to the independent acts of "the others.") But once an enforceable regulative order is accepted by each, and imposed upon all, the welfare of each herdsman will be enhanced through this system of "mutual coercion mutually agreed upon." The collective good will may be realized more economically (and in some cases it will be accomplished) only if the mutual restraint is accomplished through moral forbearance, that is, through an operative sense of loyalty to the community⁵ and to its moral values by enough (though not necessarily all) members of the community. And so we find, in the case of the tragedy of the commons, further warrant for the paradox of morality; that is, the conclusion that one's self interest might not be best served by directly seeking his self interest.

A second illustration of the advantages of the moral point of view comes from the experience of military combat. Imagine that you are an infantryman about to be assigned to the front. Your overriding interest is to survive your one-year tour of duty in the combat zone. You are given the choice of being assigned either to a platoon of twelve egoists or to a platoon of twelve altruists. Assuming that you would accept the moral position of the members of your platoon (you would be, respectively, an egoist or an altruist), which assignment would you choose--given, again, that your primary motive is personal survival?

Of course, the operative motive of each member of the platoon of egoists is personal survival. And because this motive is universally operative, there is no opportunity for cooperation and trust to develop in the group. No one will relinquish even a bit of his personal chances for survival for your advantage. In contradistinction, in the platoon of altruists, each soldier regards the value of his own life as at most equal to, but no greater than, the value of the life of each of the others. Thus if the greater safety of all is to be accomplished by the altruistic sacrifice of a few, and if you are one of those few, then you will accept your fate and make the sacrifice knowing that others would have willingly done the same. You understand, and all the others know, that this code of honor, trust and sacrifice is in effect and thus that each member can be counted on. The question, then, is simply this: In which platoon would your initial objective of personal survival most likely be realized? The overwhelming evidence of military history tells us that, other factors being equal, you will more wisely choose to join

⁵ Some allowance is made for the existence of "moral outlaws" or "free riders." The moral order need not be perfect to be effective and preferable to no order at all (Scriven, 1966; Rawls, 1971, pp. 267-70).

the platoon of altruists. The life of the altruistic soldier is protected by twelve others acting in common purpose; the egoist can look only to himself for protection. And so, again, we arrive at the paradox of morality. For when one joins the group of altruists and relinquishes total responsibility for his own personal safety while accepting shared responsibility for the safety of all others (that is, as he shifts his moral point of view from that of the agent to that of the spectator), his personal well-being will be enhanced by this operative shift in moral perspective. (A similar and striking argument for the moral paradox can be made from the intriguing game-theory example of "the prisoners' dilemma.")

The tragedy of the commons and the platoon case are but two of many paradigms that illustrate and confirm the rule that the individual's prospect for maximizing his own safety and welfare is enhanced by membership in a moral community; i.e., in a community in which the preponderant operative sentiment is to act for the maximization of the good of all.

And so, to the psychological, psychiatric and sociological arguments for self-transcendent concern, we add now these arguments from systems theory. All converge upon the conclusion that human life is more fulfilled in a moral community--in a community in which each member has loyalty to principles that serve the common good and which effectively override exclusive concern for his self interest. This is what Aristotle meant when he proclaimed that man is a political animal and what Hobbes meant when he observed that, outside of society, life for man is "nasty, mean, brutish and short." The advantages of social life in a moral community are obvious and compelling, yet they must be learned anew. Many intelligent and well-educated persons seem to have failed to appreciate the import and implications of this lesson, hence the appeal today of such writers as Ayn Rand and Robert Nozick.

And so the value of individual human life is enhanced to the degree that one (a) has self-transcending concern, and to the degree that (b) he subsumes his interest to that of the community (the paradox of morality). To this second rule, I would add two urgent provisos: First, one assumes that most members of the community share and act in accordance with the moral point of view. (Thus if, contrary to his rational wishes, the soldier is assigned to the platoon of egoists, he is simply unfortunate. He then has two choices: either to attempt to persuade and convert the others to an altruistic point of view, or failing that to reluctantly assume an egoistic point of view, correctly realizing that with no "social contract" of reciprocal protection, he has no duty to further endanger his own safety with acts of underserved and unreciprocated sacrifice.) The second proviso is that it would be a grave error of oversimplification to generalize this recommendation of communal perspective and concern to all aspects of personal life. Such an unqualified call for other-directedness would, in effect, lead toward the abolishment of individualism, and that would be an intolerable loss. By pointing out some advantages of assuming a communal point of view and

acting therefrom in matters of common interest, I am by no means required to deny the considerable advantages to each citizen of rights of privacy and of the right to hold non-conforming personal tastes and beliefs. Diversity in life communities provides stability. While this may or may not be true in the case of human communities, diverse societies surely tend to be more interesting places in which to live! In fact, these arguments from moral psychology can readily be employed to defend the maxims of personal liberty and the rights of the minorities. It is arguable that this is precisely what happened when the Bill of Rights was debated and ratified. Surely the rights to "life, liberty and the pursuit of happiness" are intended to allow the fullest realization of self-transcendent concern.

If my brief account of the moral psychology of self transcendence, alienation, narcissism, the moral paradox and the moral point of view has been essentially correct, then it follows that life in a community of self-transcendent individuals is a preferable mode of life. Such persons make better neighbors. They view their moral rights and duties from the (external) perspective of "the moral spectator," and not from the self-contained point of view of "the moral agent." Even our solitary moments are enhanced by such neighborliness. In such a community, we need not lock our doors. We can walk at night for solitary moments of contemplation and do so untroubled by concern for our physical safety. We will pay less taxes for police protection or for courts of law. In short, a community of self-transcendent neighbors is much to be preferred to a community of alienated individuals and narcissists.

A SUMMARY: NATURE AS A MORAL RESOURCE

In the foregoing, I have argued in favor of a moral point of view toward a human social community. Can we argue, from analogy, that the advantages of acting from "the moral point of view" in human communities lends warrant to adapting an "ecological point of view" to direct our dealings with natural life communities? Human communities and life communities are different not only in degree but also in kind. To cite just one essential difference, human communities are comprised of persons; i.e., of individuals with the capacity for rational, deliberative choice and the ability to comprehend and to be guided by moral principles. In communities of persons, reciprocal relationships of rights and duties can be defined, and moral responsibility can be meaningfully ascribed. But moral duties and responsibilities cannot meaningfully be ascribed to non-human natural beings. Thus attempts to extend moral rules by analogy from human communities to ecosystems can be highly questionable philosophically. Still there are advantages to assuming an ecosystemic point of view, to regarding ourselves not as masters of, but as citizens in the life community. By assuming this point of view we may better clarify and perhaps even direct our moral responsibilities and conduct toward nature. In my attempt to list these advantages of the ecological perspective, I will draw upon my earlier

discussions. Thus this final list of justifications and recommendations will serve as a summary of the entire paper.

First of all, an ecological perspective in morality reflects sound scientific principles. Ecological morality is an extension into ethics of a scientifically sound and validated point of view. Man is, in fact, a functioning member of the life community. Life forms in natural communities do, in fact, interact, and they are best understood as functioning components in integrated systems, rather than as discrete aggregates that happen to share physical space. Man, in fact, evolved in this life community, and virtually all of his taxonomic history took place in direct encounter with wild nature. Biotic "insularity" and artificiality is a late development in the career of homo sapiens. Quite possibly, then, human beings retain a neurological and even a psychological need for the natural environments in which they evolved.

From moral psychology we find that for our personal fulfillment we need to have things which "matter" to us that are not ourselves; indeed, we need things that are valued for their very independence and externality from us. Thus our personal and moral life is enriched to the degree that it is "extended out" in self-transcending enjoyment, cherishing and contemplating things, places and ideals that are remote in space and time--even, in a sense, timeless. As we assume the ecosystemic point of view, our personal egos fade in the contemplation of the vastness of natural time, space and complexity, and our lives are enriched with a sense of exuberance, variety, wonder and reverence. Wanton, thoughtless destruction of the natural order strikes the ecological moralist as supremely arrogant. When, conversely, we place ourselves in the center of our evaluative universe and thereby regard nature as a mere storehouse of commodities, these expansive sentiments vanish and we are temperamentally, intellectually and spiritually reduced to the tiny circle of our personal lives and circumstances.

There is thus a paradox in ecological morality as there is in social morality. For I am suggesting, in effect, that for mankind's sake it is wiser to love nature for nature's sake. Mankind, that is to say, is better served if mankind honors, protects, reveres, loves its biotic inheritance and its natural community. The social psychologist reminds us that our personalities, or "selves," have their origin and sustenance in our social community. We are our parents, our neighbors, our culture. In society, "the skin is a permeable membrane," and thus "social good" and "personal good" inter-connect (Partridge, 1981a, pp. 206-7). Similarly, the ecologist will insist that human good and biotic good are confluent, for nature too is the source and sustenance of our physical, neurological, even psychological selves. Thus, as we expand our ethical perspective to encompass the life community, we find that human and ecosystemic interests shift toward coincidence. "The ethical perspective," writes Holmes Rolston, is "significantly altered. That alteration centers in the dissolution of any firm boundary between man and the world. Ecology does not know an encapsulated ego over

against his environment. . . . Cleaning a dump is not different in kind from filling a tooth. The self, metabolically, if metaphorically, interpenetrates the ecosystem. The world is my body." (Rolston, 1975, p. 104).

"Nonetheless," the critic will rejoin, "a paradox is a paradox. If we seek human fulfillment, we should go after it directly. It is flatly incoherent," says the critic, "to claim that 'for mankind's sake, we should love nature for nature's sake.'" In reply, we must wonder if our critic has ever been in love. For this paradox of ecological morality is no more incoherent than the rule for fulfillment in a love relationship; namely, that one who genuinely loves one's beloved for the sake of the beloved gains most from being in love, and that unconditional gifts of love (among worthy, reciprocating lovers) bring the greatest mutual rewards. While this is a paradox, far from being incoherent and contradictory, it has been verified countless times in the lives of loving persons. And one of the great tragedies of our narcissistic, alienated age is the incapacity of so many to practice successfully what Erich Fromm calls "the art of loving."

The human chauvinist who sees nature in terms of its uses--in terms of direct human benefits--cheats himself. He closes himself to a vital dimension of fulfillment: the dimension of love. To realize and experience that fulfillment one must regard and understand nature with such respect and reverence that it becomes a value to him, even if useless--perhaps even because it is useless to him.

In moral and personal life, we observed, self transcendence and alienation are polar opposites. Thus, those who anthropocentrically value nature only in terms of its value for human beings live in an alien world. In contrast, the ecological moralist regards his "world partner" with dignity and respect. Rolston reflects:

How starkly this gainsays the alienation that characterizes modern literature, seeing nature as basically rudderless, antipathetical, in need of monitoring and repair. More typically modern man, for all his technological prowess, has found himself distanced from nature, increasingly competent and decreasingly confident, at once distinguished and aggrandized, yet afloat on and adrift in an indifferent, if not a hostile universe. His world is at best a huge filling station; at worst a prison, or "nothingness." Not so for ecological man; confronting his world with deference to a community of value in which he shares, he is at home again (Rolston, 1975, pp. 107-8).

So, once again, we gain by losing ourselves in wonder and admiration of our natural estate. Once again, the paradox of ecological morality is confirmed.

The moral perspective and mode of life exact a cost to the moralist. The conscientious are liable to temptations, to feelings of guilt and shame, as well as to the rewards of moral pride and self-respect. The compassionate suffer anguish in the face of misery. And the ecological moralist endures unavailing frustration and rage as he contemplates and encounters the present destruction and degradation of the natural estate. Moreover, he is indignant at the presumption and arrogance of his contemporaries. He shares the sentiments of the anonymous editorial writer in the New Yorker, who observed:

. . . Today we rush in everywhere with schemes of destruction and presumed improvement. With respect to the natural order, we are blind wreckers who have nothing to offer in place of what we tear down. . . . [We] have taken upon [our]selves to remake, and perhaps destroy, the legacy not just of generations but of all time (Anon., 1972).

Can we do such things and not be damaged by such arrogance, even in our own lifetime, or that of our children? Kenneth Boulding thinks not, as he asks rhetorically:

Why should we not maximize the welfare of this generation at the cost of posterity? Après nous le deluge has been the motto of not insignificant numbers of human societies. The only answer to this, as far as I can see, is to point out that the welfare of the individual depends on the extent to which he can identify himself with others, and that the most satisfactory individual identity is that which identifies not only with a community in space but also with a community extending over time from the past into the future. . . . This whole problem is linked up with the much larger one of the determinants of the morale, legitimacy, and "nerve" of a society, and there is a great deal of historical evidence to suggest that a society which loses its identity with posterity and which loses its positive image of the future loses also its capacity to deal with present problems and soon falls apart (Boulding, 1970, pp. 99-100).

Boulding's claim is stark and troubling, and yet he offers little justification for his warning. Perhaps our discussion of moral psychology provides some measure of justification for his assertion, for in describing a civilization that has lost its "nerve," isn't he in fact describing a loss of self-transcendent concern? And isn't he suggesting historical justification for the paradox of morality?

For our own moral good, and even for our own personal and communal advantage, we need to be constantly reminded that we of this generation

are not nature's favorites, not the end-product of evolution, not history's culmination. Nature, evolution and history have not all converged, through trackless time, simply to benefit us. For the sake of our good mental and moral health, we need to remind ourselves that we are but a step in the long road behind and beyond us. To think otherwise might thrill us with some brief, ill-gotten moments of false pride and conceit, but as a source of secure, long-standing, broad-based satisfaction, such a species-centered and "now-centered" perspective is as futile as it is false. Arrogance and conceit are habits and qualities of character that cannot be well contained. Arrogance toward nature and toward history spills over into arrogance toward our contemporary human neighbors. Arrogance does not lend itself to prudent provision for the future or to safe and congenial communities. One must therefore wonder if this generation can at one time be exploiters and destroyers of the natural community and at the same time good neighbors in the social community; whether amoral, or even worse, immoral, policies toward nature and toward the future can securely coexist with a sound, secure and operative social morality. Callousness and solicitude are deeply incompatible moral stances, even if the callousness characterizes an attitude toward non-human nature, and the solicitude is an admired attitude toward human beings.

If my argument has been successful, then I think we have found reason to conclude, first of all, that we need nature, in fact. We need viable, independent, flourishing natural ecosystems. We need them as scientific resources, to expand our understanding of what we are biotically and what made us what we are. We need wild ecosystems as economic and technical resources, to provide rare biochemical substances for our future use. We need nature as an aesthetic resource, to enrich our sense of delight and wonder. We need natural landscapes and seascapes as psychological resources, so that we can put ourselves at ease by returning home again to the environments that made us the natural organisms that we are. And we need nature as a moral resource--as a source of wonder, amazement, admiration, humility, perspective and solicitude.

Despoiling and developing a wild coastal ecosystem diminishes the human outlook. It reduces our sense of natural "place," or perspective, of context. Lose this and we have a diminished capacity to deal with each other. Losing our sense of "self transcendence" beyond our time, place and species, we "turn in" to our species, then to our human community, then to our own generation, then to ourselves. We become narcissistic and alienated, and the advantages of the moral perspective and the moral life are lost. Our moral universe shrinks. We lose this moral vision by diminishing our capacity to see natural contexts--to see ourselves, our species and our era in what Spinoza termed "the aspect of eternity"--to see ourselves as players in a drama of infinite duration and space, and of an infinitude of roles and their inter-relationships. We forget that we are actors in a drama and participants in an adventure too complex for us ever to comprehend, and yet despite that, even because of that, of ultimate value to us.

And so, as we deplete and shrink the range of the natural estate, we lose our ability to adopt an ecological point of view as we lose contact and acquaintance with the exemplars of ecological process and structure. This has dire political consequences, for as fewer of our citizens have the capacity to assume an ecological perspective, and as ever more of our citizens become wholly domesticated and live in totally artificial environments, as fewer of our fellow citizens encounter deserts, redwood forests, sea otters, our political capacity to protect this vital remnant of wild nature is also diminished.

On the other hand, with scientific understanding, supplemented with a humane sensitivity to the value implications of our knowledge and circumstances, we encounter sea otters in their habitat, marvelously engaged in their own business and indifferent to us, and we see beyond. We love and cherish the nature that commonly made them and us. We value its integrity and gain a commitment to ensure its continuation for the enjoyment of future generations, despite the manifold artificial threats and pressures that our generation is placing upon it. We are all the more capable of containing our selfishness and arrogance and thus refraining from thoughtless assaults upon the integrity of both our natural and social communities. And with this enhanced sense of perspective and this strengthened resolution to cherish and protect the nature that we love and admire, we become at once better stewards of the sea otters and better neighbors to each other.

A world unsafe for sea otters is a world less safe for human beings and for human moral ideals.

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OTTERS, MARINE MAMMALS AND MAN: THE HUMAN DIMENSION

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INTRODUCTION

Since we have been on this earth, men have relied on animals of all kinds. We rely on them for food, for clothing, for shelter, for amusement and recreation, as aids in the education of our children, for physical power, as objects of admiration, idolatry and inspiration, for transportation, and as symbols of our personal or ancestral spirits or of physical and mental processes. These reliances, and the mutual dependencies which they tend to create, differ from place to place in human society. The nature of the relationship is defined by the society, economy and culture within which the particular men and animals find themselves. In general, no society or culture is more or less reverent or irreverent of the man-animal relationship, when viewed from their own cultural perspective.

The Neuer and Dinka in Africa revere their cattle as symbols of life, power, authority and kinship. At the same time, they make liberal uses of the milk, blood and other parts of the cattle in ways which would seem strange to most people in the United States. Inupiat Eskimos in North Alaska still engage in the hunting of bowhead whales. At the same time, the whale is the central element of much of their native religion and cosmology. The whale hunt itself structures their society and economy from political organization to the economic relationships among households. Islanders in the western Pacific look up to many birds, fishes, and other animals as totems of individuals, families or clans. These totemic animals cannot be eaten or harmed by certain individuals or groups at the risk of injury, illness or even death. In these same islands, household pets such as dogs are treated in a less than respectful manner. They are scorned as undesirable scavengers or eaten as meat supplements to the much more preferred fish and vegetable dishes. We in the United States treat certain animals such as the eagle and the whale as symbols of what we perceive to be our national character or purpose. We crowd millions of others--cows, horses, turkeys, and rabbits--into pens to be reared and then consumed by a hungry public. We place still others on warm pillows, feed them specially prepared foods, give them better medical care than literally billions of humans receive, and bury them in cemeteries with gravestones. These relationships are much more complicated than single adjectives such as "utilitarian" or "aesthetic" could describe.

What we have, then, are man-animal relationships of commerce, subsistence, symbolism, affection and companionship which differ from society to society. In the United States these relationships exist within the fabric of a complex, industrial society where different personal preferences and political forces are at odds with one another, and where the man-animal relationships are an important part of these preferences and forces. In the following pages we will explore some of these relationships, especially those centering around men and marine mammals. Our focus will be on one particular marine mammal--the sea otter--and one particular set of people--the residents of the state of California--but in exploring this relationship we will use examples of both other marine and non-marine mammals and of other people. The economic, social, political, and ethical issues involved in the man-sea otter relationship, viewed from an anthropological perspective, cannot be adequately considered without reference to this broader arena.

MAN: THE HUNTER AND THE ASCETIC

We must at the outset distinguish among legal, moral, ethical, economic, and anthropological relationships between men and animals. These relationships, of course, overlap and the factors involved are interwoven, but since the legal, moral, ethical, and economic aspects are covered separately in this volume we will concentrate on the cultural anthropological perspective: that is, what is the cultural relationship between men and animals, with culture defined as the total set of shared beliefs and behaviors which are held or exhibited by particular groups of humans about other species. In this sense we will not present a case about what ought to be or what could be, but rather what appear to us to be the existing beliefs and behaviors behind contemporary cultural patterns. Philosophers will address the normative, moral aspect; advocates and administrators will address the goals, and the partisan objectives; we will address the present, pragmatic relationships between men and other mammals.

One general point which will surface clearly from our examples is this: the fact that men hunt mammals, or that they use some measure of control over the behavior of other mammals, does not necessarily mean that they are not concerned for the health of those mammal populations, or indeed that those men do not have a deep regard for and an often complex relationship with and dependence upon those mammals. There are examples of flagrant disregard or ignorance, certainly; but there are just as many examples of close, careful, reasoned relationships between men and other mammals. Many of these latter examples involve mammals as objects of the hunt, and we should not make oversimplified judgements concerning the quality of relationships based on surface observations of instrumentality. In these relationships, men can be both hunters and ascetics.

Mammals and Marine Mammals: The Relationship to Man

Mammal members of the animal kingdom are considered to be the nearest neighbors to man. We are not concerned here with the more traditional, and perhaps misdirected, distinctions between "man" and "animal" such as those defined by the use of fire and tools, the ability to reason, and so on. We are concerned rather with the ways in which men incorporate ideas, beliefs, and behaviors towards a particular set of species--mammals, and specifically towards marine mammals--into their everyday lives and thoughts. Besides the fact that men themselves are mammals, the sharing of self-regulating body temperature, milk-producing mammae in the female of the species, and other attributes makes it more natural for us to identify with other mammals than with insects, birds, reptiles or fish. We do not, however, either in ideology or practice view all mammals in the same light.

There are many factors which we use to distinguish mammals from one another in our beliefs and behaviors. One is physiology; some mammals (such as marine mammals; and also domestic cats) have physiological characteristics closer to man's than other mammals. A second is intelligence. Again, research has shown that some marine mammal species are among the more intelligent of the mammals. A third factor is the complex of attributes which includes the "playfulness" and "altruistic tendencies" of certain mammals (see McIntyre, 1974; and Norris, 1974 for descriptions of these attributes). The young of many mammal species exhibit playful attributes, but marine mammals such as porpoise, otters and seals exhibit these characteristics prominently even as adults. A fourth factor is what we might term the Cuddly Quotient. This quality is particularly common to many small fur-bearing mammals, and especially to young seals, porpoise, and otters. It is what makes humans say "Awwwww, look at that cute little ----," and leads toy manufacturers to produce teddy bears and other stuffed animals (not, generally, in their real skin!). These factors all contribute to the quality of the man-animal relationship, and to our culturally-constituted ways of relating to and dealing with them.

In terms of our contemporary mass culture, however, there are three general categories within the mammal genre which define three general cultural relationships in the United States between man and other mammals. The first is what we call Wild Mammals. Prominent in this category are the proverbial "lions, tigers and bears" which frightened Dorothy on her way to see the Wizard of Oz, and upon which we look with awe, fright, admiration and sometimes disdain. This category also has its relatively non-threatening component, which includes deer, skunks, badgers, squirrels, and so on. We do not usually--with the exception of hunting, which we discuss below--have an instrumental or utilitarian relationship with mammals in this category. We do, however, have a long history of attempting to eradicate certain of them, such as the wolf in Alaska or the mountain lion in the "lower 48." For this category of mammal, even though we essentially view them as protected, we allow

management in the form of relocation (bears in national parks) or controlled (wolves, deer, mountain lion) and uncontrolled (squirrels, skunks) hunting. These activities are allowed because of some danger to life or property, general nuisance, subsistence or recreation challenge posed by these Wild Mammals.

The second category we will call, in a broad sense, Domestic Mammals. These are horses, cows, sheep, dogs and cats. The animals in this category have a long history of having their activities channeled by man, and more importantly, a long history of relative complacency in this relationship. Domestic Mammals are anthropomorphized--given human attributes--as nurturers (cows), sensual/sexual symbols ("stud"; man or horse), or companions (dog-as-buddy movies, "Mary Had a Little Lamb" poems). Our relationship with most mammals in this category tends to be instrumental and utilitarian.

The third category consists, quite simply, of Marine Mammals. They may, as in the case of the whale, be viewed with awe, but they are rarely seen as threatening or as legitimate subjects of a recreational hunt as with Wild Mammals. They may, as in the case of porpoises and seals, have been trained by man to perform certain routines, but are not as a class seen as Domesticated. They are a category in their own right in the cultural context of the way in which contemporary Americans view them, as is evidenced in part by the passage of the Marine Mammal Protection Act of 1972 (MMPA). Marine Mammals are often anthropomorphized as are other mammals either through myth (Jonah and the whale) and popular culture (the "Flipper" television show) or through more scientific connections (Lilly, 1967; McIntyre, 1974). Yet Marine Mammals are different from the rest. Our culture represents them as an emotive, mystical presence, in some ways aggressively demanding and in some ways helplessly groping for our sympathy, for our friendship, or for ways to make us go away and leave them alone.

These three categories are important to our discussion because they define three general cultural pathways concerning our attitudes and behaviors toward mammals. With Wild Mammals, we perceive beauty, grace, raw power, a freedom which we envy, but also awe and sometimes fear. As a category, however, one of our most significant forms of interaction with Wild Mammals is in the hunt: a good part of our culturally-defined behavior involves trapping, shooting, and otherwise stalking the mammals in this category. In the case of Domestic mammals, our cultural understandings are completely different. We would not consider hunting them, but rather allow them to be killed in a civilized manner to feed us or to serve us as companions, beasts of burden, or amusement. Somewhat apart from both of these categories, Marine Mammals inspire a mystical presence engendered partially by the power and mystery of the ocean itself, partly by their social behavior and communication patterns, and partly because when viewed beside the fish and other animals of their aquatic environment these mammals seem incredibly close to man (Kaza, 1979). We will elaborate on these relationships below.

There are at least three other dimensions to our relationship with mammals besides the Wild Mammal/Domestic Mammal/Marine Mammal dimension. The first is the spectre of annihilation. This is the dimension of the relationship reflected by our passage of the Endangered Species Act of 1973 (ESA) and measured by the presence or absence of given species on the Threatened or Endangered roles created by this Act. Contemporary United States culture does not, in general, allow man's activity to result in the elimination of animal species. The California sea otter is on the list of Threatened species, not because its numbers or range are decreasing or dangerously low as is the case with other species on this list, but largely because of the particular vulnerability of the sea otters in California to harm by oil spills and other environmental conditions (Costa, 1978). This concern may be somewhat alleviated by the recent decision by the Secretary of Interior to delete areas north of the Santa Barbara Channel from Outer Continental Shelf Lease Sale #53.¹ For our purposes here, however, we will simply note the presence of the sea otter on this list and leave the substantive question of the "endangeredness" of the otter to the natural scientists.

A second dimension, related to the first, is the question of what "rights" accrue to men and animals, or men as animals, for that matter to all living and non-living forms and substances as parts of an holistic ecosystem. These matters have been treated extensively in the literature (see Friend, 1974; Leavitt, 1978; Morris and Fox, 1978; Stone, 1974) and will be treated directly elsewhere in this volume. We will not address these "rights" issues, but will concentrate on the cultural beliefs and practices which determine how these various notions of "rights" are applied with Marine Mammals.

The third dimension, which we will consider here at length, is the place of mammals and Marine Mammals as direct or indirect objects of man's activities. Because this distinction itself and some prominent examples of mammals as direct and indirect objects are instructive for the present discussion of the sea otter case, we will spend a few moments examining some of these examples. We have selected examples which are in some respects controversial, and do not intend them as a representative sample of man-mammal relationships. In discussing these examples, we will point out some of the ways in which contemporary United States society and culture--in the form of laws, attitudes, beliefs and behaviors--deal with man-mammal relationships.

¹ Ed. note: This situation may be subject to change because of the Reagan Administration's reconsideration of those areas of Lease Sale #53 for oil and gas leasing. A review of the current status of offshore oil and gas lease sales is included in the Epilogue to this volume.

Mammals as Direct Objects

We shall briefly examine three examples of man-mammal interactions which involve mammals as direct objects. By this we mean situations where man traps, shoots, spears, captures, or otherwise intrudes upon mammals as a specific, aggressive exercise directed at the particular mammal in question. The examples we shall use are the north Alaskan Eskimo and bowhead whales in Alaska; the Pribilof Island seal hunt; and hunting of big game and small fur-bearers in the United States. Each of these cases brings to light points to consider in an anthropological perspective on the California sea otter issue.

Eskimo and Bowhead Whales. In north Alaska, approximately 3,000 people in nine separate villages have some degree of historical relationship with and dependence on the harvest of bowhead whales. Due to Yankee whaling which decimated the bowhead population around the turn of this century, the bowhead whale is on the list of Endangered Species. It is still hunted, however, by the north Alaskan Eskimos under the Native Alaskan provisions of the MMPA and ESA. These Eskimo people still use much of the same technology they were using in the early twentieth century such as sealskin umiaks (kayaks), harpoons, and darting guns to hunt the bowheads, but they have also incorporated modern technology into the hunt in the form of aluminum boats, snowmobiles, and plastic and rubber floats in the place of the traditional skin floats. Like people in many remote areas, the north Alaska Native Americans are going through a period of rapid acculturation and social and economic change. In the midst of this change, however, the whale hunt and the whale itself retain a prominent place in their society, culture, and economy as shown in Figure 1.

In recent years, there has been a sharp increase in the number of whales landed and the number struck and subsequently lost. This is due partly to the resurgence of the whale hunt as a form of cultural revitalization, with new and younger hunters less trained and experienced in the necessary skills of the hunt. Both the International Whaling Commission and the National Marine Fisheries Service's Office of Marine Mammals and Endangered Species allow the hunt to continue, at reduced levels of take, in cooperation the Alaskan Eskimo Whaling Commission.

In the bowhead case, a direct Marine Mammal take occurs by a human population which demonstrably utilizes the physical products of the whale and views it as a sacred object integral to its social and religious life. Amid complex political machinations, these factors have led to the authorized continuation of the hunt under controlled conditions.

The Pribilof Island Seal Hunt. The first thing to note about this situation is that the seal populations involved are not threatened or endangered. In fact, in the Pribilof Island case there is evidence

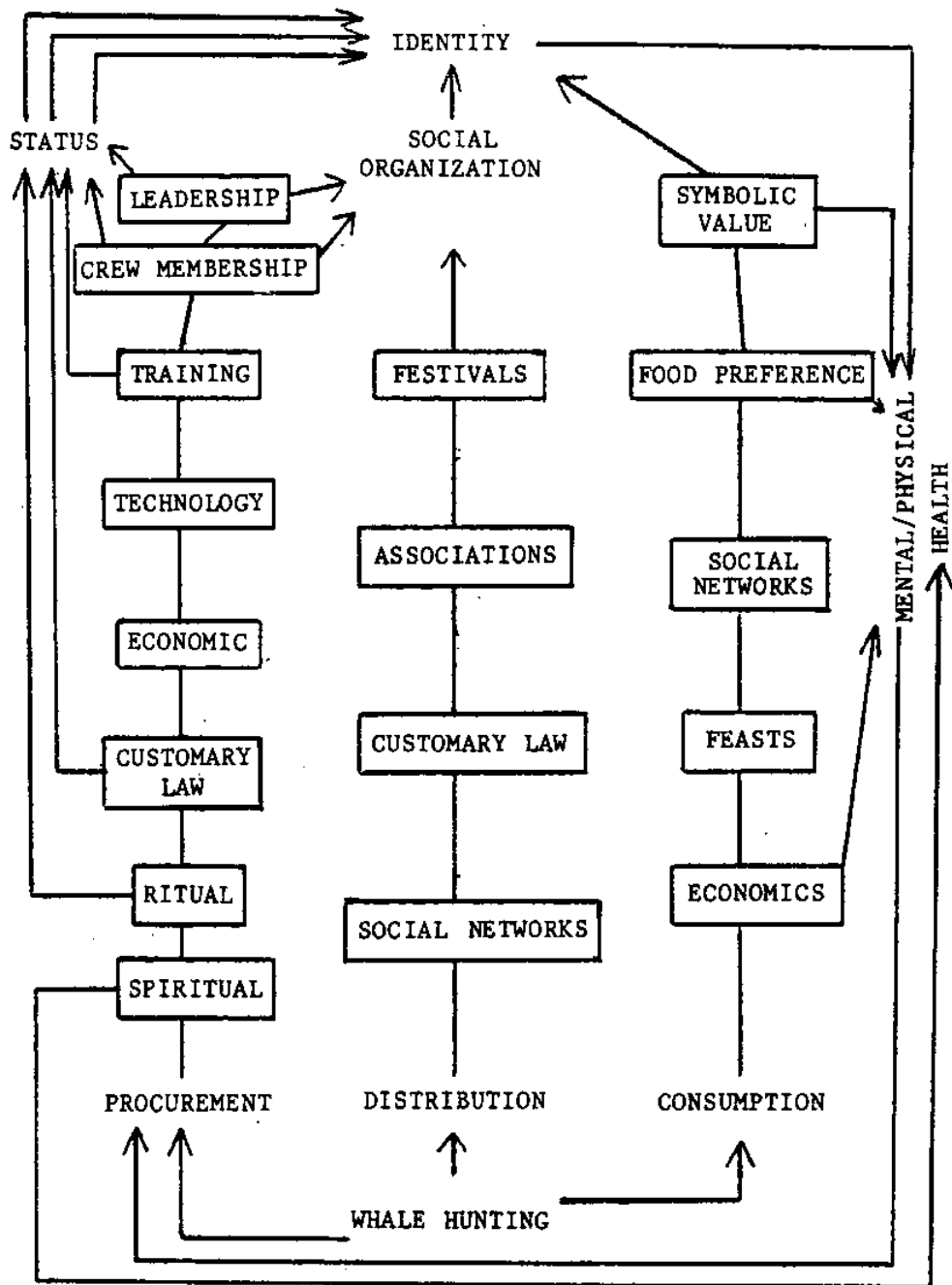


Figure 1

THE BASIC IMPORTANCE OF WHALE HUNTING IN NORTH ALASKAN SOCIETY

Source: Freeman and Orbach, 1979. (Reproduced with permission of the authors.)

to indicate that the controlled harvest may assist the population in adapting to normal environmental fluctuations.

Eskimo and Aleut populations were transported to the Pribilofs nearly 150 years ago by Russian fur traders to harvest the fur seals. After the purchase of Alaska from Russia, the hunt was continued by the people of the Pribilofs for various commercial interests and eventually, up to the present day, under the direction of the United States government. Aside from a minimal number of government jobs, the Pribilof Islanders have never known any significant indigenous employment aside from the hunt. Their yearly life cycle revolves around the hunt, even in the face of increasing in-and-out migration, education, and other acculturative patterns. The Pribilof environment is extremely isolated and harsh. Only recently has there been more than one telephone on the islands; now there are three for a population of 600. The Alaska Native Claims Settlement Act of 1971 has brought some measure of autonomy--under financial custodianship--to the Pribilofs, but the people remain uniquely settled into their century-old physical environment and social and economic lifestyle. The annual fur seal hunt is conducted under United States law (the Fur Seal Act of 1966) and international agreement (the North Pacific Fur Seal Convention). Under these laws and agreements the United States Departments of Commerce and Interior each has certain responsibilities with respect to the Pribilof Islands and their seal hunt, and the proceeds from the sale of the furs is divided among member nations of the Convention.

In the Pribilof fur seal case, a direct marine mammal take occurs by a human population which does not utilize the majority of the seal harvest directly, but rather relies on it for a social, cultural, and economic activity integral to their lives amid few alternatives. Once again, as in the bowhead case, the continuation of the strictly controlled hunt is allowed under United States law and policy.

Hunting for Big Game and Small Fur-Bearers. In 1975, 2.6 million Americans hunted, spending more than 478.6 million days in this pursuit. Thirteen million of them spent 126 million days hunting big game--deer, elk, bear, antelope, moose, and others. In addition, they spent almost 90 million days hunting rabbits and hares, almost 70 million hunting squirrels, and over 36 million days hunting woodchucks and ground squirrels. This hunting was done primarily with guns, but also with traps and bow and arrow. The modal age group of hunters was 25-34 years old. Almost 90% of all hunters also engaged in other "wildlife-related" activities such as fishing, clamming, wildlife observation, recreational shooting, archery and photography (U. S. Dept. of Interior, 1977). For all of these Americans, an aggressive relationship with mammals as a direct object was a form of recreation, partial subsistence, and challenge. There are many ways to describe the motivations and underlying benefits to be derived from hunting, but the following offers a sampler:

Now this great liberated man, the aristocrat, has always done the same things: raced horses, or competed in physical exercises, gathered at parties...and engaged in conversation. But before any of those, and consistently more important than all of them, has been...hunting. So that, if instead of speaking hypothetically we attend to the facts, we discover--whether we want to or not, with enjoyment or with anger--that the most appreciated, enjoyable occupation for the normal man has always been hunting. This is what kings and nobles have preferred to do: they have hunted. But it happens that the other social classes have wanted to do the same thing...Choose at random any period in the vast and continuous flow of history, and you will find that both men of the middle class and poor men have usually made hunting their happiest occupation.

A good hunter's way of hunting is a hard job that demands much from man: he must keep himself fit, face extreme fatigue, accept danger. It involves a complete code of ethics of the most distinguished design....

For all the grace and delight of hunting are rooted in this fact: that man, projected by his inevitable progress away from his ancestral proximity to animals, vegetables and minerals--in sum, to nature--takes pleasure in the artificial return to it, the only occupation that permits him something like a vacation from his human condition (Beatty, 1972).

The contemporary United States citizen, of course, relates to these same mammals in ways other than hunting: seeing them in zoos, over the back fence or along the road, in the wild camping or hiking, and so on. His greatest purposeful, direct contact with them, however, is in the recreational hunt. We protect them when they are endangered, and even regulate their take when economically or socially desirable to do so. We sometimes relocate them, and occasionally develop plans to reduce the numbers of certain species. With respect to the "game" mammals, large and small, United States law and policy allows a myriad of forms of interaction. United States citizens take advantage of the opportunities thus afforded in a variety of aggressive, direct, culturally-prescribed ways, the Cuddly Quotient notwithstanding.

Mammals as Indirect Objects

In man-mammal relationships which involve mammals as indirect objects, the affected mammals are not the direct object of man's activity, but are affected by man in the process of his activities towards other goals. As with mammals as direct objects, each of the following examples will shed some light on considerations relevant to the California sea otter issue.

Tuna and Porpoise. The United States high-seas tuna fleet which fishes out of San Diego, California, has for some years been embroiled in a controversy concerning the incidental killing of certain species of porpoise in their fishing operations. Because tuna follow porpoise during parts of their migratory or feeding patterns, visual sighting of porpoise is used to locate schools of tuna. As a result of problems with the purse seine methods which the tuna fishermen use and the fact that they initially surround the porpoise along with the tuna in their nets, porpoise would often become entangled in the nets and drown. The fishermen do not utilize the porpoise in any way, although porpoise are consumed as food in many parts of the world. The tunamen were aware of this problem from the early days of their adoption of the seining method, and had made several attempts in cooperation with the United States government to correct the problem through gear changes, new net retrieval procedures, special skipper's advisory committees, and other means. Many of the porpoise-saving devices such as the Medina panel--a section of very small mesh sewn into the larger net--came from the ranks of the fishermen, and they often put themselves in physically dangerous situations to help save porpoise (Orbach, 1977). Tuna fishermen have been killed and seriously injured in these activities. However, the porpoise is a mammal with which the American public has a great deal of emotional attachment.

The porpoise mortality caused by the tunamen's activity created a furor. This furor was fueled, in part, by literature put out by certain interest groups which attacked the tuna fishermen, as bad, undesirable people with dark motives and a criminal lack of concern for the environment (Becker and Sampson, 1974). The situation was compounded by the fact that the tunamen's trips last from two to three months, and the fishing is done in the Eastern Pacific far from the United States. Thus the tunamen, year after year, spend eight or nine months of the year thousands of miles out at sea, effectively isolated from the furor their industry was creating ashore and the public emotions and attitudes which lay beneath the controversy. Conversely, the public was unaware of the tunamen's constructive efforts, and an impression of the fisherman as unconcerned, ill-intentioned individuals who do not value the lives of the creatures around them was an easy impression to develop. Much of the resulting controversy would have been avoided, or minimized, and the problems attacked more efficiently if all concerned had a proper understanding of the activities, perceptions, motives, goals and constraints of others.

After political, scientific, and administrative decisions which have gone back and forth concerning the way the incidental porpoise "take" would be handled, the take of porpoise incidental to purse-seining operations is presently allowed under United States law and policy under specified conditions which are mandated to reduce the porpoise kill to "a level approaching zero."

Seals and California Coastal Fisheries. Various pinnipeds along the California coast have been a traditional nemesis of fishermen. They pick fish out of fishermen's nets, off of salmon troll gear, and in some cases out of traps. Fishermen have long claimed that this "harassment" by Marine Mammals constitutes a serious economic threat to their activity. Under section 103(b) of the MMPA, and pursuant to the same 1977 regulations (50 CFR Part 216.24) which apply to the tuna-porpoise situation, California coastal fishermen are allowed to apply for permits to take marine mammals incidentally in their fishing operations. After they have taken all other measures to avoid direct interaction with Marine Mammals, "Operators may take such steps as are necessary to protect their catch, gear, or person from depredation, damage, or threat of personal injury" (50 CFR 216.24). Less than 100 such permits are usually issued each year, although the reluctance of fishermen to call attention to their problems with Marine Mammals may render the number of permits a less than accurate picture of the extent of the interaction.

In this case, as in the tuna-porpoise, some taking is allowed incidental to commercial fishing operations and is essentially a tradeoff between impact on Marine Mammals and social and economic impact on humans. Such permits are, however, not allowed for species protected under the ESA such as the sea otter.

Dimensions of the Man-Mammal Relationship

There are several points to be derived from these examples. The first is that even though Marine Mammals are singled out as a group of species in special legislation, and have a special cultural relationship to contemporary United States citizens, hunting of them as both direct and indirect objects is allowed under current law and policy. The second is that some of these "exemptions" are for primarily economic reasons, as in the case of the pinniped situation in California, and others are for socioeconomic and cultural reasons, such as the special provisions for Native Alaskans in the ESA and MMPA. Both kinds of exemptions are embodied in enabling legislation and in regulations. The third point is that, as in the case of "game" mammals, the direct hunting of mammals is for millions a culturally-constituted part of American life. It is certainly not shared as an aspect of culture by all Americans, but hunting is a significant aspect of contemporary United States society and economy. The last point is that, as in the case of the tuna fleet, advocacy positions and emotional and ad hominem arguments are regular features of many man-Marine Mammal controversies, features which as often delay as expedite resolution of the issues involved.

Each of the cases we have presented exemplifies a different kind of culturally-constituted, direct relationship between men and mammals. These relationships, and the beliefs and attitudes upon which they are based, are constantly changing. There is evidence to indicate that the

rate of hunting participation is down (Scheffer, 1980), that anti-hunting attitudes are becoming stronger (Rohlfing, 1978), and that larger societal shifts such as movement to urban environments is decreasing the propensity of the United States public to hunt (Hendee, 1969; Kellert, 1978). The picture of the preferences and beliefs of United States citizens, however, is far from consistent. In a recent nationwide personal interview survey of 3,000 (Kellert, 1979), a majority of those interviewed disapproved of trophy and sport hunting, but approved of traditional (Native American) and subsistence hunting. In the same survey 43% were familiar with "killing baby seals for their fur" as an issue, and 57% disapproved of killing mammals for fur coats, but 55% had no awareness at all of the tuna-porpoise issue we described above. Eighty-two per cent approved of traditional Native American subsistence hunting, and a surprising 77% approved of the killing of whales if a useful product were obtained and if extinction of the species were not an issue (Geiger, 1980). What we have here termed the "culturally-constituted" relationship between man and other mammals must be viewed on a case-by-case basis.

Sea Otters and the Human Community

How do these comments pertain to the present California sea otter situation? To answer this, we must first describe the relationship between sea otters and humans, and explore the nature of the human groups involved.

Any system, including an ecosystem, is a set of interrelated components. In an holistic sense, one of the primary, most dynamic components of an ecosystem is people and their behaviors. The physical and biological, as opposed to the human, components of the ecosystem are affected by and affect individuals and groups of people who may interact closely, perform observable behaviors, and share describable characteristics. The behavior of these people comprises a set of processes which contribute to the use of fisheries and other parts of the ecosystem. These behavioral processes form the human component of the ecosystem (Orbach, 1980).

The human component of the ecosystem, or ecosystems, in which sea otters are also involved in California is composed of more than commercial and recreational harvesters of such elements in the ecosystem as clams and abalone, with whom the others compete for these resources. For every commercial fisherman, for example, there are three sets of people who are equally part of the human dimension of his or her activity: his family and "community" in the social or political sense; the people in the boatyards, supply stores, and service facilities who are integral to and dependent upon the harvesting activity; and the distributors, marketers, and consumers who create the demand for his product. These chains of involved individuals may extend thousands of miles across local, state and national boundaries. The chains of other user groups such as wildlife observers and recreational hunters and gatherers may be just as long.

It is not our purpose here to estimate the relative length or weight of these chains. Instead, we will investigate some of the characteristics of the human communities which are involved in the same ecosystems with sea otters, with attention to the cultural continuities and disjunctures of these groups in comparison with the man-mammal situations we described earlier.

There are general relationships within these ecosystems which are, or appear to be, obvious: sea otters eat clams, crabs, sea urchins and abalone--therefore, more sea otters, less clams, crab, sea urchins and abalone; urchins eat kelp--therefore, more otters, less urchins, more kelp, more finfish; and so on. The exact nature and magnitude of these relationships are themselves open to question, and are treated elsewhere in this volume.

Human groups within this ecosystem fall generally into two groups, consumptive and non-consumptive users of marine resources. Under consumptive users come commercial and recreational fishermen and infrastructural elements, such as buyers, support industries, and so on. Under non-consumptive users come certain divers, beach-goers, wildlife observers and others who obtain benefit from the ecosystem without consuming part of it although they may, by virtue of their presence and actions, alter the physical and biological portions of the ecosystem considerably while at the same time generating a great deal of economic activity.

The numbers of people in these various categories can be enormous, but are very difficult to isolate and define. While one can count the number of commercial abalone licenses, one does not know how many of the beachgoers go for particular purposes, or how to measure the relative benefits derived from given aspects of their experience. There has been work done in resource economics and other areas on these subjects, but not on all of the participants and environments involved in the sea otter case. Though we do not have data to measure the relative magnitudes, the general organization of the human component of the issue is shown in Figure 2.

Because the relative numbers and benefits derived are not known, we will concentrate here on a discussion of the characteristics of one particular user group--the commercial abalone fishermen--to demonstrate one of the ways in which it is possible to profile portions of the human component of the ecosystem if the data are available. We will not explicate the reasons behind events in that fishery, but will attempt to profile the industry participants for a period for which data are available.

The number of vessels, permit holders, pounds landed per vessel and per permit holder for the California commercial abalone fishery from 1955 to 1974 are shown in Table 1. While the number of vessels climbed

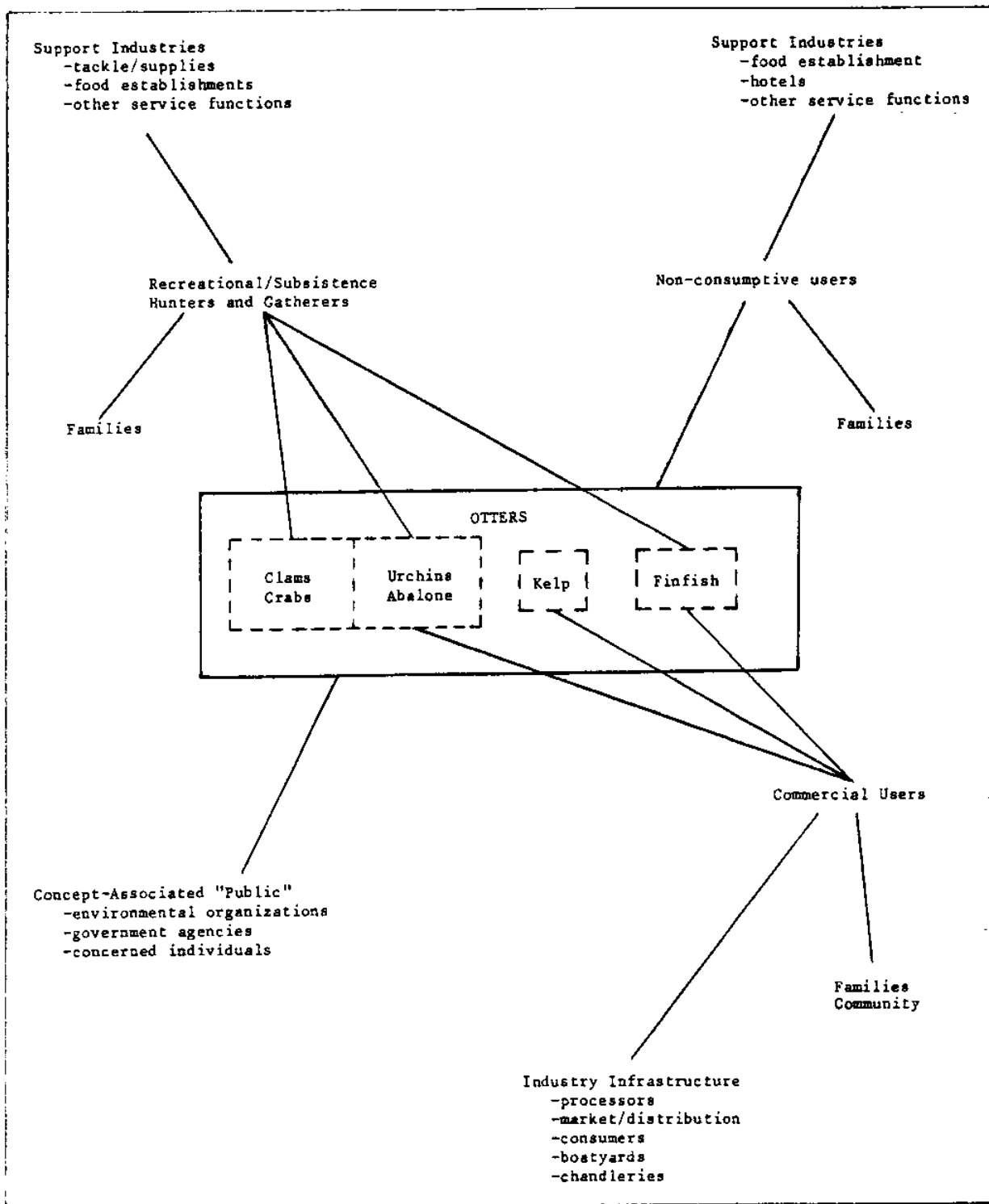


Figure 2

HUMAN COMPONENTS OF THE OTTER-RELATED ECOSYSTEMS

consistently and remained relatively constant after 1968, the number of license holders peaked in 1966 and then declined markedly. In 1975, the harvesting sector of the abalone industry consisted of 383 divers and 123 crew members who lived and worked in the area from San Francisco to San Diego (Table 2). Their abalone went through ten active processors located in Half Moon Bay, Morro Bay, Santa Barbara, and San Diego. The industry may be somewhat more concentrated than these figures indicate. A 1971 statement by the California Abalone Association estimated that 47 divers and four processors accounted for 70% of the total abalone landings in that year. In 1975, six of the ten processors accounted for 90% of the abalone processed. The three processors in Santa Barbara processed over two-thirds of the catch, and one alone processed over one-half of the total amount processed in California (Cicin-Sain, et al., 1977).

The harvesting sector of the industry consists of a stable core supplemented by a segment which exhibits fairly high turnover. Although 50% of the divers were introduced to the industry by family or friends--a possible indicator of social structure and community--between 1973 and 1975 over 30% of the licensed divers were new to the fishery, and almost 50% had less than two years experience. Of the 383 divers in 1975, 106 held permits for over six years, and another 102 from three to five years (Table 3). Income from the fishery is generally not high, and 63% of the divers supplement their income from sources other than abalone diving. Of these, 32% supplement their income with other fishery-related jobs (Table 4), a possible indicator of occupational commitment. The divers tend to be young (over 57% between 25 and 34), married (50%, 32% of those having children) and relatively well-educated (36% having attended college) (Table 5).

These data are important, because they contribute to our picture of one of the human components of the ecosystem, and of the structure of the occupations and communities to which individuals and their families are committed (Ligouri, 1977). Unfortunately, such completed data do not exist on the other human components of the otter-related ecosystems. Those data which do exist are summarized elsewhere in this volume.

The conclusions which we draw from this data with respect to human dependence on the ecosystem, however, are mixed. The social structure of the abalone industry is clearly not as tied to the environment and its resources as that of the north Alaskan Eskimos, or the Pribilof Islanders. The participants are, however, much more dependent on these relationships than most game hunters. Abalone divers exist in locales and economies which offer a significant number of alternatives. But the occupation which they have chosen from among these alternatives involves individual commitment and a unique lifestyle not generally found in other occupations. As we pointed out earlier, commercial fishermen, aside from their income, derive many of the same aesthetic and other non-remunerative benefits from their interaction with the marine environment as do recreational divers and wildlife observers. The

Table 1

RELATIONSHIP BETWEEN LANDINGS OF ABALONE AND
THE NUMBER OF VESSELS AND THE NUMBER OF PERMIT HOLDERS

	Total Landings (pounds)	Number of Vessels	Number of Permit Holders	Pounds Per Vessel	Pounds Per Permit Holder
1955	4,185,785	74	--	56,566	--
1956	4,284,063	86	--	49,815	--
1957	5,421,914	94	--	57,680	--
1958	4,224,018	109	--	38,752	--
1959	4,561,827	98	352	46,549	12,960
1960	4,206,408	106	418	39,683	10,063
1961	4,553,766	124	505	36,724	9,017
1962	4,183,181	150	582	27,888	7,188
1963	4,343,879	128	532	33,936	8,165
1964	4,079,223	145	574	28,132	7,107
1965	4,576,084	164	686	27,903	6,671
1966	4,963,556	213	880	23,303	5,640
1967	4,421,581	206	853	21,464	5,184
1968	4,474,842	223	839	20,066	5,334
1969	3,658,078	213	840	17,127	4,355
1970	2,900,813	195	530	14,876	5,473
1971	2,945,318	191	486	15,420	6,060
1972	3,091,182	207	448	14,933	6,900
1973	3,193,160	212	487	15,062	6,557
1974	2,586,571	212	554	11,531	4,669

Source: Cicin-Sain, et al., 1977, p. 12. (Reproduced with permission of the authors.)

Table 2

RESIDENCE OF ALL CALIFORNIA ABALONE LICENSE HOLDERS, 1975
(in percentages)

San Diego	Los Angeles	Santa Barbara Area ^a	Central Coast ^b	North Central Coast ^c
14.4	19.7	48.4	8.6	8.4
(N=506)				

^aIncludes Ventura, Oxnard, and Simi.

^bIncludes Arroyo Grande, Morro Bay, San Luis Obispo, Cayucos.

^cIncludes Santa Cruz to San Jose to San Francisco.

Source: Cicin-Sain, et al., 1977, p. 46. (Reproduced with permission of the authors.)

Table 3

LENGTH OF TIME SPENT WORKING THE FISHERY FOR ABALONE
"DIVERS" AND DROP-OUTS"
(in percentages)

	Under 2 Years	2-4 Years	4-6 Years	6-8 Years	Over 8 Years
Drivers (N=44)	27.3	20.4	15.9	4.6	31.8
Drop-outs (N=45)	26.7	37.8	8.8	4.4	22.1

ANNUAL ATTRITION RATES FOR ABALONE PERMIT HOLDERS, 1972-1975

	Composite Attrition Rate	Crew ^a Members Only	Divers Only
1972 - 1973	41%	83%	26%
1973 - 1974	41%	76%	27%
1974 - 1975	50%	88%	34%

^aThe computation for crew members does not take account of six divers in 1972 and five in 1973 who renewed their permits after a one-year interval.

Source: Cicin-Sain, et al., 1977, pp. 14, 50. (Reproduced with permission of the authors.)

Table 4

GROSS ANNUAL INCOME DERIVED FROM ABALONE TAKING FOR "DIVERS"

Income	%
Under \$1,500	22.7
\$15,000-2,999	11.3
\$3,000-5,999	11.3
\$6,000-7,999	13.6
\$8,000-9,999	9.0
\$10,000-13,999	11.3
Over \$14,000	20.4

Median Gross Income: \$6,750 (N=44)

PER CENT OF TOTAL NET INCOME DERIVED FROM ABALONE TAKING FOR "DIVERS"

76 to 100%	48.8	
50 to 75%	17.0	
Less than 50% annual net income	34.0	(N=41)

Source: Cicin-Sain, et al., 1977, pp. 51-52. (Reproduced with permission of the authors.)

Table 5

DEMOGRAPHIC CHARACTERISTICS OF ABALONE DIVERS AND OF DROP-OUTS
(in percentages)

	<u>Divers</u>	<u>Drop-Outs</u>		
<u>RESIDENCE</u>				
San Diego	16.3	4.5		
Los Angeles	18.6	31.8		
Santa Barbara Area ^a	46.5	31.8		
Central Coast ^b	9.3	9.1		
North Central Coast ^c	9.3	15.9		
Other	0	6.8		
			Divers	(N=43)
			Drop-outs	(N=44)
<u>AGE</u>				
Under 25	18.1	15.2		
25 to 29	22.7	37.0		
30 to 34	25.0	19.6		
35 to 39	9.0	8.7		
40 to 44	11.3	8.7		
Over 44	13.6	10.8		
			Divers	(N=44)
Median Age	32	29	Drop-outs	(N=46)
<u>MARTIAL STATUS</u>				
Single	36.4	26.7		
Married	50.0*	66.7**		
Other	13.6	6.7		
			Divers	(N=44)
			Drop-outs	(N=45)
*32% have children				
**80% have children				
<u>EDUCATION</u>				
Completed 8th Grade	2.3	0		
Some High School	4.5	4.4		
Completed High School	34.1	17.8		
Some College	36.4	55.6		
College Graduate	15.9	13.3		
Post Graduate	6.8	8.9		
			Divers	(N=44)
			Drop-outs	(N=45)

^aIncludes Ventura, Oxnard, and Simi.

^bIncludes Arroyo Grande, Morro Bay, San Luis Obispo and Cayucos.

^cIncludes Santa Cruz to San Jose to San Francisco.

Source: Cicin-Sain, et al., 1977, p. 49. (Reproduced with permission of the authors.)

stable core of divers is also concerned with preserving their economy and lifestyle in a compatible relationship with the marine environment, and with not destroying parts of it, otters included.

If such analyses were done with all of the commercial segments in Figure 2, and related analyses done with other consumptive groups and non-consumptive groups, we would have a picture of the human component of the otter-related ecosystem to match our information on the physical and biological portions. This would yield us, from an anthropological perspective, impressions of the cultural constitution of the ecosystem and the complete set of motives and goals of those who operate within it, which we could place alongside the economic structure and the physical and biological systems to obtain an holistic framework within which to consider our alternatives.

CONCLUSION

What this information would not yield us, however, is an answer or solution to the current sea otter controversy. Given adequate data and information, answers and solutions can only be rationally approached where there are clear goals and objectives, and guidelines for the ways in which the data and information are to be considered. As we saw in the examples of mammals' direct and indirect relationships with humans discussed above, United States law and policy allow us to deal in a variety of ways with Marine Mammals, even in cases where the particular mammal is endangered. To justify this action, however, some clear evidence must be shown for the social, cultural, and economic dependence of specific human populations on the mammal-related ecosystems.

These United States laws and policies generally reflect what we have called the cultural relationship between man and other mammals. Hunting and other wildlife-related laws and policies reflect the cultural importance of hunting to American society, while at the same time attempting to foster rational conservation and management of Wild Mammals. Domestic Mammals are the least protected by law and policy, but their numbers are generally great enough and the cultural relationship utilitarian enough for the Domestic Mammal-man relationship--with some help from humane animal legislation and practice--to be essentially self-regulating. These laws and policies--specifically the MMPA and the system of federal wildlife regulations (50 CFR 216)--governing Marine Mammals also reflect our cultural preference concerning Marine Mammals. The relationship is clearly special among all of those between man and other mammals. But these laws and policies also reflect our cultural bias as hunters, gatherers, and economic beings as well as conservation and preservationists.

These cultural biases, however, are not the basic polarizing agent in controversies such as the California sea otter. It is the lack of

understanding of motives and goals of others, in addition to ad hominem arguments such as occurred in the tuna-porpoise case, that lead to unproductive attempts at resolution of such controversies. These laws, as reflections of our underlying cultural patterns, demand that we consider our relationship with these Marine Mammals with due regard for the perpetuation of their numbers and for the sanctity of their species, but also that we adjust our relationship in appropriate fashion in demonstrated cases of social, cultural, and economic dependence.

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2. PHILOSOPHICAL AND SOCIAL ISSUES

DISCUSSION

DAN BOTKIN, CHAIRPERSON, ENVIRONMENTAL STUDIES PROGRAM, UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

We're now moving on to questions such as, what good are sea otters? How can we describe their values? How can we rank the different values we attach to them? This is clearly a difficult and contentious discussion and at least I think I can claim some neutrality, since I don't do any field research on marine mammals at all. My own work has to do with trees, moose and elephants. Philosophers have told us for a long time that you can't go from "is to ought," but the question today is whether we can go from "is to otter."

In a more serious vein, I think it's very clear that in 1981, we're in a major transition in the way we look at, use and value the environment, and the sea otter is an excellent example of a major problem. In my mind, the 1970s was a decade of rhetoric, and the 1980s are going to be a decade of "how to." We have to find out how to manage the resources that we decided we all respected and liked in the 1970s. I think the 1970s tended to be a decade of polarization as well, with the environmentalists setting forth their positions and their values, and the 1980s has to be a decade of communication. In the 1970s, scientists were asked to make a lot of value judgements--they were asked what were the values of animals like the sea otter, and they did their best. They tried to give answers, they did a little bit of cost effectiveness. They tried to find out whether there were unique, important, necessary roles in ecosystems for marine mammals; that is, whether marine mammals were necessary for health and stability. But it really wasn't appropriate to ask scientists to seek values and the scientists need a lot of help. So it's very appropriate today that we are turning to philosophers and to social scientists.

Philosophers can help us in two ways: First, in developing a methodology to structure how we think about deciding what a sea otter is worth, and second, in terms of ideas: What kind of values can we attach to sea otters? Social scientists can help us understand what role animals like sea otters have played in societies before. So I think this can be a very valuable discussion.

NICOLE DUPLAIX, CHAIRPERSON, OTTER SPECIALIST GROUP, SURVIVAL SERVICE
COMMITTEE, INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE
AND NATURAL RESOURCES

My role here today is to talk about extinction. I'm not here as a prophet of doom, but I'm talking about a real possibility and why it can and should be prevented. I represent the International Union for the Conservation of Nature and Natural Resources (IUCN), an international scientific organization which has over 60 member countries and countless government agencies and non-governmental organizations as members. What does it do and why is it pertinent to sea otters? IUCN advises governments and individuals on environmental matters. In order to do that effectively it relies on five commissions--legal, ecology, education, national parks and protected areas, and Species Survival Commission. I'm a member of the last one, to which I belong as Chairman of Otter Specialist Group. There are nine members of this otter specialist group in the audience who, among them, bring together 87 years of study on river and sea otters. But the Survival Service Commission has a large number of groups dealing with everything from mammals to birds, to mollusks, yes, and even to butterflies. Sometimes, as a matter of fact, one group chairman will take the other to task and say, "Hey, wait a minute, your rare otter is eating my rare crayfish!" The reason we do this, is that we know the Survival Service Commission, now called the Species Survival Commission (SSC), is responsible for declaring what species are endangered and advising the IUCN on what needs to be done to rectify the situation. The SSC for instance, compiles the red data books which are the cornerstones of data on each species of plant or animal which is considered in danger or vulnerable and people will rely on these books in their efforts to save species. The IUCN has had a great role in conservation world-wide; for instance, it was responsible for drafting the Convention on International Trade in Endangered Species, which has now been ratified by 64 countries.

Our position on the California sea otter, which will be distributed tomorrow, reflects our great concern for the future of the species. The sea otter's position is precarious and it's not just because of the human conflicts which we're here to discuss, but because of its own built-in fragility. It has an unfortunate inability to withstand any form of stress for a long time. It can be something such as a severe winter storm, depleted food resources, rough capture and handling. The sea otter is a fragile animal which has the most beautiful pelt in the world and the most fragile pelt in the world. We want to insure that everything is done by international, national, and state agencies to protect the sea otter's interests and its future, including safe capture and transport to, hopefully, oil-free areas, reduction of shellfish--or should I say "selfish"--conflicts, putting everything on the side of the sea otter to insure its continued growth, safety and well-being. Our concern overrides the growing problems of confrontation between shellfish

fisheries and other interest groups: Here we have a species which has already faced extinction because of another economic interest--the pelt industry--and, due to luck rather than management, made its comeback to ten per cent of its original numbers and ten per cent of its original range.

The otter is now showing an alarming and yet unexplained reduction in its population growth, but not expansion over its range. It's also facing a potentially more dangerous foe--and that is oil, a very indiscriminating adversary--a foe, which can and will bring together both factions that are here today, shellfisheries and conservationists, when our breathtaking coast reeks of oil and death. We also face the problem of the interests of a small, luxury gourmet market where a dozen red abalones can fetch as much as \$100.00; and an attitude that an abalone taken by a sea otter is an abalone lost to me, is an attitude which borders on extinction like other attitudes of selfish interest. Man, who has been described as the most recent marine mammal today, is competing side by side for a resource utilized by sea otters for two million years. Something that bothers me is that many years ago when there were just Indians and many, many more sea otters, there was a shellfish industry, and up to 20,000 sea otters were exploiting that shellfish resource, yet there was, after the demise of the sea otters, still quite a lot of shellfish for us to exploit. Now we are dealing with only 2,000 otters, so how long would it take the California sea otter to join the extinct California grizzly on the state flag, and who will step forward at that time to take the ultimate responsibility for the second extinction of the southern sea otter?

LUCY SLOAN, EXECUTIVE DIRECTOR, NATIONAL FEDERATION OF FISHERMEN

The National Federation of Fishermen is the only national organization of commercial fishermen. We represent a majority of the organized commercial fishermen in the United States, and our members fish from Maine to Alaska. We have several members in California and we represent all but the tuna clippers here in California.

The fourth point that Mike Orbach made is the one that is perhaps of greatest concern to us. He says, "Much of the resultant controversy would have been avoided or minimized and the problems attacked more effectively, if all concerned had a proper understanding of the activities, perceptions (and I would underline that) motives, goals and constraints of others." I think that's vitally important and that leads me to probably the most important point--the reason I'm here. I would urge those of you who are concerned about the conflict, in this case, between the sea otter and the shellfish, but for us generally, as fishermen, concerned about marine mammal/fish conflicts, to use data from fishermen, talk to fishermen; they are experts. If a man's been in the business for 20 years, he probably knows something

about it, because he has to know where they are to harvest them! And he has to know what kind of abundances there are. And I would urge you bear that in mind. Listen to what fishermen have to say on the docks when they make public presentations, but it is vital that you understand that they are not all clothed in Darth Vader costumes. Because they're not! They're men and women who are involved in an industry which is important to them, and important to the communities in which they work. In addition to asking you to talk, for instance, to Lad Handleman, who's on this panel, and to Rudy Mangué, who represents the abalone fishermen, I would also offer to any of you who are interested, anything which I, or any of the more than 30 organizations NFF represents, might be able to do to help you gather information. Bruce Mate has recently come out with a report of a meeting that was held in December of 1977, on marine mammal/fish interaction problems, and there is a section in there on the problems with data gathering. I urge you to get a copy of that report. I have the information here if any of you are interested. It speaks about some of the problems we went over in several hours of discussion about data gathering.

I think that it is also very important to emphasize that we're not part of the rape, ruin and run crowd. Fishermen, on a continuum between the perception of environmentally and ecologically pure, moral, upright individuals and the rape, ruin and run crowd, are somewhere in the middle, because we're businessmen whose business depends on a healthy environment. I think that's got to be something that people should understand. We understand it. It's an increasing factor in men and women going into the fishery and it has always been a part of the awareness of the people who have fished.

I think probably that a good bit of the discussion in Dr. Partridge's paper was essentially that man cannot live by bread alone, but it's awfully unhandy trying to live without it! And one of the things that I would also suggest you bear in mind is that in an effort to protect one isolated element of the ecosystem, you throw out of balance another part, and that includes man as a part of that system. You're looking at what we've seen on the East coast in the Canadian maritimes, a problem where the government had two choices, it could either work with the fishermen or put everybody in the community on welfare. Although there are some who say, "well, abalone divers or other fishermen who face marine mammal/fish conflicts could go to other professions," that's not necessarily so and it certainly isn't necessarily so in some of the smaller communities. It means completely uprooting the community and if you talk about the moral impact and the rights of otters, I would urge you to consider the moral imperatives and rights of other human beings. I think that is something that sometimes does get overlooked in these conflicts. I think, too, that it would be wise to bear in mind the potential and actual conflicts between the Marine Mammal Protection Act (MMPA) and the Magnuson Fishery Conservation and Management Act (MFCMA): the MMPA is up for authorization this year and I suspect that that's going to

mean quite a bit of discussion on some of the difficulties we've had in interpretations. So I would like to close by emphasizing that we want to work with all of you on this problem, but you are going to have to accept the fact that we are part and parcel of the concern that others are showing, and we will do what we can to help.

DR. BRUCE MATE, ASSISTANT PROFESSOR, MARINE SCIENCE CENTER, OREGON
STATE UNIVERSITY

By necessity, our science and philosophy these days must merge in order to make decisions that we can live with, both as people and as an environment that depend on one another in the future. My practice of science is continually influencing my philosophy, and I am not ashamed to say vice-versa. The biological fact is all animals must eat to survive, including man, and in our culture, we've grown away from the food gathering process to the extent that death is a repulsive element in our society. We've created specialists that do this for us, and we've become so isolated from it that we find it repulsive at a gut level. But we need these people, we depend on them constantly. After all, the lack of hunting experience in southern California that Mike Orbach spoke of isn't surprising, when you consider the concentration of people in a desert environment, basically displacing animal life that is there. The Los Angeles desert is a hell of a place for that many people and we're going to see a lot of problems on the land, with water, refuse disposal, pollution, and the like. The basic point is that man is the thing that's out of balance, to a very large extent.

Man is a trophic competitor with sea otters; man's harvest of prey species can theoretically be regulated to arrive at sustained yields while sea otters, although perhaps having some prey preferences, are basically opportunistic, which leads them to exploit their environment until they reach a self-regulating carrying capacity. Now, at that point, there is no harvestable surplus for a new competitor, without influencing that carrying capacity--that is, reducing it. Harvesting by man will no doubt reduce the carrying capacity for sea otters where sea otters have come into a steady state with their environment. If we regulate sea otters to lower numbers to provide a portion of those prey species for harvest by man, scientific questions may be raised as to whether we're going to reach some critically low, critical masses or thresholds, beyond which sea otters cannot survive through periods of unusual, potentially new, threatening environmental situations.

It's my feeling that man has an ability to create and to appreciate art, music, literature, and aesthetics only during affluent times. These are times when people are not devoting all of their time and energy to foraging, competing for food and other limiting resources. It's quite obvious to anyone, I think, that people are the principal problem in all world issues: We're out of balance with our

previous role in all ecosystems--man finds himself in some ecosystems in which he had never participated, such as the Antarctic. Obviously, if we were to dilute our standard of living here in the U.S., for instance, to a world-wide level, we would all now be sitting on a dirt floor, eating rice and discussing where our next meal would come from. The principal moral question, I think, regarding otters, oil development, or fishery harvests, is one of our own population self-regulation, and this is something which is absolutely necessary not only for our good as humans but for the ecosystems of which we are an integral part and depend upon exclusively for our future existence. We can't tolerate reducing the future options which are in our evolutionary bank account any more than we can afford to let inflation go unchecked. We must strive to balance the ledger through tough, prudent and informed managerial decisions, and I think it's a conference like this that's going to start dialogue not only between biologists and socioeconomic experts but among the public at large. And it's going to take effort on all of our parts because a public appreciation of these decisions is just as important as the sound, scientific decision in each of our own disciplines.

VICTOR SCHEFFER, FORMER CHAIRPERSON, MARINE MAMMAL COMMISSION;
WILDLIFE BIOLOGIST (RETIRED) U.S. FISH AND WILDLIFE SERVICE

I'm going to comment on Dr. Orbach's paper first, trying to focus upon what I consider to be highlights. He points out that we are legally able, in the United States, to manipulate the populations of any wild animal species. The blend of economics and sentiment in our approach to any species changes from year to year. He mentioned that sport hunting is on the increase; actually, per capita hunting is slightly decreasing. He points out that we do not view all animals in the same light, and I'm reminded of the sentence from T.S. Elliott, "the human kind cannot bear very much reality."

I found Dr. Partridge's paper quite impressive because it emphasized biological points of view and, after all, I am a career zoologist. His main thesis is that humans need to care for things beyond themselves--things beyond their immediate concerns, neighborhoods and lifetimes. He argues persuasively that we have a genetic need for natural environments, stating, "may we not say that the best environment is one in which the human animal can have maximum contact with the type of natural environment in which it evolved and for which it is genetically programmed?" I believe this to be true although it can't be proved. I believe also that the roots of our arts are imbedded in our genes, in some primitive man's or sub-man's awareness of his total environment, which in those days meant the difference between life and death. Dr. Partridge says that when we imperil the sea otter by restricting it's range and threaten its habitat with development and marine pollution, we diminish the possibility of

experiencing feelings of harmony with nature. He accepts the scientific thesis that diversity increases stability. I believe that theoretical ecologists are disputing this point, but intuitively I do feel that an ecosystem which is managed even "intelligently," for what must be short term objectives, is always in some danger of becoming unstuck! To the question "what good are sea otters?" he answers that they are valuable precisely to the degree that we value and admire them for themselves, for what they are. This requires a certain capacity that many of us in our brief lifetimes have been unable to develop and I think his conclusion is still echoing: A world unsafe for sea otters is a world less safe for human beings and for human moral ideals. Let me add that I think that this sea otter/shellfish industry controversy is indeed a moral issue because morals involve a sense of right and wrong. We have as much technological and biological information at the moment as we need to make a good start on management of sea otters, but what we don't quite know is what is right and wrong and what are right and wrong objectives. I assure you, the question calls for some sort of widespread Californian input, either through special inquiries such as the Australian inquiry on whales and whaling of a couple years ago; or less probably, polling or a referendum or some other legal device.

I would like to conclude with a statement by philosopher E.B. White: "I would feel more optimistic for a bright future for man if he spent more time tasting nature's sweetness and respecting her seniority and less time in trying to outwit her."

LAD HANDELMAN, FOUNDER AND CHAIRPERSON, SAVE OUR SHELLFISH

Following Dr. Scheffer, I must say that he expressed several things that I think are well worth saying, as have all the other perspectives that have been presented both in the papers and by the panelists. I'm not a philosopher, not a poet, not a politician, but I do think I can say that over the years and 10,000 hours of having worked under water, I've grown to appreciate as much about nature as any conservationist, as any environmentalist, as anyone who is concerned about the things in the world he should be concerned about.

My problem with all this is that I hear all this talk, I hear all the wrongs of the past, I hear how the sea otters were killed, and I despise that as much as anyone would. I know that the fisheries, recreational and commercial, have been destroyed in areas where the otters have had free run. I despise that, as I guess anyone would. It doesn't mean that you're against the otter, just to be for the fisheries, or for people's rights to have fisheries. I hear of the wrongs that were done in historical times and I think it's important that we consider history. I hear the discussion in this panel having to do with philosophy and social implications. It's my hope that when this meeting ends we'll have gotten beyond those issues and begin to

address what to do about this problem. I think we all ought to be ashamed of ourselves because we've been involved with this situation for so long and have done so little.

I'd like to point out a few things that I hope will tend to influence or color the choices that we'll be making here, and I hope we'll be making choices. That's an interesting point in itself. I think it should be stressed very strongly that sea otters were not found to be an endangered species. Were they an endangered species, I think that I and most of the people sitting here would be all for doing anything that could be done to protect them and get them out of danger. In fact, it was found they were not endangered, but merely threatened, and even then, found to be threatened only if a massive oil spill were to wipe out the entire population. Fair enough. That may be enough to consider them threatened, but they certainly aren't under any immediate or extreme pressure. So we do have choices. What are we going to do about this? Our choices are to treat the otter as a sacred cow, to allow it free run, to continue doing the damage it has done for the benefit of a few. Those few, I submit, have good intentions, always have had good intentions, but just went a little too far. I think our responsibility is not to continue to ignore the fact that we have conscious decisions to make. We need to look at what I would call our most important determining factor and how we look at all the decisions. I term that our social responsibility. I've heard talk about aesthetics, talk about all sorts of things that I appreciate, and I know it's nice to know certain things are there, but I wonder if we've discussed what I consider to be the essential issue: our social responsibility to other men, the total ecosystem and to future generations. We have the choice of having it all--we don't have to have only sea otters or only shellfisheries--we can have them both! Why don't we have them? Who can intelligently sit here and say they wouldn't like to see the sea otter managed if management didn't hurt the sea otter, and made it possible to continue to have our resources?

There are issues that have already been addressed today, but I'd like to reinforce them. They had to do with the abalone industry--that it's going to be doomed anyway. I can tell you from first-hand experience that it can be a renewable resource with good management. Sure, we'll have cycles, but it's very, very renewable; it will be here for the next 100 years, if it's allowed to be here. I consider that the abalone fisherman of today is a very responsible person. The abalone industry has established a variety of management measures, such as limited entry, hatcheries, a reseedling program, even posting a \$1000 reward for information leading to the arrest and conviction of any commercial divers guilty of taking shorts. Those are responsible people. They care about their fishery. They're enhancing the resource and they'd like to have the right to keep enhancing it. I believe our social responsibility deals with all of these things. I think that to allow the further destruction of the fisheries is to destroy more than

just the fisheries--it would destroy an important part of our American heritage. I think this country was founded and built upon the entrepreneurial spirit, the independent spirit of people who are represented greatly by our fishermen and farmers. I hate to be a party to decisions that would deny those people the right to exist and to have contact with nature that everyone talks about.

WYMBERLY COERR, REPRESENTATIVE, DEFENDERS OF WILDLIFE, MONTEREY

In this discussion of philosophy, the key word for me is stewardship; stewardship, in this case, of ocean ecosystems in which the otter plays a prominent part, both for the present and for the future generations. When we talk about values, we're talking about something which we individually feel, but values do not compel assent to them. Obviously we have different values here. With many of these values, after all the compromises have been made, there is going to be some incompatibility. And I'm going to be urging that this incompatibility be resolved in favor of the preservation of ecosystems.

Now, since values are individual--the things that we feel ourselves--we rather like sometimes to go back and see if there are any historical antecedents for what we feel. The concept of stewardship obviously has a long history. In Genesis, Chapter II, Adam was given the Garden of Eden to till and to keep. He later ran into other difficulties which are beyond our scope here. St. Benedict first prominently practiced the concept of stewardship of natural resources. These days, to quote something much more current, when a boy scout dedicates himself as a citizen, he says, "I will do all in my power to pass on a better America to the next generation." Of course, as Mr. Handleman has suggested, concepts of a better America are going to differ. But I hope that we here will do all in our power to pass on to the next generation healthy ecosystems in which otters are performing their functions, not endangered and no longer likely to become endangered.

A question was addressed to Dr. Michael Orbach about the perceptions of other cultures about marine mammals and methods of obtaining a balance between man and marine mammals.

MICHAEL K. ORBACH, ASSOCIATE DIRECTOR, CENTER FOR COASTAL MARINE STUDIES, UNIVERSITY OF CALIFORNIA AT SANTA CRUZ

There is a large body of literature on traditional resource management systems, which bears on that question. To cite one example, old Hawaiians had a good system. The way they managed their ecosystem was that the chief said, "you fish, you no fish." That was the way that they did it, but there are systems like that, where people by

mutual agreement and in fairly small scale societies did, in fact, balance subsistence use and trade uses with other societies and other groups. We're not as good at it here in the U.S. for two reasons: One is that the scale of the problem is much larger, and the other one is that we don't really have too much true subsistence use around, so we're just not as experienced in these matters. Among other societies in other places where they get more practice, there are some quite viable systems that balance these trade-offs, preserving the populations and allowing for commercial and subsistence uses.

Following a question from the audience regarding the relationship between oil and sea otters, the following exchange took place between Carol Fulton, of Friends of the Sea Otter, and Lad Handleman, of Save Our Shellfish.

LAD HANDELMAN

I'd like to pose that question reverse: You expressed concern about the safety of the sea otters because you say that oil is lethal to the sea otters and will kill them, and you say that the otters should be allowed to run unmanaged to their heart's content, wherever they may choose to go. While saying that, what you don't say, is that from Point Concepcion south, which is right in their path, there now happen to be 40 barrels to 800 barrels of oil released per day, every single day of the year. That has been occurring for the last hundreds of thousands of years, maybe millions of years; how do you reconcile those two things? How can you say that you're concerned about them, and yet you don't want them managed to prevent them from getting into the oil that's going to be down there, with or without people, with or without oil drilling companies? So if you're concerned about them, I submit you include in your concern a way to protect them from the lethal effects of that oil that's right down there.

CAROL FULTON, EXECUTIVE DIRECTOR, FRIENDS OF THE SEA OTTER

As you know, we are very concerned about oil and we are very concerned about getting a translocation under way to an area where the animals will be less vulnerable to oil. Unfortunately, all along the California coastline, this is a situation that has to be carefully examined. I would point out that the oil has been coming out of there for a long, long time and as you know, historically the otters were in that area. I don't perceive that natural seepage is such a threat to the otter.

LAD HANDELMAN

Oh, so oil is not a threat to the otter--I just want to get that on record.

CAROL FULTON

No, I would like to say that in 1964, off the coast of Russia, there was a tanker spill in which over 100 sea otters died. That concerns me very much.

LAD HANDELMAN

Well, which is it--is the oil a threat to the otter, or not?

CAROL FULTON

The oil is definitely a threat to the otter. In my mind, it's the greatest threat to the survival of the otter right now...

LAD HANDELMAN

I would like to see them protected and managed so they don't run headlong into all that oil.

Our major concern at SOS is that we think the sea otter needs protection from himself and man's activities and oil. Obviously, our initial concern was that we protect and preserve the fisheries and the status of shellfish in the marine ecosystem, as we now know it and don't do any more damage to it. We think you can have both. We think that there are plenty of areas up and down the coast that are more pristine than other areas. Where millions of men are living, is probably not where the otter should be. Where there are areas in which there are not so many men doing damage to the otters, to their activities, is probably where they should be. Where the fisheries occur also happens to be where the other activities of men are. So, I don't think the solutions are that hard. I think you have co-existence of otters and men, not through intermingling in a single area, but co-existence through separate territories. That's pretty basic. You have territories for the otters where you don't have the problems with men, and territories for fisheries, where they have long been part of our culture, and you can have them both. We have a choice.

3 ECONOMIC COSTS AND BENEFITS

Moderator
William Wood,
University of California
Cooperative Extension

MANAGEMENT OF SEA OTTERS AND SHELLFISH FISHERIES IN CALIFORNIA:
WHO IS AFFECTED?

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INTRODUCTION

The purpose of this paper is to describe the extent and manner in which different interests are affected by current management of southern sea otter (Enhydra lutris nereis) stocks in California. The paper intentionally ignores issues of management of other species in the same ecosystem. In an ecosystem where humans are not present, the sea otter is a "keystone species" (Estes and Palmisano, 1974, p. 1960): its presence or absence tends to determine the structure of the entire nearshore community. Thus, it is through management of the sea otter that resource managers might influence the "ecology" of specific nearshore marine communities and, indirectly, the human groups that are adversely or positively affected by management programs.

Although feared to be extinct due to the fur trade, the southern sea otter was first protected in 1911 under the North Pacific Fur Seal Treaty. In 1938, the public became aware of a remnant population of approximately 300 animals along a remote stretch of California coastline near Big Sur. This led to the establishment of the Sea Otter Refuge in 1941. Until 1972, the sea otter was under the jurisdiction of California's Department of Fish and Game (DFG). At that time, with the enactment of the Marine Mammal Protection Act, the sea otter came under the jurisdiction of the United States Fish and Wildlife Service of the Department of the Interior. During this entire period, the southern sea otter has had complete legal protection (Cicin-Sain, 1981, this volume).

Today, the range of the southern sea otter has expanded from one small pocket to 200 miles of shoreline extending from Santa Cruz in the north to Pismo Beach in the south. From the verge of extinction, the numbers of the southern sea otter have increased to approximately

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1800--10% of their former population, occupying 10% of their former range. These increases have brought the otter population into actual and potential economic conflict with several of California's valuable shellfish fisheries.

Such economic conflicts soon become costly political conflicts, in which the affected parties expend energy and resources attempting to gain credence and support for their positions. Public agencies responsible for regulation of the resources involved are compelled to conduct studies and prepare reports assessing the effects of alternative means of resolving conflict. And finally, resource conflicts often require meetings, public hearings, and sometimes judicial action where contending groups present their respective cases.

One way of minimizing the cost and intensity of such conflicts is to consider as many interests as possible at any decision point. It is important to identify the dynamics of the situation and environment, and to employ all the information available in the decision process when major conflicts among users occur. This eliminates the repetition of costly activities by actors in the process and minimizes the need for interest groups to mount information campaigns. Further, administrative and regulatory agencies need not replicate environmental impact studies every time a conflict manifests itself in a new form or geographic location, and the general public is relieved of the necessity of devoting attention to a recurring problem.

Further, if systematic review of all interests is not pursued, an optimum use of resources will not occur. One group or interest may be more effective in pressing its position when contending interests are considered in isolation. To cite one example, one could compare the values associated with the southern sea otter to the values associated with the Pismo clam (Tivela stultorum). It is conceivable that the perceived benefits of allowing the southern sea otter to displace the Pismo clam would more than counterbalance any anticipated costs. However, in a few years, the sea otter-shellfish conflict could be expected to recur in the Santa Barbara Channel over the displacement of abalone (Haliotis) and urchin (Strongylocentrotidae) fisheries as a result of reintroduction of the sea otter. It is possible that the benefits accruing from expansion of the southern sea otter's range would outweigh the costs of losing the commercially productive shellfish fisheries of the Santa Barbara Channel. Assuming that it would be possible for the sea otter to reoccupy its entire historical range, at some future time, society might look back and determine that such an outcome was not desirable in the aggregate. That is, once the full impact of the southern sea otter's expansion is evaluated, it might be determined that the total costs of the expansion far outweigh the benefits, even though at each accretion to the southern sea otter's range the decision to allow further expansion would have been based upon a positive evaluation of local consequences.

In elaborating the interests involved in the sea otter controversy, I make reference to the "economic" prospects for each resource, group, and/or value identified. I do not attempt to place a dollar value on all of the factors (e.g., preservation of an endangered species) discussed. Hence, economic concepts are utilized only in a broad and general sense. Whenever available, statistical data will be supplied. However, the primary purpose is to identify the range of interests, uses, and resources which should be considered in management decisions pertaining to the sea otter. "Economic," then, should be seen as referring to possible costs and benefits of protecting the southern sea otter, not all of which are suited to dollars-and-cents evaluations.

This paper does not conclude that resources which may come into conflict with the sea otter at some time in the future necessarily offer more net benefit to society than the sea otter, or vice versa. Rather, it suggests that this is the appropriate time to consider what the net worth of protecting this animal may be to society. That is, what are the benefits of the presence of the southern sea otter in specific coastal ranges measured against commercial and recreational interests contending for resources found in those same areas?

THE AFFECTED INTERESTS

The Sea Otter and its Preservation

Under existing federal laws (the Marine Mammal Protection Act and the Endangered Species Act), the sea otter is intended to be the primary beneficiary of management measures and precautions (e.g., listing as a threatened species). A second level of benefits is enjoyed by those who value the existence of the specie. The positive actions required to protect the southern sea otter, and other threatened marine mammals, must be seen as indicative of a belief that there is value in preserving threatened species. Therefore, it is necessary to consider what values or benefits might accrue to society from the protection of the sea otter.

When considering the range of "values" associated with a particular resource, a first indicator of value might be the size of the population. Ostensibly, the protection that the southern sea otter receives is to ensure the continuation of the species or population. With the increase in the population of sea otters, it would seem that the primary benefit of sea otter protection--maintenance of the species--is being realized. If one were trying to quantify these benefits, it could be said that the various programs which have been designed and implemented to protect the southern sea otter have provided a benefit of approximately 1,800 animals. If this animal had not been protected, it is conceivable that none of the current population would exist.

The real value of the sea otter, however, cannot be expressed solely in gross terms such as numbers of animals. One value that underpins much of the concern for conservation of species is the "moral value" of conservation. A society willing to demonstrate respect, reverence, and love by making appreciable economic sacrifices to preserve an endangered species may reap the benefit of improved personal and social lives. Our intentional efforts to protect the environment may return to us in the form of better relations with other members of human society (Partridge, this volume). Like virtually all intrinsic values, it is practically impossible to assess in monetary terms the contribution made to society. Nonetheless, a contribution to "moral value" has been made.

A second benefit associated with the preservation of the sea otter--or any endangered species--is the inherent, non-calculable worth of fostering biological diversity. Many ecologists have suggested that an ecosystem's stability is related to its complexity (e.g., see Pianka, 1978, pp. 286-303; and Pielou, p. 1075). Maintaining a variety of species, both floral and faunal, increases the probability that an ecosystem will be able to adjust or adapt to future crises.

Maintaining a complex environment has been one of the benefits of past and current efforts to protect the otter. Future efforts along these lines will further enhance this aspect. A caveat, however, is in order. The benefit derived from a complex environment can only be generated up to a certain point--the population level at which species survival is guaranteed. Beyond this level, additional animals do not contribute a benefit in this sense. Therefore the costs of management incurred after this level is reached cannot be balanced by increments to the insured complexity of the environment. For the moment though, we can suggest that such a balancing has been, and probably will continue to be, in order.

A third benefit of the expansion of the southern sea otter is their contribution to the aesthetic resources of the coast: the natural beauty of the shoreline. Many individuals, upon viewing a sea otter or group of sea otters rafting, enjoy observing the activities of the animal. The sea otter provides a natural spectacle which can be appreciated by many of those given the opportunity to view the animal. In other words, the southern sea otter is an aesthetic component of California's shoreline which is enhanced by protective measures. With increased numbers and range, more people have been able to enjoy the aesthetic value of the sea otter. This pleasure is difficult to quantify, but there should be no doubt that the spread of the southern sea otter has made such a contribution. In contrast to this third point, the decline in shellfish does not result in a similar reduction in the aesthetic resources of society. While many people find abalone shells and jewelry made from their shells aesthetically pleasing, most would agree that abalone and urchin and other shellfish are rarely appreciated solely for their natural beauty. Therefore, we must posit that the expansion of the southern sea otter has made a contribution to

aesthetics which is not offset by aesthetic losses resulting from declines in other species.

A final value associated with the sea otter is related to the aesthetic value but even more difficult to calculate. This benefit might be called the value of "knowing-it's-there": the psychological benefit derived from the preservation and expansion of the southern sea otter. Since quantification of this benefit is utterly impossible (even with aesthetics one could make some "guesstimates" based on the number of visitations or some other substitute measure), a brief explanation of the concept is all that is provided. Basically, "knowing-it's-there" refers to the satisfaction some people derive from the knowledge that a resource exists. They enjoy knowing that though it is unlikely they will ever take advantage of the opportunity to observe the behavior of otters, the possibility to do so exists. Economists refer to this as an "option demand" (Krutilla, 1967, p. 780).

Recapitulating, the sea otter directly provides several benefits--moral, biological, aesthetic, educational and psychological--which are not easily assigned quantifiable values. Regardless of this quantification problem, these values must at least be included qualitatively in any assessment of how various parties are affected by the expansion of the sea otter in California.

Commercial Fisheries

There are several species of commercially valuable mollusks and crustaceans (including squid [Loligo opalescens]) in California. Many of these are preyed upon by sea otters. Some of the conflicts involving shellfish fisheries and the southern sea otter have become manifest; others can be anticipated because of the possibility of relocating colonies (commonly referred to as translocation) or unlimited expansion of the southern sea otter; still others are postulated on an incomplete understanding of the full spectrum of fauna which the sea otter uses as forage.

The primary source of conflict arises because of the magnitude of the sea otter's appetite. Evidence indicates that in order to maintain their body temperature in Pacific Ocean waters, sea otters consume approximately the equivalent of 25% of their body weight every day. The diet of the sea otter includes some items which are also commercially harvested. Compiled data on the trophic ecology of the sea otter indicates that:

Sea urchins, abalones, and rock crabs are the preferred food items of the California sea otter, these being the first items consumed when sea otters occupy a new habitat. As these food items are depleted, other food items are utilized (e.g.

turban snails, kelp crabs, mussels, octopus, etc.) thereby increasing the diversity of the otters' diet.

It is interesting to note at this point that in several studies conducted (Ebert, 1968a; Vandever, 1969; Wild and Ames, 1974) where otters have foraged for several years, rock crabs continue to be consumed in relatively large amounts, even though abalones and urchins have become of minor importance. This may be partially explained by the advantage of mobility and visual perception that the crabs have over the latter two species which allow them to escape predation more often. A possible additional explanation is that the replacement rate of crabs under such predation pressures is greater than that of abalone or urchins...

Sea otters have a great capacity to adapt to the availability of prey species in a given habitat. This is illustrated above by their shifting from presumably preferred food items to those less preferred upon depletion of the former, and in the two examples below. In Monterey Bay seasonal squid spawning occurs in the spring and fall. During that time squid will make up a large part of the sea otters' diet (Calif. Dept. of Fish and Game, 1976) while other food items are apparently ignored. Miller, et al. (1975) report that large quantities of Pismo clams were consumed by sea otters (up to 96% of their diet by weight) when they moved into Pismo clam beds in Monterey Bay and Atascadero State Beach near Morro Bay (Woodhouse, Cowen, and Wilcoxon, 1977, pp. 36-37).

Although some relationships among the various components of the ecosystem have not been fully explained and thus cloud the picture, it is generally presumed that:

...within the sea otter's stabilized foraging range there can be virtually no human harvest of abalones, Haliotis spp., (except for a few intertidally); red crab, Cancer productus; rock crab, Cancer antennarius; sea urchins, Strongylocentrotus franciscanus and S. purpuratus; and Pismo clam, Tivela stultorum. (Further, there is also concern of possible sea otter predation on Dungeness crab, Cancer magister; spiny lobster, Panulirus interruptus; and Pacific oyster, Crassostrea gigas, as the sea otter moves into areas where these invertebrate species are harvested [Miller, 1974].) It can be argued that collapse of the abalone (or any other shellfish) fishery will result not from the reintroduction of the otter, but from the overexploitation of the resource by fishermen. But the pressure exerted on a stock of shellfish by an industry can be regulated; the pressure of the sea otter cannot. The sea otter population tends to expand to a density which usually results in a shellfish stock well below the level required to sustain a

viable commercial fishery (Woodhouse, Cowen and Wilcoxon, 1977).

Abalone

From the late 1950s through the 1960s, participants in the abalone fishery pressed the California Department of Fish and Game (DFG) for relief from the increasing encroachment of sea otters into productive abalone beds. Although DFG was responsible for management of the otter at that time, the agency refused to intervene. It argued that the data at that time were inconclusive about the impact of sea otters on shellfish fisheries and the possible incompatibility of sea otter restoration and commercial shellfish fisheries (Calif. Dept. of Fish and Game, 1963). Additional evidence, as suggested above, has made it apparent that it is impossible to maintain a viable commercial abalone fishery in an area inhabited by sea otters.

The abalone fishery was initially centered in the Monterey area. Later, the locus of the industry moved south into the San Simeon-Morro Bay region (Cicin-Sain, et. al., 1977, pp. 2-5). This area, Morro Bay to Monterey, has been lost for the commercial production of abalone largely as a result of the expansion of the otter's range (Calif. Dept. of Fish and Game, 1980). Assuming that the originally high catch levels could not be maintained (because of the pristine nature of the beds at the inception of commercial exploitation), the region could still have been expected to sustain a relatively significant harvest of abalone. During its zenith, the abalone fishery in the region in question produced some two million pounds of in-shell abalone (Cicin-Sain, et al., 1977, pp. 2-6).

Currently, the commercial abalone fishery is dispersed from Point Concepcion south to the Mexican border (an area closure exists between Palos Verdes and Dana Point) and from Yankee Point north to Point Lobos. In 1980 there were 168 divers active (of an allowed 175) in the fishery. In 1977 (the last year for which data are available) the commercial harvest accounted for 1.43 million pounds of abalone worth \$1.4 million. If given current value, the 1976 landings would be worth approximately \$3.08 million (Stuster, 1980).

It should be pointed out that, ceteris paribus, it is possible that the production of abalone will increase in the future. The California Abalone Association has established an ongoing resource enhancement program which, if successful, will augment the naturally occurring populations of abalone. Also there are efforts underway--Monterey Abalone Farm, for example--to use the techniques of aquaculture to produce marketable abalone onshore.

If the southern sea otter expands into areas where abalone are now commercially harvested, then the loss of jobs and dollars associated

with such an expansion must be considered a cost of preserving the southern sea otter.

Sea Urchins

The existence of a commercial sea urchin fishery is a relatively recent phenomenon. Commercial exploitation of this stock began in the early 1970s. Unlike the abalone, which is predominantly harvested for domestic consumption, the sea urchin is taken for export to Japan. Initial harvests yielded only a few hundred pounds of roe (Hedgpeth, 1974, p. 61). The most recent available data indicate that the approximately 200 fishermen involved earned \$1.6 million in ex-vessel payments for their efforts in producing the 1977 harvest (this would be worth \$3.6 million by 1980 prices) (Stuster, 1980).

The urchin fishery, as already indicated, is an immature fishery. It therefore has the potential to expand, particularly since Japan has consistently demonstrated a willingness to import more urchin roe than has been harvested. DFG anticipates growth in this fishery (Calif. Dept. of Fish and Game, 1980). Urchin are now commercially exploited almost exclusively in southern California, however, they are found in commercially viable densities along the northern California coast. Therefore, the potential area which could provide a harvestable population of urchins is significantly larger than the area currently under commercial exploitation (Calif. Dept. of Fish and Game, 1980).

Since an urchin fishery is incompatible with a flourishing sea otter population (Lowry and Pearse, 1973), protected sea otter expansion southward into the areas of urchin production off southern California, or translocation of colonies to areas along the coast of northern California, would entail losses to the urchin fisheries of California. In the case of southern California it would be losses to an existing fishery; for northern California, a potential fishery.

Dungeness Crab

The Dungeness crab is an example of a fishery which is not immediately threatened by the advance of the southern sea otter. However, if a colony of southern sea otters were translocated to northern California, this valuable fishery might begin to feel negative impacts. The California fishery for Dungeness crab, with centers in San Francisco, Bodega Bay, and Fort Bragg, is predominantly a fishery of northern California. As with many fisheries, the Dungeness crab goes through cycles of abundance and/or availability. For the last ten years, DFG has estimated that the landed value of Dungeness crab has averaged around \$7 million (Calif. Dept. of Fish and Game, 1980). Industry sources have suggested that the value of Dungeness crab landings during the last four years has fluctuated between \$12 million and \$20 million (Grader, 1980).

Dungeness crabs are, like rock crabs, mobile, and may evade predation by otters. Thus, while it would be incorrect to assert that this fishery would be eliminated by the reappearance of the sea otter, the fishery may be reduced by its incursion. DFG records indicate, however, that during years of heavy abundance the resource is not fully exploited (Calif. Dept. of Fish and Game, 1980). Therefore, while no actual dollar value of losses to the Dungeness crab fishery can be made, any calculation of costs and benefits of continued expansion of the southern sea otter must contain as one component the likely adverse effect on the valuable Dungeness crab fishery.

Lobster

To the south of the current sea otter habitat, an economically important shellfish fishery for spiny lobster is found. The northern extent of the commercial spiny lobster fishery is Point Purissima. The southern limit of the fishery is the Mexican border. The spiny lobster is also exploited in waters around the Channel Islands (Calif. Dept. of Fish and Game, 1980). A caveat similar to that applied to the Dungeness crab is also valid for the lobster. Because of the spiny lobster's mobility, reoccurrence of the southern sea otter should not be equated with a complete demise of commercial lobstering. Rather, the sea otter should be viewed as a competitor which will decrease the availability of lobster to fishermen by some unknown degree. Thus, the assumption is that though the southern sea otter may not eliminate the spiny lobster fishery, it may induce a decline in the productivity of that fishery. Other factors, such as the taking of sub-legal lobsters, overharvesting, and pollution, however, may also contribute to an overall decline in productivity. Currently, the lobster fishery in California is valued at \$850,000, based on landings of 250,000 pounds in 1977 (the last year for which figures are available). (Dollar figures are adjusted for 1980 landing prices.) (Stuster, 1981). Part of this catch and some fishermen's jobs might be lost if the southern sea otter returns to its former habitat.

Rock Crab

Rock crab is a general term which applies to three species of crab--yellow, red, and brown--found in the waters off California's coast. The commercial rock crab centers are located in the southern half of the state with yellow crab being the predominant species (Calif. Dept. of Fish and Game, 1980). Landings for rock crabs seem to have leveled off at approximately 1.2 million pounds per year. In terms of 1980 landing prices, this level of catch has a value of \$960,000 (Stuster, 1981). Since rock crabs are a component of the southern sea otter's diet, if the sea otter is reintroduced into areas where rock crab fisheries exist, those fisheries may experience some decline. Uncertainty exists because data indicate that stable amounts of rock crab persist in the sea otter's diet in areas of extended habitation.

Squid

The last shellfish fishery which may in the future be impacted by the spread of the southern sea otter is the market squid fishery. The evidence regarding the magnitude of the potential impact is at this time inconclusive, however, the suggestion has been made that the eggs of the squid are sometimes consumed by sea otters. Also, adult market squid have been found to be included in the diet of the sea otter (Morejohn, et al., 1978, p. 85).

There are currently two separate squid fisheries in California; one located in the vicinity of Monterey Bay-Moss Landing (an area in the current range of the sea otter), and a second which uses San Pedro as its home port while working the Channel Islands. Typically, the annual harvest from the squid fisheries is about 15,000 tons. Depending upon market conditions, these landings can have a value of between \$1.5 million and \$3.9 million. Once processed, the vast majority of squid is exported to Europe (Anon., 1980a, p. 34-35).

Again, the impact of further expansion of the sea otter on the fishery is hard to predict. The market squid is an underutilized species, the current harvest significantly below what some estimate the supportable harvest to be (Anon., 1980a, p. 35). Thus, we do not know what proportion of the total squid fishery might be lost as a result of otter predation, nor do we know with any precision what the total value of the harvestable squid fishery might be if more extensive markets were to develop.

Finfish

To this point we have discussed shellfish fisheries which may be adversely affected by the continued protection of the southern sea otter. There is a group of fisheries, collectively referred to as finfish fisheries, which could benefit from continued protection of the southern sea otter. The sea otter preys upon benthic herbivores, the most notable of which is the sea urchin. As the sea otter removes herbivores from the benthic community, kelp tends to establish itself (Estes and Palmisano, 1974; Simenstad, et al., 1978; and Kenyon, 1978). Finfish may profit because, as Duggins has observed, kelp provides,

a rich food source for organisms of several trophic levels...In effect, kelp productivity may be a major nutrient input supporting nearshore secondary productivity. Furthermore, the effectiveness of kelp beds as habitat, nursery areas, and protective cover from pelagic predators depends in large part upon the amount of kelp biomass produced (Duggins, 1980, p. 451).

Thus the expansion of the sea otter could provide opportunities for the enhancement of some finfish stocks in the form of habitat, nursery

areas, and areas of safety. There are several species which are now commercially harvested in the waters off California which may be so benefited. Among them are mackerel, rockfish, sea bass, and yellowtail (Haacker and Wilson, 1975, p. 9; and U. S. Dept. of Commerce, 1977). Any evaluation of the effects of sea otter management should include consideration of the potential benefits these fisheries might experience.

Kelp Industry

While finfish stocks may be enhanced as a result of the kelp growth associated with the presence of sea otters, fish are not the only possible beneficiaries of increased kelp resources. Kelp is harvested commercially for a variety of uses--from food additives to cosmetics. Approximately 150,000 short tons are harvested annually in the waters off California, and, according to Department of Fish and Game estimates, the value of this industry is currently close to \$20 million per year (Calif. Dept. of Fish and Game, 1980). Much of this value is derived from the export of kelp and kelp products to Japan. The demand for algin derived from kelp processing may reach as much as 23,200 short tons in 1980 and perhaps climb to 30,000 short tons by 1990. It is estimated that harvest rates not already at maximum levels (e.g., where the kelp resource is not fully utilized) will increase proportionately in the next decade. Expansion of the sea otter population may contribute significantly to the growth of this industry.

Fishing as Lifestyle

A final component of shellfish fisheries needs to be mentioned. As with other fisheries, there are several benefits associated with these fisheries which fall under the rubric of "fishing as lifestyle." When assessing the effects of managing marine resources some consideration should be given to the impacts,

on individual human beings--their physical and economic well being, their social and psychological characteristics, and their interpersonal relationships--and on the social and cultural groups that these individuals form: families, ...organizations, communities (Orbach, 1978, p. 211).

In other words, while earnings from a fishery are important, they are not the sole component of an individual's decision to become or remain a fisherman. There are psychological, social, and cultural values implicit in adopting fishing as an occupation; values which, like the aesthetic value of the sea otter, are intangible and therefore hard to quantify. For example, a recent study of former commercial abalone divers found that many of them were earning significantly more money than they had as divers, but as a group they were generally unhappy with their new, non-fisheries occupations. Their current occupations lack

the "quality of life" benefits associated with fishing as a way of life (Cicin-Sain, et al., 1981).

If the southern sea otter continues to expand and reduces stocks of shellfish significantly, then the loss of the intangible psychological, social and cultural benefits sustained by the shellfish fishermen will represent another cost of protecting the sea otters of California.

Related Industries

In addition to the individual commercial shellfish fisheries which may be adversely affected by repopulation of California's coast by the sea otter, there are several related support industries whose fortunes rise and fall with the health of the fisheries. Evaluation of the costs and benefits of protecting the southern sea otter must include assessment of the losses or gains which may accrue to these support industries.

Instead of attempting to cross-tabulate the impact on each shellfish fishery with each supporting industry, the exposition which follows provides a general appraisal of the aggregate relationship between these industries and shellfish fisheries. Stuster (1980), using a multiplier developed by the California Department of Water Resources, has calculated that the overall economic value of the urchin, abalone, spiny lobster and rock crab fisheries is around \$23.4 million. A major portion of this value is derived from the support industries.

The first businesses to feel reverberations from a fishery undergoing change are the processing and wholesaling industries. The extent to which any single processing enterprise is harmed or benefited by the disappearance of or diminished landings from a particular fishery or class of fisheries is related to the diversity of fisheries products which the processor handles or is equipped to handle. The issue of alternative processing capacity includes markets as well as physical plant capacity. A processor is not benefited by having the ability to process other species if a market does not exist for these products.

Some of the firms which process shellfish and some of their employees might become casualties of sea otter expansion if a "worst case" assumption were to hold true. But not all of these processing firms are solely dependent upon shellfish. They are also actively engaged in processing products from other fisheries--most notably finfish--which might be enhanced by the expansion of the southern sea otter. Further, some of those who process abalone supplement their domestic supplies with imports from Australia.

Assuming that a market exists for more finfish products, it would be reasonable to suppose that these processors would avail themselves of opportunities for processing additional fish. While it is impossible to indicate precisely the impact on the processing/marketing segments of the shellfish industries, it is clear that they will suffer losses if or

when sea otters are reintroduced. Part, perhaps even all, of these anticipated losses can be expected to be offset by imports of shellfish and increased production of finfish.

A second sector of commercial fishing that responds rapidly to changes in fisheries is the chandlery business. If a fishery is prospering, then fishermen can be expected to invest in more gear and equipment. Conversely, a depressed fishery will tend to discourage or prevent investment in new gear and/or equipment (particularly when the purchase must be financed through a credit agency). However, fishermen might be compelled to acquire additional chandlery in the hope of attaining a competitive edge (for example, a crabber may feel that the answer to decreasing landings may be found in the setting of additional traps). Ultimately, as fishermen are forced from a fishery because of declining stocks, the chandlers will feel economic repercussions.

For some fisheries, the amount of diminished commerce may not be too great. This is exemplified in a recent study of the abalone industry (Cicin-Sain, et al., 1981) which reported that the value of equipment (excluding vessel value) for divers active in the fishery was only approximately \$1,600 in 1978. With a total of 175 divers now participating in the fishery, it is clear that not many chandlers are dependent upon supplying only the abalone diving industry. In contrast, the average Dungeness crab fisherman owns dozens of expensive traps, and these traps need to be replaced every few years, in addition, to investments in other equipment and gear. The loss of the Dungeness crab fishermen as customers could be significant for chandlers.

As with processors, the net loss or benefit to chandlers from depletion of the shellfish resources by southern sea otters will also be a function of any offsetting increase in gear and equipment sales if there is any growth in finfish fisheries.

Finally, any change in a given fishery is likely to redound upon boatyards supplying and/or repairing vessels for that fishery. Again, the final impact cannot be accurately predicted at this time. Boatyards will experience some effects from diminished shellfish fisheries; however, they may, conversely, benefit from growth in finfish fisheries. Once more the question hinges on the magnitude of change in finfish fisheries which may occur if finfish stocks increase. This in turn becomes a question of the number of vessels which can be supported by the potential increase in finfish stocks.

Merely suggesting that some of the impacts that shipbuilders would experience as a result of fisheries which have been reduced by sea otter predation might be absorbed by increases in the finfish fleet is insufficient. A more finely honed analysis is required for a precise evaluation of the impacts to the shipbuilding industry. Many affected fishermen will be able to make the conversion to other fisheries merely by refitting their present vessels. Others use vessels designed for use

in specific fisheries (notably abalone and urchin) which would not be suitable for use in finfish fisheries. Thus, some of those switching to finfish fisheries would require new vessels; others would need modifications to their current vessels.

Mariculture

California law provides for the Department of Fish and Game to lease sections of seabed to individuals for the purpose of mariculture. The sea otter might present a negative factor to those who would like to culture shellfish in the ocean unless some mechanism for protecting those sections of seabed were devised. Existing programs for the enhancement of shellfish, such as the abalone seeding project now conducted by the California Abalone Association, might be discouraged. On the other hand, increased mariculture activities may offset some of the impacts of sea otter foraging on existing shellfish resources. Although several mariculture projects have been begun in California, not enough information is available at this time to make any meaningful assessment of the likely interactions between sea otters and mariculture activities.

Summary

It has been suggested throughout this discussion that finfish fisheries will benefit from the expansion of the sea otter. The reasoning is straightforward: as the otter removes kelp foragers, the kelp forests will flourish, and thereby create an environment in which finfish thrive. The potential for increased commercial fisheries for species such as rockfish, various ocean bass, whitefish, and lingcod (Haaker and Wilson, 1975, p. 7) exists, although many questions about their potential size and value remain unanswered.

In general, shellfish fisheries will be impacted, some even eliminated, and finfish production is likely to increase because of the expansion of the sea otter. But how much? Although the evidence suggests that the finfish biomass is directly related to the presence and abundance of kelp, there are no studies documenting the correlation between commercial finfish fisheries and kelp abundance. And what is the future market for finfish? Can we expect all of the increases in finfish stocks to be assimilated in existing markets?

Further, over what time period could an increase in the commercial availability of finfish be expected? Will it occur simultaneously with the decline in shellfish? Or will there be a lag between the decrease in shellfish stocks sufficient to support a viable fishery and the appearance of similarly viable commercial stocks of finfish? One would be inclined to suspect that the latter may be the more likely scenario. If so, this may be problematic for those who would like to maintain careers as fishermen. They may be forced to abandon a shellfish fishery and unable to begin as finfish fishermen until stocks reach commercial

levels. Therefore, it should be realized that displacement of shellfish fisheries by the southern sea otter will mean that some shellfish fishermen will be forced to seek other occupations. For reasons discussed above, only some of those currently active in shellfish fisheries may be able to make the transition to finfish fisheries.

Recreation and Tourism

Will those who are denied recreational fishing opportunities (i.e., harvesting shellfish) replace them with new opportunities or activities provided by the reappearance of the sea otter in its historic range? What is the benefit or harm which the industries supported by tourism and recreation can be expected to experience? These questions form the basis for analyzing the effects of the reestablishment of the sea otter along its historic range.

It is possible to make generalizations about tourism, although isolating the exact contribution that the southern sea otter now makes or may make in the future is difficult. For example, the Association of Monterey Bay Area Governments (AMBAG) has estimated the value of tourism (based on a 1978 survey) to the Monterey Peninsula--an area which the southern sea otter now inhabits. AMBAG's data suggests that tourism results in 10 million visitor days to the Monterey Peninsula. A value of \$350 million has been placed on revenues from tourism (\$35 per visitor day). AMBAG estimates that tourism on the Peninsula generates 17,200 jobs, which is one-third of all civilian jobs in the area (Fulton, 1980). These figures are impressive, but while some inferences can be suggested, the actual contribution of the sea otter to tourism is impossible to determine.

Recreational Shellfish Fishermen

As with commercial shellfish fishermen, those who harvest shellfish are the most evident recreational losers in a scenario that includes unlimited expansion of the sea otter into areas of historic habitation.

If the southern sea otter were to continue to reclaim parts of its historic range, which would include the entire coast of California, there are at least three types of recreational shellfish fisheries--abalone, clam, and scallop--which should anticipate significant reductions. First, many of those who now derive pleasure and satisfaction from the taking of abalone could find that resource diminished. It is estimated, for example, that some 16,500 diver days were spent between July of 1975 and June of 1976 by private recreational divers in waters off southern California. It is projected that they took some 22,000 abalones (Wine, 1979). This does not include the large number of recreational fishermen who free-dive for abalone in the coastal waters of northern California. Second, recreational clammers now involved in the Pismo Beach recreational fishery would be forced to

seek other outlets for their recreative time (Holt, this volume). Third, other species of clams (e.g., Japanese littleneck, common littleneck, razor, gaper, and Washington) which offer recreational opportunities for people on the coast of California may also be impacted by sea otter expansion or translocation. There may be more than 100,000 people who annually harvest clams as a leisure time endeavor (Calif. Dept. of Fish and Game, 1980). Fourth, individuals who spend some of their leisure time diving for scallops could lose part of this recreational resource. This loss is compounded by the fact that many of these individuals are the same people who would also be deprived of the opportunity to dive for abalone. The same 16,500 diver days mentioned above resulted in landings of approximately 15,000 rock scallops (Wine, 1979, p. 6). These recreational fisheries, then, will not only be affected by the success of the sea otter in reoccupying its historical range, but also by the magnitude of human pressure on these resources.

Additionally, several recreational shellfish fisheries will be affected, but probably not eliminated completely by sea otter foraging. Again, the cost to recreational shellfish fishermen will depend upon the extent of sea otter predation on rock crab, Dungeness crab, and spiny lobster. As stated in the discussion of the commercial fisheries for these species, much will depend upon the proportion of available crab and lobster removed by the sea otter. It should be noted that in some instances where the southern sea otter and rock crab now share a habitat, there has not been a substantial decline in the proportion of the otters' diet comprised of rock crabs (Ebert, 1968).

Recreational Finfish Fishermen

Evidence of possible increases in abundance of finfish suggests that sports fishermen who engage in saltwater fishing may derive certain benefits from extensions of the southern sea otter's foraging. Finfishing is an important pastime: DFG data indicate that some 315,000 anglers per year engage in this activity in the waters of southern California alone (Wine, 1979). Of course, not all of these fishermen would benefit; many pursue finfish species that would not be greatly affected by the incursion of the sea otter (e.g., salmon). Still others enjoy fishing in areas that are not conducive to the growth of kelp regardless of the presence or absence of kelp foragers. These exceptions notwithstanding, it should be anticipated that many of those who presently fish recreationally could enjoy increased success.

A few points, however, should be kept in mind when considering the anticipated benefits to recreational fishermen. First, many of those who fish for shellfish also fish for finfish. With these individuals, increased finfishing options may not represent additional recreational opportunities, but rather act as substitutes for the lost shellfish resource. Second, although more finfish will be available, it is not clear what the "market" (drawing a parallel once more to commercial fisheries) for additional recreational finfish will be. For example,

will the expanded recreational fishery be as valuable to the recreational fishermen as it has been in the past? In other words, how much of the value of recreational finfishing is found in the experience itself (an intangible), rather than in the actual quantity of the catch? Do recreational fishermen have a preference for shellfishing over finfishing, associated with method of harvest, location of good fishing ground, etc.? Are there people in the general population who do not go saltwater fishing, but who would be induced to do so by the presence of additional stocks of finfish? If the experience of finfishing is more important than actual success, then the benefit of added finfish stocks is decreased; on the contrary, if more people would be encouraged to engage in recreational ocean fishing by the increased availability of stocks, then the benefit derived from these enhanced fishery resources is increased.

Sports Diving Industry

The "sports diving industry" is defined here as those commercial enterprises which exist to service the sports diving community. Included are dive shops which retail diving gear and merchandise (including sales of air to sports divers, the producers of that gear and merchandise [tanks, wetsuits, gear for taking specific species, such as abalone irons and spear guns, underwater watches, etc.]), and those who provide instruction for would-be divers.

We can expect all of these, including the instructors, to be affected adversely by expansion of the sea otter's current range. As shown above, the recreational fisheries for abalone, scallops, and, to a yet unknown degree, lobster, may be adversely affected by the sea otter. It follows that since these fisheries are exploited by diving (virtually all abalone and scallops), then the sports diving industry could be adversely affected.

Clearly, the loss of recreational shellfish fisheries would diminish the value derived from supplying these recreational divers. This should not, however, be taken as indicating ruin for the sports diving industry. Not everyone who dives recreationally does so in order to take shellfish. Some dive for aesthetic reasons--not to harvest the sea's living resources, but rather to enjoy the beauty of the marine environment. Further, many of those who do hunt for shellfish also engage in underwater finfishing; thus not all of the services which they purchase from the sports diving industry would be forfeited due to reduced availability of shellfish resources.

Suppliers of Recreational Finfish Fishermen

The above discussion has indicated the difficulty of making predictions about increases in recreational fishing emanating from alterations in nearshore ecology caused by the presence of the sea

otter. This carries over to any consideration of the suppliers of gear and tackle for recreational finfish fishermen.

If, as the biological data suggest, the appearance of the sea otter in a coastal locale (with benthic features capable of supporting kelp) can be equated with future increases in finfish stocks, then those businesses which support the recreational fisheries would be positively affected. The magnitude of this benefit hinges on the level of increased effort by existing fishermen and the entrance of additional participants. The same holds for suppliers of recreational gear. Many of those who supply shellfish fishermen also supply those who fish for finfish.

Charter Boat Operators

Both recreational shellfish and finfish fishermen take advantage of the services provided by the charter boat industry. Specifically, abalone, scallop, and lobster divers use these boats to get to offshore beds. Likewise, finfish fishermen go out on commercial passenger fishing vessels to fish for species which are not accessible from the shore or from piers. Sometimes the same boats are used for both recreational fishing activities, although not simultaneously. Because of this situation, and because not all divers harvest shellfish, it is difficult to predict what impact the sea otter might have on this element of recreation and tourism. It should be noted that diving activities require some degree of preparation and equipment, while angling requires less investment in gear and training and attracts more people.

Increases in tourism might result from the expansion of the sea otter and be beneficial for the charter boat industry. As is well known, a significant industry has grown up around the activity of whale watching. Similarly, as more people come to view the otter, charter boat excursions may be established for observing sea otters. A few such enterprises have already developed on Monterey's Fishermen's Wharf. For example, one barker stands on the wharf advertising tours to observe sea otters. His enticement includes the phrase, "Hey, hey, step this way, for sea otters and assorted sea creatures." These enterprises have grossed as much as \$25,000 in a single season (Fulton, 1980), and clearly benefit the charter boat industry.

Accommodations, Restaurants, Trade and Souvenirs

Tourists attracted by the presence of the sea otter (assuming they are like other tourists) can be expected to spend money on travel, accommodations, food, and the assorted paraphernalia of tourism. "Accommodations" includes hotels, motels, and recreational vehicle parks. "Restaurants" refers to the food services required by tourists and/or recreational fishermen while they visit coastal locales.

"Travel" is mainly the business gas stations derive from the users of sea otter and shellfish resources, but it also includes the use of commercial travel facilities such as tour buses. Finally, included under "souvenirs" are t-shirts, bumper stickers, ash trays and assorted ceramic knick-knacks, and similar objects which are usually sold in recreational areas.

The expansion of the sea otter may positively affect tourism interests. The sea otter is an aesthetically pleasing animal and many people can be expected to travel to areas inhabited by sea otters for the express purpose of viewing the animal in its natural habitat. This phenomenon has already occurred in areas where the southern sea otter has reestablished itself. For example, the experience of one company may be indicative of the value of sea otter souvenirs. This firm markets a stuffed sea otter toy which retails for \$7. In 1980, 2,000 dozen stuffed otters were sold, for a total income of \$168,000. Forty per cent of the sales were on the Monterey Peninsula (Fulton, 1980), indicating that sales are probably related to the presence of the animal. Thus,

a whirlwind tour of various shops on the Monterey Peninsula revealed that almost every gift shop and gallery, and ...retail shops as well were carrying sea otter items. Ten cent postcards, \$3 salt and pepper shakers, \$5 prints, \$7 candles, \$10 t-shirts, \$15 puppets, \$25 photographs...\$100 rings, \$300 charms, \$450 water colors, \$800 sculptures and \$1,000 bronzes are just a few of the articles offered to otter-struck tourists (Anon., 1980b, p. 12).

Also, we must assume that those who travel to the region via private transportation will probably purchase fuel at least once during their stay. This gives some idea of benefits that can be expected to materialize as the sea otter becomes a more accessible tourist attraction.

So far I have indicated that the sea otter may be a boon to the tourism industry in affected coastal areas. A caveat must be added to this assessment. To a large degree, tourism is founded upon uniqueness or novelty. People travel great distances, and spend considerable amounts of money, in order to enjoy something which they feel or know to be unavailable in their areas of residence. There is only one Grand Canyon, one Disneyland, and few warm beaches in December. It is the uncommon which gives a resource its tourism value. And this may cause the future of sea otter tourism to lose some of its glow. Undoubtedly, expansion of the sea otter will be beneficial to all of the interests dependent upon tourists and the money which they spend. But what will the future be if the sea otter reclaims its historic range--or at least the coast of California? If this occurs, and if I am correct about the "uniqueness" factor of tourism, then the tourism value of the sea otter may be somewhat diminished. People are not likely to travel from San

Diego to Carmel solely for the purpose of sighting sea otters when a quick drive to Point Loma would accomplish the same objective. However, while it is likely that tourists will continue coming to California from other states to view the otter, they will no longer concentrate in any specific locale. Thus, it seems reasonable to project that the initial benefit which certain communities will enjoy from sea otter-related tourism will level off and then decline as a result of a dilution of the effect of the sea otter's presence.

Other Interests

Finally, we turn to a discussion of an assorted group of interests which are related to the question of sea otters versus shellfish.

Outer Continental Shelf (OCS) Hydrocarbon Development

Perhaps the most valuable resource (in easily measurable economic terms) involved in the web of interests affected by marine mammal protection is the oil and gas found under the continental shelf along the coastline of central California. The threat that oil spills pose for the sea otter led to the listing of the species as threatened in 1977. Normal oil activities may be compatible with the existence of the sea otter, but a major oil spill (from a tanker) or blow-out (from a drilling rig), coupled with the correct mix of environmental conditions (high seas, wind direction, tides, etc.) would lead to a significant mortality rate for the species. When the sea otter's coat is fouled by oil, it loses its ability to insulate itself, thereby making the otter susceptible to death from hypothermia (Costa and Kooyman, 1979).

The hydrocarbon issue presents an interesting paradox. Hydrocarbon-related activities have been one factor contributing to the current program of complete protection of the sea otter. To protect the otter from the dangers of oil transportation and exploitation, the population has been allowed to expand in both numbers and range. However, as these expansions have taken place, the sea otter has moved into areas where its existence can be jeopardized by proposed drilling activities. In other words, the portion of its historical habitat which has been regained by the sea otter, now poses new threats to the population.

The state of California is considering the establishment of a buffer zone twelve miles wide along those portions of the state's coast where sea otters are found to protect them from the hazards posed by oil exploration and development. Additionally, as many as 33 tracts in the Santa Maria basin are under consideration for exclusion from lease sale #53 (Anon., 1980d, p. 4). If these tracts are removed from the bidding process, the estimated value of oil from those areas may be considered a cost of protecting the otter. The United States Geological Survey (USGS) has estimated that the recoverable oil resource may be 404

million barrels in the Santa Maria Basin (U.S. Dept. of Interior, 1980, p. vii). The tracts proposed for deletion represent approximately 20% of the total basin. Of course, modern drilling technologies would allow some of the excluded tracts (if they are excluded) to be exploited from adjacent tracts. However, these technologies (e.g., directional drilling) are very expensive and would add to the costs of extracting the petroleum. Also, the company developing the resource would have to lease the tract from which the well was drilled as well as the tract from which the petroleum is to be withdrawn.

Shoreline Protection

A problem facing many coastal California communities is the erosion of shoreline and bluffs. Existing developments are continually being threatened by the actions of waves and tides. Protection of the southern sea otter could indirectly be of some assistance in this problem. Kelp can dissipate the force of waves, and in so doing, lessen the damage which wave action can perpetrate on the shoreline (Zenkovich, 1967, pp. 187-90). This may be offset by the fact that during storms kelp is sometimes uprooted and tossed ashore, and this uprooting process can contribute to shoreline erosion (King, 1959, p. 292). Again, these are very difficult factors to assess, but shoreline protection represents a potentially positive contribution of sea otter expansion.

The Balance of Trade

Any discussion of costs and benefits in a social context should include consideration of the well-being of the nation as a whole. Part of any nation's health is determined by the status of its balance of trade. In simplistic terms, a positive balance is generally viewed as beneficial for the nation, while a negative balance is viewed as detrimental. Protection of the sea otter may potentially indirectly impact the balance of trade.

The negative impact on shellfish resources caused by otter predation may add to the balance of trade deficit which the United States has been experiencing in recent years. The trade deficit in fisheries products for 1979 was approximately \$2.7 billion (U.S. Dept. of Commerce, 1980). A diminished volume of domestic shellfish products would encourage a small increase in shellfish imports. While many consumers of California shellfish would be willing to substitute finfish products, some would not. As a result, an increase in shellfish imports could increase the deficit as the southern sea otter expands in range.

Second, the current management scheme allowing southern sea otters unrestricted access to their traditional habitats may detract from the balance of trade because of lost exports; the reader should recall here that virtually all of the sea urchin products and much of the squid harvest from California waters are destined for foreign markets. Otter

predation may detract from the trade credits garnered from these fisheries.

Part (perhaps all) of the loss of exports resulting from declining shellfish exports may be offset by gains which can be anticipated from the harvest of kelp. A substantial portion of this valuable harvest is exported. Further, increased domestic kelp production could lead to a decline in existing imports of kelp products (U.S. Dept. of Commerce, 1980, p. 5). Thus, the otter, through its impact on kelp, may make a positive contribution to the balance of trade. Expansion of the southern sea otter might also make a contribution to the balance of trade through increased finfish resources. If the domestic harvest of finfish is increased as a result of sea otter enhancement of kelp beds, then some of the finfish products now imported might be replaced by domestic products.

Finally, the otter may be a detriment to the balance of trade in terms of oil importation. If certain outer continental shelf hydrocarbon deposits within the otter's range are not developed, they may have to be replaced by other reserves or by conservation. If the only other sources of hydrocarbon resources are foreign oil products, then the cost of importing oil must be counted as a cost of sea otter protection.

CONCLUSION

In the course of this paper, a wide array of interests and values has been considered. Many of these were intangibles; others could be assessed in more quantitative terms. It has been shown that some of the affected interests could expect negative impacts while others could look forward to benefits from measures to protect the southern sea otter. For other interests and values, it has been impossible to indicate the nature of the impact, if any, that might be anticipated from future expansions of range by the sea otter.

Though much uncertainty exists about the magnitude of these interests, they should nonetheless be considered in any evaluation of the costs and benefits of protecting the southern sea otter. In doing so, the political, social, and economic costs of management programs may be reduced. Future management decisions should be made in light of the potential trade-offs between these costs and benefits. For example, if zonal management were chosen as the best way of protecting the sea otter, then the zones should be selected according to their potential to maximize benefits and minimize costs, considering all users of the zone. Or, if hydrocarbon developments were constrained along the central California coast, then perhaps expansion of the southern sea otter into areas of shellfish production need not be so vigorously pursued in order to protect California's sea otter population. In any event, society is best served by a comprehensive review of the various affected interests and both economic and intangible values.

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ECONOMIC IMPACTS OF SEA OTTER MIGRATION

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INTRODUCTION

With protection of the sea otter and expansion in its range, we have witnessed an intensification of the conflicts between humans and sea otters over shellfish resources. The successful resolution of these conflicts requires a thorough-going identification of three key sets of relationships--(1) the relative biological impacts of human and otter harvesting on the abundance and vulnerability of shellfish resources, (2) the socioeconomic impacts of sea otter presence on human uses of the coastal zone, and (3) the implications of bioeconomic impacts for the design of management policies which are feasible biologically, technically, politically and socioeconomically. Unfortunately, much of the data and information necessary for identifying these biological, economic and policy relationships have not been collected or analyzed in a systematic fashion over a sufficiently long time period. This paper is devoted to filling one of these information gaps.

My intention is to develop an understanding of the socioeconomic impacts of sea otters on human uses of the coastal zone by focusing on a case study--Pismo Beach. In particular, my interest is in the potential impacts of sea otters on the recreational clam fishery and the Pismo Beach economy. The Pismo Beach clam resource was chosen for study because of both the immediacy of the conflict and its relative biological simplicity. Pismo Beach is on the southern migratory front of the California sea otter. Biologists anticipate that the otter might be able to exhaust the clam resource available to clambers within three years.¹ In addition, recreational clamming has been subject to use.

The author gratefully acknowledges the financial support of the United States Fish and Wildlife Service and the research assistance of Diane Fraser.

¹This would amount to recreational exhaustion rather than physical exhaustion. California Department of Fish and Game regulations set a minimum shell width of 4-1/2 inches. This size limit is sufficient to insure that harvested clams are mature enough to have spawned for five to six years before vulnerability to harvest. Thus it is anticipated that few if any recreationally sized clams will remain after sufficient sea otter migration to the Pismo Beach area. Yet it is recognized by biologists that an ecosystem in transition is characterized differently than an ecosystem in long run stable equilibrium. Consequently, the question remains whether a small-scale recreational fishery might be re-established after a longer period of time, particularly if regulations governing clam size limits change.

Consequently, it is relatively clear that the anticipated clam resource collapse will be due predominantly to otter predation.

The economic impacts of otters on the fishery and the local economy are understood in terms of direct benefits and costs to clambers and indirect impacts to the tourist economy. In particular, I will present data used to estimate the net benefits of clamming, benefits which will be foregone if sea otter expansion continues. In addition, I will examine data used² to determine the significance of clamming to the tourist industry.

This study is the result of a research project funded by the United States Fish and Wildlife Service and carried out by Diane Fraser, a University of California student, under my supervision. This project is a preliminary study based on characteristics of a sample of clambers and tourists in Pismo Beach in the last year. As such, the results to be discussed here are suggestive and carry a "Surgeon General's" warning.

In the following sections, I will describe the analytical framework appropriate for estimating economic impacts, evaluate the preliminary evidence for Pismo Beach, and highlight the conclusions that can be drawn from this research.

ANALYTIC FRAMEWORK

Direct Impacts on Clammers

The socioeconomic impacts of sea otters on recreational clamming can be analyzed in a benefit-cost framework. These impacts can be categorized in terms of direct versus indirect benefits and costs, tangible versus intangible, and present versus future. The direct impacts occur predominantly to clambers, in terms of the benefits and costs associated with clamming. Indirect impacts occur to the tourist industries which support clamming. The direct impacts can be represented in Figure 1 for the typical clammer.

Economists assume that recreationists decide how many clamming trips to make a year on the basis of a comparison of the costs and benefits per trip. In examining site-specific recreation such as clamming at Pismo Beach, it is assumed that benefits per trip over a given time period decline with each additional trip--i.e., as clamming is engaged in more frequently, the typical recreationist will value another trip to Pismo Beach less in comparison with other recreational alternatives. Consequently, the benefit curve is represented by the negatively sloped

²These estimates represent only potential current annual losses. No attempt is made here to characterize what the value of the recreational fishery might have been 10 or 20 years hence, had sea otters not threatened the fishery.

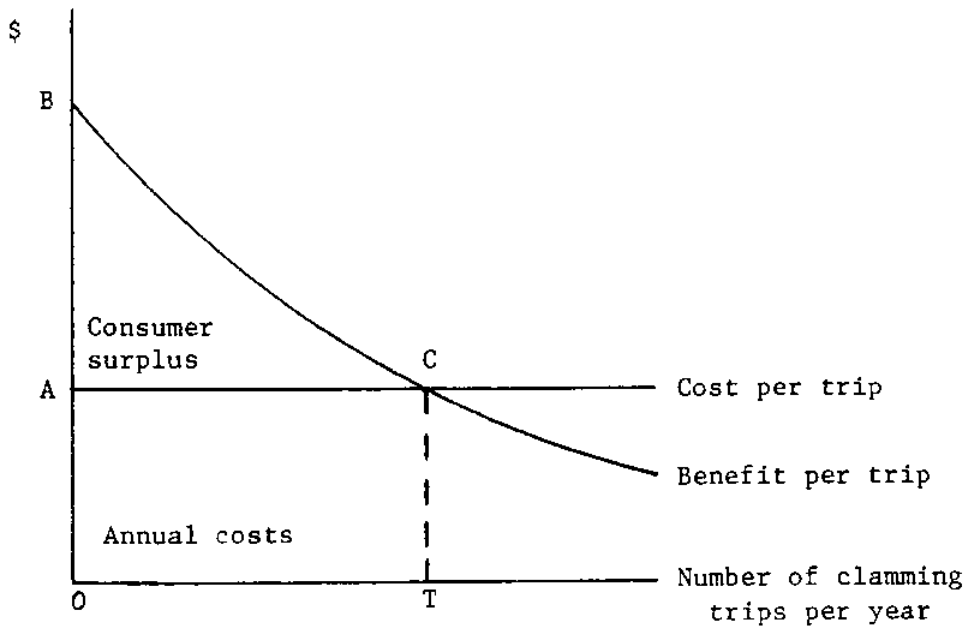


Figure 1

BENEFITS AND COSTS OF CLAMMING FOR THE TYPICAL CLAMMER

curve connecting points B and C in the figure. It is convenient to assume that costs per trip (mainly travel costs) are relatively constant. Therefore, costs are represented by the horizontal line connecting points A and C. Given these benefits and costs per trip, the typical clammer will maximize pleasure derived from clamming subject to cost conditions by making T trips in a given year. With T trips, the clammer will experience total benefits represented by the area OBCT, total costs of OACT and maximum net benefits of ABC. These net benefits are called consumer surplus, in the sense that they represent the surplus of benefits over costs enjoyed by clammers as consumers of clams.

It is important to realize that these direct costs and benefits include intangible, nonmonetary values as well as more concrete expenditures. For example, clamming costs theoretically include gasoline expenditures for travel costs plus the value of time used in travelling and clamming which might have been used in other recreational activities. Clamming benefits are essentially all intangible because they represent the pleasure associated with clamming.

Economists have developed methods to estimate these intangible benefits that make them commensurable with estimated clamming costs. In this way, consumer surplus can be estimated and used as a measure of the annual clammer costs (in terms of foregone clammer consumer surplus) of sea otter predation on Pismo clams. These surplus estimates are discussed below.

However, it is important to recognize that other intangible benefits exist for clamming, many of them tied to future rather than current benefits. For example, recreationists receive pleasure not only in the act of clamming but also from the knowledge that the resource exists and is protected (existence and preservation value), from the option to use the resource in the future (option value), and from the knowledge that the resource will be available for future generations (heritage value). These benefits will occur even if the individual never goes clamming. In addition, recreation benefits tend to increase over time, both as individual clammers develop more experience and appreciation for the activity, and as more people are introduced to clamming. All of these values can be expected to increase further if the clam resource becomes scarce. Consequently, economists admit that estimates of consumer surplus alone tend to underestimate the full benefits of the clamming opportunity both currently and in the future. It should also be noted that the presence of clams is a source of value to other users of the coastal ecosystem. For example, the clam species may promote the presence of other economically valuable species, or preserve gene pools or distinct ecosystems of value to biological research.

Direct Impacts on Otter Protectionists

A figure similar to Figure 1 can be drawn for recreationists and conservationists who value the presence of sea otters. Consumer surplus for sea otter watchers can be estimated as a benefit associated with otters to be compared to the estimated cost of foregone clammer consumer surplus. These two consumer surplus estimates would be important to otter management decisions affecting the future location of otters.

Unfortunately, no data have been collected for the surplus estimation for sea otter watchers. However, it is likely that the benefits of sea otter watchers will be a smaller percentage of the total direct benefits of the presence of sea otters. Many people across a wide geographic area probably benefit from knowing that sea otters are protected than will ever be expected to see them, relative to the number of potential clammers. Similarly, otters will benefit biological research and those who harvest resources which are more plentiful in the presence of sea otters (e.g., kelp). Nevertheless, nothing quantitative can be said about the economic desirability of sea otter expansion in terms of direct benefits and costs, without estimates of consumer surplus for otter watchers as well as clammers.

Indirect Impacts

Indirect impacts occur to industries which support clammers or otter protectionists. In Pismo Beach, the tourist industry supplies clammers with food, lodging, gas, clammer gear and entertainment. Similar services might be provided to otter watchers were otter viewing to become a feasible and popular recreation in Pismo Beach. In turn, these services create jobs and income for the local economy. Likewise, indirect impacts are incurred by industries which sell products related to clams or otters, such as t-shirts, books and bumper stickers.

Indirect impacts are important in terms of the distribution of benefits and costs across members of society rather than in terms of the balance of benefits and costs. The indirect benefits to the Pismo Beach tourist industry due to clamming are actually direct costs to clambers (represented by the area OACT in Figure 1). From a broad economic perspective, therefore, indirect benefits are cancelled out by direct costs. However, the identification of the numbers and varieties of groups who benefit indirectly from either clamming or otter expansion is just as important to the design of appropriate management policy as is the estimation of direct benefits minus direct costs.

Unfortunately, data on the distribution of indirect benefits of recreational clamming to the Pismo Beach economy are not available. As a preliminary move in this direction, data were collected from clambers and from customers of firms in the tourist industry to profile tourists and clambers in terms important to the tourist industry--party size, length of stay, and spending patterns. The results are presented below.

DATA ANALYSIS AND RESULTS

Patron Survey

Two surveys were conducted in Pismo Beach--a tourist firm patron survey and a clammer survey. The patron survey was conducted from December 1979 through August 1980. A self-selected sample of 636 patrons completed a brief questionnaire at the cash register of one of ten motels, one recreational vehicle (RV) park, one sports shop, four restaurants and two liquor stores. Each respondent indicated the data, his reasons for being in Pismo Beach, the size of his party and the length of his stay.

With these data, a statistical evaluation of the difference between clambers and nonclambers can be drawn, assuming the survey respondents are a random sample of all patrons of tourist firms. First, it can be determined whether clambers and nonclambers are statistically different from one another in their other reasons for being in Pismo Beach. Table 1 list fifteen reasons offered by respondents for being in Pismo Beach and the percentage of clambers and nonclambers claiming those reasons. The percentages listed are generally different for clambers and nonclambers, but these differences apply only to the sample, not to the population of all clambers and nonclambers. A statistical t-test allows us to determine whether differences in the sample percentages suggest that there are statistical differences in the population percentages. The t-test determines the probability that the population of all clambers and nonclambers are different in their percentages when sample percentages are different. When this probability is fairly low (e.g., less than 5%), we can be fairly confident (e.g., at least 95% confident) that clambers and nonclambers do differ in the reasons cited.

Table 1

REASONS FOR VISITING PISMO BEACH BY CLAMMER VS. NONCLAMMER

Reasons	Percentage Indicating Each Reason		
	Clammers	Nonclammers	Probability ^a
Travelling through Vacation stop	4.1	21.2	<.025
Sightseeing	24.8	35.7	>.10
Resident	7.4	16.7	>.10
Camping	5.0	8.0	>.25
Business	18.2	8.0	>.10
Clamming	1.7	15.9	>.01
Fishing	100.0	0.0	-
ORV use	27.3	1.7	<.05
Cultural/social event	6.6	8.0	>.25
Visiting friends	2.5	1.9	>.25
Shopping	2.5	3.5	>.25
Sunbathing	0.8	1.0	>.25
Rest	0.8	1.2	>.25
Other recreation	2.5	1.4	>.25
No. of respondents	121	515	

^aProbability of no difference between percentages for all clam-
mers and nonclammers.

The results indicate that very small chances exist for no differ-
ences in the percentages of clammers versus nonclammers who are travel-
ling through Pismo Beach, who are in Pismo Beach on business, or who are
going fishing. Clammers are less likely to be travelling through or on
business but more likely to be going fishing than are nonclammers. In
all other reasons, clammers are not statistically different from nonclam-
mers. In particular, they are no less likely to be residents, no less
likely to be on vacation, no less likely to be camping, and no less like-
ly to use offroad vehicles (ORVs).

Second, it can be determined whether clammers and nonclammers are
statistically different in their patronage of different types of tourist
firms. Table 2 categorizes patrons by the type of business at which the
survey was completed as well as by whether the patron clammed or not.
Of 636 respondents, 121 or 19% indicated they clammed. Given that the
percentage of sample clammers by type of business differs from 19%, a t-
test was performed to determine the probability that the percentages are
not different from 19% for all clammers. Using a 5% probability cutoff
level, the data suggest that clammers are less likely to use motels and
restaurants, but no less likely to use RV parks and sports shops, and
more likely to use liquor stores (fishing licenses are sold in liquor
stores).

Table 2

CLAMMERS VS. NONCLAMMERS BY TYPE OF TOURIST BUSINESS PATRONIZED

	Type of Firm						
	Motel/ Hotel	RV Park	Sports Shop	Rest- aurant	Liquor Store	Row Total	% of Sample
Number of Clammers	48	16	14	5	38	121	-
Percent of Column	12.2	26.7	26.4	9.4	50.0		
Percent of Sample	7.5	2.5	2.2	0.8	6.0		19.0
Number of NonClammers	346	44	39	48	38	515	
Percent of Column	87.8	73.3	73.6	90.6	50.0		
Percent of Sample	54.4	6.9	6.1	7.5	6.0		81.0
Column Total	394	60	53	53	76	636	
Percent of Sample	61.9	9.4	8.3	8.3	11.9		100.0
Probability ^a	<.0005	>.05	<.10	<.01	<.0005		

^aProbability of no difference between percent clammer composition by type of firm.

Third, it can be determined whether clammers are statistically different from all patrons in their length of stay in Pismo Beach. Data on length of stay for patrons from the patron survey and for clammers from the clammer survey are presented in Table 3. The data suggest that clammers typically stay for fewer days than do typical tourist firm patrons.

Table 3
LENGTH OF STAY IN PISMO BEACH AREA

Days	Patron Survey			Clammer Survey		
	#	%	Cumulative %	#	%	Cumulative %
1	35	6.0	6.0	130	33.5	33.5
2	340	58.4	64.4	98	25.5	59.0
3	78	13.4	77.8	80	20.8	79.8
4-7	94	16.2	94.0	69	18.1	97.9
8-14	22	3.8	97.8	6	1.6	99.5
15-30	5	1.0	98.8	1	0.3	99.8
31-260	8	1.4	100.2	0	0.0	99.8
Total Number of Respondents	582			384		
Mean Days	4.25			2.66		
Median Days	2.25			2.13		
Standard Deviation	12.75			2.42		

Probability of no difference in mean party size for population of all patrons and all clammers <.0005.

Fourth, it can be determined whether clammers are statistically different from all patrons in the size of their party. Data on party size for patrons from the patron survey and for clammers from the clammer survey are presented in Table 4. The data suggest that clammers typically travel in larger parties (with relatives and/or friends or social groups) than do typical tourist firm patrons. Of the 89% of clammers in parties of ten or fewer people, the average party size was 4.01 (standard deviation of 2.25), still statistically larger than the average patron party size.

Table 4
SIZE OF PARTY

Number of People	Patron Survey			Clammer Survey		
	#	%	Cumulative %	#	%	Cumulative %
1	63	10.0	10.0	18	4.7	4.7
2	320	50.9	60.9	94	24.3	29.0
3	59	9.4	70.3	52	13.4	42.4
4	86	13.7	84.0	71	18.3	60.7
5	44	7.0	91.0	30	7.8	68.5
6-10	41	6.5	97.5	79	20.4	88.9
11-20	12	1.9	99.4	21	5.4	94.3
21-150	4	0.6	100.0	22	5.7	100.0
Total Number of Respondents	629			387		
Mean Party Size	3.35			7.68		
Standard Deviation	5.06			14.99		

Probability of no difference in mean party size for population of all patron and all clammers <.0005.

In combination, these four tables indicate some basic similarities and differences between clammers and nonclammers (or tourist firm patrons in general). Clammers typically travel in larger parties and stay for shorter periods, making less use of motels and restaurants than typical nonclammers. Clammers are similar to other recreationists, but with a stronger likelihood of going fishing as well than nonclammers.

Nevertheless, there are certain limitations of the quality of the survey data from which these conclusions derive. First, the sample of tourist firm patrons may not be a statistically valid random sample of the entire population of Pismo Beach tourists. Nonrandomness may occur (1) because only tourist firm patrons were sampled, whereas some tourists don't buy anything in Pismo Beach, (2) because not all types of tourist firms were sampled (e.g., service stations, gift shops), (3) because the months of September through November were not sampled, and (4) because respondents were self-selected. Second, the survey responses may be biased or inaccurate. Respondents may have an incentive to give biased answers or may lack information to give correct answers. Generally, the data tend to indicate only the intentions of respondents, because the surveys were not necessarily completed on the last day of each respondent's stay.

Because no spending data were collected for nonclammers, it cannot be determined whether the typical clammer spends less per day or per stay than the typical nonclammer. It is suggested that individual clambers do not spend as much per day in Pismo Beach, because they are less likely to use motels and restaurants than are nonclambers. While the next section presents information on clammer spending, it is evident that clambers as a whole are not a sizeable percentage of tourist visitor days. The more recent local estimate of visitor days is a minimum bound one, based on use of the state beach and campground only. For fiscal 1978, these visitor days were estimated at 2,992,000 (Forst, 1980). Not included in this estimate are visitors who do not use state facilities and who stay elsewhere overnight or visit only for one day. In contrast, a recent estimate of annual clammer days by the California Department of Fish and Game (for December 1975 to November 1976) is 82,000 (Burge, 1980). Assuming these estimates are relatively equivalent for the two periods, clambers account for no more than 3% of annual Pismo Beach visitor days. If clambers abandon Pismo Beach, therefore, it appears that the revenue loss will be a relatively small percentage of total tourist dollars, and may be lost amid the more substantial effects of inflation.

Clammer Survey

The clammer survey was conducted on the beach. A sample of 388 clambers were interviewed from December 1979 to July 1980. The survey was designed to collect data for the identification of socioeconomic characteristics and spending patterns of typical clambers, and for estimation of clammer consumer surplus.

Socioeconomic Characteristics and Spending Patterns

Survey data were collected on residency of clambers, party size, characteristics of clammer parties, types of overnight accommodations

used, expected costs of clamming, and expected spending in Pismo Beach. Table 5 presents the residency patterns of survey clammers. For this study, residents were defined as those living west of the Santa Lucia Mountains and within 30 miles north or south of Pismo Beach. Some 29% of clammers surveyed were residents as least part of the year.

Table 5

RESIDENCY OF CLAMMERS

Residency	#	%
Resident	108	27.8
Nonresident	273	70.4
Part-Time Resident	2	1.8
Total	288	100.0

The characteristics of clamming parties are presented in Table 6. Not surprisingly, the data suggest that clammers typically are more likely to clam with family and/or friends than alone. Average party size is also shown to vary with residency. Nonresident clammer party size averages 9.59, statistically larger than average resident party size (3.16).

Data on overnight accommodations are presented in Table 7. The table indicates that clammers staying overnight are more likely to stay in motels and RV parks than to camp or stay with friends. Some 34% of all clammers do not use overnight accommodations. Some of these are daytrippers while others are residents.

Data on spending in Pismo Beach per clammer day and per party per stay are presented in Table 8. The typical sample clammer spends \$10.18 per day and \$260.45 per party per stay in Pismo Beach. Assuming the sample is random, a statistical evaluation of these data indicate that we can be 95% confident that, for the population of all clammers, average spending is \$8.85 to \$11.51 per clammer day and \$200.92 to \$319.98 per party per stay. The data can be broken down into spending by area residents versus nonresidents. As expected, nonresidents spend substantially more in Pismo Beach than residents in connection with their clamming activities. A statistical F-test indicates that the probabilities of no difference by residence in average spending per clammer day and per party per stay for the population of all clammers are .0026 and less than .00005 respectively.

Table 6

CHARACTERISTICS OF CLAMMING PARTIES

Type of Party	#	%
Alone	19	4.9
With Friends	91	23.5
With Family	133	34.3
With Family and Friends	145	37.4
TOTAL	388	100.0

	Party Size			
	All Sampled Clammers	Residents	Nonresidents	Part-Time Residents
Mean	7.68	3.15	9.59	2.43
Standard Deviation	14.94	1.73	17.46	1.13
Number of Respondents	387	107	273	7

Probability of no difference in mean party size by residency for the population of all clammers is .0005.

Table 7

TYPE OF OVERNIGHT ACCOMMODATIONS USED BY CLAMMERS

Type of Accommodation	Number of Clammers	% of Clammers Staying Overnight	% of All Clammers
Hotel/Motel	67	26.5	17.5
Campground	49	19.4	12.8
RV Park	124	49.0	32.5
Friends	13	5.1	3.4
Total ^a	253	100.0	66.2

^aOf 382 respondents, 129 are not included in this table, either because they were residents or did not stay overnight.

Table 8

CLAMMER SPENDING IN PISMO BEACH

	\$ Per Clammer Per Day		\$ Per Clammer Per Stay			
Mean	10.18		260.45			
Standard Deviation	11.80		528.71			
Number of Respondents	303		303			
95% Confidence Interval	8.85-11.51		200.92-319.98			
	Residents	Nonresidents	Part-Time Residents	Residents	Nonresidents	Part-Time Residents
Mean	1.54	11.74	0	5.10	302.74	0
Standard Deviation	2.45	12.21	0	12.72	559.70	0
Number of Respondents	30	216	1	40	260	3
95% Confidence Interval	0.63-2.45	10.11-13.37	-	1.04-9.16	234.71-370.77	-
Probability of no difference by residency in average spending for population of all clamblers		.0026			<.00005	

Data on costs associated with clamming are presented in Table 9. The typical sample clammer incurs costs of \$24.36 per clammer day and \$412.33 per party per stay. Assuming the sample is random, a statistical evaluation of these data indicate that we can be 95% confident that, for the population of all clammers, average costs are \$21.17 to \$27.55 per clammer day and \$321.77 to \$502.89 per party per stay. The data can be broken down into costs by residents versus nonresidents. As expected, nonresidents incur substantially larger costs than residents. A statistical F-test indicates that the probabilities of no difference by residence in average costs per clammer per day and per party per stay for the population of all clammers are both less than .00005. Average costs tend to be greater than average spending because not all costs are incurred in Pismo Beach.

Table 10 presents data on sample clammer income and employment status. The typical clammer surveyed had an annual family income after taxes of roughly \$22,000, and was likely to be employed or retired. The typical clammer was 48.4 years old (standard deviation of 15.0 years).

Table 11 presents data on years of clamming experience. While 10% of the clammers surveyed were novices, the typical clammer has had some 14 years of experience. The data also suggest that clamming experience is not likely to vary by residency.

Table 12 profiles the frequency of clamming both anywhere and in Pismo Beach alone. The data demonstrate that relatively few clammers surveyed clammed anywhere other than Pismo Beach in the last year, suggesting that the typical clammer clams only at Pismo Beach. The frequency of clamming is also shown to vary by residency, with residents clamming statistically more often than nonresidents (13.52 times in the last year vs. 3.68 times).

Given these data, it is possible to estimate clammer spending in Pismo Beach and clamming costs by residency in Table 13. These estimates are the product of average spending and costs per clammer day in the last year times an estimated 82,000 annual clammer days. The figures suggest that clammers incur costs of approximately \$2,000,000 per year (the value represented by the area OACT in Figure 1), of which some \$840,000 is spent in Pismo Beach in connection with their clamming activities.

Annual clammer spending serves as an indicator of indirect benefits from clamming resources to the Pismo Beach economy. Whether and how much of this spending would be lost due to exhaustion of the fishery is unknown. In an attempt to anticipate the outcome, our survey asked clammers whether they were likely to continue to recreate in Pismo Beach in the absence of clamming. The responses by residency are profiled in Table 14. It is important to recognize that the responses are hypothetical and speculative, subject to unknown biases and inaccuracies. These data, in combination with the multiple activity intentions profiled in

Table 9

CLAMMER COSTS

	\$ Per Clammer Per Day		\$ Per Party Per Trip	
	Residents	Nonresidents	Residents	Nonresidents
Mean		24.36		412.33
Standard Deviation		29.82		849.42
Number of Respondents		336		338
95% Confidence Interval		21.17-27.55		321.77-502.89
	Residents	Nonresidents	Part-Time Residents	Part-Time Residents
Mean	4.17	30.01	0	0
Standard Deviation	9.51	31.07	0	0
Number of Respondents	70	217	3	3
95% Confidence Interval	1.90-6.44	25.88-34.14	-	-
Probability of no difference by residency in average costs for population of all clamblers		<.00005		<.00005
			Residents	Nonresidents
			13.32	524.33
			34.32	930.96
			71	264
			5.17-21.47	412.03-636.63

Table 10

INCOME AND EMPLOYMENT OF CLAMMER RESPONDENTS

Range of Annual Family Income After Taxes		#	%
\$ 0-5,000		20	5.9
5,001-10,000		39	11.5
5,001-15,000		61	18.1
15,001-20,000		57	16.9
20,001-25,000		58	17.2
25,001-30,000		49	14.5
30,001-35,000		19	5.6
35,001-40,000		10	3.0
>40,000		24	7.1
Number of Respondents		337	99.8
Mean	21,951		
Median	17,535		
Standard Deviation	17,892		
Employment Status		#	%
Student		8	2.1
Employed ^a		244	65.8
Retired		111	29.9
Unemployed		8	2.1
Total		371	99.9

^aEmployed is defined to include homemakers.

Table 11

YEARS OF CLAMMER EXPERIENCE

Years of Experience	#	%
0	36	9.3
1	24	6.2
2	24	6.2
3	32	8.2
4-10	93	24.0
11-20	90	23.2
21-40	70	18.0
41-70	19	4.9
Total	388	100.0

	All Sampled Clammers	Residents	Nonresidents	Part-Time Residents
Mean	14.41	16.89	13.49	12.00
Standard Deviation	14.30	15.75	13.24	25.69
Number of Respondents	388	108	273	7

Probability of no difference in mean years of experience by residency for population of all clammers is .10

Table 12

FREQUENCY OF CLAMMING

Number of Times in Last Year	All Times		Pismo Beach Only	
	#	%	#	%
1	83	21.4	92	23.8
2	63	16.3	65	16.8
3	66	17.1	65	16.8
4	35	9.0	31	8.0
5-10	83	21.4	80	20.7
11-20	29	7.5	16	4.1
21-50	22	5.7	22	5.7
51-200	6	1.6	6	1.6
Total	387	100.0	387	100.1

Pismo Beach Only	All Sampled Clammers	Residents	Nonresidents	Part-Time Residents
Mean	6.44	13.52	3.68	5.86
Standard Deviation	13.81	23.27	5.66	3.93
Number of Dependents	387	107	273	7

Probability of no difference in mean frequency by residency for population of all clammers <.00005

Table 13

ESTIMATED ANNUAL CLAMMER SPENDING AND COSTS

	All Clammers	Full-Time Residents	Non- Residents
Estimated Annual Clammer Days	82,000	22,800	57,700
Estimated Average Spending per Clammer Day	\$10.18	\$1.54	\$11.74
Estimated Annual Clammer Spending in Pismo Beach	\$835,000	\$35,000	\$677,000
Estimated Average Costs per Clammer Day	\$24.36	\$4.17	\$30.01
Estimated Annual Clammer Cost	\$1,998,000	\$95,000	\$1,732,000

Table 14

INTENTION TO CONTINUE TO RECREATE IN PISMO BEACH

	Residency of Sampled Clammers					Row Total	Row % of Sample
	Resident	Nonresident	Part-Time Resident				
No. Not Intending to Continue to Recreate in Pismo Beach	9	130	0			139	-
Percent of Column	10.3	56.5	0.0			-	-
Percent of Sample	2.8	40.5	0.0			-	43.3
Number Intending to Continue to Recreate in Pismo Beach	78	100	4			182	-
Percent of Column	89.7	43.5	100.0			-	-
Percent of Sample	24.3	31.2	1.2			-	56.7
Column Total	87	230	4			321	-
Column Percent of Sample	27.1	71.7	1.2			-	100.0

Table 1, suggest that clammers are statistically likely to continue to come to Pismo Beach in large numbers to recreate in other activities, though potentially less frequently.

Clammer Consumer Surplus

Finally, it is possible to use clammer survey data to estimate the annual consumer surplus or net benefit experienced by all clammers. To generate this aggregate estimate, it is necessary to determine the annual consumer surplus experienced by the typical clammer in the survey. The major assumption necessary to the estimation process is that the clammer experiences at least as much annual benefit as costs incurred--otherwise, s/he would choose not to clam. Consequently, we can use willingness to incur clamming costs as a lower bound estimate of benefits received. Next, we assume that the primary determinants of individual clammer frequency are experience, clamming costs, catch and income. In particular, we assume that clammers with more experience or larger catches tend to go clamming more frequently, all other things equal. Conversely, we assume that clammers with higher costs or higher incomes tend to go clamming less frequently, all other things equal. Given these assumptions and the data, it is possible to examine statistically how clamming frequency varies with experience, costs, catch and income across the sample of clammers. This statistical analysis generates a clammer demand function. Then we can isolate the relationship between frequency and costs to estimate the benefit curve BC in Figure 2 for the

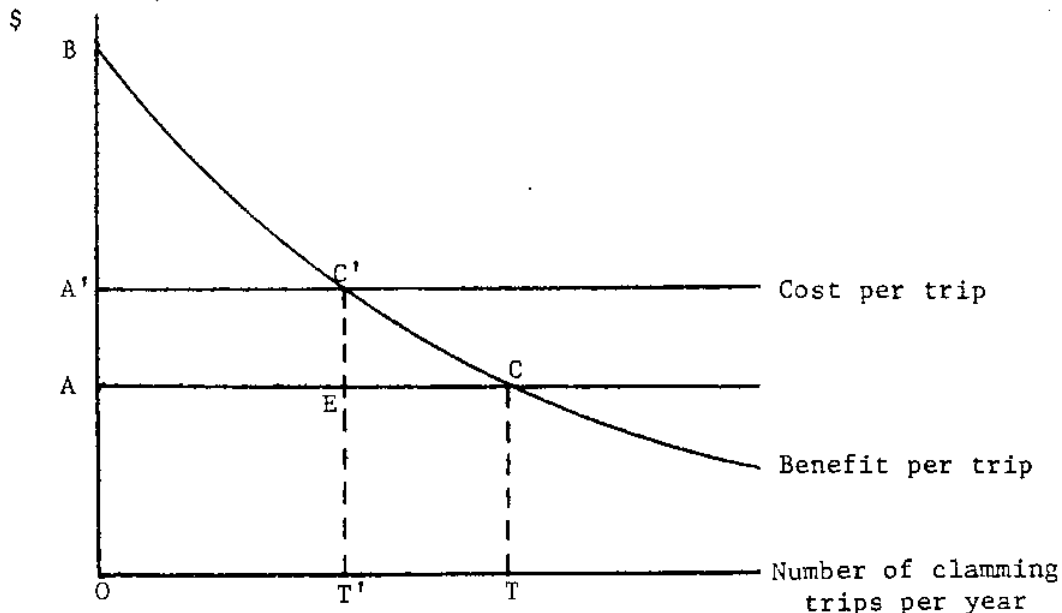


Figure 2

BENEFITS AND COSTS OF CLAMMING FOR THE TYPICAL CLAMMER

typical clammer. Holding all other things (experience, catch and income) constant, when costs per trip are AC, the statistical analysis tells us the clammer will take T trips per year, but that when costs are A'C', the clammer will take T' trips. The curve BC can be expected to represent lower bound benefits (in terms of willingness to incur costs) across all possible levels of clamming costs. Therefore, when we know average annual clammer costs (e.g., OACT), it is possible to estimate average annual benefits OBCT and average annual consumer surplus ABC for the typical clammer in the survey.

The results of this analysis are presented in Table 15.³ The clammer demand function is Equation 1.⁴ The results confirm our assumptions that frequency increases with experience and catch, and decreases with cost and income increases. In particular, the estimated coefficients tell us that a clammer with one percent more experience than the average will go clamming 0.111% more often while a clammer with one percent more income than the average will go clamming 0.1159% less often.

³Several critical assumptions are implicit in the behavioral model behind this statistical analysis. First, it is assumed that individuals minimize their costs of achieving each level of pleasure from a recreational activity. Second, in order for an individual's clamming frequency to be independent of other recreational activities, we must assume that his expenditures demonstrate weak separability (Maler, 1974, pp. 183-89).

Third, we are using actual average catch to help predict frequency when in reality clammers would decide their frequency of clamming on the basis of expected catch. Therefore, we must assume that clammers anticipate their average catch over the year fairly accurately (what economists call consistent or rational expectations). Fortunately, our statistical results do not suggest that this assumption is incorrect, because average catch is statistically significant in predicting frequency. Finally, we assume that clammers are alike in all factors affecting frequency apart from experience, costs, catch and income. Clearly, this assumption is incorrect and it helps explain why these four determinants account for only 19% of the variation in frequency observed in the sample (see the R^2 statistic discussed below). Nevertheless, each of the four determinants used is statistically significant in predicting frequency.

⁴The format is log-linear, meaning that the natural logarithm of clamming frequency is assumed to vary linearly with the natural logarithms of experience, costs, catch and income.

Table 15

STATISTICAL ESTIMATION OF CONSUMER SURPLUS

Equation 1. Clammer Demand Function

$$\text{FREQUENCY} = 12.354 \text{YEARS}^{0.111} \text{COST}^{-0.041} \text{INCOME}^{-0.159} \text{CATCH}^{0.062}$$

$$\text{Probability}^a \quad \leftarrow .0005 \quad \leftarrow .0025 \quad \leftarrow .01 \quad \leftarrow .025$$

$$R^2 = 0.189$$

$$n = 324$$

Equation 2. Clammer Benefit Curve

$$\text{FREQUENCY} = 3,800 \text{COST}^{-0.041}$$

^aProbability of no relationship between determinant and clamming frequency for the population of all clammers.

Using t-tests, the probabilities are less than 2.5% that each of the assumed determinants does not influence clamming frequency for the population of all clammers. The R^2 statistic of 0.189 indicates that variation in the determinants observed across the sample of clammers explains 18.9% of the variation observed in clamming frequency. This is an acceptable value for R^2 for data collected in one period over a large number of individuals.

Equation 2 in Table 15 is the benefit curve, derived from Equation 1 by substituting the mean values from the sample for experience, catch and income into Equation 1. The coefficient of -0.041 on costs indicates that frequency for the typical clammer is generally unresponsive to increasing costs--it means that a one per cent increase in costs will induce a decrease in clamming frequency of only 0.041%. The more inelastic frequency is in its response to variations in costs, the steeper the benefit curve is likely to be and the larger consumer surplus for the typical clammer is likely to be (i.e., when BC in Figure 1 is steeper, the area ABC is larger).⁵ Average annual consumer surplus is estimated by integrating under the benefit curve between the mean and maximum

⁵For other kinds of activities or goods purchased, the coefficient on costs is often greater than one and individual consumer surplus is relatively small.

values for clamming costs.⁶ The resulting estimate is \$240.⁷

Aggregated consumer surplus depends on the number of clambers. Given 82,000 estimated clammer days and 7.44 clamming days per year, we can estimate the number of different clambers at 12,700. Estimated aggregate consumer surplus is then \$3,050,000 (12,700 clambers times \$240 per clammer).

Several caveats need to be mentioned with respect to the preliminary nature of these numbers. First, they indicate the net intangible value lost to the population of clambers because of foregone clamming activity. They are a welfare loss to clambers rather than a revenue loss to the Pismo Beach economy. Second, we have no data on the days of clamming per trip. Our assumption that no one clams more than two days per trip may be incorrect, hereby overestimating clammer costs and consumer surplus. Third, weekday clambers are underrepresented in the sample, because most respondents were surveyed on low-tide weekends rather than low-tide weekdays. However, statistical analysis to determine whether weekday clambers have statistically higher consumer surplus than weekend clambers gave negative results.

There are additional sources of potential biases in the estimates. Clamming trips involve time costs, which are difficult to evaluate. Trips are also generally multipurpose, such that some of the costs of the trip cannot be allocated to different activities. For example, if a family takes a trip to go clamming and fishing, it is not clear what portion of the travel costs to Pismo Beach are clamming costs versus fishing costs. In order to avoid evaluating time costs and allocating travel costs across activities, the survey simply asked each respondent for an estimate of total costs associated with clamming. Implicit in this approach is the behaviorally appealing assumption that the decision to clam is based on the individual's perception of costs incurred. Unfortunately, these clamming cost responses may be biased or inaccurate. Surveyed clambers may have some unknown incentive to over- or underreport costs, and consequently the resulting consumer surplus measure would be over- or underestimated. Or clambers may not be able to report clamming costs accurately on the spur of the moment.

Finally, the consumer surplus estimated represents a potential clamming loss only if the typical clammer reallocates those previous six

⁶ Clamming costs per day ranged as high as \$250. When the top 2% of sample costs were deleted as unrepresentative outliers, the resulting estimate of maximum daily costs was \$100.

⁷ Economists call this measure of consumer surplus compensating variation (Freeman, 1979, pp. 35-43).

or seven clamming days a year to a variety of other activities. In this case, each day reallocated to a different activity at the margin can be expected to generate about as much benefit as cost to the former clammer. Consequently, there is no net gain resulting from the reallocation of time spent clamming. In contrast, all six or seven clamming days may be reallocated to a single new activity (e.g., fishing). In this second case, the new alternative to clamming would generate consumer surplus of its own. Therefore, the loss to clammers resulting from the depletion of the recreational clam stock would be clamming consumer surplus net of the consumer surplus generated in the new activity. It is common to assume that the first case obtains rather than the second. But, to the extent that the second case is more likely, the consumer surplus estimate will overestimate the loss to clammers. All of these caveats must be kept in mind in reevaluating the reliability of the consumer surplus measures.

CONCLUSIONS AND MANAGEMENT POLICY INSIGHTS

The reliability of the data presented is subject to many limitations enumerated above. Within these constraints, certain patterns appear clear. Clammer days account for a relatively small percentage of visitor days to Pismo Beach and less than \$1,000,000 in annual revenue to the Pismo Beach economy. It is anticipated that the exhaustion of the clam fishery by sea otters will not mean the loss of all of this revenue, because clamming trips are multipurpose and because surveyed clammers indicated a likelihood to continue to come to Pismo Beach. In addition, Pismo Beach is located just off Highway 1 and 101, encouraging a healthy tourist industry. Yet, while the revenue loss may be small, it may fall inequitably on one sector of the local economy. Unfortunately, no data were collected to determine whether such an excessive burden is likely.

The annual consumer surplus estimates are \$240 per clammer and \$3,050,000 for the population of all clammers. Whether these values represent the net welfare loss to clammers due to sea otter predation depends on how clammers adjust their recreational activities. If the typical clammer spreads his 6.44 former clammer days across a variety of other recreational activities (e.g., one more day of tennis, one more day of ORV use), it is likely that the new consumer surplus experienced will be less than if the days are reallocated to a single, possibly new recreational activity. This is because the value of increments at the margin to days spent in any recreation are assumed to be low relative to the value of all days spent in one recreation. (If Figure 2 represents benefits in any nonclamming recreation, then this amounts to saying that 6.44 times the area EC'C is smaller than The area ABC.) When new consumer surplus experienced from the shift in recreation is relatively low, the net welfare loss will be large. Without data, it is not clear how much of a net welfare loss clammers will suffer. The magnitude of the effect of the fishery loss on nonconsumptive uses (option value, existence value, preservation value, heritage value) is also unknown.

The foregoing analytic framework and results can be useful in evaluating alternative management policies for sea otters. Given a set of different policies which are feasible biologically and technically, it is possible to analyze their relative socioeconomic feasibilities. While it is not my purpose to provide such explicit analyses here, certain insights can be developed on the choice of appropriate policy from a broad economic perspective. Economists would be concerned with the costs of management itself (e.g., the costs of translocating sea otters to different areas), the means of financing those costs, and the effectiveness of management in promoting benefits of protected resources.

It is likely that management effectiveness is the most problematic of these factors. In general, management is capable of controlling the geographic availability and population structure of either clams (or other shellfish) or otters. Since availability and population structure are the primary determinants of clammer catch (given an appropriate catch limit), management can be effective in promoting clamming benefits. Unfortunately, management effectiveness in promoting the benefits of sea otter protection and expansion is inherently uncertain. This ineffectiveness derives from the nonconsumptive nature of otter protection benefits--viewing benefits plus option value, and existence, preservation and heritage value.

In the case of current and potential viewing benefits, it is not clear the extent to which these benefits might be increased (or decreased) from the expansion (or removal) of sea otters in different geographic areas. Several questions suggest themselves. How does the number of sea otters in an area affect viewing benefits? How does the number of otters in an area affect "viewability"? Beyond some number are the benefits relatively constant? To what extent does the geographic dispersion of viewing sites promote viewing benefits? Or are other characteristics besides numbers of otters at different sites more important to viewing benefits? If the majority of viewing benefits derive from the opportunity to view certain kinds of otter behavior (e.g., eating, breeding) rather than from the numbers of otters available in any given area, then management will be inherently ineffective in promoting viewing benefits.

Finally, it is likely that the majority of benefits associated with sea otters involve not viewing by coastal visitors but rather the knowledge across a national population that sea otters are protected. In evaluating these benefits, further research needs to be done to determine whether nonviewing benefits are affected by otter population size or geographic dispersion. I would venture the hypothesis that these benefits are not site-specific.

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3. ECONOMIC COSTS AND BENEFITS

DISCUSSION

RUDY MANGUE, PRESIDENT, CALIFORNIA ABALONE ASSOCIATION

It's nice to see so many people here, it shows that there's a lot of interest in this shellfish/sea otter conflict. I'd like to start off by saying that I've been in the abalone fishing industry for 20 years, and my father for 20 years before that. In that amount of time, I think I can relate to you just exactly what an abalone fisherman is, what an abalone fisherman has been in the past, and what the abalone fisherman's role is right now.

Other than the early Oriental harvesting and drying of abalone, the commercial abalone industry as we know it today came into being in the 1940s as a commercial industry for the restaurant trade. There was a large abundance of abalone to be had due to the absence of the sea otter for quite a few years. Also there was a large vast area, that was, in those days, more or less inaccessible due to the lack of modern equipment and diving apparatus. In the middle 1950s and 1960s, with the upgrading of diving equipment (for example, the invention of the aqualung for the recreational diver), and more efficient boats and more efficient diving equipment for the commercial diver, we saw increased effort in the commercial industry to get out to areas that hadn't been ventured to before this time, such as the Channel Islands. Therefore, we had very large landings, I think 4 to 5 million pound landings, during those times. We had an absence of sea otters, but not a total absence. There was a small herd of sea otters discovered around the 1940s in the Big Sur area. Industry did not give this discovery much thought at that time.

As the sea otter herd expanded in the 1960s and 1970s, we noticed the total poundage was dropping drastically for the commercial industry. There were many, many different reasons given for this decline--e.g., overharvesting, picking of shorts, etc. In the past, there wasn't as much heeding of rules and regulations as there is today, not only in sport fishing and commercial fishing in the abalone industry, but in all the other commercial and sport hunting and fishing regulations. I think over the last 20 years that people have become more involved with what they're doing and more aware that in order to have resources in the future, they've got to take into consideration the size limits and regulations that will insure resources for the future. This has been the role of the commercial abalone fisherman. Limited entry fishing was established due to the drastic increase in the amount of abalone permits around the 1970s, and the

drastic decline in the total landings. Limited entry fishing was instituted in the abalone industry by the abalone fishermen themselves, and supported by the Department of Fish and Game, to try to alleviate some of these problems. Some other things that the abalone industry initiated were bag limits, larger size limits--these things being the self-regulatory things that would more or less put a little bit of hardship on the diver, but by doing this, he could insure a future himself.

Let me close by saying that the abalone industry has its own seeding hatchery. The fisherman today is very concerned about keeping the resource, not only for himself, but for future generations. It is a renewable resource, and we're not going to have it unless we have management for abalones and sea otters. I'm sure we can have both and the outcome of the forum here, I think, will be a step in that direction.

CAROL ROSE, SECRETARY, CENTRAL CALIFORNIA COUNCIL OF DIVING CLUBS,
INC., SEA OTTER MANAGEMENT EDUCATION

I represent the sport, skin, and scuba diver. I'm on the faculty of the University of California, San Francisco, but in my copious free time I try to dive a lot! Diving, in California, and basically all over the United States, starts with the individual diver, works up to a club, and clubs are often formed into councils, which is where Cen Cal comes in. The councils then form themselves into a national society, which is the Underwater Society of America, and I'm an officer in that organization, also, and there goes my copious free diving time!

I do not represent Cen Cal or its position on the management, or lack of it, of sea otters because Cen Cal does not have a position. Cen Cal chooses to meet each issue as it comes about. It did oppose the potential translocation that was suggested in Santa Cruz several years ago. Amidst all of these diving groups there's an organization called SOME, which stands for Sea Otter Management Education, and is directly interested in management of the sea otter, to protect the sea otter. We are interested in SOME, in protecting the sea otter by zonally managing it, and if necessary, setting up second populations, hopefully outside of conflict with the valuable recreational fisheries and sport and commercial diving. Both of the papers presented today have directly related to the sport diver. We bring in tourist dollars--we have that consumer surplus that Dr. Suzanne Holt wrote about. We spend a lot of money and a lot of time and a lot of value. I will say I don't agree with Dr. Holt when she says once you've clammed once, then each time you clam more, it's less valuable. The divers seem to go out there after the abalone with as much vigor later in the season as they do at first, although I know the opening weekend is terribly popular. The dollar value is very intrinsic, and it can't

be discounted. Among sport divers, there is no one against the sea otter--the sport diver is very interested in renewing both its resource and the lobster, scallop and abalone resources that we treasure also.

WES CARPENTER, REPRESENTATIVE, SEA URCHIN INDUSTRY

I suppose I'm here to sell the sea urchin business to those of you who don't know what it is. You probably know what sea urchins are but you probably don't know how they're used. They've been compared to caviar--they're eaten by wealthy Japanese businessmen while they're talking about business. We don't have a lot of history in the sea urchin business because we're only ten years old. It's become a viable industry in those ten years and we do bring in a lot of trade deficit dollars to this country. In 1980, we estimate we brought in close to \$12 million worth of yen, and although that's not a lot of Hondas and Sonys, it is quite a bit of money!

The sea urchin diver is a businessman, he's a professional, and he works very hard at what he does. We've successfully replaced the sea otter as the natural predator for sea urchins. We're at the point where we're very selective in what we take. We're not going to run our resources out in a whole lot of years--they will last forever, and we'll continue to bring in those trade deficit dollars. The fishery benefits minority employment as well. We have hired approximately 450 employees from minority backgrounds in the ten processing stations that we have in southern California. We hire about 250 divers, plus tenders; we support several other industries. We draw a lot of business into the state, simply because we are the center for sea urchins in the world. A lot of Japanese businessmen come here and as they come here, they consider other investments. There's nothing in the ocean that we do that's harmful, and that's the truth. We don't pollute, we keep a balance that should be there, and I think that even though it's only a ten-year-old industry, it's one that we would want to keep in this country for a long, long time.

SIDNEY HOLT, INTERNATIONAL WHALING COMMISSION

We are all accused by our chairman of having economic interests--I should say that I certainly don't have any economic interest in this discussion. I come to this as a biologist who has worked on marine mammals, certainly, but most of my life is concerned with attempting to integrate biological and economic models of systems which will allow us to make management predictions of the kind that you're trying to do here. Also, I must say, I come to this with a feeling from working with marine mammals that the situation here is by no means unique. There is a world-wide move to find scapegoats to problems in fisheries and everywhere in the world the mammals are

being taken as the scapegoats. I don't mean to say they don't have any effect, but it leads me to look very carefully at any arguments that are made about the effect that the marine mammals have on fisheries!

I think that the attempt to quantify and to identify all of these economic factors as Sue Holt and others have tried to do is a laudable one and a very important one. However, I want to emphasize the pitfalls and problems of doing that. There are enormous technical difficulties in putting commensurate economic values on these different kinds of values that have been identified by the different groups of people involved in these controversies, on the commodity prices, on tourism, etc. We are dealing with a system in which one of the most important values is ruled out of order. And that's the value of the otter fur! Coming to this from the point of view of management, and not of ethics, it seems to me quite unreasonable to try to make any economic assessment which does not include the possible option of allowing otters to increase so much that you could have a fur industry in the future, for future generations of Californians--which would, in value, far exceed all the other values that are being identified. And I'm quite serious about this--I think that sort of thing has to be done if we're going to try to make a reasonable assessment of this.

The third problem is that, in making any economic assessment, one has to specify the time span over which that assessment is made. As a biologist, I worry about what I consider to be not a dynamic, but a static view of the system which you are discussing, whether you're discussing the biological system, or the interaction between humans and the natural system. I should like to give some examples--not necessarily connected with this particular case. One of them is connected with this particular case. The observation has been made that if otters come in, subsequent to that time, there is a certain decline of abalones or sea urchins. It is significant, but it tells me absolutely nothing about what the eventual relationship will be. Everywhere that a predator moves in, it reduces dramatically the numbers initially, but the later numbers, the later balance between the predators and the prey, is totally different and you cannot make a policy on the basis of some transient stage that you are seeing here. We have examples of this with whales, with seals, all over the world, with terrestrial predators. It is completely fallacious to apply a static model in a dynamic management situation. A second example has come where it is fallacious to apply an economic static model to a dynamic situation. The British government, a year or so ago, decided that gray seals had to be culled because they were eating too much fish, and this was made on the basis of poor biology, but even poorer economics, as was later shown when it was looked at closely. For example, the same reduction in the fish catch that could have been affected by an increase in the seals actually led to a greater value of the fish catch because of the elasticity of price of fish. Now, no one seems to me to have been looking at these kinds of things in the

situation that you're debating here. So that again, an example whereby you can, by looking at a static model, come to diametrically the wrong conclusion. There are other examples of this kind, but I wanted to say this because it leaves me very, very uneasy about an oversimplistic approach to this.

It seemed to me that Dr. Partidge, this morning, more than anyone else, has shown an appreciation of what I understand ecology is about: That we are dealing with the dynamics of strongly interacting systems. What does not show in appreciation of what ecology is about, is talk about man moving into the niche of the sea otters. To my mind this is complete rubbish because no other species except man ever reduces its prey down to zero--never! It would never have evolved or survived if that were possible. Therefore, I think that the statement in Dr. Suzanne Holt's paper that biologists anticipate that the otter will be able to exhaust the clam resource in three years, for example, is a slight exaggeration! I look at any such statements with great suspicion because I really think that there is no evidence for them.

JAMES J. SULLIVAN, PROGRAM MANAGER, UNIVERSITY OF CALIFORNIA SEA
GRANT COLLEGE PROGRAM

I'd like to pick up where Dr. Holt left off, because I think the business about oversimplification of difficult problems is what we're talking about here today, and in other places where similar meetings of this nature go on. My role in the university, for example, is to try to judiciously and fairly allocate funds for a variety of research programs. Each time we fund a particular program, at the same time, of course, we are not funding something else. That is the quietest part of the cost of us funding what some people lovingly call our octopus feeding program, which really is an abalone enhancement program! You know, we have things like that we have to worry about! But in taking off on Dr. Sidney Holt's comment of oversimplification, I think what he really said about Dr. Suzanne Holt's comment is she left the traditional, academic qualifier off of the statement in attempt to try to make it simple and understandable to a much broader audience, because it was an economic statement, not a biological statement, that she was making. And I think that has to be pointed out. So we've gotten ourselves caught in this dilemma where, on one hand we try to make matters clear to a wider set of individuals, people in different professions or occupations, of different proclivities, and yet then we get accused of oversimplifying. Yet, it is true, I think, of the kind of meeting that we have here, and I think the organizers are to be commended tremendously not only for such a fine turn-out, but I think, such a balanced presentation on a very controversial issue. So it's this type of thing, I think, that will lead, in tomorrow's discussions, to some development of options.

I think the one thing that everyone here, who has an economic interest or does not have an economic interest, would not like to see, is what Meg Greenfield has labeled "the colonization of the problem," where you can have a relatively large population feeding off of a particular problem as opposed to solving it. This, I think, would fall into what Sidney Holt described as a static approach to the resolution of conflict, as if we simply colonize it and have an annual meeting of this nature to talk about why we've not progressed further from last year. But I think the idea of a dynamic approach is correct. Being an economist, I have a limited understanding of biology or ecology. Correct me if I'm wrong, but in a static equilibrium and in an ecological situation, is it traditional that one specie will dominate a geographical area as opposed to having the diversity that you typically see, say, after a large storm has come in and racked the coast, and everything is sort of scrambling to get a foothold again? Would that be static or dynamic? I need to know the difference if I am to be able to contribute.

GORDON COTA, REPRESENTATIVE, COMMERCIAL FISHERMEN OF SANTA BARBARA, INC.

I'm a commercial fisherman from Santa Barbara, and often, like the sea otter, I feel like an endangered species! On one side there is the development of the oil industry, and on the other side, the advent of the sea otter. I am also, as was said earlier, a member of the environmental community, just like the sea otter. One of the things about the sea otter that we admire so much is its ability to use tools. With that idea in mind, I think the importance of understanding the ability of man to use tools also, as a member--as a good member--in the community of ecology, is that if we decide to look at this subject with the use of environmental platitudes, or bureaucratic mumbo-jumbo between two warring agencies, whether they are federal or state, we're not fulfilling our role as good and substantial persons in the ecological community. What a commercial fisherman from Santa Barbara, who fishes crabs in the Point Concepcion area, has to say about the analysis of what it takes to run a Winnebago effectively in Pismo Beach, I cannot address that. But I will try to explain to you that it is not in the interest of the commercial fishing industry to liquidate the sea otter, but only to get it out of the realm of emotionalism and into the field of management, employing tools which we use in the curtailing of the locust, or any other problem we might have.

In the month of June, my wife is going to be "pupping," and I would hate to think at the time that the pup matures that I am faced with the responsibility of telling him or her that I had something to do with the extinction of a specie that is no longer on earth. It is through that responsibility, as a good member of the commercial industry and of the environment, that I feel we should do something other than just have meetings about it and come up with a sound, organized, biologically enriched program for management.

I also would like to give a plug: I am a member of what the Bureau of Land Management affectionately calls, the "Regional Technical Working Group." I am the commercial fishing industry's representative to that group on the Pacific coast. I hope at this time that the environmentalists (which fishermen are also) will not be separated from the fishing community by this wedge of the sea otter in dealing with the common problems which we will be facing with Lease Sale 53 and oil development in the Santa Barbara Channel. I hope we can deal with this as mature, intelligent and conscientious members of the community of the marine environment.

JACK HUNDLEY, REPRESENTATIVE, WESTERN OIL AND GAS ASSOCIATION,
OFFSHORE MANAGER, ATLANTIC RICHFIELD COMPANY

I'm the offshore manager for Arco Oil and Gas, and here today representing the Western Oil and Gas Association. Some of our previous speakers mentioned the conflicts in resource uses or the conflicts of operation in the same general areas offshore. We, in the oil industry, have the concept of joint use of offshore lands and the waters offshore. Primarily, I'd like to mention that the oil industry works right along with thousands of sea otters in the Alaskan waters. Prince William Sound, Cook Inlet, even the great Port of Valdez, from which the Alaskan crude is being transported, are full of sea otters living in harmony with the oil industry. Down here in the Santa Barbara Channel, where I've worked for some 15 years offshore, we have the occurrence of shellfisheries, and have watched the commercial fishermen around the platforms. One notable example of shellfish fisheries is the CALMA project on Platform Holly, where we actually intend to go into commercial growing of abalone in the waters within 200 feet of an oil platform. Here again we see joint use and compatibility with those other uses surrounding us. We in the oil industry have worked with government, defense--we drilled a well in the Tanner Banks in the middle of the Naval defense area. We have fostered fishing, and also at Goleta, where I work, a company is endeavoring to start commercial kelp beds--here again, in the areas of oil operation.

This attitude is fostered by the federal government, which controls all operations in federal waters. I'd like to paraphrase just one sentence here from the Outer Continental Shelf (OCS) Land Act Amendments: "the operations in the outer continental shelf will be conducted in a safe manner to prevent and minimize physical obstruction to other users of the waters or sub soil or sea bed, or other occurrences which may cause damage to the environment or to property or endanger life or health." These are our landlords offshore: the federal government, through the U.S. Geological Survey.

We also talked about the availability of the resource and when we start talking about leases offshore and drilling for oil, I want to point out and make it clear that oil isn't everywhere that we drill for it--it isn't under every lease offered by the federal government. We've got to have a source bed, a reservoir bed, a structure to trap the oil, and last, you must drill a well in the earth to find the oil. There is no scientific way of determining if oil is in any one given spot or not. We can determine if the structures are there, yes, but we must drill wells to find the oil. Very recently, in Lease Sale 53, four of the great geologic basins were withdrawn. That simply reduced our chances of finding more oil to meet our energy needs in the nation.

In addition to that, we're importing some 1½ million barrels of products, such as gasoline and kerosene, that are refined outside the U.S. and brought in. This is the availability of the resource--we're darn near dependent; 45 per cent of our use comes from foreign lands, and we're all well aware of the precarious position of the oil exports from many of the OPEC nations. Dr. Silva brought up the balance of payment, the balance of trade, and I was reminded of the old ancient adage of all economists, that a favorable balance of trade is good for a nation's economic health--i.e., as the economic strength of the nation develops, it generally should have a favorable balance of trade. Right now we're spending about \$100 billion a year to pay for oil that is coming in from outside sources. It isn't exactly conducive to a favorable balance of trade, if you export more than you import, dollar-worth. That concludes my few remarks--I hope to be able to give another short statement tomorrow morning.

CAROL FULTON, EXECUTIVE DIRECTOR, FRIENDS OF THE SEA OTTER

I feel at a considerable disadvantage here, trying to put a dollar value on the sea otter, which to some is worthless, and to others is beyond value. I don't think you can compare the value of shellfish, which are necessary for the survival of one species, with shellfish which are used as a part-time, recreational pastime, or a gourmet luxury item by another species. Shellfish are hardly a staple in our diet, yet finfish, which may be enhanced by the return of the sea otter, are. We also have many food options, which the otters don't; however, for those who only value an animal if they can put an economic benefit to man deriving from it, I would offer an observation close to home. It's a brief history of the Pismo Beach area, but it starts long before the history written by the Department of Fish and Game, which Dr. DeMartini read to us this morning.

After the fur trade reduced the otters to near extinction, unnaturally large numbers of clams became available for man's harvest. At Pismo Beach, clams were plowed up for fertilizer and chicken feed. By the early 1900s, the bag limit was 200 clams per day, but by 1948 it

had been reduced to only ten. That same year, the commercial clam fishery was prohibited, because there were no longer enough clams left to support it. Incidentally, the clams we're all enjoying here in Pismo Beach do come from Mexico. They're imported, and I'm not quite sure what that does to the balance of trade! In recent years, before the return of the otters, the average take had declined to three to four clams. However, I am happy to report, the State Department of Parks and Recreation confirms there has been no decrease in state beach attendance since the return of the otter in February, 1979. Souvenir shops are beginning to capitalize on a market for sea otter souvenirs and, unfortunately, I left my visual aids in the car, which are comprised of three photographs of wall-to-wall vehicles on Pismo Beach on the Fourth of July. We all know the tremendous tourist attraction that the otter is on the Monterey Peninsula, and the people make good money selling otter souvenirs, some businesses doing over \$175,000 a year.

We know the otter is likely to enhance kelp harvesting, the kelp industry which is estimated to be worth between \$30 and \$60 million dollars annually. But there's something much more important. In protecting the otter, we're protecting ourselves, our coastal-based economies, our tourism, and our fishing industries. Just last May, the U.S. Army Corps of Engineers, hardly a hot-bed of environmental sentimentalists, denied Pacific Gas and Electric a permit which would have enabled them to bring foreign supertankers into Monterey Bay, primarily because it could jeopardize the continued existence of the threatened sea otter. This decision also protected a \$430 million tourism industry in Santa Cruz and Monterey Counties, tourism which is comprised 98 per cent of small businesses and which also hires many minorities, semi-skilled and unskilled laborers. In Monterey County alone, over 17,000 jobs--that's over one-third of the civilian employment--is generated from tourism. It's not that the sea otter is just a tourist attraction, but that the sea otter protects the entire tourist industry and the fishing industry and the reason that we all live along this coastline. Just about two years ago, I appeared before the San Luis Obispo County Board of Supervisors, hoping to head off an anti-otter resolution, and the ugly welcome that awaited the otters when they did return home to Pismo Beach. But today, I'm working closely with the San Luis Obispo County Board of Supervisors, and the San Luis Obispo County area council of governments and other local groups, who hope that the otter's return to San Luis Obispo County shores will protect this county's tourism and fisheries from offshore oil drilling, as it protected Monterey Bay. As you may know, acknowledging that if it's to survive, the southern sea otter is going to require special protection, Governor Brown has just recently asked Secretary of Interior, Andrus to drop the northern tracts in the Santa Maria basin, offshore tracts that do go as far north as Morro Bay. This is Lease Sale 53 that we were discussing a moment ago.

The commercial divers say to me that the sport divers poach because there aren't enough wardens up there to watch them. But the sport divers say to me that the commercial divers could ruin the resource on the north coast if they were up there legally. Since I am sure neither group would have any interest in lying to me, I tend to believe them both! We cannot let short sighted attempts to save diminishing fisheries, that are subject to tremendous human pressures, contribute to the further jeopardy of the otter. We cannot let the sea otter, once sacrificed in man's frantic rush for fur, to again be sacrificed in the risky rush for oil.

TOD GHIO, REPRESENTATIVE, CALIFORNIA SEAFOOD INSTITUTE

I have been accused of wearing three or four hats in my role. I have been president of the California Seafood Institute, representing about 87 per cent of all the seafood houses in the state of California. I also have a restaurant that is quite successful as a seafood restaurant, and my success depends upon how we manage California's marine resources. And tourism is a tremendous factor regarding my own success. Your meeting today has been in part an effort on my part many years ago, to interest somebody in Sea Grant to look into the problem of sea otters as it affects the resources of the state of California. We, in the industry, approved of the Sea Grant program. We, of the industry, affected the Fishery Conservation and Management Act in the areas of management, where the resources of the state of California were concerned. Mrs. Owings said she lived on the Monterey Peninsula for 24 years--my family has been here for 80 years! I, myself, for 45 years, have owned a piece of the coast of California, so I'm really no novice.

As to what should be had in regards to the seafood industry, we have advocated and I have continued to advocate in the state legislature, management of the resources. I say to you, today, if we are to survive in the area of tourism, if we're going to keep California's third largest industry, the restaurant industry, which hires 500,000 people a year, plus the seafood industry, that we must take a logical and a sensible view of the management of the resources. I say that the Friends of the Sea Otters have done a tremendous job in waking us up to the problems of the Endangered Species Act, but the Endangered Species Act has now served its purpose. We must go further now, and see how we can best manage our resources here in the state of California by having a logical plan which I hope will come out of this meeting. After all these years that I have looked at this problem and sent so many letters to legislators and people within the industry (and I always used to sign my name "Damn those sea otters, Tod Ghio"), I got the worst reputation you've ever heard of. Everybody keeps kidding me about the sea otters, but it's only a philosophy--it is not something I have against anything in particular. I want, and my people want, and my family wants, in the industry, that the resources

of the state of California will be perpetuated for all of us to enjoy, and we can only do that with sound management. Our economists and our biologists say it's tough. It is not a tough situation. I do not believe Dr. Sidney Holt in all that language that he used that it is a difficult problem. It is an easy management problem, and we can adjust to this situation by just sitting down and getting this management problem solved. We did it with the buffalo. WE DID IT WITH THE BUFFALO! We've got so many buffalos now that we're issuing permits to go out and shoot them, because they've foraged beyond their ranges. And it's done all over now. We've done our work.

SIDNEY HOLT

I am just trying to respond quickly to Mr. Sullivan's question to me because it's important to me, at least, that I be understood, in this respect. When I talked about a dynamic assessment, not a static one, this was very relevant to the remarks just made. For example, when a predator like the otter comes in, there is evidence about how rapidly the accumulated prey--the abalone, the sea urchins, etc.--decline. However, there is no evidence yet about what the effect of that decline will be on the sea otter itself. Any management action based on science, has to model the future as well as the present. There is no evidence whatever about the interactions in the median term between the abalones, the sea urchins, etc.--even the other animals in the area. This is what I mean when I'm talking about a dynamic model. It looks at the interactions in both directions, not just one direction in the short term.

BILL WOOD

If I may try to repeat a philosopher's question, from an economist's point of view, (that ought to be a good trick!) how valid is the analogy between the buffalo and the sea otter, to put it very briefly, in terms of restoration to some historic period?

CAROL FULTON

The sea otter's range still exists in a relatively, healthy state along most of the California shoreline. There are major problems and major threats. Although I'm not an expert on the buffalo, I don't think that's really analogous to what used to be the buffalo's range! I assume you think we are saying that we want to see a full population of sea otters everywhere they used to be, but what we are talking about, right now, is getting translocations under way to at least reestablish otters in areas where they'll be less vulnerable to oil spills. I am not advocating a translocation of sea otters to San Pedro Harbor or San Francisco Bay, or other inappropriate locations.

BILL WOOD

In terms of considering various marine species for harvest, are there management alternatives comparable to agricultural management systems that might be considered as well?

MAYNARD SILVA

I agree with you, and in my paper I mention the fact that some of the losses to the shellfish fisheries could be offset by mariculture. I think you're right, that trade-off does potentially exist.

JIM SULLIVAN

I think that's a correct statement, but I also think that from an economic point of view, we should point out that it might be at a higher cost. The cost is not going to go down.

JACK HUNDLEY

One point probably bears a little expanding on. The mariculture lease that California Marine Associates has was founded and financed by Arco, of course, but it's intended for the commercial growing of abalone--that was its objective, and it is still progressing. Item two, a study of commercial kelp farming is being conducted by Dr. Neushul of UCSB, and he, too, has a grant. All of these studies are in areas of oil seeps off Coal Oil Point, in areas of oil industry where the crew boats go back and forth quite frequently.

TOD GHIO

On that particular subject, Mia Tegner also planted 92,000 seeds at San Miguel Island in 1979, and we have until 1982 to see how this experiment comes out. Her main concern is whether the sea otters forage down there, because they do not know the legal size of an abalone. It is interesting to me, in all my years of Sea Grant programs, and the aquaculture business which I have followed very, very closely, that I wonder if you people realize that if we zone the sea otters that we will be able to plant and grow their own feed of abalone, within their own areas? There is a possibility--this is no dream! We are growing abalone today, and we can feed that same zone of abalone to the sea otter.

JIM SULLIVAN

Well, I just get the feeling that this idea is going to grab on-- the aquaculture, mariculture as a solution to what we're facing--it's a difficult problem. We're talking about fisheries versus marine mammal protection. Even the gentlemen who raised the question said that mariculture of abalone is not economically or commercially viable at this point. That presumably means one of two things, if not both things, must happen: A) the cost of doing it must come down, or B) the price of the product must go up. So if we're going to go the route of mariculture, there's going to be some higher prices and costs involved, at least initially, until you get to fair-sized units. So I just don't want everybody to say, "Well, mariculture will solve that," and still have the difficult problem to face.

IRENE FABRIKANT, (BERKELEY)

I am somewhat distressed that among all the scientists in the marine sciences, no one has addressed the issue of other population pressures on the population dynamics of shellfish and otters. The pressures, which as one example, might be indicated by the increase in the human population in California over the range of dates cited as associated with the demise of shellfish industry, are some of the issues which should be included in a discussion of this nature.

LAD HANDELMAN

I want to raise a question in connection with a number of statements that have been made, dealing with finfish and kelp beds. I think it should be raised because if it's not raised, it'll be presumed that the statements made were based on established fact. I can say from my own personal experience, that I have yet to see that, one, there have not been flourishing kelp beds in southern California prior to the advent of the sea otter, in fact, I think it's the opposite. There have been tremendous cycles of very healthy kelp beds long before the sea otter arrived. Two, I have not seen that there has been evidence that the kelp beds flourish specifically as a result of the sea otter and only because of the sea otter. So my question has to do with the statements made regarding the kelp bed and finfish-- are they based on established facts or on speculation?

MAYNARD SILVA

Some of the conclusions that I drew about kelp are drawn from the work of Wheeler J. North. In his studies on kelp beds off Point Loma, he indicated that the presence of urchins and other benthic herbivores had decreased the kelp beds. Also a study was conducted in Alaska

where there were two islands, one where otters were present and one where there weren't otters, and other environmental factors were the same for both of the islands. Where the otter was present, the kelp beds were flourishing. Maybe a question might be raised as to whether or not that Alaskan study is applicable to California kelp beds, but the conclusions were based on biological evidence.

CAROL FULTON

There are some very quiet experts on this here today. I think no one is saying that if there are no otters around that other factors don't influence kelp beds. But I think it has been shown, as Dr. Estes said earlier today, that otters and their predation on sea urchins definitely can enhance kelp growth.

PAMELA FERRIS-OLSEN, GRADUATE STUDENT IN WILDLIFE RESOURCE SCIENCE,
UNIVERSITY OF CALIFORNIA AT BERKELEY

My concern is that there are three specific areas of costs involved with the sea otter/shellfish management situation: economic, and we've discussed part of that here; ecological, which has been touched on very little; and opportunity costs--no one has really discussed the potential of having people drive to Oregon or Alaska to look at sea otters. Several people, including Mr. Handelman, have suggested that it would be very easy to go into zonal management. Without going into any great detail on the problems of trying to maintain animals in a certain area, there are certain economic costs involved in having these animals maintained within specific zones. The question is who pays that cost and, if we were to determine and agree today to go into zonal management, is that cost--let's say it's going to cost 5 million dollars a year--equivalent to or more than the returns on the fisheries themselves?

TOD GHIO

I would like to relate to you an economic figure; you can take out of it what you like. The Fishery Conservation and Management Act, when it was first conceived, was said to cost the Americans \$137 million the first year. The second year it was to cost \$237 million. The third year, it was going to cost \$337 million. Well, the figures that were projected for the FCMA, were really totally off base; they all increased about 25 to 35 per cent, because it was far more difficult than they anticipated. They didn't take into consideration the Coast Guard's cost of building more ships, etc. The point I'm trying to make is the fact that, from these costs, we have saved the fish due to the Conservation Act. The fishermen are catching more fish. We have a problem now of selling them! So I think this, in part, could answer your question. Regardless of how much it costs, if the sea otter is that important to us, we will find the method to do this.

RUDY MANGUE

I have here some information on what is at cost with the immediate shellfish resources that are at stake in this conflict. The total primary value of these resources, just on a commercial basis--not on a recreational basis, or what those costs would be to the state for the absence of licenses purchased to go dig clams, or whatever--is \$24,208,000 annually.

SUZANNE HOLT

Unfortunately, that's a gross value, not a surplus value.

MAYNARD SILVA

I think I only answered half of Lad's question when he asked about the kelp and the finfish. There is data on the kelp. I haven't seen any data on the actual impacts on finfish. If anybody has it, I'd be glad to see it.

SIDNEY HOLT

I'm sitting uncomfortably in the middle of the limb, and I want to get myself right out to the end of it right now! I believe that there is not yet any evidence for what is still a persistent assumption that sea otters, in fact, are detrimental to any of the fisheries that have been mentioned. There is no scientifically satisfying evidence as far as I'm concerned--certainly not what has been presented here and certainly not what's in the literature. Therefore, the question that comes to me is, and it's related to the cost, what would be the cost of a research program which would lead to the kind of evidence that scientifically might be acceptable, on which you could base a rational, management scheme? And I think that one of the working groups might well address that question tomorrow. You might very well find that the cost of such a program would be far greater than all the other costs put together.

4 **LEGAL AND ADMINISTRATIVE ISSUES**

Moderator

*Robert L. Friedheim, University of
Southern California*

LEGAL PERSPECTIVES ON THE SEA OTTER CONFLICT

Edwin M. Smith
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INTRODUCTION

The controversy surrounding the conservation of the California sea otter exposes conflict in the legal system and in government policy regarding living resources in the marine environment. The positions of various management agencies reflect different determinations of the appropriate balance between the exploitation of living ocean resources and the minimization of disturbances to ocean ecosystems. Some of the management strategies are at least partially determined by federal statutes which require that priority be given to certain species and groups of species.

The constitutional hierarchy imposed on the relationships between the federal and state governments heightens the conflict, since that structure limits management strategies which may be espoused by the states. While the federal-state relationship results from basic principles regarding the supremacy of the federal government in constitutionally specified areas, the application of these principles in specific situations frequently leads to legal inconsistency and uncertainty. These difficulties are heightened by inadequate biological knowledge of the consequences of most living marine resource management schemes. Consequently, even if legal conflicts are minimized and governmental relationships clarified, the environmental implications of differing management strategies still leave uncertainty.

This paper will review two federal statutes to clarify the federal statutory standards applicable to the management of the California sea otter. In addition, the paper will sketch the constitutional and statutory principles that limit the role of California in sea otter management. Options which may remain open to the state for balancing the interests will be identified. Finally, the paper will briefly consider the effect of the protections afforded to the sea otter upon the development of outer continental shelf oil and gas resources.

The continuing concern for man's impact on wildlife and ecosystems has led to the recent enactment of a number of federal statutes mandating strict conservation oriented principles to be

applied in certain specified circumstances. Two of these, the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) reflect a Congressional determination that, with regard to specified populations, species or groups of species, the effect of human interaction should be minimized until those species establish healthy populations capable of responding successfully to man-caused or natural environmental variation. These two statutes severely limit the management options of California state agencies to balance conservation and exploitation of interrelated marine species in a manner that minimizes political and economic conflict. The MMPA and ESA establish a clear priority for protection and conservation of the sea otter species rather than bioeconomic optimization of human interaction with the entire ecosystem.

THE MARINE MAMMAL PROTECTION ACT

As part of the general concern expressed by elements of American society for the perceived increase in environmental degradation, some groups sought special protection for certain marine species. The plight of the great whales became an international symbol for the entire ecological crisis, since some species were threatened with extinction as a result of commercial exploitation (Norris, 1977). Other species of marine mammals had also become depleted as a result of unregulated harvests.

As an outgrowth of the condition of many marine mammal populations, a number of different bills were introduced before Congress, offering varying degrees of protection for marine mammals (U.S. House of Representatives, 1971; U.S. House of Representatives, 1972). A range of schemes was offered, from complete hands-off conservation to management of marine mammals as a potential food resource. In adopting the MMPA, Congress took a compromise position, seeking to maintain marine mammal populations at levels which would protect the health and stability of the marine ecosystem while maintaining population levels which would result in their maximum productivity. Harvest from healthy populations would only be authorized under very strict standards after extensive public comment and review. However, the difficulty in defining and implementing appropriate management standards has created confusion and uncertainty in some areas. The highly protectionist nature of the statute has caused conflict between government and those commercial interests whose activities are perceived to be in conflict with marine mammal conservation.

MMPA Structure

Moratorium and Waiver

The primary purpose of the MMPA is the maintenance of the health and stability of marine ecosystems; whenever consistent with that primary objective, marine mammal populations should be maintained at that number of animals which will result in the maximum productivity of the population without diminishing the ability of the population's habitat to continue its support function. The operational provision relied upon to accomplish this statutory purpose is a moratorium, a permanent prohibition against the taking of any marine mammal unless that taking is specifically authorized by the agency responsible for implementation of the statute. A statutory "taking" is so broadly defined that virtually any interaction that disturbs the natural behavioral patterns of a marine mammal is in violation of the statute or of regulations promulgated pursuant to statutory authority. Virtually any interaction with marine mammals requires prior authorization.

The bureaucratic authorization of a taking must satisfy three required reviews. Initially, the statute establishes a moratorium with narrow exceptions for scientific research and public display. Upon the determination of facts indicating healthy population levels, the management agency may waive the moratorium as to specified species or populations. Where the moratorium has been waived, general regulations must be promulgated to ensure that any takings pursuant to the waiver are not to the disadvantage of the species or population. Finally, prior to any specific taking, the party proposing the taking must acquire a permit from the management agency to ensure compliance with the general regulations and any other appropriate conditions. Thus, the strict limitation of marine mammal takings is accomplished by making the moratorium subject to species- or population-specific waivers. Once a waiver occurs, permits for takings may be issued upon compliance with general regulations intended to ensure the continued health of that particular species or population of marine mammals.

In order to grant a waiver of the moratorium, certain agency determinations must be made with regard to the population of marine mammals for which waiver is proposed. The managing agency (in the case of the sea otter, the U.S. Fish and Wildlife Service [FWS]) must determine that any takings allowed will be in accord with sound principles of resource protection and conservation consistent with the policies and purposes of the MMPA. By statutory definition, those "policies and purposes" include the maintenance of marine mammals at "optimum sustainable population" (OSP), a population level consistent with maximum productivity without environmental degradation. A species or population of marine mammals below OSP will be certified as "depleted" by the managing agency. Once a species or population of marine mammals has become depleted, the moratorium may not be waived in order to allow population management through takings. The California

sea otter was designated as threatened under the ESA (U.S. Fish and Wildlife Service, 1977); as a result, it is generally assumed to be depleted.

Even if the sea otter population were not depleted, the agency would be required, as a condition precedent to waiver, to make factual findings that any takings from the population or species would not be to the disadvantage of the species and would allow continued maintenance of OSP consistent with the health and stability of the marine ecosystem. Opportunity for a full public hearing on these factual findings must be offered prior to waiver.

Regulations

After the grant of a waiver, the statute requires general management regulations to be promulgated to insure that any takings will not be to the disadvantage of the marine mammal species or population stocks and will be consistent with optimum sustainable population. In prescribing regulations, the agency is required to give full consideration to a number of factors, including: (1) existing and future levels of the marine mammal species and populations stocks; (2) existing international treaty and agreement obligations; (3) the marine ecosystem and related environmental considerations; (4) the conservation, development, and utilization of fishery resources; and (5) the economic and technological feasibility of implementation of the regulations. The consistency of the regulations with the policies and purposes of the MMPA and the above listed factors must also be the subject of a full public hearing on the record; however, the hearings on waiver of the moratorium and on the regulations may be combined.

Finally, any applicant for a permit for takings pursuant to the regulations must show that the proposed takings will be consistent with the statutory policies and the applicable general regulations. If the applicant carries the burden of proof, a permit will be issued specifying the number and kind of animals to be taken, the manner and location of the taking, the period during which the permit will be valid, and any other terms and conditions deemed appropriate. Where a permit is to be issued as a result of the overpopulation of a habitat, transplantation of individual marine mammals to another location within the historical habitat range of the species will be given first consideration before any takings of that population will be allowed.

State Management

Although the MMPA generally prohibits any state from adopting laws or regulations with regard to takings within that state's jurisdiction, the statute does establish a procedure by which a state may have its laws or regulations reviewed and approved by the agency as consistent with the MMPA in order that that state may undertake regulation of marine mammals. In order to be approved, the laws or regulations proposed by the state must be consistent with (a) the general regulations issued by the federal agency with regard to takings

of the population or species, and (b) the purposes and policies of the MMPA with regard to marine mammal management. Since waiver of the moratorium is a prerequisite to general regulations, state management programs may only be undertaken where the species or population sought to be managed is not depleted within the meaning of the MMPA. (If the state laws and regulations do not relate to the taking of marine mammals, such laws and regulations are not clearly prohibited.) Since the California sea otter has been declared threatened under the ESA, bringing it within the definition of "depleted" under the MMPA, it would appear doubtful that any state program seeking to manage marine mammal populations through takings would be lawful. A waiver would be illegal if the sea otter population is held depleted.

THE ENDANGERED SPECIES ACT

On January 14, 1977, FWS published notice in the Federal Register adding the southern sea otter (the California sea otter) to the list of threatened and endangered species protected by the ESA (U.S. Fish and Wildlife Service, 1977). Of the 291 comments FWS received regarding the listing only two were in opposition (one of which was from the state of California). The determination to list the otter was based upon several findings. First, the range currently occupied by the otter was significantly less than its full historical range and was sufficiently limited to make the species vulnerable to environmental disruptions. Second, existing regulatory mechanisms not adequate to protect the sea otter's habitat would be improved by the extension of protection under the ESA. Third, the particular sensitivity of the sea otter to oil spills posed a significant threat to the population since it was located in an area increasingly involved in oil exploration, development, storage and shipment. In order to isolate the effects of this declaration, the first task is to consider the Endangered Species Act and the particular prohibitions and duties it imposes upon those seeking to manage the sea otter.

ESA Structure

Enacted in 1973, the ESA was the result of an evolutionary process involving two predecessor statutes passed in 1966 and 1969. Expanding the obligation of federal agencies to avoid jeopardizing the existence of endangered species, the Act combined prohibition of "takings" with the imposition of affirmative conservation obligations on federal agencies. In the context of the California sea otter controversy, four particular characteristics of the ESA should be understood: (1) the listing process, (2) the taking and importation prohibitions, (3) the obligations imposed upon action by federal agencies, and (4) the provisions for state/federal cooperation in endangered species management.

Listing of Species

Under the ESA, the Secretary of Interior is required to maintain a published list of threatened and endangered species. An endangered species is one in danger of extinction throughout all or a significant portion of its range, while a threatened species is one which is likely to become endangered. In determining whether or not to list a species, the following factors must be considered: (1) present or threatened destruction or modification of the range or habitat of the species; (2) overutilization for commercial or other purposes; (3) disease or predation affecting the species; (4) adequacy of existing regulatory mechanisms; or (5) other natural or man-made factors which could affect the continued existence of the endangered species. At the same time the Secretary lists the species, there must be a specification of any habitat considered to be critical for the species. The determinations to list the species and specify the critical habitat must be made on the best scientific and commercial data available after review of the status of the species and consultation with interested parties and states that may be affected. Public notice and opportunity for comment are required whenever any of the above determinations are to be made for a species resident within a state.

The status of each species on the ESA list will be reviewed for change or for removal at least once every five years. Where a threatened species is involved, special regulations may be promulgated to prevent such a species from becoming endangered. The statute also authorizes recovery plans to be developed for the conservation and survival of any endangered or threatened species listed.

Prohibitions on "Takings"

Upon listing, and in addition to any special regulations imposed, there are a number of general prohibitions which become applicable. First, it is unlawful for any person subject to the jurisdiction of the United States to take an endangered species within the United States, its territorial sea, or on the high seas. The term "take" in the statute is defined in a manner which may be even broader than that found in the MMPA; it includes harrassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capturing, or collecting any endangered species, or attempting to engage in any of those acts. Regulations promulgated by FWS define "harm" as any act or omission which actually injures or kills individuals of the species. The definition includes any act causing significant disruption to essential behavioral patterns as well as any significant environmental modification or degradation having the effect of injuring, killing or significantly altering essential behavioral patterns. These regulations include both direct and indirect effects of human activities upon endangered species.

A particularly graphic example of the statutory meaning of the term "take" is found in Palila v. Hawaii Dept. of Land and Natural Resources, a case involving management of game animals whose feeding

habits systematically destroyed the critical habitat of the palila, an endangered species of bird. The state of Hawaii was found by a federal district court to have violated the ESA through habitat destruction by the managed game species. The Ninth Circuit Court of Appeals affirmed the district court, relying on the broad definition of "taking" included in the regulations. The Ninth Circuit asserted that the ESA requires affirmative preservation of an endangered species, an obligation which had been violated by Hawaii since maintaining the game animals in the palila's critical habitat further jeopardized the species. State agencies managing species which are ecologically interrelated with a listed species must now grant a high order of priority to the affirmative obligation to protect that listed species. Obviously, caution should be exercised by state wildlife agencies.

In addition to takings, a number of other activities are prohibited including possession, sale, transportation, importation, or exportation of any endangered species. The statute makes the violation of any regulation pertaining to threatened or endangered species subject to fines of up to \$10,000 for knowing or commercial violations and \$500 for any other violation of the statute. In certain cases, criminal violations will result in \$20,000 fines or imprisonment of not more than one year or both and possible preclusion from commercial activities involving federal licenses or the use of federal lands.

Agency ESA Obligations

The ESA imposes special obligations upon federal agencies by requiring that actions undertaken by those agencies be modified to protect endangered or threatened species. Particular obligations are imposed upon the Secretary of Interior to facilitate species recovery through all departmental programs. The Secretary is required to review all programs administered in his agency and to utilize such programs in furtherance of the purposes of the ESA.

All federal agencies are required to utilize their authorities to promote the ESA by carrying out conservation programs for listed species. Each federal agency is required to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or to result in the destruction or adverse modification of critical habitat of the species unless the agency has received a statutory exemption.

This general obligation of federal agencies has proved to be the most far-reaching provision in the statute. All planning of federal agency action must seek to avoid jeopardy to threatened or endangered species. The Supreme Court pointed out that this language indicates the very high priority intended by Congress to be given to endangered and threatened species in its opinion in Tennessee Valley Authority v. Hill, the famous "snail darter" case, which blocked the operation of a virtually completed dam project because of the necessary destruction of habitat of an endangered species of small fish by the completion of the

project. Dramatic conflicts such as the snail darter situation have been quite rare in the administration of the statute; in general, modification of the proposed agency action during the planning process has been adequate to avoid irreconcilable conflicts between the welfare of an endangered species and the completion of an important federal action (Harrington, 1981). However, there can be no doubt that the protection of an endangered species is mandated to be a first-level priority for federal agencies.

Should it appear that a proposed agency action may jeopardize a listed species, the statute requires the agency proposing the action to consult with the appropriate federal wildlife agency in order to determine the Secretary's opinion as to the effect of the action on the species and its critical habitat. Where the wildlife agency determines that jeopardy to the species is unavoidable, a review procedure may allow application to the Endangered Species Committee, a group of cabinet-level officials, for an exemption from the ESA. If the Committee finds after thorough scrutiny that (1) there are no reasonable and prudent alternatives to the proposed action, (2) the action is in the public interest, its benefits outweighing the benefits of alternatives which preserve the species, and (3) the action is of regional or national significance, the Committee may grant an exemption while establishing reasonable mitigation and enhancement measures appropriate to minimize the adverse effects of the agency action. Should such an exemption be granted, the statute is not violated by any taking which results from the agency action. This exemption process has rarely been used; in the vast majority of instances, early modification is adequate to allow the proposed action to go forward while protecting any listed species.

State-Federal Cooperation

Although the federal government is instructed to carry out programs authorized by the ESA in cooperation with affected states "to the maximum extent practicable," the statute also contains a preemption provision limiting the applicability of state laws. With regard to interstate commerce in, or exportation or importation of, threatened or endangered species, no state law may permit what is prohibited or prevent what is allowed by the ESA. Any state law relating to the taking of an endangered species may be more restrictive with regard to the grant of exemptions or permits but may not be less restrictive than the prohibitions on taking contained in the ESA.

In a section comparable to provisions in the MMPA, the ESA allows state management of threatened and endangered species upon approval of the state's authorization statutes and proposed management scheme. However, since the California sea otter is a species contained in Appendix I to the Convention on International Trade in Endangered Species of Wild Fauna and Flora, a multilateral treaty, the ESA requires application of its own specific prohibitions, preventing the state from establishing differing regulations with regard to takings. A state may apply for an exemption from the prohibitions in order to

conduct scientific research; however, that application must comply with the extensive permit requirements imposed by FWS regulations to minimize effect on the species and insure the scientific validity of the research. These requirements make it unlikely that takings by California to limit the expansion of the current range of the sea otter could be accomplished by the use of a scientific permit (Armstrong, 1979). In the absence of such a permit, even a state having an approved cooperative agreement could not conduct a management program which involved takings of species listed in Appendix I of the Convention.

Deference to MMPA

It should be noted that the ESA specifically defers to the MMPA where the latter statute contains a more restrictive conflicting provision with regard to species covered by both acts. Since the sea otter is both a marine mammal and a threatened species, that provision ensures that the most restrictive provision contained in either the ESA or the MMPA will be applied in any given situation. The implications of this statutory structure will be discussed in the following section.

ESA, MMPA, AND STATE OTTER MANAGEMENT

Population Management Goals

The ESA and MMPA have a common concern with the conservation of individual species and populations as functioning elements in their ecosystems. Both statutes follow primary standards for species status evaluation based on a population-size spectrum correlated to health, resilience, and adaptability. That spectrum ranges from large populations between biological equilibrium and maximum growth and productivity at one end to small non-functioning populations in immediate danger of extinction at the other end. Both statutes adjust the level of protection afforded to the species or population to maximize that population's inherent ability to survive, function and grow in its ecosystem.

In addition to the general statutory prohibition against the taking of any marine mammal, the MMPA management benchmark is its concept of OSP, a population level usually close to the maximum which will result in the greatest productivity of the species consistent with the continued ability of the habitat to support that population in a healthy state. The OSP concept combines both a measure of the population size and an estimate of the effect of that population on the habitat, with the continued welfare of the ecosystem as the primary criterion.

Once a population falls below OSP, that population is characterized as "depleted" under the MMPA. A population is also determined to be depleted when (1) that population has declined to a significant degree over a number of years, or (2) the population has already otherwise declined and, if such decline continued or became likely to resume, the population would fall under the protection of the ESA. The term "depleted" characterizes those marine mammal populations that are below maximum productivity, requiring additional protection but not yet within the ESA.

Any species or population of plant or animal likely to become subject to a danger of extinction throughout all or a significant portion of its range within the foreseeable future falls within the ESA definition of "threatened." As indicated earlier, a threatened species may be afforded the protections against takings specified by the ESA or it may be protected by other specially tailored regulations.

Finally, at the end of the spectrum are those species which are "endangered" under the ESA, facing extinction throughout all or a significant portion of their range. These species receive the broadest possible protection under the ESA in order to create every opportunity for population recovery.

In addition to their expressed concern for population size as an indicator of appropriate management strategy, both the MMPA and the ESA stress the relationship between species and their ecosystems. The MMPA states no major species of marine mammal should be diminished to the extent that it ceases to be a significant functioning element in its ecosystem; the OSP standard is a means toward that end. The conservation of ecosystems relied upon by endangered and threatened species is a stated statutory purpose of the ESA. The role of the sea otter in the nearshore ecosystem is important under both statutes. Scientific research indicates that the sea otter may play an important role in the preservation of the kelp community, a unique and important aspect of the California coastal ecosystem. In fact, the existence of an abalone fishery may be a result of the near extinction of the earlier sea otter population (Estes and Palmisano, 1974). There is a clear conflict between the requirements of these federal statutes and any state management system that would protect fisheries by maintaining precariously low levels of otter population.

Historically, the extinction of populations or species was a result of natural selection. However it is undeniable that the vast majority of recent extinctions were caused by human intervention into natural ecosystems (Myers, 1979). The protections afforded by the MMPA and ESA are intended to minimize human interference, imposing increasing limitations on human activity as animal populations become less able to maintain their integrity in the face of human activity. In the case of the sea otter, the protections of both statutes apply in the strictest possible terms. The effect upon the options available to the state of California is extremely limiting.

While there has been no formal designation of the sea otter as depleted under the MMPA, the population was described as such when it was listed by FWS as threatened under the ESA. It is conceivable that there could be legal challenges to any formal characterization of the sea otter status as depleted for MMPA purposes. However, it is unlikely that the finding would be overturned; showing that the sea otter was not depleted would be virtually impossible in the face of its listing as threatened. Since oil development and transportation were a critical factor in the decision to list the sea otter as threatened (42 F.R. 2965) the proposed expansion of offshore oil drilling in central California waters would only strengthen the factual foundation supporting the listing, all other factors remaining the same. Thus, those facts which led to the listing of the sea otter as threatened necessitate the characterization of the population as depleted, precluding the MMPA moratorium waiver necessary for California to assume management of the sea otter.

Interplay of State and Federal Law

In order to fully understand the relevance of federal law to state management, it must be remembered that the Constitution makes federal law the supreme law of the land, binding upon the states notwithstanding any state law to the contrary. The constitutional doctrine of preemption prohibits state interference with those powers reserved in the Constitution to the federal government. The history of the application of these doctrines to state wildlife regulation in general and commercial fisheries in particular indicates that very little leeway is left to the states when faced with contrary federal statutes and regulations (Coggins, 1980). As a consequence, the combined effect of the ESA and MMPA on California management poses a virtually insuperable obstacle unless the federal scheme changes to allow California to act.

If California is to limit the natural expansion of the range occupied by sea otters, it is difficult to conceive of any management scheme by the state which would not constitute some form of taking requiring a waiver of the MMPA and promulgation of federal regulations. Even if California adopted a program adequate under the MMPA for the management of a sea otter population at or above OSP, no measure of excellence in that program could overcome the MMPA prohibition of waivers of any moratorium for a species that is depleted. While the state may apply for and receive permits to undertake scientific research which involves takings of marine mammals, it is unlikely that any significant management program involving limitation of the sea otter's range through takings could be carried out under the guise of scientific research (Armstrong, 1979). The requirements under both the MMPA and ESA for continued review of permit activity would probably result in the revocation of state permits used in such a fashion. In addition, the ESA allows any interested citizen to bring suit in federal court to halt the actions of any party violating the ESA. Any attempt of the state of California to limit the sea otter range expansion under an ESA scientific permit would subject

the state to revocation of its permit while exposing both FWS and the state to private civil suit in federal court.

The limitations imposed upon state management by the MMPA and ESA are consistent with the philosophy adopted by both statutes. Under either scheme, the protected species comes first; the conflicting activities of commercial interests are limited in order to protect the species. Committee for Humane Legislation, Inc. v. Richardson, generated by the tuna/purpoise controversy in southern California, leaves little doubt that the MMPA requires that ordering of priorities. In fact, in floor debate of the MMPA prior to its passage, the issue of the California sea otter was raised; the sponsors of the statute clearly indicated that the abalone fishery was of secondary importance relative to the recovery of the sea otter (U.S. House of Representatives, 1972). Both the snail darter case and North Slope Borough et al. v. Andrus et al., involving offshore oil activities in the Beaufort Sea area north of Alaska, indicate that such priorities are also required by the ESA.

SEA OTTERS AND OFFSHORE OIL DEVELOPMENT

During its consideration of Outer Continental Shelf Oil and Gas Lease Sale No. 53, the Department of the Interior considered deletion of a number of tracts initially considered for inclusion in the sale (U.S. Dept. of Interior, Bureau of Land Management, 1980). However, those tracts opposite the current sea otter habitat were not considered. While California's efforts to manage and maintain its abalone fisheries may be restricted by federal statutory protection of the sea otter, those statutes may impose even more limiting requirements upon the activities of the federal government itself. The potential effects of the sea otter population on offshore oil development are significant.

In North Slope Borough et al. v. Andrus et al., a federal district court enjoined offshore leasing activities in the Beaufort Sea north of Alaska. The injunction halted lease sale activities because of potential effects upon an endangered marine mammal. That mammal, the bowhead whale, swims along the Alaskan coast during its annual migration. The district court found that the leasing agency could not ensure that activities pursuant to the leases were not likely to jeopardize the continued existence of the bowhead whale since the agency had not obtained a biological opinion that adequately considered the effects of lease activities. The court prohibited any further lease sale activities until an adequate opinion could be obtained. Although the district court was reversed on appeal, that reversal was based upon a finding that the initial opinion obtained by the agency was adequate for that stage in the lease sale. Subsequent stages in the lease sale must include all measures necessary for the conservation

of endangered species.

The Outer Continental Shelf Lands Act (OCSLA) gives authority to the Secretary of Interior to identify areas of the shelf for exploration and development of petroleum and mineral resources. The outer continental shelf is an area of the seabed beginning three nautical miles from the coastline of California. State jurisdiction ends where the shelf begins, so California has relatively little direct control over federal activities. The Secretary, through the Bureau of Land Management, offers oil development rights under leases granted to high bidders. Once the leases are sold, the federal government revises and approves exploration permits and development plans prior to exploratory and production drilling, respectively.

There is little doubt that the permit and plan approval process constitutes "agency action" for purposes of the ESA. However, there is some question as to the manner in which the stages of the process relate to the agency's statutory obligations under the ESA. At some point, an offshore drilling operation may create a likelihood of jeopardy to the otter population. If takings result, ESA prohibitions will have been violated by the lessee; the agency may be liable as well. Given the uncertainties of offshore drilling and its risk of catastrophic large spills and chronic smaller ones, an incident creating jeopardy for the otter may force the cessation of very expensive drilling operations. Clearly, the ESA imposes significant obligations upon the federal development of California's offshore petroleum reserves. The least the federal government can do is to avoid development which creates environmental risks in order to exploit areas of limited resource potential.

The recognition by the Department of Interior of the potential impact of the sea otter on Lease Sale No. 53 is reflected in several discussions in the Final Environmental Impact Statement (FEIS) for the sale (U.S. Dept. of Interior, Bureau of Land Management, 1980). The FEIS reiterates the Department's duty of compliance with the ESA during the development process. The Department's failure in this regard could expose it to a citizens' suit to enjoin development activities, creating a difficult position since the Secretary of Interior is under a special obligation to preserve endangered species, including the sea otter. The threat posed by continued oil development was a primary reason for the initial listing of the sea otter by the Fish and Wildlife Service, an agency of the Department of Interior.

While California may be effectively prohibited from any form of otter management that involves taking of otters, federal agencies are under an even greater burden to insure that none of their activities are likely to jeopardize the continued existence of any threatened or endangered species. The nature of the limitation imposed upon activities as important to the national welfare as offshore oil development leaves no question as to the priority afforded the conservation of threatened and endangered species under federal law.

CONCLUSION

The conflicts between federal and state agencies regarding a management approach for the California sea otter population are a product of drastically different priority structures. While the state seeks to jointly manage marine mammals and fisheries, federal law affords very clear priorities to two classes of wildlife populations, marine mammals and threatened or endangered species. Since the sea otter falls within these protected categories, the constitutional requirement of the supremacy of federal law severely restricts the strategies available to California. These priorities similarly restrict all federal activity which may pose jeopardy to threatened or endangered species. The realization of California's interests in otter management will require some adaptation of federal priorities before the state may balance the maintenance of fisheries against the conservation of either marine mammals or threatened or endangered species .

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SEA OTTERS AND SHELLFISH FISHERIES IN CALIFORNIA:
THE MANAGEMENT FRAMEWORK

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INTRODUCTION

Other papers in this volume have analyzed conflicts in underlying values and divergent economic and social perspectives on the sea otter/shellfish fisheries issue. As we have seen, significant differences exist in the philosophical perspectives of different groups and in the interests which each of them pursues. Existing management arrangements for the marine environment, however, afford little opportunity for potential reconciliation of such divergent interests.

Throughout history, government has traditionally played the role of arbiter among contending groups and interests, and has, in fact, been the "judge" of "who gets what, when and how."¹ Among primitive traditional societies, for example, formal government institutions first arose as societal interests became more complex and disputes developed. An arbiter or judge (government) became necessary to arbitrate and decide among competing claims. In the marine area, however, such an

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I would like to acknowledge the assistance of a number of highly knowledgeable individuals, both in and out of government, who were kind enough to share their insights on sea otter management with me during a series of personal interviews conducted between September and December 1980. Thanks are also due to my Sea Grant Trainee, Phyllis Grifman, for her research assistance. The interpretations offered in this paper, however, are solely my own.

¹This is the traditional definition of politics.

"arbiter" or overall manager that would be able to govern the use of marine resources and to arbitrate the resolution of disputes such as the sea otter/shellfish fisheries controversy--does not exist.

While the living marine resources that are the subject of this paper (e.g., sea otters, shellfish, kelp, finfish) are highly interactive parts of an overall ecosystem (and as such should be considered in a systemic perspective), the regulations that govern their use and protection emanate from a variety of different agencies at different levels of government and are based on different sources of law. The management framework that governs the marine resources at stake is thus highly complex.

This complexity is partially rooted in our federalism traditions, whereby we have always preferred to delegate responsibilities to different levels of government than to concentrate authority in any one center. In the marine area, federalism factors are especially prominent as the states retain control over many marine activities in the territorial sea (between 0 to 3 miles offshore, in most cases),² while the federal government has primary control over resources beyond the territorial sea. Complexity is also partially due to the fact that a large number of far-reaching pieces of federal legislation separately regulating distinct aspects of the marine environment were passed by the United States Congress in the past decade. Prominent examples include the Coastal Zone Management Act of 1972 (CZMA), the Marine Mammal Protection Act of 1972 (MMPA), the Endangered Species Act of 1973 (ESA), the Fishery Conservation and Management Act of 1976 (FCMA), and the Outer Continental Shelf Lands Act Amendments of 1978 (OCSLA) (U. S. Dept. of Commerce, 1979). Each of these Acts is the product of a very different combination of political forces--some emphasizing conservation factors (such as the MMPA and the ESA), some emphasizing use and development factors (such as the FCMA). Each of these Acts, too, is administered by different agencies or bureaus--each responsive to a different legislative mandate or mission and, ultimately, to a different management philosophy. Some of these Acts, moreover, pioneered novel concepts of management which have been difficult to interpret and to put into effect; prominent examples are the concepts of "optimum yield" in the Fishery Conservation and Management Act and "optimum sustainable population" in the Marine Mammal Protection Act. In view of these factors, the full implementation of this congressional body of marine law in the 1980s may at times prove problematic. As different agencies pursue their legitimately mandated goals and actions, these may come into conflict with the legitimately mandated goals and actions of other agencies. Administrative and scientific interpretations of novel management concepts may not always coincide.

²Texas and Florida are exceptions to this general rule.

The purpose of this paper is twofold. The first (and most extensive) part of the paper describes, in some detail, the existing management framework related to marine mammals, with particular emphasis on the history of management of the sea otter in California. The management framework which governs the use of related marine resources, i.e., shellfish fisheries and hydrocarbon exploitation, is discussed also, although only in very cursory terms. Second, alternative management options are described. Hypothetical management options available in marine mammal/fisheries interactions are reviewed first. Next, the management options which have been most frequently discussed in the sea otter/shellfish fisheries case are presented. Finally, a general framework for evaluating management alternatives is posited.

It should be pointed out at the outset that this paper is not aimed at evaluating alternative management options. Instead, its purpose is to synthesize past and current discussions and preferences on management as well as to offer a general framework for evaluation. The task of making specific judgements about specific management alternatives remains for the policy makers and for other parts of this forum.

PART I: THE MANAGEMENT FRAMEWORK

Managing Marine Mammals: The Sea Otter

Prior to 1972, the states had primary authority over the regulation of marine mammals. This section summarizes sea otter management under state authority until 1972.

Sea Otter Management Prior to 1972

(See Table 1 for summary of management chronology).

As has been discussed in other papers in this volume, sea otters were generally considered to be extinct in California in 1900; however, a remnant group was known to exist (primarily to local residents) near Point Sur at least as early as 1913. California state law began protecting sea otters in 1913,³ and in 1938, through the opening of Highway 1, the existence of the remnant population consisting of 100 to 150 animals became public knowledge. In 1941, the state established the California Sea Otter Game Refuge prohibiting the possession of firearms in state lands west of Highway 1 within boundaries which were enlarged in 1957 to the Carmel River in the north to Santa Rosa Creek, San Luis Obispo County, in the south. From the time of rediscovery to 1972, the

³Through the Fully Protected Mammal Statute enacted in 1913 which prohibits the taking or possession of fully protected mammals.

Table 1

SEA OTTER MANAGEMENT: 1911-1972

1911	International Fur Seal Treaty (United States, Russia, Great Britain, Japan). Prohibited taking fur seals and sea otters on high seas. Terminated 1941.
1913	California state law prohibiting possession of sea otters or skins in California. (Only a few people were aware of the presence of small numbers of sea otters in California [e.g., Pt. Sur lighthouse keeper, DFG wardens]. Not until Highway 1 opened in 1937-38, did the public become aware of the sea otter population at Bixby Creek on the Big Sur coast.)
1941	California Sea Otter Game Refuge instituted, from Malpaso Creek to Swiss Canyon Arroyo (two miles south of Point Sur) and from Castro Canyon to Dolan Creek. Firearm possession prohibited in this area.
1944	Fur Seal Act of 1944. Prohibits take of otters on high seas.
1957	California Sea Otter Game Refuge extended to include all land west of Highway 1 to the ocean from the Carmel River on the north to Santa Rosa Creek in Cambria on the south. No firearm possession.
1965	California Senate Fact Finding Committee, "Effect of sea otters on abalone population is relatively insignificant."
1967	California Senate Concurrent Resolution 74, "Determine feasibility of maintaining both sea otter and abalone populations."
1968	DFG, <u>Report on the Sea Otter, Abalone and Kelp Resources in San Luis Obispo and Monterey Counties and Proposals for Reducing the Conflict Between the Commercial Abalone Fishery and the Sea Otter.</u>
1968	DFG Sea Otter Research Project started. Capturing, tagging, and translocation studies.
1972	Marine Mammal Protection Act passed. Above-mentioned studies ceased as jurisdiction transferred to the United States Department of Interior--United States Fish and Wildlife Service.

otter remained under state control until this responsibility was pre-empted by the federal government through the Marine Mammal Protection Act of 1972. During this time, the otter population grew to approximately 1,700 and its range expanded from Seaside in the north to Cayucos in the south. (See Figure 1.)

Soon after the sea otter began to expand its range, conflicts with the shellfish fisheries developed. Odemar and Wilson report that as early as 1939, researchers were predicting the detrimental effects that the re-establishment of the sea otter population would have on human exploitation of shellfish resources, and that in the 1950s, fishermen began to complain that the sea otter was decimating abalone beds (Odemar and Wilson, 1974, p. 2). There exist few written records of the positions (and of the intensity of such positions) which different groups held in the 1950s. In the 1960s, on the other hand, a highly emotional public debate ensued between abalone fishermen who claimed that their shellfish resources were being depleted by the sea otter, and conservation groups who maintained that man, through such actions as overharvesting and polluting, was responsible for the demise of shellfish stocks--not the sea otter. During the first half of the 1960s, the California Department of Fish and Game (DFG), in fact, publicly adhered to the view of the conservation groups (although some of the department's staff biologists may have disagreed with this position). In 1963 testimony to the California Senate Fact Finding Committee on Natural Resources, the Deputy Director of the California Department of Fish and Game concluded that "...sea otters have been present off the coast of San Luis Obispo County for the past five years. Based on the best scientific information and records which we have, the sea otter, even though feeding on abalone, has not seriously depleted the abalone resource."⁴

Similarly, a 1965 California Senate Fact Finding Committee set up to examine the controversy concluded that, "Information supplied to the Committee on the sea otter's dietary habits...indicates that the effect of the sea otter on the abalone population is relatively insignificant." Therefore, in view of the "precarious position of the State's present sea otter population, the present program of complete protection should be continued indefinitely" (California State Senate, 1965, p. 1).

In the late 1960s, as new studies on the food habits of the sea otter were being conducted (Ebert, 1968), and as the sea otters neared the stretch of coast between Cambria and Point Estero (a highly productive shellfish area accounting for over 40% of the state's harvest of red

⁴This testimony went on to point out that the shellfish depletion could be due to human factors such as the increased competition among commercial fishermen (figures cited showed that the number of licensed abalone fishermen grew from 11 individuals in 1938 to 505 in 1963) (Calif. Dept. of Fish and Game, 1963, pp. 1-6).

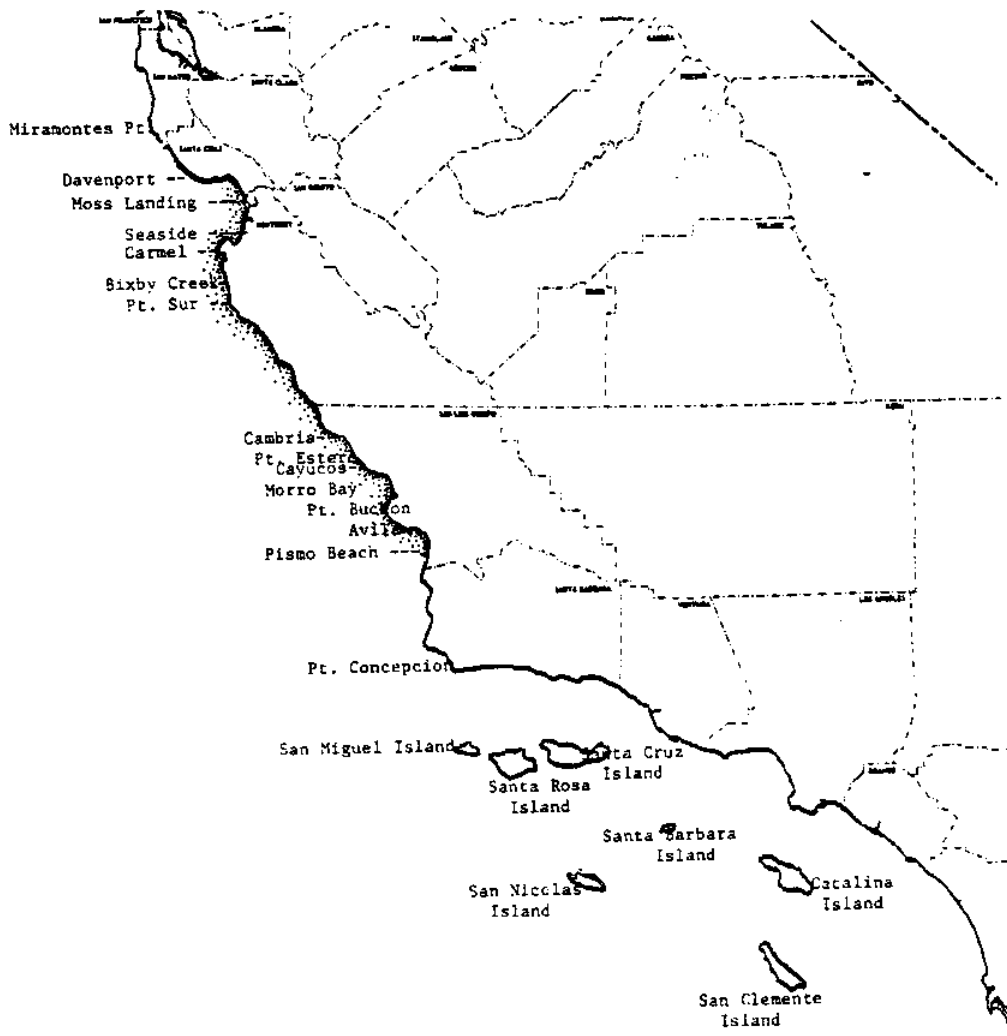


Figure 1

MAP OF CALIFORNIA SHOWING RANGE OF THE SEA OTTER

abalones), the public controversy intensified. In response, during the 1967 legislative session, the California State Senate passed Concurrent Resolution 74 requesting the Department of Fish and Game to determine the "feasibility and possible means of confining sea otters within the protection of the existing refuge or other means that would maintain the abalone and sea otter populations and would lessen the possibilities of resource conflict" (Bissell and Hubbard, 1968). DFG presented its report to the legislature in January 1968 making the following findings and recommendations: (1) presence of sea otters in significant numbers is not compatible with a commercial abalone fishery; (2) resolution of the sea otter/shellfish fisheries conflict should provide for maintenance of both resources (sea otters and abalone); (3) the state should initiate a number of short range and longer range studies to gather information necessary for confident, safe management of the sea otter and to provide a measure of relief to the commercial abalone industry; and (4) funding for these studies should partially come from federal sources (in particular, the federal Bartlett Bill, which called for the state to provide 50% of the necessary funds). The report ended by recommending that the state portion of these costs be borne by the commercial abalone fishery through increases in license fees and other levies.

From 1968 to the present, the state has consistently maintained a position which attempts to strike some balance between protection of the sea otter and preservation of human utilization of the shellfish fisheries through some form of "zonal" management.⁵ Following the 1968 report, the state initiated the Sea Otter Research Project. For the next five years, DFG conducted a series of studies on sea otter biology--e.g., capturing, tagging, and translocating studies, mortality studies, habitat surveys, and food habits studies. As part of this research effort, a limited translocation experiment was carried out, removing otters from the Cambria-Point Estero area to provide some relief to the abalone fishery. This effort failed due to the return of some of the translocated otters and the continued natural influx of additional otters into the area. As the sea otter population continued to extend its range south, the commercial abalone fishery north of Morro Bay completely collapsed (Wild and Ames, 1974). While the intent of the Sea Otter Research Project had been to establish a base of knowledge necessary to formulate a management program, this effort was preempted in 1972 by the passage of the federal Marine Mammal Protection Act. Trapping and tagging operations in progress were terminated on December 21, 1972--the effective date of the MMPA.

⁵This concept is discussed below in the section on management options.

Sea Otter Management After 1972

The Marine Mammal Protection Act was passed by Congress in 1972 largely as a response to the inability of international bodies (such as the International Whaling Commission) to reduce the alarming worldwide depletion of marine mammals due to overharvesting. The Act was supported by a broad coalition of conservation and environmental groups, humane groups, scientists, and state and federal agencies. It was opposed by fishermen concerned with the interference of some marine mammals with fishing operations (as in the tuna/porpoise case). This opposition, however, did not play a central role in the hearings prior to the passage of the Act. Review of the legislative hearings suggests that a broad coalition of conservation interests had achieved the momentum necessary to enact a protective Act; there are very few mentions in the hearings of potential conflicts between marine mammals and fisheries which might arise under a protective regime for marine mammals (U. S. House of Representatives, 1971; U. S. Senate, 1972).

On the contrary, the hearings underscored the numerous hazards to which marine mammals were being exposed--e.g., degradation of the ocean environment (through ocean dumping, pesticides, heavy metal contamination, etc.); man's increasing take of the fish stocks upon which the mammals depend; hazards due to vessel traffic and human operations. The combination of these hazards and the inadequacy of present knowledge of marine mammals in general, led the Congress to the belief that conservative action regarding these animals was required to prevent activities which might prove harmful or irreversible. As one Congressman commented, "As far as could be done, we have endeavored to build such a conservative bias into the legislation." (U. S. House of Representatives, 1971).

At its core, then, the MMPA is a protective Act. Protection was to be attained through a moratorium on the take⁶ of marine mammals (i.e., a "complete cessation of the taking of marine mammals and a complete ban on the importation into the United States of marine mammals and marine mammal products"), a long term research effort to better understand marine mammals and their environment, and a set of prohibitions and penalties for violation of the Act's provisions. A number of exceptions to

⁶The term "take" means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal (Sec. 3[13]).

the moratorium are allowed.⁷ The "taking" of marine mammals under these exceptions must take into account the following considerations (sec. 103 [b]): (1) existing and future levels of marine mammal species and population stocks; (2) existing international treaty and agreement obligations of the United States; (3) the marine ecosystem and related environmental considerations; (4) the conservation, development, and utilization of fishery resources; and (5) the economic and technological feasibility of implementation.

Beyond this immediate (and tangible) protection, there is also a strong concern in the Act with the enhancement of marine mammals and the ecosystems of which they are a part. The Act, in fact, pioneers an ecosystemic view of the marine environment by declaring that

...marine mammals have proven themselves to be resources of great international significance, esthetic and recreational as well as economic, and it is the sense of the Congress that they should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem. Whenever consistent with this primary objective, it should be the goal to obtain an optimum sustainable population keeping in mind the optimum carrying capacity of the habitat (sec. 2[6]).

This language marks a departure from the species-by-species harvest orientation that had been dominant in marine mammal management. "Optimum sustainable population" (OSP) replaces "maximum sustainable yield" as a

⁷The Act sets forth a number of exceptions to the moratorium: (a) the Secretary can issue permits for scientific research and public display after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors. No permits are allowed during moratorium for depleted or endangered species except for scientific research permits; (b) the Secretary can issue permits for taking mammals incidental to commercial fishing operations after two years (no permit is required during the first two years but fishing operations must be conducted in accordance with regulations on gear and techniques designed to produce least practicable harm to mammals, with the goal of zero mortality); (c) the Secretary can, in consultation with the Marine Mammal Commission and consistent with the policy of the Act, waive the moratorium and issue permits to allow commercial taking and importation; (d) in case of economic hardship, the Secretary can allow the taking or importing until October 21, 1973; (e) for certain purposes, such as subsistence, arts and crafts, taking by certain Aleuts, Indians, and Eskimos is allowed; (f) the Pribilof Islands fur seal program is exempt from the moratorium and the permit system but the program must be studied for possible future modification. Certain of these exceptions can be granted only after appropriate public hearings.

management objective, and an holistic approach to the ecosystem is stressed.

In terms of administration, the Act was to be administered by two federal departments. The Department of Commerce (through the National Marine Fisheries Service in the National Oceanic and Atmospheric Administration) was given authority over cetaceans (whales, dolphins, and porpoises), seals and sea lions, and the Department of Interior (through the United States Fish and Wildlife Service) was given authority over sea otters, polar bears, walruses, and manatees.

In addition, the Act established a Marine Mammal Commission (MMC) and a Committee of Scientific Advisors to oversee and conduct research studies and to oversee the coordination of management activities (secs. 202 to 207). The Commission is an advisory body, with no authority for rulemaking or endorsement. Its major duties include: (1) review and study of existing domestic and international laws concerning marine mammals; (2) continuing monitoring of the condition of marine mammals, research programs, methods of management, etc.; (3) conducting studies it deems necessary in conjunction with conservation and protection; and (4) making policy recommendations to the various agencies charged with research, regulation and enforcement related to marine mammals.

The Act also provided for management authority to be returned to the states. Under section 109[2] of the Act, upon state petition, if the Secretary (of Interior or Commerce, whichever is applicable) determines that state laws and regulations are consistent with the Act, management authority may be returned to the state.

⁸The implementation of these innovative concepts, however, has been problematic. The definitions of "optimum sustainable population" (OSP) and "optimum carrying capacity" (OCC) in the Act are tautological; optimum carrying capacity is used to define OSP and OSP is used in defining carrying capacity. In addition, scientific data to properly define these concepts in reference to specific marine mammals and their environments are largely inadequate. A "working definition" of OSP prepared by the National Marine Fisheries Service has been the object of significant scientific debate (Marine Mammal Commission, n.d.; Grifman, 1980).

⁹This split in jurisdiction followed already existing assignments of responsibilities. The Committee was not entirely satisfied with the jurisdictional split but retained the status quo in the hope and expectation of a forthcoming Department of Natural Resources (DNR), which would merge the two programs (U. S. House of Representatives, 1971, p. 179). (Although such a DNR was proposed under the Carter Administration, it has not been established.)

Following the enactment of the MMPA, the period of 1972 to 1980 for sea otter management witnessed a number of conflicts and debates, e.g., a prolonged effort of sorting out federal and state responsibilities and of defining who would have management authority; heightened interest group participation in this debate; and a series of controversies over specific scientific questions. This period also saw the establishment of a number of high quality baseline studies on the sea otter and its habitat.

Soon after the enactment of the MMPA, the California Department of Fish and Game began to prepare an application for a waiver of the moratorium and a return of management authority to the state. This was an effort which went through several iterations and reviews, and which was ultimately to fail. The state's request was consistently opposed by a number of conservation groups, most notably the Friends of the Sea Otter (a non-profit conservation group with over 4,000 members which had worked to promote the protection and enhancement of the sea otter and its habitat for over a decade). The position of this highly influential group has consistently been that the sea otter population should continue to expand naturally throughout its former range. As self-appointed spokespersons for the animal, the Friends are to be credited for their systematic, relentless, well prepared, and ever vigilant attention to management matters related to their preferred critter. Their input into management decisions during the 1972-80 period has been cogent, well researched and presented, timely, and, by and large, successful. The participation of other groups in the management debates of this period has been much more ad hoc and sporadic. While commercial fishermen made their voices heard at specific meetings and vented their emotions in the privacy of their boats and of their communities, this reaction seldom reached the public record in a systematic fashion.¹⁰ Also, among those most affected, the abalone fishermen, were busy during this period with problems specific to their industry, i.e., establishing a program of limited entry for the fishery. The participation of sports groups was also sporadic, with groups becoming active and mobilized only as their immediate beaches were being affected.

In addition, the period from 1972 to present was punctuated by a number of scientific debates. These centered on the taxonomic status of the animal, the likelihood of potential environmental threats to the population, and the role of the sea otter in structuring the nearshore community. While these scientific debates are highly complex and require some scientific understanding, their essence can be briefly summarized here.

¹⁰One exception to this general rule is the presentation of industry viewpoints presented at a meeting convened by California State Senator Donald L. Grunsky on the Sea Otter-Abalone Controversy, at the Moss Landing Marine Laboratory, November 24, 1969.

The debate over taxonomy has centered on the question of whether or not the California population of sea otters constitutes a separate subspecies from the Alaska population. Different views of this question have characterized the scientific literature (Roest, 1976, pp. 267-70; Davis and Lidicker, 1975, pp. 429-37) and have been pursued in the political arena. Conservation groups (such as the Friends of the Sea Otter) have advocated the position that the southern sea otter constitutes a separate subspecies (Enhydra lutris nereis) while others, such as the California Department of Fish and Game, have contended that subspecific separation of California sea otters from Alaskan sea otters is not scientifically justifiable (Miller 1980, pp. 79-81).

Although both the Marine Mammal Protection Act and the Endangered Species Act allow for protection of geographically isolated subpopulations of a species (such as the southern sea otter), the taxonomic debate has important (and yet unresolved) implications for management, particularly for the determination of "optimum sustainable population" under the Marine Mammal Protection Act. While it is clear that the southern population of sea otters is reproductively isolated from the northern population, it is not clear whether these populations were distinct before commercial exploitation occurred. If it could be proven that there are in fact no genetic differences between the populations, the estimate of population size for determining OSP would potentially be different than if distinct gene pools were definitely shown. If no genetic differences were found, the possibility of augmenting the southern sea otter with animals from Alaska arises; similarly, this could be a potentially viable means of ensuring the survival of the California population in the event of a large-scale oil spill. On the other hand, the absence of conclusive evidence of synonymy of southern and northern populations would preclude making OSP determinations based on both stocks.

The likelihood of large oil spills off the California coast and the damage they are likely to cause to the otter population have also been the subject of debate. Conservation groups have maintained that a large-scale oil spill off the California coast is inevitable for a variety of reasons, e.g., the hazardous location of the breeding population of the sea otter which is flanked by two major oil terminals (at Moss Landing in the north and at Estero Bay in the south), the increased oil traffic and oil drift from adjacent areas, and the proposed offshore oil exploration in areas adjacent to the sea otter's current and near future range. "Oil and otters don't mix," conservation groups contend, pointing to the fact that unlike other mammals, otters lack an insulating layer of blubber and depend entirely on their thick air-filled fur for protection from chill waters. Should the otter's fur become contaminated with oil and matted down, it would lose its insulating properties, resulting in overexposure and death (Davis, 1978). On the other hand, other groups, such as DFG, while acknowledging the potential for an oil spill, have held that it would be extremely unlikely that such an oil spill could

threaten the entire sea otter population. DFG has pointed out that no evidence exists that pollution or oil spills have ever caused the death of a sea otter in California (Calif. Dept. of Fish and Game, 1975). However, a study by Barabash-Nikiforov (1968) reports that over 100 sea otters were killed by a spill of gasoline and oil near the Kurile Island in the U.S.S.R.

The role of the sea otter in structuring the nearshore environment has also been the subject of speculation. While the detrimental effects of sea otter foraging on the human use of shellfish fisheries have been accepted by nearly all, potential long range benefits accruing to kelp forests through the re-establishment of sea otters have been suggested by several studies, mostly carried out in Alaska and the Aleutian Islands. Comparison of two chains of western Aleutian Islands showed the importance of the sea otter in determining littoral and sublittoral community structure. The presence of sea otters was associated with the removal of herbivorous invertebrate populations such as sea urchins, which in turn contributed to the growth of luxuriant kelp forests and of a large number of associated living resources. The authors conclude that the sea otter represents a "keystone species" which significantly determines the structure and dynamic relations of the nearshore environment, and its re-establishment along the Pacific coast of North America will have profound ecological effects (Estes and Palmisano, 1974).¹¹ Conservation groups have used such scientific findings to point to the potential beneficial long range consequences of sea otter foraging.

All of these issues came to a head in a 1977 decision by the Department of Interior to place the sea otter on the "threatened species" list, largely because of the potential threat of an oil spill, thus providing another layer of federal protection (the Endangered Species Act) on behalf of the animal. While the Federal Register notice explaining the "threatened" listing referred to the taxonomic status debate, it found that this question was not relevant to the determination of placing the animal under the "threatened" or "endangered" list, since "...Sections 3 and 4 of the Act [the Endangered Species Act] allow the listing of populations of species in portions of their range, as well as entire species and subspecies. Since the southern sea otter does form a significant population, it can be treated independently under the Act, regardless of its taxonomic status".¹²

¹¹ Some California Department of Fish and Game scientists, however, question the applicability of the Alaska-based findings to California coastal waters (Ebert, 1981).

¹² Determination that the southern sea otter is a Threatened Species, Federal Register, Vol. 42, No. 10, January 14, 1977, p. 2965. This Federal Register notice utilized the subspecific designation, Enhydra lutris nereis, in the rulemaking, although this decision had no connection with the decision to list as threatened.

Subsequently, the DFG withdrew its petition for a waiver of the moratorium and, instead, obtained, after several rounds of negotiation, a research permit to conduct a number of tagging and translocation studies. Since 1977, the DFG has thus been involved in sea otter research studies, while the United States Fish and Wildlife Service has been preparing a "recovery plan" which will outline recommendations to promote the recovery of the sea otter population from its present threatened condition under the ESA. Fish and Wildlife has also been concerned with conducting extensive scientific studies on the sea otter and its habitat under the provisions of the MMPA. The Marine Mammal Commission, following its own mandate, has been spurring the concerned parties and agencies along to attain an expeditious resolution of the problem which meets the requirements of the Marine Mammal Protection Act.

Because the management events which have transpired between 1972-80 are too involved to be treated in detail in the body of this paper, they are summarized in Table 2. The following section discusses in more detail current (1980) agency responsibilities and activities.

Current Agency Responsibilities and Activities

As the management chronology in Table 2 suggests, the United States Fish and Wildlife Service (FWS) is the federal agency in charge of administering the provisions of both the MMPA and ESA in reference to the southern sea otter. The FWS carries out management, research, and enforcement activities related to the sea otter at both the Washington, D.C. and area office levels. The role of the DFG is currently solely one of cooperative research and enforcement in conjunction with the Fish and Wildlife Service. The Marine Mammal Commission advises these agencies on both scientific and policy matters.

A schematic diagram of the organization of the FWS is presented in Table 3. Review of this organizational chart suggests that the functions of administering ESA and MMPA mandated management, enforcement, and research activities are diffused throughout the organization. The Office of Endangered Species in Washington D.C. and the Regional Offices carry out functions related to the management of the ESA (e.g., listing and delisting threatened and endangered species and preparation of recovery plans). Relevant research functions under the MMPA are carried out in field stations in California under a line of authority which ultimately responds to an Associate Director for Research in Washington. The MMPA management and enforcement activities are carried out through yet another branch, the Associate Director for Wildlife Resources.

Table 2

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

October 1972

Marine Mammal Protection Act is passed.

December 1973

Endangered Species Act is passed.

August 1974

DFG presents to FWS the first proposal to return management to the state. This was a brief document (circa seven pages) which called for: (1) restricting the sea otter range from Seaside (Monterey County) to Cayucos, San Luis Obispo County by live trapping and translocation of approximately 150 animals existing outside this range, (2) evaluating potential areas outside of this range where resource conflicts would not be present (Guadalupe Island in Mexico is specifically mentioned as a potential site), (3) exploring opportunities for public display in scientific and educational institutions, (4) conducting a research program.

November 1974

The DFG proposal is rejected by FWS, primarily because of the priority given in the proposal to avoiding fishery conflicts. Other values, FWS argued, need greater consideration--i.e., protection of the animal itself, evaluation of total impacts of the sea otter on the nearshore environment (not just those detrimental to shellfish fisheries), establishment of an invertebrate fishery reserve to include the coastal area having the best abalone and Pismo clam populations whereby sea otters would be removed from this reserve but would be allowed to increase and become established in all other areas; encouragement of mariculture of abalones; translocation of sea otters to other selected sites; study of the ecological relationships, particularly with regard to whether sea otters increase the total productivity of the environment.

Explanation of Abbreviations

DFG	California Department of Fish and Game
FWS	United States Fish and Wildlife Service
ESA	Endangered Species Act
MMPA	Marine Mammal Protection Act
MMC	Marine Mammal Commission
OSP	Optimum Sustainable Population

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

February 1975

Position statement by the California Chapters of the Sierra Club opposing the 1974 DFG proposal to return management to the State.^a Restriction of the sea otter's range is dangerous and premature because tampering with an animal that is making a slow comeback from near extinction and that is still listed in the Redbook of Threatened Wildlife in the United States is inappropriate. Strongly oppose limiting the animal's range in any way, preferring to allow it to expand naturally along the California coastline as it has gradually been doing for the last 64 years. Particularly oppose artificial restriction of their range to the coastal area between Seaside and Cayucos which would make the entire California population extremely vulnerable to catastrophe, i.e., death from the oil spill potential from tanker traffic related to the two oil terminals at the northern and southern edges of the range. Recommend that, to provide a reserve group, a separate colony of otters be established well away from man-induced hazards. Oppose Guadalupe Island as a possible translocation site because of the lack of jurisdiction and surveillance by state or federal agencies. Prefer, instead, San Nicolas Island since it formerly had a significant sea otter colony, presently has a healthy marine mammal population, and is subject to minimal human activity.

May 1975

The Fund for Animals, Inc. requests the FWS to list as endangered species 216 taxa of plants and animals which appeared in Appendix I of the Convention of International Trade in Endangered Species of Wild Fauna and Flora which were not already on the United States List of Endangered and Threatened Wildlife. One of these 216 taxa was the Southern Sea Otter (Enhydra lutris nereis). This proposed rulemaking appears in the Federal Register on September 26, 1975.

November 1975

DFG comments on FWS proposed rulemaking putting the sea otter on the endangered species list. Requests that the southern sea otter (Enhydra lutris nereis) not be declared endangered or threatened as it does not fit any of the five factors used to determine if a species is endangered or threatened. Moreover, believes that the subspecies classification of Enhydra lutris nereis is invalid.

^aLetter from the Ventura Chapter of the Sierra Club to the Secretary of the California State Resources Agency, February 5, 1975.

Table 2 (cont.)

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

January 1976

DFG submits its second request to delegate to the state the authority to conduct management and research under Section 109 (a)(2) of the Act, which requires a waiver of the moratorium to take sea otters as required under Section 101 (3)(A). DFG also announces its intention to submit a scientific research permit under Section 101 (a)(1) of the Act in the near future so that the "research projects contained in the management proposal be initiated as soon as possible." This second request for the return of management consisted of an impressive set of materials; close to 300 pages in text and summaries, and more than 400 pages of appendices. Objectives: (1) to provide adequate number of otters in specific areas, to protect, at the same time, the state's remaining recreational and commercial shellfish fisheries, and to enable possible development of marine aquaculture. Provisions: (1) enforcement of MMPA regulations, (2) restrict otter's mainland range from Miramontes Point in San Mateo County to Avila in San Luis Obispo County, (3) sea otters emigrating out of this range will be: translocated to the northern range limit, or be made available for scientific study or public display, (4) research program on population dynamics, (5) research program on long-term impact of sea otter foraging upon coastal ecosystem.

April 1976

Friends of the Sea Otter critique of DFG plan to FWS.^b (1) Oppose a waiver of the moratorium and return of management to the state, (2) consider the southern sea otter to be a threatened and endangered subspecies, (3) propose establishment of a formal otter reserve from Miramontes Point to Avila (and the establishment of a second population on San Miguel Island) not for purposes of containment but to give the otters additional protection through the designation of a "State of California Fish and Game Subdistrict" and through increased warden protection, (4) support establishment and long-term monitoring of baseline studies in areas occupied and not occupied by otters (establish shellfish preserves free from human use to carry out baseline studies so that man's effects on the environment may be isolated), (5) support limited study and experiments of otter behavior.

^b Letter from the Friends of the Sea Otter to the Secretary of Interior, April 1, 1976.

Table 2 (cont.)

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

May 1976

DFG request to FWS for scientific permit to conduct research while petition for a waiver of the moratorium and a return of management to the state are being considered.

June 1976

Marine Mammal Commission letter to FWS commenting on DFG request for management and on the status of the sea otter. (1) The southern sea otter should be classified as a "threatened" species under the Endangered Species Act (under the ESA, in USC. 1532 [15], "threatened" is defined as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range). (2) Although the taxonomic status of the sea otter is a matter of scientific controversy, it is irrelevant for a consideration of "threatened" status under the ESA. As an isolated population, the California sea otter fits the definition of "species" of the ESA and of "population stock" of the MMPA; the population is hence appropriately subject to the management regime of both statutes. (3) The population should be classified as "threatened" because of the potential impact of one or more oil spills, which coupled with the potential impact of a coincident severe natural storm or inclement weather could endanger the population in the foreseeable future. (4) The MMC recommends that the sea otter be classified as threatened and that sea otters be reintroduced into two or more locations previously occupied by these animals. Regardless of the threatened designation, however, translocation should be undertaken as it is a necessary and desirable management action to protect the existing population. (5) Implication for designation of "threatened status" for state application to return management: "threatened" status would make the population "depleted" under Sec. 3 (1)(B) of the MMPA. Under Sec. 101 (a)(3)(B) of the MMPA, the Secretary would thus be prohibited from issuing any permits, except for scientific research. A waiver of the moratorium would thus be precluded. California would only be able to apply for a research permit.

January 1977

The FWS designates the southern sea otter (Enhydra lutris nereis) as a threatened species. Summary of comments received prior to determination: out of 291 letters received,

Table 2 (cont.)

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

289 favored listing as endangered. In addition, many hundreds of persons signed petitions supporting the endangered classification. Only two parties opposed listing, one being the state of California and the other being a university professor whose reasons largely paralleled those of the state. FWS finds that the animal should be designated as threatened, largely on the same grounds as the MMC opinion above, i.e., threat from oil spill potential emanating from the major oil unloading facilities at Moss Landing and at Estero Bay.

August, October 1977

MMC approves DFG research permit, with a number of modifications. In October 1977, DFG begins ESA sponsored studies on sea otter mortality rates and causes, interrelationship between the sea otter and its habitat, size distribution and movements, and sea otter translocation. In terms of translocation, DFG proposes to translocate up to 40 otters from present range and translocate in area north of migrant front. Also, work with FWS to examine Pacific coast for possible sites to establish additional population.

May 1978

Letter of SOME to DFG. (SOME stands for Sea Otter Management Education, a sports oriented group, whose policy is to "protect the California sea otter by working for the establishment of a separate isolated subpopulation of California sea otters outside the state of California, if necessary, while at the same time attempting to get the state of California and the federal government to accept the concept of zonal management of sea otters in California so as to protect valuable recreational and commercial shell-fisheries.") Opposes translocation experiments to the Santa Cruz coast, as proposed by the DFG research plan, because of the damage that would be incurred to the shellfish fisheries in the area. Maintains that such experimental translocation is premature because no permanent translocation sites have yet been selected. Proposes British Columbia as a potential translocation site.

August 1979

DFG changes translocation proposal away from actual translocation to simulated experiments (i.e., putting the animals in holding pens), in an effort to separate the effects of the handling and transportation methods from those imposed by releasing animals in unfamiliar surroundings.

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

August 1979

Sea Otter Workshop held at Santa Barbara Museum of Natural History. Summary of management positions expressed by different groups:^c DFG: (1) favor zonal management, (2) management authority should be returned to the state, (3) oppose "threatened" designation, (4) all potential translocation sites should be explored using two criteria: (a) area must be capable of providing adequate shelter and sufficient food, (b) there must be minimal conflict between sea otters and existing or potential shellfish fisheries. FRIENDS OF THE SEA OTTER: (1) population should be allowed to expand naturally, oppose zonal management; (2) must establish two or more reserve breeding colonies away from oil spill potential; (3) favor San Nicolas Island as the best choice for a primary translocation; (4) oppose long distance translocations to Canada or other areas north of the contiguous United States; (5) ESA protection should be continued at least until two reserve breeding colonies have been established, MMPA protection should continue until OSP levels have been reached throughout former range; (6) support federal agent and state warden protection. SOME (SEA OTTER MANAGEMENT EDUCATION): (1) favor zonal management; (2) oppose threatened designation; (3) oppose San Nicolas as a translocation site; (4) oppose subspecies argument; (5) favor exploring possible translocation sites outside of California and possibly outside of the United States. Specifically favors Canada. CALIFORNIA ABALONE ASSOCIATION: (1) favors the translocation of sea otters to sanctuaries; (2) Port San Luis to the Davenport Pier should be designated as a sea otter sanctuary; (3) favor the translocation of sea otters to other states; (4) supports the return of management to the state; (5) oppose San Nicolas as a translocation site as they would soon disperse to all the other Channel Islands and to the mainland. IUCN (INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE): (1) restrictions of sea otter population (either in numbers or distribution) at this time to preserve local shellfish fisheries are premature and not in the best interest of this isolated and precariously situated population; (2) support threatened status; (3) favors establishing new colonies away from oil spill potential.

^cMinutes of meeting taken by Dr. Maynard Silva, University of California, Santa Barbara.

Table 2 (cont.)

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

December 1979

Meeting convened by the Marine Mammal Commission to review the process, including administrative considerations and responsibilities, by which the California sea otter issue(s) may be resolved and to establish a steering committee composed of representatives of the appropriate government agencies to coordinate and facilitate this process. Participants: FWS, MMC, DFG and its Sea Otter Scientific Advisory Committee. Principal contact personnel were to be designated by each agency.

June 1980

First draft of FWS recovery plan for the southern sea otter available for technical review only. Second technical draft due in December 1980.

July 1980

Second meeting of the inter-agency committee established by the Marine Mammal Commission. The Manager of the Area Office of the Fish and Wildlife Service in Sacramento was designated as sea otter spokesperson for FWS. Recovery plan process and timetable discussed. Extensive revisions of first draft suggested, e.g., more information on the risk and consequences of oil spills, consideration of options for minimizing the risk and possible consequences of oil spills, discussion of taxonomy question and implications of this debate for management options, more extensive consideration of alternative translocation sites. In reference to the latter, it was agreed to develop criteria to judge the biological/ecological suitability of possible transplant sites, compile and evaluate relevant biological/ecological information to identify and rank possible transplant sites in California, Washington, Oregon, British Columbia and Mexico, compile relevant socioeconomic information that should be factored into decisions concerning the suitability of potential transplant sites in the aforementioned areas, and to incorporate this information in the second technical review draft of the recovery plan.

November 1980

Newly formed shellfish fisheries group, Save Our Shellfish Committee, announces in an interview in Marine Mammal News that it is considering filing a petition with FWS to remove the sea otter from its current threatened status under the ESA.

Table 2 (cont.)

CHRONOLOGY OF SEA OTTER MANAGEMENT 1972-1980

December 1980

Letter of MMC to FWS expressing concern that the progress made to date on California sea otter problem has been too slow. Recommends that the FWS adopt the following approach: (1) Recognize the ultimate need for "zonal management" whereby the sea otter would be restored to additional sites within its former range although not to each and every area it once inhabited. (2) Recognize that zonal management will require establishing sea otter zones where the animals may be secure from human and oil threats and recover to optimum levels, and designating otter free areas because of unsuitable habitat, or because otters didn't previously inhabit such areas, because of hazards in translocation, or because of substantial conflicts with fisheries. (3) Realize that zonal management will necessitate development of new methodologies. (4) Realize that it is necessary to move expeditiously to establish a new sea otter site away from oil spill potential. (5) To select an appropriate translocation site and to accomplish the first translocation within 18 months.

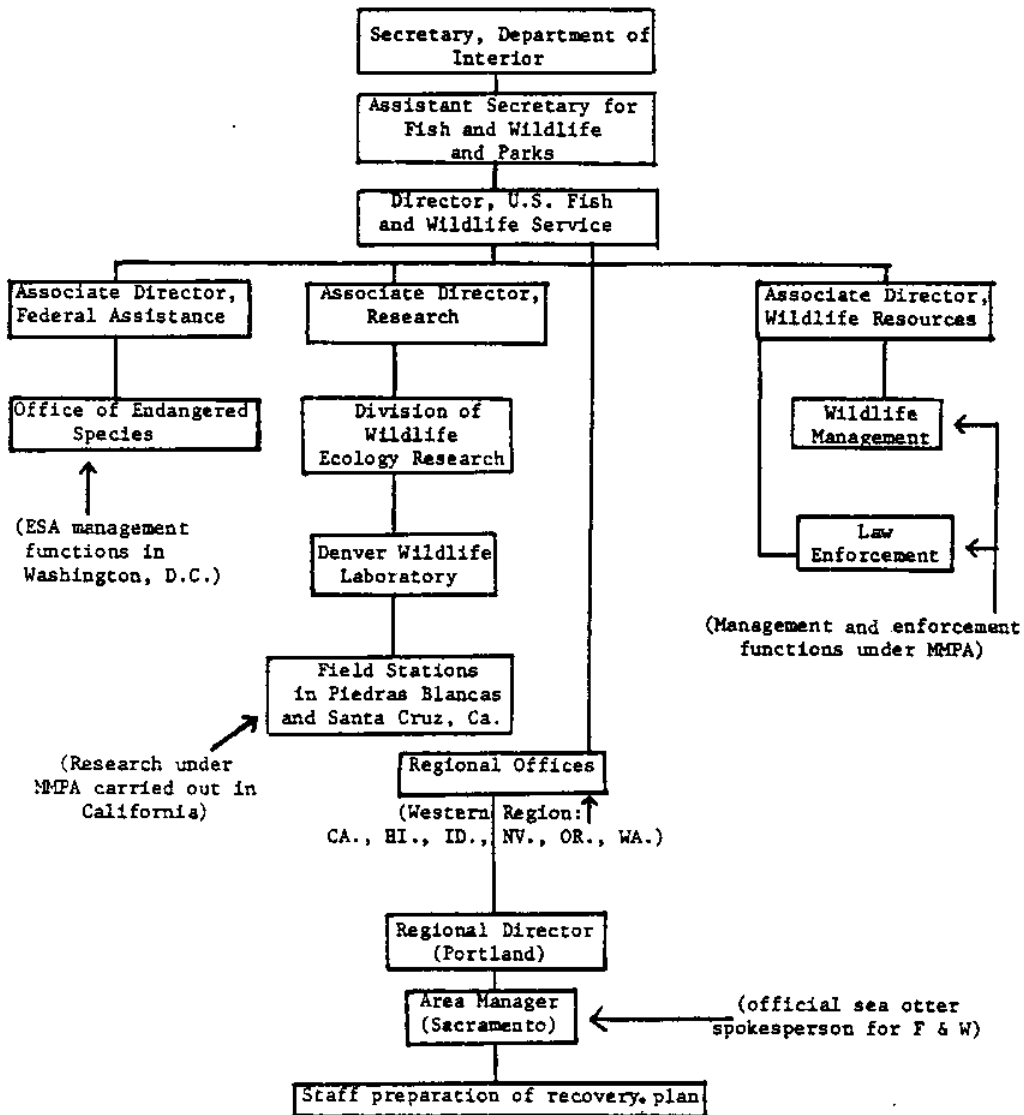
1972-1980

Major comparative research studies on the sea otter and its habitat are being carried out by the Denver Wildlife Laboratory of the FWS under MMPA funding at the FWS field station at Piedras Blancas Point and at San Nicolas Island. The comparative kelp ecosystem studies of these two areas (one currently occupied by otters, the other not occupied by otters), will help isolate the effects of sea otter foraging on near-shore marine communities. Moreover, the baseline study of San Nicolas Island (begun in 1980) may be useful in documenting changes which may occur in the marine ecosystem in the event of recolonization of San Nicolas by the sea otter.

Source: Data reported in this table relies on public documents transmitted during the months reported. Whenever other sources are used (e.g., letters from private groups) these are cited specifically as table footnotes.

Table 3

ORGANIZATION OF FISH AND WILDLIFE SERVICE
WITH RESPECT TO SEA OTTER RELATED FUNCTIONS.^a



^aThis is a simplified organizational chart pertaining only to sea otter related functions. Based on 1979 data and on communication with FWS personnel. Some titles may be out of date.

The diffusion of responsibilities throughout the organization and the lack of a central focus of authority on sea otter issues has baffled local groups not used to dealing with the intricacies of federal government bureaucratic organization and has confounded their efforts to request information and to provide public input into agency decisions. That this feeling may have been shared by other groups and agencies is suggested by the December 1979 request by the Marine Mammal Commission (see chronology) to have Fish and Wildlife designate a specific office or individual as a spokesperson on sea otter related matters. As noted in the chronology, the Area Manager in Sacramento has been designated as the official FWS spokesperson on this issue.

Under his supervision, a "recovery plan" to "restore the sea otter to non-threatened status and eventually to re-establish and maintain optimum sustainable populations in natural habitats throughout their historical range in the United States Pacific Coastal waters" was being prepared as of the time of this writing (December 1980). The major aspects of the first draft of the recovery plan (submitted for initial technical review in June 1980) were as follows: (1) research on biology and ecology of sea otters; (2) development of a sea otter monitoring program whereby declines in numbers and mortality causes may be ascertained expeditiously; (3) development of a habitat protection plan throughout the sea otter's former range (e.g., protecting existing and potential habitat against man-caused degradation that would preclude use of the habitat by sea otters); (4) translocation to other locations within their historical range--only sites within the United States should be considered to insure the continued protection of the animals under the ESA and MMPA; (5) development of a law enforcement plan to protect otters from illegal take and from harassment; (6) development of a contingency plan to capture, clean and move sea otters in case of an oil spill. Implementation of such a plan was proposed as a joint effort between FWS and DFG with funding from Fish and Wildlife (Benz and Kubetich, 1980). A second draft of this plan was to become available for technical review in December 1980, an "agency" review was expected to follow several months later, and adoption¹³ of a final plan by the FWS Director was expected by the end of 1981. The recovery plan review process was thus confined to technical experts and other government agencies.

While a major goal of the endangered species program is to return a listed species to the point where it is no longer endangered or threatened through implementation of a recovery plan, it appears that in general, to date, the recovery plan process has been guided by few formal

¹³These developments are discussed in the Epilogue section of this volume.

guidelines,¹⁴ and that the agency has had limited experience with the actual preparation of recovery plans. As reported in a 1979 General Accounting Office study, for over 700 species on the threatened or endangered list, only 22 recovery plans have been approved (U. S. Office of the Comptroller General, pp. 68-77; U. S. House of Representatives, 1980, p. 6). The effectiveness of these plans in restoring the affected species to non-threatened status has also been limited. Since 1973, only one species has been deleted and six others have gone from endangered to threatened status (U. S. House of Representatives, 1980, p. 8).

It is also unclear whether any opportunities for public participation in agency decision making may be potentially available at some stage of the recovery plan process. Under the ESA, the major opportunity for citizen input is available during the listing and delisting process. Any interested person may petition the Secretary to list or delist an endangered or threatened species. The Secretary must review the status of the species that is the subject of the petition if the petitioner presents substantial evidence warranting the review (U. S. House of Representatives, 1980, p. 10). Once a species has been listed and a recovery plan process commenced, there appear to be no formal opportunities for public comment.¹⁵ However, were a specific recovery plan to contain provisions for federal actions which may significantly affect specific groups or communities, it is possible that such actions could be subject to other federal provisions, such as the National Environmental Policy Act or Executive Order 12044 (regulatory analysis) which do allow for some form of public input. In the case of sea otter management, these are questions which are unclear at this point and are best left for consideration by the attorneys.

¹⁴Sec. 1533(8) of Chapter 35 of the United States Code on the recovery plan process only calls for the Secretary to develop and implement a recovery plan, allowing for the procurement of services of appropriate public and private agencies and institutions and other qualified persons. No specific procedures are set forth, with the exception that recovery teams set up under the subsection will not be subject to the Federal Advisory Committee Act.

¹⁵According to the GAO study, the FWS has instructed recovery teams to address only biological considerations and to leave political, socioeconomic, and media relations concerns to the responsible FWS regional director and other federal and state agencies. GAO criticized the FWS on this question, i.e., "Recovery teams had developed and FWS had approved, recovery plans that were not readily attainable because they conflicted with the views, interest and responsibilities of participating individuals and agencies, or coordinating agencies did not have the funds to implement them" (U. S. Office of the Comptroller General, 1979, p. 75).

Management of Related Uses of the Marine Environment

While the discussion above has focused on the history of issues specifically related to sea otter management, this effort would be incomplete without at least cursory reference to the intricate framework of state-federal relations which governs the use of other, and highly related aspects of the marine environment--e.g., shellfish fisheries, and hydrocarbon exploitation. Responsibilities for managing these resources which may significantly impinge upon and affect the management of marine mammals, is also highly complex and involves a variety of government agencies at different levels of government. As mentioned in the introduction to this paper, however, existing management arrangements of the marine environment afford few opportunities for considering the interrelationships among these uses.

Agencies responsible for managing related uses of the marine environment are abstracted in Table 4. Management of fisheries from 0 to 3 miles offshore is largely the responsibility of the state government, while the management of fishery resources in the 3 to 200 mile zone is currently under federal jurisdiction through a new system of regional council government established under the Fishery Conservation and Management Act of 1976. While the state has formal authority and responsibility for managing fisheries in the 0 to 3 mile zone, state personnel, at times, have claimed that their responsibilities for properly managing shellfish fisheries have been preempted in certain areas by the total federal protection of marine mammals, specifically the sea otter.

The exploitation of offshore oil and gas resources is under the jurisdiction of the federal government through the 1953 Outer Continental Shelf (OCS) Lands Act. This Act charged the Secretary of the Interior with the responsibility for administering the mineral exploration and development of the outer continental shelf. Under the Department of Interior, the Bureau of Land Management (BLM) is designated as the administrative agency for leasing submerged federal lands, and the U.S. Geological Survey (USGS) for supervising production. In the 0 to 3 mile zone, under the Submerged Lands Act of 1953, responsibility for management of hydrocarbon operations rests with the state, i.e., with the Energy Resources, Conservation, and Development Commission (the State Lands Commission and the Division of Oil and Gas).

Current developments in offshore oil and gas leasing off the coast of California dramatically demonstrate the interconnection between marine mammal management and hydrocarbon exploitation. In October 1980, the Department of Interior deleted 127 tracts from Lease Sale #53 off the California coast (north of the Santa Barbara Channel to the Oregon border) following extensive protests by environmental interests and state agencies (Anon., 1980a, p. 4). At the time of this writing (December 1980), the Department of Interior was considering a petition to delete a number of tracts in the Santa Maria Basin because of the potential jeopardy to the threatened sea otter (Anon., 1980b, p. 4). Both

Table 4

MANAGEMENT OF SEA OTTERS AND RELATED USES OF THE MARINE ENVIRONMENT

Agencies concerned with sea otter management	Agencies concerned with shellfish fisheries management	Agencies concerned with hydrocarbon operations	Other Relevant Agencies
<p><u>FEDERAL:</u></p> <ul style="list-style-type: none"> - Department of Interior - U.S. Fish and Wildlife Service <p><u>national level:</u></p> <ul style="list-style-type: none"> - Federal Assistance, Office of Endangered Species (ESA management) - Research, Denver Wildlife Laboratory (MMPA research) - Wildlife Resources (MMPA management and enforcement) <p><u>regional level:</u></p> <ul style="list-style-type: none"> - Regional Director - Portland - Area Manager - Sacramento (official sea otter spokes-person) <ul style="list-style-type: none"> - Marine Mammal Commission (MMPA research and management) (advisory) <p><u>STATE:</u></p> <ul style="list-style-type: none"> California Department of Fish and Game - Marine Resources Branch (research permit under MMPA, funding ESA) - Marine Resources Region (enforcement) 	<p>Primarily California Department of Fish and Game</p> <ul style="list-style-type: none"> - Authority over 0-3 miles <p>National Marine Fisheries Service</p> <ul style="list-style-type: none"> - jurisdiction between 3-200 miles 	<p><u>FEDERAL:</u></p> <ul style="list-style-type: none"> Department of Interior - Bureau of Land Management (leasing) - U.S. Geological Survey (supervise production) <p><u>STATE:</u></p> <ul style="list-style-type: none"> - Energy Resources, Conservation, and Development Commission - State Lands Commission - Division of Oil and Gas 	<p><u>FEDERAL:</u></p> <ul style="list-style-type: none"> - Department of Interior - National Park Service (Channel Islands National Park) - Department of Commerce - National Oceanic and Atmospheric Administration - Office of Coastal Zone Management (Marine Sanctuary around Channel Islands) <p><u>STATE:</u></p> <ul style="list-style-type: none"> - California State Coastal Commission

the California Department of Fish and Game and the California Coastal Commission have joined environmental groups in requesting the deletion of the so-called "sea otter tracts." Environmental groups interested in the sea otter have also expressed concern at BLM's recent call for nominations for a proposed May 1983 sale (OCS #73) which encompasses an area stretching as far as 200 miles seaward from the three-mile state boundary, from the Oregon border on the north to the Mexican border on the south (Fulton, 1980).¹⁶

A number of other state and federal agencies may also become relevant actors in considerations of sea otter management, particularly as potential translocation sites are considered. The State Coastal Commission is of relevance primarily through the "consistency" provision of Section 307 of the Coastal Zone Management Act of 1972 whereby federal actions affecting the coastal zone must be consistent with approved state coastal zone management plans (Breedon, 1976). The National Park Service and the National Oceanic and Atmospheric Administration may also become relevant organizational actors as specific sites in the Channel Islands are considered for sea otter translocation. Through the newly created Channel Islands National Park, the National Park Service has jurisdiction primarily over land-based resources on Anacapa, Santa Cruz, Santa Rosa, and Santa Barbara Islands.¹⁷ Through a newly created marine sanctuary, the National Oceanic and Atmospheric Administration has jurisdiction over six nautical miles seaward from the mean high water mark around the same islands. It is likely that management of fisheries in that area will be conducted under a cooperative agreement between the California Department of Fish and Game, the National Park Service and the National Oceanic and Atmospheric Administration.

Some Observations on the Management History

Our review of the long and complex history of sea otter management suggests a number of observations on the management process. First, this has clearly been a long-standing controversy; similar issues have been debated for at least the past 25 years. This debate, while intense, however, has largely been confined to a specialized (and attentive) public. The general public has seldom been involved (or interested).

Remarkably, positions on management have changed little over this long time span, with the exception of the Department of Fish and Game which at first did not fully appreciate the impact of sea otter foraging on the human exploitation of shellfish fisheries. Although details

¹⁶ Further developments on offshore oil are treated in the Epilogue section of this volume.

¹⁷ The Park's boundaries extend one nautical mile out around each island. The state of California retains ownership of these submerged lands, and has management responsibilities for fisheries in the area in cooperation with the National Park Service.

have changed over time, the basic positions of other groups (e.g., conservation groups protecting the animal and commercial fishing interests) have remained essentially unchanged.

The controversy has been punctuated by a number of scientific debates--many of which still persist. Some of these may be essentially unanswerable, while others may necessitate much further work before definitive answers may be found. The first debate over the food habits of the sea otter (the extent to which they actually ingest shellfish which are also sought after by man), was a bitter one and one which seems to have subsided only recently. The role of human action in depleting shellfish resources, however, is still very much in question, being brought up not only in historical terms vis-a-vis such fisheries as abalone, but in more contemporary perspective with reference to the current expansion of the sea urchin fishery (Davis, 1980). The debate over taxonomy (whether the southern sea otter constitutes a separate subspecies or not) may never be settled decisively; some argue that convincing evidence on taxonomic synonymy can only be obtained through long-term studies of the genetic and morphological attributes of both Alaskan and Californian populations. It is possible, too, that the different opinions on the likelihood of threat from oil pollution and other environmental hazards may hinge more on different judgements on probabilities and on different levels of willingness to accept "risks" to the population in the face of uncertainty than on deeply grounded scientific facts--as this area of research (oil pollution sources) is notoriously underdeveloped. Definitive answers to the question of the extent to which the sea otter is a "keystone" species which significantly structures (and enhances) the nearshore environment will have to await the results of time-consuming and well-prepared scientific studies which involve some experimental manipulation, e.g., establishment of baselines, control groups, and the like.

Finally, the sea otter/shellfish fisheries issue has directly involved agencies and groups at the international, national, regional, and local levels. Each of these groups and agencies has been properly pursuing its legitimately mandated legislative mission or its group interest. To mention only the most prominent examples, at the state level, the Department of Fish and Game has been pursuing a management policy which attempts to strike a balance between protection of sea otters and human utilization of shellfish fisheries. This management stance fully conforms to DFG's obligations under Section 1700 of Chapter 7 of the Fish and Game Code which calls for both the conservation and utilization of California's living marine resources. The United States Fish and Wildlife Service, on the other hand, has been pursuing a management policy of complete protection for sea otters--properly following its protection mandates under the Marine Mammal Protection Act and the Endangered Species Act. The Marine Mammal Commission, as required in its own mandate, has been prodding different institutional actors along in reaching a suitable management solution.

As was mentioned in the introduction to the paper, however, as different agencies pursue their legitimately mandated goals and actions,

these may conflict with the legitimately mandated goals and actions of other agencies. This problem is clearly evident in this case. The state's mandate to conserve and utilize fisheries as well as recent federal legislation which promotes the development and utilization of fishery resources (e.g., the Fishery Conservation and Management Act and, more recently, the American Fisheries Promotion Act) can conflict with the federal protection of marine mammals under the Marine Mammal Protection Act. The problem with this management framework, however, is not simply that it is too complex or that different Acts may conflict. Perhaps the greater problem is that avenues for reconciling potential conflicts between different sources of marine legislation are not, at present, readily available.

We turn now to a discussion of the current management options.

PART II: MANAGEMENT OPTIONS

Theoretically, a wide array of alternatives may be available for managing marine mammals, ranging from total preservation to total eradication. The following range of possible options is adapted from a recent workshop on marine mammal/fisheries interactions (Mate, 1977):

1. Total preservation (allow natural expansion)
2. Containment or zonal management
3. Translocation
4. Collection for scientific research or public display
5. Hunting
 - (a) by professional hunters
 - (b) subsistence hunting
 - (c) sports hunting
 - (d) eradication

Reviewing the management positions which different groups have expressed over time (refer to Table 2), we find that the most commonly discussed alternatives with regard to the sea otter have been options one through four: total preservation, zonal management, translocation, and collection for scientific research or public display. Hunting, to my knowledge, has never been proposed as an option in a public document.

Looking more closely at the management preferences held by different groups or agencies at different points in time, we find that most of the approaches to management can be narrowed down to two major alternatives: (1) total preservation (unlimited natural range expansion) and (2) zonal management. The other options, translocation and collection for scientific and public display purposes, can be subsumed under these two major alternatives. It is interesting to note that some form of translocation appears to receive wide acceptance as a management method, but for different reasons. While protectionists view translocation as a method of ensuring the survival of the population (away from oil spill potential), others view it as a method of removing the problem from their doorsteps.

The two major alternatives and the values that they represent thus appear to be as follows:

1. Unlimited natural range expansion

This view maintains that it would be most beneficial for the sea otter and for the marine ecosystems in which it plays a significant role for the California otter to continue to distribute itself along the California and Baja California coasts and offshore islands, and to the north as well wherever its natural movements may take it (Friends of the Sea Otter, 1979). Implicit in this view is, first, a historical perspective which antedates the fur trade (i.e., the argument that "the sea otter was there first"); second, the belief that the sea otter is an endangered population living on "borrowed time" because of the oil threat potential; third, the notion that although sea otter foraging does have detrimental short-range effects in reducing shellfish fisheries, that twentieth century man himself has played an even more active role in decimating these fisheries; fourth, the belief that the long-term benefits of the sea otter in enhancing the nearshore environment (e.g., through regrowth of kelp and attendant living communities), will outweigh any short-range losses.

Translocation under this option is viewed as a necessary method for insuring the continued survival of the animal through the establishment of reserve breeding colonies away from the oil spill potential. Translocation, however, is also viewed with some caution as it may be hazardous to otters, and incomplete scientific information exists on such questions as the appropriate number and mix of animals that are needed to ensure successful translocations. California sites, such as San Nicolas Island, are preferred for translocation. Long distance translocation to Canada or to other areas north of the contiguous United States are opposed, because the otters would no longer be protected under the Marine Mammal Protection Act and the Endangered Species Act.

2. Zonal management

This option attempts to strike a balance between protection of the sea otters and use of shellfish fisheries by humans by setting aside certain areas for otters and others for use by recreational and commercial fisheries. Implicit in this view is, first, a twentieth century perspective on the California marine ecosystem, i.e., although perhaps they grew abnormally because of the absence of sea otters, shellfish fisheries did become available as economic and recreational opportunities for a growing California population in the twentieth century; second, the belief that the sea otter is not an endangered animal; third, the notion that in view of many competing demands on coastal and ocean resources, that a balance can be reached among different uses (a balance between marine mammal protection and commercial and recreational use of shellfish fisheries in this case).

While zonal management has been a long-standing option, methods for containing otters within a "zone" are not well established and would need further research. The major methods that have been discussed in the past have been: using natural barriers (rocky habitats and sandy stretches of beach) as zone boundaries, capturing otters straying away from these zones and making them available for scientific research and public display in oceanariums and the like, and capturing and translocating otters to other locations on the Pacific Coast. Some, however, doubt that such methods will prove feasible and maintain that the only practical means of implementing zonal management is by shooting (Estes, 1980, p. 13).

Translocation, then, is a management method that forms part of both of the major management alternatives that have been proposed. While there is agreement that second populations need to be established, there are intense differences of opinion as to where. As the chronology in Table 2 indicates, at different times the following sites have been proposed: Alaska, Canada, Washington, Oregon, the northern coast of California, San Nicolas Island and other Channel Islands, and southern California. Space limitations in this paper preclude summarizing the pro and con arguments that have been made about each of these sites. Perhaps most importantly, attention must be paid to the process by which suitable sites may be selected--both in terms of the criteria that should be used in making selections and the procedures that should be followed in making such selections (Marine Mammal Commission, 1980). The technological feasibility of translocation also needs to be assessed, as some current studies have expressed pessimism about its potential effectiveness as a management tool. Out of five attempted sea otter translocations in recent years, only one was clearly successful and at least three were almost certainly unsuccessful (Estes, 1980, p. 13). Translocation may also prove to be very costly as capturing, handling, and transporting sea otters involves a highly complex and time consuming process.

Most basically, explicit criteria must be designed by which management alternatives can be evaluated. A possible evaluative framework is abstracted in Table 5. The major considerations (or evaluative criteria) which, in my view, should be taken into account in judging different management alternatives include biological protection, socioeconomic impact, technological feasibility, administrative feasibility, enforcement feasibility, and administrative costs (Cicin-Sain, 1980). These considerations are either rooted in the objectives and requirements of the Marine Mammal Protection Act, or are, as in the case of administrative feasibility, for example, mostly called for pragmatic reasons (e.g., keeping down the costs of government).

The biological preservation criterion (i.e., insuring the current and long-term well-being of a particular species and of its ecosystem) is a primary objective of the Marine Mammal Protection Act. Section 2[6] of the Act states that, "marine mammals have proven themselves to

Table 5
EVALUATIVE CRITERIA FOR JUDGING MANAGEMENT OPTIONS

MANAGEMENT OPTIONS	EVALUATIVE CRITERIA					
	Biological Protection	Socioeconomic Impact	Technological Feasibility	Administrative Feasibility	Enforcement Feasibility	Administrative Costs
Option 1						
Option 2						
Option 3						
Option 4						

be resources of great international significance, esthetic and recreational as well as economic, and it is the sense of the Congress that they should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem." According to the MMPA, then, biological preservation is the major reason for management.

The socioeconomic impact criterion considers the nature and extent of the effects that decisions about marine mammal management may have on specific human groups or communities. This is a criterion for evaluation which could well stand on its own merit. One is always interested in how people are affected by government action and in questions of social equity--what is the overall cost and benefit to society accruing to specific government actions? This criterion is also partially rooted in the MMPA--with specific reference to fishery resources. Under Section 103(b) which prescribes regulations for the taking of marine mammals, the Secretary shall give full consideration to a variety of factors, including "the conservation, development, and utilization of fishery resources."

The technological feasibility criterion raises practical considerations as to whether a particular management alternative is workable given existing levels of scientific knowledge and technical capabilities. Taking translocation as an example, one might question the extent to which sufficient scientific knowledge is available on such variables as the appropriate number and mix of animals that would be necessary to carry out a successful translocation. This criterion is also rooted in the MMPA; Section 103 (b) [5] prescribes that the Secretary shall take into account "the economic and technological feasibility of implementation" in making regulations about the taking of marine mammals.

Administrative feasibility refers to very practical considerations of how a particular management alternative may be carried out. Given the highly complex intergovernmental system that characterizes this management area, what are the best organizational means for implementing a particular management option? What organizational adjustments may be necessary (e.g., adjustment of tasks, responsibilities, communication channels, hierarchical relationships)? What interagency and intergovernmental arrangements are most workable? Through what means can consultation with affected groups, individuals, or agencies best be accomplished?

Enforcement feasibility may, in fact, be considered as an aspect of administrative feasibility. Ascertaining the likelihood of effective enforcement of proposed regulations is a highly pragmatic consideration which needs to be taken into account. Adoption of regulations which may ultimately prove unenforceable (because of political opposition, logistical difficulties, or lack of adequate deployment of funds and personnel) may thwart the intent of any management regime and render it ineffective.

Minimizing the costs of management should be of concern in any consideration of management alternatives. As we discussed earlier, because of the technical difficulties involved in capturing, handling, and transporting otters, management methods such as translocation may prove to be very expensive. Different management alternatives should thus be systematically compared in terms of their cost-effectiveness. In addition, equity considerations as to who should properly bear the administrative costs of running and enforcing a regulatory system (currently being shouldered by the taxpayers) should be raised.

In summary, policy makers need to take into account a variety of biological, social, economic, technological, administrative, and enforcement feasibility considerations in evaluating alternative options for managing sea otters and shellfish fisheries in California. These considerations served as the framework for discussions on management options during the workshop sessions of the conference (see Workshop Questions). A summary of the substance of these discussions may be found in the Plenary Session, elsewhere in this volume.

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4. LEGAL AND ADMINISTRATIVE ISSUES

DISCUSSION

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I do not have extensive comments prepared but I would like to comment on one or two points that Rip Smith made and then discuss what I think is a useful approach to a solution of this problem that is set forth in a letter of 2 December 1980 from the Marine Mammal Commission to the Fish and Wildlife Service. A copy of that letter is included in the package that most of you have received entitled "Background Materials--Management of Sea Otters and Shellfish Fisheries in California: Policy Issues and Management Alternatives."

The brief comments on the legal analysis are only to supplement what was already very nicely set forth, and that is that a fundamental result of the statutory scheme that we are operating under is that any "taking" of sea otters, including capturing and moving, may only be done at this time for the purpose of enhancing the sea otter's well-being. Anyone that wants to capture and move a sea otter must be able to convince the Secretary of the Interior, acting through the Fish and Wildlife Service, that doing so is going to help to restore the threatened sea otter population to a non-threatened status. There is no room, in my view, to play with that burden. It's clear, and it's compelling. In practical terms, however, it may be possible to devise a translocation program that is primarily designed to help the sea otter population recover to non-threatened status and also, incidentally, to avoid conflicts that are perceived to be imminent. What I mean by that is that it may turn out that the best thing to do for the otter is to take 50 animals, for example, and put them somewhere that is relatively free from the risk of an oil spill. The question of where those 50 animals come from is, as I understand the scientific information right now, unresolved. That question is going to have to be answered and all I am saying is that the primary goal in selecting those 50 animals must be the recovery of the sea otter population. A secondary goal that might be served by the same translocation, if we are lucky, is the avoidance of sea otter/shellfish conflict. But that remains to be worked out, and it's the kind of thing that people have to start looking at in the near future.

The second legal consideration is that once the otters are not threatened, then it is my view that it will be possible to undertake a zonal management scheme which will move toward establishing the optimum sustainable population (OSP) and which will not, in my view,

require sea otters throughout the entire historic range. The development of the concept of OSP as it applies to sea otters is another issue that requires attention, but I do not believe that we are paralyzed and unable to do anything in the meantime. The Commission's letter that I referred to sets forth an approach that will get us going toward that goal and help to avoid some of the problems and the conflicts that we might encounter along the way if we don't get started soon.

WILLIAM MAXWELL, ASSOCIATE MARINE BIOLOGIST, MARINE RESOURCES BRANCH,
CALIFORNIA DEPARTMENT OF FISH AND GAME

I think that, basically, the information that was presented in the preceding papers pretty accurately reflects both the historical record and the present situation with respect to this issue. I think it's important to re-emphasize what the state's policy is with respect to marine resources in general and to sea otters in particular. As legislatively mandated, the state policy is to encourage the conservation, maintenance, and utilization of the living resources for the benefit of all citizens of the state of California. The policy objectives include the maintenance of sufficient populations of all species to assure their continued existence, the recognition of the importance of aesthetic, educational, scientific and other nonextractive uses, the maintenance of sufficient resources to support reasonable sport use, and to promote the growth of local fisheries consistent with the aforementioned uses of such living resources. Within that context, our policy with respect to sea otters then, is that they must continue to receive protection, but that the use of nearshore resources by sea otters must be balanced with the historical uses of some of those resources by man. We believe that this can best be accomplished by some form of zonal management, setting aside areas for sea otters and designating other areas for use by sport and commercial fishermen. I think it's also important to recognize that in order to effectively manage our nearshore resources, it is necessary for jurisdictional authority for all the resources to be invested in one agency. For that reason, we also believe that ultimately management authority should be returned to the state.

I think that the most salient point of Mr. Smith's paper, which I would like to emphasize, is that, in fact, the Marine Mammal Protection Act, as presently written, severely inhibits any state's ability to balance both utilization and conservation of its resources. In order to resolve these problems, the Marine Mammal Protection Act should undergo some substantial amendments not only to address that issue, but to both resolve and clarify some of the other important concepts such as OSP and the health and stability of the ecosystem. I might hasten to add that we have also indicated our willingness to cooperate (which we are already doing) and to participate with the Fish and Wildlife Service in a program to develop a viable recovery

plan and to carry out a translocation effort that will establish a new population of sea otters somewhere within the historical range. However, before a site is selected, we think that all potential sites, within the historical range, should be assessed, not only to determine if these sites are adequate in terms of shelter and food for the otters, but also to determine whether they would, if chosen, have a minimal conflict with any existing or potential shellfish fisheries.

WILLIAM SWEENEY, AREA MANAGER, U.S. FISH AND WILDLIFE SERVICE

I would like to state that the two speakers, Biliانا Cicin-Sain and Rip Smith, certainly gave, I think, excellent presentations on the difficulties involved in implementing the ESA and MMPA. I think you all can understand now how constrained the Fish and Wildlife Service is in the things it is required to do, and the approaches that it has to take to satisfy these mandates.

Bob Eisenbud referred to a letter from the Marine Mammal Commission to the Director of the Fish and Wildlife Service, Lynn Greenwalt: We are in the process of responding to that letter. There will be a positive response, that will reflect exactly what Bob was suggesting. I certainly couldn't agree more with Bill Maxwell that we'd like to see the management of sea otters (and I think maybe the other 25 endangered species in California that cause me grief of one kind or another) returned as rapidly as possible to state management. I can assure you that the sea otters and condors alone are enough to take up a good share of my time. Almost every one of the other 24 or so, whatever they are, has its special interest group or groups, frequently on both sides of the spectrum. Special interest groups devote their time and effort in the interest of increasing and preserving these various endangered species. Other groups who have genuine difficulties as a result of the legislation--as a result of listing a species--create social, economic and other kinds of conflicts that are very difficult to resolve, particularly when the laws are as tightly drawn as they are.

The last thing I want to speak about is the recovery plan that Bill Maxwell mentioned. It is, at the present time, one of our jobs to produce a recovery plan for the sea otter. Our draft recovery plan has been through one technical review and is currently being reviewed again by the technical people involved in the entire sea otter restoration effort. After it gets through that one round (which we hope will be in another month or so) then all of the agencies involved, will have an opportunity to review those comments. After this first round of scientific and technical review is completed, we then will be putting out a revised edition for all of the agencies to look at. Ultimately we hope to have a recovery plan which will meet the criteria that were established by law and identified by Bob

Eisenbud in his letter to Lynn Greenwalt, and hopefully, in the long run, reach a situation, which will in fact, permit management of the sea otter to be returned to the state Department of Fish and Game. That's where we want to go, but it's going to be a rather difficult trail, as I'm sure you can all appreciate.

JOHN BURNS, MARINE MAMMAL COORDINATOR, ALASKA DEPARTMENT OF FISH AND GAME

Dr. Botkin indicated this morning that the 1970s were a decade of rhetoric and Rip Smith indicated the crosscurrents of conflict in the Marine Mammal Protection Act, and I submit to you there is no other federal act that has generated more rhetoric than the MMPA. I'd also echo the comments that a return of management for marine mammals to the state is certainly a long, hard road and we know that from first-hand experience. I won't go into the history of marine mammals in Alaska--it's long and deeply intertwined to this day. The importance of marine mammals to our residents is so great that one of the most endangered whale species continues to be harvested.

Our management goal with marine mammals was basically the same for all species--I'll speak specifically of sea otters. The goal was to ensure the perpetuation of the species and, where necessary, the enhancement of the population status and protection of habitats and optimization of beneficial uses, usually interpreted to mean consumptive uses, although, I assure you that was not, and has not been the case. Management of otters in Alaska involved a research program, an extensive live capture and transplant program, to re-establish otters throughout southeastern Alaska. These were areas of former range and some harvesting was accomplished, mainly in conjunction with studies of otter reproduction. In the 1960s, unlike the decade of the 1970s, there indeed was a can-do atmosphere in approach to programs of enhancement of populations that were depressed. With otters, the objective of reestablishing them was a simple decision to make. They were not exotics, they were animals to be reintroduced into areas of former range. The time, money, and manpower that would have been required to conduct investigations to accurately predict the outcome of an otter transplant were deemed, in this case, better to be utilized in the actual transplant and we would study after the fact the outcome of the transplant. I think it's important to say that's not an arbitrary and capricious decision, given the fact that we re-introduced them to areas where they already had been. However, we undertook that action, always assuming that there was indeed an option to manage the populations of these re-introduced otters once they became firmly established. We found, to our chagrin, in 1972, that this indeed was not the case. That, of course, was a serious miscalculation, at least to the present time.

A second miscalculation on the part of the state of Alaska was not seeing ahead to a decade when, as a result of the rhetoric, man would largely be excluded, at least insofar as some advocate groups were concerned, from being considered as a significant, functioning element of the ecosystems. This could certainly not be the case in Alaska, especially where we have tremendous, direct dependencies on marine resources, including marine mammals. Dr. Partridge, speaking from the viewpoint of a philosopher, raised the interesting point that it is possible, in seeking a specific goal, to in fact, realize the opposite. I believe one example was related to spiritual matters, and he indicated that in seeking to save one's soul, it may be lost, and vice versa. There is a similar conceptualization which is more to the point of this meeting, and that is the Marine Mammal Protection Act. I stress the point "protection." I believe the Marine Mammal Protection Act was ideally and conceptually designed, in fact, to deal with significantly depressed, depleted species of animals. It has proven impossible to come to grips with the real problems existing for species whose health and welfare is secure. This results from the conflicts inherent, as I said, from the beginning, in the Act, and especially in interpretation and implementation of the Act. The three federal agencies involved directly or indirectly with implementing the Act, the Fish and Wildlife Service, National Marine Fisheries Service, and the Marine Mammal Commission, as an advisory body, can and have been able to move very swiftly and decisively, to implement programs of protection. That is laudable, and of great benefit to the endangered and significantly depleted species. They have been unable to function in an effective manner where management, as opposed to protection, is required. I think the record is very clear on that matter. The current situation regarding the California sea otter is an example, as is the situation with marine mammals in Alaska at present. I predict that the management program which will eventually be implemented in California will not be significantly different from proposals advanced in the early 1970s, but which were, in fact, stopped by the past interpretations and the time consuming rhetorical debates resulting from the Marine Mammal Protection Act. We in Alaska are seeking a careful and thoughtful review of the Act, in order to once again be able to institute a conservation oriented management regime. This will involve a very careful review of the Act per se and of administrative actions implementing the Act.

ROBERT THORNTON, NOSSAMAN, KRUEGER, AND MARSH (FORMER STAFF MEMBER,
COMMITTEE ON MERCHANT MARINE AND FISHERIES, U.S. HOUSE OF
REPRESENTATIVES)

I thought it might be helpful to discuss to the extent that I can, what the congressional view of marine mammal and endangered species issues conflicts is, and specifically, what the view of the sea otter conflict is. I think it's important to keep in mind that although as Rip Smith indicated, most of the policy issues relating to sea otters and endangered species have been made by Congress in the

two mentioned statutes, it's also the case that one Congress cannot bind another Congress and both of these statutes are subject to change and they are not written in stone! I think the clear evidence of that is what occurred in the course of the 95th Congress, with the Endangered Species Act, which was subject to rather extensive amendment because of the controversy that developed primarily as a result of the Tennessee Valley Authority vs. Hill decision, the snaildarter case, but also because of a general sense on the part of Congress that the Endangered Species Act did not adequately accommodate all of the concerns that are expressed in a variety of other congressional enactments, including the Outer Continental Shelf Lands Act. I would say, as a bit of background, that it's difficult, of course, to predict what any particular Congress might do simply because the institution is a reflection of all the diverse constituent groups in the country. But I'll hazard a few guesses, nonetheless.

First, I don't think that there is any overwhelming enthusiasm to amend the Marine Mammal Protection Act, or the Endangered Species Act; more specifically, I think there's even less enthusiasm to amend the Marine Mammal Protection Act. There have been some fairly bloody battles in the past with regard to the tuna porpoise controversy, which pitted rather powerful interests against one another and the net effect of that was no amendment to the statute; hence, I think that amendments to the Marine Mammals Protection Act are reasonably unlikely. I don't think you can say the same thing with regard to the Endangered Species Act primarily because the impacts of the ESA are more national in scope, they affect a wider variety of constituent groups, and controversy over the Act is much greater. I think that, in addition, what will happen with the Marine Mammal Protection Act, (which is, by the way, up for reauthorization by the Congress this year, and requires a congressional action to continue the authorization of appropriations) will be much more a product of the Alaska experience than it will be a product of the experience of the central coast of California with sea otters. The controversy with regard to Alaska is much more visible, I think there is more congressional concern and interest in that issue than there is in the sea otter issue, and in fact, I think it's been rather startling how little congressional attention the sea otter conflict has received in Washington.

The Endangered Species Act amendments in the 95th Congress, were, in my opinion, a product of a general concern on the part of Congress that the Act was overly rigid, and specifically, that the critical habitat provision, Section VII of the Act, which Rip Smith spoke about, was overly rigid. Congress established an exemption process which does provide for exemptions from the critical habitat provision, Section VII, although the amendment is not an authorized exemption from the taking prohibitions of Section IX of the Endangered Species Act. There is continuing legal controversy about that. I think that it's also relevant to keep in mind that, although the critical habitat

provision of the Endangered Species Act (which requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species), represents a rather dramatic and strong prohibition on federal agency actions and has been utilized in litigation in several instances involving marine resources and Outer Continental Shelf activities (e.g., the Beaufort Sea and the Georges Bank). The bottom line of those decisions has been that the lease sales proceeded. I think that those people who spoke earlier today indicating their desire to utilize the sea otter listing as a mechanism to affect OCS Lease Sale 53 should keep this fact in mind in formulating their position on this issue.

WILLIAM KIER, ENVIRONMENTAL POLICY SPECIALIST, CALIFORNIA STATE
SENATE OFFICE OF RESEARCH

Ten years ago, I was much better qualified to speak on the subject--the subject was much simpler then, and I was on top of it, or thought I was! So I set about to see how hard it would be to bring myself up to speed on the subject, and it's painful, let me tell you! In effect, I've had a luxury that perhaps many of you have not had, in that I have been away from the issue while all the complexities described in the papers by Rip Smith and Biliana Cicin-Sain have evolved this past half dozen years. So I can attempt, at least, to look at this thicket that you all have created and speculate on how in the hell you got there, and how you're going to get out! It's not entirely humorous, it's sort of tragic-comic, in my estimate, because I think I recall what the issue was and I'll be damned if I know how you're going to resolve it with the tools that you've put together in the past half dozen years. And I don't mean to put you down, because I've seen it occur in too many other areas. I stopped off in Monterey yesterday to watch the Pacific Fisheries Management Council, which was created by another federal enactment within the past half dozen years and I listened very carefully while a management plan, (and that's in big quotes) was adopted for Pacific salmon. I came away with the distinct impression that that was less a management plan than anything that was being put together half a dozen years ago, which is to say that I think that the options are fewer as a result, and I think this is what Rip and Biliana were saying in their papers. I think that what Rip's paper said was, there isn't any "wiggle room" left, and Biliana, who provided us a road map to the Fish and Wildlife Service, said, "You can't get there from here!"

I think that the problem has been compounded by federal intervention, and that the solution is likely to decrease that federal role. I thought it was very interesting that when Bill Maxwell said that the policy of the state of California was to return jurisdiction over sea otters to the state, some of you hissed! I thought you were federal employees until I heard Bill Sweeney say the same thing. Now, Bill Sweeney is one of the ranking federal bureaucrats here, and he wants

to get rid of the job! Bill Maxwell wants it back, so who are the hissers--who are you--and why? What's your problem? Are you afraid that we are incapable of resolving the problem here in California? I don't think we are. I think probably, in this room, are represented most, if not all, the legitimate interests that come to bear on sea otters and abalones--we even have somebody here from New Hampshire, so I'm sure that we have almost all the national interests playing right here in the room. So, saying up front, that I'm not an expert on Section III-5-1-A-Sub 2, or any of those other arcane provisions of public policy that you all have generated in the last half dozen years, it strikes me, and I think the papers bear out, that to the extent that there is any way out of the thicket at all, getting the federal role reduced is probably one of the tools available to us. I can recall the U.S. Fish and Wildlife Service as cooperators rather than regulators, and I thought they did a pretty fine job in that mode. They seem strung out on their new regulatory role. I have this great feeling about California, and Californians, and I think that we can do the job and I think the job, as I've heard it described here is, in fact, in our domain and within our capabilities.

NAOMI SCHWARTZ, CHAIRPERSON, CALIFORNIA COASTAL COMMISSION

I'd like to use my five minutes to talk principally in two areas. One has to do with jurisdictional authority, and the second has to do with how government decision making, from my perspective, is done. I think there are aspects of both those questions which have not yet been hit upon, and I'd like to make some suggestions in both areas that perhaps can be discussed further tomorrow.

I want to start by saying that I am not familiar, intimately, with any of the federal laws that are relevant to the issues before us today. I don't know if the Marine Mammal Protection Act has in it any kind of preemptive clause, which for example, would affect its relationship to the Federal Coastal Zone Management Act. If that is the case, some of my comments may need to be tempered, or explained in some other way. But I'm going to proceed on the assumption that the Federal Coastal Zone Management Act is not preempted by the Marine Mammals Protection Act, because my remarks will be relevant to the Coastal Act and the attorneys can jump in at any point! Before I just say a few brief words and read briefly one policy from California's Coastal Act, I'd like to say that the Federal Coastal Zone Management Act, notwithstanding the federal Constitution, does give a rather unprecedented kind of authority to the state of California, and to other coastal states, who have coastal management plans adopted. That is what we call the "consistency provision." The state of California today, actually, does have authority over federal activities through a requirement that those activities be deemed, by California, consistent with our coastal plan. Both activities which need federal

permits and federal activities which, in fact, are deemed to have an effect on California's Coastal Zone, are subject to this consistency review. In fact, the state of California must concur with the federal government that such activity is consistent with our program in California, otherwise, that activity may not proceed. There are certain stipulations for what happens when the state and federal government are in conflict in that assessment, but I raise this at the outset because it occurs to me, in preparation for this conference today, that translocation activity, which is one potential management solution which is being discussed, may in fact be such an activity. And while it may be protective of the sea otter and may totally comply with the Marine Mammal Protection Act, it may need to be reviewed for consistency with California's Coastal Management Plan. With that in mind, I'd like to discuss, very briefly, some of the policies in California's Coastal Act that relate both to protection of the sea otter and to protection of marine resources and of commercial fishing activities. I want to read just one policy, Section 30230 in the Marine Environment Section, and ask you to keep in mind as I read it, that this policy relates on the one hand to protection of sea otters; on the other hand, protection of shellfish. It reads as follows:

Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters, and that will maintain healthy populations of all species of marine organisms, adequate for long term commercial, recreational, scientific and educational purposes.

I think the complexity is growing. That is the key policy in the Coastal Act, activities which are carried out necessarily in conformance with this Act, would have to be measured by this kind of policy. In addition to this policy, there are very strong policies in California's Coastal Act, specifically related to commercial fisheries and to protection of commercial fishing resources. There is a presumption, in fact, in our law in California, that the maintenance, enhancement and protection of coastal resources apply both to species of marine organisms, and to opportunities for commercial fishermen. I think that the conflict of this conference makes clear that there is a potential lack of compatibility, which California's Coastal Act did not and does not account for because it assumes this kind of compatibility.

I want to say, just briefly, that to date, sea otters have been relevant at our activities in the Coastal Commission in a few ways and I'd just like to mention what they are. In addition to our con-

sistency review, we have just presented to the Governor and he to the Secretary of the Interior, the state's comments on Lease Sale 53. As I'm sure all of you from San Luis Obispo County are aware, we supported this county's recommendations for deletions of those tracts which are within the sea otter range, based on the potential for devastation to the species as a result of an oil spill. That contention has been disputed today, and I imagine will continue to be disputed and certainly more data will be needed to either negate or support it. The Coastal Commission has, in terms of our statutory requirements, completed a review of the Coastal Zone for power plant siting. We have designated areas where power plants should not be sited, in conformance with the Coastal Act, the kinds of biological resources that would pre-determine no power plant siting, including concern for the sea otter. In addition, we reviewed sites along the coast of California for a potential Liquefied Natural Gas facility. The consideration of the presence of the sea otter species was relevant to that concern as well. But that is essentially the extent of our involvement to date. I imagine, however, if there is any management program being put forward that does involve, as I said, an activity per se, that the California Coastal Commission's concern will be renewed.

I want to talk finally, about one aspect of government decision making that I think is relevant, from my own experience, both on the Commission and in the Legislative Office, it's very real to me. And it's not mentioned explicitly in Biliana's paper, although I think the suggestion for my concern is there, and I want to quote from Biliana's paper. She is putting in context the placement of the sea otters on the endangered species list, and talking about the role of the Friends of the Sea Otter, says, as follows:

The position of this highly influential group has consistently been that the sea otter population should continue to expand naturally throughout its former range. As self-appointed spokesman for the animal, the Friends are to be credited for their systematic, relentless, well-prepared and ever vigilant attention to management matters related to their preferred critter. Their input into management decisions during the 1972-80 period has always been cogent, well-researched and presented, timely, and, by and large, successful. The participation of other groups in the management debates of this period has been much more ad hoc and sporadic. While commercial fishermen made their voices heard at specific meetings and vented their emotions in the privacy of their boats and of their communities, this reaction seldom reached the public record in a systematic fashion.

I want to suggest that, in addition to laws and agencies and regulations and conferences, such as this, and conclusions for the best management proposals based on the best data at hand, decisions are also made, influenced by political constituencies; the Friends of the Sea Otter have successfully been such a constituency. I just want to point out that the shellfish fishermen are, I think, a growing constituency of this kind and the fact that this conference is as much a response to their concerns as it is to the concerns of the conservationists, attests to that fact. I think that in the future, even more than in the past, that political constituency will be a factor in the outcome.

GORDON REETZ, NATURAL RESOURCES SPECIALIST, PACIFIC OUTER CONTINENTAL SHELF OFFICE, BUREAU OF LAND MANAGEMENT

The Bureau of Land Management is involved with the leasing of offshore oil and gas lines in federal outer continental shelf (OCS) waters, which are three miles offshore. Part of the more recent leasing that is taking place is Lease Sale 53, which includes the area from Point Concepcion to the Oregon-California border. Secretary Andrus has selected the Santa Maria area as the area to be selected for the sale. Sea otters are in that particular area. I think everyone here is fully aware that oil has potentially devastating effects on the sea otters--oil and sea otters just don't mix! But unfortunately, we do not live in a pristine environment. Offshore oil and gas development has continued in the past, before Sale 53, and for the new Administration, from the news accounts, it is clear that it probably will continue at an accelerated rate. Besides our development, the Bureau of Land Management, specifically, the Outer Continental Shelf office, has plans for the future; there is much oil tankering going on, which will continue with, or without, our activities there. Besides our activity, the state of California is developing the EIS, referred to as the Environmental Impact Report, to develop their state lands, turning around Point Concepcion, getting up into the sea otter range. We can't step back--we live in an environment that's threatened with oil impacts, and what we could do is to try to reduce those impacts. We could try to reduce the threat to the sea otter, which is in a very precarious position. This particular population, isolated along the coast of California, would have a better chance of surviving any mishap by being translocated. That last statement represents my opinion, not the Bureau of Land Management's, but translocation would relieve a lot of pressure.

NICK WHELAN, RESOURCE MANAGER, CHANNEL ISLANDS NATIONAL PARK

There has been considerable talk about the Channel Islands as a potential sanctuary, a last chance for the sea otter, and I'd like to give you a little background on the Park.

Channel Islands National Park was established on March 5, 1980. It consists of five islands, the four northern islands Anacapa, Santa Cruz, Santa Rosa, and San Miguel, and one southern island, Santa Barbara Island. One nautical mile around each island, has been included in the boundary of the National Park, as well; however, at the present time the Park Service manages only the three smallest islands that were originally the Channel Islands National Monument. The legislation specifies that when funds are appropriated, all of Santa Rosa Island and a part of Santa Cruz Island will be purchased. As far as the marine resources are concerned, however, the legislation also is quite specific that the state of California will continue to manage and have jurisdiction over the marine resources, the water, the living resources within the Park boundary. We, of course, acknowledge the responsibility of the state, and we intend to cooperate with the state, to insure the protection of resources as well as to continue research concerning the nearshore marine environment around the Islands. Of course, we also recognize the management responsibility of the National Marine Fisheries Service, which has ultimate responsibility for marine mammals, even though they're on our Islands sometimes and, of course, the Fish and Wildlife Service's jurisdiction over the sea otter at the present time. We have a legitimate concern for the resources around the Islands, because it's very difficult to divorce the health and the well-being of populations of animals on the Islands for instance, the brown pelican, from the health and well-being of populations of animals upon which those species depend, such as the anchovy and various other pelagic fishes.

The legislation also gives us the responsibility to recommend to other agencies how the resources of the Island, or around the Islands, should be managed. National Parks are areas which have been deemed so special that the proper use of their resources has been judged to be preservation. I don't think that everyone would agree with this but in my view, it is legitimate to look at areas and their resources in a variety of ways--aesthetically, philosophically, and economically. Perhaps most importantly, national parks can function as areas of baseline, or control, so that such scientific questions as have been raised here today, can be answered more readily. Obviously, it is as important to preserve dynamic natural ecosystems without the influence of man in the marine environment as it is on land.

I will read to you now, verbatim, the National Park Service policy on the re-introduction of native plants and animals.

The re-introduction of native species into Parks is encouraged, provided that adequate habitat exists in the Park and on adjacent public lands and waters to support the species; provided that the species, based on an effective management plan, does not pose a serious threat to the safety of Park visitors, or Park resources, or to persons

or property outside of Park boundaries; provided that the species being reintroduced most nearly approximates the extirpated subspecies or race; provided that the species disappeared or were substantially diminished because of human induced change, either directly or indirectly, to the ecosystem; and provided that the confinement of animals by fencing will be permitted only until the animals become thoroughly accustomed to the new area, or that they have become established sufficiently that threats from predators, poaching, disease or other factors, have been minimized.

It seems that the sea otter qualifies under these stipulations. However, to reiterate, all we can do, and once again this is the policy of the Park Service, is to carry out such programs in cooperation with other effective parties and agencies. Since it's actually the responsibility, totally, of the other parties and agencies, we will be glad to cooperate with any relevant parties and agencies whenever a decision is made.

ROBERT EISENBUD

The federal consistency question that Ms. Schwartz has raised is an interesting one. And just to sort of close the loop and leave this discussion with something that we might all look at, I'd say first that, obviously, the goal of the federal agencies at this time is full consultation and cooperation in an effort to achieve a consensus, which is the same thing that would be reached by the consistency consultation. Second, just looking at whether or not the consistency provision, per se, applies, I don't think the state of California identified marine mammal permitting activities among the actions that would be affected by the consistency provision in the plan that was approved. I stand to be corrected, but I don't think it did. If it didn't, my understanding is that it would have to be amended, which will require a review process, and so, it wouldn't apply right now. But third, and perhaps the most interesting thing is, if you take what might be the worst case because of the result that I'm going to project, if the consistency provision applies, and the consistency provision were exercised by the state so as to veto, in effect, a proposed translocation, the result might very well be no action by the federal government, which would be tantamount to unrestricted expansion of sea otters. That does not seem, to me, to be necessarily the best result, so I suggest that the consistency provision is best left alone.

A question from the audience, addressed to Nick Whelan: You've indicated the policies in the National Park Service regarding the new Channel Islands Park. Would you comment on the use of resources within the National Park, such as harvestable urchins and abalones, and then, if it is a sanctuary, as I perceive it to be, would you comment on the extended obligation of the Park Service, within your policy, of affecting other parties' interests, adjacent to park lands, with regard to future expansion.

NICK WHELAN

I was certainly hoping to escape any controversy! I will take your use of the term sanctuary as not referring to the National Marine Sanctuary, which is something entirely different. Yes, National Parks are supposed to be areas where management is based upon preservation and allowance of natural ecosystems to function. Nevertheless, each National Park is established by itself by an Act of Congress, signed by the President. This Act of Congress stipulates that while we are able to have a boundary of one nautical mile around each of the five islands within the National Park, that the state is to retain, to keep and to hold forever, management responsibility and jurisdiction over the marine resources. One might ask therefore, why have the boundary in the first place? There are various advantages of having the boundary. One is that we can cooperate with the state in enforcement, in expending federal funds for joint research, and also it gives us a certain legitimate right to make management recommendations. In fact, the legislation stipulates that we are to make recommendations to other agencies regarding the resources within the entire park boundary. We can comment on OCS lease sales in this respect, we can hopefully try to get other agencies to respect our point of view, regarding the legitimacy of a preservation management philosophy; but there is certainly no statutory obligation on the part of the state, to accept any of our management recommendations.

NAOMI SCHWARTZ

I think that the Marine Sanctuary status which the Islands have received is relevant to this discussion, and perhaps the Representative of the Department of Fish and Game wants to respond, because that status does afford the DFG jurisdiction over the 6 nautical miles surrounding the Channel Islands. That was a concern that was raised by the commercial fishermen on hearings on the marine sanctuary. They wanted assurances that DFG would continue to regulate fishing activities in that area, and that the federal government wouldn't preempt that.

BILL WOOD

The question that Mr. Gale asked, I think, related to the mood of cooperativeness between the particular agencies, state and federal, in trying to resolve the problem. Does anyone want to address the question of legal amendment?

ROBERT EISENBUD

I'll take a shot at part of it, on behalf of the Marine Mammal Commission. Yes, there is an interest in addressing the problem that was discussed today, and as I mentioned in my brief summary remarks, we believe that our letter of December 2, 1980, reflects a desire to get at this problem, and take into full consideration, conflicts with fisheries. But our letter is based on the idea that the first actions with respect to taking otters have to be designed to enhance their status under the existing legislation.

PAMELA FERRIS-OLSEN, UNIVERSITY OF CALIFORNIA AT BERKELEY

As far as actual oil drilling in the sea otter refuge in Lease Sale 53 is concerned, what are some of the mitigation measures involved and who will bear those costs?

GORDON REETZ

The mitigation techniques that are available, I would guess, are what's on the platforms now to prevent an oil spill, and oil spill containment equipment that would be on the scene to try to protect the animals from any sort of oil spill. Who bears the cost of the clean-up? The oil company. Who bears the cost of the death of the animals? That's a legal question; I don't really know who's involved in that. The technology involved in oil spill containment is improving rapidly. Recently, we observed a video demonstration of a new skimmer being developed by a Swedish firm, which is capable of skimming up oil in a boomed area. I believe the limiting factor now is not so much the skimmer, at least in seas up to six feet high. The technology is leap-frogging, so there are encouraging signs that oil spill containment measures are improving, and that there is going to be more safety, built-in, for these animals.

ALYCE PORTER, ATASCADERO

I'd like to address my question to Rip Smith, who spoke about the laws. Those laws could be changed, isn't that so? The point I want to make is, everybody is calling the sea otter threatened. Haven't we

heard that all day today? Now, there are 120,000 or more sea otters in Alaska, and Dr. Aryan Roest wrote a paper which a lot of you are familiar with saying that the sea otter, in California, is not a subspecies. It seems to me, if it's not a subspecies, then the federal government should have no say in what happens in California and it should be turned back to the California Department of Fish and Game, and they should handle the problem.

RIP SMITH

The process of listing of any species on the endangered species list goes through a number of considerations, and opportunity is allowed for comment by those involved. In the case of the California sea otter, the species was subject to 291 comments, 289 of them favored listing of the sea otter as a threatened species. There was consideration in that listing of whether or not the sea otter was a subspecies; that does not dispose of the question simply because the Act allows protection of independent populations whether or not they are a separate species.

PUBLIC COMMENT SESSION

Moderators

*John B. Richards and
Christopher Dewees,
University of California
Cooperative Extension
Sea Grant Marine
Advisory Program*

PUBLIC PARTICIPATION AT THE REGIONAL FORUM

The general public was provided with a variety of opportunities for participation during the two-day forum. While the first day's activities centered around presentation of commissioned papers from experts in the relevant fields and discussion by panel members representing the full range of affected interests, the general public was strongly urged to participate in each panel discussion during question-and-answer sessions that followed the panel presentations.

In addition, a public comment session on the second day of the forum was devoted to airing the views of the general public, and any person or group wishing to express an opinion was encouraged to do so. A period of one hour and forty-five minutes was scheduled for public comments by individuals and groups. To insure that all who wished to speak would have adequate opportunity, and to allow for a maximum number of speakers, a sign-up sheet was provided. Representatives of organizations, agencies, or groups were allowed five minutes for a presentation, position statement or other comments, and private individuals were allowed three minutes for comments. The public was also invited to distribute written presentations, position statements, and comments to the audience during the public comment session. Of the 22 speakers making presentations during the panel comment session, 11 represented organizations and 11 spoke as interested citizens.

Chris Dewees, Marine Fisheries Specialist with the California Sea Grant Marine Advisory Program, University of California at Davis and John Richards, co-sponsor of the conference and University California Sea Grant Area Marine Advisor for the south central California coast, acted as moderators of this session. Remarks presented during the public comment session are summarized below.

CYNTHIA GILLETTE-WENNER, MONTEREY, CALIFORNIA

Ms. Gillette-Wenner, reviewing the previous day's papers and panel sessions, noted that in 1936 the commercial abalone fishery moved from Monterey to Morro Bay at a time when the sea otter population was estimated to number only 60 animals, and that in 1947 the commercial clam fisheries were closed. Ms. Gillette-Wenner also mentioned that Dr. DeMartini showed charts during his presentation which clearly depicted how the populations of various sea otter prey items had drastically declined around the time the otter appeared in the particular area being studied. She cautioned against attributing these declines solely to the sea otter, "It seems to me that if we are to fairly interpret these charts that we must also include man in the picture as well. With his improved methods for harvesting shellfish

in such vast quantities as to actually result in moving of one industry and the closing of another, it seems to me rather ludicrous to place the total blame for these depletions solely upon the sea otter."

RICK WILLIAMS, SANTA BARBARA, CALIFORNIA

Rick Williams, owner of the Mussel Company and member of Save Our Shellfish (SOS), noted that management was a relatively new concept to man. Moreover, several new management procedures were just being initiated in the shellfish industry. However, Williams observed, "if the sea otters are allowed to continue their range expansion, any management procedures initiated by man are rather moot." Discussing the great potential of mussel farming in the Santa Barbara Channel to provide for future protein needs, Williams warned, "if there's no management initiated soon, there will be no need to attempt to farm mussels in the Channel."

PAMELA FERRIS-OLSEN, FREMONT, CALIFORNIA

Ms. Ferris-Olsen, a graduate student in Wildland Resource Science at the University of California at Berkeley, found it ironic that shellfish interests and sea otter protectionist groups find themselves adversaries, as both seek to preserve our marine resources. She informed listeners that, "the oil spill potential which has been the impetus for listing the California sea otter as a 'threatened' species under the terms of the Endangered Species Act, and chemical pollutants such as PCBs and heavy metals are equally devastating in their implications for the shellfish and fishery concerns as they are for the otters." Noting the decline in shellfish harvest in areas outside the otter's range, she attributed this not only to overharvesting and to the taking of "shorts," but to pollution as well.

Acknowledging that otter management may alleviate some of the pressures on shellfish fisheries, Ferris-Olsen felt that the dollars and manpower used to control otters might be more wisely invested directly in fishery management and mariculture programs. In closing, she urged conference attendees to "research all sides of the issue, investigate all options and critically evaluate ecological and economic opportunity costs and benefits before taking a final position," and "to work together to make this assessment and thereby insure the conservation and preservation of all marine resources."

JUDY GOLDMAN, AMERICAN CETACEAN SOCIETY, LONG BEACH, CALIFORNIA

Ms. Goldman, National Conservation Chairman for the American Cetacean Society, spoke on behalf of the national organization. The organization, she stated, believes that protection and recovery of the

sea otter is most likely to be obtained through compliance with the Marine Mammal Protection Act's objective of achieving optimum sustainable population, utilizing an ecological approach to management.

Plans for effecting the recovery of the sea otters should encompass the broadest possible spectrum of activity designed to reestablish and maintain the stability and productivity of the entire habitat. ACS believes that this goal can only be achieved in the absence of adversary positions and that participation of the shellfishing industry and its information and suggestions are crucial to all stages in the planning process. Management decision makers must be provided with sets of reasonable, hard data, informed public opinion and judgment, up-to-date economic information, and ecologically sound options. ACS feels that any alternative to range restriction and the economic feasibility of all approaches to zonal management should be thoroughly considered in the recovery planning process. We support the concept of translocation and we hope that reserved breeding populations can be established at the earliest possible time. We recognize the enormous difficulty involved in site selection. Input by the shellfishery is vital to this process in order to minimize conflict with translocated otter populations. Any increase in such conflict would be counter-productive and clearly detrimental to sea otter protection, even in the light of petroleum development. Man's ability to modify the environment increases faster than his ability to foresee the effects of his activities.

Ms. Goldman also stated that the sea otter's apparent vulnerability to oil contamination is a major concern and that it is important to identify deleterious impacts of petroleum exploitation on otters and to determine proper mitigation measures. She concluded by urging researchers to continue a thorough economic analysis of sea otters, which addresses the full spectrum of their resource value.

LAD HANDELMAN, SAVE OUR SHELLFISH, SANTA BARBARA, CALIFORNIA

Mr. Handelman, founder of Save Our Shellfish, began by noting the need to close the gap of communications between opposing groups in the sea otter/shellfish fisheries controversy. He gave an example of how reasonable discussion, rather than attacking the other point of view, can lead to a better understanding of the positions of divergent groups, and move them closer to resolving some of the conflicts. With an apology to Ms. Carol Fulton of the Friends of the Sea Otter, Handelman stated:

I misused an opportunity I had yesterday when the subject of oil and sea otters came up. I took advantage of that to point out, from our standpoint, the fact that the oil is here anyway, and if you really want to do something good for the sea otters, you'll protect them from the oil. I said it in a way that was destructive instead of constructive, and that's not what this whole thing is about. I think that we need this kind of forum to get some understanding [among] the groups. It's my belief that in the little time I spent yesterday [listening to] what people had to say and in a little private conversation, that the challenge here isn't how to drop bombs on each other--to put the other side down --but the sense of the group is that something should be done. I think that everyone is saying that.

Nobody wants to see one sea otter hurt that shouldn't be hurt, or one abalone fisherman hurt, or one juvenile abalone hurt who shouldn't be hurt. All of us want to see as little of that as possible and a maximum amount of effort put into resolving it to reduce those type of things. I think the challenge is clear--it is to me anyway. We're not really disagreeing conceptually in what we'd like to see done. The problem is based on past history, based on positions people have taken; it's difficult for either side to want to let that go, yet I sense that the people involved are big enough and care enough about the long term to look at the whole picture and meet the challenge of getting our ideas together conceptually. The most difficult job of all is how to achieve something with the framework and the very, very complex set of laws we have. The big problem is how we can jointly come up with a conceptual solution that can make it possible to protect the sea otter as he should be protected, and to do what we can to assure the survival of the fisheries, in a way that's not in conflict with the otters, and do all that within a short time, because it needs to be started now.

Mr. Handelman concluded by urging forum participants to provide the Fish and Wildlife Service with constructive ideas that will help lead to resolving sea otter/shellfish fisheries conflict.

SHARON LOVEJOY, PISMO BEACH, CALIFORNIA

Ms. Lovejoy, a businessperson from Pismo Beach, reported on a personal survey of seventy-five people who came into her store which showed that tourists were more interested in viewing the sea otter than in clamming. The sea otter, Ms. Lovejoy commented, can be thought of as type of food--"a soul food." She said that hundreds of

children and adults, many from Fresno and the Central Valley, come to Montana De Oro State Park and enjoy observing the sea otters, which can feed their souls, spirits and imaginations. Ms. Lovejoy concluded that she "welcomes the sea otter to Pismo Beach."

BOBBIE HARMS, CARMEL, CALIFORNIA

Ms. Harms read part of a talk, given at the University of California at Santa Cruz, by Dr. Betty Davis, Scientific Advisor and Executive Secretary for Friends of the Sea Otter, who had wanted to attend this conference, but could not because of a grave illness. Quoting Dr. Davis, Ms. Harms stated:

My own personal feeling is that a change is needed in human attitudes and values concerning wildlife. We must stop competing with nature and consider ourselves a part of it, before it is too late. I view the otter/abalone/man conflict as a classic confrontation between man and beast, a real test case, with man, not the otter, on trial. Here's an animal, the otter, just beginning to stabilize, after a return from near extinction, who poses no threat to the continued existence of any resources. Abalones, urchins, clams, crabs or lobsters as the otters forage does not eliminate breeding stocks. Will man, a top predator, who does nothing to enhance the marine environment, but much to deteriorate and exploit it, check his greed, examine his values, and allow a natural predator, that belongs in and enhances this ecosystem to go its way without human interference? We believe that this is a question of great import and significance to man at this critical time in his history.

In closing, Ms. Harms posed this question: "At a point in time, when we humans are just beginning to understand and appreciate the preciousness of the environment, and the interrelationships involving all living and non-living portions of it, can we afford to risk manipulation of an important, functioning element, such as the southern otter, which is still making its way back from near extinction, and whose important role in the nearshore marine environment is just beginning to become evident?"

IRENE FABRIKANT, BERKELEY, CALIFORNIA

Dr. Fabrikant commented on Dr. DeMartini's presentation on the status of California shellfish fisheries:

Although undeniable biological trends are evident in the graphic data presented, there are only two parameters which were considered for the correlation discussed, namely, shellfish and the sea otter. However, a multiplicity of interactions, both known and unknown, exist. I have great concern about the graphic representation which is used to reflect population estimates of both red abalone and Pismo clams, as specific examples, although my remarks would also be pertinent to other shellfish discussed. These graphs are seen both without confidence limits on the individual values and without a population base denominator in each case. An audience with diverse background may interpret the correlative values of these data incorrectly.

She also reiterated Dr. Estes remarks that "we may expect too much from biologists in developing predictive models by which we can understand and manage the behavior of natural populations and ecosystems." Dr. Fabrikant continued by contrasting the great amount of money spent in biomedical research and the resultant advances (except in the area of inductive stimuli which cause disease) with the relatively small amount of money spent in the biological sciences which pertain to nature. Emphasizing the importance of having all groups working together on the issue of oil spills, Dr. Fabrikant concluded by relating a European news announcement which reported in detail the deaths of thousands of oiled sea birds which had washed ashore in Sweden, due to an oil spill which was never found nor reported.

WILLABELLE MALONEY, LOS ANGELES AUDUBON SOCIETY, LOS ANGELES, CALIFORNIA

Ms. Willabelle Maloney, representing the Los Angeles Audubon Society with a membership of over 3,000 people, stated that one of the goals of her organization is the preservation and protection of unique examples of the natural world. "We consider the southern sea otter such an example. Therefore, we support those research and management techniques that will result in an optimum sustainable population." Ms. Maloney expressed the feeling that the specific management techniques should be left to the experts: "We don't care how it gets done, just so it gets done. We want to be sure there are sea otters for our children, grandchildren and great-grandchildren."

CAROL FULTON, FRIENDS OF THE SEA OTTER, CARMEL, CALIFORNIA

Before summarizing the position of the Friends of the Sea Otter, Ms. Fulton addressed two issues raised during the panel discussions. One speaker had asked why the California otter is threatened if a healthy population exists in Alaska. Ms. Fulton pointed out that in

spite of the assertion by Dr. Aryan Roest that the California and Alaskan populations are the same subspecies, the Endangered Species Act gives protection to geographically isolated populations such as the California sea otter. Other scientists, such as Davis and Lidicker and Dr. Estes, have maintained that the California population is indeed a separate subspecies from the Alaskan population. Ms. Fulton reminded the audience that the taxonomic question has long been the subject of debate, and that more data is required to resolve the issue.

Ms. Fulton next referred to a question posed by Bill Kier, as to why there is opposition to returning management jurisdiction over the sea otter to the California Department of Fish and Game. Ms. Fulton stated that although the Friends of the Sea Otter are very grateful to the Department for its attempts to protect the otter from offshore oil activities, they believe that with respect to management issues, the federal government can be more objective on the sea otter/shellfish fisheries issue than the DFG, which obtains over 90 per cent of its funding from fishing and hunting licenses.

Ms. Fulton next summarized the position of the Friends of the Sea Otter, which is supported by over 57,000 citizens:

First, we believe it would be most beneficial to the southern sea otter and for the marine ecosystem in which it plays a significant role for the California otter population to continue to redistribute itself wherever its natural movements may take it. We firmly object to management of southern sea otters by range restrictions at this point in their tenuous recovery from near extinction. We strongly support management plans to establish two or more successful reserve breeding colonies of southern sea otters in sites elsewhere within their former U.S. range. Such manipulation now appears necessary in order to preserve the California sea otter. Virtually its entire population is encompassed by proposed Outer Continental Shelf Lease Sales number 53 and number 73, and almost the entire breeding stock of this depleted southern population already lies in a vulnerable position between two major oil tanker ports in Monterey and Estero Bay.

We believe translocation of reserve colonies of California otters should be undertaken as soon as possible, and accomplished with a minimum number of animals necessary to ensure success and viability of the transplant, since translocations are hazardous for otters. Translocation sites should be as well removed as feasible from current or potential oil spill hazards, but should be as close geographically as possible to the present population distribution, preferably at locations where water temperatures and

habitat are as similar as possible, where the food supply is abundant, where there are extensive kelp beds and protective coves for shelter, where natural factors are likely to discourage emigration. At present, pending the outcome of studies of possible transplant sites within the contiguous U.S., we are looking toward San Nicolas Island in the outer Santa Barbara Channel, as the best choice for a primary translocation. We oppose long distance translocations, outside of U.S. jurisdiction, to Canada or Mexico, or other areas north of the contiguous U.S.

We believe that the protection of the California sea otter, under the Endangered Species Act of 1973, should continue until at least two reserve breeding colonies have been successfully established and that its protection under the Marine Mammal Protection Act of 1972 should continue until optimum sustainable population levels have been reached and maintained.

MICHAEL WAGNER, SANTA BARBARA, CALIFORNIA

Mr. Wagner, an abalone processor and owner of Seafood Specialities, a seafood processing company in Santa Barbara, expressed his concern over the possible unlimited expansion of the sea otter's range in California.

Our abalone production was over half a million pounds in 1980--a good year--and yet if the otter is left to continue his advance, that production and an industry which has been in existence for over 50 years will go down the drain. Unlike opinions by some biologists, there is no question in my mind that the scientific data on other depredation of shellfish stocks is valid.

We are fast approaching the very real possibility of renewing the abalone resource, the current planting study program. Abalone planted by the California Abalone Association are showing positive results. If the otters' southern migration is allowed to continue, the value of planting baby abalone becomes economically tough to justify.

The sea otter has a very real and rightful place in the ecosystem. But any move to one of the Channel Islands brings an inevitable widening of the range unless a real zonal management program is enacted at the same time. The Fish and Wildlife Service has been given 18 months to find a place to translocate otters. In that direction, the translocation is all important. Containing those otters at

the new site appears to be secondary. I do not believe a translocation is necessary. With Dr. Roest's findings that the Alaskan otter is the same as the California otter and the very remote possibility of an oil spill decimating the total population, widening the current populations range to protect it from an oil spill is not as defensible as it once was.

JIM CHAMBERS, AVILA BEACH, CALIFORNIA

Mr. Chambers, speaking as an interested citizen and on behalf of Viller's Seafood Market in Port San Luis, pointed out that "we are the ones that have experienced the sea otter coming down and ruining the fishery, not only for the commercial abalone and urchin divers, but for the sport divers and the clambers at Pismo Beach." Mr. Chambers does not believe that the southern sea otter is threatened, due to the 120,000 Alaskan otters which could supplement the California population. He favored a plan in which otters would be managed within the existing California Sea Otter Refuge from the Carmel River to Cambria, stating that there would be few, if any, conflicts in the area with commercial shellfish harvesting or offshore oil development. He also pointed out that, if the otters continue to expand their range to the south, they will be right in the middle of heavy oil development activity.

In conclusion, Mr. Chambers noted that the sea otter and shellfish management issues should be solved at the local level rather than by outside groups.

SIDNEY HOLT, INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE,
LONDON, UNITED KINGDOM

Dr. Holt began by saying that the largest fisheries declines after World War II occurred with those stocks that were being "managed." "These changes," he observed, "imply that there is something fundamentally wrong in our management procedures."

Wherever there are marine mammals in the world, the marine mammals are blamed for the decline of fisheries. This is not to say that the marine mammals are not having any effect--by no means would we say that--but it does mean, to my mind, that we have to look very closely at the accusations that are made with respect to marine mammals when fisheries begin to decline. The situation here is obviously very complicated, and I do not believe that science alone has the answer. I do, however, believe that knowledge of the facts and a careful look at them is the necessary basis for our moving [from] rhetoric to communication. The communications problem is a very difficult one.

Expressing concern over worldwide fisheries/marine mammal conflicts, Dr. Holt said he believes it is important to look at these problems on a global basis from a scientific point of view. "Although there is no substitute for knowledge of the local situation, knowledge of other situations and other problems can have a very important bearing on local decisions."

Dr. Holt concluded by saying that personally he does not believe that we know how to manage natural resources in the sea.

We talk a lot about it, we do not know much about it, and every time that we have attempted, we have lost our fisheries, one after the other. This is happening all over the world. There is something inadequate about our understanding of what is going on in the sea. What I do think we have to concentrate on is learning how to manage ourselves, rather than talking so much about managing other people and other animals.

DONNA DIROCCO, ENVIRONMENTAL SERVICES CLUB, NATURAL RESOURCE
MANAGEMENT DEPARTMENT, CALIFORNIA POLYTECHNIC STATE UNIVERSITY,
SAN LUIS OBISPO, CALIFORNIA

Ms. DiRocco remarked that the sea otter/shellfish fisheries controversy involves a multitude of conflicts, "biological, economic, ecological, sociological, physical, emotional and moral." She commented that each of these conflicts interact and it is not enough to approach the problem by dealing with only one or two parts of it. "We do not always fully analyze all aspects of [a resource] problem." Ms. DiRocco also noted that we can begin to solve the conflict between shellfish, sea otters and man by changing our attitudes about the role we play in our natural environment, adding: "Man should not think of himself as separate from his environment, but rather a part of it." She urged participants to "make an effort to incorporate a holistic approach to resource planning; involving the biophysical, socioeconomic, and other aspects of our environment; so as to render, if you will, to society the natural resources it needs to function and survive, and to render to nature, in a similar manner, the resources and space it needs to keep itself functioning in a healthy and natural balance."

J.B. HUNDLEY, WESTERN OIL AND GAS ASSOCIATION, BAKERSFIELD,
CALIFORNIA

Mr. Hundley, representing the Western Oil and Gas Association and the Atlantic-Richfield Oil and Gas Company, emphasized that past and existing oil operations in Alaska have been compatible with the sea otter, which is flourishing near oil exploration, drilling, production

and marine terminal operations. "Oil Operations fit in with fishing and shellfish fisheries in the Santa Barbara Channel. Noteworthy is ARCO's abalone growing project near Platform Holly, and kelp growing research in the channel area." Hundley pointed out the nation's immediate need to locate and utilize our potential offshore oil reserves to supply needed energy resources and to reduce our dependence on foreign crude oil.

He also commented on the difficulty of locating productive oil accumulations. California offshore records show 154 exploration wells were drilled with only 25 discovering oil in the period 1968 to 1979. Describing means of safeguarding marine resources from oil spills, Hundley said that drilling units have over 1,000 feet of boom, floating skimmers and absorbents on board at all times. He also mentioned the Clean Seas organization, funded by a coalition of oil companies, which has a response capability to minimize the impacts of "spilled" oil from any source, tankers, marine terminals or pipelines. "Most important, industry technology and government standards are now providing protection, insuring that mishaps will not occur."

Hundley believes that the federal government is a conscientious "landlord" of the outer continental Shelf (OCS), with OCS orders and frequent U.S. Geological Survey inspections that witness test of [oil spill] control operations, assuring the safety everyone is seeking. "Through leasing, exploring and discovery, we must increase our nation's independence from foreign oil imports, while creating a more productive economy." He ended by praising the positive communication and exchange of ideas at this conference.

WILLIAM FRANCIS, MONTEREY PENINSULA AUDUBON SOCIETY, SALINAS,
CALIFORNIA

Mr. Francis commented that in a "very broad sense, we are all searching for the same thing. We want the optimum use of our marine resources. Where we differ is in the definition of optimum use and the means to achieve it." It is important, however, to realize that economic factors are not necessarily in conflict with ecological factors. "Ecology is concerned with the operation and survival of the natural system; economics covers the means to utilize the production of the ecosystem for human benefit. Aesthetic and moral values are as much a part of these benefits as monetary return." Francis stressed, "We must maintain ecological productivity, or there will be no economic benefits. An economic use that degrades the ecosystem is eventually a loss, not a gain." In closing, Francis stated that we know very little about the complexities of the marine environment and that it is best to leave it alone. "The only hands-on management of the sea otter that I can justify is translocation to establish new colonies for the otter's welfare."

BOB THOMAS, CENTRAL COAST SEA LION'S DIVE CLUB, MORRO BAY,
CALIFORNIA

Mr. Thomas, a sportsdiver for over twenty-five years, expressed his concern that the southern migrant front of sea otters is now very concentrated and that the animals are eating everything in their path before moving on. Thomas favors zonal management and suggested that the California colony be "confined to an area bounded by Ragged Point in north San Luis County and Big Sur in Monterey County." He can see no conflicts in this area between sea otters and offshore oil development. In closing, Thomas stated that he prefers additional offshore drilling, which is "not devastating and damaging to our environment as are sea otters."

RALPH BUCHSBAUM, MONTEREY, CALIFORNIA

Dr. Buchsbaum began by stating:

I would like to point out that in Africa, for 100,000 or a million years, the great mammals and men have gotten along. Only in recent years, due to the development of the rifle, and modern economics, is the elephant, particularly, in danger of extinction. So that it is some of the modern technology that is responsible for this problem. All over the world, the abalone, in Australia, and in the South Pacific, are going out. A few weeks ago, I was in China, and I bought an abalone. This abalone came from Mexico! There are very few abalones left in the Orient.

The reason that the sea urchin industry is so profitable here in the U.S. is that the sea urchins in Japan have been largely exhausted--there are more Japanese than there are sea urchins available for them, so that all over the world, the industries are going out, as the humans increase their collecting.

Now these are examples of what Garrett Hardin has called "tragedy of the commons." If you have a resource available to people and there are more and more people, they will go out and collect them. You can't blame an abalone diver for picking up the next abalone that he sees. If he doesn't pick it up, the next diver will take it. The frequency of the abalone will determine how many divers there are. If there are lots of abalones, there'll be a lot of divers. If there are fewer abalones, there'll be fewer divers. Every abalone within the limits of the law is free game.

Dr. Buchsbaum noted that agriculture, on the other hand, depends on the farmer having land and taking care of it, saving some seed and keeping on year after year. In contrast,

The abalone industry is more like a mining industry--like gold mining, in which every little bit of gold is taken out and then they leave. So every abalone is mined, rather than fished, in that sense. So it seems to me that the abalone industry is doomed--there'll be a transition, and the transition is to mariculture. Mariculture for clams, abalone, oysters--for all of the creatures that are in limited supply, in the face of an advancing human population and demand. The way to go, it seems to me, is in the direction of mariculture, rather than trying to restrict the sea otter. We don't have enough information to try to confine the sea otter.

STEPHANIE KAZA, SANTA CRUZ, CALIFORNIA

Stephanie Kaza, a researcher at the Center for Coastal Marine Studies at the University of California at Santa Cruz, noted that she is working on a study of people's attitudes toward marine mammals. She commented that if we are to manage ourselves as Dr. Sidney Holt suggested, "we need to know ourselves better and we need to know how we feel about the animals involved in these situations."

Dr. Kaza observed that humans relate much easier to marine mammals such as the otter than to invertebrates such as abalones and sea urchins. She noted that, "we can see otters feeding, mating, giving birth, and this touches us in some way, because we do the same things as mammals. We observe much less easily abalones and sea urchins in the process of feeding, releasing eggs and sperm in the environment, settling down on the substrate and growing up."

Dr. Kaza pointed out several differences in humankind's perception of sea otters and invertebrates.

Given those differences, it makes it difficult for us to relate equally to all these animals, but we can take this opportunity to examine our attitude towards these different animals and see where our limited perception affects our management decisions. I would like to suggest that, in all cases, we view all of these animals as resources, whether we view them as edible resources, which we can directly consume or whether we view them as non-consumptive resources, which we use for human benefit in a viewing or aesthetic manner. In all cases, they are seen as resources rather than as community members. I would just like to argue further, along the line of Dr. Partridge's [proposition], that we see ourselves as part of an ecosystem community--not just a local community of the offshore kelp forest, or our local Pismo Beach community, or the local California coast community,

of our species, where we are socially bonded, not just to human beings--men, women and children--but socially bonded to other species which are individuals in our ecosystem.

ALYCE PORTER, ATASCADERO, CALIFORNIA

Mrs. Porter, a long-time member of the diving community in San Luis Obispo County, maintained that government inactivity on the sea otter issue had ruined central coast fisheries. She noted that in a Senate hearing on the issue in 1965, a scientist gave false information which at the time was taken as truth by the State.

Mrs. Porter also said that false testimony was used in placing the southern sea otter on the Threatened Species List. She argues that "studies as early as 1950 by the U.S. Fish and Wildlife Service and later strengthened by Roest at Cal Poly, indicate no need to continue the farce that California sea otters are a sub-species, but are a part of Alaska's 120,000 plus population."

Mrs. Porter deplored the lack of government action on sea otter management, political pressure on government agencies by preservationists, and dishonest reporting of known facts by some scientists leading to a loss of state management of the otter and public misinformation.

In conclusion, Mrs. Porter stated: "We must understand the need for replacing what we use through a replanting program of our shellfish and sane management of predators, the sea otter in particular. Honest and moral evaluation of valid studies made in the past is rendered useless until dishonest and inaccurate records are exposed and corrected."

ERNEST PORTER, ATASCADERO, CALIFORNIA

Mr. Porter, a professional abalone diver for many years in San Luis Obispo County, stressed the value of shellfish fisheries as food resources and called attention to starvation rates around the world, particularly in countries such as India, where certain animals are considered to be sacred and are highly protected:

America was assisted in becoming a great nation because we made use of our resources. We not only feed ourselves, but we feed other nations' hungry peoples. Be warned: the attitude of animal sacrosanctity, brought from India and taught to our youth, weakens America by curtailing productive use of all our resources.

All food resources are extremely important. American Indian shell mounds exposing shellfish as the main food sustenance for thousands of years are absolute evidence proving shellfish [are of] value as substantial food resources. It is proven [that] sea otters destroy shore fisheries. Permitting predator destruction of food resources is immoral and dangerous and therefore criminal.

Mr. Porter claimed that state and federal governments, politically influenced by preservationists, have ruined San Luis Obispo and Monterey County fisheries. "Those who prevent management and promote animals that destroy food resources," he concluded, "should be held responsible for criminally contributing to the future horrors of starvation. Fishermen are managed. Therefore, we must also manage this 'sacred cow' sea otter. [The] environmental impact of translocating a ravenous beast without predation control accelerates fishery destruction."

RUDY MANGUE, CALIFORNIA ABALONE ASSOCIATION, SANTA BARBARA,
CALIFORNIA

The final speaker in the public comment session, Rudy Mangué, President of the California Abalone Association (CAA), stressed the role of the California abalone fisherman today. He remarked, "I am not going to dwell on the past. I think there's a little bit too much dwelling on the past going on here. I think that the main purpose for this forum is to get down to the facts and try to solve a lot of problems on both sides of the spectrum." "The CAA and its members," Mangué added, "are a group of conservationists, so to speak." The abalone industry has instituted a hatchery and abalone seeding program, limited entry, and has established size and bag limitations in order to save this resource and insure its existence in the future. In closing, he stressed:

I hope to convey to you today that the abalone diver today is concerned about resources, specifically the shellfish resource that he depends on and has depended in the past and hopefully in the future as a renewable food resource. But the abalone diver today is concerned also with sea otters. I hope that what I have to say here will convince you people that our intent in coming to this meeting will be that both sides of the spectrum can get together. Don't dwell on the past. There are too many complications and emotional problems. Let's go ahead in this thing. The intent of this forum is to work out the problems and to communicate with each other.

DISCUSSION WORKSHOPS AND PLENARY SESSION

Moderators

*William Wood,
University of California
Cooperative Extension*

*Michael K. Orbach,
University of California
at Santa Cruz*

DISCUSSION WORKSHOPS

During the second day of the conference, a number of concurrent discussion workshops met to consider the issues posed by the academic presenters and other participants during the first day. The purposes of the workshops were twofold: 1) to foster in-depth small group discussion of the issues and questions raised by the papers, panel discussions and public comments during the first part of the forum, and 2) to foster an informal exchange of information and opinions among government agency representatives, academics, representatives from various interests, and the general public.

Each workshop was composed of 10 to 15 participants, representing a microcosm of the variety of experiences and positions present at the conference. Forum participants were pre-assigned workshops to insure balanced representation of the various interests in each group. Everyone who wished to participate in the concurrent workshop sessions was welcomed, and approximately 200 individuals took part in the five-hour sessions.

All participants in the workshops were provided with a Workshop Guide listing a set of unresolved issues and questions, prepared by the forum staff. These Workshop Guides were made available to all participants at the beginning of the forum. The guidebook was intended to provide a specific framework through which underlying value differences and management references could be objectively analyzed. To this end, workshop participants were asked to read the guide prior to the start of the workshops.

Each workshop group was free to choose discussion topics from the questions provided and was given the opportunity to formulate additional questions. The groups were responsible for discussing these questions and reporting a "sense of the group" to an afternoon plenary session. The focused workshop discussions provided a vehicle for the orderly expression of different points of view and for the clarification of underlying values and judgements.

Each group was assigned a Facilitator and a Reporter. The task of the Facilitator was to promote orderly and reasoned discussion, include less assertive members in the conversation, and insure that the specific issues were dealt with fully. In an effort to achieve truly balanced discussions in the workshop sessions, we chose as Facilitators individuals with backgrounds in group processes rather than individuals with substantive experience in the controversy. In this respect, we gratefully acknowledge the services volunteered by members of the League of Women Voters, University of California Cooperative Extension personnel and faculty and students from the University of California at Santa Barbara, Cuesta College and California Polytechnic State University.

The major task of the Facilitator, thus, was to act as a neutral moderator, insuring that all points of view were brought out. Because many of the Facilitators lacked substantive knowledge of technical issues that were raised, whenever feasible, in each group, a Resource Person (someone with considerable substantive background) assisted the Facilitator on specific substantive points. The Reporter assigned to each workshop was responsible for keeping notes on the discussions and providing a summary at the end of the session. These summaries included major points discussed, areas of agreement and disagreement, and questions that remained unresolved or unanswered. The entire group was responsible for agreeing on the accuracy of the Reporter's record.

Following the concurrent discussion workshops, the forum staff met to synthesize the results of the various workshops. A subsequent plenary session summarized the issues raised during the two day meeting, reviewed the workshop discussions, described major areas of agreement and disagreement, and enumerated some of the questions that remained unresolved.

WORKSHOP QUESTIONS

We have prepared two sets of questions to guide your workshop discussion. The first, Questions 1 through 5 in List A, raise the broad philosophical questions that are at stake in this issue. The second set of questions, Questions 6 through 9 in List B, raise more specific and practically oriented management questions. We would like your workshop session to discuss ONE question from List A and ONE question from List B.

You are free to discuss the questions that you wish. We do ask that when you decide on a particular question, that you discuss that question fully (i.e., address all sub-parts of the question). After you have addressed fully one question from List A and one from List B, if you have time left, you might wish to tackle other questions which may be of interest (including any additional questions which your group may wish to formulate).

LIST A

QUESTION 1

This question has two parts:

- A. WHAT VALUES ARE AT STAKE IN THIS CONTROVERSY?
- B. CAN THESE VALUES BE RECONCILED?

- A. WHAT VALUES ARE AT STAKE IN THIS CONTROVERSY? How do different groups and individuals who are interested in this issue view the marine resources that are at stake?, e.g.,

- How and why is this issue important to the commercial fisherman? Besides being an economic endeavor, to what extent (if any) does commercial diving represent a way of life? If shellfish fisheries were precluded, what alternatives might be available to commercial divers? What costs might be incurred? If some costs were incurred, would society have the responsibility of bearing some of these costs?

- What is the recreational experience all about? Why is it important to people to utilize specific marine resources as recreation? Can this experience be substituted with other activities?

- For those who enjoy the sea otter, how is the quality of human life enhanced by watching sea otters in their natural habitat? What is gained, psychologically and socially, by "just knowing that they are there" in their habitat, and secure as a result of our deliberate and perhaps costly policy decisions? Conversely, what would be lost if we allowed these species with a history of over four million years to be eradicated?

- What other specific values may be at stake in this controversy? (oil/energy, kelp, etc.)

- Given that the marine resources at stake are common property resources, what is (or should be) the role of the general public in addressing this issue?

B. ARE THESE VALUES RECONCILABLE?

- That is, can several values be accommodated at the same time, or do we basically face a zero-sum situation whereby one group's gain is inevitably another group's loss?

- If the values are reconcilable, how can they be reconciled?

- If the values are irreconcilable, and specific costs (both monetary and psychic) are incurred, is this a matter for societal and governmental concern?

QUESTION 2

HUMAN RIGHTS AND ANIMAL RIGHTS

WHAT ARE THE RIGHTS/ROLE OF HUMANS AND WHAT ARE THE RIGHTS/ROLE OF ANIMALS?

- We often speak of human beings as being endowed with natural rights. Do these rights extend also to animals, such as the sea otter? Can the sea otters themselves be said to have a "right" to a secure habitat? A "right" to extend their habitat? What is the source and justification of the alleged "right"? How do these alleged "rights" compare to the "rights" of humans utilizing the shellfish resources (e.g., abalone fishermen)?

- What is the basis for human management of living resources? Is man most appropriately perceived as a master of nature? A manager of nature? A Steward? A "plain citizen" of nature?

- What are the policy implications of the different views that people have about man's relationship with nature?

QUESTION 3

PRESERVATION OF FUTURE OPTIONS

HOW DO WE BALANCE CURRENT AND FUTURE INTERESTS? DO WE HAVE A RESPONSIBILITY FOR ENSURING CERTAIN OPTIONS FOR FUTURE GENERATIONS? WHAT TYPES OF OPTIONS?

- If we feel that the presence of sea otters enriches our lives, does it follow that we should ensure their survival for the enrichment of future generations? Do future generations have a "right" to share the company of sea otters?
- What is the value of "wilderness" for our lives? How much wilderness do we need? How much should we be willing to pay (e.g., in the loss of shellfish) for the "luxury" of wilderness? Do we have the responsibility of preserving wilderness options for future generations?
- What about preserving recreational and commercial fishing opportunities for future generations? Should we be interested in preserving the option of commercial shellfish diving as an occupation for future generations? What about recreational opportunities? Should we be interested in preserving specific recreational opportunities related to shellfish fisheries for our children?

QUESTION 4

HOW DIFFERENT GROUPS VIEW ONE ANOTHER

- What are the impressions that each party in the sea otter controversy holds about the motives and intentions of other parties? Do those in organizations which have lobbied for complete protection of the sea otter, for example, believe that others, such as commercial abalone harvesters, have no regard for the viability of sea otters as a species? On the other side, do the businessmen of coastal communities within the range of the sea otter believe that sea otter protectionists have no regard for their community and identity?
- How accurate are the perceptions that different groups have of other groups?
- What are the implications of the impressions that different groups in the controversy have about each other? for resolving the controversy? for arriving at a management solution that is acceptable to most?

QUESTION 5

THE CURRENT MANAGEMENT REGIME: WHOSE VIEWS DOES IT REPRESENT?

Some people say that current protection of the sea otter under the Marine Mammal Protection Act and the Endangered Species Act accurately reflects the feelings of the people of California and of the U.S. as a whole concerning the goals and objectives of natural resources management. Others disagree, saying that the sea otter is not an endangered animal and that, therefore, it should not be protected as strictly as it is today.

- Whose position is correct? How can we answer this question? What types of information do we have to answer this question? How adequate is this information?
- Are there differences of opinion on this question according to level? That is, do different views prevail at the regional level (i.e., in California or in parts of California) versus at the national level, or international level?
- What opportunities for the public expression of different views are available under the current management regime? Are these adequate?

LIST B

Questions 6 through 9 concern discussion of the two major management options (unlimited range expansion and zonal management) and of translocation as a management technique that can be used under both of these options. Question 9 concerns future management regimes.

QUESTION 6

MANAGEMENT OPTION: UNLIMITED RANGE EXPANSION

This option holds that it would be most beneficial for the sea otter and for the marine ecosystem in which it plays a significant role for the California sea otter to continue to distribute itself along the California and Baja California coasts and offshore islands and to the north as well wherever its natural movements may take it.

Questions:

1. What are the values and assumptions implicit in this option?
2. How does this option relate to other possible management alternatives or techniques, e.g., zonal management, translocation?

3. How will this option ensure the continued protection of the animal and the ultimate attainment of Optimum Sustainable Population (OSP) under the Marine Mammal Protection Act (biological protection)?

- What steps should we take to solve the problem of defining OSP for sea otters?

- How do the "threatened" status of the animal and OSP relate to each other?

- How will this option remove the threats of hazards to the sea otter population (e.g., oil spills)?

4. What might be the socioeconomic impacts of this option? What specific groups/coastal communities may be affected (either positively or negatively)? What time frame are we referring to? How do we go about ascertaining and measuring these socioeconomic impacts? If specific costs are incurred, whose responsibility is it to bear these costs?

5. How technologically feasible is this option?

6. How feasible is this option in administrative terms? What agency (or combination of agencies) shall implement this option? Through what procedures? What time frame are we referring to? What interagency and intergovernmental coordination mechanisms may be most appropriate? How is this option related to the management of other aspects of the marine environment (e.g., oil)?

7. How will this option be enforced? How many personnel and how much money will be needed to enforce this option?

8. How much will it cost to implement this option? Who should bear these costs?

QUESTION 7

MANAGEMENT OPTION: ZONAL MANAGEMENT

This option attempts to strike a balance between protection of sea otters and use of shellfish fisheries by humans by setting aside certain areas for otters and other areas for use by recreational and commercial fishermen.

Questions

1. What are the values and assumptions implicit in this option?

2. How does this option relate to other possible management alternatives or techniques, e.g., unlimited range expansion, translocation?
3. How will this option ensure the continued protection of the animal and the ultimate attainment of Optimum Sustainable Population (OSP) under the Marine Mammal Protection Act (biological protection)?
 - What steps should we take to solve the problem of defining OSP for sea otters?
 - How do the "threatened" status of the animal and OSP relate to each other?
 - How will this option remove the threats of hazards to the sea otter population (e.g., oil spills)?
4. What might be the socioeconomic impacts of this option? What specific groups/coastal communities may be affected (either positively or negatively)? What time frame are we referring to? How do we go about ascertaining and measuring these socioeconomic impacts? If specific costs are incurred, whose responsibility is it to bear these costs?
5. How technologically feasible is this option? How adequate is the scientific knowledge available on this question? What practical methods can be utilized to implement zonal management?
6. How feasible is this option in administrative terms? What agency (or combination of agencies) shall implement this option? Through what procedures? What time frame are we referring to? What interagency and intergovernmental coordination mechanisms may be most appropriate? How is this option related to the management of other aspects of the marine environment (e.g., oil spill)?
7. How will this option be enforced? How feasible are the enforcement methods available? How many personnel and how much money will be needed to enforce this option?
8. How much will it cost to implement this option? Who should bear these costs?

QUESTION 8

TRANSLOCATION

This management technique entails establishing one or more colonies of sea otters in locations away from the otter's current range in central California. Translocation can be used as a management technique to fulfill the goals of both major management alternatives (unlimited range expansion and zonal management).

Questions

1. What are the values and assumptions implicit in this option?
2. How does this option relate to the two major management alternatives e.g., unlimited range expansion and zonal management?
3. How will this option ensure the continued protection of the animal and the ultimate attainment of Optimum Sustainable Population (OSP) under the Marine Mammal Protection Act (biological protection)?
 - What steps should we take to solve the problem of defining OSP for sea otters?
 - How do the "threatened" status of the animal and OSP relate to each other?
 - How will this option remove the threats of hazards to the sea otter population (e.g., oil spills)?
4. What might be the socioeconomic impacts of this option? What specific groups/coastal communities may be affected (either positively or negatively)? What time frame are we referring to? How do we go about ascertaining and measuring these socioeconomic impacts? If specific costs are incurred, whose responsibility is it to bear these costs?
5. How technologically feasible is this option? How adequate is the scientific knowledge available to carry out successful translocations? What techniques are available to implement this option?
6. How feasible is this option in administrative terms? What agency (or combinations of agencies) shall implement this option? Through what procedures? What time frame are we referring to? What interagency and intergovernmental coordination mechanisms may be most appropriate? How is this option related to the management of other aspects of the marine environment (e.g., oil)?

7. How will this option be enforced? How many personnel and how much money will be needed to enforce this option?

QUESTION 9

FUTURE MANAGEMENT

Looking ahead to the time when sea otters are sufficiently recovered so that they can be removed from the threatened species list, a wider range of management regime options becomes available. At that time, the State of California can request return of management authority to the state under the Marine Mammal Protection Act, the U.S. Fish and Wildlife Service can continue as the lead management agency, or yet a third alternative (involving some type of intergovernmental interaction) can be formulated.

What are the pros and cons of possible alternative management regimes?

PLENARY SESSION

Opening the Plenary Session, Dr. Biliana Cicin-Sain (one of the organizers of the conference), discussed the origins of the forum. The conference grew out of a perceived local need--initially identified by John Richards, the Sea Grant Marine Advisor for the South-Central Coast--to inform and educate the public on the complex issues underlying this controversy. In response to the perceived need for public information, a truly cooperative effort between the Marine Policy Program, University of California at Santa Barbara and the University of California Cooperative Extension Marine Advisory Program, was launched. What began as a relatively simple meeting, limited in scope, grew into a much more complex endeavor as the conference sponsors began to interact with and to solicit the input of public and private groups affected by this issue. The results, after many months of planning and preparation, were the impressive variety of local, state, regional, national and international perspectives present at the conference.

After thanking the many individuals, agencies, and groups which contributed significantly to the planning of the forum, Dr. Cicin-Sain reminded the audience that the purpose of the conference was not to arrive at specific management recommendations nor to reach consensus on particular solutions. Instead, the purpose of the conference was to discuss, in a systematic manner, the complex web of philosophical, economic, social, political, legal and administrative issues underlying this controversy, and to begin a new process of communication. "In terms of the latter goal," Cicin-Sain added, "I believe that a new process of communication has indeed been generated at this conference."

Dr. Bill Wood, the moderator of the discussion workshops, in turn, made a brief statement commenting on the value of the workshop sessions:

I'm assuming that for many of you today this was partially an exercise in frustration. It was complex. Many of you, I suspect, may have had and may still have fairly simplistic solutions to a complex problem. The problem becomes complex not perhaps because of technical considerations in many cases, but because there are many people involved. We have different perceptions. One of the major objectives, as far as I was concerned, of the workshop groups, was not the actual product--whether you found some points of agreement or disagreement--as much as the fact that you were speaking with people whom you may not have known before or you may have known by reputation. Hopefully, this was useful in terms of finding that we all have certain characteristics and certain qualities, and most of us, when we sit down in a group, can discuss rationally a number of things, not all things.

Dr. Michael Orbach then summarized the workshop discussions and provided his own observations of the workshop results and of the conference itself. Dr. Orbach reported that the majority of workshops decided to discuss zonal management and translocation. Dr. Orbach stressed that the intent of the workshops was not to arrive at a consensus over any management option nor to bind any individual or group to a particular course of action.

SUMMARY OF WORKSHOPS

Translocation

Much of the discussions concerning translocation reflected implicit values and assumptions of workshop participants. Dr. Orbach summarized the general workshop sentiment as one of striving to protect the ecosystem, the commercial and recreational activity and the sea otter. Several workshop groups pointed out that translocation would assist in supplying new research data, and would help in evaluating zonal management. Most groups believed that translocation could not be considered separate from zonal management. Translocation would quite likely speed up the expansion of the sea otter's range and, as a result, would necessitate zonal management. It was suggested that the reverse was not true: zonal management would not necessarily require translocation.

Biological Issues

The groups felt that a translocation program would reduce the threat of oil spills and increase the population expansion potential of otters. However, there was concern (in terms of biological protection) over the placement of the otter in new environments. Many expressed the reservation that the selection of new sites was more difficult than is commonly acknowledged and that a careful analysis of new locations is needed. In addition, Dr. Orbach noted that there was a shared belief among the workshop participants that we don't know enough about the internal dynamics of the otter populations. A fear existed that we might remove key individuals which would possibly jeopardize the dynamics of the rest of the population. There was a great deal of concern about the technical feasibility of handling otters, yet most people believed that if translocation were attempted, new biological information would be generated.

Socioeconomic Issues

Concerning the socioeconomic impacts of translocation, workshop participants agreed with the cost-benefit frameworks presented by Dr. Maynard Silva and Dr. Suzanne Holt. The groups did point out,

however, that "just as we must be concerned about the biological impacts on the new area, we must also be concerned about the socioeconomic impacts, specifically any conflicts with the fisheries or potentially developing fisheries in the new areas." It was generally believed there would be a positive impact on tourism wherever the otter was translocated. This, of course, would generate socioeconomic benefits. However, the administrative cost of a translocation would be enormous, a consideration which must be linked to technical feasibility.

Administrative Feasibility

In discussions of administrative feasibility, Dr. Orbach noted, translocation would require tremendous cooperation among state, federal and private parties. There is the possibility that any action might be accompanied by lawsuits from a variety of sources. Given the possibility of legal entanglement, the translocation alternative might actually impede a solution to the problem; if translocation involved more than one state, then, of course, the situation would become immensely more complicated. In any event, some of the workshop participation felt that some form of federal oversight was best. Others however, believed that state and local agencies, under a federal umbrella, should play the primary roles should translocation be attempted. The question of who would pay for the program was considered more important by workshop groups than what the cost would actually be. Dr. Orbach summarized funding possibilities as ranging from levying a landing tax on commercial species which are utilized as food by otters, to direct federal support, local contributions and combined state/federal funding.

In considering a translocation program, participants in the workshops felt it could be done through existing state capabilities with few administrative changes. Workshop groups generally favored keeping federal guidelines, but with state and local agencies acting as the "watchdogs." However, many groups felt that more information was needed to make translocation legally feasible under present state and federal regulations. One group, Dr. Orbach observed, felt very strongly that translocation was a "protective device and not a management device." However, most groups believed that translocation was the most feasible alternative for long-term preservation of the otters and resolution of the sea otter/shellfish problem. Dr. Orbach summarized this sentiment by quoting one group's views:

As translocation is desirable for the survival of the sea otter, and as zonal management of the otter is desired from the fisheries' point of view to reduce fisheries conflicts, translocation may require some containment to be acceptable to all parties concerned.

Zonal Management

Addressing the concept of zonal management, Dr. Orbach repeated that zonal management and translocation were closely linked. Otters and shellfish fisheries cannot exist in the same area, but there is some question whether otters could, in fact, be contained and excluded from certain zones. There is value in both otter and non-otter ecosystems, but the technical feasibility of zonal management raised questions about our ability to control such systems.

Biological Issues

A majority of workshop groups believed that zonal management was clearly directed to the survival of the otter. However, there was concern over whether sufficient technical knowledge on the carrying capacity of the nearshore marine environment or on the dynamics of sea otter populations was available in order to implement zonal management. As far as the relationship of zonal management to other management options is concerned, Dr. Orbach pointed out that most groups considered zonal management and translocation a likely combination. Zonal management was also perceived as a compromise measure between unlimited expansion and translocating entire populations to remote areas and thus the interplay between zonal management and translocation is quite important. If zonal management was used in combination with translocation, then the biological effects would be the same as under the translocation option. On the other hand, if the zonal management method involved taking or destroying otters, clearly there would be very different biological impacts. Dr. Orbach concluded from the group discussion that any zoning method not involving translocation would have very different biological impacts on the otter and perhaps other species as well.

Technical Feasibility

With respect to technical feasibility, many people doubted whether zonal management could, in fact, be carried out. A few groups considered the possibility of protecting, or even supplying, a preferred food resource for the otters as a way of keeping the otter in certain areas. However, it was also felt that the otter's expansion was not necessarily related solely to its food source. In addition, confining the otter to a given range may have some secondary impacts, and the issue of rehabilitation or stabilization within the zones was also considered.

Socioeconomic Issues

In considering the socioeconomic impacts of zonal management, most groups recognized that the effects would again depend on the methods used to implement this option. It was felt trapping and translocating otters would be very expensive, while taking animals in some fashion would be much cheaper. Using translocation, the economic costs would vary depending on the numbers of otters, from individuals to entire colonies, to be moved. While technologically feasible according to some groups, all groups raised the moral, legal and economic questions of zonal management. The administrative feasibility of zonal management would also largely depend on whether translocation was included in the management plan. With translocation, the administrative problems would be much the same as described earlier. Without using translocation, there would be significantly fewer administration questions. It was mentioned, however, that if taking otters was used as a containment measure, legal changes in federal law might be necessary. Dr. Orbach quoted one group's views regarding the implementation of zonal management:

Our version of zonal management is a trade-off: Open the north coast under a controlled basis to fishing in exchange for allowing otters to move a little south. Also start a colony on San Nicolas Island. Management agencies should also investigate the possibility of translocating otters to Oregon and Washington to eliminate the threat of oil spills (on the present California population).

This summarized the sentiment of a number of the workshop groups, Dr. Orbach concluded.

Balancing Current and Future Interests

In general, the workshop groups believed that as many options as possible should be preserved; many groups felt there was a basis for hope in simply keeping options open. The question of irreversibility was noted, and it was generally felt that politically and socially acceptable options should always be sought. Several alternative solutions were suggested, most of which were considered in combination with one of the two major management options, and all of which depended upon technological advances. Some suggested "tongue in cheek" solutions; birth control for the otter or developing "killer abalone."

Conference Summary

Following the summary of the workshop results, Dr. Orbach proceeded to summarize the conference, noting several connections and overlapping comments among the wide variety of speakers.

Philosophical Issues

The philosophers argued the sea otter constituted a considerable shared moral resource. However, Dr. Orbach observed, the "moral stake" different people have in that resource is variable. Repeating Dr. Partridge's discussion of the anthropocentric and ecological perspectives, Dr. Orbach held that most of us rest somewhere between these poles. He equated the "moral paradox" with the "tragedy of common"; that is, that part of the issue lies in the extent to which people address their own self-interest, and the extent to which that interest goes against the public interest.

Dr. Orbach noted that legal rights for animals, per se, is a very serious legal issue which was discussed very little at the conference, and is an unresolved area. The increasing importance of this issue is related to our increasing knowledge about the social and technical behavior of non-human species, which brings the legal and moral distinction between man and animal more and more into question. This affects the otter, which uses tools, is a mammal, and ranks high on the "cuddly quotient" scale.

Economic Issues

There are three broad questions concerning the economic aspects of natural resource management: 1) How do we measure "values"; 2) How do we decide about distribution of things once we measure them; and 3) What is the equity of each pattern of distribution. One problem which surfaced frequently at the conference seemed to be the incompatibility of the levels of analysis and units of measurements used by different parties.

For example, the issue of shellfish as a luxury food came up repeatedly. But Dr. Orbach warned, "We should be very careful about saying that because an item is a luxury that it's unimportant...I don't think we should put a perjorative connotation on the use of 'luxuries'." Dr. Orbach urged more comprehensive economic analyses; one, for instance, would be the relationship between the impact of otters on abalone and the development of abalone mariculture. However, the same problem reoccurs with regard to including enough variables, measuring them accurately, and making equity decisions once measurements were made.

EPILOGUE

EPILOGUE*

Since the conference was held in January 1981, a number of developments (in both the public and private sectors) which affect this issue have taken place. This Epilogue summarizes these developments in an effort to provide the reader with an up-to-date account of the status of management programs for sea otters and shellfish fisheries in California. The following developments are discussed: 1) increased communication between fishing and sea otter protection interests; 2) status of management measures concerning the sea otter; 3) status of the sea otter population in California, 4) congressional amendments to the Marine Mammal Protection Act; 5) new developments in the commercial diving industry; and 6) development of oil and gas resources off the coast of California.

INCREASED COMMUNICATION BETWEEN FISHING AND SEA OTTER PROTECTION INTERESTS

According to the large number of reports and evaluative letters we received following the January meeting,¹ the conference appears to have fostered a new process of dialogue among the major parties concerned with this issue--the fishing industry, sea otter protection groups, and state and federal agencies of government. Several tangible manifestations of this increased communication are as follows.

Immediately following the forum, a significant meeting took place between representatives of the Friends of the Sea Otter (FOSO), Save Our Shellfish (SOS), the California Abalone Association (CAA), the U.S. Fish and Wildlife Service--Office of Endangered Species (FWS-OES), the U.S. Marine Mammal Commission (MMC). The primary topic discussed at this meeting was consideration of potential sites for translocation of sea otters other than San Nicolas Island. A consensus developed at this meeting to request the Fish and Wildlife Service to oversee a study mapping potential areas for sea otter translocation along the entire West Coast, from Washington to the Mexican border. As reported later in this section, this mapping study will include biological and

*This Epilogue has been prepared by the Editors on the basis of periodical information and informal interviews with the U.S. Fish and Wildlife Service, the California Department of Fish and Game, the U.S. Marine Mammal Commission, Friends of the Sea Otter, and Save Our Shellfish. This update includes developments which have occurred through January of 1982. Interpretations of this information are the responsibility of the Editors.

ecological as well as socioeconomic information on potential translocation sites. Several weeks after the forum, a second meeting took place in Carmel between representatives of the CAA, SOS, FOSO, and FWS. The purpose of this meeting was to review oil company information on the significant number of oil seeps which occur along the coast in the Santa Barbara Channel and southern California which might affect the health of sea otters migrating south.

STATUS OF MANAGEMENT MEASURES CONCERNING THE SEA OTTER

Several major developments on management issues have taken place since the forum: 1) The recovery plan for the southern sea otter underwent several technical and agency reviews and was signed by the Director of FWS on February 3, 1982; 2) several research studies are being carried out (or are proposed by the FWS) to implement major provisions of the recovery plan; 3) a new petition to change the taxonomic status of the otter was filed by Save Our Shellfish.

Progress on the Recovery Plan

As is discussed in the Cicin-Sain paper, at the time of the January conference, the recovery plan for the southern sea otter was undergoing "technical" review (review by technical experts only). Subsequently, the plan was to undergo an "agency" review process (review by relevant agencies), and was scheduled for approval by the Director of the Fish and Wildlife Service by December 1981.

The recovery plan was submitted for "agency" review on August 6, 1981. Compared to the technical review draft which outlined an extensive, multi-faceted, and long-term research strategy, the "agency" review draft placed greater emphasis on management action items, such as dealing with threats from oil spills and methods for translocating otters. The emphasis in the "agency" review draft also appeared to move away from "reestablishing and maintaining OSP in natural habitats throughout their (the sea otters') historical range in the U. S. Pacific coastal waters,"² to a less specific goal statement which does not necessarily imply reestablishment throughout the entire historical range.³

Another change present in the "agency" draft concerns the possibility of using Alaskan otters, in translocation efforts.⁴ Finally, while the "technical" draft ignored issues of zonal management, the "agency" review draft called for studies of zonal management as a possible method for managing the sea otters once their Optimum Sustainable Population (OSP) level has been defined and achieved.⁵

The "agency" review draft was criticized by the Marine Mammal Commission in an October 9, 1981 letter for a number of deficiencies, most notably: (1) the lack of a proposed or recommended plan and schedule for translocating otters, or, alternatively, the lack of a description of the steps to be taken in developing such a plan and schedule; (2) the failure to identify what and how many types of biological, ecological and socioeconomic information must be considered in deciding the optimal, long-range management strategy for the southern sea otter population; and (3) the failure to identify the role and responsibility of the Southern Sea Otter Recovery Team.⁶ In an October 21, 1981 letter, the Fish and Wildlife Service responded to the comments by the Marine Mammal Commission, noting, among other things, that: a contract for the mapping study had recently been awarded;* development of a detailed translocation study would have to await the determination of potential translocation sites which would not be done until completion of the mapping study in June 1982; development of a comprehensive work plan would follow completion and approval of the recovery plan; and the recovery plan was expected to be completed and forwarded to the Director for approval by December 15, 1982.⁷

After undergoing "agency" review in late 1981, the recovery plan underwent several other changes at the Washington D.C. level of the Fish and Wildlife Service in January 1982. The final version of the recovery plan was approved by the Director of the Fish and Wildlife Service on February 3, 1982. Given these reported last minute changes, it has been difficult for us to piece together all of the changes contained in the current version of the plan. Interested readers wishing further details may request copies of the approved plan from the U.S. Fish and Wildlife Reference Service, Unit 1, 3840 York St., Denver, Colorado, 80205, (303) 571-4656. While the California Department of Fish and Game, in a January 29, 1982 letter to the Director of the Fish and Wildlife Service, expressed some objections to the final plan,⁸ in a subsequent meeting between the two agencies (DFG and FWS) on February 9, 1982, both agencies pledged to work together in implementing the plan. During this meeting, the FWS emphasized the "flexible" nature of the recovery plan, which may be subject to change as new data or information become available.⁹

Fish and Wildlife Service Research Programs Related to Sea Otter Translocation and Recovery

While the recovery plan for the southern sea otter recommends that a large number of studies be carried out (both long-term and short-term studies on the sea otter and its habitat), it appears that

*The mapping study is discussed in the next section.

the FWS is focusing on five major research tasks which need to be accomplished before any translocation can take place.¹⁰ These are: 1) the coastal mapping project alluded to earlier; 2) continuation of ongoing baseline studies at San Nicolas Island; 3) a study to determine the age and sex composition, and the desirable size of any population to be transplanted; 4) a research study to develop methods of containment; and 5) a study to determine the correct taxonomy of the various sea otter populations. Reflecting the current vagaries of the federal budgetary process, the FWS reports that funding is assured only for the first two tasks (mapping study and San Nicolas Island baseline studies). Funding for the remaining tasks is still uncertain. In tune with President Reagan's "New" Federalism, the FWS is currently exploring private sources of support for these studies.

Mapping Study

A contract has been awarded to J. S. Dobbins and Associates of Toronto, Canada for the purpose of compiling and mapping available biological, ecological, and socioeconomic information relevant to the protection and management of the sea otter within the coastal waters of California, Oregon, and Washington. The purpose of this study is to compile, evaluate and map this information in order to identify potential translocation sites. The project will address the entire Pacific coastal zone of the continental United States, from the Canadian border to the Mexican border. The contract was let in September 1981 by the FWS.

The mapping project will incorporate the following information: the historic and present distribution and density of the sea otter in coastal waters; available but unoccupied sea otter habitat and the potential density of sea otters in the coastal waters of California, Oregon, and Washington; the distribution of giant kelp in coastal waters and the yield and socioeconomic value of kelp harvesting; the current distribution of abalone, clams, sea urchins and other shellfish resources; the location and value of recreational and commercial shellfish and finfish fisheries; and planned mariculture projects in the coastal waters of these three states. Additionally, in order to establish the feasibility of potential translocation sites for the safety of any relocated otter populations, the study will map oil tanker and other vessel routes and the nature and location of known hazards to shipping; oceanographic currents, wind patterns, natural oil seeps, and the likely trajectory of oil spills in these waters; the location of existing, planned and potential federal and state oil and gas lease sales; pipelines for transporting oil and gas; power and sewage treatment plants; the types of pollutants that are being introduced into nearshore environments and areas that could be affected by these activities; offshore dumping sites for radioactive wastes; military activities; and the location and nature of existing and proposed parks, wildlife refuges, marine sanctuaries, and other federal, state and local protected areas.

To complete this study, Dobbins and Associates will establish a base of operations in California. According to the terms of the contract, the mapping project must be completed by June 24, 1982.

Baseline Studies of San Nicolas Island

Major comparative studies on the sea otter and its habitat are being carried out by the Denver Wildlife Laboratory of the FWS Field Station at Piedras Blancas Point and at San Nicolas Island. The comparative kelp ecosystem studies of these two areas (one occupied by otters, the other not occupied by otters), will help isolate the effects of sea otter foraging on nearshore marine communities. The baseline studies of San Nicolas Island were initiated in April of 1980 and will continue for at least four years in order to provide a data base on the basis of which subsequent changes may be ascertained.

In addition to these short-term baseline studies, a number of more long-term ecosystem studies are being carried out at San Nicolas Island. These concern examination of kelp forest biology, studies of sea urchin activities and the role of predators, and studies of populations of black abalone in rocky intertidal habitats. It is estimated that these studies, begun in 1980, will require ten years for completion.

Socioeconomic analysis of natural resource utilization on San Nicolas Island is also the subject of investigation, in order to assess the potential impacts of recolonization by sea otters on human users of the ecosystem. Three aspects of potential impacts are being examined. First, the user groups, their socioeconomic characteristics, and the nature of their activities at San Nicolas Island are being described. Second, since human exploitation of the area will be subject to fluctuations over time (independent of the presence of sea otters), the influence of such factors other than the presence of the sea otter (e.g., market fluctuations, military operations) will also be assessed. Third, in order to assess the direct and indirect effects of sea otters on human exploitation, an economic component to the ecosystem models for San Nicolas Island is being developed. Estimated time needed for completion of these studies, which began in 1980, is three years, although follow-up studies are projected.

Petition to Change Taxonomic Classification of the Southern Sea Otter

On March 20, 1981, Save Our Shellfish filed a petition with the U.S. Fish and Wildlife Service to reclassify the southern (Californian) sea otter, Enhydra lutris nereis, as the same subspecies as the northern (Alaskan) population of sea otters, Enhydra lutris lutris. The two reasons stated in the petition for the change in taxonomic designation were: 1) to afford the U.S. Fish and Wildlife

Service and the other involved agencies a maximum number of options in their current endeavors to produce a satisfactory Recovery Plan, and in 2) to insure that any protective legislation (in connection with the California sea otter) is based on biologically correct information.

The petition documented several scientific works which hold that northern and southern sea otter stocks should not be separated at the subspecific level.¹¹ The petition by SOS was supported by DFG¹² and by Charles Woodhouse, a marine mammalogist, and Associate Director of the Santa Barbara Museum of Natural History. In a March 19, 1982 letter to the acting Director of the FWS, Woodhouse discussed the idea of maximizing management options. Referring to discussions which took place at a July 24-25, 1980, meeting of the FWS, MMC, DFG and the DFG Sea Otter Scientific Advisory committee, Woodhouse noted:

The salient point raised concerns the wider range of management options available if in fact there are no biologically significant differences between "southern" (Californian) and "northern" (Alaskan) sea otters. Given this possibility, northern animals could be used to replenish the California stock should it be seriously diminished by man made or natural causes. Another thought is that northern animals could be used to maintain genetic heterozygosity of the southern population should the latter show signs of genetic weakness.

Reviewing past and current systematics work (primarily based on cranial morphometrics), Woodhouse concludes that, "based on these recent studies, there is plausible reason to question the validity of the neréis subspecies." However, in order to establish significant differences or similarities among sea otter stocks, genetic and electrophoretic studies would be desirable.

The U.S. Fish and Wildlife Service reports that the petition to change the taxonomic status of the southern sea otter is being held in abeyance until further genetic studies are conducted.¹³ As discussed above, however, funding for such studies appears uncertain.

STATUS OF THE SEA OTTER POPULATION IN CALIFORNIA¹⁴

The last major census of the California sea otter population was conducted in June, 1979, between Ano Nuevo Island in north-central California and Pismo Beach on the south-central California coast. The estimated population from the survey was approximately 1,443 animals, although because of poor weather conditions during the counts, the estimate was not generally accepted by biologists and many felt that a

higher number of otters, about 1,800 (derived from the 1976 census), represented a better estimate. Keeping track of population trends can give biologists an idea of the relative health of the population. Both the DFG and FWS have continuing programs to attempt to gain data on trends in population density, although the methods used (mainly counts by airplane or ground counts) cannot be used to give a reliable estimate of the total number of animals in the population.

The California Department of Fish and Game has an ongoing program to collect mortality data on sea otters and to determine, whenever possible, the causes of death. Documented otter mortalities in California have increased significantly in the past two years. In 1979, 68 dead otters were recovered, but by 1980 the toll had increased by 100 per cent. In 1980 and 1981, respectively, 143 and 152 otters were recovered, representing the highest recorded mortality since records were first kept in 1968. The previous high count was in 1977, when 91 otter mortalities were documented. This upsurge in mortality has evoked a great deal of concern among scientists and environmental groups.

Some biologists point out that the increase in recoveries of otter carcasses could be due to factors other than an actual increase in mortality. An increased effort by DFG to recover dead otters, a heightened public awareness of the presence of the threatened sea otter population, and movement of the population into more densely populated areas are examples of factors which could increase recovery of dead sea otters. However, an equally relevant consideration in interpreting mortality data is that the recoveries are thought to represent only a fraction of the actual mortalities. Moreover, as the otters move into more populated areas, the possibility of illegal shooting or harassing of otters may increase.

In a majority of cases, the causes of death cannot be ascertained because of advanced decomposition of the otter carcasses that are recovered. Examination by X-ray, however, can often aid biologists in determining the cause of external wounds. In 1981, 12 otters showed evidence of death by shark attacks and five otters (all recovered in San Luis Obispo County) had died from bullet wounds. Documented shooting deaths have varied between none and five per year over the past fourteen years. In recent years (prior to 1981), known mortalities by shooting totalled as follows: 1976 (2), 1977 (4), 1978 (1), 1979 (0), 1980 (2). As most otters who die at sea are never recovered, and those that are recovered are often so decomposed that necropsies are not useful, the actual extent of shooting sea otters is not known. Both the California Department of Fish and Game and the Friends of the Sea Otter are greatly disturbed by these shootings.¹⁵ In an August press release, DFG Inspector Russell Goodrich expressed his concern about the illegal shootings and promised a DFG investigation.¹⁶

State and federal laws protect the sea otter, and conviction of shooting or otherwise harming otters, under federal statutes, may result in fines as high as \$20,000 and one year in jail. The California Department of Fish and Game has instituted a new secret witness program, called CalTIP, which can protect informants reporting illegal acts against wildlife. Rewards from privately contributed funds are paid to anyone providing information leading to the conviction of persons poaching fish and game species or otherwise harming wildlife. This program has wide support among recreational and commercial fishing organizations, and wildlife conservation and preservation groups. (The CalTIP hotline number is (800) 952-5400.)

Another issue which surfaced in 1981 concerns the correlation between high rates of mortality for sea otters and gill net fishing operations offshore in Monterey and San Luis Obispo Counties. Although no definitive proof exists that otters have drowned in gill nets, DFG biologist Jack Ames has expressed concern that some otters may be drowning in fishing nets.¹⁷ Increased sea bird mortality and high numbers of dead seals and sea lions on shore, as well as the recent high levels of otter mortality, is seen by some as an indication that gill net fishing activities are having a damaging impact on marine mammals and birds. Friends of the Sea Otter and other concerned groups are actively seeking sponsorship for legislation that would limit the gill net fishery and protect vulnerable species from these impacts.

At present, although environmentalists and biologists are greatly concerned about the increase in mortality rates for otters, it is difficult to say whether the sea otter population in California has increased or decreased significantly. While there has been a definite expansion in range in 1981, the population does not seem to be expanding in numbers; rather, biologists feel, it may currently be relatively stable.¹⁸

CONGRESSIONAL AMENDMENTS TO THE MARINE MAMMAL PROTECTION ACT¹⁹

At the national level, Congress considered a number of amendments to the Marine Mammal Protection Act (MMPA) during 1981. Hearings before the Senate Committee on Commerce, Science, and Transportation were held on April 3, 1981 and before the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the House Committee on Merchant Marine and Fisheries on April 7, 1981. On July 13, 1981 the House Subcommittee held hearings on a revised bill (H.R. 4084), which was passed without opposition by the House on September 21 and the Senate on September 29, 1981. The bill was signed into law by the President on October 9, 1981.

Congressional hearings on amending the Marine Mammal Protection Act focused primarily on implementation problems, and on the MMPA's effectiveness in protecting marine mammal populations. While environmental interests generally supported reauthorization of the Act for three to four years and reflected the view that the Act has worked as an acceptable compromise, balancing management and use considerations with preservation of marine mammals, state fish and game representatives sought substantial amendments to the Act and recommended a shorter reauthorization period during which amendments could be developed. The state of Alaska, in particular, stressed the problems that had arisen with respect to its attempts to regain management jurisdiction over several species. Other testimony described some of the difficulties encountered by federal agencies in the implementation of the concept of optimum sustainable population (OSP) and in the definition of depletion of stocks under the Act.

Following congressional hearings and negotiations among representatives of several states, fishing interests, outer continental shelf (OCS) oil and gas interests, Alaskan natives, and the environmental community, H.R. 4084 reauthorized the MMPA for three years and amended it in several ways, while generally maintaining the safeguards previously provided for marine mammals under the Act.

In amending the MMPA, Congress first clarified language relating to OSP and for determining species depletion. The definition of OSP was modified to delete "optimum carrying capacity," which was considered to lack independent significance. According to the Marine Mammal Commission's report on the amendments, the working definition of OSP (a range of population sizes between the maximum net productivity and the largest supportable level) was endorsed, clarifying the definition to reflect current agency practice. The definition of "depletion" was similarly modified to conform to agency practice--a species or population is considered depleted when it is found to be below its OSP level or listed as endangered or threatened under the Endangered Species Act. The classification of these terms is not likely to immediately affect the sea otter in California, which will continue to be treated as "depleted."

In addition, Congress made four major changes in the provisions of the Act, aimed at the following goals: 1) facilitate return of management for a given species to the states; 2) alter the Alaskan native exemption clause; 3) provide relief to the yellowfin tuna industry by allowing it to continue some incidental take of porpoise in purse-seine nets; and 4) address the issue of incidental take of marine mammals in activities other than commercial fishing.

Of perhaps the most significance to the southern sea otter are the amendments relating to incidental take in activities other than fishing, which could include offshore oil development, and the return of management authority to the states.

New language regarding non-fishing-related types of incidental take, such as those associated with outer continental shelf exploration and exploitation, establishes a scheme whereby the Secretary of Interior or Commerce, depending on the species, may authorize such incidental take by U.S. citizens if it is found that the total of such taking will have a negligible impact on the population of marine mammals and its habitat. The species or population of marine mammals subject to this provision may not be considered depleted, and the Secretary must prescribe regulations setting forth permissible methods of taking to insure the least practicable impact on the population and its habitat, and requirements for monitoring and reporting the taking. This amendment would not allow any taking of California sea otters as long as they are listed as threatened under the ESA and therefore considered depleted, but may have far-reaching implications for marine mammals not so considered. The wording of the amendment, however, is fairly stringent insofar as the taking must be considered to have only "negligible" impact on the population and its habitat.

The provision for returning management jurisdiction to the states for a given species was altered to facilitate the return of authority to a state. Under the amendment, the Secretary may transfer management authority to a state if it has developed and will implement a program with criteria set forth in the Act. The state is given the responsibility of determining the OSP and the number of animals that may be taken, but must hold a public hearing on those determinations if requested.

In related action, Congress will be hearing testimony and considering reauthorization and amendments for the Endangered Species Act (ESA), which is due to expire September 30, 1982. In what will be a major legislative battle between conservationists and commercial and industrial interests, Congress will consider the ESA in hearings before the House Merchant Marine and Fisheries Committee and the Senate Committee on Environmental and Public Works during Spring 1982.

In a review of the ESA conducted by the Department of Interior, a wide range of issues has been identified, including the desirability of retaining critical habitat designations, the need to protect lower life forms, the role of economic considerations in the listing of species, possible modification of the exemption process, and the possible modification of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) standard of "reliable population estimates." Many other issues have been raised in approximately 400 comments the agency has received from government agencies, conservationists, business, universities, and the public.

As the destruction of habitat is widely considered the single most important cause of species endangerment, Section 7 of the ESA, requiring that federal agencies insure that their actions not jeopardize any species or critical habitat, is likely to be a principal

target of those wishing to weaken the Act. A broad coalition of national and international organizations (such as the Defenders of Wildlife, the Friends of the Earth, the Friends of the Sea Otter, the Center for Environmental Education and the Sierra Club) has joined together to counteract interests opposed to reauthorization of the ESA. According to the Endangered Species Act Reauthorization Bulletin which these groups are publishing, a major goal of this coalition is to "secure a strong legal base for the effective conservation and recovery of plants and animals that are now, or may forseesably become, in danger of extinction, and to ensure that the Endangered Species Act furthers the purposes and policies it now articulates."

NEW DEVELOPMENTS IN THE COMMERCIAL ABALONE INDUSTRY

Since the early 1970s, the commercial abalone industry in California has been active in the development of an abalone enhancement program using hatchery reared juvenile abalone to supplement or enhance the production of wild abalone stocks. In 1981, the Brown Administration in California gave strong support to the idea of enhancing the state's renewable land, freshwater and marine resources through the California State Resources Agency's 20-year plan on "Investing for Prosperity: Enhancing California's Resources to Meet Human and Economic Needs." One of the specific goals set forth in this plan is to "increase annual abalone production by one million pounds." Enhancement of fisheries has similarly been supported by the California State Legislature. In recent legislative action (for example AB 2973, enacted into law in September 1980), the state established an Energy and Resources Fund which "assigns a portion of tidelands oil revenue income from a non-renewable resource to reinvestment for for restoring and enhancing California's energy and renewable resources." The Act provides for up to \$120 million each year, with the enhancement of fishery resources specifically mentioned as one of the programs to receive a portion of the available funds.

In the past five years significant advancements have been made in both hatchery rearing techniques and in methods for "open ocean mariculture" of abalone through the cooperative efforts of the commercial abalone industry, private mariculture firms, the California Department of Fish and Game and the University of California Sea Grant Program.

With the prompting of the abalone industry in the mid 1970s, the California Department of Fish and Game (DFG) and California Sea Grant initiated a joint research effort, the Experimental Abalone Enhancement Project, whose objective is to determine the biological and economic feasibility of abalone enhancement. This research represents a cooperative effort among marine biologists from DFG, Scripps Institution of Oceanography and the University of California at Santa Barbara. An advisory steering committee to the project includes

representatives from the abalone industry. This project is nearing completion and preliminary research results were made available to the industry and to state resource managers at a Sea Grant Marine Advisory meeting held in Santa Barbara in October 1981.

At this meeting, researchers were cautiously optimistic about the biological feasibility of abalone enhancement, although the results of several large-scale plants near the coast and Channel Islands had not been fully evaluated. Abalone enhancement programs in Japan seem to be quite successful. Japan's experience, however, may have limited applicability in the U.S., insofar as the Japanese abalone harvest is largely controlled by fisheries cooperatives and no sport fishery for abalone exists in Japan.

The question of economic feasibility of a large scale enhancement effort remains open for researchers and resource managers. The cost of hatchery reared juveniles varies significantly with size at the time of purchase. The longer young abalone are held in the hatchery, the higher the cost. In 1981, the cost range of a one-inch red abalone was between \$.70 and \$1.00, depending on the number purchased.

The number of abalone which will survive to reach legal sport and commercial size (7 1/4 and 7-3/4 inches, respectively) seven to eight years after planting, remains an unknown variable. This information is critical in determining the economic feasibility of a state supported enhancement program.

A number of privately initiated efforts are implementing these experimental abalone enhancement techniques in the Santa Barbara Channel. California Sea Farms (CSF), a private firm, recently requested permission from the DFG to lease specific ocean bottom areas for abalone enhancement purposes. The program is designed to allow a return to firms and individuals investing in the seeding project as well as to enhance the abalone resource for the public (for both commercial and recreational purposes).

More specifically, CSF proposed the following:

1. To lease from the state subtidal ocean bottom (areas of "proven reefs" which supported abalone populations in the past, but which now have few or no abalone) to be used as grow-out areas for hatchery-spawned red or pink abalone. These areas would remain open to the public for the harvest of legal sized abalone.
2. To allow the "seed" abalone (planted at about 3/4") to grow for three to four years in a natural habitat before harvesting. Under the guidance of the DFG, the planted abalone would be harvested at several inches less than legal

sport or commercial size, and sold by CSF. These animals must be readily identifiable (marked in some way) as hatchery reared abalone.

Since red and pink abalone become sexually mature and begin spawning at about 2" in size, even those animals that are to be harvested would have the opportunity to spawn several times while in the wild. The abalone larvae remain in the water column for approximately six to ten days or more (depending on the sea temperature) before settling. This allows a potential for the repopulation of the lease site and surrounding areas, depending on the direction of currents and the availability of certain bottom conditions which favor settlement.

3. To reimburse DFG for the time spent by DFG biologists monitoring the project. Department of Fish and Game diver-biologists would work with CSF personnel during the selection of lease sites, during plants and would monitor all harvesting.

In August of 1981, the California Fish and Game Commission approved CSF's request to lease ocean bottom, in three areas: 1) off San Nicolas Island, 2) off Santa Cruz Island and 3) off San Miguel Island. Each site is approximately four acres in size. The preliminary lease period is five years with an extension to 20 years if a review of the project by DFG proves satisfactory.

The Department of Fish and Game negotiated with CSF on the conditions for planting and harvesting red and pink abalone and the first commercial "open ocean" plant of red abalone was made with full DFG approval at San Nicholas Island in August 1981. A second plant was completed at the San Miguel site in the fall of 1981.

The California Abalone Association also applied for an open ocean mariculture lease, a three acre site off Santa Rosa Island. The Fish and Game Commission approved the application in November 1981. As of this writing, one other company has requested a state water bottom lease for open ocean mariculture of abalone off San Clemente Island. The lease is pending and will be considered by the Fish and Game Commission in April 1982.

In addition to these open ocean mariculture efforts, two firms have obtained ocean bottom leases for containment mariculture of abalone within the range of the California sea otter. Three other firms have lease applications pending, with final Fish and Game Commission hearings scheduled for the winter and spring of 1982. These firms have developed various types of containers or artificial habitats to confine and protect hatchery-reared juveniles during the

grow-out period. The containers must be strong and securely anchored to withstand the frequently rough sea conditions that occur off the California coast. There is a chance that an entire container full of abalone could be lost in heavy seas. The method is generally more labor intensive due to the necessity of harvesting kelp and feeding the animals on a regular schedule. Periodic maintenance of containers can also add to labor costs.

The major advantages of containment mariculture are: 1) predation is greatly reduced or eliminated, allowing a high survival rate during grow-out, 2) regular feeding may result in faster growing animals (although abalone grown in the open ocean may also be regularly fed or their natural diet supplemented), 3) soft bottom areas can be utilized with the container grow-out system and bottom leases can be more conveniently located near harbors, 4) harvesting of the entire stock at any size can be done quickly. Seeding of state bottom areas around the lease site is also a possibility if successful spawning of the containerized abalone occurs.

It will be several years before economic comparisons can be made between these various approaches to resource enhancement. The possible translocation or repopulation of the southern sea otter into areas below Point Concepcion will be an important factor in the future development and direction of the abalone industry.

DEVELOPMENT OF OIL AND GAS RESOURCES OFF THE COAST OF CALIFORNIA²¹

Given the sea otter's vulnerability to oil spills and the proximity of its range to potential sources of hydrocarbon resources, the development of outer continental shelf (OCS) oil and gas resources off the coast of California is thought by many to pose serious implications for the sea otter population in California. The Reagan Administration, in a campaign led by Secretary of Interior James Watt, has made it clear that the development of these resources is a major national priority, and has accelerated plans for leasing, exploring, and developing coastal tracts containing hydrocarbon reserves. The opening of the California coast to exploration and development of oil and gas deposits may affect the sea otter population in various ways: directly, by encouraging hydrocarbon activities in areas of future expansion or translocation of the otters; and by increasing tanker and vessel traffic and the development of storage and processing facilities in areas near the sea otter range. This section reviews recent controversies surrounding Lease Sale 53 (the tracts closest to the sea otter range) and plans for accelerated development of adjacent areas off the California coast.

As has been discussed elsewhere in this volume, sea otters are particularly susceptible to oil pollution. Unlike other mammals, otters lack an insulating layer of blubber and depend entirely on their thick air-filled fur for protection from chill waters. Should the otter's fur become contaminated with oil and matted down, it would lose its insulating properties, resulting in overexposure and death. While no major oil spills have occurred in the vicinity of the sea otter range in California, spills of other materials exhibiting similar patterns of movement as oil slicks underscore potential threats to the sea otter population posed by offshore hydrocarbon development. In a study recently conducted by two U.S. Fish and Wildlife Service scientists,²² the movement rates of a large quantity of lumber which was spilled in the ocean off central California during the winter of 1978 were studied. The lumber was observed to have spread through most of the range of the threatened California otter population within four weeks. The movement rates of lumber were found to be similar to those of oil slicks elsewhere. These observations, the authors conclude, indicate that a major oil spill could expose significant numbers of California sea otters to oil contamination.

Lease Sale 53

Lease Sale 53, which encompasses five major geologic basins, most immediately and directly affects the sea otter population. The southernmost area of Lease Sale 53, the Santa Maria Basin off San Luis Obispo and Santa Barbara Counties, is immediately adjacent to the southern boundary of the sea otter range. The tracts of this lease sale closest to the range of the otter were the subject of litigation in 1981.

While former Secretary of Interior Cecil Andrus, in October of 1980, recommended that the four northern basins of Lease Sale 53 (Eel River, Point Arena, Bodega Bay, Santa Cruz) be deleted from the scheduled OCS leasing program, the Santa Maria Basin remained available. In January of 1981, California Governor Jerry Brown asked the Department of Interior to delay plans to lease 31 tracts of the Santa Maria Basin off San Luis Obispo County, one of the major reasons for this request being that these tracts were adjacent to the current range of the sea otter. The California Coastal Commission made a recommendation to delete 29 tracts, based on the danger to the otter as well. Notwithstanding the recommendation of the Governor and the opinion of the Coastal Commission, however, in February of 1981, the Reagan Administration proposed leasing not only the previously deleted northern basins, but the Santa Maria tracts as well, arousing the ire of environmentalists and members of the California congressional delegation. In April, 1981, the Department of Interior announced plans to accelerate oil and gas leasing in a five-year plan (1982-86), beginning with the leasing of 111 tracts in the Santa Maria basin.

On April 29, 1981, the state of California, several state agencies and environmental organizations (Friends of the Sea Otter, Natural Resources Defense Council, and others) filed companion lawsuits against the Department of Interior in an attempt to halt leasing of the disputed Santa Maria tracts. They alleged that Secretary Watt's plans for Lease Sale 53 violated portions of the Coastal Zone Management Act (CZMA), the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and portions of the Outer Continental Shelf Lands Act Amendments (OCSLA) by not considering the state's position in the matter, and for ignoring possible impacts of development on the threatened California sea otter.

California's key legal argument was that Secretary Watt had ignored the governor's recommendation, requested pursuant to the OCSLA, and the consistency review provisions of the CZMA. The consistency provision of the CZMA holds that a federal agency cannot undertake an activity that "directly affects" a state's coastal zone if that activity is inconsistent with a state's adopted coastal zone management plan. In May, 1981, however, the Department of Commerce, apparently prompted by Secretary of Interior Watt, issued proposed regulations in the Federal Register redefining "directly affecting" as "having a direct measurable physical effect" on the coastal zone. According to the Department of Interior, the new wording indicated that leasing of OCS lands, in itself, represents no such effect on a state's coastal plan and therefore has no bearing on the CZMA consistency provision. (In October of 1981, however, the Department of Commerce withdrew this controversial redefinition because of congressional and state opposition.)

Following filing of the suits against the Department of Interior in April of 1981, representatives of environmental groups and state and local agencies in California continued to stress their opposition to the Department of Interior's plans to lease the areas off northern California, and even California Republicans became concerned that the leasing plan would hurt Republicans in state elections. President Reagan's choice for the head of the Council on Environmental Quality, A. Alan Hill, urged the Administration to veto drilling off northern California.²³ In June and July of 1981, in Congress, the House Appropriations Committee, after hearing criticisms by both Democrats and Republicans, banned leasing the four northern basins of Lease Sale 53 by amending Interior's appropriations bill for FY82 to that effect. The Department of Interior subsequently announced that the four northern basins would, for the present, be "a low priority."

On May 27, 1981, in a preliminary hearing on California's lawsuits, Judge Mariana Pfaelzer of the United States District Court in Los Angeles issued a temporary injunction against the leasing of 32 tracts in portions of the Santa Maria Basin off San Luis Obispo. In a final decision on those tracts, on July 27, 1981, Judge Pfaelzer made permanent the injunction against leasing 29 tracts in the disputed

areas off San Luis Obispo for exploration and drilling. According to Pfaelzer's decision, leasing would be in violation of the CZMA consistency provision. Pfaelzer ruled against the state and environmentalists on the other issues however; the allegations that the actions of the Department of Interior violated the OCSLA, NEPA and ESA were not upheld, although the Court found that Secretary Watt had violated the "spirit of OCSLA" requiring federal consideration of the governor's recommendations. Vowing to take the question of the consistency provision to the Supreme Court, Secretary Watt is appealing the Pfaelzer decision, and oral arguments in California v. Watt began January 15, 1982 before the U.S. Court of Appeals in San Francisco.

Environmental groups are also appealing the decision, because of a ruling that the right to sue the federal government under the CZMA is reserved to state and local governments and not to private citizens or environmental groups. Such a precedent, they contend, could significantly affect future environmental issues under laws which do not contain specific "citizen-suit" provisions.

On August 7, 1981, a Department of Interior Press Release from the Office of the Secretary officially withdrew the four northern basins from Lease Sale 53, noting that the California court decision "poses a clear threat to any decision made now with respect to leasing in the four other Basins. Lawsuits on these tracts. . . would almost assuredly go the same Court and judge who decided against our position on the 31 tracts."²⁴ At a press conference in August, Watt stated that the "decision raises some very important questions about who is in charge of the federal outer continental shelf--the state or the federal government."²⁵

These developments notwithstanding, Lease Sale 53 may still potentially impact the otter population. Auctions of some tracts have brought record bids from the industry, and exploration plans for the remaining 81 tracts not enjoined in the decision in California v. Watt have been filed by several oil companies for approval by the U.S. Army Corps of Engineers. Depending upon the outcome of Secretary Watt's appeal of the Pfaelzer decision, it is conceivable that at some point the enjoined tracts may be freed for leasing.

The Accelerated Five-Year Leasing Program

In related developments, on April 16, 1981, the Reagan Administration announced a five-year leasing program to accelerate inventory and development of hydrocarbon resources off the nation's coasts. Announcing the decision, Secretary Watt called it, "one of the most important economic and energy proposals of the Reagan Administration. . ." The program is "aimed at reducing our dependence on uncertain and costly foreign energy supplies, while continuing the excellent environmental record of gas and oil operations in U.S.

waters."²⁶ The plan would, in effect, offer every OCS tract for exploration at least once during the next five years. It would "streamline" the leasing process and the environmental impact analysis process by basing assessments of environmental impacts on broad area-wide environmental reviews rather than basin-specific reviews. In the early planning stages under the plan, environmental review would be based on "geologically promising areas;"²⁷ thus, focus would be primarily on petroleum potential rather than potential environmental hazards posed by exploration and development. Studies of potential hazards posed by the development of areas scheduled for leasing would not take place until 30 days prior to a lease sale.

The United States Court of Appeals, District of Columbia Circuit, approved the Secretary of Interior's schedule for the Revised Five-Year Leasing Program on January 19, 1982. The Court Order requires the Secretary to issue a Tentative Proposed Five-Year Leasing Program in March, to transmit the plan to Congress, the Attorney General and governors of affected states, and to invite the submission of public comments for a period of 30 days. Following consideration of the comments, the Secretary is expected to announce a Proposed Final Leasing Program in May, submitting it to the President and Congress. After allowing 60 days for congressional or Presidential action or comment, the Secretary will issue a Final Five-Year OCS Oil and Gas Leasing Program.²⁸ Affected California areas under the Accelerated Five-Year Plan, Lease Sales 68 and 73, are discussed below.

A U.S. General Accounting Office (GAO) Report severely criticized the Accelerated Leasing Program and the proposed streamlining of the environmental review process. The study found that the new schedule would not provide adequate time for states to plan for proposed OCS lease sales or for opportunities for input by state and local governments. The GAO report recommended that Secretary Watt be required to provide better information to Congress on the economic and environmental effects of proposed OCS activities.

Lease Sale 68

A Proposed Notice of Sale for Lease Sale 68 (Point Concepcion to the Mexican border) was announced by the Department of Interior on February 3, 1982, offering 172 tracts for sale in June 1982. Although tracts to be offered under Lease Sale 68 are south of the current range of the sea otter, the sale involves areas which have been discussed as possible translocation sites for the otter.

Moreover, Lease Sale 68 includes areas surrounding the Channel Islands Marine Sanctuary in the Santa Barbara Channel, which extends six nautical miles from the islands. As originally proposed, the regulations for the Channel Islands Marine Sanctuary would prohibit

oil and gas activities on future leases within the Sanctuary. However, in October, 1981, in response to President Reagan's freeze on new federal regulations, the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration suspended regulations which would effectively prohibit hydrocarbon development in the Channel Islands and Point Reyes-Farallon Islands Marine Sanctuaries.²⁹ Although Secretary of Interior Watt has temporarily delayed plans to lease areas around the Channel Islands Marine Sanctuary in Lease Sale 68, a final decision on those tracts will be forthcoming in March of 1982.

Lease Sale 73

Lease Sale 73, encompassing up to 200 miles offshore central and northern California from Point Concepcion to the Oregon border, incorporates and expands areas offered for lease under Lease Sale 53. Lease Sale 73 essentially greatly enlarges the five basins involved in Lease Sale 53 and could reintroduce areas previously deleted from scheduled leasing. Areas which could be offered in this sale include the Point Reyes-Farallon Islands Marine Sanctuary, all of the Big Sur coast, and Monterey Bay to Point Ano Nuevo. The Big Sur and Monterey Bay areas encompass all of the range of the California sea otter. Originally scheduled for January 1983, Lease Sale 73 has been delayed temporarily; an updated leasing schedule will not be available until the Tentative Proposed Five-Year Leasing Program is released in March. The State of California and Governor Brown have objected to reopening of the Santa Cruz, Point Arena, Bodega Bay and Eel River Basins as inconsistent with the California Coastal Plan.

In summary, it is clear that under the Reagan Administration, plans for leasing areas of offshore California for the development of hydrocarbon resources will be greatly accelerated. This has important implications for the southern sea otter. Areas such as the Santa Maria Basin under Lease Sale 53 and the areas offshore the Big Sur and Monterey coastlines under Lease Sale 73 could directly affect the otter population by encouraging development in areas of its current range. Development of other areas in southern and northern California, as well as the Channel Islands, could potentially remove areas from consideration as translocation sites or affect the otter in areas of future range expansion. Moreover, increased tanker traffic and the development of onshore support facilities which would be expected from intensified oil and gas exploitation may increase the likelihood of accidents and oil spills in areas likely to affect the sea otter population.

B.C.S.

P.M.G.

J.B.R.

Notes

1. Following the conference, we received a large number of letters and media reports commenting on the conference. These materials are on file in the office of the California Council for the Humanities in San Francisco.
2. Southern Sea Otter Recovery Plan, Technical review draft, p. 38.
3. Southern Sea Otter Recovery Plan, Agency review draft, p. 47.
4. Letter from Harold J. O'Connor, Deputy Associate Director-Federal Assistance, U.S. Fish and Wildlife Service to Lad Handelman, Save Our Shellfish Committee, no date (circa October 1981) p. 1.
5. Southern Sea Otter-Recovery Plan, Agency review draft, pp. 67-68.
6. U.S Marine Mammal Commission, Annual Report to Congress, Calendar Year 1981, p. 64.
7. Ibid.
8. Letter from Charles Fullerton, California Department of Fish and Game to Robert A. Jantzen, Director of U.S. Fish and Wildlife Service, January 29, 1982.
9. Personal communication with Harold O'Connor, U.S. Fish and Wildlife Service, and Bill Maxwell, California Department of Fish and Game, March 15, 1982.
10. Personal interview with Harold J. O'Connor, Deputy Associate Director-Federal Assistance, U.S. Fish and Wildlife Service, Washington, D.C., October 21, 1981.
11. Petition to the U.S. Fish and Wildlife Service for reclassification of Enhydra lutris nereis to Enhydra lutris lutris, March 20, 1981, pp. 7, 11, 12, 13.
12. Letter from Emil J. Smith, Jr., Assistant Chief, Marine Resources Branch, California Department of Fish and Game to Richard G. Williams, Save Our Shellfish, May 1, 1981.
13. Personal interview with Harold J. O'Connor, Deputy Associate Director-Federal Assistance, U.S., Fish and Wildlife Service, Washington, D.C., October 21, 1981.

14. This section relies on the following sources: interviews with Robert Hardy and Jack Ames, marine biologists with the California Department of Fish and Game, and Robert Sollen, "Sea Otter Rally May be Dwindling," Santa Barbara News Press, October 4, 1981.
15. Carol Fulton, "Sea Otters Shot!" The Otter Raft, No. 26, Winter 1981, p. 9.
16. "State Probes Killing of Sea Otters," Los Angeles Times, August 17, 1981.
17. Carol Fulton, "Gill Nets and Sea Otters," The Otter Raft, No. 26 Winter 1981, p. 9.
18. Personal communication with Robert Hardy, California Department of Fish and Game, February 11, 1982, and with James C. Estes, U.S. Fish and Wildlife Service, February 17, 1982.
19. This section relies on information gathered from: Marine Mammal Commission, Annual Report on the Marine Mammal Commission, Calendar year 1981: A Report to Congress; The Otter Raft, No. 26 (Winter, 1981); Marine Mammal Protection Act, P.L. 92-522, as amended, October 1981; Center for Environmental Education, Endangered Species Act Reauthorization Bulletin, No. 1 (Dec. 9, 1981) and Marine Mammal News, Vol. 7 No. 11 (Nov. 1981).
20. This section relies on minutes from the Sea Grant Experimental Abalone Enhancement Advisory Committee meetings (1978-81); Experimental Abalone Enhancement Information Meeting (Santa Barbara, California, August 1981); Personal communication with Emil J. Smith, Jr. (DFG), Earl Ebert (DFG), Lad Handelman and Win Swint (California Sea Farms), and John McMullen (Ab Lab).
21. This section relies on periodicals and newspaper reports, the Pacific Coast Federation of Fishermen's Associations' Friday, Press releases from the Department of Interior and Pacific Outer Continental Shelf Office, Bureau of Land Management, and The Otter Raft.
22. Glenn Van Blaricom and Ronald J. Jameson, "Lumber Spill in Central California Waters: Implications for Oil Spills and Sea Otters," Science (USA), 1982 (in press).
23. "Reagan Aide Fights Offshore Drilling," Los Angeles Times, June 25, 1981, Part I, p. 2.
24. U.S. Department of Interior, Office of the Secretary, Press Release, "Secretary Watt Announces Withdrawal of Four Northern California Outer Continental Shelf Areas from OCS Sale 53," August 7, 1981.

25. Eleanor Randolph, "Watt Halting Disputed State Oil Leasings," Los Angeles Times, August 8, 1981, Part I, p. 5.
26. U.S. Department of Interior, Office of the Secretary, Press Release, "Proposed Five-Year Offshore Leasing Program Announced," July 5, 1981.
27. U.S. Department of Interior, Bureau of Land Management, Pacific Outer Continental Shelf Office, POCS Current Events, January, 1982.
28. U.S. Department of Interior, Bureau of Land Management, Pacific Outer Continental Shelf Office, POCS Current Events, February, 1982.
29. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, Fact Sheet: Suspension of Hydrocarbon Regulations in the Channel Islands and Point Reyes--Farallon Islands National Marine Sanctuaries, October 1981.

APPENDICES

I. Biological Background

A SUMMARY OF THE LITERATURE
ON *ENHYDRA LUTRIS*

*Charles D. Woodhouse, Jr.,
Santa Barbara Museum
of Natural History*

A STATUS REPORT ON
CALIFORNIA SHELLFISH
FISHERIES

*Robert Hardy and
Fred Wendell, California
Department of Fish and Game,
and John DeMartini,
Telonicher Marine Laboratory
Humboldt State University*

II. Biographical Information on Conference Participants

A SUMMARY OF THE LITERATURE ON THE
BIOLOGY OF ENHYDRA LUTRIS, L.

Charles D. Woodhouse, Jr.
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INTRODUCTION

The sea otter, Enhydra lutris, L., is a member of the mustelid family, which includes river otters, skunks, weasels, etc. As its common name implies, the species is strictly a marine animal inhabiting coastal waters of the temperate and boreal North Pacific. The species may occur on shore, but the majority of time is spent in waters within 20 fathoms where they feed and breed. Sea otters rarely range into fresh water, unlike their river otter relatives in North and South America, which will range into marine coastal waters to feed.

Sea otters have made a comeback after severe depletion in numbers early in this century. In Alaska the population numbers over 100,000. In California the population is probably about 2,000. Animals from the Alaskan herd have been translocated to southeastern Alaska, British Columbia, Washington and Oregon.

Expansion of sea otter population stocks both naturally and artificially through translocation has created a change in nearshore ecosystems. In areas where sea otters out compete humans for shellfish resources, concern has arisen relative to the management and protection of sea otters as well as the management of exploitable shellfish resources for humankind. The question of management involves the status of certain sea otter population stocks under the terms of the Endangered Species Act. Sea otters in California are threatened, and they will probably remain in that status until it can be demonstrated that they are at Optimum Sustainable Population (OSP). Management conflicts have arisen with regard to resources and sea otters and the unresolved means to conserve both.

Management in the context of the foregoing will require additional knowledge of the biology of sea otters. Precise information on population growth and stability is presently not available to allow a definition of OSP, at least in California. Biological information on which to base other management decisions such as optimum age structure and sex ratios for a successful transplant is rudimentary at best. There is, then, a need to continue the type of biological research that is presently underway by U.S. Fish and Wildlife Service as well as California Department of Fish and Game scientists. It is the intent of this paper to recapitulate the current level of understanding of the species.

In 1977 a summary of available literature dealing largely with California sea otters was compiled (Woodhouse, et al., 1977). This paper is based on that work but includes some of the more recent published literature.

SYSTEMATICS

Three subspecies have been described: Enhydra lutris lutris, E.l. gracilis, and E.l. nereis. The former has been listed as ranging from Vancouver Island to the westernmost Aleutian Islands (Hall and Kelson, 1959; Anderson, 1947). The subspecies gracilis is known as the Kuril-Kamchatka sea otter (Barabash-Nikiforov, 1947; Kenyon, 1969). The latter subspecies, nereis, has been subject to dispute. Originally described by Merriam (1904) on the basis of one skull from San Miguel Island, California, the systematic status was subsequently questioned by Scheffer and Wilke (1950); they could find no evidence to support this subspecies. Hall and Kelson (1959) erroneously list the range of E.l. nereis as the Strait of Juan de Fuca to Sebastian Vizcaino Bay, Baja California. The source of error lies in a misquote from a paper by Taylor and Shaw (1929) which is simply a "Provisional list of the animals of the State of Washington," and makes no reference to a northern or southern limit to the range of the subspecies nereis. The most recent work which contributes new data from skull measurements indicates the subspecies designation is invalid (Roest, 1976, 1979). There is strong evidence for a cline in the subspecies E.l. lutris with the strongest gradient between the Aleutians and Prince William Sound, Alaska, but very little significant difference between Prince William Sound and California specimens (Roest, 1979).

SEA OTTER MORPHOLOGY

Adult sea otters average 29 kg for males and 19.5 kg for females having average total lengths of 136 cm and 126 cm respectively. Alaskan otters may tend to be larger than California specimens. At birth, pups may weigh between 1.4-2.8 kg. Average length of newborn pups is 53.9 cm (Kenyon, 1969; Miller, 1974) Adult fur is generally dark-brown, though adult males may become grizzled over the head with age. E. lutris gracilis tends toward a more red-brown pelage.

Forepaws are adapted primarily for feeding; the hindlimbs have become adapted for locomotion in water. The forepaws have retractile claws and the palms have well developed pads. Sea otters are capable of grasping, holding and manipulating prey with their forepaws. The hindlimbs, on the other hand, have been modified as flippers; claws are non-retractile and pads are poorly developed. The fifth digit is longest. Descriptions of the musculature of both fore- and rear limbs are given by Howard (1973, 1975).

Descriptions of the skeleton have been provided by Taylor (1914), Lensink (1962), and Morejohn, et al. (1975). The teeth have also been described for aging purposes (Lensink, 1962; Kenyon, 1969; Schneider, 1973). However, teeth do not give reliable estimates of age (Schneider, 1976). The dental formula of adults is I-3/2; C-1/1; PM-3/3; M-1/2 = 8/8.

Table 1 shows organ weights as percentage of total body weight. The values were obtained from Morejohn, et al. (1975) and Kenyon (1969). The sea otter's liver is at least twice the size of the average relative liver weight for marine mammals. Morejohn, et al. (1975) correlate this to the hypothesis of the role of the liver in maintaining high metabolic rates in marine mammals stating, "the larger size of the otter liver probably relates to the otters' small body size, extremely high metabolic rate, and the relatively inefficient insulation provided by its fur versus the blubber or fat of most other marine mammals." This is possibly supported by the even larger liver size in the Alaskan otters which inhabit the colder northern waters. Sea otter kidneys are also large compared to other marine mammals. This may relate to salt balance and water flux (Kenyon, 1969; Costa, 1977).

Table 1

ORGAN WEIGHTS AS A PERCENTAGE OF TOTAL BODY WEIGHT

Organ	Sex	California			Alaska ^a		
		Number	Average % of Body Weight	Standard Deviation	Number	Average % of Body Weight	Standard Deviation
Heart	M	48	0.733	0.233	6	0.61	0.045
	F	36	0.703	0.140	9	0.69	0.093
Liver	M	49	4.60	1.25	6	5.29	1.063
	F	35	4.61	0.834	9	5.92	1.184
Kidney	M	49	1.86	0.596	6	2.40	0.134
	F	35	1.86	0.386	9	1.76	0.158
Spleen	M	45	0.427	0.170	6	0.31	0.091
	F	35	0.483	0.241	9	0.38	0.068

^aData derived from Kenyon (1969).

Source: Morejohn, Ames and Lewis, 1975, p.27. (Reproduced with permission of the authors.)

PHYSIOLOGY

On the average, sea otter adults require 190 kilocalories/kg body weight/day (Kenyon, 1969). Costa (1976) gives a value of 253 kilocalories/kg body weight/day based on a study of food consumption and results of bomb calorimetry carried out on four captive California sea otters. Approximately 20 to 25% of a sea otter's body weight in food is required every day. If an otter is not fed, it may lose 10% of its body weight/day. A 25% weight loss is normally fatal (Kenyon, 1969). Stallken and Kirkpatrick (1955) found that the sea otter will pass the food it eats in about three hours; this rate has been verified by Dr. Mattison in Kenyon (1969). Residence time of food in the gut may exceed three hours however (Ames, 1979).

Costa (1976) reports some preliminary results of water balance among four captive California sea otters. Three of the four drank sea water, and of a total water input of 0.266 liters per kilogram body weight per day, 67.5% entered via food, 9.2% via respiration, and 23.3% via seawater drinking (mariposia). Of this input, 76.2% leaves through the urine. He also reports that sea otter urine contains 93.7% of electrolytes and 88% of nitrogen excreted from the body. Mean water flux was determined to be 26.6% of body weight and there was no correlation between food input and seawater drinking. Both Costa (1976) and Fausett (1976) independently report nearly similar assimilation efficiencies for captive animals, i.e., the former reports average values of 86.5% and the latter values of 80.9%. Fausett (1976) investigated assimilation efficiencies for different food types, but assimilation values were not statistically significant.

The lungs are large by volume and provide almost all buoyancy while also serving as an important oxygen store (Kooyman, 1973). The sea otter's lung has been reported to comprise 67% of oxygen storing capacity whereas the remaining 33% is in the blood and muscles (Lenfant, et al., 1970).

The dense fur of sea otters is the primary means of heat retention. The species does not have a layer of insulating blubber that is typical of other marine mammals. By trapping a layer of air within the fur, water is excluded from touching the skin. The otter's high caloric intake allows it to maintain its body temperature which is $38.1 \pm 0.34^{\circ} \text{C}$ under normal conditions (Morrison, et al., 1974). Morrison, et al. reported the sea otter's average basal metabolism to be 2.5 times the expected basal metabolism for a terrestrial mammal of equal size.

Sea otters can adapt to fluctuations of temperature from 0 to 28°C . The feet comprise 17% of total body surface area (Iverson and Krog, 1973), and play a role in thermoregulation. Khromovskikh (1968) and Morrison, et al. (1974) noted this and the latter states "more than two-thirds of the heat load must go through the paws in water at 26°C and perhaps four-fifths in air at 22°C ." Food consumption has been

noted to decrease with an increase in habitat temperature (Cornell, 1976). In warm water the fur loses its resistency to water; this has been interpreted as a means to allow greater heat removal, which would be important in water temperatures of 28° C and higher (Morrison, et al., 1974).

Recently, some experimental work on the physiological effect of crude oil contamination of sea otter fur has been conducted. Using 5 California sea otters, Costa and Kooyman (1979) measured oxygen consumption over a 5 - 30° C range to determine the resting, average, and active metabolic rates. Furthermore, these investigators measured metabolic rates before, during and after experimentally oiling approximately 20% of body surface area of 3 experimental animals. They detected no significant increase in oxygen consumption among unoiled otters tested at different temperatures. A standard metabolic rate of 12.0 ml O₂ kg-min⁻¹ was determined. Using an average oxygen consumption of an unoiled otter in 15° C water (16.0 ml O₂ kg-min⁻¹) as a baseline, the rate increased 41% after oiling. On washing the oiled otter, the rate increased 106%. Oil was left on one animal for eight days; the metabolic rate rose 127%. Experimental work such as this illustrates the degree of thermoregulatory stress that oiling by crude oil can cause.

Several investigators have looked at reproductive physiology. Sinha, et al. (1966) have shown that during gestation there is a long period of delayed implantation. The delay lasts 4 to 4.5 months, after which the blastocyst becomes implanted and development proceeds for another 4 to 4.5 months until birth (Schneider, 1972). For California, Vandevere (1979) gives an estimated gestation period of 6.5-7 months. Fetal development has been described by Sinha and Mossman (1966). Kenyon (1969) noted that fetal orientation was about equally cephalic and caudal, and the births normally occurred on land. From the lack of any births being observed on land in California, Miller (1974) assumes that birth occurs while the mother is in the water. Twinning has been reported by Barabash-Nikiforov (1947), Lensink (1962), and Schneider (1972), though it is rare. Wild and Ames (1974) found an adult female that had apparently died while trying to give birth to twin fetuses.

Sea otters are not accomplished divers like the pinnipeds and cetaceans. Maximum duration of dives is probably less than 6 minutes (Kenyon, 1969). Otters may dive as deep as 164 ft. (Barabash-Nikiforov, 1947), although most animals tend to occur, and feed, in waters 20 fathoms (120 ft.) or less (Kenyon, 1969). Diving sea otters exhibit bradycardia. Galantsev and Maminov (1979) report on decreases in heart rate by 1/2 to 1/8 the normal rate with intensity of bradycardia correlating to length of dive and partial exhalation under water.

Work on the physiology of the senses is greatly lacking. Gentry and Peterson (1967) found the sea otter's underwater visual acuity to be

fairly accurate in distinguishing differently sized discs. Kenyon (1969) has found that on land, smell is apparently more important than sight as a warning sense. For food gathering, the otters will use sight as well as their tactile sensors: vibrassae and paws. Kenyon (1969) has found the sensory vibrassae present in three locations: mystacial, superciliary, and nasal. He noted that in the wild, the otters' vibrassae are usually short and worn, (1.5 to 2.5 cm), whereas in captivity, where the otters need not search for their food, the vibrassae commonly grow long (10 to 12 cm). The otter's sense of hearing has not been found to be exceptionally good or poor.

The sea otter's brain and nervous system is entirely lacking work except for a brief anatomical study by England and Dillon (1972) of the cerebrum.

TROPHIC ECOLOGY

A list of food items identified as being consumed by sea otters had been compiled from Kenyon (1969), and the California Department of Fish and Game (1976) with additional information from Hines and Loughlin (1980), Estes, et al. (1978), and Calkins (1978), and is seen in Table 2. Frequency of species eaten has not been included.

Table 2

FOOD ITEMS OF THE SEA OTTER, ENHYDRA LUTRIS

Echiura (worms)	Arthropoda (cont.)
<u>Urechis caupo</u>	Malacostraca
Nemertea (worms)	Decapoda (crabs)
<u>Emplectonema</u> sp.	<u>Blepharipoda occidentalis</u>
Annelida	<u>Cancer</u> sp.
Polychaeta (worms)	<u>Cancer antennarius</u>
<u>Arenicola</u> sp.	<u>C. magister</u>
<u>Eudistylia polymorpha</u>	<u>C. productus</u>
<u>Nereis</u> sp.	<u>Cryptolithoides sitchensis</u>
<u>Nereis vexillosa</u>	<u>Hapalogaster</u> sp.
Arthropoda	<u>H. cavicauda</u>
Crustacea	<u>Lopholithodes foraminatus</u>
Cirripedia (barnacles)	<u>Loxorhynchus crispatus</u>
Thoracica	<u>Panulirus interruptus</u>
<u>Balanus nubilus</u>	<u>Paralithodes</u> sp.? (larval)
Isopoda	<u>Placetron wosnessenski</u>
<u>Idotea (Pentidotea)</u> sp.	<u>Pugettia producta</u>
Amphipoda (probably incidental)	<u>P. richii</u>

(continued on next page)

Table 2 (cont.)

FOOD ITEMS OF THE SEA OTTER, ENHYDRA LUTRIS

Mollusca	Polyplacophora (chitons)
Gastropoda (snails, limpets, abalone)	<u>Cryptochiton stelleri</u>
<u>Acmaea (Collisella) sp.</u>	<u>Ischnochiton sp.</u>
<u>Argobuccinum oregonensis</u>	<u>Mopalia sp.</u>
<u>Astrea gibberosa</u>	<u>Tonicella marmorea</u>
<u>Buccinum sp.</u>	Cephalopoda (squid, octopus)
<u>Crepidula adunca</u>	<u>Loligo opalescens</u>
<u>Haliotis cracherodii</u>	<u>Octopus sp.</u>
<u>H. rufescens</u>	Echinodermata
* <u>H. walallensis</u>	Echinoidea (urchins)
<u>Lottia gigantea</u>	<u>Strongylocentrotus drobachiensis</u>
<u>Megathura crenulata</u>	<u>S. franciscanus</u>
<u>Natica clausa</u>	<u>S. polyacanthus</u>
<u>Polinices lewisii</u>	<u>S. purpuratus</u>
* <u>Tegula sp.</u>	Asteroidea (starfish)
<u>Tegula brunnea</u>	<u>Ceramaster sp.</u>
<u>T. montereyi</u>	<u>Henricia sp.</u>
* <u>T. funebris</u>	<u>Leptasterias sp.</u>
Bivalvia (clams and mussels)	<u>Patiria miniata</u>
<u>Clinocardium ciliatum</u>	<u>Pisaster brevispinus</u>
<u>C. facanum</u>	<u>P. giganteus</u>
<u>Liocyma viridis</u>	<u>P. ochraceus</u>
<u>Macona sp.</u>	<u>Pycnopodia helianthoides</u>
<u>Modiolus modiolus</u>	Ophiuroidea
<u>Musculus vernicosa</u>	Brittle star
<u>Mytilus californianus</u>	Holothuroidea
<u>M. edulis</u>	<u>Cucumaria sp.</u>
<u>Pododesmus cepio</u>	Chordata
<u>P. macroschisma</u>	Ascidiacea (tunicates)
<u>Protothaca sp.</u>	<u>Styela montereyensis</u>
<u>Saxidomus gigantea</u>	Pisces (fish)
<u>S. nuttalli</u>	Cottidae
<u>Serripes sp.</u>	Embiotocidae
<u>Siliqua patula</u>	<u>Anoplopoma fimbria</u>
* <u>Spisula hempelli</u>	<u>Cyclopterichthys glaber</u>
<u>Tivella stultorum</u>	<u>Hemilepidotus hemilepidotus</u>
<u>Tresus nuttalli</u>	<u>Hexagrammos sp.</u>
<u>Volsella volsella</u>	<u>H. superciliosus</u>
	<u>Mola mola</u>
	<u>Pleurogrammus monoptygius</u>

*Indirect evidence of foraging noted; actual feeding not observed.

Many food habit studies have been conducted (Fisher, 1939; Limbaugh, 1961; Booloottian, 1961; Hall and Schaller, 1964; Ebert, 1968a; Kenyon, 1969; Vandevere, 1969; and Calkins, 1978), however such parameters as study areas, time of study and length of time otters had inhabited a given study area vary considerably (Wild and Ames, 1974). Conclusions from most of the studies conducted in California have considered sea urchins, abalones and rock crabs to be preferred food items since these are typically the first items consumed when California sea otters occupy a new habitat. As these food items are depleted, other food items are utilized (e.g., turban snails, kelp crabs, mussels, octopus, etc.) thereby increasing the diversity of the otters' diet. Bivalve molluscs, decapod crustaceans, starfish, sea urchins and fish such as the globe-fish predominate in the diet of Aleutian and Prince William Sound otters (Kenyon, 1969; Calkins, 1978). Otters in Prince William Sound have been noted to use a rock "tool" to open large clams, i.e., *Saxidomus gigantea*, (Calkins, 1978). This is the first evidence for Alaskan sea otters using stone tools in the wild in Alaskan waters.

In several studies conducted in California (Ebert, 1968a; Vandevere, 1969; Wild and Ames, 1976) where otters have foraged for several years, rock crabs continue to be consumed in relatively large amounts, even though abalones and urchins have become of minor importance. This may be partially explained by the advantage of mobility and visual perception that the crabs have over the latter two species, allowing them to escape predation more often. A possible additional explanation is that the replacement rate of crabs under such predation pressure is greater than that of abalone or urchins.

Most data on the sea otters' food habits have been compiled to show the percentages of total diet each item comprises by using the number of items consumed. The yield by biomass of a particular prey species may be far greater than another. Ebert (1968a) showed this by equating various organisms in terms of biomass. One abalone equals:

- 63 sea mussels
- 10.7 rock scallops
- 3 red sea urchins
- 31.6 purple sea urchins
- 2.2 gaper clams

Percentage by number should be analyzed in conjunction with percentage by biomass and amount of available food items to gain a further appreciation for sea otter food preferences.

Availability of food is probably a major limiting factor of the otters' depth of food dives. California sea otters rarely dive deeper than 20 fathoms, the depth at which most food items become nearly non-existent (Calif. Dept. of Fish and Game, 1976).

The effect that sea otter predation on herbivores (especially urchins) has on the kelp canopy development appears to be complex and variable. North (1965) correlated the presence of sea otters with enhancement of Macrocystis canopies. Miller and Geibel (1973) point out that increase in Macrocystis beds were noted concurrently outside the sea otters' range in California. More recently, Estes, et al. (1978), compared islands in the western Aleutians with and without sea otters. They note that the macroalgae has an inverse relationship with the sea urchins and that this algae was more abundant near the sublittoral fringe where sea otters could efficiently forage on sea urchins. On islands where sea otters were absent, sea urchins were notably larger and exploiting the algae. Foster (1979), reporting on kelp forest studies in central California coastal waters, provided evidence to show that algal species composition, abundance and distribution are significantly affected by storm surge motions which may have a far greater effect on kelp forest variability than effects caused by sea otter predation. Several factors influence kelp growth. Because of variable observations such as those cited in the foregoing, it is evident that more study is needed before the full impact that the sea otter has on this problem is understood.

PREDATION

The sea otter appears not to have any predators that effectively limit population density (Miller, 1974). In California, attacks by white sharks are relatively common (Orr, 1959; Morejohn, et al., 1975; Ames, et al., 1979; Ames, 1979). An attack by a killer whale has been reported (Nikolaev, 1965). Estes and Smith (1973) report limited predation on sea otter pups by bald eagles at Amchitka Island, Alaska.

PARASITOLGY AND PATHOLOGY

Internal parasites are common among sea otters. Morejohn, et al. (1975) found that young otters less than 65 cm total length were generally not infested, while almost all otters in excess of 70 cm total length were infested. Trematode and acanthocephalan parasites make up the majority of the known internal parasite load and nasal mites have been reported from wild Alaskan otters (Margolis and Dailey, 1972; Hennessey, 1972; Kenyon, 1969; and Hochberg, et al., 1979).

Much of the pathological information is based on necropsy of beach cast specimens. Acanthocephalan worms may perforate the intestinal wall, thereby causing peritonitis (Kenyon, 1969). The most common symptom of dead otters that have shown no sign of traumatic death is enteritis (Morejohn, et al., 1975; Kenyon, 1969). Captive animals have been observed to develop enteritis when fed an insufficient diet or in those which exhibit nervous tension resulting from stress (Stullken and Kirkpatrick, 1955; Kenyon, 1969). Morejohn, et al. (1975) have also

reported pneumonia-like conditions from the lung tissues of several dead otters. The effects of petroleum on sea otters have been discussed in the section of physiology above.

BEHAVIOR

The literature on sea otter behavior is relatively extensive. Behavioral observations of Alaskan and Siberian animals were documented earlier than for Californian through such monographs as Kenyon (1969) and Barabash-Nikiforov (1947). Behavioral studies of the California population were conducted shortly after their discovery off Bixby Creek in the 1930s, but much of this earlier work is lacking in quantifiable information and at times is strongly anthropomorphic. In the more recent past, several papers have been published that make a greater attempt to quantify the behavioral repertoire of individual sea otters (Hall and Schaller, 1964; Vandevere, 1969; Sandegren, et al., 1973). Other studies have been concerned with relating behavioral patterns of sea otters to ecological parameters and hence take a more ethological approach (Loughlin, 1976; Packard and Ribic, 1979). For the purposes of this summary, I have compiled the behavioral literature into three major categories: that associated with feeding, that associated with reproduction, and that associated with general activity or movement.

Feeding behavior in sea otters includes the use of tools, food gathering, and diel activity cycles in which a portion of time is spent gathering or eating prey items. Kenyon (1969) points out that sea otters studied around Amchitka were never observed to use a rock tool to smash open shellfish, and this behavior was only rarely seen in Alaskan and Siberian waters. When eating mussels, the otters would crack open the shell with their post-canine teeth (Kenyon, 1969; Barabash-Nikiforov, 1947). California otters will frequently place a stone anvil on their chests against which they pound shellfish such as mussels and clams (Hall and Schaller, 1964; Hines and Loughlin, 1980). Kenyon (1969) mentions that mussels in Aleutian and Alaskan waters don't reach the size that California mussels do and the implication is that the necessity for tool use is lacking. Perhaps more revealing is the display of tool using behavior by captive northern otters when presented with hardshelled clams (Kenyon, 1969; Miller, 1974). More recently, Calkins (1978) reports on wild Alaskan otters using stone tools to open gaper clams, i.e., Saxidomus gigantea. Kenyon (1969) indicated that chest pounding and pounding other objects with a stone held between the forepaws may also be an expression of frustration or, at times, of play.

Sea otters typically dive for food, although feeding animals will also remove prey from the sides of exposed rocks. Prey species are removed by grasping with forepaws, grasping with the mouth and then using the forepaws to hold the item, or by use of a stone tool (Kenyon, 1969; Houk and Geibel, 1974). Once the food is secured, it is generally brought to the water's surface and consumed, although subsurface feeding

has been observed (Miller, 1974). Stone tools may be employed in cracking open hard-shelled items or in jarring abalones loose; this behavior is prevalent among the California population, although it has been induced in captive northern animals, and has been observed in animals feeding on barnacles off Sitka (Kenyon, 1969; Houk and Geibel, 1974; Calif. Dept. of Fish and Game, 1976). Underwater observations of sea otters in California indicate that the paws are used to search for food especially in dense stands of kelp, hence the tactile sense is important to the species (Shimek, 1977). The forepaws are also used to dig for clams. Underwater observations in Monterey harbor have shown that sea otters have the ability to dig holes 1.5m in diameter and 0.5m deep (Hines and Loughlin, 1980). The methods used by sea otters in eating specific types of invertebrates are described in detail, for example, by Fisher (1939); Hall and Schaller (1964); Kenyon (1969); Houk and Geibel (1974); Calkins (1978) and Hines and Loughlin (1980). The high food requirement of sea otters dictates that a relatively high proportion of activity is dedicated to feeding. During daylight hours, sea otters spend an average 16-24% of the time feeding (Vandevere, 1969; Hall and Schaller, 1964; Loughlin, 1976; Shimek and Monk, 1977). For any individual, this percentage is a function of food type, food availability, and for females, the presence of pups. Females with pups that are old enough to supplement nursing with solid food will spend the greatest amount of time feeding compared with other classes of otters; conversely, females with very young pups spend significantly less time feeding (Sandegren, et al., 1973; Vandevere, 1969). Hall and Schaller (1964) summarize the periods of feeding behaviour in the California population: 1) daily peak in the early morning; 2) gradual decline over mid-day; 3) during mid-afternoon an increase in feeding activity until darkness. The nature of the cycle must vary with seasonal change in day length, but Hall and Schaller report that never more than 50% of the herd was observed feeding at any one time in their study at Point Lobos, California. The same authors also describe the consistency with which an individual otter will dive for a particular kind of food. There is evidence of nighttime feeding (Calif. Dept. of Fish and Game, 1976; Loughlin, 1976; Shimek and Monk, 1977). Nocturnal food gathering places a greater emphasis on the advantages of a well developed tactile sense.

Behaviors associated with reproduction include: territoriality, behavioral phases of a mated pair, copulation, maternal behavior and segregation of the sexes. Adult male sea otters express a degree of territoriality when in a breeding phase, although territoriality per se is not as strongly expressed as with other species (Kenyon, 1969). Calkins and Lent (1975) describe territorial defense in one instance by a breeding male in Prince William Sound. They suggest that habitat may play a significant role in eliciting this type of behavior. Such features as the topographic effects of small lagoons and uniform distribution of food species in Prince William Sound are suggested causes relative to the expression of territorial defense. Territoriality and territorial defense have been observed in California sea otters (Vandevere, 1970). The territory defended by the males in each case centered

around their "rafting station." Even though mature females were present with the intruding males, it was the latter which received the brunt of the defending males' aggressive attacks. There is a tendency for the sexes to segregate in both Alaskan and Californian populations (Lensink, 1962; Marakov, 1965; Kenyon, 1969; Schneider, 1972; Wild and Ames, 1974; Loughlin, 1976). Kenyon (1969) extensively discusses segregation around Amchitka Island and points out that it is more frequent among adults and sub-adults. Schneider (1972, 1978) investigated segregation and distribution by sex and age class around several Aleutian Islands. He correlates proportion of adult males in female areas with peak in numbers of estrous females; the data he discusses shows a proportion of 1.5-2.0 males per female with enlarged follicles, but the qualification is that "hunter bias may be a problem." (Schneider's study was conducted during surveys and harvests of sea otters by the Alaska Department of Fish and Game.) Wild and Ames (1974) provide a description of sexual segregation among California otters based on trapping operations. Their work indicates that males predominate at the extremes of the range. Loughlin (1976) presents some of the first detailed information on sexual segregation, home range, and movement among California sea otters based on observations of tagged and telemetered animals near Monterey. He estimates a home range for a single sea otter of about three miles parallel to the shore. Movement patterns noted were: 1) movements of males in male rafts and independent females in female rafts; 2) females with dependent pups; and 3) single males in association with female rafts. Otters were observed to leave their rafts to forage, but each exhibited a preference for a particular raft. Females with pups appeared to have preferred areas which they might leave for periods up to two days before returning. Solitary males associated with female rafts, i.e., occupy an area adjacent to the female raft, may be territorial; they rarely left their area except to enter the female raft and attempt copulation, or a single male would take a female from the raft and pull her to his area to copulate. Finally, Loughlin notes that three such males remained in areas adjacent to female rafts a minimum of five months.

Behavior of a mated pair has been divided into four major phases: courtship or pre-copulatory period; copulatory period; post-copulatory period; and separation (Kenyon, 1969; Vandevere, 1970). Not all males and females will exhibit this behavior, and Vandevere (1970) observed cases in California where copulation or attempted copulation occurred without a pair-bond relationship forming. Both investigators describe the period of breeding behavior as lasting for approximately three to four days, although Vandevere (1970) feels that the post-copulatory period as defined by Kenyon (1969) is not applicable to California otters. The basis for this lies in the former's observations of copulation or attempted copulation throughout the three day period of togetherness. Sea otters have not been observed to mate on land (Kenyon, 1969; Miller, 1974). Either a male or female will initiate copulation (Fisher, 1939; Kenyon, 1969; Vandevere, 1970). The general pattern involves the male grasping the female from behind. The male establishes a grip by grasping the female's nose with his teeth. A receptive female will

appear limp, according to Vandevere (1970), and Kenyon (1969) noted the northern female otters become rigid. This apparent discrepancy is probably a result in part of low numbers of observations. Ensuing copulatory activities involve thrashing or rolling at the water's surface about the common longitudinal axis of the mated pair. Each copulation may be relatively lengthy; Kenyon (1969) reports two sessions each lasting 35 minutes. During coitus, frequent rest periods occur (Vandevere, 1970). After a session, the female's nose often appears bloody, and nose scarring has been noted among females in a herd (Foott, 1970).

Sandegren, et al. (1973) report on maternal behavior of sea otters. The daily activity cycle of females with pups is similar to other otters without pups. About 8% of daylight hours is devoted to nursing; this is spread over an average of 6 bouts per day, with each session lasting about 9 minutes. Females with pups spend about 10% of the daylight hours grooming themselves and an average of 20% grooming their pups. Motor patterns involved with grooming develop slowly, hence young pups require proportionately more attention from their mothers. Some grooming periods with pups last 50 minutes, with the majority of the grooming activity concentrated on the hind quarters of the pup. Females with pups may tend to stay away from other otters. Vandevere (1972) describes the transition from nursing to taking solid food in pups as well as the development of the ability of a pup to effectively groom itself. The period of pup dependency in California, at least, appears to be about eight months (Vandevere, 1972, 1979).

General activities of sea otters include hauling out, rafting, swimming/ diving, grooming and occasional vocalizing. Sea otters may come ashore in northern habitats as well as California, although individuals may spend their entire lives in the water (Kenyon, 1969; Vandevere, 1976; Miller, 1974). Kenyon (1969) postulates land birth in Alaska. When available, kelp beds are used as areas to rest, or for relative shelter from storm waves. In the Aleutians, otters will typically haul out during stormy periods, whereas in California, they will stay within the kelp, or if kelp or protected coves are unavailable, they will apparently raft one to three miles offshore (Calif. Dept. of Fish and Game, 1976).

The hind legs and tail are used in swimming. The tail has been described as a "sculling oar" and is used as such when the animal is slowly moving belly-up (Kenyon, 1969). Rapid swimming is accomplished belly-down and use is made of the hind legs and webbed hind feet. The forelimbs are typically held to the chest and have no function in swimming.

Vocalization among sea otters is discussed by Fisher (1939), Kenyon (1969), and Sandegren, et al. (1973). Fisher provides a phonetic description of several growls and cries associated variously with the close presence of another otter, or with painful bites associated with mating or brief aggressive encounters, both of which involve a painful

bite. Kenyon (1969) describes a longer list of sounds uttered, some of which are associated with captive animals. Sandegren, et al. (1973) analyzed vocalizations of mother otters and pups and attempted to quantify the sounds by producing sonograms showing the duration and frequencies over which most of the sound is concentrated.

Much of the behaviour associated with general activities can be related to daily cycles, and attempts have been made to determine the relative time segments over which daytime activity patterns are partitioned (Fisher, 1939; Kenyon, 1969; Sandegren, et al., 1973; Hall and Schaller, 1964). The amount of time spent by any single individual sea otter in the various activities appears to be a function of food availability and in the case of females with pups, a function of food and grooming requirements of the pups. Summarizing Fisher (1939), Kenyon (1969), Sandegren, et al. (1973), Loughlin (1976) and Shimek and Monk (1977), daily activity cycles are comprised of:

- a) Feeding activity in the early morning hours.
- b) A resting and grooming period over the mid-day.
- c) A second feeding period followed again by a period of resting, grooming, or mating.
- d) A late afternoon feeding period which may continue until dusk or darkness descends.
- e) There is some evidence for a third peak in feeding activity around midnight. Activities at night are apparently similar to daytime although on a percentage basis there is less overall activity at night.

Loughlin (1976) noted that sea otters are inactive more than half the time, and feed about one-third the time over a 24 hour period. He also notes that activity periods appeared to be arrhythmic and thus were non-circadian with no apparent correlation to tidal cycles.

Sea otters are not a migratory species, although long distance wandering by young males is evident in California (Miller, 1974; Wendell, 1979). The gradual range expansion in California is an expression of group movement based on food requirements (Miller, 1974; Wild and Ames, 1974; Miller, 1976). Movements have also been noted among adult males in search of estrous females (Schneider, 1972). Tagging operations discussed by Wild and Ames (1974) and Wendell (1979) strongly indicate that otters are capable of traversing significant distances and that translocated animals transversed a distance of 45 miles in 11 months along a continuous rocky shore-kelp bed habitat. Wendell (1979) provides evidence for males traversing distances of over 100 miles in several weeks time.

POPULATION BIOLOGY

Estes (1980) summarizes the present range of sea otters. In a band from the Kuril Islands to Prince William Sound, the species has reoccupied much of its former range. South along the west coast of North America, sea otters have been translocated to the Alexander Archipelago (Chichagof and Baranof Islands), Vancouver Island, and the coasts of Washington and Oregon. The Oregon population has probably declined to zero in recent years. The southernmost population is in California and currently ranges from about Santa Cruz to about 10 miles south of Pismo Beach. This population stock has gradually increased over the years from an estimated population of 50 animals in 1914 near Point Sur. Today the California population is considered threatened under the Endangered Species Act largely because of the potential threat of a major oil spill affecting the entire stock.

Kenyon reports that isolated populations in the Aleutians with unused habitat to expand into may increase at a rate of 10 to 12% per year. He reports a rate of 4 to 5% per year in areas of dense populations bounded by unpopulated habitat. Sea otter densities in established Aleutian Island populations are 10 to 15 per square mile of habitat (Kenyon, 1969). Lensink (1962) states that population growth is about 10% per year in Alaska when food is not limiting. In California, the population has been growing at an average annual increase of about 5.4% since 1940 and densities in areas of established population average 13 animals per square mile (Calif. Dept. of Fish and Game, 1976). The average rate of range extension in California since 1938 has been 2.52 miles per year, (0.92 miles/year to the north and 1.61 miles/year to the south) (Calif. Dept. of Fish and Game, 1976). An exception has been the rate of range extension in 1973, when the otters' range limits passed over sandy beach areas (14 miles/year in the north and 18 miles/year in the south).

The California population is in a state of steady population increase as well as range expansion, hence when treated as a unit, considerations of population dynamics cannot be comparable to populations at such sites as Amchitka, where sea otters occupy all suitable range, and population size is strongly influenced by food supply (Raines, et al., 1971). The center of the California range which has been occupied longest by sea otters does not exhibit signs of overcrowding with subsequent die-off; while that portion of the population appears to be increasing, the excess numbers are apparently contributing to the range expansion (Wild and Ames, 1974).

Miller (1978) provides a model for the sea otter population in California. The range can be divided into units starting with the established population where the density of sea otters is in equilibrium with the environment. Moving symmetrically north and south the next units are: colonizers, migrant front, advanced foragers, and wanderers. As the population size increases and the food in the occupied habitat is

depleted, the otters must extend their range. "The migrant front, a large aggregate of animals apparently mostly males, concentrates at the periphery of an expanding range." (Calif. Dept. of Fish and Game, 1976). These fronts, which average around 50 animals, (up to 150 have been observed), will occupy an area until food becomes scarce before they move into a new area. Once a front has moved on, the area it moved from will be colonized either by otters remaining from the front or by otters moving in from within the range. Generally, once colonized, the density will be similar to that of the established range.

CONCLUSION

Published results of studies on sea otters provide a relatively complete picture of behavior, systematics, zoogeography, diet and habitat requirements. A number of sources provide information on food items eaten, but it remains to be seen quantitatively what impact sea otter predation has on the ecosystem. Ecological processes at the population and community levels are not as completely understood as would be desired for management decisions such as determination of Optimum Sustainable Population, translocation success, or effects of containment. General habitat requirements are fairly well known, i.e., a rocky shore and rocky-sub-littoral with many crevices and kelp is probably the preferred habitat from both physical and biological standpoints.

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A STATUS REPORT ON CALIFORNIA SHELLFISH FISHERIES

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and
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Humboldt State University

INTRODUCTION

By statute, the California Department of Fish and Game manages species of fish and wildlife in California. The objectives of management include the maintenance of sufficient stocks of sport and commercial species for harvesting and also the maintenance of species possessing aesthetic, educational, scientific and non-extractive recreational uses.

This paper gives an assessment of the red abalone, Pismo clam, sea urchin, Dungeness crab, rock crab and lobster fisheries in California. Declines in standing crops of red abalone, Pismo clam and sea urchins are associated with the arrival and persistence of sea otters. Declines in standing crops of red abalone along the southern California coast are attributed to improper picking and to habitat degradation. The decline in rock crab harvesting associated with the sea otter is not as dramatic. Declines in spiny lobster stocks, a species outside the present sea otter's range, is attributable to the harvest of sublegal-sized animals.

For consumptive species like abalones and crabs, management is based on biological and historical catch data which is used to establish harvest methods, size and catch limits, and seasons. The ultimate aim of management programs is to obtain maximum sustainable yields.

ASSESSMENT OF SELECTED SHELLFISHERIES

Data for the following assessments was procured primarily from unpublished records of the California Department of Fish and Game.

The authors thank the following persons and agencies for aiding in the construction of this presentation: Earl Ebert, California Department of Fish and Game, Marine Culture Laboratory, Monterey, California, for supplying much of the information; Pacific Gas and Electric Company, TERA, Lockheed, and ECOMAR for information on rock crabs and purple sea urchins.

Red Abalone (*Haliotis rufescens*)

Utilization

Commercial divers using surface-supplied air have harvested an average of 740,000 pounds of red abalone annually since 1974. In the early 1960s annual landings averaged about 2.5 million pounds. Sport use of the red abalone resource occurs mainly north of San Francisco where commercial diving is illegal. Estimates of the 1976 sport harvest use are reported as a minimum of 1.1 million pounds.

Status of Stocks Outside the Sea Otter Range

Commercial landings of red abalone south of the sea otter's range have declined in recent years. Reasons for this decline include mortality from improper picking, habitat degradation in some areas (i.e., mainland shelf along Los Angeles and Orange County coasts), take of sublegal animals and attainment of maximum sustained yield in most fishing areas. Accessible north coast red abalone populations are fully utilized by sport harvest pressures. Localized areas are overutilized due to the take of sublegal animals and to mortality from improper picking.

Management

Reduction in harvesting and effort and an increase in law-abiding divers are the objectives of recently enacted limited entry to the commercial fishery. Sport harvests have recently been limited by both shorter seasons and lowered bag limits. Changes in the regulation abalone iron, closing areas to abalone harvesting and reseeding efforts are also part of the program to obtain maximum sustainable yields of abalone.

Status of Stocks Within the Sea Otter Range

Abalone stocks inside the sea otter's established range are too low to provide for sport or commercial fisheries. Studies of red abalone populations at Point Estero illustrate the relative change in abalone density when sea otters become established. This area was very productive commercially for at least 30 years prior to 1970 (Figure 1).

Pismo Clam (*Tivela stultorum*)

Utilization

A commercial fishery existed in California until 1947.

A large and popular recreational fishery is available to both shorepickers and free-divers. Three areas of historical abundance are identifiable and each possesses a discrete stock. These areas are

Monterey Bay, Pismo Beach and southern California. Only the southern California beaches are outside the sea otter's present range.

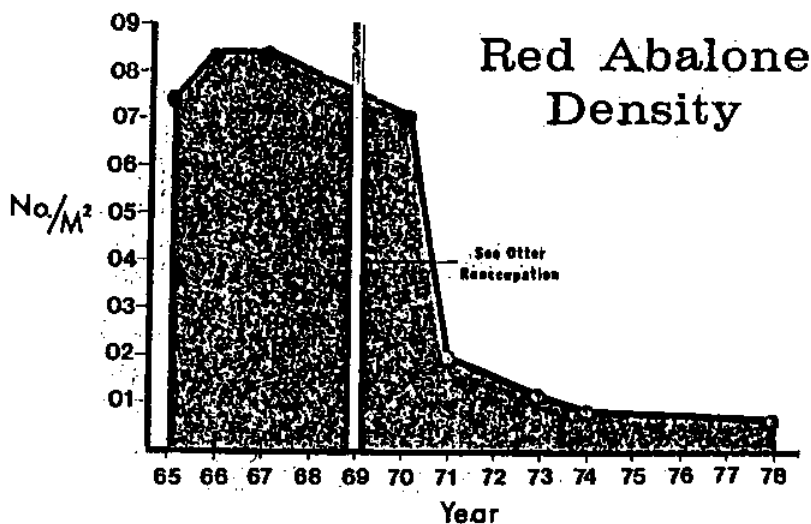


Figure 1

AVERAGE DENSITIES OF RED ABALONE
AT POINT ESTERO FROM 1965 THROUGH 1978

Source: California Department of Fish and Game, unpublished survey.
Data used with permission of the Department of Fish and Game.

Status of Stocks Outside Sea Otter Range

The recreational fishery in southern California remains fairly stable. Clamming success was poor during the 1980 annual census. The census, however, occurred during very inclement weather.

Management

Management includes the continued enforcement of existing regulations and monitoring of natural population fluctuations.

Status of Stocks Within the Sea Otter Range

Sea otter predation has eliminated the Pismo clam fishery on all

clamming beaches in Monterey Bay and Estero Bay. The fishery has also been eliminated from the northern half of Pismo Beach. The remaining clamming beaches in that area are now being foraged.

The best documentation on the association of sea otter reoccupation and decreased abundance of Pismo clams was obtained by monitoring catch per clammer at Pismo clam beaches (Figures 2, 3, 4, 5 and 6). No recovery of the fishery after movement of migrant sea otters is indicated.

Documentation of the effects of otter predation on the subtidal component of the Pismo clam population is poor. Two students from the California Polytechnic University, San Luis Obispo, studied pre-otter clam densities. Twenty-four square meter samples procured north of Pismo pier averaged 1.7 clams per square meter, while south of the pier samples averaged 2.3 clams per square meter. After otters had foraged on the north beach and during their foraging on the southern beach a quick, random, depth stratified clam survey was conducted by the California Department of Fish and Game. Eighty one-fourth square meter samples north of the pier yielded 0 clams per square meter and 160 one-fourth square meter samples south of the pier yielded 1.5 clams per square meter.

Sea otter prey observed being consumed along Pismo beach show that Pismo clams predominate (573 Pismo clams, 1 Dungeness crab, 1 rock crab and 11 unidentified items).

Red Sea Urchin (*Strongylocentrotus franciscanus*)

Utilization

In the existing commercial sea urchin fishery in California, between ten and twenty million pounds of red urchins have been harvested annually in recent years. The fishery is conducted almost entirely in southern California.

Status of Stocks Outside the Sea Otter Range

The resource, or standing crop, is very large along the southern California mainland and particularly the Channel Islands. Fishing areas are sustaining a large harvest and recruitment appears good in areas surveyed.

Management

Field surveys to determine standing crop and recruitment are being done to evaluate the effects of commercial harvesting. Most of the current harvest is the result of growth and recruitment from exploited stocks.

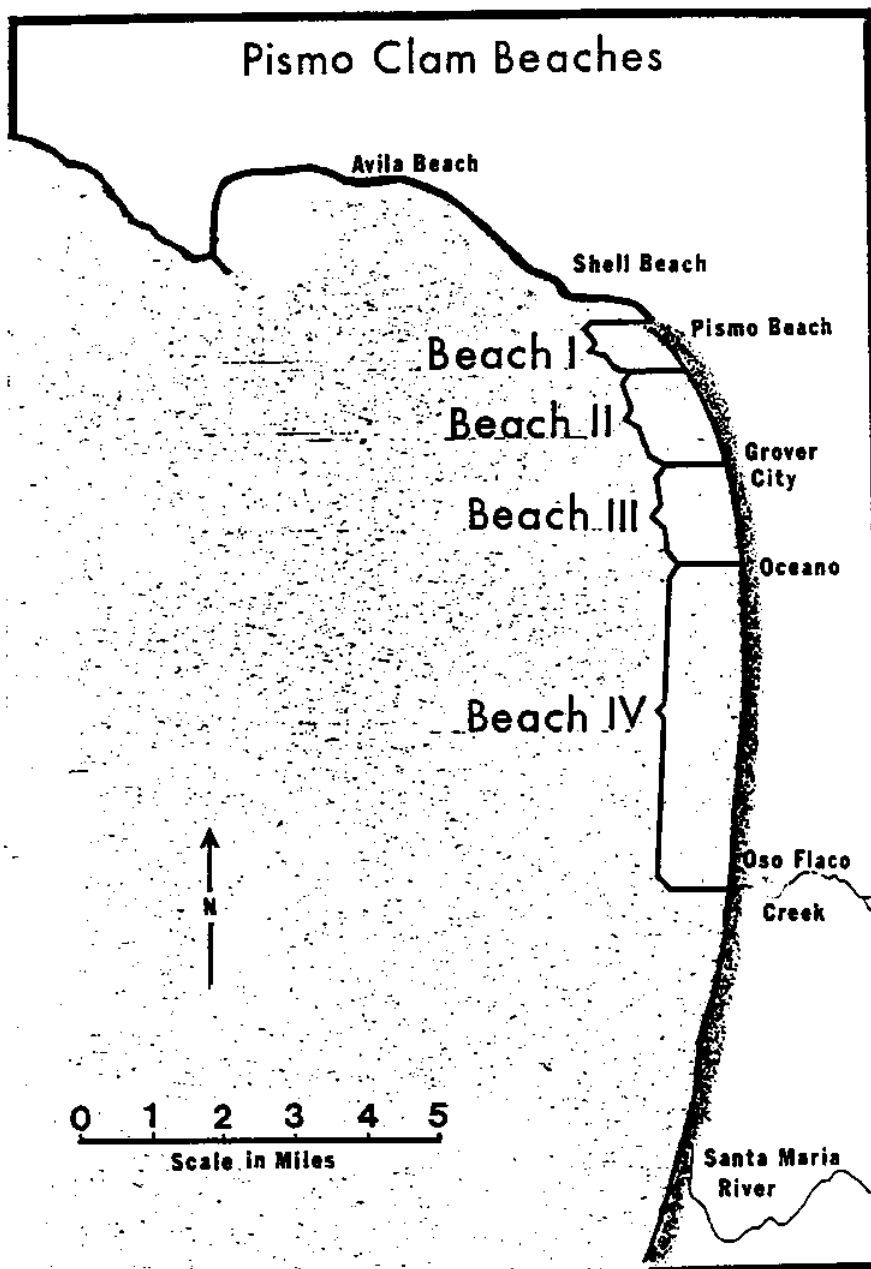


Figure 2

THE LOCATION OF FOUR PISMO CLAM BEACHES
BETWEEN SHELL BEACH AND OSO FLACO CREEK

*Beach I extends from the rocks at Shell Beach 0.9 miles south to the Pismo Pier.

Source: California Department of Fish and Game, unpublished surveys. Data used with permission of the Department of Fish and Game.

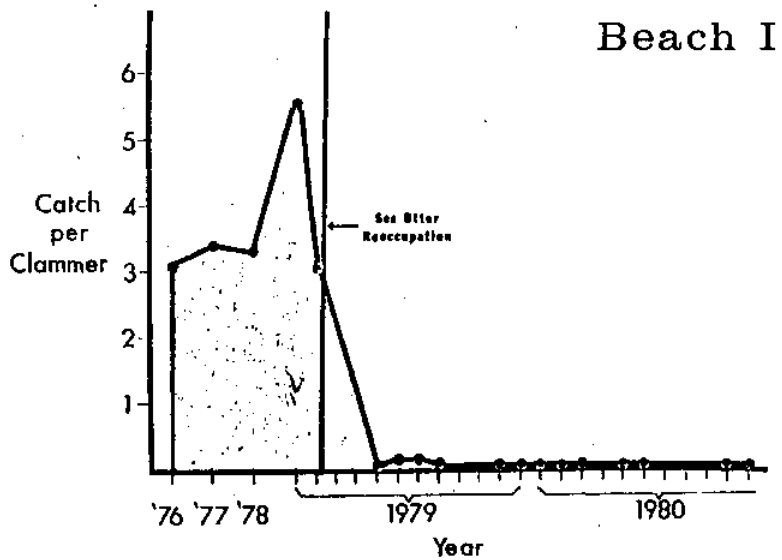


Figure 3

CATCH PER CLAMMER OF PISMO CLAMS AT BEACH I

Source: California Department of Fish and Game, unpublished clammer survey. Data used with permission of the Department of Fish and Game.

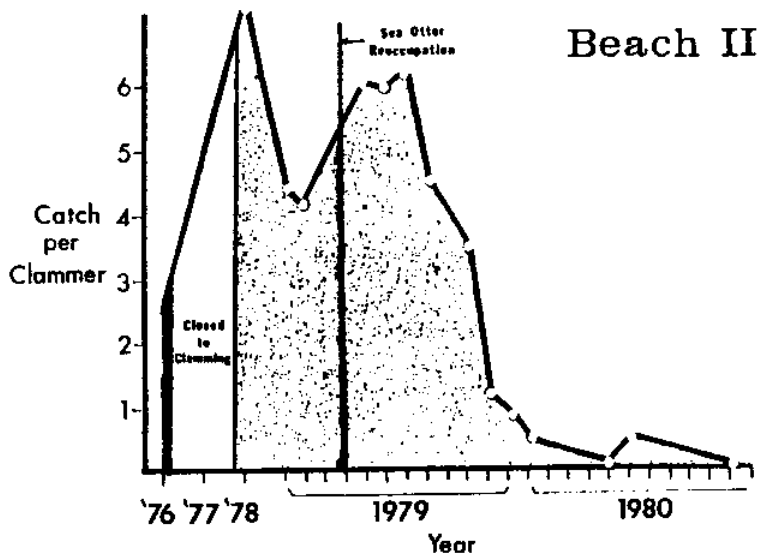


Figure 4

CATCH PER CLAMMER OF PISMO CLAMS AT BEACH II

Source: California Department of Fish and Game, unpublished clammer survey. Data used with permission of the Department of Fish and Game.

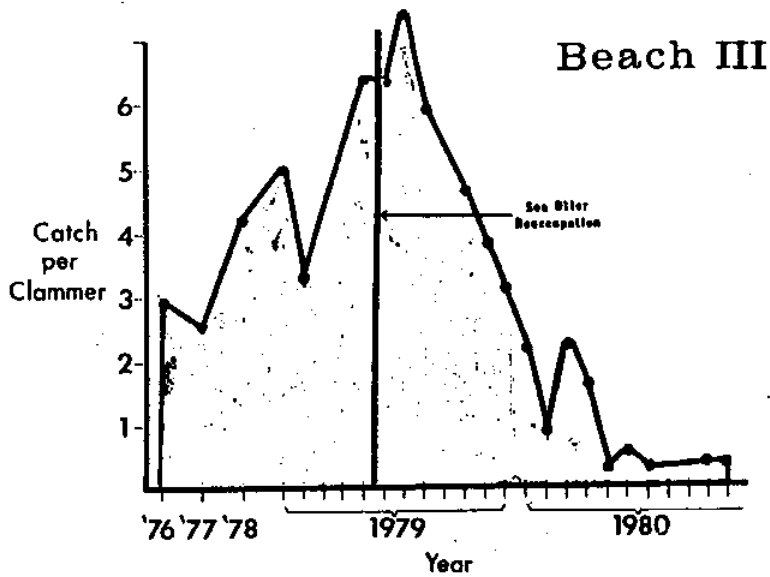


Figure 5

CATCH PER CLAMMER OF PISMO CLAMS AT BEACH III

Source: California Department of Fish and Game, unpublished clammer survey. Data used with permission of the Department of Fish and Game.

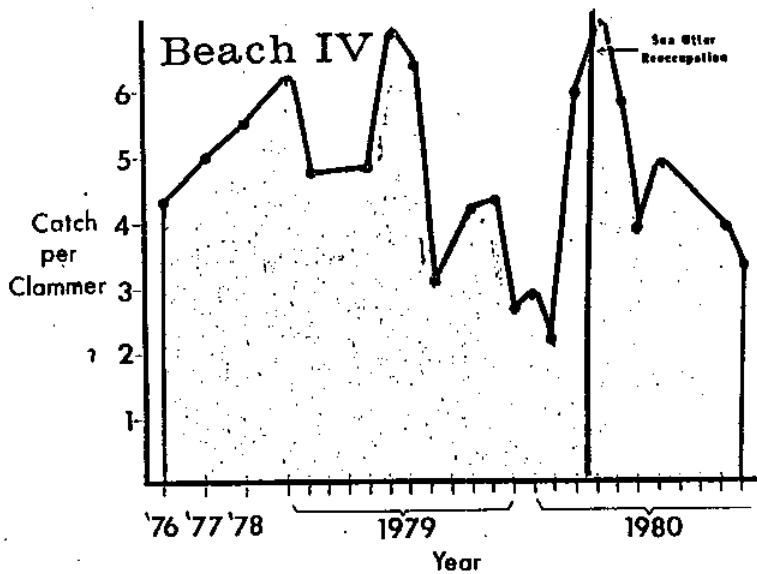


Figure 6

CATCH PER CLAMMER OF PISMO CLAMS AT BEACH IV

Source: California Department of Fish and Game, unpublished clammer survey. Data used with permission of the Department of Fish and Game.

Status of Stocks Within the Sea Otter Range

Sea urchins are a favored food item for sea otters when the latter establish themselves in new areas. Urchin populations are among the first to show dramatic reductions from sea otter predation. Three sources of quantitative survey data are available to establish the relative and potential impact of sea otters on red urchin populations in California.

Transects surveyed by the Department of Fish and Game in 1967 and resurveyed in 1978 (Ebert, 1967, 1978) show the reduction of red urchins down to undetectable levels.

Suzanne Benech (1980) surveyed sea urchins in one kelp bed near Pecho Rock for six years. She measured a reduction of the population down to less than 0.3% of pre-otter densities. The data from the California Department of Fish and Game surveys at Point Estero and Diablo Canyon (Figure 7) indicate a similar reduction in the population of urchins that existed prior to the reoccupation of that area by sea otters.

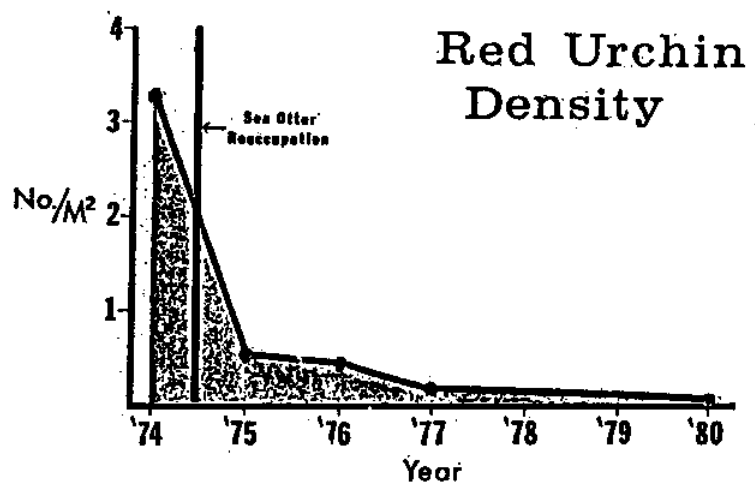


Figure 7

AVERAGE DENSITIES OF RED SEA URCHINS
AT DIABLO CANYON FROM 1974 THROUGH 1980

Source: California Department of Fish and Game, preoperational studies at Diablo Canyon. Data used with permission of the Department of Fish and Game.

Dungeness Crab (Cancer magister)

Utilization

An important commercial Dungeness crab fishery exists in central and northern California. The landings from central California for the past decade averaged slightly over 0.5 million pounds per year. Northern California averaged approximately 10 million pounds per year.

The sport fishery is concentrated in harbors and bays in northern coastal areas. The total recreational catch was estimated to be less than 0.5% of the commercial landings in northern California.

Status of Stocks Outside the Sea Otter Range

There appear to be discrete stock units. The stock sizes are undetermined and variable. Statewide landings have fluctuated greatly during the past decade with a low of approximately 1 million pounds during the 1973-74 season and a high of over 26 million pounds during the 1976-77 season. Central California stocks remain depressed with landings far below past yields. Variations in year-class densities result in large annual fluctuations in harvests.

Management

A variable season was established to allow harvesting of crabs when they are in prime condition. In the commercial fishery, only males over 6-1/4 inch carapace width may be taken. All traps must have escape ports. There is a recreational 10-crab bag limit and the same season and size restrictions that apply to the commercial fishery. A five-year (1975-80) program mandated by the California State Legislature is being conducted to determine the cause of the decline in central California and to make management recommendations for protecting and increasing the resource.

Rock Crab (Cancer antennarius)

Utilization

For 20 years prior to 1970, the commercial rock crab catch averaged slightly over 176,000 pounds per year. The rock crab catch increased to over 1,200,000 pounds from 1970 to 1975, whereupon it apparently leveled off.

The recreational harvest of rock crabs has not been estimated, but was significant in central and northern California. The principal sport fishing gear are baited hoop nets and traps set off piers, jetties or boats.

Status of Stocks Outside the Sea Otter Range

Landings indicate that the fishery is being harvested at or near a sustained yield level.

Management

Increased research and field activities led to management regulations designed to protect immature crabs and crabs in lost traps. Regulations include mesh size minimums to allow escapement and require the inclusion of destruct panels. Sportfishing regulations now include a limit of 35 crabs and a minimum size of four inches across the carapace.

Status of Stocks Within the Sea Otter Range

Sea otter predation may eliminate shallow water recreational fisheries (i.e., Monterey pier and Soquel Pt.), however, other areas continue to provide some recreational use (i.e., Santa Cruz pier). The impact on deeper water commercial fisheries is not clear. A limited (one fisherman) commercial fishery still exists in Estero Bay.

Rock crabs are an important component of the sea otter's diet within the established range. Their ability to withstand otter foraging pressure is reflected in the continued existence of at least a limited commercial fishery.

In the Diablo Canyon areas, Lockheed and TERA have a mark and recapture study which shows a decline in catch-per-unit-effort after re-occupation of the area by sea otters (Figure 8).

California Spiny Lobster (*Panulirus interruptus*)

Utilization

Commercially, California spiny lobsters are a luxury seafood especially in demand in the restaurant trade. The 1968-77 average annual landings were 263,000 pounds.

California spiny lobsters are trophies for sport divers. However, the recreational harvest is small relative to the commercial catch.

Status of Stocks Outside the Sea Otter Range

There is no measure of abundance other than landing statistics, which indicate a steady decline since the 1950s. The chief obstacle to increasing California's lobster production has been the widespread practice of taking undersized lobster.

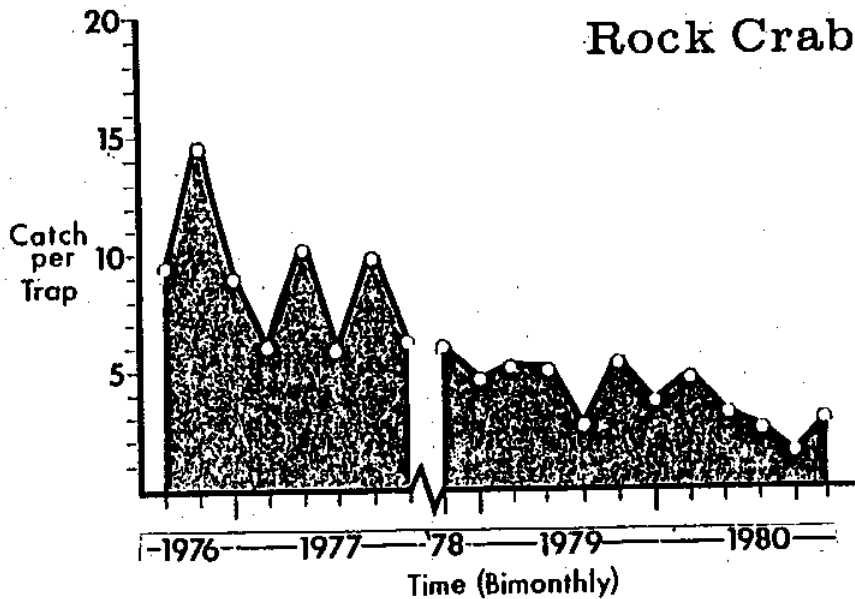


Figure 8

AVERAGE CATCH PER TRAP OF ROCK CRAB
AT DIABLO CANYON FROM 1976 THROUGH 1980

Source: Pacific Gas and Electric Company, Diablo Canyon study 316a.
Data used with permission of the Pacific Gas and Electric Company.

Management

Lobster are capable of spawning several times before reaching legal size. However, California commercial fishermen are thought to be taking about equal numbers of both legal and undersized animals. To help solve this problem, an escape port is now required to be built into the second chamber of every lobster trap. The escape port retains legal lobsters but permits undersized lobsters to escape.

CONCLUSION

If one has a legally mandated responsibility to manage shellfish fisheries for maximum sustainable yields and concurrently manages a shellfish predator, the sea otter, for an optimum sustainable population, then obviously a managerial dilemma exists. The superimposition of higher managerial authority may add further problems when the latter's prime concern is the predator. When combined with the desires and demands of vocal, concerned and influential groups of the general citizenry having differing viewpoints, the dilemma is greatly increased.

An unresolved problem is that of defining an optimum sustainable population of the sea otter. It may be feasible, based on human demands for shellfisheries maintenance and development, not to define optimum sustainable population as completely reoccupying former range. To ameliorate the threat of sea otter extinction, sections of the Pacific coastline not necessarily restricted to California may be considered as transplant sites. Zonal management of the Pacific coastline could be instituted in an attempt to satisfy the pluralism within our society.

Resolution of the aforementioned problem could allow for better partitioning of public funds used for managing both sea otters and shellfisheries. Presently, state and federal funds are spent to enhance shellfisheries and sea otters (i.e., The National Sea Grant Program and U.S. Fish and Wildlife Service, respectively). With continue expansion, the sea otter could negate shellfisheries enhancement, which may be considered a very cost-ineffective stewardship of public funds. With the present scrutiny being given to the use of tax monies, I believe that it behooves us to hasten implementation of a sea otter management plan.

The matter of both commercial and sports fishermen not abiding by size or catch limits is a problem that may never be completely solved. Wise and credible management programs that are explained effectively may foster adherence to regulations.

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APPENDIX II

BIOGRAPHICAL INFORMATION ON CONFERENCE PARTICIPANTS

DANIEL B. BOTKIN is the Chairman of the Environmental Studies Program and a faculty member in the Department of Biological Sciences at the University of California at Santa Barbara. He has done field and theoretical research on long lived and endangered organisms in wilderness ecosystems. Dr. Botkin is a member of the Marine Mammal Commission Science Board and an ecologist on the U.S. Space Science Board. In 1979 he was a recipient of a fellowship from the Woodrow Wilson International Center for Scholars, Washington, D.C., where he began a book tracing the history of the concept of the balance of nature.

RICHARD BURGE currently serves as Director of the Point Whitney Shellfish Laboratory for the Washington State Department of Fisheries. His previous position was with the California Department of Fish and Game, where he was co-principal investigator on the Abalone Enhancement Project, and Unit Manager for San Luis Obispo and northern Santa Barbara County Marine Resources. Mr. Burge was also project leader of the California abalone population studies. He is knowledgeable in the area of kelp ecosystem interactions and has done extensive research on the Pismo clam recreational fisheries.

JOHN J. BURNS is the Marine Mammal Coordinator for the Alaska Department of Fish and Game. He was active in the original passage of the Marine Mammal Protection Act of 1972. Publications include "Marine Mammal Management in Alaska" published in Alaska Seas and Coasts, 1976.

WES CARPENTER represents the sea urchin fishery, and has been active in that industry in the Santa Barbara Channel for many years. He is now a broker for several sea urchin processors in southern California, coordinating purchase of sea urchins from fishermen.

BILIANA CICIN-SAIN is Director of the Marine Policy Program, Marine Science Institute, and an Associate Professor of Political Science at the University of California at Santa Barbara. She has conducted several studies in the marine policy area, including studies on limited entry and on the implementation of the Fishery Conservation and Management Act of 1976. She recently served in the Office of the Administrator of the Office of Policy and Planning, National Oceanic and Atmospheric Administration.

WIMBERLEY COERR represents the Defenders of Wildlife in Monterey, California.

GORDON COTA lives in Santa Barbara, where he is a rock crab fisherman and a leader in the local fishermen's organization, Commercial Fishermen of Santa Barbara, Inc. Mr. Cota is also the Pacific Coast Federation of Fishermen's Associations, Inc. representative on the Bureau of Land Management Regional Technical Working Group.

JOHN DEMARTINI is the Director of the Fred Telonicher Marine Lab and a Professor of Biology at Humboldt State University. He is a member of the Sea Otter Scientific Advisory Committee of the California Department of Fish and Game, and on the Advisory Board for Underwater Parks and Reserves of the California Department of Parks and Recreation.

CHRISTOPHER DEWEES is the Marine Fisheries Specialist for the University of California Cooperative Extension Sea Grant Marine Advisory Program. He has statewide responsibilities for fisheries and marine education, and was one of the first marine specialists in California. He has been with the Marine Advisory Program since 1972.

NICOLE DUPLAIX currently chairs the Survival Service Committee Otter Specialist Group of the International Union for the Conservation of Nature. She also serves as an executive staff member for the private organization TRAFFIC, U.S.A., concerned with stopping illegal import trade in endangered species and their by-products. Dr. Duplaix was formerly with the New York Zoological Society. As a practicing biologist, her current area of study deals with the worldwide otter population, including the sea otter.

JAMES C. ESTES is a biologist at the U.S. Fish and Wildlife Service Denver Wildlife Research Center, Santa Cruz Field Station. He is Chairman of the Standing Committee on Marine Mammals for the American Society of Mammalogists. Dr. Estes had done extensive research on the sea otter and its habitat, both in Alaska and California, and has published several papers on the subject.

ROBERT EISENBUD is an attorney who has been involved with domestic and international marine mammal protection efforts for several years. He has been the Legal Counsel for the Marine Mammal Commission since 1974.

ROBERT FRIEDHEIM is the Associate Director for Marine Policy at the Institute for Marine and Coastal Studies at the University of Southern California. He is the author of numerous works on ocean policy, and is a Professor of International Relations at the University of Southern California.

CAROL FULTON is now Executive Director of the Friends of the Sea Otter, and has been active in that organization for over three years. She has been interested in marine mammal protection and the protection of other endangered species of wildlife for several years.

TOD GHIO is an owner of Anthony's Fish Grottos in southern California, and has spent 45 years in the seafood industry. He has served for five years as President of the California Seafood Institute, and as Vice President and Secretary of the National Fisheries Institute. For ten years he was industry advisor to the California Sea Grant program, and is a member of the Institute of Marine Resources, the State Aquaculture Advisory Committee, and the Swordfish Sub-Panel. He has been active in problems confronting the seafood industry.

LAD HANDLEMAN was active in the abalone fishery from the early 1950s to the 1960s, having been diving since age 17. He is the founder and former President of Oceaneering International, a worldwide diving service company engaged in underwater construction and deep water diving and salvage work. He is now Chairman of Santa Barbara-based Cal Dive International and is a leader in the Save Our Shellfish Committee.

SIDNEY HOLT is an internationally renowned authority on marine mammals and fisheries. He is a member of the International Whaling Commission and a faculty member of the Department of Environmental Studies at the University of California at Santa Cruz. Dr. Holt is now living in England and teaching at St. John's College, Cambridge.

SUZANNE HOLT is an Assistant Professor of Economics at Crown College, University of California at Santa Cruz. Her major field of research is resource economics, with emphases in fisheries management and recreation economics. Dr. Holt has studied the southern California swordfish fishery and the West Coast albacore fishery extensively. She has served as Resource Economist on the Billfish and Oceanic Shark Fishery Management Plan development team for the Pacific Fishery Management Council.

JACK HUNDLEY represents the Western Oil and Gas Association, and is experienced in dealing with mitigation of oil spill damage and problems of offshore oil production. He is the offshore manager for the Atlantic Richfield Corporation oil and gas operations.

BILL KIER is the Environmental Policy Specialist of the Senate Office of Research in Sacramento. He has been with the Office of Research since 1971 and before that served as a consultant to the State Senate Committee on Natural Resources and the former subcommittee on Fish and Game. He holds a degree in Fisheries Science.

RUDY MANGUE has served as president of the California Abalone Association for four years, and has been active in the abalone fishery for many years. His father was an abalone diver as early as 1944 in Half Moon Bay, Bodega Bay and Monterey, and Rudy has been diving in central California since 1960 in Half Moon Bay, Morro Bay and the Santa Barbara Channel.

BRUCE MATE is Assistant Professor in the School of Oceanography at the Marine Science Center at Oregon State University. He has been involved in examinations of marine mammal/fisheries interactions, particularly with regard to the problem of incidental take of marine mammals during fishing operations. He has prepared a report on the "Workshop on Marine Mammal-Fisheries Interactions in the Northeastern Pacific" for the Marine Mammal Commission.

WILLIAM MAXWELL is an Associate Marine Biologist with the Marine Resources Branch, California Department of Fish and Game, Sacramento, California.

HAROLD O'CONNOR is the Deputy Director of the Office of Endangered Species of the U.S. Fish and Wildlife Service in Washington, D.C.

MICHAEL K. ORBACH is currently the Associate Director of the Center for Coastal Marine Studies at the University of California at Santa Cruz. He served for three years as a Social Anthropologist and Social Science Advisor for the National Oceanic and Atmospheric Administration in Washington, D.C. Dr. Orbach is the author of Hunters, Seamen and Entrepreneurs, an ethnography of the high-seas tuna fishermen of San Diego, and numerous articles and reports on maritime communities and industries and social science research applications in natural resource management.

MARGARET OWINGS is the President and founder of the Friends of the Sea Otter. She is a former member of the California State Parks Commission, the founder of the Rachel Carson Council and a Fellow of the California Academy of Sciences, which awarded her its 1979 Conservation Award. A trustee for the Environmental Defense Fund and the Defenders of Wildlife, Mrs. Owings was recently awarded the Humane Society of the United States 1980 Joseph Wood Krutch Medal.

ERNEST PARTRIDGE is Visiting Professor of Environmental Studies at the University of California at Santa Barbara. His specialty is Environmental Ethics and Moral Philosophy, and he has published several papers dealing with moral philosophy, moral psychology, and the philosophy of education and environmental ethics. He is a member of the Board of Editors of The Journal of Environmental Education and Environmental Ethics. In 1978, Dr. Partridge was awarded a Rockefeller Foundation Fellowship in Environmental Affairs, under which he conducted original research relating to the moral question of the duty to posterity. One product of that research, an anthology entitled Responsibilities to Future Generations, was published in 1981.

GORDON REETZ has served for the past two and one-half years as a Natural Resource Specialist for the Bureau of Land Management, Pacific Outer Continental Shelf (OCS) Office in Los Angeles. His duties are to provide management with needed information regarding marine mammals and seabirds, and to develop marine mammal and/or seabird related studies and administer the technical aspects of contracts for such studies. Prior to his position with the OCS Office, Mr. Reetz worked for five years as an ecologist for the Army Corps of Engineers.

JOHN RICHARDS is Area Marine Advisor with the University of California Cooperative Extension Sea Grant Marine Advisory Program. He has worked in fisheries, marine and estuarine research for 18 years. He currently conducts an applied research and extension education program in marine science and fisheries for the marine community in San Luis Obispo, Santa Barbara and Ventura counties, an area including 250 miles of coastline, the northern Channel Islands, and six ports. Richards assists Sea Grant researchers in initiating and conducting applied marine research projects and provides information to the fishing industry, marine resource management agencies, and the public.

CAROL ROSE is a representative of Sea Otter Management Education (SOME), an educational group centered in northern California, and is Secretary for the California Council of Diving Clubs, Inc.

VICTOR SCHEFFER is a former Chairman of the Marine Mammal Commission and is renowned in the area of pinniped research. Dr. Scheffer worked as a federal biologist from 1937 to 1969, when he retired from the Bureau of Commercial Fisheries. His books on marine mammals include the widely cited Seals, Sea Lions, and Walruses, The Year of the Whale, The Year of the Seal, A Natural History of Marine Mammals, and, The Amazing Sea Otter.

NAOMI SCHWARTZ has served on Assemblyman Gary Hart's District Office staff for the past six years. Her primary responsibilities are in the areas of energy, transportation, planning and resources. She serves as liaison with state and local government agencies and community organizations. Ms. Schwartz is presently chairperson of the California Coastal Commission, to which she was appointed by the Governor in 1977, after serving for three years as a member of the South Central Regional Coastal Commission.

MAYNARD SILVA holds a postdoctoral research fellowship at Woods Hole Oceanographic Institution, where his current research interests include parallels between fisheries development policy and agricultural policy, fisheries management, implementation of ocean thermal energy conversion technology, and environmental ethics. Dr. Silva's past research includes studies of the California abalone fishery. He has recently completed a doctoral dissertation on "Property, Scarcity, and Natural Resources."

DONALD B. SINIFF is a Professor in the Department of Ecology and Behavioral Biology at the University of Minnesota. He has been a Commissioner on the Marine Mammal Commission for several years, and has done extensive research on California and Alaska sea otters.

LUCY SLOAN is Executive Director of the National Federation of Fishermen in Washington, D.C., which represents commercial fishermen on legislative and administrative matters concerning the development of fisheries.

EDWIN M. SMITH is an Assistant Professor of Law at the University of Southern California and a Research Associate for the Institute for Marine and Coastal Studies. His teaching specialties are in the areas of Marine Resources Law and Copyright Law. He has served as Staff Attorney, Office of the General Counsel, Northwest Region, National Oceanic and Atmospheric Administration, and participated in legal review of fishery management plans developed by the Pacific Fishery Management Council. He has also been involved in the prosecution of administrative civil penalty proceedings enforcing the Fishery Conservation and Management Act and the Marine Mammal Protection Act, and regional law review of proposed research grants for marine fisheries development. He practiced law with the firm of Rosenfeld, Meyer and Susman in southern California before his current position at USC.

THORN SMITH currently serves as a part of the General Counsel's Staff of the National Oceanic and Atmospheric Administration in Washington, D.C. He is a former California abalone diver, active during the mid-1960s, and is familiar with the local history and problems of that industry. Mr. Smith is an attorney and holds a Master's degree in Marine Affairs.

JAMES J. SULLIVAN is Program Manager for the University of California Sea Grant College Program and a member of the Institute for Marine Resources of the University of California at San Diego. An economist, Dr. Sullivan has published several articles on environmental decisions and their economic impacts.

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