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ABSTRACT

Developing an awareness of the need to evolve an environmental ethic is the intent of this module, designed for the senior high school level (grades 10-11). The module is divided into two sections. Section 1 contains a series of dilemma/discussion activities raising issues regarding human behavior toward animals and the natural environment. Dilemmas are brief stories posing a critical decision to be made by a main character. This decision revolves around conflicts between two or more moral/ethical issues (as identified by Kohlberg) presented in the situation, and it is the moral/ethical implication that provides the thrust for later student discussions. Preceding each dilemma are readings/case studies providing background information regarding issues in the dilemma. Questions are also provided to stimulate thinking about the issues and generate discussions. Section 2 contains two role-playing simulations, the first addressing issues related to appropriate use of national/state parks and "right" of inanimate objects and the second addressing issues related to use of the oceans. The module may be used as a separate unit of study, as a mini-course, or incorporated into such subject areas as science, psychology, history, philosophy, language arts, or civics. (JN)

PREPARING FOR TOMORROW'S WORLD

Of Animals, Nature and People

Institute for Science, Technology and Social Science Education

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Preparing for Tomorrow's World
An Interdisciplinary Curriculum Program

Coastal Decisions: Difficult Choices
Energy: Decisions for Today and Tomorrow
Future Scenarios in Communications
Space Encounters
Technology and Changing Life-Styles
Food: A Necessary Resource
Perspectives on Transportation
Future New Jersey: Public Issues and the Quality of Life
People and Environmental Changes
Environmental Dilemmas: Critical Decisions for Society
Of Animals, Nature and Humans
Beacon City: An Urban Land-Use Simulation
Dilemmas in Bioethics
Technology and Society: A Futuristic Perspective

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PREPARING FOR TOMORROW'S WORLD

Of Animals, Nature and People

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PREFACE

We live in an exciting, rapidly changing, and challenging world a world highly dependent upon science and technology Our world is changing so rapidly that we sometimes fail to recognize that much of what we today take for granted as common, everyday occurrences existed only in the imaginations of people just a few short years ago. Advances in science and technology have brought many dreams to fruition. Long before today's school children become senior citizens, much of today's "science fiction" will, in fact, become reality. Recall just a few accomplishments which not long ago were viewed as idle dreams:

- *New biomedical advances have made it possible to replace defective hearts, kidneys and other organs*
- *The first air flight at Kitty Hawk lasted only a few seconds. Now, a little over half a century later space ships travel thousands of miles an hour to explore distant planets.*
- *Nuclear technology—of interest a few short years ago because of its destructive potential—could provide humankind with almost limitless supplies of energy for peace-time needs.*
- *Computer technology has made it possible to solve in seconds problems which only a decade ago would require many human lifetimes.*
- *Science and technology have brought us to the brink of controlling weather, earthquakes and other natural phenomena.*

Moreover, the changes which we have been experiencing and to which we have become accustomed are occurring at an increasingly rapid rate. Changes, most futurists forecast, will continue and, in fact, even accelerate as we move into the 21st Century and beyond. But, as Barry Commoner has stated, "There is no such thing as a free lunch." These great advances will not be achieved without a high price. We are now beginning to experience the adverse effects of our great achievements:

- *The world's natural resources are being rapidly depleted.*
- *Our planet's water and air are no longer pure and clean.*
- *Thousands of plant and animal species are threatened with extinction.*
- *Nearly half the world's population suffers from malnutrition.*

While science and technology have given us tremendous power, we are also confronted with an awesome responsibility to use the power and ability wisely, to make equitable decision tradeoffs, and to make valid and just choices when there is no absolute "right" alternative. Whether we have used our new powers wisely is highly questionable.

Today's youth will soon become society's decision-makers. Will they be capable of improving upon the decision-making of the past? Will they possess the skills and abilities to make effective, equitable, long-range decisions to create a better world?

To the student:

This module has been prepared to help you—the student and future decision maker function more effectively in a rapidly changing world. Other modules in the *Preparing for Tomorrow's World* program focus on additional issues of current and future importance.

To the teacher:

It is our belief that this module—and indeed the entire *Preparing for Tomorrow's World* program will help you the teacher prepare the future decision-maker to deal effectively with issues and challenges at the interfaces of science/technology/society It is our belief that the contents and activities in this program will begin to prepare today's youth to live life to the fullest, in balance with Earth's resources and environmental limits, and to meet the challenges of tomorrow's world.

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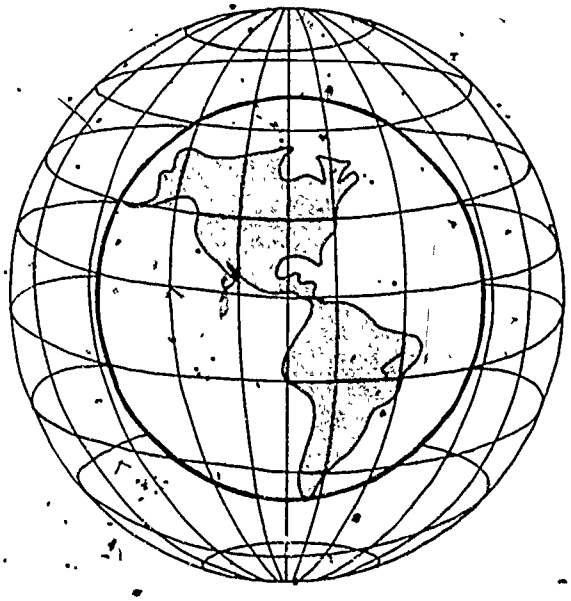
Section One:



Life On Earth

Reading 1

Excerpts from *New Jersey's White Tail Deer*

EMERGENCY DEER REDUCTION— HERCULES, INC.

This deer shows the side effects of malnutrition. Sores on the nose and ears are caused by skin parasites, which are more prevalent on starving deer.

The following description of a deer overpopulation problem at the Hercules plant in Kenvil, New Jersey, is the grimmest example of what a no-harvest policy could do to New Jersey's deer herd. The Hercules problem is exceptional because of the security demands of this explosive-making business. However, it does illustrate the inhumane consequences of the "natural" controls, disease and malnutrition. We believe that this well-documented example should leave no doubt that the wise use idea of wildlife conservation is the most intelligent path to take. Proper hunting seasons backed with sound information will ensure that the exceptional case at the Hercules plant remains just that, an exception and not the statewide rule.

In early March, 1976, division biologists destroyed 38 deer within the 1,100-acre enclosure owned by Hercules, Inc., in northern Morris County. Because of the overpopulation of deer within the fenced area, several animals starved and the remainder were in poor condition, posing a disease threat not only to the Hercules herd but to the wild deer population outside the fence.

At the request of plant officials division biologists investigated the Hercules deer problem during November, 1975. Because of the poor condition of the deer and the high probability of starvation with the onset of winter, it was recommended at that time that the population be reduced by half. Since the population was estimated at about 100 [an aerial count on March 11 indicated that approximately 93 deer were within the enclosure prior to January, 1976], 50 deer were to be removed.

Because Hercules, Inc., is an explosives-producing facility, firearms could not be employed. As an alternative, a controlled archery hunt was recommended. However, the corporate headquarters located in Wilmington, Delaware, decided to adopt a "wait and see" policy and temporarily postponed any form of reduction.

However, by the end of February, 11 deer were known to have died. Postmortem examinations were performed on seven deer by division biologists. Fawns showed almost a total absence of body fat, plus heavy infestation of lung worms, lice, and other parasites. Though

their stomachs were full, there was little evidence of digestion. Adult deer (those older than one year) also showed low body fat levels and stomach deterioration as a result of not having enough quality food available. Stomachs were filled with a variety of items including evergreen needles, lettuce leaves, celery, carrot ends, and onion skins. None of these items are capable of sustaining a deer.

As a result of the continued deterioration of the deer and the inevitable loss of many more to malnutrition and disease, division biologists recommended an immediate reduction of the population. The danger of a disease outbreak which could possibly spread to wild deer inhabiting areas outside the enclosure was the major consideration in the decision to destroy 35 to 40 deer.

The exceptional conditions at the Hercules Powder Plant in Kenvil do not allow hunting by outside hunters. These deer had to be killed by division biologists to assess the disease potential of the highly malnourished deer.

Of the 38 deer collected, 14 (36.8%) were fawns and 24 adults (14 males and 24 females). Weights recorded were some of the lowest on record. Male fawns averaged 35.3 pounds dressed weight and female fawns 34.3 pounds. Comparable dressed weights for fawns from Deer Management Zone 9 average 60.0 and 52.8, respectively. The Hercules, Inc., enclosure is located in the northwest corner of Zone 9.

Examination of the reproductive tracts of 23 females indicated a very low reproductive potential. Only one out of four yearling does (between one and two years of age) was bearing young, and that was a single fetus. Adult does, those two years old and older, had a reproductive rate of .83 (less than one fetus per doe). In comparison, the reproductive rates for Zone 9 recorded during the December 1975 deer hunting season were 1.5 fetuses for yearling does and 1.75 fetuses for adult does. Like weight, reproductive potential is an indication of habitat quality.

Disease and parasite examination revealed a variety of conditions. Fawns were found harboring heavy infestations of lice, resulting in extensive skin inflammation and hair loss. Tapeworm cysts, botfly larvae, and nodular worms were also recovered in large numbers. Fat reserves were very low, with bone marrow reserves all but depleted in some cases. Male fawns exhibited poor development of antler pedicles (buttons) and sex organs.

Adults also harbored extensive parasite infestations of nodular worms, cecal worms, tapeworm cysts, gullet worms, botfly larvae, and lice. Inflammation of intestines was common. In short, the picture was one of a badly undernourished herd subsisting in an overpopulated "wildlife ghetto."

Because of the recent severe outbreak of Epizootic Hemorrhagic Disease (EHD) in portions of northwestern New Jersey, it was feared that the Hercules deer might be a potential source of infective virus. Blood samples from 27 deer were collected and sent the U.S. Department of Agriculture Veterinary Services Laboratory in Ames, Iowa. Fortunately, the test results were negative.

Both the hunting and nonhunting public demonstrated considerable concern over the need to destroy the deer. Some felt that alternatives such as relocation or supplemental feeding had not been considered.

On the contrary, these as well as other alternatives were reviewed, but the deer were in such poor condition that few would have survived the handling process involved in relocation. In addition, their parasite loads were so heavy that they would have become a potential source of infection to healthy wild deer.

The problem was not only one of health and physical condition. The Hercules deer, like most confined populations that have lived in close association with man for many years, were no longer "wild" animals. Their release into the wild would have resulted in considerable conflicts with human activities. Because of their

lack of fear and their past dependence on man, they would seek his company. They would be more likely than their wild counterparts to become pests, damaging ornamental plants and agricultural crops.

Deer don't necessarily stay where you put them. On the contrary, extensive movement after relocation is common. Because of this tendency to travel long distances after release, their unfamiliarity with the area, and their lack of fear of man, relocated deer are more susceptible to highway and poaching losses.

Tame deer can be dangerous. This is especially true of bucks during the fall breeding, or "rut," period. Several individuals have been injured by "pet" deer in New Jersey as well as in other states. Because of the potential public hazard, it is the division's policy not to release into the wild any deer that has been living under confined conditions.

Zoos and other suitable facilities have plenty of deer and even on the rare occasions that they will accept a deer, will take only healthy specimens.

Supplemental feeding is no answer. Not only is it costly, but it does nothing but postpone the inevitable: the control of the population through the annual removal of a number of deer equal to the number of fawns produced.

The lack of management of confined deer populations, such as that inhabiting the Hercules enclosure, which are not subjected to the control that annual hunting seasons provide, is a constant problem in New Jersey. It results in the development of "wildlife ghettos" inhabited by unhealthy animals subsisting under inhumane conditions.

In the case of Hercules, it is difficult to justify the presence of deer at all. It is not a zoo, but an industrial installation which is neither designed nor equipped to maintain a deer population in adequate health. The continued presence of deer within the Hercules enclosure should be discouraged and it is the division's recommendation that the populations be reduced over a period of time and eventually eliminated.

THE WAY WE SEE IT

"For millions of years we survived as hunters. In the few short millenia since our divorce from that necessity there has been no time for significant biological change — anatomical, physiological, or behavioral. Today we have small hope of comprehending ourselves and our world unless we understand that man still, in his inmost being, remains a hunter."

Robert Ardrey
The Hunting Hypothesis

Man the Hunter – Sinner or Saint?

Man has been a hunter for as long as he has been a man. Modern times and attitudes will not in such a short period of time diminish the need for us to exercise this expression of freedom.

Anthropologists tell us that man evolved as a hunter and predator. In fact, man has lived 99 percent of his history as a hunter. Scenes of deer hunting have been found on the walls of caves dating from the Paleolithic, more than 15,000 years ago.

At one time, there were two forms of pre-man, one a vegetarian and one a flesh eater. The vegetarian did not produce tools and required little social organization for survival. Little effort, thought, organization, or cooperation were necessary to dig tubers or pick bananas. But the hunter, in developing weapons and the social structure necessary to be successful in the chase, became man.

That hunting has played an integral part in the evolution of modern man is an understatement. We are what we are because we were and are hunters.

Today, man is still basically a predator. He still enjoys eating meat and continues to kill other living organisms to feed himself. However, much of the killing is no longer observed. Only the packaged and labeled cuts of meat on the supermarket shelf are seen by this now vicarious predator.

Meat no longer comes from a dead animal, but from the store. Heat doesn't come from the combustion of fuel, but from the furnace in the basement. This estrangement from the natural world grows greater each day at a time when man's drain on natural resources is also greater than ever. Such ignorance or apathy of our dependence on natural resources may have grim consequences. Man is in danger of losing touch with the land, the natural environment, and his dependence on it. However, many people are still aware of this relationship, and among these are the hunters.

The famous author of "The Territorial Imperative," Robert Ardrey, in his most recent work, "The Hunting Hypothesis," takes man's dependence on hunting even further. He predicts grim consequences because man has strayed from the hunting way. He reminds us that our current relatively mild climatic period represents only a temporary instant in geologic time. He predicts that the Ice Age will return and that man as we know him is doomed because of his dependence on agriculture and loss of the hunting life style. Only the hunter survives in a harsh, rapidly changing environment.

Many people still enjoy venturing into the woods and fields each year to seek out and kill wild game. Most would find it difficult to say why they are there, except that they find it extremely satisfying.

The famous Spanish philosopher José Ortega Y Gasset noted that "essential human nature is inseparable from the hunting and killing of animals and that from this comes the most advanced aspects of human behavior." Through hunting, once again, even if just for a brief period, man becomes part of the natural system instead of apart from it. He becomes a participant instead of a spectator.

Noted psychoanalyst Erich Fromm believes that both primitive and modern hunters were and are motivated by two principal desires. First, through the act of hunting, man and animal become one. Man briefly becomes part of the system. In primitive man, this is a conscious experience. Though modern man finds it difficult to describe, or even to be aware of why he hunts, this need is still very much alive in many human beings.

The second desire is the opportunity to enjoy the experience of one's skill. The motivation of the primitive hunter was not the pleasure in killing, but in the development and use of various skills needed for a hunter to be successful.

Certainly, this satisfaction is rooted in the maintenance by man of an old and harmonious relationship with nature.

Today, whenever the subject of sport hunting is discussed the question of morality arises. Some individuals feel that sport hunting is immoral, while others see nothing inherently wrong with sport hunting. The question is a philosophical one, which will never be answered to the satisfaction of all.

In the biological sense, hunting can only be considered "immoral" if it destroys the ability of wildlife populations to perpetuate themselves. The annual removal of surplus individuals is no violation of nature's system. Nor does nature recognize the importance of the individual animal.

The arguments of the antihunting movement are psychological and discriminatory against those who just don't believe as they do. Each of us has his own set of values, and resists attempts to force on him another set of values. The hunter must respect the right of those who choose not

to hunt, as the nonhunter should respect the right of those who still feel the need "take their guns, whistle for the dog and go to the mountain."

The antihunting controversy is a wasteful issue. It distracts time, effort, and attention from the real threat to wildlife survival habitat destruction. Those who are genuinely concerned with the conservation of New Jersey's wildlife resources must direct their concern toward saving, maintaining, and improving the base upon which the wildlife resource depends – the land.

In addition, only the hunter has demonstrated enough interest in saving wildlife to provide a source of revenue to carry out the research, management, and acquisition projects necessary to keep our wildlife resources healthy and productive.

Our Philosophy of Deer Management

As stated before, it is the goal of New Jersey's deer management program "to develop and maintain a healthy and productive deer population at a density compatible with other land uses and to maximize the recreational and economic benefits of this renewable resource."

This statement summarizes in a few words our basic philosophy regarding the deer resource. First, it implies a truism not often recognized by man, be he hunter or nonhunter. Deer and other wildlife species are managed to maximize *human benefits*. The deer hunter does not hunt to control the population for the sake of the deer. He hunts because he likes to hunt. Nor does the animal "protectionist" fight against hunting to "save" the deer, but to protect and encourage those values he sees in deer that are important to him.

Both hunter and nonhunter alike recognize that deer have real value. Some are obvious, like sport or meat, some are not so obvious, such as the enrichment of life and the appreciation of objects free and beautiful.

The deer manager must recognize these positive values but must also look at the negative aspects of a large deer population living in close association with a dense human population. The damage to agricultural, nursery, and ornamental plantings is substantial in many areas. The frequency of deer-vehicle collisions exceeds 5,000 annually, resulting in more than $1,000,000 in damage and the occasional loss of human life, in addition to the thousands of deer wasted. Deer seldom survive an encounter with the all-American status symbol.

The manager must find a common ground between the various public attitudes and demands; between the hunter who would prefer a deer behind every bush to the constantly harassed farmer who wishes he had seen his last deer 20 years ago. This is a difficult problem at best, but not the major problem.

We live in the most densely populated state in the union. The demands on our remaining open space are staggering and the pressure increases daily. As our environment becomes more and more a manmade one, more and more of our people are becoming estranged from the natural environment. Our knowledge of wild things and wild places becomes a vicarious one, via the TV and the motion picture. The result is the development of points of view concerning wildlife that are foreign to the "real world" of nature.

One is the "hands off" attitude expressed by many so-called antihunting, antimanagement groups. Nature can take care of itself, is their credo. However, they fail to realize that man is part of the system and a major influence. Man cannot be excluded, he cannot stay back aloof, waving his protective hand over the "lesser creatures." Man must take an active role in managing natural systems, like the deer resource, for the benefit of both the resource and man himself.

The second, and by far the most dangerous attitude developing in the minds of urban man is that "more is better"; more cars, pools, color TV's, public beaches, picnic grounds. Many still fear "the woods" and its creatures. If the outdoors is to be used, it must be mowed, trimmed, etc.—in short, made artificial. The arrogant attitude toward wildlife of a growing portion of our population is symptomatic of our estrangement from the natural world. We are at the point now where people demand the removal of a wild animal just because it's there! "There's a rabbit on my lawn, come and remove it immediately."

In short, it is often heard in these times of so-called "environmental enlightenment" that man needs "wild things and wild places" to renew his spirit and maintain a quality life style. This sounds good, but does our growing urban population really want wild places and

animals or does it want picnic tables on compacted earth next to a softball field, and an occasional chipmunk if it doesn't bother anyone?

The future of New Jersey's deer resources is what its citizens want it to be. The knowledge and technology are available. But the public must tell us what it wants. We believe the goals we have established to direct our efforts are in the best interest of both man and deer. But as conditions and public attitudes change, so will goals. What will be the future for our deer, our environment, and us? The choice, truly, is ours.

These selections are excerpted by permission from *New Jersey's White Tail Deer,* Deer Report No. 3, The State of New Jersey Division of Fish, Game and Shellfisheries, pp. 4-6, 20-24.

Reading 2

Reprinted by permission from The Legal Institute. *LAW REVIEW JOURNAL*, Volume 2, Issue 2.

Excerpt from Exploring The Abolition of Sport Hunting

By Luke A. Dommer

Published in The Legal Institute Law Review Journal Volume 2, Issue 2

Recently, in testimony before Congress, world renowned Marine Biologist and Oceanographer, Captain Jacques Cousteau, stated: "The real cure for our environmental problems is to understand that our job is to salvage Mother Nature." He added: "We are facing a formidable enemy in this field, it is the hunters . . . the hunters who feel compelled to carry on the courageous struggle against nature that was true for a million years, and to convince them that they have to leave their guns on the walls is going to be very difficult . . . very difficult."

It has been argued that: "Starvation, disease, predation, and destroyed habitat result when hunting is not used as a management tool." This claim, which constitutes a basic justification for recreational hunting is premised on the theory "that hunters take only surplus animals, thus helping to keep wildlife in balance with available food and shelter." A good excuse but a debatable theory at best.

In fact, it is an established biological principle "that most natural populations of terrestrial vertebrates, including some game species, are regulated by a complex interaction of environmental variables which maintain population size within certain limits." These influences include food, space, territories, predators, parasites, disease, inter-specific competition, and hunting. Generally, variations in one population factor will be offset by adjustments in other factors so as to maintain a population within certain limits.

Wayne Evans, Ph.D., Assistant Director of the Fish and Game Commission of the State of New Mexico, put it this way: "Hunting has *never* been a necessary adjunct to population control and it is highly dangerous to assume that hunting can act as a substitute for any mortality factor. It produces its own set of population characteristics distinct from any type of mortality factor. Those who claim that hunting is a necessary 'management tool' for population control are actually referring to its theoretical role in managing a population to achieve a specific goal (i.e. hunting). No one will be so rash as to claim that if there is no hunting,

the population would grow to infinity or sink to extinction." Now that we know that the idea of hunting being necessary is at least debatable, we can go on to another aspect of our exploration.

It is a little known fact that in 1842 the United States Supreme Court declared: "Wildlife is held in trust for all citizens." To me, this means that Government would be responsible for the protection of wildlife for the benefit of all citizens. It would also indicate that wildlife could not be exploited by any segment of the population at the expense of the rights of other citizens for whom it was held in trust. In fact, wildlife management has been operating with utter disregard to anything resembling this declaration.

At the turn of the 19th Century, wildlife management created a major disaster on the Kaibab Plateau in Arizona. A stable herd of 4,000 deer existed on the Plateau at that time and the idea was to increase its population. So, management exterminated every last natural predator and abruptly removed 195,000 sheep from the area. This experiment worked so well that the deer population exploded . . . 60,000 starved to death and the habitat was decimated! Eventually, the herd stabilized at approximately 10,000 head. Sportsmen claim it was all because there was no hunting, but we'll get to that later on in the article.

From 1944 to 1950, the Arizona Fish and Game Commission used steel traps, strychnine, drop baits, thallium sulphate, and deadly Compound 1080 to destroy every living predator (and quite a number of domestic dogs) on an area comprising 17,000 square miles. The reason? "To increase the antelope herd to huntable proportions."

During the Seventies, another such predator control program began in Alsaka. It was apparent to many wildlife biologists that the depletion of the moose herds in three management zones comprising 9,000 square miles south of Fairbanks, was because of over-hunting by man. Some even recommended that hunting be banned, but sport hunting organizations all across the United States put tremendous pressure on the Alaskan Fish and Game Commission which was reluctant to exterminate the wolves in the area because they were not the cause of the problem and the public was well aware of this.

A strong outcry to spare the wolves was coming from all over the United States. The hunters then even blitzed the mass media with stories of how wolves were killing and eating their dogs when they left them chained to posts overnight. On one occassion, in 1973, these "concerned" hunters killed 710 moose out of a herd of 3,000.

By 1976, there were less than 2,000 moose left in the entire area out of a herd of over 12,000 because over a ten-year period management allowed the killing of females to placate the hunters' demands for these big game targets.

Yet, the then Commissioner James W. Brooks ordered the extermination of the 175 wolves estimated to exist in Zone 20A. Why? Commissioner Brooks was not only confronted by the decimated moose herds and the howling hunters, he was also obligated to abide by the official policy of the Alaskan Fish and Game Commission: "Wolf Management Policy"; i.e., "Whenever substantial conflicts arise between humans and wolves over the use of prey, the wolf population will be managed (reduced by killing) to minimize such conflicts." I would like to point out that hunting has been banned on Royal National Park Island in Lake Superior for 25 years. The moose herds are healthy and thriving on this island alone with the wolf.

There were many other such predator control programs, but let's get into some other methods used to create a surplus of such species as deer and what some of the results have been. One method is "controlled burning" to create browse for deer. However, this also results in the roasting alive of countless non-game animals composed of species representing 90 percent of all domestic wildlife species. Millions of acres of public lands have already been torched by Fish and Game Commissions and plans are in the works to burn down additional millions of acres to produce more game animals by increasing their browse at the same time making the habitat useless to other species.

"The philosophy of deer management is to maintain them at optimum levels", better known to wildlife biologists as the *"Maximum Sustained Yield"* principle or "M.S.Y.". M.S.Y. works this way — natural predators are managed (killed off) in order to allow more ungulates, such as deer, to survive, while habitat manipulation increases their food supply and prompts the female's maximum reproduction potential. For example, the white-tailed doe will bear two fawns annually under good browse conditions as opposed to one under a browse shortage and will fail to ovulate if population levels are beyond carrying capacity of a given range.

State Fish and Game Agencies manipulate habitat by burning, clear cutting and planting. In Michigan, for instance, 1.2 million acres of state forests were clear-cut to increase the browse for deer. The January 27, 1975 issue of the "Detroit Free Press" reported: "The Wildlife Division says it is necessary because a forest managed by nature cannot support a fraction of the deer needed to provide for a half million hunters." The plan was to build the herd from 4000,000 to one million by 1980.

Normally, for every hundred fawns born, 52 are males and 48 are females or about a one-to-one ratio which wildlife managers alter through "legal hunting" toward a desired sex ratio of five-to-ten females for each male in order to drastically increase the number of births. The September-October 1976 issue of "The Conservationist" (N.Y. State Department of Environ-

mental Conservation Magazine) put it this way: "Ideally, if the desired number of antlered and antlerless deer are taken (killed) each year the population will comprise the highest number of breeding females and the lowest number of males. As a result, a maximum fawn crop will be produced each year."

The "Times Herald Hunting" edition dated September 30, 1978, contained this statement by Terry Moore, Regional Wildlife Manager of the N.Y. State Department of Environmental Conservation,: "We will attempt to increase the number of deer until we experience high incidences of deer-car collisions, depredation of agricultural crops becomes intolerable and/or the effects on deer habitat begin to result in deterioration" "Why?" "To increase the success rate of big game hunters."

In Vermont, as in many other states, this trophy buck policy has created a surplus of deer. The deer population in Vermont is in the neighborhood of 20,000 head. Of these, an average of 40,000 starve to death annually, about 8,000 are taken by hunters and another 2,000 die as a result of deer-car collisions and attacks by wild dogs. You can see then that hunting does not prevent starvation. In fact, hunting increases the amount of starvation because of management policies to provide an abundance of trophy animals for hunters.

On a national level state angencies have created a large population of 15 million deer. Here are the results in Pennsylvania which has a population of 70,000 M.S.Y. deer. Roger Latham, a former Outdoors Editor for the "Pittsburgh Press" described it in this way: "An ecological disaster and nothing short of a catastrophe." He continued, "8 million acres of mountain forests have become barren and uninviting to most wildlife including the deer which have severely depleted the ground cover, (shrubs, bushes, wild flowers, etc.) Because of this, soil erosion has undermined the quality of the mountain streams while many species of trees are being killed in their younger stages of growth and natural forest reproduction is failing to occur on hundreds of thousands of acres in the main deer ranges."

"Rabbits, song birds, grouse and other species are vanishing because they can barely be supported on this land and birds of prey have become a rare sight. The black bear is endangered from over-hunting because it has nowhere to hide from hunters. As if that's not bad enough, staggering 3 million acres of farmland have been abandoned because of crop damage, and insurance companies are paying out 150 million dollars in claims annually of the yearly toll of 25 to 29 thousand collisions with deer in which some motorists have lost their lives."

Let's examine the necessity of hunting on wildlife refuges where conservation employees are busily breeding and hatching a few species of waterfowl for the gunnery season. Of course, "as originally conceived, these refuges were to be sanctuaries where sport hunting was to be prohibited." Donald J. Hankla, former Chief of Resource Management for all Wildlife Refuges, in testimony at a 1970 trial regarding hunting on the Great Swamp in New Jersey, stated: "Wildlife refuges are managed in part to produce surplus game for hunters,"

The hunting advocates' argument incorrectly assumes "that reductions in recreational hunting must necessarily result in physiological compensations which are harmful to wildlife." Actually, a species may adapt to the cessation of hunting by adjustments in diet or range, alterations in reproductive behavior, or other changes which do not adversely affect the individual or the species.

Writing in the January 1974 issue of "Smithsonian", former hunter, Jack E. Hope noted: "That even the unusual case of white-tailed deer, which now exist in far greater numbers than in the 18th Century, the concept of the hunters' harvest as a conservation measure has only contrived, short-term validity. Approximately 13.8% of the total white-tailed deer population is taken annually (not including crippling losses) by hunters. This hunting pressure has created a biological imbalance since it does not permit the herd to fluctuate with changes in habitat, but maintains it at an unnaturally high level."

According to Mr. Hope, "In areas where the white-tailed deer population exceeds the carrying capacity of the land, the immediate results of a cessation to recreational hunting would be over-browsing, damage to agricultural crops, starvation, predation, and a general deterioration in the health of the population. But within a period of several years, the population would stabilize at a new level in balance with the available food supply. This transition would be facilitated by a characteristic of several game species: the white-tailed doe does not ovulate when the deer population is high. Therefore, an alteration in population numbers will be affected by a reduction in natality as well as changes in mortality influences."

"The new population balance would probably be genetically healthier than the one maintained by recreational hunting since natural thinning of the herd would be more selective in eliminating the aged and infirmed animals than is the hunter. With the reduction in deer numbers, habitat changes would also occur as a result of reduced deer browsing and other wildlife species could then increase their populations to occupy a portion of the space now used by deer."

In an interview which appeared in "National Wildlife" Magazine, a prominent Wildlife Biologist, Dr. A. Starker Leopold, discussed an extension of this theory as it applies to small game species: "There are very few cases where small game is capable of destroying its habitat. Hunting small game simply takes

a portion of populations such as quail, pheasants, or cottontail rabbits which overproduce regularly. It has no heavy relevance one way or another in terms of maintenance of the range or maintenance of the total population. They are almost completely regulated by the habitat in which they live — the availability of food and cover." Mr. Leopold was expressing a view shared by many wildlife biologists. It must be noted here that natural predators are not the primary or sole limiting factor in the population control of herbivorous species such as ungulates. They are only one of a series of interacting factors which determine population levels other than the availability of food for plant-eating animals, which is the primary factor. Actually, herbivores have more influence upon what the populations of predators will be than predators have on them because natural predators are at the end of the food chain — no plants, no plant-eaters, no meat-eaters.

The main reason the deer population on the Kaibab Plateau exploded was not because of the extermination of natural predators but because their food supply was increased. Wildlife Scientist Graeme Caughly wrote in a 1970 issue of "Journal of Ecology": "195,000 sheep, competitors for food, were removed from the Kaibab Plateau, dramatically increasing the food supply for the deer."

This is something hunters never tell because they want non-hunters to believe their propaganda about taking the place of natural predators. Now we all know natural predators cull (remove the unfit) the prey animals and this insures the survival of the hunted species, barring an unforeseen natural disaster or killing by man, by habitat destruction, or hunting. Now, who could really believe that the modern day hunter with scientifically designed weapon in hand, along with binoculars, riflescope, and electric socks would hunt down a sick and diseased animal to take home for dinner? In fact, he diminishes the long-term survival potential of the game animals he hunts by destroying their best gene pools. Millions of years of the process of evolution wind up hanging on the walls of the trophy den as in the case of the 15-point Buck of the Berkshires.

The Endangered Species Act of 1973 lists hunting as "one of the two major factors in the endangerment of wildlife species", and the President's Council on Environment Quality has estimated that "at the current rate of the extermination of mammal species, virtually all of them will be gone in about 30 years". Wildlife management's preoccupation with creating a surplus of a comparatively few game species at the expense of all other non-game animals in order that recreational hunters be provided with a harvest of game animals is not logical wildlife conservation. Management should be oriented toward a balanced ecological system that offers the greatest potential for the greatest variety of wildlife, and for the many satisfactions people can derive from their existence.

The stranglehold over the destiny of our wildlife heritage by a 7 percent special interest group must be broken. Our state and federal lands must be made safe again for bird-watchers, hikers, campers, and wildlife. Our private property rights and safety from hunter intrusions and bullets must be restored. The posting laws must be changed and the burden of this expense and labor shifted to the state agencies that fill the woods with hunters every year and endanger home-owning citizens with their antiquated safety zone laws, puny fines for violators, and almost non-existent protection.

We as human beings should not condone or support the terrorizing, crippling and killing of millions of innocent and defenseless animals in the name of "recreational hunting". If we do, then how can we claim we are more noble than animals when at least they do not kill for fun? And, how can we allow the wanton destruction of the earth's ecology simply because the victims do not resemble us?

The time is long overdue to heed the alarms being sounded by sincere and brilliant men like Jacques Cousteau. We must accept the knowledge that men like Lynn A. Greenwalt, Director of the U.S. Fish and Wildlife Service, is attempting to convey to us in this statement: "The entire fish and wildlife habitat is vital to everyone. People need to take action, to demand, to press for change. We cannot continue to exploit our natural resources with utter abandon. The fate of animals and that of man are inexorably intertwined, and the world must be treated as one vast ecosystem."

DILEMMA 1:
"The Wild Deer Harvest"

A wildlife preserve in the northeast is faced with an overabundance of deer. The forest ranger's annual spring count indicate that there are too many deer for the area. If the population is not reduced, many deer will die from starvation. To save the deer from starving or dying from disease, the rangers announce that five days be set aside for a "deer harvest" when hunting will be permitted.

When the Society of the Preservation of the White Tail Deer heard this, they organized a massive demonstration at the ranger's headquarters. They protested,

"Your hunters will go in in large numbers. Many of them will not even kill the deer. Many animals will only be wounded or maimed and left to suffer needlessly. It is inhumane.

"Also, these deer have lived in a protected area. They have not learned to fear people. Many will come right up and eat out of your hand. Now you are going to turn around and gun them down. These innocent deer don't have a chance.

"We think you can solve the problem simply by bringing in food or taking them to an area where there are few or no deer."

The ranger replies,

"The hunt is the best way to protect the welfare of the deer. Too many deer will result in mass starvation and also cause destruction of the trees and plants here. Other animals will also suffer.

"Bringing in extra food is no solution. It is expensive and is only a temporary solution. Next year and the following we will still be faced with too many deer. Taking them to another area is risky. Many are not healthy enough to survive the trip. They will have trouble adjusting to a new area — the food and land will be different and these deer may not know how to protect themselves.

"Besides, hunting is a natural human instinct. Humans evolved from being a food gatherer to a hunter. To hunt is to keep in touch with nature,"

The Society does not agree that a "deer harvest" hunt is right and brings the case to court. It wants the judge to halt the "deer harvest."

Should the judge allow the "deer harvest"? Why or why not?

DISCUSSION QUESTIONS

- What are the two conflicting sides of this issue? What values are in conflict?
- Why do rangers want a "deer harvest"?
- Why does the Society object to the "harvest"?
- Would more harm result if the deer population continues to increase?
- Are people ever justified in taking the lives of wild animals? Why or why not?
- Are there other ways to manage wildlife? What are they?
- If a natural preserve becomes overcrowded, what responsibilities must people assume?
- Is it right for humans to decide which animals should live and which animals should die?
- Is it any more humane to let over-population cause wild animals to die from starvation and disease than to kill them?
- If a deer wanders out of an overcrowded preserve and injures a person, who should be blamed? The park rangers? The people opposed to hunting? Explain.
- What is your response to a "lizard harvest"? Does the type of animal make a difference? Explain.

Reading 3

By David Nevin

Scientist helps stir new movement for 'animal rights'

Former wolf researcher Michael Fox gives impetus to crusade for more humane conditions on U.S. factory farms and in laboratories

A tattooed monkey is kept isolated in laboratory cage, common practice in this country. But U.S. cages are half the size of recommended standard in Britain.

He comes swinging through the park, a slender man with a drooping moustache and a very quick smile, and pulling ahead on a long strap leash is a *wolf*. You don't expect to see a wolf in a city park in Washington, D.C., so you ask him—it's really a dog, is it not, just an odd-looking dog, leaner and larger and more feral than most dogs?

"Oh, no," he says in an impeccable British accent, most professional, most assured, smiling, "it's a wolf, left over from a research pack. I studied wolves and their behavior for years. This is the only one left."

He introduces himself: he is Michael W. Fox, veterinarian, animal ethologist, scientist, crusader for animal rights. And readily, there in the park, with the wolf gamboling at the end of the leash as people stop to gape, he ticks off in his crisp accent the obscenities that an ever larger, ever more sophisticated and technological culture works on animals today. He used to be part of that world and its effects obsess him. Now he intends to change it. There are a great many people with similar views who make up the new animal rights movement.

It is a movement that is growing rapidly, at a time when Americans are rights conscious and action oriented; it fits with our concern for our environment, our air and water and food. If we care about rights, worry about endangered species, question the carcinogens that appear in our fields and our food, can we be unconcerned about the means that lie behind the pale white egg we crack into the skillet?

What obsesses Michael Fox is the range of abuses routinely inflicted upon livestock and laboratory animals, the almost random examples of unnecessary suffering that are all too easy to find.

An East Coast research laboratory, for example, autopsied animals used by the military in developing a non-lethal missile, at a time of intense interest in

In confinement house, a veal calf spends its entire 16-week life in chute 24 inches wide. It lives in dark about 22 hours a day to minimize its motion.

domestic riot control. According to a lab assistant who is now a veterinary student at Colorado State University, researchers fired various projectiles—Ping-Pong balls filled with water, three-inch water balls, hard rubber balls—with varying force at anesthetized baboons and pigs. The pigs took body shots. The baboons took a series of shots to the head—either the forehead, back, or side. "The baboons bothered me most," said the former lab assistant. "I liked the pigs, but the baboons had fingers and fingernails—they were more like humans. Sometimes I brought my flute and played for them and they liked that."

The researchers killed about ten baboons a day. The animals were anesthetized, strapped in chairs, impacted (as it was phrased) and recaged. The most seriously injured animals were killed at once, but others were required to live overnight before they were killed. When the anesthesia wore off the baboons sat crouched, leaning against a corner, eyes hooded, sad, ill, unable to eat or drink. They were given no analgesics. Sometimes the assistant would ask if they couldn't be given pain-killers, because he was convinced they were suffering. "Made no sense to me—wouldn't the rioter who had been hit in the head take an aspirin?"

If research animals sometimes seem to be the victims of our progress, many farm animals are faring no better. A Virginia farmer has just gone into the veal business. He is a small man, a former conscientious objector who owns six-and-a-half acres. The plot is too small for real farming, so he built a veal confinement house, a windowless warehouse of cinder blocks that contains 80 chutes made of oak slats. Each chute is 24 inches wide. In each, on this day, was a five-day-old bull calf. Dairy cows are impregnated regularly to keep their milk flowing. Heifer calves are kept for milk cows and bull calves become veal. But first—in the modern veal systems—they will live for 16 weeks in a chute like those on this Virginia farm. The farmer has a frightening investment and he obeys the rules of the feed company, which for the first year supplies the calves, the feed and the medication, on which he depends. Each animal is chained in place. The calf can back up 12 inches and he can thrust out his head to eat the high-intensity mash made of milk solids low in iron. (This diet induces anemia, which results in the white meat prized in veal.) The chute floor is of slats. It is rough when he lies down, for it has no straw, which would interfere with the cleaning and which he would eat, since at about three weeks he requires roughage to develop his rumen. The calf learns to brace his cloven hoofs against the cracks and his leg muscles develop for bracing instead of walking. The lights are on only at feeding time; the calf lives in darkness 22 hours a day; this reduces motion, and is said to produce more tender meat. The calf can barely move—he stands perpetually in one position or else he lies in his cold feces.

British cattle often graze on open-range grasses until slaughter, as on this Derbyshire farm. This is more efficient use of energy, argues Fox, than practice of "finishing" cattle on grains that people could eat.

So he will live out his allotted 16 weeks of life in darkness, almost motionless in a cage the size of a coffin, and he will never have turned or stretched or run or touched another calf or had a bit of roughage, and when he comes out for slaughter on untried legs, he may fall down. And you may say, well, he had food and shelter and has known nothing else and who knows what a calf wants anyway? But stand before the cages of this veal confinement house and present a knuckle—and the little calf will thrust out its head and suck your knuckle with instinct so desperate that you will have your answer.

The cruelty of such isolation is matched by the bucolic bedlam in which modern hens are kept. After a lifetime in the egg business, another Southern farmer finally put his hens in battery cages, which is the method used in at least 90 percent of American egg production.

For years his hens had lived in 38 separate houses, scratching about in the yard by day and roosting by night. The houses stretched up and down the hills of his farm near Chesapeake Bay. But his old father, who always resisted change, went into a nursing home, his sons weren't very interested, hired hands were hard to find and he couldn't handle alone the awful labor of 38 separate chicken houses. He built two long, narrow barns and installed standard laying-hen cages.

He is a small-scale operator by the standards of the modern chicken industry; he has 10,400 birds. The cages are in long banks. Running along each bank is a trough carrying water and a small conveyor belt carrying feed. The cages, with no perches, are made of wire mesh which allows feces to fall through. The mesh catches eggs, which roll forward for collection. The birds come from a pullet house where they are debeaked—each beak pressed to a hot iron to blunt the end, which reduces pecking damage. Sometimes a careless operator burns off most of the beak, but that is undesirable since such a chicken has trouble eating and will lay fewer eggs. Each cage is 12 by 18 inches and four birds are put into each. Four chickens are crowded in a space 12 by 18 inches, so they scramble, pecking and clawing each other, and one of the four generally is on the bottom. In a minute or two the down chicken will lunge upward and, in the ensuing turmoil, another of them will be forced to go under.

The lights are on 18 hours a day to encourage the chickens to lay constantly. And it is a disastrous anomaly for the chickens that under these hellish conditions, egg production rises. Each hen averages an egg every 32 hours for 14 months and then goes to slaughter. And if the cages and the lights and sheer hard *use* of the birds seem like a scene conceived by Dante, well, who really is to say what a chicken wants?

Most people would agree that animals have rights, but there is far less agreement on what those rights are, or how far they extend. Nevertheless, the new animal rights movement is attempting to define those rights, not simply as matters of faith or philosophy, but of science. Michael Fox, who runs the Institute for the Study of Animal Problems in Washington, D.C., points out that rights imply a grasp of the animal's intrinsic nature and its needs. It is inhumane to deprive an animal of its natural needs, he says, just as it is inhumane to inflict unnecessary pain.

Adopting a simple code first proposed in England, Fox suggests that all farm and laboratory animals should be granted five basic rights, or "freedoms": the freedom to be able easily to get up; lie down; turn around; stretch; and groom or preen. Social animals, he points out, should have a right to some kind of social interaction. What rights does a veal calf have? "Veal calves have eyes and legs," Fox says, "therefore they should have light to see by and sufficient freedom to move." This is not determined by scientific research, he adds. "It's obvious."

It is from these new perceptions that the animal rights movement is developing in the United States

On giant Colorado feedlot, cattle spend last 120 days being fattened for market on diet of rich grains and antibiotics (to stimulate growth, prevent disease). Average American eats 126 pounds of beef a year.

and Europe. It arises in direct response to the ever vaster and more impersonal systems provided by technology and mechanization that dominate modern agriculture and have made the old idea of barnyard animals an anachronism. It grows from the humane movement, but has gone far beyond it. Its broad umbrella includes the antivivisectionist groups, but its modern approach and its emphasis on incremental change make it much different from the strident old agitation. It has an intellectual rationale, it is taught in universities, it has adherents that probably number in the millions. And it has Michael Fox.

A graduate of the Royal Veterinary College, doctor of philosophy in medicine and doctor of science in ethology from London University, Fox is an intensely practical man. As an advocate, he brings an immense array of scientific facts to the battle.

Yet the issue of animal rights is so fraught with emotion that this scientist-crusader is written off as a sellout by some radicals in the movement, and regarded as a radical by moderates who fear his activism will destroy everything they have accomplished in the past.

The man who inspires equally choleric views in such opposite quarters (which attests to his centrist position in the movement) lives with his wife, Deborah, a psychiatric social worker, in a Washington town house. In a cage out back, with a mongrel dog for companion, lives the wolf, Tiny, a refugee from the wolf study at Washington University in St. Louis that made Fox's scientific reputation. She is a pleasure and, Fox insists, a teacher—but not a pet. As a professional, Fox warns against the dangers of keeping wild animals as pets and he handles Tiny with great care.

Fox was born in northern England in 1937 and quickly developed a predilection for science. In graduate school he moved through animal neurology to the study of animal behavior and on to animal ethology, the new field generated by Konrad Lorenz, just as serious work was beginning. Animal ethology is the study of animal behavior—the nature of the animal—done in terms of its environment. It is that emphasis on the animal's nature that makes Fox effective today.

Fox came to the United States in 1962 for a research fellowship in Maine. Then he went to a research hospital in Illinois and on to a professorship in psychology at Washington University. His work in canid ethology—specifically, examining the effects of domestication on dogs compared with wolves—led to his second doctorate from London University and a growing reputation. But it also led, in that era of campus protests, to serious self-questioning. He read that wolves were being destroyed in Alaska, and it made him think. His wolf pack, of which Tiny was a member, was giving him everything—knowledge, reputation, academic honors. What was he giving the wolves? Nothing, really.

About this time John Hoyt, president of the Humane Society of the United States, was putting together the Institute for the Study of Animal Problems. The trouble with the old humane approach, Hoyt thought, was its lack of scientific rigor. Humane advocates were often accused of emotionalism or of the anthropomorphic tendency to vest animals with human characteristics and desires. The use of animals in America is rooted largely in science. Laboratory studies aim at scientific analysis or discovery. The livestock industry depends on science—drugs, chemicals, genetics, animal sciences—for ever greater production. What animal rights needed, Hoyt thought, was its own scientist—and Fox proved to be just the man he was seeking. The institute opened in late 1976 with Fox as its director.

Vast numbers of animals are involved in the problem. American laboratories use some 20 million animals a year, of which about 18 million are rats and mice. The livestock industry handles 4 billion creatures a year, of which 3.5 billion are poultry.

Fox's role is a natural for an ethologist because his training is to see the animal as an animal. In our increasingly production-oriented, remote, antiseptic, scientific time, this is not so easily done. People who use animals today are more likely to see them as production units.

In factory farming, all the emphasis is on economies of scale, mechanization that reduces labor costs and maximum production per unit of time. The laying hens in their tiny cages become egg machines—feed them, water them and collect their eggs. The lights are on unnaturally long hours to make them lay more, just as there are experiments to make beef cattle and other animals eat more and thus gain faster. Total confinement pig barns may be the worst abuse of all, for there sows live for years chained alone in cages while they nurture litter after litter of piglets. Like veal calves they never touch each other—and anyone who has ever seen pigs nudging, scratching and licking each other in a pen will understand the deprivation. "All animals engage in social grooming," Fox says. "It is absolutely basic to their lives. It keeps them neat and healthy, but even more important, it is their basic mode of social interaction—which is the trouble with isolating them, you see. When you break those patterns, that's real deprivation, and it makes for much less healthy animals too."

The costs of feeding our 'protein habit'

Taking a broader economic view of factory farming, Fox sees the issue of exploitation as only a facet of an environmental crisis rooted in our diet. On the average, Americans are eating twice as much animal protein as they need, which is not only a luxury but a hazard to their health, increasing the risk of heart disease, colon cancer, stroke and other ailments. In order to maintain this protein habit, most of the modern system of farming is geared not to provide food for people but to provide food for farm animals. More than 80 percent of our corn, barley and oats is fed to livestock, he says. As a result, we are using five to ten calories of fossil fuel to produce one calorie of food, because of the energy (petroleum, fertilizers, etc.) to raise the crops. Fox points out that if the entire world were fed based on our energy-wasteful food system, according to the calculations of Professor David Pimentel of Cornell, the world's known petroleum reserves would be gone in 13 years.

"It is ecological and economic suicide to continue this," Fox says. "If we were to reduce our farm animal production to half the amount, we would be healthier, there would be less soil erosion, less pressure on the land, less pesticides, herbicides and fertilizers, all derived from fossil fuels; and food would be cheaper."

Fox is not preaching vegetarianism (which is one reason some animal rights advocates consider him a sellout). "In a highly technological society," he insists, "it is sound to eat some animal products, because we have a lot of industrial and agricultural byproducts that can be recycled through animals, including carefully refined sewage sludge. Underneath all the human ethics, we must address the ecological underpinnings of it all: we should produce animals and food in order to minimize ecological impact. The main flaw in the animal rights movement so far is that it has not realized this.

"If some animal liberationists had their way," Fox adds, "they would let all farm animals loose, and have them out free ranging. That would mean more destruction of natural habitat, causing greater ecological imbalance than we have already. All animals have a right to humane treatment, but there is only one absolute right, the right of all life to a whole and healthy biosphere, and that implies ecologically sound strategies as well as a humane ethic."

Fox argues with similar moderation for reduced use of animals in scientific research. "The Humane Society is not antivivisectionist," he says, "nor am I. Our policy is that animal suffering is justifiable if it can be demonstrated that it is going to alleviate a greater suffering in other animals or man." The problem is that the same "intensive use" which characterizes factory farming also runs through the lab animal world, as when countless products such as hair rinses, or shampoos, are tested in a rabbit's eye, sometimes causing acute pain and blindness.

"One of my primary roles," Fox says, "is to raise consciousness, to get people to see animals as animals and treat them so. Sometimes so little can make such a difference. The self-mutilating monkey may not want out of its cage as much as it wants companionship. Put mirrors before a monkey's cage and you have improved its life. Give chickens perches. It has been proved that pigs get along best with no more than 29 in a pen. Let confinement pigs get together—that's all they want. Put veal calves four to a pen and let them move around. And, my God, it seems that laying-hen cages could be big enough for all the birds to stand up and even to have a perch, doesn't it?"

Considering the magnitude of the problem, the animal rights movement sometimes seems like a match in a hurricane—but little flames can grow large. One solution is new legislation to protect animals. Encouraging new laws are going on the books in Europe. Veal confinement, for example, was developed in Holland and France; now those countries are outlawing practices which are common in America.

But Fox has more faith in persuasion than in legislation. "In England," he points out, "the Ministry of Agriculture now has a permanent farm animal welfare advisory council which sets up minimal codes of prac-

tice, with government inspectors who have made all farmers aware of these codes. We need this in this country. It does not mean more government regulation but rather it means that the farmer and the company that contracts the farmers can abide by professional standards and have some pride in what they do."

At least 12 universities now offer animal rights courses, and activism on behalf of animals is on the rise. The signs of activism are scattered and small, like early straws in the wind. But ever larger numbers of people are involved. A recent poll indicated that eight million Americans are vegetarians—and, as Fox puts it, "37 million conscientious consumers are really concerned about what and who they eat, for health reasons and for ethical reasons."

Michael Fox knows the facts of life. He is aware of the difficulties of bringing about fundamental change. But he makes change seem the most practical of prospects when, after a discourse on the evils of factory farming, a young woman asks him, "What can I do for animal rights?" Fox unhesitatingly ticks off the opportunities. "Know who you eat," he says. "Find a local producer. Try to find somebody who's producing free-range eggs. Secondly, you might find a local hog farmer who keeps his pigs outdoors much or most of the time; and if you want to eat a pig, when you've met a pig, OK. But cut out veal, because here it's probably been raised under total confinement conditions, and cut back on eating all animal products, for your own health as well as a protest."

DILEMMA 2:
"The Life of 'Chicken Little': An Excursion into Poultry Farming"

"Chicken Little" is typical of broiler chickens today — an estimated 3 billion alone in the U.S. — raised for our consumption. After hatching, he is picked up the next day along with 20,000 other chickens by the broiler producer and taken by truck to the farm. From the truck he is carted into a long windowless shed where he will spend the rest of his days. In the shed are rows of cages stacked one on top of the other. "Chicken Little" is tossed with others into one of these cages.

The surroundings seem pleasant enough now. The shed is brightly lit and there is plenty of food and water in the troughs. But the lights never go off; they burn brightly day and night. The reason is because chickens after hatching have been found to grow faster under bright light, 24 hours a day. After a week, a hand reaches into the cage and pulls "Chicken Little" out. He is placed into a contraption that holds his head firmly. He squirms but his head does not move. Then a blade comes down, and part of his beak is removed. Back he returns to his familiar surroundings, but he has to relearn eating now that he no longer has a pointed beak. Then, after two weeks something changes — the light becomes less bright and goes off for two hours and on again for two hours. "Chicken Little" finds himself sleeping during the dark hours, and as soon as the lights go on he makes his way to the feeding trough and starts eating again. In this routine of light and darkness he grows rapidly. There is less room now, and there is much pushing and shoving in the cage. Fighting and feather picking often breaks out. But no one gets seriously injured because no one has a sharp beak. The light is turned even lower, and this seems to cut down the noise and excitement in the cages.

DILEMMA 2 Continued

The air grows more stale each day because larger birds produce larger droppings. The acrid smell of ammonia never leaves but hangs over like a stifling cloud. It is summer, and the heat is intense. There is no place to cool off. Whenever the keeper opens the door, a whiff of breeze sometimes comes through. This sudden change and noise frightens "Chicken Little's" cage mates, and there is frantic squawking and scrambling. Sometimes he is pushed so hard against the corner by the wall of chickens that he can barely breathe.

"Chicken Little" is eight weeks old now and has grown large and plump — nearly three pounds. Moving around the cage isn't what it used to be. In fact, he has barely enough room to turn.

One day there is suddenly no food. A few hours later, the cage door opens and "Chicken Little," now a full three pounds and perhaps a bit more, is grabbed by the legs and stuffed into a crate with several others. If the cage was crowded, this crate is even worse. As the crate is taken out of the shed, "Chicken Little" sees his first glimpse of sunlight. The crate is bounced onto a truck, and there is a bit of jostling inside.

The ride is several hours, but with the fresh air blowing through, the crowded condition with no food and water seems more bearable. Finally, they reach their destination — the processing plant. The crates are unloaded and stacked and "Chicken Little" and his fellow travelers await their turn to be killed, plucked and dressed. . .

Although chickens are raised to be eaten, should they be raised in these unnatural conditions? Why or why not?

DISCUSSION QUESTIONS

- Do domestic animals, such as chickens, have the right to experience sunlight, normal day and night, and fresh air? Why or why not?
- In a cage, chickens are denied the opportunity to behave like chickens. For example, in a farmyard situation they develop a pecking order where each bird has a known place in the order of the social system. Each bird respects those who rank above itself, yielding to them at the feeding trough or favorite perch. Once an order has been established, fighting is infrequent. Should the development of a social life be important to chickens? Why or why not?
- When people raise animals to satisfy their needs, have they become unnecessarily cruel? Why or why not?
- Since humans depend on animals for food, is it right for them to treat animals however they please? Explain.
- Can the suffering of animals who provide us food be reduced? Give some examples.
- Our current practices of raising food animals is based on the policy of "highest production at the lowest prices." How does this influence one's attitudes towards animals?
- If chickens are raised in a barnyard setting, more land and labor will be required. This would drastically increase the cost of food. How might this affect people who even now can barely afford to buy meat?
- Should people be expected to change their lifestyles or standard of living so that animals can lead a less oppressive life? Why or why not?
- Should the rights of animals ever be considered in our livestock raising practices? Why?
- How might we change the ways in which we deal with food producing animals?
- Find out about methods of raising other animals such as sheep, cattle, and pork. Are there any practices that you think are abusive or unnecessary?

Reading 4

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BURDEN OF THE BEASTS

A new kind of activist presses for alternatives to experiments on animals

by JAMES GORMAN

Some 60 million animals will be killed in the U.S. this year in the course of scientific research. Awesome tolls like this, year after year, have been shrilly denounced by antivivisectionists, whose opposition to virtually all animal research led scientists to look upon them as sentimental eccentrics. Now a more pragmatic group of opponents, the animal welfare movement, is using scientific arguments in a campaign to find responsible alternatives to animal experimentation. In December the new movement won its biggest victory yet. Revlon, which has been criticized for its animal research, announced that it was giving more than $750,000 over three years to the Rockefeller University in New York City to finance a scientific search for an eye-irritancy test (for cosmetics and other products) that does not use animals.

Animals are used in about 60 per cent of all biomedical research in the United States. In the past year, for example, scientific history was made when new genes were added to mouse embryos to produce a genetically altered mouse. A 1980 Nobel laureate in medicine won his prize for using skin grafts and tumor transplants in mice to advance knowledge of the human immune system. Monkeys and apes are used to study diseases like dysentery, pneumonia, malaria, and hepatitis. Animal research includes teaching sign language to chimpanzees, depriving baby monkeys of their mothers, cutting open dogs to develop lifesaving operations like open-heart surgery, and feeding millions of mice high doses of chemicals that may cause cancer.

The new opponents of animal research recognize the value of many experiments and do not want to bring science to a halt. But they contend that scientists can often get the same results with some remarkable new research techniques. Examples: testing chemicals and bacteria on bits of living tissue grown in the laboratory, creating computer models of living systems, and developing ever more sophisticated instruments to analyze chemicals. When people in the animal welfare movement join the fray with scientists, they come equipped with experts and argue science—Is this experiment valid? Is that research poorly designed?—as much as morality.

They have also acquired political savvy. Evidence of their impact is a bill recently introduced in Congress by Representative Frederick Richmond of New York, and likely to be reintroduced in 1981. The measure, one of several concerning

animal experimentation that Congress is considering, has more than 50 cosponsors. It calls for diverting 30 per cent to 50 per cent of the federal money allotted for animal research into developing alternative experiments. Concerned about the bill, the National Institutes of Health is sponsoring a February conference in Washington to discuss animal and non-animal techniques in research. A number of animal welfare supporters plan to show up.

The movement for animal welfare has been active since the 19th century, when organizations for the prevention of cruelty to animals were formed in England and the United States. Its new approach was perhaps best set forth in the 1975 book *Animal Liberation*, by an Australian philosopher named Peter Singer. He argues that the natural successor to the human rights movement is an animal rights movement. He is not asking for one puppy, one vote, he is concerned primarily with pain.

Singer thinks that causing pain is wrong, and that the gulf of intelligence that separates men from beasts does not lessen the wrong. Inability to do calculus does not make an electric shock hurt less, or a tiny cage seem more spacious. Singer finds his roots in the British utilitarian philosopher Jeremy Bentham (1748-1832), who wrote of animals: "The question is not, Can they *reason*? nor, Can they *talk*? but, Can they *suffer*?" If society agrees that a brain-damaged infant who can never learn to talk or a person in an irreversible coma should not be the subject of painful experiments, why deny the same compassion to a dog or a monkey? Animals have needs, desires, and lives of their own, apart from their usefulness to human beings.

Discussing the ethics of eating animals or experimenting on them, Singer says that in the Judaic and Christian traditions, man is given dominion over animals. He quotes Thomas Aquinas: "It matters not how man behaves to animals, because God has subjected all things to man's power." The tradition of Hinduism, says Singer, shows more respect for nonhuman animals, and strict Hindus have been vegetarians for 2,000 years.

Singer argues the obvious, that physical pain hurts all mammals, and the less obvious, that emotional pain hurts too. He writes of dogs and rabbits killed by being subjected to heat from microwaves. He cites infant monkeys deprived of their mothers and given mechanical mothers covered with cloth. To see how strong a baby's need to cling to its mother was, the experimenters created a variety of monster surrogate mothers, one of which could shoot out sharp brass spikes that jabbed the baby. Yet the babies, alone in a cage with this mechanism, would return to cling to it, again and again.

Singer's philosophy underlies the animal welfare movement, but in practice perhaps nothing sums up its nature as well as its battle against Revlon. The company uses a test, named for pharmacologist John Draize, to determine whether a chemical is likely to irritate human eyes. A substance is put into the eyes of rabbits; their heads briefly held in stocks to restrict movement. The effects, which are given numerical scores, range from mild reddening to ulceration and blinding. Revlon and other cosmetics companies use the test to measure the safety of their products for human beings, as required by federal regulations.

Last spring a New York City high school teacher named Henry Spira began a campaign against Revlon. A former merchant seaman and labor organizer who several years ago led demonstrations against experiments on cats at the American Museum of Natural History, Spira brought together more than 400 animal welfare groups to lobby, advertise, write letters, and stage demonstrations. With political pragmatism, he chose Revlon because it is big and vulnerable. It must protect its image; fashion-model glamour fits poorly with the notion of tortured rabbits. Yet it cannot claim that eyeliners are scientifically important. Spira craftily demanded not that Revlon stop making new cosmetics, but that it pay for a program to develop an alternative testing method.

While Spira handles the rough stuff (one of his favorite phrases is "The meek don't make it"), the campaign has marshaled scientific arguments about the defects of the Draize test. In a book written for the Research Defence Society in England, animal researcher D.H. Smyth suggested that the Draize test could and should be replaced. Biochemist Andrew Rowan, of the U.S. Humane Society, one of the organizations in Spira's coalition, has written a detailed critique of the test, arguing that it is outdated and imprecise. He says that the test has been used for chemicals already known to be irritants, and proposes that tissue cultures be developed to provide the needed information.

Revlon responds that in its laboratories no rabbits are blinded, killed, abused, or even misused. "Rarely do we ever test a substance that is more than mildly and temporarily irritating, and *never* knowingly," writes Roger Shelley, the company's vice president for corporate affairs.

The federal government has also felt the impact of the animal welfare movement. The Interagency Regulatory Liaison Group of government agencies involved in safety testing issued new guidelines at the end of last year. One states that acids and bases and other known irritants should not be tested in eyes; substances as corrosive as oven cleaners have been dropped into rabbits' eyes.

The battle against the Draize test and Revlon seems to be just the beginning. Rowan believes that many kinds of animal research can be done by other methods. "If the research is worth doing, the Humane Society does not come out against it," he says. "We agree that legitimate research should be permitted to continue. The argument is about what really constitutes legitimate."

On his scale of legitimacy, basic research ranks a good deal higher than the maw of safety testing that devours mice and rats by the truckload. He objects in particular to a test called the LD-50. The name refers to the dose that is high enough to be lethal for 50 per cent of the animals tested—a way of finding out how poisonous a substance is. "Extrapolating from mouse to human in this case is fraught with so many problems," says Rowan, "that using the LD-50 as a precise measurement for human beings is utter nonsense."

Like other animal welfare activists, Rowan hopes that some day no animals used in research will be hurt. But even in the short term the animal movement is asking for a basic change. Whereas the government requires good care for experimental animals, it does not regulate experiments. As Rowan puts it, researchers "can do what they damn well please." He sides with Bernard Rollin, a professor of philosophy, physiology, and biophysics at Colorado State University, who writes: "We ought to legitimately demand of all uses of animals in research that the benefits (or likely benefits) to humans (or to humans and animals) clearly outweigh the pain and suffering experienced by the experimental animals."

To many scientists, that is a restriction on freedom of inquiry, comparable to restrictions on human research, and they react to it as if someone were trespassing in their laboratories.

Joe Held, a veterinarian who is the NIH's director of research services (one function: breeding lab animals), states the basic biomedical defense of research with animals by contending that human welfare requires it. He terms the notion that all or most experimental animals suffer terribly a "gross misconception."

In most research, he says, animals are well treated and the experiments are not painful. "I feel we ought to be using more animals in research," he says. "At this time, it gives a false impression to the public to say that we can reduce research and continue to improve he'th." The alternatives that animal activists tout, says Held, are not fully developed and in many cases are unsatisfactory because the success of an experiment depends on the complexity of a living animal.

Held recently opened a lecture with a slide showing a deformed child whose mother had been given thalidomide during the first trimester of her pregnancy. He followed that with a slide of a baby rhesus monkey similarly deformed by thalidomide. If the monkey test had been done first, Held said, the deformities in human babies might have been avoided. Other examples (among many) of the benefits to human beings of animal research: pacemakers, tetanus antitoxin, and polio vaccine.

Clarence Dennis, past president and current secretary-treasurer of the National Society for Medical Research, points out that scientists often do not know where research will lead. Dennis himself studied absorption in the intestine by operating on dogs. His work led to a new way of sewing intestines back together that has saved the lives of children who develop intestinal problems in the first two years of life.

Nevertheless, the pragmatic tactics of the animal welfare movement seem to have mollified some scientists and converted others. Dennis says he has objections to the Draize test. Many scientists are willing to credit the animal welfare movement with sensitizing researchers to what animals feel. According to Susan Fowler, editor of a magazine called *Lab Animal*, "Scientists are getting a little less nervous; both sides are willing to compromise."

As evidence of the rapprochement between science and animal welfare, several scientists helped found the Scientists' Center for Animal Welfare. The Humane Society has set up an Institute for the Study of Animal Problems. Its associate director is biochemist Rowan, who acknowledges that he killed laboratory mice in the course of his education. The institute publishes a journal in which veterinarians, behavioral scientists, biomedical researchers, and animal welfare activists discuss the shortcomings of experimentation on animals.

Gordon Burghardt, a professor of psychology and ecology at the University of Tennessee at Knoxville who sympathizes with the basic principle of animal welfare, says ethologists and others who study animals in their natural environments are far more likely than laboratory researchers to support restrictions on animal use. As an example, he points to Jane Goodall, who wrote about her experiences watching chimpanzees in a book titled *In the Shadow of Man*. She and others give scientific support to a view of animals as complex creatures that deserve respect. Ecological research, a mainstay of the environmental movement, is often cited to show that human beings belong inside rather than outside natural systems. Says Burghardt, "It's the difference between 'The world is created for man's use' and 'We're all in this together.'" While disagreeing with the "abolitionists" who want to stop all animal research, Burghardt believes that the scientists who want no restrictions are just as extreme.

If Burghardt meets the animal activists halfway, Ardith Eudey goes the full distance. A primatologist at the University of Nevada at Reno who studies macaques in Thailand, she is an animal activist and co-chairman of the International Primate Protection League (IPPL). Says Eudey, "We champion the rights of primates wherever we feel there is a potential for abuse."

Eudey says that even well established uses of monkeys could be changed. The Sabin polio vaccine is grown in the kidney cells of African green monkeys (and tested in Rhesus monkeys). The fragile greens often die on the way from Africa, where they are captured wild. If medicine were to switch back to the Salk method, the vaccine could be grown and tested in human cells cultured in the laboratory.

The IPPL's push to reduce use of primates is concerned not only with the individual animal. Eudey points out that "primates throughout the world are threatened with extinction." Until recently, most primates used in research in the U.S. were caught wild, and Eudey says that sometimes they were used simply because they were animals of great scientific prestige.

Eudey's organization, less than ten years old, has about a thousand members, many of them primatologists. "We don't assume an antivivisectionist position as such," says Eudey; but, like Rowan, she would welcome the day when painful animal experiments ended for good.

There is little chance of animals disappearing from research labs any time soon. As the animal welfare movement well knows, if experimentation is reduced, it will not be done by holding back scientific progress. It will be done by scientists themselves finding new ways to get the answers they seek. ▣

DILEMMA 3:
"Beauty on the Surface'

Lewis Ames, married with three children, has been superintendent of the animal quarters at the Beves Cosmetic Company for the past three years. He is in charge of caring and feeding of the animals used in the safety testing of the cosmetics manufactured by the company. Under his care are several thousand rabbits, hamsters and dogs.

In the past, the company simply tests the safety of the cosmetic by applying the product — face cream, powder, lipstick or hair coloring — on the shaved skin of the animals and observes whether the product produces skin irritations. But a number of law suits brought against other cosmetic companies, by parents of children who accidentally swallow or eat the products and fall ill, have alarmed Beves company officials. The company now believes that it needs a more thorough testing program and have added new tests.

Among one of these new tests used at the lab is the acute toxicity test or LD/50 test. In this test, experimenters feed large amounts of the product to the animals to determine the amount needed to kill half the animals. In some cases, the amounts the animals must ingest are too large to be simply mixed into their food and thus the product tested, such as face powder, is pumped directly into the stomach of the animals. Ames observes that this force feeding bloats the animal's stomach, causing severe discomfort and often ruptures the organ. In addition, he has watched them suffer great distress, dying a slow death, a week or two later.

Ames feels that the animals are needlessly tortured and tries to convince the scientists to discontinue that type of testing program. He has written government officials, but they inform him that there is nothing they can do. Since no one in the company or government seems to be interested in how lab animals are treated, Ames decides that the problem must be brought before the public. His plan is designed to attract so much attention and public outrage that the company will be forced to change its method of testing. Tonight he will take the caged test animals from the lab and place the cages in different locations all over town. When the news reporters begin to question the sudden appearance of sick and dying caged animals all over town, Ames will then step forward and tell his story.

By taking such an action, Ames could immediately be fired. Should Ames carry out his plan? Why or why not?

DISCUSSION QUESTIONS

- What right has Ames to take property from the company?
- When Ames accepted his job, does that mean that he is obliged to accept the activities the company engages in? Why or why not?
- Since Ames needs his job to support his wife and children, shouldn't he consider how losing his job might affect his family? Is this an important consideration? Why or why not?
- Should Ames be punished if he takes this action? Why or why not?
- Why might it be important to test the safety of a product before it is sold for human use?
- Since animals can't speak for themselves, should it be important for Ames to inform the public?
- Should people who use the products that have been tested on animals have any responsibility towards these animals? Why or why not?
- Should safety of a product to humans be the most important consideration for using animals to try out the product first?
- Often it is possible to test products without using animals, but this can greatly increase the cost. Should people be required to pay more for a product? Why or why not?
- Are cosmetics such as shaving lotions, shampoos, lipsticks, mascara, suntan creams necessary when one considers the suffering animal's experience? Would it be difficult for people to give these up?
- What rights should be entitled to laboratory test animals? How might such rights be protected?
- If products are not adequately tested, we would never know whether they can cause dangerous illnesses. Is that reason enough to use animals in testing?
- What do you consider to be acceptable ways to use animals in laboratories? Unacceptable?

Debating Procedure

The following dilemma(s) may be conducted as an informal class discussion or as a debate. If the debate format is the choice, the guidelines offered below should be helpful.

Overview

Debate is a process for resolving controversy. It is perhaps one of the most common methods used by our lawmakers and government officials in decision making and enacting laws and regulations. The basic idea is that by using a series of logical arguments one can persuade another to agree to a given point of view. This process exposes issues to logical and critical analysis and can result in more reasonable decisions because a range of arguments have been examined. A debater tries to win the audience over to his or her side and therefore, must develop convincing arguments to support his/her viewpoint.

Procedure

1. The class should first establish the rules for the debate and agree upon
   a. The number of speakers for each team;
   b. Time allotted for each speaker's presentation and rebuttal;
   c. Whether questions from the opposing team or audience will be permitted;
   d. The criteria and procedure for selecting the winning team.
2. The teams should first meet together to identify the main issues of the question. That is, what are the major points of the disagreement?
   a. Select the issues that the two teams will address:
   b. For each issue a team member on each side will develop the arguments in support or in opposition to the issue. (See example of Debater's Worksheet)
3. In developing the arguments team members should
   a. Identify the evidence that support one's position. Decide whether or not the evidence will help prove the point. How strong is the evidence? Is it reasonable? Does it follow logically?
   b. Place the arguments in the order of most important to least important. For each argument, write a short statement that clearly states the arguments, present the evidence that supports the argument and explain its importance (i.e., what are the benefits or disadvantages?). Remember that the debator will be judged on how well the arguments have been thought out and presented.
   c. Each debater should try to imagine the arguments that the other side will present. In this way one can determine whether one has covered all the points and can counter the opposing argument with one's own arguments.
4. Members of the audience should set up an evaluation sheet (use the example given on page 27) to judge each debater.
   a. For each issue, try to identify the major arguments presented by each side. Jot down the argument in a short outline form in the appropriate column.. Next to each argument on the rating column, give a grade for that argument. (Use letters, numbers, stars or whatever is convenient, but be consistent.)
   b. In rating/evaluating the arguments, ask the questions:
      - Is the argument well presented?
      - Is the argument well supported by the evidence?
      - Does the argument follow logically?
      - Is the argument based on emotion or facts?
      - Have the facts been used effectively?
5. The questions at the end of the dilemma situation should be useful in identifying the *points* or *issues* to debate the topic (e.g., *An Inventor May Obtain Patents on New Strains of Bacteria).* Issues to be considered in the debate might include some of the following points:
   a. Inventors have a right to their inventions:
   b. Bacteria are very low forms of life and need not be treated in the same way as other animals.

Issue _____ **DEBATER'S WORKSHEET*** Pro___ Con___

Argument	Evidence or Facts	Further explanation (what does the argument mean in terms of benefits or effects?)
1		
2		
3		
4		
5		

*Each debater should make a worksheet similar to this example.

DEBATE EVALUATION SHEET

Debate Question: _____

	For		Against	
	Arguments	Rating	Arguments	Rating
Issue 1: _____	1. 2. 3. 4. 5.		1. 2. 3. 4. 5.	
Issue 2: _____	1. 2. 3. 4. 5.		1. 2. 3. 4. 5.	
Issue 3: _____	1. 2. 3. 4. 5.		1. 2. 3. 4. 5.	
Issue 4: _____	1. 2. 3. 4. 5.		1. 2. 3. 4. 5.	
Issue 5: _____	1. 2. 3. 4. 5.		1. 2. 3. 4. 5.	

Judges should make an evaluation sheet similar to this example.

Reading 5

High Court Will Decide Whether Patents Should Be Granted on Living Organisms

By Stephen Wermiel
Staff Reporter of The Wall Street Journal.

WASHINGTON — The Supreme Court agreed to decide whether forms of life may be patented.

The case could have broad ramifications for the scientific community, opening the field of genetic engineering and research to the question of whether patents should be granted on discoveries.

The Justices said they will review a decision by the U.S. Court of Customs and Patent Appeals that living organisms may be patented. The government sought Supreme Court review, disagreeing with the patent-court ruling covering two cases.

In one case, the patent court ruled that a patent should have been granted to Upjohn Co. for a microorganism isolated in a soil sample and used to make the antibiotic lincomycin.

In the other case, the patent court favored granting a patent license to General Electric Co. for a new strain of bacteria, created through genetic engineering, capable of breaking up such complex substances as crude oil. The bacteria can be used to disperse oil spills.

Federal officials argue that Congress never intended the patent law to cover living things. The living materials Congress wanted covered, federal officials argue, were described in 1930 by the Plant Patent Act, which covers certain types of plants developed by breeders.

Earlier Court Consideration

The patent court said there isn't any basis to distinguish between living and nonliving matter. It also found it "illogical" to grant patents to processes that use living organisms while withholding them for the organisms themselves. For example, in the Upjohn case, the Government Patent Office patented the process of making the antibiotic but refused to patent the microorganism used in the process.

The Upjohn and GE cases have been to the high court before, but there wasn't any final decision. In June 1978 the Justices ruled that a computer program couldn't be patented because it was based on a mathematical formula that is a principle or law of nature that isn't patentable. When a 1977 patent court decision awarding a patent to Upjohn for the microorganism reached the Supreme Court on government appeal, the Justices sent the case back to the patent court with instructions to apply the June 1978 computer-program decision.

A short time later the GE case reached the Supreme Court, but the appeal was withdrawn and the case taken back to the patent court to be reargued with the Upjohn case.

The patent court, however, decided in March that the Supreme Court's computer-program decision didn't change the outcome of the case. The patent court said both the microorganism and the strain of bacteria should receive patents.

Reading 6

SHOULD SCIENTISTS 'PLAY GOD'?

The business of gene splicing

Courtesy Memorial Sloan-Kettering

A single lymphocyte—A human blood cell from which interferon is now obtained. Work has been going on to produce interferon by gene splicing. Will it prove to be effective against cancer?

by Lee Edson

As many of us know by now, molecular biology—long an abstruse academic discipline—has become the latest big-business craze and the darling of Wall Street pundits. Millions of dollars are being poured into the field by such hardheaded *Fortune* 500 corporations as Exxon, Revlon, Dupont, Inco and Shell Oil Company, as well as by major pharmaceutical companies. Why? The lure is gene splicing, or the use of recombinant DNA—a recently developed cloning technique that enables scientists to take DNA from one organism and stitch it into the DNA of another to create new life forms. The "recombined DNA" is then allowed to infect bacteria, which duplicate the new life forms by the bushel as the microorganism reproduces. These new life forms are then harnessed to turn out biological and chemical products useful to humankind.

Case One: In South San Francisco a firm called Genentech (standing for Genetic Engineering Technology) has come up with a bug-breeding operation that, it is said, can create human insulin more easily and cheaply than the conventional method of extracting insulin from the pancreas of cattle and hogs. The firm, which started with $1,000 in seed money in 1976, now has an asset value of $11 million. Recently Genentech announced it had decided to go public at a much higher valuation.

Case Two: In Berkeley a hush-hush project is going on at a company called Cetus, aimed at producing alcohol and other industrial chemicals by a breed of bacterial clones created by gene splicing. This work has brought in backing from a number of corporate sponsors, including Dow Chemical Company and Standard Oil of Indiana.

Lee Edson is the author of five books and numerous articles on science and medicine.

Case Three: In Switzerland a firm called Biogen S.A. has created the ultimate gene-splicing product—a copy of a natural body substance that might combat two of our most recalcitrant ailments, cancer and the common cold. Financing consists of a healthy contribution by International Nickel, whose usual interest lies in batteries and metals.

These examples of corporate backing for work that has barely come out of the test tube are only hints of what some enthusiasts are beginning to call the new big biobusiness of the Eighties, and the clone industry of the 21st century. As *The Economist* put it recently: "Within the next human generation, genes could become one of man's most powerful tools helping to revolutionize the treatment of disease, the feeding of the hungry, the manufacture of chemicals, the conservation of resources, the control of pollution, and no one yet knows what else." What's even more dramatic is that the gene-splicing technique may not remain on the bacterial level but may eventually introduce novel and useful characteristics into higher plants and animals. An obvious place to begin is nitrogen "fixing" in plants, that is, using genetic engineering to allow the plants that now require fertilizer to take nitrogen directly from the air. This idea contains no less than the total revolutionizing of world agriculture.

What is there about the emergence of genetic engineering that has caused this unusual exuberance and, if I may say so, hype? Let us start with the cell, the unit of life. At its heart is the nucleus, which directs most of the details of cellular maintenance and reproduction. The CEO of the cell is the chromosome; there are 23 pairs of them in the human cell, each pair consisting of one chromosome from each parent. (Other species have different numbers of chromosomes. A pea plant has 14; a rhizopod 1,500.)

In the early 19th century it was found that the chromosome—like the nucleus of the atom—could be further divided into units of heredity called genes (from genos, the Greek word for breed). Although nobody has ever seen a gene, scientists believe that all our traits, perhaps 50,000 of them, ranging from eye color to body build, are controlled by these genes, or by pairs of genes called alleles. According to this theory, there are at least 100,000 genes, more than 2,000 per chromosome, in every one of the 10 trillion cells in our body. Eighty percent of these genes are supposed to control the common characteristics of the species; the balance carry details of our families. These genes carry the information that makes us simultaneously alike and unlike one another.

Science, incidentally, is currently learning where the different genes are located in the chromosomes. In time it is expected that we will be able to map in detail the magnificent genetic network that can convert a single fertilized cell into an infinitely complex human being. Recently, immunologists found the location of the genes that "code" for susceptibility to disease and are thinking of ways to utilize this knowledge to help individuals to ward off the onset of certain illnesses.

Over the years, our understanding of genetics has been a bit like knowing God through His works. Most of our knowledge of human genetics comes from accidents of nature. We learn *indirectly* about genes through the absence of a genetic component—or defects in structure or function that may show up as birth defects, spontaneous abortion, and certain diseases. A lot of this knowledge is backed up by experiments that started with hybrid pea plants in the days of Mendel, going on to fruit flies with Morgan of Columbia, and finally ending up with inbred strains of mice—strains so sophisticated and exquisitely fashioned that an entire colony can be developed differing from other colonies in the location of a single gene, which shows up, say, as a tiny change in the iris of the eye or an inability to smell.

The complexity of the human genetic makeup, or genome—and indeed the makeup of other higher life forms—led biologists to turn their attention to one of nature's simplest, though not lowliest living things, the bacterium. If life is unified, as biologists believe, and the behavior of fruit flies and pea plants can shed light on the genetics of people, why wouldn't one-celled bacteria be equally useful? Enter E. coli, the key figure in modern molecular genetics and perhaps the most intensely studied organism outside of man. Since its discovery, back in 1885, in human feces, the rod-like E. (for Escherichia) coli has been measured, magnified, scrutinized under the microscope, ripped apart and reconstructed, and utilized for all kinds of mutations. E. coli, living contentedly in the human gut, is useful to scientists because it is usually nonpathogenic to any organism, grows easily, and its genetic makeup, unlike that of multicelled creatures, is such that its genes are free-floating in the cytoplasm and easy to examine. Today, E. coli is particularly important because it is a leading performer in the gene-splicing activities opening molecular biology to big business.

E. coli and other bacteria have been heroes in the evaluation of the chemical makeup of the gene. Back in the '40s Oswald Avery of Rockefeller University, through work with bacteria, found that genes are made of chemicals called nucleic acids. Moreover, these nucleic acids—DNA and RNA—contain all the coded information that is passed on from generation to generation to make each living thing what it is. This coding is so versatile that the number of genetic messages transmitted in the process of creating progeny is virtually infinite—so life is not only unified but also incredibly diverse, capable of producing a pygmy shrew, the smallest mammal, and the whale, the largest.

In 1953 James Watson and Francis Crick came up with the chemical structure of the DNA molecule and opened a new era in understanding the physical basis of heredity. The structure is, of course, the famous long double-helix, or twisted ladder molecule in which the rungs and sides are the nucleotides. These nucleotides come in four varieties—or bases, as the chemists say—which are arranged in certain sequences to produce an amazingly informative genetic message. This language of heredity, written with its alphabet of four letters, results in life as relatively simple as a virus, whose printout might fit this page, or as complex as a human being, whose printout would take up all the pages of a library of Britannicas. All creatures talk the same genetic language, demonstrating once again the common origins of life.

In the short period that followed the elucidation of the structure of the DNA molecule and the cracking of the genetic code, the "greatest success story in the history of biology," as geneticist Theodosius Dobzhansky put it, was launched. Not only was the double-helix model devised by Watson and Crick shown to correspond to reality but it led to insights into gene replication, mutation, and the production of proteins, the basic product of the genetic works and the building block of all life.

This model made it possible to envisage in detail how genes direct their own replication and how the mutations occur that lead to different individuals and species. For instance, just prior to reproduction the threads of the genetic material unravel and separate. This leaves the surface of the nucleotides on each thread exposed. Since, like all molecules, they have a specific shape or configuration, the exposed surface becomes a pattern, or template. Nucleotides freely floating in the surrounding medium are attracted and are duplicately arranged as a new thread. The duplicates then separate, creating two threads in the place of one.

Occasionally certain conditions in the environment cause changes in the structure of the nucleotides. If that change doesn't immediately destroy the organism, the modified template will reproduce the modification, and a mutation results. If the difference is big enough, a whole new species will emerge. This is the basis of the current concept of evolution. Mutations can occur randomly, or can be caused by cosmic rays or radioactivity in the atmosphere. The mutation that produces an improved species—that is, one with an advantage in coping with the environment—will survive while the less-endowed species will die out.

The uncovering of the molecular mechanics of life opened up some tantalizing questions for the scientists. Could they create their own mutants, building hybrid organisms and thus creating in the laboratory in days what evolution had taken millions of years to do? The answer proved to be yes. By the late 1960s, Prof. Paul Berg of Stanford had devised a method of hybridizing a strain of virus into the DNA of the E. coli organism. Nevertheless, Berg did not put it into effect because of his concern that such an experiment might prove to be hazardous in the event that the new strain escaped, entered the human gut, and proved to be lethal. Subsequently, a number of concerned (some say overly concerned) scientists, including Berg himself, called for a moratorium on this work. The Mayor of Cambridge urged the City Council to bar Harvard and M.I.T. from doing this kind of research, and after considerable argument and agitation, the National Institutes of Health came out with safety guidelines for any laboratory engaging in recombinant DNA research under Federal grants. Other laboratories have voluntarily agreed to follow the guidelines. (See box on the following page.)

Nonetheless, even while questions were being raised, theoretical and experimental work in the field had continued, and in 1973 two California scientists came together in what has since been heralded as the most fateful technological marriage of our time. It happened in, of all places, a Jewish delicatessen in Waikiki Beach, Honolulu. Stanley Cohen of Stanford, a clinical pharmacologist turned molecular biologist, was having a sandwich with Herbert Boyer of the University of California at San Francisco, following a heady session of an American-Japanese conference on molecular biology. In between bites of a tongue and salami sandwich, Cohen made a suggestion to Boyer. Would he join an experiment that might open a new way to create hybrids of DNA molecules?

The idea Cohen proposed was a simple one, based on the new developments in recombinant DNA. Boyer, an expert in enzymes, had isolated a so-called restriction enzyme from bacteria. This enzyme acts as a chemical scissors; *it can cut the chain of nucleotides that make up the strand of DNA*. Interestingly, the cut is not random but is made only at selected places within the sequence of nucleotides. "Restriction enzymes" up to this time were regarded as merely an interesting finding of molecular biological research.

Cohen was working with the technology of bacterial plasmids—circular fragments of free-floating DNA that are found in the cytoplasm of E. coli. Cohen had found a way to remove the plasmids by grinding up bacteria, centrifuging them, and then isolating the DNA by special chemical means. These plasmids are like ticker tape face-to-face, and like ticker tape they contain information—in this case about the kind of organism that will emerge when the plasmid reproduces.

The agreement between the two scientists amounted to this: Boyer's enzyme would be used to cut Cohen's plasmids at certain points. Then a strip of information from another type of cell would be inserted into the gaps. (The ends are "sticky," so the new strip adheres without trouble.) The DNA patchwork would be returned to Cohen who would put it into E. coli. When the bacterium replicates, its progeny contains new information from another species. Presto—new life forms are created. The snip-and-fit process has been described as comparable to a

Careful, careful

At Fort Detrick, Maryland, one-time center of the U.S. Army's chemical and biological warfare research, there is a laboratory unlike any other. It is a converted barrack-like building so completely contained that a single virus would find it hard to get in or out. To enter the heart of this laboratory one has to wear special protective clothing and go through an airlock, to leave the laboratory at any time one has to strip off this clothing and take a shower. Even then, there is no contact between scientist and material. All material and tools like test tubes and microscopes are manipulated through "glove" boxes, glass-fronted steel cabinets, fitted with shoulder-length gloves. As if that were not enough to ensure against hazard, the air pressure inside these cabinets is lower than the outside pressure.

This extraordinary, leak-proof laboratory is the maximum-security facility of the National Institutes of Health for recombinant DNA experiments. Known as "P-4," it is certified as the place where the riskiest research projects permitted by the NIH can be performed. Only one other laboratory—the Department of Agriculture's facility at Plum Island, New York, where dangerous animal diseases are studied—holds an active "P-4" license.

The NIH guidelines, hammered out by the scientific community, embrace four levels of physical containment, based on risk. Most major universities are equipped to do "P-3" work, the level of hazard just below that of Fort Detrick. "P-3" does not require the elaborate and expensive trappings at the Fort (it cost the Government $250,000 to convert the two-story structure into the nation's first "P-4" laboratory) but it does require such things as the maintenance of negative air pressure and allows moderately hazardous experiments with the genes of mammals other than man. As to the other two containment levels, "P-1" involves only standard laboratory care, while "P-2" takes on a few extra precautions, especially in the control of aerosols.

The physical containment levels of the NIH guidelines are designed to work in conjunction with three biological containment levels known as EK-1, EK-2 and EK-3. EK stands for E. coli K-12, the strain that is intentionally weakened for use in recombinant DNA experimentation. The numbers, one, two and three specify the level of genetic modification required of the host strain to ensure that it will perish outside the laboratory. The higher the number, the weaker the strain and the less likely to survive if it escapes.

A preliminary set of guidelines was born in late 1975 following a stormy conference of scientists at Asilomar, California, at which the scientists themselves called for a moratorium on recombinant DNA research. In 1977 the National Academy of Sciences got into the act. Out of the head-busting came revised guidelines and a committee to monitor them—actions that were not accepted with equanimity by all of the scientists engaged in this type of work. For instance, an attempt to set up a "P-3" facility at Harvard's aging biological laboratory building resulted in one of the more acrimonious confrontations of the period. Elsewhere, some leading scientists were accused of violations of the guidelines to obtain advantage over competitors. In 1978, owing to continuing pressure from most of the scientific community, the guidelines were somewhat relaxed, which provoked outcries from hardheaded and vocal critics who believe there is no way to prevent human error, especially as the work is speeded up.

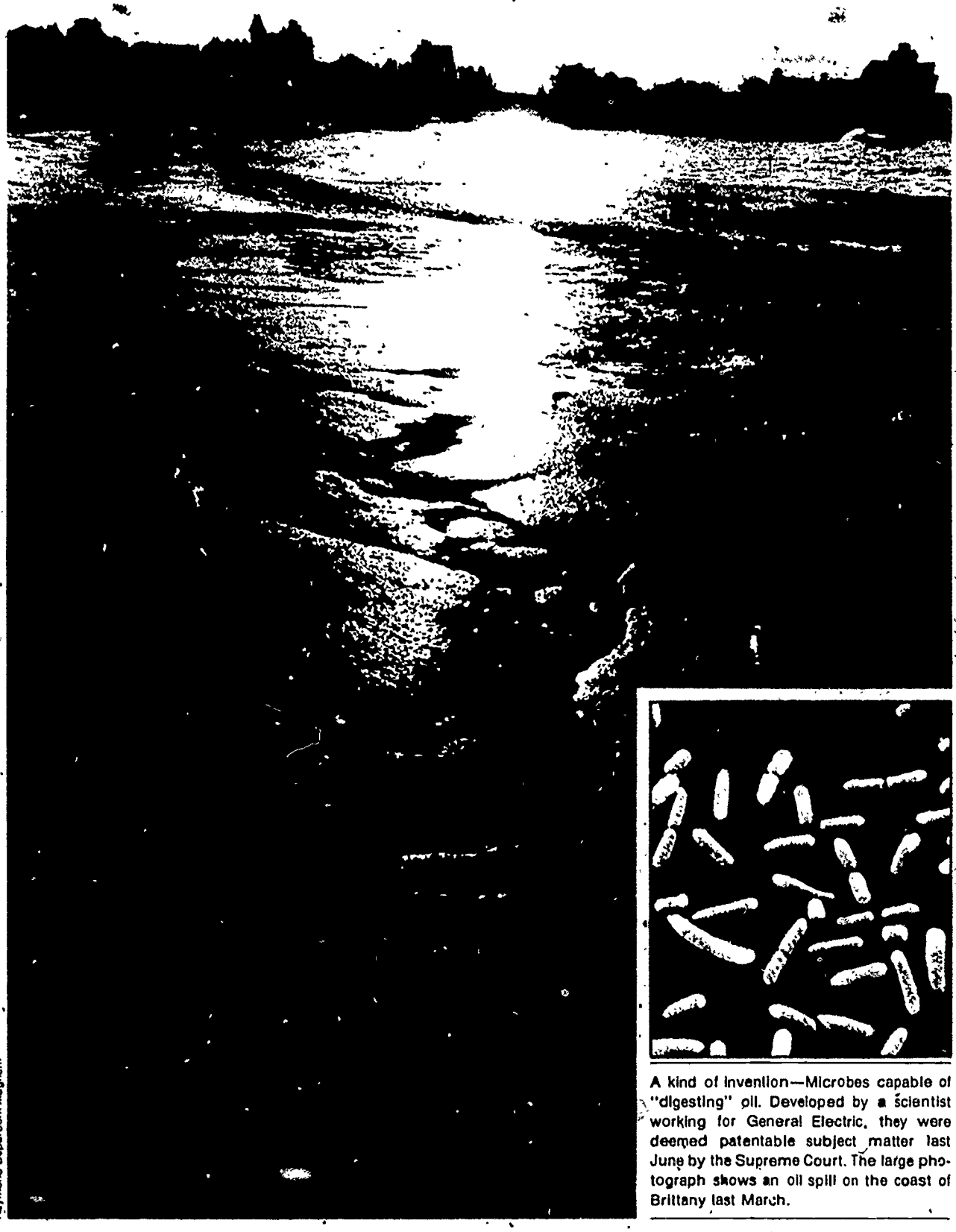
This summer, the press broke a story about a cloning error at the University of California in San Diego—an error that created a virus prohibited by the guidelines because it may be capable of causing serious disease. Although the university claims that the public and the laboratory personnel were never in danger, the event is being investigated by the NIH. No one knows as yet what the consequences of this investigation will be, but already some critics are girding for a new battle, while defenders, it is said, are trying to minimize the impact of the incident.

—L.E.

jeweler's expanding a ring by adding tiny pieces of material obtained from another ring and cementing the ends. DNA from toads and from fruit flies have been stitched in this way into bacterial plasmids.

The two scientists could hardly wait to get back to their laboratories and perform the experiment. By late 1973, they knew that the idea developed over delicatessen sandwiches in Honolulu worked—they had made three splicings. The resultant hybrids carried the qualities of the genetic insert and could produce what the insert was coded for. In short, they had made new life forms and could clone them on demand. And what is more, unlike the earlier work in recombinant DNA, they had made them by a method that, it is said, could be worked out by a high school student, that is, one with a scientific bent.

Such was the beginning of practical genetic engineering. The two men quietly wrote a scientific paper on their work for the National Academy of Sciences, and it was picked up by the press. A reporter for *The New York Times* phoned Boyer to ask what it all meant. Boyer



Raymond Depardon/Magnum

Courtesy General Electric Company

A kind of invention—Microbes capable of "digesting" oil. Developed by a scientist working for General Electric, they were deemed patentable subject matter last June by the Supreme Court. The large photograph shows an oil spill on the coast of Brittany last March.

suggested, off the cuff, that with the appropriately cloned bugs one could produce hormones such as insulin as well as chemicals used in fertilizer. The page one story broke on May 20, 1974.

One of those who read *The Times* report was Niels Reimers of Stanford, a watchdog of professorial invention. Reimers, sensing something important, encouraged Cohen and Boyer to file an application for a patent, not, as he put it, to use its protection to kill innovation, but to encourage investment in recombinant DNA. "Fleming never filed a patent for penicillin," Reimers argued, and "as a result drug companies were afraid to make it and the public was denied this important product for 11 years after its discovery."

As things turned out, the two scientists did apply for a patent just a week before the expiration date for filing. Stanford and the University of California agreed to share royalties, if any, and both scientists signed over their share to the universities. Just in time, too. Patent applications from many scientists working on gene splicing began to stack up in the U.S. Patent Office. Then, last June, the Supreme Court ruled that a live, human-made microorganism is patentable subject matter. The ruling concerned bacteria, developed by a scientist working for General Electric, that can "digest" oil slicks. The way seemed open for the Patent Office to rule on the many applications for organisms, products and processes developed by recombinant DNA techniques.

The scientists have not gone the route of the shy professor of the past, who voluntarily handed over his valuable work to humanity. Quite the contrary. Herb Boyer teamed up with a young venture capitalist named Robert Swanson to found Genentech, which is now backed by a number of firms, notably the Lubrizol Corporation. Cetus in Berkeley, which now employs 30 Ph.D.'s and has two major facilities, already has Nobel Prize winner Don Glaser on the board of directors. Genex, a new firm in Rockville, Maryland, employs leading scientists from the University of Michigan and M.I.T., among others. Biogen's founding fathers include Dr. Walter Gilbert of Harvard. Most of these scientists, and others who are just staking claims in this biological gold rush, stand to make a good deal of money—like their entrepreneurial physicist brothers in the semiconductor field—should molecular biology take off as expected. Says Peter Farley, chairman of the board of Cetus (which, incidentally, means whale): "We're building nothing less than a new IBM of biology."

The first potentially commercial product to come out of gene splicing is a synthetic brain hormone called somatostatin, which was produced by Genentech scientists and their colleagues at the City of Hope National Medical Center in Duarte, California. This substance was first isolated by a laborious method from the hypothalami of thousands of pigs. Animal experiments show that it inhibits, and thus helps regulate, the secretion of a number of other hormones, including growth hormone and insulin. This action has suggested its possible therapeutic use against acromegaly (excessive growth), pancreatitis, and diabetes. At present, however, it is sold by Genentech for research only. Nonetheless, this laboratory success with synthetic somatostatin has since been followed by other similar successes, notably the production of synthetic human insulin (once thought an impossible feat), human growth hormone and thymus hormone. In July, Eli Lilly and Company announced that for the first time insulin synthesized from bacteria was being tested on human volunteers in England. Additional tests are expected.

One of the most heralded products of recombinant DNA is interferon, a protein normally derived from the blood. In some quarters it has been hailed as the latest wonder drug—a potential modern-day "penicillin" to fight viral infections and cancer. On the other hand, Dr. Thomas Merigan, one of the early interferon pioneers, cautiously says that it is just "threatening to become important." The truth at the present time is probably somewhere in between.

Interferon was actually discovered in the 1950s by two British virologists, Alick Isaacs and Jean Lindenmann, working for the National Institute of Medical Research in London. The scientists were studying flu, using cells from a chicken egg membrane in a nutritive solution. They infected the cell with flu virus, then they added other viruses to the culture. To their surprise, none of the new viruses infected the cells. The reason? Evidently the infected cells produced a substance that set up a barrier to infection by any new viral onslaught. The scientists named the defending substance interferon, a space age designation that so fascinated cartoonist Dan Barry, who draws Flash Gordon, that in one strip he calls upon it to save the lives of astronauts dying of deep-space plague.

A drug that can kill viruses the way antibiotics destroy bacteria would mark a new era in medical therapeutics. Interferon has not yet shown this ability. "Much of the excitement over it at present lies in the hope that it will become the viral penicillin of the future and if so that it will be particularly useful because it is a natural body substance," says Dr. William E. Stewart of Memorial Sloan-Kettering.

The exact mechanism of its operation is still unclear but, seemingly, it is a primitive line of defense preceding the evolution of such specific immunity devices as antibodies and the killer T cells of the human immunity system. Mathilde Krim, who heads interferon research at Memorial Sloan-Kettering, likes to describe it as a microscopic Paul Revere racing from cell to cell to sound the

alarm. Nobody knows how the message gets across or what the cells do to arm against invasion. But the prevailing belief is that somehow the interferon enhances the body's general immunity system.

But interferon is difficult to produce in quantity. The standard method is to centrifuge whole blood, creating a layer of white cells, known as a buffy coat. Then a mild virus is added to stimulate the white cell layer to produce interferon, which is then removed. This method was developed by virologist Kari Cantell of the Finnish State Serum Institute in Helsinki, who works with the Finnish Red Cross to obtain blood. The method is used currently to supply most of the world's demand for interferon. Very little is obtained, however—about 100 mg. from 31,000 liters of blood, making a gram worth millions of dollars at present.

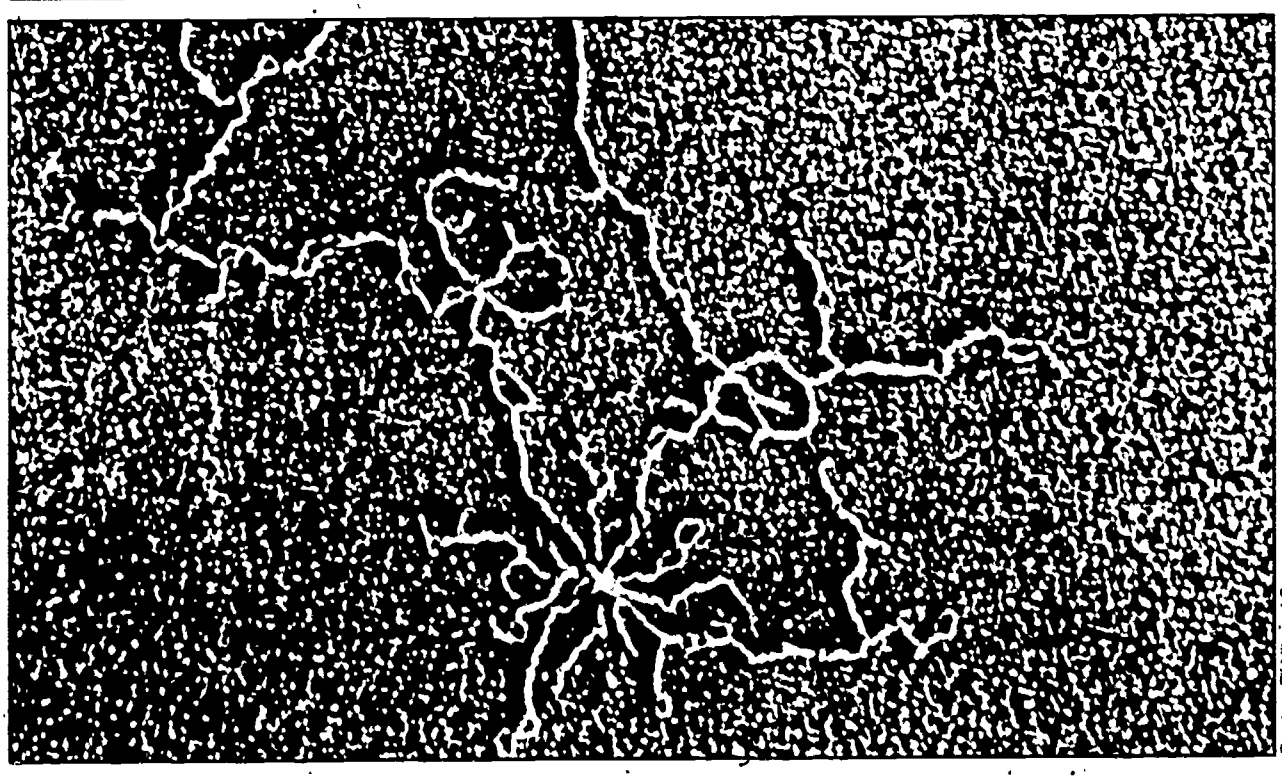
Dr. Merigan, head of the Division of Infectious Diseases at Stanford, was one of the first researchers to try interferon in clinical trials—against the common cold. While in London on sabbatical he tested a nasal spray made of the antiviral agent against different bugs. He found that of 35 volunteers exposed to cold virus only one developed symptoms. By contrast, 13 of those untreated showed signs of infection. Merigan sees potential in using interferon against herpes zoster, chicken pox and flu but admits that he has to await results from clinical tests now going on at Stanford.

The most publicized potential of interferon is, of course, its use against cancer. This possibility first surfaced as a result of preliminary work in Karolinska Institute in Stockholm, where interferon was given to 35 patients with a virulent, quickly spreading form of bone cancer. The substance didn't cure the cancer, but in two thirds of the patients it apparently controlled its spread for as long as two years.

This was followed by a report from Jordan Gutterman of M.D. Anderson Hospital in Texas that claimed unusual success with interferon in treating breast cancer. Gutterman is known for his enthusiasm over anticancer drugs and his claims have been questioned by other researchers but, coming at a strategic moment, they were influential enough for the powers that be in cancer research to launch a campaign on behalf of interferon. It is said that Mary Lasker, the queen bee of cancer funding, was the first to urge the American Cancer Society to act on interferon. The result: the ACS invested $2 million in interferon research, even before the scientists could agree on interferon's true potential.

A media blitz ensued in which science writers met with scientists and fund raisers and gave interferon a play that, in the words of one scientist, was never given to any other substance on the basis of the evidence on hand. Laurance Rockefeller, the chairman of the board of Sloan-Kettering, jumped on the bandwagon, contributing some of his

The real thing—An electron micrograph of a plasmid DNA molecule.



Courtesy Eli Lilly and Company

own funds on the basis, he admitted to friends, of seeing an article on interferon in one of the weekly news magazines. Most recently Shell donated another $2 million. Attempts by some scientists to hold up a caution sign on interferon have been to no avail. "I guess the cancer field needs some form of emotional uplift at present after the debacle of the Nixon cancer war," says a scientist who is skeptical about the vaunted potential of interferon.

One unfortunate feature of this interferon hoopla is the effect on some cancer victims. Patients have beseeched authorities for the scarce drug. Indeed, one specialist, who refuses to be identified, says that there is a lively black market in interferon, in which some physicians have joined with patients to obtain the material for treatment even though the Federal Drug Administration has not yet put its imprimatur on the drug.

The interest in interferon has led to various methods of manufacture other than extraction from human blood. For instance, at Frederick Cancer Research Center in Maryland, biochemist Richard White has been making interferon from a cell line that is derived from special cancer cells. Another form of interferon is made from fibroblasts—connective tissue—extracted from infant foreskins removed at circumcision. Yields of up to 10,000 units of interferon per milliliter of culture are said to have been achieved by this method. Finally, several drug manufacturers are attempting to break down and sequence the molecular makeup of interferon, so that it may be made synthetically.

Against this background, the recent announcement by Biogen in Switzerland that its scientists had succeeded in making interferon by gene splicing had an explosive effect on scientists and businessmen. *Science* magazine called the date of the announcement—January 16, 1980—the day that marked the beginning of biological business. The National Academy of Sciences called it a great day for molecular biology.

Specifically, Biogen stated that Dr. Charles Weissman of the University of Zurich and Walter Gilbert of Harvard had laboriously tracked the human interferon gene and transplanted it to E. coli. They produced only a few molecules of interferon but enough, apparently, for the scientists to hold a press conference about their findings, before publication in a scientific journal. The press conference, it is reported, sent the stock of Schering-Plough, which owns 16 percent of Biogen, up eight points. It also resulted in a critical review in *The New England Journal of Medicine* about scientific presentation by press conference and failure to give ample credit to researchers who earlier had done some of the important work. In any case, at the moment scientists are awaiting the results of further research to determine whether the substance is close to human interferon and can be mass-produced.

Despite the enthusiasm shown by the new science-business alliance over gene splicing, the full significance of this new technology will not be known until many more findings are published, both experimental and clinical.

A number of scientists, including Nobel Laureate George Wald of Harvard, are concerned with the important ethical questions raised by science's newfound ability to manipulate genes and create new life forms. The big question: Is genetic engineering moral? Should scientists be allowed to tamper with living things at a fundamental level and thus create a world of "creatures" that might escape and cause irreversible harm to future generations, even to the course of evolution? In other words, should scientists "play God?"*

These questions affect the entire field of recombinant DNA and they continue to bubble to the surface like a restless Mount St. Helens, sometimes pitting scientist against scientist, sometimes upsetting entire institutions. The key, of course, is the real, or fancied, danger. DNA research partisans contend that the dangers are exaggerated and that, in any case, the benefits to be gained far outweigh the risks. Indeed, one researcher has stated that E. coli K-12 (the intentionally enfeebled variety used in the laboratory) cannot be converted into an epidemic pathogen with DNA inserts, even when deliberate attempts are made to do so. And the guidelines provided by the NIH assure that the risks of escape and mass infection are minimal. The anti-DNA critics argue that, quite to the contrary, the risks far outweigh the benefits; any risk of accidentally creating an Andromeda strain and disrupting the course of evolution cannot be regarded in the same terms as other risk-benefit ratios.

Perhaps the answer to the challenge of recombinant DNA lies in some kind of compromise position in which the precious freedom of scientific inquiry is maintained, while the public is given a measure of protection that goes beyond the promise of scientists to be watchful. Even though regulation is currently a bad word in the businessman's lexicon, the idea of a special agency for gene-splicing activities does have the support of a number of scientific and social observers. The goal of the agency would be to act as a kind of watchdog, like the Public Health Service, without intruding severely into the work of business and science. Such an agency should include laymen, so that the public might participate in decision-making and thus assure itself that this remarkable new technology is developed for the maximum potential good. ■

*The ethical issue deepened with two recent developments. Scientists at Johns Hopkins University reported they had cloned fragments of the human X chromosome, using gene-splicing techniques. And Yale University scientists said they had transplanted foreign genes into the embyros of animals (mice). Further experiments may be tried with a human gene, one essential for the production of hemoglobin. Is this "playing God"?

DILEMMA 4:
"The Right to Own"

Joyce Heinz, a research biologist, shouts with joy. She has finally achieved her goal after 15 long years of work — the development of a new strain of bacteria, a one-cell organism. Her newly developed organism can be used to clean up oil spills.

How to clean up oil spilled into oceans, lakes and rivers has been a major and serious problem. Oil, spilled from tankers transporting oil from the wells to refineries, poison and kill fish, birds and other marine life. The damage can affect large areas and is long-lasting. Present methods of clean up are expensive and, in many cases, are not very effective.

This new strain of bacteria will be a major solution to the oil pollution problem, because it is capable of "eating up" oil, thereby breaking up the oil slick. Whenever a spill occurs, quantities of this organism can be simply sprayed over the area to ingest the oil.

Dr. Joyce Heinz feels that she deserves the benefits of her long years of research. The sale of the bacteria for oil clean up operations would be very profitable, especially if she were the main supplier. Or else, people could pay her a royalty each time they produce batches of the organism. She filed an application for a Patent on the new strain of bacteria with the Patent Office.

The Patent Office is now faced with an unusual problem. It has never had a request to patent a living organism and therefore sends the question to the Patent Appeals Court for its decision.

Should the court grant permission for patenting a living organism? Why or why not?

DISCUSSION QUESTIONS

- If the Court rules in Dr. Heinz' favor, this would mean that she has complete control of the organism, having final say over who can produce and sell it. Should a person have a right to do so? Why or why not?
- Is the development of a new organism the same as inventing a new machine, writing a song or book, or developing a new drug?
- If a person creates a new form of living organism, does that mean it is his/her property?
- Is owning a species the same as owning a cat or dog? Why or why not?
- What rights does a person have to life he/she creates?
- Since bacteria are a low form of life, should they be treated differently from other living things? What if Dr. Heinz created a new type of four-legged animal?
- How should Dr. Heinz benefit from her long years of work?
- Would it be fair if Dr. Heinz decides that only people who pay the high price she charges be permitted to use the organism?
- If Dr. Heinz were not allowed to patent her organism then anyone can use it. Should all people expect to share in the benefits of a newly created form of life?
- The exchange of information freely and openly between researchers has been an important tradition in science. When scientists become businessmen, will a cloud of secrecy come over scientific research?
- Should an animal species ever be considered the exclusive property of one person?
- Much basic research is funded by the government. Should scientists whose work has been government supported be allowed to patent their discoveries?

Reading 7

A controversial dilemma involving an endangered species and an endangered way of life presents hard choices for conservationists

by KATHRYN KARSTEN RUSHING

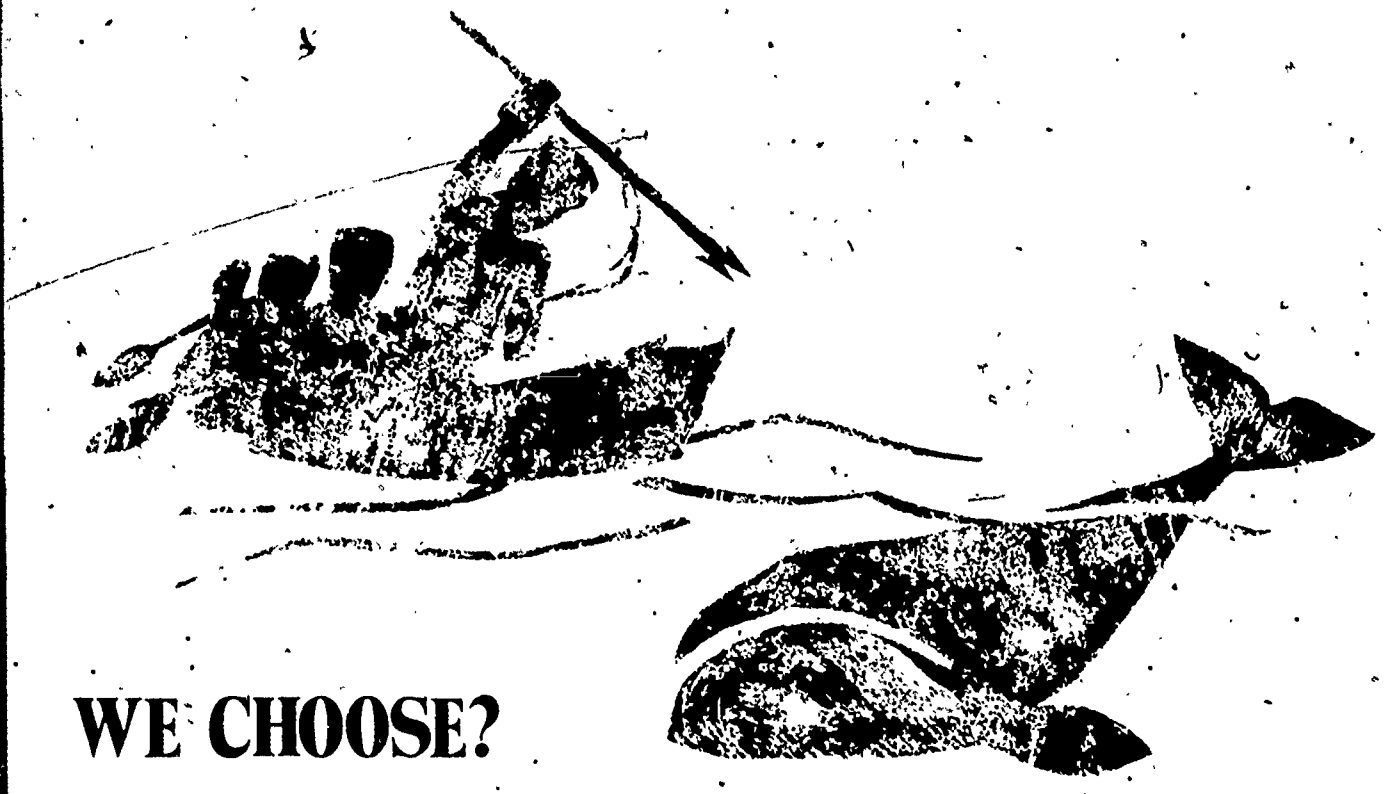
THE BOWHEAD OR THE ESKIMO: MUST

THE BOWHEAD WHALE and the Inupiat Eskimos of northern Alaska lived for centuries in harmony with their environment and each other. They might have continued on the same way forever except for the encroachment of the white man's civilization. Now, though Yankee whalers have long since left the Arctic waters, the whale and the Eskimo are still trying to cope with the effects of that alien influence. The whale is fighting for its very survival as a species, and the Eskimos are fighting for their way of life; the survival of both are inextricably entwined. In their struggles, both man and whale have generated an international controversy involving the U.S. government, the other member nations of the International Whaling Commission (IWC), and conservationists. Some, fearing the extinction of a species, would take away from the Eskimos the right to hunt the bowhead, but others support a more moderate course.

In the meantime, the people of the nine Eskimo villages that hunt the bowhead—Kaktovik, Nuigsat, Savoonga, Gambell, Wales, Kivalina, Point Hope, Wainwright, and Barrow—have formed the Alaska Eskimo Whaling Commission (AEWC) in the hope that a balance can be struck between their cultural and dietary needs and the importance of preserving the whale on which they are so dependent for so many reasons.

THE RELATIONSHIP between man and bowhead dates back to prehistoric times. Until some time around 900 A.D., when Siberian Eskimos invented the sealskin float that enabled them to keep large animals buoyant after they were killed, the bowhead was probably the only whale the Eskimos could hunt. Like other right whales, the bowhead, or Greenland right whale, will float when dead, making it the "right" whale to catch. This quality, combined with its relative slowness and high oil content, made it the central figure in Eskimo subsistence and culture for centuries. A winter without the meat and oil of the bowhead could mean starvation or at best living on the brink of survival for an entire village and reliance on the meat of smaller animals, which required daily and exhausting hunts. No wonder the bowhead came to dominate the legends and festivals of the northern Eskimos, who literally owed their existence and way of life to the animal. Life for the bowhead and the Inupiat Eskimos, however, began to change in the late 1500s, though at first slowly and imperceptibly, when the bowhead was discovered by Dutch ships in Arctic waters. The discovery was significant because the Dutch and other Europeans had already hunted the Atlantic black right whale to scarcity, major commercial whaling having begun in Europe in the eleventh century. The right whale's baleen was highly prized for its length and was used to make such articles as whips, stays, and umbrellas. Its oil-rich blubber lit the lamps of Europe for hundreds of years.

The British and other Europeans later joined the bowhead hunt, though the whale was not pushed to the edge of extinction for another 250 years, when Yankee whaling ships took up the slaughter of the bowhead in earnest. During the mid-nineteenth century American vessels took some four hundred arctic whales yearly. In 1886, Yankees established their first whaling station along the Arctic coast, which came to be known as Jabbertown because of the many tongues spoken there. With the establishment of the



WE CHOOSE?

northern outpost of white influence, the Yankees succeeded in a relatively few years not only in decimating the whale population of the area but in degrading the lives of the Eskimos by introducing alcohol and prostitution. They also irrevocably changed the ancient ways of the hunt by adding an exploding shell of gunpowder to the harpoon and by using shoulder guns to finish off the dying whales.

When the Yankees abandoned Jabbertown, the whales had practically disappeared and the surrounding Eskimo villages were in a state of chaos. Fortunately for the Inupiat and for the history of the role of the white man in the area, a New England missionary/doctor, John Driggs, gradually won the confidence of the natives and helped turn the situation around. By means of education coupled with an unremitting respect for Eskimo culture, Driggs helped the Eskimos ease into the twentieth century, regain their lost dignity, and strike a reasonable balance between the ancient ways and the white man's influence.

For some fifty years, until the early 1960s, bowhead hunting was minimal, with an average of only ten bowheads taken each year. (This figure is only an estimate, however, as reporting was incomplete during this time.) From then on, the number of bowhead taken or struck gradually increased—to an estimated high of 111 in 1977. Opinions vary as to the reasons for the steady increase, but some of the factors involved probably have to do with improved weather conditions, an increase in the number of whaling crews, an increase in the whale population, or a combination of factors. Although Barrow is moving toward a cash economy, it and the other whaling villages still rely on the sea to provide their protein, traditional food, and oil. And all the villages value the importance to their social organization and culture of the ritual of preparing for the hunt, the hunt, the festivals, and the sharing of the bounty.

THE OFFSHORE ICE begins to move some time in April, the signal that the bowheads will soon make their annual northward migration through the leads—channels between the ice. Tension mounts as the time for the hunt grows near. Whaling crews check their paddles, inflate sealskin floats, and clean and prepare their harpoons and guns. From rooftops children scan the horizon for a glimpse of the whales while novice hunters practice spearing with broomsticks in the snow.

Almost everyone has a role to play in the yearly search for the bowhead. A week before the hunt the women sew new covers of bearded sealskin over driftwood boat frames—a task their ancestors have performed for eons. Before that they prepare the hides by drying them until the hair rots off. Then they scrape off the hair from one side of the skin and scrape off the fat from the other. They sew the skins together with braided caribou sinew, which swells when wet, producing a completely waterproof seam. They then stretch and lash the prepared skins onto the boat frame; when the skins dry, they fit tightly to the frame, and the *umiak*, as the boat is called, is ready for the hunt.

For a time in the early 1900s many Eskimos abandoned the traditional *umiak* in favor of whaleboats purchased from Yankee ships. The white whalers had scorned the lightweight *umiak*, made from mere driftwood, and brought lumber with them from New England to build what they

thought would be sturdier boats. What white and Eskimo soon discovered, however, was that the drifted spruce of the native boat was not only lighter in weight but sturdier than any wood used to replace it. Motorboats and aluminum crafts are sometimes used for the hunt in Barrow. The other villages, however, use the traditional *umiak*—unchanged and not improved upon for thousands of years—almost exclusively.

Before the actual whaling operation can begin, the crew must establish a base camp on the ice, next to open water, several miles away from the village. The camp consists of a tent with a chimney for a homemade stove, with whale blubber providing the fuel and creating a sweltering oasis in subfreezing temperatures and biting winds. If strong or warming winds threaten to melt or break up the ice, the base camp must be moved to a safer location.

The camp serves as a lookout point for whales and a retreat for weary and hungry whalers, though this was not always the case. Before the Yankee whalers arrived on the scene, the Eskimos believed it was bad luck to eat at the base camp or to enjoy any comforts while on the hunt. They carried only enough water—in containers made from seal intestines—and food to keep themselves going. However, the customs changed after the Eskimos witnessed the Yankees' comfort and success.

The crew at the base camp—usually young boys and women—work hard at keeping the fire stoked, cutting blubber for the stove, melting snow for drinking and washing, and cooking. A typical meal might consist of chopped whale skin and blubber, cooked with onions and water, and thickened with flour. Fried bread, caribou meat, and coffee also fuel the hunters.

What is clear from accounts of bowhead whaling expeditions is the incredible endurance, patience, and stamina required by all members of the crew to catch even one whale. In coastal Alaska, fear of the sea is both natural and accepted. Seas can be rough, winds difficult to paddle against, and snow, blinding. When the hunters are lucky, the ice breaks a mile offshore, during other years it might break as far away as five to ten miles, increasing the dangers, and complicating the work of transporting equipment. And the whale can be a formidable prey, capable of smashing small boats or dragging vessels long distances after being wounded.

Then there is the frustration of being within sight of whales but unable to reach them through the ice, waiting for the opportunity to strike—sometimes a week, sometimes more—knowing that the lucky strike might never come. If the hunt is successful the crew must then tackle the arduous task of towing a whale that weighs as much as forty five tons, or more, ashore, which requires the back-breaking efforts of some fifty people, tugging and pulling for hours. Butchering requires an additional ten hours of labor.

For the cooks and the land crew the work is also grueling and difficult, requiring at times all-night vigils to ensure that the boat crew has enough to eat during the hunt, tending the fire round the clock, and sometimes hauling rations in extreme weather conditions several miles from town either on foot or by snowmobile.

In Eskimo society the whaler is the most respected member. The courage and strength necessary for the hunt are obvious reasons, but the roles of the captain and his crew in maintaining social stability and in providing the community with most of its yearly protein needs are even more important.

The economy of northern coastal Alaska has been described as a modern subsistence culture, the natives having been able to strike a successful balance between their ancient social network and the contemporary monetary culture of which they are, by necessity, a part. The initial investment to support a whaling crew—around $6,500 in 1977—is acquired in several ways. either the crew is supported entirely by the captain, sponsored by a working sister or wife, or financed by donations from the crew's relatives.

Although the whaling operations are supported by only a relative few, everyone in the community as well as inland relatives receive a share of the bounty. Profit is not the motivating factor in making such an investment—the only tangible benefit comes if the boat makes a successful strike, then the crew receives one of the better cuts of the whale. Intangible rewards such as social cohesiveness and stability and the welfare of the community along with the prestige, honor, and satisfaction of being a provider are of overwhelming importance. Therefore, although money is necessary to finance such an important undertaking, the return on the investment is not monetary. Investor, captain, crew, relatives, the elderly, the young—all share alike. The annual whale hunt provides the only communal subsistence opportunity for the coastal towns—essential to the preservation of the traditional cultural values and social bonds. In the whale hunt no one person supports his or her family alone—community members support each other.

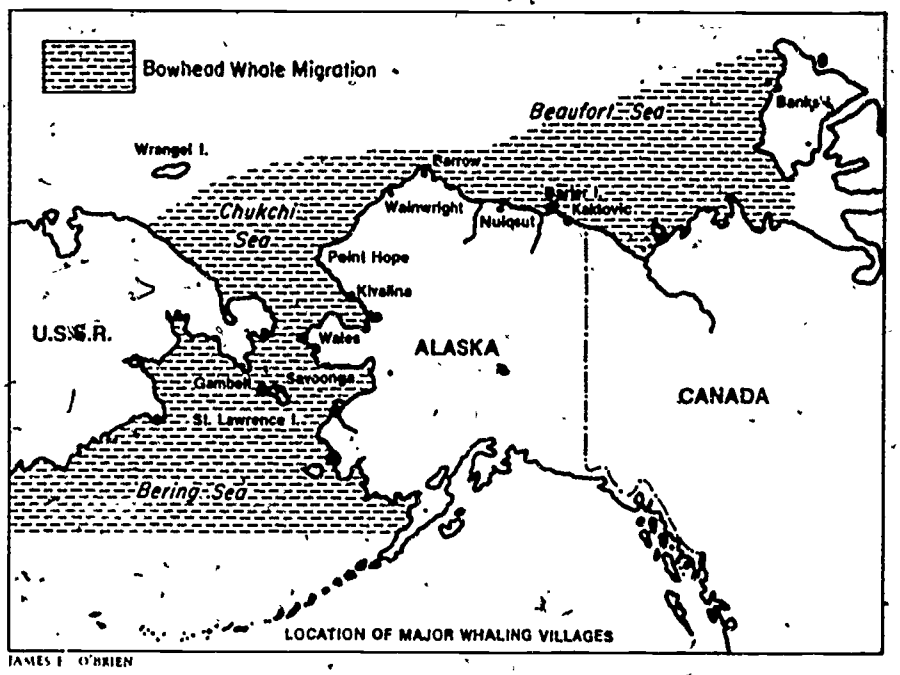
After the initial sharing of the whale among members of the community, the sharing of the remainder is ritualized in ceremonies and feasts—the Captain's Feast, where the section from the tail to belly is divided, the Whale's Tail Feast, Thanksgiving, and Christmas, when caribou and fish are also distributed.

The cultural importance of the hunt is not the only reason for the northern Eskimos to value their annual hunt, however. The whale, along with seals and caribou and fish, birds, and walrus to a lesser degree, is an important component in the diet of the northern Eskimo. Contrary to what an outsider accustomed to a more varied diet and schooled in the seven basic foods edict might believe, the traditional diet supplies all essential nutrients, whale blubber being a good source of vitamins A, D, and C. In addition, whale blubber, unlike

other animal fat, is polyunsaturated, probably accounting for the low serum cholesterol of premodern Eskimos and the healthier status of Eskimo adults whose diet most closely resembles that of the aboriginal Eskimos. Natives of this area frequently exhibit lactose intolerance, which would preclude the use of milk or milk products as a source of calcium. They obtain their calcium requirements by consuming the cartilage and soft bones of the native species. Therefore, importation of alternative food sources from the lower forty-eight states not only would be costly but would not provide the basic diet to which the Eskimos seem to be metabolically adapted.

Replacement of the whale by other native species is not a viable alternative either. Caribou hunting has been severely restricted by law for the past few years. Beluga whales, which also inhabit the northern waters, are also sought by subsistence hunters in western Canada, so the United States is reluctant to encourage its natives to further impose on this species, which is not in large supply. The gray whale—like the bowhead, an endangered species—is much more difficult and dangerous to hunt and sinks when killed. In addition, the blubber is inedible because it is difficult to chew, and the skin is encrusted with barnacles. Smaller native species such as seals, walrus, waterfowl, and fish could not substitute for bowhead because of the time and effort that would be required to hunt for them.

THE ESKIMOS' traditions, social structure, relationship with the sea, and rhythm of life have an appeal that argues eloquently for their preservation. The bowhead cannot speak for itself. In addition, it is perhaps the least understood of the great whales. What little we know of it is primarily related to its importance to humans and human history. We know what it looks like, we know of its value as a food source, we know that it was once of utmost economic value, we know it was hunted almost to extinction, we know where to hunt it today, we know it floats when dead. precious little knowledge when questions of survival or extinction are involved.



JAMES F. O'BRIEN

The massive, slow-moving bowhead reaches lengths of up to sixty feet and weighs as much as fifty tons. Its curving, cavernous mouth hosts the longest baleen found in any species of whale—the average measuring ten feet in length—which extends from its palate in fringed plates. For man, these plates at one time represented a ton and a half of whalebone, for the whale, they function as a sieve through which pass sea water and plankton—its primary food as far as we know. Its twenty inches of blubber—the thickest developed by any species of whale—once yielded twenty-five tons of oil and, by the way, protects the whale from its harsh Arctic environment.

The bowhead has a limited migration pattern, never straying far beyond Arctic regions. Females give birth in Arctic waters, the calves being protected by an incredibly thick layer of blubber. Presumably in adaptation to living in ice-filled waters, the bowhead can remain underwater one hour—another distinction—longer than any other species of whale. Scientists have yet to discover its whereabouts in summer and winter, though they presume that it keeps to the edge of pack ice. Except for subsistence hunting, the species has been protected by international convention since 1935.

IN JUNE 1977 the IWC banned all hunting of the bowhead whale on the basis of an admittedly inexact population estimate of between 1,600 and 2,500 individuals and an alarming increase in the number of bowheads struck and lost during recent years (twenty-seven in 1974, twenty-six in 1975, thirty-five in 1976, and eighty-two in 1977). The IWC decision caused a storm of controversy among Eskimos, conservationists, and U.S. officials and placed the United States in a double bind situation. The U.S. government has long been a leader in whale conservation and yet has legal and moral obligations to its native people. To support the ban would mean turning its back on the Eskimos' needs, to support the Eskimos would seem to indicate a "do-as-I-say-not-as-I-do" attitude and might indeed further endanger the bowhead.

Although the United States did not file an objection to the IWC ban, government officials did agree to meet in December 1977 with the IWC to discuss the problem. At the December meeting, a majority of the IWC member nations present voted to adopt a compromise quota

for the spring 1978 hunt. twelve whales taken or eighteen struck, whichever came first. Calves and nursing mothers were completely protected for the first time.

The compromise pleased no one: Conservationists who had supported the complete ban were outraged, and the Eskimos predicted that the low quotas would not meet the natives' nutritional needs and would result in violations.

Once the dust had settled, however, the United States and the Eskimos hunkered down to deal with the IWC decision. The government started to face squarely an issue it had long ignored, and the natives began to take a long look at some of the reasons for the recent heavy losses of bowheads and took steps to modify their weapons and procedures to eliminate as much waste as possible. In a concerted effort to preserve the bowhead while also affirming and preserving the natives' right to hunt, the U.S. government and natives began to work together.

The joint effort required a variety of approaches. rigorous self-policing of the spring 1978 hunt by the Eskimos; improvement of weaponry and hunting techniques, and more complete and accurate whale censusing procedures.

The Eskimos' predictions of violations of the IWC quota during the spring hunt did not quite come true. First of all, the Eskimos were generally very cooperative in their desire to adhere to AEWC regulations. Secondly, a low struck-and-lost number—five in 1978 as opposed to eighty-two in 1977—was also achieved, probably because of a much shorter than usual whaling season, weapon improvement, and more efficient hunting techniques. An incident in Barrow in May 1978 that was widely reported in the newspapers, in which whalers took one more whale than their quota, occurred, according to the whalers, because they thought that the extra whale was not a bowhead. After the U.S. commissioner stressed that all whales in the herd were considered to be bowheads, the natives ceased their whaling activities. Furthermore, Point Hope transferred its unused quota to Barrow so that the final tally did not exceed the IWC quota.

In order to improve the efficiency of the weapons used for the hunt, whalers, federal representatives, and the manufacturer met to decide upon modifications to the dart and shoulder guns and bombs. Some of the changes that were made included reducing the amount of rust accumulation, which interfered with the proper discharge and travel of the bombs; lightening the weight of the guns for easier handling, increasing the flexibility of the harpoon shaft to reduce the likelihood of dislodgement, blunting and shortening the bomb point to reduce the possibility of misplacement, and shortening gun barrels to facilitate checking the position of the bomb.

The natives have long contended that government estimates of the bowhead population were low, and a truly comprehensive census had never been made. Therefore, during 1978 the United States employed more accurate censusing techniques while also studying the population dynamics and acoustic techniques of the bowhead. Around-the-clock observations from ice-based and land-based camps by government scientists and AEWC representatives backed up with aerial surveys yielded a count between 1,783 and 2,865 whales, with 2,264 given as the best estimate, a larger population than had been generally believed to exist. Several reasons have been given for the higher-than-expected count: favorable weather conditions, twice as many days and four times as many hours spent in observation as during the two previous censuses, shorter watch hours and greater rotation of observers, and the fact that the lead was open the entire season, allowing for continuous observation. Because Russia denied the United States permission to count bowheads on the Siberian side of the Chukchi Sea and because some whales migrate later in the year and were not included in the most recent census, even more whales may exist than actually were counted. A complementary vessel survey to be completed late in 1978 will update the latest estimate.

THE IWC MET in London in June 1978 to determine, among other issues, the 1979 quota for bowheads. The result of the meeting was a quota of eighteen landed or twenty-seven struck, whichever comes first. In addition, United States representatives requested that two additional whales be added to the fall 1978 quota, a request that was denied and that appalled some conservationists.

The result of the most recent IWC meeting was, again, to please no one. The Eskimos would still like a higher quota, and many conservationists would like to see a complete moratorium on hunting of the bowhead. On one fact both sides have agreed: more research on the natural history and population of the bowhead is needed.

EVEN A SOLOMON would have found it difficult to make a completely acceptable decision on the bowhead controversy—unless, of course, he had a crystal ball. A definitive answer may never come, though if it does, it will be only after many more years of accumulation of data and a continuation of the intensive research that has just begun. In the meantime, we can only hope that the bowhead population will not suffer adversely from subsistence hunting and that the whalers will continue their efforts to increase their efficiency and adhere to their own stringent regulations. If not, we stand to lose two irreplaceable resources. a cultural tradition both of intrinsic value and of value as a model of individual commitment to the community and a little-understood giant of a species. The world would be much poorer for the loss of either one. ■

Kathryn K. Rushing worked as assistant editor for this magazine for more than five years. In addition to her editing duties, during 1976 she co-authored a series of bicentennial articles on historical topics of significance to the National Park System.

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Hunting Bowhead Whales: The Eskimos Follow the Rules

Story and Photos by Jeffrey Knight

ESKIMO WHALERS ENDED THEIR SPRING HUNT for bowhead whales at the end of May, staying within the quota set for them at last year's meeting of the International Whaling Commission. For a few tense days it looked as if the Eskimos might ignore the quota; if they had done so it would have sparked an international incident at the coming IWC meeting, and further damaged the United States' ability to press for lowered quotas for commercial whalers.

The Eskimos, with whom a FOE delegation of five spent a week during the hunt, do not have much respect for the IWC or for other outsiders who try to tell them how to conduct their lives. They consider the IWC quota (18 landed or 26 struck, whichever comes first) inadequate to feed all the people who depend on whalemeat. An alternate scheme for calculating a quota is favored by the Eskimos—drawn from a subsistence whaling regime once proposed by the US to the IWC. This suggests that 2 percent of the estimated population of whales can be taken without endangering the species. In the case of the bowhead, this would mean a quota of about 45 whales. In the end, the whaling captains met in Barrow and agreed to call the crews of whalers back off the ice. (A few crews actually stayed out, but bad weather, poor ice conditions, and the fact that most of the whales had gone by already made their presence largely symbolic.) At the end of the hunt, the Eskimo villages had struck 26 whales, and landed 15.

Since 1977, the US government has worked in the IWC to secure a small subsistence quota for the Inupiat whalers of Alaska's north coast. FOE has supported this effort, believing that the hunt is necessary not only to feed the people but also to keep together the oil-stressed Eskimo culture. FOE's position has two goals: to save the whales and to permit the natives to save their traditional culture. Many other conservation groups have disagreed with the FOE position, and there are rumors that a renewed push for a zero quota on bowheads will be proposed at this year's IWC meeting. Had the quota been violated this year, the IWC might well have reacted harshly.

ONE OF THE ARGUMENTS ADvanced by supporters of efforts to preserve the native culture is that regulation of bowhead whaling will never succeed unless the Eskimos do it themselves—and it appeared to the FOE team that Washington has been lax in building the kind of confidence necessary to result in a careful bowhead recovery plan. (The IWC precipitated the bowhead-quota crisis by voting a zero quota in 1977. IWC officials had repeatedly asked the US to do something about the rapidly climbing bowhead kill, and the US sat on its hands. The first the Eskimos heard about it was when they were told that an organization they had never heard of had voted to stop them from whaling.)

For the past three years, the Eskimos have operated under a new, self-imposed regulatory scheme, and while they now know of the IWC, we found that they are still not fully aware of the deep international significance of exceeding a quota. Other nations are waiting to jump on the US for any such violation.

AT ONE POINT DURING OUR VISIT, WE DISCUSSED WEAPONS TECHNOLogy with our host Jake Adams, chairman of the Alaska Eskimo Whaling Commission. Much as been made of the antiquated and inefficient harpoons the Eskimos use, and much has been said about improving them, so that fewer whales will be struck and lost. Much has been said, according to Mr. Adams, but little has been done. He said that one new weapon sent up a year before had not been any improvement, and that a letter he had written to the National Marine Fisheries Service had gone unanswered for three months. Communication between the Eskimos and officials of the Interior Department and the National Oceanic and Atmospheric Administration is still sporadic at best. Visits of high-ranking officials have been almost non-existent, in contrast with a parallel situation where officials of the State Department are working closely with Eskimo leaders negotiating a caribou treaty with Canada.

The Eskimos are criticized at once for using old-fashion weapons and for using accoutrements of modern society: the first for allegedly being cruel to the whales, the second as proof that the Eskimo subsistence society is no more. The main modern items used in the hunt are the snowmobile, the CB radio, the portable gas stove, and the thermos bottle. None significantly affects the essential nature or purpose of the hunt or its critical importance—nutritionally and culturally—to the Eskimos. The radios permit better communication and coordination; the snowmobiles permit quicker travel, eating gasoline but saving seals that would otherwise be fed to sled dogs; the other two items keep people warm.

ESKIMO LEADERS UNDERSTAND BETTER THAN THEIR CRITICS what might be the most important point of all: that the bowhead whale is in far greater danger from proposed oil drilling in the Beaufort Sea, the animals' summer feeding grounds, than from Inupiat hunters. The draft environmental impact statement on the first lease sale predicted that up to 1,000 whales, nearly half the population and more than 60 times the number killed this year, could be wiped out by an oil spill. Biologists at the Naval Arctic Research Lab in Barrow explained why oil is so dangerous to bowheads. When it comes into contact with oil, the whale's skin inflames, drawing blood to the surface. If this were to occur over the entire body, the animal could freeze to death—if the oil hadn't already clogged its baleen or it hadn't suffocated on the gaseous hydrocarbons suspended between water and air.

The Beaufort Sea lease sale is currently stalled in the courts, delayed by a lawsuit brought jointly by the Eskimos and by environmental organizations including Friends of the Earth.

Despite threats to the contrary, the Eskimos have played by the International Whaling Commission's rules this year. It remains to be seen how the IWC will respond this summer.

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LET THE ESKIMOS HUNT

LAEL MORGAN / MY TURN

NEWSWEEK

Recently, over lamb chops, a hostess remarked to me how cruel it was for Eskimos to kill those baby seals. Hoping to dismiss the subject, I told her they weren't *our* Eskimos but Canada's. Alaskan Eskimos hunt mature seals of which there is an overabundance, and they hunt them because they need the food.

In the arctic, it would be hard to sustain oneself on pizza and veal cutlets—even if such supermarket fare were available. To function in that abysmal cold, the body cries out for the meat of the fat-rich sea mammals that nature has provided there.

Outside the arctic, which is my second home, I find little comprehension of the remarkable skill, work and endurance it takes for Eskimos to live off the land and sea in one of the world's most inhospitable climes. This spring, when Eskimos are expected to defy the International Whaling Commission (IWC) and kill more than the quota of possibly endangered bowhead whales allotted for their subsistence use, I'll have an even more difficult time explaining.

The whale has traditionally been, and still is, a large and important part of the Eskimo diet. Even today, natives usually hunt it as their ancestors did—paddling up to the quarry in homemade driftwood-framed sealskin boats, then dispatching the giant with a hand-thrust harpoon or shoulder gun, the design of which was patented in the 1800s. As part of the hunt ritual, the Eskimos return the whale's skull to the sea to appease the spirit of the magnificent beast.

Since bowheads are fairly wily, weigh a ton a foot and sometimes grow to be 60 feet long, the crews require considerable courage. Their primitive method of hunting definitely limits the take which, until 1978, was unrestricted by law.

WATCHDOG: In 1977, with little warning, IWC announced a total ban on Eskimo whaling. In later negotiations, Eskimos managed to get a quota of twelve bowhead whales for the 1978 season—36 less than they'd taken the previous year and seventeen less than their average annual kill over the previous decade. As a trade-off, U.S. negotiators allowed commercial hunters from Japan and Russia to take an additional 5,681 sperm whales, a whopping increase from the 763 originally allowed to them.

Eskimos maintained they were simply pawns in a larger game of international politics, and that IWC, established as a watchdog for *commercial* whaling, had no jurisdiction over their subsistence efforts. But they agreed to abide by the IWC quota until a long-neglected bowhead census could be taken.

The ensuing whale count was something of a disappointment because the electronic underwater detection devices failed to work. However, depending on visual sightings, scientists judged the bowhead whale population to be about 1,000 more than their original estimate. (Many Eskimos believe that even this count is low.)

In light of the new census, Eskimos expected the IWC to up their quota considerably. They were dumbfounded to learn the commission had increased by only six the number of mammals that could be taken for family use by their nine Eskimo whaling villages.

The natives, who have formed their own Alaska Eskimo Whaling Commission, point out that they are as concerned about whale conservation as anyone since whales are their bread and butter. The Eskimos have pledged to limit their kill to no more than 2 per cent of the *known* number of bowheads, which is estimated to be 2,264. This, of course, is well over the IWC quota.

Many mindlessly oppose hunting, even where animal populations are dangerously high.

Although the income of the average Eskimo hunter is below poverty level, the IWC penalties to be imposed on natives for violations are the same as for a commercial whaling ship: a $10,000 fine and/or a year in jail. Nevertheless, some Eskimos—who maintain that their traditional way of life is far more endangered than the bowhead—are prepared to take that risk.

It will not, I expect, be a popular cause for a reason quite apart from the justifiable debate on the well-being of our gentle cetaceans. The problem is a real lack of understanding of the balance of nature. Many Americans mindlessly oppose hunting, even in cases where animal populations are dangerously high.

In some areas of Alaska wolves have become so prolific they are running out of hunting ground and prey heavily on moose, deer and occasionally dogs. In the past, game managers curbed wolf populations by trapping and aerial hunting without wiping out the species. Still, whenever they propose to do this nowadays, they receive tens of thousands of letters of protest.

Growing deer populations in parts of California threaten to starve themselves out. Sea-otter colonies, burgeoning along the Pacific coast, are fast running out of fodder, too, as well as putting commercial fishermen out of business.

Nature's answer is starvation: the survival of the fittest. "That is nature's way," the purists murmur approvingly, although they stop short of recommending this solution for the starving masses of India.

BENEFITS: There is, however, a scientifically sound argument to be made for selective hunting that serves not only the animal population but also benefits mankind. This is no trivial consideration in an overpopulated world that may be running out of food.

Scientists, noting that whales exhibit more rapid growth than other mammals, have speculated that we may one day be forced to cultivate our great cetaceans to meet a world food crisis. When you consider that during a year's captivity at Sea World a young gray whale gained 10,000 pounds and grew 9 feet, this is a comforting thought.

Unfortunately these concepts are offensive to our well-fed society, although folks seem to feel no guilt at all about enjoying a "Big Mac" or buying beefsteak in plastic-wrapped packages.

The stockyard scene, the plight of hothouse-raised, hormone-stuffed chickens and force-fed geese seldom concern us for long. Yet we pride ourselves on our compassion for sea mammals.

Some of my Eskimo friends suggest that perhaps the best way to bring their point home would be to have every American personally kill and butcher one animal for his own consumption annually. But that would not appease those who object to the eating of meat. When informed that gardens don't thrive in the arctic and man can't live by bread alone there, some vegetarians blithely suggest that the dwellers of the northland move to warmer climes.

To them I can only repeat the well-documented theory that "plants have feelings, too" and wonder, in passing, if boiling is the most humane way to execute spinach.

Lael Morgan

Lael Morgan is an editor for Alaska Northwest Publishing Co.

DILEMMA 5:
"For Food and a Way of Life"

Captain John and his whaling crew have just struck and lost their third whale in three weeks. Their small skin boat is unable to maneuver quickly enough through the ice floats to capture the injured whale which then disappears out of sight. This means that they have reached the quota allotted by the International Whaling Commission. According to the agreement made by the members of the Commission, the twelve Eskimo villages can land a total of 18 whales or strike 26. The Eskimos have reluctantly agreed to the rulings, and a quota is determined for each village. Captain John, the "provider" for his village of Port Hope, is thus allowed to take a total of two whales or strike three. Violation of the ruling will bring a fine of $10,000 or a year's jail term.

Gloom prevails over the crew. Several months have been spent preparing for this yearly hunt. Captain John and his family have used over $8,000 for fuel, guns, food and other supplies for the whaling expedition. The nutritious whale meat is to be distributed among the 500 members of the village. For the villagers, whale meat is an important source of meat protein, because they cannot afford the high prices for other types of meat. In addition to the loss of a valuable meat source, the spirit of the village's yearly festivals — the Captain's Feast, the Whales' Tail Feast, Thanksgiving and Christmas — well be severely diminished. Most of the community's activities and ceremonies center around the sharing of the whale. It can be said that the whale is a source of community togetherness, stability and welfare.

As Captain John gazes sadly towards the horizon, he suddenly spots two bowhead whales well within rifle range. The sight of the whales conjured images of the laborious but excited activity of the base camp when a whale is hauled to shore. It will be such a disappointment to the people at the camp if the hunters do not bring back a single whale. So much depends on a successful hunt. He becomes overwhelmed by the urge to take aim with his dart gun but also remembers the quota that has been imposed to protect the endangered bowhead whale.

Should Captain John fire at the whale? Why of why not?

DISCUSSION QUESTIONS

- Should the fact that hunting the whale would break an agreement be an important consideration for Captain John? Why or why not?
- Should Captain John risk the heavy fine or jail sentence in order to bring a whale back to the villagers? Why or why not?
- Since the whale is such an important part of Eskimo life, isn't that reason enough for Captain John to try again? Why or why not?
- If the bowhead is endangered, shouldn't everyone try to do their part to save the species? Why or why not?
- If overhunting greatly reduces the bowhead population, the Eskimos will be affected more severely. Should this be an important consideration for the Captain? Why or why not?
- When people in the U.S. violate the regulations, other nations who profit by whaling may also disregard the agreement. This would lead to uncontrolled killing of whales. Should this be important for Captain John to consider? Why or why not?
- Since whaling is an important part of Eskimo culture, should Eskimos be given special permission to hunt as many whales as they need? Why or why not? When a resource, the whale in this case, is scarce, does anyone have the right to kill more than his/her fair share? Why or why not?
- The Eskimos have hunted the bowhead for centuries. Should this fact give them greater claim to the whale? Why or why not?
- Is the International Whaling Commission being unfair by setting a quota for the Eskimos?
- Should whalers who hunt for food and those who hunt for profit be treated differently by the law? Why or why not?

Reading 10

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Fragile Lands

by Anthony Wolff

For many of the world's poor farmers it is a fact of life that the harder they work, the poorer they get. Their land is either too steep, or too dry, or the soil too poor, to support more than a mean level of existence for a few people. But because of increasing populations, and intractable patterns of land use and tenure, fragile environments are being subjected to more intensive use – and misuse – than they can much longer sustain. Agriculturally marginal to begin with, they are becoming useless; their farmers, ecological refugees.

The View from Above

"There is no better place to begin an examination of deteriorating mountain environments than Nepal," says Erik P. Eckholm of the Worldwatch Institute. "In probably no other mountain country are the forces of ecological degradation building so rapidly and visibly." Increasing at a high rate, Nepal's population is being forced ever upward onto the slopes of the Himalayas, part of the mountain arc that extends from Pakistan to Burma. The slopes are too steep and the soils too thin to permit intensive cultivation, even with the aid of terracing. Nevertheless, the average hectare of arable land in Nepal's hills must now support nine people.

More than food for people and fodder for livestock is being withdrawn from the hillsides' shallow reserves. The ceaseless search for heating and cooking fuel has devastated the mountains' forests. A Swiss technical assistance group has concluded, "It is evident that Nepal is likely to be all but totally denuded by the end of the century." Meanwhile as firewood becomes increasingly scarce, cattle dung is collected and burned instead of being returned to the soil as fertilizer, increasing the drain on the soil's biological capital.

The net effect of overcropping, overgrazing, and overcutting on Nepal's steep hillsides is the accelerated erosion of fertile topsoil. "Brown, soil-laden rivers . . . are carrying away forever the basis of the very life of the people," noted a 1967 report. An estimated 250 million cubic meters of soil are thus exported free of charge each year from Nepal to the Gangetic Plain of India, one of the world's most productive agricultural areas, and beyond. Nepal's silt stains the Indian Ocean as far as 400 miles from shore.

Meanwhile, in the densely populated eastern hills of Nepal, as much as 40 percent of what was once farmland has been abandoned because it is no longer fertile enough to support crops. According to the Nepalese National Planning Commission, the degradation of the region is "almost to the point of no return. . . . The continuation of present trends may lead to the development of a semi-desert type of ecology in the hilly regions."

The View from Below

Only 10 percent of the world's people live on the relatively steep highlands, like Nepal's, that make up one quarter of the earth's land surface. Fully 40 percent of the human race, however, lives in the lowlands adjacent to mountains or steep hills, vulnerable to the consequences of ecological misuse of the slopes above. Moreover, in many parts of the world, the processes of deforestation and overcultivation on steep slopes, leading to severe erosion and downstream flooding, have been going on for centuries. In the 4th century B.C., Plato was already complaining, "Our land, compared with what it was, is like the skeleton of a body wasted by disease." By the mid-20th century, man had reduced the world's natural forest cover by one-third to one-half; cases similar to Nepal's can be drawn from every quarter of the globe. On the Indus River in Pakistan, a World Bank study group reports more serious flooding in the last 25 years than in the previous 65. In Java, the headlong clearing of forested hillsides threatens to nullify the benefits of an ambitious and expensive irrigation system. Across Asia, similar situations can be found in India, Thailand, the Philippines, Malaysia; almost everywhere that poor farmers cling to the sides of mountains.

Woodsman, Spare What Tree?

Halfway around the world, along the western coast of South America, the Central Andes are well on the way to being deforested. In the mountainous part of Peru, which makes up one-third of the country, the population has doubled and redoubled just since 1900. Armed with none of the careful and tedious technology known to their Inca ancestors, Peru's mountain farmers have been forced into large-scale deforestation, overgrazing, overcropping, and drastic reductions in the fallow periods that might allow their depleted soils to regain fertility and resist erosion. Driven beyond the self-defeating practice of burning nutrient-rich dung for fuel, the highland farmers have taken to digging up even the roots of trees and shrubs, greatly increasing the soil's susceptibility to ruinous erosion.

The same calamity afflicts the East African highlands that stretch from Ethiopia through Uganda, Kenya, and Tanzania. In Ethiopia, erosion from the mountain-studded, 2000-meter-high Amhara Plateau that covers most of the country is hardly anything new. Ethiopian silt, carried by the Nile, fertilized Egypt's farmland for centuries before the interposition of the Aswan Dam. Whereas some 75 percent of Ethiopia was once covered with forests that moderated the loss of topsoil, however, recent surveys indicate that substantial forest cover has diminished to only 4 percent of the country. The deforestation is still going on, at an estimated rate of 1,000 square kilometers per year.

Making the Deserts Grow

More than one-third of the earth's total land area is arid or semi-arid desert; at its margins, and in other semi-arid areas, some 60 million people eke out a precarious existence. Even such a small population dispersed over such a vast area, however, is often enough to overstrain the fragile life-support systems of such environments, turning semi-arid areas into true, barren deserts.

The most famous example of "desertification" in modern history struck the Sahel—the southern border region of the Sahara Desert in West Africa—during the early 1970's. A United States Agency for International Development report estimates that during the last half-century some 250,000 square miles of the Sahel—an area almost as large as Texas—has been annexed by the Sahara, no longer capable of supporting agriculture of any kind. On its northern frontier, meanwhile, the great desert is overrunning the one-time North African granary of the Roman Empire, now a chronic food-importing area, at the rate of 100,000 hectares per year.

Whatever the long-term climatic trends may be, it is their short-term variability that sets the stage for human tragedy. During periods of relatively abundant rainfall, the availability of forage encourages farmers to increase their herds right up to the carrying capacity of their pasture lands. Agriculture expands onto marginal soils and grasslands, fallow periods are abbreviated or eliminated to take advantage of the beneficent conditions. Nomadic populations are encouraged to settle permanently around suddenly plentiful supplies of water.

When the inevitable drought comes, the burgeoning desert civilization quickly collapses. The recently enlarged herds devour every last bit of vegetation before they starve. Crops shrivel and die before they can produce food, or even seed for another planting. The dessicated soil, stripped bare and deeply plowed, turns to sand and drifts in the wind. A desert has been created.

The dieback does not spare the human population. Those who survive migrate to some other area, perhaps to begin the cycle again, or they end up in urban misery. Well-intentioned aid for the drought victims often includes deep wells to provide water, the results being, often, a drawdown in the water table and an eventual decline in the water supply, together with an increase in demand for water, the beginning of another tragic cycle.

Remember the Dust Bowl?

The process of desertification can take place on a much larger scale when mechanized monoculture, the agricultural technology of the developed countries, is introduced into fragile, semi-arid environments and replaces the better adapted agriculture of the indigenous peoples. The classic case for Americans is the Great Plains region of the Middle West. In the second half of the 19th century, westering homesteaders began to transform the wild grasslands of what had been called the Great American Desert into a sea of wheat, stretching from horizon to horizon.

When a drought of unusual severity settled in during the late 1920's and early 1930's, the Great Plains had been stripped of their protective cover of closely packed grasses with tight-knit roots. The land simply dried up and blew away. In the spring of 1934, the several successive years of drought culminated in a series of terrible windstorms that blew hundreds of millions of tons of midwestern topsoil in a black cloud all the way to the East Coast and out to sea. The Great Plains was rechristened the Dust Bowl, and no amount of public relations effort could erase the images fixed in the American consciousness by the photographers of the Farm Service Administration and by John Steinbeck's *The Grapes of Wrath*. Only a massive soil and water conservation program, emanating from the White House and extending to every farm, was able to rescue the Great Plains from becoming a sterile desert.

On a smaller scale, perhaps, but at a tremendous cost in human suffering, deserts are spreading in arid and semi-arid areas around the world. In southern Africa, overgrazing and other abuses of semi-arid lands are creating desert environments in Botswana, Kenya, and Tanzania. A long history of land abuse throughout the Middle East, from the Mediterranean coast to Afghanistan, has resulted in reduced agricultural productivity and, in the worst cases, the transformation of once vegetated landscapes into barren dunes. In the Western Hemisphere, new deserts have appeared in parts of Argentina, while the natural Atacama Desert in northern Chile advanced at a rate of up to 3 kilometers per year along an 80- to 160-kilometer frontier, during the dry years of the 1960's.

Clearing the Jungle

Optimists insist that it hardly matters how much marginal agricultural land is lost to deserts, or how many mountain slopes lose their fertility to erosion; there are always the jungles to fall back on. One-quarter of the Asian, African, and Latin American tropics is canopied with lush vegetation, seemingly limitless in its biological diversity and sheer mass. It is tempting to believe that this sparsely inhabited, largely unexploited landscape is a huge reservoir of fertility, needing only a technological key to unlock its riches.

Unhappily, however, the evident fertility of the jungle is deceptive. The ecological fact seems to be that most tropical rain forests are closed systems: almost all of the available nutrients are locked up in the plants, and almost none are held in reserve in the soil; when a plant dies, the products of its decay are quickly incorporated into its successor. Stripped of their natural vegetation and exposed to the heat and rains of the tropics, jungle soils soon become infertile.

The ecological fact of life is that tropical jungles are best suited by nature to hit-and-run agriculture, rather than to the intensive cultivation typical of high-yielding temperate-zone environments. Jungle farmers the world over have arrived at more or less similar systems. A small patch of forest is crudely cleared, leaving the roots and stumps to hold the soil against erosion and promote prompt regrowth when the land is abandoned. The felled trees and undergrowth are burned, fertilizing the soil with their ashes. With little if any soil preparation, the farmer plants a mixture of crops, assuring an extended harvest and maximum yield, and providing continuous cover for the soil. After two to five years of this regime, the land is abandoned to forest fallow for a period of years, as many as 25 or more, to allow the natural flora time to recover. The farmer, meanwhile, repeats the process on other jungle plots.

As long as the game is played by these rules, this kind of shifting cultivation—called "slash and burn" agriculture—can support indefinitely a modest, nomadic population, perhaps no more than one person per fifteen hectares or more. Attempts to establish large populations or fixed agricultural settlements in tropical jungles have often resulted in failure and the degradation of the land. Nevertheless, ambitious attempts are being made in many

tropical countries to impose intensive agriculture on fragile jungle ecosystems.

In eastern Nigeria, the most densely populated part of Africa south of the Sahara, for instance, traditional shifting cultivation has been almost completely replaced by continuous cropping to meet increasing demands for food. The result, reports one expert observer, is that "soil degradation, in terms of the progressive loss of nutrients and breakdown of structure, is well nigh universal. . . ." Meanwhile, in South America, government-sponsored programs to bring vast tracts in the Amazon Basin under the plow have aroused concern among many specialists that the African experience may soon be repeated.

Until quite recently, notes Dr. John A. Pino, director of the RF's Agricultural Sciences Program, "the special technical and social problems posed by fragile agricultural environments have been largely neglected by scientists and policymakers." Yet, while they provide only a small part of the world's total agricultural production, Pino adds, "the fragile lands are indispensable as sources of food, fuel, fiber, and habitat for many millions of people.

"We hope that the RF's long experience in tropical agriculture will be useful in designing approaches to the special problems of farmers in these ecologically fragile areas." The Agricultural Sciences Program is presently planning a series of international conferences, under the direction of Dr. Gary H. Toenniessen, to explore the dimensions of the problem and the possibilities for further RF commitment, to define the critical research priorities, and to identify and bring together the key people who can make important contributions in the field.

Additional Reading:

Erik P. Eckholm, *Losing Ground*, New York: W. W. Norton & Co., Inc., 1976.

Reading 11

Ninety-five percent of the people in rural areas of the Third World depend on firewood for cooking and heating; but indiscriminate tree cutting is disrupting the environment, and collecting the firewood is more difficult as wood becomes scarcer

by ANIL AGARWAL

The Poor Man's Energy Crisis

IN THIRTY YEARS' time, a second India will come into existence as the population of the subcontinent doubles. What stresses and strains will this growth place on the fabric of the nation's life? To try to answer that question, the Indian government initiated in 1974 a series of Second India Studies.

Perhaps the most surprising conclusion of these studies is that although India stands a good chance of being able to grow enough food to feed twice as many people, those people certainly will not have enough firewood to cook it. A poor man's energy crisis, on a massive scale, is emerging.

Mahipal Singh already knew about it. It is one of the reasons that he now lives in Delhi, hundreds of miles from his family. He left his remote Himalayan village years ago because life there had become unsustainable. Today he earns £20 a month, driving a three-wheeled tempo, and sends £3 a month back to his wife. For the first few years he could not return to see his family at all. "To ask for a holiday," he says, "would have cost me my job." Now, he has an employer who allows him a few weeks leave each year to return to his village.

POPULATION GROWTH and the division of land into smaller and smaller plots meant that Mahipal Singh—like a quarter of the population of the Himalayan region of Uttar Pradesh—did not have even the one acre necessary to feed himself and his family.

At the same time the felling of trees—for firewood, for clearing new croplands, and for the timber-hungry industries of India—has disrupted the ecological balance on which the livelihood of the hill people depends. Like 95 percent of the people in the rural areas of all the countries of the Third World, their main source of fuel for cooking and heating is firewood. As wood becomes scarcer—and the daily task of collecting it becomes longer and harder—more and more dried animal dung is used as fuel instead of being returned to the land as fertilizer. In India as a whole, the amount of animal dung now going up in smoke every year is the equivalent of one-third of the subcontinent's fertilizer needs.

Deprived of valuable nutrients, the fertility of the soil begins to fall, and, for people like Mahipal Singh and his family, life becomes even more difficult to sustain. For Mahipal's wife and children, the clearing of the forest has meant an ever-lengthening struggle to provide two of the family's most basic commodities—fuel and water.

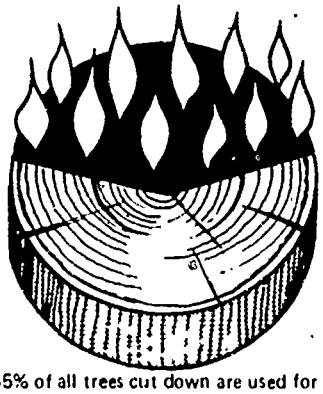
"Once the broad-leaved trees on the hills and hill-tops are gone," explains Mahipal, "the humus, which acts like a giant water-sponge, disappears. The perennial stream in each village begins to dry up soon after the monsoons. I have seen this myself in village after village.

"My wife now has to walk five kilometers for the day's firewood. In fact, she is quite fortunate. Some of the women in other villages have to walk much more than five kilometers for wood and water. At least one member of the family has to devote himself every day to the back-breaking job," says Mahipal.

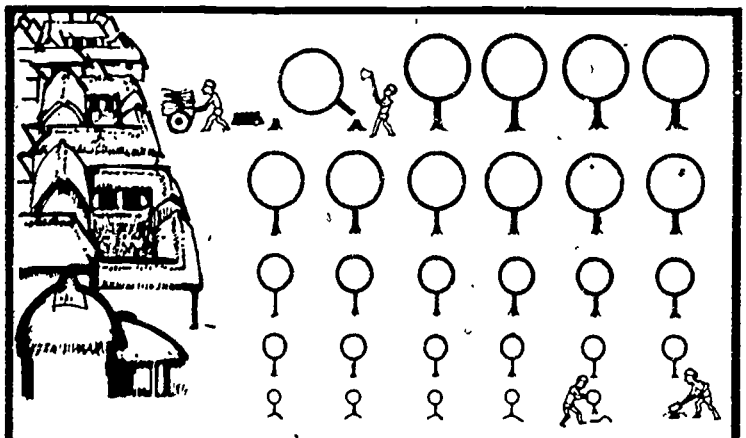
Caught in this pincer movement of land fragmentation and ecological disruption, thousands of people like Mahipal Singh are squeezed out of the hills to join the ranks of domestic servants, the night watchmen, the menial laborers, and the unemployed of Delhi.

IN RECENT TIMES, the hill people have begun to fight for their forests. One of their most successful weapons has been the Chipko Movement led by the popular Gandhian Chandi Prasad Bhatt. Translated literally, Chipko means "to hug the trees," and the slogan is more than metaphoric. When a forest auction is announced, the Chipko supporters move in to stop the destruction by literally hugging the trees. Their most famous victory was won by a group of women who confronted fifty armed men

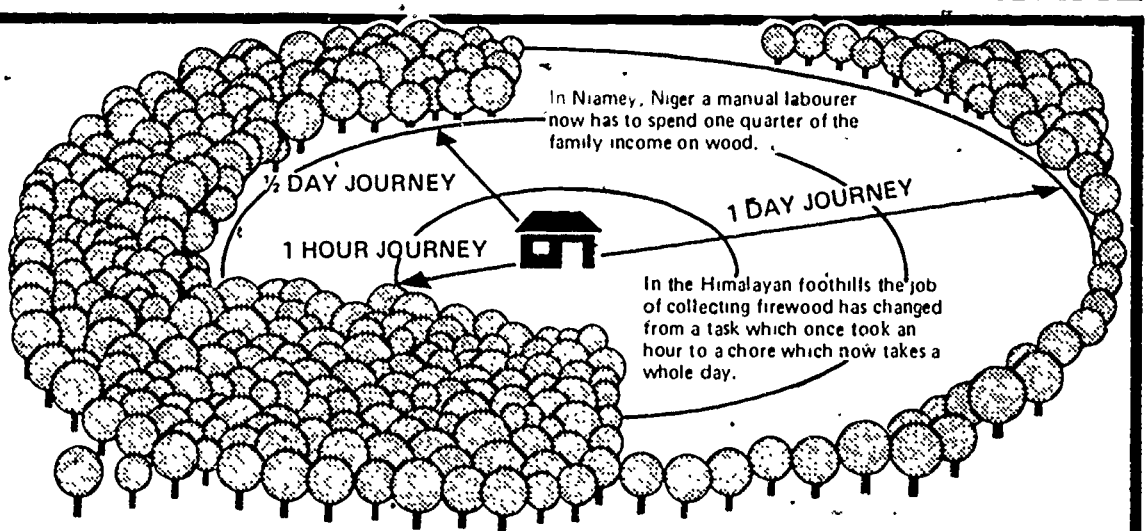
Firewood: The poor man's Energy Crisis



45% of all trees cut down are used for firewood and half the world's people still depend on wood for two of their most basic needs – heating their homes and cooking their food.

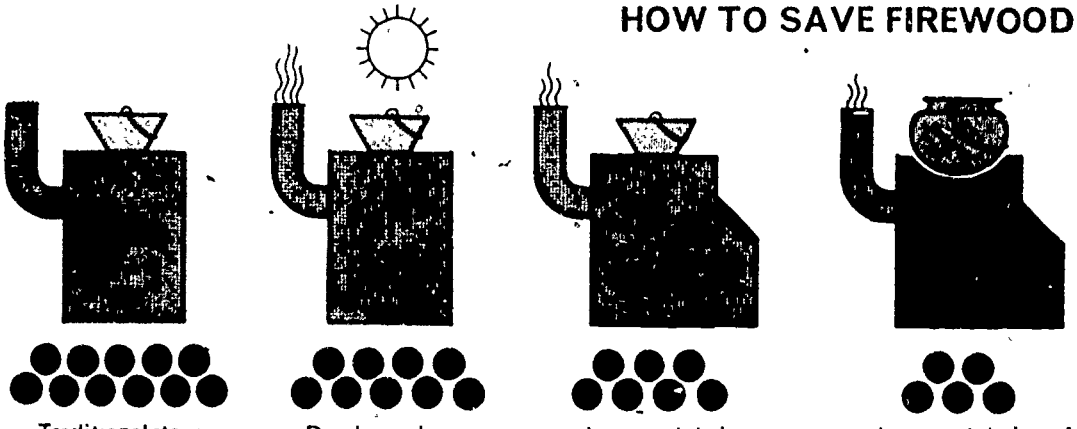


A ten hectare tree plantation could meet the firewood needs of a 1,000-family community in rural India — in a sustainable way (Assuming a 50 per cent increase in the efficiency of firewood use.)



FIREWOOD — the increasing trek to provide a family's fuel

HOW TO SAVE FIREWOOD



Traditional stove: up to 94% of the wood's heat value wasted

Dried wood can cut waste by 10%

Improved design can cut waste by 20%

Improved design of cooking pot can cut waste by 30%

PETER SULLIVAN, SUNDAY TIMES (LONDON)

(Continued on next page)

from a logging company and stopped the destruction of the forest by simply refusing to let go of the trees.

Direct action of this kind eventually won praise from a scientific committee set up by the Uttar Pradesh government. The committee found that felling the forest could cause serious damage to the watershed and ecology of the area.

Mr. Bhatt explains, "We must protect these trees because our entire future is tied up with them. They not only provide us with our livelihood, they also give us our water and food systems. Cut these trees, and our streams will dry up. The climate will change. Soil erosion will increase, and productivity of our lands will fall."

The Chipko leaders argue that the destruction of their forests is also bad for the national economy. The soil erosion caused by felling trees could bring about serious flood and silting problems in major rivers like the Ganga, which passes through some of the most densely populated areas of India.

In some parts, the Uttar Pradesh government has accepted Chipko's demand that no forest should be auctioned for the next five years at least.

Chandi Prasad Bhatt and his followers are illiterate and semiliterate rural people. But the billboard they have erected in Gobeshwar, headquarters of Chipko, is a scientific statement: "One oak tree draws in 400 hundred gallons of water each day from the atmosphere. Cut one oak tree, and the rivers and streams will lose 400 gallons of water. Forests are not merely for beauty, our entire food systems are dependent on them. If ever it becomes necessary to cut a tree, remember three new saplings will have to be planted to make up the damage. Avoid cutting one tree, or else plant three new trees."

The aims of the Chipko Movement go beyond simply preventing the trees from being cut down. "The trees are our only resource base," says Mr. Sundaral Bahuguna, another Gandhian leader in the area. "The state must develop an enlightened forest policy. But to do that, it must first have a well-defined people's policy so that the two can be properly integrated and our area can have economic advance without environmental damage. Either policy in isolation will bring disaster. A farmer who owns less than half an acre is quite understandably going to look upon the forest lands with a hungry eye —and indiscriminately chop them for fodder and firewood."

The Chipko Movement has its own plan to meet this problem. It wants more opportunities for employment outside agriculture—based on appropriate technology, forest farming, food orchards, and small one-to-five-kilowatt systems of electricity generation using the abundant hydropower. They also want small-scale industries based on forest products so that the local people, instead of earning a pittance as lumberjacks, are able to process the timber to at least a semimanufactured stage before they export it to the plains and the cities. They feel that the forest should be auctioned in small lots so that they could afford to bid for them—and that these cooperatives should also be responsible for replanting the area.

In this way, an entire new range of employment opportunities could be opened up and the area could become self-reliant. With the increase in purchasing power from employment in small-scale industry, the hill villagers could afford to invest in cooking and heating systems based on electricity and solar and wind power, reducing their dependence on firewood and so helping to reserve the trees.

But until that happens, says Mr. Bhatt, "appropriate technology should help us to develop small and cheap devices for carrying firewood so that we can reduce the drudgery of our lives. Otherwise who will ever have the time to invest in economically productive activities?" ■

DILEMMA 6:
"In Need of Wood and Forests"

Sandie, a thin, gangly girl of 14, struggles up to the steep mountain slopes towards the distant public forest to cut firewood. Today it is more important than ever for her to bring back a large supply of wood. Ever since her father left their small family farm and moved to the City to work as a porter, it has been Sandie's job each day to gather firewood from the distant mountains for cooking and heating. This task grows harder each day because she has to go further and further before she can obtain enough wood for her family's needs.

As Sandie hikes past the nearby government forest preserve, she greedily eyes the strong sturdy stands of trees. The thinks to herself, "My task will be so much easier if I could only cut those trees!" She will also be able to bring back some extra to sell. Her youngest brother is seriously ill, and money from the sale of extra wood will mean money to buy medicine and purchase a small piece of meat for her brother's dinner. However, she knows that it is against the law to take trees from this forest. This forest preserve is part of the government's project to restore the mountain forests that are rapidly disappearing because so much wood is needed by the village people for cooking and heating. Anyone who is caught chopping here will be severly punished.

Sandie has seen the forest ranger leave the day before for a meeting in the city and knows that he will be gone for several days. She muses, "Perhaps today I will cut one tree and suprise mother with a truly large bundle of wood! Then I will be able to buy some medicine and food for brother."

Should Sandie cut a tree from the government forest? Why or why not?

DISCUSSION QUESTIONS

- Should the fact that her brother needs food and medicine be an important consideration for Sandie? Why or why not?
- Should Sandie disregard the law in this situation? Why or why not?
- What might happen if everyone decides to cut wood in this forest?
- Cutting down forests can lead to erosion and drought. Should Sandie be concerned about this effect? Why or why not?
- Does the need for food and heat give one the right to steal? Why or why not?
- If you were Sandie, what might you do? Why?
- When Sandie's father left to work in the city, Sandie became her mother's main helper. What should be Sandie's responsibility as the eldest in the family? Why?
- Would Sandie be acting responsibily if she takes wood from the government forest? Explain your answer.
- Sandie's family might endure greater suffering if Sandie were caught and punished. Should she think about this possibility before she decides? Why or why not?
- Since wood is the only fuel available to many people, is it right to prevent them from denuding the forests? Please explain your answer.

Reading 12

Excerpts from Off-Road Vehicles On Public Lands

by David Sheridan

PART 1: The Issue

GROWTH OF A PHENOMENON

Thus far, development and production of off-road vehicles has moved faster than our regulatory, management and legislative machinery

J.R Penny,
California State Director,
Bureau of Land Management,
1971

It began, oddly enough, in a bomb-shattered section of Hamamatsu, Japan, in 1947. There, in a board shack, Soichiro Honda, a 41-year-old mechanic and college dropout, removed a small motor from a war surplus field generator and strapped it to a bicycle. He sold enough of these improvised motorbikes to exhaust the supply of surplus generator engines. He was soon designing his own motorbike and motorcycle. Throughout the 1950s, Honda and his employees advanced the art of making and selling lightweight, high performance, and economical motorcycles.

By 1960, Honda was marketing in the United States a 50 cc motorcycle for less than $300 when most motorcycles cost $1,500 or more. People riding the Honda "dream" machine could travel 55 miles per hour for 180 miles on 30 cents worth of regular gas. Or, if the spirit moved them, they could cut off the road and drive the open countryside, unlike the big motorcycles being built by American, British, and German firms at the time, the Honda was light and durable enough to take over rough terrain, and unlike the motorbike, it was powerful enough. In 1961, the director of a prominent British motorcycle manufacturer reported: "When we stripped the machine (Honda), frankly, it was so good it frightened us. It was made like a watch and it wasn't a copy of anything." By 1971, Honda had captured over half of the growing U.S. motorcycle market.

But Honda's success involved much more than good technology. Honda recognized that if large numbers of Americans were going to buy a motorcycle, it would be for recreation rather than transportation. The trouble was that motorcyclists had a bad image in the United States. The public mind associated them with leather-jacketed thugs such as the Hell's Angels. Hollywood reinforced this image with popular movies such as "The Wild One" (1953), starring Marlon Brando. So Honda mounted a massive advertising campaign, depicting well-scrubbed, respectable people riding motorcycles for the pure fun of it. In 1964 and 1965, Honda cosponsored the Academy Awards ceremonies on national television. Never before had a motorcycle sales pitch been made to such a broad audience. There they were, youthful, definitely middle-class Americans climbing on their motorcycles and barreling down highways, which always seemed to be empty, and down lonely country roads and crossing fields, splashing through streams, and hurdling hilltops.

Motorcycles took hold fast in the 1960s. At the beginning of the decade, there were fewer than 400,000 registered motorcycles in the United

U.S. Government Printing Office, Council on Environmental Quality, 1979.

States. Registrations jumped 279 percent during the next 10 years, compared to a 40 percent rise in automobiles. By 1976, there were 8.3 million motorcycles in use in this country. Some 5.4 million, or 66 percent, were used off-road at some time. Honda still ranks first, with 38 percent of the market, but today there are more than 50 motorcycle manufacturers and hundreds of different models. The Japanese dominate the market—Yamaha, 20 percent; Kawasaki, 17 percent; and Suzuki, 12 percent. Harley-Davidson (U.S.) has 7 percent; BMW (German) and Triumph (British) less than 1 percent.

Today's motorcycle advertisements stress either the sex appeal of youthful motorcyclists—male or female but usually male—or wholesomeness of the family-oriented, outdoorsy motorcyclist. In the latter category, a recent Suzuki ad is fairly typical. It shows a man, a woman, and a young boy all riding their own Suzukis along a dirt trail against a green backdrop. The headline reads: "How to beat around the bush with your family." And beneath this is the copy:

> Just put your gang on Suzuki's DS trail bikes. And head for the boonies. Doesn't matter where you go. Peaks or valleys, it's all the same to these rugged off-road machines. Tractoring up a hillside or going flat-out on a dry lake is no sweat. [T]hese fun-bikes are very affordable. Which means your family can beat around the bush without beating up the family budget.

In a recent Kawasaki ad, three young women and two young men relax in a woods clearing. Their Kawasakis are parked around them. Behind a tree in the background, a black bear peers out. The headline reads: "Does a Kawasaki go in the woods?" The copy has a familiar ring:

> It's a jungle out there. And sometimes it's a desert. Or a mountain pass. Or just a cow trail. But it's all home to us. Kawasaki enduro bikes are built to cope with the only thing you can expect in the boonies. The unexpected. Whether you're a pro. Or just a babe in the woods.

The refinement in the 1950s in Germany of the relatively light, 2-stroke internal combustion engine which produces more horsepower per pound of engine weight than the traditional 4-stroke engine made the mass production of snowmobiles practical. Heretofore, snowmobiles had been large, expensive, and custom made for special uses. J. Armand Bombardier of Quebec seized the opportunity and built the first commercial snowmobile. In 1959, Bombardier, Ltd., sold 259 vehicles. Other manufacturers soon joined the field and business boomed. In the 1968–69 season, some 265,000 were sold throughout North America; the 1970–71 season saw sales of 572,000. The snowmobile explosion had ignited. Today, there are an estimated 2.2 million snowmobiles in operation in the United States and about 1 million in Canada.

These machines spread swiftly throughout the snowbelt, especially in the smaller cities and towns. An elaborate advertising effort to stimulate demand was not necessary—apparently a built-in demand already existed. The snowmobile soon became *the* social outlet during the long winter, *the* business venture in such places as St. Johnsbury, Vermont; Boonville, New York; Eagle River, Wisconsin; Fergus Falls, Minnesota; Ironwood, Michigan; and West Yellowstone, Montana. "These are the towns that froze up and shut up back in the old days." In fact, the snowmobile's popularity advanced so rapidly that the carcasses of wornout and abandoned snowmobiles became a more common summertime sight in the rural northland than junked cars.

The phenomenal growth in motorcycles and snowmobiles peaked in about 1973. Since then, new registrations have either declined from the previous year or increased more gradually than before 1973. The absolute number of motorcycles and snowmobiles in operation continues to rise, however.

Figures on other types of off-road vehicles are less certain. There are probably about 250,000 dune buggies in operation in the United States. The number of four-wheel drive vehicles (4x4s) is not known, but there certainly must be more than 3 million. Of this number, perhaps half are used regularly for off-road driving. Other off-road vehicles include half-tracks and air boats (for swamp travel), all terrain vehicles, and minibikes (not included in the motorcycle figures). All together, there are probably 10 million off-road vehicles and snowmobiles in the United States today. Of course, conventional vehicles such as automobiles and 2-wheel drive pickup trucks are driven off-road at times as well. The focus here is on those vehicles whose primary purpose is off-road travel.

Four-wheel drive vehicles are the hottest items on the ORV market today. In the last 4 years, the sales of American-made 4x4s have increased 96 percent, with 776,808 sold in 1977. Mass media advertising of 4x4s has expanded, too, and it has followed the path blazed by the motorcycle industry. The vehicle's ability to scale hills, cross streams, and traverse rough open land is trum-

peted. In a current television ad for an International Harvester Scout, for instance, we see this big machine perform remarkable feats. It makes 90 degree turns at full speed on loose dirt—throwing up a cloud of dust in its wake. It wades through axle-deep water. It ascends steep, boulder-strewn slopes. It even jumps the crests of hills, with all four wheels actually leaving the ground. A current Dodge truck commercial shows its vehicle in a somewhat less acrobatic light than the Scout but capable of just as much environmental havoc—churning up soils on wet hillsides, plowing through wild streams, etc. In another TV ad, a 4-wheel drive Subaru chases mountain sheep across a rocky landscape.

From the standpoint of public land management, the initially important characteristic of the motorcycle, 4x4, and snowmobile boom was that it struck without warning. Recreational planners and economists who specialize in the use of natural resources for recreation did not anticipate the phenomenon; nor did they fully grasp its far-ranging significance once it was underway. For example, in Resources for the Future's *Land and Water for Recreation*, published in 1963 and considered the *magnum opus* on the subject, there is no mention of these vehicles nor recognition of the very difficult land use conflicts which their use entails. Motorized recreation is not included in the Bureau of Outdoor Recreation's (Department of the Interior) *Selected Outdoor Recreation Statistics*, 1971, not even in the section on projected recreation activities through the year 2000. The Department of the Interior's *Outdoor Recreation*, the first nationwide outdoor recreation plan, released in 1973 with considerable fanfare, barely mentions motorized recreation.

In other words, the public land managers were ill prepared for the onslaught. This was particularly unfortunate because over half of all the off-road motorcycle, 4x4, and dune buggy driving in the nation takes place on federal land. Indeed, over half occurs on land managed by one federal agency—the Bureau of Land Management (BLM).

According to a recent survey commissioned by the Heritage Conservation and Recreation Service, some 43.6 million Americans engaged in some form of ORV activity in 1977, including snowmobiling. Although this statistic, along with the others previously cited, is certainly impressive, it is important to keep it in perspective. Motorized recreationists represent 25 percent of the population. Motorized recreation now surpasses some more traditional outdoor activities such as sailing—19.1 million or 11 percent of the population—and yet hiking with a backpack is more popular than motorized recreation—48.1 million or 28 percent. Walking or jogging attracted 116.1 million, or 68 percent of the American public. Or to look at a specific activity: some 13.8 million Americans (8 percent) went snowmobiling, more than went downhill skiing, for example—11.9 million or 7 percent—but a traditional wintertime activity, sledding, attracted 35.5 million people (only persons over 12 years old were counted in the survey), or 20 percent of the population. Moreover, snowmobiling is no longer the fastest growing wintertime recreational activity; cross-country skiing is, and some recreational planners expect that it might surpass snowmobiling in popularity within the next decade, although it still accounts for less than 1 percent of the population.

In sum, motorized recreation continues to grow but within a social context that features the growth of many other recreational activities, new and old. Americans appear to be spending an increasing proportion of their leisure time outdoors. They are riding off-road motorcycles, 4x4s, and snowmobiles more than ever, but they are hiking more than ever as well. Motorized recreation is riding the crest of an even larger wave—recreation.

ORV BENEFITS

Dirt biking is the last haven for those contemporary young men and women who feel that golf and bowling and television baseball are poor excuses for exercise, a boring and feeble kind of fun.

Lee Gutkind, writer
and motorcyclist, 1973

For many ORV users, the ORV experience presently provides the *only* method by which they can escape the tedium of modern urban living. Frequent escape from urban existence is a necessity that many people find essential to maintaining a reasonable standard of mental health.

R.D. Morgenthaler,
President, Trail Division,
Northwest Motorcycle
Association, 1976

Motorized recreation gives pleasure to millions of Americans. That is its greatest benefit. There are also certain economic benefits derived from

ORV and snowmobile recreation. For the most part, these benefits accrue to the people and firms who make the equipment and those who sell them. In addition, communities in areas which attract riders enjoy a certain influx of dollars. For example, gas stations, restaurants, and motels in communities such as Gorman, California, or Webb, New York, benefit from money spent by people who visit those areas for motorized recreation. The overall economic benefits of this recreation have never been determined. In considering the national economic benefits of motorized recreation, we have to remember that large numbers of ORVs are imported and therefore represent a negative factor in the nation's balance of payments. A few efforts have been made to assess the regional economic benefits of motorized recreation.

One study of ORV and snowmobile economic impacts in the Upper Great Lakes region (Minnesota, Wisconsin, and Michigan) concluded that "the current state of knowledge is still too fragmented and contradictory to make economic analysis at the regional level possible." The authors did observe, however, that within the upper tier of counties in the region, a prime snowmobiling area, "[p]eople are spending hundreds of millions of dollars in the enjoyment of this new form of recreation. The increase in the overall level of business activity is modest, but significant, especially in a region which is concerned about a lack of employment opportunities and slow economic growth. . . . Snowmobiling is particularly interesting. . . . This activity utilizes many facilities, including everything from eating establishments to recreation land, which would otherwise be only infrequently used . . . and occurs at a time when seasonal unemployment is likely to be highest."

What is it that people enjoy about motorized recreation? When asked this question in polls, ORV enthusiasts most often answer: family togetherness, escape from civilization, and comradery with their fellow ORVers. Surveys in the field have demonstrated that the majority of ORV recreationists are with members of their family. ORV enthusiasts also say that the "sights, sounds, and smells of nature" are important to them. For example, in one California survey, off-road motorcyclists consistently expressed an appreciation for the beauties of nature. ORVers, however, do not value solitude and quiet as highly as non-ORV recreationists, especially hikers. The nature of the ORV experience seems to be less contemplative, less aesthetic and more gregarious, more visceral, although ORVers appear to share with hikers and other nonmotorized recreationists a desire to get away from confining jobs and urban life and into wilderness and open spaces.

According to a theory at least as old as Immanuel Kant, a purely aesthetic experience is possible only in the presence of something which provokes no reaction other than contemplation. By this measure, ORV riding is not primarily an aesthetic experience—its pleasures lie elsewhere.

Perhaps, though, this is too narrow a perspective. A trail bike rider in a forest, for example, may stop to enjoy the sight of a mountain waterfall before barreling up a 20 degree incline for the sheer muscle-throbbing sensation of it. To him, it is the combination of the two different experiences which make trail riding pleasurable. Another off-road motorcyclist may be content to roar about in an abandoned quarry doing "wheelies," figure eights, and so on, completely oblivious to his natural surroundings. A four-wheel drive owner may take his vehicle off-road solely as a means of transport into the backcountry for hunting or fishing. For him, the trip itself in the 4x4 may be simply a matter of getting from here to there and back as quickly and conveniently as possible. The rewards and motivations of ORV riding or snowmobiling are sufficiently varied that one should be wary of the generalization of social scientists who seek to pigeonhole the experience.

It is true, however, that popular authors who have sought to evoke the joys of ORV and snowmobile riding have emphasized the physical sensations of the experience. Sally Wimer, for example, wrote:

> Use your body to maneuver your machine up the side of a mountain or around a sweeping turn. It's the skill of the driver that makes the snowmobile perform, makes it glide and drift and speed.
>
> It's maneuvering the snowmobile that makes you feel young, that gives you a new involvement outside of yourself and your work.

Author Lee Gutkind provides this account of an off-road motorcycle romp near Red Lodge, Montana:*

> Suddenly, he was flying and his shoulders were so light he could hardly feel them. The Indian [a brand of motorcycle] bellowed as it bounced over the sage, and folded down the yellow grass on either side of the wheels.

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. . . He felt the breath of the wind. He felt the hard rubber handle grips scratch his palms. . . . He jetted off across the prairie for a while, breathing in the red dust that the wind and his wheels were kicking up, and then coughing it out again. He trampled the sagebrush at first and then started playing loop games around each clump. . . .

Before he knew it, he had run into some "whoop-de-do" jumps—a series of brief hills, about 25 feet apart. He cranked on, climbed the hill, and disconnected from the ground, landing about four or five feet down on the other side of the next hill. He stood up on his pegs and wedged his hands tightly against the handlebars, so that his arms shot straight out from the handgrips, and cranked it on some more. Each time he hit the top of a hill, his wheels left the ground and his stomach ricocheted into his throat. . . . [H]e saw himself streaking through the sky, floating silently through that part of the universe where there was no gravity nor civilization to build gates and tall buildings or concrete roads.

The hills ran out and he was over the prairie again, grounding down the sagebrush with the wheels of his machine.

When ORVers are asked what kind of terrain they prefer, they invariably say hilly and rolling terrain. More than anything else, they like land that will challenge them and their machines; land that is varied and allows the greatest freedom of movement.

In considering the benefits of ORVs or of the nonmotorized forms of recreation with which ORVs sometimes clash, this report takes the view of the National Academy of Sciences 1968 Conference on Recreation: "[T]he traditional view that human activities in the pursuit of recreation are a form of indulgence having marginal status among the concerns of society is no longer tenable." In other words, recreation is a basic human need.

The verb "recreate" comes from the Latin *recreare*, which means create anew, restore, refresh. In more primitive societies, fulfillment of this need is woven into the very fabric of everyday life so that it becomes an unconscious part of almost every human activity—food gathering, healing, worship, decisionmaking, etc. The more advanced a society becomes, as sociologist Jacques Ellul has observed, the more each human activity becomes rationalized, that is, it is made a separate entity and consciously structured to achieve a primary purpose. In such a society, therefore, specific times have to be set aside to recreate so that this human need does not interfere with the fulfillment of other social functions, especially economic ones.

The Industrial Revolution greatly accelerated this process of specialization. In so doing, it created an even greater need to recreate. As Karl Marx warned, "Constant labor of one uniform kind destroys the intensity and flow of a man's animal spirits." Even the drudgery of farm work afforded a person some variety and therefore some refreshment. Factory and office work offered almost none. But the Industrial Revolution actually reduced the time available for recreation. With increasing prosperity and labor militancy, however, this situation began to change, at least within the United States. More time was allotted to refresh human "strengths and spirits after toil." The problem then became how to fill that time.

ENVIRONMENTAL COSTS

The widespread use of off-road recreational vehicles (ORVs) is causing significant impacts on the nation's land and water and its native plants and animals.

The Geological Society of America, 1977

ORVs have damaged every kind of ecosystem found in the United States: sand dunes covered with American beach grass on Cape Cod; pine and cypress woodlands in Florida; hardwood forests in Indiana; prairie grasslands in Montana; chaparral and sagebrush hills in Arizona; alpine meadows in Colorado; conifer forests in Washington; arctic tundra in Alaska. In some cases, the wounds will heal naturally; in others they will not, at least for millennia.

Remnant wild and semiwild areas near urban environments in the West have been particularly hard hit by ORVs. One scientist reports: "The desert countryside in the immediate vicinity of the Las Vegas and Phoenix airports is marked with ORV tracks that look like a tangled skein of yarn. From the air, hillsides, vacant lots, streamborder growth, and other patches of nature are becoming scarred with ORV trails. Nearly every town now in the West seems to have its motorcycle shop and scarred hills and valleys."

Federal lands have borne a disproportionate share of the damage. State lands are far less extensive; in addition, some states have either prohibited ORV use on their lands (Indiana) or have restricted their use to designated trails (Massachusetts). And the federal government has been more willing to open the lands which it manages for the American public to ORVs than

have private landowners. For example, in Texas public land is relatively rare, so tens of thousands of Texans travel 2 or 3 hours to New Mexico, where public land is abundant, in order to drive their ORVs. In southern California, private landowners in San Bernardino and Riverside Counties successfully lobbied for ordinances requiring ORVers to get their permission before riding on their land. No such requirement exists on the BLM-managed land in these counties. Similar ordinances have been passed in counties in the snowbelt. The National Forests in the region, however, are open to snowmobiles unless otherwise designated, which means in most cases that they are open.

Off-road motorcyclist Thierry Sagnier notes that "virtually every county, every area, and every town that sells motorcycles has at least one if not more 'secret places' where bikers and others trash their machines in relatively wild abandon, heedless of any threat save that of an occasional police raid when the noise gets too loud for the good citizens." If the area is in the West, then the place is probably not very secret, and more likely than not it is publicly owned land. In the East, it is probably private and the bikers are probably trespassing.

The Destruction of the California Desert

Once an inhospitable wasteland to early explorers and settlers, the California Desert now is a recreation mecca for millions of Americans. The paradox is not yet fully understood, even by Federal agencies attempting to manage those arid lands. [I]t is the use of off-road vehicles that generates most of the enjoyment, most of the accidents, most of the economic spin-off.

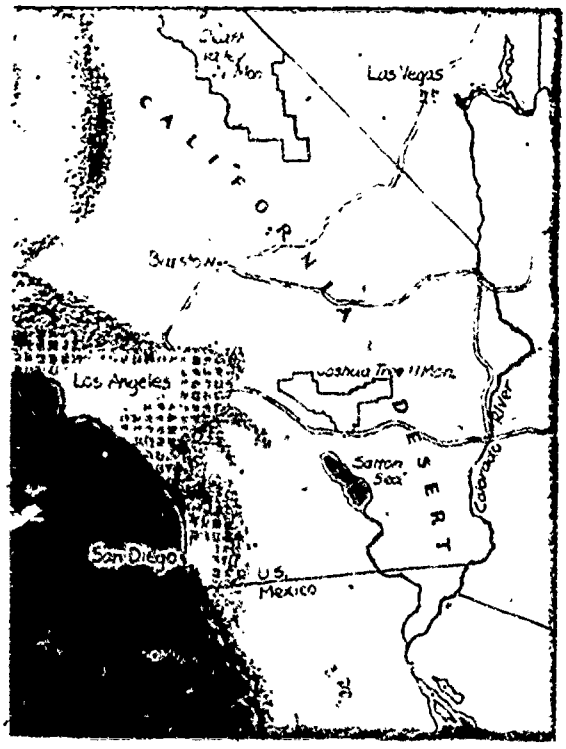
Jerry Harrell, "Desert Lands Serve Many Needs," *Our National Resources The Choices Ahead* U.S. Department of the Interior, 1974

Dove Springs Canyon is not an exception. ORVs are tearing up other places in the California Desert. Jawbone Canyon, Johnson Valley, Stoddard Valley, Horse Canyon, Sage Canyon, Rainbow Basin, the Spangler Hills, Rand Mountains, the Ricardo fossil beds, the Salton Sea marshes are some of the places scarred by motorcycles, dune buggies, and four-wheel drive vehicles.

The California Desert was the first area in the United States to feel the full brunt of the ORV explosion. For this reason, and because the federal government has presided over the degradation of perhaps one million acres of the desert's land, the fate of the California Desert will be examined in some detail here.

Twenty-four million acres of land—mountains, basins, dry lake beds, hills—11 million of which are Natural Resource Land owned by the public and managed by the BLM. That is the California Desert. The term California Desert is administrative rather than geographical. Congress has designated this area the California Desert Conservation Area. In reality, the desert stretches east beyond the California state line and the Colorado River into Nevada and Arizona and south beyond the Mexican border into Baja.

The California Desert represents one of the largest, relatively unbroken sections of wild land in the United States outside Alaska. It is also at the back door of one of the nation's largest urban sprawls—the Los Angeles-San Diego megalopolis, population about 11 million. On any weekend when the weather is not too hot, literally tens of thousands of ORV enthusiasts fan out from Los Angeles-San Diego and environs to play on their machines. Some of the



desert's choicest spots are within an hour or two drive.

The California Desert possesses a remarkably rich and varied animal and plant life. As the description of Dove Springs Canyon suggests, it is not the dead wasteland so often associated with the word "desert."

Actually, the California Desert Conservation Area is two major desert types. the lower third is a Sonoran or low desert and is referred to as the Colorado Desert, the upper two-thirds is the Mojave or high desert. The Colorado Desert generally stays warmer in the winter due to its lower elevation and southerly location. It features such vegetation as the fan palm. smoketree, palo verde. ocotillo, teddybear cholla cactus. (The vegetation found in Dove Springs Canyon is typical of the Mojave.)

When scientists grew concerned about ORV damage to the California Desert in the early 1970s, they began to document the effects of ORVs on the desert environment. These efforts are now bearing fruit. Although more research remains to be done. an impressive body of facts is accumulating.

The question that scientists are asked most often in the field by ORV enthusiasts is: "ORV damage? So what? This land isn't good for anything else anyway."

And that is where the ORVers are wrong, say the scientists. The desert is good for something, many things, as a matter of fact.

To begin with, the desert contains an invaluable storehouse of genetic information which humankind can ill afford to lose. The different plants and animals found in the desert are the result of a millenia-long struggle for survival under very harsh circumstances. In addition, these species have undergone genetic modification in isolated ecological systems within the desert—in springs, stream remnants, oases, playas, and sand deposits. Dr. Robert Stebbins likens the desert's isolated ecological systems to a series of archipelogos, each possessing its own distinctive characteristics and biota.

"Perhaps some of the desert grasses harbor genes potentially useful in breeding disease-resistance or other desirable traits. perhaps the ability to grow in salty soils, into our cereals," says Stebbins. "The Indians gathered the seeds of the desert rice grass. What may be the potential of the many plants and animals that have not been studied?"

Just 5 years ago a new species of lungless salamander was discovered in the California Desert—only the second desert salamander ever found. Preliminary study suggests that this discovery will clarify the origin and evolution of the largest group of living salamanders. Study also indicates that the species or its ancestor may have been living in this area in the Miocene age, 70 million years ago, before the major upthrust of the Sierra Nevada and the formation of the desert.

Stebbins, a zoologist, a curator at the University of California at Berkeley's Museum of Vertebrate Zoology, and author of the renowned *Field Guide to Western Reptiles and Amphibians*, states that the desert and its adjoining arid lands "rival the famous Galapagos Islands in their potential for shedding light on evolutionary processes."

The California Desert is also a place of extraordinary beauty. The aesthetic values of many different locations in the desert have inspired visitors for years. Consider, for example, Stebbins' description of the Imperial Sand Hills after runoff water from storms in the nearby Chocolate Mountains has formed ponds hundreds of feet across and several feet deep:

> The water brings forth a surge of life. . . The ponding area is a biologist's paradise. The stark, buff-colored dunes and stands of yellow-green paloverde are reflected in the glassy waters. There are giant creosote bushes reaching heights of 12 feet. The waters soon teem with fairy shrimps and spadefoot tadpoles. At this time, birds from the Salton Sea to the northwest drop in and one may witness the charming sight of long-billed curlews and other water birds moving about among the dunes as they work the edges of the ponds. I have travelled many parts of the world, but have found no place more fascinating.

Ecologist Raymond Dasmann has pointed out that the desert's very starkness gives it the sharp outlines and vivid colors not to be found where the influence of running water has smoothed the landscape and the humidity of the air has modified the clear tones.

In prehistoric times, the California Desert was a lush savannah with broad lakes, and today it contains a wealth of fossils. Paleontologists have unearthed prehistoric camels, sabre-toothed cats, three-toed horses, and other species from the desert's fossil beds. Indeed, fossil mammal discoveries from the desert have played an important part in establishing a correlation between North American and European fauna of the Pleistocene age, 65 thousand years ago.

The desert is also rich in archaeological re-

sources. Artifacts of human occupancy can be traced back about 12,000 years. There are hints that man may have been present 50,000 to 80,000 years ago. The desert contains the largest concentration of prehistoric art anywhere in the world, including petroglyphs (carvings on rock), pottery, and intaglios, the rarest form of prehistoric art. People living in the desert thousands of years ago created vast designs (intaglios) by scraping aside a layer of dark pebbles at the surface and exposing lighter material beneath. Some of these intaglios are geometric designs or mazes—up to 2 miles in diameter; others are human and animal figures, the longest of which is 489 feet. Almost all the desert's known intaglio sites have been crosscut by ORV tracks.

ORV riders have caused serious damage to the other cultural resources of the desert as well. Vandalism of other archaeological sites has accelerated with the onslaught of ORVs because of the increased access to remote areas these machines provide. Petroglyphs are being carried off as souvenirs.

ORVs are also obliterating the surface evidence which both paleontologists and archaeologists rely upon in searching for new sites. A small bone fragment wedged between two rocks or a tiny shell lodged in a sedimentary rock face may be the clue which leads to further discoveries. Indeed, if ORVs had gotten to Olduvai Gorge in Tanzania before Dr. L.S.B. Leakey, we might very well know a good deal less than we do today about prehistoric man.

ORV damage to the desert's natural resources, in a relatively brief time—less than 20 years—has been great. Geologist Dr. Howard Wilshire of the Geological Survey estimates that ORVers have scarred perhaps 1 million acres of public land in the California Desert. By comparison, it took strip miners a century and a half to "orphan" 2 million acres of land across the entire country.

Desert soils have proven exceptionally vulnerable to ORV attack. The soil breaks down very rapidly under ORV tires on desert slopes. They do not have to be very steep either. Wilshire reports that even flat surfaces denuded by ORVs are vulnerable to accelerated erosion because wind erosion is independent of slope. Many desert soils are fairly loose to begin with, and as soon as ORVs strip away the vegetative cover, they become very susceptible to wind, water, and mechanical erosion. In some spots, such as

Intaglios, Blythe, California

Jawbone Canyon, ORVs have completely removed the thin soil mantle and now they are actually quarrying the more pliable forms of bedrock.

In some flat areas of the desert, a thin layer of rocks of varying sizes called "desert pavement" protects the soft, fine-grained materials underneath from wind erosion. But the desert pavement cannot withstand more than one or two passes by an ORV. ORVs also demolish

the crust which forms over many other nondisturbed parts of the desert, exposing the fine soil particles underneath. This desert crust is created after rains or flooding when the surface soil particles bind chemically together. Where organic material is sufficiently great in the surface layers, fungal filaments further bind the soil particles. Other biological components of the crust may include algae and lichens.

Desert winds attack these exposed soils. Some dust pollution in the air is, of course, natural, especially during periods of high wind. However, man's disruption of the desert surface greatly increases the dust in the air. For example, a 1-day motorcycle race across BLM land in 1974 produced more than 600 tons of airborne dust.

Analysis of a satellite photograph of the western Mojave shows that ORV-denuded land is now one of the sources for dust storms in the region. The photograph, taken on January 1, 1973, a day which featured a strong Santa Ana wind, showed six dust plumes in the western Mojave. Investigating these plumes to locate their sources on the ground, researchers found that in each case the dust originated from "man's destabilization of the natural surface." Each plume was traced to a specific dust source: roadbuilding in one area, stream channelization in another, and so on. One of the dust plumes came from a 10-kilometer-long area along the south edge of El Mirage Dry Lake to the south tip of the Shadow Mountains—an area "severely destabilized by off-road vehicle activity," that is, the plants which anchored the fine grained surface material had been destroyed by ORVs.

Dust pollution poses a number of problems. It damages crops and property. It reduces visibility and therefore the aesthetic value of the desert. It is considered a health hazard because it aggravates certain respiratory ailments such as allergic bronchitis and asthma. In cases where ORVs expose soil and rock with a high asbestos content to wind erosion, which has happened in at least one semiarid area in the San Francisco area, then dust pollution could potentially be carcinogenic. Another possible health hazard associated with dust pollution in the California Desert is valley fever or coccidioidomycosis. This sometimes fatal lung disease is caused by a dust-borne fungus which is endemic to much of the desert.

Desert land heals slowly. Some of the tracks made by General Patton's tanks and jeeps in the eastern Mojave during training maneuvers more than 35 years ago are still clearly visible. Even the paths cut by the wagons of pioneers more than a hundred years ago can still be seen today in the north Mojave.

So long as ORV use continues in a particular area, the native vegetation does not recover. Once ORVers abandon an area, as they eventually do, the plant life slowly returns *if* there is at least some soil mantle left in which to sustain life. However, it is not the native vegetation, for the most part, which comes back. It is the noxious weeds such as Russian thistle or tumbleweed. A specific area may have once contained a number of different grass and shrub species, but one or two invaders (weeds) dominate the recovery, and once established, the invader species push out the remaining native species which survived the ORVs. Thus, a complex plant community gives way to a highly simplified one.

F.R. Fosberg, curator of botany, U.S. National Museum of Natural History, and a recognized authority on alien plant species, has warned the BLM that "unless you are in favor of changing the character of the vegetation, and hence of the whole landscape of the desert areas under BLM jurisdiction . . . you must limit vehicular traffic to established roads and open the desert areas only to hiking and other less ecologically destructive forms of recreation."

The damage done by ORVs to desert vegetation is well documented by R. Bruce Bury, Roger Luckenbach, and Stephen D. Busack in work sponsored by the Fish and Wildlife Service. Examining 16 sites in the desert, Bury et al. discovered that "moderate" ORV use reduced the shrub biomass by about 50 percent; in heavy use areas shrub biomass declined 70 percent. In those areas where ORV users congregate, parking their trucks, cars, and campers—the so-called "pit areas"—shrub biomass was reduced by about 95 percent from comparable undisturbed areas.

The most common shrub in both the Mojave and the Colorado deserts is the creosote bush; therefore it is the ORVs' number one victim. These shrubs are surprisingly long lived and durable, but once damaged by ORVs take years to recover. Bury et al. note that "the creosote shrub community is an ancient, diverse assemblage of plants and animals. The shrubs themselves may require decades to mature, and even partial damage to plants, particularly the root systems, may subject them to stress in dry years or drought."

Photographs of desert vegetation taken from the same sites near the Arizona border in 1894 and 1965 reinforce this view. They reveal little change in the stature and arrangement of some of the perennials, especially the creosotes. Some of the same plants appear to have persisted for more than 70 years. A creosote bush appearing in one of the 1965 photographs must have been at least 80 years old because it was already of mature stature in 1894.

In fact, recent studies suggest that 80 years may be extreme youth in the lifespan of some

creosote shrubs. Radiocarbon dating showed that decayed wood at the center of some creosote bush rings was approximately 580 to 700 years old. As the center of the shrub dies, new growth develops around the periphery forming a kind of ring. Botanists speculate that some of these rings date back to the time when the creosote bush first established itself in the desert This means that in places such as Johnson Valley some of the creosote shrub rings demolished by ORVs may have been there since the end of the last ice age—some 10,000 years ago.

Not too surprisingly, Bury et al. discovered that extensive reduction in the wildlife accompanied the destruction of plant life wrought by ORVs. They found that "moderate" ORV use sharply reduced the biomass of an area's terrestrial vertebrates—by almost 60 percent. Heavy ORV-use areas suffered a 75 percent decline in vertebrate biomass, a 45 percent decline in the number of such animals, and about a 10 percent drop in the species present.

Bury et al. point out that certain desert animals have a "low recruitment rate or a long maturation rate." The desert tortoise, for example, may require 15 to 20 years to reach sexual maturity in the field. The leopard lizard has a lifespan of at least 7 to 8 years and the western whiptail lizard of at least 7 years; females of both species usually do not reproduce until 1.5 to 2 years of age. "Death or removal of these long-lived animals will result in a loss of not only these individuals but also their reproductive potential for a relatively long time. Recovery of desert communities would be slow, even where there are no further ORV activities."

Preliminary studies indicate that bird life fares just as badly in ORV-use areas. In Anderson Valley, an undisturbed area had twice the bird biomass and number of species and 1.5 times the number of birds as a similar area of "moderate" ORV use.

Bury et al. conclude that desert vegetation and wildlife are "depauperate, if not obliterated," in areas of intensive ORV use.

Scientists such as Stebbins and Dr. Nathan Cohen, a biologist at the University of California at Berkeley, are particularly concerned about the propensity of ORVers to drive their machines down or across desert washes. Wash banks provide homes for burrowing animals and wash brush and trees provide food and cover for all manner of creatures.[177] Many of the bird species which inhabit the desert nest in wash areas. In the Colorado desert, for example, smoketree washes represent a unique habitat, supporting high concentrations of birds and other vertebrate species, often 10 to 50 times higher than in surrounding areas of desert. Many bird species are concentrated in these washes: verdins, black-tailed gnatcatchers, and Costa's hummingbird, for example.

"Contrary to popular opinion," Stebbins and Cohen report, "washes are fragile natural environments containing many plants and animals, some of which are particularly attracted to wash habitats." In their survey of ORV use of washes along state or federal highways in the desert, they found the "growing incidence of ORV damage truly alarming."

Assessing overall ORV damage to the desert environment, Stebbins and Cohen conclude that "ORVs are steadily destroying (essentially for the foreseeable future) some of the most attractive and fragile natural areas [in the desert]." They point out that natural areas severely damaged by ORVs, of which there are now an abundance in the desert, cannot really be reclaimed in the sense of restoring the original natural ecosystem. It is not humanly possible to reconstruct the complex and delicate interrelationships that have developed over a vast stretch of evolutionary time. Hence a reclaimed area will probably always be something less desirable than that created by historic processes.

(1) Recognize Magnitude of Enforcement Problem

First and foremost, the federal government must recognize the magnitude of the problem, especially as it affects enforcement of regulations. It is not enough to publish maps which show areas open to ORVs in white, areas "restricted" in yellow, and areas "closed" in red. The public land management agency must be able to enforce these designations. To announce ORV restrictions which are unenforceable under current personnel and resource conditions merely gives the illusion of control. If a public land management agency cannot increase its personnel and resources either because of budget restraints imposed by the executive branch or because Congress will not appropriate the funds, then it must adapt its regulations to fit its enforcement capabilities. In the opinion of many land managers, it takes a greater effort to enforce the open-unless-designated-closed approach than the closed-unless-designated-open. However, the latter approach is no panacea. To close a large area to ORVs, especially if it has been previously used by them, requires a presence in the field. If the land management agencies adapt their ORV regulations to their enforcement capabilities and are still unable to control ORV environmental

damage and conflict with other users, then the agencies should publicly acknowledge the dilemma. If Congress or the executive branch chooses to accept the damage instead of providing the resources for adequate enforcement, that fact should not be obscured. The public ought to know what the choice is, who made it, and why.

The U.S. Geological Survey points out:

> The interaction of vehicles and soils is a physical phenomenon that does not distinguish lawful from unlawful or proper from improper use. In the San Francisco Bay area, more than 80 ORV sites are being monitored, of which about 75 are used in trespass. The condition of the land is no different in the lawfully used areas than in the areas used in trespass. The adverse impacts, therefore, will generally reflect only the vehicle load and cannot be predicted to be light merely because the use is not sanctioned.

Thus enforcement is indissolubly linked to plans for protection. When the Interior Department refuses to discuss in the EIS how its plan for implementing Executive Order 11644 will be enforced, the omission is crucial. Nor does it make sense for the Forest Service to designate 599,161 acres on the four National Forests in North Carolina as open and 543,193 acres closed, and then to add that "[f]unding for the purpose of law enforcement, trail reconstruction, and/or maintenance is not expected to increase considerably beyond the present token level during the time frame for which this management direction was developed (1985)." It is no wonder that one district ranger (Bob Carey, Unharrie National Forest) observed that the ORV plan is "inadequate and offers practically no control at all." How can the Forest Service keep ORV riding, an increasingly popular sport in North Carolina—especially four-wheel drive vehicles—out of "closed" areas and on designated "routes" in open areas with only "token level" funding?

There is abundant evidence that the BLM and Forest Service's past efforts to control ORV use, even though not very extensive, have run into severe enforcement problems. Some examples have already been cited. There are many others, such as the Barstow-to-Las Vegas motorcycle race. Held for many years on the Saturday after Thanksgiving across National Resource Land, this event attracted as many as 3,000 motorcyclists. In 1974, before the eighth race, the BLM did an EIS on the event. Although the EIS provided considerable evidence of adverse environmental effects, including damage of historical or cultural resources, the BLM permitted the race to be held that year. An Evaluation Report done afterwards by the BLM showed that the EIS had, if anything, underestimated the damage. Thereafter, the BLM refused to issue a permit for the race. This, however, has not deterred some motorcyclists. Consider the following account in *Cycle World* of the 1977 "unorganized" Barstow-to-Las Vegas motorcycle race across BLM land:

> Once again our semi-legendary friend, the Phantom Duck of the Desert, has pulled it off. The annual unorganized trail ride from Barstow, California to Las Vegas, Nevada took place without major incident, or harassment . . . .
>
> [W]hen the Barstow-to-Las Vegas race, formerly the best and most famous of the desert races, was shut down because the BLM denied the use permit, the Duck didn't give up. He decided that every year there would be a ride across the desert, using public land already open for riding. The ride isn't organized because while there's no rule against motorcycles, there are firm rules against motorcycle events, which is how the race was stopped in the first place. So. Although there was no organization, there were volunteers to mark the trail. There were maps. There were reminders to close gates where the ride went across land owned by friendly ranchers. There was a Jeep riding sweep (and handy it was, too. We picked up one guy who'd fallen . . . .)
>
> About 200 people, all ages and equipment and experience, rode the 130 miles. At the site of the former finish line, there was good spirits, even finisher pins. . . .
>
> The Duck has his detractors. There weren't many serious racers on the ride. Some of the racing clubs in the area believe that riding the old course will offend BLM. They schedule races elsewhere on the day of the ride to keep people away.
>
> We don't agree. . . .
>
> Because the ride isn't organized one cannot issue invitations to it. But in case any readers have their bikes east of Harvard Road on the north side of Interstate 15 about 8 a.m. on the Saturday after Thanksgiving, why, you're probably riding the same direction we are, so let's go riding together. . . .

DILEMMA 7:
"The Race Across the Sands"

Hundreds of motorcycles are waiting at the starting line for the annual Barstow to Las Vegas race, a race across 130 miles of open desert dunes. As the cyclists make their last minute adjustment before the starting signal, a large group of people suddenly converge in front of the racers. Carrying banners and chanting "No more desert races!", "Save our animals!", "Motorcycles are death machines!", they stop along the race course and refuse to budge.

These protesters — men, women, and children — have come to stop the race. They argue that the cycles churn the desert dunes, destroying the fragil desert plants and homes of the desert animals The activity of the offroad vehicles are rapidly devastating the desert by crushing its vegetation and creating ugly gully scars. They feel that rules on the use of the desert have not been very strict and want to make their concerns heard at this important race. Although certain areas of the desert are closed to vehicle traffic, this group believes that not enough has been done to stop the environmental damage. The many large races of this type trample and uproot plants on such a vast scale that recovering is a near impossibility.

Tom Stokes, a champion racer, and his fellow cyclists are outraged and angered. They have looked forward to this race for months and, moreover, believe that they have as much right to use the desert for recreation as anyone else. Where else can they find such wide open and unobstructed space? The desert is the only place an event of this size could be held. The racers shout and threaten but cannot move the protesters.

Tom is determined that nothing will stop the race. He wants to win the grand prize of $2,000. The only way to disperse the protesters, he decides, is to lead the hundred of cycles into the crowd and chase them off the course. The loud roar and power of the motorcycles will surely create panic and send the people running.

Should Tom take this action? Why or why not?

DISCUSSION QUESTIONS

- Are the protesters infringing on the rights of the motorcyclist to use the desert? Why or why not?
- Rushing a large crowd with motorcycles could result in injuries. Should Tom consider this in his decision?
- Who should be held responsible if someone is hurt? All the cyclists? Tom? The protesters? Why? All the cyclists and protesters?
- Since this part of the desert is public land, should everyone be allowed to use it in the way they desire? Why?
- Recreation vehicles, such as motorcycles, in great numbers can lead to irreparable damage of the desert environment. Should there be controls on how the desert be used? Why?
- Since ORV recreationists are the major users of the desert, are they being unfairly denied their pleasures by the protesters? Why?
- Should plants and animals also have a right to exist?
- Many people come to the desert to enjoy its beauty. Should their rights also be protected?
- How should the desert be managed in order to be fair to everyone?
- Many people believe that riding free and unrestrained is a unique pleasure in today's world of crowded cities and hectic work place. Should this be an important consideration in a plan to manage the desert?
- Many parts of the desert have been altered by housing developments, highways and farming. How might such uses be compared to the use by ORV?
- Why should it be important to protect the desert?

Reading 13

Excerpts from *Congressional Record*

Senate Testimony of Senator Alan Cranston, Calif. • January 31, 1978.

Mr. CRANSTON. I thank the Senator from South Dakota.

Mr. President, I rise in support of S. 1976, to enlarge the Redwood National Park. This legislation is essential to protect the investment the Federal Government has already made in the existing park. Logging in the Redwood Creek watershed is causing serious erosion and siltation in the creek which, in turn, threatens the stability of the grove of the world's tallest trees within the park.

Redwoods, Mr. President, are not just a California resource but a national heritage. Preserving them is not just a California problem but a national challenge. Here is what some newspapers across the country have said about the giant redwoods and this bill to expand the Redwood National Park:

Detroit Free Press (Apr. 5, 1977): Since the Redwood National Park was established in 1968 . . . 12,000 acres of some of the finest remaining redwoods in the world (have been cut.)

Kentucky Courier-Journal (Apr. 30, 1977): If America's natural resources were ranked for interest and beauty, the California redwood would stand as tall as the trees themselves.

Washington Post (May 3, 1977): There are few things on earth as magnificent as those giant redwoods and the policy of the government ought to be to preserve as many, not as few, of them as it can. Redwood National Park should be expanded. And this should be done not merely to protect the watershed of the existing park . . . but also to protect additional trees. The question is not one of serving just a few thousand acres of redwoods so that future generations can know what they look like, but rather of saving a part of our national heritage.

Battle Creek (Michigan) Enquirer & News (June 2, 1977). . . century ago, two million acres of redwood forest flourished in ranks 30 miles wide from south of San Francisco to Oregon. Now only a small portion of that acreage remains. It is making a last stand against the intrusion of man . . . Congress should take appropriate action to save the giant trees within the park and outside its borders. That way, men and women of the future can stand in awe of nature's giants instead of wondering why we, in a previous generation did not fight to save them.

Houston (Tex.) Post (Aug. 2, 1977): Take a building — a 25-story building . . . The redwood would shade the top floors of the skyscraper. The building can be demolished and rebuilt in a few months or years. The redwood cannot be regrown in the lifetime of the living. It takes 20 to 25 generations to grow a giant redwood. Some are 15 to 22 centuries old . . . Congress . . . should act quickly to protect a national heritage comparable to Grand Canyon, Monument Valley and Niagara Falls. Once gone, the redwood giants will never again scrape the skies of America.

Fort Wayne (Ind.) Journal Gazette (Aug. 4, 1977): Redwood National Park is 2,300 miles from Indiana on California's north coast, but distance and problems close to home shouldn't deter Hoosiers from safeguarding the park's grand forest of giant trees. a unique part of nature's gift to all Americans.

Mr. President, the rugged, lonely coastline stretching northward from San Francisco is a land of rolling fog, breakers smashing against high bluffs, and of moist, deep mossy forests. The most renowned of these hold the stately redwoods, which soar to 200 or 300 feet in height and endure for a lifespan over many centuries.

Few humans experiences compare to standing within a grove of those ancient redwoods, where the light is a dim cathedral luminescence broken by occasional beams of sunlight filtering through to the forest floor.

In 1820, when California logging began there were 2,000,000 acres of redwoods in a strip extending from the Big Sur country south of San Francisco into northern California, the far North. Today, less than 270,000 acres of virgin redwoods still stand. And all but a few thousand acres stand in danger of desecration by the end of this century.

The Redwoods National Park, which was established in 1968, will preserve for posterity 58,000 acres of the most handsome virgin redwood stands. But the park is oddly shaped as it now stands. To reach it, one often has to drive past huge sawmills and tepee burners and fight for highway space — even on roads through the national forest. One writer describes it as "an impoverished little park — whose resources are constantly menaced, whose peace and quiet are reserved for the hard of hearing and whose unspoiled vistas are most impressive to those with tunnel vision."

As a Nation, we sometimes too easily use superlatives without thinking about what they mean. And so the idea of saving the world's tallest trees may not have immediate significance when we hear the words.

But think about it: The tallest living thing — the greatest expanse of life from deep within our Earth, stretching into the heavens.

What better symbol is there for the eternal struggle of all living things to live, to grow, and to improve. These trees are the tap roots of eternity. To lose them would be to lose part of that divine spark which must inspire all of the work of man and nature.

Surely in this eighth decade of the 20th century we can resolve the economic problems of a few hundred men and women without destroying these creations of the ages.

Reading 14

Environment: *The Redwood Protest*

ENVIRONMENT:
The Redwood Protest

A convoy of logging trucks rumbled through the streets of Eureka, near the heart of California redwood country. Thousands of Eureka's own residents followed on foot. Businesses closed down so employees could march, and clerks and secretaries streamed out of downtown offices. Hard-hatted loggers paraded next to businessmen in three-piece suits. Some carried signs (SIERRA CLUB—KISS MY AXE), and everyone converged on the municipal auditorium to protest a bill they thought would cost them jobs: a major expansion of nearby Redwood National Park. Several hours later, the loggers climbed back into their trucks and, along with twenty busloads of supporters, drove 300 miles through the night for another protest against the redwoods in San Francisco. At 8:30 a.m. the 112-truck convoy crossed the Golden Gate Bridge. "We want jobs, we want jobs," the chants began.

Few environmental symbols have been as enduring as *Sequoia sempervirens*, the stately California coastal redwood that grows to be the tallest living thing in the world. But few have been as controversial, either. Loggers protested bitterly when 58,000 acres of land were set apart as Redwood National Park in 1968. They are even more disturbed by a new proposal that would expand the park by 74,000 acres. Jobs are the main issue. Eighty per cent of the economy around Eureka depends on logging. Unemployment is already 14 per cent, and a state-sponsored study indicates the expansion could mean the loss of 2,200 more jobs.

NATIONAL AFFAIRS

"There are a lot better things to do than preserve that area as wilderness," says William Walsh, senior vice president of Arcata Redwood Co., one of three major logging companies in the area. "The emotional climate makes it seem if you don't do something right away, your kid may never see a redwood."

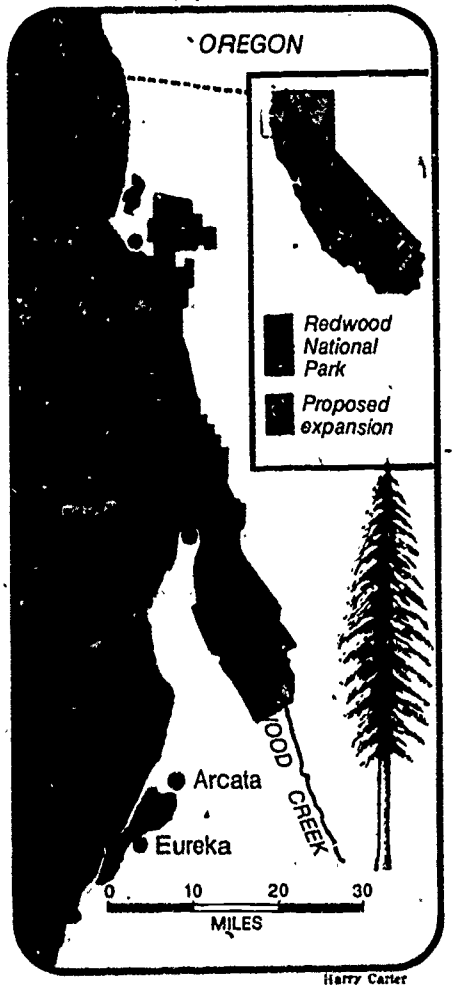
Long Hike: The loggers note that cut redwoods regenerate from the stump. They argue that California has 800,000 acres of redwoods, a quarter of them already set aside in 100 state, national or local parks. And they remind environmentalists that Redwood National Park is one of the nation's most expensive and least utilized. Last year tourism was only 2 per cent of what a 1968 study had projected it to be. The park has no campgrounds and no visitor center, and tourists must hike 16 miles in and out to see the world's tallest tree (it rises 367 feet above the forest floor). "The only people who go in there are back-packing hippies and their naked girlfriends," grumbled Marvin Barlow, a logger for Louisiana-Pacific Corp.

But environmentalists say that logging on the steep slopes just beyond the park is causing erosion that threatens the redwoods. They also complain that hikers—rather than trekking through the forest in primeval silence—frequently hear buzz saws and crashing timber on the commercial property nearby. And they are afraid that the lumber companies will overcut these redwoods.

The solution, say the conservationists, is to expand the park. San Francisco Rep. Phillip Burton is the sponsor of the bill to add 74,000 acres, and he prompted the demonstration in Eureka last week by holding a hearing on the bill there. As a crowd inside the municipal auditorium hooted Burton, Eureka's own congressman, Don Clausen, denounced the proposed expansion as "a smoke screen for a land grab. The state and Federal government already own 982,000 acres in Del Norte and Humboldt counties, and that's enough."

Fear: By the next day, when Burton held a hearing in San Francisco, he seemed impressed by the opposition to his bill. "I've conducted a lot of hearings," he said, "but seldom have I seen the fear I saw in Humboldt County related to the loss of jobs." That fear has also been noticed by the Carter Administration. It is expected to announce soon a compromise expansion—47,000 more acres, plus a program of job retraining to teach new forestry skills. "It will be good hard work," promised a Department of Interior spokesman. "We're not trying to make loggers into bellboys."

But it is far from certain that Eureka's loggers would be willing to accept the compromise. "They made all kinds of promises when they took the first park," said Marvin Barlow. "Nothing ever came of them." If the loggers don't like what they're offered, they may just take their grievances—and their logging trucks—to Washington to demonstrate.



Harry Carter

77

DILEMMA 8:
"Giant in the Forest"

As the morning fog lifts, John Roland begins to see the midbranches of the great redwoods towering overhead. These are the ancient giants of the tree world and provide John, a lumberjack, with his livelihood. As he and his fellow loggers trek through the forest, John finds himself looking at the trees, trees that he saw every day for the past ten years, in a very different way. "Could the book on redwoods my son brought back from school and which I happened to read have that much of an effect on me?" he asks himself. Yet, he can't help from thinking about those words in the book as he surveys the forest, ". . . the magnificent wonders of the natural world, defying time and change. . . . among the oldest and tallest of all living things. . ."

The lumber crew and their huge tractor finally reach the area of trees marked for the week's work. As they unload the powerful chain saw, John suddenly straightens with a start. This is the same tree he had seen pictured in his son's book. It is the oldest tree in that forest tract, over 3,000 years old! It has survived all the years, and after today the only remains will be a bare stump. As he gazes at the tree and feels a surge of awe and wonderment, the tree appears to take on another meaning. Then John thinks of his son. Following today's work, the tree will only be a picture in a book. "How can my son know what this tree is truly like from looking at the picture?" he muses.

He doesn't know what has come over him, but over the sounds of the moving men and machines he shouts, "We can't cut that tree!" The other men look at him strangely, laugh, and proceed with the preparations for felling a neighboring tree. John senses a feeling of desperation knowing that they will soon transform a living thing to boards. Then an idea comes to him. He will take matters into his own hands. The loggers will not get to the old giant until the next day. Tonight he will return to put the saws out of commission. Repairs may take at least a week and allow time to start a campaign to save the tree. Many local groups are very concerned over redwood logging and will surely be outraged when they learn about the intended fate of this giant tree.

Should John return in the night to sabotage the equipment? Why or why not?

DISCUSSION QUESTIONS

- Why does John feel so strongly about saving the tree?
- Why should a particular type of tree be considered a "natural heritage?"
- Should trees have any rights? If so, what type of rights and how can they best be protected?
- If the redwood forest were destroyed, what might this mean to the world?
- Since the tree is on privately owned lands, should the owner have the right to decide how it is to be used? Why or why not?
- Should a tree be so important that John risks his job to try to save it? Why or why not?
- Should a tree that requires hundreds of years to mature be cut down for our use? Why or why not?
- Redwoods provide a valuable source of lumber for home building, furniture, fencing, etc. Isn't that reason enough to harvest this resource?
- Many thousands of acres of redwoods were bought by people intending to harvest the wood. Why should they be prevented from doing so?
- Should people have the right to use trees and plants in any way they wish? Why or why not?
- What guidelines should one follow in deciding what plants/trees to use or preserve?
- How can unique natural resources be protected so that they can be enjoyed by people in the future?
- How does one decide what is a necessary or wasteful use of a resource?
- When we use natural resources that cannot be replaced, should we consider how people living in the future might be affected?

Reading 15

Are dolphins trying to say something, or is it all much ado about nothing?

By Michael Parfit

Research on cetacean intelligence is booming, but where one scientist finds a 'language' another may hear only 'a rat's nest of sound'

Like the atmosphere of the whole debate over the intelligence of dolphins, the air at Flipper's Sea School was filled with an enthusiastic and sometimes discordant clamor. Laughing gulls cried, peacocks screamed, loudspeakers informed small groups of tourists about the value of green turtle shells and the feel of dolphin skin, Napoleon the heron screeched at larcenous pelicans, and dolphins leaped and splashed to the constant sound of human cheers: "All *right*, Gipper!" "Beautiful, beautiful, Longnose!" "Atta girl, Rose!"

The quietest thing going on was the research. Off to one side, from a plywood box in which a man crouched under a poncho behind one way windows, came an occasional short, whistled tune. If I had not known what it was, I wouldn't have noticed it at all.

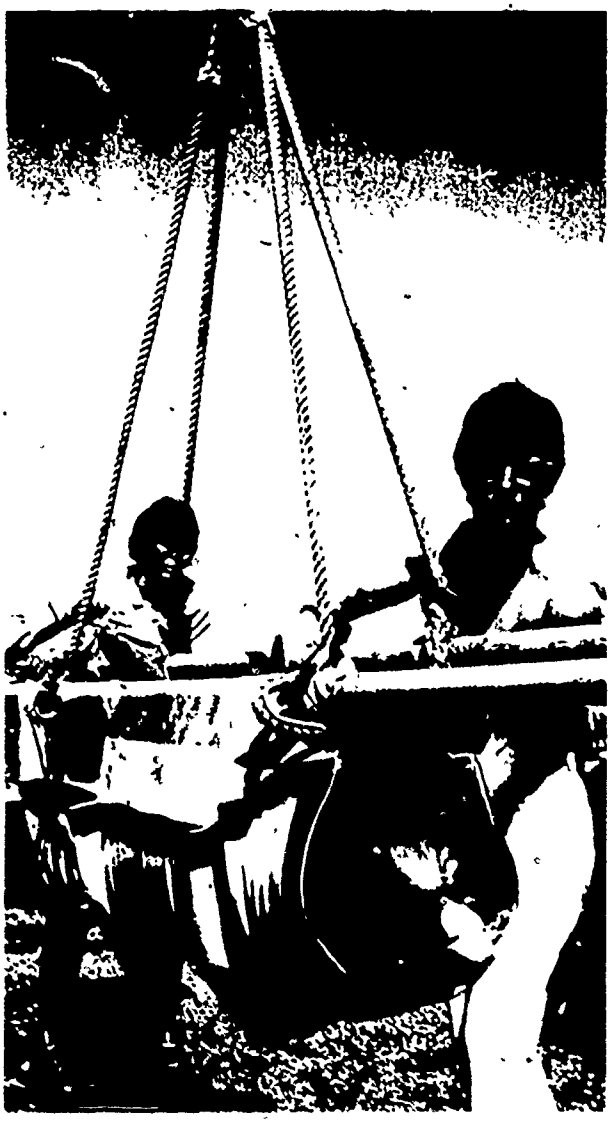
But the odd noise was a message, a request made by a human being to a dolphin in a code that resembled language. Although I knew that what it was asking was simple—that the animal touch a ball with its fluke—I knew also that the procedure represented a complex probe into a frontier of knowledge. Here, as at a few other places in California, Florida and Hawaii, people are examining, through language, an idea that has been broadly popular for years: that dolphins and their cetacean cousins, whales, may be among the smartest creatures on Earth, as intelligent as humans.

I arrived at Flipper's Sea School near the end of a trip I made to try to find out just how smart dolphins are. By then I had learned that the argument over their intelligence is both intricate and fierce, and seems to involve its participants in an intellectual and emotional tangle of metaphysics, science, speculation and hope so intense it sometimes doesn't leave much room for the simple beauty of the animals themselves.

I began, as anyone must, with the patriarch of what might be called the "smart dolphin movement," John Cunningham Lilly, M.D. "I invite you to entertain some new beliefs," Lilly wrote recently, "[that] *these Cetacea with huge brains are more intelligent than any man or woman.*"

In the 20 years that Lilly has espoused this view, based on his own research, many people, inspired by what they have seen of these sleek animals at sea, at the movies, on television or at oceanaria, and by Lilly's five books on the subject, have not just been entertained by this notion of surpassing intelligence, they've been captured by it. They've heard recordings of the sonorous tunes of the humpback whale, they've read of wild dolphins playing with children, they've seen testimonials from men rescued from drowning by porpoises. Grieving at all the ways human beings have found to behave foully on this planet, they're ready to believe in the dolphin Lilly describes: an alternate sentient being—benign, philosophical, and gifted with the patience and wisdom of the sea.

Lilly lives in the hills of Malibu, California. Stored there on tape are the voices of several bottlenose dolphins he worked with in the 1960s. One afternoon I stood and listened to one with him in a room walled with brown shag. Lilly was lean and almost bony, his slimness accented by one of the one-piece jumpsuits that seem to make up his entire wardrobe. Red light from the ceiling edged his face. He turned on the stereo and the room filled with the slosh of water and with a collection of sounds that seemed at once to be made by a drum, a rooting boar, a mouse, a smoke



Briefly out of his element, dolphin in a John Lilly research program is carried in a sling for a blood test.

alarm, a thumb rubbed on a clean plate, a bullfrog, a number on a push-button telephone, and the slow, theatrical opening of a castle door, all punctuated regularly by sudden, fierce breaths.

Lilly's voice was dry. "He's trying to convince us of something," he said, "and we don't know what it is. With that kind of repertory we don't think they're simpleminded."

But there is no peace between scientists. A few days later I negotiated the concrete maze of the Naval Ocean Systems Center in San Diego and met Forrest G. Wood, a Navy staff biologist who, back in the middle 1950s, first introduced Lilly to the voices of dolphins by playing him tapes.

"I'm not sure if I hadn't played him the tapes the world would be a different place now," Wood said with some regret. "Nobody other than Lilly, no *scientist*, I believe, has attempted to say how intelligent these animals are with respect to humans." He elaborated. "With all our ability to communicate and express insights, if we cannot come up with something to measure our own intelligence adequately, I can't see how we could do it with dolphins."

Among dolphins, what is intelligence?

Wood's sharp attack on Lilly's point of view and on his credibility as a man of science framed the argument. It also lit the warning flasher on the first substantial barrier I encountered to learning about dolphin intelligence. I soon found that most scientists agreed with Wood that intelligence, as a word and as a concept, becomes pretty fuzzy when applied to dolphins. That was why many scientists recoiled when I asked them to place the dolphin on an intelligence scale, between dogs and chimpanzees, say, or chimps and humans, although most of them simply replace the word with phrases that seem more specific: information storage capacity, plasticity, behavior potential, cognitive characteristics. These words and phrases allow them to move gingerly from a semantic debate into something more rewarding: the dolphin's brain.

Cetaceans have remarkably large brains in general. The sperm whale's brain is up to six times human size, and the bottlenose dolphin, the most studied cetacean, has a brain about the same size as ours. Raw size alone is not as significant as other factors, but Dr. Harry Jerison, a neurobiologist at the University of California, has developed a measure of what he calls structural encephalization, comparing the volume of the brain to the surface area of the body. This, he thinks, indicates how much of the brain's processing capacity goes beyond the amount needed to handle ordinary body functions. Jerison, a short, wry, cheerful man, places whales and dolphins near the human

Getting acquainted, researcher Gabrielle Lauer swims with Terry, one of two dolphins Lilly is studying at a California facility. The tank is equipped with audio system and a TV screen linked to a computer.

section along the "structural encephalization scale."

The anatomy of that mass of neurons is just as important as its size, however, and here again tangible specifics like volume give way to interpretation. In human beings that part of the brain known as the neocortex—the more recent structure, in terms of evolution—is often described as the area whose dominance of our brain's surface results in the capacity to create, innovate, solve, choose, articulate and reason, which we call intelligence. In the kangaroo, says a Russian scientist named I. N. Filimonov, the total cortical surface is 69 percent neocortex, in the macaque monkey it is 93 percent neocortex, and in the human it is 96 percent neocortex. In dolphins the neocortex covers as much as 98 percent of the surface.

But even this statistical hierarchy does not clarify much: the dolphins' expanse of highly folded neocortex is considerably thinner than it is in humans, and it differs in many other ways. Discussing brain anatomy is almost as bad as arguing about the word intelligence. The further in you wade, the more mired you become in the fallacies of direct comparison. But one broad conclusion reached by many of the people studying dolphins is appealing: their large brain's high metabolism is a prodigious consumer of fuel, and it's unlikely that the cetaceans made it 25 million years on merely a gas-guzzler mind. They're using all that power for something.

Once you start rowing out from the swampy shore of brain size and structure you run into a sea of speculation. To Lilly, dolphins have used their brains to develop their own language, culture, oral history, philosophy and system of ethics—a concept that has led some believers to propose establishing diplomatic relations with the cetacean nation.

Forrest Wood and many others figure that the animal's incredible talent for finding and examining objects with its sonar probably puts much of that brain to use. This position is supported by recent Navy studies of records of electrical activity from the brain that "are consistent with a large percentage of brain devoted to auditory analysis." Dr. Kenneth Norris, a noted biologist who calls himself a "porpoise watcher," and who exudes an air of pragmatism even while engaged in flights of fancy, said that there are some researchers who speculate that dolphins may use their sonar sounds to project images into other dolphins' brains, and that dolphin sonar, which apparently can penetrate various substances in perhaps the same way hospital sonic equipment can penetrate a mother's womb to draw an image of an unborn child, may give the animals an in-depth understanding of each other that human society is denied. Norris himself doubts that it is likely to happen that way, but believes "some sort of sonic imaging is possible."

Stove in and wrecked by all these marvelous guesses, by now I wanted to encounter one of these creatures. But there was more to study. If you cannot learn the

nature of the dolphin mind by looking at bits of its brain, and you aren't satisfied with speculative adventure, you have to look at behavior.

Observations of dolphin behavior have been largely gathered from lucky meetings in the wild or from captive dolphins. From this limited data most scientists have at least agreed that dolphins are highly social animals. Their relationships with one another seem intricate. Although there appear to be hierarchical arrangements within dolphin clusters, they may also have what one scientist calls an open society, in which members can move from group to group within a larger herd, like humans at a cocktail party.

In captivity they have been trained to perform amazing and often absurd tricks, like towing a dog on a surfboard or shooting baskets, tricks they can apparently remember for long periods of time. In a celebrated experiment dolphins were taught to present new behavior - leaps, spins, dives and splashes their trainer had not seen the animals perform, but tasks they apparently grasped with ease. Although this experiment is often cited as an example of dolphins being able to understand and use generalized rules, it does not prove that they are unusually clever, the researcher who performed the experiment says she has seen equally impressive creativity in pigeons.

In the wild, dolphins have shown some ability to adapt to new situations, but the deaths of dolphins in tuna nets has declined recently owing to improved industry techniques, performance and gear, and not necessarily because the dolphins have learned to facilitate their own release. Kenneth Norris noticed off Hawaii that small dolphin schools learned to identify and avoid boats that were out to capture them. But with larger groups he has seen no evidence for animals transmitting such information.

To do that, of course, they'd have to have something like language. And language is at the heart of this debate. As human beings it's our specialty, the peak of our mind's achievement. So, when we go looking for something smart, really smart, the first thing we assume it should do is talk.

John Lilly postulates the existence of "delphinese," a dolphin "language" a bit like Norris' musings about image formation using sound, but with an intricacy that would allow it to carry historical and ethical information from generation to generation. Norris and many others challenge that assumption. "There isn't anything that even *hints* at language," Norris said, slightly irritated at the difference between what he clearly labeled as his own speculation and Lilly's assertions. "What I see instead is a great rat's nest of sound which nobody—*nobody*—knows about."

A number of experiments have, however, been aimed at unraveling that tangle. In 1965, in an experiment now considered a classic, Dr. Jarvis Bastian, a University of California (Davis) psychologist, separated two dolphins visually but not acoustically, then trained them so the first, a female, had to tell the second, a male, which of two paddles to push so both could be rewarded. During a series of tests the two whistled and buzzed back and forth, and the male pushed the correct paddle most of the time. But this didn't mean that the two shared some kind of detailed code or language. Bastian concluded it was just as likely that the female was making conditioned noises that the male had independently learned to interpret to his advantage.

Back in 1962, scientists watched five bottlenose dolphins apparently send out one of their group to examine an artificial barrier. The dolphin swam out to the barrier making sonar clicks and swam back to the group whistling, and shortly the entire group swam through the barrier together. But however common this kind of action may be for dolphins, it remains today a rare scientifically recorded observation of the animals scouting the terrain, and so stands isolated like a little patch of color in an obscure puzzle.

Thousands of feet of recordings have been made of dolphin sounds. In 1961 a Lockheed researcher said the 12 most common whistles he recorded in a tank containing nine dolphins were used in about the same frequency and order as the 12 most common English words. A few years later David and Melba Caldwell first published studies that clashed with both these data and Lilly's idea of "delphinese." At least 90 percent of the time, they said, each dolphin in a group is just whistling a single, stereotyped sound that may serve as a sort of name—a signature whistle—but is not at all like language. Now both Lilly and the Caldwells have been challenged by a young behavioral biologist, Dr. Sheri Gish, who today studies bird song at the National Zoo. During the middle and late 1970s Gish taped dolphins making sounds at each other over a two-way, underwater apparatus similar to a telephone. She found that most sounds were not the whistles some investigators have reported, but were clicks. She did not hear anything that she would call language.

"The exact information they're transmitting is unknown to me," she said. "But what they're doing is limited. It doesn't appear to have a syntax or any other attribute of language, assumptions made by some past researchers.

"Dolphins are unique among mammals," she continued. "We shouldn't confuse their behavior with human behavior. That's the mythology and it gets in the way of science."

Oddly, Melba Caldwell used a similar word. When I asked her why people are so fascinated by Lilly's hypotheses, she said mildly, "I think mainly because we can't find out anything about dolphins, so there does remain a mystery. So then you can attach a myth to a mystery. But the thing is: do you want answers to questions, or do you want to keep your myth?"

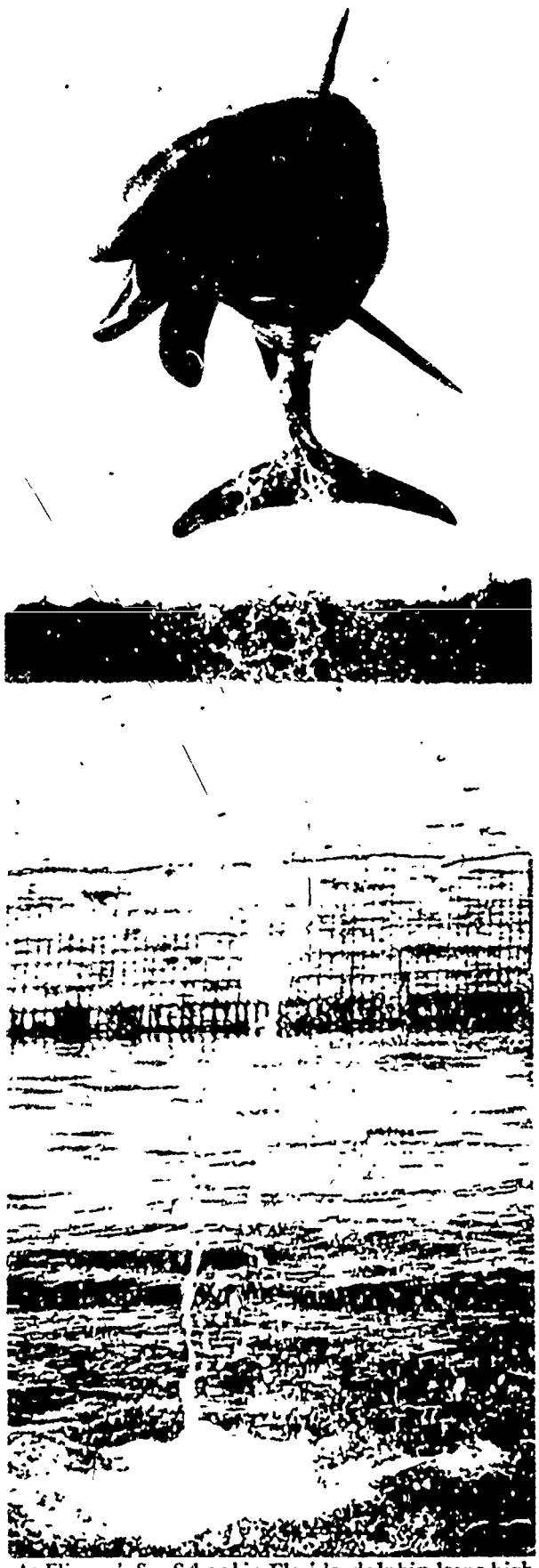
Kewalo Basin Marine Mammal Laboratory

Louis Herman holds dolphin Phoenix as Akeakamai responds to the signal, "Akeakamai, Phoenix Over."

Today at least four separate groups of investigators, exploring terrain already found by ape language researchers to be mined with controversy, are working to teach dolphins artificial languages. At Flipper's Sea School (so named because stars of the television series were trained there), dolphins are learning a whistle code. Near St. Augustine, Florida, graduate student Bill Lambaur is teaching two dolphins to recognize and use sheet-metal symbols. And in Redwood City, California, John Lilly himself, who is still respected as a scientist by many of his peers in spite of the scorn some heap upon him, is planning to beep and whistle at dolphins with an elaborate computer arrangement, observed by a constant stream of journalists paying homage to the durability of his vision. But the most advanced and dramatic work is being done by Dr. Louis Herman, a comparative psychologist specializing in the behavior of dolphins and whales, at the University of Hawaii. In a typical test, Herman puts a ball, a Frisbee, a hoop, a piece of plastic pipe and a fountain of water in a pool, tells a dolphin in a computerized whistle code to push the ball to the pipe, and the animal does as asked. More important, when he then asks the dolphin to push the pipe to the ball, the animal again behaves correctly, showing a rudimentary understanding of the structural differences we call syntax. Herman can also throw a ball in the pool and another dolphin will whistle "ball" in the same languagelike code.

A vocabulary of more than 25 "words"

Herman is a methodical man. "I'm thoroughly impatient with speculation and wildness and extrapolation," he said, with a confident, apologetic smile. "In scientific life there's no substitute for hard work and patience." Over ten years Herman has built a broad foundation of knowledge about dolphin mental capacity on which to base his language work. He has published studies demonstrating, among other things, that they can remember single sounds and series of sounds about as well as humans, that they can see clearly above water and underwater, that they can identify tiny changes in the pitch of sounds, and that



At Flipper's Sea School in Florida, dolphin leaps high above flimsy wire fence, barrier against predators.

they can learn a symbol. Now, although his current project has been going only a year and a half, one dolphin already understands a vocabulary in the computerized whistle code of more than 25 nouns, verbs and adjectives. The other animal has a similar vocabulary based on gestures of the trainer's arm and hand, and it can also recognize an object and name it in whistle language. At least one researcher thinks that polyglot dolphins, like talking apes, may simply prove the skill of trainers rather than the special ability of the animals themselves; but Herman and others do believe that something like language is taking shape.

"We have a whole philosophical issue centered around the uniqueness of human language," Herman said. "Is it in fact a unique specialization, or can we find at least an elementary language capability in some of the large-brained social mammals?" Listening to Herman, I thought: this world of dolphin research is clearly a frontier. After years of speculation and wonder made possible by some pioneering but perhaps too hopeful leaps of thinking, the real work has begun. And it's exciting. No matter what you expect to find, you become enthralled by the size of the unknown and by the promise of the new exploration.

In the lazy heat of the Florida Keys, Flipper's Sea School bustled with that excitement. It was alive with noise and laughter, like a mining camp that's heard rumors of ore.

I watched Mandy Rodriguez, 31, director of training, whistle in code to a five-year-old dolphin named Natua, who was born here. "If you had told me five years ago that I would be whistling a language to a dolphin named Natua, I would have taken you with a grain of salt," Rodriguez said. "But I think we're going to get a lot done in this language. I think we can get a common ground taking place."

I sat on a dock with Carol Smith, 24, a research trainer, while she talked happily in English and sign language to a dolphin nicknamed Longnose. "Their friendship goes so deep and true," she said. She waved her foot in the air. Longnose dived and leaped. "Beautiful, Longsnouts," Smith said. "You can't spend much time around these guys without falling in love with them; then you become an emotional tree hugger and suspect in some people's eyes. It's so hard to get it down on paper so it's not just a girl in a bathing suit saying, 'Oh, I *know* they're smart, I *know* they are.' "

I watched videotapes in a white van with Ron Reisman, 26, director of research, a college graduate in classical Greek and philosophy who has also worked with ape-language projects. Reisman has clamped a steel framework of scientific method—blinds, statistics, random tests—over Flipper's free-ranging approach. "The name of the game at this operation is quantification," he said, "to take the vast wealth of anecdote and speculation generated over the years and test these in a controlled situation and produce quantifiable results. Nice, hard data gets you some-

where." I asked him why he has turned down lucrative jobs to work here. "Obviously," he said, "I'm a hopeless romantic."

And there were the dolphins. Flipper's has 14 bottlenose dolphins held in large natural pools blasted from coral rock. Everywhere I walked they seemed to follow, cruising along beside the docks, each listing to one side to show one eye and a smile, watching speculatively, like crocodiles. They were more alien in person than on paper, the caricatures we draw of them, large brains and all, always wear human expressions. They were big, like streamlined horses, quick as otters, as firm and squeaky as rubber dolls, flexible as snakes. All grace and no hands, they could not move without flowing, like their sea.

On a warm afternoon I put on a mask and swam with them, at last. They passed before my face, slabs of shaded gray, patterned with scars, letting me slide my hand their length. One man has compared the first touch of a dolphin's skin to the feel of the new wet bottom of your own child, but this was a firmer contact, less emotional on both sides. I rode through the water grasping the base of a dorsal fin; I was whacked about the lower legs by flukes and noses; I dived from the quicksilver sky into heaving water and watched the shapes whirl around me, jaws, teeth, eyes, scars and flukes, a dance of speed and power.

I surfaced, breathed and ducked below again. A face met mine, head on, a strange countenance: the long, blunt beak, the eyes almost invisible from the sides, a broad forehead, the body tapering away behind. The head bobbed and nodded slightly in a sonar scan, and I heard a faint buzz as the animal examined my skull, my skin, perhaps even the shape of the air held in my lungs or the pace of my heart. I felt scrutinized and known. For a moment—my need to judge would return—intelligence seemed indeed an artificial structure, like the pyramid of species on whose summit we humans have placed ourselves. I rose to breathe. So did the dolphin.

DILEMMA 9: "Home at Sea"

Kenneth L. and Steve S. are on trial for grand theft. Six months ago they were students working at a marine research laboratory where studies were being conducted on two dolphins. Their responsibility was the care and feeding of these animals which were used in the study of dolphin memory, vision, hearing and learning ability. One night they sneaked back into the labs, took the dolphins out of their tanks and released them at a nearby beach.

The two defendents claim that they are not thieves but liberators. They have merely taken the dolphins home to the sea where they will again play freely and be with other dolphins. Dolphins, they argue, are highly intelligent and social animals. Held captive in isolated tanks, they are deprived the joys of frolicking over ocean waves and surf. With brains as large as humans they can certainly sense their loss of freedom. To confine them and subject them to tedious experiment is cruel treatment.

The director of the lab, a world authority on dolphins, vehemently disagrees. He has studied these two dolphins for over six year, performing experiments on their ability to learn sound signals. The time, effort and money spent to train the animals have led to important progress in scientific knowledge and information about how to protect these sea mammals in the wild. Loss of the two dolphins will be a serious setback for scientific research. Moreover, he is concerned that these two dolphins, tamed after all these years under human care, cannot protect themselves in the ocean wrought with dangers. They may be an easy prey in the shark infested waters, especially since they are Atlantic dolphins and may not easily adopt to the conditions of the Pacific where they were released.

The court jury is to decide whether Kenneth and Steve are guilty of stealing or are liberating intelligent, captive animals.

How should the jury decide?

DISCUSSION QUESTIONS

- Why do the defendents feel that they are taking the right action?
- Should human beings have a right to hold intelligent animals in captivity?
- Should the right of dolphins to be free important?
- Should releasing the dolphins be considered a theft?
- Should dolphins be considered property?
- Is there any difference between using dolphins for experiments and training dolphins to perform in shows?
- What if the defendents had released another animal, such as a shark? Is there a difference?
- Many scientists believe that knowledge about how dolphins live and communicate can provide important clues for the improvement of human society. From this viewpoint, have the defendents done human society a disservice?
- Is the fact that the tamed dolphins may not be able to adjust back to ocean life an important issue in the case?
- If zoos and oceanariums have a right to keep animals, should scientists be allowed to conduct research on animals?
- How does one determine what is cruel and unnecessary treatment of animals?
- Why might it be important to learn more about dolphins?

Reading 16

WHY THE DOLPHINS DIED

BY HARDY JONES

SCORES of dolphins lay motionless on the beach. Others waited in shallow water, their beaks tangled in nets as the tide ran out. Across the bay, a group of about 60 men with spears and knives waded among still more dolphins, stabbing as they went. The water around them was red with blood. I had hoped to prevent this massacre, but now I was face-to-face with it.

Fishermen here on Iki Island in southwestern Japan have been killing dolphins for several years, although most outsiders did not learn about it until 1978. The fishermen blame the marine mammals for sharply declining catches of fish and squid, and their response has been to declare war on the animals. As a filmmaker specializing in dolphins, I thought I could help, and last year I journeyed to Iki with a handful of dolphin researchers. Together, we brought sophisticated acoustical gear which showed some promise for repelling dolphins without injuring them. The Japanese seemed interested and were friendly. I came away from that first visit with a better understanding of how complicated the cultural and economic issues were.

When we returned this past spring, the situation had changed. The islanders on Iki were hostile and there was talk of dolphin extermination. Worse, there were ominous signs elsewhere in Japan that some coastal districts were gearing up an entire new fishery for small whales. To many international conservationists, the appalling events at Iki appeared to mark the beginning of a massive assault.

In all, there are 90 species of cetaceans. The larger of these torpedo-shaped marine mammals are popularly referred to as whales. The 53 smaller ones include groups frequently called dolphins and porpoises. Among the smaller species are three that swim past Iki in the spring in pods of up to 1,000. bottle nosed dolphins, false killer whales and Risso's dolphins.

People in many parts of the world have hunted the great whales for four centuries with devastating consequences. Now, in most countries, whaling is regulated by the International Whaling Commission (IWC), which sets quotas for the numbers of whales that can be killed each year. The IWC has never regulated the killing of dolphins and other small cetaceans, but it was scheduled to review the matter at its annual meeting in England this past July.

That review is long overdue. Like the people of Iki, other fishermen around the world also view dolphins as direct competitors for their catch. As a result, dolphins have been killed by fishermen in the Aegean, in the Mediterranean, off Norway, Australia and even Florida. Last winter, the Soviets harvested 906 orca, or killer whales, in the Antarctic. The most flagrant killing, though, is done in Japan.

Before our first visit to Iki in 1979, we did not know what to expect when we arrived. We joked a little uneasily about the reception a Japanese environmental group would get if it tried to lecture San Diego tuna fishermen on their problems with dolphins. (In the

U.S., more than 200,000 dolphins accidentally died each year for a decade in the nets of tuna fishermen until passage of the Marine Mammal Protection Act in 1972 led to a reduction in that toll.) At the same time, we wondered what kind of human could butcher dolphins in wholesale lots, leaving them to rot on the beach.

We need not have worried. The fishermen were anxious to tell their side of the story. At the home of Susumu Harada, president of the young fishermen's union, we were served tea and fed mountains of food as we talked. Harada wore a green jogging suit, his hair was cropped short, and he looked like a college athlete. Sitting cross legged on a tatami mat, he spoke freely of the difficulties facing the fishermen of Iki. "I love this island," he said, "but if we do not fish, we have no livelihood. I love my hometown and my fishing . . but right now I am rather afraid about our future."

Harada's life story is simple. After graduation from high school in 1970, he started fishing, as do almost all of the men of Iki. The squid catch in 1973 enabled him to buy his home. "When I graduated from high school there were so many squid, they were like trash," he continued. "These days the fish have become very few, and I really think it is the fault of the dolphins. We now bring in only ten percent of what we caught eight years ago."

One day, Harada took us out to the fishing grounds – the Shichiri-ga-sone Bank. Hundreds of boats moved rapidly back and forth, engines running and CB radios blaring. The men of Iki each fish with a single line, which they drop 300 feet deep and haul back hand over-hand. They have voluntarily discarded trolling and netting in order to prevent overfishing, but in 1978, despite their precautions, the take of yellowtail, their prime catch, was still dropping. They blamed the dolphins.

One evening, we went back to sea to observe fishing for squid, which are also eaten by dolphins. Ten miles offshore we could see a vast shoal of lights – a huge cluster of fishing boats with blazing lamps strung their full length. The lamps attract the squid which are brought aboard the boats on mechanized lines with multiple barbs. On this night, though, only six squid were cranked aboard Harada's boat.

The following morning we went to the daily fish auction at dockside, where the catch is sold. An average yellowtail brought $15. By the time it reached Tokyo it would be worth $50. As we followed the fish through the streets to the stalls where they are sold, it became clear that fishing is much more than a job here. It is a way of life.

Now, the fishermen believe, dolphins are threatening this life-style. There are 300,000 dolphins in the area, according to Kazuhiro Mizue, a fisheries expert now at Tokyo University. Other experts place the total population at only 50,000, but for Iki's fishermen, the numbers don't matter. As their catches of yellowtail and squid dwindle, they see a them-or-us situation. A dolphin will eat 10 percent of its body weight a day, biologists say. That translates to 30 tons of fish per day at Iki.

Why the dolphins have descended on the Shichiri-ga-sone fishing grounds is a more complicated issue, and fishermen themselves may be partly to blame. Overharvesting has ruined many of the Japanese coastal fisheries. As a result, says Toshio Kasuya, a whale biologist at the University of Tokyo, dolphins may congregate at the Shichiri-ga-sone Bank because it is one of only a few places where they can find food in season. A huge squid fishery 200 miles north of Iki was destroyed ten years ago by overfishing. Significantly, that was exactly the time dolphins began to be a problem on Iki.

But the events leading up to the slaughter at Iki were building even before that. In 1964, Kenne H-K Chang, a student from Stanford University, was on Iki writing his doctoral thesis. He observed that the fishermen then thought of the dolphins as only a mild nuisance. In fact, the islanders actually revered dolphins and believed bad luck came to a person who killed one. Just ten years later, the same fishermen were using shotguns, harpoons and everything else they could think of to drive the dolphins away.

By the mid-1970s, the dolphins were taking fish right off the fishermen's lines in such numbers that the people of Iki began to fight back. In 1976, they killed 223 dolphins. In 1977, they killed 950. By 1978, the fishermen were so confident of the rightness of their cause that they called a press conference to announce their next kill. They expected photographs of the dolphin bodies piled on the beach to prove their point – that they needed government help. But the strategy backfired. The photographs of 1,368 dead dolphins were widely published and set off a storm of protests around the world. The fishermen, who had erected a monument to the "souls" of the dolphins they had killed, were stunned and resentful. They constantly reiterated their claim that they did not want to kill dolphins – only to protect their livelihood. The next year, though, the toll reached 1,600.

Some environmentalists think the Japanese have other alternatives. One possibility is better management of the fish themselves. The government could give fish stocks a chance to regenerate by subsidizing the industry for reducing its catch. Or it could pay fishermen for time and fish lost due to dolphins, much as some state governments in the U.S. compensate farmers for damages caused by beaver, deer and other wildlife. The Japanese government could also discourage dolphin killing instead of encouraging it. In Newfoundland, Canadian fishermen are paid a reward when humpback whales caught in their cod traps are freed. In Iki, the regional government pays a bounty of $80 for each dolphin killed.

One short-term possibility is to frighten dolphins away from fishing areas, a solution we hoped to demonstrate with our own acoustical gear. We brought an electronic synthesizer, amplifiers, underwater speakers and a device called a "beluga spooker." The "spooker," which broadcasts amplified killer whale sounds under water, has been used in Alaska to scare beluga whales from salmon nets.

Dolphins hear their world rather than see it. They have highly sophisticated sonar systems and can probably communicate among themselves. Some of the people in our crew had been involved in experiments in the Bahamas, which used music to attract a large school of spotted dolphins. Now, they would attempt to use sound to chase dolphins away.

Employing techniques like these at Iki was a tall order, we discovered on our visit in 1979, because the sea in which fishing takes place is vast. As it turned out, we didn't even have a chance to try because the dolphins had already passed through. A week before, the fishermen had killed 500 of them. At the beach where the slaughter took place, we found the carcass of a bottle-nosed dolphin in the water, its pectoral fin pointing stiffly to the sky.

A false killer whale nearly 12 feet long was on the beach, a gaping hole in its neck. The sand we walked over was saturated with blood.

For those of us who have studied dolphins and swum with them in the sea, the scene was especially appalling. To us, at least, dolphins hold a special place in the animal kingdom. Perhaps their affinity for people was what led the Greeks and Cretans to call them gods. Certainly, some dolphins are among nature's most intelligent creatures. The bottle nose has a brain size 20 percent larger than our own.

Given our own strong feelings, we were particularly disturbed to hear the reaction of Harada's brother, also a fisherman on Iki. He told us quite explicitly that he hated dolphins and enjoyed seeing them herded into the bay and killed. Perhaps that should have been the tip-off that our second visit might not be so easy.

I went back to Iki again late in February of this year. With me was photographer Howard Hall, who had been at Iki in 1979. Jim Nolan, a westerner who had long experimented with dolphin communications, had been on Iki for nearly a month before we arrived, putting together his acoustical equipment and maintaining liaison with the fishermen. He had received a promise from the executive director of the fishermen's union that we would be given a chance to test our gear on the fishing banks before any dolphins were rounded up.

As it turned out, though, we postponed our trip to Iki for a week because of a disturbing report from the old whaling port of Taiji about 200 miles south of Osaka. Some 200 rare melon-head, or electra, whales had been herded into a bay there and were to be killed for food. We hopped aboard the next train for Taiji.

That night, much to the consternation of the people there, we entered town with nine cases of diving and photographic equipment. The fishermen did not want us to make them into another Iki by filming the mass killing. After three days, they decided to free the whales, and we had the satisfaction of seeing the school move slowly to the opening of the bay.

But the news from Taiji wasn't all good. Toshio Kasuya, the University of Tokyo whale biologist, was in the port when we arrived. He was there to study the population dynamics of small cetaceans in nearby waters. He told us he hoped the fishermen would kill the melon heads – "the more the better, the sooner the better" – because 200 corpses would give him a good sample for his study. Then he dropped his bombshell. "We are exploring the possibility of expanding our exploitation of the small cetacean populations in Japanese waters as a food source," he said.

The issue isn't simple. Japan has a relatively small amount of land to support a very large population. Fish are already expensive, and down the road, Japan has ample reason to fear a cutoff of some fish protein sources. Japan has long been one of the world's most aggressive whaling nations, but supplies of meat from large whales are already down because of serious depletion of the great-whale stocks. Although the Japanese total fish catch continues to increase every year, the country's coastal fisheries are apparently in serious decline. And Japanese factory ships are encountering more and more restrictions in fishing waters of nations such as New Zealand. An expansion in the harvest of small cetaceans could take up part of the slack. Already, according to some estimates, the Japanese may be harvesting 20,000 small cetaceans a year, although in Tokyo and elsewhere in Japan, there is strong resistance to using the meat for food.

After this side trip, we headed straight to Iki. The news there wasn't much better. The dolphin species at Iki are seldom used as human food, but with the help of the regional government, fishermen there had purchased a machine that grinds up dolphins into fertilizer and pig food. Apparently, by making use of the dead dolphins rather than leaving them on the beach, they hoped to remove some of the stigma attached to wasteful killing. Clearly, however, the issue was no longer simply a matter of competition for fish.

On our first day at Iki, we phoned the union executive to let him know we were on the island. To our astonishment, he told us to leave Iki. Instead, we went to find our old friend Susumu Harada who had been so open and friendly the year before. Harada's wife saw us as we came along the dockside, and she ran up smiling and bowing. Her husband was working on the engine of his boat. She called and he stuck his head above the engine room hatch. I awaited Harada's warm smile upon seeing us, but instead he looked shocked and, I thought, embarrassed.

Through our interpreter we exchanged small talk. I asked about the catch of fish and learned, again to my surprise, that it had been very good. But that gain had partially been offset by the doubling of diesel fuel prices and by very bad weather.

By now other fishermen had gathered around. Harada blended with them, seeming not to want to be closely associated with the *gaijin* ("foreigners"). One of the fishermen mentioned casually that a group of 800 dolphins had just been herded into the bay at nearby Tatsunoshima Island.

I expected our presence, especially with cameras, to inhibit a slaughter, but the union had ordered fishermen not to take us to the killing site. Finally, we found an old man who had not heard the edict, and he agreed to give us a tour of the bay. "Something exciting is happening," he said. "There are dolphins, you know." There were indeed dolphins and that turned out to be the day they died. Finally, almost inexorably, it seemed, all of our planning, hoping and preparing had brought us to the very thing we wanted most of all *not* to see, a massacre.

At Tatsunoshima Island, we headed toward the nets which contained hundreds of bottle-nosed dolphins. A constant staccato of dolphin breaths was audible above the noises of the motor and the sea. No obstacles prevented these animals, so famous for their spectacular leaps in oceanariums, from jumping over the nets. But they did not do so here, because the jump is a learned behavior.

As our boat approached, fishermen ran alongshore waving us away. They clearly did not want our cameras there, so we swerved around a point and landed out of sight. Going cross-country, we headed down a brushy path to a clearing at the edge of the beach. The bodies of perhaps 80 bottle-nosed dolphins lay in front of us.

Howard and I moved forward, filming as we went. Almost immediately, a fisherman began telling us to go away. We evolved the tactic which served us for the rest of the day: "*Wakarimasen. Wakarimasen.* ('We don't understand')." Finally, the fisherman waved us on. Up ahead, the water had turned bright red. The beach itself was piled high with the bodies of dead and dying dolphins. I could see many

were still alive, blood pumping from open wounds in their sides. Hundreds more were being hauled ashore and stabbed to death. By the end of the day, some 500 of the 900 captured dolphins had been slaughtered.

It was a nightmare made all the more horrible by a macabre element of mindlessness. When it comes to using wildlife resources, many conservationists have considered whales a special case deserving total protection. But even conservationists who believe some harvesting of dolphins is acceptable would have found the situation at Iki repugnant. There was no scientific management consensus on the populations of those animals -- or on how many could be killed without endangering the rest. There was no systematic procedure for killing. What I was watching was a pogrom, and even in Japan, I found out later, many people found the fishermen's conduct out of line. I wondered where it would lead and how many years it would keep on happening.

I looked at those magnificent creatures and saw them one minute full of life and beauty — the next, a slab of bloody flesh on the beach, heading for a grinding machine that would turn them into fertilizer. Toward the fishermen I felt no hatred. They did not understand what I find so remarkable in this creature they call "*iruka*," or sea pig. When I really examine why it is that I consider dolphins so special, I can only recall the many times I have looked into the eyes of dolphins and seen them looking back. ■

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> *"The narrow-minded idea of protecting dolphins exclusively is not conservation of nature or prevention of cruelty to animals."*

Readers React To Dolphin Kill

ONE year ago, fishermen of Iki Island in Japan killed 1,600 dolphins. Newspapers and television stations around the world reported this event and, in some countries, the reaction was one of outrage. The Iki fishermen said they were protecting their livelihood because dolphins had moved in and were gobbling up their fish stocks. Writer Hardy Jones and photographer Howard Hall traveled to Iki to cover this complicated issue for INTERNATIONAL WILDLIFE (see "Report from Iki Island: Why the Dolphins Died," September-October '80). Predictably, the response to that story and its graphic photos was heavy. Reactions (which are summarized here) came from seven scholars who are members of the editorial committee of the Japanese Wildlife magazine, as well as from western countries. Here are some of them – from very different perspectives.

> *"For the people of Iki, especially the fishermen, the problem caused by dolphins is a question of survival, not just jobs."*

REACTION: JAPAN

Narrow-minded protectionism

There are some people among so-called animal lovers who cause destruction of nature by insisting on trying to protect some animals in a particularly hysterical way, not caring about the consequences of their actions on other species of wildlife. The dolphin problem is a good example of this thinking.

Fishermen make their living from the resources of the sea, so, as the article pointed out, they are afraid of overfishing. As the development of fishing is followed by overfishing, quotas have had to have been introduced and regulations established for no-fishing areas and closed seasons. The fishermen have long been carrying out these measures. If the dolphin population becomes excessive, the ecosystem will be unbalanced and measures must be taken to restore the balance. It may be an interesting experiment academically to drive dolphins off using sound waves, however, this will not be useful to protect the ecosystem.

It is difficult to know the exact quantity of sea resources at the moment. But we must find out how dolphins and other animals, and mankind in general, can maintain their food chains. We must learn how much fishermen can catch and we must know how much can be allotted for dolphins' food, so they can reproduce without destroying the ecosystem. The narrow-minded idea of protecting dolphins exclusively is not conservation of nature or prevention of cruelty to animals. *Dr. Tadashige Habe, Professor of Oceanography, Tokai University*

Different ways in different lands

A long time ago when I first visited the United States as an exchange professor, I ran across some situations which I had not experienced in Japan. I saw about ten hens in the window of a shop in San Francisco. Although there was a lot of food on the floor, none of the animals looked healthy. There was a sign above the window saying, "Choose any you like." In Japan, hens are not sold before they are slaughtered. The story reminds me of an old Japanese saying: "People do different things in different places."

After that, I lived in Egypt for six months and found another example. Egyptians do not eat pork for religious reasons, but they kill a lot of sheep for food. In the market, I thought it was awful to see rows of sheep heads laid out on big boards. People who feel very sorry to see the bodies of dolphins on the beach – what would their reaction be to the scene of these bleeding sheep heads? *Dr. Yasuo Suyehiro, Manager, Meikyo Aburatsubo Marine Park*

One possible solution

I attended a conference held in San Diego last year in which we were fully informed about what is being done in regard to dolphins in the United States. For the first time, I realized how seriously the matter is considered and how insufficient are the suggestions proposed by the Japanese government and private organizations.

While fishing for tuna in the North Pacific, U.S. fishermen formerly killed more than 200,000 dolphins annually. To reduce this number, fishing nets were improved and the method of fishing modified, and an annual quota was assigned for the number of dolphins which could be killed. This number has decreased every year.

At present, the Japanese Fisheries Agency has been making efforts to come up with a solution to the problem of the dolphins of Iki Island by playing recordings of killer whales or supersonic signals to drive the dolphins away. However, what I suggest is to play a high-pitched sound like a siren to a group of dolphins, then shoot some of them. After this is done a few times, the dolphins will swim off when they hear this sound. *Dr. Tadashi Koga, Chairman, Tokyo Zoo Society*

Careless writing, wrong impressions

The writer of the article does not seem to have a clear idea that there are two main philosophies

underlying modern nature conservation 1) complete prohibition of killing and 2) the protection of endangered species. In reality however, the former must compromise with man's need for animal protein.

I would like people who write articles like this one to be fully aware of the difference between the two philosophies and proceed only after careful examination of the problem. It is a shame that this article does not do this and is in part purely emotional. There is a danger that careless writing like this could give readers the wrong impression or lead them to the wrong conclusion. *Dr. Yoshinaro Yamashina, Chief Director, Yamashina Ornithological Research Center*

Outsiders shouldn't judge

The thinking of the writer of this article seems to be based on a biased view of prevention of cruelty to animals rather than conservation of nature or true prevention of cruelty to animals. If it is very important to protect dolphins, he should give the reasons for this on scientific grounds. He should not merely appeal to people's emotions with photographs of violent scenes of dolphins being killed.

For the people of Iki, especially the fishermen, the problem caused by dolphins is a question of survival, not just jobs. There is no alternative to fishing for one's livelihood. Because of this it is not a matter to be sentimentally judged by outsiders whose lives are secure. On top of this, if you insist something is wrong, you should be able to suggest a practical alternative. *Dr. Norio Kondo, Tokyo Agricultural College*

Not just enemies of fishing

Dolphins are regarded as enemies of fishermen in Japan, but westerners say, "It is cruel and barbaric to kill these such large, clever animals." Since this is such an emotional issue, we cannot hope to win any arguments using reason or scientific theory. We have to regard dolphins as a fundamental structural element in the ecosystem. We have to accept with humility the warning that if we keep regarding dolphins only as enemies of fishing, the existence of mankind as a member of the earth's ecosystem will be threatened. But if Americans insist on forcing their opinions on us in a purely emotional and sentimental way, it will become hard to accept them. In fact, there is considerable resistance, especially from those who make their living by fishing. We should take advantage of this opportunity to reconsider the importance of the ecosystem. *Dr. Makoto Numata, Chiba University*

Killing livestock — or wildlife

There is no difference between us killing whales or dolphins and westerners killing cattle or pigs. Why then do they accuse Japanese of cruelty?

It seems to me that they are against the way dolphins are killed. Probably they are more upset because the animals being killed are wild. In primitive times, mankind relied on wildlife to provide clothes and food. When agriculture and forestry were developed, wildlife gradually lost its value as a resource. As man's culture developed, people began to recognize the value of wildlife as an essential part of the environment in which they lived. Fishing, including whaling, is a relatively primitive industry. The reason it still exists is that only a few of the countries which regard fish and sea mammals as food have the technical capability to catch them in quantity. In the current international climate, even if we plead on the basis of the particular situation in which our fishing industry is placed, no one will listen. Sooner or later the Japanese fishing industry will have to go through a drastic change. I think it would not be a waste of taxpayers' money if our government starts dealing with this pressing concern right away. *Dr. Yoshinori Imaizumi, President, Japan Mammal Institute*

> "In my opinion, your lack of taste and consideration is no better than the mindless slaughter of animals per se."

REACTION: THE WEST

To print the pictures or not?

After reading this upsetting article, I had tears in my eyes and a raging anger against the Iki Island fishermen. I feel printing the pictures was a wise decision. More articles of this sort should be printed in other magazines. *Cathy Welch, Lansing, Michigan*

In my opinion, your lack of taste and consideration is no better than the mindless slaughter of the animals per se. For a week I couldn't hold any food down and almost constant nightmares made sleep impossible. *L. Deuck, Kayenta, Arizona*

Your decision to print the pictures reminds me of the old adage "When in doubt, do without." *Jody Rosenblatt, Big Pine Key, Florida*

The pictures may not be pleasant to some, but life is not all roses. *Harlan Schuenck, Clarkesdale, Wisconsin*

Such issues aren't solved emotionally, but I can tell you the photos got the attention of other people I know. Their curiosity was followed by intelligent discussion. *Terry Sullivan, San Francisco, California*

The "systems" approach

The real questions are: What are the species populations? How much mortality can these populations handle, if any? And how can the human social and economic problems be met at the same time? These are what engineers call "systems" problems, with many different components. As scientific consultant to the U.S. tuna industry since 1976, I have witnessed the solving of a similar problem. A concerted effort by government, the public, scientists and the fleet has reduced a once starkly high mortality to a biologically negligible minimum in terms of the populations involved. The porpoises have also contributed by learning to avoid behavior leading to mortality in the nets.

Systems problems are capable of solution, but only if all concerned abandon the "adversary" position and learn to look at all sides of the conflict. I congratulate you on presenting the Iki issue in a manner encouraging that approach. *Karen W. Pryor, New York, New York*

Practicing what we preach?

I became very angered toward the Japanese until I found out that their dolphins killed were fractions of our "accidental" deaths from the tuna industry. You stated in the article that the Marine Mammal Protection Act of 1972 reduced the 200,000 death toll. What you neglected to say was what it was reduced to. Was the amount still so staggering that you didn't wish to mention it? Is it safe to assume that we are setting a good example for those nations we are protesting about? Are we practicing what we preach? *Laura A. D'Argo, Des Plaines, Illinois*

In 1979, the "accidental" take of dolphins by U.S. tuna fishermen was 17,000. — Editor

Terrific Strain

I have just spent the last ten minutes trying to gain my composure and trying to stop crying. Mr. Jones and Mr. Hall are to be commended for their objective approach to a contemporary horror story. I know they must have been under a terrific strain to keep their perspective while such a macabre incident was happening right under their noses. *Deborah L. Greer, Louisville, Kentucky*

> "Mr. Jones and Mr. Hall are to be commended for their objective approach to a contemporary horror story."

DILEMMA 10:
"Unwilling Bait"

Jerry Green has an inkling that there will be trouble today so he and his fellow fishermen have come prepared with rifles. He and the other tuna fishermen have received a letter from the Save the Porpoise and Dolphin Foundation protesting the killing of these animals. The letter warns that the group will take action if the fishermen continue to fish for tuna by "purse seining." This method relies on using porpoise to attract the tuna. To do this, nets are used to surround the porpoise and keep them together. Often, however, porpoises who swim in schools above the tuna become entangled in the nets and, if they can't get air, drown. But, Jerry is not about to give up tuna fishing because some people do not approve of the fishing methods.

The fishing boats have just located a school of porpoises, surrounded them with a large net and wait for the tuna to swim underneath. Suddenly, several small boats appear. The leader of the group announces over the loud speaker, "Release your nets, or we will cut them. Stop the killing of porpoises! They are highly intelligent animals and shouldn't be used mercilessly."

"Get away from our fishing water," Jerry shouts back. "We have to make a living. Find another animal to protect. We haven't killed over our quota of porpoises. You have five minutes to leave. After that we will ram your boats!"

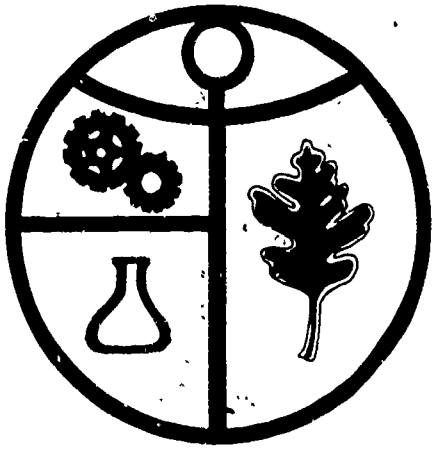
To show that they meant business, Jerry signals the other fishermen to ready the engines.

Should Jerry ram the protesters? Why or why not?

DISCUSSION QUESTIONS

- Does Jerry have the right to chase away the demonstrators? Why or why not?
- Do the demonstrators have a right to interfere with other people's livelihood?
- Since the fishermen are keeping to the quota of porpoises they can kill, should the demonstrators expect any more? Why or why not?
- If the demonstrators are injured, do they have the right to blame the fishermen? Why?
- The fishermen claim that they can't make a decent living if they don't obtain good catches. Does this allow them to use the porpoises for their benefit?
- If the porpoises interfered with the fishing of tuna, or ate up the fish, do the fishermen have a right to kill them?
- When they cut the nets, the protestors would be destroying property that doesn't belong to them. Can such an act be justified?
- The tuna fishing industry will be jeopardized if fishermen cannot continue to use these fishing methods. Should other animals be sacrificed for the sake of an important industry and the food it provides? Why or why not?
- Does our need for food justify the killing of other animals?
- Should wild animals have a right to live undisturbed by people? What about animals such as bears or wolves?
- Why do you think the demonstrators feel it to be so important to protect the porpoise?

Section Two:



Resources and Choices

Activity 1, Part 1

THE CASE OF MINERAL KING: A Role Play Simulation

Introduction

Mineral King Valley, in the Sierra Nevada mountains of California, was so named because it was once the site of extensive mining operations during the late 1800's. When mining ceased, the 15,000 acres were declared the Sequoia National Game Refuge. Since that time, this isolated wilderness area of unusual beauty had been a haven for backpackers, campers and fishermen seeking escape from the man-made world in this country's most populous state. However, only the more hardy ventured here because there were no paved roads through the valley nor were there tourist facilities such as campgrounds, motels, and other modern comforts.

In the late 1940's, the Forest Service began to consider the possibility of developing Mineral King as a recreational area. It evaluated a number of proposals. Finally, in 1964, the Walt Disney Enterprises proposal was selected, and its Master Plan was approved in 1969. The company planned to develop the area into a winter ski resort, complete with ski lifts, trails, village, restaurants, lodges. These facilities would accommodate over 1.7 million visitors a year. This development would require building a road through part of Sequoia Park to provide access to the Valley. The facilities would occupy over 300 acres while the ski trails would span over 13,000 acres.

The Sierra Club, an organization concerned with preserving natural environments and maintaining the integrity of ecosystems, became alarmed by the prospect of this large tourist development. It felt that developing the area for skiing and other winter sports would harm or destroy the scenery, natural and historic objects and wildlife of the park and reduce the enjoyment of the park for future generations. It then filed suit against the Forest Service and the Secretary of Agriculture (the U.S. Forest Service is a bureau of the Department of Agriculture) and the National Park Service and the Secretary of Interior (the National Park Service is a bureau of the Department of Interior) to halt development of the Disney project. It charged the Forest Service on the following grounds:

1) It violated a ruling by Congress that limits resort development on national forest land to a maximum of 80 acres. In the lease arrangement, the Service agreed to lease an additional 300-acres on a year-to-year basis.
2) Development in the valley would change the character of the area which is now a National Game Refuge.
3) The Forest Service had failed to hold public hearings on the development proposal. (The Service felt that hearings held in 1953 were sufficient.)

Although the Sierra Club protested the development of Mineral King, other groups supported its development. In the following activity you will conduct a court hearing and examine some of the arguments "for" and "against" the development.

Procedure

1. Members of the class will play one of the following roles:
   - Member of judicial panel (three to five judges) hearing the case
   - Member of one of the following interest groups (2-4 in each group)

     Against Development

     The Sierra Club
     National Environmental Law Society
     Wilderness Society

     For Development

     Walt Disney Enterprises
     County of Tulare
     Far West Ski Association

   - Defendents (3-4 in the group)

     The Forest Service

   Roles may be student selected, assigned by the teacher, or drawn at random.
2. Members of each interest group will meet together to develop their testimony for presentation at the court hearing. (At this time (a) spokesperson(s) for each group may be selected.) Judges will meet to prepare questions to ask each of the groups. The presentations should be about 5 minutes in length. After each presentation judges may question the witnesses. (A time limit or limit on the number of questions should be determined by the class prior to the hearing.)

Development of the Presentation

Each group involved in this controversy has a different interest and concern. In developing the testimony:

1. Analyze the brief description given for your interest group. Each member should try to imagine how he/she might best portray a person who is a member of that organization. Decide how a person in that group might react to the problem.
2. Identify the major concerns of your organization and how it might best argue its case. What is at stake? How might the group's interest be best protected? What rights, if any, might be violated?
3. Select the strongest argument(s) in support of your group's position. Develop the arguments for the presentation using the worksheet (Student Handout #1)

provided. Incorporate your own ideas, ideas of other group members and information gathered from outside research. Consider, your argument from the viewpoint of possible future effects or benefits. Who might benefit or be adversely affected by the Mineral King development? How does one determine what is best for the public?

The Presentation

1. A spokesperson (or spokespersons) will present the argument to the panel of judges. A timekeeper should keep track of each presentation to make sure that the speaker stays within the time limits.
2. Judges will question the witnesses after each presentation.

The Decision

1. After all presentations have been heard, the judges will meet to discuss the testimony presented. This meeting is open to the entire class.
2. After this discussion the judges will adjourn to their "offices" to write their decision. The decision, accompanied with an explanation, is to be read to the class-at-large.
3. When the judges have completed their task, the class will reconvene to hear the decision.
4. The "chief" judge will announce the results and then call upon each judge to read his/her reasons for arriving at that decision. What was the decision?

Positions of the Interest Groups

THE SIERRA CLUB:

Your club, founded in 1892 by John Muir, a famous American conservationist, has over 78,000 members throughout the United States. A major purpose of the Sierra Club is to protect and conserve the natural resources of the Sierra Nevada mountains. In more recent years, its activities and concerns have expanded to include the conservation and sound maintenance of national parks, game refuges and forests of the country, as well as wise use of our natural resources.

As members of the club, you feel that development of the Mineral King Valley would destroy the unique beauty of the area and what it has to offer as an undisturbed wilderness. Affected would be the scenery, natural and historic objects and wildlife of the park. If development takes place, people now and in the future would be robbed of recreational opportunities in a place that is largely untouched by humans. Places of natural beauty, from your point of view, are a special resource of the country and must be protected from destruction.

NATIONAL ENVIRONMENTAL LAW SOCIETY:

The arguments of your group focus on land use policies of public lands. Mineral King is designated as a National Game Refuge. This means that the Forest Service has a duty to protect the flora and fauna of the area. You question the extent to which the development will destroy animal and plant habitats and change the wilderness character.

Decisions made by the Forest Service on how public lands are to be used are intended to best serve the interest of the American public. You are concerned that most decisions have been made to serve limited interest groups and are often dictated by immediate monetary returns. Large tracts of public lands have been sold or leased for lumbering, mining and livestock grazing. Many of these activities have left the land spoiled and scarred. Much public land today are unwanted leftovers. You believe that management needs to consider broad public interest and the future public. Clean air, wilderness and scenic beauty are becoming increasingly scarce. Although one cannot place dollar prices on these resources, you believe that the public-at-large hold them as important values. You argue that the Forest Service must fulfill its duty to the general public, present and future, by protecting forest lands. To base its management policies on the amount of revenue it receives is shortsighted and serves only a small group of people. If the wilderness experience is important to people, then the irreplaceable wilderness must be guarded with care, by not encouraging development. In this case, you feel that the Forest Service has not fulfilled its responsibilities.

WILDERNESS SOCIETY:

Your society, like the Sierra Club, is concerned with the preservation of natural lands from destruction. Many members of your organization are hikers, fishermen and backpackers who are finding it more and more difficult to find wilderness areas unmarred by human activity. This is especially true in many parts of California where superhighways and suburban sprawl has taken over. For example, Yosemite National Park, one of the world's natural wonders, has become so crowded in the summer that tents are literally pitched one on top of another; driving has been banned on the floor of the valley because smog created by automobile exhaust fumes posed a health hazard.

As members of this organization, you believe that the extensive development proposed threatens the habitat of the wildlife. Many of the ecological communities are unique to the area. Destruction of or change in the area can lead to elimination of rare plant and animal species. Once a species dies out, it is lost forever. If Mineral King Valley is developed, its present status as a wildlife refuge will no longer be possible. Mineral King, as a ski and recreational resort, will bring far greater numbers of visitors than Yosemite now attracts. Ski trails will gouge the mountains. Litter and garbage will need to be disposed. Sewerage facilities need to be built. Development will change everything.

WALT DISNEY PRODUCTIONS:

You are officers in the Walt Disney Production Corp company which developed Disneyland and Disney World, the monumental amusement and recreational parks that have brought joy to millions, young and old. Your proposal to develop Mineral King is by no means one that will approach the massive scale of the amusement parks. You plan to develop Mineral King into a winter sports complex with the major emphasis on skiing. There will be resort facilities that include shops, restaurants, and motels. In addition, the $35 million dollar resort complex can be used for summer vacationers. Your attractive plan has been selected by the Forest Service from among the six other proposals submitted.

The location of Mineral King is ideal because it can serve residents from both the populous San Francisco and Los Angeles area. Moreover, people now have more leisure time and money and seek new recreational opportunities. Skiing, of course, has become a major winter sport, having experienced phenomenal growth in recent years.

Your company believes that the resort complex will open up the park lands for over 1.7 million visitors, most who would not visit there if the facilities were not available.

COUNTY OF TULARE:

You represent the county of Tulare, adjacent to the parklands. Primarily an agricultural community, it has not shared in the economic growth experienced in other parts of the state. The development of a resort facility nearby would bring new business and people into the county.

In a study conducted by the Tulare Chamber of Commerce, it was found that the development would create thousands of new jobs, new homes would be built, new stores would open and the county would start booming. The price of land in the area would increase, and local land owners would benefit.

A major development, such as the one Disney proposes, will attract visitors from all over. Your sleepy rural towns will grow because the vacationers will need services, places to eat and other entertainment. You will share in the millions of dollars that the tourists spend. One only needs to look at the areas that surround the other Disney developments to get an idea about how the economy of this area will improve.

FAR WEST SKI ASSOCIATION:

A major purpose of your group is to promote the sport of skiing, one of the country's most rapidly growing sports. You view the Mineral King site as the ideal location for a new ski resort, an easy drive for residents in both the San Francisco and Los Angeles areas. Furthermore, there are few nearby ski areas for Los Angeles residents, and in order to ski they often have to travel over 500 miles to northern California.

You find the Disney proposal most attractive because it includes an Alpine style village complete with hotel that will serve over 3,000 guests, restaurants, a convention center, theatre, indoor and outdoor swimming pool, ice skating rink, over 20 ski lifts and a gondola, as well as a complex of gift shops and boutiques. The development will provide a total vacation resort, unlike any other, and in addition, will offer spectacular skiing. Everything that skiers want will be there.

While the recreations benefits of skiing are quite obvious, you also want to point out the fact that many jobs and industries depend on skiers — resort operators, equipment manufacturers, clothing makers, shop keepers, to list a few. Skiing is a multimillion dollar industry.

THE FOREST SERVICE:

The care of the nation's public lands is your responsibility. Under the Multiple Use-Sustained Yield Act of 1960 you have the authority to determine how these lands can be best used. Public lands you maintain can be used in many ways; you might choose between a number of possible uses — the land can be used for recreation, cattle grazing, lumbering, preserved as a watershed or as a fish and wildlife refuge. Your decision is based on what you think best meets the needs of the American people.

For the past twenty years, you have considered the possibility of developing Mineral King for resort recreation use. In addition to opening up the area to thousands of people you will be earning from the lease of the land over $600,000 a year for the government. At present only a few people come to the area each year because there are no good roads leading into the area. Rental from the few cabins you maintain does not bring in much revenue.

You believe that a wilderness area such as Mineral King should be open to public use. As it stands now, only a rugged few — hikers and campers — make use of the isolated area. With the Disney development the area will be in use all year round. It can entertain 12,000 skiers each day in the winter, and in the summer the ski lifts can take vacationers for rides up the mountains for spectacular views of the surroundings.

After having reviewed the several different plans that were submitted, you considered the Disney plan most desirable because it would transform the valley into a complete vacation resort for people of all ages with different recreation needs and provide the comforts that people today desire. With the shops, restaurants and entertainment facilities it will become a major tourist attraction. You believe that this is what people want, and your belief is supported by the fact that people are flocking to vacation resorts and national parks. In fact, many parks have become so overcrowded that they have to limit the number of visitors. In some places campers have to reserve their campsite a year in advance. More areas, therefore, need to be opened up.

When the Disney proposal was selected you announced:

"Our goal is to provide a needed public service so that scenic, aesthetic and recreational resources of Mineral King can be enjoyed by the American people as part of their heritage. At the same time we intend to work with the Disney organization to assure that development can be accomplished without substantial impairment or permanent undesireable ecological impact. We are confident that these twin challenges have been faced in a creative and artistic fashion."[1]

[1]Oscar Gray, *Cases and Materials on Environmental Law*, 2nd Ed., Washington, D.C., The Bureau of National Affairs, 1973, p. 1973.

JUDGES:

Although the charges (in the actual case) brought against the Forest Service focused on whether or not it had violated rules when it approved the development, the underlying issue in the case is whether or not the Mineral King Valley should be developed. In this simulation you will ignore the legal technicalities (e.g., Did the Forest Service fail to hold public hearings on the proposal?) and deal with the issue, "preservation vs. development."

When you hear the testimonies consider the following points:

- *How well are the arguments presented?*
- *What evidence is there to support the argument?*
- *Are the arguments presented in a logical manner?*
- *To what extent is the argument important? That is, is the point being argued of important concern to people? The environment?*
- *What are the benefits and disadvantages of preserving Mineral King in its natural state? Of development?*
- *What are the possible effects of development? Of preservation?*

Make up a worksheet (see example of Judge's worksheet on page 91) to take notes and make comments. This worksheet will help to summarize the main ideas presented and provide a review of the testimony when you make your decision and write an explanation for your decision.

Your decision will have widespread implications. It will determine, to a large extent, how other public lands will be used in the future because other cases will follow the precedent that you establish. Therefore, you must evaluate thoughtfully the different arguments and choose wisely.

WORK SHEET FOR JUDGES — (EXAMPLE)

	Argument	Evidence	Importance of Argument
1. Sierra Club			
2. National Environmental Law Society			
3. Wilderness Society			
4. Walt Disney Productions			
5. County of Tulare			
6. Far West Ski Association			
7. The Forest Service			

WORK SHEET FOR DEVELOPING TESTIMONY

STUDENT HANDOUT ONE

Activity 1, Part 1

Interest Group _____ Major Concern/Needs _____

Arguments to Support Position	Evidence to Support Arguments	Present and Future Effects/Benefits
1.		
2.		
3.		
4.		

Activity I, Part II

VOICES OF TREES AND RIVERS — A CLASSROOM TRIAL

Background

The Supreme Court Decision on the Mineral King Case

The Supreme Court in 1972 delivered the opinion that the Sierra Club did not have a case against the Secretary of Agriculture and the Forest Service. The presentation of the majority of the judges (four out of the seven) are summarized as follows:

- *The court questions whether or not the Sierra Club has the right to sue or the right of "standing" before the court. From a legal standpoint a person/party has a right to sue if the party has a personal stake in the outcome. While the Sierra Club has argued that the development would destroy or harm the scenery, natural and historic objects and wildlife of the park and prevent future generations from enjoying the park, the Club has not shown that it or its members would suffer harm or injury because of the development.*
- *The court recognizes the intent of the Sierra Club to protect and preserve the Nation's natural heritage and this, in fact has been a major concern of the club for many years. However, simply because it has a special interest does not give it the right to sue. If the Sierra Club can claim "special interest," then any person or organization can bring a case to court based simply on "interest in the matter" without having to show that one has suffered injury or that one's rights have been violated. This can create legal difficulties in determining who is to claim the award for the damages inflicted. Although the Court recognizes that aesthetics and environmental well-being are important to the quality of life in our society, the court must decide if the club or its members have suffered injury. In this case, the Club has argued in the interest of the general public. Yet, not everyone will be affected by the development, and many people even support the development. Nor was it shown that activities of the Sierra Club members will be adversely affected by the Disney development. Have they been deprived of their opportunities to hike, fish or camp?*
- *The court feels that the courts cannot be used to make rulings on values preferred by one group or the other. Here the Sierra Club is asking that the Court support its value — the value it places on maintaining wilderness areas in the natural state.*

The other three Supreme Court Justices were not in agreement with the majority opinion and presented their dissenting views:

Justice Blackman in his dissenting opinions noted that the case was not an ordinary run-of-the-mill case but one which raises important questions about our nation's increasing environmental problems. He argued that our laws must not be so rigid and court procedures be so inflexible that we cannot address new issues and questions. He offered two suggestions:

- *The Sierra Club alters its complaint so that it can meet the specifications of the court on the right to sue; that is, to show that it or its members have suffered injury.*
- *The concept of standing (or right to sue) might be extended so that organizations such as the Sierra can bring environmental cases to Court. Therefore, it would not be necessary to be a resident or user of the area, because a true lover of the wilderness would not be among the masses of users who would converge into the Mineral King development.*

Justice Douglas suggested that inanimate and natural objects should have a right not to be used. If they are despoiled, defaced or invaded by roads or bulldozers, an injury has occurred. We could pass a federal law which permits objects which suffer injury to bring their case to court. This is not a totally new idea, for inanimate objects such as ships and corporations are represented in court. Once a ship is launched she has a name and an identity and is treated as a "person" in the court of law in the same manner as corporations.

"So it should be as respects valleys, alpine meadows, rivers, lakes, estuaries, beaches, groves of trees, swampland, or even air that feels the destructive pressures of modern technology and modern life. The river, for example, is the living symbol of all the life it sustains or nourishes — fish, aquatic insects, water ouzel, otter, fishes, deer, elk, bear, and all other animals, including man, who are dependent on it, who enjoy it for its sites, its sounds or its life. The river as plaintiff speaks for the ecological unity of life that is part of it. Those people who have a meaningful relation to that body of water — whether it be a fisherman, a canoeist, a zoologist or a logger — must be able to speak for the values which the river represents and which are threatened with destruction.

". . . With all respect, the problem is to make certain that the inanimate objects, which are the care of America's beauty, have a spokesman before they are destroyed."[1]

Suppose the Supreme Court decided differently and allowed persons or organizations to sue on the behalf of natural objects. That is to say, inanimate objects have legal rights and can be heard in court. How might such a

[1] *Ibid.*, p. 475.

court case be presented? (Carefully review Reading 18 for suggestions.) In this activity the class will conduct a trial in which the injured party is an inanimate object. (e.g., forest, beach, river, etc.). The case will be selected and developed by members of the class; other class members will serve as judges and rule on the dispute.

Procedure

The class members will serve in one of the three groups:

- PLAINTIFFS
- DEFENDENTS
- JUDGES

Plaintiffs

The plaintiffs will select a problem situation and draw up a complaint. Some possible issues that might be considered are found in the following list, or alternatively, the group may develop another problem situation of its own choosing.

- . . . Laboratory animals (dogs, cats, monkeys, etc.) who suffer unnecessarily or inhumanely in scientific/medical experimentation.
- . . . Animals who have lost their homes and food sources as the result of road building, surburban developments of shopping centers, etc.
- . . . Coral reefs which have been damaged by oil spills
- . . . Mountains which have been scarred by the mining of metals or minerals
- . . . A rare plant or animals whose habitat has been destroyed by the building of a dam or other large construction project
- . . . Birds that have been inadvertently poisoned by insect sprays
- . . . Wilderness areas that have been spoiled by too many visitors
- . . . A lake polluted by run-off containing fertilizers from surrounding farmlands.
- . . . Livestock that are slaughtered by inhumane methods

After selecting the problem topic, the plaintiff will assume the role of an interest group (e.g., Audubon Society, Humane Society, Clean Water Commission, etc.) who will speak for the injured party. It will write a complaint which will be submitted to the defendents and the panel of judges. In this complaint the issue should be clearly identified by listing the party (parties) injured and the injuries suffered. The defendent(s) are named and the charges against them are brought out. Damages and claims should also be indicated.

The plaintiffs will then meet to organize the arguments to be presented to the court. A lawyer or several lawyers may be selected from among the group to argue the case for the plaintiff or alternatively, each member of this group will serve his/her turn as the lawyer presenting one of the arguments. Members of this group may also serve as witnesses for the plaintiff.

Defendents

The defendents will assume the role of the party (parties) named in the complaint. The group will then meet to prepare the defense arguments. The arguments should be organized around the charges brought before the court. The group may select from among its members a lawyer or lawyers to argue its case or alternatively, each member may serve his/her turn as the defense lawyer.

Members of this group may also serve as witnesses for the defense.

Judges

The panel of judges will meet to organize the rules for the court proceeding. Judges shall determine the following:

1. The length of time allotted for each speaker's presentation.
2. The length of time allowed for questions and the number of questions permitted.
3. The type of evidence that will be accepted by the court.
4. The number of witnesses that each group may call upon.
5. The time allotted for closing arguments.

Written copies of the court rules shall be submitted to the plaintiffs and defense prior to the trial.

The judges will select from among its members a presiding judge who will conduct the trial. The role of the presiding judge is to make sure that the trial is carried out in an orderly manner and that both sides in the case are fairly heard.

During the trial, the panel of judges shall listen carefully to the arguments in order to come to a wise and fair decision. A worksheet similar to the example shown on page 96 should be helpful in keeping notes on the trial.

After all the evidence and arguments have been presented, each judge will write his/her decision giving reason(s) for arriving at the decision. The following considerations should be taken into account in the decision.

- Have the rights of all parties involved been fairly protected?
- What are the changes or effects brought about by this decision?
- What values does the decision address?
- How does the decision reflect our attitude towards nature? Should nature serve people? Should people serve nature? How should people and nature interact?
- As a result of this decision, what adjustments, if

any, will people have to make? Will these adjustments be difficult?
- Who or what will benefit as the result of this decision?
- What compensations, if any, should be awarded?

Each judge will submit his/her written decision to the presiding judge who will then announce the majority position (the majority vote of the judges). At this time he/she will briefly summarize the majority and minority position statements, explaining why they ruled in favor of the plaintiff or defendent.

Final Comments

At the conclusion of the trial the class as a whole may wish to discuss or comment on the outcome. Some questions that might be considered include the following:

- Was the court decision a legal, aesthetic, economic, political or social decision?
- What values were upheld in the decision?
- Was the decision reasonable? Does it resolve the problem or create more complex problems?
- What possible problems might arise as a result of the decision?

JUDGE'S WORKSHEET (EXAMPLE)

Plaintiff Arguments	Evidence	Meaning/Importance of Argument	Is Argument Well-Presented? Logical?
Defense Arguments	**Evidence**	**Meaning/Importance of Argument**	**Is Argument Well-Presented? Logical?**

Reading 18

Trees have rights, too

by C.E. Downey

Christopher Stone is a modest, soft-spoken man who habitually dreams up unexpected visions of the law's possibilities. In 1971, the 37-year-old University of Southern California law professor drew on his background in philosophy (Harvard B.A., *magna cum laude*) to write *Existential Humanism and the Law*, hardly a familiar combination. The next year he co-authored *Law, Language, and Ethics*, one of the most unusual casebooks ever used in American law schools. Then came an offbeat book called *Should Trees Have Standing?*

Trees? And the law? That was certainly a new concept. But Stone was no romantic environmentalist sallying forth to save the great outdoors from Man, the Despoiler. So where, some people asked, did he get the idea that nature should have legal rights?

"I was very interested in the history of property law in respect to what things are ownable and don't have rights," Stone said, recalling how the idea struck. "In a class on property, I wanted to relate the historical development of our court system to a broader notion of social awareness and I thought of a really radical shift in our legal system, one in which we grant legal rights to the environment. Later I stopped and said, 'Hey, what did I say in there?' "

The more he talked about his idea, the more guffaws and criticism he heard from his colleagues. But Stone, son of investigative reporter I.F. Stone, was undaunted. Encouraged by the skepticism, he traced the development of civil rights and observed that children, blacks and women had all at one time been ownable "things," without rights. And by the 1970s, nation-states, municipalities, and joint business ventures all had independent legal lives, so why shouldn't the environment?

"One of my colleagues said, 'But Chris, here's the thing: trees can't talk!' And he was very excited," Stone recalls. "I told him that if you listen very, very closely, a tree will make the exact same sounds as a corporation."

Stone admits, of course, that corporations can't speak either, but attorneys speak for them and could speak just as well for the environment. "I'm not proposing that no one ever be allowed to cut down a tree again," he explained. "Corporations have rights, too. But they can't, for instance, plead the Fifth Amendment. So, basically, extending rights to the environment would involve granting it three things now denied under common law. First, give the environment standing in court. Second, treat natural objects as legal incompetents. And third, let any relief for damages go to benefit the environment."

Stone's concept goes further than an occasional court order to stop polluters from their dirty dealings. The problem with environmental cases traditionally has been that actions can be instituted only if there are people who will complain about and can prove an invasion of their rights. But if, as Stone suggests, a natural object were treated like an incompetent, a court could simply designate someone to represent it and manage its affairs.

Still, getting into court is hardly worthwhile if the environmental injuries aren't measured and taken into account. Courts now tend to base decisions on the competing human interests. What should weigh in the decision, Stone contends, is actual damage. Thus, if a polluter is forced to pay $20,000 for damages to, say, a stream, the money should go into a trust fund tended by the legal guardian, who could use it to aerate the stream or restock it with fish. "Suing polluters or developers because the rights of people to enjoy the environment have been or will be harmed isn't enough," Stone claims. "The guardian would be entitled to raise the land's rights in the land's name, without having to make the roundabout and often unavailing demonstration that the 'rights' of some club member were being invaded."

What happens then, one might wonder, when the tables turn? Is Mother Nature to be held responsible for damage caused by forest fires and floods? Would money be paid out of funds recovered by the environment in successful actions on its behalf? "No," said Stone, "the logic isn't there. A child can sue his parents, but parents can't sue a child."

Stone is less than dismayed by objections to his theory. He thinks, in fact, that widespread judicial acceptance of his standing concept is close at hand. Justice William Douglas adopted Stone's view in a dissenting opinion in *Sierra Club v. Morton*, which involved Disney Enterprises' plan to build a skiing development in the Mineral King Valley of the Sequoia National Forest, an untouched mountain wilderness. "Contemporary public concern for protecting nature's ecological equilibrium," wrote Douglas, "should lead to the conferral of standing upon environmental objects to sue for their own preservation. . . ."

If Stone's theory continues to gain ground in legal circles, it could become an important and invaluable tool in environmental litigation. It's already made considerable headway. In New York, for example, standing was granted to livestock in a case involving a complaint against ritual slaughter, and to the Byram River in a pollution case. The Attorney General of New Jersey has used Stone's argument in litigation concerning fish kills, and California's attorney general plans the same strategy to win compensation for the destruction of wildlife caused by the 1969 Santa Barbara oil spill. ■

C.E. Downey is a freelance writer based in Long Beach, Calif. This article originally appeared in *Juris Doctor* as "He speaks for the trees."

Activity 2

THE LAW OF THE SEA CONFERENCE — A Simulation

Introduction

In 1970, the United Nations General Assembly unanimously adopted the resolution that declared the oceans "the common heritage of mankind" and not be limited to control by a few nations. It held that the resources of the oceans should, therefore, be exploited to benefit all of mankind. The third Law of the Sea Conference was convened in 1974 to draft the Law of the Sea Treaty.

After several years of meetings, a constitution, governing how the sea is to be used and how its living creatures can best be protected, is yet to be agreed upon. To write a treaty acceptable to all nations is difficult because the laws must cover so many complex issues — the rights of scientific research, protection of the ocean environment, development and sharing of marine technology — and the fact that different nations have different interests in the seas' many resources. The number of conflicts and potential conflicts regarding use and management of the sea has increased as new technologies are developed to extract the seas' resources and as countries with growing populations seek new food sources.

Landlocked nations, for example, want to be assured that even if they do not have direct access to the sea they will still be able to benefit from what the seas can provide. Many lesser developed nations depend on fish as an important food source and want to protect their fishing waters. Some of the highly industrialized nations, in order to expand production, need to find additional sources of raw materials such as nickel, copper and cobalt and look towards mining the seas for these important materials. However, mining the seas requires a highly developed technology and large sums of money to finance the exploration and drilling. Thus, only the wealthier nations can afford to embark on such ventures.

The many issues that need to be resolved and agreed upon by all nations include some of the following:*

Fishing: How can landlocked nations share in the harvesting of fish?

Protection of Marine Mammals: How can endangered sea animals be protected from over hunting or being killed because they become trapped in or interfere with the fishing nets?

Marine Pollution: How can ocean pollution be controlled? If oil tankers collide and a large spill occurs, who would be responsible for the damages to property, marine life, beaches, etc.?

Shipping and Navigation: Do nations have the right to restrict or control the types of vessels that travel over the seas?

Territorial Zone: How far out to sea can coastal states claim their control? (Many countries have extended their claim to economic rights from 12 miles to 200 miles from their coast)

Mineral Resources: Who will control the mining of minerals in international waters? (An International Seabed Authority is being organized, but its role and membership has yet to be established.)

Scientific Research: How should rules be established in conducting scientific research? Would research conducted by another country violate the privacy of the country? Should research be monitored by an international body?

Marine Disputes: How should disputes between nations be settled? Should an international court be established to settle disputes?

Overview of the Simulation

In this activity the class will participate in the Law of the Sea Conference and develop a set of resolutions governing the use of the oceans that will be acceptable to all nations. While such a task is complex and intricate in real life and has perplexed even the experts, the object in this simulation activity is simply to consider some of the different interests and concerns involved in establishing rules governing the use and protection of an important resource. With new, advanced technology the depths of the ocean have now become accessible. Yet to ensure that all people will share in its benefits, a fair and just Law is necessary.

The class is not expected to cover all aspects and details of the Law of the Sea Treaty. However, in the process of examining some of the major aspects of an international treaty, one can begin to see that protection or development of resources requires much wisdom and foresight. The Law of the Sea will perhaps reflect the types of issues that people will encounter in the future when they explore space or colonize currently undeveloped lands such as Antarctica.

Procedure For Developing The Group Laws

1. The class will be divided into three groups, each of which will effect a set of rules and regulations. (See flowchart, Figure 1)

2. Each group will represent one of the following groups of nations:

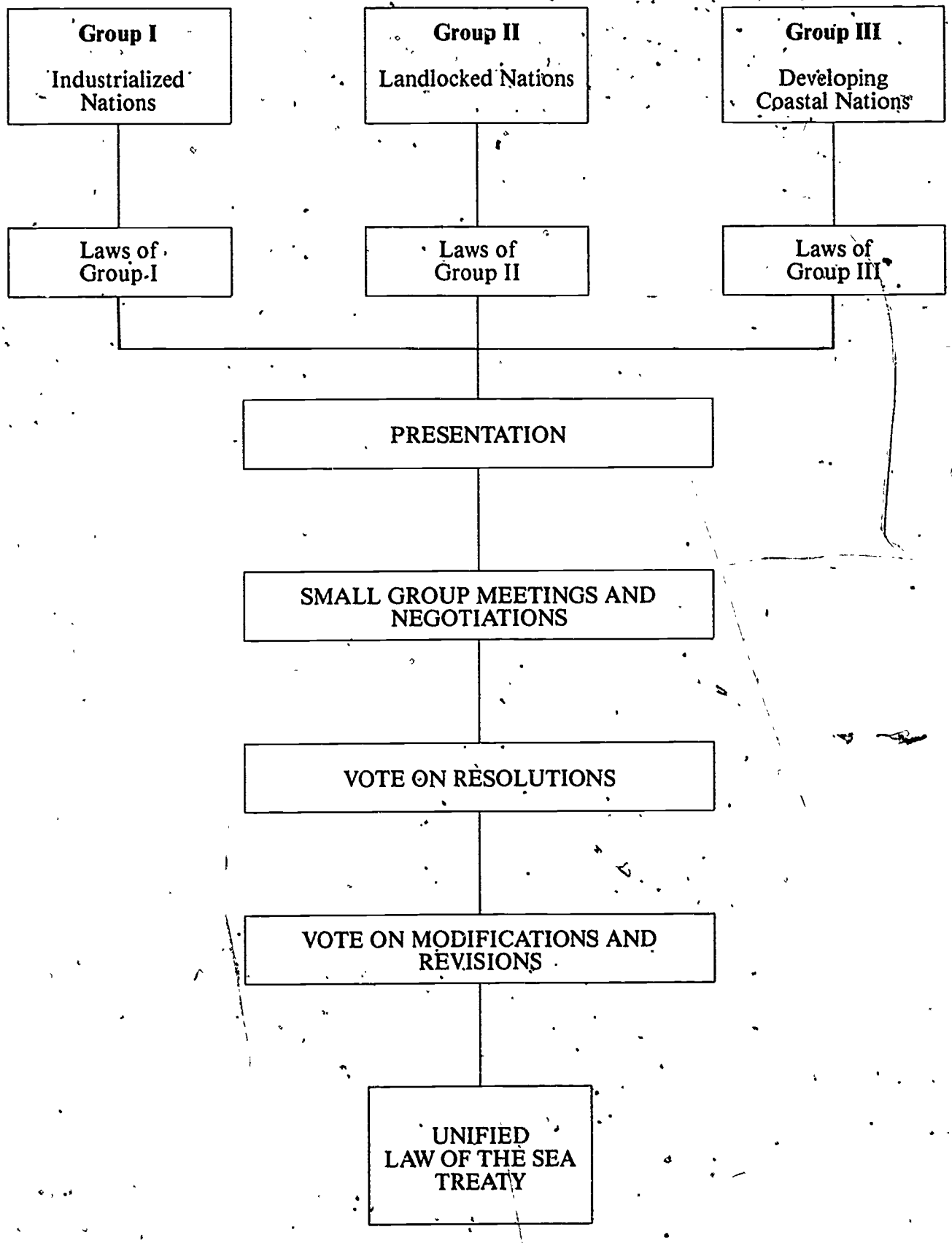
- DEVELOPED NATIONS
- LANDLOCKED NATIONS
- DEVELOPING COASTAL NATIONS

Each group member is to select a different country to represent. Make sure that each person selects a different country and takes some time to become familiar with the concerns and needs of that country. For example, look up some of the basic information on the country selected. What is its land and population size? What is

*Unlike national laws which are established by the government, international laws cannot be imposed on a nation unless it chooses to adopt those laws.

Figure 1.

LAW OF THE SEA CONFERENCE



the average income of its people? What are its major products? What does it import or export?

What are some of its problems? How does it utilize the sea and to what extent does the sea play in its economy? Make a nameplate with the name of the country and list some of its important characteristics. This nameplate will serve as your identification throughout the simulation.

3. From the perspective of the group that you are representing, develop a set of laws that will best meet your needs and protect your interests.
   a. Read the "perspective" of your group on pages 102 to 103 and background information on marine resources and the Conference on the Law of the Sea on pages 98 to 101.
   b. Identify the area of your major concern. What types of laws should be written to regulate the use and protection of this resource? Since there are areas of greater interest to you, the laws dealing with subject categories related to your concerns should be developed with greatest care and detail.
   c. Use Student Handout #2 as a guide in developing rules/regulations for each of the subject categories listed:
      - FISHING
      - PROTECTION OF MARINE MAMMALS
      - MARINE POLLUTION
      - SHIPPING AND NAVIGATION
      - TERRITORIAL ZONE
      - MINERAL RESOURCES
      - SCIENTIFIC RESEARCH
      - MARINE DISPUTES
   d. As you develop a resolution for each subject area, consider the following questions:
      - Does the rule put a nation or some nations at a disadvantage?

      That is, will all nations support the rule?
      - Will permitting or prohibiting an activity be harmful to the marine environment?
      - Will it be easy or difficult for nations to abide by the regulations?
      - Will nations feel that their rights will not be adequately protected?
      - Will the rule/regulation create more or less conflict between nations?
      - How might the economy of a nation be affected by the rule?
      - What problem(s) might arise as the result of the ruling?
   e. Some of the issues needed to be resolved are briefly listed below. Consider these issues from the perspective of your group as well as the nation you represent and, as a group, develop a resolution that addresses each of the issues.

Issues

Fishing

- How should nations insure that their waters will not be overfished and result in depletion of fish species? Who would determine this?
- How should landlocked nations be provided access to fishing?
- How should harvesting of highly migratory fish be controlled? Who should determine this?
- New fishing techniques used by some countries can bring large harvests. Should fishing methods be controlled to prevent overfishing? Should practices, such as dynamiting coral reefs to obtain fish, be prohibited?

Marine Mammals

- Given that whaling, seal hunting, etc. are important to the economy of many nations, how can marine mammals be protected?
- On what basis does one determine what species should be protected?
- Marine mammals are often killed because they interfere with fishing. Should this be permitted?

Marine Pollution

- Should each nation establish its own pollution standards or should international standards be established?
- If a nation's own pollution standards are more stringent than international standards, does it have a right to regulate the waste disposal of foreign ships that enter its territorial waters?
- Who should be responsible for monitoring pollution in the marine environment?
- How should dumping of waste and dangerous chemicals be controlled? If one country dumps toxic chemicals which affect a neighbor, how should the problem be settled?
- How can the quality of the ocean environment be best protected?

Shipping and Navigation

- How do landlocked nations gain access to the sea? Should neighboring coastal nations be obligated to provide port facilities?
- Should all nations be permitted to sail whatever type of vessel they wish on the high seas (e.g., commercial, military, super-tankers, submarines)? Should all ships be expected to pass a safety check?
- Should there be any regulations on a ship's conduct on the high seas?
- How should crowded shipping lanes be regulated to avoid collisions at sea?

Territorial Zones

- Nations have agreed to accept the concept of territorial sea as the sea out to the 12-mile limit from the nation's coast. That is, it has control over all activities that occur within this area and other nations

must abide by its regulations. Several nations, in addition, have claimed an economic zone out to 200 miles (claiming the right to all living and non-living resources within that zone such as fish, oil, gas, minerals, etc.). Will this economic zone (excluding the 12-mile territorial sea) still be considered the "high seas"?

- Many navigational straits are narrow, often less than 24 miles wide. With the territorial sea defined as out to 12 miles, coastal nations could claim control of these straits. These straits are an important part of international shipping lanes. Should ships of all nations be permitted to use these straits freely without constraints imposed by the coastal nation? Will passing ships have to meet the pollution and safety standards set by the coastal nations? Does this interfere with the concepts of "freedom of the high seas"? Should, for example, submarines have to surface so that the coastal country can keep track of its activities? Does the country have a right to keep out ships that might cause harm, such as large supertankers that carry oil?
- If a coastal nation does not use or develop all the resources within its 200-mile economic zone, can other nations, especially landlocked nations, be permitted to freely exploit these resources?

Mineral Resources

The issue of mineral resources is perhaps the major issue of the third Law of the Sea Conference and has raised numerous question.

- How should the concept of "common heritage" be defined? Developed nations favor a free and open access to the seabeds so long as they are not part of a nation's territorial zone. Developing nations, on the other hand, feel that exploitation of humankind's heritage should not be a "free for all" but controlled by an accepted international authority.
- How should each nation be assured of a fair share of the mineral resources? (Only a few nations or large private companies have the sophisticated technology and money to mine the deep seabeds.)
- If an International Seabed Authority is established, how should it be organized? What powers should it have? Developing nations outnumber developed nations and because of this, developed nations feel that they will not be heard and that their interests will not be considered.
- How might a cooperative sea mining venture be organized? The Enterprise, a public international mining company, has been proposed. (It would operate on behalf of all nations or a group of participating nations.) What might happen if seabed minerals compete with the minerals produced on land, to the extent that the land mining nations lose customers? The highly developed industrialized nations for the most part would prefer to mine minerals on their own since they have the finances and technology. Should they be obligated to share their technological knowledge and capital?
- Mining could interfere with the habitat of marine animals. How might living resources be protected?

Scientific Research

- Should a coastal nation have the right to regulate another country's scientific research when that research is conducted within its economic zone? How can one distinguish between research conducted to gain new scientific knowledge and research related to economic or military purposes? If the research results in monetary benefits, should the country conducting the research share the monetary gains with the other country?
- If a nation conducts research within a coastal nation's economic zone, is it obligated to share its research findings? What if a coastal nation does not want research reports (especially if they involve military security) concerning its territory published? How can the country's privacy be protected?
- Should a coastal nation have a right to refuse permission to another nation who wishes to conduct research? Are there any circumstances which might provide grounds for refusal? What if the research requires use of explosives, the building of large ocean platforms, or artificial islands?

Marine Disputes

- What method should be employed to settle marine disputes between countries? If a court is established, how might its members be selected? Will the court have the power to enforce its decision? Will the interests of every nation be fairly represented?
- What if the nations involved do not accept the decision of the court?

Group Positions

DEVELOPING NATIONS:

As developing nations you depend on fishing to provide your people with an important source of protein food. If you do not obtain an adequate harvest of fish, hunger and malnutrition will become an even greater problem. When you allow other countries who have large, fast fleets of boats and more modern fishing equipment to fish in your waters, your own small fishing fleets are put at a severe disadvantage. In addition, overfishing of certain types of fish can deplete that fish species and can result in the decline of your fishing industry. Already, many types of fish are rapidly declining. Your boats have to go farther out to sea and, in many cases, have to go beyond your own territorial boundaries. Also, fish are constantly moving and to harvest them one must follow their migration. For example, some fish breed and spawn in your waters but move to distant places during their lifetime. You feel that fish originating from your waters rightfully belong to you.

On the topic of ocean mining, your concern is that you will be deprived your fair share of the resources. Ocean mining is no simple task; it requires highly sophisticated technology, expensive equipment, large sums of capital and the capability to refine the extracted ore. In that respect, you cannot compete with highly industrialized nations simply because you lack the technology and money. If there is no control over ocean mining, the developed countries will reap all the resources, leaving you with nothing. From your perspective, the idea that the oceans are a common heritage holds no meaning if you cannot share in that heritage. You want assurance that you, too, will have a share of the valuable resources. You support the idea of an International Authority to govern all seabed mining. It is only in this way that the common heritage of the sea can be protected. The authority will operate on behalf of all nations; nations who develop the technology and scientific expertise will make it available to the authority.

Several member nations of your group are major producers of such metals as copper, manganese, nickel, cobalt, etc. If the ocean becomes a major source of metals, the land mining industries of those nations will become severely jeopardized. It is even possible that they will not find buyers for their products or the current prices will drop. Ocean mining can create even more severe economic problems for these nations than they presently experience.

LANDLOCKED NATIONS:

As landlocked nations, you maintain that you cannot be denied access to ocean resources simply because you have no claim to coastal waters. Since most fish are found within 200 miles of the coast, having free access of fish beyond that zone really has no meaning. Some of your fishing fleets have traditionally harvested certain areas of the ocean and depend on being able to continue fishing there. Although nations are willing to allow you to fish whatever they consider to be surplus, you believe that this is insufficient. You believe that you are entitled to a greater, more equitable share of the sea's living resources.

In addition to the living resources of the sea, you want the right to exploit the mineral resources on the continental shelf, lying within the 200-mile zone that many nations have claimed economic rights. You support the establishment of a strong seabed mining Authority of which all nations, coastal and landlocked, are included. Such an Authority would control all mining activities; members would contribute technical knowledge, equipment and money, and all nations would share in the production and sales of the minerals.

However, several members of your group are not enthusiastic about large scale sea mining because they fear that their own land mining activities would be threatened. Mining large quantities of metals that are currently scarce will bring prices down and force them out of business. For many countries, the export of certain minerals is their major source of income. They would prefer to see mining controlled in a manner that will not in any way disrupt or threaten their economy.

It is also important that your shipping vessels and aircraft be permitted to travel over territorial waters without restrictions that might place you at a disadvantage. In order to use the sea, you need access to port facilities as well as unrestricted land passage to the seaports. You might be placed at a trade disadvantage if high taxes or tolls are charged by neighboring coastal countries.

DEVELOPED INDUSTRIALIZED NATIONS:

As highly industrialized nations, you require large quantities of nickel, copper, cobalt, manganese, etc. in the manufacture of your products and building materials. The strength of your economy depends upon your ability to obtain these resources, and not having to rely on limited land supplies or on other countries that are your current suppliers. Depending upon the goodwill of other countries can place you in a precarious position for you cannot always be assured that a supplier will continue to sell at a favorable price, especially when a resource becomes scarce. (Petroleum is a good example.)

You have the capital, equipment, and technical "know how" to develop ocean resources. You advocate complete freedom to exploit the seabed in international waters with no restriction on the amount of minerals you mine. The vast supplies of metal ores in the ocean bottom (estimated to last thousands of years) can free you from the dependence of importing needed metals. You prefer the formation of an International Seabed Authority which simply oversees mining activities in international waters by issuing licenses to private or national companies and insuring that those activities do not endanger the ocean environment or interfere with fishing or shipping. From your perspective the common heritage doctrine means that the seabeds are free to all to exploit as long as the activities do not infringe on another nation's territory. You oppose the idea of an authority which sets controls on the amount of metal mined, mining locations, and the sale and profits of the metals.

If deep sea mining in international waters is placed under the strong control of an international authority, your mining activities can be severely hampered. Since landlocked countries and developing countries represent the majority of nations, your voice in various matters may not be heard. Your investments in the research and development of seabed mining is wasted if you cannot reap its benefits. Just setting up exploration operations can cost hundreds of millions of dollars. To put a mining project in operation is estimated to cost at least a billion dollars. You want assurances that you will not be risking your investments for nothing. It is your belief that those countries which have made substantial investments in developing seabeds should have greater voice in the matter.

You do offer to help set up a separate mining operation, the Enterprise, to assist developing nations in establishing their ocean mining industry. You are willing to contribute your technical expertise and some financial aid, but, of course, do not expect to place all your technology and capital into a common pool for all to share. From your viewpoint, you don't want to do all the work while the others sit back and profit from the results.

PROCEDURES FOR COMPLETING THE LAW OF THE SEA TREATY

1. Set a timeline for the groups to complete the "laws" of the groups. Upon completion of the groups' laws, each group will make two copies of its own laws and submit one to each of the other groups. These group laws are to be reviewed before the presentation.
2. Each group will select (a) spokesperson(s) to present the laws developed by the group. It is suggested that the set of laws be divided into several parts (equal to the number of members in the group) and that each group member present one of the sections. In this way no one person assumes the entire responsibility of the presentation. The presentation should include an explanation of the law and the reasons why such a law should be adopted. It is important to develop a strong case for the law proposed by one's group.
3. Following each group's presentation, other members of the world organization may raise questions.
4. Upon completion of the presentation and questioning, the class will again meet in the individual groups to discuss the laws. During this group meeting, the members will identify those laws which they approve or disapprove. That is, what laws are objectionable or go against the group's interest? Do some laws seem grossly unfair?
5. After identifying the laws that do not meet its approval, small committees from the group will be formed. These committees will arrange to meet with members of the group that proposed the laws. In these small meetings the members will try to convince the others to make changes or adjustments so that the law is more agreeable to everyone. To reach an acceptable agreement involves the art of negotiation. Some "give" and "take" is necessary. Making some concessions or "trading off" on minor points may result in achieving positive results on the major points. Some important questions to keep in mind include:
   - What are the possible effects of the law?
   - Will the law increase or decrease the likelihood of international disputes?
   - Who will in the long run benefit from the law?
   - Will the quality of the ocean environment be adversely affected by the law?
6. When the group members have completed their negotiations, modifications and revisions, the members will assemble as an entire group to finalize the Law of the Sea Treaty. The laws pertaining to each subject will be voted upon.
7. Each of the major subjects will be discussed in turn. On the chalkboard or large sheet of paper list all the proposed laws pertaining to that topic (e.g., fishing). Try to group the laws in some order: that is, the laws that addressed the same point should be grouped together. The members will examine the laws and are permitted to raise questions or discuss the merits/disadvantages. If two laws are very similar, incorporate them into one.
8. Following parliamentary procedures, member nations will call for a vote. Each law will be voted upon in turn. Only laws that receive unanimous approval will be adopted. When all the laws pertaining to a given topic have been voted upon, examine the approved set of laws governing that issue.
   - Are there any laws that contradict one another. Can both rulings be applied without creating disputes or misunderstandings?
   - Have too many laws been eliminated so that major areas of concern are not addressed?
   - Should any other laws be added?

   Member nations may propose changes or modifications so that the set of laws is consistent and complete. These additions must attain the approval of the other members.
9. Use the above procedure for selecting the laws governing the other topics. Continue in this same manner until all topics have been discussed.
10. Compile all the adopted laws into a complete and finalized form — The Law of the Sea Treaty. To complete the simulation, each member nation will sign the treaty.

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WORKSHEET FOR DEVELOPING LAWS OF THE SEA

Topic to be addressed: _____
(fishing, marine pollution, etc.)

ISSUE	POSSIBLE PROBLEMS/DISPUTES	HOW YOUR COUNTRY MIGHT BE AFFECTED	POSSIBLE SOLUTIONS	PROPOSED LAW

Reading 19

The Oceans In Our Future

by Larry Booda

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Live under the sea? Mine the ocean floor? Grow salt-water oysters in Kansas City? All these are real possibilities for the coming decades. In the following article, a specialist in ocean affairs reports on what is now happening in the utilization of the sea, and what can be expected in the future.

Man is a land animal, but is more closely tied to the sea than most people ever realize. Sixty percent of the world's largest cities are located within less than 30 miles of the ocean, and an estimated two-thirds of all of the world's people live within 50 miles of the coast. This heavy concentration of people in only 12% of the total land area comes from the fact that the sea has, from the earliest times, served a multitude of human needs. Down through the millennia, coastal-dwelling people have harvested bountiful crops of food from the sea, often depending almost entirely on fish and marine invertebrates for their dietary protein. In addition, the sea has provided man with an efficient means of travel, making worldwide trade very easy.

Today man is beginning to run out of resources on land, and is turning ever more to the sea, which until recently seemed an inexhaustible storehouse. But he is fast learning that the sea, though immense, also has limits. Already he has seriously overfished many of its most productive areas, so that they now produce only a fraction of their former bounty.

Offshore oil exploration began only three decades ago, but vast quantities of oil and natural gas now are being pumped from beneath the Gulf of Mexico and the North Sea. Valuable deposits of manganese and phosphates are known to exist on the ocean bottom, but are not yet being exploited. Vast renewable sources of energy exist in both the motion of the water and the temperature gradients of the sea, and engineers believe that they can tap this energy, if adequate development funds are provided.

As man's technology to exploit the resources of the sea advances, the political climate surrounding the oceans is becoming heated. Revolutionary changes came after World War II when more efficient methods of catching fish and killing whales were developed. In recent years, foreign fleets have been literally "vacuuming" the rich fishing grounds off U.S. coasts without regard to species.

However, the situation is now changing. Law of the Sea conferences have been held for the past six years in Geneva, Caracas, and New York, and one of the few points of agreement is that every coastal nation should have control over a zone along its shores extending out to 200 nautical miles. The coastal nation would have jurisdiction over the resources of that zone, though the zone of total territorial control would be only 12 miles. (Traditionally, it was only three miles.) Many countries have established such zones, and the United States joined them last year when Congress passed a law establishing a 200-mile zone. Starting last March, foreign fishermen became subject to licensing and fishing quotas. Several countries disregarded the new ruling at first, but after the well-publicized seizure of two Soviet fishing vessels by the U.S. Coast Guard, compliance improved markedly.

By the year 2000 there should be complete international agreement on fishery quotas so that a maximum sustainable yield of every species will be maintained. There are partial controls in effect now through bilateral and multilateral agreements and through organizations covering the northwest Atlantic and the northern Pacific. These agreements have brought under control such practices as the Japanese taking salmon in the deep Pacific before they could return to spawning grounds in northwestern U.S. and Canada, and in the Atlantic where the Danes have been taking salmon that would otherwise have spawned in Scottish streams. International conferences on whales have reduced the destruction of the magnificent mammals, though the Soviets and the Japanese still operate whaling fleets.

Oceanographic research scientists also have a stake in the Law of the Sea negotiations. In the past, scientific vessels were free to roam wherever they pleased. Now they find it increasingly difficult to keep from violating other countries' zones. Paul Fye, Director of the Woods Hole (Massachusetts) Oceanographic Institution, states that his research vessels spend 38% of the time within 200-mile limits, and that it is becoming increasingly difficult to make arrangements with controlling countries to conduct research in their zones.

Mineral Wealth Snags Negotiations

The potential mining of the deep sea has created an international furor, threatening to upset all other Law of the Sea negotiations. The principal reason is that vast areas of the ocean floor beyond the 200-mile limit are covered with black, potato-sized, mineral-rich nodules that may eventually be worth many fortunes to their takers, whoever they may be. The nodules carpet the ocean bottom in many places, lying within inches of each other at depths of from 15,000 to 18,000 feet. The principal component of these nodules is manganese—about 29% in the Pacific nodules. Other metals in the nodules include iron (6.3%), nickel (1.28%), copper (1.07%), and cobalt (0.25%). It is the last three metals rather than the manganese that make mining the nodules economically attractive.

Some 15 years ago, Deep Sea Ventures, Inc., of Gloucester Point, Virginia, began to investigate the nodules in the Pacific at a location about equidistant from Hawaii, Los Angeles, and Acapulco, Mexico. They

Submarine *Nekton Gamma* cruises into port after mission. Designed, built, and operated by General Dynamics, Inc., of San Diego, California, she and her sister ships *Nekton Alpha* and *Nekton Beta* are commercial "workhorse" submarines. The three have made a total of about 2,000 dives on a wide variety of missions including pipeline inspections, environmental studies, fisheries research, dam inspections, and search and salvage missions. *Nekton* submarines are 15 and a half feet long, carry a crew of two, are powered by lead-acid batteries, cruise at two knots submerged, have a range of seven miles, and have a maximum operational depth of 1,000 feet. Photo: General Oceanographics, Inc.

invested heavily in developing methods to retrieve the nodules and refine them, and began test-mining operations early in 1977. In the meantime, three consortia headed by U.S. firms (Kennecott Copper, International Nickel, and Lockheed) plus German and French combines, have entered the field. The Japanese are active in several of these groups. The companies have now advanced to the point where they have the know-how and the technology for profitable mining of the nodules.

The realization of the full potential of the nodules dawned suddenly on the developing nations participating in the Law of the Sea Conferences. This group, the so-called "77," gathered their votes together and proposed a radically different approach for control of deep-sea mineral exploitation. The developing nations want control of deep sea mining placed in the United Nations, with the mining operations conducted by a UN "Enterprise" which would be launched with financing and technological know-how from the developed nations but dominated by the "77" through their numbers. Some delegates fear that the Law of the Sea negotiations will polarize the industrialized and the developing nations on completely divergent and incompatible courses. One delegate has said that the developed nations will go ahead with their mining plans regardless of whether agreement is reached.

In November 1974, Deep Sea Ventures sent a lengthy legal document to the U.S. Secretary of State asking for protection of its investment if the company began mining, and to allocate a "claim" in which it would be protected. The State Department did not act on this claim, believing that it would adversely affect the Law of the Sea talks. Because of Administration inaction, bills were introduced in Congress that would protect companies that want to mine in the deep sea. Hearings were held early in 1977, and chances of passage of such laws are good whether the State Department approves or not.

Besides these jurisdictional problems, there may be serious environmental problems to be solved before large-scale undersea mining can take place. Over the past two years, the U.S. National Oceanic and Atmospheric Administration (NOAA) has been conducting a study of deep ocean mining to determine its environmental effects. NOAA officials believe that they should give guidance to industry on equipment design to meet environmental standards, and that this must be done soon, before the companies commit vast sums of money for equipment that would be difficult to change later. If these jurisdictional and environmental problems can be solved and mining companies given the signal to go ahead, undersea mining operations could be well under way by 1982 and a large-scale industry existent by the year 2000.

Other valuable mineral deposits are known to exist on the seabed, including phosphorite (calcium phosphate), which is used mainly for fertilizer. NOAA has identified valuable deposits along the coasts of California and Georgia that could be exploited without developing any new technology. Present domestic sources will be nearly exhausted by the 1990s. By that time these large marine deposits could relieve pressures on land sources and ease the necessity of transporting the mineral over long distances.

Other hard-rock minerals that exist on the seabed include barite, copper, molybdenum, lead, zinc, and possibly uranium. Coal deposits are known to exist off Massachusetts and metallic sulfides off the U.S. Gulf Coast. California and Alaska are famous for their alluvial gold deposits; during glacial periods, when much of the world's water was frozen in glaciers, the oceans were lower and streams extended much farther out than they do now. The ancient stream beds, now submerged, are thought to contain gold and other precious metals. Other promising submerged stream bed sites exist in Lake Superior and off the Atlantic coast between Cape Henry, Virginia, and Cape Hatteras, North Carolina.

Aquaculture Promises Abundant Food

Throughout history, the sea has served man primarily as a source of food, and even though we may be about to witness a great expansion of man's uses of the sea, food production will probably remain the most important. One of the most economically promising and environmentally acceptable ways of exploiting the sea for human needs is through controlled-environment fish farming, or aquaculture. The culture of fish and shellfish is an ancient skill, practiced in the past mainly by oriental peoples. They raised many kinds of fish, clams, and oysters in primitive ponds and protected waters. Today's aquaculturist, in western countries, at least, is more likely to run a highly scientific, specialized operation. For example, "Domsea Farms" in Puget Sound, Washington, is raising pan-sized salmon that never go through the cycle of leaving the streams where they were hatched, migrating to the sea, spending their adult lives there, and returning finally to their birthplace to spawn and die. Domsea's 12-ounce beauties are raised in pens that permit circulation of the natural waters of Puget Sound, and are fed scientifically-balanced rations. After years of trial, the company has now become a profitable venture.

The outlook for a U.S. national aquaculture program, supported by legislation now before Congress, is good. A special committee of the National Research Council of the National Academy of Sciences is constructing a National Aquaculture Plan. Committee Chairman Don Walsh, Director of the Institute for Marine and Coastal Studies, University of Southern California, hopes to have the plan ready for the second session of the 95th Congress. The plan will take into account not only the role of government, but also of private industry and universities. Walsh, incidentally, is co-holder of the world's depth record of 35,800 feet, set in January 1960, in the bathyscaphe *Trieste*, in the Marianas Trench west of Guam. It is the task of the Walsh Committee to determine the extent that aquaculture can contribute to the U.S. food supply. Possible roles of government, industry, and universities in aquaculture research are being examined, and the committee will recommend ways to stimulate a program.

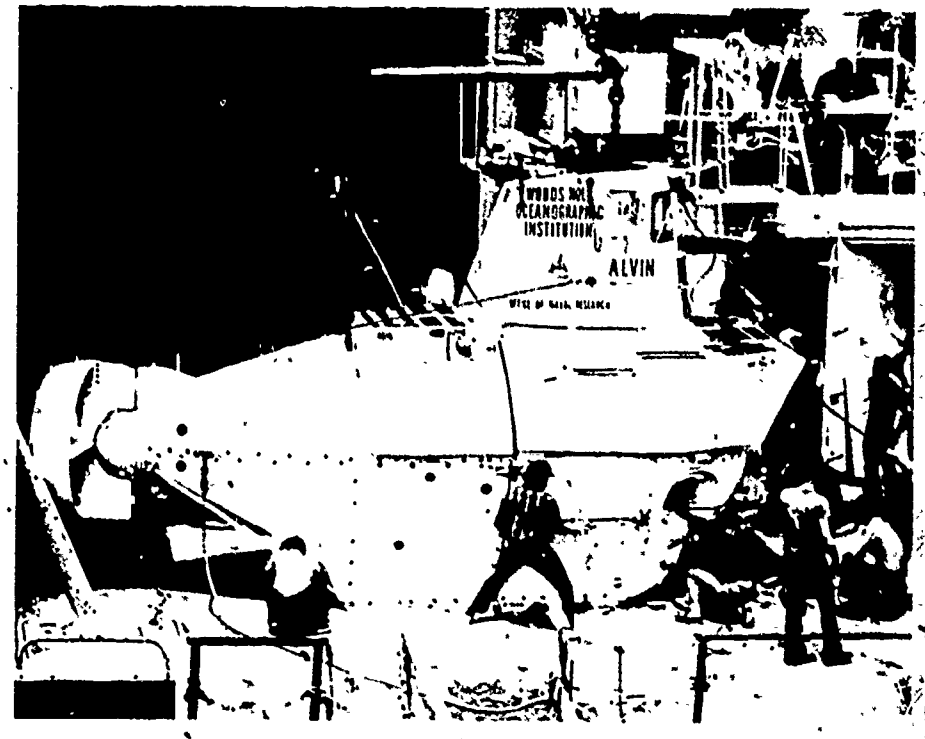
The United States established a National Sea Grant Program in the mid-1960s, and it is now active in the universities of all of the coastal states and one Great Lakes state. It is hoped that the Sea Grant Program, by funding research, can lead the way in marine food production, much as the Land Grant College Program that was started in 1865 helped the U.S. to become the greatest agricultural nation in the world. The Program now allocates $27 million a year, and is matched by local and state funds.

Following is a sampling of Sea Grant-supported research:

- Salmon are being cultured in pens on both the Atlantic and Pacific coasts as part of investigations now under way in the controlled growing of popular salt-water fish.
- Marine shrimp farming is developing along the Texas Gulf coast and on the east coast of Florida and Georgia.
- Very large fresh-water prawns are being grown in Hawaii, Puerto Rico, Georgia, and Florida.
- Lobsters are being grown experimentally in the northeastern states and at one location on the west coast.
- The blue, or hardshell crab, is a subject of investigation from Maryland to Miami, while other crabs are being experimented with in San Diego and Guam.

A project in Maine uses the heated effluent of a power plant to speed the growth of shellfish. In both Maine and Massachusetts, experimenters are using "raft" culture in which the oysters are grown in multiple trays suspended vertically from rafts in natural waters rich in algae, the food of the mollusks.

Oyster culture is currently of very special interest, and the Woods Hole (Massachusetts) Oceanographic Institution is a leader in the field. Under the guidance of biologist John Ryther, young oysters feed on algae fertilized with human wastes as part of a project to develop a way to convert sewage into food. The cycle begins with human wastes being mixed with sea water and held in settling ponds. During the summer, a lush growth of algae occurs in the ponds, and this water is then circulated through tanks with long trays of young oysters. Oysters are "filter feeders," siphoning tremendous quantities of water through tubes lined with microscopic projections called cilia, which extract the algal cells. In winter, the sewage-enriched



Research submarine *Alvin* is loaded onto large oceangoing vessel for transport to site for Mid-Atlantic Ridge study. *Alvin* is a deep-diving vehicle designed specifically for oceanographic research and is operated by the Woods Hole (Massachusetts) Oceanographic Institution. Powered by lead-acid batteries, it has a submerged cruising speed of one and one fourth knots and a range of 15 miles. It can remain submerged for 24 hours and work at depths down to 6,000 feet. It has a mechanical arm for collecting objects from the sea bottom, and has a sonar telephone system for voice or code communication with the mother ship.

Photo: Woods Hole Oceanographic Institution

sea water is bubbled in plastic-sided tanks where fluorescent lights take the place of the sun.

This kind of aquaculture can be carried one step further by adding sea worms, young lobsters, and juvenile flounders to the mollusk farm. The worms thrive in the sludge of solid wastes produced by the oysters, and are in turn eaten by the lobsters and bottom-feeding fish.

A similar effort is under way at the Virginia Institute of Marine Science at Gloucester Point, Virginia. The Institute has been engaged in oyster culture for several years, and is now beginning to process human wastes to grow algae nearby Special care is being taken to prevent toxic chemicals from nearby industries from entering the waters.

The College of Marine Studies at the University of Delaware is now growing oysters under completely closed-cycle conditions in its laboratory at Lewes, Delaware. The mature oysters are placed in trays to spawn, and the juveniles—so small they look like pepper specks—siphon the algae-rich salt water and grow rapidly to marketable size. The algae are grown in a plastic-covered quonset building where sunlight rather than fluorescent lighting promotes photosynthesis. After the water flows by the oysters, it is run through a purifier. This closed-cycle system is now perfected to the point where only 10% replacement water is needed, and that need not be fresh sea water, but could be artificial sea water made by dissolving sea salt in fresh water. William Gaither, Dean of the College, predicts that future oysters may be grown far from the sea, perhaps in Kansas City, using purified stockyard wastes to feed the algae.

Another method of aquaculture—confining fish to a portion of the sea near shore where they can eat small fish but not be eaten by bigger ones—is advancing rapidly but is troubled by problems relating to the rights of boaters and sport fishermen in the area. State legislatures may have to settle this problem with new regulations.

Marine plants, such as kelp, a form of seaweed, hold promise in aquaculture. The Japanese have grown seaweed for centuries, and use large quantities for food. In the U.S., kelp beds off southern California and Maine furnish algin, an emulsifier used in many foods such as ice cream and salad dressing, and in paints. Scientists are also making progress in producing protein and biomedicals from seaweed.

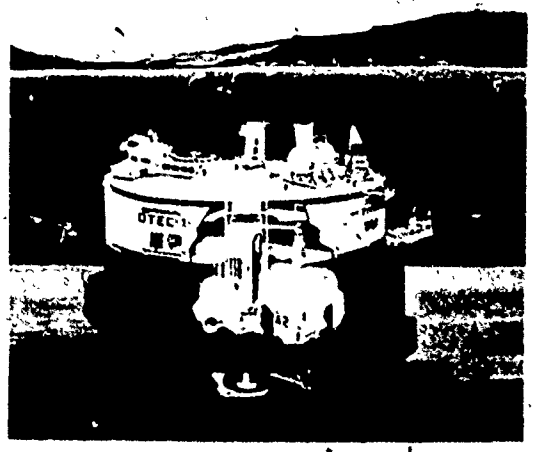
Ocean Thermal Energy Conversion: A Promising Energy Source

The sun heats surface waters in tropical seas to temperatures of about 85° F. At the same time, frigid polar water at temperatures of around 40°F. flows in beneath these warm seas. This great difference in water temperature can be put to use generating electricity by utilizing low-boiling liquids like ammonia to drive turbines in closed systems. To obtain this power from the sea, large floating power-generating plants would be moored in warm seas such as the Gulf of Mexico or the Bay of Bengal. The electricity generated by Ocean Thermal Energy Conversion (OTEC), as it is called, could be economically transmitted via submarine cable to land that is within 100 miles. Beyond that distance, the power could be put to more efficient use at the generating site, manufacturing such energy-intensive products as ammonia (used in fertilizers) or aluminum metal.

Several large corporations are now working on designs for prototype OTEC plants which may be operating by the early 1980s. The first OTEC plants will generate about 25 megawatts of power, and engineers hope to have plants in operation by 1985 that will generate 100 megawatts or more.

Capital construction costs for the first OTEC plants are expected to be around $2,000 per kilowatt generated, but for later models may be reduced to as little as $1,100 per kilowatt, making it very competitive with oil-fired generating plants.

Environmental impact of the power generation would be minimal, and could even enhance the growth of desirable sea life by enrichment of the surface waters with mineral nutrients brought up from the depths in the cold water.



OTEC plant proposed by TRW Systems of Redondo Beach, California, would produce 100 megawatts of power. The 340-foot diameter floating concrete structure would bring up cold water from as deep as 4,000 feet through a 50-foot diameter fiberglass pipe, to cool the working fluid, probably ammonia. Manufactured goods such as aluminum ingots are shown being loaded onto an oceangoing vessel.

Diagram: TRW Systems Group

One aquaculture enthusiast is Robert B. Abel, head of the Sea Grant Program for its first 10 years, and now Director of Oceanographic Education and Research at Texas A&M University. "Although most projects are not yet breaking even economically," Abel says, "the beautiful part of aquaculture is that you don't need a boat, and the demand is greater than the supply of oysters, shrimp, and salmon." The consensus of opinion among informed members of the oceanic community is that within the next 10 years, aquaculture will become attractive to private capital, and from that point onward it will grow rapidly.

Oceans Offer New Energy Sources

The past 15 years have witnessed great strides in the technology of tapping undersea oil and gas. The continental shelves off the U.S. Gulf Coast and beneath Europe's North Sea have been the sites of some of the most important new oil strikes made by western nations, and have helped greatly to save Great Britain from economic disaster. By the year 2000, however, the world's continental shelf deposits of oil and gas will have been widely tapped and seriously depleted. There are hints that deeper ocean deposits exist, but these would require tremendously expensive equipment.

With oil and gas deposits being used up rapidly, many countries are seeking alternative sources of energy, some of which exist in the ocean. Possibly the most promising of these potential sources would take advantage of the

temperature differential existing between water on the ocean's surface and water at great depths, often as much as 450° F. That difference in temperature can be put to use in a way similar to the steam in a steamship. (The ship's boiler heats water to produce steam, which turns turbines and then is condensed by cool sea water for use once again.) In the case of Ocean Thermal Energy Conversion (OTEC), the difference in the temperature between water at the surface of the sea and the water some distance below would be used to boil and recondense a volatile liquid (ammonia, for example) in a closed system. The OTEC principle was demonstrated by a Frenchman, Georges Claude who experimented with it in Cuba during 1929 and 1930. More recently, a demonstration plant was operated in the U.S. Virgin Islands, pumping cold sea water through the jacket of a vapor condenser utilizing a low-boiling liquid. As an added benefit, the deep-ocean water—rich in dissolved mineral nutrients—provided fertilizer for algae growing in shallow ponds and used as food for fish and shellfish. Future OTEC plants will probably be large installations moored at sea. If close enough to land, they could transmit electrical power directly to shore via undersea cable. If far from land, they could be put to such uses as providing power for manufacturing ammonia and urea (both used as fertilizer) from air and sea water.

Congress recently gave the U.S. Energy Research and Development Administration (ERDA) $25 million to prove the OTEC concept. ERDA has taken over the barge used by the submarine salvage ship *Glomar Explorer*, and is converting the barge to carry an OTEC plant which should be ready for demonstration runs sometime during 1978. Eight companies, including TRW, Inc., General Electric, and Lockheed, are experimenting with designs for possible large-scale development. By the year 2000, OTEC may be an important source of electrical power, taking indirect advantage of the sun's energy on an ever-yielding basis.

Ocean currents offer another source of energy. A conference of engineers and economists, held in Miami three years ago, declared that huge, submerged, anchored watermills (the seagoing equivalent of windmills) in the Gulf Stream could produce great quantities of power. So far, however, the U.S. government has not appropriated any funds to develop this source of energy.

ERDA is now paying some small attention to wave power, another possible source of energy, but the funding is very modest. Two engineers at the University of Delaware have envisioned a coastline system of moored floats that, as they moved up and down, would pump seawater to elevated reservoirs on land, which, in turn, would produce hydroelectric power.

Long-Range Weather Forecasts

The science of weather forecasting has developed rapidly since World War II. A network of automatic instruments on land, sea buoys, ships, aircraft, and satellites permits almost real-time analysis of atmospheric conditions. Forecasts of up to five days can now be made with relative accuracy. When meteorologists venture beyond that five-day period, however, their accuracy declines sharply because the longer-term atmospheric effects are regulated by the massive heat sink of the oceans. Water is 800 times as dense as air and moves commensurately slower. It stores great quantities of heat or cold. The major currents such as the Gulf Stream in the North Atlantic, the Kuroshio Current off Japan and Alaska, and the Humboldt Current off the west coast of South America are relatively stable, but now and then aberrant eddies spin off. These eddies may last for several weeks and markedly alter the weather patterns over the continental land masses.

Little has been done as yet to plot the movements and temperatures of the deep ocean, where these eddies mainly occur. NOAA has deployed a number of big weather buoys in the Pacific, the Gulf of Mexico, and the Atlantic, but these are limited to readings of the ocean surface and the nearby atmosphere. What is needed for long-range weather forecasting is a network of buoys that will read the ocean temperatures and currents as far down as 2,000 feet and transmit this data constantly to weather computing centers.

The year 2000 should see an advanced network of automatic weather stations that will enable meteorologists to make long-period forecasts and provide valuable information for agriculture, shipping, and many other human activities.

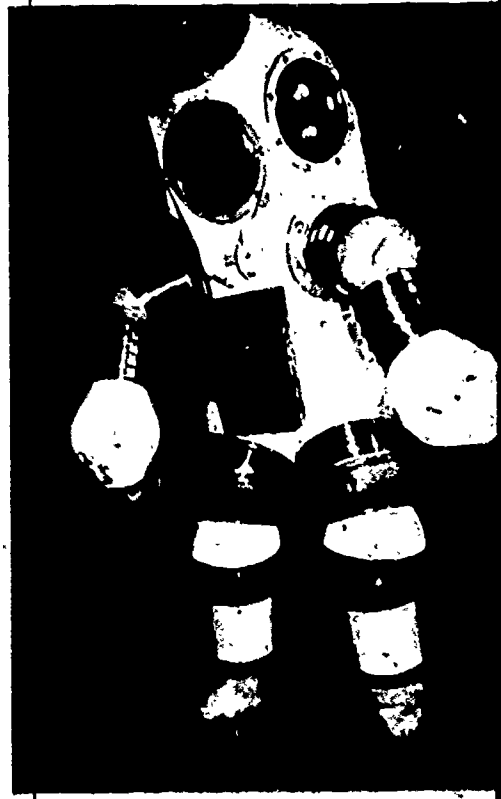
Pollution: A Growing Problem

Scientists are becoming increasingly concerned about the oceans as the ultimate recipient of man's wastes. The pervasiveness of pollution of the sea is well-illustrated by the pesticide DDT. DDT was developed and put in

Living Beneath the Sea

Technology is enabling man to explore ever deeper into the sea by overcoming the long-standing problem of adjusting to changes in pressure. Changes of pressure in deep dives place great physiological strain on the human body and long periods of time are required for returning to sea-level pressure after a deep dive, in order to avoid the painful and sometimes fatal condition known as "the bends."

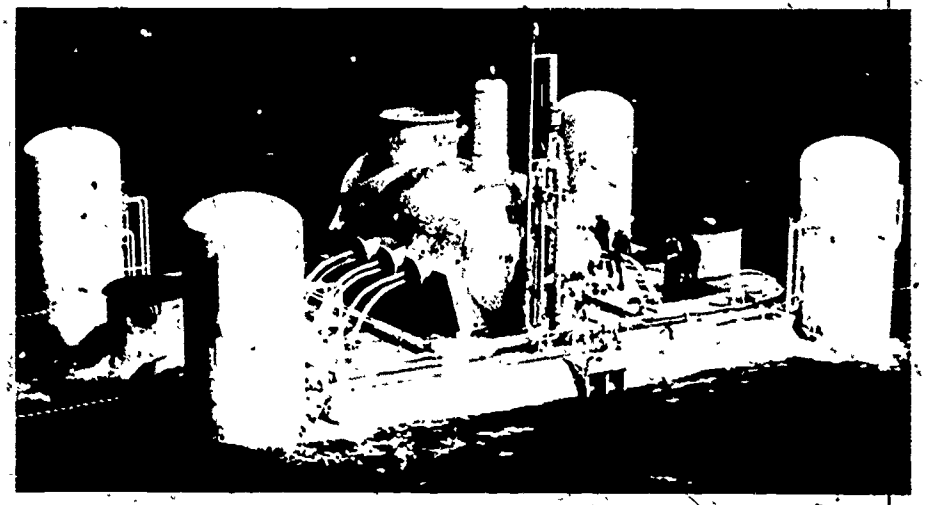
The new undersea technology eliminates this problem by providing the diver with diving suits and undersea chambers that are maintained at sea-level pressure (one atmosphere). Thus, the problem becomes one of engineering design, not human physiology. The development of strong new materials has made this development possible.



Advanced model of "Jim"-diving suit has more flexible arms than earlier model. Arms are equipped with external manipulators that are hand-controlled from inside suit. Diver in suit can walk, climb ladders, and do almost any task associated with underwater construction, repair, maintenance, inspection, and salvage.
Photo: Oceaneering International, Inc.

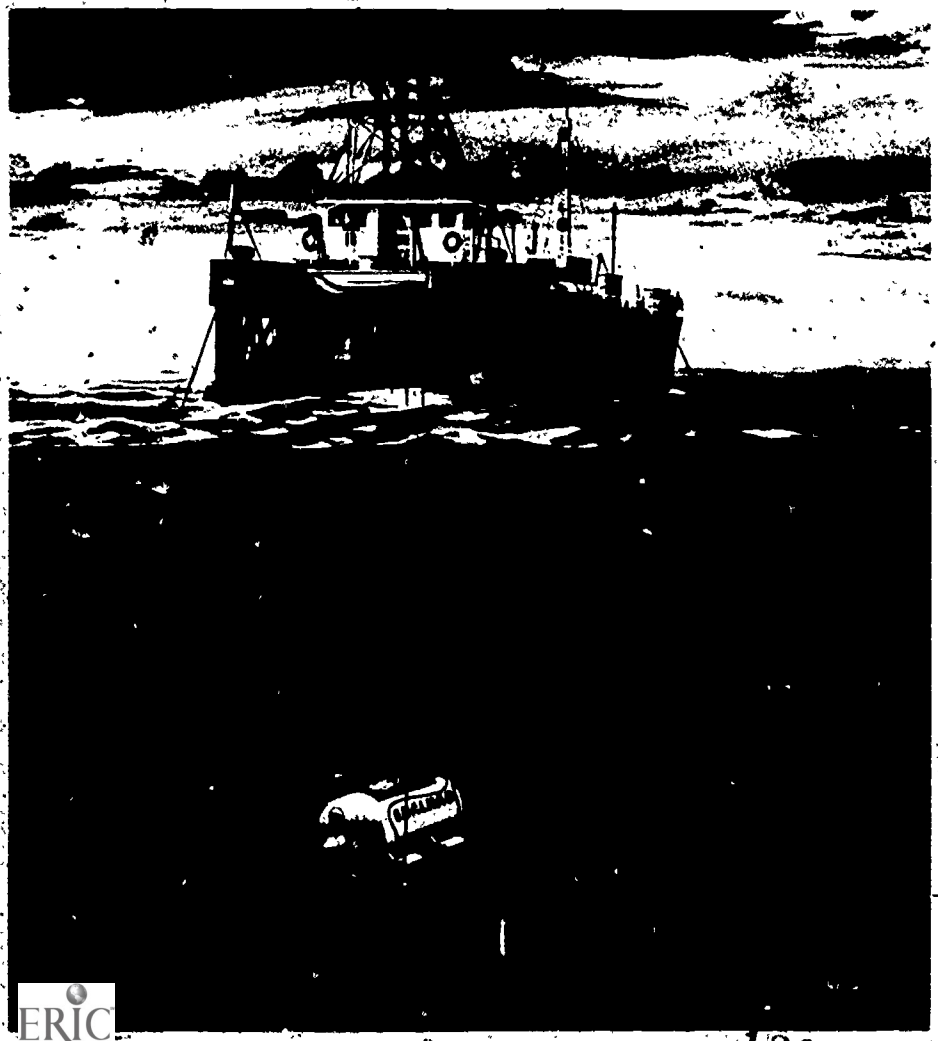
Diver is readied for deep dive in "Jim," a rigid metal-and-fiberglass diving suit that is maintained at one atmosphere of pressure, and will take the diver down to depths of 1,500 feet. Human divers are still considered indispensable for seafloor oil drilling, and the "Jim" diving suits greatly extend the depths at which exploratory drilling can take place. "Jim" diving-suit models now on the drawing boards will take divers down to 3,000 feet.

Photo: Oceaneering International, Inc.



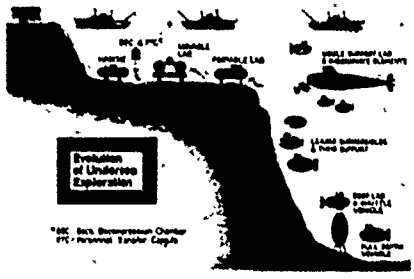
A modern (1976) undersea living habitat is being towed 100 miles out into the Gulf of Mexico before being sunk in 240 feet of water, where it will be used in the manned control of production from oil and gas wells on the ocean floor. It is maintained at one atmosphere of pressure and is designed for use in water down to depths of 3,000 feet.

Photo: Shell-Lockheed



An early (1972) undersea living habitat rests on the bottom beneath 50 feet of water and is maintained at the pressure of the surrounding water. Divers live in the subsea environment for days at a time while going about their work.

Drawing. NOAA Manned Undersea Science and Technology Program



Artist's diagram shows progression from scuba-diving habitats on shallow continental shelf to manned exploration of the continental slope, and a living chamber at one atmosphere of pressure on the deep-sea bottom. Engineers are steadily increasing the depths at which man can work and live in the sea.

Drawing: NOAA Manned Undersea Science and Technology Program

widespread use as an insecticide in the U.S. some 30 years ago. Soon the runoff from agricultural lands dispersed this relatively indestructible compound along coastal zones where traces began to be found in fish. The stately pelican became a victim, because female pelicans that ate fish contaminated with DDT laid eggs with shells so thin and fragile that most broke, killing the embryos and preventing the bird from reproducing. The bald eagle, national bird of the U.S., suffered a similar decimation of its numbers, as it, too, feeds largely on fish. But the telling evidence of widespread pollution came some years later when Antarctic penguins, also fish eaters, were found with traces of DDT in their bodies! Due to such discoveries, the use of DDT has been cut to nearly zero, but other substances just as lethal are now being used.

Pollution of the sea is an international problem, and it is being taken up at the Law of the Sea conferences. Nearly everyone agrees that controls are needed. But here again the underdeveloped nations have offered a novel plan under which pollution regulations would be followed by the developed countries but not by the emerging nations! If the sea is to be saved from serious pollution, an agreement restraining all nations will have to be worked out.

Ocean transportation will probably change relatively little in the next 25 years. The oceans will continue to offer the cheapest avenue for bulk carriage of commodities. The hydrodynamic design of ships will improve, though no great breakthroughs are foreseen. Handling of cargo will also improve, with ships carrying barges, containers, and roll-on, roll-off cargo leading the way for further improvements.

The roll-on, roll-off system already is revolutionizing the world's transport system. Barges leave inland ports on the Rhine River, are towed down to Europort, loaded aboard ocean-going ships, carried to New Orleans, unloaded and towed up the Mississippi and Ohio Rivers. Truck trailer-size containers are loaded in Japan, carried by ship to Vladivostok, put on flatcars for shipment across Siberia and Europe, and reloaded on ships which ply to numerous North American ports. More and more ships are being built to allow truck tractors direct access for loading and unloading their trailers, thereby eliminating the use of huge cranes.

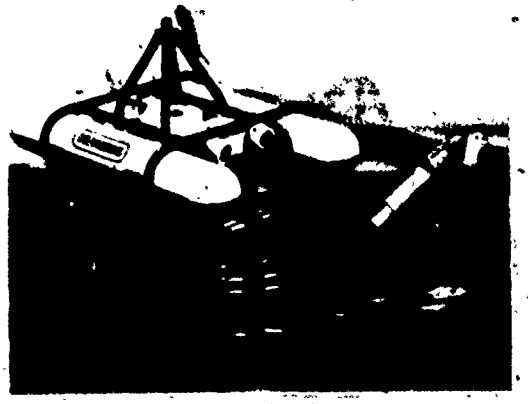
Shipping will benefit from more accurate weather forecasts. Vessels will be controlled much as air traffic is today. International bodies such as the Intergovernmental Maritime Consultative Organization are seeking to bring the traditionally independent-minded ships' masters to accept control from central points and to be better trained.

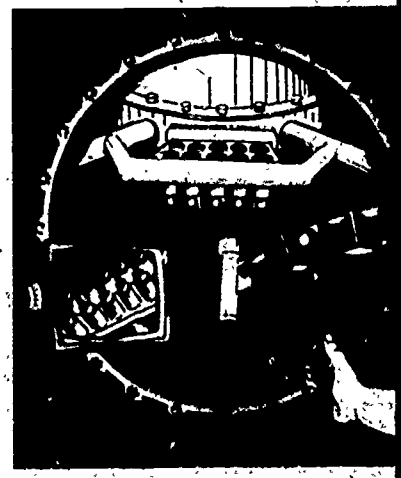
There has been much speculation about floating cities, since land will grow increasingly crowded. Most of the current research is being done in universities, with densely-populated Japan leading the way. (Such a "city" was constructed in Japan three years ago for exhibition in a major ocean conference in Okinawa.) Floating manufacturing plants could offer an economic base for floating cities. A joint study by the Continental Oil Company and a Tokyo group of Mitsui companies is currently examining the feasibility of constructing a floating methanol plant. The concept was proposed as a means of developing natural gas in remote areas. By the year 2000, there will probably be numerous floating industrial plants moored near sources of raw materials or near markets.

Manipulators Speed Undersea Work

Manipulators developed for space technology have entered the undersea domain. Two U.S. companies, General Electric and Oceaneering International, are building a diving capsule equipped with external arms operated by a diver sitting in comfort inside the capsule at one atmosphere of pressure. The diver looks through large viewing ports while he operates the controls to do mechanical work outside the capsule. The tethered capsule, called ARMS, for Atmospheric Roving Manipulator System, will be able to dive to 3,000 feet and promises to become extremely useful in the maintenance of offshore oil wells.

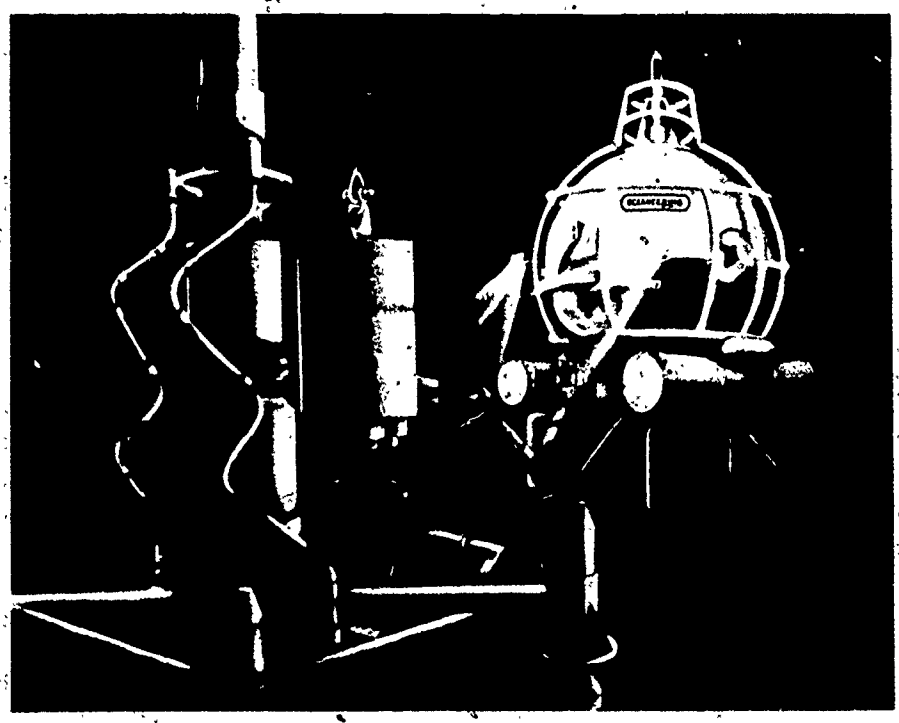
The two companies are also developing a tethered, unmanned remote-controlled manipulator vehicle, with television "eyes." Since no life-support system will be needed, the vehicle will have a much greater range, both in depth capability and in operating time duration.





Deep-diving, remote-controlled vehicle has television "eyes" and a force-feedback manipulator arm. Force-feedback "feeling" will be very important in cloudy water that blocks television viewing. Unmanned remote-controlled underwater work systems represent a new capability of infinite value to the diving industry in terms of economics, reduced personnel hazards, and increased work capability. View from inside capsule shows diver's hand operating "master" arm.

Drawings: General Electric



Diver, inside ARMS capsule, installs blowout preventer component on a sea bottom oil well. External arms can duplicate motion of human arms.
Drawing: General Electric

Operator demonstrates underwater manipulator in laboratory. "Slave" arm (foreground) duplicates motion and amplifies power of "master" arm, held by operator. Forces exerted by the slave arm are reflected back to the master, providing force feedback or "sense of touch."
Photo: General Electric

Seafloor living is becoming a reality with an underwater oil-production system developed by a Lockheed subsidiary in Vancouver, Canada. The system consists of a steel "house" located over a sea-bottom oil or gas well, at depths potentially as great as 3,000 feet, and maintained at sea-level pressure. Whenever maintenance or repair work is to be done, men are lowered from the surface to the "house" in a transfer chamber. The men descend quickly at sea-level pressure, transfer to the "house," and work there in comfort, still at sea-level pressure. This isn't a "dream system," but one already in production and use. By the year 2000, oil production systems utilizing sea-level pressure chambers will probably be in common use at 3,000-foot depths.

Military Uses of the Ocean Depths

One shudders when contemplating the war-making capabilities that will exist in the oceans by the year 2000. Today, ballistic missile submarines of the U.S., the Soviet Union, Great Britain, and France are lurking beneath the waves with their deadly loads. Attack submarines, fitted from stem to stern with hydrophones, seek them out, aided by ships and aircraft. Bottom-mounted hydrophones can detect ships and submarines across an entire ocean, and in the future there will be no privacy anywhere above or beneath the seas: Every vessel, no matter whether on the surface, in the depths, or on the bottom, will be tracked in real time. Perhaps so many detection and kill systems will have been perfected that all forces will have neutralized each other!

In closing, I would like to make a few recommendations for utilization of the sea as a source of food:

Man should shift from simply harvesting the oceans' natural production of food to actually *farming* the seas. The following steps should be taken, under some international auspices such as the United Nations Food and Agricultural Organization (FAO):

- Sponsor research on how much sea life can be harvested without harming the ability of the living things to replenish themselves.
- Provide funds for experiments on the domestication of sea creatures. Could the porpoise, for example, be domesticated?
- Encourage intensive aquaculture in bays, estuaries, and close-in shores.
- Offer incentives to private industry to invest in aquaculture.

Neither public nor private enterprise, alone, can initially farm the seas effectively. With both operating, competition hopefully would provide the incentive for developing efficient management techniques.

Man Readies Technology for Exploitation of Sea Bottom

The sea will become increasingly important as a source of energy and minerals as land deposits dwindle, according to a report from the U.S. National Academy of Sciences. Until recently, the submerged riches were unavailable because the technology did not exist for finding and exploiting them. Within the last two decades, however, the situation has changed, and man has begun, with offshore oil drilling, to tap the riches of the ocean floor.

The Academy's Committee on Seafloor Engineering, which conducted the study, had two main objectives: (1) to examine present capabilities in seafloor engineering and predict the capabilities required to meet future national needs, and (2) to identify the research necessary to extend present techniques and recommend procedures for implementing research programs. The report, entitled *Seafloor Engineering: National Needs and Research Requirements,* has identified five areas demanding expertise in seafloor engineering: energy, minerals, waste disposal, transportation and communication, and national security.

Offshore oilpools are the principal seafloor mineral deposits currently being exploited, but about two-thirds of the continental shelf off U.S. shores is still inaccessible to drilling, the Committee says. The world's deepest sea-bottom location of a producing well at this time is 400 feet beneath the surface of the North Sea, but oil companies are preparing for exploratory drilling in 850 feet of water off California and in 1,000 feet of water in the Gulf of Mexico.

Robot equipment with television camera "eyes" and mechanical arms will soon be available, engineers say. The robots will be far easier to maintain at great depths than human divers, who require complex life-support systems.

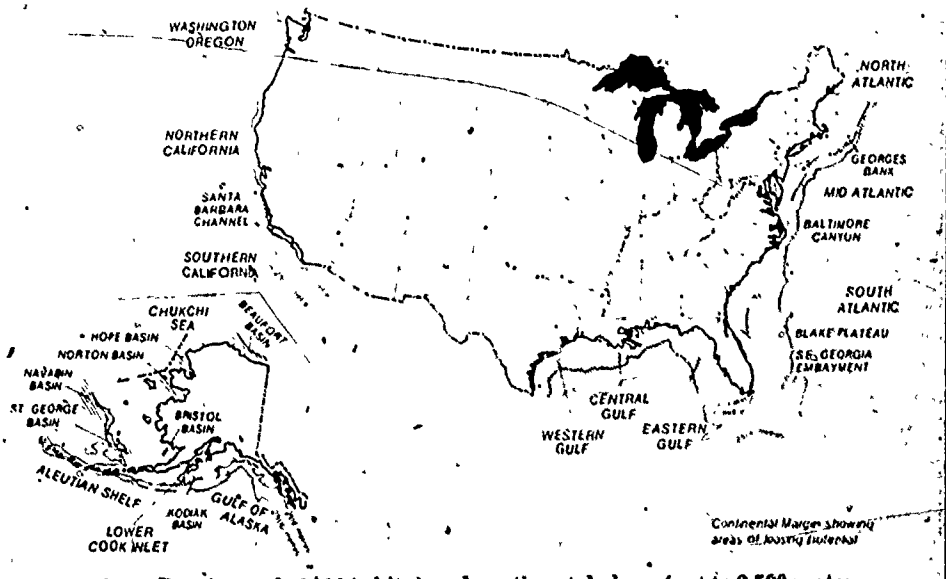
Vast, potentially oil-rich continental shelves exist off the coast of Alaska in the Bering, Chukchi, and Beaufort Seas, but the exploration of these areas awaits the development of new undersea technologies that are not subject to the destructive force of arctic ice and raging seas.

Although the sea bottom is thought to be very rich in minerals, the deposits have hardly been exploited at all so far, except for petroleum, because of the difficulties of prospecting on the ocean bottom. Effective technology for extracting non-petroleum minerals from the sea bottom is now becoming available. One unsolved problem is the clouding of the water when the seabed is disturbed. Clouding is seriously objectionable not only to environmentalists, but also to miners, for whom visibility is of great importance.

The sea has long been a dumping ground for solid waste. This practice is beginning to create major problems in some areas such as the coast of Long Island, New York, which has become heavily polluted from sludge and debris washing ashore. The Academy report states, however, that there are many places on the seafloor which are well-suited to solid waste disposal. Furthermore, solid wastes could be useful in the construction of artificial islands.

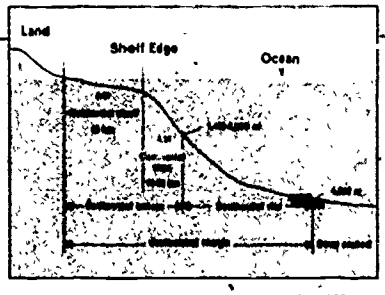
The report says that the ocean holds great advantages for renewable energy sources such as waves, tides, and currents. Two of the most promising technologies involve: (1) the use of differences in temperature between relatively warm surface waters and the colder water below to operate electric turbines, and (2) the use of photosynthesis to grow seaweed which could be processed to yield methane and other fuels. To do this, the seaweed (kelp) would be attached to a steel mesh 40 to 80 feet below the surface of the ocean. The mesh, in turn, would be anchored to the ocean bottom in waters up to 1,000 feet deep. The crop would be fertilized and the water temperature conditioned by artificial upwelling of cold water rich in nutrients from the sea bottom. Periodically, the tops of the plants would be harvested and taken to processing facilities located either on the ocean surface or along the coast. Sewage wastes could be used to fertilize the kelp beds, and these large "energy farms," with their high concentration of nutrients and limitless hiding places, might prove very productive of many forms of marine life including commercially valuable fish.

The sea bottom is already crisscrossed with many pipelines, cables, sensors, and transmitters used for oil transport, communication, navigation, and national security, and the amount of such equipment on the ocean floor is certain to grow exponentially, the report states.



Map shows continental shelf (white) and continental slope (out to 2,500 meter contour) off continental U.S. and Alaska. Promising areas for oil exploration are cross-hatched. Most U.S. offshore oil now comes from the western and central Gulf of Mexico. Areas of high interest for exploration include the Baltimore Canyon and the Santa Barbara Channel.

Map: U.S. Geological Survey



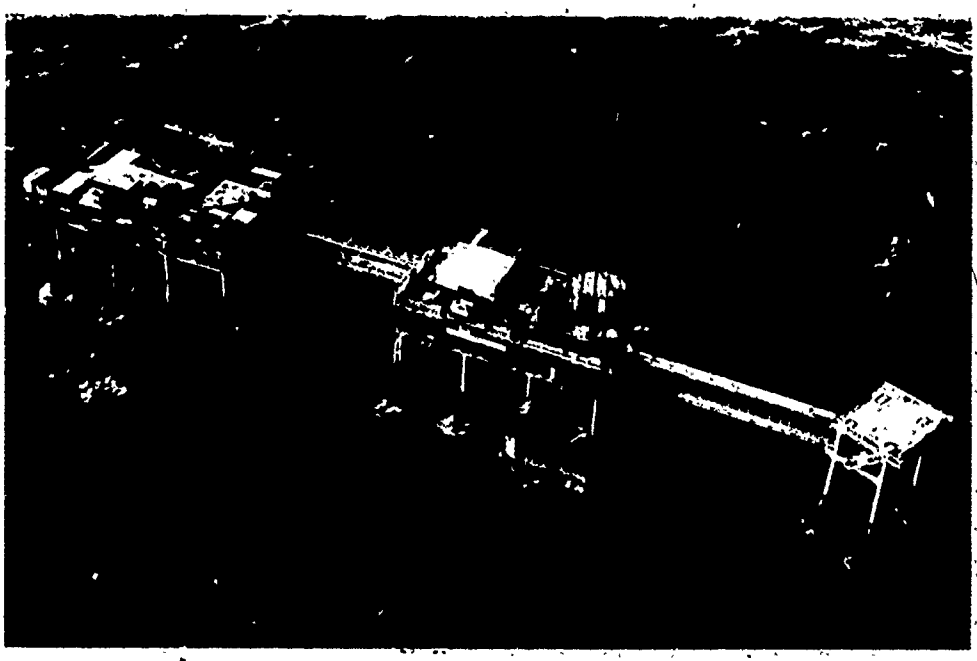
Profile of continental margin illustrates concept of continental shelf, slope, rise, and deep seabed. Continental shelf extends down to 200 meters. Although oil deposits are thought to exist beneath waters more than 2,000 meters deep, most exploration is still confined to the continental shelf zone.
Diagram: U.S. Geological Survey

The equipment is frequently damaged by heavy-duty fishing trawls, ship's anchors being dragged, and the corrosive action of sea water. Maintenance is costly and difficult, and improving the technology will be a high-priority assignment for engineers.

The Academy study predicts a proliferation of large ocean-bottom structures as well as anchoring systems for tethered floating islands. For these developments, knowledge of the character of the ocean bottom will become increasingly important. Seafloor architects will need a thorough knowledge of the terrain in order to build their structures. The importance of sea-bottom soil, sediment, and bedrock surveys will rival the importance of similar studies on land, but few such surveys have been done so far. Bottom contours have been fairly well mapped, and the stratigraphy of potential oil-bearing formations is being actively worked on, but no comprehensive surveys have been made of the bearing strength of the sea floor.

The environmental impact of man's exploitation of the sea bottom will figure heavily in any programs of seafloor development. The report cautions that seafloor development must proceed carefully so that it does not disturb nature's balance or degrade the quality of the environment.

The 81-page report, No. PB-254 171, *Seafloor Engineering: National Needs and Research Requirements*, can be purchased from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22151.



North Sea oil drilling platform on a calm day. Winter gales and 350-foot depths make oil exploration here hazardous and expensive, but the rewards are high. The British economy has received a major boost from oil and gas discoveries, and the Norwegians are now sometimes called the "Arabs of the North" due to their new-found oil riches.
Photo: Exxon Corporation

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Reading 20

UNCLOS: Scrambling for Sea Treasure

by Lynn H. Miller

The nations of the earth are on the threshhold of a scramble for riches in the oceans that could soon resemble the competitive European conquests of the New World in the sixteenth and seventeenth centuries when the likes of Pizarro, De Soto, Cortes, the Cabots, Henry Hudson, and La Salle helped Spain, England, Holland, and France carve up the Americas.

Five-and-a-half years after the start of the United Nations Conference on the Law of the Sea (UNCLOS), the draft treaty nearing completion foreshadows massive changes in national behavior in the oceans. Whether or not the treaty conference does produce a document that will be widely ratified—and there are reasons to doubt that it can—its work already has shown that the race is only beginning. It may be too much to hope that these deep-sea conquests can take place without serious conflict among the world's varied political groups, but it is the task of UNCLOS to try to provide a framework, a legal regime, within which this hitherto untapped wealth can be exploited in reasonably orderly fashion.

To succeed, a treaty for the oceans must be viewed as equitable by extraordinarily diverse groups. So far, the search for equity mainly has been skewed into satisfying the greed of nations by permitting them to claim more of the earth for themselves—paradoxically, in very unequal shares. Those parts of the draft treaty now agreed upon (some 90 percent of the whole) legitimize national economic expansion for most nations that is unmatched in history. This takes the form of authorizing exclusive economic zones of two hundred miles out to sea for all coastal states in the world. Since there are far more countries with seacoasts than without, this resolution of one central issue generally has been popular with most of the rich and poor nations alike. Once these zones come into being, more than 90 percent of the world's fisheries will be removed from direct global competition, one-third of present high seas will disappear, and—most significant of all, perhaps—almost all the exploitable offshore oil reserves will come within national jurisdictions.

It was in fact the huge block of 114 poor nations (still known, Lewis Carroll fashion, as the Group of 77 from the days, fifteen years ago, when the smaller grouping first began to make its presence felt on international economic policy) that proposed creating these 200-mile zones. They did so in the knowledge that they were conceding a disproportionate share of the sea's resources, not to themselves, but to many highly developed countries. A glance at the map reveals that most of the big gainers are either rich (Canada and Australia are examples), or powerful (the United States and the Soviet Union), or both. The losers are, of course, the landlocked or other geographically disadvantaged states that are generally, although not always, among the world's poorest. This group of 49 countries makes bedfellows of the likes of East and West Germany, Niger, Paraguay, and Upper Volta. Nearly half the exclusive zones will go to high-income countries with less than one-quarter of the world's population.

These facts duly noted, one may wonder if the members of the Group of 77 simply fell victim to their own short-sighted cupidity. They willingly offered a plan in which the comparative advantages of the wealthy would actually be increased, though it did assure the poor of substantially more scraps from the table of the rich than they had enjoyed in the past.

For the most part, the 77 were not, in fact, that short-sighted. There are two important reasons why their offer of exclusive zones made sense to most Third World governments. The first is simply that poor states without substantial navies or maritime industries have little interest in seeing the widest possible portion of the oceans kept free for use by all. Since the *sine qua non* of the international legal order is reciprocity, such countries have little to lose in insisting that extensive stretches of the oceans off their coasts are reserved for their use exclusively. In recent decades, Peru and Ecuador have claimed 200-mile territorial seas since it was obviously in

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their immediate interests to do so, if they could get away with it. Those claims were meant to reserve for the economic benefit of their own people the substantial tuna and nitrate resources off their shores, and to prevent the very real prospect of losing that wealth to technologically more advanced—and apparently insatiable—competitors from the north. Neither Peru nor Ecuador had much to fear from possible claims to wide territorial seas by other states, since neither had reason to venture much into distant waters.

Conversely, the great maritime powers traditionally have understood that they had everything to gain by insisting upon the international character of all but the slimmest band of ocean waters. It is California-based tuna fishermen, after all, who have an interest in fishing waters relatively close to Peru, there to claim ownership of whatever catch they take, rather than Peruvian fishermen who care what happens to fishermen in the North Pacific. It is the Pentagon that worries about freedom of access to the Indian Ocean, not the chief of staff of the Ecuadorian navy.

It is a cliché among international lawyers to say that the doctrine of freedom of the seas that emerged coterminously with the modern nation-state (a doctrine that is only now being radically modified) grew out of a marriage of British gunboats to the economic doctrine of laissez-faire. It is less often noted that the Dutch jurist, Hugo Grotius, who was the seminal proponent of freedom of the seas, wrote his *Mare Liberum* nearly thirty years *after* Queen Elizabeth I proclaimed the principle of high-seas freedom and successfully enforced it, particularly against the declining naval power of Spain and Portugal. Above all, Grotius understood that international legal doctrine must be based upon an astute understanding of where real political power lies and how it can be wedded to community values if the doctrine is to be persuasive.

In this sense, the 200-mile exclusive-zone principle embodied in the UNCLOS draft may be regarded as a sensible reading of where at least some of the relevant power and values lie today. First, every coastal state now has some ability to harvest at least a portion of those resources that lie within 200 miles offshore (if only fish, and however crudely by, say, Japanese standards). More importantly, coastal states are able to assert their claims to exclusive control with some measure of effectiveness. In the Cod War between the United Kingdom and Iceland several years ago, it was Britain that ultimately was forced to make concessions because, without them, Iceland had the means to increase the costs for British fishermen in the area to an intolerable level.

Secondly, creation of these economic zones reflects, however imperfectly, the growing ecological and environmental concerns of coastal states. Here are the beginnings of a historic perception of the ocean's resources as potentially scarce, rather than limitless, as they seemed to be in Grotius's day. Of course, establishment of exclusive zones doesn't guarantee rational ecological management in those areas—although other sections of the draft treaty attempt to provide for it—but it at least creates a single franchise for exploitation in place of uncontrolled competition.

But what of the interests of the great maritime states in the face of these moves? Recognizing the widespread support that existed at UNCLOS for the economic zones, the United States and the Soviet Union, in accepting them, have taken pains to insist that they are not to be defined as the equivalent of territorial seas (which the draft treaty limits to twelve miles in a compromise between the traditional three miles and the claims of up to 200 miles made increasingly in recent years, especially by poor states).

Moreover, what might be called the cupidity factor no doubt made the economic-zone concept more acceptable to the superpowers than strategic considerations alone might have allowed. After all, they reason in Moscow and Washington, the new zones are meant to be exclusive for economic purposes only. They point out that the treaty is careful to avoid any assignment of sovereignty over those areas to adjacent coastal states. Traditional navigational routes in accepted sea lanes presumably will be maintained.

Yet the layman, including national politicians who are not experts in the niceties of legal distinctions, may have some difficulty in seeing a real distinction between sovereign control (or outright national ownership) and exclusive jurisdiction for economic purposes alone. Moreover, difficulties are almost sure to arise in attempting to define the precise limits of activities relevant to economic exploitation and control. Where does a purely economic activity leave off and a noneconomic activity, such as scientific research, begin?

To look at the most obvious problem area, the UNCLOS draft specifically does not exclude military activities from taking place in the economic zones of other states. As is the case now while the seas are still relatively open, naval powers will be permitted to engage in military maneuvers close to the twelve-mile territorial seas of other states. This practice is certain to appear more threatening to one's opponent than it presently does once each country has exclusive jurisdiction to mine the continental shelf, drill for oil, and conduct other economically beneficial activities two hundred miles offshore.

In such a situation, the proposed right of, for example, the Soviet Union to enter the United States's zone and there conduct naval exercises, test weapons, and otherwise "show the flag" is bound to look mischievous to many Americans. One can easily imagine that the state whose *economic zone* has been so dealt with by a potential adversary will be inclined to react as if its *sovereign territory* had been breached. As Elizabeth Young asked in a recent article ("Law of the Sea—An Arms Control Issue," *Bulletin of the Atomic Scientists*, 34, no. 9

[November 1978], p. 55): "Who can benefit from these rights except a state that is intending to apply military pressure?" The answer might be: all maritime powers who have a mutual interest in maintaining freedom of movement in global waters. But such a response is likely to mean little if American companies find themselves surrounded by Soviet warships while drilling for oil on the continental shelf.

Maritime states appear to have been persuaded to join in collective admiration of the emperor's new clothes.

In short, with the far greater exercise of exclusive rights of one kind in coastal waters, nations may soon find the need to extend their exclusive activities of another kind—most obviously, for their vaunted security—into the area as well. With the loss of one dimension of high-seas freedoms in these zones, it may be only a matter of time before restrictions are placed on others. Even if outright sovereignty over these areas does not evolve through practice, at the very least a new bundle of problems for maritime states will have been created. In an insistence that the new economic zones are woven of an entirely different fabric from that of territorial seas, maritime states appear to have been persuaded by the nonmaritime crowd to join in collective admiration of the emperor's new clothes.

The second major reason why the world's poor nations agreed to offer this giant economic giveaway to coastal states stemmed from the bargain they hoped to strike as a result of the now greatly diminished high-seas area. Here they have sought to create an International Seabed Authority powerful enough to give meaning to the notion that the seabed's wealth is not the exclusive preserve of those few who can grab it for themselves simply because they have the technology to do so. They have built their strategy for a strong authority on a concept that was meant to motivate all the negotiations at UNCLOS, that the deep seabed and its resources constitute "the common heritage of humankind."

That term came to light back in 1967 when Dr. Arvid Pardo, then Malta's ambassador to the United Nations, first proposed a seabed treaty to assure exploitation of its mineral wealth by the international community for the benefit of all. In making his proposal, Pardo deliberately turned around the traditional Grotian doctrine of *res communis*, a doctrine that had always been used to justify free and open access of all nations to ocean resources, which were regarded as free goods available to appropriation by anyone. For Pardo, the emerging technology that would soon permit a quantum leap in the amount and kind of wealth that could be harvested from the ocean floor demanded that the international community now act to govern that exploitation and to reap the reward. It meant, in his view, that the need existed to create real governing institutions where now there were none, thereby making illegitimate any expropriations unauthorized by the international community.

The common-heritage concept was nothing short of revolutionary when it was proposed—the sort of idea that, if taken seriously, strikes terror in the hearts of transnational mining company executives, because of its implications for their social responsibility. The main response to it by U.S. officials, therefore, has been to not take it seriously, but to "accept" a definition of the common heritage that reduces it to a vague platitude, if not Orwellian newspeak. In the American view, the common heritage principle could not be construed to forbid unilateral mining of the deep seabed, even though to most of the world that was precisely the kind of action the concept was intended to prohibit.

Nonetheless, the Group of 77 no doubt hoped that the chances were greater of filling the principle with something close to Pardo-like meaning if they first conceded the richest one-third of the seas to the coastal states, to exploit in whatever manner they wished—a move, by the way, that Pardo himself has described as contributing to the kind of nationalistic expansion in the seas that he had hoped to avoid. That concession has not bred many notable counter-concessions from the rich nations, and it is, therefore, the 10 percent or so of the draft treaty's provisions for a Seabed Authority that have threatened UNCLOS with failure. The positions held by various groups of states are still so widely divergent that no agreement is in sight.

In general, these positions fall, not simply into the two categories alluded to already, but three. Industrialized countries, led by the United States, want only a very weak authority, one that would license either private or state mining enterprises (thus bridging the private enterprise-socialist gap). The authority would be empowered to "tax" them for a share of their profits, but without real power to oppose or regulate their activitie in any effective way. Such an authority would be largely a collection and disbursement agency, lacking real police power.

At the other extreme, and in keeping with their interpretation of the meaning of common heritage, the Group of 77 started negotiations insisting that the authority should be granted a monopoly to exploit seabed resources itself, with a large share of the revenues going to assist poor countries in their own economic development. Such an authority would be genuinely supranational, with a governmental capability unprecedented for a global institution. A third group of countries cuts across the other two, and includes those land-based producers of minerals concerned about the effect of deep-sea mining on their own markets. Canada, with its important nickel industry, is a typical example.

These states propose that the international authority should be empowered to control seabed mining so as

not to undercut their domestic industries. This would no doubt entail giving it a stiffer dose of supranational power than most industrialized countries would like, but it would be power used to restrict or prevent much seabed mining, rather than encourage it, with correspondingly less revenue being generated for the benefit of the poor.

After it became apparent, several years ago, that these opposing interests were deadlocked in UNCLOS negotiations, then-Secretary of State Kissinger proposed what was purportedly a "compromise," but actually simply acknowledged the deadlock by incorporating its features into the negotiating text. This provided for a "parallel system" for the Seabed Authority, giving it both the coordinating and the governmental roles. It would license private and state enterprises, and these would pay royalties or a share of the profits for their license to mine. But it would also sponsor a mining enterprise of its own, the profits from which would be shared by countries unable to participate themselves in seabed mining. This parallel-system approach now serves as the basis for the continuing negotiations, although the divergent interests naturally remain, each insistent upon providing real muscle only for the arm of the authority it favors, and determined to see the other arm shrivel, if it cannot be lopped off entirely.

> *Is the United States "now geared to fine-tuning a fundamentally unacceptable treaty"?*

At the extreme laissez-faire side of the argument, many U.S. mining interests still take the position that even the parallel-system approach is unacceptable. They continue to insist that the treaty recognize what they describe as their "inherent right" to engage in economic exploitation of the deep sea's resources, even when those resources lie beyond areas ever intended by anyone to fall within the jurisdiction of states. Last year Elliot Richardson, the United States's chief negotiator at UNCLOS, was publicly excoriated by a Kennecott Copper lobbyist testifying before a Senate subcommittee for conceding that the United States supported even a very modest capability for the authority. He complained that U.S. negotiators were "now geared to fine-tuning a fundamentally unacceptable treaty" (quoted in *The Interdependent*, 5, no. 7 [July-August 1978], p. 4).

The mining companies base their position on what they take to be traditional *res communis* doctrine for the high seas, even though that doctrine originated to treat global space and resources that, in Grotius's time, were incapable of being seized or divided. This was an eminently reasonable observation to make of fluid oceans and mobile schools of fish; add the sensible view for the seventeenth century that these resources apparently were inexhaustible, and the good sense of *res communis* doctrine for its time becomes clear.

But it is surely straining logic to argue that manganese nodules fixed to the ocean floor or oil deposits underlying them are like saltwater or fish and thus subject to expropriation by whoever gets there first. They are firmly attached to land, and for that reason alone cannot be satisfactorily apportioned under the rubric of *res communis*.

Indeed, the mining companies seem to recognize that weakness in their *res communis* argument; otherwise they would not have lobbied so hard in this country for legislation granting them property rights to begin mining operations on the deep seabed. In the usual order of things, property rights can only be granted by those whose property (or territory) is being conveyed. Little wonder that the 77 view this kind of legislation as flouting *both* the common heritage *and res communis* concepts. The Carter Administration now supports passage of such legislation, on grounds that it would be only an interim measure until a treaty becomes effective. (It is not coincidental, of course, that such a stance also tightens the screws at UNCLOS so that the Group of 77 will give in to a weakening of the Authority before the prospect of unilateral mining becomes a reality.) Such legislation no doubt has appeal to those chauvinists who still regard the world as our oyster—or more accurately, the oyster of multinational corporations—but it almost surely would produce costs far in excess of the benefits that a handful of corporations can expect.

At base, this position remains totally unacceptable to a huge majority of the governments negotiating at UNCLOS. We would be lucky if the reaction did not go beyond prolonged and acrimonious court tests—no doubt while the Third World proceeded to establish the kind of regime for the deep seabed it wanted all along, thereby forcing the United States to fly in the face of such action and to greatly weaken the prospect for an acceptable universal standard of behavior.

One might argue that such an outcome wouldn't matter much; certainly it would not be the first time that we self-righteously assumed our interests demanded action that ran counter to the proclaimed interests of many other nations. But it would most likely produce grave, new problems for us in both the short and long term. The immediate likelihood would be for sporadic acts of terrorism to accompany the effort of U.S. companies to mine the ocean depths. We could expect to see violence on the high seas, quite possibly on a scale not witnessed in peacetime for centuries. Forestalling that, we should have to commit armed vessels to accompany the mining companies' ships and to protect their mines as they plied the oceans.

For the long run, such domestic legislation almost certainly would sow the seeds for yet another extension of national claims to jurisdiction over what was left of the high seas. It would be the start of the same pattern of

unilateral extensions over continental shelves that now has culminated in the establishment of exclusive economic zones of 200 miles. And again we should be reminded that what is good for Kennecott Copper is far from good for international commerce and the U.S. Navy.

What is good for Kennecott Copper is far from good for international commerce and the U.S. Navy.

The issues here obviously go well beyond those debated when Congress passed legislation creating an exclusive fishing zone of 200 miles for the United States. That legislation, which became effective in March 1977, has been much criticized—and widely copied. Although it was another instance of going it alone even while the international community tried to negotiate a common solution to UNCLOS, it at least had the merit of complementing, rather than contradicting, the UNCLOS negotiations on exclusive economic zones. The same cannot be said for proposed unilateral mining legislation.

The debate at UNCLOS over the structure and powers of the International Seabed Authority remains, at heart, a debate about what is equitable and just in a sector of the world's future economy. Now that the poor states have conceded so much of the common heritage to national jurisdictions, they are in no mood to agree that the rich have a right to take what they can get from the seabed for themselves. Having no foreseeable technological capability to compete with the multinationals in this area, they naturally rely upon the only weapon they possess, the high moral argument which says that the resources in question are the common patrimony and are not subject to the selfish expropriation of the few.

It is an argument that is very reminiscent of that between America's nineteenth-century "robber baron" capitalists and social progressives of the time about the obligations, or lack of them, for some sharing of the wealth available within society. We have long since accepted the view domestically that unrestricted laissez-faire without any recognition of the obligations owed by the rich to the poor is unacceptable. We have even begun to recognize, through such techniques as environmental standards and pollution control, that what looked like free goods to earlier generations—water, air, land—cannot be exploited indiscriminately without serious social costs, and that, therefore, they cannot be regarded as in all senses free for the taking.

At the international level, however, an analogous agreement seems far away. If nothing else, this debate at UNCLOS is a mark of our continued thralldom to the view that the effort to achieve social justice—even to recognize social consequences of selfish actions—need not extend beyond a nation's boundaries.

Clearly, it is not the breakdown of the doctrine of *res communis* for the high seas that is troubling. That is a doctrine built upon an earlier reality of great abundance that existed before our exploitative capacities in the oceans were what they are today. Like all laissez-faire doctrines, it made most sense only in the context of great potential abundance. Conversely, like laissez-faire in national economic life, its foundations could not hold for long in our time in the face of two inexorable trends in the oceans. The first was the growing perception of scarcity—primarily of fish and other food resources in today's world, but increasingly, of oil and various minerals located in the seabed. Although one may wonder whether the wildly different standards that will prevail in the various exclusive economic zones will constitute the most sensible protective arrangement for the resources within 200 miles of shore, creation of those zones is at least feeble acknowledgment of the scarcity issue, and an attempted, partial solution to it.

The second development working against untrammeled laissez-faire—in the oceans today as in the America of the Gilded Age—is the perception that its permissiveness has led and will lead to greater and greater social inequities. Governmental regulation and control have been the traditional techniques adopted to reduce inequities in national societies. International regulation and control are the logical techniques for the international community to adopt to forestall the growth of similar inequities on a global basis. That is the position taken by those who seek a strong International Seabed Authority. That is the philosophical premise upon which Ambassador Pardo called for recognition that the seabed's resources are the common heritage of humankind. That is the concept that is as foreign to the thinking of many executives of multinationals and their congressional supporters today as it was to Cornelius Vanderbilt.

It is clear that the creation of exclusive zones without a corresponding agreement on a strong Seabed Authority will simply accentuate the perception of inequity on the part of many. It would take a Candide to suppose that any regime for the seabed that is likely to emerge from UNCLOS could look equally fair and just to such diverse interests as Exxon and the foreign minister of Chad. Yet it is important not to lose sight of the fact that the debate is really about advancing economic justice in the world. How addled is one's optimism to suppose it should still be possible to place such interests of the global community above those of the tribe—no, not even of the tribe, but only of a handful of its most vocal members? Perhaps very addled, if what one wants is also a quick and successful conclusion to UNCLOS. Over the long run, though, community interests surely must come through. Yet it was Keynes who reminded us that we'll all be dead in the long run, and that may have something to do with the increasingly vocal demands of less-developed countries for a new international economic order now, rather than in some never-never dream world of the future. ●