Luncheon Addresses
LUNCHEON ADDRESS

May 25, 1983

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Byrne: Thank you Richard. I stand here with some trepidation now that I know Davidson is down there with his pencil in hand. It is always a pleasure to come here. I don't know whether or not you folks who live here appreciate what a pleasure it is to visit Hawaii but let me assure you that the pleasure is increased by an order of magnitude if you come from Washington, D.C. And a few of my colleagues here know exactly what I'm talking about. They came earlier than I did. In any case it is a special pleasure to be here for this particular symposium. We knew it was going to be a good one, because the last one you had was very good. The papers I heard this morning demonstrate very well the excellent research that has been going on here for the last 5 years.

One of the things that I'd like to share with you are some of my thoughts with respect to research, and what I call linkages. One of the advantages that I have in my present position as Administrator of NOAA is, although I don't have the opportunity to get involved in research, I do have the opportunity to see the results of research from a variety of subject areas. The thing that is most intriguing to me is the kind of linkages that can exist among areas of research that appear to be disparate, that appear to be isolated, and separate. And when you do discover these linkages, it really is exciting. Just think of it in your own field. We are at a time where, as you look around, you can see all sorts of clues, tools, techniques, new ideas coming out of other fields that can be very useful to you in terms of solving problems which heretofore have been unsolvable. To mention several examples; for the biologists, certainly advances are being made by geneticists on mitochondrial DNA which is a new tool to determine stock identity in marine populations. Some of you involved with fisheries may have found the occasion to use some of the new satellite imagery. Satellite imagery coming from Nimbus-7 includes both infrared and ocean color, surface colors that show all sorts of patterns that we haven't seen before. Thinking back to SEASAT which lasted only a short time, we find that geodesists can make better identification and interpretation of the sea floor from the surface measurements made by SEASAT's altimeter than we've ever been able to do on a synoptic basis with echo sounders. Statistics and the advent of computers of course make it possible to do all sorts of things in modeling, and in fisheries population dynamic's that were impossible just a few years ago. Traditional fisheries biologists
would say that even ecologists are beginning to recognize the importance of recruitment and recruitment models for studies of population density and community structure.

There are a lot of ways at looking at the linkages. I think the film this morning showed several. One of the things that was intriguing in the film was the linkages between the study of coral reefs and the geological history of the archipelago. You recall the film opened up with a shot of how the Hawaiian Archipelago was formed with the plate moving over the hot spot. How the islands developed from undersea volcanos, rose up forming majestic high islands only to subside, erode, and gradually move off the hot spot to the northwest where they eventually drowned at a latitude called the Darwin Point where coral growth ceases to keep pace with island subsidence. If we looked at one area of the earth where it was most appropriate to do these kinds of interdisciplinary studies, I think it would clearly be the Pacific.

And if there was any question of that in the past, there certainly shouldn't be any question about it this year. In 1982-83, we have been going through an event, called the El Nino event or southern oscillation event... some oceanographers are even calling it the thermal event of 1982-83 -- which because of its extreme nature makes it easier for us to see the linkages that exist between the atmosphere and the ocean in terms of physical oceanography and some biological activities.

The Pacific is certainly the largest ocean -- and the most active in terms of volcanic activity and in terms of the weather patterns. Again from a geological perspective I would like to mention several studies going back to Charles Darwin. One of the early books that Darwin wrote was called "Coral Reefs" in which he did a masterful job of describing coral reefs, identifying them, putting them into categories, and so on, and then attempting to describe why the different categories of coral reefs should exist. And those of you who are familiar with Darwin's hypotheses, recognize that he very accurately perceived the role of subsidence, and the upward growth of coral in the development of atolls. This was long before there was any idea of plate tectonics, of movement and subsidence of plates away from spreading centers, and I suspect Darwin would be delighted with what we have learned in recent years. That for example the Pacific plate on which the Hawaiian chain rides got its start 190 million years ago and is constantly growing and constantly moving to the northwest carrying atolls to a watery grave is a remarkable prophecy of Darwin's atoll theory. Another aspect of plate tectonics which has biological connections is contained in a recent publication by Victor Springer of the Smithsonian. Springer has looked at plate tectonics to explain the process of species distribution and endemism of fishes in the Pacific. And I think it's intriguing that a systematic biologist would turn to plate tectonics, which is a relatively new concept in geology, to help explain some of the things that he is concerned with. I recall
... when I was teaching marine geology at Oregon State just a few years ago, we had some neat concepts as to how the Pacific Ocean was formed. It was either pulled out as a big chunk of material at the time the moon was formed or it was actually the result of a giant meteorite impact and that it was really a crater. As I said, when I first started teaching marine biology we had no idea what formed the Pacific. Another thing that happened about that time which was intriguing was that some people, in fact one of the pioneers of NOAA, had made some magnetic measurements in the northeast Pacific and they came up with some very stange lineations of paleomagnetic measurements which couldn't be explained. The first thing that many geologists did was to get the original data and recontour it because it was very clear that the original contouring was biased since long, straight patterns just couldn't possibly exist. Of course what came out was the key to understanding sea floor spreading and plate tectonics, the magnetic anomalies being evidence of new crust being formed on either side of spreading centers. The point I'm trying to make is that many existing links in our understanding are very new. This is part of the explosion in science that is going on now. I think it's interesting that Springer's incorporation of plate tectonic theory helps to explain the endemism he finds in the distribution of fish and a very strong gradient, a sharp decrease if you will, in the number of fish taxa as one proceeds eastward across the western margin of the Pacific. I should mention that the western Pacific is the oldest portion of the plate and gets progressively younger as you go to the east.

I'd like now to touch on several aspects of fisheries that demonstrate linkages between the earth and atmospheric sciences. For example, since World War II the annual world's fish catch has increased markedly, largely as a result of increased effort. Immediately after World War II the yearly catch was about 25 million metric tons. By the late 1950s and 1960s scientists were projecting catches of upward to 200 million metric tons. Some of you can remember those early papers in which people were claiming it was 150 million and other people were claiming 200 million and so on, but for some reason these estimates were never realized but instead stabilized around 1970 to the present in the vicinity of 75 million metric tons. No matter what we do, we don't seem to be increasing significantly toward the 150 million or 200 million level.

The question is why hasn't the fish catch measured up to past expectations? Probably a number of factors, but I think if you look at the way these totals were derived you find that the estimates in those days were made species by species, and simply adding them all together. And now as we look at what happens in fisheries biology we find that when one species increases another species frequently declines. There is a tendency to say at the expense of the other species but I think in most cases this isn't so. More often we are now seeing that there are linkages,
between the species distributions and some very important oceanographic processes. To give you an example, many of you perhaps remember the California sardine which was a major industry before WWII. Steinbeck's book about Cannery Row talks about the sardine industry. This was back in the 1930s and 1940s when at the peak there were about 800,000 tons of sardines landed per year. Then the fishery collapsed. I think the original thought was that it was strictly due to overfishing. Now we know that's probably not the entire explanation, although fishing pressure was undoubtedly a contributing factor. As a result, we begin to see anchovies increasing, and in time they began to replace the sardine. However, in recent years anchovies are declining and sardines are beginning to reappear. And so it's very clear there are other factors at work here.

The same sort of things seem to have happened off Japan. The sardine populations off Japan peaked at about 1.6 million metric tons in the 1930s and then dropped to about 9,000 tons in 1965. In recent years there has been a rather substantial recovery. In 1980 the catch was up to 2.2 million metric tons. It's hard to know whether or not the increase is due to good management, luck, or whatever. It's very clear to many of us that there are many factors at work.

The Peruvian anchovy is another example. In 1970 about 12 million metric tons were landed. This single fishery constituted about 20 percent of the total world catch in that year. A major, major fishery! And from this peak of 12 million metric tons it has tumbled to a low of 720,000 tons 10 years later. We now know from this year, that the environment has had a significant impact on the fishery. If there's one series of linkages that we're becoming more and more aware of, it's the linkage between the atmosphere and the ocean and its impact on the biology of the ocean. Last June (1982) we began to see that there was a fluctuation appearing in the southern oscillation index. The southern oscillation index is a term that atmospheric scientists use to measure the difference in pressure between Tahiti and Darwin, Australia, i.e., a high pressure cell over Tahiti, and a low pressure cell over Darwin, Australia. And as long as this high pressure cell is maintained over Tahiti it stays low near Darwin, and there is a general movement of water from east to west across the Pacific such that it piles up in the western Pacific. Charles Darwin noticed this. He knew that one of the reasons there were coral reefs in the western Pacific was that the currents along the equator were moving warm water farther to the west and that the warm water actually piled up there. The depth of the thermocline (he didn't call it the thermocline) actually increased as you went towards the west. In any case, the southern oscillation occurs when the high pressure in Tahiti and low pressure in Darwin begins to relax. And when it relaxes, we think now, a wave of water (not a current) moves back across the Pacific from west to east. This results in a current of warm water in the area of Ecuador and Peru that has been called the El Nino for many, many years now. It has only been in recent years.
that the El Nino has been attributed to the southern oscillation although the southern oscillation has been known since 1926.

In any case, last June we began to see a shift in the southern oscillation and as a result there was a great deal of attention paid to watching what happened with respect to the El Nino. This was fortunate because what we saw was an event which we have never measured before. The extremes that have taken place in 1982 and 1983 are far greater than any that we have ever seen with respect to the ocean in the tropics and particularly the eastern Pacific. The El Nino effect has been known a long time ... you can go back to the classic text by Swedrup, Johnson, and Fleming in 1940 and read about the kill-off of the anchovies around Ecuador and Peru, the death of the shorebirds, the high incidence of decaying fish, the production of hydrogen sulfide, and so on. What we're now beginning to see are the linkages that take place between the southern oscillation and the fishery. The warm water moving into an area where there is normally cold upwelled water either kills them off, or as is frequently the case, causes them to migrate to some other area. In the Peruvian case, we find that as the sardines and the anchovies begin to decrease, they may actually increase in the waters further to the south. That suggests there has been a movement of these fish.

Let me explore the linkages a little bit more about El Nino. With the major shift of warm water from the western Pacific to the eastern Pacific during this year, we've also experienced a shift in atmospheric conditions, causing terrible droughts in Australia and torrential rains in California, Peru, and Chile. The atmosphere patterns shifted in the form of something like an echelon, that is, to the east and caused extremes in weather which we have never experienced before. All our records don't show anything that measures up to this El Nino event.

There are other linkages. In continuing to look for oceanographic linkages, we see that the tidal level as far north as Vancouver Island off Canada is 6 to 8 inches higher than normal during this period. Temperature anomalies -- warm water where it normally is not that warm -- extended all the way around the Pacific during December 1982 and January 1983. They occurred all the way up the west coast into the Gulf of Alaska. They also occurred in the waters off Japan and in the area west of Japan. The temperatures in the central Pacific are anomalously low. These, we think, will certainly have an impact on fisheries and on the biota in these areas. In southern California where sport fishing is a big industry, they're advertising that this is the time to catch fish that are normally caught off southern Mexico.

There are other things that we don't quite fully understand. We find, for example, that storms in the Atlantic, particularly hurricanes, have an almost mystical correlation with respect to the southern oscillation index. When the southern oscillation index is low, that's when an El Nino event occurs and the number of Atlantic hurricanes is very low. It doesn't mean that the
hurricanes that do form are any less severe but there are fewer of them. Another thing is that in the year following an El Nino there appears to be frequently higher than normal hurricanes in the Atlantic. Thus, not only is El Nino an ocean-atmosphere coupling affecting the oceanography in the Pacific but it also appears to be affecting the atmospheric conditions in the Atlantic and other parts of the tropical world.

Another thing we have suspected for some time is that El Nino also has an impact on the jet stream as it occurs in the high latitudes. You perhaps recall that the weather on the mainland during the winter is frequently a result of where the atmospheric waves in the jet stream impinge on North America. If the wave comes down over Canada, mainland weather is very cold. Last year in November because of the volcano that erupted in Mexico a lot of predictions were made that it was going to be the severest weather that the United States had ever experienced. And there were a number of meteorologists who made that prediction. The people in the long term forecasting unit of the Weather Service at the National Meteorological Center sort of held off, and said that we'll give you our prediction in mid-November. And they did. And the prediction was that the eastern United States would have the mildest winter of the century. Their reasoning was based on the southern oscillation and the development of El Nino, and they were right on target. In fact, they were so much on target that they're now a little bit leery about making predictions for next winter.

One of the reasons that they were so successful was that this was an extreme event. The thing that is intriguing to me is to look at some of the research which is going on and see how it all links up. In the case of El Nino as I said, we think it has an effect on the jet stream position. Further, we think that the jet stream position has an effect on the ice coverage in the Bering Sea and if we can predict where the jet stream will come down we can make some general predictions as to whether the ice in the Bering Sea will be extensive or not. And that, of course, is of value to the people who have to transit the Bering Sea during the winter, but it's also very important for the survivability of King crab larvae. When the ice sheet is extensive the larvae don't do very well for a number of complex reasons. From a biological point of view that's a nice curiosity, but if you're a crab fisherman it is more than a curiosity, because it means that if that larval stock doesn't survive 8 or 9 years later when the crabs should be mature, then they are not going to be there. And so we begin to see that we can possibly explain some of the major fluctuations in King crab stocks as a result of the position of the ice in the Bering Sea which in turn is the result of what has happened in the tropics some year or so earlier as a result of the southern oscillation. And if you're a banker in Alaska that's important because you probably have all sorts of loans out on crab fishing vessels that are dependent on catching crabs. In any case that's an example of the kinds of linkages that I'm referring to — in this case the linkages exist between
atmospheric sciences, oceanography, fisheries, biology, and banking. Another example is what has been discovered in the fisheries laboratory in Seattle about pollock in the Bering Sea. Biologists now suggest that what we ought to do is fish the adult pollocks a little heavier because it turns out that the adult pollock is cannibalistic and eats each juvenile pollock and so if we can strip off the adult stage, we may in fact increase the size of the overall pollock population in the Bering Sea.

Well, these are just a few examples. I think that the symposium here today provides all sorts of appropriate linkages. I always see the value of a symposium like this as something that stimulates ideas rather than something that just presents ideas. We had one member of the audience this morning suggest that we should perhaps try animal husbandry techniques in maintaining populations of monk seals in the Northwestern Hawaiian Islands. That's a new idea! And it may stimulate other ideas. And so I congratulate those who have been involved with the development of this symposium. I'm delighted that it includes not only the National Marine Fisheries Service and the Sea Grant Program, both of which have a direct link to NOAA, but that it also includes our colleagues in the Department of Interior, the Fish and Wildlife Service, as well as the State of Hawaii. I think the time has come when we can no longer rely on doing research in isolated agencies but that talents and skills wherever they exist need to be pooled. So I guess in conclusion I would say, keep it up, you're on the right track and to my colleagues in Interior, I know they will provide continued funding for this important research and I can assure you that in NOAA we'll certainly do the same. Thank you very much.
LUNCHEON ADDRESS

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Some say there are always two sides to an issue and both should be reviewed before a decision can be rendered. Someone may quickly add, there are really three sides when you include the third party, the one rendering judgment. Counting two or three matters little to me so long as this basic management precept is followed. The approach is a good one. It functions well in business and public administration and is a key element in our nation's judicial system.

As I understand, that's why we agreed to conduct these cooperative studies, and that's why we are here today reporting on study results. Basically we are all concerned with the conservation, i.e., as Gabrielson put it, 'wise use,' of the fish and wildlife resources in the Northwestern Hawaiian Islands (NWHI). This use focuses on what portion can be harvested for economic return or recreational use and what portion needs to be protected, for as you all know a sound resource base makes harvest possible and sustainable. The advancement of scientific knowledge and education fits into the question of resource allocation as well.

These questions are important ones, for development and perpetuation of fish and wildlife resources are each critical to human needs in the Pacific islands, in the United States, and worldwide. The cooperative way various disciplines have gone about collecting the information required for management or further planning is admirable. It reflects professionalism of the highest quality and is important to an informed decisionmaking process. Improving the scientific basis for U.S. Fish and Wildlife Service (FWS) recommendations and decisions is an important objective by which this administration (Reagan/Watt) manages.

State-federal cooperation is another important element of the philosophy and practice this administration brings to government. I am pleased to see that cooperative philosophy in action here in Hawaii. Having experienced both the state and federal perspectives, I am well aware that issues such as the ones before us can quickly degenerate to nonproductive personal differences rather than constructive, scientific resolution. That's another reason why scientific fact is so important to an intelligent decisionmaking process. I have reviewed the abstracts of your papers and find the scope and results of your studies impressive. Although not all the questions researchers and managers seek to
resolve have been answered, the data base on which future studies, plans, and decisions will be made regarding the resources of the unique and beautiful islands of Hawaii has been greatly improved.

Speaking of decisions, FWS director Bob Jantzen and I are not here today to render a decision on what is the appropriate level of fishing or wildlife protection. Under the tripartite agreement, FWS, National Marine Fisheries Service (NMFS), and Division of Aquatic Resources of the Hawaii Department of Land and Natural Resources (DLNR) agreed that those decisions would be developed through planning based upon the results of the studies.

Rob Shallenberger will be reviewing that process with you. Consequently, I'll say little about it beyond my expectations for the considerations which will enter into that process. For starters, I expect that planning by FWS will follow policies and procedures supported by the administration, as reflected in the revised "Refuge Manual" and other policy statements. Namely, these include:

- Enhance and maintain the wildlife values for which this refuge was established
- Follow the National Wildlife Refuge Master Planning System for determining the development, management, and use of the Hawaiian Islands National Wildlife Refuge (HINWR)
- Provide for public and economic uses of its wildlife resources where compatible with the primary purpose of the refuge
- Closely cooperate with the state of Hawaii and other agencies who have adjoining or overlapping interests
- Simplify regulations governing uses on the refuge
- Protect or enhance the antiquity values inherent to the refuge
- Expand the "user pay" approach as appropriate to offset costs of general and special uses on service lands

Now, to expand upon these expectations. In doing so, my discussion will reflect both national context and local specifics.

National direction calls for the maintenance, enhancement, and recovery of priority fish and wildlife resources. Closely allied to this direction is the objective to improve resource management based upon a greater reliance on objective scientific information. Associated tasks include resolution of threats and
conflicts affecting resources on service lands and the administration of the endangered species program. Results generated by scientific studies will prove helpful in resolving the use versus non-use issue, and in considering endangered species' needs through my next topic, the planning process.

Development and implementation of National Wildlife Refuge Systems Plans is one of the key tasks supporting the department's and service's objective to promote appropriate multiple use of lands administered by FWS. This effort took form with the establishment of the National Wildlife Refuge Master Planning System last December. Revision and issuance of the Management Planning chapter of the Refuge Manual, the document guiding planning and management of the 86.7 million acres of lands in 413 refuges that comprise the system, were completed in February.

A planning needs review was conducted for all refuges and a master planning priority listing developed for refuges in each region. The HINWR was ranked a top priority in this region and nationwide, meeting all national criteria. Rob Shallenberger will be announcing the formal initiation of that process here today. That process calls for an environmental impact analysis and includes opportunity for you -- the state, other federal agencies, the university, and private groups and individuals -- to interact, assist, and have your interests considered thoroughly in that planning process. As I said, the National Wildlife Refuge Master Planning System is a key element in achieving our multiple-use objective for service lands.

Expanding economic and public uses and increasing fishery management on National Wildlife Refuges (NWRs) are two other tasks supporting our objective to promote the appropriate multiple use on service lands. The issue here is not one of the service being opposed to resource utilization. Make no mistake, FWS has and will continue to support the concept and practice of harvest -- take -- as a valid tool in managing fish and wildlife resources. At the national level, the end result of our ongoing program review will be development and expansion of appropriate uses within existing funds by June 1984 and completion of state-FWS cooperative agreements to increase fishery management on selected refuges by October 1984. The appropriateness of fishing and other uses in the HINWR will be determined through refuge master planning, the fishery management assessment, and the review of potential economic and public uses. All refuges in the system are undergoing these reviews and being considered for master planning. I am pleased that these efforts will have timely application to the planning and management decisions arising from our joint study efforts here.

Regulatory reform by this administration has impacted FWS business in a positive way. We have successfully taken steps to simplify and ensure timely response to federal planning, permit, and license actions.
Regulations governing uses on NWRs have also been simplified. Hunting and fishing regulations on service lands are more closely attuned to state regulations and stand until changed rather than requiring Federal Register publication each year for each refuge. The use of a generic endangered species biological consultation for operations in the HINWR and the clarified and standardized use of the refuge special use permit process are local contributions to that effort.

Another significant contribution made by this administration deals with state-federal cooperation. On March 18, 1983 the office of the secretary published in the Federal Register, the Department of Interior's fish and wildlife policy regarding state-federal relationships. This policy was developed in close coordination with the International Association of Fish and Wildlife Agencies (IAFWA). The purpose of the policy is to clarify state and federal responsibilities, enhance cooperative relationships, and identify areas for potential cooperative agreements respecting fish and wildlife management. This policy is intended to reaffirm the role of the states in fish and resident wildlife management, especially where states have primary authority and responsibility, and to foster improved conservation of fish and wildlife. In developing and implementing this policy, the department will be furthering the manifest congressional policy of state-federal cooperation that pervades statutory enactments in the area of fish and wildlife conservation.

However, in recognition of the existing jurisdictional relationship between the states and the federal government, Congress, in the National Wildlife Refuge System Administration Act of 1966, has explicitly stated that nothing therein shall be construed as affecting the authority of the several states to manage fish and resident wildlife found on units of the system. Thus, Congress has directed that, to the maximum extent practicable, such public uses shall be consistent with state laws and regulations. Units of the National Wildlife Refuge System, therefore, shall be managed, to the extent practicable and compatible with the purposes for which they were established, in accordance with state laws and regulations, comprehensive plans for fish and wildlife developed by the states, and regional resource plans developed by FWS in cooperation with the states.

So once having passed the test of compatibility, generally a use on a refuge would also have to be consistent with state regulations. The policy also directs the following: (1) preparation of fish and wildlife management plans in cooperation with state fish and wildlife agencies and other appropriate federal agencies; (2) the use of management strategies and practices that cooperatively complement those of the states; (3) provision for public uses in accordance with state and federal regulations and within statutory and budgetary limitations; (4) consultation with affected states on recommended closure of refuge lands open to public uses; and (5) consultation with the states, and general compliance with state permit requirements, in carrying out
research involving the take or possession of fish and wildlife, in the removal and disposition of surplus or harmful fish and wildlife. This same consultation and general compliance with state permit requirements applies to programs involving reintroduction of fish and wildlife.

The policy recognizes and addresses the international dimensions of fish and wildlife issues and ensures that effective programs at the state level are not weakened. In soliciting the advice of affected states in relation to the management of hundreds of millions of acres of land within the several states, the Department of the Interior will continue to seek new opportunities to foster a "good neighbor" policy with the states. Interior lands affected by this policy include those administered by the bureaus of reclamation and land management, plus NWRs, national fish hatcheries, and national parks.

In 1962 and 1966 Congress authorized the use of NWRs for outdoor recreation, provided that the use is compatible with the primary purposes for which the particular refuge was established. The principal reason for the establishment of a unit of the National Wildlife Refuge System is almost invariably the conservation, enhancement, and perpetuation of fish and wildlife; it was the reason for the establishment of the Hawaiian island bird reservation.

Consequently, federal activity respecting management of migratory birds, endangered species, marine mammals, and other wildlife utilizing units of the National Wildlife Refuge System involve a federal function specifically authorized by Congress. It is, therefore, for the Secretary of the Interior to determine whether units of the system shall be open to public uses, such as fishing, hunting, trapping, and native study, and on what terms such access shall be granted.

The practice of implementing cooperative agreements for a variety of fish and wildlife conservation programs is sanctioned and encouraged by the policy. Appropriate areas of cooperation are exemplified by practices here in Hawaii. Of special note are the cooperative research and inventories on and adjacent to refuge lands and waters in the Northwestern Hawaiian Islands; the agreements for the protection, development, and maintenance of endangered waterbird habitat; the support of the state's wildlife propagation program; and the agreements with Department of Defense for the management planning and assistance for fish and wildlife on their installations.

Cooperative agreements between FWS and NMFS covering shared responsibilities for the management and recovery of the Hawaiian monk seal and between FWS and DLNR for fisheries support are under consideration.

Bob Jantzen and I have had the delightful opportunity to visit French Frigate Shoals (FFS) and review the very real issues
involving potential multiple use that focus on the area. Our visit to FFS, this meeting, and related discussions with many of you will be very helpful in considering resource utilization in the HINWR. I cannot predict to what degree we'll be able to accommodate the various proposed uses and interests, but I can state quite emphatically that they will be given every consideration and that the planning process will continue to solicit wide participations.

Thank you for the opportunity you have given me to participate in this important symposium. My activities during these past several days -- the dialogue with state officials; aerial surveys of endangered forest bird and waterbird habitat; on-the-ground observation of French Frigate Shoals and Tern Island; briefing by FWS and NMFS personnel; exchange of views with research team leaders; renewing acquaintances with old friends and meeting new ones -- have been an enjoyable learning experience for me. Please accept my sincere thanks for your cooperation and many courtesies extended to me. Best wishes for continued success.
Panel Discussion
OPTIMUM USE SCENARIOS

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DEFINITION OF TERMS

The title of this section of the program is "Optimum Use Scenarios." Just what does that mean? Does it mean the same to each one of us? Most likely it does not and, chances are, it never will, simply because each of us values things differently and has different expectations.

Webster identifies optimal as an adjective meaning "most favorable or advantageous; best," and the noun scenario as "an outline of a proposed series of events." My conclusion is that my purpose at this point in the program is to outline what I see as a proposal for the best series of events for wisely utilizing the invaluable fish and wildlife heritage in the Northwestern Hawaiian Islands (NWHI).

In my view, the consideration of this panel includes the emergent islands and shoals as well as the submerged lands and waters of the NWHI out to the 200-mile boundary of the fishery conservation zone and the exclusive economic zone of the United States, the latter designated by Presidential Proclamation 5030, dated March 10, 1983. With this action, the President proclaimed sovereign rights and jurisdiction of the United States for the "purpose of exploring, exploiting, conserving and managing natural resources . . . of the seabed . . . and subsoil and the superjacent waters." For the purposes of this discussion, I will focus primarily but not exclusively on the fish and wildlife resources that inhabit the NWHI lagoons and nearshore waters. A key test of reasonableness for a scenario is that it is broad enough in geographic scope to contain the complex interrelationship of terrestrial and marine species that inhabit the NWHI.

The U.S. Fish and Wildlife Service's (FWS) mission statement provides a context appropriate for the word "use": " . . . to conserve, protect and enhance fish and wildlife and their habitats for the continuing benefit of people." The concept of public "use" is implicit in that statement. Indeed, public use of fish and wildlife resources has always been an important objective of FWS, both on and off its lands. The history of this agency reflects the importance of resource utilization.

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This administration has focused its attention on the need to explore means to expand public use opportunity, including economic use, on FWS lands. Yet, at no time in the history of this agency has the public use objective been given priority in management programs over the effort to conserve and enhance fish and wildlife populations. Where conflict has arisen between the perpetuation of these resources and the public use opportunity, the conflict is by necessity resolved in favor of the resource. Never has this been so true as when the conflict has involved threatened or endangered species.

These priorities reflect the legislative mandates that direct this agency’s activities and the realization that the concept of public "use" is not restricted to the harvest of fish and wildlife resources. In fact, FWS’s public use program is broad enough in scope to also include various nonconsumptive activities such as environmental education, research, interpretation, wildlife photography, bird-watching, and other forms of wildlife oriented recreation. Yet, even these activities are not always appropriate on all FWS lands as they too can conflict with the primary wildlife conservation objectives, particularly where endangered species are at stake.

During the studies and deliberations leading to this symposium, the "multiple use" approach to resource management was (and probably is) inherent in the perspectives of some individuals. Few land use agencies practice true multiple use. Even those agencies legally based on the multiple use concept are frequently viewed by the public as practicing an overriding or primary focus. Make no mistake about it, our National Wildlife Refuge System is by legal definition and practice a dominant land use program. Wildlife use is the primary purpose; economic and recreational uses are secondary and may be permitted only where compatible with the wildlife needs.

Although only inferred in the title, a time horizon requires definition. It is an unfortunate fact that a meaningful judgement is most easily attained by hindsight rather than foresight. True, the accuracy of our predictive capability increases with the accumulation of information and experience. Yet, it will be future generations who will be the best judge as to whether we, their forebearers, actually took the most "optimum" path.

All too often our sights are focused on far too short a time period into the future. This is particularly ironic when the actions we take have the real potential of affecting the survival of species who have made it to this point, over many millions of years of evolution, without our help or our hindrance.

Next year marks the 75th anniversary of the Hawaiian Islands National Wildlife Refuge (HINWR), originally the Hawaiian Islands Reservation. Recognizing the value of past experience in this management process, let us analyze our history before looking forward. A good starting point would be the year 1909. In that
year, President Theodore Roosevelt recognized the inevitable future for NWHI wildlife if immediate action was not taken to protect this unique area. Although his action was critical, it did not prevent the extinction of at least three land bird species soon after. However, it did insure that the overharvest of monk seals that marked the latter half of the previous century would not be repeated. In so doing, it signaled the start of a slow recovery for this species from the brink of extinction at the turn of the century. It also led to the gradual recovery of seabird populations devastated by commercial harvest and introduced herbivores.

Interest in the commercial potential of bird, seal, and fishery resources has been a driving force that has led to the exploration of the NWHI for two centuries. Few species escaped the interest of early explorers and entrepreneurs, but most attempts at commercial harvest were short-lived due to logistic constraints, marketing problems, and, in some cases, rapidly depleted resources. For some targeted fisheries, such as the pearl oyster at Pearl and Hermes Atoll, recovery never attained pre-harvest populations. Several targeted species, including the monk seal, green turtle, and some seabirds, became the protected species of today, in part due to the lasting direct and indirect effects of the harvest. Other fishery resources, such as lobster, tuna, and bottomfish, have sustained commercial interest over several decades but are now drawing increasing attention with the development of longer-range vessels, expanding markets, and new harvesting methods.

In retrospect, would it seem safe to characterize the last century of resource "use" in the NWHI as "optimal"? I think not. On the negative side of the balance sheet, three bird species present at the turn of the century are now extinct. In spite of substantial recovery, the monk seal population is again in the midst of a dramatic downward trend.

Shared use of the NWHI for military activities has also left its mark on several islands. Exotic plants and animals have altered the ecology of these fragile, insular ecosystems. On the positive side, most seabird populations have recovered substantially from earlier impacts. The consumptive and nonconsumptive uses of NWHI resources have increased dramatically, particularly in very recent years. The results of recent research and management studies have the potential of benefiting the NWHI species and human use for years to come.

From the standpoint of commercial fishery use in the NWHI, the last century was clearly not one which, by any perspective, could be characterized as optimal. Some might more appropriately describe it as fraught with unattained expectations. Even with recent promises of substantially expanded economic potential, and the growing number of boats heading northwest, few fishermen have made large profits. Most are marginal operators at best. The development of markets and infrastructure to support the NWHI
fishery has not kept pace with the growing interest to tap this resource.

Our look backwards leads us to conclude that resource utilization in the NWHI in the last century cannot be appropriately described as optimal, either in the area of wildlife conservation or fishery development. Now let us focus on the future of the Northwestern Hawaiian Islands; the future I define as the next 75 years.

Before we do, I think you should know something about my assumptions. Understanding the assumptions underlying the train of logic on which a scenario is based is every bit as important as understanding the ideas which structure that scenario. Understanding the assumptions used in each of the scenarios presented to you is also important for comparative purposes.

ASSUMPTIONS

First, I assume we will continue to hold certain tenets of western society's conservation ethics/laws to be true, that is, conservation or wise use of resources carries with it use a stewardship responsibility, a responsibility that the natural resource heritage will be available for future generations, that we hold those resources in trust for the common and future good of all.

Stated another way, the fish and wildlife resources we have inherited are a legacy, a trust (fund) from which we can only safely withdraw and use the annual interest that accrues -- the optimal sustainable yield (OSY) reflected in fishery management planning. However, that use carries with it the responsibility to ensure that the resource capital remains strong and intact, capable of providing for current and future generations. In addition, where capital resources have diminished we have a responsibility to restore them. History, administrations, and Congress have repeatedly held this truth -- this assumption -- to be self-evident in our conservation laws.

Maintaining or enhancing our trust fund is inherent in treaties and conventions with other countries for migratory birds and endangered species, in the long-standing federal aid in fish and wildlife restoration programs which make important contributions through our state fish and wildlife programs; in the Magnuson Fishery Conservation and Management Act (FCMA) of 1976 which spawned the fishery management councils and a refined role for the National Marine Fisheries Service; in the executive order and subsequent actions by Congress which recognized the unique and important fish and wildlife resources in the NWHI by the designation of the HINWR; and in the fish and wildlife management planning for Department of Defense lands such as Midway Islands under the Sikes Act.
Restoration of our resource capital to a level of optimal sustainable populations (OSP) and yield has been of growing concern and is most recently reaffirmed and strengthened by the Marine Mammal Protection Act (MMPA) and the FCMA. The Endangered Species Act also focuses on recovery of our capital stock. The MMPA provides, "The term 'optimum sustainable population' means with respect to any population stock, the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the (optimum) carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element."

Second, I assume the Hawaiian Islands National Wildlife Refuge will continue to exist with a primary purpose of maintaining and enhancing the associated fish and wildlife resources and a secondary purpose of permitting compatible use of those resources. Third, uses of these resources may not jeopardize the continued existence or recovery of threatened or endangered species. Fourth, these views represent the mission, goals, objectives, and policies of FWS.

EXPECTATIONS

For those who follow us to look back 75 years hence and say we followed the "optimum use scenario," we will have to achieve the following resource results:

1. The population decline of Hawaiian monk seals is reversed and recovered to the point that healthy sustainable subpopulations exist at French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Atoll, and Kure Atoll, and subpopulations at Midway Islands, Nihoa, and Necker Island are protected and not adversely affected by economic, defense, or other human-related impacts.

2. The recent trend of increasing recruitment and survival of green turtles at French Frigate Shoals has continued so that the breeding population at this site has at least doubled in size. Declines of turtle populations at Laysan, Lisianski, and Pearl and Hermes Atoll have reversed and substantial increases in survival and recruitment have been documented.

3. Populations of the four endangered land birds in the HINWR are at the carrying capacity level of their habitats, adverse effects of previously introduced pest insects and plants have been minimized, and actions to prevent future introductions or other habitat impacts have been fully implemented.

4. Seabird populations, including sensitive species, have fully recovered from effects of previous pest introductions and predation and have reached carrying capacity on refuge islands. Effects of rodents, pest insects, and exotic plants at Midway Islands have been minimized. Critical habitats as defined in the
Migratory Bird Treaty with the USSR are effectively protected.

5. Unique opportunities for terrestrial and marine research investigations in the NWRI have been exploited without adverse impacts on species and habitat. Scientific investigations have provided useful information for addressing management problems facing fish and wildlife resources in the NWRI.

6. Recreational and educational public use of selected areas of the NWRI has been accommodated without adverse impacts. Offsite interpretive and educational opportunities have been emphasized.

7. Research has uncovered and developed effective measures to detect and combat ciguatera so as to eliminate this as a significant problem affecting fishery development or monk seal survival.

8. The U.S. fishing industry is successfully harvesting selected NWRI fishery resources at OSY without adversely impacting fish and wildlife species and their habitat.

9. Minerals and energy resources have been developed at selected sites without conflict with fish and wildlife resources and the human environment in Hawaii and the Pacific basin.

Simply stated, that's where I would like to be 75 years from today. I expect there is a lot of agreement among us that those are good objectives. What may be controversial, however, is the path to those objectives, the best way to get there from here.

GETTING FROM HERE TO THERE

Yesterday, Rob Shallenberger addressed some of the steps we see as necessary, both within and outside the HINWR, to reach those objectives. We see the best or optimum path as one that is a blend of both conservative and innovative, perhaps even, radical action. The conservative, careful approach should apply where the risk of irreversible future impacts is a legitimate concern. More decisive and timely action is appropriate to arrest and reverse disturbing trends in species populations and habitat condition. The details of these two approaches in the immediate future will be the substance of the Regional Resource Plan, recovery plans, fishery management plans, and the refuge master plan described yesterday.

Attainment of the objectives I portrayed will require the continuing cooperation of agencies which have shared in this study and all others who share a stake in the wise management of the fish and wildlife trust in the NWRI. Our task is clearly not over with the completion of this phase of scientific investigation. The hard part is yet to come, but I'm confident -- given understanding and acceptance of resource objectives, potential, and limitations -- we can get there cooperatively and effectively.
I personally have truly enjoyed the opportunity of working closely with all of you and look forward to our determination and actions to improve both the continuity and rewards of our fish and wildlife legacy.

Henry M. Sakuda

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The objective of the Northwestern Hawaiian Islands (NWHI) Tripartite Cooperative study is to gather information on the resources of the Northwestern Hawaiian Islands which would serve as a basis for management decisions. Rational decisions are essential to ensure protection of the unique wildlife resources and their habitat, and the orderly development of fishery resources of the NWHI. Optimum use of the NWHI resources requires that ecological and economic goals be balanced to protect the terrestrial and aquatic life found there, and yet carefully allow fisheries development to take place.

With the increasing demand for fish in Hawaii, and the heavy fishing of stocks around the main Hawaiian islands, the thrust of commercial fisheries development must be directed towards the NWHI. If our fishing industry is to remain a major contributor to the economy of Hawaii, development of distant-water fisheries must occur. Hawaii should not continue to import from foreign sources a large proportion of the fish consumed here. In order to reduce imports and provide growth potential for Hawaii's fishing industry, the fisheries resources in the NWHI must be utilized. However, because of the long distance from the main Hawaiian islands to the NWHI the cost of travel is high and large vessels are required. These factors tend to discourage fishing ventures. Infrastructural support for fisheries must be extended into the NWHI to shorten the distances between the fishing and landing operations. Accordingly, a NWHI use scenario with the establishment of an advance fishery support base at French Frigate Shoals is currently being proposed by the state.

It has been shown that single-resource fisheries such as lobster trapping and bottomfish handlining in the NWHI on a long-term basis are marginally feasible, economically. However, a multi-resource fishery such as proposed below could be feasible for the NWHI.

A multi-resource fishery is proposed with fishing vessels maximizing the profitability of their operation in the NWHI by conducting their fishing in two phases. The first phase, outward bound from Honolulu to the NWHI, would direct the vessels to fish selectively for species that can be stored fresh frozen in good
quality. Those species could include spiny lobster, shrimp, thick-lipped ulua, white ulua, shark, mahimahi, sea bass, and ono, aimed at the restaurant/hotel markets or a frozen seafood market. Further, with live baitfish supplies from the shallow lagoon waters of Lisianski and French Frigate Shoals, the aku (skipjack tuna) associated with the extensive shoals of the NWHI would be fished and frozen for transshipment to the tuna cannery in Honolulu.

The fresh frozen catch would be offloaded from the fishing vessels to a mothership or support freezer barge anchored near Tern Island, French Frigate Shoals. The mothership/barge would supply the fishing vessels with frozen storage, fuel, water, provisions, and gear. Tern Island could be used for emergencies, short rest, and recreation stops for fishing crews and for fishing gear storage. The fishing vessel could choose to remain in the NWHI and continue fishing for the frozen seafood market, or it could return to the main Hawaiian islands.

On the return trip to the main islands, the vessel could fish for species intended for sale in the fresh seafood market. Those could include the snappers and other bottomfish, the larger yellowfin and bigeye tunas, as well as other high-value species mentioned previously. A variety of fishing gear should be utilized by each vessel to maximize the effectiveness of its fishing time.

The success of this scenario depends on the careful development and integration of frozen and fresh seafood markets in the main islands. Export as well as domestic markets should be considered. The development of this scenario would require active industry involvement in a variety of directions ranging from the vessels to marketing.

The presence of a mothership/barge support facility on Tern Island would open up the NWHI to medium-sized vessels 50 to 70 feet long as well as even smaller boats which could be towed or barged into the area. A medium-sized vessel could even serve as a mothership to a number of smaller fishing boats. This type of operation is typical of foreign distant-water fisheries.

The support facility could be operated by a private enterprise under permit from the state of Hawaii and the U.S. Department of the Interior. Since the mothership/barge would be anchored near a national wildlife refuge and Tern Island would be used on a limited basis, fishing and support operations would be stringently regulated to avoid impact on the unique wildlife and the refuge.

At the same time, the fishery support base could benefit the federal refuge operations at Tern Island through support of the research activities and logistics between the main Hawaiian islands and the refuge. Also, some of the fishing, for example
for ulua or sharks, could directly benefit the endangered/threatened species on the refuge by reducing a major predator.

Further, while we appear to lay blame on our domestic fishers for disturbance to the endangered species, we cannot neglect the foreign fishing activities taking place around the NWHI. Particularly the fishery for squid, the preferred food of seals, with its miles of nets a potential hazard for entanglement. A real problem is also present where squid fishermen may be angered into shooting at seals that are sighted eating the squid off the nets; as we know they would.

Although not strictly a fishery resource within the NWHI, the albacore tuna fishery located in waters north and west of Midway Islands is an important area for development by the state. The larger albacore trolling vessels can fish these long-distance grounds while based in Honolulu as long as albacore tuna prices are good. Their operations are constrained by the 1,500 or more miles that must be traveled to reach the fishing grounds at great cost in fuel and fishing time, limiting the number of trips that can be made. Should a fishery support base at Midway Islands prove feasible and be established, the range of American fishing vessels would be extended into the Pacific Ocean whereby the entire western North Pacific would become available. The presence of an American fishery in these international waters would establish considerable prestige to both the state and the nation. Furthermore, the support operations at Midway Islands and French Frigate Shoals could be integrated to realize economies of scale, thus making them even more attractive.

Although there is little recreational fishing activity currently taking place in the NWHI, the potential development of fisheries resources for this purpose should not be overlooked. Sport fishermen from Hawaii now fly to Christmas Island, Alaska, and Canada on recreational fishing tours. Sportfishing ventures with no adverse impact on endangered/threatened species could offer economic as well as cultural benefits well worth pursuing. In addition to sport fishing, conservation/recreation programs such as the guided nature tours in the Galapagos Islands and more recently even to the Antarctic could be considered. However, public activity in the refuge would not be permitted if the fragile ecology of the area were to be endangered. On the other hand, extensive public wildlife-associated recreation is allowed and is consistent with the policy of the U.S. Fish and Wildlife Service for its National Wildlife Refuge System.

Finally, the state's position, as outlined in the Hawaii Fisheries Development Plan, is that the major potential for expansion of our fishing industry lies in the NWHI. To neglect this economic resource to foreign interests or non-use is wasteful to our state and nation. As a result of the tripartite study, we are in a better position to more clearly define and pursue the management objectives that allow for prudent development of the NWHI fisheries resources and at the same time
maintain strong protection of the area's unique wildlife and habitat. Optimal use of the NWHI resources demands a balance between fisheries development and wildlife conservation. To sacrifice one for the other would be a grave dereliction of our charge in stewardship of the natural resources found therein. However, a status quo attitude in this day of worldwide fisheries expansion is not acceptable. We must take positive yet careful actions. We must harvest the resources, manage the resources, and conduct research on the resources; only then can we justify any controls on foreign fishing activities which may be a greater threat to the endangered/threatened species in the NWHI. Let us work together to ensure the optimal utilization of our NWHI resources.

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ABSTRACT

A general optimum use scenario is presented by highlighting the importance of the Northwestern Hawaiian Islands (NWHI) to Hawaii's changing fisheries. Support uses of Midway Islands and Tern Island are seen as being essential to the growth prospects of Hawaii's fisheries. Endangered species and fisheries interactions are discussed for the NWHI spiny lobster fishery, bottomfish fishery, the precious corals fishery, and the fisheries for migratory, pelagic fish. A conclusion is reached that Hawaii's fishermen do not compete with the animals of the refuge for food or for any other reason. Environmental concerns with respect to the use of Midway Islands and Tern Island can be dealt with through rule making, education, enforcement, and contingency planning.

multi-resource fishery
use of Midway Islands and Tern Island
fisheries and wildlife interactions

INTRODUCTION

The importance of the Northwestern Hawaiian Islands for fisheries development can be understood by examining the character and nature of the present-day fisheries in Hawaii. Since about 1979, there has been a steadily increasing number of mainland albacore troll vessels basing their operations in Hawaii. There has also been an influx of mainland boats in the NWHI trap
fishery for spiny lobsters. This fishery, from its very beginning around 1976, has been characterized by many boats entering and leaving the fishery. Economic projections in the Western Pacific Regional Fishery Management Council's (WPRFMC) spiny lobster Fishery Management Plan (FMP) suggest that after initially high catch rates in the virgin NWHI fishery are reduced, the relatively low concentrations of spiny lobsters there will make it difficult, if not impossible, to achieve the scale of production that large vessels targeting on a single species need to cover their operating costs. That is why the larger boats have left the fishery and why more and more medium-sized boats are diversifying their operations into other areas such as bottom-fishing, and longlining for sashimi-grade tuna.

The bottomfish stocks near the main Hawaiian islands are thought to be fully or nearly fully exploited, and some nearby stocks of opakapaka and onaga are considered to be overfished. In direct contrast, the bottomfish stocks in the NWHI are considered to be underfished with a sustainable annual yield estimated to be worth a few million dollars. The spiny lobster resources in the NWHI are considerable when compared with those in the main Hawaiian islands because there is much more habitat for this species in the former area. The WPRFMC's spiny lobster FMP estimates an "optimum yield" or a potential annual harvest in the NWHI of between 200,000 and 400,000 legal animals. This range is not a quota, nor is it a harvest target or a harvest guarantee. The potential harvest of 200,000 to 400,000 spiny lobsters is simply the WPRFMC's best estimate of the "equilibrium yield" after the virgin stocks are reduced.

The tuna handline and longline fisheries are the fastest growing segments of the state's commercial fishing fleet. Neither tuna handliners nor longliners fish to a large extent in the NWHI at present. The potential of the NWHI for further development of Hawaii's longline fleet is suggested by the pattern of foreign longline fishing in the recent past in the waters of the U.S. fishery conservation zone (FCZ) surrounding the Hawaiian Archipelago. For the 5-year period, 1973 to 1977, the NWHI produced about twice as much fish on the average for the foreign longline fleets than did the FCZ waters off the main Hawaiian islands. This is to be expected since the NWHI are nearer to the home ports of foreign fleets, since the NWHI FCZ is significantly larger than the FCZ of the main Hawaiian islands, and especially since one of the world's best fishing ground for bigeye tuna, a deluxe or premium market species in the sashimi trade, lies within the FCZ of the NWHI and just north of it on the high seas.

Foreign longline statistics on catch and effort reveal a marked seasonal variation in abundance among the billfish and tuna species. Striped marlin generally occur in greater numbers during the winter months and blue marlin during the summer months. During the 5-year period, 1973 through 1977, foreign longliners fishing in the FCZ of the NWHI caught four times as much tuna and twice as much billfish during the winter months
than they did during the summer months. Striped marlin and swordfish accounted for over 90 percent of their NWHI billfish catch, whereas bigeye and albacore tuna dominated their tuna catch. Historically, the foreign longline fishery in the NWHI diminished its intensity during the summer months, shifting its focus more toward the main Hawaiian islands. Thirty-four percent of the billfish catch of foreign longliners made in the FCZ of the main Hawaiian islands during the summer months is comprised of blue marlin, followed closely by swordfish (27 percent), and striped marlin (26 percent).

The domestic fisheries for the large pelagic predators are generally summer oriented. The seasonal variations in species composition in the catches of domestic fishermen are dependent upon movements and local abundance of the migratory fish. Both of these factors are influenced by a number of environmental factors such as sea surface temperatures and the relative availability of prey. Generally speaking, it appears that striped marlin and bigeye tuna are winter fish in Hawaii responding to a different set of environmental factors from the blue marlin and yellowfin tuna which are mostly summer fish. Commercial fishermen, whether foreign or domestic, adjust their fishing strategies by reading market conditions and hope to find the fish that they are seeking on the basis on their past experiences. Foreign longline fishermen follow the fish that they are seeking by dipping in and out of the FCZ as the fish do. Domestic fishermen are not as mobile, although some local longline fishermen make trips into the waters of the NWHI.

**MULTI-RESOURCE FISHERY**

The WPRFMC has never advocated nor maintained, either with the spiny lobster fishery or the bottomfish fishery, that commercial vessels can be supported by a single resource. Its position has always been that the NWHI fishery can only develop as a multi-resource one. Given the character and extent of the resource base, this is the only sound strategy for development. This pattern is developing now with more and more boats mixing lobster fishing with bottomfishing and seasonal albacore trolling. Some boats are now trying their luck with deep-water shrimp. Fishermen are highly individualistic, and each has his/her own idea about whether or not to fish the NWHI and how to best fish there. The most successful fishermen are often the most guarded about their operations; it is expected that more should be heard about their failures than their successes at a public forum such as this. Fishermen, like everyone else, have a right to fail as well as succeed.

The immediate role of the WPRFMC with respect to the NWHI fisheries -- whether for bottomfish, lobsters, seamount groundfish, precious corals, or migratory pelagic species -- is to promote development within the sustainable limits of the resources. There is a sound conservation reason in doing that. By opening up Midway Islands and Tern Island for fishery support
use, the risk of overfishing bottomfish stocks around the main Hawaiian islands lessens. Without the development of a distant-water fisheries, the fishing industry in Hawaii will lose commercial fishermen. The quantity of bottomfish and spiny lobsters marketed in Hawaii will decline sharply causing extremely high prices for the limited quantities that can be harvested around the main Hawaiian islands. The high prices will eventually induce more part-time fishermen to put further pressure on already reduced stocks, making present-day management problems worse.

More of the albacore boats based in Hawaii are equipping themselves with bottomfishing and longline gear, allowing them to fish for high price market species during the off-season for albacore. If the albacore tuna grounds off Midway Islands are able to sustain more boats, then more of these boats can be expected to enter the fisheries in the western reaches of the NHW. The use of Midway Islands is essential for this kind of growth to happen.

USE OF MIDWAY ISLANDS AND TERN ISLAND

Initially, Midway Islands can be viewed as a base of opportunity, luring away more albacore boats from the mainland and even some that are now based in Hawaii. The albacore fishery will eventually diversify into multi-species operations catching bottomfish, spiny lobsters, and shrimp. If a market for frozen species can be developed, the fishery could further develop and include other species of pelagic fish besides albacore. Also, some opportunities can be seen for domestic fishermen to enter the seamount fisheries for alphonson and armorhead, and, perhaps, even make possible a joint venture fishing operation for precious coral.

The impacts on monk seals, green sea turtles, and seabirds are not envisioned to be any different with a fishery support base at Midway Islands as they are with the present level of human uses there in support of national defense purposes. There are certain rules with respect to endangered and threatened species and seabirds that apply to present users of Midway Islands. These rules would be made applicable to fishermen using the islands. Fishermen would have to be made aware of these rules and the reasons behind them. Compliance with the rules would be a condition of the use-permit. Additional on-site enforcement presence would help guarantee compliance with the rules.

A different fisheries support role is envisioned for Tern Island. The scale of fisheries support needs there would be much smaller than on Midway Islands. The in-place fisheries support infrastructure is much more primitive on Tern Island, and the island itself is small. Albacore boats would not have need for Tern Island, because they would have access to Midway Islands. Instead, Tern Island would be used to support a small fleet of combination-gear fishing vessels from the main Hawaiian islands.
fishing for lobster, bottomfish, and fish caught by trolling on banks and around fish aggregation devices. Some of the products would be frozen aboard the catcher vessels and transferred to containers on a barge for subsequent shipment to Honolulu markets. Some of the fish and lobsters would be delivered in fresh form upon the vessels' return trip to Honolulu and other island ports. About 10 medium-range local boats are envisioned that would be interested in using Tern Island during the course of a year. A schedule could be worked out where no more than two or three boats could be moored in the lagoon near the island at any one time. The state of Hawaii has prepared a proposal along the lines suggested here for the use of Tern Island and has submitted it for the review to the Department of the Interior. I believe that the impacts of fisheries support use of Tern Island on monk seals and green sea turtles would be minimal if the fishery support operations are properly planned and controlled. That is the challenge that needs to be met and, I believe, can be met.

GREATER PUBLIC USE AND ENJOYMENT

To me, the word "optimum" suggests a wider spread of opportunities for our citizens to be able to fish in the waters of the NWHI, or to study or just look. To do this requires gaining controlled access to limited portions of Midway Islands and Tern Island. My long-term vision, a scenario if you will, is of more fishing whether for sport or for profit, of limited nature study tours guided by professionals, and of additional research and resource assessment and impact studies in the NWHI. The Galapagos Islands are considered to be one of the world's showcases of evolutionary processes, and yet they are not off limits to the interested lay people. Trained park rangers and natural history interpreters lead small tours of visitors through the area. Why can't a similar program be developed for selected areas of the NWHI?

FISHERIES AND WILDLIFE INTERACTIONS

My optimism for greater public use and enjoyment of the NWHI stems from my belief that fisheries impacts on food chains, and interactions of endangered species with fishing gear used by domestic fishermen, are minimal. One of the scientists who spoke the day before yesterday calculated that the populations of seabirds that roost and nest on the islands consume somewhat more than 400,000 metric tons of baitfish and other sea creatures annually. Just think about how much is eaten by the complex of pelagic tunas, billfish, mahimahi, and ono. The amount has to be staggering. Now considering that Hawaii's largest fishery, the skipjack tuna fishery, managed to produce only 16 million pounds (7,250 metric tons) in 1965, its best year ever, then a doubling or tripling or even a tenfold increase in landings of pelagic fish caught by local fishermen could not be expected to scratch the surface in terms of throwing the pelagic species ecosystem towards disequilibrium. If anything, fishermen should be
encouraged to catch a heck of a lot more pelagic fishes. Whatever competition there may be in food chains, it is mostly between seabirds and pelagic species of predatory fish. The present fishing capacity of Hawaii's commercial fishing fleet is very minor compared with natural mortality in the populations of many species of migratory pelagic fish.

The lobster fishery is another example of a possible food chain interaction between a fishery and an endangered species, in this case monk seals. While an examination of a few scat and spew samples have established that spiny lobsters are a part of the monk seal's diet, the data also suggest that they are a relatively minor part of the diet and there are differences in feeding preferences among seals on the various islands. Of course, the differences may not be of preference but, rather, of prey availability. Research has shown that monk seals are opportunistic feeders, eating a wide variety of prey animals by foraging near coral reefs, over the extensive banks surrounding some of the islands, and down precipitous bank slopes, and possibly even capturing prey in pelagic waters.

By now, thousands upon thousands of lobster traps have been hauled in the eastern and central reaches of the NWHI and no monk seal/fishery interactions have been reported. There have been many observations by scuba divers at Kure Atoll and French Frigate Shoals of monk seal behavior in the presence of traps containing lobsters, but no negative interactions have been seen. To me, this suggests that monk seals, by-and-large, are not very interested in fishing traps. I would think that there is enough other prey around to satisfy the appetites and curiosity of monk seals. In short, I don't think that there is at present much of an interaction effect, direct or indirect, between the small commercial fishery for spiny lobsters and the monk seals. Neither do I anticipate a strong interactive effect between monk seals and the commercial lobster fishery in the future because I believe that the fishery will be conducted in accordance with the WPRPMC's spiny lobster PMP and that the regulations will be adhered to and enforced. I am happy to report that the federal regulations implementing the plan were put into effect on March 9, 1983. The plan is doing much to protect monk seals -- much, much more than was possible to do just 3 months ago.

I mentioned earlier that there is a budding fishery for bottomfish in the NWHI. In contrast with the main islands, the bottomfish resources of the NWHI are underutilized at the present time. The estimated annual harvest is worth a few million dollars. In the NWHI, besides the monk seal, some species of whales and porpoises, and turtles are considered threatened or endangered. None of the threatened or endangered marine species is known to feed on bottomfish, so it seems very unlikely that competition between fishermen and these animals for bottomfish as a food source can be a real factor.
The probability of incidental mortality of endangered or threatened species as a result of bottomfish handlining operations is slight, due to the great depths at which hooks are generally set for onaga, hapuupuu, opakapaka, and some other bottomfish species preferred by Honolulu's markets and restaurants. Although incidental mortality of monk seals or sea turtles can occur as a result of animals becoming entangled in lost netting or lines, domestic fishermen have never used nets to harvest bottomfish in the NWHI with the exception of a few exploratory surveys by the National Marine Fisheries Service. However, monk seals and green sea turtles have been observed tangled in net fragments. But it seems to me that the major contributors to the problem of entanglement are the foreign seamount trawl and foreign gill net vessels that normally operate on the high seas.

As a point of interest, I should mention that the apparent decline in monk seal populations in the western and central reaches of the species range happened in the virtual absence of any domestic fishery in the area. The only possible interaction in the area could have been entanglement of monk seals in fishing lines and netting materials lost or discarded by foreign fishermen operating near the area or on the high seas.

In vivid contrast, the population of monk seals has increased and shows a more normal balance in sex and age ratios precisely on those islands near where some of Hawaii's old-time fishermen have traditionally operated and where most of the recent growth in Hawaii's commercial fisheries has been. Clearly, I do not see how the present-day domestic fisheries could be implicated as a contributing factor in monk seal declines under the catch-all term "human disturbances."

Consideration has also been given to the possibility of impacts on marine mammals and endangered species of the precious coral fisheries covered by the WPRFMC's precious corals FMP. Because of the depth of the precious coral habitat and the fishing techniques used to harvest precious corals, the WPRFMC has concluded that there is little or no possibility of any such impact. While many species of fish, some of which are of commercial value, occur on or near the bottom in the depth zone of precious corals, none are known to depend directly or indirectly, on precious corals for food or habitat. Therefore, biological impacts of harvesting precious corals or other species can be expected to be less than the biological impact of harvesting precious coral itself. It is unknown what impacts could result from coral dredging on seamount groundfish habitats.

All in all, I conclude that if there are real impacts from domestic fisheries operating in the NWHI, they have to be landside impacts. Environmental problems could be caused by the illegal or emergency landing of fishermen on island preserves. The harassment of monk seals and turtles on the beach, the trampling of bird burrows and eggs as well as rare plants, and
the unintentional introduction of rats and noxious weeds are all of concern to us. Monk seals and sea turtles may be displaced from their preferred habitat (NWHI beaches) due to the presence of fishing vessels that are too close or due to crew members coming ashore for either recreation or as a result of grounding. But I believe that most of these problems can be dealt with through strict rule making, education, enforcement, and contingency plans. None of these problems is insurmountable if there is a will to deal with it.

**SUMMARY**

In summarizing my remarks, I will say that I see Midway Islands and Tern Island as being essential to the growth of Hawaii's fisheries. Simple geography should tell us that. One cannot expect to develop a Hawaii-based fishery when major stocks of albacore tuna, seamount groundfish, bigeye tuna, and smaller stocks of bottomfish, precious corals, and spiny lobster are 1,000 miles away from Honolulu. The use of Midway Islands is essential for opening up multi-species fisheries opportunities for domestic fishermen in the northwestern end of the Hawaiian Archipelago and on the high seas.

Tern Island offers a different set of opportunities. I see a small fleet of local fishing vessels using a small portion of the island for gear storage and for rest and recreation. A barge moored off of Tern Island would serve as a depot to supply the vessels and to carry frozen catches of lobsters and fish back to Honolulu.

If carefully planned and carefully controlled, Tern Island could also eventually be used as an entry point into the NWHI for environmental education and natural history tours. Led by professional guides, the tours could include light-tackle sport fishing in areas that would not impact threatened and endangered species.

That is my general scenario of optimum-use of the NWHI. It involves more of our citizens using the area. It is based on a belief that the green sea turtle population and monk seals on each island can increase to their optimum sustainable levels in the presence of fishermen and in the presence of controls that are enforced. Hawaii fishermen have explored and used the area on an on-and-off basis since the 1930s. Names of boats like Lanikai, Islander, Sima, Daikoku Maru, Katsuren Maru, Koyo Maru, Reliable, Kaku, Sea Hawk, Osprey, and Taihei Maru are legendary in the fish lore of Hawaii. Based on my own experience and on the experience of old timers, I feel that fishermen of Hawaii do not compete with the animals for food or for any other reason. I hope that I have illustrated the need for the NWHI to become more open to island fishermen who, perhaps more than any other people, are conservation and ecologically minded. In closing, I would like to suggest that perhaps it would be better to make less "last-ditch" efforts to rescue monk seals from processes which we
really don't yet understand and take a more reasoned, slower, and democratic approach to wildlife conservation. I may add that by democratic approach, I mean with a small "D."

Richard S. Shomura
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INTRODUCTION

The charge to the members of this panel is for each to provide a personal view of how the resources of the Northwestern Hawaiian Islands (NWHI) can be best utilized. It should be emphasized that the viewpoints expressed in my presentation are strictly my own and do not represent those of the National Marine Fisheries Service (NMFS).

I am pleased that the discussion is organized around the concept of an optimal use strategy rather than that of advocacy positions. The former provides a more positive outlook, whereas the latter suggests a process of tearing down the opposition to make a point.

It is difficult to develop an acceptable optimal use scenario since there are many and varied interest groups to consider, and the scenario should consider the merits of consumptive and nonconsumptive resources. The interest groups include the military, commercial and recreational fishing interests, conservationists, preservationists, and the public-at-large. On the one hand the commercial interests would argue that the resources should be made accessible to provide food. They would make a further point that developing a fishery in the Northwestern Hawaiian Islands will expand Hawaii's economic base and reduce the state's reliance on imported fishery products. On the other hand, conservationists are concerned about the nonconsumptive resources and would like to see these resources maintained at optimum population levels. Of special concern are the Hawaiian monk seal and green sea turtle. Discounting the extremists, most people would like to see both objectives achieved, that is, to utilize as much of the fishery resources of the region without adversely affecting the nonconsumptive resources.

PROPOSED SCENARIO

The optimal use scenario I propose is (1) to develop Midway Islands as a major U.S. fishing base in the central North Pacific; (2) to refrain from developing all the other emerged lands of the Northwestern Hawaiian Islands, that is, allow no
fishing bases or human habitation; (3) to encourage the utilization of the deep-water fishery resources, including the snappers, groupers, tunas, lobsters, and shrimp; and (4) to approach the utilization of the nearshore resources cautiously. Caution is needed to evaluate nonconsumptive resources, e.g., seabirds, Hawaiian monk seals, and green sea turtles.

The optimal use scenario I propose is based upon an assessment of the present fish marketing structure, a projection of what might happen if a number of assumptions I make are correct, and finally on a review of fishery development in the context of the nature and size of the resources in the Northwestern Hawaiian Islands.

At present, there is a limited market in Hawaii for fresh fish, especially the higher-priced snappers and groupers. If one were to discount the restaurant trade, I would guess that the consumers of fresh fish would form a pocket market. By this I mean that the demand for fresh bottomfish is not widespread. Although one could presumably overcome the marketing problem by education and promotion, a more critical problem is that of the relatively short shelf life of these species. Shelf life is of economic concern to the producers, that is, the fishermen, the dealer, and the consumer. It has been reported that the shelf life of bottomfish is about 12 days. When one considers the relatively great distance between the Northwestern Hawaiian Islands and the population centers in the state, and that the population in Hawaii is scattered over several islands, the short shelf life represents a critical problem in developing the fishery.

Within the size limits of the fishery resources in the NWHI, the growth of the fishery, in my opinion, will be dependent upon the expansion of the frozen-fish market. The expansion certainly will be dependent upon whether fish from the NWHI can be harvested and sold as frozen products at prices that are competitive with those of imported frozen-fish products. I should note that considerable advances have been made in recent years in handling and freezing fish. For example, if one agrees that the Japanese are connoisseurs of fresh fish, and a hundred million Japanese can't be wrong, then the fact that the bulk of the fish that is consumed as sashimi in Japan is landed as frozen tuna clearly demonstrates the potential for freezing fish in Hawaii.

If my premise is correct that at present there is a limited market for fresh fish in Hawaii and that the future expansion of the fishing industry to the Northwestern Hawaiian Islands depends on the development of a market for frozen fish, then the need for fishing bases in the NWHI takes on a new perspective.

Weather considerations and the lack of safe anchorages in the Northwestern Hawaiian Islands will generally restrict fishing in the area to larger vessels. Although I have not worked out the economics, I would guess that a vessel which would be capable
of bottomfishing in the NWHI would probably be equipped with freezing facilities. Rather than having the catch trans-shipped from a fishing base in the NWHI, it would more likely land the catch at a port in the main islands.

Given my comments on why I do not envision a fishing base in the lower reaches of the Northwestern Hawaiian Islands, I would now like to review the resources and indicate why I feel that a fishing base at Midway Islands would be advantageous in the development of fisheries for tunas, squids, seamount resources, precious coral, spiny lobster, shrimp, deep-water fishes, and nearshore fishes.

TUNAS

For tunas we have an albacore fishery located north of the Hawaiian Archipelago at about 30°N latitude and higher. The albacore is a highly prized species with an estimated fishable stock of about 100,000 tons in the North Pacific. The U.S. catch in recent years has been in the neighborhood of 10,000 to 20,000 tons. Of this U.S. total, approximately 2,000 tons has been taken in recent years from the area north of Midway Islands. The U.S. boats in this fishery are small troll or jig boats with carrying capacities of about 30 to 60 tons. The catch is frozen on board the ship. Because of its limited capacity these albacore boats generally have to return to port several times during the fishing seasons to discharge their catch, refuel, and resupply.

In 1979, Castle and Cooke provided a mothership which operated out of Midway Islands. With a mothership, the albacore boats were able to discharge their catch at Midway Islands and obtain fuel and supplies without traversing great distances. During other years the boats had to go to Dutch Harbor (Alaska) or to Honolulu to land the catch, refuel, and resupply. Thus one can see the advantages of having a base at Midway Islands.

Based on Japanese pole-and-line fishing records, the center of skipjack tuna abundance appears to be around latitude 20°N. Skipjack tuna are also caught in the immediate vicinity of the Northwestern Hawaiian Islands. In considering the development of a Hawaii-based pole-and-line fishery to harvest this species, baitfish is a major problem. I will not go into further details of the skipjack tuna resource or discuss the yellowfin tuna resource, other than to note that purse seining is becoming the principal method of fishing for both in the central and western Pacific. It has been suggested that small purse seiners probably could operate economically in the NWHI. Thus, the albacore fishery and to a limited extent a small vessel purse seine fishery for skipjack and yellowfin tunas could make use of a base at Midway Islands.
SQUID

In recent years, fishermen from Japan as well as Taiwan have developed a fishery for squid in the higher latitudes of the central North Pacific. The squid are taken with jigging machines or gill nets. My only comment here is that a potential for a U.S. squid fishery exists in the area north of the Northwestern Hawaiian Islands. Midway Islands could serve a squid fishery in the same way it would the tuna fisheries.

SEAMOUNT RESOURCES

The seamount resources are principally armorhead and alfonsin which are taken on a number of seamounts in the central North Pacific. In recent years the Japanese have been trawling for armorhead and alfonsin in the Hancock Seamounts area. The annual catch has been less than the U.S. allocation of 1,000 tons. Similar to the squid fishery, there is a potential for the development of a U.S. fishery for armorhead and alfonsin. A base at Midway Islands would prove invaluable, especially if smaller vessels are utilized.

PRECIOUS CORAL

Several years ago foreign fishermen fishing illegally within the Hancock Seamounts area discovered new beds of precious coral in deep waters (1,000 to 1,500 m). Information on the extent of this resource is not available. Again, the precious coral represents another fishery that could be developed by U.S. interests using small fishing vessels.

SPINY LOBSTERS

At present, the spiny lobsters from the Northwestern Hawaiian Islands are being marketed live and as frozen tails. Should the market for live lobsters increase greatly, a fishing base at Tern Island could be valuable. However, if development of the frozen tail market is greater, then the need for a base at Tern Island or Midway Islands would be minimal.

SHRIMPS

Considering the very short shelf life of fresh shrimp, development of a fishery in the Northwestern Hawaiian Islands would be based on the marketing of a frozen product. A shrimp fishery, if it develops, would be capable of operating independently from a base at Tern Island or Midway Islands.

DEEP-WATER FISHES

My views of the market for the deeper-water snappers and groupers have already been presented.
NEARSHORE FISH RESOURCES

While the species composition of the nearshore fauna is different from that of the deeper-water fauna, many of the problems noted in marketing and developing the deep-water fishery resources in the Northwestern Hawaiian Islands would also prevail for the nearshore resources. One further consideration is that the effect on the nonconsumptive resources in the NWHI is much greater for the nearshore resources than it is for the deeper-water fishes. This would need to be taken into consideration in any decision on the development of fishing bases.

NONCONSUMPTIVE RESOURCES

I would like to conclude my discussion on resources with a brief review of the nonconsumptive resources. My guess is that there are very few commercial or recreational fishermen who would take the extreme position of not caring at all about the fate of nonconsumptive resources. In fact, most commercial pole-and-line tuna fishermen are very concerned about the well being of sea-birds since they depend on the flocks of feeding seabirds to locate tuna schools. For those whose priorities lean towards the nonconsumptive resources, the best thing that could happen perhaps is that no fishing bases at all would be established in the Northwestern Hawaiian Islands.

The major concern in establishing a fishing base at Tern Island would primarily be its effect on the green turtle and monk seal populations at French Frigate Shoals. The Honolulu Laboratory of NMFS is currently undertaking a study to assess the stock size of the green sea turtle. Unfortunately, French Frigate Shoals, which has been identified as the major nesting site for the green turtle, is being considered as a site for a fishing base. If one were to guess the adult turtle population in the Northwestern Hawaiian Islands I would venture to say that the figure was around 1,500 animals. Thus, for the turtles, it appears that French Frigate Shoals is extremely important. For the Hawaiian monk seal a similar situation exists in that French Frigate Shoals supports the largest fraction of the monk seal population in the chain. Based on recent animal counts, the French Frigate Shoals population represents more than 53 percent of the total population.

The question may be raised as to what effect the development of a fishing base at Midway Islands would have on the nonconsumptive resources of the region. As most of you are aware, Midway Islands has been and still is a military base; thus, people have lived there for a long time. Whether this has resulted in the present low number of turtles and monk seals is not a point that I wish to argue. It should only be noted that currently turtles and monk seals are not numerous at Midway Islands. For seabirds, the most abundant species are the Laysan and black-footed albatrosses. Roughly 40 percent of the total albatrosses counted in the Northwestern Hawaiian Islands are on Midway Islands. From
all accounts the albatross population appears to be holding its own despite the presence of humans at Midway Islands. Other species that make up a large percentage of the seabird population in the NWHI include the red-tailed tropic bird, sooty tern, and white terns.

CONCLUSION

In summary, I hope I have made a case for the establishment of a single fishing base in the Northwestern Hawaiian Islands. A fishing base at Midway Islands would meet the needs of fishery development in the region while minimizing the impact on the non-consumptive resources in the area. Given the projected future direction that the fishing industry will probably be taking, there appears to be no need for a fishing base in other sectors of the Northwestern Hawaiian Islands.

Skip Naftel
Commercial Fisherman

Today I would like to address some of the points which I think are really important on issues of both developing and preserving the Northwestern Hawaiian Islands (NWHI). I don't have to answer to anybody but myself. Some people walk on the right-hand side of the road and stand a chance of getting hit by a car; others walk down the left-hand side and also stand a chance of getting hit by a car. But if you do as I do, that is, walk down the middle of the road, you stand a chance of getting hit by two cars. I think that most of the people in this symposium have been on one side or the other of the issues. As far as I am concerned, both sides have got to meet in the middle.

For example, the Tern Island issue has been going on for 11 years. I will dispute the fact that you can't medivac people out of there. I've medivacted three of my crew members out of Tern Island. The Hawaii Princess operation transported an important hydraulic part to Tern Island which the U.S. Fish and Wildlife Service people were gracious enough to put on a plane and it saved their operation. So Tern Island, I feel, has already played an important role in fishery development in the NWHI. But to let Tern Island turn into a fishing camp, if it be for support gear, support fuel, R&R, or whatever, is ludicrous -- it is just absolutely ludicrous. Anybody who has been there, and gone in and out with a boat, worries about the channel. You'd have to take dynamite and blow up part of the reef. I'll tell you, it's a no-win proposition for the fishing industry to take on the environmental concerns in the NWHI. We're going to lose!
I'd like to see the fishermen give up on Tern Island and concentrate on developing the infrastructure at Midway Islands. This is the crux of the problem if Hawaii is to become a major fishing state in the union. Many species in the seamount and albacore fisheries, as well as pelagic species, shrimp, and Kona crab have been totally overlooked near the end of the chain. Granted, there is no opakapaka up there, but the ehu fishery is unbelievable. In the Midway Islands area you put four hooks down and you catch ehu. In the seamounts area I have personally trapped alfonsin and armorhead. As for shrimp fishing efforts, we catch shrimp all the way up and down the chain. Hence, I see Midway as a major stepping stone for Hawaii to develop its fisheries.

I was wrong on lobsters. I can stand up here and look everybody in the face and say that. I wish I had 15,000 trap nights before I did what I did, but it didn't take very long to see that the lobster fishery is a small mom-and-pop operation for the John Dominis restaurant or a frozen tail market. It is not the kind of fishery that we used to talk about in spending $5 million in the last 5 years to develop in the Northwestern Hawaiian Islands.

I see four possible fisheries that could return truly high volume. The first is pelagic fish. The Japanese, Taiwanese, Filipinos, and everybody else, are all fishing it, but we're just barely into it.

The second, of course, is the seamount fishery. Within 200 miles of Midway Islands there is a tremendous volume of fish that could support a tremendous effort, but it needs the support of a fishing base at Midway Islands. Fishermen aren't going to run from Seattle or Honolulu to fish there. It doesn't make economic sense on the world market with the kind of price you get for the fish. But a small, versatile trawler, such as the kind used on the East Coast, could use Midway Islands as a base for that fishery. It is a tremendous fishery as proven by the Russians, the Japanese, and the U.S. National Marine Fisheries Service.

Number three is the squid fishery, but I'm a strong advocate of not using nets. That's where the problems are coming from. Squid can be caught by jig machines. The Japanese are using them now, but unfortunately about half the boats out there use drift nets. I think we should lobby through the international whaling commission and other bodies to get rid of the nets. They represent a tremendous potential menace to monk seals and sea turtles. So, the third fishery potential is there but only with the development of jigging machines.

Number four is the domestic, fresh-fish fishery. I believe there are about 44 longline boats fishing out of Honolulu and they're exporting the excess fresh fish out of the state. These exports are very good for the state. There is no reason why fresh fish can't be flown to Honolulu from Midway Islands. There
are two MAC flights a week which go up with cargo and come back empty.

In conclusion, let me again say that we, as fishermen or conservationists, or as people working within governments, or as scientists, all have to get together and give up on Tern Island. It's a "no-win proposition." There's just not enough economic return to justify jeopardizing the wildlife. There are two endangered or threatened species there. If Tern Island were to be opened up to fishing it would just be a matter of time before somebody made a mistake, and all the seals or turtles or some birds were lost forever. So, I advocate developing Midway Islands with a processing plant and freezer facility. Let's put all of our emphasis and focus on Midway Islands where the biggest return on our investment lies. Tern Island belongs to the seals and the turtles.
REACTION PANEL

Louis K. Agard
Commercial Fisherman

I appreciate having been here for the past 3 days and being able to develop some points of view even though they may not be exactly consistent with what you have heard. And I don't expect everyone to agree with me.

It is evident that the Northwestern Hawaiian Islands make an excellent laboratory. As a member of the commercial fishing sector some observations may be in order. To put things into perspective, first as a former Sunday School teacher attending a Baptist college in California, I'd like to say that the Bible makes reference to fishermen and their role in society. Fishermen in olden times, as now, did offer a service. Today fishermen still provide an important function or they would not exist. In contrast, I have not found any reference in the Bible to fishery biologists. In this regard, with the completion of the 5-year tripartite-Sea Grant study an important question might be: what has been done on behalf of the fishermen in the Northwestern Hawaiian Islands? More regulations, more stringent restrictions? I suppose it's a natural thing to condemn previous exploiters including fishermen. I know one thing for sure, the answer is not clear but it does serve to polarize fishermen.

This all started about 81 years ago when President Roosevelt created the Hawaiian Islands Wildlife reservation. You may find this strange but some fisheries are not dependent on emergent lands, Tern Island, or Midway Islands. I do not speak against those that advocate the use of emergent lands, but there are fisheries that are practical without the need for lands in the Northwestern Hawaiian Islands. But the reason we have been here for the past 3 days is an essential difference in philosophy between a group of fishermen who are talking about harvesting renewable resources and an opposing group with a view speculating about the fate of wildlife species in the Northwestern Hawaiian Islands. A conclusion seems to have been drawn that human presence, especially fishermen, will be detrimental or even fatal to the wildlife. In this regard, there has been an argument for some time that the Northwestern Hawaiian Islands do not have sufficient resources to sustain a fishery, and therefore we should not have fisheries. I believe this is prejudicial. For example, stock assessment studies show that there might be some 150 million pounds of reef fish including large amounts of baitfish for tuna production, which is extremely important to Hawaii. I've had the experience of loading up tuna boats with bait at French Frigate Shoals in the past. Other studies reflect that there are relatively high productivity rates for the same region.
Fishermen work at their own risk and with their own capital. They are not seeking to be paid to fish, but rather to be self-reliant and self-sufficient. An overly restrictive climate in Hawaii has precluded several proposals for feasibility studies using baitfish from the lagoons of the Northwestern Hawaiian Islands for harvesting tuna. Saltonstall-Kennedy funds for this purpose have been lost. Bait is in short supply in Hawaii and the tuna industry is currently depressed. A vital element to the fishing industry in Hawaii is the tuna cannery. Some canneries have already closed down elsewhere in the world. Hopefully, these conditions will not contribute to the closing down of our long-established cannery in the near or even distant future. With regard to the economics I believe that all of us, every single one of us, has the right to choose a profession and we also have the right to fail, and I don't think that someone in Washington, D.C. or wherever should be making decisions on behalf of people who are going to put up their own capital and attempt to do a job. Fishing is important to us in Hawaii since our per capita consumption of fish is higher than any other state in the union. Even so, Hawaii still imports millions of pounds of fish; in fact it is estimated that about 75 percent of the fish we consume is imported. Harvesting renewable fisheries resources, although difficult, is essential. Hawaii's population has doubled in the last 40 years and the number of tourists has quadrupled. Fishermen are helping to meet the increasing demand for food; hence, there should be less rather than more constraints on fishing. It would seem inadvisable to try to stop immigration to Hawaii or to strangle tourism simply because we cannot manage our renewable resources.

For those of you who have not gone to sea to fish commercially -- if you'll pardon me for saying this -- you have missed a great American experience of wondering where the next dollar is coming from. And at the same time you have missed an opportunity to appreciate the real world. This is the world of fishing and, contrary to being the terrible exploiter, the fishermen is more often the exploited. They have as much at stake in the wildlife as any other segment of our society, particularly in the birds that help them to locate tuna fish schools.

Unfortunately, fishermen do not have assured incomes and must spend much of their time at sea to earn a living. This means that they have little time to be involved in popular causes which work to their disadvantage. As an example, many decisions made by policymakers do not reflect the fishermen's interests and it is not clear whether such decisions are free from severe bias. However, it seems that Congress has expressed a view that fishery rule-making should involve fishermen at every level and that fisheries should be regulated with their input. This seems to be a reasonable approach. The fluctuations of the animal populations in the Northwestern Hawaiian Islands are not solely related to domestic fishing but more often to predator-prey interactions. For example, there has been no effective fishing in the lagoon at
French Frigate Shoals since 1957 and yet declines in some species have occurred there.

In summary, fishermen question the procedure used to establish the reservation in 1903 and its relevance to the present. What benefits are offered by the reservation and to whom do they accrue? With the lack of data going back to 1903 in spite of the tripartite-Sea Grant studies, can the resources be effectively managed? Is an ever expanding governmental role envisioned with broader jurisdiction? Instead, cannot society consider the question of resource management in terms of cost-benefits? What may be overlooked is the importance of the fishermen's contribution to the gross national product, not to mention the taking of a natural resource and converting it into a benefit to society, and creating something where possibly nothing otherwise would exist -- possibly not even research.

Robert A. Jantzen

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Good morning. I'll take a part of my 10 minutes first to thank you all for your hospitality and the opportunity to attend and participate in this symposium. I also had an opportunity to visit Tern Island and so this has been a wonderful experience for me. Now I know what you're talking about. And I'd like to particularly congratulate the people who had the foresight to enter into the tripartite agreement 5 years ago. You recognized the need for information in a situation that certainly called for a solution and you had the ability to go after the information before you sat down to work on the solution. Quite often I find that's not the case. One is often in the middle of a conflict situation and must base an opinion on deductive reasoning, but it is mostly opinion and usually in a forum like this any person's opinion is just as good as anyone else's. But here you do have the facts or at least some of them.

I'm not a marine fisheries scientist or a biologist, but some of the facts kind of stick out -- for example, you have depleted fisheries around the Hawaiian islands. I think a number of people have alluded to that. There are probably a number of reasons for it. Another fact, one which came out from Mr. Shomura's talk, is that the stocks in the Northwestern Hawaiian Islands are not as high as originally thought. However, in some areas near Midway Islands apparently a significant number of harvestable fish are present. We've heard people from the commercial fishing sector speak about their efforts to develop some of these fisheries; the spiny lobsters stick in my mind, and Mr. Naftel's experience with them. Suggestion has also been made
that markets can be better developed. I think we all know that can happen to a certain extent, but this brings to my mind the analogy of leading a horse to water. You can get him there but you can't make him drink. So I think that the market place has to be given an opportunity to work. You can manipulate it to a certain point but not completely.

The responsibility of the U.S. Fish and Wildlife Service on the refuge is twofold. You've heard a description of the planning process that we plan to enter into, based on an 18-month time schedule, and there's a possibility that we can accelerate that to some extent. Contrary to what some of you might believe, Hawaiian island issues are a high priority with the U.S. Fish and Wildlife Service within Region 1. We have the mainland issues too, but we are not forgetting the Hawaiian islands. The master planning effort will fold in the endangered species responsibility that we have with the green sea turtle with that of the Hawaiian monk seal, and also the overriding responsibility we have with migratory seabirds. It will help us determine what is compatible as far as the use of the refuge is concerned. Mr. Arnett mentioned yesterday that we will encourage public utilization, recreational use, and commercial use in the National Wildlife Refuge System; this is true. But what I'd like to point out is that there is no one set of criteria that can be applied universally to all 413 refuges. I'm sure you appreciate that they were all created for different reasons. All have different geographies and climatic conditions, so multiple use compatibility on a refuge is really determined on a case by case basis.

The public use question in the NWHI has been talked about in terms of commercial fishing and recreational or sport fishing. We will do our best to accommodate these concerns. And I will make this commitment to you, to take these aspects into consideration in our planning process. But it must be an open process. It has to be by law. It will allow all of you a voice in the planning process. I know the land use issue regarding the use of the refuge is in dispute and Mr. Yee commented on this. I'm not prepared to debate the issue here but if there is a dispute and it is over legal ownership, perhaps it should be settled legally in court. It may change the planning process that I'm talking about but until it does, we have a responsibility to follow accepted procedures and to meet our responsibility in protecting the wildlife.

I would like to leave you with one last thought -- another analogy. I come from the southwest United States where there is a great need for energy and transmission lines that cover great distances, and what popped into my mind in listening to this discussion and the proposal was that perhaps Midway Islands might be the place to start. It is kind of like installing a transmission line where there is an existing corridor. And I think it makes good sense that, instead of putting down another corridor, utilization be made of the one already existing. It makes good sense from a land management standpoint.
Perhaps you're looking at somewhat the same sort of a thing here, in talking about developing a fishing facility at Midway Islands vs Tern Island. If you are, I think that you're going to have to take into consideration very early, from an administrative standpoint, the main mission of the Department of Defense at Midway Islands and try and make them a full partner. I think perhaps there could be an accommodation here and I would encourage you to look at that. If you want to fully utilize state of Hawaii resources, personally, I think that an extension to Midway Islands would be much more effective than stopping at Tern Island. However, we will seriously consider the uses that can be made of Tern Island based on the information that has been presented here and the information that is going to be forthcoming.

Sheila Conant

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Just because a culture or society has a conservation ethic, it doesn't necessarily mean that its conservation measures work. Let me point out two figures to you. Since 1776, 23 endemic Hawaiian birds have become extinct. Between the time these islands were colonized by Polynesians and 1776, at least 40 species of birds are known to have become extinct. I think it's an interesting and pertinent thing to keep in mind as this discussion continues. And I want to comment or add something to what Buzzy Agard said: Thank goodness birds and lilies are mentioned in the Bible, although I haven't seen any mention of ornithologists.

The approach that I see which has dominated this symposium, and in fact much of the tripartite-Sea Grant research, has been to see if protecting wildlife resources in the Northwestern Hawaiian Islands will negatively impact fisheries. Some of us approach it from a different point of view. We want to see whether or not the fishery proposed within the wildlife refuge is going to negatively impact the wildlife. It's the same question turned around, but it makes a difference.

In my talk this morning, I really do have some optimistic conclusions, providing existing enforcement measures are effective and providing accidental landings do not result in the introduction of noxious organisms. The development of a fishing industry does not necessarily need to negatively impact the wildlife resources in the NWHI. And I do want to say that we hear an awful lot about seals and green sea turtles but I want to remind you that 12 endemic plants, probably 100 endemic insects, and 7 endemic birds also live out there. I don't hear these figures often enough so it makes my ears feel good to hear them repeated.
But again, I think the implementation of effective protection measures does not necessarily need to negatively impact the fishing industry.

Now then, it's time for me to pick my side of the road and walk down it, and I can't help it if the cars want to risk getting hit by me! I guess I'm like an albatross in that regard. Now, what are the essentials for the protection of wildlife resources out there? First of all, it's essential to minimize disturbance to the wildlife, and of particular interest here are the ones that are designated endangered or threatened, that is, green sea turtles, monk seals, and four land birds. Another essential priority is to avoid reducing seabird food sources and seabird populations. A third thing is to minimize landings -- intentional, accidental, illegal, or whatever -- on all uninhabited refuge islands to avoid introducing exotic organisms and to avoid disturbing the unique terrestrial ecosystems. It is a problem and it deserves very careful attention. There are, of course, existing federal and state laws that mandate the kind of protection I'm talking about.

If we're going to develop a fishing industry out there, there are going to be a lot of costs involved. Fisheries development is certainly risky, we all know that; the Nightingale which ran aground on Midway Islands 2 days ago is an example. With fisheries development, the need for protection will increase. Therefore, I propose in all seriousness that the fishing industry share in the increased cost. I'm not saying it must take over the cost of the U.S. Fish and Wildlife Service in sending people out to monitor resources or do research, but I do feel it should share the cost of increased monitoring and increased enforcement. For example, the U.S. Fish and Wildlife Service has already sent a biologist to Midway Islands to check the situation regarding the Nightingale. Who should pay for this? This is a legitimate question to ask. The U.S. Fish and Wildlife Service has not fared well budgetarily on the national scene so this is a fair question.

I would like to discuss a few things that I think we should consider as limitations to the development of fisheries in the wildlife refuge area. But I would like to first emphasize that we should not put all of our focus in the NWHI; let's also look at our fisheries right here in the major islands. Why are our fisheries depleted here? Let's be sure that we don't use the depletion of fisheries here as the reason to develop fisheries out there. Let's also be concerned about the health of fisheries throughout the Hawaiian Archipelago. First of all, I'm very concerned about the negative impact of inshore fisheries and I agree with Richard Shomura that nearshore development has to be approached very cautiously. And I'm very skeptical about the development of a fishery for baitfish, for example at Tern Island where there are large populations of monk seals and green sea turtles. Baitfishing involves approaching very close to land and it increases the likelihood of accidental landings (accidental
introductions of plants and animals) that could result in negative impacts.

When it comes to the question of public education and public recreation, if you want to increase public appreciation at Midway Islands, that's fine. However, I believe it is highly inappropriate to even consider such a thing on uninhabited refuge islands such as Nihoa. Allowing researchers ashore is bad enough, but the public—at-large would be too hard to educate and control. I certainly think that public education is essential, but I do not advocate any kind of nature tours to uninhabited refuge islands. Midway Islands, Kure Atoll, and possibly a very limited use of Tern Island should be all that is considered for this. And it is really not appropriate to compare the Hawaiian islands, particularly the Northwestern Hawaiian Islands, to the Galapagos. The Galapagos islands are much larger, and most of them have rats and an extensive, exotic biota. When it comes to Tern Island I just have one thing to say and that is "God bless Skip Naftel." I really don't think I have to say anything more about that.

I would certainly agree with Richard Shomura and the others who are looking very optimistically at the development of a fisheries infrastructure on Midway Islands. It seems highly appropriate to me. All kinds of exotic biota already exist there so the chance of negative impact on the terrestrial ecosystems as a result of further introduction of exotic organisms is minimal. The monk seal and sea turtle populations have already suffered seriously.

Let me summarize my points. A conservation ethic does not necessarily produce good conservation. A very good enforcement infrastructure is required. So again, I think industry needs to consider sharing in the cost of increased monitoring and enforcement. I think we need regular aerial surveys of fishing boats to make sure that regulations are being followed. And I think we also need to consider the judiciary. Let's have no more $25 fines, "slaps on the wrists" as it were. Let's talk about some serious fines, and this may require educating the judiciary. I also think it should be written into fisheries development plans and refuge management plans that a response to monitoring efforts is required. For example, if seal or turtle populations begin to decline, we should target what fishery is involved and try to mitigate the impact. One of the biggest problems, of course, is that we don't know what contributes to a significant population decline so we've got to continue monitoring in order to find out.

Finally, I would like to conclude by saying that I feel the wildlife resources in the Northwestern Hawaiian Islands are clearly a matter of global significance scientifically, aesthetically, and culturally. I also feel that fisheries resources in the NWHI are primarily, because of their scale, of local and limited significance. In other words, I feel the economic returns must justify the risks that we are proposing to take and there
seems to be considerable skepticism in this group that the economic returns are going to be great enough. Certainly people should have the freedom to decide how they are going to make their living, but they had better be ready to bear the responsibility entailed. That obligation extends far beyond Hawaii and far beyond the United States. It is an important obligation that we must not lose sight of in optimizing resource management in the NWHI.

William G. Gordon

Ladies and gentlemen, I would first like to congratulate not only those who organized this outstanding program of research but also all those researchers who spent time and effort in completing what must now be considered indeed a major programmatic achievement.

Rather than comment too intensively on the talks that have already been given, I would like to raise several new issues and questions as a challenge to you. First, I think people should think very carefully about the magnitude of investment that the United States has made in the refuge system and the research and enforcement that is associated with it. This program represents a multimillion dollar investment over the years, similar in kind to what we have in fisheries management. I think we're learning from the experiences of the past that, by and large, the major problems have been caused by the misinformed, the short-sighted, and the very greedy. We have to understand that man is the ultimate predator and will remain so. I wonder what Queen Isabella would have done had she had a conservation ethic and a concern for the biota of North America before she turned Columbus loose. But nevertheless, the fishing industry in the United States, I believe, is one that has a tremendous growth potential unlike the textile, auto, steel, and a number of other industries which are giving way to more competitive foreign markets. When I look at fishing from my perspective, I wonder why we're buying 50 percent or better of what we consume in this nation when we have roughly 15 percent of the world's living marine resources that are all renewable within our conservation zone. At the same time we allow a variety of foreign countries to enter our zone to fish and take the product to the world market. In looking around, you candidly have to agree that perhaps in our haste we have over-regulated a number of industries in this country. As a result we have been losing ground to the rest of the world and we'll continue to lose ground unless this trend is reversed. The Magnuson Fishery Conservation and Management Act of 1976 (FCMA), which the rest of the world looks upon as one of the most far-reaching fisheries management acts ever passed, provides a good foundation
for management of fisheries as well as other resources. It calls for the best scientific information to be used, but candidly, I wonder if the best scientific information is always used. We give way to emotion, short-sightedness, and greed in many of the decisions we make in this political world. There can and should be multiple use and wise use, particularly if we are to use our scientific information correctly.

Some people speak about U.S. presence in the Pacific which has been very great since World War II. We were handed the custodianship for a vast number of islands and I think we can turn and look at that custodianship and say we have done very well. However, some of these islands have turned from almost a self-sufficient economy to one where they import most of their food including fish. Is that trend going to continue or can we turn it around? There has been a lot of talk during the last 3 days about the scientific aspects but very little comment on the socioeconomic aspects of the island communities. I submit that we must change the way we manage our fisheries. Take the major Hawaiian islands as an example. The comment has been made several times here that the nearshore resources of these islands are depleted. I ask the question, why? Where is that conservation ethic? In my 25 years with the fishing industry, I think I can say that many fishermen are biologiste without the benefit of a degree. Of course sometimes they don't see the big picture. We have to inform them of the big picture. Once the fishermen, the leaders of the fishing community who make their livelihood from the sea, understand the big picture, I find that most of them are ardent conservationists, demanding better management. Unfortunately, it's not the professional fishermen who generally cause the problem. In my view, it is a group that would exploit for the short term without wisdom or concern regarding the results of their exploitation.

I think too we must examine international aspects and take them into full consideration. One problem is by enforcing withdrawal of foreign fishing fleets to areas outside of our 200-mile limit, they may intercept resources destined for our 200-mile zone. Another problem is the highly migratory species which, I think, are going to be seriously impacted by fisheries beyond the 200-mile zone where there is no conservation ethic. It's a situation of catch today before someone else does tomorrow. So let's not be too hasty in regulating inside of our 200 miles until we face up to implications of managing international waters.

A number of people have made comments on the U.S. budget. When fully one-third of the national budget is aimed at entitlement programs such as unemployment, food stamps, and retirement systems; about one-quarter is spent on defense; about one-eighth is interest payment on the money that the government has borrowed from somebody; and about the same amount is available to all other civilian components of the government; then who pays for conservation programs? Within the FCMA we can sock it to the foreigners, but the law says we can't charge any of the domestics
other than for administrative costs of issuing a permit to fish. I go back to my point: should we not change the way we manage fisheries?

Lastly, I'd like to talk about the role of science. I have heard that we are going to use science in a regulatory mode. Why don't we turn that around and use science so we don't have to regulate. Management does not necessarily imply regulation. Let's apply the science in a way which minimizes the impact of regulations, if that is at all possible. What we are trying to do is achieve better and wiser use of our living resources. And we should use science to inform the uninformed, and use regulations to get at the short-sighted and the greedy.

I will leave you with one final point, and that's the role of animal husbandry in the management of our living resources. Humankind is not too concerned about using genetics when it comes to cows or chickens or pigs, or fish. And some would claim that the world hasn't changed much since the Pleistocene, and that everything is static. But what happened to the saber-toothed tiger and the woolly mammoth? Now I don't think man wiped them out -- nature did. And evolution is still ongoing for us. I don't remember too many 7-foot tall basketball players when I was in college. So let's think about how we can apply some of the techniques of animal husbandry to preserve, maintain, and enhance our fishery resources rather than just accept the fact that all we can do is lock it up or let nature take care of it.

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Let me begin by stating that the state of Hawaii in general, and the Department of Planning and Economic Development in particular, is committed to improving the climate of business in Hawaii by supporting and protecting Hawaii's existing productive enterprises and diversifying the local economy by developing new, preferred-growth industries such as commercial fisheries. Currently, Hawaii's fishing industry accounts for only about eight-tenths of 1 percent of the gross state product. There is no question that the potential for expanding the industry is found in the distant-water fisheries of the Northwestern Hawaiian Islands. But there is the question of how best to proceed. Even though the optimum use scenarios have not stated so specifically, there is a distinct division of opinion that focuses on whether Tern Island at French Frigate Shoals should become a fisheries support station or whether it should remain a field station in support of a wildlife refuge. This polarization of opinion could
seriously retard development of the multi-species fishery resources of the Northwestern Hawaiian Islands unless the Tern Island question can be resolved.

First, let me emphasize that French Frigate Shoals is important to the state of Hawaii as a wildlife refuge. The bird resource there is of national and international significance. In excess of 90 percent of all green turtles in Hawaii breed and nest there. In excess of 53 percent of the total population of Hawaiian monk seals live there. The highest diversity of fish and coral in the Hawaiian Archipelago is at French Frigate Shoals, including corals of the genus Acropora, which are very notable ecologically. Let's also consider the finding that the establishment of fishery development facilities at Tern Island apparently may not generate revenues large enough to offset probable environmental impacts.

In this regard, it is important also to realize that the potential impact of fishery development on the biological systems of the entire archipelago is of a much greater scale today than heretofore experienced in Hawaii's history. We only have to think about the profound differences in fishing power now relative to just a few years ago. And what about the even more efficient technological advances of tomorrow? Also consider the difficulties that have arisen in managing fisheries throughout the world. Even in cases where the data base is extensive enough to afford elegant, sophisticated mathematical treatment the record of management is not flawless. Then too think about the information that still needs to be collected to best manage our natural resources in the Northwestern Hawaiian Islands. Collectively we've made great strides in assessing the resource potential over the past 5 years, but we are just beginning to understand the dynamic complexities that are involved. It therefore makes sense to preserve options for doing new things in the future by exercising restraint in the way we harvest resources now. Now is the time we should experiment with new schemes of management to gain experience and better understanding.

Considering both the biological complexities and the socio-political problems associated with development of a multi-species fishery adjacent to a wildlife refuge, I believe managers of both sets of resources should be concerned with two major questions involving the interaction between wildlife and fisheries. First, what kind of practical benefits might the wildlife refuge have for managing adjacent fisheries? Second, what fishery practice would be most compatible with the management of the wildlife refuge? In answer to the first question my studies on spiny lobsters afford an example. The fisheries research I conducted on Hawaiian spiny lobsters since 1979 has been done almost exclusively within state and federal wildlife refuges in the Northwestern Hawaiian Islands. This research has provided, and continues to provide, much of the biological information required by the Western Pacific Regional Fishery Management Council in managing the commercial fishery for spiny lobsters in this area.
A wildlife refuge can thus provide fishery managers the opportunity to assess population characteristics of commercially important species in the absence of any history of fishing. Additionally, a refuge can provide the opportunity to assess the effects of a variety of fishery management regimes either through controlled experimentation within the refuge or by comparison with changes occurring outside the refuge. These opportunities simply will not exist on the commercial fishing grounds unless fishing is temporarily halted, or unless areas are closed, and such steps could be detrimental to the fishermen.

In answer to the second question, I suggest that fishery support operations that exist entirely at sea would be most compatible with management of a wildlife refuge. In this regard, I believe that all of the support functions necessary for a multi-species fishery for bottomfish, lobsters, and shrimp in the Northwestern Hawaiian Islands conceivably could be based entirely from a mothership. Given an appropriate mothership, local fishermen could fish from their own boats and sell their catch to the mothership while receiving fuel, ice, bait, and fresh water as part of a negotiated agreement. The savings and direct costs to local fishermen could be comparable with any analogous nearshore support operation based in the Northwestern Hawaiian Islands but should not involve environmental risks to the refuge.

However, let me present just a brief scenario as an example to demonstrate that we haven't begun to exhaust options for management. If an appropriate mothership is not available locally, an international joint venture with a country fishing the high seas around the seamounts north of Hawaii might be considered. Additional benefits of such a joint venture, also exist. Frozen bottomfish, for example, for which there is little present demand in Hawaii, could be marketed immediately through established channels within foreign markets and thereby accelerate development of that fishery. Ex-vessel prices paid to local fishermen presumably could be stabilized because there would be no market glut. Tax revenues paid to the state would increase along with productivity -- exchange of know-how, technological advances, and deeper cultural ties all of which are important to Hawaii's future would increase. The terms of any such agreement could be set for a limited number of years with options to phase in or out as economic conditions dictate. This could prevent overcapitalization of the local industry. Fresh fish could also be provided to traditional markets whenever local fishermen return to the main Hawaiian islands. This is just one possible option that could be developed, simply to indicate that our thinking doesn't have to be set in concrete.

Finally, I agree that fisheries operations in the vicinity of Midway Islands, either as a shore-based operation or in association with a mothership, appear to involve far fewer environmental risks and potentially much higher yields. Thus, I feel that fisheries development in that region of the archipelago should be particularly encouraged.