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AN EVALUATION OF THE FISHERIES SECTOR IN OMAN

By

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EXECUTIVE SUMMARY

1. Oman is blessed with a large and varied marine fauna that has supported a sizable fishery for many years. Until recently, this fishery was prosecuted solely by traditional (artisanal) fishermen. It is now augmented by a modern trawl fishing operation run by a Korean firm under a concession agreement. This was preceded by a two-year agreement with a Japanese firm.

2. The supply of fish seems more than adequate to support fishing at current levels. Unfortunately, there are no reliable catch statistics, no biological studies designed to measure the impact of fishing on the stocks, and only a few surveys of stock size. These do not give any clear measures of abundance, distribution, availability or the effect of fishing. The lack of statistics is a major "missing piece" in Oman's present fisheries development program.

3. Everyone who has reviewed Oman's fishery agrees that there is room for expansion. The unanswerable question is by how much. Until at the very least Oman institutes suitable programs designed to obtain measures of potential yields, any significant expansion is risky. The degree of risk will vary with the stocks concerned.

4. The Government of Oman gives high priority to fisheries development, believing it is one sector that can be built into a major component of the economy. This is reflected in Sultanic Decree 26 of 1975 establishing what is now the Ministry of Agriculture and Fisheries, and in both of the five-year plans.

5. The government has decided not to take part in the business aspects of fisheries. This has led to the formation of the Oman National Fisheries Company, which has taken over the former government landing and cold store facilities and operations at Muttrah and Salalah.

6. Governmental priorities go to the traditional fisheries. The program of the Directorate General of Fisheries reflects this, emphasizing low-interest loans and grants and the development of shoreside facilities and services. The current program is well conceived and serving the purpose for which it was designed.

7. The Second Five-Year Plan has provisions for a Marine Sciences and Fisheries Center and a fisheries statistics system, but apparently neither will be functional until late in the period. The need for the information they will provide is urgent if fisheries development is to take place in an orderly and rational fashion. At least a prototype statistical sampling system, designed to provide data on catch by species and gear together with a measure of fishing effort, should be expedited.

8. The Directorate staff is actually too few in number to carry out its current programs and certainly should not be expected to take on and manage such meritorious new projects as the Marine Sciences and Fisheries Center, the statistics effort and the fisheries extension services. Further, there is need for academic as well as paraprofessional training in fisheries subjects. There is in consequence an across-the-board need for recruitment of new staff members, and the appropriate education and training of both existing and new staff if the Directorate is to be able adequately to carry out its mandate.

9. Oman needs to evaluate its marketing, cold stores and fish distribution projects with special respect to their adequacy and economic viability. It needs an evaluation of its requirements in law enforcement and surveillance in its zone of extended fisheries jurisdiction, and in food technology and quality control. It should investigate the potential for mariculture.

10. Advisory committees made up of internationally recruited senior fisheries administrators and scientists are recommended to serve the Director General and the Marine Sciences and Fisheries Center.

11. The government has done an excellent job in preparing for and implementing its programs in fisheries and in the conservation of its natural resources. The priorities governing fisheries programs carried out to date were appropriate until now. The time has come when a shift must be made from a developmentally-oriented program to one in which acquiring the requisite data base for long-term management occupies an equally important niche. The Fisheries staff seems fully aware of this, and has planned for an expanded and well-rounded program.

12. The Joint Commission can render a real service by helping the Ministry institute and carry out these new priority projects, especially in fisheries statistics and stock assessment.

I. INTRODUCTION

I spent the period 17 May 1981 - 12 June 1981 in the Sultanate of Oman at the request of the Omani-American Joint Commission for Economic and Technical Cooperation. The purpose of my trip was to assist the Commission in its assessment of Oman's fisheries sector, and to recommend a course of action to the Commission and the Directorate General of Fisheries, Ministry of Agriculture and Fisheries.

During my stay, I was able to visit most of the key fisheries ports and facilities that had been recommended to me. The chief exceptions were Sur and, in the Musandam, Khasabi. Details appear in the travel log which is appended to this report, together with a list of my principal contacts. Thanks to the unfailing cooperation of my hosts, both Omani and American, I was able to accomplish the mission within the allotted four weeks time.

I had personal copies of several key publications relative to Arabian Sea fisheries generally and Omani fisheries particularly. The Joint Commission and the Fisheries Directorate made other material available to me, both published and unpublished. All papers in the public domain are listed under "References." Unfortunately, time did not permit a stopover in Rome to consult with FAO's Department of Fisheries. I do not believe that I would have found anything that would cause a substantive change in my conclusions, but I probably would have been better able to document them.

II. PURPOSE AND SCOPE OF THE STUDY

The objective of the study was, in the language of the contract "to assist the Omani-American Joint Commission to assess the fishing sector in Oman."

The scope of work included this key paragraph:

> " The Contractor will review and assess the development status of the fisheries sector in Oman and the Government's capabilities regarding the implementation of its plan for further sector development. This evaluation of

the fisheries situation must provide the Joint Commission with the basis to develop a program of technical assistance in fisheries. The assessment will include discussions with Department of Fisheries officials, visits to fishing villages and processing facilities, review of relevant reports and studies on Oman Fisheries, and other tasks necessary for the full evaluation of the fishing sector and its development requirements."

The contractor's report is, again in the language of the contract, to:

" Describe the results of the evaluation, evaluate Oman Government's strategy for development of fisheries, identify issues to be considered in discussing assistance to this sector, suggest development projects appropriate for Joint Commission's, or others, assistance and address other questions which may arise during the reviews or during discussions with the Joint Commission."

III. CURRENT STATUS OF OMANI FISHERIES - AN OVERVIEW

On the surface at least, the fisheries sector is moving ahead. The first five-year plan is bearing fruit; the second plan is designed further to improve the lot of the artisanal fisherman, to build up the marketing and distribution system, and to institute a marine research laboratory. Domestic demand appears to exceed supply, in part because Omani wholesalers find it more profitable to truck fish to the Emirates or Saudi Arabia than to sell on the local market. Not everyone agrees; as one example, the FAO Fishery Country Profile for Oman (October 1979) says this:

" With a relatively low population in relation to available resources and an already high per capita consumption - much of any increase in production will need to be exported."

My feeling is that there remains an unfilled and partially latent domestic demand that can be met through higher local prices (discouraging exports) and through better quality control and distribution systems. The whole socio-economic structure, however, needs further analysis.

The supply of fish seems more than adequate at current levels of exploitation. A harvestable surplus remains to be captured; the question is how big a surplus.

The kinds of fish taken by the artisanal fleet (except for the moment sardines and anchovies) are high-quality food fish, including, for example, tunas, billfish, mackerels, sea basses, groupers, jack crevalles and many more.

Handling, preservation and distribution leave something to be desired. Sanitation and quality control need to be addressed at the dock, the wholesale level and in retail outlets. The Fisheries Directorate is fully aware of these matters, and has a proposal in the Second Five-Year Plan for an extension program that is, I am told, designed to deal with at least some of them.

The principal current use of the large (but how large?) sardine resource is dried as a cattle feed supplement, in the Salalah area at the time of the most critical fodder shortage. Plans are afoot for a sardine canning-reduction plant at Raysut, a topic I address under "Issues".

The fishermen themselves are receiving considerable help from the government: boats and outboards at virtually no cost; outboard repair facilities in several places, with more facilities on the drawing boards; cold store facilities. Less directly, the development of the paved road network is making distribution to the interior more and more feasible.

According to El-Rikaishy (1980), the fishing population in 1979 was nearly 7,400 (down from a reported 15,000 in 1967), and there were roughly 5,000 boats. Under the Fishermen's Encouragement Fund, the Government had made available 505 small craft, 100 diesel engines, and 1,577 outboards as of April 29, 1980. This program seems to be working very well indeed, and the government-run repair facilities for outboards appear well-managed and operated. I note parenthetically that the fishermen overwhelmingly prefer Yamahas to Johnsons, saying they are far more reliable. The mechanic's services at the facilities are free, but the

fishermen must provide their own spare parts. The Peace Corps has agreed to help staff the shops, and starting this summer will have six experts in outboard maintenance and repair assigned to the program. This is the first Peace Corps fisheries project in Oman and it will fill a real need.

Looking beyond the traditional fishery, the Oman National Fisheries Company, which is largely privately owned, has taken over the commerical activities in Muttrah and Salalah, under terms of the government's policy to divest itself of commerical activities. The company appears to have strong leadership, though the effectiveness of this new system remains to be tested.

Oman's only industrial-scale fishery is pursued by a Korean firm under terms of a concession agreement that became effective in 1978. Apparently the government is reasonably well-pleased with the arrangement, which is now in its fourth year. A similar agreement with a Japanese firm lasted only two years, 1976 and 1977.

Finally, there is the Musandam, the northernmost district, separated geographically from the rest of Oman. It poses a special problem because of the political arrangement under which the area is essentially administered separately by the Musandam Development Committee. Fisheries fall under its purview rather than that of the Ministry. The fisheries of the entire nation should be developed under a single plan and policy, and that indeed seems to be the concept in both the five-year plans. How this will work out in practice remains to be seen. In any event, the Musandam peninsula has considerable marine resources and a considerable export trade to go with its low population. Trade is not only with the UAE, but in shark fins with east Africa and the Far East, and this ties in with trade from Masirah Island. Sharks are apparently extremely abundant in the Musandam. Knowledgeable observers report that fishery for spiny lobsters and both jumbo and regular prawns could be instituted or expanded, using traps.

The striking thing about Oman's fishery sector is the lack of adequately trained people at all levels in all disciplines to administer and manage a growing fish industry. In fact, there is a shortage of people regardle of training. Personnel is another serious matter to be dealt with under other Issues.

The question of communications (e.g. ships and roads) appears to be solving itself insofar as fisheries needs are concerned, and is expected to be under control in a year or two. There remain shortages of equipment despite the strides made in providing outboards and boats. More is needed both in terms of boats and gear, facilities and, in another area, scientific laboratories.

Finally, today in Oman there is a frightening lack of knowledge as to the extent of the nation's living marine resources, their availability, their susceptiblity to capture, their potential sustainable yield, their current yield.

All this being said, I am optimistic that the needs can be met and an optimal fishery developed, given the government's interest in and support of this sector.

Several of the documents listed under references contain useful background information and provide the basis for many of my remarks and conclusions here and elsewhere. These include the Mardela Report (1975), Royce (1977), FAO/IOFC (1979), FAO Country Profile (1979) and El-Rikaishy (1980) who makes a cautionary remark in the latter that is worth quoting:

> " Despite continuous government efforts under the five year plan, fish production has increased only slightly."

IV. CURRENT AND POTENTIAL FISHERIES YIELDS

A. General

While Oman's fisheries can almost certainly be expanded, there are a number of serious questions that must be addressed before any major expansion is warranted. These topics form the basis of discussion in the pages that follow.

Experts report that Masirah Island has an unrealized potential in lobsters and, particularly, abalone. Sur has, I am told, a tremendous potential for expansion of its catch. It has a high-level existing

competency in fishing and boat building. I was also told that the best fishermen in Oman live on the Kuria Muria Islands, but that there are only a handful of them. Kuria Muria Bay is reputedly the best fishing ground in Oman, the key area in the rich stretch from Masirah to Salalah, where, unfortunately, roads and public transport are virtually nonexistant and the population is small. I understand that Su'aymiah is scheduled to be developed as a major fishing port and to be linked by paved road with the rest of the country. This would allow significant fisheries development in the Kuria Muria area.

B. Catch Statistics

The FAO Yearbook of Fishery Statistics (Volume 46 for 1978 is the latest I have available) places Oman's catch for 1978 at 197,984 metric tons (mt), of which 159,380 mt were sardines and anchovies. Mackerel landings were 3,890 mt, and so on, all the figures displaying a remarkable precision.

The figures for 1975-77 were exactly the same, and the totals for 1970-74 were in each year 180,000 mt. My point is not to belittle FAO, for this is clearly one of those cases wherein FAO obtained such data as it could from the government at some point in time and carried the figures forward each year, lacking any new information. This situation is anything but uncommon. My reaction was that any relationship these FAO statistics bore to reality was a coincidence. This was substantiated at the midpoint of my visit when I was given copies of Shimura's 1978 FAO reports. I quote from them below.

So far as I can determine, the only reasonably accurate catch statistics in Oman are those from the Korean and, before them, the Japanese concessions. These need scrutiny to determine under what degree of control they were compiled, though my impression after seeing Yesaki's (1978) report is that they are quite accurate.

Royce in his paper (1977) uses FAO's set of numbers (160,000 mt of sardines and anchovy and 40,000 mt of all else), and attributes them to the Ministry. He also notes that there are unduly varying estimates of the catch.

Forgetting the unreal precision of the FAO records, this does make it sound as if the real catch was indeed on the order of 200,000 mt. However, the fisheries chapter of the second five year plan, a translation of which was made available to me, estimates the sardine catch at only 40,000 mt. It puts the traditional fisherman's catch at 60,000 mt, which I am presuming, though the text is somewhat ambiguous, is in addition to the sardine catch, for a total yield of 100,000 mt, to which you can add a Korean catch of about 5,000 mt for a grand total of 105,000 mt. This is a far cry from 200,000 mt (El-Rikaishy gives the Korean catch as 5,409 tons in 1978 and 4,497 tons in 1979).

If this is not a sufficient discrepancy, consider the FAO Fishery Country Profile for Oman (October 1979) that gives these production data: fish for direct human consumption, 30,000 mt; fish for animal feed, etc., 10,000 mt; or 40,000 mt in all. Again there is the Korean catch, given in this paper as about 6,000 mt, for a grand total of 46,000 mt.

We are faced with this:

Catch per FAO Yearbook:	around 200,000 mt
Catch per Five Year Plan:	around 105,000 mt
Catch per FAO Profile:	around 46,000 mt

I am not saying all this to disparage anyone's estimate, for we can assume they were all made in good faith. However, it is essential to point out that clearly no one knows what the catch is, and that without reasonably accurate catch data it is impossible to manage a fishery on a continuous and sustainable basis.

My first priority project is establishment of a statistical system that will give a reasonable approximation of the catch with a breakdown at least by principal species and species groups. Such a project is in the second plan, but implementation is too far in the future.

The groundwork for a statistical system was laid by T. Shimura of the FAO Department of Fisheries as part of its Regional Fisheries Survey and Development Project and reported on in two 1978 papers. The first of those reports on his findings during a general survey of the region. The second deals with and makes specific recommendations for Oman.

Shimura had the same difficulty with the Omani statistics as I, and he has these comments to make in the first of his papers:

> " In Oman, 98,000 metric tons of anchovies were caught by the artisanal fishermen offthe Batina Coast between Muscat and Sohar in 1976 according to information the Expert obtained. This is the same as the figure appearing in the FAO Yearbook of Fishery Statistics as the Catch of "Anchovies" for 1976. The Expert could not find any basis for this figure, and he thinks that this is a very much overestimated figure.
>
> " Off the same Batina coast, between Muscat and Sohar, 29,430 metric tons of sardine were caught in 1976. In the Dhofar region, 33,750 metric tons of sardine were caught in 1976. Again the Expert could not find any basis for these figures. The total of those sardine catches makes 63,180 metric tons, which appears in the FAO Yearbook of Fishery Statistics as the catch of "Sardinellas" for 1976.

He summarizes thusly in his findings:

> " Anchovy catches along the Batina Coast between Muscat and Sohar were 98,000 metric tons. Sardine catches in the same area were 29,430 metric tons, and sardine catches in the Dhofar Region were 33,750 metric tons. The total catches of anchovies and sardines make 161,180 metric tons, which is more than 80% of Oman's total catch of 197,984 metric tons in 1976. For these data on anchovy and sardine catches, the expert was unable to find any basis for estimation, in spite of his efforts, and he feels that they are very much overestimated."

I quote this further to emphasize the urgency of establishing a statistical system. The research staff is fully aware of the importance of catch and effort data, and has a well thought-out plan of action based on Shirmura's work that was submitted as part of the five year plan. All that is needed is approval and funding.

C. Potential Yields

Every document I have read states almost as an article of faith that Oman's fishery can be expanded. The questions remain as to by how much and of what species.

The yield projections are based on estimates of total biomass derived from resource survey cruises. Mardela made such a survey; FAO/UNDP has made a number of cruises using the research vessel Dr. Fridtjof Nansen; El-Rikaishy cites a survey carried out by the former Trucial States Council in 1968-71; Royce simply mentions "resource surveys" in his paper, apparently (but not certainly) referring to some of the FAO surveys; Mundt (1980) in his FAO report on legal aspects in Oman does not give the source of his data, but like Royce, he doubtless drew on FAO. Most of the surveys are of demersal (bottom-dwelling) species and small pelagic species (such as sardines and mackerel). They are gross estimates with an unknown sampling error. They are also the only estimates available and must suffice until more definitive studies based on adequate catch statistics and further resource surveys are possible. The estimates of potential yields from these various sources in thousands of metic tons are these:

Source	Demersal	Pelagic
Trucial States Survey	---	600 (sardine)
Mardela Survey	up to 300	"high yield"
FAO (5 Nansen cruises)	24	190
FAO - 1979 Survey	50	18-64
Royce	50	200
Mundt	around 250	200 small; 30 large
Second Five Year Plan	"potential for growth is large"	

In addition, there is the potential for substantially increased takes of shellfish and crustaceans, particularly abalone, oyster and lobster. This would be a very small tonnage, but a very high-price product. Tuna presumably, but not certain, are omitted from the estimates and represent another potential for increased high-value catch.

Finally, the Nansen surveys disclosed the existance of huge quantities of what are knownas mesopelagic species in the whole Arabian Sea. These are small mid-depth fishes (lanternfish) that are currently unutilized and for which new or improved fishing techniques and new processing techniques will be required. A mesopelagic fishery may be years away and it may never come, but it is worth bearing in mind. The quantities are astounding. The FAO report (October 1979) prepared for the Indian Ocean Fisheries Commission describes a stock of up to 100 million tons in the Arabian Sea. A conservation yield from such a stock would be on the order of 10 million tons. Mundt is probably more realistic. He lowers the figures by an order of magnitude to a 10-million-ton stock and a million-ton take -- still a lot of fish. There are no data as to how much of this stock might inhabit the Omani zone of extended fisheries jurisdiction.

All of these numbers, varying and imprecise though they may be, show on the average a potential harvest greater than the current catch is believed to be based on the equally varying and imprecise catch statistics. Royce, an extremely competent scientist, suggests a gap between current catch and potential yield on the order of 25 percent.

The FAO Country Profile, taking all the surveys into account, notes the "there is sufficient information to justify a significant expansion of demersal, small pelagic and large pelagic species production as well as serious consideration of the mesopelagic species."

All things considered, I would accept Royce's estimate until better data are available. Royce may be conservative, but it is bette to be so when dealing with such ephemeral numbers.

The importance of at least rough approximations of standing crops and potential yields is probably not apparent, except to those familiar with fisheries problems. Without a knowledge of catch, catch rates, and their impact on the fish population being exploited, it becomes impossible to regulate catches for maximum production on a rational basis. It is difficult even with this knowledge; without it one must rely on intuition. To oversimplify an extremely complex

dynamic relationship, there is a maximum sustainable yield (MSY) in tons for any given population of fishes. Take more than that and the population will diminish, and the fisherman will have to work harder to catch less fish. If fishing pressure becomes sufficiently great, the fishery will ultimately collapse. Take less than the MSY and you are "wasting" protein, though at a measurable point below the MSY you reach a level of fishing that will provide the maximum economic return. (Taking socio-economic factors into account provides a measure known as the optimum sustainable yield or OSY. The fisheries management laws of the United States are keyed to the OSY).

The best source of data for measuring the MSY is from the fishery and the first thing you need is adequate catch statistics. Then you need some measure of fishing effort. Such a system takes time to build and the question may be asked whether Oman need worry about it. In the short-term the answer might be argued "no". But if Oman wants its fisheries to prosper over a long period of time, as is its announced goal, it must gear up for the collection, processing and analysis of these data. The collection of catch and effort data will become quite urgent when and if Oman builds a sardine canning and reduction plant at Raysut. Clupeoid fishes such as sardines and anchovies are notoriously susceptable to wide fluctuations in abundance, and there are all too many examples of the total collapse of huge fisheries because of heavy fishing, environmental factors, or most likely, both (Peru, California, Japan). Collecting and analyzing data will not prevent a disaster, but the advance warning of trouble can give the prudent manager time to adapt, and with a certain amount of luck, time to institute regulations curtailing the catch that will minimize or ward off a collapse.

Both five-year plans recognize the need for catch and effort data, and the proposed Marine Science and Fisheries Center is to be "oriented toward gaining the basic information necessary for the rational development of the country's marine resources" (Canzonier and Simon, 1980). The Fisheries Directorate fully appreciates the magnitude of the task, and has plans for a stock assessment function as part of the Center.

In summary, a continuing viable Omani fishery will require instituting not only a statistical system but developing the capability of analyzing the data. The two go together as very high priority items in a fisheries development program. To quote from Royce, "providing essential catch data is urgent at this time because the existing estimates of the difference between actual catch and the maximum sustainable catch indicate that only a 25 percent expansion of the fishing is possible without danger to the productivity of the resources." As I remarked earlier, he may be overly conservative, but I certainly would not count on it.

GOVERNMENT CAPABILITY AND STRATEGY

A. General Comments

Before considering Oman's capability and strategy, I should like to discuss the sort of things one should expect to find in a government fisheries organization charged with developing national fisheries to and managing them at their optimal sustainable yield (the OSY). The OSY is no magical or esoteric number. It is simply the best estimate of sustainable biological yield tempered by social, economic and political factors. A further concept of national development and management schemes is that their goal is to insure the maximum supply of wholesome marine products for the people at a reasonable price, and at the same time to maintain an economically viable fishing community.

The general requirements for a fisheries organization designed to meet such a charge include these:

1. A strong national fisheries policy promulgated at the highest level and backed with the funds necessary to carry it out.

2. A cadre of professional fisheries administrators and scientists in all senior posts save those subject to political appointment. The individuals filling those posts require as a minimum a university degree in an appropriate discipline.

3. A supporting staff of professionals and paraprofessionals trained at the appropriate level for the job. This level will range from high school or less through post-doctoral studies.

4. Basic and comprehensive legislation establishing fisheries law and providing for implementing legislation.

5. An enforcement and surveillance capacity sufficient to insure compliance with domestic law and to prevent unauthorized incursions into zones of extended jurisdiction.

6. A statistical system that will insure the collection of appropriate data on catch and fishing effort.

7. The scientific competency to conduct appropriate research, to analize biological and fisheries data, and to make appropriate recommendations on management to fisheries administrators. This requires strength in the social sciences, particularly economics, to complement the biological and oceanographic inputs.

8. An extension system designed to assist fishermen, wholesalers, retailers and consumers.

9. Competence in product utilization, food technology and quality control to insure that a wholesome product reaches the consumer and to help develop new products.

10. A concern for the environment, aesthetic standards, the protection of rare or threatened species, and pollution control.

11. As appropriate, provision for and competence in fish culture techniques.

12. Maintenance of a comprehensive fisheries library.

13. Concern and, as appropriate, provision for the needs of marine recreationists (sport fisherman, scuba divers, nature watchers).

14. Participation in regional and global fisheries organizations, both to be aware of development elsewhere in the world and to be a party to international fisheries decision-making.

15. Support for the fishing industry, including capital development funds and fishermen's loan funds.

16. A continuing training program to insure an inflow of competent people and to upgrade the level of the current staff.

17. A long-range fisheries development plan with a rolling horizon, updated annually.

B. The Situation in Oman

As a general observation, Oman seems fully aware of the importance of the fisheries sector in the general economy, and to be responding to its needs through the two five-year plans. The question must be asked as to whether the response is adequate. The answer appears to be that it is in some respects but that it is lagging in others. It would indeed be remarkable if any plan as large and complex as that for fisheries could be implemented intoto at the speed its sponsors might wish. Obviously, government planners with responsibility for all Ministries cannot necessarily provide for everyone's wishes within the funds available, and priorities must be established. This leads to the question as to whether the priorities are appropriate from the point of view of fisheries. I shall comment on this on a case-by-case basis later in the discussion.

The staff in the Fisheries Directorate, while far too few in number and short individuals trained in fisheries science and management, has none-the-less done a highly commendable job in identifying gaps in knowledge, programs, and facilities and in developing proposals for the five-year plans. These proposals have met varying fates, with slippages in implementation dates seemingly not uncommon.

A copy of an English translation of Chapter 10, Fisheries, from the second five-year plan was made available to me, but it speaks in general terms. I did not see a copy of the program submissions, except for a quick view of one section. If that one was a fair example, the fisheries sector plans are well thought-out and realistic. Unfortunately, I was not aware of this document until late in the trip. Consequently, I was unable to review it and comment on it in the time then remaining to me, and had to rely on the more general papers and on individual observations.

El-Rikaishy's 1980 paper describes government policy as encompassing seven points which I quote:

> - The development of fisheries shall constitute a mainstay of the government's efforts to promote non-oil sources of income.
>
> - The basic policy shall be to provide the services and incentives necessary to encourage the private sector to engage more actively in fish production and in other aspects of the fisheries sector. The government itself does not intend to operate fishing ventures.
>
> - Priority shall be given to artisanal fishermen and reserved fishing zones will be allocated to them, and in order to raise their income, government support shall be made available to them. Specifically, the government shall participate in an overall program aimed at improving fishing equipment such as boats and fishing gears, upgrading fishing harbours and landing facilities, establishing maintenance workshops, and implementing an appropriate training program in fishing and related activities.
>
> - The policy of licensing foreign fishing fleets in specific zones of Omani waters shall continue, but such concessions will be based on sharing the gross catch, training an agreed number of Omanis on board the foreign fleet, and obtaining ing full records of fish catches in each area.
>
> - To facilitate marketing, government efforts to create the necessary infrastructure, such as ice plants and cold stores in various localities, shall continue, with the intention of eventually transferring their management and control to the private sector.

- The private sector shall be encouraged to engage in the exploitation of commercially undeveloped species such as lobsters, abalone, and oysters and in the development of fish and other marine farming operations, as well as in the creation of fish-based industries whenever they prove viable.

- The control of the national fishing zone shall be reinforced in order to prevent unauthorized fishing and the depletion of national resources.

The translation of Chapter 10 of the Plan describes targets and policies in these terms:

1. To assign top priority to the development of the traditional fishermen.

2. To expand the program of establishing fishing and marketing centers.

3. To start a program for constructing docking facilities in areas where fishermen keep their boats.

4. To expand the support program which is implemented by the fishermen fund.

5. To strengthen the technical capabilities of the Ministry of Agriculture and Fisheries and provide it with the necessary expertise.

6. To improve the basic statistical data on the quantity and number of active fishermen.

The chapter lists these as "important projects":

1. The establishment of a marine study and research center.

2. The establishment of a number of fishing centers in various regions, which include cold storage, ice-plants and repair work shops.

3. The construction of docking facilities along the coast.

4. The establishing of fish marketing centers in the interior.

5. The carrying out of an economic and statistical survey of the fisheries sector in Musandam.

6. The establishment of a fisheries extension services center in Musandam.

While these two source documents are not in conflict, neither are they identical. The first five-year plan is now history, and it is useful to see how actual progress compared with the original objectives. El-Rikaishy presents the following tabulation in his 1980 paper:

Projects of the First Five-Year Plan
(1976-1980)

1. Completed Projects: as of September 1979

   a. Muttrah Fisheries Project
   b. Project for the International Union for the Conservation of nature and natural resources
   c. Fishermen encouragement fund
   d. Fishing harbor in Raysut and Salalah cold storage complex

2. Projects under Implementation: as of September 1979

   a. Musandam Fisheries Project
   b. Buraimi fish marketing network
   c. Muttrah fish marketing network
   d. Mirbat marine workshop
   e. Masira Island Project

3. Unimplemented Projects: as of September 1979

   a. Establishment of Fishermen cooperative
   b. Salalah Fish Marketing network

c. Fishing Law

d. Sur Fisheries Project

e. Nizwa Cold Store

f. Duqum Fisheries Project

g. Establishment of marine workshops in various areas

h. Fishmeal plant in Salalah

i. Establishment of a fishing boat shipyard

j. Aquatic Resources Reserved Center

k. Feasibility study and survey of fish wealth

I do not know whether funds were insufficient to implement all the projects, whether it was more a matter of insufficient manpower, or whether in some cases at least it was a matter of second thought as to desirability.

The policies and programs of the five-year plans are fully consistent with the directives contained in Sultanic Decree No. 26 of 1975 which organized the Ministry of Agriculture, Fisheries, Petroleum, and Minerals (predecessor to the existing Ministry of Agriculture and Fisheries). Mundt (1980) paraphrases these directives as follows:

To achieve the highest and best use of fisheries.

To develop fisheries so that the economy of Oman increases and becomes free from dependence on petroleum.

To encourage local production.

To achieve economic self-sufficiency.

To conduct surveys of the fisheries resources of Oman.

To conduct development projects in fisheries

To rely on economic and technical information and to follow up on such projects.

To encourage cooperatives in fisheries.

To manage and follow-up the Sultanate's interest in contracts with companies dealing with the development of fisheries resources.

To train the Omani staff that works at the Ministry.

This background information regarding the Sultanic Decree and the two five-year plans, together with my discussions with Omani fisheries people and with knowledgeable Americans and Britishers, make it possible to evaluate Oman's fisheries program with respect to the 17 points I listed earlier as general requirements for any government fisheries organization.

1. A strong national fisheries policy appropriately funded. The policy as described by El-Rikaishy is strong and is consistant with Sultanic Decree No. 26 of 1975. Judging from what I heard about program slippages within the plan and the fact that so many of the first plan's projects were not implemented on schedule, I can only conclude that funds had some bearing. Certainly the Fisheries Directorate staff is ready to move ahead now with projects that have been slipped until late in the second plan.

2. A cadre of fisheries professionals in senior level posts. Many of the senior people are not trained in fisheries. The concern is not over their dedication but rather over their lack of a fisheries background. One solution is to see that they take appropriate courses overseas; another is to start educating young people now so that they will be ready to take over when the time comes. There is also a shortage in numbers and the Directorate is faced with a recruiting problem.

3. A supporting staff. The ranks are woefully thin, appropriately trained or not. The only solution here, too, lies in a major recruiting and education program, starting just as rapidly as possible.

4. Legislation. Mundt suggested a basic fisheries law the text of which is in his paper. Legislation based upon his draft, and which might form the basis for similar laws elsewhere in the region was approved and promulgated during my stay.

5. Enforcement and Surveillance. The subject has not been overlooked, but so far as I can determine a detailed study of national requirements remains to be made.

6. A statistical system. The urgency of establishing a system is well-known to the staff. They have a plan of action based on Shimura's work. This is a subject of highest priority.

7. Scientific competence. It scarcely exists but, as in other areas, the Omanis are fully aware of the need and have quite detailed plans for a marine science center. It is in the five-year plan but as I understand it, implementation has been delayed. This project, too, is a matter of urgency.

8. Extension system. The formal program is designed and in the five-year plan, but with full implementation delayed. Meantime, some preliminary field work is either going on or about to start. This is another priority program.

9. Food technology and quality control. Some work is planned in the extension program.

10. Environmental factors. Governmental concern predates Decree No. 26 setting forth the fisheries charter. Sultanic Decree No. 34 of 1974, the Marine Pollution Law:

> " declares the policy of the Sultan to be the elimination of all forms of pollution of the waters within 50 miles of the coast of the Sultanate so as to preserve the ecology of the area (Article 1.1). The term "pollutant" is described broadly to include all substances of a dangerous or noxious nature which would degrade the waters. Pollutants from commerial and industrial sources are specifically covered by the Law, and the Minister of Communications is empowered to promulgate regulations extending the Law to private persons as well (from Mundt)."

Oman is a signator to the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment (1979). Sultanic Decree No. 26 of 1979, according again to Mundt, "relates to the creation of National Parks and Nature Reserves for the plants and animals of both sea and land". The Fisheries Directorate is involved in turtle research on Masirah Island in conjunction with the World Wildlife fund and there is a bird sanctuary in Salalah and a nature reserve in the capital area.

11. Fish culture. There are no possibilities for fresh-water culture unless permanent reservoirs are someday built, which seems most unlikely. Mariculture is another matter, and a feasibility study would be appropriate.

12. Fisheries library. A library is part of the Marine Sciences and Fisheries Center. This is an absolutely essential component, for there is no existing source of fisheries reference material available to Oman's managers and scientists.

13. Marine recreation. When and if Oman is opened to tourists, there is a tremendous potential for marine recreational fishing, patttern-ed perhaps after the Florida and Southern California models.

14. International fisheries organizations. Oman is a member of the FAO Committee on Fisheries and the Indian Ocean Fisheries Commission. Its attendance record is regretably spotty.

15. Fisheries industry support. Successful programs seem to be in place and continuing.

16. Training. This is an area of major deficiency. An across-the-board training program needs to be instituted.

17. Development plan. There is of course the Second Five-Year Plan. It is not clear to me how it is revised, or if it is subject to revision once adapted. An annual "rolling horizon" would seem to be more useful.

What this seems to tell us is that Oman has made remarkably good progress in some areas. This is particularly true of the support programs for artisanal fishermen, such as the loan programs, the ice houses, and the outboard repair facilities. It has progressed little, if at all, in other areas that are critical in the long run, if the fisheries are to be controlled. These areas include statistics and marine science.

The approach so far is quite understandable. The first consideration in setting up a fisheries development program is the growth of the fisheries sector. Matters of conservation, regulations, scientific knowledge, all seem remote and unimportant compared to increasing the catch, the livelihood and the living standard of the fisherman and increasing the amount of animal protein available to the consumer.

Nevertheless, the fact must be faced that without a knowledge of the resource base and its potential yield, the long-term prospects for a productive and sustainable fishery are reduced. With it, they are enhanced. This is the most important fishery issue confronting Oman's government.

VI. ISSUES

A. General

Oman has stated quite unequivocably that it looks to fisheries as a major source of food, employment and income in the years to come. It has set forth a policy of support for the fisheries sector in its five-year plans, with particular respect to increasing the domestic food supply and assisting the traditional fishermen.

During the past five years, Oman has implemented a number of fisheries projects and has plans for more in the next five. The government's attention and its priorities have focussed on assistance to the artisanal fishermen; relatively little attention has been given to determine the structure and extent of the resource base on which the fishery depends.

The issues I discuss below are really not discrete units but instead form an interrelated web. A decision on one can have a major impact for good or for ill on the others, and the first three issues particularly set the tone for those that follow.

B. The Supply of Fish

The major issue that must be faced is whether there are enough fish in Omani waters to support a large enough sustainable fishery to constitute a significant portion of the national economy. The belief is that there are enough fish and that the fishery can be greatly expanded. The fact is that no one knows, for the data on standing fish stocks and current catch rates are scanty indeed and exhibit such a wide variation that little faith can be placed in them. Until some reasonable approximation can be made, fisheries development in Oman is a gamble. While everyone who has written on the subject agrees that there is a harvestable surplus, that surplus may not be as large as anticipated, and there is always the danger that even a small increase in fishing pressure can be enough to bring about overfishing. Further, each species or species group has its own particular dynamics, so the resource cannot be treated as a unit. For example, the sardine-like species complex, the most important today in terms of tonnage, must be treated by itself.

None of this is to suggest that all development should cease while the scientific community is making its estimates. However, a statistical field survey should be instituted at once, and immediate steps taken to develop people with the requisite analytical capacity.

If this is done, the fishery data should be available in time to be useful for management. If the decision is against implementing a resource assessment program, it means taking a calculated risk of overcapitalization and ultimate collapse, and makes the fisheries sector less desirable as a target for outside support.

C. Shared Stocks

Many of the species exploited by Omani fishermen are migratory and during the course of a year occur off the coasts of several if not all of the nations bordering the Arabian Sea. The obvious example is the small pelagic resource, largely sardines, that supports the southern Oman fishery, and that is equally available to South Yemen.

Investing in fishery of this sort obviously has a risk associated with it. If the other nation or nations exploit such a stock without regard for conservation principles, it clearly can collapse no matter how stringent the controls your institute. Shared stocks require some sort of an intergovernmental arrangement if they are to be managed effectively. Where this is not possible, and the nations fish unilaterally, each must decide how much risk capital it wishes to put into the fishery. Precisely this problem faces Oman with respect to the proposed sardine cannery and reduction plant at Raysut. A significant investment would seem unwise until a better idea is obtained of the magnitude of the resource and of its migratory habits. A highly competent fisheries stock assessment expert might find enough data on which to base an opinion in the archives and publications of the Indian Ocean Fisheries Development Project, FAO Fisheries Department, Rome.

D. Scope of the Fisheries Program

The governments program to date has emphasized fisheries development: building shoreside facilities, assisting the traditional fishermen, arranging for and administering the Japanese and, subsequently, the Korean concession. Meantime, plans have been prepared for further development (e.g. the cannery at Raysut), and for a variety of programs designed to provide the scientific data base for fisheries management (e.g. the Marine Sciences and Fisheries Center). It is appropriate that the effort so far has gone predominantly into development of the infrastructure and into direct assistance for fishermen. However, the time has now come to broaden the scope of the program to permit long term rational management. This means implementing on a priority basis programs that will provide requisite scientific and statistical data analyzed on a timely basis for use in making management decisions. A decision is urgently needed as to whether this will be done, for, as noted in the preceding paragraphs, a broad program should be a prerequisite to outside interest and support. Some of the issues discussed in the paragraphs that follow presume a positive decision.

E. Statistics

I have emphasized throughout this paper the lack of Omani statistics on fish catch and fishing effort. To repeat, these are the essential building block of a viable national fisheries development program such as Oman desires. Without these data, the foundation of the program is built on quicksand; with them success is not guaranteed, but educated and informed decisions can be made. This is in my opinion the most important project issue facing Oman. Immediate steps should be taken to institute a continuing statistical program; as an interim measure, I urge a one-year sampling survey to be conducted under contract with an appropriate institution.

F. Research

If the decision is to attempt to determine the size of the resource available to Oman and a statistical system is set up, a means of data analysis is an obvious essential. The Fisheries Directorate has well-laid plans for a Marine Sciences and Fisheries Center that would have this capacity, as well as competency in biological and physical oceanography, marine biology and fisheries science. It will take a number of years to train Omani scientists and to construct the laboratory complex itself. Overseas training in key disciplines should start at once, and the construction timeable advanced so far as possible and expedited. Expatriate assistance will be needed in the early years, and a Scientific Advisory Panel providing oversight could be most useful, this in addition to having scientists posted in Oman.

G. Policy and Law

Oman has a long-standing fisheries policy, and during the course of this review, promulgated a basic fisheries law. This law reportedly (the English text was not yet available) is comprehensive and can easily be adapted by neighboring nations to fit their own needs. This would for practical purposes set up a uniform regional code.

This is all excellent, and Oman deserves high praise. The issue remaining is implementation and immediate steps need to be taken to develop an operational protocol. This would concern surveillance of Oman's zone of extended fisheries jurisdication to prevent unauthorized foreign incursion as well as enforcement of domestic statutes. The United States has assisted other nations in developing systems and protocols involving government structure, vessel and aircraft requirements and the use of satellites. Oman could presumably arrange for a similar service.

H. International Organizations

Oman is a member of several global and regional fisheries bodies, including the Indian Ocean Fisheries Commission (IOFC) and the FAO Committee on Fisheries (COFI). It unfortunately has not participated regularly in either IOFC or COFI. IOFC is concerned with fisheries issues of the Indian Ocean and provides an excellent forum for discussion of regional and subregional problems. COFI serves as a forum for global issues, and has the important function of recommending courses of action to the FAO Department of Fisheries and of reviewing its program of work. Oman could both profit from and contribute to these organizations. I urge it to send a delegate to future meetings, starting with the IOFC's seventh session in Bali, Indonesia, in 1982. COFI has just met, and it will probably be 18 months before the next (fifteenth) session.

1. Extension

I have commented on Oman's excellent job in assisting its small-scale fishing community and have at the same time urged that the total fishery program be broadened to include programs providing a scientific basis for management. This does not preclude further assistance to fishermen, the marketers and the consumers. A well-planned extension service project is in the current five-year plan but I am told it is not scheduled for implementation until 1984. It would be most helpful to the potential recipients of the program if it could be advanced in time, and at least a prototype project and agent training to be instituted by 1982.

J. Personnel and Training

The single biggest issue facing Oman is finding and developing a large enough and well enough trained staff to carry out not only the projects already in place but those envisioned in the second five-year plan as well. It takes nothing away from the present staff to say that there are not enough people and that some lack sufficient professional or technical training. The remarkable thing is that the Fisheries Directorate has done as much as it has in the relatively few years of its existence.

But the system is stretched taut, and I do not see how the present staff can cope with the planned expansion of the current projects. It certainly cannot cope with new projects.

One need is further education or training for members of the current staff who have the basic attributes to do higher level work. Obviously, this would require careful scheduling over a period of years to insure that the Directorate was not stripped of key people at any one time.

Another need is for a significantly augmented staff of professionals and technicians appropriately trained to carry out the wide variety of tasks envisioned under the second five-year plan. These range from field agents and extension workers, who will need a nominal amount of on-the-job training, up through the middle management level, where academic training will likely be required, through the top level administrative and scientific posts where a university degree is a virtual prerequisite, and where a small number will require a doctorate.

This is indeed a massive training program that appears necessary. The Directorate staff has thought things through and provided what appear to be reasonable and comprehensive training requests. These have been submitted as part of the new five-year plan and have met varying fates, mostly negative, as they moved through the system. Training tends to receive a low priority in most bureaucracies. But the Directorate, the Ministry, and planning and budget officials must recognize that Oman's desire for an augmented and prosperous fisheries sector is likely to remain just a dream if provision is not made for a cadre of highly skilled and trained people.

K. Artisanal Fisheries Needs

Oman gives top priority to meeting the needs of the traditional fishermen, and most of the national programs of the past few years have been directed to this end. This has been appropriate, but the time has now come when a more comprehensive fisheries program is required. This should not mean less for the artisanal fisherman, provided the new programs receive new funding, and indeed the traditional fishermen seem to be slated for increased assistance in the years to come. If, however, funding is inadequate for the artisanal sector and for such efforts as those proposed for statistics and fisheries science, Oman will be faced with a decision. The current situation requires in my opinion implementing these new projects even if it means holding the artisanal support budget at a constant level.

L. Social Sciences

The directorate has just completed its first economic survey and has plans for a second, so the social sciences are far from forgotten. There should be provisions, and there well may be, for routine socio-economic input into all the programs, with the need especially strong in stock assessment. To realize optimal benefit from the resource requires this consideration.

M. Canning and Reduction

The plans for a sardine cannery and reduction plant should, in my opinion, be reevaluated and perhaps at least scaled down if not postponed. There are several problems for which there are no answers at this time. The two critical and interrelated ones concern, first, total stock size and potential harvest and second, the fact that this is a shared stock with the principal sharer being the Yemen PDR. Joint management is clearly out of the question, so even assuming a sufficient stock now to support a major Omani fishery, there is no reason to believe that the condition will continue if Yemen places a significant

strain on the population. So there may or may not be enough fish to support a significant fishery, and there is no way to manage it. There remains the issue of how much of a market exists for canned sardines coming from the Salalah area, and how much of a market for fish meal. Further, what takes the place of dried sardines as a supplemental feed for cattle? Or is a portion of the catch to be allocated for drying in the traditional manner?

Basically, Oman must decide whether to go ahead with this project, recognizing that it is dealing with a shared stock of uncertain magnitude, and with a most uncertain economic future.

N. Aquaculture

Fresh-water fish culture has no apparent potential in Oman but marine culture seems to have real possibilities. This is especially true of high value marine shellfish such as abalone, clams and oysters. Lobsters, because of their complex larval life history, are less likely candidates. There may be opportunities among the fin fish and with seaweed. Culture operations may have policy implications with respect to allocation of water bottoms and the private ownership of marine resources, but the options should be explored. The marine center includes space for a mariculture laboratory. It will not be constructed unless a survey of mariculture's potential indicates a need for it, as things now stand. This seems a wise decision.

O. Joint Ventures

Oman's experience with the Japanese concession was not good; that with Korea is apparently working well. Large-scale fishing operations such as these, working on otherwise unutilized stocks, seem appropriate. At the same time, any significant expansion might be unwise at this time, given the lack of knowledge of the real extent and resilience of the exploited stocks. Oman has a real opportunity to develop smaller-scale joint ventures concerned with low-volume, high-priced (on the export market) species such as abalone and lobster.

Oman must, however, find a way to speed up the legal procedures. One company from the United States has been negotiating for a year or more; the joint venture is still not in place, a whole fishing season for abalone has been lost, and the American entrepreneurs are beginning to lose heart.

P. Marine Recreation

Oman has long-range plans to establish a tourist industry. I do not know whether or not these plans include a marine recreation component, but suggest it be considered if it has not been included. A wide variety of marine game fish are abundant in Oman's waters, and marine sport fishing business adapted from the California and Florida models should be a tremendous attraction. The impact on game fish stocks would be negligible. Non-consumptive activities such as scuba diving and snorkeling would be equally popular. Even a modest charter boat fleet catering to both groups could make a significant contribution to the economy. However, establishing such an activity means allocating at least part of any harvestable surplus of potential game fish to it, and implies a lower potential catch to the traditional fishermen who now harvest these species. This must be borne in mind.

Q. Environmental Concerns

The record shows that the Omani Government is fully cognizant of the need to protect the marine environment and such threatened species as the turtles at Masirah Island. The most commendable turtle program at Masirah, the bird reserve at Salalah and the nature reserve near the Intercontinental Hotel are good examples of Oman's resolve. Environmental issues, however, can get overlooked in any development program unless they are routinely considered in the planning process. They should be if they are not.

R. Food Technology

As the Fisheries Directorate is fully aware, quality control of fishery products is not good. The whole system of fish handling from the time the fish is caught to the time it reaches the ultimate consumer needs scrutiny, as does the matter of preparing the fish for the table. The same thing holds true for new product technology. Much can be accomplished through the extension system and the advance planning may be adequate. This needs looking at, and steps taken to bolster up the plans if need be.

S. Private Versus Public Sectors

The Government has decided that it should not be in the fish business, and has established the Oman National Fisheries Company to take over appropriate functions from the Fisheries Directorate. These include so far the marketing and cold stores facilities at Muttrah and Salalah. The question may not be fully resolved as to how far the private sector extends - - as an example, is the Buraimi facility appropriately run by the government? I assume the answer is no, based on the second five year plan which calls for further transfers of facilities of this sort to the private sector.

VII. APPROPRIATE PROJECTS FOR SUPPORT BY THE JOINT COMMISSION

The recommendations I have for the Omani-American Joint Commission concern (1) three specific projects included in the Fisheries Directorate's current five-year plan, (2) the overall need in the Directorate, for training and (3) several suggestions for projects requiring expatriate assistance. My major recommendations include support for:

The Fishery Statistics Project
The Marine Science and Fisheries Center
The Extension Project
Across-the-board Training

The other proposals concern:

1. An internationally recruited Advisory Committee to assist the Director General.

2. An evaluation of and plan for enforcement and surveillance requirements.

3. An evaluation of plans for and the economic soundness of marketing and cold stores centers and the fish distribution system.

4. An evaluation of and plan for needs in the area of food technology, quality control, and sanitary standards.

5. An evaluation of the potential for mariculture and the need for special laboratory facilities in the Marine Sciences and Fisheries Center.

The United States is well qualified to provide scientific and technical support in all these subject areas.

A. Fishery Statistics

I have expressed repeatedly Oman's serious need for adequate fisheries statistics as the foundation for a fisheries management and development program.

The Fisheries Directorate is fully cognizant of this need and has an implementation schedule in the Second Five-Year Plan. This is based on the work of T. Shimura, an FAO fisheries statistics expert. I understand that implementation of the project has been delayed and that plans for training the necessary field and office staff have been cut back. I have not seen the project description, but from what I have been told, I believe, it is sound and meets the requirements of the Directorate. I would want to review before giving it a carte blanche endorsement, however.

Even with full governmental support, it would take a year or two to implement the statistics project. I feel that Oman cannot wait. I suggest a one-year intensive field-sampling and data analysis project designed to provide base-line knowledge as to the extent of the catch by key species and specie-group. This project would have to be contracted, but designed to make maximum use of Fisheries Directorate personnel and Omani nationals who know the fisheries of specific regions or ports. The survey should include Musandam. A spin-off of the survey would be a better estimate of the soundness of the long-range program and the opportunity to modify it if it seemed desirable.

I propose these actions to the Joint Commission:

1. That the Commission strongly endorse the implemencation, at the earliest possible date, of a fisheries statistics collection system suitable for Oman, one that insures that the data collected meet the requirements of the stock assessment unit presumably to be included in the Marine Sciences and Fisheries Center.

2. That the Joint Commission urge that the necessary training of Omanis to carry out the project be expedited. This includes training of managerial-level people overseas and training field agents in Oman.

3. That the Joint Commission support a one-year field sampling and analysis project as an interim measure.

B. <u>The Marine Sciences and Fisheries Center</u>

The Center is a critical element of Oman's fisheries development and management plan and is designed to provide the fundamental information needed to permit rational development of Oman's marine resources. Its Fishery Biology and Technology Department will provide for the analysis of the status of the stocks on which rational management so much depends, as well as basic biological information on the species

themselves, studies of fisheries product technology and ultimately mariculture if it proves feasible in Oman. The Physical Oceanography Department will provide background information on physical, chemical, and biological oceanography and will conduct pollution studies. The Center plans to aquire a research vessel in the 25-30 meter range, and there will be a much-needed library.

While the whole Center deserves support, one element is particularly critical at this time. That is the stock assessment unit. I am presuming that a primary function of the Center will be to prepare evaluations of the status of the stocks and to make recommendations for management to the Director General when and if circumstances warrant. I also presume that economic and social factors will be considered and taken into account before recommendations are made. While there is provision for economic feasibility studies in the five-year plan, I am not aware of a permanent unit to prepare economic and sociological analyses. These must be prepared, though not necessarily in the Marine Science and Fisheries Center, so that recommendations for management will not be based on biology alone.

According to Canzonier and Simon (1980), the laboratory facility will cost about $1.9 million to build, while staff housing will cost about $775,000. Training of the permanent staff will require about $1 million. There is no estimate as to the cost of the research vessel or of annual operating costs. The facility will clearly have to be staffed largely by expatriate scientists during its first few years.

This is a major investment. While part of it may not be required at this time - - e.g., a mariculture laboratory - - there is no facility like the one proposed in this part of the world. It could become an important link in the global net of marine laboratories, and it is wise to make it as useful as can be. Certainly, the Joint Commission need have no reservations over endorsing the concept.

The disciplines required to staff the Center are ones in which the U.S. has considerable strength, and the U.S. could be most helpful in providing both short- and long-term experts. It will be hard, perhaps impossible, to get senior-level scientists to come to Oman for an extended (e.g. 6 months or more) tour. Mid-career and junior scientists are much more likely to be available, but there will remain the need - - indeed the necessity - - to get the advice and counsel of acknowledged experts in the field of marine science. This can be done through a Scientific Advisory Committee made up of a group of internationally-recruited senior marine scientists acting in their personal capacities, not as representatives of their institutions or governments. Such a group, meeting once or twice a year, could provide the guidance the fledgling center will need for the indefinite future. This system has worked well elsewhere, and there is every reason to believe it would here. The group should not be large, and those selected would be expected to participate actively.

I suggest the Commission endorse the Center, as a whole, taking particular note of:

1. Constructing and equipping the Fisheries Biology and Technology Department's buildings and the library as a first order of business, followed by the Oceanography Department.

2. Training a staff for the departments and the library, with priority within this category to population dynamics, statistics (if not in a separate unit) and computor science.

3. Establishing a scientific advisory committee.

C. <u>The Extension Project</u>

The Fisheries Directorate has what appears to be a good extension project in the new five-year plan. Unfortunately I was told it is not scheduled to be funded until 1984, when about $250,000 is provided for a two-year project. The proposed staff includes a food

technologist and a gear technologist in addition to a dozen field agents. In the meantime, the staff has devised a data collection form that it hopes to test in the field fairly soon. The agents would obtain information on each village surveyed and on each vessel, its engine and its gear. There are questions on operations (time at sea, fishing days per year, and the like), and questions on production (the annual catch, catch per day, annual revenue, and main marketing centers). All this information, particularly with respect to fishing operations and catch, will be of great value to the statistics and stock assessment projects.

The Joint Secretariat could be most helpful by recommending that the time table be advanced from 1984 to permit as a minimum the training of the staff and implementation of the prototype field survey in 1982.

D. Training

I have emphasized throughout this paper the critical need for training at all levels if Oman is to make the best use of its fisheries resources. There is no need to repeat the arguments.

The single greatest service the Joint Commission could render fisheries development in Oman would be to help insure by all appropriate means that a viable training program is instituted immediately. The Fisheries Directorate knows what its critical gaps are, and a schedule could quickly be prepared that would fill those gaps and provide for an orderly progression of training that would not strip the agency of key people at any one time.

E. Other Matters Recommended to the Joint Committee

1. Advisory Committee to the Director General.

This committee would do for the agency as a whole what I visualize the scientific advisory committee as doing for the Marine Science Center - - providing advice and counsel that could not otherwise be obtained. There are a few very senior professional fisheries administrators who could be available for such an appointment and who understand the needs, desires and problems of nations such as Oman, if not Oman itself. Their services could not be bought for any length of time but I think they would be pleased to serve as committee members in their capacities as independent experts. I visualize a group of perhaps a half dozen who would convene at the pleasure of the Director General. A Secretariat would be needed. An expatriate serving as a long-term advisor might handle this task.

2. Ad hoc teams of experts seem needed to visit Oman in the near future to prepare evaulations of and operational plans for:

a. Surveillance and enforcement, both with respect to domestic fishermen and to foreign fishing, vessels who might enter Oman's exclusive zone.

b. Marketing centers,cold stores and distribution, including the economic soundness of facilities built and proposed to be built.

c. Needs in the area of food technology, quality control and sanitary standards.

d. The potential of mariculture, with special respect to abalone and other molluscs, and to the need for a laboratory facility as part of the Marine Science and Fisheries Center.

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14 May	Traveled from San Francisco to Washington, D.C.
15 May	In Washington for briefings and signing of contract. Left for London in the evening.
16 May	In London. Consulted with W.P. Appleyard, a fisheries expert who has worked in Oman.
17 May	Traveled from London to Muscat.
18-19 May	Muscat. Conferences with Joint Commission and Fisheries Directorate officials.
20 May	Visited fish landing places, markets and government facilities in Shinos, Soha and Saham, accompanied by Hamyar Riyami.
21 May	Similar visits with Mr. Riyami in Muscat, Muttrah, Sidab, and Seeb. Balance of the day at the Joint Commission.
22 May	Muscat, working up notes and reviewing reports.
23 May	Meetings with officials of the Oman National Fisheries Co. and Dr. Alam Hassam. Balance of day at Fisheries and the Commission.
24 May	A scheduled trip to Masirah Island was cancelled after a long wait. Balance of the day at the Commission.
25 May	Meetings with Mr. Nehoda, Peace Corps, and Dr. El-Rikaishy, Planning Directorate. To Salalah in the afternoon with Abdullah Mohammed.
26 May	Visited the fisheries installations in Salalah and in Marbat, and toured the port of Raysut.
27 May	Meeting with Patrick Hoon, formerly an advisor to the Wali and now with the Zawawi Trading Co. Returned to Muscat in the afternoon.
28 May-3 June	Muscat, with time divided between the Fisheries Directorate, where an office was made available, and the Joint Commission. Meeting with the Director General on June 2.
4 June	Trip to Buraimi to see the fisheries installation, accompanied by Ali Al Harasy.

5-6 June	Muscat, at the Commission and the Fisheries offices.
7 June	Trip to Masirah Island with Rashid Barwani, and Mssrs. Al Hashar and Prabhu, Oman National Fisheries Co.
8-11 June	Muscat, completing the report and making final calls at the Fisheries Directorate.
12 June	Traveled, Muscat to London.
13 June	Traveled, London to San Francisco.

PRINCIPAL CONTACTS

Omani-American Joint Commission
- Chester S. Bell, Jr.
- F. Gary Towery

Directorate General of Fisheries

Muscat
- Abdullah Ali Bakathir, Director General
- Rashid Amour Al Barwani, Director of Production & Marketing
- Hamid Yahyai, Deputy Director of Production & Marketing
- Hamyar Riyami, Production and Marketing Department
- Ali Mohammed Aidroos, Director, Fisheries Projects
- Abdullah Mohamed, Director
- Thabit Zahran Al Abdisalem, Deputy Director, Research
- Aziz Ali Al Amry, Research Officer
- Ali Saleh Al Harasy, Research Assistant
- Nils Gustafsson, Advisor (FAO) to Director General
- Mahmoud Ahmed Mahdi, Fisheries Expert

Salalah
- Ali Omar, Director
- Ali Said Salim Al Marhoon, New Projects

Buraimi
- Mohamed Al Shanfari, Officer-in-Charge
- Salaman Badry, Plant Engineer

Masirah - OIC

Other Government Officials
- A.N. El-Rikaishy, Directorate General, Planning
- Alam Hammad, Planning Office, Ministry of Agriculture & Fisheries

Oman National Fisheries Co., Muscat
- Khamis Al-Hashar, Chairman
- S.M. Prabhu, General Manager

Others
- W.P. Appleyard, Fisheries Consultant, London
- Keith Cox, Development Applications Corp., Los Altos, California
- Patrick G. Hoon, Zawawi Trading Co., Salalah
- Warren Ketler, Development Applications Corp., Los Altos, California
- Albert J. Nehoda, Director, Peace Corps, Muscat
- Pervez A. Shaikh, Project Manager, Global Chemical Systems Ltd., Masirah Island
- James A. Storer, Director, Office of Fisheries Affairs, U.S. State Department, Washington, D.C.