

PN-AAW-546

PN-AAW-546

SOCIOECONOMIC ASPECTS OF THE FISHERIES OF OMAN

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June 1984

ICMRD



INTERNATIONAL CENTER FOR
MARINE RESOURCE DEVELOPMENT

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CONTENTS

THE FISHERMEN OF OMAN: INTRODUCTION	1
THE FISHERMEN OF OMAN: GENERAL BACKGROUND CHARACTERISTICS	5
THE FISHERMEN OF OMAN: THE HARVESTING SECTOR	9
VESSELS	9
Vessels in 1984	17
Vessels along the Batinah Coast, 1984	19
Vessels in Muscat-Mutrah area, 1984	22
Vessels in Sur - Al Ashkara Region (1984)	24
Vessels on Masira (1984)	26
Vessels along the coast from Mahout to Ras Madraka (1984)	27
Vessels in Dhofar Region (1984)	27
GEAR	28
FISHING GEAR (1984)	29
Batinah Coast	29
Capitol Area	30
Sur-Al Ashkara	30
Masira	30
Coastline from Mahout to Ras Madraka	30
Dhofar	31
SOCIAL STRUCTURE OF FISHING	32
OWNERSHIP PATTERNS	32
CREW STRUCTURE	32
SUPPLEMENTAL INCOME SOURCES	33
THE MARKETING SECTOR	39
INTRODUCTION	39
MARKETING AND DISTRIBUTION OF FRESH FISH ALONG THE BATINAH COAST	39
BARKAH FRESH FISH MARKET	40
AL Khabura FRESH FISH MARKET	41
SAHAM FRESH FISH MARKET	42
THE SOHAR FRESH FISH MARKET	43
MARKETING AND DISTRIBUTION OF FRESH FISH IN THE CAPITOL AREA	45
THE MUTRAH FRESH FISH MARKET	45
MARKETING AND DISTRIBUTION OF FRESH FISH IN THE SUR/AL ASHKARA REGION	46
SELLING THE FISH CATCH IN SUR	47
MARKETING AND DISTRIBUTION OF FRESH FISH ON MASIRA	48
MARKETING AND DISTRIBUTION OF FISH ON THE EAST COAST (MAHOUT TO RAS MADRAKA)	48
MARKETING AND DISTRIBUTION OF FRESH FISH IN DHOFAR	49
SALALAH VICINITY (MUGSAIL TO MIRBAT)	50
REGIONS IN DHOFAR REMOTE FROM SALALAH	50
ATTITUDES TOWARD LEAVING THE OCCUPATION OF FISHING	52
FISHERMEN AND LOANS	57

OMANI FISHERMEN'S ATTITUDES TOWARDS THE FISHERY	62
PERCEPTIONS OF DIFFICULTIES	62
SOCIOCULTURAL CORRELATES OF PERCEIVED DIFFICULTIES	65
Attitudes towards fishing in 1984	73
DEVELOPMENT ISSUES	78
PRODUCTION	78
MARKETING	78
MARKET PLACES	79
FISHERY LABOR FORCE	80
SUPPORT FOR PART-TIME FISHERMEN	81
TECHNOLOGY	82
INFORMATION NEEDS FOR THE DEVELOPMENT OF OMAN'S SMALL-SCALE	
FISHERY	84
OPERATION OF A FISHERY	84
HIGHLIGHTS OF THE OMANI CASE	85
DATA REQUIREMENTS	89
Catch Assessment Survey	94
General suggestions for sampling for the CAS	101

THE FISHERMEN OF OMAN: INTRODUCTION

It is obvious that development of any aspect of a fishery must take into account the fish resource, the technology used to harvest the resource, the society and culture of those who use the technology, as well as the processing, distribution, and marketing of the product. Failure to consider any one of these elements can potentially result in undesirable outcomes ranging from ones in which a development project investment which has absolutely no effect on the fishery to those which result in total destruction of the resource. The purpose of this report is to provide sociocultural and economic information and recommendations which can be used by decision makers to facilitate the development of the small-scale fishery of Oman.

The following report is the realization of four objectives: (1) the analysis of sociocultural survey data collected in 1979; (2) the updating of this analysis with observations made in Oman in 1984; and (3) the utilization of the information generated to make sociocultural and economic recommendations concerning the particular issues in the development of Oman's small-scale fishery; and (4) the utilization of available information for the short-term Catch Assessment Survey design.

There are several weaknesses in this report which should be made clear from the outset. The writers of this report did not take part in the 1979 survey; hence, certain questions brought up in the report can only be answered by those who conducted the survey. Although attempts were made to clarify certain issues prior to report preparation (e.g., location codes not included in the code book), answers were not received prior to the completion of the report. Additionally, time constraints placed on the present research left some questions unanswered. Part of the recommendations in this report involve obtaining answers to these important questions. Despite these weaknesses, the report does provide information and recommendations which will facilitate the development of programs for improving the small-scale fishery of Oman.

Fish are one of the important natural resources of Oman. Most of the fish harvested from the waters of Oman are captured by small-scale fishermen descended from peoples who have been fishing the waters for centuries. The fish captured are consumed both domestically and abroad. Most observers claim that the fish resources of Oman are underexploited; hence, the push to develop the fishery. The government of Oman, however, has wisely intervened in this development process in an attempt to insure that the changes introduced will not result in undesirable socioeconomic and cultural effects such as under- or unemployment and/or the concentration of peoples in large urban areas. This report is aimed at facilitating this planned development.

The fishermen of Oman are spread throughout the country in numerous communities, both small and large, scattered along the coastline (see Figure 1). Many of these communities were visited in 1984 and most were sampled in the 1979 survey. The locations of most of the fishing communities mentioned in this report can be found in Figures 1 and 2.

Figure 1 also delineates the regional breakdown used in the analysis of the 1979 survey data. The regions are constructed on the basis of observations made in 1984 and are justified in both the analysis of the 1979 survey data and the 1984 research. This data and research is detailed in the remainder of the report.

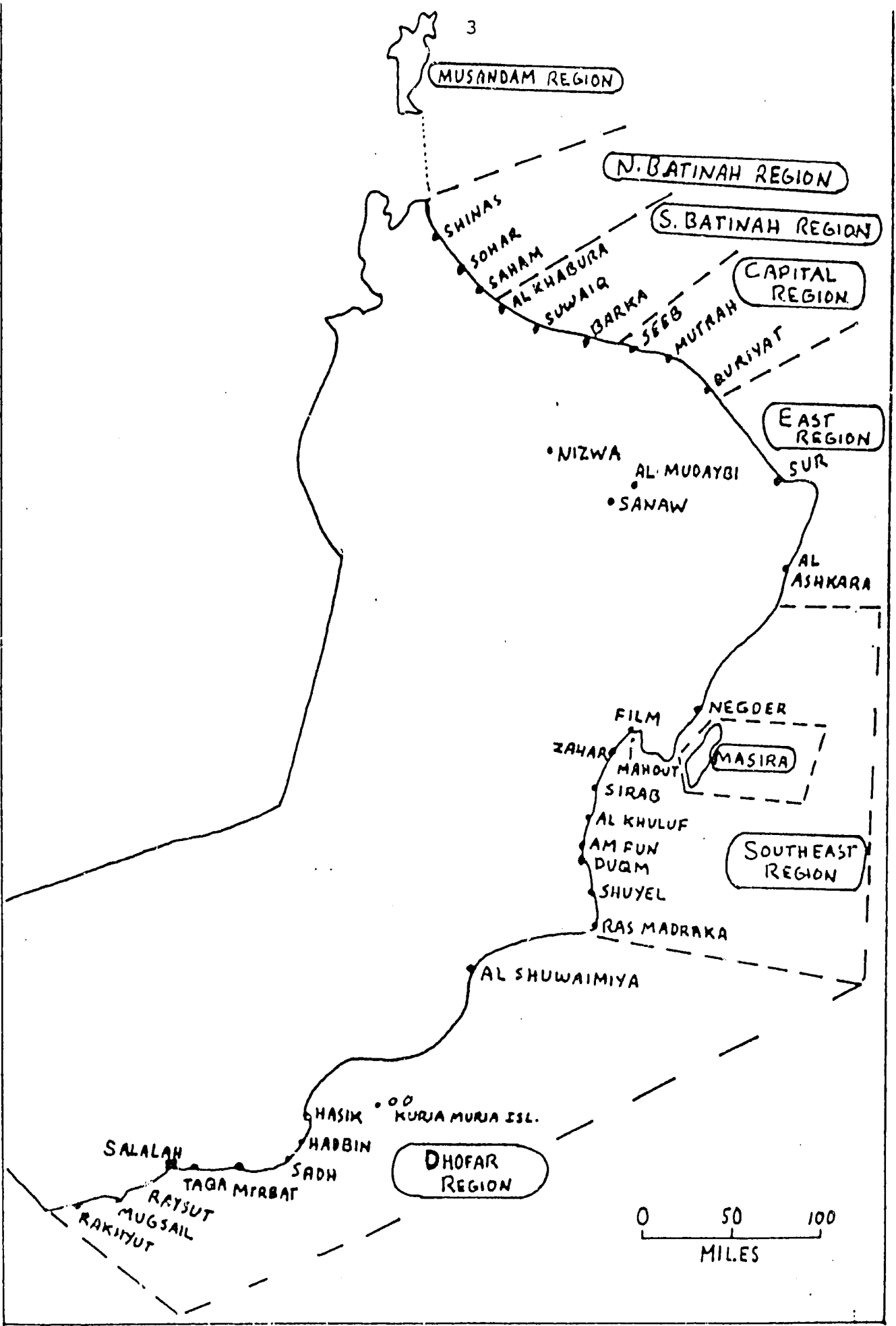


Figure 1. Fishing communities mentioned in report.

DESALINATION
PLANT

QURH AREA

N

DARSAIT

MUTRAH
FISH
MARKET

ASH SHUTAYFI

SIDAB

BUSTAN

QUANTAB

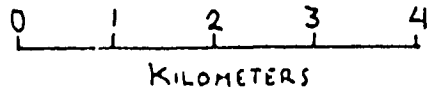
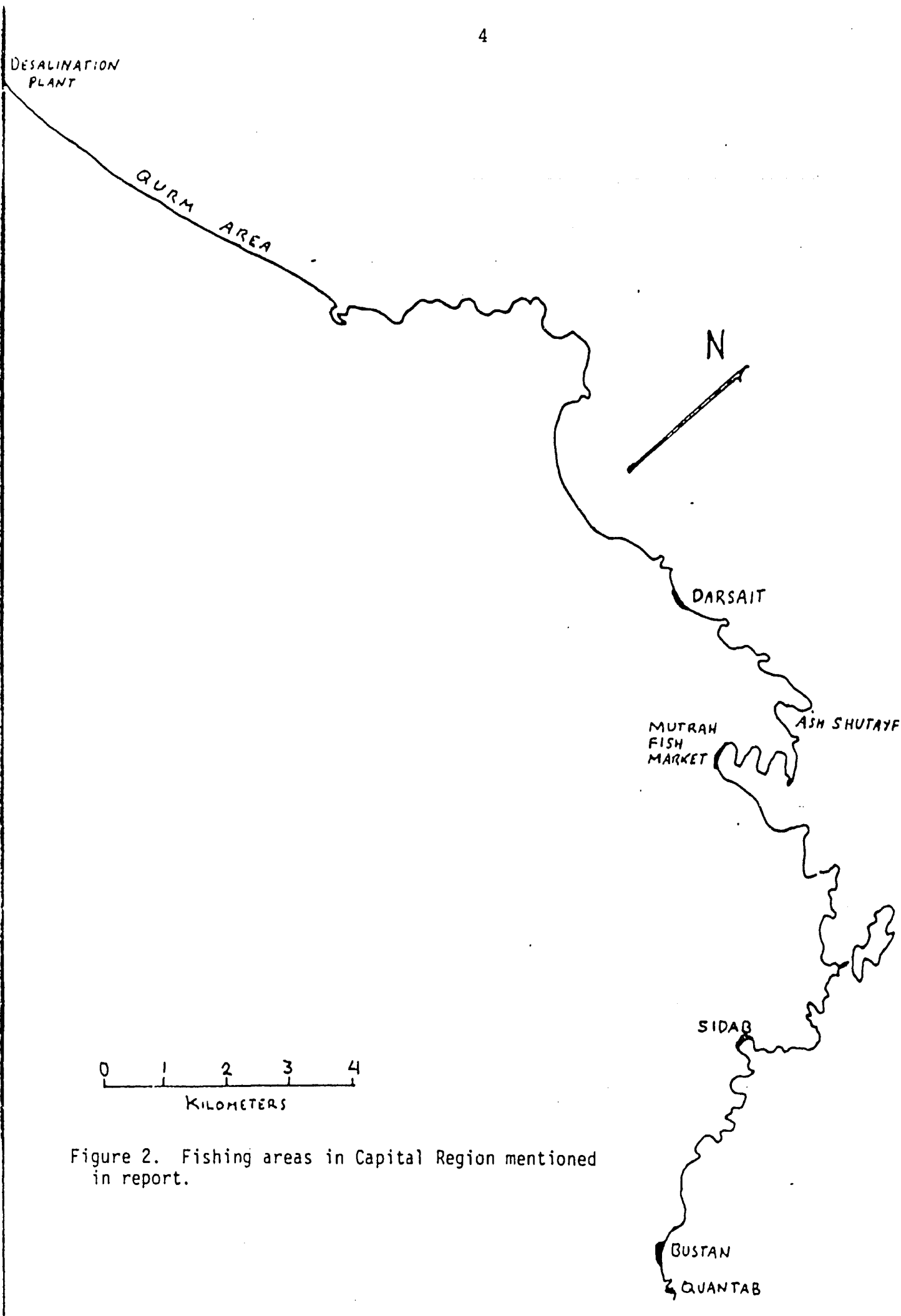


Figure 2. Fishing areas in Capital Region mentioned in report.



THE FISHERMEN OF OMAN: GENERAL BACKGROUND CHARACTERISTICS

General background characteristics of the fishermen of Oman are obtained from analysis of the detailed survey conducted in 1979. Certain characteristics (e.g., water and electricity sources) may have changed in the intervening years, but in general, the data is the best available, and much of it is still valid today. The survey was conducted in almost every fishing community in Oman, and a total of 6617 fishermen were interviewed. The analyses of background characteristics are found in this section of the report.

Table 1 presents distributions of age, dependents, and literacy status of fishermen. Turning first to age, the mean age is in the thirties in all regions. Overall, the youngest are in Dhofar and the

Table 1. Selected demographic characteristics of fishermen.

Region	Age		Dependents						Literate %	N
			Male Family		Female Family		Others			
	\bar{X}	Sd	\bar{X}	Sd	\bar{X}	Sd	\bar{X}	Sd		
Capitol	36.3	11.9	3.0	1.7	3.0	1.9	1.1	1.7	15.5	709
Masira	34.3	6.7	2.6	1.6	2.5	1.7	2.5	1.9	18.3	104
Unknown	37.2	11.2	3.3	1.7	2.9	1.8	1.4	2.3	16.3	245
Dhofar	32.0	11.2	2.6	1.9	2.2	1.9	1.1	2.1	32.5	1408
East	36.5	9.8	2.7	1.8	2.5	1.9	0.7	1.5	5.0	957
Southeast	34.5	10.3	2.4	1.6	2.1	1.6	2.3	2.9	2.9	417
S. Batinah	35.8	10.6	2.8	1.5	2.7	1.6	1.0	2.4	7.5	1419
N. Batinah	38.4	9.8	2.8	1.6	2.6	1.5	0.6	1.3	8.7	1079
Musandam	37.7	11.1	2.3	1.3	1.8	1.4	0.1	0.4	1.8	279
All Regions Combined	35.6	10.8	2.7	1.7	2.5	1.8	1.0	2.0	13.5	6617

oldest in the North Batinah. An examination of the standard deviations, however, suggests that the age structure of the fishermen in Masira differs significantly from those in the other regions. The regional distributions of fishermen classified into age groups can be found in Table 2.

Table 2 clearly shows that in Masira the fishermen are all in their 20s, 30s, and 40s, while in the other areas, they range from the teens to 80 years and over. This distribution of ages in Masira raises several questions: First, why are no teenagers fishing? Are they all in school, or are there simply no young entrants to the occupation? If there are no young entrants, does this mean that as those fishing become older and leave the occupation, no one will take their place? Finally, does the lack of fishermen 50 and older indicate that the occupation of fishing in Masira has little time depth or that the occupation is too demanding for older men from this area?

With respect to dependents, the data indicates that most fishermen have around two to three male and two to three female dependents from their family living in their household (these figures include the fisherman and his wife). They also have an average of about one non-family member living as a dependent in their household. Musandam fishermen have the lowest number of non-family dependents living in their households, while those from Masira and the Southeast regions have the most. These differences indicate variance in household structure between the regions which may have some impact on development plans.

Table 2. Distribution of fishermen within age groups across regions.

Region	Age								
	10-19	20-29	30-39	40-49	50-59	60-69	70-70	80+	
Capitol	19	176	214	172	80	34	8	2	705
Masira	0	32	43	29	0	0	0	0	104
Unknown	4	50	88	52	37	12	1	0	244
Dhofar	185	398	427	252	117	20	3	1	1403
East	4	203	350	243	113	28	0	1	942
Southeast	20	90	156	108	26	5	1	2	408
S. Batinah	22	337	482	365	152	51	3	2	1414
N. Batinah	13	148	320	393	164	30	2	2	1072
Musandam	4	59	83	91	31	8	1	2	279
	271	1493	2163	1705	720	188	19	12	6571*

* 46 cases had incomplete data

Finally, Table 1 indicates that the lowest percentage of literates are found in Musandam and the Southeast Regions, while Dhofar has the highest level of literacy among fishermen. These findings have implications with respect to appropriate materials for use in training programs. Overall, the level of literacy is quite low, suggesting that written materials would have little impact.

Table 3 indicates the distribution of fishermen classified according to civil status. Overall, most fishermen are married, the lowest percentage married being found in Dhofar and the Southeast region, two geographically contiguous regions.

Housing status of fishermen can be found in Table 4. In general, Table 4 indicates that the largest percentage of fishermen (over 93 percent) own their houses in Masira and the smallest in Musandam and Dhofar. Conversely, the smallest percentage live in family-owned homes in Masira, while in Musandam and Dhofar the opposite holds true. In the capitol region and along the Batinah coast about one-half the fishermen live in self-owned homes while the other half live in family-owned homes. Generally, very few fishermen rent their houses (the largest percentage, two percent, being in the Capitol region). These between region differences in housing status lead one to ask if there are differences in family versus private ownership patterns between the

Table 3. Civil status of fishermen.

<u>Region</u>	<u>Civil Status (Percent)</u>			
	<u>Single</u>	<u>Married</u>	<u>Divorced</u>	<u>Widowed</u>
Capitol	4.8	92.2	0.3	2.7
Masira	4.8	88.5	3.8	2.9
Unknown	2.9	95.1	0.4	1.6
Dhofar	21.3	74.4	2.7	1.6
East	7.2	89.7	1.5	1.7
Southeast	13.2	82.0	3.1	1.7
S. Batinah	4.9	93.2	0.4	1.6
N. Batinah	4.8	93.9	0.5	0.8
Musandam	8.6	86.4	1.4	3.6
All Regions Combined	9.3	87.7	1.3	1.7

Table 4. Percent distribution of housing status of fishermen.

<u>Region</u>	<u>Self Owned</u>	<u>Family Owned</u>	<u>Rented</u>	<u>Other</u>
Capitol	50.5	47.0	2.1	0.4
Masira	93.3	6.7	0.0	0.0
Unknown	37.6	61.6	0.4	0.4
Dhofar	9.7	83.9	1.4	5.0
East	25.7	44.6	1.1	28.5
Southeast	24.5	61.4	0.2	13.9
S. Batinah	44.6	55.2	0.1	0.1
N. Batinah	49.7	50.5	0.0	0.0
Musandam	2.9	97.1	0.0	0.0
All Regions Combined	33.4	59.7	0.7	6.2

regions. Such differences can affect the ideal structuring of development projects involving ownership (of vessels, gear, etc.) and responsibility for debts incurred in the purchase of equipment, property, etc.

Finally, Table 5 indicates the distribution of access to electricity and water among fishermen. These figures, especially in the more urban areas, are most likely to have changed since the survey was conducted. In general, however, recent research in Oman indicates that fishermen in the Southeast region still have little access to electricity, while those from the Capitol, Dhofar, and (in contrast to the survey data) Masira have the most access.

Table 5. Percent distribution of water and electricity sources.

Region	Electricity			Water Sources			
	Generator	Municipal	Other	Canal	Well	Municipal	Reservoir
Capitol	2.7	17.1	0.3	41.3	12.8	45.8	0.0
Masira	0.0	0.0	0.0	98.1	0.0	5.8	0.0
Unknown	0.0	0.0	4.1	33.5	14.3	52.2	0.0
Dhofar	7.5	43.5	0.9	15.9	35.4	37.1	13.1
East	0.2	0.1	0.2	27.1	1.6	70.0	1.4
Southeast	0.0	0.0	0.0	1.0	0.7	98.6	0.0
S. Batinah	0.0	0.0	0.6	41.6	3.2	54.7	0.4
N. Batinah	1.4	0.3	8.3	15.7	0.8	83.0	0.5
Musandam	0.0	0.0	0.7	67.8	0.4	16.8	1.1
All Regions Combined	2.1	11.1	1.9	29.8	10.5	57.2	3.2

THE FISHERMEN OF OMAN: THE HARVESTING SECTOR

The purpose of this section of the report is to provide a brief description of various aspects of the harvesting sector as a means of providing the techno-environmental matrix for the socioeconomic sections which follow. The section is divided into three major parts: vessel types, gear types, and a brief description of fishing techniques focusing on human factors such as crew size and ownership patterns. The section will include analyses of selected written reports, the 1979 fishermen's survey, and data obtained during March and April, 1984.

VESSELS There is a fair amount of confusion regarding the names for the wood vessels of Oman (e.g., see the Durham Report, 1978). Some refer to all small wooden vessels as 'hour'i' and all large as 'dhow'. As can be expected, the boundary between 'small' and 'large' is ill-defined. Some insert an intermediate category between the two, which they refer to as a 'launch'. Others break the 'dhow' category down into 'sambuk' (also referred to as a shu'i, cf. Durham Report, 1978) and 'Shahuf'. The survey conducted in 1979 had a closed-ended question concerning vessel type used, using the categories listed in Table 6 as well as 'Al Amla', 'betail', fiberglass, and 'other'. The latter three categories were types used by only a few respondents, so they are not emphasized in this report. It is assumed that the 'shasha' category refers to a small vessel constructed of palm-frond as described in the Durham Report (1978). A more detailed description of this vessel type, as it has evolved over the past several years, is provided in our discussion of today's vessels which appears below.

The various vessel categories crosstabulated with vessel length, width, and region can be found in Tables 6, 7, and 9 respectively. Vessel length is crosstabulated with region in Table 8.

Table 6. Vessel type crosstabulated with length categories.

Vessel Type	Length (ft.)							Total
	≤10	11-20	21-30	31-40	41-50	51-60	>60	
Hour'i	18	594	1335	530	49	1	0	2527
Shasha	6	1183	296	10	0	0	0	1495
Shahouf	9	76	35	5	2	0	1	128
Launch	3	24	90	136	46	4	1	304
Aluminum	3	79	2	0	0	0	0	84
Alamla	0	0	1	0	2	0	0	3
Betal	0	2	5	3	0	1	0	11
Fiberglass	0	8	0	0	0	0	0	8
Other	0	34	1	3	0	0	0	38
Total	39	2000	1765	687	99	6	2	4598

2019 cases had incomplete data.

Table 7. Vessel type crosstabulated with width categories.

Boat Type	Width (ft.)					Total
	≤5	6-10	11-15	16-20	>20	
Houri	2066	445	7	2	1	2521
Shasha	1185	295	10	0	1	1491
Shahouf	39	79	7	3	0	128
Launch	16	132	126	27	3	304
Aluminum	46	35	0	1	0	82
Alamla	1	2	0	0	0	3
Betal	0	8	1	2	0	11
Fiberglass	8	0	0	0	0	8
Other	35	2	0	0	0	37
Total	3396	998	151	35	5	4585

2032 cases had incomplete data.

Table 8. Vessel length categories crosstabulated with region.

Region	Length (ft.)							Total
	≤10	11-20	21-30	31-40	41-50	51-60	≥61	
Capitol	2	116	287	110	1	1	0	517
Masira	0	5	37	13	4	0	0	59
Unknown	2	47	108	53	1	0	0	211
Dhofar	11	228	52	13	2	0	0	306
East	8	167	363	97	27	4	0	666
Southeast	0	25	200	99	25	0	0	349
S. Batinah	3	557	467	193	15	0	0	1235
N. Batinah	3	776	154	53	20	0	0	1006
Musandam	10	79	97	56	4	1	2	249
Total	39	2000	1765	687	99	6	2	4598

Table 9. Percent distribution of vessel types.

Region	Vessel Type						N
	None	Houri	Shasha	Shahuf	Launch	Aluminum	
Capitol	13.3	86.6	0.0	0.0	0.0	0.1	709
Masira	0.0	91.3	1.9	0.0	6.7	0.0	104
Unknown	4.1	91.0	4.1	0.8	0.0	0.0	245
Dhofar	49.2	19.1	0.1	0.8	1.6	6.9	1408
East	9.5	84.3	0.3	0.1	5.7	0.0	957
S. East	3.6	91.8	0.7	0.0	3.8	0.0	417
S. Batinah	2.2	80.1	17.3	0.0	0.3	0.0	1419
N. Batinah	0.6	72.7	25.8	0.4	0.6	0.0	1079
Musandam	5.0	70.3	15.8	4.3	4.3	0.0	279
All Regions Combined	14.4	68.1	8.9	0.5	1.9	1.5	6617

Table 6 and 7 present some rather interesting data. First, there are some relatively large vessels classified as 'hourí' and 'shasha'. Ten shasha were reported in the category 31 to 40 feet in length. These figures may reflect inaccurate reporting on the part of fishermen or coding errors. Additionally, the authors have never seen a hourí over 50 feet in length, leading us to suspect the one reported in those categories. Nevertheless, the data looks good for the most part and can be used to help interpret the categories used in the 1979 survey.

Table 9 presents some data which is difficult to interpret. First, the question posed concerned the type of vessel used in the past year. Why were there 'fishermen' interviewed who reported not using a vessel in the past year? Was the question misinterpreted? The relatively high percentage of 'none' answers for the Dhofar region should be investigated. This could reflect shellfishermen who do not use vessels. Additionally, only one region reported use of the 'Al Amla' vessel type -- Dhofar, where 311 respondents (or 22 percent) reported using this category of vessel. Unfortunately, only three respondents reported the size. Finally, with respect to the vessel size data from the 1979 survey, it should be noted that there was much missing data, hence, the variance in sample size found in Tables 6 through 9.

The 1979 survey also asked the purchase year of the vessel. This data can provide some information concerning the useful life of the various vessel types as well as some indication of the status of the fleet. Year of purchase is crosstabulated with both region and vessel type in Tables 10 and 11. Table 10 is interesting in that it answers a question posed above. The purchase date of vessels in Masira suggests that the fishery does not have the same time depth as in the other regions. The zeros to the left of an approximate diagonal in Table 11 are probably a function of both vessel life and year of introduction. The reported year of purchase of some shasha is amazing if true. The repairs necessary to keep a palm frond vessel seaworthy for so many years probably result in very little of the original material being present in the vessel being used at the time of the interview.

Table 10. Region crosstabulated with year of vessel purchase.

Region	Year of Purchase									Total
	1949 or Earlier	1950-59	1960-64	1965-69	1970-71	1972-73	1974-75	1976-77	1978 or Later	
Capitol	1	10	13	43	38	54	143	125	90	517
Masira	0	0	0	0	12	17	19	6	5	59
Unknown	3	10	9	20	10	22	50	59	27	210
Dhofar	4	12	11	28	29	30	73	66	73	326
East	3	5	18	40	41	131	203	115	112	668
Southeast	1	0	3	16	19	33	71	119	87	349
S. Batinah	8	15	23	44	107	85	322	273	363	1240
N. Batinah	4	4	5	10	20	40	91	153	680	1007
Musandam	0	4	10	8	16	20	44	93	61	256
Total	24	60	92	209	292	432	1016	1009	1498	4632

1985 cases had incomplete data.

Table 11. Vessel type crosstabulated with year of purchase.

Vessel Type	Year of Purchase									Total
	1949 or Earlier	1950-59	1960-64	1965-69	1970-71	1972-73	1974-75	1976-77	1978 or Later	
Hourti	14	47	76	192	198	358	695	578	396	2554
Shasha	3	4	5	5	62	19	199	261	937	1495
Shahouf	0	3	3	5	12	14	38	40	20	135
Launch	0	0	1	4	16	31	58	95	99	304
Aluminum	0	0	0	0	2	6	10	28	38	84
Alamla	1	0	0	0	0	0	1	0	1	3
Betal	0	0	5	2	1	1	2	0	0	11
Fiberglass	0	0	0	0	0	0	2	4	2	8
Other	6	6	2	1	1	3	11	3	5	38
Total	24	60	92	209	292	432	1016	1009	1498	4632

1985 cases had incomplete data.

Vessel types are crosstabulated with power type and engine type in Tables 12 and 13. Table 12 indicates that at the time of the 1979

Table 12. Vessel type crosstabulated with power type.

<u>Vessel Type</u>	<u>Power Type</u>			<u>Total</u>
	<u>Sail</u>	<u>Oars</u>	<u>Engine</u>	
Hourí	19	593	1943	2555
Shasha	0	861	635	1496
Shahouf	1	119	15	135
Launch	0	13	291	304
Aluminum	4	5	75	84
Alamla	0	2	1	3
Betal	0	10	1	11
Fiberglass	0	0	8	8
Other	<u>0</u>	<u>15</u>	<u>23</u>	<u>38</u>
Total	24	1618	2992	4634

1983 cases had incomplete data.

Table 13. Vessel type crosstabulated with engine type.

<u>Vessel Type</u>	<u>Engine Type</u>			<u>Total</u>
	<u>Inboard Diesel</u>	<u>Outboard Gas</u>	<u>Other</u>	
Hourí	68	1869	6	1943
Shasha	2	631	2	635
Shahouf	7	7	1	15
Launch	275	16	0	291
Aluminum	4	71	0	75
Alamla	0	1	0	1
Betal	1	0	0	1
Fiberglass	0	8	0	8
Other	<u>0</u>	<u>23</u>	<u>0</u>	<u>23</u>
Total	357	2626	9	2992

Survey almost two-thirds of the fishing vessels were mechanized. A little less than one-half (42 percent) of the shasha were mechanized, which indicates great improvement since the Durham study was conducted. Three-fourths of the hourí and almost all of the launch and aluminum vessels were mechanized. Most of the motors reported in the survey are outboard gasoline engines. Two shasha are reported as having inboard diesel, which is possible, but no shasha powered by diesel were in evidence in 1984. The confusion may have stemmed from the fact that the outboards are mounted inboard as is described below.

Power type is crosstabulated with region in Table 14. As would be expected, the capitol region manifests the highest percentage of mechanization. It is interesting to note that the Batinah coast and the Musandam have the highest percentage of oar use in the 1979 survey, while Masira reports the largest percentage of sail power. These figures changed drastically by 1984 as is discussed below.

Vessel cost categories are crosstabulated with region and vessel type in Table 15 and 16. The wide range in cost for the houri is related to the fact that this vessel category is used to refer to a large range of sizes of wooden vessels (refer to Table 6). The modal range category (251-500R) probably corresponds to the modal size category (21-30 ft.). The high prices reported for some shasha probably reflect inaccurate reporting, recording, and/or coding.

Table 14. Power type crosstabulated with region.

Power	Region									Total
	Capitol	Masira	Unknown	Dhofar	East	Southeast	S. Batinah	N. Batinah	Musandam	
Sail	0	12	0	8	3	0	0	0	1	24
Oars	50	9	35	109	237	74	507	475	122	1618
Inboard Diesel	2	8	0	22	114	16	7	59	129	357
Outboard Gas	465	30	176	185	313	257	724	472	4	2626
Other Engine	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>0</u>	<u>9</u>
Total	517	59	211	326	668	349	1241	1007	256	4634

1983 cases had incomplete data.

Table 15. Vessel cost categories crosstabulated with region.

Region	Vessel Cost (Reals)								Total
	≤100	101-500	501-1000	1001-3000	3001-5000	5001-7500	7501-10000	>10000	
Capitol	30	294	168	25	0	0	0	0	517
Masira	0	37	11	10	1	0	0	0	59
Unknown	30	128	45	8	0	0	0	0	211
Dhofar	70	206	35	12	0	0	0	2	325
East	143	368	35	49	34	24	9	6	668
Southeast	59	194	64	26	1	1	2	1	348
S. Batinah	660	386	123	70	1	0	0	1	1241
N. Batinah	791	89	47	66	10	3	1	0	1007
Musandam	<u>20</u>	<u>100</u>	<u>12</u>	<u>55</u>	<u>17</u>	<u>26</u>	<u>19</u>	<u>7</u>	<u>256</u>
Total	1803	1802	540	321	64	54	31	17	4632

1985 cases had incomplete data.

Table 16. Vessel type crosstabulated with cost categories.

Vessel Type	Vessel Cost (Reals)									Total
	<100	101-250	251-500	501-1000	1001-3000	3001-5000	5001-7500	7501-10000	>10000	
Houri	322	569	967	490	189	12	3	1	1	2554
Shasha	1426	44	18	5	1	0	0	0	1	1495
Shahouf	21	70	27	7	6	2	1	1	0	135
Launch	2	2	11	24	124	49	49	29	14	304
Aluminum	7	26	38	11	1	0	0	0	1	84
Alamla	0	0	0	1	0	1	1	0	0	3
Betal	2	0	9	0	0	0	0	0	0	11
Fiberglass	0	7	1	0	0	0	0	0	0	8
Other	23	7	6	2	0	0	0	0	0	38
Total	1803	725	1077	540	321	64	54	31	17	4632

1985 cases had incomplete data.

Ownership patterns of vessels used by fishermen are crosstabulated with vessel type in Table 17. The shasha is the vessel type least

Table 17. Percent distribution of ownership patterns of boats used by fishermen.

Vessel Type	Vessel Owner				
	Respondent	Other Fishermen	Non-fishermen	Group of Fishermen	Company
Hourí	82.0	10.0	6.9	1.0	0.1
Shasha	98.2	1.5	0.2	0.1	0.0
Shahouf	57.7	6.4	34.6	1.3	0.0
Launch	59.8	16.9	20.5	2.6	0.2
Aluminum	73.7	8.8	1.8	14.9	0.9

likely to be owned by someone other than the fisherman himself. As can be seen in Table 17, 98.2 percent are owned by the fishermen who use them. In contrast, 34.6 percent of the Shahouf and 20.5 percent of the launch used by respondents are owned by non-fishermen. This variance in ownership patterns most likely reflects the relatively high cost of the latter two categories of vessel. The region most likely to have non-fishermen boat owners is the Musandam, where 52 percent of the vessels are not owned by fishermen. The region with the next highest percentage of nonfisherman boat owners is the East, with only 20 percent. It is important to note that these are the two regions having the highest percentage of Shahouf and launches.

Vessels in 1984 Observations made in fishing communities in 1984 found that a fair amount of change had taken place in the composition of the fleet since the 1979 survey. Perhaps the most notable changes include the vast increase in the number of fiberglass vessels and out-board motors, as well as modifications of the shasha on the Batinah Coast. Most of these changes can be attributed to the Fishermen's Encouragement Fund which is discussed elsewhere in this report. Here we will focus on describing the changes observed in March and April, 1984.

Methods used to obtain information on vessels in 1984 differed from the fisherman survey conducted in 1979. In 1984 most of the information was obtained through direct observation and interview of key informants (e.g., fishermen with knowledge of the local fishery). This approach was necessary due to severe time constraints placed on the research.

Two basic methods of direct observation were used: the beach survey and the landing survey. In an area of long, flat beachfront like the Batinah Coast, the beach survey was conducted by driving a vehicle down the beach and counting the occurrence of all vessels. Vessels are parked above the tide line, just outside the fishermen's houses, and if the survey is run at a time when the vessels are all in, the probability is high that all vessels are included. For example, at Sohar the survey was run in the early evening (about 4 to 5 p.m.) on a day when the seas were too high to permit fishing. In other areas the run was made close

to noon when most fishermen are resting. Two individuals counted the vessels; each restricting himself to specific types. In areas where the coast is rocky and mountainous, with cliffs jutting directly from the ocean, as in much of the capitol area, the fishing communities are more concentrated, and a count of vessels can be made by simply walking along the landing spot within the cove where the village is located.

A landing survey consists simply of a vessel and crew size count by vessel type. All vessels landing fish at the landing site are observed and classified by type and crew size. Landings are observed from the first landing in the morning until no more vessels are observed at sea. Binoculars are used to facilitate the count and to determine if there are any boats at sea. On an open coastline like the Batinah Coast, it is possible to see almost all the vessels at sea which will be landing at a site where the observer is stationed. Very few vessels fish beyond the horizon, and those can usually be spotted when the fisherman stands to pull his net or pot.

In the observation of vessel types several major distinctions are made. First, vessels are classified as wood, fiberglass, and aluminum. With both the fiberglass and wood vessels it is possible, in most instances, to make further distinctions. The fiberglass vessels can be roughly categorized into two size groups: large (typically about 10m x 2m) and small (typically about 7m x 1½m). The aluminum vessels are grouped into only one observational category although they ranged in size from about 5 to 7m. For purposes of this report, the wood vessels are categorized into three categories: small houri (6 to 7½m), large houri (10 to 13m), and shui (about 10m). At the beginning of the research the consultants were not aware of all the distinctions used to classify wooden vessels, hence, some of the categories are quite rough, but adequate for the purposes of this report. For example, on the early beach surveys, the distinction between the beach seine vessels (baden and shahuf) and the large plank houri (also known as lanch) was not made by our local assistant, therefore it does not appear in the report in sections concerning the beach survey of the Batinah coast. Where retrospective analysis of field notes and accompanying photographs allow, however, reference to vessels will be as specific as possible.

The shasha will be described in some detail here due to the fact that it is a fine example of the ingenuity of the Omani fisherman with respect to adapting modern materials and technologies to traditional technology. The consultants first saw an Omani shasha at Al Khabura. The shasha is a small (about 15 feet) vessel, pointed on both ends and constructed of palm fronds in the traditional manner¹, but today styrofoam is placed between the layers of fronds for added buoyancy. Additionally, a board is mounted across the vessel approximately four-fifths towards the rear, a hole cut in the floor, and an outboard engine (we observed up to 25 hp.) mounted on the board with the prop extending through the hole. The vessels are apparently quite stable -- they ride relatively high, yet fishermen seem to be able to walk all over the boat while setting and pulling gear.

¹See the Durham Report (1978) for a good description of the traditional Shasha.

The same type of shasha are found from a bit south of Al Khabura to the northern border of the Batinah coast. An added feature in the vicinity of Sohar, however, is an upward extension of the sides with the use of a board approximately eight to ten inches high. Sohar seems to be a center of innovation with respect to the shasha. More variations on the basic vessel were observed there than anywhere else along the Batinah Coast. Some of the Sohar shasha are made of palm fronds and styrofoam with no motor, some are of palm frond, wood motor mount, styrofoam, and have an outboard engine; others have the side built up with boards; others yet use iron rods for ribs, have bare styrofoam bottoms, and an outboard; and finally, some are made of wood (no palm fronds) which forms the bracing and much exposed styrofoam. The wood used to form the sides of the latter type of shasha is nothing but one-eighth inch plywood. It merely holds the styrofoam in place.

The styrofoam for the shasha is purchased in Dubai. Informants stated that both the palm frond and wood shasha cost R100 completely constructed. The wood and styrofoam costs R30; thus, the labor for a wood shasha costs some R70. In Al Khabura an informant stated that a frond shasha has a life expectancy of 9 months to a year. In Sohar, the life expectancy is reported as 6 to 9 months, but the wooden shasha is reported to last a full year.

Vessels along the Batinah Coast, 1984 The examination of vessels along the Batinah Coast will begin with a summary of landings surveys conducted at Barka, Al Khabura, Saham, and Sohar between 11 and 25 March 1984. The surveys were conducted from the time of first landing (usually between 0600 and 0730) until the last landing close to noon.

All landings at the Barka market were observed on 11 March 1984, and the distribution of vessel types and crew sizes can be seen in Table 17. As can be seen in Table 17, fiberglass vessels constitute the

Table 17. Distribution of vessel types and crew sizes landing fish at the Barka, 11 March 1984.

<u>Vessel Type</u>	<u>Crew Size</u>			<u>Total</u>	<u>Percent</u>
	<u>01</u>	<u>02</u>	<u>03</u>		
Fiberglass	5	20	4	29	85
Aluminum	1	1	0	2	6
Small Hourd	<u>2</u>	<u>1</u>	<u>0</u>	<u>3</u>	9
Total	8	22	4	34	

majority of the landings at the Barka market. All vessels were powered by outboard motors. Four of the fiberglass vessels had 2 outboards mounted on the rear -- one as a spare. Overall, the landings represent the activities of 64 fishermen.

All landings at the Al Khabura market were observed on 15 March, and the distribution of vessel types can be seen in Table 18.

Table 18. Distribution of landings at the Al Khabura market by vessel type, 15 March 1984.

<u>Vessel Type</u>	<u>Number</u>	<u>Percent</u>
Shasha	13	54
Small Fiberglass	8	33
Large Fiberglass	2	8
Aluminum	<u>1</u>	4
Total	24	

A larger percentage of shasha are active in the market at Al Khabura than at any of the other markets observed. This impression was reconfirmed when the market was observed on the 25th of March. Although a constant count was not kept, at 9 a.m. there were 6 fiberglass, 1 small dhow, and 8 shasha moored at the market. On both days of observation all of the shasha landing fish at the market were powered by 15 to 25 hp. Yamaha outboard engines. All vessels landing fish were powered by outboard motors.

A landing survey was conducted at the Saham market on 24 March 1984. The results of this survey are presented in Table 19.

Table 19. Distribution of vessel types and crew sizes landing fish at the Saham Market, 24 March 1984.

<u>Vessel Type</u>	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>Total</u>	<u>Percent</u>
Small Fiberglass	2	8	0	0	10	48
Large Fiberglass	0	2	1	1	4	19
Aluminum	3	1	1	0	5	24
Shasha	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	10
Total	7	11	2	1	21	

As can be seen in Table 19, small fiberglass vessels constituted the majority of the landing vessels. All vessels were powered by outboard motors. The modal crew size was two crew members. Overall, thirty-six fishermen landed their harvest at the Saham market on this day.

Landing surveys were conducted at Sohar on 20 and 21 March, 1984. Additional observations were made on 23 March. The results of the surveys are presented in Tables 20 and 21 below.

Table 20. Distribution of vessels and crew size landing fish at the Sohar Market, 20 March.

<u>Vessel Type</u>	<u>Crew Size</u>			<u>Total</u>	<u>Percent</u>
	<u>One</u>	<u>Two</u>	<u>Three</u>		
Small Fiberglass	2	11	4	17	44
Large Fiberglass	0	7	8	15	38
Shasha	0	1	0	1	3
Shasha/wood	0	1	0	1	3
Aluminum	<u>4</u>	<u>1</u>	<u>0</u>	<u>5</u>	13
Total	6	21	12	39	

All vessels landing fish at Sohar were powered with outboard motors. Fiberglass vessels outnumbered all others at the landing on the first day of the survey (20 March). This was not expected due to the fact that the boat survey indicated that over one-half (56%) of the vessels along the Sohar beach are shasha. The few shasha represented in the landing survey may be due to the fact that the seas were extremely rough the previous night and into the early morning hours. Radio broadcasts were also advising boats not to go out. Thus, this first day survey may not be representative of normal landings.

A landing survey was conducted on 21 March after a relatively calm evening the day before and a calm morning. The distribution of crew and vessels can be found in Table 21.

Table 21. Distribution of vessels and crew size landing fish at the Sohar Market 21 March.

<u>Vessel Type</u>	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>Total</u>	<u>Percent</u>
Small Fiberglass	2	7	3	0	12	42
Large Fiberglass	0	0	8	1	9	32
Aluminum	2	0	0	0	2	07
Shasha	<u>5</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>5</u>	18
Total	9	7	11	1	28	

The findings in Table 21 indicate an increase in the percentage of shasha landing fish. Hence, the weather may have affected the results of the previous day.

Little observation has been made of fishing activity on Friday; thus, the Sohar market was visited Friday, 23 March. Friday seems to be the big day for landings at the Sohar Market. This conclusion is based on several observations. First, at nine in the morning on Friday, 23 March, 45 vessels were moored at the beach selling point. This total included 25 small fiberglass, 8 large fiberglass, 6 aluminum, and 6

shasha. Second, the numbers of buyers and sellers on the beach far exceeded the number seen on any other day. Overall, the observed landings involved anywhere from 60 (21 March) to well over 80 individual fishermen. Finally, several informants stated that most people come to market and purchase fish on Friday; thus there is more fishing activity that morning and the preceding night.

Results of beach surveys on the Batinah Coast can be found in Table 22. Where a town (e.g., Sohar) is listed in Table 22, the area covered by the survey is the length of the beach from boundary to boundary. Boundaries were identified by our key informant and may not be totally accurate. The distance covered, however, is as accurate as a vehicle odometer can be when traveling on sand.

Comparing Table 22 with Tables 18 through 21, it is clear that while the shasha is the predominant type of vessel on the beach, it represents a much smaller proportion of the vessels landing at the markets for commercial sales. The only market where shasha landings predominated was Al Khabura, and even there, it was not proportionate to the number of shasha seen on the beach. It is important to note that samples at various stretches of beach indicate that in most cases some 50 percent of the shasha are motorized--the only exception was Saham with 20 percent. Hence, the vessel does represent a moderate investment. Why then were so few landing catches at the market? Tracks left from dragging the shasha onto the beach (skid marks) indicate that more are fishing than landing fish at the market, but the numbers are small in proportion to the total number of shasha that they are insignificant. Perhaps, the time period the consultants visited the Batinah Coast (March 1984) did not correspond to the time of year that the shasha is typically used. Overall, however, the proportion of vessels landing catches at the markets is unexpectedly small, and observations of skid marks and binocular aided observations of fishing activity from landing sites suggest that only a proportion of the vessels are fishing on any given day.

For example, at Saham, of all the boats counted, including a large proportion of Shashas, 5 percent appeared at the Saham market to land fish; 16 percent of the fiberglass and aluminum boats and less than 1 percent of the shashas. Yet of all the shasha present, 25 percent had tracks leading from their beaching site to the sea. This figure was 40 percent for fiberglass and aluminum boats. Little can be safely concluded from this one day's observation except that the newer boat types appear to have encouraged production beyond owner and crew family consumption as investment in them was designed to do.

Vessels in Muscat-Mutrah area, 1984 The configuration of the coast in the Muscat-Mutrah area is not conducive to the type of beach survey of vessels that was conducted along the Batinah coast. Additionally, it is difficult to count vessels along the small beaches of the fishing communities because of varying fishing hours -- men are out fishing, at the market, or traveling between the market and home at various times

Table 22. Distribution of vessel types along the Batinah Coast.

Location	Distance (km)	Vessel Type					Density of Vessel Type per km				
		Shasha	Large Houri	Small Houri	Fiber- glass	Alumi- num	Shasha	Large Houri	Small Houri	Fiber- glass	Alumi- num
21.1K S. Shinas Market to 27.4K N.	48.5	413	69	11	32	33	8.5	1.4	0.2	0.7	0.7
Sohar boundary to 5.5 N.	5.5	73	35	21	35	9	13.3	6.4	3.8	6.4	1.6
Sohar	14.3	265	61	11	92	44	18.5	4.3	0.8	6.4	3.1
Sohar to Saham	12.1	155	13	3	13	22	12.8	1.1	0.2	1.1	1.8
Saham	16.2	224	18	5	45	76	13.8	1.1	0.3	2.8	4.7
Al Khabura	16.9	367	34	6	68	15	21.7	2.0	0.4	4.0	0.9
Al Khabura boundary to 27.6K S.	<u>27.6</u>	<u>491</u>	—	<u>8</u>	<u>163</u>	<u>42</u>	<u>17.8</u>	—	<u>0.3</u>	<u>5.9</u>	<u>1.5</u>
Total	141.1	1988		65	448	241	14.1		0.5	3.2	1.7

during the day. Some fishermen go to check pots in the early morning, some set nets in the late afternoon, and some in the late evening. Hence, one of the best indicators of fishing activity is the market survey, but it also has limitations: sometimes vessels coming to the Mutrah fish market carry the catch of several vessels.

A landing survey conducted on March 29 at the Mutrah fish market found 126 vessels landing fish: 119 fiberglass, 4 aluminum, and 3 small houri. Twenty-nine percent of the vessels had two outboard motors -- one a spare. Twenty-three vessels had crews of three, 44 crews of two, and 59 had only one crew member; thus, the landings on that date involved 216 fishermen. The following day (a Friday) some 180 vessels landed fish at the market -- a 50 percent increase. Nevertheless, these landings represent only a fraction of the fishermen in the area -- in 1983 alone the Fishermen's Encouragement Fund is reported to have subsidized 456 vessels and 340 engines in the Capitol area.

Interviews made in fishing communities around the Muscat-Mutrah area (e.g., Qurm, Darsait, Ash Shutayfi, Sidab, Al Bustan, and Quantab) indicate that not all vessels fishing on a given day take their catches to the fish market. If the catch is not large, it may be used for home consumption and the remainder sold in the vicinity of the fishing community. Additionally, as was mentioned above, fishermen sometimes pool their catches, and one vessel will take the catch of several to the market. Finally, since some fishermen have other jobs, not all fish every day. These factors combine to make a landing survey an imperfect measure of either fishermen or vessels in the Capitol area.

The one definitive statement that can be made about the vessels is that the majority are fiberglass today. Only a few aluminum and wood vessels are being used in the Muscat-Mutrah area. To the north of the city, around Qurm, the large houri (shahuf) used for beachseining is seen with increasing frequency on the beach, but it is still outnumbered by the fiberglass boat.

Vessels in Sur - Al Ashkara Region (1984) Driving conditions (rocks, cliffs, sand conditions) would not allow a beach survey of the type conducted on the Batinah; hence, vessel counts must be treated with caution. A count of vessels along the crescent-shaped beach that fronts Sur was conducted in the early evening of 8 April 1984. The results of this count can be found in Table 23.

Table 23. Vessel count at Sur, early evening, 8 April.

<u>Type</u>	<u>Number</u>	<u>Percent</u>
Shu'i	20	32
Fiberglass	21	33
Small Houri	17	27
Aluminum	<u>5</u>	8
Total	63	

Table 23 should be viewed with caution, since early evening is the time that some vessels are departing for nighttime driftnetting for kingfish and tuna. For example, when the count was made, there were no launch (large houri) in the harbor, yet landing surveys conducted on the 8th and 10th include a significant number of launches. The results of these landing surveys can be found in Table 24.

Table 24. Landing survey vessel counts, 8 and 10 April, Sur.

<u>Type</u>	<u>8 April</u>		<u>10 April</u>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Shu'i	25	56	24	63
Launch	11	24	6	16
Small Houri*	7	16	8	21
Fiberglass*	2	4	0	0
<hr/>				
Total	45		38	

*Used for transporting fish from larger vessels to shore.

The fiberglass vessels and small houri listed in Table 24 were used only to move fish from the larger vessels to shore. Informants stated that during the kingfish and tuna season, the smaller vessels are not used -- fishermen use the larger vessels and concentrate on the high-priced species. An informant also stated that there are some 300 launch and 200 shu'i in Sur, 100 of which are inactive due to crew shortage. This large fleet was not visible, and it was not possible to ascertain its location; thus, the information is doubtful.

Very little fishing activity could be seen to the north of Sur along the beach. Much of the beach could be seen from the high cliffs, and the only activity visible was at a location some 25 km up the coast (Labab) where 2 fiberglass vessels and 3 small houri were beached.

South of Sur the next large concentration of fishing activity is at Al Ashkara. A landing survey was conducted there on 9 April, and the results can be found in Table 25.

Table 25. Landing survey vessel counts, 9 April, Al Ashkara.

<u>Type</u>	<u>Number</u>	<u>Percent</u>
Shu'i	31	56
Launch	9	16
Small Houri*	<u>15</u>	27
Total	55	

As at Sur, the small houri are used to carry fish from larger vessels to the shore. Eight fiberglass vessels were high and dry on the Al Ashkara beach, apparently not being used at this time of the year.

A small concentration of vessels to the north of Al Ashkara was also visited on April 9. There, two launch were fishing offshore, and 8 small houri, 4 fiberglass, and 5 aluminum vessels were resting on the beach.

Overall, the preponderance of vessels in the Sur - Al Ashkara area appears to be the larger wood vessels - the shu'i and the launch. At the time of the research smaller vessels were either inactive or used only to move fish from the larger vessels to shore.

Vessels on Masira (1984) The main concentration of fishermen and vessels is found at the northwest corner of the island, adjacent to the military installations. The results of a vessel count made along the beach in this area can be found in Table 26.

Table 26. Beach vessel count on northwest tip of Masira, April 6.

<u>Type</u>	<u>Number</u>	<u>Percent</u>
Shu'i	5	12
Launch	21	49
Small Houri	10	23
Aluminum	5	12
Fiberglass	<u>2</u>	5
Total	43	

Vessel counts were also made at five other small fisherman concentrations around the island. On the eastern side of the island, three small sites were visited, and on the western side, two. The results of these vessel counts can be found in Table 27.

Table 27. Vessel counts along beach at small sites on the west and east coasts of Masira.

<u>Type</u>	<u>East Coast</u>		<u>West Coast</u>		<u>Total</u>	<u>Percent</u>
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>		
Small Houri	16	64	10	63	26	63
Aluminum	4	16	5	31	9	22
Fiberglass	<u>5</u>	20	<u>1</u>	6	<u>6</u>	15
Total	25		16		41	

As can be seen in Table 27, the majority of the vessels in the smaller fishing communities visited on Masira are small wood houri. No shu'i or launch were seen at the smaller villages. All vessels were motorized.

Vessels along the coast from Mahout to Ras Madraka (1984) A total of seven fish landing sites were visited along this rocky, barren coastline between 31 March and 4 April 1984. In general, the number of vessels actually seen on the beach never corresponded to the reported number of fishermen or vessels with the exception of Mahout.

Moving from south to north, the first site visited is Ras Madraka. No boats were visible, but several drift nets were stored on the beach. The informant said there were some 20 to 30 fishermen who use small wood houri. Shuyel is the next site to the north visited. There, only three small houri were visible at the landing. At Duqm, it is reported that some 20 to 30 vessels use the landing. While at the site, only four houri appeared to be active, although some 13 drift nets were stored on the beach. The next site visited to the north of Duqm is Am Fuun (Nafuun?). In the late afternoon only 11 small houri were on the beach, but the Wali from Duqm said that 45 houri are located there. Continuing north, the next site visited is Halat, where a reported 20 houri land their catches. At Zahar, some 60 km north of Halat, eleven small houri were on the beach, along with one fiberglass vessel crewed by a fisherman from Mahout. In general, one can only report with some confidence that the principal vessel type used along this portion of the coast up to Zahar is the small wooden houri powered by outboard motor. Only one fiberglass vessel was seen along the entire coastline from Ras Madraka to Zahar, and it belonged to a fisherman from Mahout. Vessels actually seen were much less than reported numbers, although attempts were made to visit sites when fishermen would not be out fishing and the horizon was scanned with binoculars around each landing site.

In contrast, Mahout Island represents a real concentration of fishermen. There, 118 houri (small to medium sized), 10 shu'i, and 2 fiberglass vessels were anchored in the water or just at the water's edge. Another 51 launches and 15 shu'i were high and dry on the beach. Many of the launches and shu'i on the beach were in ill repair. All operational vessels appeared to be mechanized.

It should be noted that at the landing near the Mahout Workshop on the mainland, which serves primarily Mahout, 13 small houri were anchored. They were most likely from Mahout, as suggested by an informant interviewed at the landing.

The next fish landing to the north of Mahout is Negder, which serves principally as a landing place for fish from Masira. In the early afternoon of 4 April, there were 4 fiberglass vessels, 16 small houri, and 8 shu'i anchored or beached near the landing.

Vessels in Dhofar Region (1984) For the most part, the vessels in the Dhofar Region are aluminum. This contrasts greatly with other regions visited, especially the Batinah Coast where fishermen found that the aluminum vessel suffered from metal fatigue after little use because

of local landing conditions and procedures. The fishermen in Dhofar, however, appear to be satisfied with the aluminum vessel.

Five landing sites were visited in the Dhofar from 11 to 14 April 1984: Mugsail, Raysut, Taqah, Mirbat, and Hasik. There are two major landing sites at either end of a long sandy beach at Mugsail. A total of 86 vessels were on the beach, 65 aluminum and 21 fiberglass. Some of the fiberglass vessels are hard to identify from a distance due to the fact that they are patterned on the aluminum vessel. Raysut, another fish landing site, is located adjacent to a major harbor. There, a total of 133 vessels were on the beach: 88 aluminum, 30 fiberglass, and 15 small wood houri.

Two fish landing areas were visited at Taqah which had a total of 29 aluminum vessels on the beach. At least ten vessels, and possibly more, were out fishing at the time as evidenced by the 10 vehicles parked at the landing spot. Sometimes one vehicle will transport several fishermen and the catches from several vessels. During a flight over Taqah two days later, 57 vessels and 18 vehicles were counted on the beach in the early afternoon. Mirbat also has two fish landing spots, both of which were visited. At the first, seven aluminum vessels and one small houri were counted at the landing. At the second landing in Mirbat, a total of 21 aluminum, three fiberglass vessels, and one houri were counted. Finally, Hasik is reported to have 60 regular fishermen (up to 100 of occasional fishermen are counted) and some 40 vessels -- most were out fishing during our limited visit there. Only 10 aluminum and one fiberglass vessel were visible on the beach.

GEAR The survey conducted in 1979 included a question concerning gear types used during the past year. Responses to this question were cross-tabulated with region, and the results are presented in Table 28.

Table 28. Percent distribution of gear types used.

<u>Region</u>	<u>Gear Used During Last Year</u>						<u>N</u>
	<u>Gill Net</u>	<u>Cast Net</u>	<u>Troll Line</u>	<u>Hand Line</u>	<u>Traps</u>	<u>Other</u>	
Capitol	80.1	62.8	12.6	85.1	32.9	5.8	709
Masira	99.0	99.0	1.0	98.1	0.0	0.0	104
Unknown	93.9	70.6	35.9	75.1	49.8	0.8	245
Dhofar	23.4	88.5	8.1	97.2	30.4	8.3	1408
East	63.1	78.7	2.2	74.1	16.3	0.8	957
S. East	93.3	73.4	7.2	52.5	26.1	1.2	417
S. Batinah	87.6	76.7	28.3	90.3	68.3	0.4	1419
N. Batinah	93.0	46.8	28.8	88.8	80.6	5.0	1079
Musandam	83.9	26.5	57.0	90.7	50.9	0.7	279

6617

Note: Row sums exceed 100% because an individual can use more than one gear type.

All gear types are employed in the Capitol region, but the most widely used are handlines and gillnets. No traps were employed on Masira at the time of the 1979 survey, but handlines, cast nets, and gillnets were used almost universally. The predominant gear in Dhofar is the handline followed by the cast net. In the east region, no one gear was employed by over 80 percent of the fishermen interviewed, but the cast net and handline were most widely used. In the Southeast, the predominant gear type is the gillnet. Fishermen on the Batinah Coast use a wide range of gears and manifest the highest percentage of trap use in Oman. Finally, the Musandam is also characterized by a wide range of gears with the handline predominating.

FISHING GEAR (1984) To a large extent the employment of various gears depends on the types of fish available or the fishing season. Therefore, the observations made in March and April of 1984 could be, to a greater or lesser extent, the result of the time of year. Nevertheless, these observations combined with the 1979 survey data will help fill out the techno-environmental matrix for the sociocultural analysis.

Batinah Coast All types of gear surveyed in the 1979 study were seen along the Batinah Coast in March and April of 1984. At the time of our observations, however, cast nets were not being used. This is probably due to the fact that the sardine and anchovetta were just beginning their migration down the coast.

Gillnets are deployed in several ways in communities along the Batinah Coast. Netting material is imported and is almost exclusively multifilament nylon. At the time of observation, most were used as fixed nets. The pen type fixed net described in the Durham Report (1978) was only seen at Barka. Linear types of fixed nets were seen at all other locations to the north of Barka. Fishermen report checking their fixed nets daily, usually in the early morning hours. Drift nets are usually deployed in the late evening and pulled several hours later. The fish are brought to market beginning at dawn.

Many fishermen at all locations along the Batinah Coast use traps. Most who were interviewed report that they deploy between five and fifteen traps. A few used less than five or as many as 50. Material for the traps is frequently bought in kit form (e.g., pre-cut wire mesh, steel cable, etc.) from Dubai and assembled by the fisherman himself. The traps are shaped like flat-bottomed domes with an intrusive cone shaped entrance on the side (The Durham Report provides good illustrations). The most common sizes are approximately five feet and eight feet in diameter. Traps are set in areas where bottom fish are known to be concentrated. In some areas from Al Khabura northward, artificial fish attracting areas are created by tying together bundles of brush, weighting them with stones or other heavy material, and sinking them to form artificial "reefs". Pots are then set near the man-made attracting areas. Frequency of checking traps usually depends on the number of traps. A man with four or five may check them all every two or three days. A man with 50 may check ten of the fifty each day; hence, any given trap will be checked every five days. Most fishermen, however, check their traps on Friday morning to sell the catches at the large Friday market.

A type of fishing not surveyed in the 1979 study which is quite common along the Batinah Coast is beach seining for sardine or anchovetta. These fish were just beginning to spread down the coast in late March, 1984, and beach seining was the most commonly observed fishing activity from Shinas northward. All activities observed used the jaruf system as described in the Durham Report. A vessel (a shahouf) loaded with net deploys the net, one end secured ashore, around a school of sardines or anchovetta and brings the other end to shore. Depending on the length of net and amount of fish, anywhere from 10 to 30 men then pull the net into shore. It was reported that four-wheel-drive vehicles are sometimes used in hauling the net, but this was not observed.

Capitol Area All gears discussed for the Batinah Coast are also used in the Capitol area, but in different proportions. For example, in areas close to the main port or its approaches, fishermen are prohibited from using fixed gear. This prohibition has decreased the amount of fixed gear, and there is a subsequent increase in the use of driftnets. Hence, most fishermen in the Capitol area must now fish at night, in contrast to the early morning checking of fixed gear (pots and fixed nets). Fishermen in the Capitol area also possess a wider variety of gillnets, which are used for various species.

There is also geographical variation in gears which is related to the technological and physical environment. As noted above, fixed gear is prohibited in certain areas due to large ocean-going traffic. Fishing communities close to the port and its access routes are thus less likely to deploy fixed gear. In one community (Ash Shutayfi) most of the fishermen use only handlines. Cast nets are used to capture live bait. Their location in a cove just west of the main port with all its oceangoing vessels mitigates against the use of nets or traps. Additionally, the Capitol area is characterized by a rocky, mountainous coastline with cliffs jutting abruptly from the water. The northern extremes of the Capitol area, however, blend into the Batinah Coast environment, with long stretches of sandy beach. It is thus only on the long expanses of sandy beach (e.g., around Qurm) that beach seining is practiced in the Capitol area.

Sur-Al Ashkara During the research (April 1984) practically all the fishermen in the Sur-Al Ashkara area were focusing their efforts on kingfish and tuna, fishing with large drift nets from shu'i and launches. It was reported that pots and smaller drift nets are used from smaller vessels when the tuna and kingfish runs are light. Only a few pots were seen on the beach, and they were of the type described for the Batinah Coast. No fixed gear was seen in the water in early April. It was also reported that most fishermen, at some times, use handlines baited with live bait caught with cast nets.

Masira Almost all the fishermen on Masira used gillnets (only a few fixed), cast nets, and handlines. No traps were reported or seen during the research period.

Coastline from Mahout to Ras Madraka Only handlines, gillnets, and cast nets were seen being used during the research period. It was

reported that some fishermen use traps, but none were in evidence in early April 1984. Very few fixed nets were seen in the water, and all were linear.

Dhofar Cast nets, troll lines, handlines, and drift nets are the most frequently used gear in the Dhofar region. Some traps were reported, but none were seen. Lobster fishermen were interviewed only at Hasik, and they reported that they only use a mask and spear, no complex diving gear or traps. This may differ in other locations where interviews concerning lobster were not conducted.

SOCIAL STRUCTURE OF FISHING In this section the focus will be on several aspects of the social structure of fishing. First, ownership patterns will be discussed. This will be followed by a brief discussion of crew structure, including relationships between crew members and systems for dividing the catch. Finally, the occupation will be described in terms of full-time and part-time fishing along with a consideration of alternative and/or supplemental sources of income.

OWNERSHIP PATTERNS Ownership patterns are examined in terms of vessel type in the section on vessels (see Table 17). There it was demonstrated that the larger, more expensive vessels were more likely to be owned by non-fishermen. At the time that the survey was conducted (1979) shasha were least likely to be owned by non-fishermen, and the shahouf, the most likely. Very few vessel types manifested high percentages of company or group of fishermen ownership.

The same kind of relationships held in 1984. It was at Sur and Al Ashkara that non-fishermen owners waited onshore to evaluate the landings of their launch and shu'i. And it was the smaller vessels -- the fiberglass, aluminum, and shasha -- that were most likely to be owned by the fisherman himself. It was said by some in both Sur and Al Ashkara, that the proliferation of smaller vessels and motors drew crew away from the larger vessels, thus increasing the number of owners who were forced to fish themselves in order to have an adequate crew.

CREW STRUCTURE In general, crew size varies according to vessel size -- the larger the vessel, the larger the crew. For example, the smallest of the vessels used, the shasha, usually has a crew of one. The aluminum and fiberglass vessels, which are larger, usually have crews of two, and crews of three, when seen, are most frequently associated with the larger fiberglass vessel type (see tables 17 through 21). The shu'i and launch usually have crews of from three to six, with four or five being the most frequent crew size.

In the larger vessels crew size is influenced by net size. The larger the net, the more fishermen needed to pull it. Hence, shu'i with large nets will carry crews of four or five, while vessels with smaller nets can make do with three or four fishermen.

The largest crews in the coastal fishery are the beach seine crews. The usual crew size is about 16 to 18 men. Seven or eight men are pulling in each side of the net, and one or two are in the vessel helping to keep the net in shape. Near the end of the pull, they also help haul the net onto the beach. During the research, crews as large as 30 were seen operating a beach seine.

Relationships between crew members also vary. In smaller crews, the members are frequently from the same family -- father and son, brothers, or some other close family relationship. If not close family, they are frequently neighbors and friends. As crew size increases, however, it is less likely that the vessel and gear owner will find enough family members to work with him. Nevertheless, the preference is for family, and this type of relationship will be found among the largest of crews, but it will be less frequent. Family members are found less frequently on vessels owned by non-fishermen.

Systems for dividing the catch are influenced by several factors including relationships between crew and owner, size and cost of gear and vessel, and fishing type. Beginning with the most common vessel types -- the small wooden houri, shasha, aluminum, and fiberglass vessels (most of which are mechanized) -- the most frequently encountered system for dividing the catch is to divide it into one equal share for each crew member and the vessel (including gear). In most cases, costs for fuel and oil are deducted before dividing the proceeds into shares. A few report that fuel costs are deducted from crew shares.

Larger, more expensive vessels, such as the shu'i fishing from Sur and Al Ashkara, provide larger shares for the vessel and gear, since they represent a sizeable capital investment. Two different systems were encountered for these large vessels. The first, and most common, is to divide the total catch into three equal parts: one for the vessel and two for the crew. Costs for fuel and food are deducted from the crew shares. The second system encountered was to first deduct fuel costs and then divide the catch into two equal shares: one for the vessel and one for the crew.

Only one system was reported for beach seining along the Batinah Coast. There the catch is first dried, divided into equal sized mounds which are put into 50 kilogram feed bags, and two-thirds of the bags are divided among the crew (which can vary between 15 and 30) and one-third goes to the boat and gear.

The systems reported here are as described by the fishermen. They are ideals which vary somewhat in practice. For example, when crewmembers belong to the same household, the proceedings are often pooled into the household. If one or more of a crew are sons of the vessel owner and still live in his household, the proceeds go to the household, and the father gives the sons "what they need". In some cases where there are extraordinary costs at the beginning of a fishing season, the owner and crew may agree that all profits above those actually needed by the crew will revert to the vessel and gear to cover expenses. Normal sharing will begin after the extraordinary expenses are covered.

Finally, as is common in most small-scale fisheries, systems of "welfare" and/or reciprocity result in some of the catch being given to children who help unload and/or carry the catch to the selling point. Frequently these children are those of fishermen who did not (or could not) go fishing that day. In this case, the fishermen expect like treatment on days that they do not (or cannot) go fishing. The children may also be those of poor families or of fishermen who can no longer go fishing because of injury or illness.

SUPPLEMENTAL INCOME SOURCES Fishermen were asked in the 1979 survey if they had sources of income other than fishing. They were also requested to identify the sources. The results of the analysis of responses this question crosstabulated with region can be found in Table 29.

Table 29. Supplemental income sources crosstabulated with region.

Region	Other Source of Income (Percent)					Total*
	Agriculture	Trade	Industry	Government	Other	
Capitol	1.4	0.3	0.1	7.3	1.8	10.4
Masira	0.0	0.0	0.0	58.7	11.5	70.2
Unknown	17.1	2.9	0.0	4.9	4.9	28.2
Dhofar	1.1	0.2	1.6	30.4	1.3	34.2
East	0.1	0.0	0.0	0.0	0.2	0.3
S. East	4.1	0.2	0.0	0.5	0.7	5.5
S. Batinah	4.4	0.6	0.2	1.1	1.1	6.9
N. Batinah	4.7	0.4	0.2	1.0	0.8	7.0
Musandam	1.8	0.4	0.0	3.6	0.7	6.5
All Regions Combined	3.1	0.4	0.4	8.9	1.3	13.8

N = 6617

*Total may not equal sum of row because an individual may have more than one alternative source of income.

Table 29 indicates that Masira fishermen are the most likely to have income outside of fishing. There, some 70 percent of the fishermen report other sources of income, with most of them obtaining this other income from the government. In Dhofar, where a little over one-third of the fishermen report outside income, the reported source for most is once again the government. The government appears to be the major source of outside income for fishermen. Overall, the government is the outside source of income for 8.9 percent of the fishermen interviewed. This is followed by agriculture which provides outside income for 3.1 percent of fishermen. Overall, 13.8 percent of the fishermen report that they have income from sources other than fishing.

These findings are consonant with observations made in 1984. In 1984, respondents in Masira and Dhofar were the most likely to report that they had another occupation, usually some government job. The government job was usually full-time, but fishermen reported that they still had time to obtain adequate catches in the afternoon after work, or in the evening and early morning before work. In cases such as these, however, fishermen relied on either middlemen or the National Fish Company to do the marketing, in contrast to full-time fishermen who do most of the marketing themselves (see section on marketing and distribution).

In an attempt to determine the characteristics of fishermen who had supplemental income, supplemental income was crosstabulated with age (dichotomized at the mean), literacy status, and boat ownership. The results of these analyses can be found in Tables 30 to 32.

Table 30. Age crosstabulated with supplemental income.

<u>Age</u>	<u>Other Income</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
Below mean (35)	3141	595	3736
Above mean (35)	<u>2517</u>	<u>318</u>	<u>2835</u>
Total	5658	913	6571

46 cases had incomplete data for age.

Table 31. Literacy crosstabulated with supplemental income.

<u>Literate</u>	<u>Other Income</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	5111	614	5725
Yes	<u>591</u>	<u>301</u>	<u>892</u>
Total	5702	915	6617

Table 32. Boat ownership crosstabulated with supplemental income.

<u>Boat Owner</u>	<u>Other Income</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	1477	506	1983
Yes	<u>4225</u>	<u>409</u>	<u>4634</u>
Total	5702	915	6617

Table 30 indicates that younger fishermen are slightly more likely to have an outside source of income than older fishermen (15.9 versus 11.2 percent respectively, $\chi^2 = 29.88$, $p < .001$). Table 31 demonstrates a much stronger relationship between literacy and outside sources of income. While slightly over one-third (33.7 percent) of literate fishermen have other sources of income, only about one-tenth (10.7 percent) of the non-literate fishermen do. This difference is also statistically significant ($\chi^2 = 343.20$, $p < .001$). Finally, Table 32 indicates that there is a relationship between boat ownership and having another source of income: boat owners are less likely to have an outside source of income than non-owners (8.8 versus 25.5 percent respectively, $\chi^2 = 324.67$, $p < .001$).

Age, literacy status, and boat ownership were also crosstabulated with outside income from agriculture and government -- the two higher frequency sources of outside income. The results of these crosstabulations can be found in Tables 33 through 38.

Table 33. Age crosstabulated with outside income from government.

<u>Age</u>	<u>Income From Government</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
≤ 35	3319	416	3735
> 35	<u>2661</u>	<u>174</u>	<u>2835</u>
Total	5980	590	6570

47 cases had incomplete data.

Table 34. Boat ownership crosstabulated with outside income from government.

<u>Boat Owner</u>	<u>Income From Government</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	1581	402	1983
Yes	<u>4444</u>	<u>189</u>	<u>4633</u>
Total	6025	591	6616

1 case had incomplete data.

Table 35. Literacy status crosstabulated with outside income from government.

<u>Literate</u>	<u>Income from Government</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	5360	364	5724
Yes	<u>665</u>	<u>227</u>	<u>892</u>
Total	6025	591	6616

1 case had incomplete data.

Table 36. Age crosstabulated with outside income from agriculture.

<u>Age</u>	<u>Income from Agriculture</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
≤ 35	3641	94	3735
> 35	<u>2727</u>	<u>108</u>	<u>2835</u>
Total	6368	202	6570

47 cases had incomplete data.

Table 37. Literacy status crosstabulated with outside income from agriculture.

<u>Literate</u>	<u>Income From Agriculture</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	5547	177	5724
Yes	<u>866</u>	<u>26</u>	<u>892</u>
Total	6413	203	6616

1 case had incomplete data.

Table 38. Boat ownership crosstabulated with outside income from agriculture.

<u>Boat Owner</u>	<u>Income From Agriculture</u>		<u>Total</u>
	<u>No</u>	<u>Yes</u>	
No	1940	43	1983
Yes	<u>4473</u>	<u>160</u>	<u>4633</u>
Total	6413	203	6616

1 case had incomplete data.

Tables 33 through 38 indicate that while age, literacy status, and boat ownership status have very little influence on whether or not a fisherman has outside income from agriculture, there is a relatively strong relationship between these variables and outside income from some sort of government job. For example, 11.1 percent of the younger fishermen obtain outside income from the government in contrast to only 6.1 percent of the older fishermen ($X^2 = 49.3$, $p < .001$). While only 4.1 percent of the fishermen who own their own boat have outside income from the government, fully 20.3 percent of the non-boat-owning fishermen have this type of outside income ($X^2 = 447.6$, $p < .001$). Finally, only 6.4 percent of the illiterate fishermen have government jobs in contrast to a little over one-fourth (25.4 percent) of the fishermen who can read ($X^2 = 345.7$, $p < .001$).

In contrast, the relationship between outside income from agriculture and the three independent variables is very slight, less than one and one-half percent difference in all cases. For example, 2.5 percent of the younger fishermen have outside income from agriculture in contrast to 3.8 percent of the older fishermen ($X^2 = 9.04$, $p = .003$). Outside income from agriculture is obtained by 2.9 percent of the literate fishermen and 3.1 percent of the illiterate. This difference is not even statistically significant ($X^2 = 0.08$, $p = .775$). Finally, 3.5 percent of the boat owners and 2.2 percent of the non-boat-owning fishermen report outside income from agriculture ($X^2 = 7.71$, $p = .006$). Although two out of three of these latter chi-square values are what would normally be considered statistically significant, the percentage

differences are so slight that the differences have no practical significance.

It is important to note that these "part-time" fishermen catch significant amounts of fish, which can add significantly to their income. For example, two military men interviewed upon landing fish at Taqah brought in 20 large kingfish they caught using handlines from an aluminum boat. They spent only five hours fishing (1330 to 1830). They reported that they would sell the fish to the Oman National Fish Company for about two to three Reals apiece. After deducting 5 reals for gasoline, these two men will have earned somewhere between 35 and 55 Reals, which works out to between \$52.50 and \$82.50 for each fisherman. Two other vessels landing at about the same time were not as fortunate -- one had 10 large kingfish and the other had 8. They reported, however, that the two previous days had been much better for all the military men who fished from this particular spot -- they claimed that they all got at least 70 fish.

Summing up the examination of fishermen with supplemental income from sources other than fishing, it is possible to make several generalizations. First, those with outside income are most likely to be from either Masira or Dhofar. They probably work in a government job, are usually 35 years of age or less, do not own their own boat, and are literate. They are also a significant part of the fishery in terms of both landings and income.

THE MARKETING SECTOR

INTRODUCTION The most general statement that can be made about the marketing sector of the Omani fishery is that it is for the most part a free market filled with individual entrepreneurs who respond to the forces of the free marketplace. Due to the differences in infrastructure and the physical location of the population and fishermen, the process of fish marketing differs in the various areas of Oman. Hence, this section of the report first examines marketing on a regional basis beginning with the Batinah Coast.

MARKETING AND DISTRIBUTION OF FRESH FISH ALONG THE BATINAH COAST Five fish markets were visited along the Batinah Coast: Barkah, Al Khabura, Saham, Sohar, and Shinas. These markets exhibited several characteristics in common which will be examined first. Following the discussion of general characteristics, brief descriptions of several of the markets will be provided to give the reader a feel for some of the specific characteristics of the fresh fish market on the Batinah Coast.

Fishermen along the Batinah Coast have several options for selling fish. First, if catches are small, they can go directly to shore, close to their residence, and sell fish to a few neighbors who are steady customers. If catches exceed this outlet, they then have several other options: (1) They can land the fish at the central market of their town, spread the fish out on a mat, and sell directly to whoever wants to buy -- consumer or middleman; (2) they can land the fish, make a deal with a middleman, and sell the entire catch to him; (3) they can land the catch and have an auctioneer auction the catch to the highest bidder. In addition, various combinations of the three basic techniques can be used with different portions of a day's catch.

In general, the market is open and free. Fishermen are free to use the technique they prefer and maximize whatever is of value at the time of landing. If they place a high value on time, they can sell the lot directly to a middleman or through an auctioneer. If time is not the deciding factor on a given day, they can spread out a mat and spend some time selling the fish themselves.

Various factors influence whether or not a fisherman has the time to sell the fish themselves, directly to the consumer. First, the time spent fishing is usually not excessive. A man generally goes out about 4 or 5 in the morning, checks his fixed gear and is back to the beach around 8 or 9 a.m. Hence, he has both the time and energy to sell the catch. If he has another job, however, he may prefer to sell the fish as rapidly as possible so that he can get to work on time. Another consideration is the time he lands the fish. If the fish are landed late -- 10 a.m. or later, the most rapid selling technique is preferred since the market is generally closed prior to noon.

The marketplace also serves several functions for fishermen besides the selling and buying of fish. The marketplace is a location of intense social interaction. Fishermen meet other fishermen, townsmen, and middlemen. All are engaged in friendly competition with one another, while engaging in conversation, joking, and other transactions.

Since the fish market is usually adjacent to town center (coastwise), fishermen can also engage in shopping for goods for the home after selling their fish. Fishermen were almost always observed loading their vessels with other market purchases -- groceries, alfalfa, petrol, etc. The availability of these other markets is thus important to the fisherman so that he can perform several necessary purchases while expending a minimum of energy.

A final important characteristic of the fresh fish market along the Batinah Coast is that there seems to be a premium on freshness. Recently caught fish, uniced, and just brought ashore demands a premium price. Because of their proximity to the shore and a plentiful fish supply, the residents of the Batinah Coast are quite demanding with respect to the quality they expect in their fish. They do not like iced fish and will not purchase it if they can buy fish fresh from the boat. They take time off from work to get to the market to buy the freshest fish. For example, policemen in uniform can be observed making purchases of fresh fish at 9:30 or 10 a.m. to be taken home and cooked later. Additionally, the fishermen and auctioneers emphasize the freshness of the fish they are trying to sell. Fish less than fresh are frequently rejected outright. On numerous occasions fishermen were observed angrily reloading rejected fish onto their vessels -- fish that remained in the gill net too long, that were spoiled by the heat during the journey to shore, etc. The premium on freshness is reflected in the price of fish which drops rapidly as noon approaches as well as the low prices paid for iced fish when fish fresh from the boat is available.

BARKAH FRESH FISH MARKET The configuration of the shallow, sandy bottom at Barkah makes it impossible to moor directly adjacent to the beach when the tide is low. Fishermen anchor just beyond a small sand bar (exposed only at low tide) and carry their catch, small basketloads at a time, to the middlemen and consumers. Large fish (e.g., kingfish or billfish) are carried one or two at a time, and very large fish (shark) may be left on the sand bar, cut up, and carried in a piece at a time. Sometimes fishermen wait for high tide to float larger fish to the marketing point.

Middlemen gather in a small, open building, along with the auctioneer, awaiting the arrival of the landings. When fish are landed, some middlemen rush to the beach and approach the fisherman as he carries his catch to the auction. They begin making offers, and if the fisherman is satisfied, he can sell at the beach. If not, he enters the auction building with his catch, and it is auctioned to the highest bidder. Some ten to fifteen buyers crowd the auctioning shed from the first arrival of fish (about 7 a.m.) until landings begin to slack off (about 10 a.m.). After this time a few remain to bid on catches that trickle in until about noon.

Some middlemen come with small pickup trucks and purchase fish for distribution inland. Others come in from the UAE with fish to be sold at Barkah and take different species of fish back to the UAE. A few buyers load their purchases into baskets slung over the backs of donkeys to be sold 10 to 15 km inland. Finally, some 25 dealers sell their purchases directly to consumers and/or other middlemen.

There are three distinct selling locations in the Barkah market: (1) a fully enclosed marketing site, devoted entirely to fish, where the fish are displayed on a concrete slab floor directly in front of the seller; (2) tables on either side of the entrance to the enclosed fish market; and (3) mats on the ground across the road from the auctioning shed which is adjacent to the enclosed fish market. On a representative day, thirteen dealers displayed their wares inside the market, six sold from the outside tables, and a varying number (five to seven) displayed relatively small amounts of fish on their mats across the road.

AL KHABURA FRESH FISH MARKET The market at Al Khabura is located 9.7 km from the north boundary of the town's beach and 7.2 km from the south. The new workshop is located 2.6 km southward along the beach from the market; hence it is in a less central location than the market.

Fish are sold in two locations at the Al Khabura market. A shed (open on all sides) approximately 50 feet long and 16 feet wide is on the beach side of a short extension of the unpaved road that leads to the beach/market areas. The shed has a corrugated roof supported by posts. The fish are placed on wooden platforms raised by stones at each end. Fish sold from this location are sold principally by middlemen and consist of larger fish which are cut into pieces for sale. Some strings of fish and whole fish are also sold in the shed. The fish are displayed on 16 wooden pallets distributed evenly throughout the shed. On the beach side of the shed there are five cold storage chests (est. 2.5 x 4 x 2.5 feet) none of which contained ice on the three days the site was visited in late March (14, 15, 25 March).

The other point of sale is on the beach side of the market shed. There, auctioneers and individual fishermen sit at the town side of a square of cardboard or mat, facing the water, surrounded by a group of buyers (both middlemen and consumers). Fishermen who bring their catch to the auctioneer suggest a starting price and stand to the side as the fish are auctioned. The fishermen can reject the offered price if he considers it too low.

The fish can be auctioned whole, one at a time (for large fish), by the pile (small fish), or by a string for medium size fish such as jack and snapper. In a few cases, they were auctioned by the basketful. The auctioneer tries to show the best qualities of the fish by opening the gills to display its freshness.

The activity at the market picks up rapidly. The first vessels begin to arrive by about 7:30 a.m., and by 8:30 on the mornings the market was observed there were three auctioneers on the beach, some 12 to 16 sellers under the shed, and between 40 and 50 buyers milling around the auctioneers, bidding on fish and/or just observing until the prices suited their fancy. The market peaks in terms of activity between 8:30 and 9:00 a.m. and includes middlemen in pickup trucks who buy to transport further inland. These middlemen bought primarily from the auctioneers, but some were observed buying from middlemen in the shed.

Informants stated that the auctioneers are given a small amount for their services. The amount is not set, but depends on the willingness of the fisherman. It is usually several hundred Biasas per sale, but can be more or less at the discretion of the fisherman and in relation to the amount of the sale.

Some indication of the degree of markup was obtained by observing the auctioning of a tuna, following the tuna to the market shed, and having an Omani bargain for it with the middleman. The middleman purchased the tuna for 1.5R and sold it for 2.0R some 5 minutes later. This was done at the peak market time at Al Khabura (around 8:30 a.m.); thus, the markup may have been a bit less later in the day when market activity diminishes. On days that the Al Khabura market was observed, the activity diminished rapidly around 9:30 a.m., and the market was deserted by noon.

SAHAM FRESH FISH MARKET The selling place at Saham is on the beach, beachward from the last line of buildings. A small (10 by 16 foot) stall area is located adjacent to a building wall. This stall area was being used by only two sellers who placed fish on small wooden pallets raised approximately 8 inches from the ground. Dealers in the stall were selling only kingfish which were butchered into approximately one to one and one-half kilogram pieces. The stall enclosure was simply a palm frond roof supported by six uprights, approximately telephone pole diameter.

The selling area commanding the most attention was beachward from the shelter. By 7:45 four vessels had arrived, and fishermen had displayed their fish on mats for sale. Two trucks were on the beach, one buying fish to take inland and another bringing fish from farther down the Saham beach. The truck buying to sell at inland locations had an ice chest for storing fish. The ice was purchased at Sohar. A small shelter for selling fish was also erected on the beach. It consisted of 2 poles approximately 8 feet apart with a four by eight burlap roof stretched between. At the rear of the fish selling area some vegetables and a great deal of alfalfa were displayed for sale. The alfalfa was brought in by donkey cart, the carts being constructed over salvaged automobile rear axles. Numerous vessels landing their catches at Saham carried alfalfa back to their homes for sheep and goats.

As selling progressed, a pickup truck from As Suwayq (67 km S) arrived with approximately 50K of fresh fish to be sold. Some fish was also carried in by hand. One old man was observed dragging something up the beach in the far distance. As he got closer, it could be seen that he was dragging a large ray with one hand, and carrying two strings of small fish with the other. The fish were destined to be sold at the market.

Most of the fish sold at Saham are sold directly by the fishermen. Middlemen play only a small role in this "free market". Free markets, however, have some drawbacks. For example, several fishermen landed fish that were rejected by both middlemen and buyers because they were in the net too long and had become less than acceptably fresh. The fish were relatively large kingfish that should have brought over 5R apiece;

hence, the fishermen were quite disappointed when they loaded them back on their vessels to take home or possibly try to unload elsewhere.

As the morning progresses more fishermen land their catch and try to sell it on the beach. By 8:30, 13 sellers were on the beach and four in the stall. At 9:30 the number of sellers reached a peak of 26. Some 80 customers, onlookers, and fishermen were milling around. For the first time fishermen were observed weighing fish sold. A balance was constructed of a stick with one small basket suspended from each end. A stone (est. 1/2 to 3/4K) was placed in one basket and the fish in a plastic bag in the other. The whole balance was held aloft by the seated fisherman. The small fish being sold were in high demand. He was surrounded by buyers who purchased a plastic bag containing a "stone's" weight for 600B. Another fisherman sitting adjacent was using a similar procedure.

The selling of fish by the fishermen is usually accompanied by bargaining. For example, a man asked the price of a large kingfish. The fisherman replied 10R; the man said "too much" and offered 6R; he walked away with the fish after paying 8R. Additionally, at the height of the market day, boats are not unloaded all at once. The aforementioned fisherman selling a desired species using a scale sold all the fish in his bag and left. About 15 minutes later, he pulled another bag of fish out of his boat and set up his scales again.

By 1010 the market started winding down. Only one vessel could be seen at sea with binoculars, and it was heading directly into shore (not to the market place). The total number of sellers had dropped to 16, and there were only about 35 customers and onlookers milling around.

THE SOHAR FRESH FISH MARKET The fish market at Sohar is centered around an open shed, approximately 10M square, located in the commercial center of the town, approximately midway along the beachfront of Sohar. The roof of the open shed is palm thatch, and covers some 13 low wooden tables on which fish are displayed and butchered if necessary. The shed also contains several cold store boxes with locks which are used for the few fish kept overnight. Ice is obtained from an ice plant some 10 km from the center of Sohar at the cost of 1R per 50 kg.

When the market is fully underway (by about 9 a.m. on most days) all of the small tables contain fish; fish are additionally displayed on from two to four mats laid out beachside under the roof. Anywhere from four to six mats are mounded with dried anchovetta on the north side of the shelter, and the southeast corner is devoted to a fish auction. The sellers concentrated in or adjacent to the covered stalls do not complete the market, however. On the beach, about 20M from the stalls some 30 to 40 (daily maximum) fishermen and middlemen display fish on mats. On one Friday (the biggest market day) fish were displayed on 56 mats in the beach selling location. The number of buyers range from a maximum of some 150 at a time (during weekdays) to over 250 at a time on Fridays.

The Sohar market is what is referred to as a "free market". Fishermen are free to sell their fish through the auction to a middleman, they can choose a middleman who will represent them at the beach selling point and try to get a good price for the fish, or they can sell the fish themselves. When the beach seller sells the fish, the fisherman gives him several hundred Baisas, but this is completely up to the fisherman.

There seems to be a premium on fresh fish at the Sohar market. No ice is used in the displays, and fish begin to lose their fresh appearance after only a short period of time under the hot sun. This apparent decrease in quality is reflected in prices paid. Prices drop rapidly, reaching a low point by about 11 a.m. By noon, the market ceases operation, except for one or two middlemen selling one kilogram slices¹ of kingfish steak under the shelter. No one was observed in the market after 1230.

Although most of the fish are brought to the Sohar market by boat, directly from the harvesting spots, some is carried in by hand, and a fair amount is trucked in. Some from landing spots in adjacent communities is brought in in the trunk of an auto or the back of a small pickup truck. Sometimes significant amounts are brought in from farther away. For example, bad weather kept many fishermen from going out for one day, and the following day radio spots were warning the fishermen of heavy weather. Some entrepreneurs perceived this as a chance to make a good profit and brought kingfish from as far away as Sur to the Sohar market. One small pickup brought fresh fish from Musandam. Additionally, some pickup trucks brought thawed frozen fish from the Oman National Fish Company. Sufficient fish were landed at Sohar, however, and the fish brought in did not sell due to the premium paid for fresh fish.

Fish brought in by boat are usually carried to the selling point by the individual fishermen. In some cases, especially early in the day when few boats have landed, one or two sellers will go down to the vessel and help the fisherman unload or request to sell their catch. Large fish are removed one at a time -- the highly desired species frequently causing a stir of excitement among the buyers. Fish such as snapper and hake are strung, usually four or five, on strings to make approximately a one kilogram string and brought to the selling point a string or two at a time. Some fish are brought in feed bags (sometimes separated into one kilogram strings) and doled out to the sellers. When the market is at its peak of activity, fishermen sometimes hold fish back, check market prices, and bring them to the buyers a string or two at a time.

It is important to emphasize the fact that the traditional fish market at Sohar is approximately midway along the Sohar beachline (7.7 km from the southern end and 6.6 km from the north). It is located at what appears to be a center of both population density and commercial activity. For example, fishermen were observed making purchases for home in local shops after selling their catch and prior to sailing home. They were also observed purchasing gasoline at a filling station

¹Only whole fish were observed being sold on the beach.

adjacent to the landing site. Finally, a high premium appears to be placed on very fresh fish. The maximum number of buyers have easy access to the traditional market since it is in the center of population; thus they are more likely to get their fish home fresh.

The new, unused market is 1.9 km northward along the beach from the old. It is not in a marketing center, and it is not located in an area of high population density. Hence, fishermen would not be able to make home purchases as easily, buyers would have to travel farther for purchasing fish and would have to travel farther to get home, thus decreasing the freshness of the fish when it finally arrives home. In a climate where the temperatures reach 120°F and more in the hottest times of the year, 1.9 km of extra travel cannot be considered trivial. Further, it was noted that fishermen and fish sellers seem to enjoy the social interaction that characterizes activities at the market. They discuss the day's fishing, fish prices, the news, and gossip. The new market isolates them into stalls -- an effort must be made to communicate in contrast to the swarm of interaction at the crowded beach selling point. This may be another factor which contributed to the failure of the beautiful, but unacceptable, new fish market.

MARKETING AND DISTRIBUTION OF FRESH FISH IN THE CAPITOL AREA Marketing and distribution of fresh fish in the capitol area is similar to that along the Batinah Coast, but the intensity is much greater because of the large fish-eating population concentration. Fishermen from numerous locations around the capitol have several options with respect to disposition of their catch: (1) if catches are light, they can land at their home beach, take what they need for home consumption, and if any is left over, sell it to neighbors; (2) sometimes when catches are light, several fishermen will pool their catches, and one will take them to the Mutrah fish market; (3) when catches are moderate to heavy and information concerning the catches spreads to middlemen, they may come to the home beaches of the fishing communities and try to purchase the fish directly to be taken elsewhere by truck; (4) when catches are moderate to heavy, the fishermen also have the option of delivering the fish directly to the Mutrah fish market by boat; (5) finally, some consumers will meet the vessels when they land the catch at the home beach and purchase directly from the fishermen. We will now turn to a more detailed examination of the Mutrah fresh fish market.

THE MUTRAH FRESH FISH MARKET The Mutrah fish market is the main selling point in the capitol area. Fishermen from as far away as Quantab, some 11K to the east, and beyond Qurm, some 21K by sea to the west of Mutrah, land their catches at the Mutrah market when they have more fish than they can easily sell in the local area. Sometimes fishermen cooperate, several vessels entrusting their catches to one vessel to take it to market to sell. None were observed using ice when bringing fish to market. The Mutrah market is also a center to which fish trucked from all areas in Oman are brought and sold -- some being transshipped to other areas of Oman, and some being sold directly to consumers at the market.

Pickup trucks, most with ice chests filled with chilled fish, begin arriving from all parts of Oman in the early morning hours. On arrival

at the market at 0545 on 29 March, some 25 trucks were already present. Four or five people were at each truck discussing the product, buying, and selling. Six vessels had already unloaded their catches for sale, and one had already purchased a bundle of alfalfa to be taken back home for goat/sheep feeding. Fish were being carried from the boats in baskets, buckets, on strings, and whole if large. By 6 a.m. twelve vessels had arrived.

Although on a much larger scale, the market at Mutrah appears to be operated like other markets along the Batinah coastline. It is a free market. Many fishermen unload their catches, display their fish, and sell them directly to the consumer, middleman, or whoever else will give the price asked. Some fishermen sell through an auctioneer who is located inside the market shelter. For the most part, those in the market shelter are middlemen butchering larger fish to be sold by the kilo. The auctioneer is usually given about 5% of the value of the sale.

By 0640 there were 29 sellers displaying their catches on the concrete surface outside the shelter and 14 inside. Tuna seemed to be the moving item at the time, and they were being sold for between 1.2 and 1.25R per tuna (3-4K). Kingfish of about 10-12K were going for 6 to 7R.

At 0730 some 56 individuals were selling fish at the market. Bottom fish captured with the use of pots started to arrive at the market by 0745. Fishermen usually go out to check their pots around 0500 or 0530, spend several hours checking (if numerous pots), and start getting to the market around 8 a.m. By 8 a.m. the boats started flowing in about two to three at a time and the market area was packed with fish, fish sellers, and pickup trucks.

The number of buyers, sellers, and consumers at the market peaked between 9:00 and 9:30 a.m. At about 0915 the price of tuna began to drop to between 1.1 and 1.2R apiece, and by 0930 one could purchase tuna for as little as 1R. This price held throughout the rest of the morning. Landings and sellers had decreased rapidly between 0930 and 1000. By noon there were only a few sellers selling butchered fish by the kilo in the inside market. By 1030 a total of 126 vessels had landed catches at the market.

As at markets observed along the Batinah coast, the fishermen use their trip to the fish market to make other purchases as well as sell their fish. Plastic bags with fruit and vegetables, bundles of alfalfa, etc. were loaded on the vessels which were cleared of fish. Some fishermen brought passengers (usually family members) for shopping in the Mutrah Suk -- a major market area selling almost anything one could want.

MARKETING AND DISTRIBUTION OF FRESH FISH IN THE SUR/AL ASHKARA REGION

The landings of fresh fish in the Sur - Al Ashkara region far exceed the local population's ability to consume it; hence, although local markets exist, the majority of fish are trucked to other areas both within and outside Oman. The market is free. In other words, fishermen are free

to sell their catch by any means available, directly to the consumer or through various levels of middlemen; nevertheless, in a situation where supply greatly exceeds local demand, fishermen are much more dependent on middlemen/transporters to deliver fish to the consuming public. A brief description of marketing and distribution of fresh fish at Sur, provided below, should give the reader a general idea of the operation in this region.

SELLING THE FISH CATCH IN SUR In contrast to the Batinah Coast and Capitol area, the fish market in Sur is not located adjacent to the fish landing; hence, fish are sold to consumers both on the beach and at the Sur market which is located several blocks from the beach. The landing point, the beach, is the location where fishermen sell their catches. A free market exists on the beach -- fishermen sell directly to consumers and/or middlemen.

The landing point is where most of the fish selling activity is concentrated. By six in the morning on a busy day at least a dozen pickup trucks with iceboxes will be awaiting the landings which begin about sunrise. On two days in early April when the landing was visited, an average maximum of 20 pickup trucks were on the beach by 9 a.m. On both days approximately one-half of the trucks had ice boxes; the other half merely loaded fish in the back without ice for short trips to markets in surrounding communities.

Most pickup trucks are owned by middlemen who will transport and sell the fish in other areas. Some trucks are used merely to transport fish to the Sur market or some other local market. In the latter case, the middlemen select and buy the fish at the beach and pay the truck driver/owner to transport the fish to the selling point. Some fish is transported to the Sur market by donkey or taxicab. Four donkey and two taxicabs were observed transporting fish to the local market. To be transported by donkey, large fish (e.g., kingfish or large tuna) are first tied together at the tail and then draped over the donkey's back which is covered with a blanket. Small fish are strung together through the gills and then hung on the donkey's back. Fish transported by taxicab are placed on a feedbag in the trunk. No ice is used for these short trips.

At the height of commercial activity some 110 fishermen, buyers, sellers, and transporters were conducting business on the beach. Some men, hired especially for the purpose, were also observed conducting some preliminary processing. For example, tuna which were to be transported some distance were cleaned on the beach. Other tuna destined to be roasted before selling were also being prepared, although the final roasting was to be done several kilometers outside of Sur. This preliminary processing is carried out directly on the sand and the remains are left to rot and/or wash out to sea at high tide.

Activity on the beach drops off rapidly as morning progresses. At the time of the research the number of pickup trucks and people on the beach was drastically reduced by 8 a.m. By 10 a.m. no more selling was observed on the beach. Only the remains of tuna processing and a few vessels could be seen.

Much of the selling to local consumers takes place at the Sur market. There is a special location for selling of fish in the market. As in most markets visited in Oman, the fish selling area is adjacent to the area where other meats are sold. Selling takes place, for the most part, under a roof. Some 16 sellers butchered and sold fish within the open shelter. Some middlemen sold fish on the ground just outside the shelter. Displayed fish are not iced or covered in any way -- they are completely exposed. Nineteen cold storage boxes were located at the perimeter of the shelter to be used to store fish overnight. Although most of the dealers at the market sold fresh fish, one was observed selling dried shark. At the height of the market at around 9 or 9:30 a.m. in early April, some 50 customers were present.

MARKETING AND DISTRIBUTION OF FRESH FISH ON MASIRA As mentioned in another section of this report, most Masira fishermen have full-time occupations in addition to their fishing activities. This leaves them little time to sell their catches in the manner found along the Batinah Coast and the Capitol. They, for the most part, take advantage of facilities offered by a government cold store which buys their catch at a fixed rate. By using the government cold store as a buyer, fishermen can rapidly dispose catches without the bargaining or waiting that accompanies sales in the free market.

Although most fishermen with other jobs use the services of the government cold store on Masira, they also have other outlets. There is a small open market devoted to fish located on the beach on the northwest coast of Masira. This small market is approximately central with regard to the population concentration, but little activity was observed in early April. No more than 15 to 20 people were observed buying fish there. Fishermen also have the alternative of selling their catches to middlemen who transport them to Negder, on the mainland, where they are sold to other middlemen who own trucks and will transport them elsewhere in Oman and sometimes beyond to Saudi Arabia and the UAE. Finally, as elsewhere in Oman, fishermen bring some fish home for home consumption and sell some to neighbors.

MARKETING AND DISTRIBUTION OF FISH ON THE EAST COAST (MAHOUT TO RAS MADRAKA) This extensive region of the East Coast is sparsely populated; hence, fishermen are quite limited with respect to marketing opportunities. Besides the small quantities needed for home consumption and sold in the small settlements to friends and neighbors, fishermen must deal with middlemen who drive the difficult roadways to their relatively hard to reach locations -- roadways that overconsume the expensive gasoline, oil, tires, and mechanical parts that keep their four-wheel-drive vehicles running. These expenses are reflected in the marketing and distribution of fish from this isolated region. Middlemen are reluctant to take anything but highly desired species (e.g., kingfish, spiny lobster) or species that will keep (dried shark); hence, appropriately reducing their chances of loss. The brief description of fish marketing at Duqm in early April 1984 which follows is representative of some of the problems that exist in the marketing and distribution of fish along this isolated coastline.

Five land-rover type trucks used by middlemen were present on arrival (8 p.m.) at the beach where fish are landed at Duqm. This number increased to nine by sunrise. Throughout the night there were comings and goings of trucks and people involved in buying and selling of nighttime landings. Early in the morning, three shu'i were observed resting at anchor in the relatively protected cove. It was reported that the shu'i were probably resting from a night of fishing for kingfish, and that they were probably from Masira or farther north. It was also reported that they will probably be selling their kingfish to the plant at Masira. A good question that could not be answered is did they land any kingfish and sell them to the trucks we heard during the night? It is further reported that local fishermen sometimes obtain fish (for free) from the dhows...fish with small commercial value.

Commercially important species at Duqm seem to be confined to lobster, kingfish and shark. Middlemen look primarily for kingfish and lobster, but they also transport dried shark to inland markets where it is sold to nomadic peoples. This emphasis results in much waste. Large fish of other species command such low prices that fishermen are reluctant to "give them away" to middlemen, and they remain rotting on the beach. For example, while the authors were at Duqm, a fisherman was trying to sell 15 large (5 kilo each) fish to a middleman. The middleman offered one Real (\$3) for five, and the fisherman refused, taking the fish back to his houri. A third party entered the dealings, and he also offered only one Real for five fish. Once again the fisherman refused, requesting one Real for four. The dealing continued, and the middleman agreed to buy all 15 large fish (all croakers except for one shark) for three Reals (or 5 fish for one Real). They were sold and loaded into the cold tank on the back of the truck.

Although it may superficially appear that middlemen are taking advantage of fishermen at Duqm, they are taking a large chance by buying somewhat less than highly desired species in an area remote from major markets. Reported costs for a round trip to Sanaw or one of the other major inland markets is R30-40 for gasoline and R10 for ice. The price for gas might seem high, but it must be remembered that there is at least 300 miles of dirt road, each way, in a 4WD vehicle that gets from about 10 to 15 miles per gallon at best. These costs also do not include depreciation on the vehicle and repairs. For example, we had two blowouts on new off-the-road tires on the very same roads that the middlemen travel. One blowout occurred to the landing site, and one occurred on our return journey. Given the fact that the fish referred to above might sell for one or one and one-fourth Real if the market is good, but only one-half Real (or less) if the market is bad, the middlemen appear to be taking large risks for relatively small profits.

MARKETING AND DISTRIBUTION OF FRESH FISH IN DHOFAR For purposes of the discussion here, Dhofar will be divided into two major regions: (1) the area within relatively easy reach of Salalah (e.g., from Mugsail to Mirbat); (2) all other areas. This division is made for several reasons. First, the population is concentrated in Salalah, hence providing a market for fresh fish. Additionally, the Salalah market has a relatively large area devoted to fish marketing. There is also a branch of the Oman National Fish Company in Salalah as well as a private

enterprise dealing in shellfish. Finally, relatively good roads connect the fishing communities between Mugsail and Mirbat with Salalah. In contrast, fishing communities further from Salalah are relatively isolated with small population densities. Travel to population centers such as Salalah is difficult and time-consuming. The distinction between the two regions is thus relative ease of access to marketing.

SALALAH VICINITY (MUGSAIL TO MIRBAT) Fishermen fishing along the coastline in the vicinity of Salalah have several options with respect to marketing their catch. First, they can sell it directly to the Oman National Fish Company which offers a fixed price. Fishermen who take this option are frequently those who have other jobs (usually government jobs) during the day. By using the facilities offered by the Oman National Fish Company, they are able to fish in the late afternoon or evening after work, and be assured of rapidly selling their catch, thus having time for both family and work in addition to fishing which adds substantially to their incomes.

Fishermen in the Salalah region can also sell their fish to middlemen who will then sell the fish at the Salalah market. Many fishermen truck their catches directly from the beach to the market, where they deal with the consumer directly. Those who take this option are frequently full-time fishermen, fishermen who have the time to haggle in the marketplace. The Salalah fish market is as large as any seen along the Batinah coast. On a representative day, some 50 fishermen and middlemen can be observed with their fish spread out before them, selling them directly to the public. Fish are displayed, without ice, on mats spread on the ground. As in other markets, larger fish will be cut into smaller portions for the consumer if requested, and if the price is right.

Fishermen in Salalah who fish for shellfish (e.g., spiny lobster) can sell them directly to a private company which distributes them within Oman and abroad. This company also transports shellfish from more remote areas. Finally, fishermen in the Salalah area can sell fish directly to consumers who live near the landing spot or near their home. For example, it is reported that at least one-third of the fish caught at Mirbat are sold and/or consumed in the community -- the rest going to Salalah and other locations.

REGIONS IN DHOFAR REMOTE FROM SALALAH More remote regions in Dhofar (e.g., beyond Mirbat) suffer from many of the same problems found in other remote regions to the south of Mahout; they must, for the most part, depend on middlemen to truck their catches to market. In some cases, the areas cannot be reached by land, and catches destined for market must be transported by boat to more accessible landings. These problems result in a focus on highly desired species (to minimize risk concerning sales) and shark, which is dried and therefore not as risky in terms of spoilage before marketing.

Hasik is one of these isolated communities. The people of Hasik have been fishermen for generations. Originally, fish were dried for transport to other regions in Oman as well as export abroad to regions as far as Yemen and the East Coast of Africa. Locally obtained gums

also formed part of this trade. Large trading dhows passed and still pass regularly to pick up the products. Although dried shark is still exported from Hasik, the markets for this product have, in general, decreased somewhat, and the fishermen report that most fish caught is used merely for local consumption. When kingfish are in plentiful supply, fishermen sometimes take catches to Hadbin, which can be reached by truck, and sell their catches to middlemen who frequent the community. These middlemen, however, are reported to come irregularly, so fishing for kingfish is at best a risky business at the present time.

Although Hasik is exceptionally isolated -- surrounded by tall mountains -- its fish marketing problems are probably representative of other small fishing communities in the more remote coastal regions of Dhofar and the Southeast region -- low population density and difficult access to marketing centers -- problems that plague many developing fisheries. Hasik, however, is somewhat fortunate due to its location in a sheltered bay with access to valuable shellfish (abalone and spiny lobster). The private fish company which is located in Salalah has provided the fishermen with cold store containers which are used to store the shellfish which are then picked up by company representatives at approximately two-week intervals.

ATTITUDES TOWARDS LEAVING THE OCCUPATION OF FISHING

As an economy begins to change, to "modernize" through increased access to higher levels of formal education, development of new occupational specializations, and the building of modern urban centers for trade, industry, and government, it usually goes through a transitional period where many of those involved in primary production (e.g., farmers and fishermen) desire to leave their old way of life and become involved in the new. In many parts of the developing world this has led to unmanageable urban growth and severe drops in rural food production -- drops so severe that countries once self-sufficient have found it necessary to import food they were once able to grow themselves. An understanding of the attitudinal factors involved in this shift can aid in the development of programs which may mitigate this undesirable side effect of modernization. It was with this idea in mind that questions concerning leaving the occupation of fishing and perceived problems with fishing were included in the 1979 survey of fishermen in Oman. This section of the paper examines fishermen's attitudes and characteristics which are associated with an expressed desire to leave the occupation.

The regional distribution of the expressed desire to leave the occupation of fishing and reasons given can be found in Table 39. Overall, only 165, or 2.5 percent of the fishermen interviewed state that they are thinking about leaving the occupation. The greater percentage of those thinking about leaving are from Dhofar where 94, or 6.7 percent of the fishermen interviewed expressed a desire to leave fishing. The reasons most frequently given are age or other job prospects.

Table 39. Desire to leave fishing and reasons why crosstabulated with region.

<u>Region</u>	<u>Plans to</u>					<u>Other Go To</u>			<u>N</u>
	<u>Quit</u>	<u>Age</u>	<u>Health</u>	<u>Income</u>	<u>Literacy</u>	<u>Job</u>	<u>Town</u>	<u>Other</u>	
Capitol	12	4	0	3	0	4	3	1	709
Masirah	0	0	0	0	0	0	0	0	104
Unknown	2	0	0	2	0	0	0	0	245
Dhofar	132	94	0	0	1	49	0	1	1408
East	1	1	0	0	0	0	0	0	957
S. East	5	3	0	0	0	1	1	4	417
S. Batinah	5	2	0	1	0	3	1	1	1419
N. Batinah	7	1	0	0	0	0	1	5	1079
Musandam	1	0	0	0	0	0	0	1	279
All Regions Combined	165	105	0	6	1	57	6	13	6617

It is interesting to note that when the fisherman's age is crosstabulated with age as the stated reason for leaving the occupation, there is no relationship (see Table 40). 1.6 percent of the fishermen below the mean age use that reason as well as 1.6 percent of those above. As a matter of fact, 57 percent of the fishermen who give age as a reason are below the mean age.

Table 40. Age crosstabulated with age as a reason for leaving occupation of fishing.

<u>Reason for leaving is age</u>	<u>Fisherman's Age</u>	
	<u>35</u>	<u>35</u>
No	3676	2790
Yes	<u>60</u>	<u>45</u>
Total	3736	2835

Perhaps a more effective method for determining factors associated with leaving the occupation of fishing will be to examine selected socioeconomic characteristics of those expressing a desire to leave. This is done in Tables 41 through 48.

Table 41 indicates that there is no relationship between age and an expressed desire to leave the fishery ($X^2 = .121$, $p = .73$). Table 42, however, indicates that 1.7 percent of the fishermen who do not have an outside income express a desire to leave, in contrast to 7.4 percent of those who do ($X^2 = 106.49$, $p < .001$). Table 43 suggests that there is more of a tendency for government employees than others to want to leave the fishery (10.3 versus 1.7 percent respectively; $X^2 = 163.51$, $p < .001$). Literate fishermen are also more likely than non-literate to want to leave the fishery (6.5 versus 1.9 percent respectively; $X^2 = 68.14$, $p < .001$).

Tables 45 and 46 suggest that there is little or no relationship between receiving government assistance in the form of loans and a desire to leave the fishery ($X^2 = .595$, $p = .44$ and $X^2 = 5.14$, $p = .0234$ respectively). Table 47, however, indicates a moderate relationship between boat ownership status and expressed desire to leave the fishery -- boat owners are less likely than non-boat owners to want to leave (1.2 versus 5.4 percent respectively; $X^2 = 101.5$, $p < .001$). Finally, Table 48 suggests a very weak relationship between total number of dependents and a desire to leave the fishery. Those with more than the mean number of dependents are slightly more likely to express this attitude than others (2.9 versus 1.9 percent respectively; $X^2 = 6.56$, $p = .0104$).

Table 41. Desire to leave fishing and age.

Age	Desire to Leave	
	No	Yes
≤ 35	3640	96
> 35	<u>2766</u>	<u>69</u>
Total	6406	165

Table 42. Desire to leave fishing and other income.

Other Income	Desire to Leave	
	No	Yes
No	5605	97
Yes	<u>847</u>	<u>68</u>
Total	6452	165

Table 43. Desire to leave fishing and government employment.

Government Employee	Desire to Leave	
	No	Yes
No	5921	104
Yes	<u>530</u>	<u>61</u>
Total	6451	165

Table 44. Desire to leave fishing and literacy status.

Literate	Desire to Leave	
	No	Yes
No	5618	107
Yes	<u>834</u>	<u>58</u>
Total	6452	165

Table 45. Desire to leave fishing and ministry assistance.

Receive Loan	Desire to Leave	
	No	Yes
No	6088	158
Yes	<u>364</u>	<u>7</u>
Total	6452	165

Table 46. Desire to leave fishing and ministry assistance.

Receive Engine Loan	Desire to Leave	
	No	Yes
No	6122	163
Yes	<u>330</u>	<u>2</u>
Total	6452	165

Table 47. Desire to leave fishing and boat ownership.

Boat Owner	Desire to Leave	
	No	Yes
No	1875	108
Yes	<u>4577</u>	<u>57</u>
Total	6452	165

Table 48. Desire to leave fishing and total number of dependents.

Dependents	Desire to Leave	
	No	Yes
≤ 6	3616	109
> 6	<u>2836</u>	<u>56</u>
Total	6452	165

In sum, the 1979 survey data suggests that those most likely to express a desire to leave the fishery have a source of income other than fishing, are employed by the government, are literate, do not own their own boat, and have more than six dependents. It may now be profitable to look at complaints expressed by those who want to leave the fishery.

Specific complaints about the fishery were crosstabulated with expressed desire to leave the fishery, and results are presented in Table 49. Rather than present each crosstabulation separately, which would have resulted in 13 tables, the presentation is simplified by

Table 49. Relationship between complaints about fishery and expressed plans to leave fishery.

Complaint	Percent Expressing Complaint			X ²	Prob.	N
	Total Sample	Desire to Leave	Those who have no Plans to Leave			
Marketing	20.0	9.6	20.3	11.24	<.001	6617
Distribution	48.3	11.5	49.2	91.48	<.001	6617
Storage	7.0	6.7	7.0	0.03	.866	6617
Mechanization	6.4	1.2	6.5	7.62	.006	6617
Servicing	1.4	16.4	1.0	258.99*	<.001	6617
Fuel Supply	2.9	1.8	3.0	0.40*	.525	6617
High Cost of Equipment	9.7	9.1	9.7	0.07	.788	6617
High Cost of Spare Parts	8.6	22.4	8.2	41.46	<.001	6617
High Cost of Netting	8.5	35.2	7.8	155.55	<.001	6616
High Cost of Landing Facilities	4.2	17.6	3.8	75.64	<.001	6617
Intrusion of Large Vessels	5.4	55.2	4.1	818.12	<.001	6617
Natural Occurrences	14.9	1.2	15.3	25.11	<.001	6617
Other	6.3	41.8	5.3	364.87	<.001	6617

*X² Yates corrected

presenting percent of total sample making a specific complaint, percent of respondents who expressed a desire to leave the fishery who made the complaint, and percent of those with no plans to leave the fishery who made the complaint. For each complaint type, the statistical test of differences in the distribution of responses is also presented in Table 49.

There are several interesting reversals in Table 49. For example, it is fishermen who have no plans for leaving the fishery who are more likely to complain about marketing, distribution, and natural occurrences. These are the high frequency complaints and complaints heard from fishermen around the world. Those who express a desire to leave the fishery are more likely to complain of things like mechanization, the high cost of spare parts, netting, and landing facilities, as well as the intrusion of large vessels and other unspecified complaints.

It may also be revealing to examine the relationship between an expressed desire to leave the fishery and total number of complaints about the fishery. Total number of complaints across the thirteen categories listed in Table 49 were calculated for each fisherman. The values ranged from a minimum of zero to a maximum of 9 with a mean of 1.44 (mode = 1). Total number of complaints are crosstabulated with expressed desire to leave the fishery in Table 50.

Table 50. Total number of complaints crosstabulated with expressed desire to leave the fishery.

<u>Expressed desire to leave fishery</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3 to 9</u>	<u>Total</u>
No	1338	2829	1283	1002	6452
Yes	<u>10</u>	<u>35</u>	<u>45</u>	<u>75</u>	<u>165</u>
Total	1348	2864	1328	1077	6617

Table 50 makes it clear that fishermen who express a desire to leave the fishery are more likely to express a large number of complaints than other fishermen ($X^2 = 128.95$, d.f. = 3, $p < .001$).

Overall, it must be emphasized that only a small proportion (2.5 percent) of fishermen said they were thinking about leaving the fishery in the 1979 survey. Those who did were more likely to have other sources of income, especially government jobs, and to be literate, non-boat owners, and have more than 6 dependents. They were also more likely to have complaints about the costs of fishing and the intrusion of large vessels. They did not, however, have as many complaints about marketing, distribution, and natural occurrences as other fishermen.

FISHERMEN AND LOANS

Some sort of subsidized loan program often forms part of a fishery development program. Since these loan programs are costly and may potentially have undesirable effects on the development of a small-scale fishery, it is important to determine the socioeconomic characteristics of those receiving loans. As a step in this direction, the 1979 fishermen's survey asked fishermen if they had received ministry loans; if yes, for what purpose; whether or not the loan has been repaid; and what types of aid the fisherman would prefer in the future. This data is analyzed in this section of the report.

Loan types and repayment information are crosstabulated with region in Table 51 below.

Table 51. Percent distribution of Ministry loans by type and repayment across regions.

Region	Type of Loan (%)			Repayment (%)			Total Loans	N
	Boat	Engine	Other	Partly	Fully	None		
Capitol	0.1	9.0	0.4	25.0	75.0	0.0	68	709
Masira	0.0	13.5	0.0	0.0	100.0	0.0	14	104
Unknown	0.8	5.3	0.0	40.0	60.0	0.0	15	245
Dhofar	0.4	6.3	4.1	62.5	4.6	32.9	152	1408
East	0.9	3.3	0.1	59.5	31.0	9.5	42	957
S. East	0.0	4.6	0.0	15.8	34.2	0.0	19	417
S. Eatinah	0.1	3.3	0.0	16.6	43.8	39.6	48	1419
N. Batinah	0.0	4.3	0.0	2.2	93.5	4.3	46	1079
Musandam	0.0	3.2	0.0	11.1	0.0	88.9	9	279

There is nothing really striking in the distribution of loans as ascertained from the 1979 survey. It can be noted that purchase of engines was the most frequent use of the loan. Data concerning repayment is hard to interpret since repayment is a function of the initial date of the loan.

The types of equipment that fishermen report wanting assistance in obtaining is crosstabulated with region in Tables 52 through 54. Table 52 indicates that the majority of fishermen desire assistance obtaining an outboard gasoline engine. Inboard diesel are wanted by a moderate percentage of the fishermen in the East and Musandam, two areas where fishing is done from large wooden vessels (large houri and shu'i). With respect to vessel types, the only striking statistic is the large number of fishermen desiring assistance with obtaining aluminum vessels in Dhofar. The present high percentage of this vessel type in the Dhofar suggests that they obtained this aid. At the time of the survey, the fiberglass vessel was not a highly desired item as it is today. Finally, with respect to gear, most fishermen would like assistance obtaining gill nets. There are very little regional differences except for the percentage of traps mentioned by fishermen from the North Batinah coast.

As a next step in the analysis of loan data from the 1979 survey, receipt of a loan from the ministry is crosstabulated with selected socioeconomic variables in Tables 55 through 60.

Table 52. Percent distribution of engine type (if any) for which fishermen would like assistance in obtaining.

Engine Type	Region									Total
	Capitol	Masira	Unknown	Dhofar	East	Southeast	S. Batinah	N. Batinah	Musandam	
None	16.6	19.2	18.8	10.9	16.0	14.6	7.4	9.5	63.4	14.1
Inboard Diesel	0.3	3.8	0.8	3.2	21.9	7.2	0.8	3.6	19.7	6.0
Outboard Gas	83.1	76.9	80.4	85.9	62.0	78.2	91.8	86.9	16.8	79.8
Other	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

N = 6616

Table 53. Percent distribution of vessel type (if any) for which fishermen would like assistance in obtaining.

Boat Type	Region									Total
	Capitol	Masira	Unknown	Dhofar	East	Southeast	S. Batinah	N. Batinah	Musandam	
None	48.7	54.8	52.7	12.6	38.1	74.3	63.9	78.7	90.3	51.3
Houri	50.4	12.5	46.9	10.3	43.7	23.5	29.3	14.6	0.7	26.0
Shasha	0.0	0.0	0.0	0.1	0.2	0.0	1.5	2.6	0.0	0.8
Shahuf	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.2
Launch	0.1	1.0	0.4	0.1	10.1	0.5	3.2	0.7	0.4	2.4
Aluminum	0.7	31.7	0.0	76.8	7.1	1.7	1.9	2.7	8.6	19.3
Alamla	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Betail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fiberglass	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

N = 6617

Table 54. Percent distribution of gear type (if any) for which fishermen would like assistance in obtaining.

<u>Gear Type</u>	<u>Region</u>									<u>Total</u>
	<u>Capitol</u>	<u>Masira</u>	<u>Unknown</u>	<u>Dhofar</u>	<u>East</u>	<u>Southeast</u>	<u>S. Batinah</u>	<u>N. Batinah</u>	<u>Musandam</u>	
None	29.1	23.1	29.8	42.0	9.0	46.3	31.9	38.8	17.2	31.7
Gillnet	66.7	70.2	64.5	53.3	89.0	52.8	64.5	49.9	78.1	63.4
Castnet	2.1	6.7	0.8	1.5	0.7	0.2	0.6	0.6	0.7	1.1
Trollline	0.4	0.0	0.0	1.5	0.6	0.0	0.3	0.5	0.4	0.6
Handline	0.4	0.0	0.0	1.6	0.2	0.0	0.0	0.1	0.0	0.4
Traps	1.3	0.0	2.0	0.0	0.0	0.7	1.3	7.7	0.4	1.8
Other	0.0	0.0	2.9	0.0	0.4	0.0	1.3	2.5	3.2	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 55. Loans crosstabulated with age.

Age	Receive Loan	
	No	Yes
≤35	3537	199
>35	<u>2667</u>	<u>168</u>
Total	6204	367

Table 56. Loans crosstabulated with outside income.

Outside Income	Receive Loan	
	No	Yes
No	5390	312
Yes	<u>856</u>	<u>59</u>
Total	6246	371

Table 57. Loans crosstabulated with government employment.

Government Job	Receive Loan	
	No	Yes
No	5703	322
Yes	<u>542</u>	<u>49</u>
Total	6245	371

Table 58. Loans crosstabulated with literacy.

Literate	Receive Loan	
	No	Yes
No	5419	306
Yes	<u>827</u>	<u>65</u>
Total	6246	371

Table 59. Loans crosstabulated with boat ownership.

Boat Owner	Receive Loan	
	No	Yes
No	1910	73
Yes	<u>4336</u>	<u>298</u>
Total	6246	371

Table 60. Loans crosstabulated with number of dependents.

Total Dependents	Receive Loan	
	No	Yes
≤ 6	3572	153
> 6	<u>2674</u>	<u>218</u>
Total	6246	371

There is apparently no relationship between age or outside income and receipt of a ministry loan. There is, however, a very weak relationship between government employment and obtaining a loan. Fishermen with outside income from the government are a bit more likely to have had such a loan than other fishermen (8.3 versus 5.3 percent respectively; $X^2 = 8.83$, $p = .003$). There is also a slight tendency for literate fishermen to be more likely to have had a loan than illiterate fishermen (7.3 versus 5.3 percent respectively; $X^2 = 5.50$, $p = .019$). Boat owners are also more likely than non-boat owners to have received this assistance (6.4 versus 3.7 percent respectively; $X^2 = 19.84$, $p < .001$). This probably reflects the fact that most loans were for engines, and boat owners are more likely to obtain a loan for an engine. Finally, Table 60 indicates that fishermen with more than the mean number of dependents are more likely to have received ministry loans than other fishermen (7.5 versus 4.1 percent respectively; $X^2 = 36.21$, $p < .001$).

OMANI FISHERMEN'S ATTITUDES TOWARDS THE FISHERY

Plans to change a fishery should take into account the various comments and complaints that fishermen have concerning the present state of their occupation. As a means of ascertaining how the fishermen of Oman feel about their occupation, several of the questions in the 1979 survey were aimed at ascertaining fishermen's perceptions of difficulties encountered in the fishery. In this section the responses to these questions will be analyzed and updated with information gathered in 1984.

PERCEPTIONS OF DIFFICULTIES Fishermen were asked what difficulties they encountered in the fishery. The regional distribution of the responses can be found in Table 61.

Fewer than 25% of the fishermen from all regions, except for those from the East coast region (the area south of the Capitol region) felt marketing was a difficulty; but 57% of the men from the East coast felt this was a problem. Since most of the East coast fish is sold to middlemen who transport the fish out of the region to the Capitol, UAE or Saudi Arabia, the fishermen may feel that potential profits are escaping them. The response of the majority of fishermen may indicate that catch levels of most fishermen are well matched with local demand. Other regions where marketing was somewhat of a problem include the Capitol area, Unknown area, N. Batinah and the South East region.

Almost half of the fishermen felt that fish distribution was a problem. The greatest proportion of Capitol area fishermen agreed that distribution was a difficulty, followed in order by fishermen from the East Coast, S. and N. Batinah coast, and the Southeast coast. We could assume that the existing distribution system of local sales, mixed with sales to men willing to truck the fish to other markets, is an adequate one. Surprisingly, those fishermen from regions distant from the Capitol area felt that distribution was not a problem. The fishermen from Musandam and over 90% of those from Dhofar did not mention distribution of their catches to be a serious difficulty. The data for Masira suggests that the question about difficulties may not have been asked there.

Seven percent of the fishermen said that fish storage was a difficulty, with most of these responses coming from East Coast fishermen whose fish had to be trucked long distances. The fishermen may mean that they lack short-term storage to keep the fish quality high while they are waiting to sell it, such as would be provided by adequate ice or a small cold storage room, or they may mean they lack storage facilities for holding dried, salted or frozen products. Short-term storage problems could be addressed by government programs to support wind or solar generators for ice-making plants, programs to introduce insulation materials to ensure better cold storage, etc. It should be noted, however, that many unused ice boxes, concrete fish holds, and other holding facilities were seen, unused and decomposing at reputed fish landing spots along the coastline between Mahout and Ras Madraka. Are these examples of failed development schemes?

Table 61. Percent of respondents reporting specific difficulties in each region.

Difficulty	Region									All Regions Combined
	Capitol	Masira	Unknown	Dhofar	East	Southeast	S. Batinah	N. Batinah	Musandam	
Marketing	23.3	0.0	22.4	7.0	57.2	16.8	7.4	25.6	2.9	20.0
Distribution	81.2	0.0	88.2	8.9	63.4	42.0	60.9	58.0	1.1	48.3
Storage	9.6	0.0	7.3	4.7	21.8	14.1	2.7	0.5	0.0	7.0
Mechanization	2.7	0.0	1.2	2.5	26.3	7.2	1.3	3.6	10.0	6.4
Servicing	2.3	0.0	1.6	4.5	0.1	0.0	0.6	0.1	0.0	1.4
Fuel Supply	10.3	0.0	3.3	5.5	0.6	0.0	1.3	1.1	0.0	2.9
Equipment Cost	21.7	0.0	17.1	6.5	7.4	7.0	7.9	13.3	0.0	9.7
Parts Cost	19.7	0.0	13.1	5.8	11.7	11.5	8.7	2.9	0.0	8.6
Nets Cost	8.9	0.0	13.1	15.8	10.8	7.7	2.8	6.3	0.0	8.5
Landing Cost	7.6	0.0	7.8	5.7	5.1	2.6	1.8	3.6	0.0	4.2
Intrusion of Large Boats	7.6	0.0	1.2	12.1	3.9	4.6	2.0	2.7	5.7	5.4
Natural Occurrences	1.1	0.0	0.8	63.5	1.5	1.2	4.3	0.1	1.4	14.9
Others	1.8	1.0	4.1	10.6	0.4	43.4	0.6	4.4	0.4	6.3

N = 6617

Since we cannot easily interpret what the fishermen meant by saying that they felt marketing, distribution and storage were difficulties they must face, a small sample survey might be useful to address some of the following questions: is selling fish a pleasure to you; does it take too much time; do you worry about what price you might get as you are drawing close to shore; are you troubled about the chance your fish will not sell; do you ever think of having someone else sell your fish for you; do you think about drying/salting/smoking your fish for later sale; are some fishermen better than others at selling their fish; if you had ice available (at some cost x) how would you use it; and so forth. These kinds of questions would be valuable if the government was considering a policy of providing marketing experts in each region, introducing cooperatives, or introducing fish storage/processing facilities. The government seems to be relied upon heavily for the future well-being of the fishermen; thus, it may be that a government-introduced marketing and distribution program would be thought to be a fair one, with the best interests of the fishermen in mind. If the government was to plan for fishery development, the fishermen should be asked their opinions on longer fishing trips, marketing at far distances, working on larger boats, division of labor between catching and selling fish.

Only 6% of the fishermen thought that the expenses of modernization of mechanization of the fishing industry were difficulties, and these men were predominantly from the East Coast, Musandam and the South East. Servicing equipment was even less of a problem, mentioned most often by men from Dhofar and the Capitol. Only 3% of Omani fishermen mentioned fuel supply as a difficulty, and they were from the Capitol, Unknown and Dhofar. These questions address the availability of the items, not their cost; the answers allow us to infer that the infrastructure necessary for a moderately mechanized artisanal fishery is in place. Training programs for small businessmen interested in selling fishing supplies, training programs in small motor repair, incentives for existing businesses to diversify, might reduce the difficulties faced by the fishermen. This must, of course, be balanced with a realistic assessment of the available fish and markets. Improving mechanization may increase catch, but not increase income if a) the markets are limited or b) the nearshore stocks of fish decline.

Less than ten percent of the fishermen said that the costs of equipment, spare parts or netting were difficulties. Many of these men fish in the Capitol region, although the cost of netting was less of a problem there than elsewhere in Dhofar, the East and southeast coasts. Only 4% of the fishermen included landing costs as difficulties. The data do not tell us whether or not any of the costs alter the way the fishermen fish. For example, if netting was less expensive, would they use larger nets? set more nets? make higher profits? find that more men became fishermen? Is the cost of spare parts so high that fishermen do not repair some equipment? In order to suggest ways in which the government might help the fishermen, these kinds of questions must be asked.

Most of the concern about large fishing boats comes from fishermen in the Capitol, Dhofar and Musandam regions. Many nearshore fishermen know that large, offshore boats have been known to destroy fixed gear, disperse schools of fish, catch the easily available fish, and lower prices in the market when their large catches are landed. There are several solutions to conflict at sea. India has zoning of its coastal waters to protect fishermen of different vessel classes. The area 0-6 miles from shore is designated for non-motorized boats; the area from 6 to 14 miles is for small (less than 66') motorized boats, and beyond 14 miles for the larger, offshore boats. This system seems to be easily enforced by the fishermen reporting the names of vessels which violate the zones.

While the 64% of the fishermen from Dhofar agreed that nature -- the weather, changes in fish supply, etc. was a difficulty in their fishing, very few fishermen from the other regions mentioned this variable. This is probably due to the fact that the monsoon has the greatest impact in Dhofar. The heavy seas and storms make fishing in this region practically impossible for almost six months of the year.

SOCIOCULTURAL CORRELATES OF PERCEIVED DIFFICULTIES Perceived difficulties were crosstabulated with selected variables and the results of this analysis can be found in Table 62. Table 62 presents the percent distribution of respondents belonging to various sociocultural categories who perceived specific difficulties. For example, Table 62 indicates the percent of individuals 35 years of age or younger who mentioned marketing as a difficulty (17.7 percent). This is contrasted with the percentage of respondents older than 35 years who mention the same difficulty (22.8 percent). In the discussion which follows, the statistical significance of these differences will be evaluated.

Table 62. Results of analyses crosstabulating perceived difficulties with other sociocultural variables.

Difficulty	Percent Distribution Mentioning Each Difficulty											
	Age		Other Job		Literate		Receive Loan		Own Vessel		Total No. Dependents	
	≤35	>35	No	Yes	No	Yes	No	Yes	No	Yes	≤6	>6
Marketing	17.7	22.8	22.4	8.2	20.8	14.8	20.3	15.6	19.1	20.4	19.2	20.9
Distribution	45.3	51.9	51.9	25.6	50.1	36.5	48.2	48.8	32.7	54.9	44.6	53.0
Storage	6.2	7.9	7.8	2.2	7.4	4.4	6.9	8.4	9.3	6.0	6.4	7.8
Mechanization	5.2	8.0	6.8	3.8	6.7	4.6	6.5	4.3	9.3	5.2	5.6	7.4
Servicing	1.4	1.4	1.1	3.3	1.2	2.8	1.4	1.8	2.2	1.1	1.6	1.2
Fuel Supply	2.8	3.1	3.3	0.4	3.0	2.7	2.8	5.1	1.7	3.5	2.1	4.0
Equipment Cost	8.9	10.7	10.2	6.9	9.6	10.1	9.7	9.4	6.6	11.0	8.5	11.2
Parts Cost	7.4	10.2	8.6	8.1	8.6	8.2	8.7	6.7	8.0	8.8	7.9	9.4
Nets Cost	8.2	8.7	8.5	8.4	8.1	10.7	8.4	8.9	9.6	8.0	7.0	10.3
Landing Cost	3.3	5.3	4.0	5.2	4.1	4.5	4.2	4.3	4.6	4.0	3.5	5.0
Intrusion of Large Boats	5.4	5.5	4.6	10.7	5.0	7.8	5.6	2.2	6.8	4.8	5.4	5.4
Natural Occurrences	18.3	10.8	11.2	38.0	11.6	36.7	14.6	21.0	41.1	3.8	16.7	12.7
Other	6.7	5.5	5.8	9.1	6.2	6.6	6.4	4.3	7.1	5.9	5.3	7.4

N = 6617

In the discussion which follows, only differences which are statistically significant at better than the .001 level will be discussed. Even when the level is set at .001 (less than one chance in 1000 that the observed differences could have occurred by chance alone), the percent difference may have little or no practical significance. This is due to the fact that the sample size is so large. With a sample exceeding 6000, such as the one analyzed here, two or three percent differences are statistically significant. It is up to the decision maker in Oman to determine whether or not observed differences, which are statistically significant, have practical significance with respect to fishery development plans.

Turning to the first perceived difficulty, we find that older fishermen, those who do not have a job outside fishing, and illiterate fishermen are most likely to cite marketing as a difficulty ($X^2 = 25.6, 92.6, \text{ and } 103.2$ respectively; all $p < .0001$). Older fishermen, those with no other income, and those who are illiterate are also more likely to cite distribution as a problem ($X^2 = 28.4, 218.8, \text{ and } 56.6$ respectively, all $p < .0001$). In addition, fishermen with more than 6 dependents and those who own their own boat are also likely to mention distribution as a difficulty ($X^2 = 45.8 \text{ and } 275.5$ respectively; all $p < .0001$).

Storage as a perceived difficulty manifests a relatively low percentage of occurrence. Nevertheless, it is fishermen who do not own their own boat and those who have no outside income who cite this as a difficulty ($X^2 = 22.65 \text{ and } 37.8$ respectively; all $p < .0001$). Mechanization, another low frequency difficulty, is most likely to be mentioned by older fishermen ($X^2 = 21.29, p < .0001$), those without an outside income ($X^2 = 11.81, p = .0006$), and those who do not own their own vessel ($X^2 = 40.30, p < .0001$). Servicing as a difficulty is more frequently mentioned by fishermen with alternative incomes, those who are literate, and those who do not own their own vessels ($X^2 = 26.2, 14.06, \text{ and } 12.89$ respectively; $p < .0001, p = .0002, \text{ and } p = .0003$ respectively). Fuel supplies appear to be a problem for those who do not have income other than from fishing ($X^2 = 23.4, p < .0001$), those who have more than six dependents ($X^2 = 20.3, p < .0001$), and fishermen who own their own vessel ($X^2 = 16.29, p = .0001$). Complaints about the cost of equipment is significantly related to only boat ownership and number of dependents. Fishermen who own their own vessel and those with more than six dependents are most likely to complain about equipment costs ($X^2 = 32.0 \text{ and } 13.2$ respectively; $p < .0001 \text{ and } p = .0003$ respectively).

The cost of parts and landings were most likely to be cited as difficulties among older fishermen ($X^2 = 16.1, p = .0001 \text{ and } X^2 = 17.19, p < .0001$ respectively) while the cost of netting was most frequently cited as a problem among fishermen with more than six dependents ($X^2 = 22.52, p < .0001$). Intrusion of larger vessels is more likely to be perceived as a difficulty among literate fishermen and those with income outside of fishing ($X^2 = 11.97 \text{ and } 58.3$ respectively; $p = .0005 \text{ and } < .0001$ respectively). All of the independent variables are significantly related to natural occurrences as a perceived difficulty. Younger

fishermen ($X^2 = 70.96$, $p < .0001$), those with income outside of fishing ($X^2 = 445.2$, $p < .0001$), as well as those who are literate ($X^2 = 382.3$, $p < .0001$), who have received loans ($X^2 = 11.42$, $p = .0007$), who do not own their own vessel ($X^2 = 1523.5$, $p < .0001$), and who have six or less dependents ($X^2 = 20.57$, $p < .0001$) are likely to cite this difficulty. Finally, other difficulties are likely to be cited by fishermen with outside incomes ($X^2 = 14.34$, $p = .0002$) and those with more than six dependents ($X^2 = 12.15$, $p = .0005$).

In some cases it is possible to explain some of these relationships on the basis of the interrelationship between region and the dependent and independent variables. For example, natural occurrences were cited as a difficulty primarily in Dhofar. If one turns to the first section of this report it will be seen that the fishermen in Dhofar are, for the most part, younger and more likely to be literate; hence, these two variables are also strongly related to perception of natural occurrences as a difficulty.

It may be useful to next examine the correlates of total number of difficulties cited. Total number of difficulties cited is crosstabulated with region in Table 63. The total number of complaints ranges from zero to nine with a mean of 1.44. The modal number of complaints is one. While table 63 is quite informative (e.g., we can see that the only region with individuals providing 8 or more complaints is the Capitol region, and the only one with individuals giving two or less is Musandam), it may be more useful to look at a collapsed distribution. Total number of complaints were subcategorized into the categories

Table 63. Regional distribution of total number of difficulties cited.

Region	Total Number of Difficulties										Total
	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	
Capitol	71	311	148	79	31	11	33	19	5	1	709
Masira	103	1	0	0	0	0	0	0	0	0	104
Unknown	9	130	57	21	15	4	6	3	0	0	245
Dhofar	55	885	195	213	59	1	0	0	0	0	1408
East	71	322	289	142	52	29	31	21	0	0	957
Southeast	30	250	62	36	22	13	4	0	0	0	417
S. Batinah	462	602	240	93	21	1	0	0	0	0	1419
N. Batinah	317	325	326	102	8	0	1	0	0	0	1079
Musandam	230	38	11	0	0	0	0	0	0	0	279
Total	1348	2864	1328	686	208	59	75	43	5	1	6617

"none", "one" and "two or more" and crosstabulated with region. The results of this analysis can be found in Table 64.

Table 64. Total number of difficulties crosstabulated with region.

<u>Region</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>Total</u>
Capitol	71	311	327	709
Masira	103	1	0	104
Unknown	9	130	106	245
Dhofar	55	885	468	1408
East	71	322	564	957
Southeast	30	250	137	417
S. Batinah	462	602	355	1419
N. Batinah	317	325	437	1079
Musandam	230	38	11	279
Total	1348	2864	2405	6617

It is much easier to examine between region differences in total number of complaints in Table 64. For example, it is clear that the modal categories for the Capitol, the eastern region, and North Batinah are two or more complaints. A Chi Square calculated for this table indicates that the differences between the regions are too great to have occurred on the basis of chance alone ($X^2 = 2018.1$, $p < .0001$).

Total number of difficulties, subcategorized into four categories, were also crosstabulated with other sociocultural variables. The results of these analyses can be found in Tables 65 through 70.

Table 65. Percent distribution of number of difficulties mentioned crosstabulated with age.

<u>Age</u>	<u>Number of Difficulties</u>				<u>Total</u>
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	
≤ 35	19.5	47.6	18.7	14.3	100.0
> 35	21.8	37.7	21.9	18.7	100.0
Total	20.5	43.3	20.0	16.2	100.0

N = 6570

Table 66. Percent distribution of number of difficulties mentioned crosstabulated with non-fishing income.

<u>Outside Income</u>	<u>Number of Difficulties</u>				<u>Total</u>
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	
No	20.8	41.4	21.5	16.3	100.0
Yes	<u>18.0</u>	<u>55.0</u>	<u>10.9</u>	<u>16.1</u>	<u>100.0</u>
Total	20.4	43.3	20.1	16.3	100.0

N = 6616

Table 67. Percent distribution of number of difficulties mentioned crosstabulated with literacy.

<u>Literate</u>	<u>Number of Difficulties</u>				<u>Total</u>
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	
No	21.8	41.7	20.6	16.0	100.0
Yes	<u>11.4</u>	<u>53.4</u>	<u>16.9</u>	<u>18.3</u>	<u>100.0</u>
Total	20.4	43.3	20.1	16.3	100.0

N = 6616

Table 68. Percent distribution of number of difficulties mentioned crosstabulated with obtaining loan from ministry.

<u>Obtain Loan</u>	<u>Number of Difficulties</u>				<u>Total</u>
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	
No	20.4	43.2	20.2	16.2	100.0
Yes	<u>19.1</u>	<u>45.3</u>	<u>18.3</u>	<u>17.3</u>	<u>100.0</u>
Total	20.4	43.3	20.1	16.3	100.0

N = 6616

Table 69. Percent distribution of number of difficulties mentioned crosstabulated with boat ownership.

<u>Own Boat</u>	<u>Number of Difficulties</u>				<u>Total</u>
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	
No	11.2	53.3	16.7	18.8	100.0
Yes	<u>24.3</u>	<u>39.0</u>	<u>21.5</u>	<u>15.2</u>	<u>100.0</u>
Total	20.4	43.3	20.1	16.3	100.0

N = 6616

Table 70. Percent distribution of number of difficulties mentioned crosstabulated with number of dependents.

Number of Dependents	Number of Difficulties				Total
	0	1	2	3	
≤ 6	22.9	43.8	18.8	14.5	100.0
> 6	<u>17.2</u>	<u>42.6</u>	<u>21.7</u>	<u>18.5</u>	<u>100.0</u>
Total	20.4	43.3	20.1	16.3	100.0

Table 65 indicates that older fishermen cite more difficulties than younger ($X^2 = 67.603$, d.f. = 3, $p < .0001$). There is over four percent difference in the "three or more" category. This difference has two alternative explanations. First, older fishermen may be more likely to speak their minds than younger fishermen. Alternately, older fishermen have more experience, and thus are more likely to be able to identify difficulties.

Table 66 indicates that those without income outside fishing are more likely to mention two difficulties than those with other income ($X^2 = 80.597$, d.f. = 3, $p < .0001$). We saw above that those without outside income are more likely to mention difficulties in marketing and distribution problems; hence, they would be less likely to cite more than one difficulty.

It is clear in Table 67 that literate fishermen mention more difficulties than the illiterate ($X^2 = 72.253$, d.f. = 3, $p < .0001$). This observation can probably be accounted for by the fact that literate fishermen are probably more critical, and more likely to mention their criticisms in an interview situation.

There appear to be no significant differences between those who have received ministry assistance and those who have not with respect to total number of difficulties mentioned. A chi square analysis of the distribution supports this observation ($X^2 = 1.487$, d.f. = 3, $p = .6852$).

Boat ownership, however, is significantly related to total number of difficulties mentioned ($X^2 = 208.992$, d.f. = 3, $p < .0001$). Boat owners are more likely to mention no difficulties than fishermen who do not own a boat. In general, boat owners are probably more satisfied. Additionally, since they have probably received some form of assistance from the government, they are probably less likely to voice complaints to government interviewers.

Finally, table 70 indicates that fishermen with more than six dependents are more likely to voice numerous complaints than those with fewer dependents ($X^2 = 50.025$, d.f. = 3, $p < .0001$). This is probably due to the fact that with more dependents, the fishermen have more financial demands being made on them; thus, they are more sensitive to any problems which have some influence on income, no matter how slight.

Attitudes towards fishing in 1984 Except for the Capitol area, which will be discussed separately below, the fishermen of Oman seem to have realistic attitudes concerning their occupation. Most fishermen report that they prefer fishing in comparison to other occupations and that they would not mind if their sons became fishermen. They note, however, that they want their sons to become educated first, and then see if they want to become fishermen. But, they are not opposed to them entering the occupation.

In some urban areas (e.g., around Salalah and the capitol) fishermen who are positive towards the occupation note that the younger generation probably will not want to become fishermen. They say that the work is too hard for them -- the sons, unlike their fathers, want to have a steady job in an office in the city.

In general, fishermen outside the capitol region indicate that despite difficulties discussed in other sections of this report, their lot as fishermen has improved over the past five years. They have better gear and more assistance from the government, and they feel that the government will continue and even increase their assistance in the future. Fishermen on the Batinah Coast, however, note that catches are decreasing somewhat, despite the more effective gears. The decreases are not reported as being of the magnitude to hurt the fishermen, however, until one approaches the capitol area.

Fishermen in the capitol area present a completely different picture of the fishery. The fishermen in the capitol area are well situated with respect to access to a major urban market, most being only one-half to one hour sailing time from the Mutrah fresh fish market. Their communities are also situated in settings of great natural beauty, with natural harbors of azure blue water, golden sandy beaches, and craggy cliffs climbing abruptly skyward.

These apparently positive aspects, however, also have real and potentially negative impacts on their communities and livelihood. As is described more fully in brief community reports below, increased port activity has resulted in prohibitions on setting gear in certain areas; needs for port expansion threaten some communities with displacement; and the expansion of hotels and tourist activities threatens the removal of people who have been residing and fishing in an area for centuries.

Added to these problems is an apparent decrease in catch per unit effort. Government subsidies and high demand for fish has resulted in what are reported as dramatic increases in effort. Numerous part-time fishermen are reported to have entered the fishery in the capitol area, focusing their efforts on the Friday market, the largest of the week. Even if the stocks are remaining constant, it is easy to understand the decrease in returns to the individual. It is not known, however, if the increased effort has had a negative impact on stocks in the Capitol area. What is known is that almost all fishermen interviewed complain of declining catches over the past five years.

The pessimism seems to be focused close to the urban areas. As one begins to move a bit further north (e.g., the fishermen around Qurm and a bit farther north) there is much a more optimistic outlook for the future. Fishermen report that for the most part they are making a sufficient amount of money and that they feel little threat from the encroaching suburbs of the capital area. They report declining catches, however. When questioned, they state that the government will look out for them if they feel that they have any problems. At this point it is hard to tell whether the pessimism voiced in the urban area is due to some sort of "urban ethos" or real problems. Perhaps the contrasts in wealth and the glitter of the urban area make the fishermen feel more strongly the relative deprivation that is not so salient in the more rural areas.

Turning to complaints voiced in specific communities in the capitol area, the fishermen interviewed at Sidab were quite negative about the status of the fishery. They reported that individual catches had decreased significantly in the past 5 years; that they were working harder and earning less. Some stated that earnings frequently did not meet costs. When asked why they did not leave the fishery, they stated that either they could do nothing else or that they had tried and could not find any other work. They were unanimous in stating that they would not advise a young man to enter the occupation of fishing today.

The fishermen of Sidab attribute their problems to several distinct sources: (1) the increase in the number of part-time fishermen, fishermen who do not have to make a living from fishing, has impacted the catch and market prices; (2) they are restricted from setting nets in areas that they feel are more productive; (3) they cannot find crew members, yet are reluctant to fish with one another. "If I have a boat, why should I fish on someone else's boat?" They suggest that one solution to their problems would be the importation of immigrant labor to fish with them. When told that this would just increase the number of fishermen and pressure on the stocks that they were complaining about with respect to the part-timers, they stated that it is not the same. A dissenting fisherman said that some want foreign labor so that they can stay at home and let others do their work for them -- that they are not real fishermen.

Turning to another community in the capitol area, most of the fishing in Darsait is now conducted with drift nets, due to restrictions on the use of fixed gears in the inshore areas of the capitol region. Many fishermen also use hemispherical traps, but must set them quite far out, beyond an offshore island, because of previously mentioned restrictions on fixed gear. The distance out causes problems both with respect to travel to the traps and possible damage by trawlers fishing close to the shoreline. One of the common complaints by the fishermen of Darsait is that their traps are destroyed by the trawlers. The fishermen also blame the trawlers for the declining catches they have been encountering over the past several years. Fishermen interviewed at Darsait say that it is becoming increasingly impossible to support a family by only fishing. They say that they need either other part-time work or a child who helps out with a job.

Fishermen interviewed in Quantab were probably more than usually pessimistic in their outlook due to the fact that there were no fish beyond what was needed for home consumption over the two days previous to the interviews. They stated that the fishing throughout past year had been very poor -- the weekly value of the catch averaging between 50 and 60R. Given costs and the system for distribution of catch proceedings, this amounts to a weekly income for each fisherman of about 15R.

The fishermen were quite pessimistic about the future of fishing in Quantab, attributing their poor outlook to the fact that the quantity of fish has been decreasing for the last several years. They also note that in the recent past they could get enough fish close to shore. Now they have to go further and further out for less fish. They say that they would not advise their sons to fish -- the work is too hard for the small returns.

Fishermen in Ash Shutayfi now fish primarily with handlines. In the past many used pots, but they now complain that they must set them too far out due to regulations, and that they have lost many through the actions of trawlers. On a good day a handline fisherman can make as much as 15R, and on a bad day, less than 10R. Fishermen say that they must make at least 200R per month to live decently -- an income they only occasionally achieve.

The fishermen feel that there has been a drastic decrease in catches in recent years and that this has impacted their incomes. They feel that the catches would be increased if fishermen were forced to stop trawling and using nets -- techniques they think have negatively impacted the stocks. Because of declining catches, they say that it is impossible to live only by fishing, that men who only fish for a living must depend on other family members for supplemental income. If this is true, many must have other occupations or supplemental occupations, since most of the houses sport TV antennas and numerous expensive automobiles are parked along the road.

A shadow hanging over the residents of Ash Shutayfi is that they have been hearing for the past several years that they might be moved out of their homes due to planned expansion of the port at Mina Qaboos -- they are not sure if this will ever come to pass. They feel it would be difficult to shift to another area for fishing. Due to the apparent decrease in catches and other uncertainties, they would rather see their sons engaged in occupations other than fishing. The future of fishing seems to bleak to them.

Fishermen interviewed at Al Bustan provided a welcome contrast to the negative attitudes encountered elsewhere in the capitol area. Al Bustan is a fishing community situated in an exceptionally beautiful cove approximately ten kilometers from the Mutrah fish market. The beauty of the setting has not gone unnoticed as evidenced by the fact that a large modern hotel is being constructed on a rise just behind the village. This hotel is a mixed blessing, since the government of Oman plans to relocate the fishermen. The fishermen interviewed, however, indicate that they felt no remorse at the move, but felt that the government would do what it could to take care of them if there are any problems.

Fishermen interviewed were rather optimistic concerning the future despite the fact that they also had decreasing catches over the past two years. They attribute the decrease to natural cycles and feel that the catch is bound to increase soon. This optimistic attitude is reflected in the fact that they had no objections toward their sons becoming fishermen. The sons of one fisherman were present when he made this statement, and they agreed.

Optimistic fishermen were also encountered in what we will refer to here as the Qurm area. This area extends from a bit east of the Muscat Intercontinental Hotel to about 5 to 6 km west of the Desalination plant. Fishermen beyond this area usually land fish at Seeb. The coastline in the Qurm area is quite regular, lacking the mountains, small coves, and jutting cliffs of the other areas near the Capitol. The beach is sandy, long and smooth -- perfect for the beach seining which is practiced in the sardine and anchovy season which was just beginning in late March 1984. The whole linear stretch of this beachline is backed by rapid development -- ministry offices, hotels, elite residential areas, and some industry. The rapid development does not bother the fishermen interviewed who say that if any problems develop, the government will take care of them. The activities of the fishermen, however, could be considered undesirable by some, although this observer has not heard any complaints. Perhaps most troublesome to some overly sensitive residents may be the flies and smells associated with drying anchovy and sardines on the beach.

Fishermen from the Qurm area report that catches have been decreasing over the last two years although they had been increasing up until that time. They say that there have been ups and downs in the past 10 to 15 years and are optimistic about the future. Nevertheless, they are pessimistic about young people entering the profession. They note that young men do not have the time or patience for the hard work of fishing; they would rather work in the city at some easy job.

Few of the fishermen from this area complained about income. One noted that he has been very unlucky although others had been getting good catches, but for the most part they feel that their incomes are sufficient. They report that they are averaging 200R or more per month.

Fishermen noted that outsiders from Darsait and other communities have been setting gear in their territory. Some set pots which are not a problem, but some set drift nets in the evening which sometimes become tangled with the local fixed nets, spoiling the catch. No fishermen reported problems with trawlers, but several said that some of outsiders have Indians on their boats. In general, they feel that if any real problems arise, the government will look after them.

In sum, with few exceptions the fishermen of Oman are rather positive towards the fishery and the government's assistance programs. They, like fishermen elsewhere in the world, would rather fish than do anything else. Although they would like their sons to become more educated and, perhaps, find other opportunities, they are not negative towards their becoming fishermen. Only in the more urban areas, especially the capitol region, does one find fishermen discouraged and

pessimistic concerning the future of the occupation. Reasons for this pessimism were discussed above and are understandable. Perhaps the only solution possible will be to somehow reduce the fishing pressure in the capitol -- while at the same time looking out for the welfare of the displaced fishermen.

DEVELOPMENT ISSUES

PRODUCTION It is possible to respond to fishermen's complaints about marketing and distribution problems by providing inputs which will improve the process such as ice machines, cold stores, refrigerated trucks, etc. It is, however, important to determine the potential impacts of these improvements on production.

For example, at the present time, the supply of fish along the Batinah Coast appears to be in balance with both the needs of consumers and fishermen. People who want fish for consumption can usually purchase fish of the desired quality. They may pay a little more than they want to pay, and this observation may influence some to say that improved distribution from other regions would lower prices; but would that be good? If the amount of effort required per unit of income increases, more fishermen may leave the fishery -- an undesirable effect. This observation is supported by the fact that fishermen on the Batinah Coast could catch more fish if more effort were applied. They have probably learned from experience, however, that increases in effort do not result in equivalent increases in satisfaction -- satisfaction being the summation of good from income, time spent with friends and family, time spent relaxing, etc.

While these observations are particular to the Batinah coast, the sensitivity of this issue there and the implications for development activities in other parts of the country require that further study be initiated on this topic. An immediate step would be to have reliable observers volunteer for short periods of time as crew with a sampling of fishermen. There is a serious lack of information in this respect.

Mitigating or supporting evidence of this apparent anomaly should come about as a result of the year-long Catch Assessment Survey. Over a period of a year, one should be able to get indications of increases in quantities supplied to increased prices. Furthermore, the survey should result in improved estimates of the number and percentage of persons fishing in different communities and in the numbers and percentages of those fishing who obtain a surplus and bring it to market.

MARKETING It is clear that marketing - in the sense of reliable outlets for catch - is the most serious problem for isolated areas in the Southeast and in the eastern Dhofar beyond Mirbat. The Government and others have recognized this for a long time. In terms of encouraging entry into the fishery in these areas, marketing is of primal importance. The effects of the fishermen's encouragement fund in these areas is as impressive as it is in most areas. From this point forward, however, the largest benefits to be gained by the fishermen for money spent by the Government, it appears, will come from systems of pickup and transport of catch or the initiation of the cold chain. However, the accumulation of chilled or frozen fish in these coastal areas is of little advantage. This investment in holding facilities must be accompanied by the identification and/or promotion of demand for chilled or frozen products in inland regions. The use of mobile markets with

cooling/freezing capability to identify and promote demand for not-strictly-fresh fish products has been successful in several parts of the world and should be given consideration here. The catches of highly valued species such as lobster and kingfish in these areas are in demand by energetic small-scale transporter-traders. What is recommended here in relation to the establishment of marketing facilities in these regions, however, refers to demersal species which are now vastly underutilized and/or wasted.

In an attempt to increase marketing opportunities for fishermen from remote areas, consideration should be given to encouraging the number and range of small fish traders. As with the fishing occupation, entry and exit in the trading occupation is based upon estimates of earnings as compared with costs. This encouragement would increase the number of traders and therefore the competition among them for the fishermen's products. This competition should improve the prices offered to fishermen or reduce the costs to fishermen of having their products simply transported to market. Licenses, quality regulations and access to data could be made part of this program. It might extend as far as offering premiums for servicing particularly remote areas of the coast. The need for this encouragement is simply that it appears that these traders bear substantial risks - risk of product spoilage, risk of accidents on the roads, risks of poor demand at the end of their journey, risks of long waits with half-filled iceboxes at landing sites.

The consultants were impressed with the enterprise of several of these small traders who had interpreted weather reports to imply that fishing activity was depressed along a certain stretch of coast, had invested in iced and frozen fish, and had driven two hundred kilometers in an attempt to sell fish. Some sort of information service via the radio might be worth exploring for its usefulness in reporting prices and the level of fish supplies on the various parts of the coast and at inland markets - a RADIOSAMAK, if you will.

Inland marketing channels are fairly well established and understood, although the importance of Sanaw as a marketplace was not appreciated by many. The flow of products through these channels per period of time is an important indicator of the state and of change in the state of the artisanal fishery system by region and by output. The few major intersections connecting regions could supply some information on the magnitude of these flows. Perhaps more fruitful would be information on destination, quantity and product type which could be gleaned in conversation with traders at the strategically located petrol stations in the heavily and lightly populated areas. It is suggested that a marketing study be initiated which would measure these flows and their nature, and suggest least cost methods of providing accurate data on a continuing basis.

MARKETPLACES Initial, superficial observations of fish marketing along the Batinah Coast suggest that the system can be improved. But improvements must take into account the multiple functions of existing marketplaces.

Present fish markets have evolved through time in response to the various needs of fishermen, fish sellers, and consumers. They evolved in conjunction with the town where they are located as a part of a total system with environmental, social, economic, technological, and cultural components. For example, along the Batinah coast, fish markets are usually located on the beach; thus minimizing the distance fishermen have to transport fish. They are also approximately central with respect to local population concentrations which function to minimize customer travel distance -- a factor which is significant in such a hot climate both with respect to the freshness of the fish and human energy expenditure. For similar reasons, other markets have also evolved nearby the fish market. This is convenient for the fishermen since it minimizes the amount of effort he makes in purchasing other goods for work and home consumption.

Finally, patterns of social interaction have evolved along with the development of the traditional marketplace. Fishermen, fish sellers, and consumers are clustered into what seems to be an unorganized crowd, but observation reveals patterns of interaction. Fishermen sit next to friends to sell their fish. People are close enough to keep track of prices offered and paid. Sellers and buyers can observe most of what is going in and out of the market as well as discuss current events, the fishery, problems, family, etc. The marketplace is thus an arena of intense social and economic interaction.

Any attempts to improve the marketplace must take these observations into account. Participation in the "improved" market must supply the same or more benefits in terms of minimizing human energy expenditure traveling to and from the market and providing access to non-fish marketing activities in the same general area. It must also facilitate the same types of human interaction. If sellers are strung out linearly, somewhat isolated from one another, the traditional social and economic forms of interaction will be inhibited. The omnidirectional interaction with neighbors and friends which characterize the traditional market should be taken into account. The new, unutilized fish market at Sohar which is discussed in the body of the report is perhaps a good illustration of ignoring the results of this phenomena.

FISHERY LABOR FORCE Fishing has a long and important history in Oman. Fishing is apparently traditionally an honorable occupation. Yet, the government feels that too many people have dropped out of fishing to become involved in other occupations. The report details reasons for dropping out of fishing along with a detailed analysis of problems as perceived by fishermen. As discussed with respect to marketing, apparent solutions to some of these problems may result in even greater numbers of fishermen leaving the occupation unless the solutions are carefully thought out as is advocated here.

What is missing from our analysis of the workforce is a comparative analysis of job satisfaction and perceptions of occupations across the various alternative occupations available to the Omani workforce. The methodology for conducting such analyses is well developed and can result in development of strategies and programs which can effectively reduce the number of dropouts in the fishery as well as increase the

number of recruits. It is therefore suggested that Oman conduct an analysis of job satisfaction and perceptions of fishing as well as alternative occupations among the potential and actual fishery workforce.

Much can be said about the use of foreign labor in the artisanal fishery. The economic consequences of foreign crews operating for national owners in the artisanal fishery are quite clear. If there is a shortage of crews for boats as has been claimed - the evidence of Sambuk and Launch construction in Sur does not bear this out - then introducing foreign crews would increase effort and hence catch. There would be two impacts of this increased catch, one rather immediate and the other of longer maturation. The increased catch, unless accompanied by increased demand from other than local markets, would drive the local prices of fish downward. The reduction in revenue to local fishermen, depending upon its magnitude, would counteract those measures now designed to encourage fishermen to enter the fishery again. To be sure, consumers would be better off with the increased supply, but this high level supply would be dependent on the continued employment of the non-national crews. The longer term effect would depend upon which stocks of fish are affected by the increased effort. If pelagic stocks are the sole objective of this mixed fleet, the reduction in stocks available to local fishermen would probably be minimal. If the target of this increased effort is the demersal species, then serious problems could arise in terms of local overfishing unless, of course, the boats involved in the increased effort fished beyond the 50M isobath.

On the other hand, to the extent that the fleet employing foreign crews is regulated in the same manner as the Thai and Korean Fleets - separated from affecting as much as possible the resources available and markets available to the artisanal fleet - then to that extent such fleets are not objectionable. As with the Thai and Korean fleets, however, there is little reason not to manage them for national profit. Control over the activity of such a fleet representing at least several owners would be much more difficult than that which can be exercised over a contracted foreign flag fleet.

The arguments presented here should not, however, be interpreted to be arguments against the semi-industrial development of the artisanal fleet. While this development possibility is several years away, there is reason to believe that eventually all of the fishing activity of whatever scale could be carried out locally.

SUPPORT FOR PART-TIME FISHERMEN The predominance of part-time fishermen appeared to be in the Dhofar Region and on Masira Island. Significant numbers are also reported for the Capitol. In both cases their output, for the most part, did not seem to be in competition with the output of the full-time or seasonal fishermen. No complaints in this respect were encountered in Dhofar and Masira, although in the Capitol part-timers are said to influence the Friday market. In Dhofar, as has been mentioned, the part-time fishermen we met were careful not to be seen in the market. No doubt some of their catch was sold to transporters who placed it in the market. But at least an equal amount was said to be sold to the ONFC. On Masira several rather large mixed landings were

observed being sold to full-time transporters who were going, we assume, to Negder. Some of the iced fish might have found its way from Negder to Mutrah, but there is no firm evidence of this. The larger part probably went inland or to the UAE in iced trucks.

The part-time fishermen represent a backup system of fish supply in a sense. These are indeed energetic and, for the most part, young fishermen and businessmen. We suspect that they would continue to fish even if explicit measures aimed at reducing the competition of their catch with that of the full-time fishermen were forthcoming. We have no idea whether withdrawal of the subsidy would inhibit the entry of more part-time fishermen. The cost of the boats and motors and the amount of money to be made is such that the subsidy does not appear to be a factor in the decision to fish. This can be said also of many full-time fishermen who have already received the subsidy. A major by-product of the Fishermen's Encouragement Fund is the ready availability of boats and motors for purchase, subsidized or not, in the country.

TECHNOLOGY There have been a few examples of the use of monofilament nets observed, the use of the translucent filament has led to rapid increases in effort. Daytime fishing became a possibility for the first time. In many places in Oman the relationship among fishermen is such that nets can be left unattended for days without fear of their being pilfered. Where this is true, the use of the monofilament net could dramatically increase the effectiveness of fixed and drift net fishing. It would seem prudent to initiate some baseline statistical analysis comparing the catch rates of mono and multifilament nets, and to monitor the increased usage of the newer gears. The testing could be done rather inexpensively on an experimental basis by the department in different areas so that control over deployment and size could be maintained.

Care should be taken to monitor minimum mesh sizes for all regions for fish traps or pots as well as for gillnets and tangle nets.

Wooden and wire traps have been in use in the Batinah for many years. The most common trap seen now is made of galvanized wire of medium gauge. These have apparently been used for several years now. Their estimated useful life is on the order of one year plus or minus a half year. There is little evidence of the manner in which no longer used traps are disposed of. If they are simply abandoned at sea and used as fish attracting devices, they may still be catching fish - so-called "ghost fishing". It would be worthwhile to determine the nature of their deterioration and disposal. The same principal applies to lost or abandoned nets. Monofilament nets, in particular, have long "lives" after their useful productive lives. The disposal of all nets should be explored.

In a few locations fiberglass boats with two motors have been observed - in particular at Suwaiq and in the Capitol. The reasons for the two motors is not clear, although it has been suggested that boats which range further from shore require the safety factor given by a second engine should the first fail. While this may be true, it seems that having to use two relatively large engines is an expensive way of

providing this assurance. The use of smaller, truly auxiliary engines or a sail arrangement might be explored.

The development issues suggest the need for acquiring more information concerning socioeconomic aspects of the fishery in Oman.

The following section builds on earlier sections and makes suggestions concerning data acquisition and its conversion into information for use in more adequately addressing the issues discussed above.

INFORMATION NEEDS FOR
THE DEVELOPMENT OF OMAN'S SMALL-SCALE FISHERY

OPERATION OF A FISHERY It is worthwhile to examine how any fishery works to provide employment, create national wealth, and provide food to consumers. This brief review will point out data needs and show how various kinds of data are related. This is followed by a brief discussion of Oman's fisheries explained in the same format. The need for economic data and indicators will be shown, as well as that for biological data.

The fishery consists of several elements:

1. the resource - its composition, rearing environment, productivity and availability (time and location);
2. the harvesting sector - the input markets for boats and gear, the availability of fishermen (location and number), the location and timing of the effort they expend, and the infrastructure they need for landing; and
3. product markets - the quantity, composition, quality, location and timing of the supply of fish, the services of middlemen and traders, the attitudes, preferences, location and number of consumers and the marketing infrastructure needed to bring supply and demand together.

These elements work together because the people involved can gain income and food by cooperating. However, several things which could help make the fishery perform better - provide more fish to more people at lower cost, for example - are clearly beyond the control of the cooperating individuals. Governments have well-established roles in providing roads, markets, transportation and communication systems which 1) make new opportunities possible and/or 2) lower the cost of operating the present fishery system. The natural endowment of resources cannot significantly be altered. But here, too, any government has a role in managing the use of the resource to the fishery's "best" advantage. While there are examples of individuals cooperating to manage the resource themselves, exploitation of common property resources has led to many more cases of economic and biological resource abuse than to examples of cooperation.

A government's development actions - investing to open up new opportunities or to reduce the existing costs of the fishery, and its management actions - protecting breeding areas and controlling the level of resource exploitation - reflect its goals for the fishery. These goals are usually stated in terms of employment, food production, substitutes for imports, foreign exchange for exports and greater utilization of natural endowments (increasing national wealth). These goals are all clearly desirable. They are interdependent in the context of any natural resource exploitation. They are very interdependent and can be in conflict in the context of commonly owned natural resources - especially in the case of commonly owned renewable natural resources such as fish resources.

The interdependence and conflict among goals is usually not obvious in the early stages of resource exploitation, as there is usually ample demand for the product and ample stocks to be sought. As the profitability of fishing attracts new entrants, output increases. While catches per boat may not decline significantly, the nature of the demand for the output may cause revenues to the individual fishermen and to fishermen as a group to decline. Consumers will be better off, of course, as more fish is made available at lower prices.

It may be that alternative employment opportunities are so few or so unattractive that entering the fishery at later, higher levels of exploitation is still attractive to many. In this case it is possible that the large amount of fishing effort applied to the stocks will result in an actual overall decline in total catch. No one is a beneficiary in this situation. Large numbers of people are employed as fishermen, but the level of their income will have fallen to that which they earned in previous employment. Consumers are finally worse off than they were when the maximum yield was supplied to markets at lower prices than now prevail.

The creation of national wealth from the fishery's operation results from the excess of revenues over costs of fishing. Whether this profit goes into the general treasury or is allowed to be retained by the fishermen is determined by the management measures which are enforced to limit effort and its cost. In general, the pursuit of this national profit or wealth goal is most clearly desirable if 1) the fish caught is exported, 2) industrial-scale technology is used, and/or 3) foreign fleets are contracted for the fishery. Tradeoffs are generally made between the profit goal and the other goals of employment and increasing domestically supplied protein as the technology is less industrial and more artisanal, as the number of nationals employed goes from few to many, and as the fleet involved is a private, domestic enterprise or many individual national producers, versus a foreign corporation.

In summary, it can be said that development activities such as extension, education and investment open up new possibilities for increasing revenue and decreasing costs to those in the fishery system. Management, on the other hand, determines the distribution and level of benefits from the fishery's operation among the competing goals of national wealth, employment and the supply of domestically priced protein. In very broad terms, then, the data about the operation of the fishery which is needed is that which will provide information for decisions about management and development actions of a government.

HIGHLIGHTS OF THE OMANI CASE The fishery discussed above was a simplified abstraction of what usually exists in the real world - but real enough to show the possibilities of conflicts in the goals of its operation. The discussion was in terms of a single stock of fish, an homogenous fleet and a single market.

In general, fisheries in Oman (with the exception of the Musandam which is not included in this description) are considerably more complicated than the simple example fishery. While the fisheries will be

discussed as a whole in what follows, it will be helpful to think of several different fishery systems in Oman, each with a resource area available to it and with similar, but not homogeneous, technology and differing densities of boats and men. The element of each system which is most shared - though not to a large extent yet - is in markets for catches which exceed very localized demand.

The gross classification of resources (according to FAO) of the Gulf of Oman and the north west Arabian Sea are as follows: small pelagics - predominantly sardines and anchovies; large pelagics - king mackerel, several species of tunas and barracuda; demersals - including grunts, jacks, queens, breams among the more than 50 species or species groups of varying commercial value; and mesopelagic resources - lanternfish.

Although research is beginning to be carried out, little is known about the susceptibility of rearing areas for the pelagic or demersal species to fishing activity. There is legislation in Oman restricting fishing areas relating to several species of turtle. Legislation does exist for minimum mesh sizes for trawling, and there are prohibitions against certain fixed gear barriers.

FAO has estimated safe levels of sustainable exploitation for the demersal, small pelagics, and large pelagics at, respectively, 45,700 mt., 215,000 mt. and about 69,000 mt. Current exploitation levels for both artisanal and industrial fleets are between 12-18,000 mt. for demersals, 37,000 mt. for small pelagics and 34-40,000 mt. for large pelagics.

While all boats fishing in Omani waters are required to have licenses, it is not surprising that the license scheme has not to date been used to limit effort, given the amount of fishing in relation to available yields. The richest waters - those of the Arabian Ocean - are worked by the fishermen of Dhofar. These are the least exploited waters and are said to offer the greatest opportunity for expansion of the fishery. The rich but less productive waters of the Gulf of Oman are host to the largest number of full-time fishermen and to the highest density of fishermen per length of coastline, save for Mahout island.

Demersal stocks, which are present year round, are assumed to inhabit deeper waters as well as the shelf areas. The shelf, which affords fishing areas to the artisanal fishermen given their present level of technology, is narrowest from Shinas to Al Ashkara and broadens for the Southeast and easterly Dhofar regions. The amount of fishing activity for demersal species in the artisanal fishery, however, is in almost opposite proportion to the nearby shelf area. This phenomenon is caused by the presence or absence of markets for the lower valued demersal species and is reinforced by the presence of high valued pelagic species.

Small pelagics are caught all along the coast. Their appearance and availability is seasonal. This seasonality varies at different locations along the coast. FAO suggests that this availability is a

function of inshore and offshore movement, movement in the water column, geographic variability in the Gulf of Oman and the Arabian Sea, and large year-to-year fluctuations in abundance. There is evidence of investment in gear for small pelagics all along the coast with the largest being made in the North Batinah region. This investment suggests some reliance on seasonal availability - a reliance probably justified by the low level of exploitation of these stocks.

Large pelagics are distributed along the entire coast as well. Their availability appears to be seasonal as well, but of longer duration than that of the small pelagics. This may appear so simply because the gear used to capture kings, tunas and barracuda is more appropriate for these species than the beach seines and cast nets are for sardine and anchovy. There is significant evidence of investment in gillnets - fixed and drifting - in all regions, particularly in the East and South-east.

Two monsoons are said to affect the fishery: the south-west monsoon from May to September and the north-east monsoon from November to March. Evidence of the effect of the latter on small craft - especially shashas - has been discussed elsewhere. It is not possible here to discuss the overall effect of these monsoons on fishing activity in general, except to say that all coastal regions are affected by both to some extent. The periodicity of fishing introduced by the monsoon needs to be considered, of course, in sampling.

Fishing is carried out by the artisanal fleet over the entire length of the coast with the possible exception of the coastal area around the Wahiba Sands. The density of fishermen is very low between Sur and Quriyat, in the Southeast region in general and along the eastern stretches of the Dhofar region. Industrial fishing activity occurs beyond the 50m isobath - in the North carried out by the Thai trawlers (5) on contract with the Oman National Fish Company and in the South by Korean trawlers (3) through an agreement with the Ministry. These fleets do not overlap. Masira Island is the dividing line.

In 1983 approximate landings for the Korean concession fleet were on the order of 7,000 mt. and those for the Thai fleet on the order of 5,000 mt. The majority of the catches are of demersal species, but kingfish and barracuda are well represented. The reporting of catches by species and effort by days fishing and zones for the commercial fleets is well organized. Monitoring is also to be reinforced with an observer program.

The artisanal fleet is composed of full-time, seasonal and part-time fishermen. Their catch and hence revenue is, with a few geographic exceptions, based on catches of each of the species groups, demersals, small pelagics and large pelagics, and on other non-fish resources (discussed below). The artisanal fishery, using shashas, wooden houris, fiberglass and aluminum outboard skiffs, inboard engine sambuks and dhow assisted beach seines are responsible for 94% of the total landings in the country. The approximate distribution of the number of fishermen based upon a "best guess" estimate is included in Table 71 below.

The reliance on catching pelagic species for income is significant in all regions. However, the regularity of income to fishermen is probably least variable with regard to demersal species - only 11% of total artisanal landings by weight, higher with large pelagics - 40% of landings, and highest with small pelagics - 36% of artisanal landings.

Demersal species were a larger proportion of the catch from the Batinah coast to the eastern edge of the Capitol region. The proportion fell off in the east and southeast, and increased somewhat in the Dhofar region. This is not because of different availability of demersal species but because fishermen direct their effort at species for which there is a market. Because of this, too, there is little idea of the amount of demersal species actually caught in the Southeast. Very large fish such as the Queen and Cobia are landed occasionally in hopes of finding a market with transporters. Without actually sampling at sea, however, little can be known about the magnitude of demersal bycatch in the search for kings and small sharks.

For the most part, fishing for demersal species and large pelagics can be carried on simultaneously by fishermen of any region. Fishing for small pelagics using the beach seine is done in lieu of other fishing activity where the gear directed at large pelagics and demersals cannot be left out unattended.

The most frequently observed gears during the visit are included in Table 72. Again, the predominance of gears, while reasonably consistent with the 1979 survey, is valid for the period of the visit only and may vary greatly with seasonal factors. The proportion of part-time fishermen to the local total of those fishing in the period appeared to be highest in the greater Salalah area, and, it has been said, in the Capitol region.

Abalone and lobster fisheries exist in the Dhofar region, a lobster fishery around Masira Island and a shrimp fishery off of Mahout Island. Each is very seasonal. The abalone fishery is said to earn revenue for "several thousand people" (FAO, 1984). The method of capture - by hand (diving and wading) does not limit the resource to fishermen as the shrimp and lobster resources are. Each resource is said to be under little pressure but very susceptible to any major changes in the technologies used in their capture. The seasonality of capture in the case of the shrimp is a function of the resource's migratory habits in relation to the gear used and the range of the hours. The seasonality of the abalone harvest is considered more a function of weather and sea conditions. That of the lobster is affected by the weather as well, but to a lesser extent.

A good review of marketing channels for all artisanal landings is contained in FAO (1984). Of the total of all landings of all species made by artisanal fishermen, 32.5% is sold to consumers in fresh form. 12%, though landed fresh, reaches consumers in iced form (predominantly higher priced large pelagic species sold inland and out of the country); 8% reaches consumers in frozen form having been sold to either the government or to the ONFC at Mutrah, Masira or Salalah; 8%, it is estimated, is consumed by fishermen and their families and their crew's

families; 26%, anchovies and sardines, are dried for animal consumption; 4% is cured in some fashion for human consumption - predominantly inland; and 9% is lost in handling, transport, etc. These are national figures. The options open to fishermen to sell their landed catches (as opposed to what they could land) vary from region to region. This heterogeneous distribution of marketing opportunities is unfortunate but helpful for purposes of sampling and stratification.

The industrial catch is exported as part of the concession agreement or contract, sold frozen to large institutional consumers, e.g., Ministry of Defense, or shipped to inland MAF-controlled cold stores. There is at this time little effective competition between the artisanal and industrial catches as they currently serve different markets. On the other hand, it must be agreed that there is the potential for competition for consumers of frozen fish.

To briefly paraphrase the government's goals for the fishery, it can be said that consumers are to have an increase in per capita consumption of fish and a reduction in the inland-coastal disparity of this consumption; fishermen are to increase in number to a number at least as great as that which existed before the rapid development of the oil resource; the resources are to be exploited fully and safely - the inshore resources by the traditional fisheries and the offshore for national wealth, import substitution and foreign exchange earnings by private initiative.

The Government's development priorities for the fisheries sector is reflected in both the first and second five-year plans. Threshold-level technology and support services to that technology - subsidies for outboard engines, aluminum and fiberglass boats and repair services carried out at workshops - continues to be increased. The Fishermen's Encouragement Fund has succeeded and continues to succeed in attracting fishermen to their former profession by opening up the possibility of competitive incomes from fishing in relation to the income from alternate employment. The Government has made and continues to make investments in marketing infrastructure - sheds, coldstores, landing facilities and inland fish selling units which increase the saleable life of the fish product which is landed. Financial commitments have been made for considerable consultancy services and for the establishment of a Marine Science Center in order to provide the research and advice necessary for the proper utilization of Oman's Marine Resources. In addition, the legal framework for protection of the living marine resources and for the management and control of fishing in Oman's EEZ have been formalized. A broad set of Decrees has charged the Ministry of Agriculture and Fisheries and certain other bodies with an extensive mandate and given them a variety of flexible regulatory tools.

DATA REQUIREMENTS In simplified fishery systems the usual data collection procedure is to first conduct a thorough frame survey of the entire area. From this frame survey a sampling scheme is designed. Samples are taken on a regular basis (by location and time), and the data connected in a central office. This conversion, in the simple

case, involves changing the data by various "raising factors" - numbers which allow samples to represent the whole or universe of activity.

The determination of these raising factors would take some time in Oman, even if a complete frame survey were done because of the temporal variation in the availability of stocks, to say nothing of geographical factors. As such, a different approach has been planned. Data on what is actually occurring along with data upon which to base "raising factors" will be collected simultaneously. The reason for this is that some baseline indicators, comparisons, etc., are needed as rapidly as possible. Given this approach, the following definitions apply:

- a. preliminary data - data on the causes of variation in catches and fishing activity from day to day, from place to place to determine frequencies of samples and data to relate what is observed to the populations involved. It consists of hard numbers of fishermen, boats, gear and the nature of the fishing activity by location by day, month, and season. This report constitutes a first iteration at establishing some of this data.
- b. Short run data whose principal purpose is to ascertain the current state of well-being of the resource and those using it, and to allow for preliminary comparisons between areas and time periods. It constitutes "what can be done first" given the degree of organization of the short term collection scheme and the level of support for that collection.
- c. Long run data - that which results from incorporating the preliminary data on the spatial and temporal distribution of catch, effort, and resources, with refined schemes which usually lend themselves to modelling.

In the near term we assume that both preliminary and short run data will be collected by one or more centrally located teams which will travel the country over the course of at least a year. Their observations will be based upon what occurs and what can be observed or estimated during the visit as opposed to being based on weighted samples of accurately identified populations. The important considerations in light of this are 1) the best effort at collecting data on total amounts will be made at each site; and 2) the best effort will be documented so that it will be repeated in the following time period. These two considerations will help assure that consistent, valid comparisons can be made. It will help in avoiding the trap of citing increases in production, for example, where the only improvement was in the sampling method used. Some comments on the importance and identification of preliminary, short and longer run data by subject areas is given below, followed by some considerations for carrying out the short-run and preliminary data collection scheme - the Catch Assessment Survey (CAS).

The data required for management and development purposes can be classified into five broad subject areas: 1. the resource in relation to its habitat, 2. the resource and its level of exploitation, 3. the economics of harvesting, 4. the state of market demand, supply and distribution, and 5. unexplored resources.

Short of identifying large oil spills or localized dumping of pollutants, the need for information on the resource and its spawning and rearing habitat - seasons, areas, etc. - is considered of second order of importance in the short run, given the level of fishing and the absence of any clear examples of localized interference in stock reproduction. The human and money capital investments needed for this research require long-term commitments appropriate to the work to be carried out at the Marine Science Center - and probably for the pelagics - work to be carried out through regional cooperation with regional research institutions.

Knowledge of the state and level of resource exploitation is obviously of primary importance regardless of the time frame. The short run data collection goals are to provide comparisons between areas and between months, seasons and years of estimates of 1. total catch, 2. catch by major species groups, 3. catch by most important (commercially) species within groups, and 4. gross measures of effort such as estimated number and type of boats fishing. In addition, it is important to initiate shortcut methods of measuring pressure on stocks which will lend themselves to more than the spatial and temporal comparisons mentioned above. Examples are measures of average length and/or weight of important species. Basic comparisons will come automatically via the visit schedule. More meaningful will be comparisons by gear type and characteristics of the gears. What distinguishes this last endeavor from a comprehensive length-frequency study is that the measurements are based upon what is encountered during the visit to the landing site as opposed to being based on a true random sampling scheme which covers the entire catch of that identified area.

Preliminary information for more refined sampling schemes in this subject area are well-known and include time of fishing (or checking gear), duration of gear deployment, nature of gear deployment, and information on the total number of boats by type and the number and type of gear associated with each type of boat. The distinction between what is preliminary and what is short run data is non totally distinct since all information gathered for short-term comparisons is usable as input into the design of sampling schemes. The major distinction between the short and long run data collection scheme in this subject area is that in the short run the catch will be related to numbers of boats and related gear, while in the longer run more effective measures of effort will be adopted.

A comment is in order with regard to the longer term data collection scheme. It is more in the nature of opinion than a statement resulting from any extensive research. The dynamics and behavior of the various species groups available to the artisanal fishermen of Oman, the more likely development of markets which affect them directly, and the areas that seem to be of most likely near term concern are such that the largest payoff for long range data collection and modelling efforts would seem to be with the demersal species. High concentrations of fishermen in certain areas of the Batinah coast can exert high levels of very localized effort on demersal stocks. Likewise, the economic importance of small dried sharks to fishermen in the Southeast and

northeastern Dhofar region has led to what appears to be a large but again localized amount of effort directed at these species. Useful and relevant work has been done in the adaptation and application of the basic Schaefer model to multispecies fisheries by Munro (1973 series) in the Caribbean and Pacific, and by Pope (1979) in the Gulf of Thailand.

The need for data on the economics of exploitation is of first order of importance in the short and long term. The purposes of short run data collection, like that for catch and effort data, is for comparisons of totals and average between regions and periods of time of incomes from and costs of fishing to those found fishing in a given visit to a site. Unlike the catch-effort information, however, the difference in number between those who fished and those who did not is quite important - both for calculation of short-term averages and as primary data for the design of longer term cost and earnings studies. For example, while average catches per boat of demersal species between Saham and Duqum may be of biological significance, the average revenue to fishermen of each town may be quite distorted if when visiting the Batinah Coast one encounters only five of over two thousand fishermen, while at Duqum one encounters 20 of a much smaller total. In other words, inter-period and inter-regional comparisons must be valid. What further distinguishes the biological and economic averages is that when one is not fishing, one still incurs economic costs. On the other hand, two valid statistics are the quantity and value of fish coming into a community in a given period of time.

The longer term analysis of cost and earnings is somewhat more complicated although the sampling scheme is almost coincident with that for catch and effort. A fairly thorough discussion of this longer term task is found in Steverson, Pollnac and Logan (1982) and in several FAO publications.

The preliminary information for a successful sampling scheme for this longer term effort is concerned with the frequency of fishing and number of each type of boat and gear combination. This latter investment in boat and gear distinguishes one fishing "firm" from another, and for cost and earnings studies the firm is the primary focus. Very generally, it is this cost and earnings analysis which will indicate by region and boat gear combination the profitability of fishing and the likelihood of satisfaction with fishing as an occupation in relation to alternative opportunities.

The desirability of fishing as an occupation, however, is a very localized phenomenon, a judgement made by an individual based on very local conditions - local amenities, local market conditions, the state of the resource within range, and the density of fishermen in the area. In this sense, then, it can be said that the longer term study - which should be initiated as quickly as is possible - is more important than the results of the short-term economic data analysis, although gross indicators of economic activity are important in themselves. In the very short term the presence of a waiting list for boat and motor subsidies with the Fishermen's Encouragement Fund is a sufficient, but not perfect, indicator of the desire for people to reenter the fishery.

This data could be analyzed to determine the actual percentage of applicants who are leaving other employment for fishing.

The question of data requirements from markets - we refer to consumer markets here - is an important and somewhat complicated one. The quantity of fish available in markets is a good measure of the amount of fish available to consumers above the requirements of fishermen and their families. In another sense it is a measure of the product available for trade by those who facilitate fish distribution. In the short run the most important variables to be measured - again for comparisons - are the total quantity of fish by commercially important species flowing through the market in a given period of time and the per unit average price of those species. The short term goal is to establish a method for consistently gathering this data where consistency means repeated samples or visits to as many markets as possible on the same days throughout the year so that comparisons are valid.

In many instances the landing sites are also the markets and represent opportunities for gathering other information of use. However, the consultants feel that the difficulty of estimating quantities entering the market and in gathering enough observations on sales to arrive at an average price by species and an average price per weight, when the weight is not measured or is hidden by sales on strings, is too much activity to be covered by one individual. In the past, observations on total returns to individual fishermen have been made in conjunction with observations on average prices and total quantities sold have been made by a single individual, with great perseverance and difficulty. While this commendable effort was necessary, given that it constituted the single most effective data collection effort occurring nationally, we feel that the tasks of determining returns to fishing trips and determining total quantities available and average prices should be separated.

In the longer term it is important that studies be carried out which estimate the other determinants of demand for fish. The price quantity relation data being collected in the short term should be continued in the longer term. In order to arrive at true demand relations, however, studies which indicate the effects of income and imported substitutes for fish on the demand for fish should be pursued.

The question of data on distribution of products from the various fisheries has been addressed in the section on marketing issues. It is sufficient here to re-emphasize that consistent repeatable measures of type, quantity, source and destination of various products are valuable indicators of the fisheries' operations and indications of possible new marketing opportunities.

The preliminary data required in this task are first order measures of frequencies of fish transporter visits by intersection, market, or petrol station.

No judgement can be made at this juncture regarding the need for activities related to exploration for new resources. The impact of such activities will, in the short run, lie with the private industrial

sector rather than with artisanal fishermen. Sufficient resource wealth exists now for artisanal needs, and the potential for increased incomes is limited in the short run by marketing opportunities. However, it can be said that data collection efforts for the purposes mentioned above require substantial support as the first major activity to be carried out and as a basis upon which so many decisions will be based.

In the longer term, say within two years of this writing, it would seem reasonable to decentralize the data collection scheme to division centers with oversight coming from the headquarters. The logistical problems will be greatest in Dhofar, and because of this, several of the workshop complexes should act as data collection centers. One can envision differential development of the various workshops in response to the different needs of the different divisions. One initial step in establishing a working relationship with fishermen in the area of data collection - as distinct from enforcement activities - could be the initiation of advice to fishermen on simplified accounting techniques.

It should be fairly clear that the number of factors which affect catches and revenues to fishermen in the different regions and over the course of a year is very large. Many of these are quite random in their arrival and in the duration of their effect on fishing. One reasonable method of dealing with this randomness, although not without a significant effort, is to transfer the responsibility for observation from those who are not on site 24 hours per day to those who are. The enticement for the fishermen taking on this added responsibility is an insight into the finances of their fishing operation, their expenditures over time and the many benefits which come with the ability to plan and see, to tradeoffs in the use of their time and money.

The accounting methods - more accurately called bookkeeping methods and accounts of activities - can be tailored to each region given the variety of resources available and the manner in which they are pursued. Support for the scheme can come from assurances of anonymity and from the provision of printed forms and instructional services tied in with the extension services. This scheme cannot be entered into lightly, but should be preceded by pilot scale tests of volunteers who could suggest changes and additions relevant to region.

The statistical use of the information gleaned from these forms - assuming that agreement has been made for the anonymous use of some of the data they contain - should be based upon the principles of random sampling even though more than the required number of fishermen per town are involved.

Catch Assessment Survey To summarize, the catch assessment survey should be designed to collect two sets of data: 1. that needed for inter-temporal comparisons within regions and towns and that for inter-spatial comparisons within a given period of time; and 2. Preliminary information for the design of longer term random sampling schemes. Both sets of data relate to three subject areas: A. data on the level of exploitation of the stocks; B. data on the economics of exploitation; and C. market data. The data required at each site for the duration of the visit are:

CAS-Baseline

CAS-Preliminary

A

Total Catch. Total Catch by Species Group. Total Catch by Major Species. Number of Boats Fishing by Type. Average length and/or weight of major species landed.

A

Total number of boats in "Town". Average number and type of gear in use by boat type. Number of each type of boat. How each gear is deployed. When gear is deployed or checked. Usual landing times. Any other related information on effective effort. Species sought in last 3 months/next 3 months. Amount and kind of discards at sea or on beach.

B

Total revenue accruing to fishermen during visit. Number of fishermen landing fish. Variable costs to boat of this trip. Day of week when most landings made. Relative numbers. Average percent of catch kept from sale for any reason.

B

Average number of trips fishing in last week. Average number of crew. Cost and source of gear. Life of gear. Last major purchase in gear. When repairs done last. Nature and cost of repairs. Seasonality of fishing (since last visit or until next visit - say 3 months).

C

Total quantity of fish offered for sale to consumers. Total quantity offered for sale by major species. Average price per unit weight of major species. Total quantity, by product type, source and destination of transported goods.

C

Number and kind of different product forms. Relative amount of different product forms. Relative amounts of species and products offered for sale on Friday versus other days. Frequency of truck transport at market, intersections, and petrol stations. Prices per kilo of fresh and frozen meats and poultry in market.

The definition of some of these variables is obvious; some are not. Total revenue accruing to fishermen is the amount of money earned by the fishermen at that site during the duration of the visit - to those who landed fish. Number of fishermen refers to the owner and crew members. Variable costs are defined for this landing, for this fishing trip and consist of cost of fuel (quantity used this trip X price per unit), oil costs, bait costs, losses of gear - value if sold today as is. A thorough discussion by each item is in Stevenson, Pollnac and Logan (1982).

The CAS is a sampling scheme in its own right, but one based on relatively little knowledge of hard numbers and how they vary through time. As a first approximation, it is suggested that the relative numbers of each region dictate the weighting of the total number of visits to be made over the course of an entire calendar year. This approximation can be improved even before the CAS gets off the ground by trying to identify how and when and for how long the monsoons affect the amount of fishing in each division. Short of this information, it appears to us that the divisions suggested here represent a best approximation to an ideal proxy which identifies homogeneity within and differences between parts of the country as far as 1. number of boats per length of coast, 2. gears used, 3. number of fishermen per length of coast, 4. resources currently sought, 5. the marketing opportunities available to the fishermen, and 6. the socioeconomic condition of the fishermen. This breakdown essentially defines the different artisanal fishery systems. It also takes into consideration the nature of the current road system. The largest variation within region on several counts is within Dhofar. Parts of this region are very remote indeed. For this reason it is worth considering initiation of a bookkeeping type of data collection system as early as possible.

If a single team of enumerators is assigned the CAS task, then given the weights based upon the number of fishermen in each region, the following time considerations are of importance. Each division should be visited quarterly; this is in the attempt to increase knowledge of the timing and duration of the availability of small and large pelagics, the migrations of fishermen, and the effects of weather on fishing and selling activities. Each site visit should last at least twenty-four hours regardless of the size of the site being visited. For the very smallest sites, the team can be subdivided. This, of course, raises accommodation problems. Mobile campers are a possible solution. The distribution of visits within divisions should also reflect the numbers of fishermen at each site. The ordinal ranking numbers of fishermen in each site is much more reliable than the cardinal ranking. The estimated distribution of fishermen within and between divisions is given below - with apologies for towns missing, misspelled or redundant made beforehand.

Table 41. Estimated distribution of fishermen based upon number and use of vessels, average crew size, visible conditions, and key informant information.

	<u>2-50</u>	<u>51-150</u>	<u>151-300</u>	<u>301-450</u>	<u>451-600</u>	<u>600-1000</u>	<u>1000</u>
NORTH BATINAH							
Liwa		x					
Shinas						x	
Sohar							x
Saham					x		
Estimated Total:	2524						
SOUTH BATINAH							
Khaboura					x		
Suwaiq							x
Barka			x				
Estimated Total:	2324						
CAPITAL							
Al Seeb					x		
Qurm		x					
Darsait		x					
Ash Shutayfi		x					
Mutrah		x					
Muscat		x					
Sidab		x					
Bustan		x					
Quantab		x					
Yiti	x						
Quriyat				x			
Estimated Total:	1422						
NORTHEAST							
Tiwi	x						
Sur						x	
Al Askhara				x			
Estimated Total:	950						
SOUTHEAST							
Negder	x						
Filim	x						
Mahout Is.				x			
Zahar	x						
Halat	x						
Nafun		x					
Duqm				x			
Shuyel	x						
Madraka	x						
Estimated Total:	767						

Table 71, continued.

	<u>2-50</u>	<u>51-150</u>	<u>151-300</u>	<u>301-450</u>	<u>451-600</u>	<u>600-1000</u>	<u>1000</u>
MASIRA							
Dawwah			x				
Sur Masira	x						
Rasua	x						
Urf	x						
Haqi	x						
Kalban	x						
Estimated Total:	398						
DHOFAR							
Al Jazir	x						
Sograh		x					
Sharbithat		x					
Kuria Muria Is.		x					
Shuwaimiya	x						
Hasik		x					
Hadbin		x					
Sadh		x					
Mirbat					x		
Taqa			x				
Salalah		x					
Raysut					x		
Mugsail			x				
Dahlrbot		x					
Rakhyut		x					
Darkut		x					
Estimated Total:	2313						
Estimated Grand Total:	10,698						

NOTES:

1. Observations made 15 March - 15 April 1984.
2. Underestimates number of people involved in fishing where vessels are not involved, e.g., abalone fishery in Dhofar.
3. In general, estimates felt to be on high side given number of boats observed and crew size estimates.
4. Some factors taken into consideration:
 - a. Crew size: Shasha 1.5; aluminum, fiberglass, small wooden houri 2.1; larger wooden houri 2.3; Sambuk 3-4 at Batinah and Masira, 4-8 at Sur and Al Ashkara.
 - b. Redundancy of larger vessels used with beach seines.
 - c. Poor condition of approx. 35% of Shashas in Batinah.
 - d. Condition of many beached vessels.
 - e. Number of nets and gear collections on beach.
 - f. Time of day, likelihood of boats fishing when site visited, use of binoculars, etc.

Table 72 contains a breakdown of information on each town - where it is known - pertaining to the act of sampling and measuring for all three purposes (subject areas). The items are labeled A, B, C, D, etc. and the entries are 1 = yes, 0 = no, $\frac{1}{2}$ = almost, ? = don't know, * = educated guess.

ITEM

- A. If you are at the site, you will see all that is being landed at that time, i.e., the total catch for that identified area, say, Saham, in that period of time.
- B. If you are at this site, you can ascribe the catches to particular boats.
- C. If you are at this site, you will be able to talk with those who fished.
- D. Here, the landing site is also the consumer market and information for all subjects areas can be gathered at one site.
- E. Landing site remote from place where boats anchor or beach (not visible).
- F. Landing site where landings and sales are made at night.

In addition, the major gear types observed are included with the abbreviations as follows: H-handline, T-traps, N-nets, B-beach seines, C-cast nets, T-troll lines. They are listed in order of frequency of observation. This information should be useful in preparing a strategy for each visit - determining the duration of the visit and selecting what proxies will be chosen when the totality of different variables cannot be observed.

Table 72. Preliminary breakdown of landing sites by difficulty of collecting various data.

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>Major Gear Types Observed</u>
NORTH BATINAH							
Liwa	0	1	1	1	0	0*	B G T
Shinas	0	½	1	½	0	0*	
Sohar	0	1	1	1	0	0*	
Saham	0	1	1	1	0	0*	
SOUTH BATINAH							
Khaboura	0	1	1	1	0*	0*	G T B
Suwaiq	0	1	1	1*	0*	0*	
Barka	0*	1	1	1	0*	0*	
CAPITAL							
Al Seeb	0	1	1*	0	1*	0*	G H
Qurm	0	1	1*	0	1*	0*	
Darsait	0	1	1*	0	1*	0*	
Ash Shutayfi	0	1	1*	0	1*	0*	
Mutrah	0	1	1	1	1*	0*	
Muscat	0	1	1*	0	1*	0*	
Sidab	0	1	1*	0	1*	0*	
Bustan	0	1	1*	0	1*	0*	
Quantab	0	1	1*	0	1*	0*	
Yiti	0*	1*	1*	0	1*	0*	
Quriyat	0*	1	1*	0	1*	0*	
NORTHEAST							
Tiwi	0*	1*	?	1*	0	0	G H
Sur	1	0	0	0	1	1*	
Al Askhara	1	0	0	0*	1*	1*	
SOUTHEAST							
Negder	1	1	1	1	0	1	G H C
Filim	1	1	1	1	0	1*	
Mahout Is.	½	1	1	0	0	0*	
Zahar	1	1	1	1	0	1	
Halat	1	1	1	1	0	1	
Nafun	1	1	1	1	0	1	
Duqm	1	1	1	1	0	1	
Shuyel	1	1	1	1	0	1	
Madraka	1	1	1	1	0	1	
MASIRA							
Dawwah	0	1	1	0	1	1	G C H
Sur Masira	1	1	1	1	0	0*	
Rasua	1	1	1	1	0	0*	
URF	1	1	1	1	0	0*	
Haql	1	1	1	1	0	0*	
Kalban	1	1	1	1	0	0*	

Table 72, continued.

	A	B	C	D	E	F	Major Gear Types Observed
DHOFAR							
Al Jazir	?	1*	1*	1*	0*	0*	T C G
Sograh	?	1*	1*	1*	0*	0*	
Sharbithat	?	1*	1*	1*	0*	0*	
Kuria Muria Is.	?	1*	1*	1*	0*	0*	
Shuwaimiya	?	1*	1*	1*	0*	0*	
Hasik	1	1	1	1	0	0*	
Hadbin	?	1	1	1*	0*	0*	
Sadh	?	1	1	1*	0*	0*	
Mirbat	$\frac{1}{2}$	1	1	0	0	0*	
Taqa	$\frac{1}{2}$	1	1	0	0	0*	
Salalah	0	1	1	0	0	0*	
Raysut	1	1	1	0	0	0*	
Mugsail	$\frac{1}{2}$	1	1	0	0	0*	
Dahlrbot	?	1*	1*	?	0*	?	
Rakhyut	?	1*	1*	?	0*	?	
Darkut	?	1*	1*	?	0*	?	

General suggestions for sampling for the CAS The following are suggestions about the act of observation, the use of proxies, leaks, and money. Many relate to the fact that the landing and selling of fish takes place very rapidly at times and at other times is carried out over 24-hour periods.

(1) In large markets such as those at Mutrah, Sanaw, Nizwa, Salalah, two persons are required for the appropriate coverage of the short-term and preliminary data collection. (2) At places such as the Batinah coast in general, one individual of the team can carry out the tasks defined for market information. (3) In intermediate size landing spots where sales take place and fishermen are available for discussion - we will define this as the "average town" - the following personnel are required for the following tasks:

Baseline A - two: one at the waterline watching everything coming off boats and one getting average lengths. These tasks occur simultaneously and last the duration of the market. Temporary purchase of total catches of random boats is suggested for length measurements. One could assure fish to measure by buying slightly high from the fishermen and selling slightly low to a middleman.

Baseline B - one: as in the CAS, we are not ascribing revenue to particular fishermen but an average to those who fished. This average can be arrived at by having the person estimating total catch at the water line also count the number of boats landing and the number of fishermen on each. The total revenue will

result from the total quantity landed multiplied by the average price per unit by species.

Baseline C - one: in this town the total amount landed and the total amount offered for sale are the same. One person is required to inspect as many transactions as possible over as many important species as possible. He might merely ask the offering price for the fish. Differences in asking prices over the duration of the market morning should be averaged into one single price for a species on a given day at that location. In the longer term premiums for freshness might be examined in a study of the acceptability of frozen fish. One person will be required to interview those either minding the boat in the surf or carrying fish up to the selling point to ask questions about variable costs.

Preliminary A, B and C, none additional. This is an "after market" activity. The data involved is not particular to those who fished but to the community as a whole.

(4) The number of personnel involved in sampling in town which vary from this "average experience" should be adjusted on the basis of the number of tasks which have to be performed simultaneously. (5) Those items requiring interviews with fishermen are best left to Omani Nationals. It is far easier to transmit the nature of what is required to a small set of counterparts and test the nature of this transmission than to do so with hundreds of fishermen.