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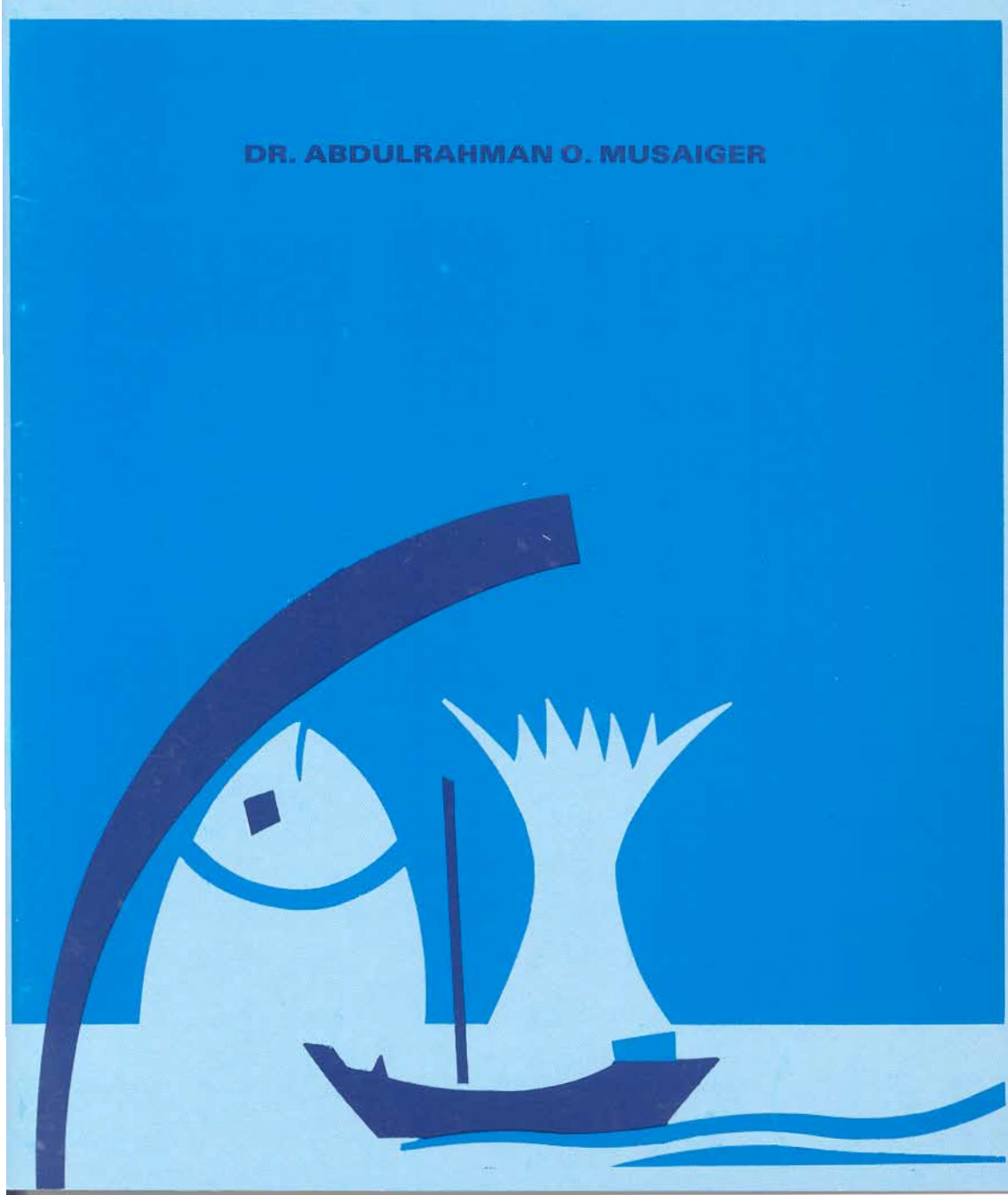

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ABSTRACT

This report reviews the fisheries in the State of Bahrain. Although the country has fishing resources, there are some difficulties in utilizing such resources. A decline in the number of fishing fleets and of full-time Bahraini fishermen was reported (10% and 16.2%, respectively). Traditional methods such as barrier traps and fishpots are widely used and contribute to about 55% of the total fish landing. Harbour in the villages are lacking storage and marketing facilities. Fish imports have increased rapidly from 927 tonnes in 1979 to 2932 tonnes in 1986, which indicates that Bahrain is still not self-sufficient in fish production. Annual per capita fish consumption has also increased from 14.3 kg in 1979 to 25.8 kg in 1986. Factors determining the fisheries resources were briefly discussed, and some suggested measures to develop them were provided.

INTRODUCTION:

Fishing, pearl diving, and agriculture were the common occupations of the Bahraini inhabitants before advent of oil. At that time the Bahraini community was self-sufficient in fish and agriculture products (Musaiger, 1987). It was reported that fish was the main protein diet for the average family through 11 out of 12 months of the year (FAO, 1968). Recently, these occupations are seldom chosen due to several factors; the advent of cultured pearls, the development of oil industry which attracted many fishermen and farmers, and rapid development of trade of livestock and poultry as they replaced the consumption of fish.

The present report discusses the current situation of fisheries in Bahrain, difficulties, and some measures to develop fisheries resources.

LANDING SITES:

There are many sites around the inhabited coast of Bahrain, and generally speaking fish landing could be possible around the islands. The Directorate of Fisheries classified these sites into two categories depending on the landing and methods of fishing. The first category (A) includes the sites where the landing is relatively high and fishing depends mainly on boats. The second category (B) includes the sites where barrier traps (haddra) is the main fishing method (Abdul-Qader,1983). Geographically, the fishing sites were grouped into four main areas; East, North, West and Muharraq provinces.

FISHING VESSELS:

There are six categories of fishing vessels used in fishing in Bahrain; they are classified according to their keel-length and tonnage. Table 1 shows the characteristics of these fishing vessels. The common one is Banoush which is a wooden vessel built locally. These wooden boats are only used by

artisanal sector, and the fishing efficiency is low when compared to steel vessels used by industrial sector (Abdul-Qader, 1983). Hoory is another important vessel. It is made from wood or fiberglass, and it is smaller in size than Banoush.

Table (2) illustrates the distribution of fishing vessels in Bahrain according to their categories and fishing sites for the year 1983. It can be noticed that Horry was the major vessel used in Bahrain. There were 1428 vessels used in fishing, 83% of them were small in size and had lower fishing efficiency. This of course affects the total fish landing and more attention should be paid to enroll big size vessels or to increase the efficiency of current vessels.

There was a decline in the number of vessels used between the years 1978 and 1983. This decline reached almost 10% of the total vessels. The main drop was found in big size vessels especially Banoush, in which the number fell from 154 in 1978 to only 21 in 1983. This is due to the decline of the

number of full-time fishermen working in this kind of vessel. The decrease in the number of big steel vessels was due to close down of the Bahrain Fishing Company in 1979, which used these types of vessels (Fisheries Statistical Services, 1985).

LABOUR FORCE:

The number of fishermen has increased from 4101 to 4554 during the period 1978-1983. Most of this increase has occured in the Bahraini fishermen, where their number rose by 13.4% during the same period. However, the non-Bahraini fishermen showed a similar decrease, 13.5%. This drop of non-Bahraini fishermen was mainly due to the close down of the Bahrain Fishing Company which employed a large percentage of non-Bahraini workers (Fisheries Statistical Services, 1985).

It is important to note that there was a decrease by 16.2% among the full-time Bahraini fishermen, and more part-time as well as occasional fishermen involved in the fisheries (Table 4). This may imply that many full-time fishermen have shifted to a better paying job in other sectors.

Table 1

Characteristics of fishing vessels used in Bahrain.

Local name of vessel	Characteristics	
	Keel length meters	Total tonnage metric ton
Hoory (wood or fiberglass)	< 5	< 0.9
Small-Banoush (wood)	5.0 - 7.9	1.0 - 4.9
Medium-Banoush (wood)	8.0 - 10.9	5.0 - 9.9
Big-Banoush (wood)	11.0 - 20.0	10.0 - 24.9
Small-Steel Boat	15.0 - 21.9	50.0 - 99.9
Big Steel Boat	22.0 - 30.0	100.0 - 149.9

Table 2

The distribution of fishing boats according to their classification and landing site[1] (1983).

Landing sites	Classification of the boats											
	Hoory		Small Banoush		Medium Banoush		Big Banoush		Big Steel Boat		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
East	396	33.2	46	39.7	35	38.5	-	-	8	100.0	485	100.0
North	252	21.1	41	35.3	5	5.5	1	4.8	-	-	299	100.0
Muharraq	449	37.7	24	20.7	38	41.7	18	85.7	-	-	529	100.0
West	95	8.0	5	4.3	13	14.3	2	9.5	-	-	115	100.0
Total	1192	100.0	116	100.0	91	100.0	21	100.0	8	100.0	1428	100.0

[1] Landing site is an area used by fisherman either as residence or for boat mooring or landing of his catch.

Table 3

Total number and percentage of fishing boats used in Bahrain according to their classification for the years 1978 and 1983.

Classification	1978		1983		% of change
	No.	%	No.	%	
Hoory	1193	75.2	1192	83.4	- 0.08
Banoush, small	118	7.4	116	8.1	- 1.7
Banoush, medium	99	6.2	91	6.4	- 8.1
Banoush, big	154	9.7	21	1.5	- 86.4
Small-Steel Boat	17	1.1	9	0.6	- 47.1
Big-Steel Boat	5	0.3	-	-	-100.0
Total	1586	100.0	1429	100.0	- 10.0

Table 4

Distribution of fishermen in Bahrain according to their involvement in fishing during the 1978 and 1983 censuses.

Nationality	Year	Category of fishermen						Total	
		Full-time[1]		Part-time[2]		Occasional[3]			
		No.	%	No.	%	No.	%	No.	%
Bahraini	1978	2212	59.2	1331	35.6	195	5.2	3738	100.0
	1983	1822	43.0	1489	35.1	929	21.9	4240	100.0
Non-Bahraini	1978	321	88.4	32	8.8	10	2.8	363	100.0
	1983	304	96.8	10	3.2	-	-	314	100.0
Total	1978	2533	61.8	1363	33.2	205	5.0	4101	100.0
	1983	2126	46.7	1499	33.0	929	20.4	4554	100.0

[1] Full-time fisherman: One who spends more than 90% of his working hours in fishing.

[2] Part-time fisherman: One who spends between 30 to 90% of his working hours in fishing.

[3] Occasional fisherman: One who spends less than 30% of his working hours in fishing.

Table 5

The distribution of Bahraini fishermen according to the province fishing sites (1983).

Province fishing sites	Category of fishermen							
	Full-time		Part-time		Occasional		Total	
	No.	%	No.	%	No.	%	No.	%
East	653	35.8	395	26.5	236	25.4	1284	30.3
North	578	31.7	404	27.1	179	19.3	1161	27.4
Muharraq	484	26.6	473	31.8	508	54.7	1465	34.5
West	107	5.9	217	14.6	6	0.6	330	7.8
Total	1822	100.0	1489	100.0	929	100.0	4240	100.0

Table 5 presents the distribution of Bahraini fishermen by province fishing sites. It is clear that Muharraq province has the highest percentage of fishermen (34.5%), followed by East province (30.3%). Full-time fishermen were more concentrated in East and Northern provinces. The number of full-time fishermen and of course type of vessels are highly influenced the fish landing in each province.

FISHING METHODS:

There are several mehtods or gears used in fishing in Bahrain. These could be grouped into 4 main methods:

a. Gagoors: They are dome-shaped basked traps fabricated locally from a metal wire of one millimeter thickness and supported by aluminum pipes or palm fronds. There are two sizes of gargoors: A large one which has a mesh-size of 5 to 7.5 Cm and a base diameter of 2 meters. While a smaller gargoor has a mesh-size ranging from 2.5 to 3.5 Cm, and about one meter in diameter at the base. Gargoors are laid

in the sub-littoral sand-mud flats at depths ranging from 4 to 12 meters. Floating buoys made out of thermocole are used as a marker to locate the position of gargoors. Groupers, Emperors, Grunts and Rabbitfishes are the main fishes caught by gargoors (Al-Baharna, 1986).

b. Hook and line: There are various type of gears involving hook and line. Haddag which is a hand-line is the most commone one. It is used to catch fishes such as Groupers and Emperors. A troll-lines called "Lafah" is another type commonly used to catch Mackerels and Groupers (Al-Baharna, 1986).

C. Nets: Various types of nets are used by fishermen in Bahrain. The nets include gill-nets and seines. The gill-nets are formed by joining several sections of netting with length of 40 to 50 meters. Mesh-size is varied depending on size of fish. For smaller fish, the mesh-size is 2.5 Cm, while for larger fish it is 10 Cm. The gill-nets are used to catch Mackerels, Rabbitfishes, Barracudas,

Mullets, Garfishes and Sliverbiddies (Al-Baharna, 1988).

Another types of nets used are beach seins, surrounding nets, shrimp and fish trawles.

d. Haddrah or barrier traps: Haddrah is one of the oldest methods used in fishing in Bahrain, and other Gulf States. Haddrah is complicated in its design with an arrowhead shape, the pointed and directed from the shore. It consists of a fence made of plam stakes fronds driven into the mud-sand bottom and supported by stones at the base. The fronds are fastened to each other with nylon ropes and covered on one side by a mesh of one inch size. The haddrah is laid on intertidal slopes, particularly near the lower water line. Rabbitfishes, Shrimps, Jacks, Needlefishes, Barracudas, and Snappers are the main fishes catch by haddrah (Al-Baharna, 1986).

There was a sharp decline by 45% in the use of the barrier traps (the number fell from

971 in 1978 to 535 in 1983). This decrease in the number of barrier traps is due to reclamation and dredging operations which were carried out in several places along the coast of Bahrain.

It was noticed that there was a general trend toward using shrimp trawlers, hook and line, and small gargoors. Shrimp fishing becomes highly profitable, more and more fishermen are involved in this activity. FAO (1978) reported that there was a growing interest in shrimp fishing, and the shallow sea of the Gulf contains good shrimping ground. Therefore, new trawlers were added to the fleet each year. As the number of occasional fishermen increased, the use of hook and line rose, since this method is the main one used by such fishermen.

FISH LANDING:

The total fish landing has increased from 3801 tonnes in 1979 to 8057 tonnes in 1986 (an 112% increase). The two sectors contributing to fish landing are the artisanal and the industrial sectors which contribute 76% and

24%, respectively. It is apparent from Table 6 that the contribution of the industrial sector show a significant decrease sine 1981. The total catch from this sector was 2238 tonnes in 1980, which slowly fall to 1927 tonnes in 1986, a 14% decrease.

The artisanal sector is a major one. It is operated by traditional fishing methods such as haddra and gargoors Since this sector is the main supplier of fish in Bahrain, more emphasis should be given to develop it.

Bahrain landing consists mainly of rabbit fishes, shrimps, groupers, perches and trevallies which represent 68.6% of the total landing in 1986. Crustacean fishery depends largely on shrimps which form 90% of the total landing. The contribution of rabbit fish (Siganus canaliculatus), the most popular fish in Bahrain, to the total landing increased from 11.9% in 1979 to 16.4% in 1986. Groupers came second in order; its contribution to the total landing slightly increased from 13.4% to 14.5% during the years 1979 and 1986, respectively (Table 7). In general, the fin fish landing increased by 69%, and the

crustaceous by 831%, while molluscans rose by 270% between 1979 and 1986.

Gearwise, the highest percentage of landing in 1986 was caught by trawl net (39%), followed by gargoor (32%), and haddrah (17%), as shown in Table 8. Fish trawlers are operated by industrial fishery sector, while the shrimp trawlers are operated by both sectors (Fisheries Statistical Service, 1985). A significant increase of shrimp trawling is noticed. The contribution of shrimp trawling to the total fishing methods in 1979 was 7.4%, and increased to 23% in 1986. In contrast, fish trawling dropped from 33.8% to 16% in the same years, respectively.

LANDING FACILITIES:

There are about 51 fishing sites distributed in four areas in Bahrain. Table 9 gives the main landing facilities available in these sites during 1983. Clearly from this table we can notice that the majority of the fishing sites in Bahrain were lacking facilities for servicing the ice, fresh water, fuel and mooring pier. Beach landing and

marketing facilities were available in 86.3% of the total fishing sites.

HANDLING AND PROCESSING:

Fish catch is stored in insulated boxes. An adequate amount of ice is used which is mixed with the fish in order to get rapid cooling (MATCH 1982, and Cole et al, 1977). Big boats took 6 to 18 hours or may be longer to complete their fishing, while small boats usually land their catch within a few hours, and use ice before trucking the fish to the market (MATCH 1982).

Cole et al (1977) have noticed that fish during handling and processing were bulked too deep with at least 8 feet. This will damage and crush the fish, especially in the bottom and in the middle of the pile. Consequently the shelf-life and eating quality of the fish will be reduced. To solve this problem Cole et al (1977) suggested that pound boards or dumage could be used, so that the fish are packed in layers not more that 2 feet deep. Plastic boxes are also suggested to store the fish with ice, and this will improve the fish

on landing as well as reduce the time and efforts needed to handle the fish from the boats to the shore.

When boats arrive at the landing sites, the fish are transported in insulated boxes, by pickups to the market. Almost all the fish landed are marketed as a fresh product. Some kind of fish, like rabbit fish, are threaded together to form "strings" by means of a palm leaf passed through the grills. This practice was also found by Neve and Al-Aiidy (1983) to exist in Saudi Arabia.

Unsuitable handling and transportation of fish in Bahrain have been mentioned in other reports (Cole et al, 1977 and Al-Alawi, 1981). The ice is brought in open pickups and lorries with the result that much of the ice is lost through melting. The fish are transported in open pickups and therefore they are exposed to direct sunlight. This may lead to a reduction of the shelf-life of fish. Al-Alawi (1981) reported that some fish in Bahrain have less shelf-life due to improper ice storage and handling. Shelf-life of the fish depends on many factors such as proper handling, storage,

methods of fishing and species. Cole et al (1977) found that Lethrinus lentjan has a shelf-life of 15 days and Scomberomorus commerson of 11 days when stored in ice. Al-Alawi (1981) found that Trachurus indicus and Rastrelliger kanagutra have a shelf life of 7 and 8 days, respectively, when stored in ice.

Fish, shrimps and other marine products are displayed in baskets made of date palm or on mats on the ground or in the concrete display. This depends on the market facilities, since some central markets have been constructed for the sale of fish. In Manama Central Market (the main fish market), facilities for fish marketing available include proper display shops, cold storage and running water. Processing of fish includes cleaning, filleting and/or eviscerating, all of which are provided to the consumers (MATCH 1982). In many other markets, particularly in the villages, handling and processing facilities are lacking. The fish are displayed without ice on mats on the ground.

Unsold fish are kept overnight in cold storage and brought back for sale the next

day. Most of the fish are sold as fresh products. Small proportions of fish are dried or salted. Shrimps are the most common types of marine products chosen for drying purposes, especially at peak seasons.

Salted fish are less consumed in recent years, as a result of changes in the dietary habits of Bahrainis. Canned fish are highly consumed when compared to other processed fish. The most popular varieties are tuna, mackerel and sardine. Frozen fish and shrimps are also available in the supermarkets, and widely consumed by non-Bahraini.

MARKETING AND DISTRIBUTION:

The fish inflow to the market begins early in the morning around 0400 o'clock. As soon as the fish arrive, the auction starts. It may be done on part or on all the catch. Usually the wholesaler controls the auctions, but sometimes the marketing is done directly between retailers or institutional purchasers, such as hotel traders, caterers, supermakets and other cold stores. When the auction is finished, the retail sale begins (MATCH, 1982 and Abdul-Qader, 1983).

There are various ways of fish marketing in Bahrain. In towns which have a central fish market, storage and fresh water facilities are available and the possibility of fish spoilage is relatively low. In other villages which are lacking most facilities, the marketing is done in an open area and the fish are not protected from heat, particularly from direct sunlight. Under this condition a rise in fish temperature is possible, and this influences the subsequent shelf-life. Many purchasers, therefore, prefer to buy the fish early in the morning or in the afternoon, soon after the fishermen land their catch.

In some villages, especially those far from the seashore, small pickups drive round the houses to sell fish, which are mixed with ice and covered by wet cotton or jute cloth. In this case fish are exposed to contamiantion and spoilage, since these vehicles have no proper storage facilities.

Local consumers prefer small and medium size fish such as rabbit fish and trevallies. Large size fish like groupers are usually bought by hotels and restaurants.

Prices of fish depend mainly on the seasons of fish species. For example the peak season for Spanish mackerel landing is during the winter months, November till February. Shrimps and rabbit fish landing peak is during summer. Groupers are continuously landed all through the year.

FISH IMPORTS AND EXPORTS:

The imports of fish have shown a marked growth from 927 tonnes in 1979 to 2932 tonnes in 1986. The major imports being fresh, chilled, and frozen fish.

The contribution of fish imported to the total fish consumed in Bahrain in 1986 was 26.7%. This indicates that Bahrain is still not self-sufficient in fish production, and a programme is needed to encourage the fisheries and their various sectors, especially the artisanal one which contributes 55% of the total fish consumption (Table 6).

Bahrain does not export any fish or fish products during the period 1983-1985. Prior to that period there were some fish exports

and the amount fluctuated from year to year. It was reported that in 1976 Bahrain exported 1366 tonnes of fish, most of them were frozen shrimps (MATCH 1982). The Fisheries Statisitcs Services (1985) reported that the amount of fish exported in 1979 was 15.3 tonnes representing 1.2% of local fish landing in the same year. The amount, then, increased sharply to 179.2 tonnes in 1980, and to 218.9 tonnes in 1981, representing 8.0% and 10.2% of total fish landing, respectively. Export in 1982 dropped dramatically to only 21.2 tonnes which represented 1.1% of the total fish landing.

FISH CONSUMPTION:

The annual per capita fish consumption in Bahrain has risen from 14.3 kg in 1979 to 25.8 kg in 1986, as reported by Fisheries Statistical Service 1987. The 1986 figures is less than that reported by the Household Budget Survey (1985), as the annual per capita consumption of fish was 34.3 kg for 1983-1984, and the consumption was higher among Bahraini (35.8 kg) than non-Bahraini (27.5 kg). Possibly this is due to the fact that fishing

Table 6

The contributions of artisanal and industrial sectors and fish import to the total fish consumed in Bahrain during the years 1979-1986.

Year	Artisanal Sector		Industrial Sector		Import		Total	
	MT	%	MT	%	MT	%	MT	%
1979	2496	52.8	1305	27.6	927	19.6	4728	100.0
1980	2877	46.4	2238	36.1	1090	17.6	6205	100.0
1981	3599	47.7	2148	28.5	1803	23.9	7550	100.0
1982	3750	49.8	1844	24.5	1932	25.7	7526	100.0
1983	3303	41.9	1509	19.1	3081	39.0	7893	100.0
1984	4242	49.2	1357	15.7	3021	35.0	8620	100.0
1985	6185	57.9	1578	14.8	2929	27.3	10692	100.0
1986	6130	55.8	1927	17.5	2932	26.7	10989	100.0

Table 7

Total landing in Bahrain by fish species for the period 1979 and 1986 (in Metric Tons).

Fish group	1979 MT	1979 %	1986 MT	1986 %
Fish group				
Rabbit fishes	451	11.9	1323	16.4
Perches	688	18.1	874	11.7
Groupers	509	13.4	1166	14.5
Trevallies	321	8.5	433	9.3
Mackerels	85	2.2	290	4.0
Parrot fishes	91	2.4	147	2.7
Sea breams	53	1.4	355	2.4
Grunts	80	2.1	181	1.9
Silver biddies	6	0.2	101	1.7
Snappers	247	6.5	62	1.6
Other fishes	1051	27.5	1162	15.0
Crustaceans				
Shrimps	182	4.8	1733	14.4
Crabs	23	0.6	154	2.9
Shovel lobsters	2	0.1	40	0.3
Molluscs				
Sepia, clamars	10	0.3	37	0.9
Total	3801	100.0	8057	100.0

Table 8

Gearwise landing in Bahrain for the years 1979 and 1986.

Methods of fishing	1979 Landing (MT)	%	1986 Landing (MT)	%
Haddrah	570	15.0	1373	17.0
Gill net	113	3.0	481	6.0
Gargoor	1431	37.7	2568	31.9
Hook and line	119	3.1	479	5.9
Shrimp trawl	281	7.4	1852	23.0
Fish trawl	1286	33.8	1304	16.2
Total	3801	100.0	8057	100.0

Table 9

Landing facilities in all fishing sites (51) in Bahrain (1983).

Facilities	Availability			
	Yes		No	
	No.	%	No.	%
Mooring pier	5	9.8	46	90.2
Beach landing	44	86.3	7	13.7
Fuel	2	3.9	49	96.1
Fresh water	2	3.9	49	96.1
Ice	1	2.0	50	98.0
Marketing	44	86.3	7	13.7

is a hobby of many people in Bahrain, especially among Bahraini, and therefore many families consumed more fish that were caught by their members.

The consumption of fish is influenced by many factors. Prices of fish, types of fish, nationality, preferences and socio-cultural occasions are among these factors. It was found that the household expenditure on fish and fish products has decreased during the past ten years. The household expenditure on fish during the period 1973-74 was 13.2% of the total food expenditure dropped to 10.2% during 1983-1984, which was largely due to changes in dietary habits as more meat and poultry were consumed.

During Ramadan (the fasting month of Muslims) the consumption of fish falls to its lowest level. It was reported that the amount of fish available in the market during this month decreased by 70%. The demand on fish decreased sharply, and as a result many fishermen stopped fishing.

Table 10 shows the annual per capita consumption of various types of fish in

Table 10

Per capita annual fish consumption in Bahrain (1983/1984).

Type of fish	Annual per capita consumption (kg)		Total
	Bahraini	Non-Bahraini	
Rabbit fishes	8.4	1.9	7.2
Groupers	7.7	4.9	7.2
Mackerels	2.5	1.6	2.3
Trevallies	1.7	1.5	1.7
Perches	5.6	2.1	5.0
Other fresh fish	4.3	7.6	4.9
Fresh shrimps	4.5	4.7	4.6
Frozen, salted fish	0.3	2.1	0.6
Frozen, dried shrimp	0.6	0.6	0.6
Other sea products	0.2	0.5	0.2
Total	35.8	27.5	34.3

Table 11

Composition of some fish commonly consumed in Bahrain (per 100g edible portion).

Scientific name	Local name	Common name	Proximate composition						Minerals		
			Moisture g	Protein g	Fat g	Ash g	Carbo-hydrate g	Energy (kcal)	Calcium mg	Phosp-horus mg	Iron mg
Portunus sp.	Gubgub	Crab	85.8	11.4	0.7	2.0	0.5	57	-	-	-
Tylosurus sp.	Hagool	Gar fish	76.7	21.1	0.6	1.5	-	90	52	268	3.21
Seriolina nigrofasciate	Hamam	Trevallie	75.7	20.4	2.1	1.8	-	100	66	256	1.68
Epinephelus tauvina	Hamour	Grouper	76.4	18.8	35.7	1.1	-	107	18	210	0.64
Liza sp.	Maid	Mullet	67.3	18.6	12.1	1.9	-	183	339	367	1.74
Diplodus kotschyi	Muchawah	Sea bream	70.4	19.0	8.0	2.5	-	148	512	433	1.65
Lethrinus lentjan	Sharee	Perche	78.3	19.9	0.4	1.3	-	84	48	215	1.06
Rachycenteron canadus	Sikin	Sergeant f.	78.7	19.7	0.4	1.2	-	82	25	238	2.76
Penaeus semisulcatus	Rubian(dried)	Shrimp	8.1	76.4	1.2	10.5	3.9	331	1158	969	62.00
Penaeus semisulcatus	Rubian(raw)	Shrimp	78.1	17.8	0.9	1.6	1.5	85	164	276	2.61

Bahrain according to nationality. The Bahraini preferred to consume rabbit fish, groupers and perch more that non-Bahraini. The annual per capita consumption were 8.4, 7.7 and 5.6 kg, respectively for the Bahraini, compared to 1.9, 4.9 and 2.1 kg for the non-Bahnraini. However, it was found that the non-Bahraini consumed six times more canned fish than Bahraini.

NUTRITIONAL VALUE OF FISH COMMONLY CONSUMED IN BAHRAIN:

There is insufficient data about the composition of fish consumed in Bahrain and other Gulf states. Kamel and Allam (1979, 1980) analysed some of the common fish in Kuwait, which were also consumed in Bahrain. Table 11 shows the results of their analysis. Generally, fish are rich in protein and it ranged from 19.0 to 21.1 g/100g of edible portion. Dried shrimps are very high in protein (76.4%), due to its low moisture content (8.1%). Some fish are rich in fat content such as groupers (35.7%) and mullets (12.1%). Iron content is very high in dried shrimp 62 mg/100g, as well as phosphorus

content (969 mg/100g). This made dried shrimps a nutritious food. One limitation in eating dried shrimps is its high content of sodium, so that they are not suitable for hypertensive people.

Recently, it was documented that fish consumption helps in reducing heart diseases. These diseases are highly prevalent in Bahrain, and considered to be one of the major causes of death. From the nutritional and health standpoints, therefore, it is strongly recommended to increase fish consumption in Bahrain.

FACTORS INFLUENCING THE FISHERIES RESOURCES IN BAHRAIN:

There are several factors influencing the development of fisheries resources in Bahrain; these could be summarized as follows:

1. Lack of fishing and harbour facilities, particularly ice plants, cold storage, fuel and marketing facilities.

2. Shortness in investment capital for fishing industry, as most of the invest-

ment is spent on poultry, milk and other food industries.

3. Insufficient research and studies related to Bahrain fisheries, and how to improve and develop them.

4. Inadequate regulations and legislations related to handling, processing and marketing of fish. Although Bahrain is applying FAO/WHO Codes Alimentarus Standardes, the need for local standards is emphasized.

5. Shift of fishermen from fishery industry to better paying jobs in other industries. This leads to a gradual reduction of labour force, particularly, the full-time fishermen.

6. Dredging and land reclamation activities which carried out along the Bahrain coasts, affect the inshore biosystem with many corals being killed. It was reported that the total area dredged in 1982 was about 13,500,000 m2, while that reclaimed was 9,000,000 m2 (Al-Alawi 1982).

7. Shortage of qualified manpower in various aspects of fishery science. Saleh (1986) explained that the shortness of qualified persons in the fishery industry may be due to socioeconomic factors, as fishing became less attractive to the new generation, and hence fewer people were involved in this sector.

8. Pollution of the sea either by oil spill which occurs occasionally from time to time, or by industrial wastage and untreated sewage, which affect the marine life (Saleh 1986).

CONCLUSIONS AND RECOMMENDATIONS:

Although there is an increase in fish production and consumption, the rise in population and the high demand for fish, especially fresh fish, make it difficult to rely on local fish. As a result fish importation is increasing annually. Additionally, there are many barriers to developing the marine fisheries in the country. In order to develop the fisheries resources in Bahrain, the following measures

and activities should be taken into consideration:

1. Providing basic facilities for landing, processing and marketing of fish in Bahrain.

2. Introducing modern techniques and improvement of traditional methods in fishing.

3. Stimulating local fishermen to be more involved in fisheries by providing them easy access to credit and gear technology.

4. Establishing local regulations and legislations for fisheries in Bahrain. This could be done through assistance from other related International Organizations.

5. Controlling dredging and reclamation activities through regulating them, and carrying out geological and bio-ecological surveys in areas which planned to be dredged or reclaimed (Al-Alawi, 1982).

6. The training of manpower in different aspects of fishery science.

7. Encouraging research and studies in fisheries, and providing adequate facilities, to carry out these studies. Laboratory equipment should be given first priority in order to attain this recommendation.

8. Financial subsidizing of fishing gears and other equipment used for fishing, to encourage the fishermen to enroll in fisheries.

It is important to note that some of these recommendations were considered in the five-year plan for the development of the fishing sector in Bahrain (Ministry of Commerce and Agriculture 1980), however serious efforts should be put to applying these recommendations.

Recently, the government of Bahrain, the United Nations Development Programme (UNDP), and the Food and Agriculture Organization of the United Nations have signed an agreement to

establish a regional fish marketing service for the Arab World "INFOSAMAK". The main objectives of this project are to provide information and technical assistance to the fishery industry, to assist in opening up new markets for fish and fish products, to assist exporters of fish products, to generate new investment information in the Arab fishing industry and to establish a basis for cooperation among the Arab countries in fisheries matters (INFOSAMAK 1986). It is hoped that this project will help in developing fisheries resources in Bahrain and other Arab countries.

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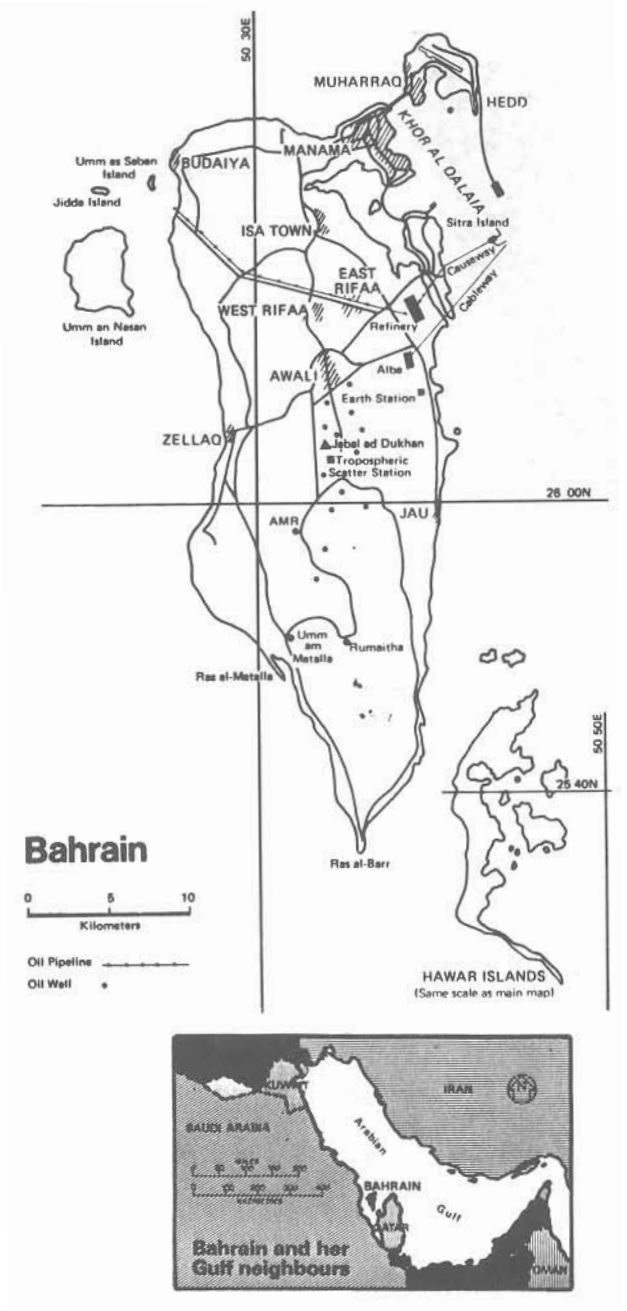
50 30E
MUHARRAQ
HEDD
KHOR AL QALAIA
Umm as Saban Island
BUDAIYA
MANAMA
Jidda Island
ISA TOWN
Sitra Island
Causeway
Causeway
EAST RIFAA
WEST RIFAA
Refinery
Umm an Nasan Island
AWALI
Albe
Earth Station
ZELLAQ
Jebel ad Dukhan
Tropospheric Scatter Station
26 00N
AMR
JAU
Umm am Metalla
Rumaitha
Ras al-Matalla
50 50E
25 40N
Bahrain
0 5 10
Kilometers
Oil Pipeline
Oil Well
Ras al-Barr
HAWAR ISLANDS
(Same scale as main map)
KUWAIT
IRAN
SAUDI ARABIA
Arabian
BAHRAIN
Gulf
QATAR
Bahrain and her Gulf neighbours