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STUDIES ON BOTTOM TRAWLING AND DEMERSAL FISHES OF QATAR WATERS, ARABIAN GULF

By

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ABSTRACT

The bottom trawl fishery and their by-catch from Qatar waters were analysed on a systematic basis for species composition, length, weight and girth-among other things-during the year 1986-1987. The resuls proved a steady level of landing during the years 1981-87 with a mean of 720 + 97 metric tons/year with an expected landing (in 1990th) of about 970 tons. Great variability was noticed between hauls both qualitatively and quantitatively. It showed also that 40-60% of the catch (496-635 tons) was included as by-catch. The relatively high % of the by-catch was attributed to smaller codend mesh size, prolonged towing time and high towing speed.

The study recommended increasing codend mesh size to 60 mm, reducing both towing time and towing speed. It also recommended establishment of a mini pilot plant for fish-meal and fertilizers production either on a remote island or on a floating rig working as a mother boat between the trawlers in-situ.

INTRODUCTION

The finfish fishery in Qatar is predominantly a demersal one where it contributes more than 60% of the total commercial catch. Relative to the demersal varieties, the artisanal sector contributes about 65%, while the commercial sector contributes only 35%. Moreover, during the past few years fish production in Qatar has been at an almost steady level as a result of insignificant changes in the fishing effort. The total fish production in Qatar was 2171,1860,2060,3068,2394, and 1883 metric tons for the years 1981 to 1986 respectively (Anon., 1981 to 1986).

The mean density of the commercially valuable demersal finfish species in Qatar waters was estimated as 2.7 tons per sq. km. This density should perhaps be considered as one of the best in the Arabian Gulf. The annual total production of the demersal species in Qatar is more than 3000 tons including the discarded fish. This production level, in relation to the estimated biomass, indicates that the fishing is not intensive and that the yield is insignificant in comparison to the biomass (Siva and Ibrahim, 1982). It is considered necessary to evaluate the effect of bottom trawling on the demersal fish stock to ensure rational exploitation and utilization of the resource. This is necessary, since more than 50% of the trawler's catch is discarded overboard as by-catch compared to only 4% from the artisanal fishery.

It must be mentioned that some of the discarded fish species may be marketable in other parts of the world but not in Qatar. In addition; fish of less than 15-20cm in total length are considered unmarketable in Qatar. Hence, young and juveniles of popular varieties are also discarded overboard as by-catch. It is also important to note that the by-catch is dead prior to being discarded which represents a lost opportunity and unharvested resource. Grantham, (1980) reported that 35000 tons of fish by-catch are available in the Arabian Gulf. Mathews and Samuel (1984) estimated that 8000-12000 tons were harvested annually from 1978-1981 and were discarded at sea. In Qatar, fisheries can increase their contribution to the national income by optimum use of the resource through improved production, management, conservation and reduced wastage.

The Marine Sciences Department of the University of Qatar in collaboration with the Fisheries Department of the Ministry of Industries and Agriculture are undertaking a comprehensive programme to catch up with the basic information required for a sound development and management policy for the fish resource in Qatar. This resource was the sole source of livelyhood for the people of the country before the era of oil exploitation. The findings of this programme are being published elsewhere.

The aim of the present paper is limited to the evaluation of the effect of bottom trawling - used extensively by the fishing fleet of Qatar National Fushing Company (QNFC) - on some demersal fish stocks in Qatar waters. It should be kept in mind that the boundaries of Qatar waters are not the boundaries of the stocks, hence the possibilities exist that the stocks in Qatar are in common relations with those in the adjacent waters of Bahrain, the UAE and Saudi Arabia.

MATERIALS AND METHODS

The Information used in this study was collected mainly from the three fishing trawlers of QNFC during their regular commercial fishing operations in Qatar waters during the year from January 1986-87, from the QNFC accounting and operation records and from the annual fishery statistics of Qatar.

'F/V Gazelle', one of the trawlers, is a stern trawler built in 1975. She makes short fishing trips of 3-4 days. The type of trawl net used by the vessel is an Engle's-Ballon-Bottom-Trawl 527 meshes circ. by 200mm stretched mesh designed for a stern trawler with 600 HP main engine. The mesh sizes of the net are: the wings; 200mm., the belly; 200,160,120,80,40 and the codend 40mm. It is constructed throughout of nylon webbing with a head rope and a foot rope of 34 and 39 metres long respectively. It carries bobbins and rubber discs on the ground rope (Fig. 1). The otter doors are 2.6×1.4 metres. The net is operated with trawl winches and the net drum is electrically driven.

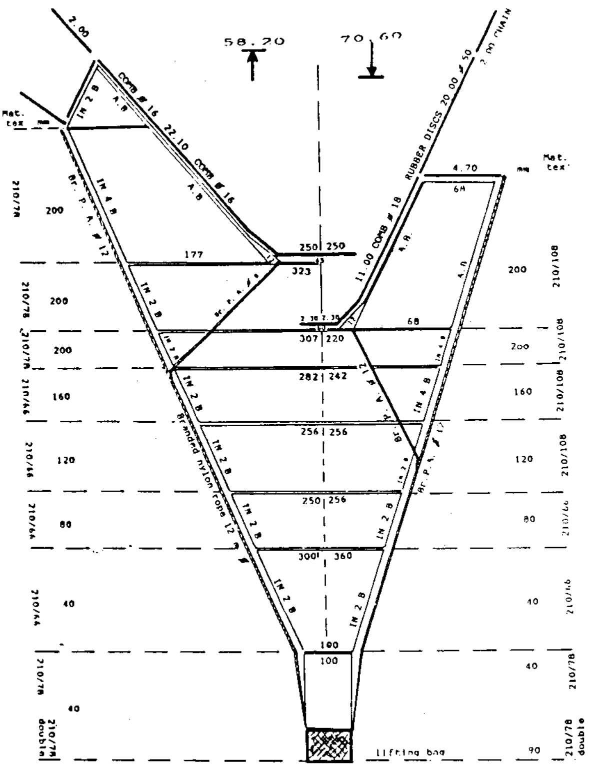

Fig. 1: Detailed diagram of the Engle's-Balloon-Bottom-Trawl 527 meshes circ. used for collecting by-catch samples from Qatar waters during the years 1986-87.

The fishing operation area of the vessels is on the eastern side of Qatar Pepinsula between 25°00'-26°00'N. and 52°00'-53°00'E, with the more frequented area between 25°20'-25°55'N. and 52°25'-52°50'E. The bottom type of this area is muddy-sand and is confined within 15-25 fathom isobaths (Fig.2). The surface water temperature within the area may range from a low of 16°C. to a high of 34°C. between January and August. At the deeper end of the area the bottom temperature varies within a narrow range of about 18°-22°C. Which results in an almost vertical isotherm in winter and a very clearly defined thermocline in summer. Salinity varies around 39‰. at the surface and is slightly greater at the bottom.

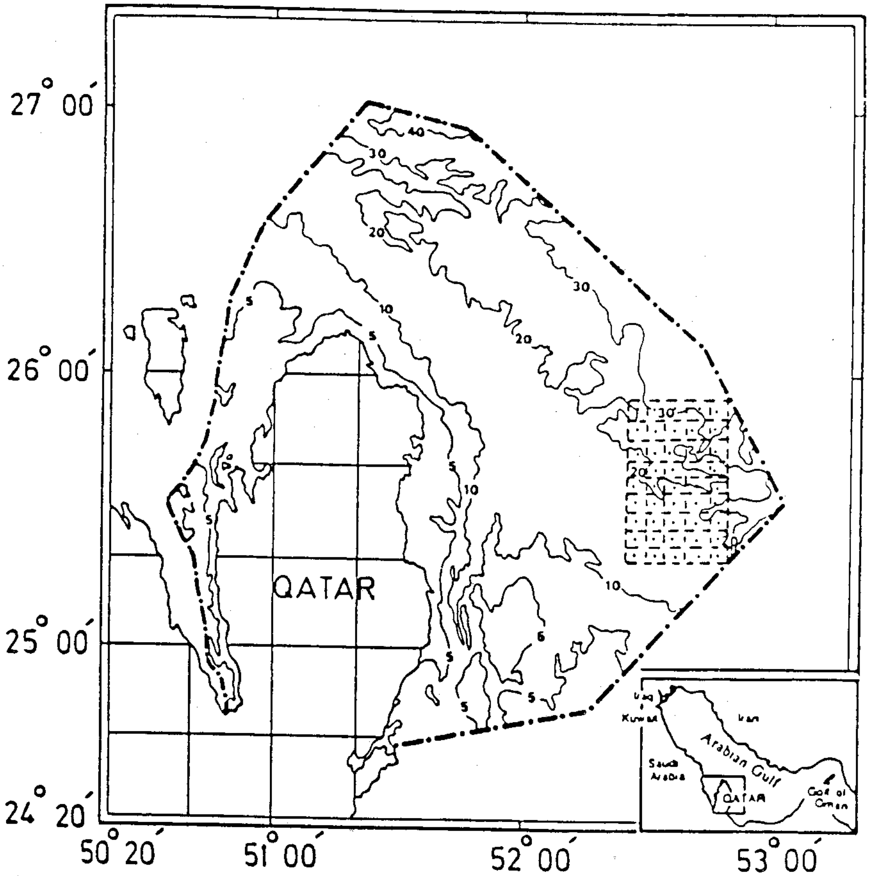

Fig. 2: Location map showing the boundries, the isobath (Fm) and the more frequent area of operation (dotted squares) of F/V 'Gazelle' in Qatar waters during the study period (1986-87).

The data for analysing the catch composition, fishing effort, catch rate. fish discarded....etc., were collected monthly by random sampling of the actual catch on board one of the vessels, mainly 'GAZELLE', at the land-base sorting facilities of the QNFC on arrival and/or from the accounting and operation records of the QNFC. Also 2-4 baskets of by-catch (ca.40kg.each) were brought ashore for bimonthly detailed analysis.

The data taken from the skipper's log book and fishing log forms include: time spent at sea, time spent fishing, trawl shoot time, trawl duration, fishing area, fishing depth, trawling speed, estimated catch per haul, estimated weight of trash fish per haul and actual landings per fishing trip. The detailed analysis included among other things: species composition, length, weight and girth relationships, sex ratio, maturity and age composition of each species or species groups.

To examine the frequency of predominancy of each species or group in each fishing trip; each species or species group was credited N,N-1,N-2,....or 1 point every time it appeared as either 1st, 2nd, 3rd or last predominant species or species group respectively. The mean catch rates were estimated as the weight, in kg., of fish caught per hour of trawling.

It should be mentioned that in case of pooling the catch of more than one trawler for shipping from the fishing grounds to the land facilities; it was considered as if from one trawler after performing the necessary adjustment calculations. Data for the detailed analysis were taken by random sampling of about 5% estimate of the catch either on board or mostly at the sorting facilities of (QNFC), after sorting out the catch into species or species-groups. Then the actual catch was obtained from the accounting records. Length and girth were taken to the nearest mm., weight was taken on a portable electronic balance either to the nearest gm., in case of smaller fish, or to the nearest 5 gm., in case of bigger fish.

RESULTS AND DISCUSSION

The total landings of the finfish and the landings from the bottom trawls through the years 1981-87 are presented in Table (1). The mean of total landings of the mentioned years is about 2300 tons/year with nearly 17% deviation about the mean, while that of the bottom trawls alone is about 720 tons with only 10% deviation. Smoothing the data of that table according to the standard formula (A+2B+C)/4 and plotting the results on Fig. (3); it appeared that there is a steady level of landings with annual increase in total and trawls landings of 50 and 30 tons respectively (the total landing estimate of 1984 was neglected due to extremely unjustified high estimate).

Table 1

Annual finfish landings from Qatar Waters during the years 1981-1987. (landings in metric tons), Number in parenthesis represents percentage in total landings of the particular year.

YEAR	ANNUAL FINFISH LANDINGS	
	BOTTOM TRAWLERS ONLY	TOTAL LANDINGS
1981	613.3 (28.2)	2171
1982	594.0 (31.9)	1860
1983	781.0 (37.9)	2060
1984	792.0 (25.8)	3068
1985	648.0 (27.1)	2394
1986	764.0 (40.6)	1883
1987	870.0 (34.5)	2522

When analysing the contribution of each fish family to the annual landings; the authors were of the opinion that the data of QNFC are more reliable than that of the total landings of all fisheries in the country. This is due to the fact that the former is based on actual book keeping and accounting basis, while the later is on visual estimates in the fish market. Hence, only the bottom trawls data will be delt with here.

The annual contributions of the fish families to the bottom trawl catch were considered only for those families who contributed about or more than 1% and are presented in Table (2). It is evident from the table that there is a high degree of variability in the percentage species composition between years. The families: Lethrinidae, Carangidae, Serranidae, Lutjanidae and Siganidae contributed more than 75% of the annual landings (F. Lethrinidae alone contributed about 40%).

Table 2

Annual finfish-families landings by bottom trawl fishery from Qatar waters (m.tons) during the years 1981-1987. Number in parenthesis represents percentage in year of landing.

YEAR	FAMILY SYMBOL														OTHER	TOTAL
	A	B	C	D	E	F	G	H	I	J	K	L	M	N		
1981	122.7	173.8	64.9	23.1	13.1	6.1	3.0	3.7	28.8	49.9	9.6	10.2	35.4	9.1	59.6	613.3
	(20.0)	(28.3)	(10.6)	(3.8)	(2.1)	(1.0)	(0.5)	(0.6)	(4.7)	(8.1)	(1.6)	(1.7)	(5.8)	(1.5)	(9.7)	
RANK	2	1	3	7	8	12	14	13	6	4	10	9	5	11		
1982	101.0	211.7	34.0	36.6	2.1	8.3	4.8	9.5	20.9	34.3	46.6	30.9	35.8	10.6	6.9	594.0
	(17.0)	(35.6)	(5.7)	(6.2)	(0.4)	(1.4)	(0.8)	(1.6)	(3.5)	(5.8)	(7.8)	(5.2)	(6.0)	(1.8)	(1.2)	
RANK	2	1	7	4	14	12	13	11	9	6	3	8	5	10		
1983	146.2	258.2	27.0	55.2	18.8	8.0	8.1	11.4	9.4	38.9	55.2	41.4	47.1	19.7	36.2	781.0
	(18.7)	(33.1)	(3.5)	(7.1)	(2.4)	(1.0)	(1.0)	(1.5)	(1.2)	(5.0)	(7.1)	(5.3)	(6.0)	(2.5)	(4.6)	
RANK	2	1	8	3	10	14	13	11	12	7	4	6	5	9		
1984	134.7	325.7	44.5	29.3	11.4	8.1	8.6	12.0	16.4	42.7	41.5	33.5	33.3	11.3	38.3	792.0
	(17.0)	(41.1)	(5.0)	(3.7)	(1.4)	(1.0)	(1.1)	(1.5)	(2.1)	(5.4)	(5.2)	(4.2)	(1.4)	(4.8)		
RANK	2	1	5	8	11	14	13	10	9	3	4	6	7	12		
1985	129.4	281.4	24.3	13.6	8.1	4.5	8.9	5.0	15.5	43.5	43.3	30.9	21.7	7.6	9.9	648.0
	(20.0)	(43.5)	(3.8)	(2.1)	(1.3)	(0.7)	(1.4)	(0.8)	(2.4)	(6.7)	(6.7)	(4.8)	(3.4)	(1.2)	(1.5)	
RANK	2	1	6	9	12	14	11	13	8	3	4	5	7	10		
1986	174.7	331.0	39.6	5.5	4.3	4.8	8.6	4.4	13.2	68.2	34.9	29.7	24.4	11.4	9.6	764.3
	(22.9)	(43.3)	(5.2)	(0.7)	(0.6)	(0.6)	(1.1)	(0.6)	(1.7)	(8.9)	(4.6)	(3.9)	(3.2)	(1.5)	(1.3)	
RANK	2	1	4	11	14	12	10	13	8	3	5	6	7	9		
1987	99.9	469.9	42.7	2.5	5.6	6.2	7.6	4.2	15.1	98.8	32.4	36.9	33.1	7.4	7.4	870.0
	(11.5)	(54.0)	(4.9)	(0.3)	(0.6)	(0.7)	(0.9)	(0.5)	(1.7)	(11.4)	(3.7)	(4.2)	(3.8)	(0.9)	(0.9)	
RANK	2	1	4	14	12	11	9	13	8	3	7	5	6	10		
MEAN	129.8	205.2	39.6	23.7	9.1	6.6	7.1	7.2	17.0	53.8	37.6	30.5	33.0	11.0	23.9	723.2
S.D.	24.2	89.4	12.5	17.2	5.4	1.5	2.1	3.4	5.8	21.0	13.4	9.1	7.7	3.9	19.4	96.9
%	18.2	39.8	5.5	3.4	1.3	0.9	2.1	1.0	2.5	7.3	5.2	4.2	4.6	1.5	3.4	
S.D.%	3.3	7.8	2.2	2.4	0.7	0.3	3.3	0.5	1.1	2.1	2.0	1.1	1.2	0.5	3.0	
AVE. RANK	2	1	4	8	11	14	13	12	9	3	5	7	6	10		

Family Key:
A = CARANGIDAE, B = LETHRINIDAE, C = LUTJANIDAE, D = MULLIDAE, E = NEMIPTERIDAE, F = POMADASYIDAE, G = RACHYCENTRIDAE, H = SCARIDAE, I = SCOMBRIDAE, J = SERRANIDAE, K = SIGANIDAE, L = SPARIDAE, M = SPHRAENIDAE, N = SYNODONTIDAE.

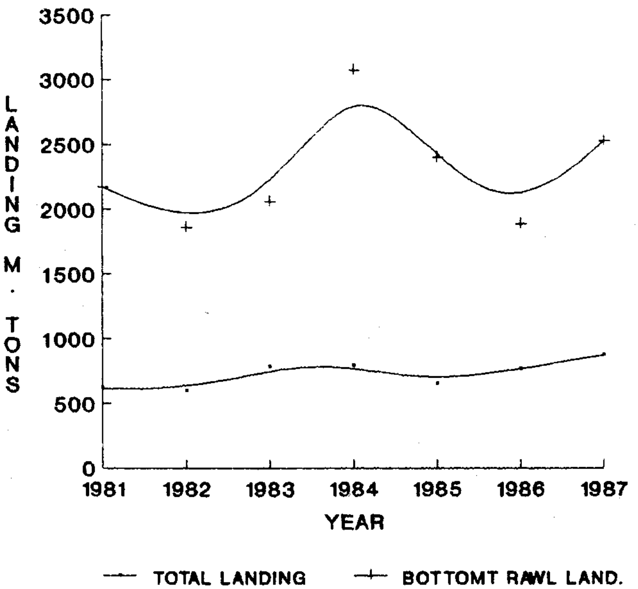

Fig. 3: Annual total and bottom trawl finfish landings (m.tons) from Qatar waters during 1981-1987.

Applying the standard statistical method of the linear regression as described by Snedecor, (1956) on the data of table (2): the results are then shown in Table (3). The variable (X) for the regression analysis was considered as the right two digits of the calender year. When the landings data show wide scattering - according to the test of the slope - they were smoothed as pointed out before. Test of significance of the slope was denoted by one or two asterisks if significant at 0.05p or at 0.01p respectively, otherwise denoted by (NOT).

The test of significance of the slope of the annual landings from each fish family indicated that, among the fourteen fish families tested in Table (3), only four families namely; Carangidae, Lethrinidae, Serranidae and Sparidae showed a trend of increased annual rate in their specific landing of about 5%, 14%,15% and 8% respectively. On the other hand, the families: Mullidae, Pomadasyidae, Rachycenteridae, Scaridae, Scomberidae, Sphyranidae and Synodontidae showed a decreasing trend of 33%, 13%, 12%, 15%, 10%, 11%, 12% and 10% respectively. This indicates that under the present circumstances, and in the very near future, the landings from these families will be marginal among the bottom trawl catch as shown from the calculations of the expected landing in 1990's, Table (3). The two families: Lutjanidae and Siganidae did not show significant specific trend of either increase or decrease. The expected mean total landing of about 945 tons in the year 1990 will be contributed to mainly by F. Lethrinidae (57%), F. Carangidae (18%), F. Serranidae (10%), F. Sparidae (5%) and the rest of the families will contribute marginal percentage.

Table 3

Statistics of linear regression analysis, test of significance of the slope, the mean and standard deviation of the finfish annual landings by bottom trawl fishery from Qatar waters during the years 1981-1987. The variable X is the right two digits of the calender year. The variable Y is the annual landing in metric tons. (the symbols:* = significant at 0.05P, ** = sig. at 0.01P, NOT = not sig. at either P, I = increased trend, D = decreased trend, N = no specific trend, (+) = yes and (−) = no.

	FAMILY SYMBOL														TOTAL
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
REGRESSION:															
a	−404	−3157	92	790	107	72.2	112	53	168	−604	167	−171	375	111	
b	6.4	41.1	−0.7	−9.1	−1.2	−0.8	−1.2	−0.5	−1.8	7.8	−1.5	2.4	−4.1	−1.2	
r	1.0	0.9	−0.4	−0.9	−0.6	−0.9	−0.7	−0.3	−0.6	0.7	−0.5	0.5	−0.9	−0.8	
DATA SMOOTHED?	+	−	+,−	+	−	+	+	−	−	−	+	−	+	+	
SIGNIF. OF SLOPE (at .05 P)	**	**	NOT	**	**	*	*	*	**	**	NOT	**	**	*	
LANDING/YEAR:															
MEAN	135	293	35.6	27.2	9.6	6.7	8.1	7.2	17.0	53.8	42.4	30.5	32.9	11.9	
ST D.	1.6	96.6	1.6	1.6	3.0	1.3	2.7	2.2	6.2	22.7	5.2	9.8	7.1	2.4	
LANDING TREND	I	I	N	D	D	D	D	D	D	I	N	I	D	D	
EXPECTED LANDING (IN 1990) (ton)	172	542	29	<1	<1	<1	4	8	6	98	32	45	6	3	945 (±117)

Family key:
A = CARANGIDAE, B = LETHRINIDAE, C = LUTJANIDAE, D = MULLIDAE, E = NEMIPTERIDAE, F = POMADASYIDAE, G = RACHYCENTRIDAE, H = SCARIDAE, I = SCOMBRIDAE, J = SERRANIDAE, K = SIGANIDAE, L = SPARIDAE, M = SPHRAENIDAE, N = SYNODONTIDAE.

The monthly variations of the bottom trawl fishery (as obtained by the three F/V of QNFC) in the year 1987 are presented in Table (4), and as three diamentional diagram in Fig. (4). The eight major families presented in the figure showed a general pattern of variation with minimum landings during the summer months (July-October) than the other months. This is due to the fact that the fishing effort slackens during the former months as a result of decreased demand for fish then. This is because a lot of expatriates and others leave the country for summer vacation abroad as well a number of fishermen working on the fishing fleet. It is also the time for the regular maintenance of part of the fishing fleet. Moreover, the mean catch from waters less than 20 Fm. deep (where most of the fishing operations take place) was lower in summer than the other cool seasons, but in the deeper waters the trend was vice versa.

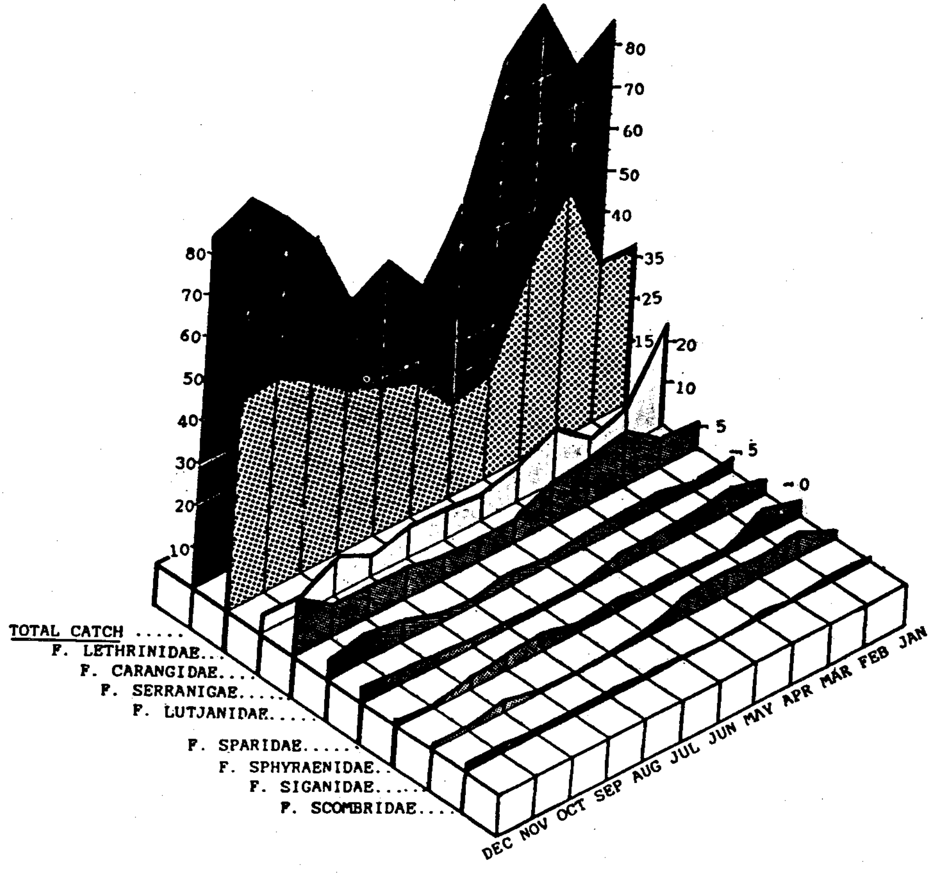

Fig. 4: Monthly variations of the finfish landings (by family in metric tons) by bottom trawl fishery from Qatar waters during the year 1987. Only the eight major component families are present.

Table 4

Monthly finfish-families landings by bottom trawl fishery from Qatar waters during the year 1986-87 in metric tons. Number in parenthesis represents the percent in the particular month.

MONTH	FAMILY SYMBOL										TOTAL
	1	2	3	4	5	6	7	8	9	other	
JAN	37.0 (43.4)	23.5 (27.6)	5.6 (6.6)	2.8 (3.3)	3.2 (3.8)	3.8 (4.5)	2.3 (2.7)	1.2 (1.4)	2.3 (2.7)	3.5 (4.1)	85.2
FEB	37.7 (47.6)	8.7 (11.0)	6.9 (8.7)	1.3 (1.6)	6.3 (8.0)	6.3 (8.0)	5.7 (7.2)	2.0 (2.5)	0.8 (1.0)	3.5 (4.4)	79.2
MAR	60.3 (61.1)	5.5 (5.6)	12.6 (12.8)	3.7 (3.7)	4.5 (4.6)	1.7 (1.7)	5.2 (5.3)	0.7 (0.7)	1.5 (1.5)	3.0 (3.0)	98.7
APR	45.6 (50.9)	12.5 (14.0)	11.2 (12.5)	3.2 (3.6)	3.7 (4.1)	1.6 (1.8)	5.4 (6.0)	1.7 (1.9)	0.8 (0.9)	3.8 (4.2)	89.5
MAY	25.2 (41.9)	8.2 (13.6)	10.0 (16.6)	3.0 (5.0)	3.9 (6.5)	2.2 (3.7)	5.2 (8.6)	0.3 (0.5)	0.2 (0.3)	1.7 (2.8)	60.2
JUNE	22.3 (51.0)	5.5 (12.6)	5.9 13.5)	2.3 (5.3)	1.5 (3.4)	2.6 (5.9)	1.6 (3.7)	0.3 (0.7)	0.1 (0.2)	1.6 (3.7)	43.7
JULY	32.2 (58.9)	6.5 (11.9)	5.5 (10.1)	2.9 (5.3)	1.2 (2.2)	2.5 (4.6)	0.9 (1.6)	0.4 (0.7)	0.3 (0.5)	2.3 (4.2)	54.7
AUG	24.7 (49.7)	7.3 (14.7)	5.6 (11.3)	1.1 (2.2)	1.0 (2.0)	4.1 (8.2)	0.6 (1.2)	1.7 (3.4)	0.1 (0.2)	3.5 (7.0)	49.7
SEP	38.5 (56.9)	5.2 (7.7)	6.5 (9.6)	1.9 (2.8)	0.5 (0.7)	3.9 (5.8)	0.7 (1.0)	1.5 (2.2)	0.6 (0.9)	9.1 (13.4)	67.7
OCT	45.5 (57.7)	8.5 (10.8)	7.4 (9.4)	5.2 (6.6)	2.7 (3.4)	2.3 (2.9)	2.6 (3.3)	1.6 (2.0)	0.3 (0.4)	2.8 (3.5)	78.9
NOV	50.8 (65.0)	4.2 (5.4)	7.8 (10.0)	6.4 (8.2)	3.0 (3.8)	0.6 (0.8)	1.2 (1.5)	2.1 (2.7)	0.1 (0.1)	1.9 (2.40)	78.1
DEC	50.1 (59.6)	4.3 (5.1)	13.8 (16.4)	4.9 (5.8)	4.2 (5.0)	1.5 (1.8)	1.0 (1.2)	1.6 (1.9)	0.3 (0.4)	2.4 (2.9)	84.1
TOTAL	469.9 (54.0)	99.9 (11.5)	98.8 (11.4)	42.7 (4.9)	36.9 (4.2)	33.1 (3.8)	32.4 (3.7)	15.1 (1.7)	7.4 (0.9)	33.5 (3.9)	869.7

Family key:

1 = LETHRINIDAE, 2 = CARANGIDAE, 3 = SERRANIDAE, 4 = LUTJANIDAE, 5 = SPARIDAE, 6 = SPHYRAENIDAE, 7 = SIGANIDAE, 8 = SCOBRIDAE, 9 = SYNODONTIDAE.

The species composition (or family composition) of the by-catch (averaged for the whole year) is presented in Table (5), both in percentage of numbers and weights, and is shown in Fig. (5). Generally, when considering the Length (cm)-Weight (gm) relationship of the fish as a logarithmic function; it is evident that the absolute number of the weight is smaller than that of the corresponding length at the smaller size range, while higher at larger size range. The first situation could be noticed in fig. (5) for the families: Carangidae, Clupeidae, Gerreidae, Leiognathidae, Mullidae and Theraponidae. This means that the mentioned families were being represented in the by-catch by smaller sizes not fit for the consumer's demand in Qatar. On the other hand, the rest of the families (with the exception of F. Nemipteridae which lies on the boundaries between the two situations) represent the second situation mentioned. Yet, inspite of their relative commercial size they were discarded as by-catch either due to lower commercial value, not consumed in Qatar and/or sliped into the by-catch unintentionally due to intermingling with the immense amount of the by-catch encountered in each haul. The same is true for all the large size individuals of popular varieties recorded among the by-catch.

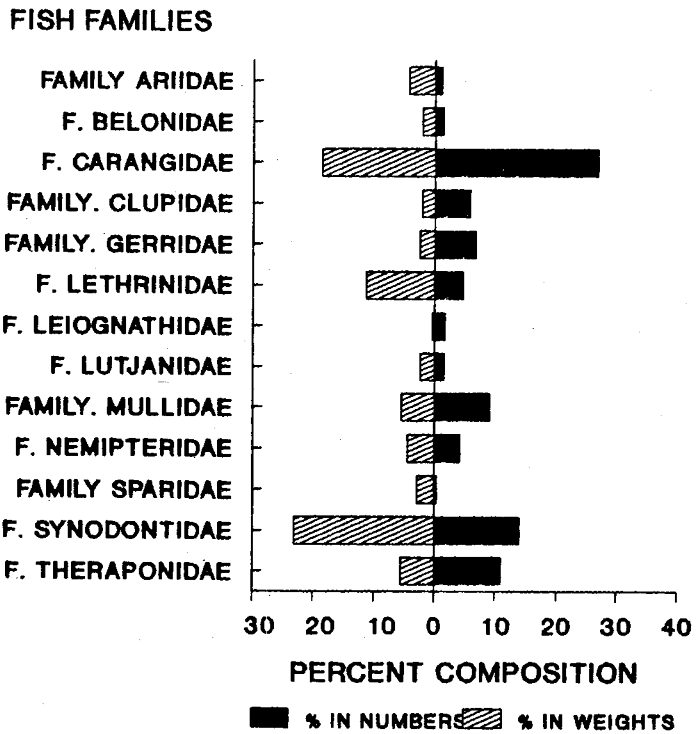

Fig. 5: % Fish-families composition in the by-catch of bottom trawl fishery from Qatar waters during 1987.

Table 5

Percent in numbers and in weights of the finfish families comprising the by-catch of the bottom trawl fishery from Qatar waters, pooled for the year 1986-87. The mean, the standared deviation, the minimum and the maximum values for the parameters of length (mm), weight (gm) and girth (mm) are also shown.

	FAMILY SYMBOL													Other	Total
	1	2	3	4	5	6	7	8	9	10	11	12	13		
% NUMBER	1.1	1.4	26.9	5.7	6.7	4.8	1.8	1.6	9.1	4.3	0.4	14.0	11.0	11.2	100.0
% WEIGHT	4.3	2.1	18.6	2.1	2.4	11.3	0.3	2.3	5.4	4.4	2.8	23.1	5.6	15.4	100.1
LENGTH mm															
MEAN	375	242	133	125	111	194	84	165	133	156	159	217	125		
S.D.	38	26	39	13	11	25	18	19	21	30	28	36	16		
MAX.	448	333	215	165	136	245	123	216	178	270	195	399	187		
MIN.	298	199	80	102	76	95	52	109	58	80	124	130	101		
WEIGHT gm															
MEAN	538	77	34	18	18	115	8	74	29	50	71	81	25		
S.D.	191	25	21	6	5	47	4	26	15	24	38	58	16		
MAX.	1022	165	100	45	36	190	25	170	67	133	125	345	100		
MIN.	205	45	9	10	5	15	2	18	6	8	30	15	10		
GIRTH mm															
MEAN	189	81	71	55	75	136	61	105	73	87	124	82	72		
S.D.	38	10	24	6	9	20	12	15	13	20	18	16	14		
MAX.	228	105	120	78	102	165	110	180	100	140	153	140	125		
MIN.	145	65	50	45	50	70	40	60	40	44	81	45	47		

Family key:
1 = ARIIDAE, 2 = BELONIDAE, 3 = CARANGIDAE, 4 = CLUPIDAE, 5 = GERREIDAE, 6 = LETHRINIDAE, 7 = LEIOGNATHIDAE, 8 = LUTJANIDAE, 9 = MULLIDAE, 10 = NEMIPTERIDAE, 11 = SPARIDAE, 12 = SYNODONTIDAE, 13 = THERAPONIDAE.

It is known generally that, the meshes of the trawl will retain fish whose girth is greater than approximately the circumference of the opening, and also to a lesser extent on the size of the net twine, stretch of the fiber, the system of knotting and the way in which the net spreads out while fishing. Table (5) shows that the mean girth of almost half of the families comprising the by-catch is less than the codend mesh size, at least, because of the large biomass encountering the cross section of the trawling net. This biomass decreases the selection factor of the net and results in more smaller-size fish being caught.

The results proved also a high degree of variability in the percentage species composition between hauls of the same or different vessels. This may be due to bottom conditions, it is known that bottom conditions influence demersal species composition, and/or the time of the day or night during which fishing operations take place, where different demersal species show different behaviour in relation to penetrating light reaching the different depths. In summer and due to high day temperature in the area; fishing effort was higher during night than day. This variability may also be attributed to selectivity of the gear itself which is governed by the interaction of the gear with the fish. This in itself depends on the material, the design and the size of the net together with the place and time. It is also dependent on the species composition of the fish association, the length composition of the population and the biological status, such as: maturation, state of nutrition, etc. It was also noticed that the selection of the net was much affected by the size of the catch where more small fish being caught in case of rich catch.

The Engle's 527 bottom trawl type of net (described before) being used by 'Gazelle' have been used also by the FAO Regional Fish. Survey and Devel. proj. 1975-79, for the survey purposes. It seems that the net has a rather small mesh which causes the catch to include a lot of by-catch, and a considerable time is consumed in sorting the fish on board the vessel and also an appreciable percentage of commercial fish gets intermingled with the by-catch thrown over board.

During the study period; samples of the by-catch from 15 different hauls were analysed for species composition, length, weight and girth measurements. The analysis showed that by-catch represents 40-60% of each haul. The number of species appearing in a single haul varied between 13-41 with an average of 19 species. It was also evident that there was a high degree of variability in the species composition between hauls.

The comparatively large biomass taken by the trawl net under the prevailing circumstances affects not only the fish species caught through 'recruitment over-fishing'. El-Agamy, (1986) reported that for Gerres oyena (F. Gerreidae); the minimum absolute fecundity is obtained at a mean total length of 197mm. Yet, the mean total length of this species retained in the trawl net was only 111mm. It also affects organisms that interact with them and alters the balance among them. If such practice persists and intensifies; it will lead at first to sharp fall in the catch per unit of effort and then to a fall in the total catch. Some other families such as Lethrinidae and Serranidae who spawn in rocky areas Ibrahim, in press) will not be directly affected.

To counteract the last mentioned expectation, certain simple measures have to be taken into consideration. First, to reduce trawling time from 2-3 hours/haul to only 1-2 hours and to reduce trawling speed from 3-4 knots to about 2 knots. These measures will give the smaller-size fish a chance to escape through the meshes. Second, to increase the codend mesh size to retain mainly the commercial-size fish.

As pointed out before, increasing mesh size displaces the selection curve to the right towards the bigger-size fish. Generally, the mesh size (m) is related to the length (l) of the fish caught by the formula:

$$m = k.\ l \qquad (1)$$

The best fit for the Girth (G)-Total Length (TL) relationship, both in mm, of the pooled species comprising each family in the by-catch was obtained by the least of squares method and are presented in Table (6) as guidance. The mentioned relationship was best expressed as power formula:

$$G = a.\ TL^{b} \qquad (2)$$

The girths at 150 and 200 mm were calculated by formula (2) for the major families comprising the by-catch and are presented also in Table (6).

It is evident from the calculations that the mean girth of all the families tested was about 84±16mm. This indicates that about half of the by-catch of the concerned trawl is below 150mm in total length with a small percent around 200mm. Hence, the by-catch was of little consumer demand in Qatar. On the other hand, when considering a mean total length of about 200mm for all the families under consideration, then the corresponding mean girth would be about 112±23mm.

To attain the last mentioned target, the codend mesh size has to be increased to about 60 mm together with the necessary adjustments in the net design. Another advantage of this modification is that the resistance of the trawl under the new conditions, namely reduced water resistance and or less catch load, will be greatly reduced. It should be also expected that less number of fish will be caught. This will be compensated for by increased average weight approximated to the power of 3 of the length (as based on length-weight relationship of the fish retained).

Table 6

Regression parameters of girth (mm) at length (mm) relationship expressed as: ($G = a \cdot TL^b$). The calculated girth (mm) at both LT = 150 and 200 (mm) are also shown for the finfish-families comprising the by-catch of the bottom trawl fishery from Qatar waters during the year 1986-87.

	FAMILY SYMBOL						
	1	2	3	4	5	6	7
REGRESSION:							
a	0.365	0.481	0.968	0.360	0.529	1.083	0.890
b	1.055	0.933	0.889	1.046	1.047	0.909	0.939
GIRTH AT:							
TL=150mm	72	52	83	68	100	103	98
TL=200mm	98	67	107	92	136	134	129
	8	9	10	11	12	13	
REGRESSION:							
a	0.577	0.552	1.310	0.145	0.506	0.420	
b	1.022	0.988	0.842	1.309	0.950	1.067	
GIRTH AT:							
TL=150mm	97	78	89	102	59	88	
TL=200mm	130	103	113	149	78	120	

Family key:

1 = ARIIDAE, 2 = BELONIDAE, 3 = CARANGIDAE, 4 = CLUPIDAE, 5 = GERREIDAE, 6 = LETHRINIDAE, 7 = LEIOGNATHIDAE, 8 = LUTJANIDAE, 9 = MULLIDAE, 10 = NEMIPTERIDAE, 11= SPARIDAE, 12 = SYNODONTIDAE, 13 = THERAPONIDAE.

CONCLUSION AND RECOMMENDATIONS

Landings from the bottom trawl fishery as exercised by the three F/V of QNFC have been at a steady level during 1981-87. The mean landing was about 723±97 metric tons per year. The families: Lethrinidae and Carangidae contributed about 40 and 18% of the annual landing respectively. The last mentioned two families in addition to families: Serranidae and Sparidae showed a trend of increased annual landings, while the rest of the families comprising the landings showed either a decreasing or no specific trend. Extrapolation of the landing regression line to the year 1990 showed that 90% of the landing then will be obtained from the last mentioned four families.

The results showed that 40-60% of the trawlers catch was being discarded overboard as by-catch. This indicated that, about an estimate of 496-635 metric tons of fish were discarded during 1987 by QNFC fleet alone. The discarded fish were either small in size and or of no consumer demand in Qatar. This amount of by-catch could be attributed to smaller mesh size at the trawls codend, to prolonged towing time (2-3 hours/haul) and/or to higher trawling speed (3-4 knots). So, it is strongly recommended to increase the codend mesh size to 60 mm along with the necessary design adjustments, to reduce the trawling speed to only two knots and to shorten the towing time to only two hours per haul.

This comparatively huge by-catch should draw the attention of the decision makers either in QNFC or in the government to take advantage of this by-catch in fish-meal or fertilizers production through a pilot plant either on a remote island within Qatar waters or on a floating rig working as a mother boat between the fishing trawlers in-situ.

REFERENCES

Anonymous, 1981-1986. Fishery Statistics Year Book. Ministry of Industries and Agriculture. Qatar.

El-Agamy A.E., 1986. The Fecundity of Gerres oyena Forskal 1775 (Fam. Gerreidae) in the Qatari Waters of the Arabian Gulf. Qat. Univ. Sci. Bull. 6: 371-388.

Grantham, G. J., 1980. The prospects for by-catch utilization in the Gulf Area. FAO Report No. FI: DP/RAP/71278.

Mathews, C.P., and **M. Samuel. 1984.** The stock of 'mixed fish' in Kuwait, 'by-catch' and their potential for exploitation. Proceedings of the First Finfish Fisheries Management Workshop, Kuwait Institute for Scientific Research, Kuwait.

Sivasubramaniam, K., and **Mohamed A. Ibrahim. 1982.** Demersal Fish Resources Around Qatar. Qatar Univ. Sci. Bull. 2: 305-352.

Snedecor, G.W. 1956. Statistical Methods, 5th edn, Iowa State College Press.

دراســـات على حرفة الصيد بالبحر والأسماك القاعيـــة في الميـــاه القطريـــة (الخليـــج العـــربي)

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جمعت عينات وبيانات دورية خلال عام ٨٦ ـ ١٩٨٧م بإستخدام سفينة الصيد غزال التابعة لشركة قطر الوطنية لصيد الأسماك أثناء رحلات صيدها العادية ، كما تمت الاستعانة بالبيانات المتوافرة لدى إدارة الشركة وإدارة المصايد عن كميات ونوعيات وأماكن الصيد بالسفن الأخرى التابعة للشركة ، كما أخذت بيانات علمية عن عينات عشوائية من الأسماك المصادة تمثل الطول والوزن والجنس ومحيط الجسم ونسبة تواجد كل نوع وغيرها من البيانات اللازمة لاجراء الدراسة .

أوضحت النتائج أن من بين الأسماك المصادة ما يقل في الطول عن ١٠ سم نتيجة لضيق الشباك المستخدمة بالاضافة إلى كمية ضخمة من الأسماك تصيدها الشبكة في كل مرة ويتخلص من حوالي ٥٠٪ منها بالقائها في البحر بعد أن تكون قد هلكت وتهتكت تحت تأثير ثقل المصيد فوقها .

واتضح أن هناك ٨ عائلات من الأسماك إنتاجها السنوي آخذ في التناقص (من الأمثلة : عائلات الحامر والباسي والمكرونة) وربما يكون هذا نتيجة للصيد الجائر عليها في مناطق توالدها .