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PELAGIC FISH RESOURCES AND THEIR FISHERY AROUND QATAR

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ABSTRACT

The existing pelagic fishery around Qatar is relatively smaller than the demersal fishery. Inshore and offshore gillnetting trolling and even bottom trawling, contribute to the production of pelagic fish species. About 30 pelagic species are of commercial significance, but only sardines, king-mackerels and sharks were identified as the main varieties. The sardines are the most abundant pelagic variety but are practically unexploited and large quantities of sharks entering the gillnet fishery are discarded.

Though the productions of large and samll pelagic varieties are estimated to be 570 M. tons and 70 M. tons per annum, their maximum potential yields are considered to be in the regions of 2,200 M.tons and 20,000 M.tons, respectively. Around Qatar, the extent of the area with high density of any one pelagic species is less than 50% of the total area of the Qatar waters. The north-east and north coasts are relatively richer areas than the west and south-east coasts. The size ranges of various species entering the fishery and their distribution behaviour, are discussed. High seasonality in the availability of these fish to the fishery is evident, and it appears to be influenced by the seasonal changes in the environmental conditions.

About 19% and 7.5% of the pelagic fish production by the artisanal and commercial fisheries, respectively, are discarded at present.

INTRODUCTION

Traditionally, the fishery in Qatar has been primarily a demersal fishery and even today the pelagic species contribute only about 30% of the annual total fish production. The effort on the fishery for pelagics is mainly directed on king-mackerels (Scomberomorus spp.) and many other pelagic varieties entering the fishery may be considered as by-catches.

The pelagic fish species are relatively more migratory than most of the demersals and their movement into and out of the waters around Qatar causes significant seasonal variations in their availability to the fisheries around Qatar. These resources around Qatar and her neighbours, such as Bahrain, Saudi Arabia and the United Arab Emirates, may belong to common stocks. In this event, the sustainable yield for such resources within Qatar-waters will not only depend on the strength and characteristics of whole stocks but also on the degree of exploitation by the neighbouring states.

The acoustic survey of the abundance of small pelagics in the Gulf, carried out by the Regional Fishery Survey and Development Project, revealed that a potential yield of about 350,000 M. tons of sardines and small carangids, such as scad mackerels and horse mackerels, could be expected from the whole Gulf and that the area between Qatar and the United Arab Emirates has a large biomass of such varieties (Vidal, 1981; Mitchell and Simmonds, 1981). Based on limited information available on the larger pelagics in the entire Gulf region, some estimates of the present yield level and the possibility of doubling the present production, have also been considered (Sivasubramaniam, 1981).

In relation to the estimated abundance of sardines and other small pelagic species in the Gulf, the present level of exploitation is negligible because sardines, which are the primary small pelagic fish resource, have a limited market in the Gulf. Though attempts to utilize sardines to produce fish meal were unsuccessful in one of the Gulf States, it is likely that any expansion of the fishery for small pelagic species in the immediate future, would be mainly for industrial use rather than for human consumption. Among the large pelagics, sharks form a reltively large percentage of the catches around Qatar and their utilization is already a problem.

DATA AND ANALYSIS

The area within the boundaries demarkated by the State of Qatar for the exclusive exploitation of oil and gas resources, has been considered as 'Qatar-waters'. For analytical purposes, the Qatar-waters have been divided into six Areas and each Area subdivided into Sub-Areas, according to the depth contours (Figure 1).

The density distribution and biomass of small pelagics in Qatar-waters were etimated from the results of the acoustic survey of the whole Gulf, conducted by the Regional Fishery and Development Project (1976-1979). Information from the indicative purse seining operations in the Qatar-waters, conducted by the same project, was also used. Sepcies compositions and size compositions of the pelagic varieties were determined from data of the sampling carried out during the acoustic survey, results of the indicative fishing and the observations on the catches made by artisanal and commercial fisheries.

Present level of exploitation of large and small pelagics and seasonal variations in such rates and catch compositions, were estimated through weekly sampling of the fishery at Al-Wakrah, Doha, Al-Khor and Al-Ruwais from February 1980 to March 1981. Information on pelagic species caught during the bottom trawl survey of the Gulf (Sivasubramanaim 1981 B) was also used as supplementary data. Information concerning the environmental conditions in the Qatar-waters has been reviewed elswhere (Sivasubramaniam and Ibrahim, 1981A, 1981B) and this was used for discussions in this paper.

Pelagic fish species composition

About 30 pelagic species, including about 6 cartilagenous fish species, were identified in the

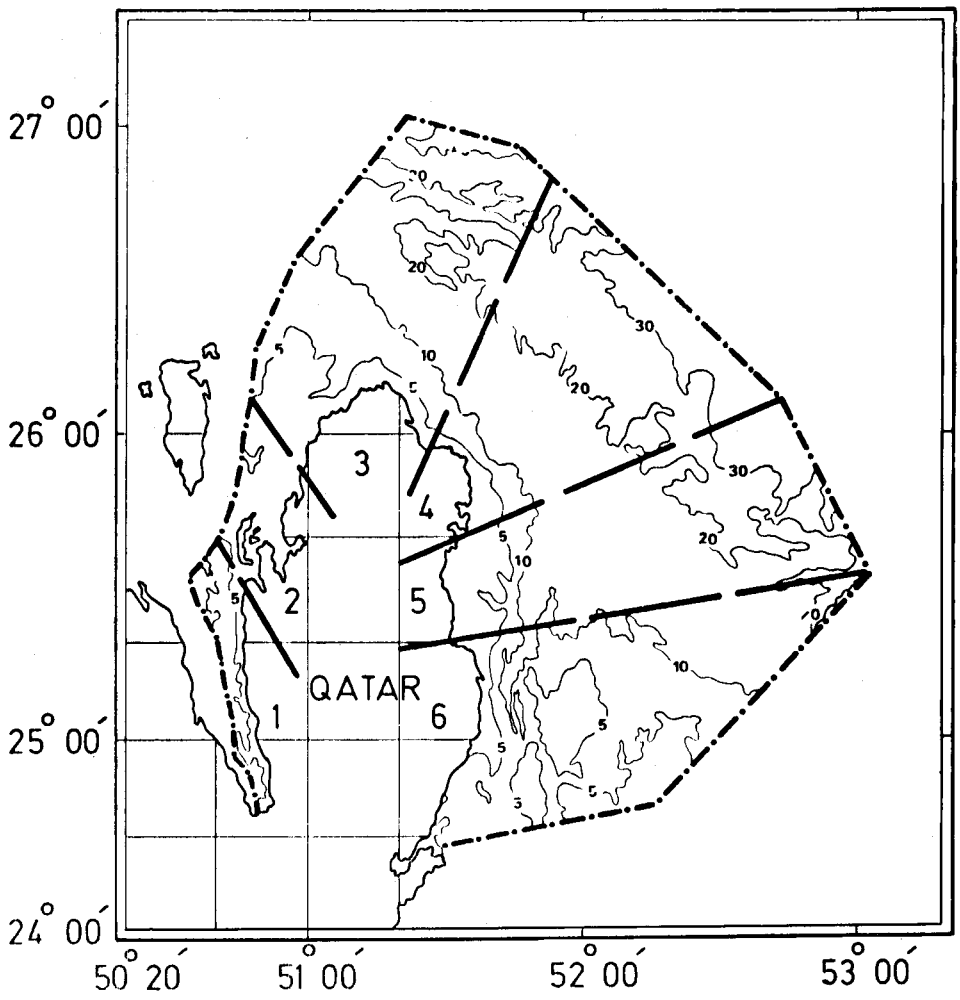

Figure 1. Boundaries demarkated for exclusive exploitation of oil and gas, by the State of Qatar. The six fishing areas and the stratification of each area into sub-areas, according to depth contours (in Fms), are also shown.

catches from Qatar-waters. This number is relatively much smaller than that of the demersal species entering the fishery. The commercially important pelagics commonly observed were identified as follows:

Sardinella fimbriata	Fringe scaled sardine
Sardinella gibbosa	Gold stripe sardine

Nematalosa nausus	Gizzard shad
Trachurus indicus	Horse mackerel
Decapterus kiliche	Scad mackerel
Cypselurus oligolepis	Flying fish
Hemiramphus marginatus	Halfbeak
Rastrelliger kanagurta	Indian mackerel
Liza macrolepis	Mullet
Chirocentrus dorab.	Wolfherring
Ablennes hians	Garfish
Tylosurus leiurus	Garfish
Euthynnus affinis	Eastern little tuna
Scomberoides commersonianus	Queenfish
Chanos chanos	Milkfish
Scomberomorus commerson	Narrow-barred King-mackerel
Scomberomorus guttatus	Indo-pacific King-mackerel
Thunnus albacares	Yellofin tuna
Istiphorus platypterus	Sailfish
Carcharias palasorrah	Grey dog shark
Carcharhinus melanoptera	Black tip shark
Carcharhinus seali	Black spot shark
Carcharhinus brevipinna	Spinner shark
Sphyrna mokarran	Hammerhead shark
Rhinptera adspersa	Cow ray

Around Qatar, species of sardines, horse-mackerels and scad-mackerels are more significantly represented in the demersal fishery catches than in the existing pelagic fishery. On the other hand, some other semi-pelagic types, not included in the above list, such as *Alepes mate* (Crevalle) *Carangoides bajad* (yellow spot cavalla) *Carangoides malabaricus* (Malabar cavalla) and *Sphyraena jello* (banded barracuda), enter mainly the demersal fishery.

Biomass and Distribution

During the acoustic survey for small pelagics in the Gulf and Gulf of Oman (Mitchell and Simmonds, 1981), Qatar-waters were surveyed three times: October 1977, April 1978 and August 1978. The results for the relevant areas were extracted and the biomass esimated on the basis of densities multiplied by surface areas, was found to be 137'275, 20'684 and 148'599 M.tons for the three respective seasons. The results indicate an extremely low biomass value for April 1978, the cause of which was not clearly evident. The mean biomass value of 104,852 M.tons was considered subjectively and the mean density based on this value was estimated as 2.9 M.tons/km^2.

The acoustic survey and the accompanying sampling operations revealed that sardines were evenly distributed over the major part of Qatar waters, with tendency to from high concentration on the north and north-east coast (Mitchell and Simmonds 1981; Vidal 1981).

The acoustic survey and the accompanying sampling operations revealed that sardines were evenly distributed over the major part of Qatar waters, with tendency to from high concentration on the north and north-east coast (Mitchell and Simmonds 1981; Vidal 1981). Vidal (1981) estimated that the size of schools of small pelagics ranges between 2-8 M.tons in this area and that the average size is about 2.5 M.tons. Mitchell and Simmonds (1981) reported that sardines in the Gulf generally concentrated in waters less than 40 m in depth and they were distributed from the bottom to the surface, being more often near the surface at dawn and dusk. This behaviour is also evident from the sardine catches made during bottom trawling. Hence, the data on the sardine catches made during the bottom trawl survey by the Regional Fishery Survey and Development Project (Sivasubramaniam 1981B), was analysed to determine the density distribution pattern projected by this method (Figure 2). Besides exhibiting considerable similarity to the patterns shown by the results of the acoustic survey, the present analysis revealed the presence or sardines in the south-west coast of Qatar, which was not covered during the acoustic survey. However, the biomass of sardines and other small pelagics derived from the results of the bottom trawl survey, was only about 16,400 M.tons (Table 1) which is very small compared to the estimates by acoustic methods for August and October, but is reasonably close to the estimate for April. During the indicative fishing operations in Qatar-waters in May 1978, it became evident that, even when the fish finder failed to record the presence of sardines in the pelagic zone at night, light attraction technique brought about catches of over 10 M.tons per purse seine setting (Table 2). Significant quantities of sardines present may have been too sparsely close to the bottom, to provide sufficiently strong echo, to appear on the echogram.

Table 1

Biomass of pelagic varieties in Qatar-waters, estimated from the results of the acoustic and bottom trawl surveys.

VARIETY	BIOMASS (M.tons)	METHOD
Sardines & mackerels	137'275	Acoustic, Oct. 1977
Sardines & mackerels	20'684	Acoustic, April 1978
Sardines & mackerels	148'599	Acoustic, Aug. 1978
Sardines	4'738	Bottom trawl, 1978
Mackerels (small)	11'700	Bottom trawl, 1978.
Garifishes	2'457	Bottom trawl, 1978
Barracuda	2'651	Bottom trawl, 1978
Kingmackerels	2'949	Bottom trawl, 1978
Pel. sharks	4'996	Bottom trawl, 1978
TOTAL (large pelagics)	13'053	

Table 2

Summary results of the catches made with sampling gears for small pelagics and indicative fishing - purse seine net, in Qatar-waters

Gear	Season Area	Number of operation	Catch (kg)	Remarks
**p. seine 13mm	Feb. '79 5 C	3	450	98% S. gibbosa 2% carangids
**p. seine 13mm	Mar. '79 5 C	2	210	100% S. gibbosa
***p. seine 13mm	May '79 3 C	3	37,700	94% S. gibbosa, 2% S. carangids, 4% others
***p. seine 13mm	May '79 5 C	1	15,000	96% S. Gibossa 4% barracudas
*Midwater trawl	May '79 5 E	1	446	61% scads, 18% Sardins 21% demersal
*Midwater trawl	June '78 4 C	3	456	92% S. carangids, 1.5% barracuda 2.1% Indian mackerel
*P. seine 20mm	July '77 5 C	1	1,050	95% sardines 5% Indian mackerel
* P. seine 20mm	Aug. '78 5 C	1	65	99% S. Gibbosa 1% S. fimbriata
* P. seine 20mm	Aug. '78 4 C	1	127	97% S. gibossa 2% S. fimbriata 1% scad
*P. seine 20mm	Oct. '77 5 C	2	1,008	99% sardines, 1% scad and Indian mackerel
*Midwater trawl	Oct. '77 5 C	3	434	94% Sardinella gibbosa, 1% S. fimbriata 5% barracudas and Indian mackerels

* Sampling gear
** Indicative fishing - day time
*** Indicative fishing - night-time with light attraction (1000 W underwater and 500 W above)

Sardines formed at least 90% of the catches made during the sampling and indicative fishing. Other varieties enetring the catches were scad and horse mackerels, Indian mackerels and few demersal varieties which move into the pelagic zone at night (Table 2).

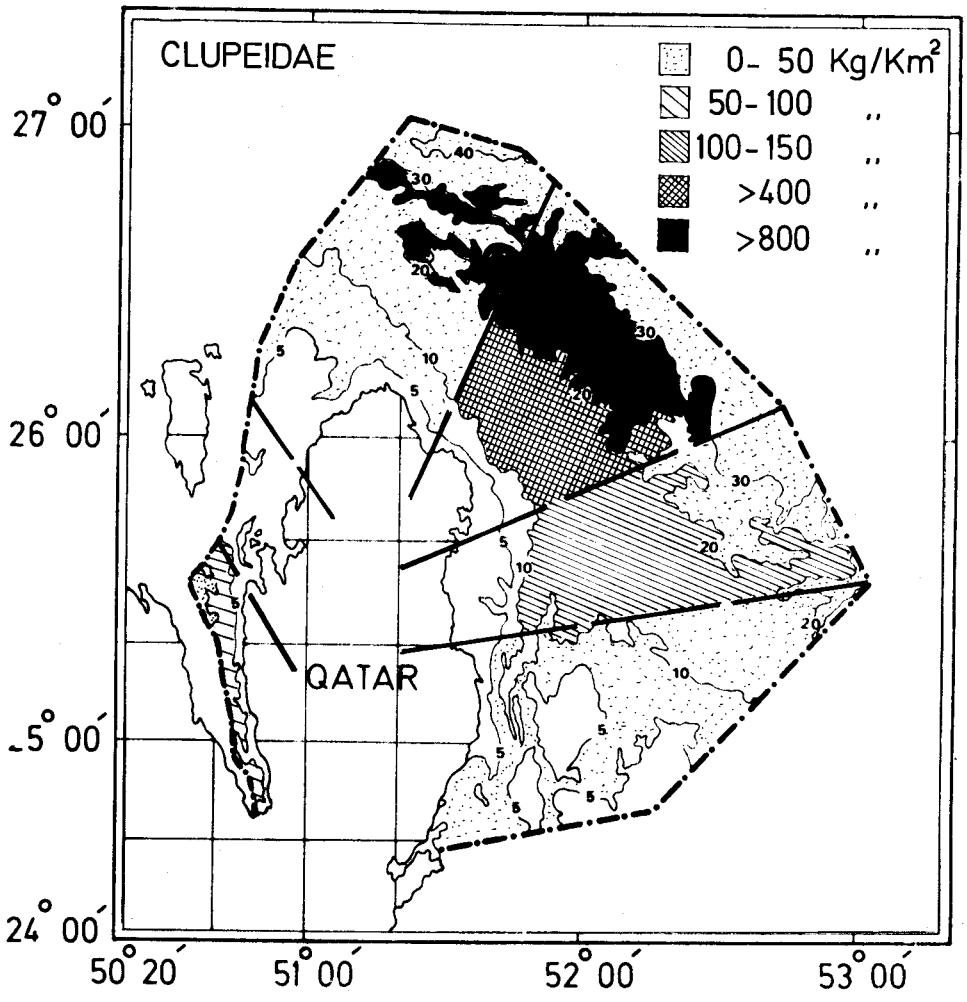

Figure 2 Density distribution of sardines in Qatar-waters, as determined fom the catches made during the trawl survey.

It has also been reliably understood that the commercial fish trawler, belonging to the Fisheries Department of Qatar, catches large quantities of sardines, scads and horse mackerels and hauls with predominantly sardine catches, are often dumped back into the sea. Only small quantities are landed because of the difficulty in marketing sardines. Though absolute correlation could not be established, it was evident that seasonal differences in the biomass estimates by the acoustic method are reflected in the seasonal variations in the catch rate of sardines entering the bottom survey trawl (Figure 3).

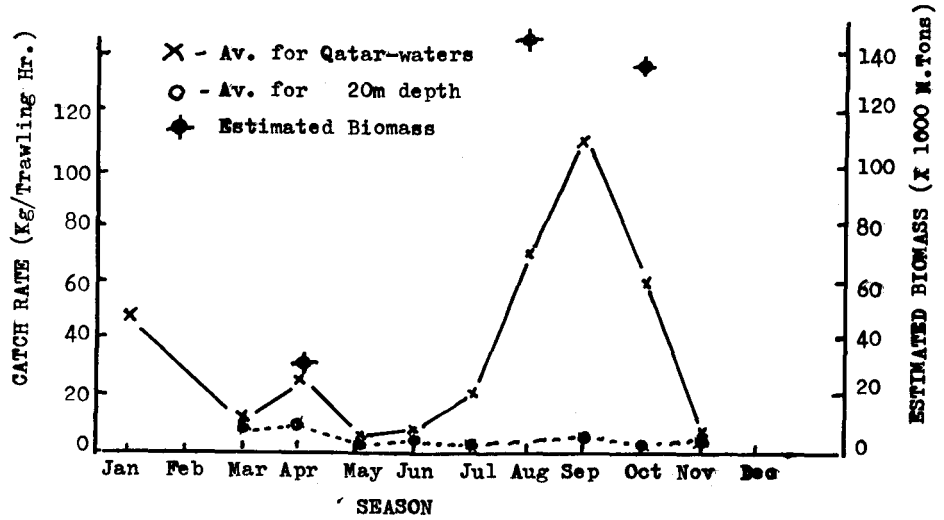

Figure 3 Seasonal variation in the catch rate of sardines caught during the survey with the bottom trawl gear.

Systematic survey of large pelagic species in the Gulf have not been carried out and hence, the evaluation of this resource around Qatar is based on sporadic investigation, carried out in the Gulf and Gulf of Oman (Sivasubramaniam 1981A), indirect information gathered during the demersal resources survey (Sivasubramaniam, 1981B) and on information collected on the existing pelagic fishery in Qatar. Of the large pelagics, king-mackerel is the most important and most common variety around Qatar, followed by barracudas, tunas and bonitos, wolfherrings, queenfishes, mullets, needlefishes, sailfishes and milkfishes. Though sharks are the second most common variety, it is economically unimportant at present.

As in the case of sardines, the data of king mackerels caught during the bottom trawl survey, was used to map its relative density distribution pattern (Figure 4). The results revealed highest concentration in the north-east coast of Qatar, followed by the north and south-west coasts. The east and south-east costs showed relatively very poor densities. In the case of barracudas, the

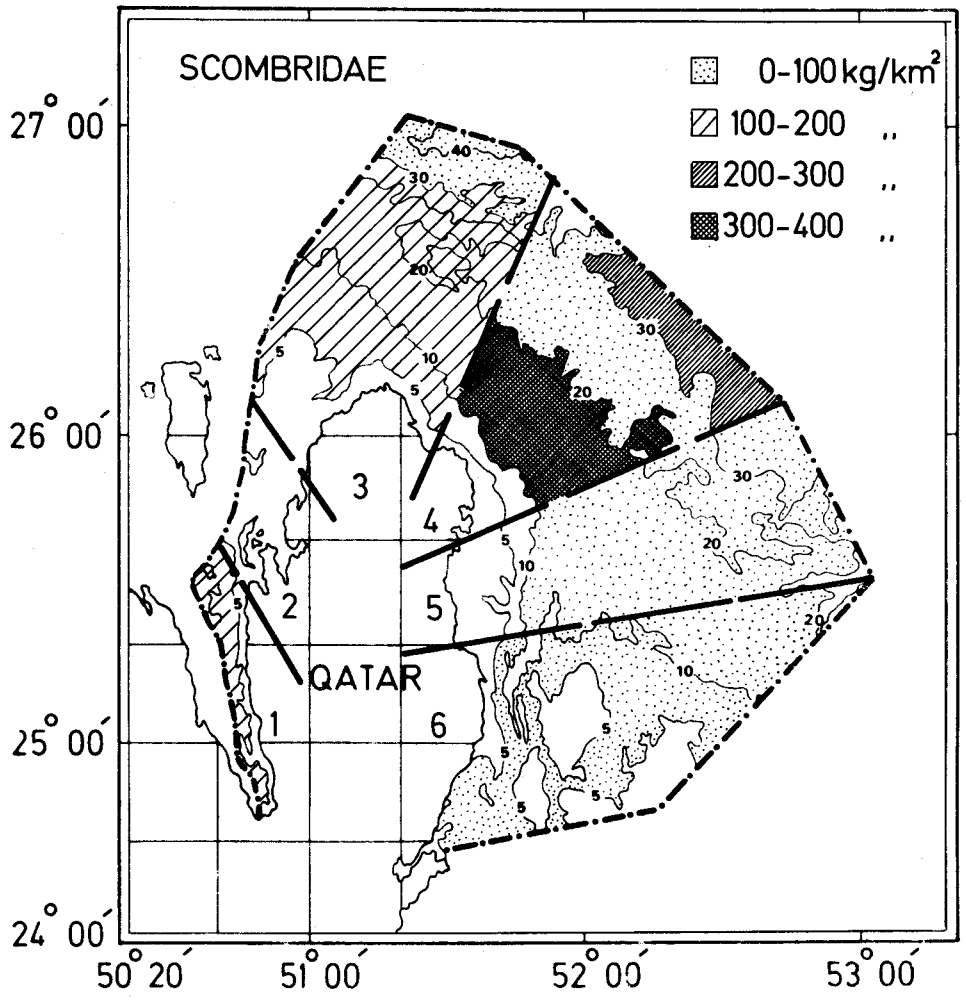

Figure 4. **Density distribution of King mackerels caught during the bottom trawl survey.**

major component of the stock was observed to be vulnerable to the demersal trawl and of the two species in Qatar waters, *S. obtusata* appeared practically in demersal trawl catches only, while *S. jello* appeared in demersal trawl catches and pelagic drift-net catches, according to changes in their habitat with age-the older fish becomes increasingly vulnerable to the driftnet fishery; but this component, is smaller than the component of the young fish available to the trawl fishery. Hence, the resource of this variety has been discussed under the resources for demersal fishery (Sivasubramaniam and Ibrahim, 1981A). Other important large pelagics were very poorly represented in the trawl catches.

Trolling operations, conducted by the Regional Fishery Project, indicated that tuna concentration declined westwards, from the Straits of Hormuz and was extremely poor in the north-west part of the Gulf. In Qatar-waters, higher concentrations were around islands, such as Halul, where catch rate of 2.8 kg/hour/3-single hook lines, was obtained in February (Sivasubramaniam, 1981B).

Information from existing fishery

By sampling the fishery landings in Qatar, the annual total production of pelagic varieties has been estimated as 639,739 kg, of which about 90% is made up of large pelagics. The relative proportion of the major varieties contributing to the production is evident from the figures in Table 3; the descending order of varieties contributing to the production is more or less in keeping with descending order of abundance of varieties as indicated by the biomass estimates. Sardines caught were mainly *S. gibbosa* with a small amount of *S. fimbriata*.

Table 3
Annual production of pelagic varieties in Qatar, 1980/81
(Kg)

VARIETIES	LARGE PELAGICS	SMALL PELAGICS
King mackerels	269'094	
Pelagic sharks and rays	135'000	
Tunas and bonitos	25,930	
Queenfishes	23'498	
Wolfherrings	20'075	
Barracudas	13'898	
Grey mullets	11'727	
Garfishes	11'086	
Remoras	6'000	
Sailfishes	5'950	
Milkfish	783	
Sardines and shads		20'453
Scad and horse-mackerels		16'292
Indian mackerels		2'227
Others	47'536*	30'190**
TOTAL	570'577	69'162
GRAND TOTAL		639.739

*Includes dolphins, dugongs, some large carangids etc.

**Includes mainly silverbiddies mojarras, some halfbeaks, flying fishes etc.

The fishing methods, fishig areas and fishing seasons determine the percentage composition and catch rates for the varieties caught. The percentage composition of the pelagics entering various types of fisheries in Qatar, are presented in table 4. This illustrates the relative distribution pattern of the pelagic varieties in the inshore and offshore ranges around Qatar. Seasonal variations in the production of pelagic varieties and the changes in their percentage composition, in different areas around Qatar, are evident from Table 5. Observations showed that milkfish catches are made only in the south-east coast and mullets are caught only on the northern coast of Qatar.

Table 4

Percentage composition of only the pelagic varieties entering various fisheries in Qatar 1980/81

VARIETY	OFFSHORE GILLNET	TROLLING	INSHORE GILLNET	OFFSHORE FISHTRAWL	INSHORE SHRIMPTRAWL
Kingmackerels	47.0	55.0	1.4	0.4	0
P. sharks	26.0	0		0.3	0
Wolfherrings	19.6		6.7	0.2	0.1
Tunas	1.7	36.9			
Barracudas	1.5	4.5		2.4	0.5
Garfishes	1.0		5.9		
Queenfishes	1.2	3.2	12.7		0.1
Milkfishes	0.1				
Mullets	0		16.5		
Sailfishes	1.1	0.2			
Sardines	0		1.6	1.3	1.5
Mackerels	0.1		12.8	★	
Others, including Demersals	0.7	0.2	42.4	95.4	97.8

★ Included with "Others"

Major varieties, such as king mackerels and sharks, are caught throughout the year but the production during the summer season is about 10% of that for the winter season.

Coryphaena spp (Dolphinfishes), *Elagatis spp* (rainbow runners), *Thunnus tonggol* (long tail tuna) were seldom or never observed in the catches from the Qatar-waters, during the period of this study.

Table 5

Monhtly landing of main pelagic varieties at various fishing centres in Qatar, 1980 (Kg).

VARIETY	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
DOHA														
Kingmackerel	3290	4671	6163	200	1590	0	461	200	2200	602	374	0	19571	41.4
Tunas and bonitos	814	166	935	0	0	3000	72	4013	888	7556	0	0	17444	36.7
Barracuda	0	123	196	2376	373	90	145	0	394	0	0	0	3697	7.8
Queenfish	82	0	196	0	184	0	108	110	1578	464	953	153	3828	8.0
Wolfherring	55	0	0	0	0	0	0	0	0	0	0	0	55	0.1
Indian mackerel	150	275	515	50	0	0	0	0	0	0	0	0	990	2.1
Garfishes	0	0	0	1188	380	0	0	0	0	0	0	0	1568	3.3
Sardines	0	0	0	0	0	0	0	60	65	90	45	50	310	0.6
DOHA-TOTAL	4391	5235	8005	3814	2527	3090	786	4383	5125	8712	1372	203	47643	
WAKRAH														
Kingmackerel	3656	0	7185	1531	3873	68	813	0	0	1781	35	3360	22302	63.2
Tunas and bonitos	0	0	0	0	0	0	0	0	0	165	0	0	165	0.5
Barracuda	377	24	358	269	649	0	116	0	0	349	59	225	2426	6.7
Garfishes	0	0	1190	357	0	0	0	0	0	0	0	116	1163	4.7
Queenfish	57	47	0	40	0	0	115	230	1231	2508	183	128	4539	12.9
Wolfherring	750	0	0	0	0	0	0	0	0	0	0	120	870	2.5
Sharks	754	0	0	838	0	0	378	0	0	0	215	380	2565	7.3
Milkfish	270	0	0	203	0	0	0	0	0	0	0	310	783	2.2
WAKRAH-TOTAL	5864	71	8733	3288	4522	68	1422	230	1231	4803	492	4639	35313	

Cont. Table 5

VARIETY	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
AL-KHOR														
Kingmackerel	35343	22537	10790	23324	12076	1508	—	—	—	1257	54556	60673	222064	55.8
Tunas and bonitos	80	1385	0	1340	297	0	—	—	—	678	2300	2241	8321	2.1
Wolfherring	4239	3676	4196	191	0	0	—	—	—	0	828	166	13296	3.3
Barracuda	1520	239	975	880	1825	255	—	—	—	0	1104	60	6858	1.7
Queenfish	92	239	150	689	1167	1572	—	—	—	0	552	1494	5955	1.5
Sharks	3870	18383	55601	7545	4648	4596	—	—	—	1065	22356	13529	131593	33.1
Garfishes	0	239	0	345	0	0	—	—	—	0	0	0	584	0.1
Sailfishes	1350	900	1100	0	0	0	—	—	—	0	0	2600	5950	1.5
Shad	100	0	0	0	0	0	—	—	—	200	300	480	1080	0.3
Sardines	160	260	340	334	170	0	—	—	230	160	170	140	1964	0.5
AL-KHOR TOTAL	46754	47858	73152	34648	20183	7931	—	—	230	3360	82166	81383	397665	
AL RUWAIS* **														
Kingmackerel	X	X	X	X	X	X	X	X	X	X	X	1000	3.8	
Mullet	X	X	X	X	X	X	X	X	X	X	X	11727	44.3	
Queenfish	X	X	X	X	X	X	X	X	X	X	X	8762	33.0	
Garfishes	X	X	X	X	X	X	X	X	X	X	X	2302	8.7	
Wolfherring	X	X	X	X	X	X	X	X	X	X	X	2696	10.2	
AL-RUWAIS TOTAL	—	—	—	—	—	—	—	—	—	—	—	26487		

Cont. Table 5

VARIETY	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
COMMERCIAL TRAWL, DOHA														
Kingmackerel	—	109	186	640	237	40	160	115	1120	1210	160	—	3977	18.5
Queenfish	X	X	X	X	X	X	X	X	X	X	X	X	160	0.7
Wolfherring	X	X	X	X	X	X	X	X	X	X	X	X	200	0.9
Sardines	0	365	3450	1404	1165	730	840	615	270	235	625	1075	10765	79.9
													+6332*	
SUBTOTAL													21434**	

* Discarded at sea; estimated from samples of discarded fish.

**Does not include varieties such as sharks, carangids, barracudas etc, which have a mixture of demersal and pelagic species.

***Annual total estimated from seasonal sampling and hence monthly catch not presented.

(—) No fishing activities.

(X) Monthly estimates not available.

The offshore driftnet fishery at Al-Khor involves short over-night trips, lasting about 12 hours and only one setting per trip. In Doha and Al-Wakrah, the drift-netters have a variable number of days per trip, as well as the number of settings. However, the specifications and numbers of units of gear used, are almost the same for all three fishing centres. The mean catch rates (kg/boat/day) for the offshore driftnet fishery at Al-Wakrah, Doha and Al-Khor, were estimated to be 130, 144 and 155 kg/day, respectively (Figure 5).

In the inshore gillnet fishery, the crafts operate only short trips of 4 to 7 hours,with a constant number of crew and units of gear, but the crafts from Doha are out of port for about 2 hours more than the crafts from Al-Khor, during each trip. The mean catch rates for this fishery in Doha was observed to be 26/kg/boat/trip as against 16/kg/boat/trip at Al-Khor (Figure 6).

Offshore drift-netting by the Doha fleet was restricted to the period of November to February and peak catch rate was observed in January (Figure 7). Unlike in doha, this fishery at Al-Wakrah extends from November to July and peak periods were November and March (Figure 7). At Al-Khor, the fishery is almost completely suspended from July to September and during the rest of the year, offshore-netting is the primary operation. The peak periods for catch rates at this centre (Figure 7) are the same as at Al-Wakrah. The seasonal changes are more or less similar for crafts operating from all three centres, but the catch rates tend to decrease from the north-east to south-east coast. When the mean catch rates for individual varieties were considered, it was observed that there is a single dominant peak in November for king mackerels in the north-eastern area and another samll peak in May is formed after a decline in March (Figure 8). The tunas and wolf-herrings were steadily poor in the catches, except for a noticeable increase of tunas in October.

About 19% and 7.5% of the production of pelagic species by the artisanal and commerial scale fisheries, respectively, are discarded at present (Sivasubramaniam and Ibrahim, 1981B).

Biological Information

Offshore bottom trawling for fish and inshore trawling for shrimps, are the only two methods that are catching sardines around Qatar. *S. gibbosa* caught by these methods were 3-18 cm in total length. In view of the limited seasonal sampling for size frequency, the data were pooled for two periods: February to May and August to November in which sardine landings by the fish trawler 'Gazelle' were 'large' and 'small', respectively. The size range during February - May was 10 - 18 cm and that for August - November was 3-14 cm (Figure 9). The sardine entering the inshore shrimp trawl fishery during the latter period was predominantly of the 3-7 cm size range. Sex ratio determined from a few samples of the larger individuals, indicated a predominance of males and females with fully mature or ripe ovaries were commonly observed during April/May. Examination of the size frequencies for sardines, caught by bottom trawl, midwater-trawl and purse-seine, during the Regional Fishery Survey, failed to show any consistant differences between the size ranges of the sardines close to the bottom, in the midwater and near the surface.

The gizzard shad (*Nematalosa nasus*) entering the inshore trawl fishery from September to December 1980, was 6-12 cm in length, while that for inshore gillnet landings between

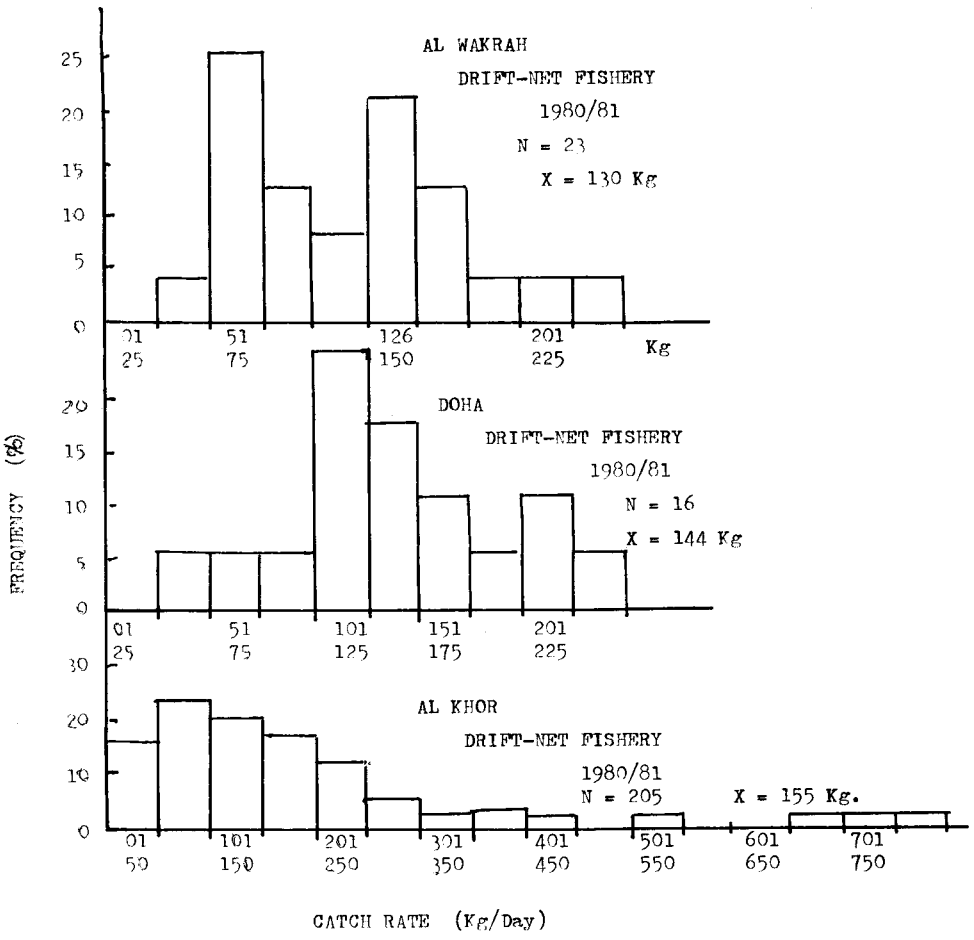

Figure 5. Frequency distribution of catch rates for the offshore driftnet fishery at AL WAKRAH, DOHA and AL KHOR.

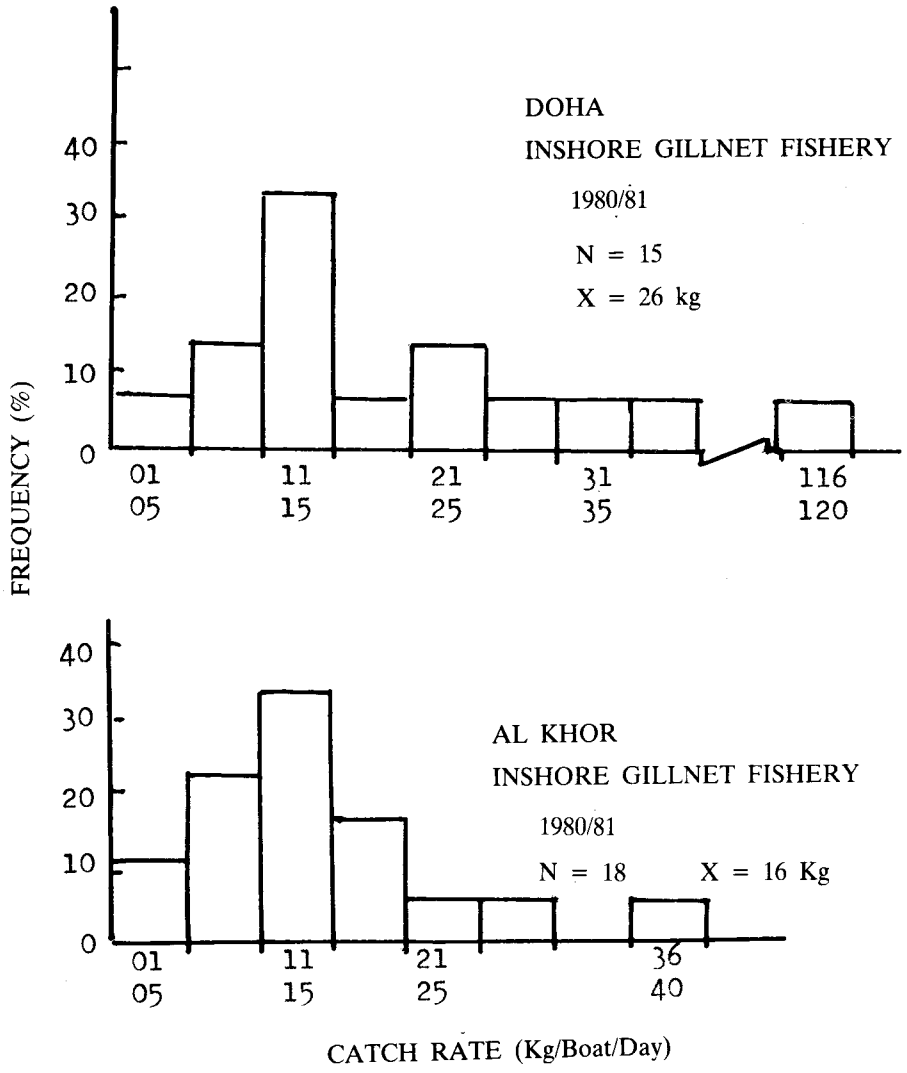

Figure 6. Frequncy distribution of catch rates for the inshore gillnet fishery at DOHA and AL KHOR.

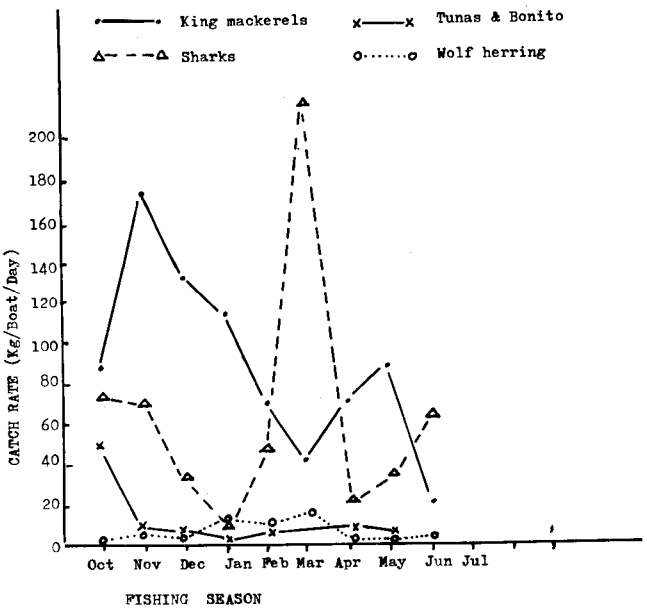

Figure 7. Seasonal variation in the Catch rates of large pelagic species, for the off-shore drift fishery at Al Khor (1980/81).

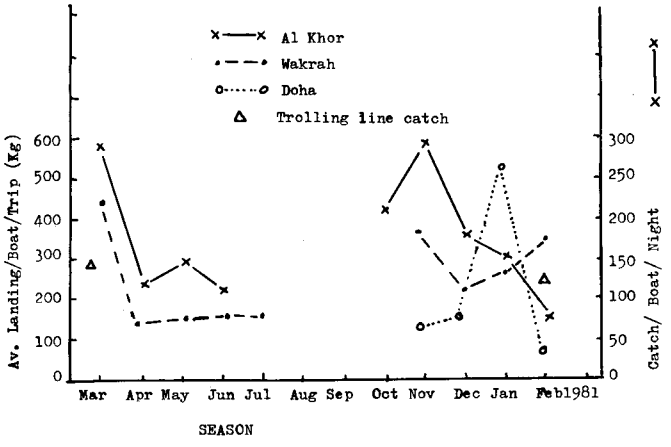

Figure 8. Seasonal variation in the landings of large pelagics, per trip, by drift-netters at Al Wakrah, Doha and Al Khor.

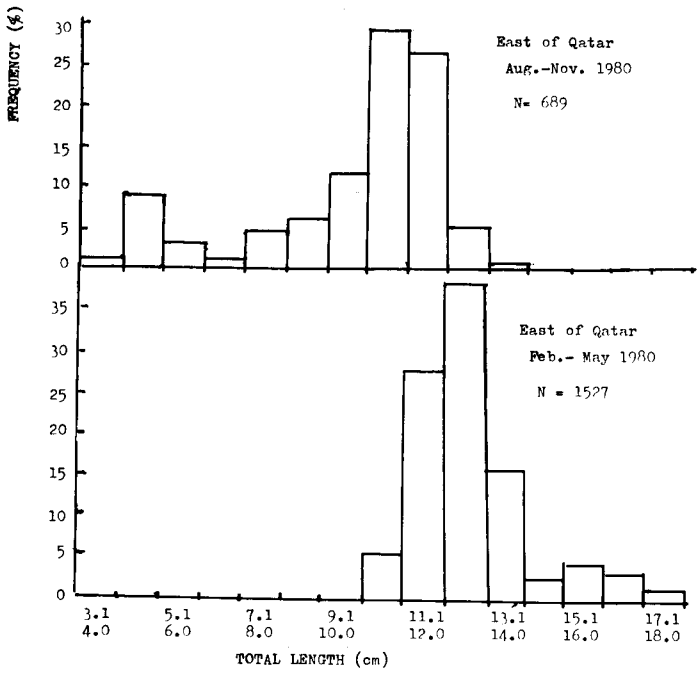

Figure 9. Length-frequency distribution of Sardinella gibbosa caught in the bottom trawl, during summer and winter seasons.

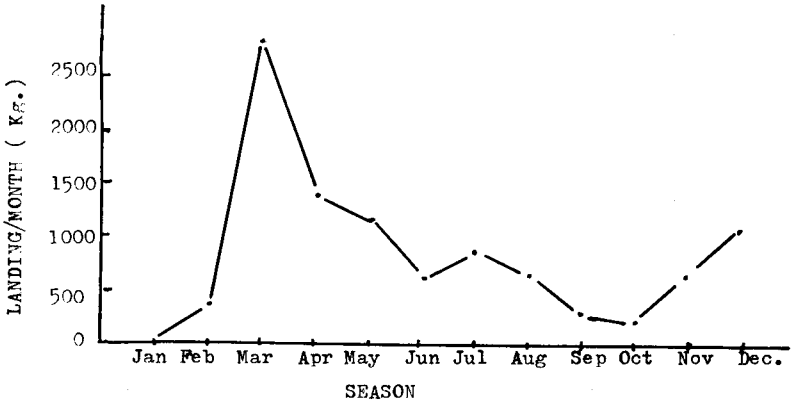

Figure 9a. Monthly landings of sardines, by the trawler - GAZELLE, 1980.

November 1980 and March 1981 was 12-19 cm (Fig. 10A). The inshore gillnet fishery for Indian mackerel *(R. kanagurta)* had a very short season and the size range over that period was observed to be 16-21 cm (Figure 10B). The mullets *(Liza macrolepis)* entering the intertidal traps and the inshore gillnet in the north, are of the same size (Figure 10C). Though February/March was the best season in 1981, the good season in 1982 extended through the period of very heavy rainfal in Qatar, until the beginning of May.

The size range of milkfish (Chanos chanos) entering the gillnet fishery off the south-east coast was 26-40 cm at the beginning of the winter, but the size range during the major part of the winter season was 50-85 cm (Figure 10D).

Larger species of sharks, such as hammerheads *(S. mokarran)*, blacktip *(C. melanopterus)*, spinner shark *(C. brevipinna)*, black spot shark *(C. seali)* and tiger shark *G. Cuvieri)* are relatively less common than the grey dog shark *(C. palasorrah)* in the offshore drift-net catches. The grey dog shark catches were consistantly of the 58-72 cm length range throughout the offshore drift-net fishing season. The sex ratio was ♂ : ♀ :: 1 : 0.57 and there was no difference in the length frequency distribution of males and females (Figure 11A). More than 50% of the females examined had embryos and the number of embryos were more often 2 than 1 per female. The embroys from 26 females showed a sex ratio of 1:1. The total length of the embroys ranged between 20-28 cm, but mean length of the female embroys appeared to be greater than that of the male embryos (Figure 11B).

The narrow-barred kingmackerel *(S. commerson)*, entering the fishery in Qatar, was 35-100 cm in fork length, whereas that of the Indopacific king mackerel *(S. guttatus)* was 30-50 cm. Much larger narrow-barred kingmackerel, occuring in the Gulf of Oman, are rarely seen in the catches around Qatar. The length frequency distribution was unimodal in the case of Indopacific kingmackerel (Figure 12A), but bimodal in the case of the other species (Figure 12B). The fisrt mode appeared from the size group entering the fishery during the peak period at the beginning of winter and the second mode appeared fom the catches made during he samller peak period at the end of the winter. It was also evident that their size frequencies for the eastern and western sides of Qatar, were very similar (Figure 12B). Indopacific kingmackerels appeared with the catches of narrow-barred kingmackerels, at the beginning of the winter.

The size range of little tuna *(E. affinis)* in the drift-net and troll fishery around Qatar in 1980, was 28-68 cm in fork length. The modal progression is presented in (Figure 13). Very large quantities of the 30-60 cm length group, were landed in December 1979, most of which were discarded, due to difficulties in marketing large quantities of this variety. The length frequency distribution obtained for 1980 was in conformity with that obtained for this species in the south-eastern part of the Gulf in 1978/79 (Sivasubramaniam 1981) and is composed of the 2nd and 3rd year age groups. The 3rd year group appeared in the catches between April and October. The fishery of this large pelagic species is heavily reduced from June to September and landings became very sporadic and poor. The sex ratio observed was ♀ : ♂ : : 1 : 1.3 and preliminary investigated failed to show any females with ripe ovary.

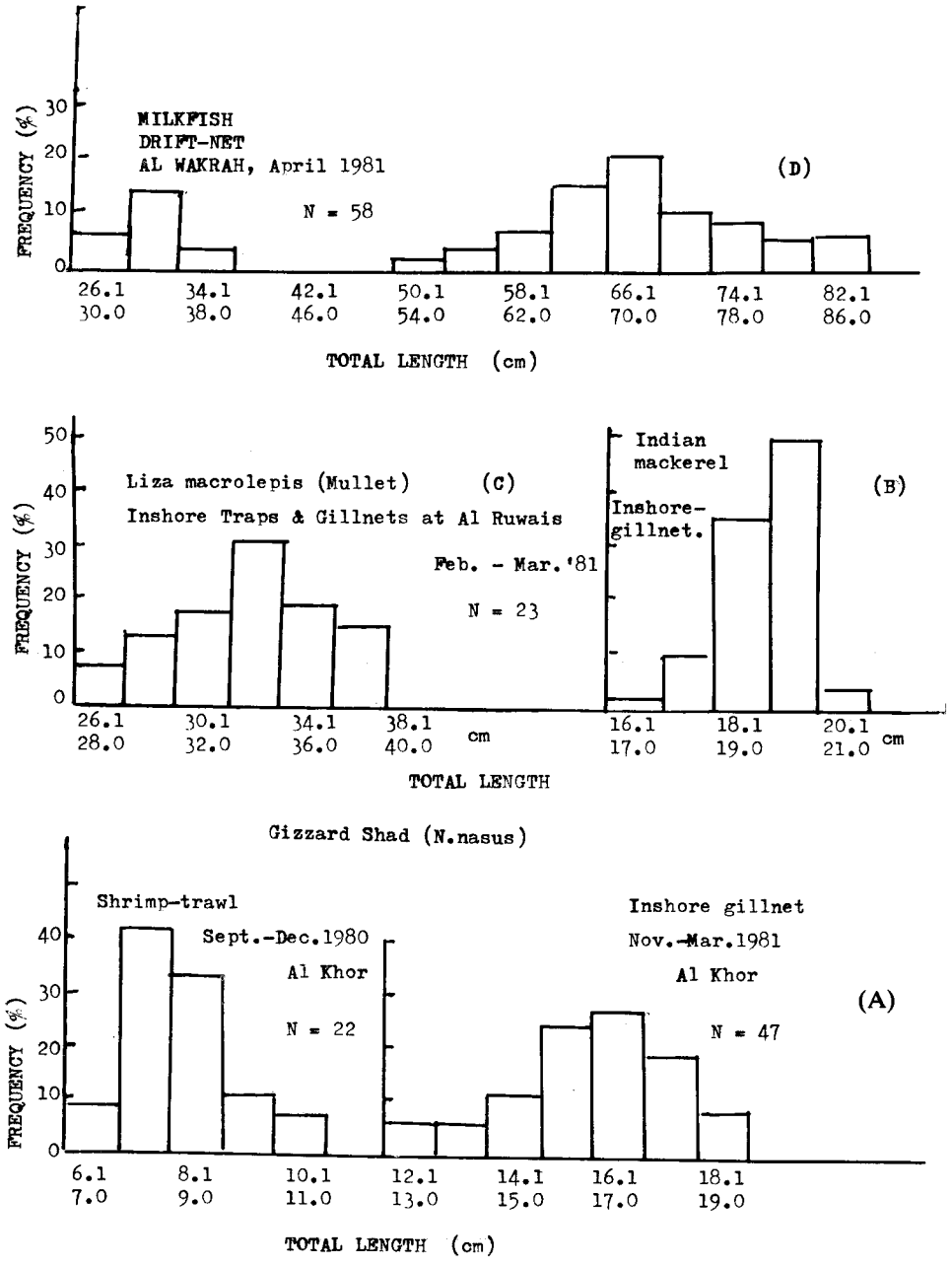

Figure 10. Length-frequency distribution of (A) gizzard shad, (B) Indian mackerel, (C) Mullet and (D) Milkfish, in Qatar waters.

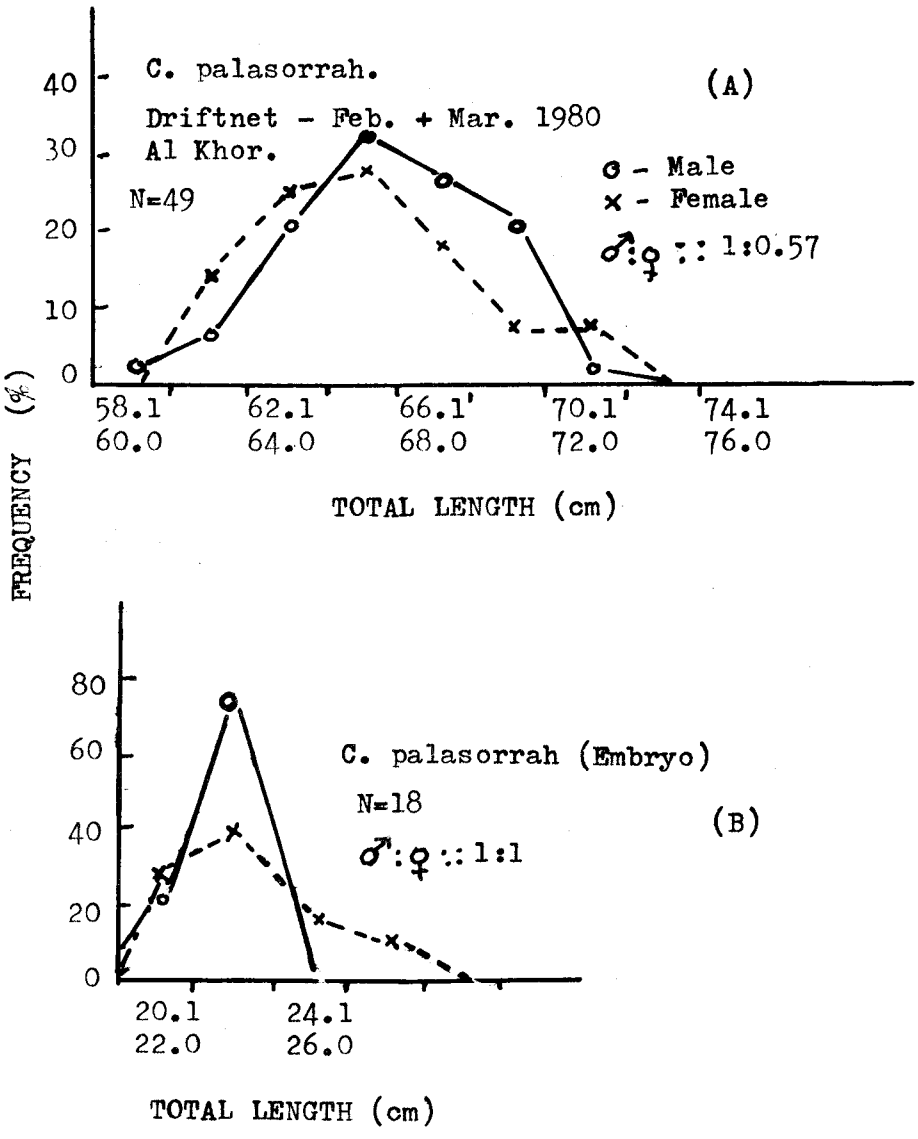

Figure 11. (A) Length-frequency distribution of the Grey dog shark caught in Qatar waters and (B) the size range of its embryo.

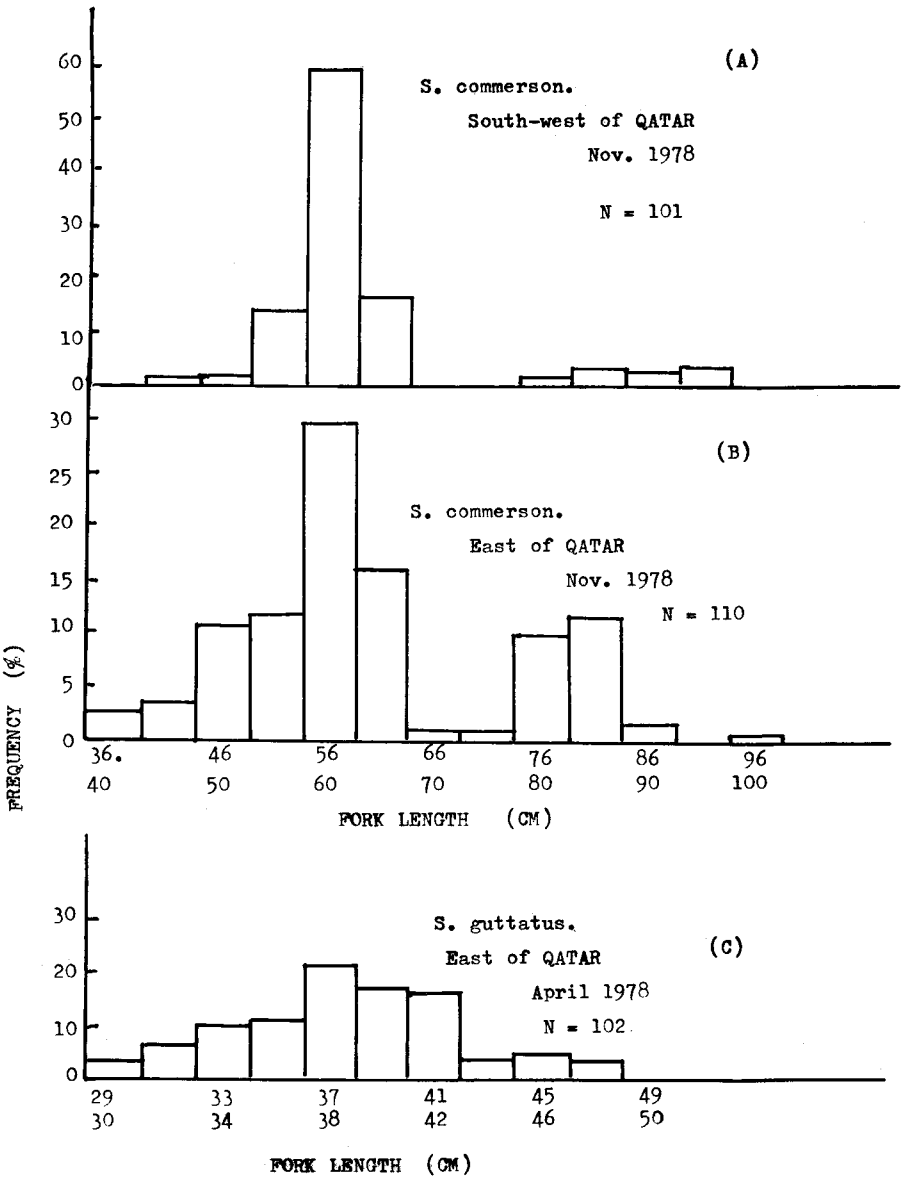

Figure 12. Length - frequency distribution of S. commerson from the (A) south-west coast and (B) West coast and (C) S. guttatus from the East coast, of Qatar.

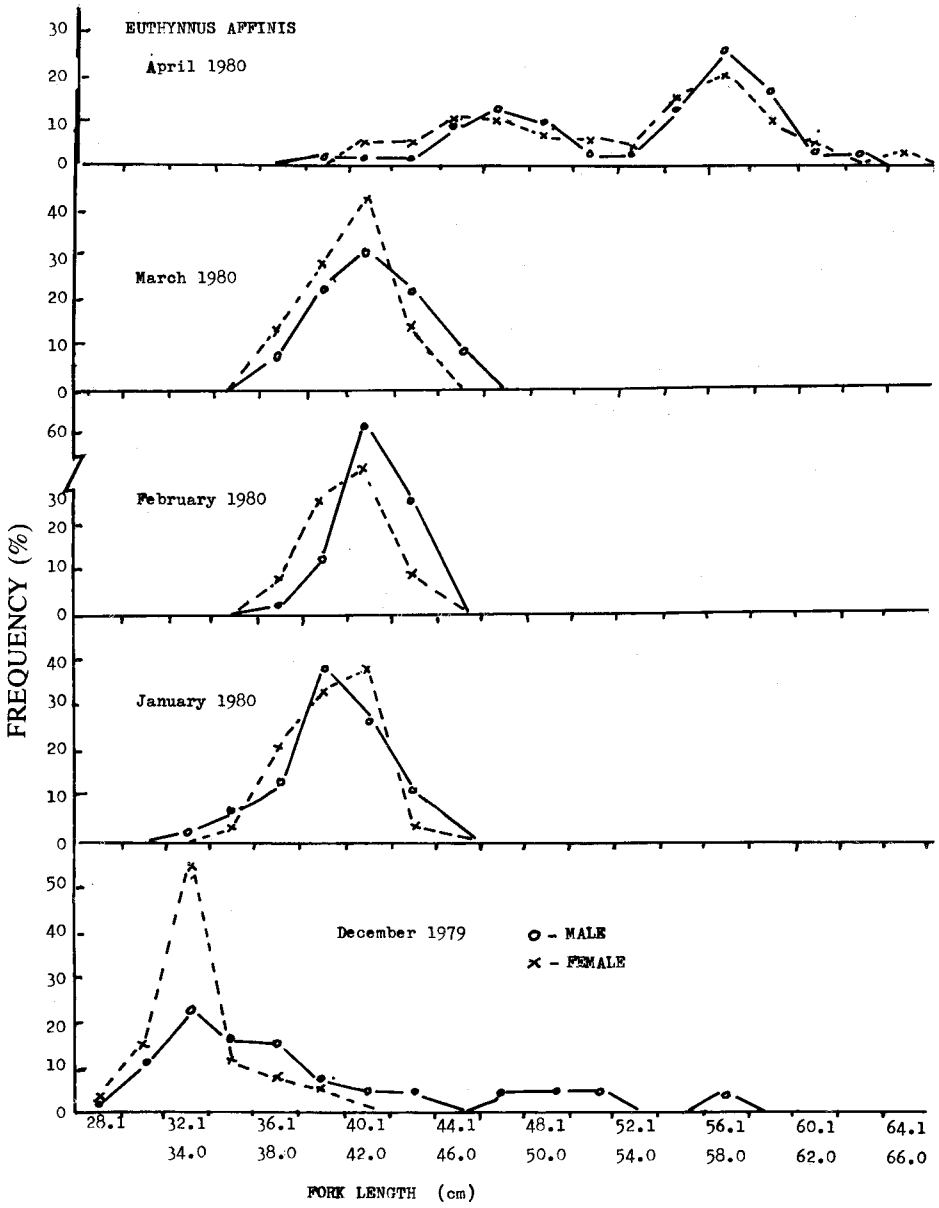

Figure 13. Length-frequency distribution of E. affinis (Little tuna) caught off the East coast of Qatar, by Driftenetting and Trolling.

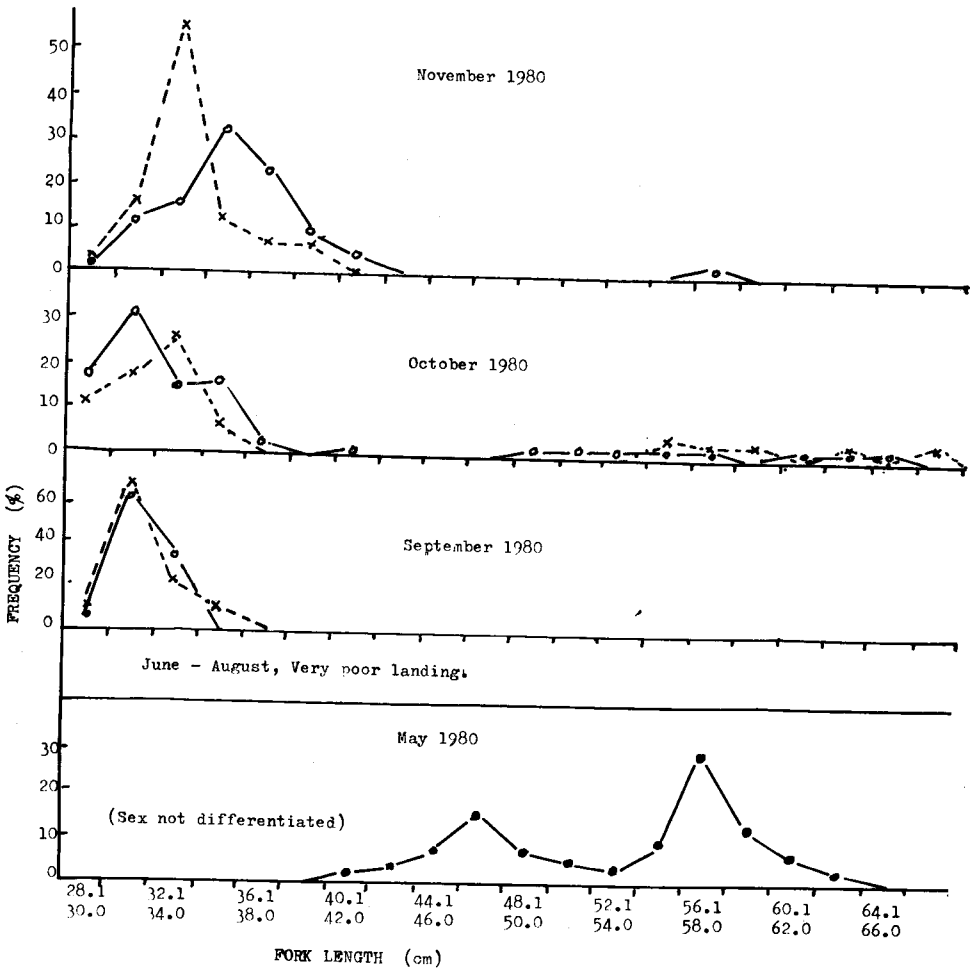

Figure 13 (Cont.)

Frigate mackerels (Auxis spp.), which generally associate with little tuna in the Indian Ocean, were not present in the catches around Qatar.

The yellowfin tuna *(T. albacares)* caught around Qatar were 30-60 cm in fork length and were probably of the 0 and 1 year age groups (Figure 14). Both age groups were almost equally represented in the catches and much older individuals did not appear in the catches in 1980. Being more efficienty caught by trolling than by the gillnet presently used in Qatar, the landings were sporadic and scattered over the year. The sex ratio was 1 : 1 and none of the individuals examined had mature gonads.

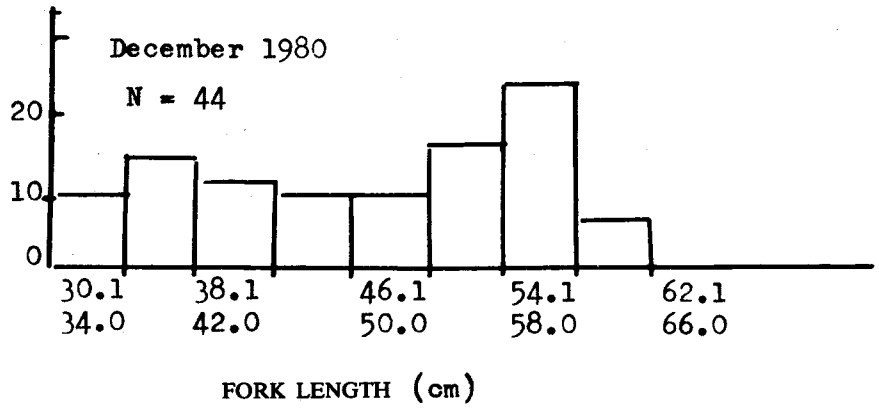

Figure 14. Length-frequency disribution of yellowfin tuna caught off the East coast of Qatar, by driftnetting and trolling.

Long tail tuna *(T. tonggol)*, known to occur in the Arabian Sea and even the Gulf of Oman, was absent in the catches around Qatar. Very few sailfish *(I. platypterus)* were caught during 1980 and they were 110-160 cm in fork length.

Potential yields

Catch and effort statistics are not available for the fisheries in Qatar to determine maximum sustainable yields and there is no fishery for small pelagics, such as sardines. As such, potential yields for small and large pelagics were determined from the available information on biomass estimates.

The rate of natural mortality (M) and the rate of fishing mortality (F) tend to equalise around the maximum sustainable yield level and the catch rate at this level tends to become half the value obtained when the stock was virgin or unexploited. A first approximation to determine maximum potential yield for an unexploited resource, is expressed as $Y_{max} = 0.5 \times M \times Bo$, where Y_m is the maximum potential yield, M is the natural mortality rate and B_O is the virgin biomass in M.tons. The natural mortality rates for the pelagic sepecies in the Gulf are also unknown.

In the case of the small pelagics, natural mortality rate of 0.8 to 1.0 and a 2 to 3 year live span were considered as reasonable assumptions for the mixture of species. (Mitchell and Simmonds 1981; Holt, 1960; Nair, 1960). The present level of exploitation of small pelagics, mainly sardines, is extremely neglibible compared to the biomass estimated. Hence, the first approximation mentioned above was applied, using the lower limit of the natural mortality rate (M = 0.8) and the mean biomass of 104,000 M.tons. Thus, a potential yield of 41,000 M.tons was estimated.

Though there is a major fishery for large pelagics in Qatar-waters, no records of catch and effort have been maintained and systematic surveys have not been carried out on these resources. Hence, a preliminary and indirect estimation of the potential yield was carried out with the biomass values, obtained from the trawl survey catches of large pelagics.

The bottom trawl net used was an Engel's high-opening type and, as the areas around Qatar are relatively shallow, it was assumed that the catches of pelagic varieties with this gear would provide at least a crude estimate of the resources level. However, the biomass values estimated through this indirect method, involving the use of a relatively inefficient sampling gear for pelagics, are expected to be under-estimates. Being exploited stocks, the modification of the first approximaiton, $Y = 0.5 (C+MB)$, where C is the annual catch in tons and B is the mean annual biomass, was applied.

As the majority of the large pelagics entering the fishery in Qatar are long-lived, it is assumed that M is in the range of 0.5 to 0.2. On an average for the mixed composition of species, $M = 0.3$ was considered as a resonably low rate of natural mortality for a cautious estimation of the maximum potential yield. Applying the annual total catch of large pelagic varieties (Table 3) and their total biomass (Table 1) to the equation, a maximum potential yield of 2200 M.tons was estimated.

DISCUSSION AND CONCLUSIONS

The area of Qatar-waters is approximately 35000 km^2 and nearly 75% of it is on the eastern side, which is relatively risher in pelagic fish varieties than the smaller area on the western side. Though a number of pelagic species have been identified from these waters, sardines, kingmackerels and sharks are the most significant pelagic varieties. The first variety is a small pelagic which is the most abundant group, but it is the least exploited of all pelagic varieties and no fishing effort is presently directed on it. The other two are large pelagic varieties, which contribute very significantly to the production by offshore gillnet fishery. The kingmackerel is one of the most valuable variety, while the sharks are one of the least valuable variety and are a by-catch of the gillnet fishery for kingmackerels.

Though the main varieties are distributed around Qatar, the areas with high densities of commercial interest amount to less than 50% of the total area, for anyone variety. For relatively less abundant varieties, such as Indian mackerel, milkfish, grey mullets etc., the areas of occurrence appear to be even more reduced. Generally, the areas off the west and south-east coasts exhibit very poor densities and they may not be able to support economically viable pelagic fisheries. North-east and northern coasts of Qatar appear to be the main areas for expansion of the pelagic fisheries.

The catch rates of pelagic varieties exhibit seasonal variations. These were clearer in the catches of pelagic fisheries than in the catches of pelagic varieties by demersal fishing methods. However, the information from all available sources indicate that certain components of the pelagic stocks are available for exploitation throughout the year. Sardines are more often vertically dispresed than they are in well defined large schools near the surface. Hence,

techniques such as light attraction by night will help to concentrate them near the surface for efficient exploitation, even on a year-round basis.

The seasonal variations in the catch rates and length frequency disribution indicate the trends in recruitment, migration and age groups entering the fishery. The length frequency distribution of sardine entering the trawl fishery, indicate that young fish are recruited to the fishery during summer, which projects the possibility of spawning towards the end of winter. 3-5 cm length group, entering the catches from inshore waters of Qatar, suggest that spawning of sardines may be occuring within Qatar-waters also. Similar trend was observed in the case of the gizzard shad too. There is some evidence of westward migration of kingmackerels in the Gulf, from the Strait of Hormuz area, with the cooling of the Gulf waters and that the process is reversed when the Gulf begins to warm up (Sivasubramaniam, 1981A). This characteristic of the kingmackerel may provide an interpretation of the seasonal variation in their catch rates in Qatar-waters. The peak periods coincide with the beginning and end of the winter, probably because their westward and eastward migrations, respectively, bring them close to Qatar during these periods. Though seasonal sampling of the length-frequency distribution could not be carried out, it was observed that during the peak season in November, the average size of the fish was slightly smaller than that of the catches during the peak season in the following May. In fact it is noteworthy that very large sized kingmackerels, occurring in the Gulf of Oman, were not observed in the Gulf, particularly around Qatar.

The common occurrence of mullets in the northern area. gizzard shad in the north-eastern area and the milkfish in the south-eastern area, probably indicate ecological restrictions in the distribution of these varieties.

The acoustic survey showed that small pelagic varieties, such as sardines, tend to concentrate in the 10-40 m depth range and the south-eastern part of the Gulf, which is between Qatar and U.A.E., has a relatively larger area up to the 20 Fm isobath. Perhaps this factor contributed to the large biomass of small pelagics in this part of the Gulf. The areas with less than 10 m depth of water was not covered during the acoustic survey, due to problems of inaccessibility to the vessel. However, presence of sardines in this shallow inshore area around Qatar has been shown by the catches made during inshore shrimp trawling. It is also known that any fish in the fisrt 6 m layer of the surface water, would not have been effectually detected by the acoustic survey equipment, due to its functional limitation (Mitchell and Simmonds 1981). This could have contributed to an under-estimation of the total biomass of small pelagic species.

Seasonal difference in the estimated biomass of small pelagics, could have been caused by various factors, including significant changes in the vertical and spatial distribution, migration into very shallow areas and areas outside Qatar-waters, as well as due to changes in the performance of the instrument used. If April/May is the spawning season, as conjectured earlier, then the very low biomass value for the month of April could have been partly caused by the spawning migration and very large biomass values for August and October could have been partly due to regrouping of the stock and entry of new recruits.

In view of various limitations and incomplete information, the biomass and potential yield estimated for both small and large pelagic varieties have been made very cautiously. However, certain components of the biomass are present in very low densities in some areas around Qatar and it may be uneconomical to establish pelagic fishery in such areas. Even in the areas with relatively higher densities, the components of the stocks may not be wholly available to the fishery or wholly vulnerable to any one main-method of fishing. In the light of these reasons, the exploitable potential may be in the region of 20-25,000 M.tons and about 80-90% of it is expected to be sardines.

In the case of large pelagic varieties, the etimated maximum potential yield of 2200 M.tons is about four times the present production. However, the biomass determined through an indirect approach is only a modest and crude estimate and hence, it would be safe to recomend only a 100% increase in production at this stage. Any increase beyond the recommended level, should not be considered before carrying out more intensive and direct investigations.

The results and conditions presented above should be considered as preliminary findings for planning, development and management of the pelagic fishery resources around Qatar, in the immediate future. More detailed information should be collected on seasonal changes in abundance, distribution and migration, through well designed surveys and vital parameters, such as age structure, growth rate and mortality rates must be determied for proper management of these resources around Qatar.

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REFERENCES

Holt, S.J. 1960. A preliminary comparative study of the growth, maturity and mortality of sardines; Proceedings of the World Scientific Meeting on the Biology of Sardines and Selected Species. Edited by H. Rosa Jr and G. Murphy; F.A.O. Rome; Vol. 2; 553-561.

Mitchell, L. and **Simonds, J. 1981.** Acoustic estimation of the biomass of the stocks of small pelagic species in the Gulf and Gulf of Oman; Regional Fishery Survey and Development Project Report No. RAB/71/278/11 - part 3.

Nair, R.V. 1960. Synopsis of the biology and fishery of the Indian sardines; Proceedings of the World Scientific Meeting on the Biology of Sardines and Selected Species; Edited by H. Rosa Jr and Murphy. F.A.O. Rome Vol. 2: 329-414.

Sivasubramaniam, K. 1981A. Large pelagics in the Gulf and Gulf of Oman; Reg. Fish. Res. Survey and Development Project Report RAB/71/278/11 - part 5.

——————— **1981B.** Demersal resources of the Gulf and Gulf of Oman. Ibid Report No. RAB/71/278/10.

Sivasubramaniam, K. and **Ibrahim, M.A. 1981.** Demersal Fish Resources around Qatar. Bulletin of the Univ. of Qatar, Vol. 1 (summary) and Vol. 2 (main report).

——————— **1981B.** Fisheries in Qatar (manuscript report) University of Qatar.

Vidal, J. 1981. Report on the preliminary phase of the acoutic survey for small pelagic stocks in the south eastern Gulf. Reg. Fish Res. Survey and Devel. Project Report No. RAB/71/278/11-part 2.

مخـزون الأسماك السباحة ومصايدها حول قطـر

ك . سيفا سبرامانيام محمد أمين إبراهيـــم

تعتبر مصايد الأسماك السباحة حول قطر أقل من مثيلاتها من الأسماك القاعية . فوسائل الصيد العاملة في المياه الشاطئية والبعيدة عن الشاطىء وبالتحديد بالشباك الخيشومية وبجر الخيط والميدار (السنار) وكذلك شباك الجر القاعية تساهم جميعاً في صيد الأنواع العائمة من الأسماك .

فهناك حوالي ٣٠ نوع من الأسماك السباحة ذات مدلول تجاري إلا أن العوم (السردين) ومجموعة أسماك الكنعد واليريور (القروش) تتميز بأنها المكون الأساسي لها . فالعوم من أكثر الأسماك السباحة توافرا إلا أنه لا يستغل أقتصادياً كما أن كميات كبيرة من القروش تتخبط في الشباك الخيشومية ويتم التخلص منها بألقائـها ثانية في البحر .

والانتاجية السنوية للأسماك السباحة الكبيرة تبلغ ٥٧٠ طناً بينما هي ٧٠ طناً فقط من النوعيات الصغيرة الا أن الانتاج المتاح الذي يمكن الحصول عليه فهو ٢٢٠٠ طناً من النوعيات الكبيرة بالاضافة إلى ٢٠ر٠٠٠ طناً من النوعيات الصغيرة .

والمساحة المتاحة لتركيز كبير من أي نوع من هذه الأسماك حول قطر يقل عن ٥٠٪ من مساحة المياه الكلية لها . فالشاطىء الشمالي الشرقي والشاطىء الشمالي يعتبران أغنى نسبياً من الشاطىء الغربي والشاطىء الجنوبي الشرقي .

وقد تم في هذا البحث تتبع التغير في الأنواع المختلفة منها ، والتي تدخل المصيد وكذلك دراسة انتشارها وسلوكها . حيث أتضحت موسمية تواجد هذه الأنواع تبعاً للتغيرات البيئية المختلفة .

وبمثل ما يتخلص منه حالياً من هذه الأسماك بحوالي ١٩٪ من كمية المصاد بالمصايد الأهلية بالاضافة إلى ٥ر٧٪ من المصيد بمراكب الصيد بالجر .