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EVALUATION OF THE TRADITIONAL FISHING GEAR (HADDRAH) ALONG THE COASTALINE OF ARABIAN GULF IN SAUDI ARABIA

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ABSTRACT

The present work aims to evaluate the fishing efficiency of the traditional fishing gear, which has local name Haddrah and its effect on the fish stock productivity in the Arabian Gulf in Saudi Arabia during the period from April 2002 to April 2003. Haddrah is a type of inshore setting net, which constructed on the intertidal zone along the coastal line of the Arabian Gulf in Saudi Arabia. Naturally, most fishes swimming up to the inshore during the rising tide then they return to the sea during the ebb tide, which occur twice daily and many of them were interning to the trap of Haddrah, which called the Sirr. When the water level declines to about half meter during the ebb tide the fishermen harvesting many fish species from the Sirr. It was found from surveys that the majority of Haddrah traps are setting at Al-Qatif and Al-Jubil coasts. Water temperature and water salinity were estimated monthly and their relation with catch per unit effort were studied, it was found that the average fish catch is highly effected by the water temperature than the water salinity. Average catch of diurnal and night ebb tides during the different months of the year were also studied. Annual fish yield was determined, classified by species, fishes measured, weighted and biologically investigated. Also, exploited Haddrah traps were economically evaluated. The maximum fish yield was harvested during the autumn then spring then summer while the minimum catch was collected during the winter season. The yield was belonging to 26 families and classified to 48 fish species, two shrimp species, one species of squid fish and one species of crab. The present results indicated that Haddrah has a highly efficiency for catching the young and immature fishes. Consequently, the present research recommended that it must be exchange the Sirr nets of narrow mesh size (1cm) with nets of large mesh size (4cm) to prevent catch of young fishes and allow to reach their maturation to reproduce at least one time before catch. This may lead to developing the production of fishery resources of the Arabian Gulf on the long run in the Kingdom of Saudi Arabia.

Keywords: Fisheries, Fishing gear, Setting net, Trap, Haddrah, Arabian Gulf.

INTRODUCTION

The fixed intertidal barrier trap, which has local name Haddrah, is an ancient traditional fishing gear but still in use along the coastal areas of the Arabian Gulf and Red Sea. Haddrah is a permanent fish trap built in the intertidal zone as a setting net. It works by intercepting the seaward movement of fish on the ebb tide or the longitudinal movement of fish along the beach when the tide is up, and diverting the fish towards an enclosure where they are trapped. The catch is recovered when the tide recedes. The size, shape and structure of Haddrah is variable according to local topography and tradition, but they all work on the same basic principle. The intertidal zone from the shore ranged 1000 - 2000 meters at Al-Qatif coasts

while it ranged 100-200 meters at Al-Jubil coasts. The water depth at the Sirr of Haddrah ranged between 2 and 3 meters during the raise tide and ranged between 0.5 and 1.0 meters during the ebb tide. Many authors were studied the ecology and fishery resources of the Arabian Gulf (Price and Jones, 1975, Wray, 1979, Basson *et al.*, 1981, Jones, 1986, Kuronuma and Yoshitaka, 1986, Samuel *et al.*, 1987, Price *et al.*, 1993, El-Gindy and Hegazi, 1996, Krupp *et al.*, 1996 and Carpenter *et al.*, 1997). But a few of them discussed the fishing gear dealing with Haddrah as describing but no respect to its evaluation. Jones (1986) mentions that about 50 species are caught in the haddrah traps of Kuwait and it is likely that all of the common inshore fish and commercial crustacean species in this area will be caught at some time. Consequently, the present work was an achievement to study some ecological factors of intertidal zone, fishing efficiency of Haddrah, catch per unit effort, species composition, fish size at first capture, the biological effect of exploited Haddrah traps on the productivity of fish stock and economic evaluation of these traps.

MATERIALS AND METHODS

Initially in the present study, the eastern coastal line of the Arabian Gulf in Saudi Arabia was surveyed by speedboat for determine Haddrah numbers, exploitation status and their situations. It was found that approximately all Numbers of Haddrah are concentrated at Saihat, Dammam, Al-Khobar, Tarut Bay, Al-Qatif coasts, Abu Ali Island and Jubail coasts. Monthly field trips using fishing boats were made to measure water temperature by a Thermometer and water salinity by a Refractometer inside Haddrah.

Although traditionally Haddrah built of palm fronds stuck upright in the beach, the modern haddrah is made of steel poles and nylon netting. The net is 40 mm in mesh size and is mounted top and bottom on 8-mm polypropylene rope. This rope is then tied to steel bars of 20-mm diameter and 4-m height stuck upright in the sand. There are three components to the haddrah (Fig. 1): a- The "yad" is usually a straight section of upright netting running at a right angle to the shoreline. Its length is variable, depending on the distance between the high and low tide marks. Its purpose is to divert fish, which are moving along the beach towards the trap area. b- The "janb" consists of a pair of open-ended rectangular constructions at the seaward end of the yad. They provide the first area of entrapment, enclosing the fish without causing them to panic and leading them towards the final area of the trap. Once the fish are in the janb area they will follow the walls in an attempt to escape. One obvious route out of this area is through the narrow neck into the final enclosure. c- The "sirr" is a circular enclosure of about 4 m diameter surrounded by the net of 10 mm mesh size, where the fish are finally trapped. Fishes enter it through the narrow opening from the janb; once inside they are unlikely to be able to locate this opening and escape. The floor of the sirr is often dug out to provide a pool of water, thus keeping the fish alive and fresh until they are collected. The sirr is situated so that it will be accessible for emptying at low water level during the ebb tide. The traps were emptied once or twice a day, depending on the time of low water.

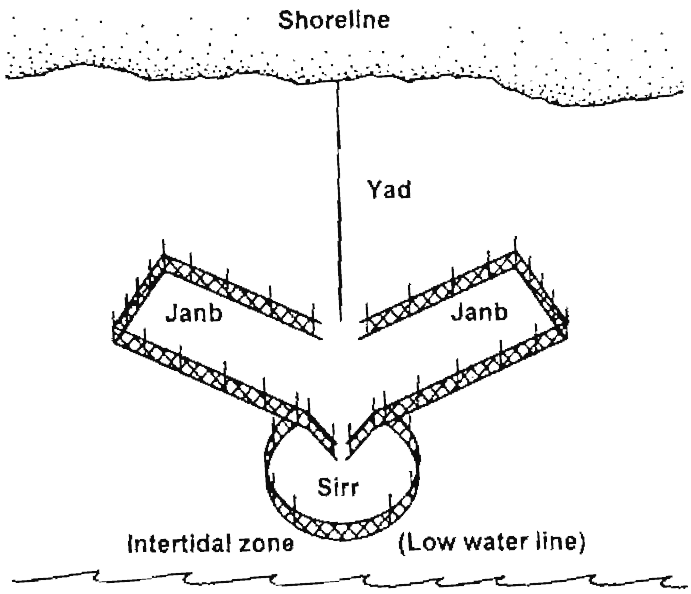

Figure 1: Diagram of Haddrah trap as a traditional fishing gear at the Arabian Gulf coast.

Fish catches were collected during the day and night ebb tides monthly throughout the year from April 2002 to April 2003. Total catch and all observations data were recorded periodically and fishes were classified by species, counted, measured, weighted, and dissected for investigating the fullness of alimentary canal, sex and gonads maturation. Fish species were classified according to Basson *et al.*, 1981, Kuronuma and Yoshitaka, 1986 and Carpenter *et al.*, 1997. Average catch per unit effort of day and night per months was recorded to investigate the seasonality of fishing and catchability. Fish sizes at first capture and at first sexual maturity were estimated by the method described by Tharwat, (1995). Age of fishes was determined by counting the annual ring on pony structure according to species then computed the age composition followed Richer (1975). Data were statistically analyzed for average, standard deviation, simple linear regression and variation using the statistical computer program (SAS, 1990).

RESULTS AND DISCUSSION

Ecological conditions and catch per unit effort (CPUE):

The average monthly of water temperature (°C) and water salinity (‰) of the Arabian Gulf coast at Al-Qatif and Al-Jubil in Saudi Arabia are shown Table (1). The results are obvious that water temperatures were highly variable with months throughout the year. Where, they reach to the highest values of 38 °C and 37 °C during August and the lowest values of 12 °C and 11 °C during January at the coast of Al-Qatif and Al-Jubil, respectively. The

average water temperatures (°C) were 14.0 & 13.0 during the winter, 27.0 & 25.3 during the spring, 36.7 & 35.0 during the summer and 27.7 & 26.0 during the autumn at Al-Qatif and Al-Jubil coasts, respectively. Generally, the average water temperature of Al-Jubil is relatively lower than of Al-Qatif, this fact may be related to the different natural topography. Standard deviations of the average temperature measurements within each month are ranged between 0.2 and 0.5 °C for the two studied areas.

On the other hand, there are low fluctuations in the values of water salinity between the months of the year (Table 1). The average monthly water salinity (‰) attained the highest value of 44 & 42 during August and the lowest value of 38 & 37 during January at the coast of Al-Qatif and Al-Jubil, respectively. This may be respected to the highly increase of water temperature and evaporation rate in the Arabian Gulf during the summer season. It can be noticed also that the water salinity is slightly lower at Al-Jubil coast than of Al-Qatif coast, this may be attributed to the differentiation between the two areas in natural topography, which correlated with temperature and other ecological factors. Standard deviations of the average salinity measurements within each month throughout the year were ranged between 0.1 and 0.3 for the two studied areas. The present results are in agreement with the results of Brewer *et al.*, (1978), where, they indicated that the higher water density of the Arabian Gulf is found inshore of Arabian coasts as a result of the higher evaporation rates. It well known, that water density depends mainly on water temperature and salinity. El-Gindy and Hegazi, 1996 reported that the evaporation rate of the Arabian Gulf is higher than the rate of fresh water supply from the rain and rivers. Therefore, the water salinity increases in the middle and northern areas of the Arabian Gulf to reach 42-43 ppt that values are higher than of those values in other open seas. Where water salinity in the open seas are ranged between 33 and 38 ppt (Ibrahim, 1987). Present results are in agreement also with the results of many authors dealing with the ecological conditions of the Arabian Gulf (Schott, 1971; Brewer and Dyrsen, 1985 ;El-Samra and El-Gindy, 1990; and El- Gindy and Habashi, 1993). They indicated that the water temperature of the Arabian Gulf are ranged between 14 °C in winter and 35 °C in summer and it increases gradually towards the south east of the Gulf. While in the water salinity, they did not noticed changes with seasons except for the water surface which, has relatively higher exchange between water and air. In the present results, it can be noticed that the water temperature of the intertidal zone ranged between 12-38 °C and 11-37 °C during the year at Al-Qatif and Al-Jubil, respectively. However, the coastal inshore water is shallow and more influences by the air temperature while the deeper offshore water changes slowly and is more balanced. Hunter, (1984) indicated that there are a daily current of low and high tides in the region of the Arabian Gulf situated between north of Qatar peninsula and Iran, which is beside of Saudi Arabia coast.

Table 1: The average water temperature (°C) and water salinity (‰) of the intertidal coast areas of the Arabian Gulf in Saudi Arabia.

Season	Month	Al-Qatif		Al-Jubil	
		Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)
Winter	Dec.	15.0	40.0	13.0	38.0
	Jan.	12.0	38.0	11.0	37.0
	Feb.	15.0	40.0	15.0	39.0
	Total	14.0	39.3	13.0	38.0
Spring	Mar.	23.0	39.0	21.0	38.0
	Apr.	27.0	40.0	26.0	39.0
	May	31.0	41.0	29.0	40.0
	Total	27.0	40.0	25.3	39.0
Summer	Jun.	35.0	40.0	33.0	40.0
	Jul.	37.0	42.0	35.0	41.0
	Aug.	38.0	44.0	37.0	42.0
	Total	36.7	42.0	35.0	41.0
Autumn	Sep.	32.0	43.0	32.0	41.0
	Oct.	28.0	41.0	26.0	40.0
	Nov.	23.0	42.0	20.0	39.0
	Total	27.7	42.0	26.0	40.0
Total annual		26.3	41.0	24.8	39.5

On the other hand, the catch per unit effort or fishing efficiency by Haddrah is highly affected by the ecological conditions, especially by changes in water temperature throughout the year. The relationships between the average water temperature and the average catch per unit effort as Kg/Haddrah/Day during the different months of the year are shown in Figures (2 & 3) at Al-Qatif and Al-Jubil coast, respectively. It well be noticed a similar trend for both areas where, the fish yield decreased sharply by the decline in water temperature during winter season (December, January and February). Then the fish yield increases gradually with the increase in water temperature starting from March to reach the high fish yield at June. Hence, the fish yield relatively decreases with the highest water temperature during July and August. This result may be illustrated as the fishes escape from the direct sunrays at shallow coastal areas (water warmed-over) toward the deeper water at offshore (moderated water). Then, the fish yield was highly increased when the water temperature sharply decreased during September and October. Afterward, the fish catch is much decreased starting from November followed by December and January during the winter season when the water temperature deeply lowered. Similar trend was observed between the monthly catch per unit effort of trammel gill net and monthly water temperature of the river Nile in Egypt (Tharwat, 1995).

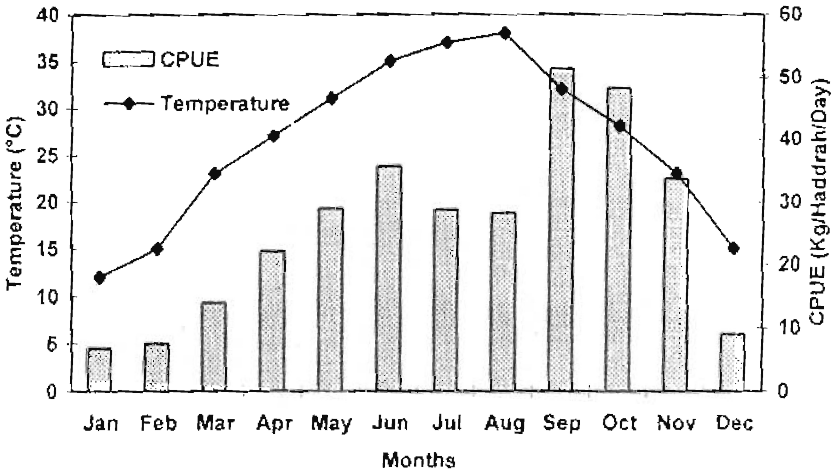

Figure 2: Catch Per Unit Effort (Kg Fish/Haddrah/Day) monthly according to the average water temperature at Al-Qatif coasts of the Arabian Gulf in Saudi Arabia.

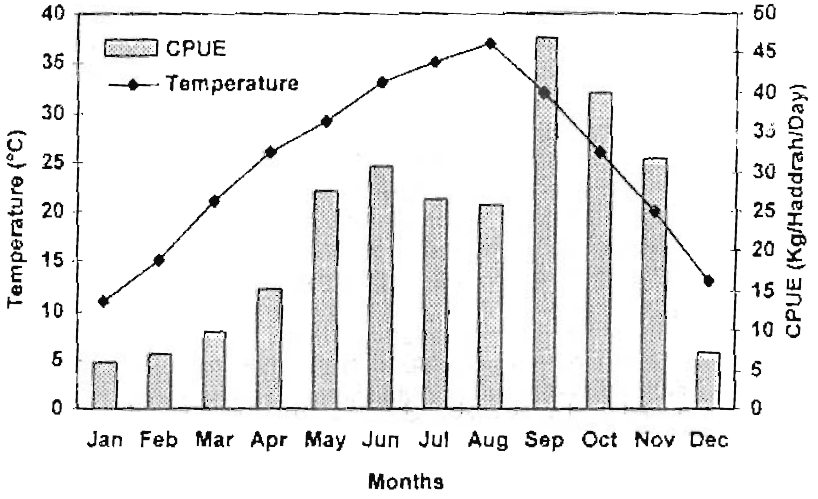

Figure 3: Catch Per Unit Effort (Kg Fish/Haddrah/Day) monthly according to the average water temperature at Al-Jubil coasts of the Arabian Gulf in Saudi Arabia.

The relationships between the average water salinity (ppt) and the average catch per unit effort as Kg/Haddrah/Day during the different months of the year for both of Al-Qatif and Al-Jubil coasts are shown in Figures (4)

and (5), respectively. It well be noticed a trend of slightly fluctuation in water salinity throughout the year for both areas and this relation has not displayed a clear correlation between average fish catch and water salinity. Adversely, there is a strong correlation between water temperature and average fish catch by Haddrah during the different months. This may be attributed to the narrow range of water salinity fluctuation in comparing with the wide range of water temperature, and may be also related to the natural acclimatization of fish species to the high salinity of the Gulf water.

Fishing efficiency:

Generally, fishermen collected the fish yield from Haddrah twice daily, the first time at the day ebb tide and the second time at the night ebb tide. In few cases, fishermen obligated to collect the fish yield once daily at the night ebb tide. Where fishes could not escape from the trap so the yield is accumulated but some fishes can not still alive at the low water level under direct sun rays during the day, also marine birds may hunt some of them. The average fish yield (Kg/Haddrah/ebb tide) of day, night and total yield daily harvested during the different months of the year for Al-Qatif and Al-Jubil coasts are shown in Table (2). It is obvious that the fish yield increases in the day ebb tide than in the night ebb tide during the cold months or winter season. Adversely, in the summer season the fish yield increases in the night ebb tide than in the day ebb tide. However, there is a relatively moderate fish yield in day and night ebb tides during the spring and autumn seasons. This result can be illustrated as the strength of direct sunrays during summer, which lead to raise water temperature in shallow water to warm-over than of deeper water at offshore, therefore, the CPUE decreases at day ebb tide during the summer season. While the CPUE increases during the winter season at the day ebb tide (warm enough) because the water at night is relatively colder, which leads to escape the majority of fishes to deeper water that still keep their moderate temperature. On the other hand, the CPUE is approximately in balance with day and night ebb tides because the water temperature is equilibrium for both. Consequently, the CPUE by Haddrah that fixed set fishing gear depends mainly on the ecological conditions, with especially influence by changes in water temperature throughout the year. Standard deviations (± SD) of the average CPUE within each month are ranged between 0.4 and 5.9 for Al-Qatif and between 0.3 – 5.2 for Al-Jubil, the lowly SD values were occurred during cold months while the highly SD values were occurred during warm months.

Table (3) shows the fish yield (Kg/Haddrah) for each day and night ebb tides and total monthly yield during the year. It can be noticed that the maximum fish yield was obtained during autumn follows by spring follows by summer follows by winter for both Al-Qatif and Al-Jubil coasts in the day ebb tide. However, the present result indicated that the maximum fish yield was obtained during autumn follows by summer follows by spring follows by winter for both Al-Qatif and Al-Jubil coasts in the night ebb tide. While, the total monthly fish yield (Kg/Haddrah/Month) attains 3999 & 3561 during autumn, 2778 & 2487 during summer, 2163 & 1881 during spring and 696 & 600 during winter from both Al-Qatif and Al-Jubil coasts, respectively.

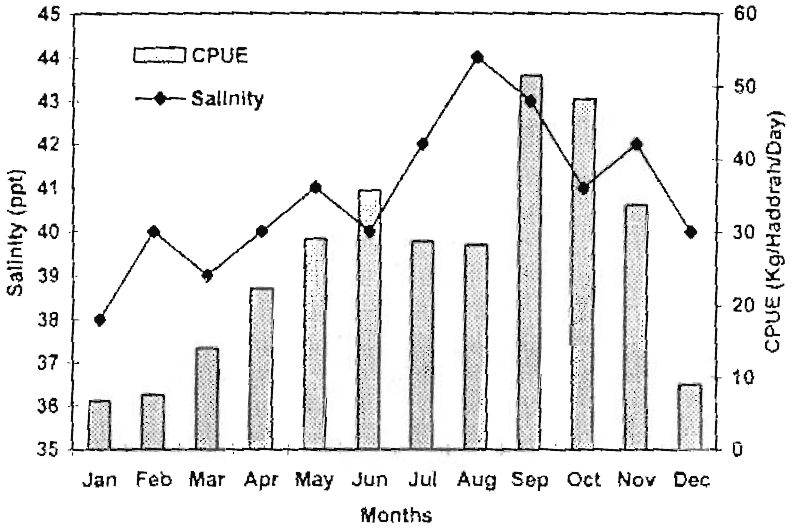

Figure 4: Catch Per Unit Effort (Kg Fish/Haddrah/Day) monthly according to water Salinity at Al-Qatif coasts of the Arabian Gulf in Saudi Arabia.

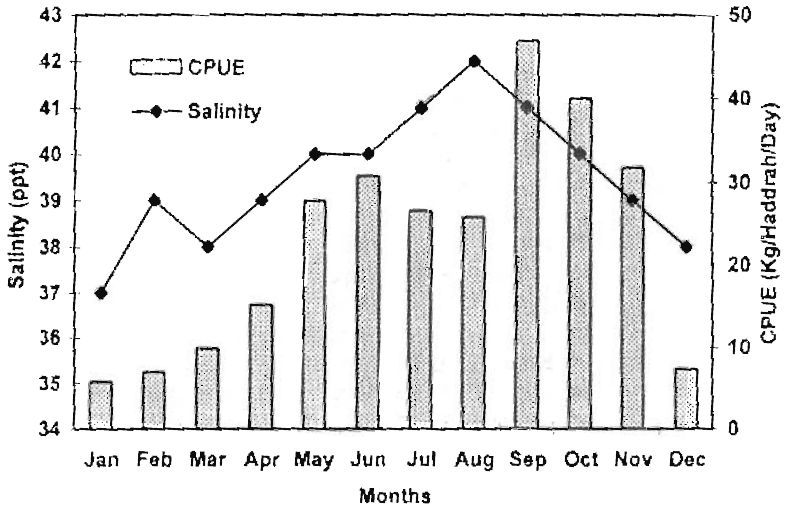

Figure 5:. Catch Per Unit Effort (Kg Fish/Haddrah/Day) monthly according to water Salinity at Al-Jubil coasts of the Arabian

Table 2: The average catch per unit effort (Kg /Haddrah / ebb tide) daily harvested by Haddrah during the different months of the year along the Arabian coastal line in Saudi Arabia.

Season	Month	Al-Qatif			Al-Jubil		
		Day	Night	Total	Day	Night	Total
Winter	Dec.	5.6	3.4	9.0	4.2	3.1	7.3
	Jan.	3.8	2.9	6.7	3.5	2.3	5.8
	Feb.	4.3	3.2	7.5	3.9	3.0	6.9
	Avg.	4.6	3.2	7.7	3.9	2.8	6.7
Spring	Mar.	8.1	7.8	15.9	7.5	6.3	13.8
	Apr.	11.7	12.5	24.2	9.2	10.0	19.2
	May	15.0	17.0	32.0	14.6	15.1	29.7
	Avg.	11.6	12.4	24.0	10.4	10.5	20.9
Summer	Jun.	11.2	24.5	35.7	10.0	20.7	30.7
	Jul.	8.4	20.3	28.7	9.0	17.5	26.5
	Aug.	6.8	21.4	28.2	7.1	18.6	25.7
	Avg.	8.8	22.1	30.9	8.7	18.9	27.6
Autumn	Sep.	19.4	32.0	51.4	20.7	26.2	46.9
	Oct.	22.8	25.4	48.2	19.1	20.9	40.0
	Nov.	17.2	16.5	33.7	17.2	14.6	31.8
	Avg.	19.8	24.6	44.4	19.0	20.6	39.6
Average annual		11.2	15.6	26.8	10.5	13.2	23.7

Table 3: Monthly fish yield (Kg/Haddrah/Month) harvested by Haddrah during the different months of the year along the Arabian coastal line in Saudi Arabia.

Season	Month	Al-Qatif			Al-Jubil		
		Day	Night	Total	Day	Night	Total
Winter	Dec.	168	102	270	126	93	219
	Jan.	114	87	201	105	69	174
	Feb.	129	96	225	117	90	207
	Total	411	285	696	348	252	600
Spring	Mar.	243	234	477	225	189	414
	Apr.	351	375	726	276	300	576
	May	450	510	960	438	453	891
	Total	1044	1119	2163	939	942	1881
Summer	Jun.	336	735	1071	300	621	921
	Jul.	252	609	861	270	525	795
	Aug.	204	642	846	213	558	771
	Total	792	1986	2778	783	1704	2487
Autumn	Sep.	582	960	1542	621	786	1407
	Oct.	684	762	1446	573	627	1200
	Nov.	516	495	1011	516	438	954
	Total	1782	2217	3999	1710	1851	3561
Annual Total		4029	5607	9636	3780	4749	8529

It can be concluded that the monthly fish yield by Haddrah is highly variable and depends on the ecological variations, mainly water temperature throughout the year. Where, water temperature raises the physiological activities of Gulf fishes including; feeding, swimming, growth and reproduction during the warm months that lead to more probability for trapped by setting nets than during cold months. This conclusion may be confirmed by the biological investigation of fishes which revealed the fullness of alimentary canal and gonads maturation of most fishes harvested during autumn and spring seasons. This conclusion is in agreement with many studies (Price and Jones, 1975, Basson *et al.*, 1981, Kuronuma and Yoshitaka, 1986, Tharwat, 1995 and Krupp *et al.*, 1996). It can be also noticed that the fish yield of Al-Qatif is relatively higher than of A-Jubil as a result of more water fertility which is very clear by more turbidity, abundance of algae and Mangrove trees at Al-Qatif intertidal coasts.

Biological evaluation of fish yield by Haddrah:

In the present study, it was found that all harvested fishes by Haddrah are belong to 26 families and their average quantities (Kg) and their percentage in the fish yield during the year for both Al-Qatif and Al-Jubil coasts of the Arabian Gulf of Saudi Arabia are listed in Table (4). Moreover, fishes (fish, crustacean and cephalopods) belong to each family were classified by species, scientific, English, Arabic local names, average fish length (cm), average fish weight (gm) and their type of feeding as listed in Table (5). The present investigation revealed that harvested fishes by Haddrah belong to different fish categories concerning size & shape, feeding behavior and their natural habitats. Concerning feeding behavior, the catch contains fishes belong to herbivorous fishes such as Siganidae, fishes belong to carnivorous fishes such as Serranidae and fishes belong to omnivorous fishes such as Mugilidae. According to their natural habitats there are pelagic fishes such as Clupeidae, demersal fishes such as Soleidae, and intermediate water column fishes such as Lethrinidae. On the other hand, it can be noticed that the representation of fish families (%) of the total annual catch were as the following; Clupeidae (10 %), Carangidae (9 %), Sparidae (7.9 %), Siganidae (7.5 %), Belonidae (5.9 %), Mugilidae (5.7 %), Lutjanidae (5 %), Serranidae (4.9 %), followed by Engraulidae, Haemulidae and Sepiidae (which represents 4 % for each), Lethrinidae (3.2 %) and followed by Soleidae , Paralichthyidae and Portunidae (which represents 3 % for each). The rest fishes belong to ten families and were represent 19.9 %, including shrimp that belong to family Penaeidae and represents 2 % from the total annual yield harvested by Haddrah setting at Al-Qatif coasts. Similarly, it is obvious that fish catch by Haddrah setting at Al-Jubil coasts including the same fish species that belong 26 families with relatively different representations (Tables 4 & 5) in comparing with Al-Qaif yield. Annual fish yield of Al-Jubil were represented as the following; Clupeidae (9.3 %), Carangidae (8.2 %), Sparidae (7.6 %), Siganidae (7.2 %), Belonidae (6.3 %), Lutjanidae (6.2 %), Mugilidae (6.0 %), Sepiidae (6 %), Serranidae (5.4 %), Portunidae (5 %), Haemulidae (3.7 %), Engraulidae (3.6 %) and Lethrinidae

(3.0 %). The rest fishes belong to 13 families and were represent 22.5 %, including shrimp that belong to family Penaeidae and represents 2 % from the total annual yield harvested by Haddrah using at Al-Jubil coasts.

Table 4: Annual fish yield of the fish families harvested by Haddrah fishing gear located along the Arabian coastal line in Saudi Arabia.

Family	Al-Qatif coasts		Al-Jubil coasts	
	Fish yield (Kg)	%	Fish yield (Kg)	%
Belonidae	568.52	5.9	537.33	6.3
Carangidae	867.24	9.0	699.38	8.2
Clupeidae	963.60	10.0	793.20	9.3
Engraulidae	385.44	4.0	307.04	3.6
Gerreidae	183.08	1.9	179.11	2.1
Haemulidae	385.44	4.0	315.57	3.7
Lethrinidae	308.35	3.2	255.87	3.0
Lutjanidae	481.80	5.0	528.80	6.2
Mugilidae	549.25	5.7	511.74	6.0
Mullidae	192.72	2.0	221.75	2.6
Nemipteridae	125.27	1.3	42.65	0.5
Paralichthyidae	289.08	3.0	170.58	2.0
Penaeidae	192.72	2.0	170.58	2.0
Platycephalidae	192.72	2.0	102.35	1.2
Plotosidae	86.72	0.9	25.59	0.3
Portunidae	289.10	3.0	426.45	5.0
Scombridae	279.44	2.9	230.28	2.7
Scorpaenidae	67.45	0.7	68.23	0.8
Sepiidae	385.44	4.0	511.74	6.0
Serranidae	472.16	4.9	460.57	5.4
Siganidae	722.71	7.5	614.09	7.2
Sillaginidae	192.72	2.0	153.52	1.8
Soleidae	289.08	3.0	170.58	2.0
Sparidae	761.24	7.9	648.20	7.6
Sphyraenidae	192.72	2.0	213.23	2.5
Sphyraenidae	211.99	2.2	170.58	2.0
Total	9636	100	8529	100

Based on this work, Haddrah has highly efficiency to catch young fishes and fingerlings because the net of final trap, which called "Sirr" has small mesh size of 10 mm diameter. Moreover, the analysis of catch revealed that the average size of Anchovies and Sardine was 7 and 10 cm total length and 19 and 32 gm total weight (Table 5), this means that there is no chance for young fishes to escape through the too narrow mesh size net. Therefore, many of young fishes (immature fishes) can be caught before they attain their maturation and marketable size that lead to break down their reproductive cycle.

Table 5: Classification of annual fish yield harvested by Haddrah and some biological aspects for each species at the Arabian Gulf coast in Saudi Arabia.

Species			Avg. total length (cm)	Avg. total weight (g)	Feeding
Scientific Name	English Name	Arabic Name			
Belonidae:					
Ablennes hians	Flat needlefish	Hakul	67 ± 7.2	280 ± 9.7	Small fishes
Strongylura leiura	Banded needlefish	Hakul	36 ± 4.7	180 ± 7.3	Small fishes
Strongylura strongylura	Spottail needlefish	Hakul	25 ± 3.4	120 ± 6.5	Small fishes
Carangidae:					
Alectis indicus	Indian threadfish	Khait	40 ± 6.1	715 ± 18.0	Fishes, squids & crustaceans
Gnathodon speciosus	Golden trevally	Rabeeb	31 ± 4.2	170 ± 9.2	Crustaceans, mollusks and small fishes.
Scomberoides commersonianus	Talang Queenfish	Lihla	45 ± 5.7	372 ± 12.4	Fishes and Squids.
Carangoides bajad	Orangespotted trevally	Hammam	38 ± 4.5	210 ± 9.8	Fishes and Squids.
Caranx sexfasciatus	Bigeye trevally	Jash	35 ± 3.9	175 ± 8.7	Fishes and crustaceans
Scomberoides lysan	Doublespoted Queenfish	Lihla	41 ± 5.7	296 ± 10.8	Fishes and crustaceans
Clupeidae:					
Sardinella longiceps	Indian oil sardinella	Sardine	17 ± 1.3	52 ± 2.9	Plankton (Zoo & phyto)
Sadinella gibbosa	Goldstripe sadinella	Sardine	15 ± 1.2	43 ± 2.4	Plankton (Zoo & phyto)
Sadinella melanura	Blacktip sadinella	Sardine	10 ± 1.2	32 ± 1.7	Plankton (Zoo & phyto)
Nematalosa nasus	Bloch's gizzard shad	Juwwaf	19 ± 1.6	59 ± 2.7	Plankton (Zoo & phyto)
Engraulidae:					
Encrasicholina devisi	Devis'Anchovy	Anchovies	7 ± 1.0	19 ± 1.4	Small crustaceans
Stolephorus indicus	Indian anchovy	Um	12 ± 1.1	27 ± 1.7	Small crustaceans
Gerreidae:					
Gerres oyena	Common silver biddy	Badh	16 ± 1.1	43 ± 2.0	Small benthos
Haemulidae:					
Plectorhinchus sordidus	Sordid sweetlip	Janam	29 ± 2.3	147 ± 6.2	Benthic invertebrates and small fishes
Pomadasys argenteus	Silver grunt	Naqrur	32 ± 2.7	172 ± 7.9	Benthic invertebrates and small fishes
Pomadasys stridens	Striped piggy	Imyam	13 ± 1.2	36 ± 2.8	Small fish & crustaceans

Table 5: Cont.

Lethrinidae:					
Lethrinus nebulosus	Spangled emperor	Sha'ri	30 ± 3.6	347 ± 15.2	Echinoderms, mollusks and crustaceans
Lutjanidae:					
Lutjanus fulviflamma	Blackspot snapper	Naisara	25 ± 2.4	128 ± 6.7	Small fish & crustaceans
Lutjanus ehrenbergii	Ehrenberg's snapper	Naisara Streaked	21 ± 2.4	117 ± 5.3	Small fish & crustaceans
Mugilidae:					
Mugil cephalus	Flathead mullet	Biah	30 ± 2.9	286 ± 9.9	Detritus, Benthos & algae
Liza persicus	Persian mullet	Biah	23 ± 2.0	235 ± 9.0	Detritus, Benthos & algae
Valamugil seheli	Bluespot mullet	Biah	26 ± 2.3	251 ± 9.4	Detritus, Benthos & algae
Mullidae:					
Mulloidichthys flavolineatus	Yellowstripe goatfish	Barbony	22 ± 1.9	61 ± 2.2	Benthic invertebrates
Nemipteridae:					
Scolopsis ghanam	Peppered Grunt	Ainshmalo	15 ± 1.2	36 ± 1.8	Crustaceans, mollusks, Echinoderms and fishes
Paralichthyidae:					
Pseudorhombus arsius	Largetooth flounder	Khaufah	26 ± 2.5	85 ± 3.9	Benthic animals
Penaeidae:					
Penaeus semisulcatus	Green tiger shrimp	Rubian	15 ± 2.1	32 ± 2.7	Small crustaceans & mollusks
Metapenaeus affinis	Jinga shrimp	Rubian	12 ± 1.7	29 ± 2.1	Small crustaceans & mollusks
Platycephalidae:					
Platycephalus indicus	Bartail flathead	Wahara	47 ± 3.6	227 ± 8.0	Benthic invertebrates & fish
Plotosidae:					
Plotosus lineatus	Striped eel catfish	Ai	23 ± 2.1	69 ± 2.4	Benthic invertebrates
Portunidae:					
Portunus pelagicus	Blue swimming crab	Qubqub	22 ± 1.9	61 ± 2.2	Small fishes and Benthic invertebrates
Scombridae:					
Rastrelliger kanagurta	Indian mackerel	Mackerel	27 ± 3.0	208 ± 7.2	Small fishes and shrimp
Scorpaenidae:					

Table 5: Cont.

Pterois miles	Military turkeyfish	Deesh	13 ± 1.6	63 ± 2.5	Benthic invertebrates and Small fishes
Sepiidae:					
Sepia pharaonis	Pharaoh cuttlefish	Habbar	28 ± 2.9	320 ± 7.9	Crustaceans & small fish
Serranidae:					
Aethaloperca rogoa	Redmouth grouper	Najil	42 ± 3.6	371 ± 8.4	Small fishes and mollusks
Epinephelus coioides	Orangespotted grouper	Hamoor	39 ± 3.0	390 ± 11.2	Fishes and Crustaceans
Epinephelus areolatus	Areolate grouper	Qutwa	29 ± 2.7	231 ± 6.6	Fishes and Crustaceans
Siganidae:					
Siganus canaliculatus	White spotted spinefoot	Safi	21 ± 2.1	165 ± 4.3	Algae and sea grasses
Siganus javus	Streaked spinefoot	Sunaifi	19 ± 2.0	97 ± 3.2	Algae and sea grasses
Sillaginidae:					
Sillago attenuata	Slender sillago	Hasum	26 ± 3.7	26 ± 3.7	Polychaete, worms and small Crustaceans
Soleidae:					
Pardachirus marmoratus	Finless sole	Mousafish	20 ± 1.9	79 ± 3.4	Benthic invertebrates
Solea elongata	Elongate sole	Lisan	21 ± 2.3	77 ± 2.9	Benthic invertebrates
Euryglossa orientalis	Oriental sole	Mazlqana	18 ± 1.7	68 ± 2.1	Benthic invertebrates
Sparidae:					
Acanthopagrus latus	Yellowfin seabream	Sha'm	26 ± 2.3	140 ± 4.5	Echinoderms, worms, Crustaceans and mollusks
Diplodus sargus	Onespot seabream	Imshawha	15 ± 0.9	75 ± 2.8	Algae & small invertebrates
Sparidentex hasta	Silvery seabream	Sobaity	22 ± 2.1	122 ± 4.1	Small fishes & invertebrates
Rhabdosargus haffara	Haffara seabream	Qurqufan	24 ± 2.3	94 ± 3.7	Benthic invertebrates
Acanthopagrus bifasciatus	Twobar seabream	Faskar	25 ± 2.3	213 ± 4.9	Small fishes & invertebrates
Sphyraenidae:					
Sphyraena flavicauda	Yellowtail Barracuda	Barracuda	33 ± 4.4	393 ± 8.5	Fishes and squids
Sphyraenidae:					
Sphyraena jello	Pike-handle barracuda	Agam	50 ± 7.4	587 ± 12.6	Fishes and squids

Consequently, Haddrah at the present status of narrow mesh size has a negative influence on the productivity of economical fish species and developing the fishery resources of the Arabian Gulf at the long run. Especially, the intertidal coast areas represent the reproduction habitats for broodstock and the nursery grounds for fry and fingerlings of many economical fish species and in the same time constitutes the situations for the fixed fishing gear net 'Haddrah'. It is well known that some of these young fishes are belonging to smallish species that cannot grow to marketable size and considered as trash fishes but they are also important as preys to play an important role in the natural food chain in the Arabian Gulf. The classified fish species in the present study were also found in the Arabian Gulf by some authors (Wray, 1979, Basson *et al.*, 1981, Jones, 1986, Kuronuma and Yoshitaka, 1986 and Carpenter *et al.*, 1997).

Economical evaluation of Haddrah:

The total surveys for exploited and abandoned Haddrah fishing gears of Al-Qatif and Al-Jubil coasts and their economic evaluation are summarized and shown in Table (6). Nowadays, it appears to be no serious threat to fish stocks or other marine life in Saudi Arabia judging by increase the number of apparently abandoned traps in the study area and it would appear that the use of these traps is in decline for political and social reasons. Where the number of exploited Haddrah declined from 55 to 24 at Al-Qatif coasts and from 49 to 40 at Al-Jubil coasts. The costs for construction of one Haddrah attain 10000 SR (2660 US$) and the return is variable, according to its position. It was obvious from Table (6) that the annual fish yield was 9.636 and 8.529 ton/ Haddrah for Al-Qatif and Al-Jubil coasts, respectively. That may be attributed to the natural productivity, which is relatively higher at Al-Qatif coasts than Al-Jubil coasts. So, the net annual return per Haddrah is also higher in Al-Qatif (19438 $ /year) than in Al-Jubil (17083 $ /year). The average monthly return per Haddrah is 1620 $ /month in Al-Qatif and 1424 $ /month in Al-Jubil with a total average of 1522 $ /month in Saudi Arabia. The return percentage per capital was 731, 642 and 687 % for Al-Qatif, Al-Jubil and total average, respectively. The same trend is obvious in Table (6) for the totality of fish yield and totality of net return for the present number of exploited Haddrah traps at the eastern coast of Saudi Arabia.

RECOMMENDATION

Based on the present work, it can be recommended that it must change the narrow net of 10 mm mesh size of the Haddrah trap "Sirr" with a relatively wider net of 40 mm mesh size in order to give chance for young fishes to escape through the mesh size. Also, it must make survey to all coastal areas of the Arabian Gulf for detection the reproduction habitats and nursery grounds for the protection from the negative Human activities in order to develop fish wealth at the long run.

Table 6: Economical evaluation of Haddrah fishing gear located at the intertidal coastal areas of the Arabian Gulf in Saudi Arabia.

Source	Al-Qatif		Al-Jubil		Total	
	Exploited	abandoned	Exploited	abandoned	Exploited	abandoned
Initial Number	55	43	49	36	104	79
Final Number	24	74	40	45	64	119
Change (No.)	-31	31+	9-	9+	40-	40+
Change (%)	-56.4	72.1+	18.4	25.0+	38.5-	50.6
Avg. annual Yield (Ton/Haddrah)	9.636	-	8.529	-	9.083	-
Coast/Haddrah ($)	2660	-	2660	-	2660	-
Average fish price ($ / Ton)	2128	-	2128	-	2128	-
Variable coast / Haddrah ($ / year)	1064	-	1064	-	1064	-
Average Income ($ /Haddrah/year)	20502	-	18147	-	19324	-
Net return ($/ Haddrah/Year)	19438	-	17083	-	18260	-
Monthly return ($/ Haddrah)	1620	-	1424	-	1522	-
Return/Capital (%)	731	-	642	-	686	-
Totally fish yield (ton/year)	231.3	-	341.2	-	572.5	-
Total variable coast ($/year)	25536	-	42560	-	68096	-
Totally income ($/year)	492048	-	683320	-	1175368	-
Totally net return ($ / year)	466512	-	640760	-	1107272	-

REFERENCES

Basson, P.W., Burchard, J.E., Hardy, J.T. and Price, A.R.G. (1981). Biotopes of the western Arabian Gulf. Marine life and environments of Saudi Arabia. The Aramco department of loss prevention and environmental affairs, Dhahran, Saudi Arabia.

Brewer, P.G. and Dyrsen, D. (1985). Chemical Oceanography of Persian Gulf. Prog. in Ocean., 14, pp. 41 – 55.

Brewer, P.G., Fleer, A.P., Kadar, S., Stafar, D.K. and Smith, C.L. (1978). Chemical oceanographic data from the Persian Gulf and Gulf of Oman. Report WHO 1-78-82 Woods Hole Oceanographic Institution, USA.

Carpenter, K.E., Krupp, F., Jones, D.A. and Zajonz, U. (1997). FAO species identification guide for fishery purposes. Living Marine Resources of Kuwait, Eastern Saudi Arabia, Bahrain, Qatar and the United Arab Emirates. Food and Agriculture Organization of the United Nations, Rome, Italy.

El-Gindy, A.A.H. and Habashi, B.B. (1993). Hydrographic conditions in ROPME Sea Area; calibration of Mt. Mitchell, 1992, cruise data and annual variations. Accepted for publication in the proceedings of the scientific workshop on the results of R/V Mt. Mitchell, January 24-26, 1993, Kuwait.

El-Gindy, A.A.H. and Hegazi, M.E. (1996). Atlas on hydrographic conditions in the Arabian Gulf and the upper layer of the Gulf of Oman. Doha, Univ. of Qatar, Scientific and Applied Research Center.

El-Samra, M.I. and El-Gindy, A.A.H. (1990). Vertical distribution and interrelations of oxygen and nutrients in the Arabian Gulf and Gulf of Oman in summer. Quatar Univ. Sci. Bull., 10, pp. 445-464.

Hunter, J.R. (1984). A review of the residual circulation and mixing process in the KAP region with reference to applicable modeling techniques. UNESCO reports of Marine Science, 28, pp. 37-45.

Ibrahim, M. A. (1987). Introduction of Biological Marine Science. Univ. of Qatar. Fac. of Sci., Marine Sci. Dept., B. O. box 2713, Doha, Qatar.(in Arabic)

Jones, A. D. (1986). A Field Guide to the Sea Shores of Kuwait and the Arabian Gulf. Univ. of Kuwait, Blandford Press, U.K.

Krupp, F., Abuzinada, A.H. and Nader, I.A. (1996). A marine wildlife sanctuary for the Arabian Gulf: Environmental research and conservation following the 1991 Gulf War oil spill. National Commission for Wildlife Conservation and Development, P.O. Box 61681, Riyadh 11575, Kingdom of Saudi Arabia.

Kuronuma, K. and Yoshitaka, A. (1986). Fishes of the Arabian Gulf. Kuwait Institute for Scientific Research, State of Kuwait.

Price, A.R.G. and Jones, DA. (1975). Commercial and biological aspects of the Saudi Arabian Gulf shrimp fishery. Bulletin of the Marine Research Centre of Saudi Arabia No.6.

Price, A.R.G., Mathews, C.P., Ingle, R. W. and AL-Rasheed, K. (1993). Abundance of zooplankton and Penaeid shrimp larvae in the western Gulf: Analysis of pre-war (1991) and post-war data. Marine Pollution Bulletin, 27: 273-278.

Richer, W.E. (1975). Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can., 191, 383.

Samuel, M., Mathews, C.P. and Baddar, M.K. (1987). Stock assessment of Hamrah (*Lutjanus coccineus*) and Hamoor (*Epinephelus tauvina*) from the Arabian Gulf using surplus production and dynamic pool models. Kuwait Bulletin of Marine Science 9: 195-206.

SAS. (1990). Statistical Analytical Systems, user's guide (Vol. 2). Cary, NC : SAS Institute Inc. USA.

Schott, G. (1971). Oceanographie und Klimatologie des Persischen Golfes und des Golfes von Oman. Annalen der Hydrographie und Maritimen Meteorologie, 1-46.

Tharwat A.A. (1995). Biological and ecological studies on fishery resources of the River Nile. Ph.D. Thesis, Fac. Agric. Cairo Univ., Egypt.

Wray, T. (1979). Commercial fishes of Saudi Arabia. Saudi Fisheries Company, Ministry of Agriculture and Water Resources, Saudi Arabia.

تقييم حرفة الصيد التقليدية "الحضرة" في ساحل الخليج العربي بالمملكة العربية السعودية

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يهدف هذا البحث إلى دراسة وتقييم الكفاءة الإنتاجية لحرفة الصيد التقليدية المعروفة بالحضرة بمناطق المد والجزر بساحل الخليج العربي في المملكة العربية السعودية تحت ظروف الإستغلال الحالي ومدى تأثيرها على إنتاجية الأسماك الهامة بالخليج. والحضرة هي عبارة عن بناء من أسياخ حديدية أو من جريد النخيل وعيدان البوص تثبت كقوائم في قاع المناطق الساحلية وتشد بأسلاك وحبال قوية بمنطقة المد والجزر للخليج العربي وتثبت عليها الشباك بوضع عمودي على سطح الماء حتى القاع مكونه ما يعرف بالقيد والجناحين يؤديان لمداخل أو بوابات تساعد على دخول الأسماك مع انحسار المياه أثناء الجزر حتى تتجمع في حيز صيد محدود يعرف بالمصيدة أو السير يصعب خروج الأسماك منها. وفي بداية البحث تم مسح المناطق الساحلية للخليج العربي بالمملكة العربية السعودية بواسطة لنشات سريعة وخفيفة (طرادات) يمكنها الاقتراب من الشواطئ من أجل حصر مناطق إنتشار الحضرات وتحديد مواقعها وأعدادها وحالتها عما إذا كانت مستخدمة للصيد أم غير مستخدمة (مهملة) وتبين إنتشارها بسواحل القطيف (سيهات ودارين وسنابس وجزيرة تاروت) وسواحل الجبيل وجزيرة أبو علي. وبناءا عليه تم اختيار هذه المناطق لدراسة وتقييم الحضرات والقيام بالزيارات الميدانية الدورية شهريا لأخذ القياسات البيئية وحصاد الأسماك من هذه الحضرات على مدار عام كامل من أبريل ٢٠٠٢ إلى أبريل ٢٠٠٣ من خلال المشروع البحثي رقم ٣٠١٧ المدعم من عماده البحث العلمي لجامعة الملك فيصل. وهي أول دراسة تم عملها بمشيئة الله تعالى لتقييم حرفة الحضرة على السواحل السعودية بالخليج العربي حيث لم يتم العثور حتى الآن على أي دراسة علمية أو بحث منشور عن تقييم هذه الحرفة والأنواع المصادة بها. وقد تعرضت هذه الحرفة في الأونة الأخيرة من فترة البحث إلى إندثار بعضا منها وتقلص في أعدادها وقد تم رصد هذا التغير في سياق البحث. ويتم النزول للحضرات مع أصحابها في مواعيد الجزر النهارية والليلية وهي تمثل وقت حصاد الأسماك بهذه الحرفة لشراء المحصول السمكي وتسجيل كمية المصيد الكلي من الأسماك وفرزه وتصنيفه وعده لتحديد التركيب النوعي للمصيد ثم وزن الكميات المصادة من كل نوع. ثم نقل عينات الأسماك مبردة إلى معمل قسم تنمية الثروة المائية لفحص الصفات المورفولوجية لكل سمكة بعد التأكد من تصنيف الأسماك. وقد تبين من الدراسة أن درجة حرارة المياه أكثر تأثيرا من درجة ملوحة المياه على كمية الأسماك المصادة بحرفة الحضرة كما أن هناك إختلاف في كمية المصيد السمكي تبعا لمواقيت الجزر النهاري أم الجزر الليلي بإختلاف فصول السنة. كما تم التقييم الاقتصادي للحضرات العاملة حاليا من حيث كمية الإنتاج السمكي السنوي وتكاليف إنشاء الحضرة وتكاليف الصيانة والصيد ومتوسط الدخل السنوي وصافي العائد السنوي والشهري من الحضرة الواحدة. ومن تحليل وتصنيف المصيد بهذه الحرفة تبين اصطياد ٤٨ نوعا من الأسماك ونوعين من الربيان ونوع من القبقب ونوع من الحبار وجميع هذه الأنواع تندرج تحت ٢٦ فصيلة. وقد وجد أن حرفة الحضرة ذات كفاءة عالية في إصطياد أحجام متباينة كثيرا من الأسماك بما في ذلك صغار الأسماك الاقتصادية الهامة والتي لم تصل بعد إلى مرحلة النضج الجنسي أو الحجم التسويقي المناسب مما يؤثر سلبيا على إنتاجية أسماك الخليج على المدى الطويل. ومن خلال هذه الدراسة أمكن التوصل لحل هذه المشكلة بطريقة عملية وسهلة التطبيق وهي تغيير شباك المصيدة أو السير للحضرات بشباك أكثر إتساعا ذات سعة فتحة عين الشبكة مقاس ٤ سم (ماجة ١٢,٥) بدلا من الموجودة حاليا ذات سعة فتحة عين الشبكة مقاس اسم (ماجة ٥٠) لرفع إختيارية الشباك لصيد الأسماك الأكبر حجما والتي يكون معظمها قد وصل لمرحلة النضج الجنسي لكي تعطي الفرصة لغالبية الأسماك لاستكمال دورة حياتها بالتكاثر ولو لمرة واحدة على الأقل قبل صيدها، فضلا عن إتاحة الفرصة لهروب العديد من زريعة و إصبعيات الأسماك خلال فتحات شبكة المصيدة حيث تتوافر بشكل تجمعات هائلة وخاصة في هذه المناطق الساحلية الضحلة والتي تعتبر مرابي طبيعية وأماكن لحضانة هذه الأسماك.