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The Fishery Status in Jordan's Gulf of Aqaba, Red Sea

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ABSTRACT

Scattered information on marine fisheries was gathered to evaluate the status of Jordan's marine fishery during the last three decades. In addition, assessment of some commercially valuable species was conducted during July 1999 until June 2000 in Jordan's Gulf of Aqaba. Fish landing size, composition, gears and efforts expanded by Jordanian fishermen were compared and analyzed. Variation in the landing size was observed accompanied with gradual decline of commercial fish production. The Jordanian fishermen employ artisanal methods using different fishing gears that differ according to species kind and density. Fluctuation in total landing of marine fish could be attributed to the strict security measures and the depletion of bottom soft communities due to rapid urban development in coastal areas of the Gulf of Aqaba. The majority of the commercial catch comprised of the following fish families; *Scombridae, Carangidae, Triakidae, Scaridae, Mullidae, Caesionidae, Siganidae, Mugilidae, and Serranidae*. Fish species of Scombridae represented about 60% of the total catch. Fish imports were substantially increased in the last decade. Local marine fish production does not exceed more than 1 % of the total fishery consumption of Jordan. At the same time, Fresh fish in relation to the total consumption was extremely low (0.04%). Similarly, the per capita consumption is considerably low (3.4 kg/head) in comparison to the world's average (13 kg/head). These figures are continuously changing according to the undulation in fish production and imports which are strongly affected by the political and economic conditions in the country. The marine fishery resource would continue to decrease in the future if the past and present restrictions are to continue. Deep-water fishery and mariculture have good potential to reduce the exploitation rate of Jordan fishery resources in the Gulf of Aqaba. Measures to mange these resources are discussed in the context of the present study.

KEYWORDS: Fishery, Gulf of Aqaba, Jordan, Scombridae.

1. INTRODUCTION

Fish are among the most important food resources of the world (FAO, 1994). Fish and shellfish, including crustaceans and molluscs are considered as an excellent source of high-grade protein consumed by humans. Fish of the Red Sea support marine fisheries of the countries surrounding its coastline such as Egypt, Jordan, Sudan, Saudi Arabia, Yemen, Djibouti and Ethiopia. The importance of these marine resources varies from total dependence in the case of Djibouti to only minor importance as in the case of Sudan (FAO, 1989).

Most of the fish catch in the Red Sea comes from small-scale fishermen who exploit inshore coastal waters. Some large-scale commercial fishing is also undertaken, especially in Yemen with the help of several co-operative arrangements with other countries.

Commercial fishing in Jordan's Gulf of Aqaba is very limited due to the short length of the coastline (27 km) and the narrow continental shelf which limits fishing process to artisanal methods. Most of the coastal strip is rocky with fringing coral reef and at the same time the deep waters are close to the shore. The water within this northern portion is characterized by its low productivity (Al-Najjar, 2000; Badran, 2001). During the last three decades, intensive industrialization, trading and recreational activities along the Jordanian coast have adversely affected the shallow water communities such as

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the fringing coral reef and its associated fauna. In addition, the marine environment in this area suffered sometime before 1970 from the illegal use of dynamite for fishing. Until mid seventies, Jordanian fishermen were able to practice fishing as far as the Straits of Tiran down to Saudi Arabian and Egyptian waters. The use of these fishing grounds however has since been banned. The local fishermen therefore are now restricted to utilize the Jordanian waters only and that significantly affected Jordan's fish catch despite the efforts made to benefit from the FAO and other related projects (Bartkowiak, 1955; Braid and Khalidi, 1962; Dabaj, 1981; Eriksen, 1957). The main objective of this study is to review the status of fisheries during the last three decades in Jordan.

2. MATERIALS AND METHODS

The scattered data on fish catches (landings) were obtained from the fish inspector statement and files of the Ministry of Agriculture Office in Aqaba. The fish imports from 1970-2000 were obtained from previous reports (Gilberg, 1966; Dabaj, 1981; Department of Statistics in Jordan: Trade, 1966-1968, 1979-1982; Ministry of Agriculture, 1996-2000). The number of fishermen and fishing boats were obtained from the official files of the licensing office in Aqaba Port Authority. The number of fishing trips per boat was obtained from the files of the Jordanian Coast Guard Forces. The Jordanian Military Coast Guards checkpoints at the two landing sites are responsible for monitoring all fishing activities in the area. Data on fishing regulations implemented in the Gulf of Aqaba were also recorded.

During the period from July 1999 to June 2000, a comprehensive study was undertaken to collect data on commercial fisheries in the Gulf of Aqaba. Data on fishing activities were collected on a daily basis. Fishes of selected species were measured directly from the fishermen catch. Most of the fishermen in Aqaba were interviewed and information about their fishing activities was collected. The number of fishermen and fishing boats, time spent at sea on each fishing day, number of fishing trips, type of fishing gear, location of fishing grounds and landing sites were recorded. Monthly catch for each fish family was also estimated by counting and recording fish landing at the two landing sites. Catch Per Unit Effort (CPUE) was estimated on a monthly basis as follows: CPUE = CAm / (Tm X By), where CAm is the total catch in Kilograms per month, Tm is the average number of trips per boat per month, and By is the average number of active fishing boats per month during the fishing season (Simón et al., 1996). Information on marketing and existing policy of commercial fishery was collected from local fish markets in Aqaba town.

3. RESULTS

Fishing Areas

To investigate the most accessed areas by fishermen within the Jordanian water body of the Gulf of Aqaba, the entire coastline was monitored during the present study. Fishing activities were mainly restricted to the northern portion of the Jordanian coastline in addition to Al-Mamlah bay in the south. Fishing areas and landing sites are shown in (Fig. 1) These are mostly characterized by the presence of a biotic soft bottom in addition to sea grass beds and algal communities. Deep-sea fishing is practiced during certain seasons mainly during summer in the Gulf of Aqaba. Fishing takes place down to 500 m using long lines to catch selected species such as dwarf sharks or by traps to catch Sparids. One major landing site (No.1) usually receives most of the fish catch in Aqaba. The site has an easy access to the local fish markets. The second landing site is located in the southern part of the coast about 20 km from town center. The Jordanian coastguard has two checkpoints at both landing sites in order to record the number of fishermen and duration of fishing trips on a daily basis.

Fishing Boats

The fishery resource is obviously small due to the narrow continental shelf and the very limited shoreline of the Jordanian coast. Accordingly, fishermen are obliged to use small boats of length range between 2.5-5 m. Boats are made of fiberglass or wood and operated with either out or in board engines of not more than 60 HP. Fishing boat licenses are essential to get fishing permission. Licenses are issued by the Ministry of Agriculture and include records on boat type, length and engine power. The number of boats operating during the investigation period was about 65 boats. However, almost double this number is registered at the Ministry of Agriculture. These boats are maintained by two workshops situated near the coastal guard checkpoint and down town. The fishing trip for Jordanian fishermen usually begins early morning at sunrise and terminates late in the evening or sometimes terminates earlier if the fisherman is satisfied with the

catch size. Nevertheless, all fishing vessels must return before sunset (Coastguard regulation). The number of the fishing crew on each boat is usually composed of 2 to 3 fishermen. The number of fishing trips varies according to season and depends mostly on the quality of the catch in that season. In winter for example, tuna is the most abundant fish stocks and the average number of trips reaches 50 while during summer the number decreases to about 25 trips per day.

Fishing Methods and Gear

Different types of fishing gears and methods are practiced. Gears are still limited to artisanal methods. Sometimes Jordanian fishermen use more than one fishing gear during a single fishing trip. The gears include fish traps, gill nets, seine nets and hooks and line. The various fishing gears such as hand lines, nets and other fishing logistics like ropes and floats are available in Aqaba but their prices are considered quite high since most of these are imported from outside the country mainly from Egypt. This certainly prevents fishermen not to continuously maintain their fishing tools.

The following is a brief description of each fishing method and the fish species caught by each gear:

Baited Fish Traps: It is a common fishing trap to the area and made of wire-mesh with a shape of basket. Bait used mainly flour but sometimes it varies according to the target species. Bread, trash fish and marine algae are widely used as bait. The trap is deployed at sea bottom at depth range between 7-50 m with the use of rope and float. However, the following are some potential problems associated with the use of fishing traps:

- Lack of regulations to control opening size of the mesh as well as fishing ground and season.
- Fish species mainly those of non commercial value are commonly trapped by this method.
- Traps usually cause considerable damage to fragile corals when used on or between the reefs. The common species caught using fishing traps are listed in Table (1).

Offshore Pot Fishing: The shape of trap is similar to the above mentioned but with larger and wider mesh opening. It is deployed in deep waters down to 400 – 600 m deep. The trap is fixed with a rope tied with a large float. Fish species trapped using this method is Polystganus caeruleopunctatus which occupies the highest commercial value compared to other available species in the fish market of Aqaba. The potential problems associated with the use of such traps are:

- Lack of regulations to control mesh size.
- Lost traps which commonly exist will continue to catch fish that eventually die and become additional bait attracting more fish to enter the trap and face similar result.

Bottom Gillnet: A long fishing net (60-100m) moored at sea bottom either in straight or in zigzag pattern. The net is mounted on polypropylene ropes from top and bottom in a way that allows it to stand vertically from the seabed up to 4-6m in height. Mesh size is variable but ranges usually from 2.5 to 8 cm depending on the target species. Fish species trapped by the use of gillnet are presented in Table (2). The potential problems of using gillnet are:

- Lack of regulation for control of mesh opening size.
- Gill nets are not species-selective. Consequently, fish of any size and shape which encounter it is likely to be caught resulting in a relatively high rate of discards of non-commercial fish species.
- Gillnet may be entangled with corals or rocks and then lost. Trapped nets at bottom continue to catch non-commercial fishes and other animals.
- Nets accidentally lay over coral reef and cause damage to bottom habitat when retrieved.

Seine-Nets: It has a circular shape like a large umbrella. The net is made of nylon and cotton with a diameter of about three meters and the mesh size is about 1-2 mm. The use of such a net is restricted to coastal areas only. Target species are mainly silverside fish or small mullet. These fish are used as bait to catch highly valued fishes such as groupers and tunas.

Hooks and Lines: Primarily a monofilament with single or multiple barbed hooks, baited with cut pieces of fish or complete living silver sided fish. This method is considered selective and mostly targeted carnivorous species like Tuna, Groupers and Jacks.

Long Lines: Tenths of hooks are attached to a non filament line of about 800 m long. Hooks are attached at intervals of about 2 m to avoid tangling each other and their numbers are up to 800 hooks on a single long line. Hook size is variable according to target species. The line and hooks are coupled with swivel to another line of greater strength. Bait is mainly small fish of silver side species, pieces of Decapterus sp. or cuttlefish. Fishing usually takes place on the seabed when baited and set at depth down to 600m or more and left overnight. The

catch quality is dependable on bait, hook size and depth though any carnivorous fish may be caught. The problem in using such fishing gear is the accidental entangling of seabirds by the discarded or lost lines.

Trawling Lines: Artificial lures made of chrome-plated steel with a single large hook attached to a steel wire and towed behind the boat. When a fish strikes the lure it hauled on the fishing boat. Main target species is the common dolphin fish (Coryphaena hippurus), Spanish mackerel (Scomberomorus commerson). Tuna and other large pelagic fishes. During winter season this method is widely used to catch different species of tuna.

Annual Landing

Annual landing of marine fishes executed by Jordanian fishermen during 1970 to 2000 are given in (Fig. 2). It was unfortunate that the data on the size of landing was lacking during the period from 1984-1994. However, the figure clearly reveals fluctuation in the landing size throughout the three decades. The following are some reasons for such fluctuation.

1. The political conditions since the Gulf of Aqaba is surrounded by four countries. It prevented the fishermen to utilize wider fishing grounds at the southern regions in the Gulf of Aqaba, particularly along the Egyptian and Saudi coastal waters of the Gulf of Aqaba.
2. The strict security measures implemented in Jordan and in the other three neighboring countries limited the fishing grounds to Jordan's territorial waters only.
3. In the past, fishermen used dynamite in fishing. However, the Jordanian "fishing law" No. 25 for 1943 and the law of Agriculture No. 20 for 1973 prohibited the illegal use of dynamite which was enforced and strictly implemented after 1970.
4. During the last decade, many fishermen had left fishing searching for better income jobs specially those provided by port establishment, industry and tourism development in Aqaba.

Monthly and Seasonal Landing

Total fish landings of the most important commercial fish families during the period from July 1999 to June 2000 are shown in (Fig.3). Total catch during this period was estimated around 153 tonnes. Data showed that Scombridae accounts for about 60.3 % of the total catch followed by Carangidae (14.52%), Triakidae (6.46%), Scaridae (4.98%), Mullidae (3.40%), Caesionidae (1.88%), Siganidae (1.82%), Mugilidae (1.24%) and Serranidae (1.16%). Other fish species are occasionally found in the catch and comprise about 4.5%. Those fishes belong to the families; Synodotidae, Holocentridae, Fistulariidae, Priacanthidae, Nemipteridae, Lethrinidae, Sparidae, Chaetodontidae, Pomacentridae, Sphyraenidae, Labridae and Acanthuridae. The different species of Scombridae (tuna fish) usually appear in the Gulf of Aqaba during the period from October until June with maximum catch occuring in December and a minimum in June. The catch percent of different tuna species during July 1999 to June 2000 is shown in (Fig.4). The figure reveals that 52% of the tuna catch belongs to *Katuswanus pelamis*, followed by *Euthynnus affinis* (40%) and other Scombridae species such as S*comberomorous commerson*, *Thunnus tonggol*, and *Thunnus* albacares accounted for 8% of the total catch.

Monthly variation of the total catch of commercially important fish families is shown in (Fig.5). Scombridae and Carangidae were the highest during October until March.

Relation between Catches and Number of Fishermen and Fishing Boats

(Fig.6) shows the variation in the number of registered fishermen during the last three decades (1970-2000) in the Gulf of Aqaba. The number of issued licenses was also variable over time. Nonetheless, the number of working and registered fishermen has increased since the 1970's and currently the valid fishing licenses are 120. Active fishermen as reported in this study represent 60% of the total licensed fishermen. The remaining fishermen are engaged in other jobs seeking for better income. The statistical analyses of the data generated during one year study have shown that the number of fishing trips is more important in affecting the size of catch. Thus, fishing effort was estimated as per trip.

Catch Per Unit Effort (CPUE)

The number of fishing trips/ month ranged from 17 to 44 trips/ boat during July 1999 - June 2000 (Fig.7). Fig.8 showed the monthly variation of CPUE (kilograms per trip per boat) for all fish families investigated in this study. Fishes in most of those families were available in the catch but seasonal fluctuation in size was obvious. Maximum CPUE for Scombridae was recorded in February (196) while the minimum was in June (11.3) despite their absence during July until September (Fig.7).

These fish exhibited the highest value of CPUE in comparison to other fishes. The maximum CPUE for the remaining fish families were found in the range between 4-40 kg/ boat/ trip (Fig.8).

Fish Markets

Table (3) summarizes the price (Jordan Dinar) range for the most commercially important species landed by fishermen in Aqaba. It was observed that the prices changed according to fish quality and size of the catch. Variability in prices of certain fish species could be also due to short shelf life of fish as a result of limited storing capacity available in the market. Nevertheless, Groupers (Serranidae) like Epinephelus fasciatus, Cephalopholis hemistiktos and C. miniata represent the most commercially valuable species and fetch the highest market prices.

Fish Consumption vs. Import

(Fig. 9) shows the accumulated data collected on fish consumption and the ratio between the locally produced and imported fish during 1985 until 2000 in Jordan. The fish consumed was calculated from the total imported fish including fresh, frozen, smoked and canned fish. In addition to that, the net production of fish including marine fish and cultured freshwater fish in Jordan. An exponential correlation form was observed between the total fish consumption versus time. The relation was almost similar when the percent ratio between the local production and imported fish versus time was established. The trend lines of both relations were more or less parallel to each other. This could indicate that the fish consumption as well as the net imported and produced fish exhibit similar pattern of increase by time. But, the percent ratio of the net fish produced and the net imports of fish are still very low even if we know that both marine fish and freshwater culture fish were included. This figure could also be completely different if marine fish is considered only. Our data suggest that the catch size of marine fish could support about 1% only of the total consumption of fish in Jordan. Currently, the catch of marine fish per import ratio is at its minimum value (0.04%).

The population in Jordan exhibited a linear increase that showed high correlation with time (R^2 = 0.993) specially during the last decade. However, polynomial relationship was also observed between the increase of population and per capita consumption of both imported and fresh fish in Jordan (Fig.10). The highest fish consumption per head (capita) was 3.9 kg in 1993 but kept fluctuating from 2.5 to 3.5 during the study period. Whereas the per capita consumption of fresh fish was extremely low (0.04-0.16 kg/ head/ year).

4. DISCUSSION

The fishery in the Jordanian Gulf of Aqaba is quite small and artisanal in nature and this could be due to the limited size of the available fishing grounds (27 Km of coastline). Sea products are mainly utilized in the local market of Aqaba city. The results of the present study showed that the fishery resources in this considerably narrow area support a diverse fish group to include several fish families that have a commercial value. The Jordanian Gulf of Aqaba is characterized by various marine habitats such as coral reefs, seagrass beds, sandy bottom and offshore deep-water. These habitats together could support a year-round fishery in the Gulf of Aqaba. In general, fishery resources depend on several environmental factors, and the most important factor is believed to be primary production (Levanon-Spanier et al., 1979; Sheppard et al., 1992). Despite the wide variety of species in coral reef habitat, the fisheries exploitation in Aqaba is limited to fish only while other marine organisms like shellfish are not considered. This is related to the fact that the quantity of such products is very small. Fishery yield is heavily dependent on the ease with which resources can be exploited. Trawling, purse seining, gillnetting and long lines are among the most efficient and active methods for commercially exploiting fisheries. Their use however, is limited to the open sea, or areas that have relatively featureless bottoms. Contrarily, as in the case of the Aqaba Gulf, the irregular shape and shallow topography of the coral reef areas make utilization of fishery resource very difficult for large boats. In addition, it prevents the use of trawls, seines and large nets. Consequently, fisheries within this area are mostly dependent on artisanal fishing methods which operate on small scale boats and primitive fishing gear. Therefore, the catch composition of many stocks exploited in the Gulf of Aqaba is often dependent on the fishing method used. For example, hook and line targeted mainly predatory species like grouper, while trap and gill nets are less selective and catch species representing several trophic levels, including herbivorous species (parrotfishes and rabbitfishes), detrivores (mullets) and

planktivores (fusiliers) as well as predatory piscivores (tunas). The catch may also be composed of different species as fishermen may use different fishing gears in one fishing trip. Nevertheless, the basis of the artisanal fishery from Aqaba is mostly composed of carnivorous species. Detailed analysis of the artisanal fishery at Thuwwal on the Red Sea coast of Saudi Arabia showed that catches (50% by weight) were predominantly composed of predatory piscivores (Kedidi, 1984a). Similar findings were obtained from commercial Sudanese reef fisheries where grouper and emperor fishes constituted an average of 64 % of the catch by weight estimated at two landing sites for two years (Kedidi, 1984b; Morgan, 1985).

Most of the fishes commonly landed in the Gulf of Aqaba show marked seasonality. The highest catch for most fishes occurred in winter. Changes in the fish behavior may increase their catchability during this period and this could be related to the seasons of spawning and onshore-offshore migration of the resident fish (Sheppard et al., 1992). The bulk of the catch during this time composed of tuna species that migrate north from the Red Sea and reach the Jordanian waters. They are not frequently present during the rest of the year. They probably migrate to exploit the high biological productivity and availability of food during the winter season due to the oceanographic mixing caused by vertical upwelling (Al-Najjar, 2000; Badran, 2001; Kedidi, 1984a). Catch may also be driven by market factors and its seasonal availability that fetch better market price. This seems to be true because the effort by fishermen is higher during winter that overlaps with the tuna season. The number of active fishing vessels per day was higher in winter and almost double than that in summer. In terms of catch percentage, tuna represents over 60% of the total annual catch in the present study. The other 40% of the catch is composed of other fish families which showed minimum catch between November and February. The lack of catches as shown in the monthly variation for the families Caesionidae, Muglidae, Mullidae, Scaridae, Serranidae, Siganidae and Traikidae could be due to species specific fishing practices. Most of these fishes are non-migratory and keep resident among coral reef instead. Therefore, it seems that the fishermen do not focus their efforts on catching them as their abundance in kilograms is far less than that presented by the tuna stocks that appear at the same period. In general, the fishery in the Jordanian Gulf of Aqaba seems quite unstable. The total landing during the past three decades reveals a very variable catch that fluctuates by about 100 tonnes difference from year to year. From interviews with the local fishermen, significant decline has been observed in the fishery production. The catch composition at present is made up of non-commercial species of small sizes. Larger commercially sized fish are not available in a large number with the exception of tuna fishery. The total catch fluctuation can be explained by several reasons. Firstly, the catch in the Gulf is not regulated with limits but still dependent on the number of fishermen and their fishing activities. The number of active fishermen has remained stable, however the fishing activities and the exploitation degree on the various fish families perhaps altered catch sustainability (excluding tuna) to supply commercially viable adult population. At the same time, fishing regulations regarding the minimum landing size as well as fishing gear are hardly available. Developed regulations might help in preventing the reduction in the viable commercial catches. A reduction in the annual landings may also be attributable to the reduction in fishing grounds during the investigated period. This occurred for various reasons, the politically unstable conditions and conflicts in the region. These have effectively reduced the fishing areas and the amount of time spent at sea and thus the size of fish landing. The current results indicated that local fish production is far to meet the market demand, of fish in Jordan. This is reflected by the fact that fish imports have substantially increased. The last decade recorded maximum fish imports into the country. In order to supply the market demand a stable supply must be guaranteed and it seems that this has been supplied mainly from imports as indicated by their gradual and steady increase.

The catch per import ratio however is lower now than between 1992 and 1994 and this could be observed from the average fish consumption (2.5-3.9 kg fish/ head/ year) in Jordan. This is lower than the world average (13 kg/head) and even lower than the average reported for many Arab countries (Juma et al., 1981) such as in Yemen (51.6), Oman (22) and Saudi Arabia (4.2 kg/head). The present fishery, excluding the tuna stocks in Aqaba is not in a good state and the future of the fisheries without management intervention is unclear. The overexploitation of certain species has led to a reduction in the fish sizes and therefore led fishermen to invest a lot of effort with little economic gain.

The Catch Per Unit Effort (CPUE) was the highest for Scombridae while it was variable for the other fish families throughout the year depending on catch. The CPUE was considerably high during winter. The effort with more fishing trips has increased during this period of the year. Low CPUE for other components of the catch was observed during the rest of the year. Nevertheless, the mismanagement of the fishery due to the current fishing practices does not provide stable working conditions for fishermen to work full-time in fishing.

The ecosystem in Aqaba supports a wide variety of fish species (Khalaf and Disi, 1997; Khalaf and Kochzious, 2002). There is therefore an encouraging potential for the expansion of the fishery and increasing production to include more fish species and other organisms such as shellfish and crustaceans. However, caution must be taken in the selection of the species to see if the local populations could sustain a fishery and certainly this must be based on good scientific evidence. For example, harvesting lower down the food chain, catching greater quantities of herbivorous and Planktivorous fishes would lead to an increase in production. Similarly, deep water fishing should be encouraged as other species are supposedly available in large quantities that could be exploited. At present, only predatory fishes mainly snappers and groupers are exploited from these areas in the Gulf of Aqaba. The employment of new fishing gears might be subsidized by the government to assist this changeover phase.

In addition, it is becoming increasingly commonly practiced recently to subsidize for lack of natural fish landings by aquaculture. Fresh water culture ventures are coming up successfully in the Jordan Valley. Mariculture in Jordan on the other hand has not yet been developed. Mariculture is a nutrient generating industry and coral reefs cannot compete in elevated nutrient levels. Therefore, it is the natural way of thinking that if Mariculture is to be introduced in Jordan, it has to be restricted to inland ponds. However, development of mariculture in inland ponds coupled with subsequent biological filtration of nutrients and suspended particles from the culture water before it goes back to the sea. These precautions may potentially affect the running cost of inland mariculture in the rather limited space along the Jordanian coast. Recently, efforts are being undertaken to develop the so called land-based mariculture system. The technology of Recirculating Aquaculture System (RAS) is advantageous in terms of its low environmental impact. This enables lower water consumption and a more effective effluent treatment scheme for reducing the nutrient load on the receiving water body. In addition, low water consumption of marine RAS allows locating marine fish farms in-land, at a distance of several kilometers away from the expensive and overexploited Jordanian coastland.

In summary, the current fishing regulations must be revised and implementation of new regulations regarding the minimum landing sizes, upper catch limits of the given species and mesh sizes of the fishing gear must also be imposed. The use of practices, which negatively impact the environment such as the use of anchors by fishermen on the reef structure, must be completely banned. Closed seasons during the reproductive periods would also be useful to ensure the supply of juveniles to the population. The involvement of coastguard checkpoints is important monitoring fishing effort and regulate the time spent at sea. Their duties could be further expanded to oversee the implementation of new regulations regarding changes to fishing practices and gears.

The fishing industry in general would be better served if re-organized with the formation of a cooperative effort to provide more stable working environment for fishermen in Jordan. This would be useful to set market prices, which prove variable depending on the quality and quantity of the fish available. It could also assist in the development of environmentally friendly fishing practices, new markets, and storage facilities such as ice-houses and processing.

Fishery management depends on scientific research and it is recommended that research must continue on fish catches from the wild as well as fish production through RAS development. Research is also necessary for potential catch of new species and further biological studies of exploited species like growth, age, natural mortality and reproduction. Successful achievement in such information will help managers to determine the optimum fishing rate and the exploitation intensity of the fishery resource in Jordan's Gulf of Aqaba.

Table.1: Fish species observed or reported to have been caught by the use of traps.

Scientific name	English name
Calatomus viridescens	Dotted parrotfish
Chaetodon paucifasciatus	Crown butterfly fish
Coris caudimacula	Spottail coris
Dascyllus trimaculatus	Dominofish
Epinephelus fasciatus	Blacktip grouper
Leptoscarus vaigensis	Marbled parrotfish
Parupeneus forsskali	Red Sea goatfish
P. macronema	Longbarbel goatfish
Pomacentrus trichourus	Reticulated damselfish
Sidereal grilse	Grey moray
Synodus variegatus	Variegatus lizardfish
Siganus luridus	Squaretail rabbitfish
S. rivulatus	Rivulated rabbitfish
Sufflamen albicaudatus	Bluethroat triggerfish
Thalassoma klunzingeri	Klunzinger`s wrasse

Table 2: Fish species observed or reported to have been caught by the use of gillnet.

Scientific name	Common name	Scientific name	Common name
Hemantura uarnak	Honeycomb stingray	*Chaetodon auriga*	Threadfin butterflyfish
Saurida gracilis	Gracile lizardfish	*Chaetodon paucifasciatus*	Crown butterflyfish
Synodus variegatus	Variegatus lizardfish	*Heniochus diphreutes*	Pennantfish
Sargocentron diadema	Crown squirrelfish	*Chromis pelloura*	Duskytail chromis
Dendrochirus brachypterus	Shortfin lionfish	*Dascyllus trimaculatus*	Dominofish
Inimicus filamentosus	Indian walkman	*Pomacentrus trichourus*	Reticulated damselfish
Pterois miles	Lionfish	*Anampses twistii*	Yellowbreasted wrasse
Scorpaenopsis diabolus	Devil scorpionfish	*Cheilinus abudjube*	wrasse
Synanceia verrucosa	Stonefish	*Cheilinus. Sp.*	wrasse
Epinephelus fasciatus	Blacktip grouper	*Coris caudimacula*	Spottail coris
Apogon aureus	Golden cardinal fish	*Ptragogus pelycus*	Seagrass dwarf wrasse
Cheilodipterus lachneri	Lachner`s cardinal fish	*Thalassoma klunzingeri*	Klunzinger`s wrasse
Decapterus macarellus	Mackerel scad	*Calatomus viridescens*	Dotted parrotfish
Caesio lunaris	Lunar fusilier	*Leptoscarus vaigensis*	Marbled parrotfish
C. suevica	Suez fusilier	*Uranoscopus fuscomaclatus*	Stargazers
C. varilineata	Yellowstriped fusilier	*Acanthurus nigrofuscus*	Brown surgeonfish
Lethrinus sp.	Emperor	*Siganus luridus*	Squaretail rabbitfish
Parupeneus forsskali	Red Sea goatfish	*S. rivulatus*	Rivulated rabbitfish
P. macronema	Longbarbel goatfish	*Euthynnus affinis*	Kawakawa
P. rubescens	Rosy goatfish	*Sufflamen albicaudatus*	Bluethroat triggerfish

Table 3: Average prices (Jordanian Dinar/kilogram) of commercially valuable fish species in the Gulf of Aqaba.

Scientific name	Local name	JD/Kg
Cephalopholis hemistiktos	Gsharr	4.5-5.0
Cephalopholis miniata	Gsharr	4.5-5.0
Variola louti	Boosia	4.5-5.0
Epinephelus fasciatus	Daghma	4.0-5.0
Parupeneus cyclostomus	Sabalan	4.0-5.0
Parupeneus forsskali	Sabalan	4.0-5.0

Siganus rivulatus, S. argenteus, and S. luridus	Sigan	4.0-5.0
Mulloides vanicolensis	Sultan Ibrahim	4.0-5.0
Calatomus viridescens	Ghabban	3.5-4.5
Scarus ghoban	Hareed	3.5-4.5
Lethrinus mahsena	Sho'r	3.5-4.5
Priacanthus hamrur	Fanas Abu ein	3.0-4.0
Scomberomorus commersoni	Shak Abu isnan	3.0-4.0
Caesio lunaris. C. suveicus, C. varilineata	Bagha	1.5-2.5
Thunnus tonggol	Shak Abutheil	1.5-2.0
Decapterus russelli	Sardina	1.0-2.0
Trachurus indicus	Sardina	1.0-2.0
Carcharhinus plambeus	Qersh	1.0-1.5
Carcharhinus sorrah	Qersh	1.0-1.5
Galeocerdo culvieri	Qersh	1.0-1.5
Mustelus mosis	Qersh	1.0-1.5
Katsuwonus pelamis	Fatla	0.5-1.0
Euthynnus affinis	Qambarur	0.5-1.0
Fistularia commersoni	Qasab	1.5
Rhinobatos punctifer	Salfooh	1.0

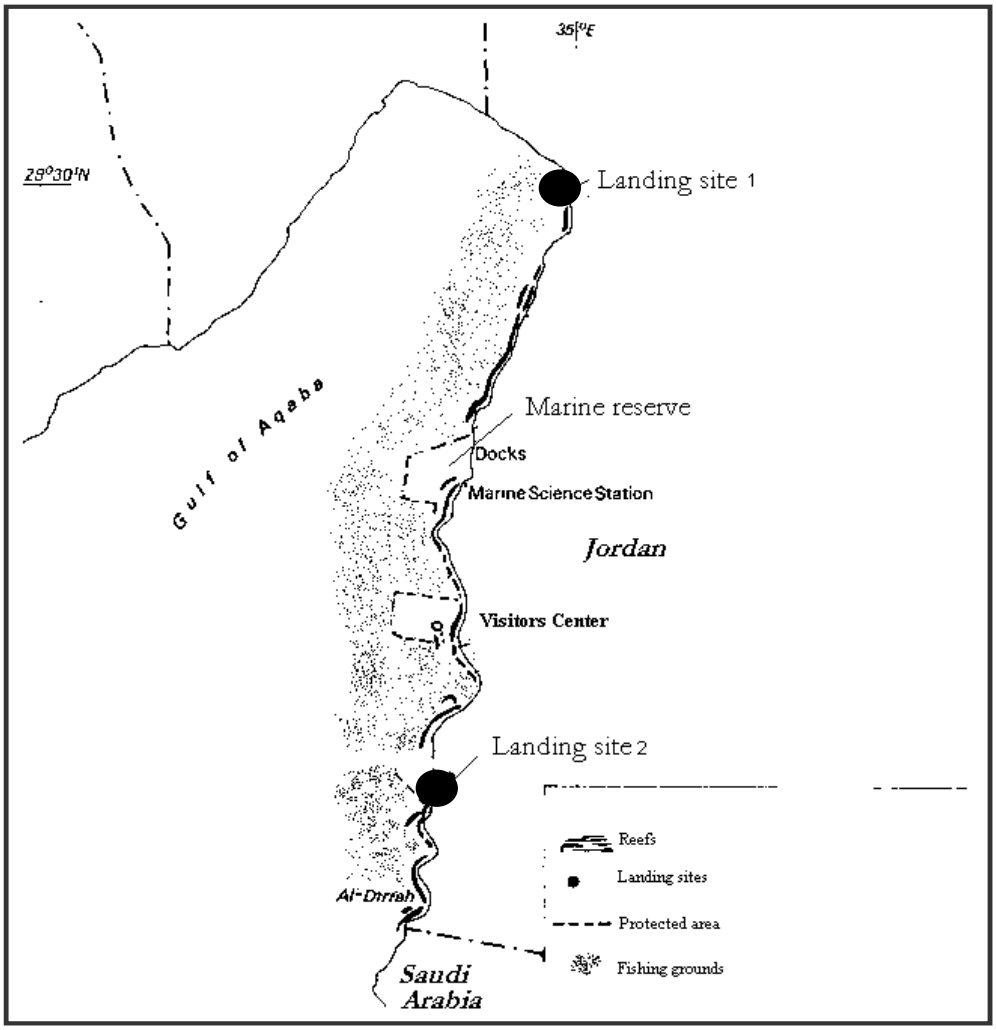

Fig. 1: The fishing ground and the two landing sites of fish catch along the Jordanian coast of Gulf of Aqaba.

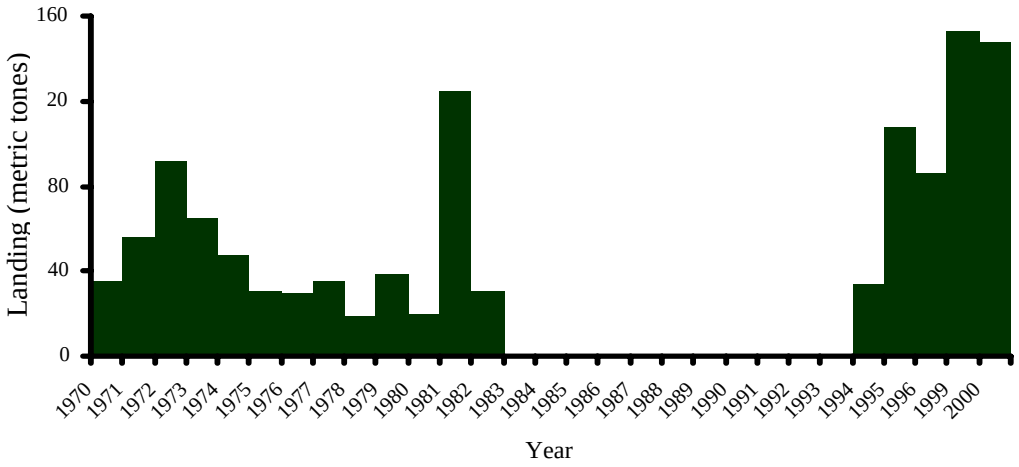

Fig. 2: Landing size (metric tonnes) during 1970 until 2000 from the Gulf of Aqaba. The figure clearly reveals fluctuation in the landing throughout the entire period.

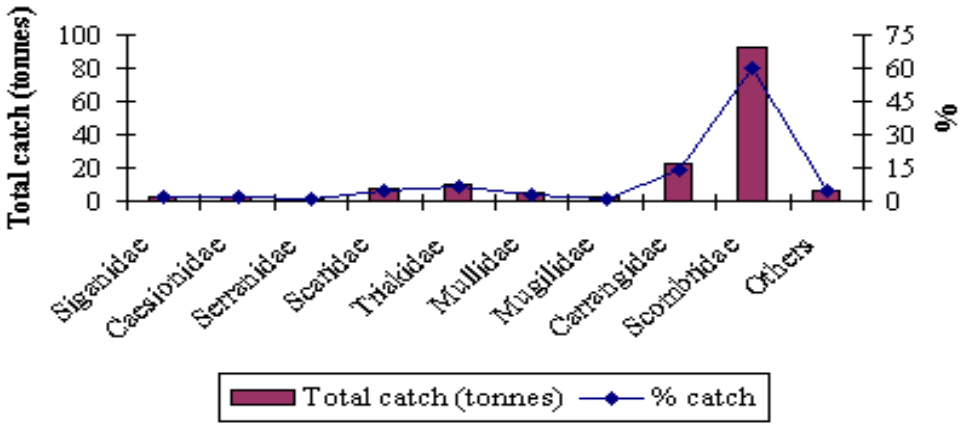

Fig.3: Landing (tonnes) and % catch of the most important commercial fish families during July- 1999 to June 2000 from Jordan's Gulf of Aqaba.

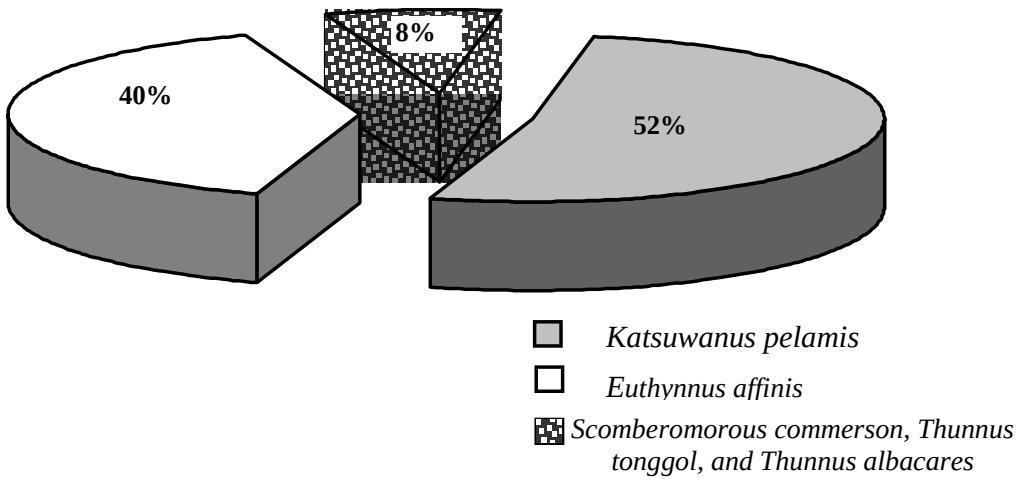

Fig. 4: The percent catch of different tuna species during July 1999 to June 2000 from the Gulf of Aqaba.

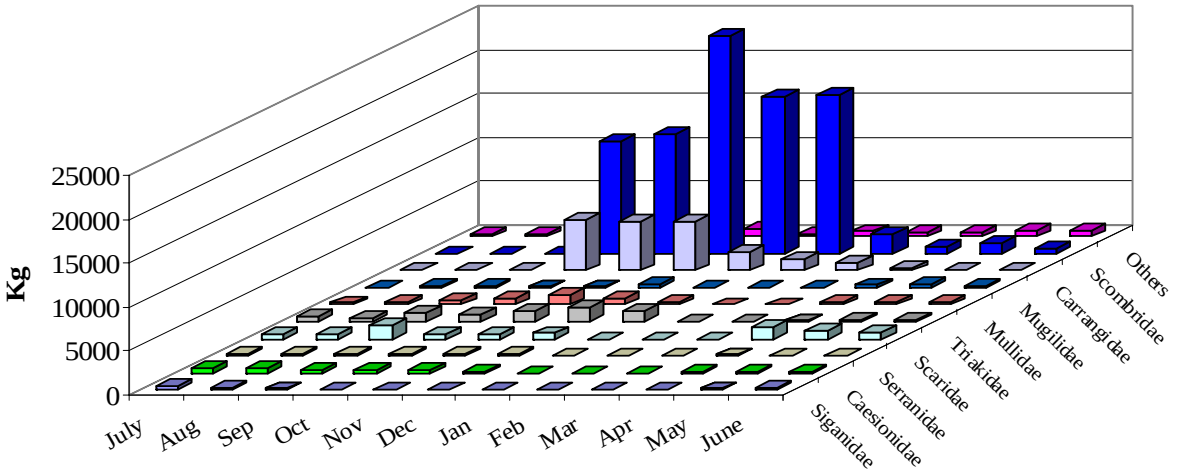

Fig.5: **Monthly variation in total catch of ten commercially important fish families in one year period (June1999-July2000) from Gulf of Aqaba.**

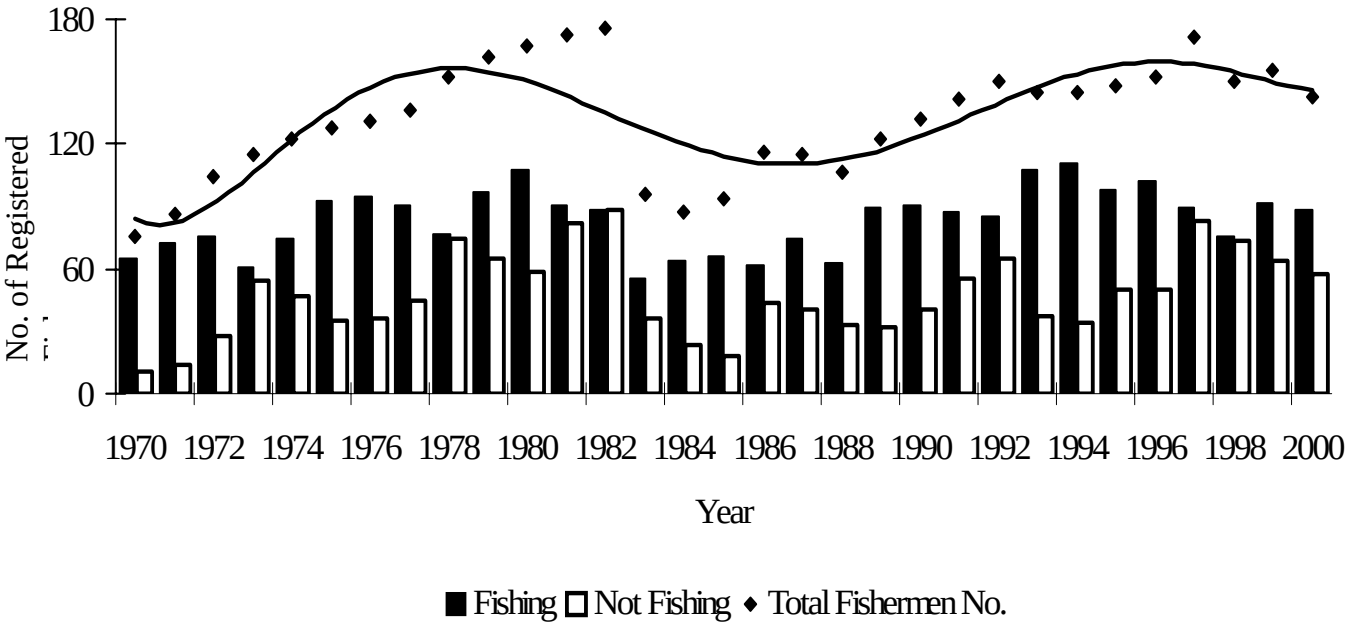

Fig.6: Active, non active and total number of licensed fishermen during the past three decades in the Gulf of Aqaba.

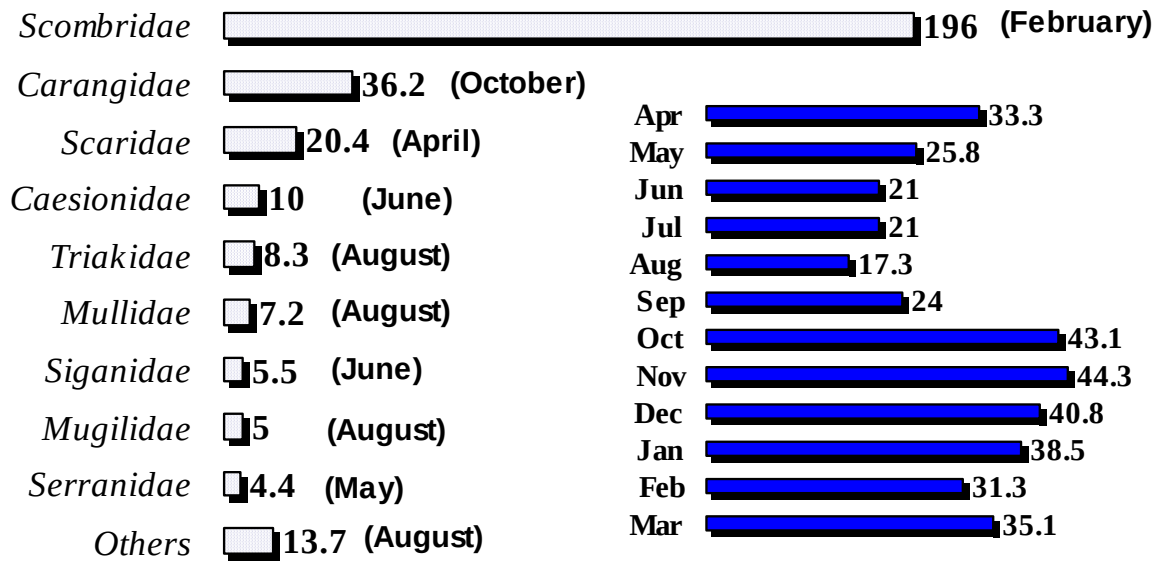

Fig.7: Seasonality and the maximum value of the CPUE for all investigated fish families as well as the average number of boat trips during one year period (1999-2000) in Gulf of Aqaba.

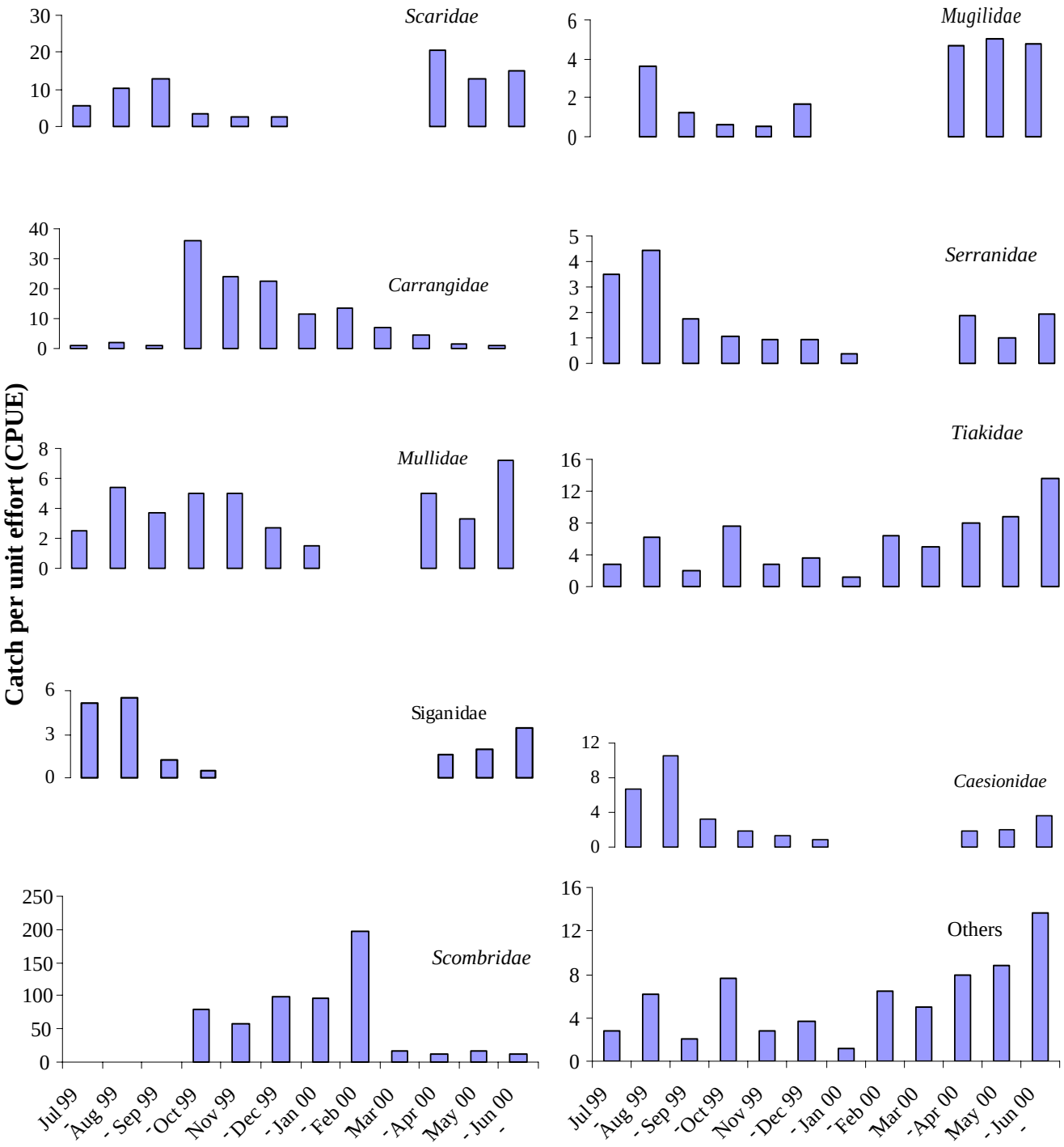

Fig.8: The monthly variation of catch per unit effort (CPUE) in Kg/ trip/ boat for all fish families during one year period (July 1999-June 2000).

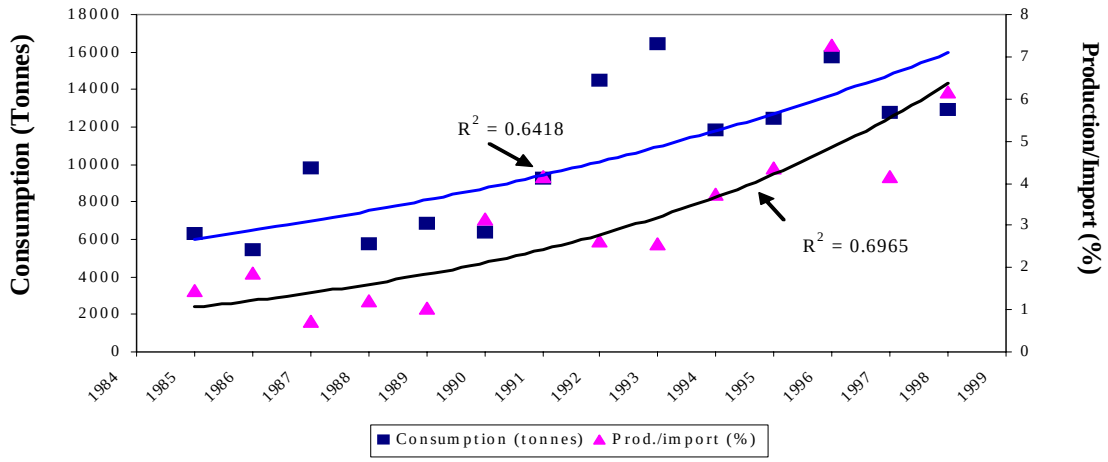

Fig.9: Fish consumption and the ratio between the locally produced and imported fish during 1985 until 2000 in Jordan.

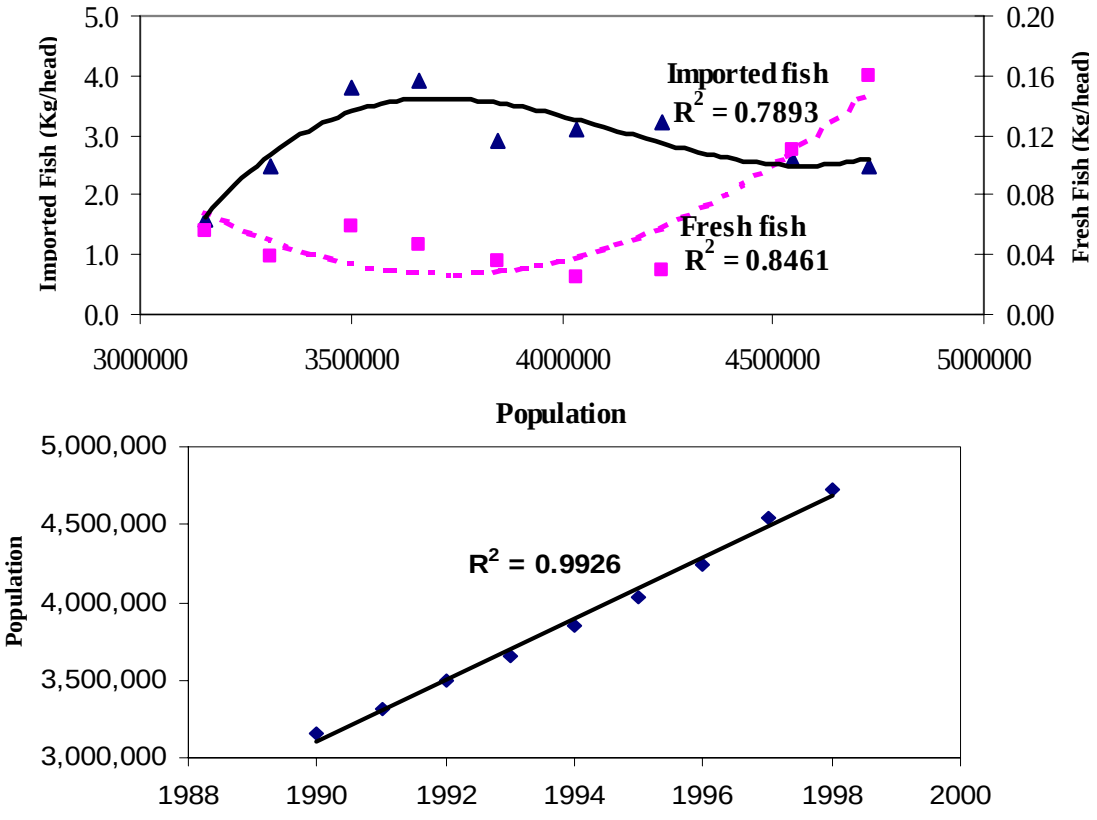

Fig.10: Relation between fish consumption of the imported and fresh fish in Kg per head (capita) and population number during the last decade in Jordan (chart below show the population increase profile in Jordan during 1990-1998). ***Data from the statistical department.***

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واقع المصائد في خليج العقبة الاردني- البحر الميت

محمد الزيده، ومعروف خلف، ونضال عودات*

ملخـص

تم جمع معلومات من مصادر متفرقة عن الثروة السمكية ومصائدها في خليج العقبة. شملت هذه المعلومات المصيد الكلي من الأسماك البحرية والاستيراد والاستهلاك وذلك لمعرفة وضع المصائد خلال الثلاثة عقود الماضية في خليج العقبة. كما تم إجراء دراسة مفصلة في الفترة بين تموز 1999 وحزيران 2000 لتقدير بعض الأسماك الاقتصادية في الجانب الأردني من الخليج. بينت النتائج تذبذباً واضحاً في كميات المصيد مع تناقص في الصيد التجاري بالرغم من الزيادة الظاهرية لعدد الصيادين وقوارب الصيد. إن الصيد لا يزال يتبع الطرق الأولية وذلك حسب ما يتناسب مع نوعية المصيد وكثافته. تبين أيضا أن التذبذب في المصيد قد يكون ناتجا عن الإجراءات المتعلقة بالأمن والتناقص الواضح لأحياء القاع الطرية كمصدر مهم لغذاء الأسماك. يتبع محتوى المخزون السمكي بشكل رئيسي العوائل السمكية التالية: *Scombridae, Carangidae, Triakidae, Scaridae, Mullidae, Caesionidae, Siganidae, Mugilidae, and Serranidae*، وتشكل اسماك التونة اكثر من 60% من المصيد، وقد دلت النتائج على أن الاستيراد السمكي قد ازداد باطراد والعقد الأخير سجل أعلى قيمة, ومع ذلك فان الإنتاج المحلي من الأسماك البحرية لم يزد عن 1% من الاستهلاك الكلي للأسماك. وفي الوقت نفسه فان نسبة المستهلك من الأسماك الطازجة المحلية مع تلك المستوردة كانت قليلة جدا (0.04%) وان استهلاك الفرد الأردني لم يتعد اكثر من 3.4 كغم/ شخص/سنة بينما المعدل العالمي يزيد عن 13 كغم/شخص/سنة. ورغم ذلك، فان هذه الأرقام تتغير نتيجة التغير في الإنتاج والاستيراد فيما يرتبط بالأوضاع الاقتصادية والسياسية للدولة. ويمكن استنتاج أن مصائد الأسماك البحرية قد تستمر في الانخفاض إذا ما استمرت الظروف المحيطة بمصادرها وخاصة النمو المطرد على الشواطئ والنواحي الأمنية. ورغم هذا كله، فان إمكانية استغلال المخزون السمكي في المياه العميقة وكذلك تطوير المزارع السمكية البحرية لا زالت قائمة وقد تساهم بشكل إيجابي في الإنتاج المحلي. المعايير لإدارة هذه المصادر سوف تناقش في سياق هذه الدراسة.

الكلمـات الدالـة: المصائد، خليج العقبة، الأردن، اسماك التونة.

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