Reconstructing Red Sea fisheries catches of Saudi Arabia: National wealth and fisheries transformation[1]

Dawit Tesfamichael[a,b] and Peter Rossing[a]

[a] *Sea Around Us, Fisheries Centre, University of British Columbia*
2202 Main Mall, Vancouver, BC, V6T 1Z4, Canada
[b] *Department of Marine Sciences, University of Asmara, Asmara, Eritrea*
d.tesfamichael@fisheries.ubc.ca; p.rossing@fisheries.ubc.ca

Abstract

Saudi Arabia is the largest country in the Arabian Peninsula with access to both the Persian Gulf and the Red Sea, of which it represents most of the east coast. Despite the Saudi Arabian coastline in the Red Sea being three times longer than its Gulf coast, Saudi catches from both coasts are very comparable. The catch of Saudi Arabian fisheries in the Red Sea was reconstructed from 1950 to 2010. Catch reports were searched to be used as base information for the reconstruction and for the years information was missing, they were used as anchors for estimation. The reconstruction was conducted separately for each fishery sector: artisanal, subsistence, industrial and recreational. The total catch of each sector was further divided into its taxonomic composition. The catch was low at the beginning of 1950s (7,000 t·year^{-1}). The major change in total Saudi Arabian catch occurred at the beginning of the 1980s, with the massive motorization of artisanal boats and the beginning of industrial fisheries. The peak of the total catch happened in the mid-1990s (about 50,000 t) and after which it decreased slightly to about 40,000 t at the end of 2000s. Artisanal fishery had the highest contribution to the total catch (64%), followed by industrial (23%), subsistence (10%) and recreational fisheries (3%). Although a large number of taxa were identified in the catch, few groups were dominant. The reconstructed catches were compared with the data Saudi Arabia reported to the Food and Agriculture Organization of the United Nations (FAO). The reconstructed catch was 1.5 times the Saudi catch in the FAO data from 1950 to 2010. The major differences appear following the mid-1980s, because of the industrial fishery, which then became very active and whose substantial discards remain unreported. The procedures and assumptions used here are clearly stated, because they may be useful for further research on specific aspects of the fishery, and to improve the catch time series presented herein.

Introduction

Saudi Arabia occupies 80% of the Arabian Peninsula, and has coastlines on both the Red Sea (in the southwest) and the Persian Gulf (also known as Arabian Gulf in the northeast), with the former more than three times as long as the latter. Consequently, people in the coastal areas of the lands now comprising Saudi Arabia have been fishing in both seas since ancient times. In fact, in the past, almost all coastal communities derived their entire livelihood from fishing (Neve and Al-Aiidy 1973). However, the development of fishing was uneven, with the Red Sea providing only about half of the Saudi Arabian catch despite being about three times longer.

The aquaculture sector, both freshwater and marine, has grown from 2,696 t in 1995 to 14,376 t in 2005; during that period the growth was higher for mariculture from 158 t to 11,259 t (MAW 1996, 2006).[2] The freshwater sector emphasizes on tilapia farming, while the mariculture is mainly for shrimp. The total aquaculture output is still growing and the amount for 2009 was about 26,000 t (Tim Huntington, pers. comm.). The rapid increase in aquaculture is in line with a government policy to supply the rapidly growing population with fish, given the stagnating yields of the capture fisheries (FAO 2003; see also below).

Saudi Arabia has the largest shelf in the Red Sea, about 70,000 km^2. This shelf is narrow in the north, about 40 km, but broadens in the south (Figure 1). In the

Figure 1. Map of the coast of Saudi Arabia in the Red Sea, shelf area and Exclusive Economic Zone (EEZ).

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[2] The fishery statistics publications by the Saudi government do not have the year of publication. We have assigned them the next year of the latest data presented in the reports, e.g., data for 2005 would be published in 2006.

past, most of the landings came from the productive southern grounds, particularly those adjacent to the Farasan Banks (Barrania *et al.* 1980; Sanders and Morgan 1989). Recently, about half of the catch comes from the southern part and the rest from the central and northern part (MAW 2006). Because the Saudi Arabian coast in the Red Sea has a narrow shelf and deep water is close to shore, nutrients are rapidly lost and hence pelagic fish landings are low. The Farasan Islands (not Farasan Banks) are probably the most productive grounds in the Saudi Arabian Red Sea because of the considerable run-off. In addition, the southern part (South of Jeddah) has well developed mangroves that serve as nursery areas for many reef-associated fish (Price *et al.* 1987).

The inner shelf is characterized by shallow fringing reefs, which run for few meters to more than half a kilometer. The reefs are interrupted at the mouths of valleys or *wadi* beds, which created natural deep water harbors (Neve and Al-Aiidy 1973). The reefs are more developed in the north, while in the south the water is more turbid due to run offs from the mountainous areas and influx of nutrient rich water from the Indian Ocean through the narrow strait of Bab-al-Mandeb. There are well-developed off-shore reef systems around Al Wajh, Yanbu and Farasan Islands (Bruckner *et al.* 2011). Beyond the narrow shelf, depth increases abruptly. The coastal area is hot and dry, with air temperatures reaching more than 45°C in the hot season. There are as many as 88 settlements along the coast where fish are landed, of which some of the largest are Yanbu, Jeddah and Gizan in the northern, central and southern part of the coast, respectively. In the past, most of the supplies for fishing such as ice-making machines, engines, spare parts, gears, services, workshops were found only in the major settlements (Neve and Al-Aiidy 1973). The fishery in the Red Sea was overwhelmingly artisanal and it used mainly small boats, which started to be motorized at the end of the 1950s. By the beginning of 1990s, all the boats were motorized. The industrial fishery, experimental at first, took off at the beginning of the 1980s (Ferrer 1958; Sanders and Morgan 1989). However, due to narrow shelf area and reefs, there are no large trawlable areas to support a large number of trawlers.

The population density on the Red Sea coast of Saudi Arabia has traditionally been low, due to the dry and hot climate. The economy was based on agriculture, fishing (including pearling), nomadic herding, commerce, and since the ascent of Islam, catering to pilgrims to and from Mecca. The discovery (in 1949) and the exploitation of petroleum in Saudi Arabia profoundly modified the economy, with oil accounting for over 85% of government's revenue in the early 1970s (Neve and Al-Aiidy 1973), reducing the traditional sectors to insignificance; thus, in 1998, fisheries accounted for only 0.3% of GDP (Sakurai 1998). Easy access to air conditioners allowed major population centers to grow along the hot coast. The oil wealth also changed the demography of fisheries in that foreign fish workers, both on boats and in processing, mostly from India and Bangladesh, increased significantly starting in the mid-1980s and account for more than 60% of the fishers (Sakurai 1998). Most of the local people prefer the meat of land animals (goat, mutton, beef, chicken and camel) over seafood. On the other hand, the rather large expatriate community has a high seafood consumption, and thus Saudi Arabia imported 58,300 t, half of its seafood supply, in 1996 (Sakurai 1998) and 112,683 t, about two third of total supply, in 2003 (FAO 2003). Saudi Arabia exported a small amount of seafood, about 2,000 t in the 1990s and early 2000s, of which shrimp accounts for about 20%.

The administration of fisheries was placed under the Animal Husbandry Department of the Ministry of Agriculture and Water up to 1990. In 1991, recognizing the importance of fishery in national food security policy, the government created a Deputy Minister for Fisheries Affairs under the Ministry of Agriculture and Water, tasked to manage the fishery resources of the country. The deputy minister, in 1993, created three departments each with specific responsibilities: Marine Fisheries Department, Aquaculture Department and Marine Protection Department (Sakurai 1998; FAO 2003).

In this contribution, the Saudi Arabian fishery catches in its Red Sea exclusive economic zone (EEZ) are reconstructed from 1950 to 2010, i.e., an attempt is made to account for all catches of all fisheries (including recreational fisheries, the discards of industrial trawlers and other catches usually ignored in official fisheries statistics (see e.g., Zeller *et al.* 2011). The fisheries are reviewed and the catch standardized by the major fishery sectors in order to establish a long time series data. The fishery is divided into four sectors: artisanal, subsistence, industrial and recreational. The catches are further disaggregated into taxonomic groups. For each sector, general introduction is given, followed by a detailed description of the catch reconstruction methodology, and results and conclusions at the end.

Artisanal fishery

The artisanal fishery, sometimes referred to as 'traditional' fishery in Saudi Arabia as elsewhere, is conducted from small boats, ranging from 5 to 20 m, and simple gears with no sophisticated technologies such as winch, fish finder, electronic navigation or communication equipment (MAW 2000). Most of the boats are small 6 – 9 m, and only about 10% are bigger than 9 m. In the past, traditional boats were exclusively made of wood (locally called *sambuks* and *houris*), and used to have sails (El-Saby and Farina 1954). The fishery was not highly developed, but the economy of coastal communities depended heavily on fishing (Tesfamichael and Pitcher 2006). Part of their catch was for local consumption, and part was dried or salted to be sold or bartered in exchange for other necessities (El-Saby and Farina 1954). Dried and salted fish were the only fish product to be available inland (Neve and Al-Aiidy 1973). Fishers were part time, and often would work from September to January in the agriculture sector (Gilberg 1966). Fishing was done only during the day, because it was difficult to navigate the coral reefs at night. Small boats performed day trips, but larger boats performed trips of up to 7 days (Kedidi *et al.* 1984); in some exceptional cases, even trips of up to 14 days occurred (Neve and Al-Aiidy 1973). Except for a few large boats, ice was not carried onboard, and fish were sold fresh bundled in strings (Barrania *et al.* 1980). Crew size ranged 1 to 4 per boat (Kedidi *et al.* 1984). The artisanal fishery changed with the advent of oil wealth: in 1983, fiberglass boats were introduced (Sanders and Morgan 1989) and by the mid-1990s, they accounted for about 80%, with the majority having outboard engines (Sakurai 1998). Motorization of boats started at the end of 1950s (Ferrer 1958) and was

completed by the beginning of 1990s (Sakurai 1998). The number of boats also increased in the artisanal fishery of Saudi Arabia. The dominant fishing gears are gillnet, and hook and line, which account for more than 90% of the artisanal catch, while trolling and trap are rarely used (MAW 2000). Handlining is dominant in the northern coast, targeting coral reef fishes, while gillnets are used in the southern coast, targeting pelagic fishes. Fishing licenses for the traditional fishery are issued by representatives of the Fisheries Out-Stations at the district level (MAW 2000). According to the fishery administration, traditional fishers are Saudi citizens who work on board one of their own traditional fishing boat; however, a traditional fisher can own up to 4 fishing boats (MAW 2000). Since the 1980s, most Saudi fishers are not directly involved in fishing, sometimes referred as 'investor fishers'. They own the boats, but the fishing is done by foreign workers through an arrangement where the owner gets half of the profit and the crew shares the other half. To limit effort (because catches are not increasing anymore), the issuing of new licenses has stopped in the mid-1990s (Sakurai 1998).

Subsistence fishery

The majority of the subsistence catch includes what the fishers consume and give to their families and friends to sustain their communities. These catches are not reported at all because the catch is given away before the official recording, if it exists. In the coastal areas, community members, mainly children, are also involved in catching fish for consumption by the family. For cultural and religious reasons, women are not involved in fishing in Saudi Arabia. The subsistence fishery catch can be significant. Based on interview with fishers in the Red Sea, it can amount up to half of the total catch. The catch amounts given freely have changed over time: in the past where the fishery was less commercialized, they were relatively high, but they diminished later.

Industrial fishery

The history of Saudi Arabian industrial fishery in Red Sea is tied to the history of the Saudi Fishing Company. Experimental fishing by chartered boats, mainly trawling for shrimps, started in 1952 (Ferrer 1958). The Saudi Fishing Company did not have its own boats until 1954, and it became inactive in 1961, due to engine failures, lack of maintenance and lack of profits (Gilberg 1966). The company re-established itself again in 1981, when shrimp trawling started with Thai vessels operating under contract (Sanders and Morgan 1989). Eventually, the Saudi Fishing Company grew, and owned and operated its own vessels. Currently, the company leased its operations to other companies. Its main base in the Red Sea is Gizan, in the south, close to the border with Yemen, and its main fishing grounds are located off the Farasan Islands, and near Al-Qunfotha and Al-Khoriebah. Some industrial fishing vessels operate outside the Saudi territorial waters in the neighboring countries or international waters (Sakurai 1998). Although the industrial fishery is mainly trawling (hence sometimes referred as trawl fishery), the vessels are also involved in purse seining, as well (MAW 2000). The issuance of fishing license for industrial fishing is a sole prerogative of the Minister of Agriculture and Water or the Deputy Minister for Fisheries Affairs in the same ministry (MAW 2000).

Recreational fishery

Recreational fishing was not commonly practiced in Saudi Arabia. However, once the country acquired oil wealth, and saw numerous expatriates practice the sport, recreational fishery or 'pleasure fishing', as it is called locally, took off. In the mid to late 1990s, there were 2,126 to 2,445 boats registered as 'recreational' (Sakurai 1998; MAW 2000). Most of the fishing happens on the weekend (Thursday and Friday), using handline. There are rare reports of trolling and longline fishing (MAW 2000). Recreational fishing with net is prohibited (Sakurai 1998).

Methods

Artisanal fishery

The earliest catch estimate for Saudi Arabia's artisanal fisheries in the Red Sea was from a partial survey of the fishers from which the average catch was calculated and multiplied by the total number of fishers in order to estimate the total catch for 1953, which was 3,000 to 5,000 t (El-Saby and Farina 1954). The mid-range value 4,000 t was taken. The same amount was assumed from 1950 to 1952. After 1952, the next estimate was for 1963, from a survey which led to a total catch estimate of 5,000 t (Gilberg 1966). From 1965 to

Table 1. Sources used to adjust Saudi Arabian Red Sea catches (tonnes) reported by Sanders and Morgan (1989).

Year	Reported catch			Adjusted catch
	Sanders and Morgan (1989)	Others	Source	
1976	11,500	10,200	Peacock (1978)	-
1977	11,700	10,200	Peacock (1978)	-
1978	13,300	12,900	Barrania *et al.* (1980)	-
1979	13,100	-	-	11,328
1980	13,200	10,350	Barrania *et al.* (1980)	-
1981	13,200	-	-	11,415
1982	13,200	-	-	11,415
1983	13,200	10,742	Chakraborty (1984)	-
1984	13,200	-	-	11,415
1985	21,800	-	-	18,851
1986	22,700	-	-	19,630

1971, total catches were available for the whole of Saudi Arabia, i.e., both the Red Sea and Persian Gulf together, where it is stated that 'about half' of the catch came from the Red Sea (Neve and Al-Aiidy 1973). Another report gave a more precise estimate, 53%, (Barrania *et al.* 1980), which was used to calculate the Red Sea catch. From 1976 to 1986, catches from the Red Sea were estimated by halving the total Saudi Arabian reported catch (Sanders and Morgan 1989). Estimates for the Red Sea only were available for 1976 and 1977 (Peacock 1978), 1978 and 1980 (Barrania *et al.* 1980) and 1983 (Chakraborty 1984). The data from Sanders and Morgan (1989) were used for years for which there were no other estimates, after adjusting it using weighted mean for the years where there were estimates for the Red Sea only (Table 1). This resulted in that the Red Sea catch was only 86% of that reported by Sanders and Morgan (1989).

Starting 1987, data availability improved, and the following sources were used: 1987-1994 (Sakurai 1998), 1995-1998 (MAW 2000), 2004 to 2007 (MAW 2008) and 2009 (FSDP 2011) . Also, the number of fishers data were available from 1991 to 2007 (MAW 2008), which was used to calculate the catch per fisher from 1991 to 2007. A linear regression was fitted to the data (Figure 2). Using this function, the catch per fisher was calculated for 1999 to 2003, which was multiplied by the number of fishers to estimate the total catch. Interpolation of the total catch was used to fill in the data gaps in 1954 to 1962, 1964, 1972 to 1975, 2008 and 2010 (Table 2).[3]

Part of the artisanal fishery catch is not reported at all. The major contributions to unreported catch in artisanal fisheries are fish landed outside the major landing sites where data recording occurs, if any. The second contributions to unreported catch occurs when boats land their catch at the major landing sites, but before their catch is recorded, part of the fish is sold in the non-formal market before recording. These catches are different from catch that is allocated for subsistence, which is treated separately below. It was difficult to estimate the unreported catch of artisanal fishery, as we were unable to locate pertinent studies for Saudi Arabia. We used some qualitative information that the first author collected during a field trip to the neighboring Red Sea countries of Sudan, Eritrea and Yemen (Tesfamichael *et al.* in press). The market and data recording infrastructure improved with the motorization of artisanal boats starting the beginning of 1960s facilitated by the government. This knowledge, jointly with the general pattern of the fishery, was used to estimate the unreported catch. The reconstructed time series reported Saudi artisanal catch can be divided into three phases (Figure 3): low catch level until 1963, a slight increase until 1984, and rapid increase after that, followed by decline. Thus, we assumed conservative unreported catch to be 30 % of the total catch from 1950 to 1963, 20 % from 1964 to 1984 and 10 % from

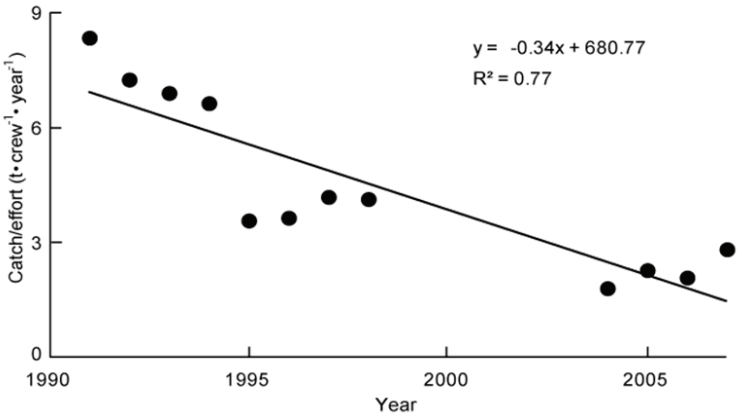

Figure 2. A linear function fitted to the catch per fisher in Saudi Arabia's Red Sea artisanal fishery.

Table 2. Sources and methods for estimating reported artisanal fishery catch of Saudi Arabia in the Red Sea.

Year	Source	Remarks
1950-52	-	Assumed the same as 1953
1953	El-Saby and Farina (1954)	Average of reported range
1954-62	Interpolation	Linear change in total catch
1963	Gilberg (1966)	-
1964	Interpolation	Linear change in total catch
1965-71	Neve and Al-Aiidy (1973)	-
1972-75	Interpolation	Linear change in total catch
1976-77	Peacock (1978)	-
1978	Barrania *et al.*(1980)	-
1979	Sanders and Morgan (1989)	Adjusted (see Table 1)
1980	Barrania *et al.*(1980)	-
1981-82	Sanders and Morgan (1989)	Adjusted (see Table 1)
1983	Chakraborty (1984)	-
1984-86	Sanders and Morgan (1989)	Adjusted (see Table 1)
1987-94	Sakurai (1998)	-
1995-98	MAW (2000)	-
1999-2003	Interpolation	Based on linear function of catch per fisher (Fig. 2) and total number of fishers
2004-07	MAW (2008)	-
2008	Interpolation	Linear change in total catch
2009	FSDP (2011)	-
2010	Interpolation	Linear change in total catch

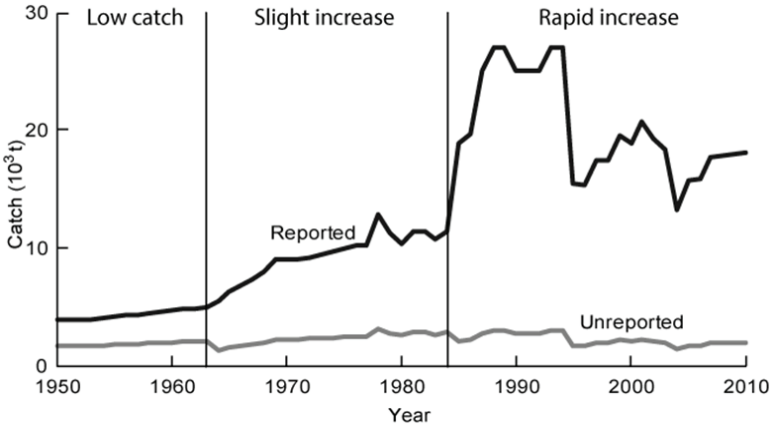

Figure 3. Reconstructed Saudi Arabian artisanal Red Sea fishery catches. (Note that apparent constancy of 'unreported catch' is a reflection of the improvement of data recording system).

[3] When this report was being published Saudi Arabia published fishery statistics up to 2010. Our estimates are very similar to the official published values.

1985 to 2010. In addition, fishers from Jordan fished in Saudi waters from 1950 to 1984 (Tesfamichael *et al.* 2012). The catches were very small (maximum of 100 t) compared to the Saudi catch (minimum of 5,700 t); nevertheless they were included with the unreported catch.

Catch composition data for Saudi Arabia's artisanal fishery were available for some years, the earliest being 1980. Data points were often only available for the major target species, reflecting the over-aggregated nature of the reported data. From 1950 to 1998, where the catch composition was highly aggregated, we created a comprehensive catch composition list consisting of 20 major taxa and the category 'others' for the species not identified. To fill the species composition matrix for all the years, some aggregated taxonomic groups were disaggregated using data from other years. Indian mackerel and Spanish mackerel ('kingfish') were reported as 'Mackerel' for the 1980 and 1983 (Barrania *et al.* 1980; Chakraborty 1984). This category was split based on disaggregated ratio reported for 1985, i.e., kingfish 91% and Indian mackerel 9% (MAW 1986). The same source was used to split parrotfish and surgeonfish, with contribution 98% and 2%, respectively. Tunas were reported separately for most of the years, but not for all years. For 1985, their catch was calculated by splitting the reported 'others' using the proportion of tuna relative to 'others' for 1983. The catch ratio of tunas for 1995 (MAW 1996) was assumed to be similar to 1996 (MAW 1998; Sakurai 1998). Catch rates for cobia, wrasses, sea breams, rabbitfish, goatfish and cutlassfishes were not available for 1980 and 1983. We estimated their proportions from 'others' using ratios reported for 1985 (MAW 1986). The final result is a standardized catch composition (Table 3).

Table 3. Source for catch composition (%) of Saudi Arabian Red Sea artisanal fishery.

Year	1950-80	1981-82	1983	1984	1985-94	1995	1996	1997	1998	1999-03	2004	2005	2006	2007-10
Spanish Mackerel	21.84	24.70	27.57	28.98	30.40	16.20	16.93	18.49	23.91	15.97	15.93	14.08	11.03	12.43
Jacks	15.00	15.36	15.73	13.86	12.00	10.70	13.52	12.01	11.81	13.30	16.03	15.88	14.02	13.48
Groupers	9.00	8.90	8.80	10.90	13.00	10.60	17.91	14.04	15.30	16.02	16.45	17.94	19.71	17.47
Emperors	8.00	6.89	5.77	9.84	13.90	12.40	17.49	14.66	12.78	14.88	14.44	15.84	16.75	15.87
Snappers	12.00	8.44	4.87	6.44	8.00	4.90	4.91	5.62	5.53	5.27	6.83	4.93	4.89	4.93
Barracudas	4.00	5.20	6.41	6.70	7.00	3.90	4.01	4.01	3.99	5.14	5.23	6.73	6.92	6.74
Tunas	7.00	6.28	5.55	3.74	1.94	2.46	2.46	2.46	2.45	3.60	4.71	4.58	4.70	5.28
Mullets	8.00	6.21	4.42	3.21	2.00	1.90	1.90	1.90	1.89	1.49	1.21	1.11	0.95	1.19
Sharks	6.00	6.84	7.67	4.84	2.00	1.80	1.80	1.80	1.79	2.24	2.18	2.69	2.69	3.38
Indian Mackerel	2.16	2.44	2.73	2.86	3.00	15.10	2.91	2.91	2.89	4.07	1.01	1.58	3.00	3.47
Parrot fishes	4.90	4.12	3.34	2.17	1.00	3.00	2.33	2.33	2.32	2.21	1.89	1.72	2.24	2.05
Cutlass fish	1.15	2.63	4.10	3.55	3.00	2.10	2.10	2.10	2.09	1.04	0.00	0.00	0.00	0.00
Rabbit fish	0.01	0.02	0.03	0.02	0.02	4.00	3.50	4.53	2.65	2.50	1.51	1.35	1.41	1.25
Sea breams	0.01	0.01	0.00	0.02	0.03	1.20	1.20	1.20	1.19	1.08	0.83	0.79	0.98	1.29
Surgeon fish	0.10	0.08	0.07	0.04	0.02	0.60	0.60	0.60	0.60	0.91	1.26	1.29	1.28	1.12
Grunts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	1.09	0.91	0.97	0.95	1.57
Wrasses	0.00	0.01	0.01	0.06	0.10	0.80	0.80	0.80	0.80	0.63	0.59	0.44	0.44	0.41
Queenfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	1.74	0.86	0.44	0.92
Cobia	0.00	0.01	0.01	0.06	0.10	0.10	0.10	0.10	0.10	0.26	0.45	0.41	0.31	0.57
Goat fish	0.00	0.01	0.01	0.01	0.01	0.20	0.20	0.20	0.20	0.14	0.07	0.11	0.09	0.03
Others	0.82	1.86	2.90	2.69	2.48	8.04	5.33	10.23	7.17	7.18	6.75	6.71	7.20	6.56
Sources/ remarks	Barrania *et al.* (1980)	a	Chakraborty (1984)	b	MAW (1986)	MAW (1996)	MAW (1998)	MAW (2000)	MAW (2000)	c	MAW (2008)	MAW (2008)	MAW (2008)	MAW (2008)

[a] Average of 1980 & 1983, [b] Average of 1983 & 1985, [c] Average of 1996-1998 & 2004-2007

The most detailed (disaggregated) catch composition available was from 2004 to 2007 (MAW 2008). The catch was divided into 40 taxonomic groups and 'others' (Table 4). The 40 groups included all the 20 groups from 1950 to 1998 and 20 new ones. The 'others' from 1950 to 1998 were further divided to the 20 new groups in 2004-2007 using their average ratios. For the years catch composition was missing altogether, it was estimated by interpolating between the closest years for which catch composition was available. From 1950 to 1979, the catch composition was estimated using the earliest available ratio (1980). From 1986 to 1994, the phase of the Saudi artisanal fishery characterized by high catches (Figure 3), the only catch composition available was for 1985, and it was used for the whole period. Species composition data were also missing for the period 1999 to 2003, the mean of 1996 to 1998 and 2004 to 2007 (i.e., similar phase of the fishery; Figure 3), was used. From 2008 to 2010, the catch composition of 2007 was used. The final catch composition of the artisanal fishery consisted of many taxa but for clarity of presentation of the result only the major taxa are included and the minor taxa are lumped together in the group 'others' (Figure 4). The detailed composition is presented in the Appendix Table (A1).

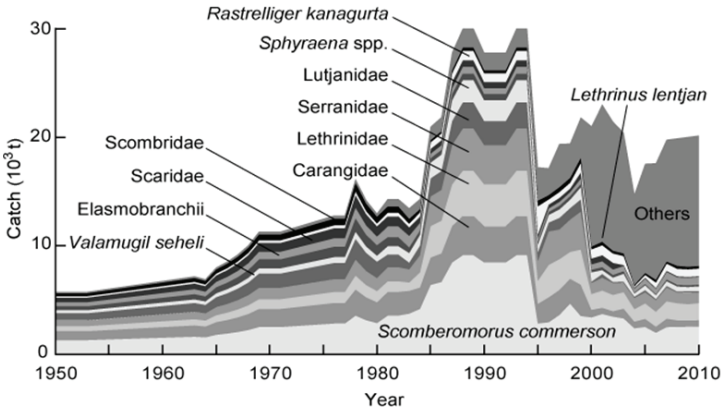

Figure 4. Catch composition of Saudi Arabia's artisanal fishery in the Red Sea.

Table 4. Sources for the expanded catch composition (%) of Saudi Arabian Red Sea artisanal fishery (2004-2010)

Taxa	2004	2005	2006	2007	2008-2010
Spanish Mackerel	16	14	11	12	12
Jacks	16	16	14	13	13
Groupers	16	18	20	17	17
Emperors	14	16	17	16	16
Snappers	7	5	5	5	5
Barracudas	5	7	7	7	7
Tunas	5	5	5	5	5
Mullets	1	1	1	1	1
Sharks	2	3	3	3	3
Indian Mackerel	1	2	3	3	3
Parrot fishes	2	2	2	2	2
Cutlass fish	0*	0	0	0	0
Rabbit fish	2	1	1	1	1
Sea breams	1	1	1	1	1
Surgeon fish	1	1	1	1	1
Grunts	1	1	1	2	2
Wrasses	1	0	0	0	0
Queenfish	2	1	0	1	1
Cobia	0	0	0	1	1
Goat fish	0	0	0	0	0
Squirrel fish	1	1	1	0	0
Sea catfish	1	1	0	1	1
Needle fish	1	1	1	1	1
Mojarras	1	1	1	1	1
Milkfish	0	0	1	0	0
Snubnose chub	0	0	0	0	0
Angle fishes	0	0	0	0	0
Rainbow runner	0	0	0	0	0
Triggerfishes	0	0	0	0	0
White pomfret	0	0	0	0	0
Marine crabs	0	0	0	0	0
Sail fish, marlin	0	0	0	0	0
Sardins	1	1	1	1	1
Batfish	0	0	0	0	0
Fuslier fish	0	0	0	0	0
Rays	0	0	0	0	0
Flatfishes	0	0	0	0	0
Goggle eye	0	0	0	0	0
Lizardfishes	0	0	0	0	0
Squids and cuttle fishes	0	0	0	0	0
Others	3	2	3	2	2
Sources	MAW (2008)	MAW (2008)	MAW (2008)	MAW (2008)	2007 values

* Values presented as zero in tables are higher than zero and used in calculation. But they are very small, hence presented as zero because of rounding off

Subsistence fishery

The amount of the subsistence catch was estimated based on information obtained through interviews with fishers in the Red Sea areas of Yemen, Eritrea and Sudan (Tesfamichael *et al.* in press). The amounts of fish allocated for subsistence changed over time; in the past: when fishing was mainly for subsistence, catch rates were high, and there was lack of extensive marketing, fishers reported to give about half of their catch. But later, as their catch became more valuable and their catch rates started to decrease; fishers gave less of their catch away. In order to capture the different phases of the fishery, we used the trend of the total reported catch of the artisanal fishery (Figure 3). The Saudi reconstructed reported artisanal catch can be divided into three phases: low catch level until 1963, which is the pre-motorization phase; a slight increase until 1984, and rapid increase after that, followed by decline. We assumed the subsistence fishery to be 30% of the artisanal catch until 1963. This is a conservative estimate, because fishers told us in the years before motorization gained momentum, they used to give up to 50% of their catch away. For 1964, the subsistence percentage was reduced to 20%, and for 2010 only 10%. From 1965 to 2009, the percentages were interpolated. Before these percentages were applied, some taxa not usually given away were eliminated. The taxa included the ones usually targeted for the export market, i.e., shark fished for their fin and many invertebrates such as shrimp, crab and lobster. Traditionally most of these taxa were not consumed locally and their consumption

was introduced by foreigner (mainly European) visitors to the region. Nowadays, they are consumed by the communities mainly in the affluent bigger urban centers, yet still not given freely to family and friends. The local names of most of these taxa are based on European names, rather than Arabic as is the case for most of the fish (Tesfamichael and Awadh 2012). The remaining taxa of the artisanal fishery constitute the composition of the subsistence fishery (Figure 5, Table A2). Thus, to clarify: our definition of subsistence fishery considers only the portion of the catch that is not sold by the artisanal fishers. We ignore classifications, wherein the entire artisanal fishery, especially before motorization was considered a 'subsistence fishery'.

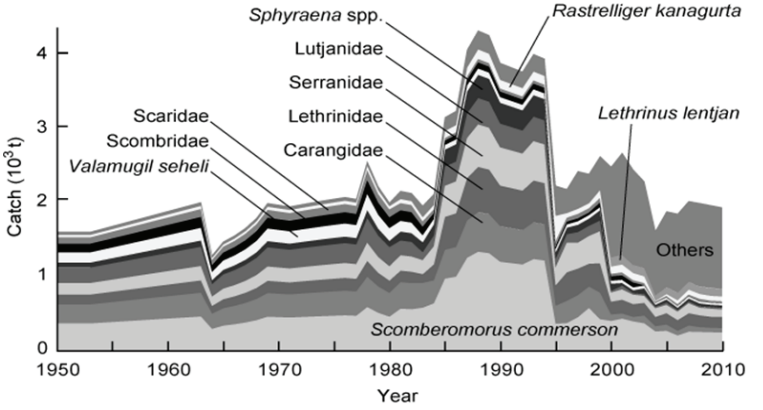

Figure 5. Catch composition of Saudi Arabia's subsistence fishery catch in the Red Sea.

Industrial fishery

An exploratory trawl fishing conducted for the Saudi Fishing Company in 1952 initiated industrial fishing in the Saudi Arabian waters of the Red Sea (El-Saby and Farina 1954; Ferrer 1958). The company became inactive and closed in 1961 (Gilberg 1966), but re-established itself in 1980 and carried out trial trawling until it started commercial operation in 1982 in the southern part of the Saudi Red Sea coast around Gizan (Sanders and Morgan 1989). The sporadic experimental trawling in the early 1950s, which yielded negligible catches, are not included in this reconstruction. Rather, it starts in 1982, with a first substantial catch, of which 466 t of shrimp and 703 t of fish were retained. The dataset is not continuous after 1982, but catch data were available for some years: 1987 to 1996 (Sakurai 1998), 1997 to 1998 (MAW 2000), 2004 to 2007 (MAW 2008), and 2009 (FSDP 2011) which were used as total reported catch for the respective years (Table 5). For the periods where catch was not reported 1983 to 1986, 1999 to 2003, 2008 and 2010, interpolation was used to fill in the gaps. The interpolation for the earlier period reflects the rapid expansion of the industrial fishery in Saudi Arabian Red Sea (Sanders and Morgan 1989), while the latter period depicts a somewhat stable high catch.

Table 5. Sources and methods for estimating the industrial fishery reported catch of Saudi Arabia in the Red Sea.

Year	Source	Remarks
1950-1981	Sanders and Morgan (1989)	Catch was negligible
1982	Sanders and Morgan (1989)	
1983-1986	Interpolation	Linear change in total catch
1987-1998	MAW (2000)	
1999-2003	Interpolation	Linear change in total catch
2004-2007	MAW (2008)	
2008	Interpolation	Linear change in total catch
2009	FSDP (2011)	
2010	Interpolation	Linear change in total catch

For the years data were available, the sources reported total (both fish and shrimp) catch or usually the commercially lucrative shrimp only. To reconstruct the catch composition, first a continuous shrimp catch was established from 1982 to 2010. Shrimp data were available for 1982 (Sanders and Morgan 1989) and 1987 to 2007 (MAW 2008). The missing data from 1983 to 1986 were interpolated between the 1982 and 1987 data and for 2008 to 2010 the ratio of shrimp to the total catch for 2007 (11%) was applied (see Table A3) for the total reconstructed shrimp data). Then, the shrimp catches were subtracted from the total reconstructed to determine the total catch of fishes, i.e., non-shrimp retained catch. This procedure was used to get the best possible species distribution as available shrimp catches went back to the early 1980s, whereas the retained fish was available only for 1997 and 1998 (MAW 2000) and 2004 to 2007 (MAW 2008). The catch compositions of 1997 and 1998 were highly aggregated in 5 major groups and more than 30% in the category 'others'. However, the data from 2004 to 2007 were more detailed with 31 groups and 'others'. The category 'others' for 1997 and 1998 was further disaggregated using the average of 2004 to 2007. From 1982 to 1996, the catch composition of 1997 was used, from 1999 to 2003, the average of 1998 and 2004 was used, and for 2008 to 2010 the composition of 2007 was used (Table 6). The shrimp catch was added to the non-shrimp catch to establish the composition of the industrial total catch of Saudi Arabia in the Red Sea (Figure 6, Table A4). Of the shrimp catch, *Penaeus semisulcatus* accounts for more than 90% (Sakurai 1998).

Unlike the artisanal fishery, where the main source of unreported catch is the catch landed without being recorded, the main source of unreported catch for the industrial fishery of Saudi Arabia is discarding. Data of retained catch were collected using logbook (MAW 2000). Fish thrown overboard (i.e., non-target species or the young of target species) usually have a low market value and are not recorded in the logbook at all. In the Saudi fishery recording system, the catches of industrial fisheries are not separated by gear, i.e., only the total is given, and usually, the same vessels use both trawling and purse seining gears (MAW 2000). Estimating the unreported catch from the total industrial catch would be misleading, because the source of discard is trawling and the proportion of trawl and purse seine catch is not constant. Using the percentage of shrimp and Indian mackerel, the main catch of trawl and purse seine, respectively, from the total catch for the years data were available for both; we found that they have inverse relationship, i.e., when the share of one increases that of the other decreases indicating the relative

Table 6. The catch composition (%) of Saudi Arabian Red Sea industrial fishery excluding shrimp.

Taxa	1982-97	1998	1999-03	2004	2005	2006	2007	2008-10
Indian Mackerel	24	31	38	45	42	41	43	43
Scads, Jacks, trevallies	18	13	9	4	6	7	8	8
Emperors	9	8	6	4	7	7	6	6
cuttlefishes, squids	8	9	10	11	12	9	9	9
Barracudas	5	5	4	3	5	4	4	4
Catfish	3	3	2	2	2	3	4	4
Crabs	4	4	3	3	5	4	3	3
Threadfin bream	3	3	2	0	3	5	3	3
Lizardfishes	3	3	3	3	2	2	3	3
Kingfishes	3	3	3	3	3	2	2	2
Queenfishs	2	2	2	1	2	3	2	2
Grunts, sweetlips	2	2	2	2	2	3	2	2
Mojarras	2	2	3	1	2	3	1	1
Snappers	1	1	1	0	1	0	1	1
Flatfishes	1	1	1	1	1	1	1	1
Ribbonfish	0	0	0	0	0	0	1	0
Tunas	1	1	1	2	1	1	1	1
Bony fish	0	0	0	0	0	0	1	0
Goatfish	1	1	1	0	0	1	1	0
Groupers	1	1	1	0	1	0	1	1
Shark	1	1	1	0	0	1	1	0
Fuslier fish	1	1	1	1	0	1	0	0
Cobia	0	0	0	0	0	0	0	0
Rabbit fish	0	0	0	0	0	0	0	0
Sardins	0	0	0	0	0	0	0	0
Rays	0	0	0	0	0	0	0	0
Parrotfishes nei	0	0	0	0	0	0	0	0
Seabreams	1	1	1	3	1	1	0	1
Needle fish	0	0	0	0	0	0	0	0
Milkfish	0	0	0	0	0	0	0	0
Triggerfishes	0	0	0	0	1	0	0	0
Others	4	4	4	10	1	2	2	2
Source	MAW (2000)	MAW (2000)	a	MAW (2008)	MAW (2008)	MAW (2008)	MAW (2008)	b

[a]Average of 1998 and 2004; [b] based on 2007 values

share of each gear (Figure 7). Because of its high value shrimp is the main target of trawling, the main factor in discarding fish, and because a wider coverage of shrimp catch data were available; the reconstructed shrimp data were used as a base to estimate the amount of unreported catch. Estimates of retained and discarded catches were available from experimental fishing in 1952/53, where it was found that for 750 kg of retained catch, 1.5 to 2.0 t were discarded (Ferrer 1958). Taking the mid-range, discards were 2.3 times the retained catch or 70% of the total catch. However, these values cannot be used directly as the retained catch (despite the main target being shrimp) contains other species and our base of estimating unreported catch is shrimp. The earliest, which is also the highest, percentage of shrimp in the retained catch was 40% for 1982 (Sanders and Morgan 1989), and is used to calculate the amount of shrimp in the retained catch of the experimental fishing. Using these ratios, the discard was calculated to be 5.8 times the shrimp catch. This is a conservative estimate because shrimp accounting 40% of retained catch is high and for other countries in the Red Sea discard can be more than 6 times the amount of shrimp catch (Tesfamichael and Mohamud 2012).

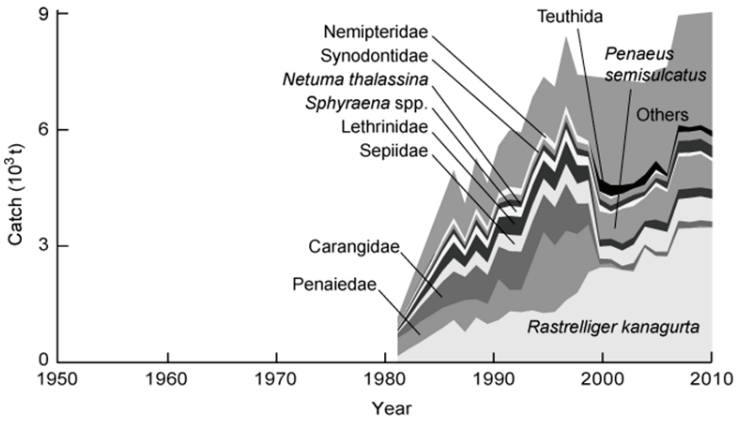

Figure 6. Composition of the retained industrial fishery catch of Saudi Arabia in the Red Sea.

The species composition of discarded catch is different from that of the retained catch. There was no any data for the composition of discards from the Saudi Arabian Red Sea trawl fishery. However, such data were available from the Yemeni part of the Red Sea (Walczak 1977), which was used for Saudi Arabia with some modification. Jacks, lizard fish, breams, grunters, catfish and barracuda were reported as discards in Walczak (1977). They were removed from the discard list of Saudi Arabian industrial fishery, as these species were believed to have been retained (Sanders and Morgan 1989). The remaining taxonomic groups of the discard were scaled to make the total 100% (Table 7). The final catch composition is presented in Figure (8) and the actual values in Table (A5).

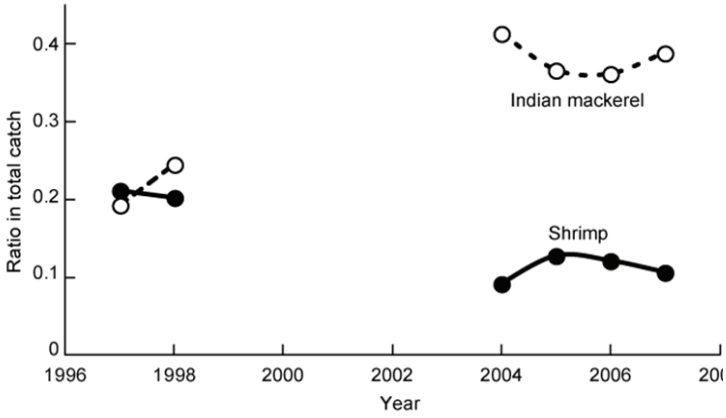

Figure 7. The contribution of shrimp and Indian mackerel to the total industrial catch of Saudi Arabia in the Red Sea for the years data were available.

Recreational fishery

Very little data were available for Saudi Arabia's recreational fishery catches. They have not traditionally been accounted for in the reported fisheries statistics, possibly because their catch is very small compared with artisanal or industrial fisheries. The only catch estimate available was 1,500 t for 1998 (MAW 2000). This tonnage was used as anchor point. We assumed, in lack of other data, that recreational catches had been ongoing since the beginning of 1970s. This is the time the oil wealth started to have effect in the fishing sector. Many Saudi citizens started to buy fiberglass boats and hired foreigners to do the fishing (Sanders and Morgan 1989; Sakurai 1998) while they would go fishing for pleasure usually in the weekend. Thus, the catch was assumed to be zero until 1969 and interpolated between 1969 and the anchor in 1998. The population size of Saudi Arabia was used as a proxy to calculate the recreational fishery catch from 1998 to 2010 using the 1998 catch as anchor.

Recreational catches were reported to consist mostly of emperors, then sea breams followed by groupers (MAW 2000). We transformed this qualitative information (using 10% steps between the ranked groups) into percent contributions, which yielded: emperors (Lethrinidae) = 40%; sea breams (Sparidae) = 30%; groupers (Serranidae) = 20% and 'others' = 10% (Figure 9, Table A6).

Table 7. Catch composition (%) of Saudi Arabia's discarded industrial catch in the Red Sea.

Species	%
Pony fish	63.3
Grunters	7.1
Mojarra	4.1
Cutlass fish	4.1
Flatheads	2.0
Puffers	2.0
Soles	2.0
Black pomfret	2.0
Blue Swimming crab	2.0
Sardines, anchovies	1.0
Goatfish	1.0
Mantis shrimp	1.0
Others	8.2

Comparing reconstructed catch with the FAO data

The reconstructed catch was compared to the catch reported in the United Nations Food and Agriculture Organization (FAO) database on behalf of Saudi Arabia (www.fao.org/fishery/statistics/software/fishstat/en). FAO uses broad statistical areas to geographically subdivide catches, and in the case of Saudi Arabia, both coasts fall in the same statistical area ('Western Indian Ocean'). Thus, the Saudi Arabian catch reported to FAO needed to be divided into the two coasts. This was done using reports that allocated ratios to the Red Sea and the Persian Gulf (Table 8).

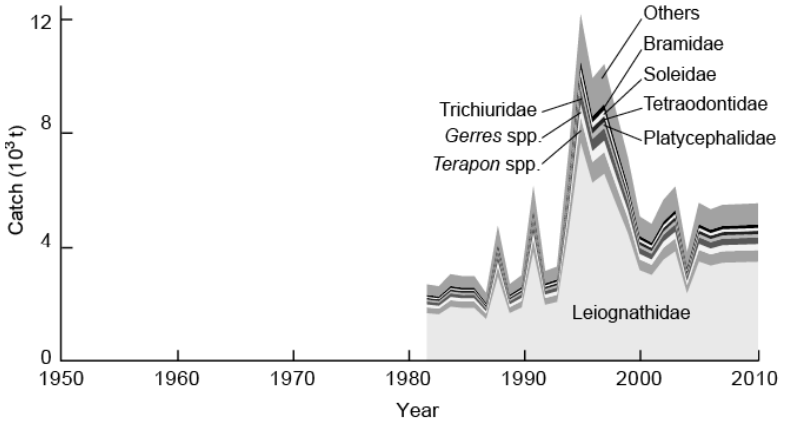

Figure 8. Composition of the discarded industrial fishery catch of Saudi Arabia in the Red Sea.

The earliest available Red Sea-to-Gulf ratio was for 1979 (Barrania *et al.* 1980), 1987 to 1998 (Sakurai 1998; MAW 2000) and 2000 (FAO 2003). For 2002, the Regional Commission for Fisheries (RECOFI 2009), which is active in the Gulf, reported the Gulf catch of Saudi Arabia, which in turn was used to calculate the percentage for the Red Sea. In more recent years, Saudi Arabia published annual fishery statistical reports, separate for each coast, which we relied on for 2004 to 2007 (MAW 2008). The latest year with data disaggregated between the two coasts was for 2009, and statistical data were presented separately for the artisanal and industrial sectors in the Red Sea and the artisanal sector in the Gulf (FSDP 2011). The industrial catch in the Gulf was calculated using the ratio for the two sectors in 2007, where industrial catch was 0.38% of the artisanal catch.

For years where data were not available, they were estimated using different methods. For 1950 to 1960 and 1975 to 1978, the earliest available data (for 1979) were used. Using the 1979 Red Sea-Gulf ratio for 1961 to 1974 resulted in unreasonably very high Red Sea catches, thus a different approach was used for this period. The closest period with data that separates the Red Sea and Gulf catches was for 1987 to 1994. Thus, an average ratio was calculated for the total reconstructed Red Sea catch without the industrial discard to the FAO catch of Red Sea from 1987 to 1994. (Note that discarded catches are not reported to FAO at all). The result, that FAO Red Sea data were on average 92% of the reconstructed catch, was used to calculate the FAO Red Sea catch for 1961 to 1974. Then the FAO Gulf catch was obtained by subtracting the Red Sea amount from the total Saudi catch in the FAO database. The same ratio was also used for the period 1980 to 1986. Although there were ratios available for 1995 to 1996, they resulted in the FAO Red Sea catch being slightly higher than the reconstructed catch, which is unrealistic given the pattern for the other years. Thus, the reconstructed catch (without industrial discard) is assumed to be equal to the FAO Red Sea catch. For 1999, 2001, 2003, 2008 and 2010, the ratios were interpolated from the neighbouring years (Table 8). [4]

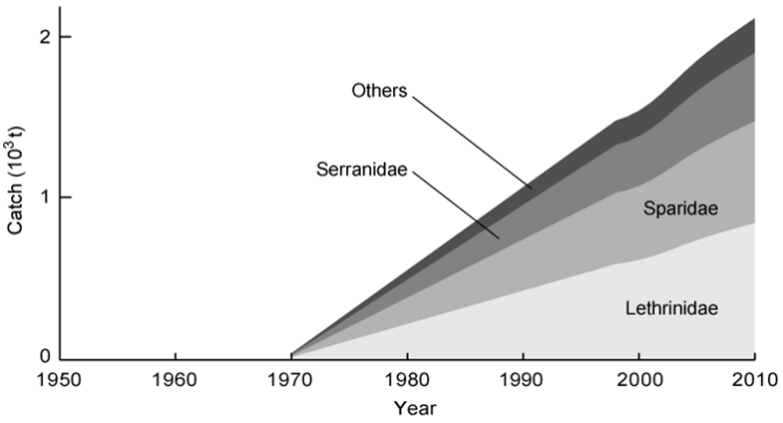

Figure 9. Catch composition of Saudi Arabia's recreational fishery in the Red Sea.

Once the FAO data for Saudi Arabia in the Red Sea were separated, they were compared with our reconstructed catch. The FAO data have more taxa (127) than the reconstructed catch, which is strange given that we used the Saudi official national and technical reports for our catch reconstruction. The large number of taxa started in 2000 when the country introduced an extensive data recording and reporting system. Most of the taxa that were included starting in 2000 have very low catch amounts and they were aggregated as 'miscellaneous' in the national reports we used. To make full use of the additional information on catch composition in the FAO data, it was used to further disaggregate the reconstructed catch composition. First the distribution of the taxa were verified using FishBase (Froese and Pauly 2012) to check if each taxon was to be included in both the Red Sea and the Gulf or only in one of these bodies of water. Then, for the taxa included in the FAO data, but not in the reconstruction, the ratios of the taxa in the FAO data were used to disaggregate the catch composition of the reconstructed data. For example, in the reconstructed catch, there was only one taxon item for groupers (Serranidae), but in the FAO data there were 18 taxon items for groupers, mainly species, but also including Serranidae. Overall, the "Serranidae" of the reconstructed Gulf catch was disaggregated into 17 groups using their ratios in the FAO data.

After the reconstructed and the corresponding FAO catch by taxa were tabulated, comparison was done at taxonomic level. The part of the reconstructed catch that is accounted in the FAO data is referred as 'reported catch' in our result. If the value of a taxon in reconstructed catch was higher than its value in the FAO data, then the difference was labeled as 'unreported catch'. If the FAO value for a taxon was higher than the reconstructed catch, the difference is over-reported catch in the EEZ of Saudi Arabia in the Red Sea. Since, the comparison of the reconstructed catch with the FAO data has modified the catch composition of the reconstructed catch, the final ratios are not exactly what are reported in the methodological tables given in the above.

Results and discussion

The Saudi fishery in its Red Sea EEZ had, for a long time, catches less than 10,000 t·year^{-1}. The fishery was dominated by traditional fishers who used small sailing boats and simple gears for decades (El-Saby and Farina 1954; Neve and Al-Aiidy 1973; Tesfamichael and Pitcher 2006). The catches were largely for subsistence and very localized markets, and the fishery lacked modern technology. The rapid change started at the beginning of 1980s, when the catch increased drastically to attain its maximum in the mid-1990s. After the mid-1990s, the total catch was declining, but remained higher than in the earlier years. The maximum catch attained was around 50,000 t in 1994. The rapid increase in the total catch starting the 1980s is due to the motorization and the introduction of fast fibreglass boats in the artisanal fisheries (Sanders and Morgan 1989; Sakurai 1998), which resulted in higher catches (Figure 10, Appendix Table A7). The artisanal and subsistence fisheries were the only ones operating in the Red Sea until the 1980s, when the industrial and recreational fisheries started, and contributed to a drastic increase of the total catch (Sanders and Morgan 1989). The catch of the artisanal fishery decreased dramatically in 1995, but this was compensated for by an increase of the industrial catch. The contribution of the recreational fishery was very low. The slight decrease from the peak is taken as a sign of resource depletion by the fisheries administration and precautionary approaches are being considered, for example new licenses are not issued (MAW 2000). Overall, artisanal fishery contributed to the highest to the total catch from 1950 to 2010 (64%), followed by industrial fishery (12%), discards (11%), subsistence catch (10%) and recreational fishery (3%).

[4] After the completion of the report, we came to realize that data only for the gulf were available at FAO/RECOFI. Our sources gave us similar results. In addition we used the FAO data only as a way of comparison and did not have any impact in our reconstruction.

Table 8. Ratios used to calculate the Red Sea catch from Saudi Arabia's catch reported to FAO.

Year	Red Sea	Source/Remarks
1950-60	52.74	1979 values
1961	39.01	FAO Red Sea catch assumed to be 92% of reconstructed catch
1962	35.25	FAO Red Sea catch assumed to be 92% of reconstructed catch
1963	33.59	FAO Red Sea catch assumed to be 92% of reconstructed catch
1964	35.80	FAO Red Sea catch assumed to be 92% of reconstructed catch
1965	39.39	FAO Red Sea catch assumed to be 92% of reconstructed catch
1966	38.69	FAO Red Sea catch assumed to be 92% of reconstructed catch
1967	38.13	FAO Red Sea catch assumed to be 92% of reconstructed catch
1968	43.70	FAO Red Sea catch assumed to be 92% of reconstructed catch
1969	47.18	FAO Red Sea catch assumed to be 92% of reconstructed catch
1970	47.83	FAO Red Sea catch assumed to be 92% of reconstructed catch
1971	46.55	FAO Red Sea catch assumed to be 92% of reconstructed catch
1972	44.76	FAO Red Sea catch assumed to be 92% of reconstructed catch
1973	41.39	FAO Red Sea catch assumed to be 92% of reconstructed catch
1974	47.47	FAO Red Sea catch assumed to be 92% of reconstructed catch
1975-78	52.74	1979 values
1979	52.74	Barrania *et al.* (1980)
1980	48.13	FAO Red Sea catch assumed to be 92% of reconstructed catch
1981	46.03	FAO Red Sea catch assumed to be 92% of reconstructed catch
1982	44.71	FAO Red Sea catch assumed to be 92% of reconstructed catch
1983	40.09	FAO Red Sea catch assumed to be 92% of reconstructed catch
1984	40.59	FAO Red Sea catch assumed to be 92% of reconstructed catch
1985	51.44	FAO Red Sea catch assumed to be 92% of reconstructed catch
1986	52.69	FAO Red Sea catch assumed to be 92% of reconstructed catch
1987	66.07	Sakurai (1998), MAW (2000)
1988	67.93	Sakurai (1998), MAW (2000)
1989	68.49	Sakurai (1998), MAW (2000)
1990	72.28	Sakurai (1998), MAW (2000)
1991	74.57	Sakurai (1998), MAW (2000)
1992	68.13	Sakurai (1998), MAW (2000)
1993	69.17	Sakurai (1998), MAW (2000)
1994	62.53	Sakurai (1998), MAW (2000)
1995	53.75	Sakurai (1998), MAW (2000)
1996	50.76	Sakurai (1998), MAW (2000)
1997	53.10	Sakurai (1998), MAW (2000)
1998	48.91	Sakurai (1998), MAW (2000)
1999	47.41	Interpolated
2000	45.73	FAO (2003)
2001	43.61	Interpolated
2002	41.93	RECOFI (2009)
2003	39.43	Interpolated
2004	36.85	MAW (2008)
2005	38.59	MAW (2008)
2006	35.79	MAW (2008)
2007	40.01	MAW (2008)
2008	40.11	Interpolated
2009	40.21	FSDP (2011)
2010	40.31	Interpolated

The reported catch (the reconstructed catch accounted in the FAO data) had the highest contribution to the total catch (54%). The discarded catch (11%), originating from the trawl fishery, appeared only since 1982 when the Saudi industrial fishery started operating in the Red Sea. The unreported landed catch accounted for 35%. The reconstructed catch and the catch reported by FAO on behalf of Saudi Arabia assigned to the Red Sea were close to each other from the 1960s to mid-1980s. The major differences are in the 1950s and from the mid-1980s on (Figure 11, Table A8). In the 1950s, there was not any catch recording system. The fishery was traditional and there was no regulatory body, hence its catches were not properly reported. The main difference after the mid-1980s is the discarded catch of the industrial fishery, which is included in the reconstructed catch, but missing in the data supplied to FAO. As in many other sub-tropical fisheries, the Saudi Red Sea fishery catch consisted a very large number of taxonomic groups. However, only 5 taxa made up 50% of the total catch from 1950 to 2010: Spanish mackerel (17%), emperors (9%), jacks (9%), groupers (8%) and pony fish (7%). These dominant taxa are caught by artisanal fisheries. The

highest contribution of the industrial fishery were pony fishes (Family Leignathidae, which are systematically discarded) and which, with 7%, ranked fifth in the total catch (Figure 12, Table A9).

This long time series of reconstructed Saudi Arabian catches in the Red Sea, the first of its kind, is very informative, and should be useful in the assessment and management of the fisheries (Tesfamichael 2012). Unreported catches are estimated for the different sectors given explicit assumptions, on the basis of the best information available. Some of the procedures and assumptions used here will certainly require correcting when new information is available. In the meantime, this is provided in the hope that it will be found useful.

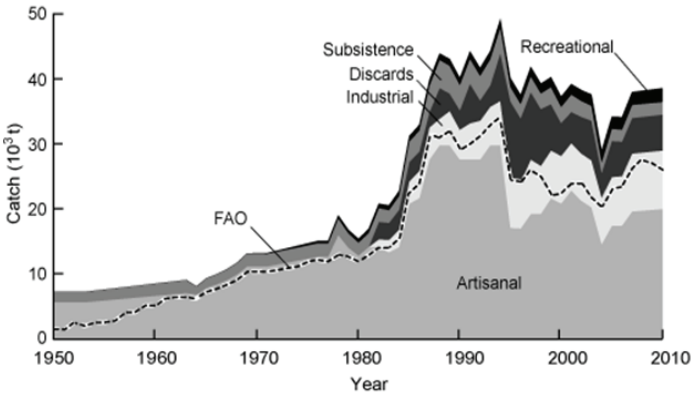

Figure 10. Reconstructed catch of Saudi Arabia in the Red Sea by sectors and its comparison to the data reported by FAO on behalf of Saudi Arabia.

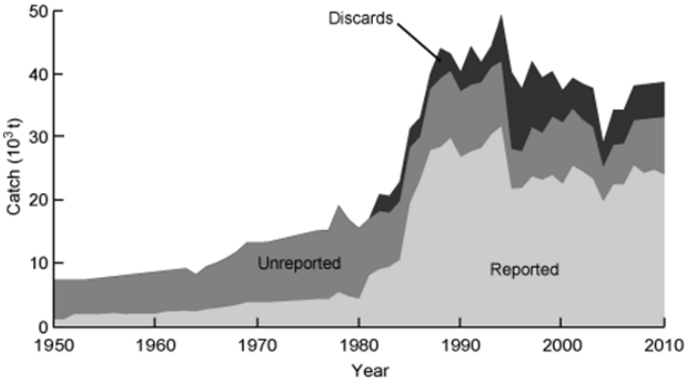

Figure 11. Reconstructed catch of Saudi Arabia in the Red Sea by components. Reported catch refers to the part of the reconstructed catch accounted in the FAO data.

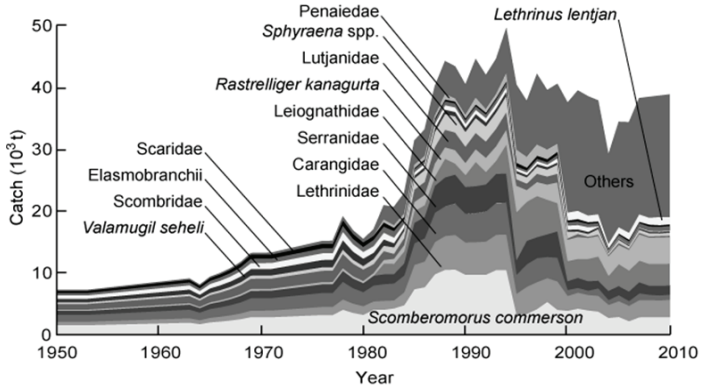

Figure 12. Composition of the total catch of Saudi Arabia's fisheries in the Red Sea.

Acknowledgments

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Appendix Table A1. Catch composition (in tonnes) of Saudi Arabia's artisanal fishery in the Red Sea by major taxa.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1950	1,248	857	457	514	686	229	457	343	400	123	0	280	0	0	0	0
1951	1,248	857	457	514	686	229	457	343	400	123	0	280	0	0	0	0
1952	1,248	857	457	514	686	229	457	343	400	123	0	280	0	0	0	0
1953	1,248	857	457	514	686	229	457	343	400	123	0	280	0	0	0	0
1954	1,279	879	469	527	703	234	469	351	410	127	0	287	0	0	0	0
1955	1,310	900	480	540	720	240	480	360	420	130	0	294	0	0	0	0
1956	1,342	921	491	553	737	246	491	369	430	133	0	301	0	0	0	0
1957	1,373	943	503	566	754	251	503	377	440	136	0	308	0	0	0	0
1958	1,404	964	514	579	771	257	514	386	450	139	0	315	0	0	0	0
1959	1,435	986	526	591	789	263	526	394	460	142	0	322	1	0	0	0
1960	1,466	1,007	537	604	806	269	537	403	470	145	0	329	1	0	0	0
1961	1,498	1,029	549	617	823	274	549	411	480	148	0	336	1	0	0	0
1962	1,529	1,050	560	630	840	280	560	420	490	151	0	343	1	0	0	0
1963	1,560	1,071	571	643	857	286	571	429	500	154	0	350	1	0	0	0
1964	1,502	1,031	550	619	825	275	550	413	481	149	0	337	1	0	0	0
1965	1,736	1,193	636	716	954	318	636	477	557	172	0	390	1	0	0	0
1966	1,852	1,272	678	763	1,018	339	678	509	594	183	0	416	1	0	0	0
1967	1,997	1,371	731	823	1,097	366	731	549	640	197	0	448	1	0	0	0
1968	2,185	1,501	800	900	1,200	400	800	600	700	216	0	490	1	0	0	0
1969	2,460	1,689	901	1,014	1,352	451	901	676	788	243	0	552	1	0	0	0
1970	2,460	1,689	901	1,014	1,352	451	901	676	788	243	0	552	1	0	0	0
1971	2,460	1,689	901	1,014	1,352	451	901	676	788	243	0	552	1	0	0	0
1972	2,525	1,734	925	1,040	1,387	462	925	694	809	250	0	566	1	0	0	0
1973	2,590	1,779	949	1,067	1,423	474	949	711	830	256	0	581	1	0	0	0
1974	2,655	1,823	972	1,094	1,459	486	972	729	851	263	0	596	1	0	0	0
1975	2,720	1,868	996	1,121	1,494	498	996	747	872	269	0	610	1	0	0	0
1976	2,785	1,913	1,020	1,148	1,530	510	1,020	765	893	275	0	625	1	0	0	0
1977	2,785	1,913	1,020	1,148	1,530	510	1,020	765	893	275	0	625	1	0	0	0
1978	3,522	2,419	1,290	1,451	1,935	645	1,290	968	1,129	348	0	790	1	0	0	0
1979	3,093	2,124	1,133	1,274	1,699	566	1,133	850	991	306	0	694	1	0	0	0
1980	2,826	1,941	1,035	1,164	1,553	518	1,035	776	906	279	0	634	1	0	0	0
1981	3,525	2,192	983	1,270	1,204	742	886	976	895	349	0	588	2	0	0	0
1982	3,525	2,192	983	1,270	1,204	742	886	976	895	349	0	588	2	0	0	0
1983	3,702	2,112	775	1,182	654	860	594	1,030	745	366	0	449	4	0	0	0
1984	4,136	1,978	1,404	1,555	918	956	458	690	534	409	0	310	3	0	0	0
1985	6,368	2,514	2,911	2,723	1,676	1,466	419	419	406	628	0	209	4	0	0	0
1986	6,630	2,617	3,032	2,835	1,745	1,527	436	436	423	654	0	218	4	0	0	0
1987	8,444	3,333	3,861	3,611	2,222	1,944	556	556	538	833	0	278	6	0	0	0
1988	9,120	3,600	4,170	3,900	2,400	2,100	600	600	582	900	0	300	6	0	0	0
1989	9,120	3,600	4,170	3,900	2,400	2,100	600	600	582	900	0	300	6	0	0	0
1990	8,444	3,333	3,861	3,611	2,222	1,944	556	556	538	833	0	278	6	0	0	0
1991	8,444	3,333	3,861	3,611	2,222	1,944	556	556	538	833	0	278	6	0	0	0
1992	8,444	3,333	3,861	3,611	2,222	1,944	556	556	538	833	0	278	6	0	0	0
1993	9,120	3,600	4,170	3,900	2,400	2,100	600	600	582	900	0	300	6	0	0	0
1994	9,120	3,600	4,170	3,900	2,400	2,100	600	600	582	900	0	300	6	0	0	0
1995	2,787	1,841	2,133	1,824	843	671	327	310	290	2,598	0	516	688	0	0	45
1996	2,899	2,315	2,994	3,066	841	687	325	308	314	498	0	399	599	0	0	63
1997	3,579	2,322	2,837	2,718	1,088	776	368	348	333	563	0	451	877	0	0	107
1998	4,638	2,289	2,478	2,967	1,072	774	367	347	297	561	0	449	514	0	0	115
1999	3,481	2,898	3,243	3,491	1,148	1,120	325	489	542	887	0	482	545	0	0	158
2000	3,353	713	1,457	1,001	155	814	313	471	511	854	963	259	525	637	209	162
2001	3,673	581	1,591	1,159	378	321	343	516	526	935	1,022	324	575	641	508	171
2002	3,421	515	1,509	1,072	127	363	319	480	581	871	863	253	536	735	617	85
2003	3,258	915	1,525	800	168	702	304	457	59	830	904	246	510	1,297	255	483
2004	2,343	635	1,154	1,007	148	260	178	320	46	149	579	130	222	409	429	432
2005	2,467	770	1,428	993	235	406	194	471	42	277	794	184	237	543	695	601
2006	1,939	582	1,372	1,040	140	314	167	473	30	528	881	252	248	493	819	661
2007	2,454	796	1,598	1,260	174	400	234	667	57	684	952	193	247	441	782	766
2008	2,470	628	1,575	957	126	420	236	671	69	689	880	278	248	542	750	806
2009	2,486	598	1,503	1,039	173	336	237	675	54	693	1,024	235	250	519	866	876
2010	2,502	605	1,576	949	167	393	239	680	53	698	918	248	251	640	826	886

1: *Scomberomorus commerson*; 2: Carangidae; 3: Lethrinidae; 4: Serranidae; 5: Lutjanidae; 6: *Sphyraena* spp.; 7: *Valamugil seheli*; 8: Elasmobranchii; 9: Scombridae; 10: *Rastrelliger kanagurta*; 11: *Lethrinus lentjan*; 12: Scaridae; 13: *Siganus* spp.; 14: *Epinephelus tauvina*; 15: *Sphyraena barracuda*; 16: *Euthynnus affinis*

Table A1 continued

Year	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1950	0	0	5	0	0	0	0	5	4	4	0	0	0	0	0	208
1951	0	0	5	0	0	0	0	5	4	4	0	0	0	0	0	208
1952	0	0	5	0	0	0	0	5	4	4	0	0	0	0	0	208
1953	0	0	5	0	0	0	0	5	4	4	0	0	0	0	0	208
1954	0	0	6	0	0	0	0	5	4	4	0	0	0	0	0	211
1955	0	0	6	0	0	0	0	5	4	4	0	0	0	0	0	213
1956	0	0	6	0	0	0	0	5	5	4	0	0	0	0	0	216
1957	0	0	6	0	0	0	0	5	5	5	0	0	0	0	0	218
1958	0	0	6	0	0	0	0	5	5	5	0	0	0	0	0	221
1959	0	0	6	0	0	0	0	5	5	5	0	0	0	0	0	223
1960	0	0	6	0	0	0	0	5	5	5	0	0	0	0	0	226
1961	0	0	6	0	0	0	0	6	5	5	0	0	0	0	0	229
1962	0	0	7	0	0	0	0	6	5	5	0	0	0	0	0	231
1963	0	0	7	0	0	0	0	6	5	5	0	0	0	0	0	234
1964	0	0	6	0	0	0	0	6	5	5	0	0	0	0	0	229
1965	0	0	8	0	0	0	0	6	6	6	0	0	0	0	0	248
1966	0	0	8	0	0	0	0	7	6	6	0	0	0	0	0	257
1967	0	0	9	0	0	0	0	7	7	7	0	0	0	0	0	263
1968	0	0	9	0	0	0	0	8	7	7	0	0	0	0	0	272
1969	0	0	11	0	0	0	0	9	8	8	0	0	0	0	0	289
1970	0	0	11	0	0	0	0	9	8	8	0	0	0	0	0	283
1971	0	0	11	0	0	0	0	9	8	8	0	0	0	0	0	277
1972	0	0	11	0	0	0	0	9	9	8	0	0	0	0	0	276
1973	0	0	11	0	0	0	0	10	9	9	0	0	0	0	0	256
1974	0	0	11	0	0	0	0	10	9	9	0	0	0	0	0	266
1975	0	0	12	0	0	0	0	10	9	9	0	0	0	0	0	266
1976	0	0	12	0	0	0	0	10	10	9	0	0	0	0	0	250
1977	0	0	12	0	0	0	0	10	10	9	0	0	0	0	0	241
1978	0	0	15	0	0	0	0	13	12	12	0	0	0	0	0	301
1979	0	0	13	0	0	0	0	11	11	10	0	0	0	0	0	273
1980	0	0	12	0	0	0	0	10	10	9	0	0	0	0	0	258
1981	0	0	31	0	0	0	0	26	24	24	0	0	0	0	0	588
1982	0	0	31	0	0	0	0	26	24	24	0	0	0	0	0	595
1983	0	0	45	0	0	0	0	38	36	35	0	0	0	0	0	850
1984	0	0	44	0	0	0	0	38	35	34	0	0	0	0	0	852
1985	0	0	60	0	0	0	0	51	48	47	0	0	0	0	0	997
1986	0	0	63	0	0	0	0	53	50	49	0	0	0	0	0	1,038
1987	0	0	80	0	0	0	0	68	63	62	0	0	0	0	0	1,322
1988	0	0	86	0	0	0	0	73	68	67	0	0	0	0	0	1,428
1989	0	0	86	0	0	0	0	73	68	67	0	0	0	0	0	1,428
1990	0	0	80	0	0	0	0	68	63	62	0	0	0	0	0	1,322
1991	0	0	80	0	0	0	0	68	63	62	0	0	0	0	0	1,322
1992	0	0	80	0	0	0	0	68	63	62	0	0	0	0	0	1,322
1993	0	0	86	0	0	0	0	73	68	67	0	0	0	0	0	1,428
1994	0	0	86	0	0	0	0	73	68	67	0	0	0	0	0	1,428
1995	0	0	160	0	0	0	0	136	127	124	0	0	0	0	0	1,784
1996	0	0	106	0	0	0	0	90	84	82	0	0	0	0	0	1,452
1997	0	0	229	0	0	0	0	195	181	178	0	0	0	0	0	2,203
1998	0	0	161	0	0	0	0	137	127	125	0	0	0	0	0	1,975
1999	0	0	181	0	0	0	0	154	143	141	0	0	0	0	0	2,363
2000	473	364	175	214	184	379	588	149	138	135	297	241	203	251	174	4,626
2001	624	447	191	329	280	644	370	163	151	148	278	197	141	176	146	5,440
2002	556	13	178	393	429	234	507	152	141	138	327	187	181	254	235	5,140
2003	577	396	170	182	387	242	371	144	134	132	246	99	201	152	122	4,123
2004	428	487	127	245	297	171	341	97	91	76	189	156	182	132	94	3,158
2005	538	449	177	295	386	335	209	99	126	97	212	210	208	211	184	3,452
2006	518	518	162	205	379	265	212	59	109	110	247	275	232	257	270	3,817
2007	579	288	74	276	350	204	182	216	106	148	171	222	221	223	252	4,528
2008	452	389	151	441	410	351	241	129	119	117	161	269	184	216	245	4,653
2009	381	532	152	529	262	329	201	129	120	118	205	270	255	223	281	4,447
2010	501	451	153	536	227	308	227	130	121	119	231	272	334	225	282	4,379

17: *Decapterus russelli*; 18: *Atule mate*; 19: *Sargocentron spiniferum*; 20: *Carangoides bajad*; 21: *Gnathanodon speciosus*; 22: *Epinephelus multinotatus*; 23: *Lutjanus gibbus*; 24: *Netuma thalassina*; 25: *Tylosurus crocodilus crocodilus*; 26: Clupeidae; 27: *Lethrinus borbonicus*; 28: *Plectropomus areolatus*; 29: *Epinephelus areolatus*; 30: *Plectropomus pessuliferus*; 31: *Variola louti*; 32: Others

Appendix Table A2. Catch composition (in tonnes) of Saudi Arabia's subsistence fishery catch in the Red Sea by major taxa.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1950	374	257	137	154	206	69	137	120	84	37	0	0	0	0	0	0
1951	374	257	137	154	206	69	137	120	84	37	0	0	0	0	0	0
1952	374	257	137	154	206	69	137	120	84	37	0	0	0	0	0	0
1953	374	257	137	154	206	69	137	120	84	37	0	0	0	0	0	0
1954	384	264	141	158	211	70	141	123	86	38	0	0	0	0	0	0
1955	393	270	144	162	216	72	144	126	88	39	0	0	0	0	0	0
1956	402	276	147	166	221	74	147	129	90	40	0	0	0	0	0	0
1957	412	283	151	170	226	75	151	132	92	41	0	0	0	0	0	0
1958	421	289	154	174	231	77	154	135	95	42	0	0	0	0	0	0
1959	431	296	158	177	237	79	158	138	97	43	0	0	0	0	0	0
1960	440	302	161	181	242	81	161	141	99	44	0	0	0	0	0	0
1961	449	309	165	185	247	82	165	144	101	44	0	0	0	0	0	0
1962	459	315	168	189	252	84	168	147	103	45	0	0	0	0	0	0
1963	468	321	171	193	257	86	171	150	105	46	0	0	0	0	0	0
1964	300	206	110	124	165	55	110	96	67	30	0	0	0	0	0	0
1965	343	236	126	142	189	63	126	110	77	34	0	0	0	0	0	0
1966	362	249	133	149	199	66	133	116	81	36	0	0	0	0	0	0
1967	386	265	142	159	212	71	142	124	87	38	0	0	0	0	0	0
1968	418	287	153	172	230	77	153	134	94	41	0	0	0	0	0	0
1969	465	320	170	192	256	85	170	149	104	46	0	0	0	0	0	0
1970	460	316	168	190	253	84	168	147	103	45	0	0	0	0	0	0
1971	455	312	166	187	250	83	166	146	102	45	0	0	0	0	0	0
1972	461	317	169	190	253	84	169	148	103	46	0	0	0	0	0	0
1973	467	321	171	193	257	86	171	150	105	46	0	0	0	0	0	0
1974	473	325	173	195	260	87	173	152	106	47	0	0	0	0	0	0
1975	479	329	175	197	263	88	175	153	107	47	0	0	0	0	0	0
1976	484	333	177	200	266	89	177	155	109	48	0	0	0	0	0	0
1977	478	328	175	197	263	88	175	153	107	47	0	0	0	0	0	0
1978	597	410	219	246	328	109	219	191	134	59	0	0	0	0	0	0
1979	518	356	190	213	284	95	190	166	116	51	0	0	0	0	0	0
1980	467	321	171	192	257	86	171	150	105	46	0	0	0	0	0	0
1981	575	357	160	207	196	121	145	146	96	57	0	0	0	0	0	0
1982	567	353	158	204	194	119	143	144	95	56	0	0	0	0	0	0
1983	587	335	123	188	104	137	94	118	71	58	0	1	0	0	0	0
1984	647	310	220	243	144	150	72	84	48	64	0	1	0	0	0	0
1985	983	388	449	420	259	226	65	63	32	97	0	1	0	0	0	0
1986	1,009	398	461	431	266	232	66	64	33	100	0	1	0	0	0	0
1987	1,267	500	579	542	333	292	83	81	42	125	0	1	0	0	0	0
1988	1,348	532	616	577	355	310	89	86	44	133	0	1	0	0	0	0
1989	1,328	524	607	568	350	306	87	85	44	131	0	1	0	0	0	0
1990	1,212	478	554	518	319	279	80	77	40	120	0	1	0	0	0	0
1991	1,193	471	546	510	314	275	79	76	39	118	0	1	0	0	0	0
1992	1,175	464	537	502	309	271	77	75	39	116	0	1	0	0	0	0
1993	1,249	493	571	534	329	288	82	80	41	123	0	1	0	0	0	0
1994	1,229	485	562	526	323	283	81	78	40	121	0	1	0	0	0	0
1995	370	244	283	242	112	89	43	38	68	345	0	91	0	0	6	0
1996	378	302	391	400	110	90	42	41	52	65	0	78	0	0	8	0
1997	459	298	364	349	140	100	47	43	58	72	0	113	0	0	14	0
1998	585	289	312	374	135	98	46	37	57	71	0	65	0	0	14	0
1999	431	359	402	433	142	139	40	67	60	110	0	68	0	0	20	0
2000	408	87	177	122	19	99	38	62	32	104	117	64	78	25	20	58
2001	439	69	190	139	45	38	41	63	39	112	122	69	77	61	20	75
2002	402	60	177	126	15	43	37	68	30	102	101	63	86	72	10	65
2003	375	105	176	92	19	81	35	7	28	96	104	59	149	29	56	66
2004	265	72	130	114	17	29	20	5	15	17	65	25	46	48	49	48
2005	273	85	158	110	26	45	22	5	20	31	88	26	60	77	67	60
2006	211	63	149	113	15	34	18	3	27	57	96	27	54	89	72	56
2007	261	85	170	134	19	43	25	6	21	73	101	26	47	83	82	62
2008	258	66	164	100	13	44	25	7	29	72	92	26	57	78	84	47
2009	254	61	154	106	18	34	24	6	24	71	105	26	53	89	90	39
2010	250	61	158	95	17	39	24	5	25	70	92	25	64	83	89	50

1: *Scomberomorus commerson*; 2: Carangidae; 3: Lethrinidae; 4: Serranidae; 5: Lutjanidae; 6: *Sphyraena* spp.; 7: *Valamugil seheli*; 8: Scombridae; 9: Scaridae; 10: *Rastrelliger kanagurta*; 11: *Lethrinus lentjan*; 12: *Siganus* spp.; 13: *Epinephelus tauvina*; 14: *Sphyraena barracuda*; 15: *Euthynnus affinis;* 16*: Decapterus russelli*

Table A2 continued

Year	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1950	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1951	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1952	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1953	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1954	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1955	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	30
1956	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	31
1957	2	0	2	0	0	0	1	0	1	2	0	0	0	0	0	31
1958	2	0	2	0	0	0	1	0	1	2	0	0	0	0	0	32
1959	2	0	2	0	0	0	1	0	1	2	0	0	0	0	0	33
1960	2	0	2	0	0	0	2	0	1	2	0	0	0	0	0	34
1961	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	34
1962	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	35
1963	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	36
1964	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	23
1965	1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	26
1966	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	28
1967	2	0	1	0	0	0	1	0	1	2	0	0	0	0	0	29
1968	2	0	2	0	0	0	1	0	1	2	0	0	0	0	0	32
1969	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	36
1970	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	35
1971	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	35
1972	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	35
1973	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	36
1974	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	36
1975	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	37
1976	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	37
1977	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	37
1978	3	0	2	0	0	0	2	0	2	2	0	0	0	0	0	46
1979	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	40
1980	2	0	2	0	0	0	2	0	2	2	0	0	0	0	0	36
1981	5	0	4	0	0	0	4	0	4	5	0	0	0	0	0	84
1982	5	0	4	0	0	0	4	0	4	5	0	0	0	0	0	83
1983	7	0	6	0	0	0	6	0	6	7	0	0	0	0	0	119
1984	7	0	6	0	0	0	5	0	5	7	0	0	1	0	0	111
1985	9	0	8	0	0	0	7	0	7	9	0	0	3	0	0	141
1986	10	0	8	0	0	0	8	0	7	9	0	0	3	0	0	145
1987	12	0	10	0	0	0	9	0	9	12	0	0	4	0	0	182
1988	13	0	11	0	0	0	10	0	10	12	0	0	4	0	0	193
1989	13	0	11	0	0	0	10	0	10	12	0	0	4	0	0	190
1990	11	0	10	0	0	0	9	0	9	11	0	0	4	0	0	174
1991	11	0	10	0	0	0	9	0	9	11	0	0	4	0	0	171
1992	11	0	9	0	0	0	9	0	9	11	0	0	4	0	0	168
1993	12	0	10	0	0	0	9	0	9	11	0	0	4	0	0	179
1994	12	0	10	0	0	0	9	0	9	11	0	0	4	0	0	176
1995	21	0	18	0	0	0	17	0	16	20	0	0	18	0	0	196
1996	14	0	12	0	0	0	11	0	11	13	0	0	18	0	0	157
1997	29	0	25	0	0	0	23	0	23	28	0	0	20	0	0	232
1998	20	0	17	0	0	0	16	0	16	20	0	0	19	0	0	208
1999	22	0	19	0	0	0	18	0	17	22	0	0	17	0	0	252
2000	21	44	18	26	22	72	17	46	16	3	36	29	16	25	31	564
2001	23	53	19	39	34	44	18	77	18	0	33	23	17	17	21	649
2002	21	2	18	46	50	60	17	27	16	8	38	22	16	21	30	606
2003	20	46	17	21	45	43	15	28	15	2	28	11	15	23	18	470
2004	14	55	11	28	34	39	10	19	9	0	21	18	10	21	15	357
2005	20	50	11	33	43	23	14	37	11	0	23	23	9	23	23	394
2006	18	56	6	22	41	23	12	29	12	0	27	30	8	25	28	434
2007	8	31	23	29	37	19	11	22	16	1	18	24	9	24	24	497
2008	16	41	13	46	43	25	12	37	12	1	17	28	8	19	23	501
2009	16	54	13	54	27	21	12	34	12	1	21	28	8	26	23	473
2010	15	45	13	54	23	23	12	31	12	1	23	27	8	33	22	456

17: *Sargocentron spiniferum*; 18: *Atule mate*; 19: *Netuma thalassina*; 20: *Carangoides bajad*; 21: *Gnathanodon speciosus*; 22: *Lutjanus gibbus*; 23: *Tylosurus crocodilus crocodilus*; 24: *Epinephelus multinotatus*; 25: Clupeidae; 26: *Gerres* spp.; 27: *Lethrinus borbonicus*; 28: *Plectropomus areolatus*; 29: Labridae; 30: *Epinephelus areolatus*; 31: *Plectropomus pessuliferus*; 32: Others

Appendix Table A3. Sources and methods for the reconstruction of shrimp (in tonnes) of the Saudi Arabian trawl fishery in the Red Sea.

Year	Total (t)	Shrimp (t)	%	Source/Remark
1982	1169	466	40	Sanders and Morgan (1989)
1983	1927	455	24	Interpolation
1984	2684	528	20	Interpolation
1985	3442	516	15	Interpolation
1986	4200	517	12	Interpolation
1987	4957	412	8	MAW (2007)
1988	4079	820	20	MAW (2007)
1989	5274	468	9	MAW (2007)
1990	4610	521	11	MAW (2007)
1991	5591	1060	19	MAW (2007)
1992	5995	547	9	MAW (2007)
1993	5929	574	10	MAW (2007)
1994	6824	1280	19	MAW (2007)
1995	7356	2105	29	MAW (2007)
1996	7098	1717	24	MAW (2007)
1997	8411	1803	21	MAW (2007)
1998	7417	1515	20	MAW (2007)
1999	7382	1235	17	MAW (2007)
2000	7348	878	12	MAW (2007)
2001	7313	833	11	MAW (2007)
2002	7278	979	13	MAW (2007)
2003	7244	1060	15	MAW (2007)
2004	7209	660	9	MAW (2007)
2005	7535	961	13	MAW (2007)
2006	7618	922	12	MAW (2007)
2007	8942	949	11	MAW (2007)
2008	8971	952	11	2007 % value
2009	9000	955	11	2007 % value
2010	9029	958	11	2007 % value

Appendix Table A4. Composition (in tonnes) of the retained industrial fishery catch of Saudi Arabia in the Red Sea by major taxa.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	172	466	130	47	63	0	30	33	21	21	20	23	8	17	15	16
1983	359	455	272	93	131	0	62	69	44	43	41	47	21	36	32	34
1984	526	528	398	139	193	0	91	101	64	64	60	69	28	53	47	50
1985	714	516	540	191	261	0	123	137	87	86	82	94	35	73	64	68
1986	899	517	680	285	329	0	155	173	110	109	103	118	0	91	81	85
1987	1,109	412	839	352	406	0	191	213	136	134	127	146	0	113	99	105
1988	795	820	601	252	291	0	137	153	97	96	91	105	0	81	71	75
1989	1,173	468	887	372	429	0	202	226	144	142	135	154	0	119	105	111
1990	998	521	755	316	365	0	172	192	122	121	115	131	0	101	90	94
1991	1,106	1,060	836	351	405	0	190	213	135	134	127	145	0	112	99	105
1992	1,329	547	1,005	422	486	0	229	256	163	161	153	175	0	135	119	126
1993	1,307	574	988	414	478	0	225	251	160	158	150	172	0	133	117	124
1994	1,353	1,280	1,023	429	495	0	233	260	166	164	155	178	0	137	121	128
1995	1,282	2,105	969	406	469	0	221	247	157	155	147	169	0	130	115	121
1996	1,313	1,717	993	416	480	0	226	253	161	159	151	173	0	133	118	124
1997	1,613	1,803	1,217	511	590	0	278	310	197	195	185	212	0	164	145	153
1998	1,810	1,515	786	512	472	0	241	269	171	170	161	184	0	142	126	132
1999	2,338	1,235	543	602	367	0	212	222	138	173	166	109	0	122	154	111
2000	2,461	83	146	312	180	721	223	177	145	182	175	18	322	1	22	0
2001	2,465	103	109	345	180	636	223	64	145	183	175	68	290	47	0	0
2002	2,396	5	101	397	178	896	217	75	141	178	170	0	220	1	59	0
2003	2,352	39	185	476	185	801	213	150	138	174	167	0	130	6	20	0
2004	2,974	5	77	461	140	596	184	59	103	181	175	0	255	6	3	0
2005	2,754	11	101	583	246	855	305	109	108	213	126	86	225	14	0	0
2006	2,750	1	115	514	225	801	239	76	185	119	130	0	79	6	0	0
2007	3,465	5	199	555	247	847	260	95	306	182	228	0	175	6	3	0
2008	3,476	2	156	622	243	824	261	100	307	183	229	0	110	7	5	0
2009	3,487	44	148	615	231	860	262	80	308	183	229	0	120	7	6	0
2010	3,499	3	150	587	241	718	263	93	309	184	230	0	150	17	5	0

1: *Rastrelliger kanagurta*; 2: Penaeidae; 3: Carangidae; 4: Sepiidae; 5: Lethrinidae; 6: *Penaeus semisulcatus*; 7: Brachyura; 8: Sphyraena; 9: *Netuma thalassina*; 10: *Scomberomorus commerson*; 11: Synodontidae; 12: Nemipteridae; 13: Teuthida; 14: Haemulidae; 15: *Gerres* spp.; 16: *Scomberoides* spp.

Table A4 continued

Year	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	7	0	0	0	0	8	5	0	7	0	4	4	0	54
1983	0	0	15	0	0	0	0	17	10	0	15	0	9	8	0	113
1984	0	0	22	0	0	0	0	25	14	0	22	0	13	11	0	165
1985	0	0	30	0	0	0	0	33	19	0	30	0	17	15	0	225
1986	0	0	38	0	0	0	0	42	24	0	37	0	22	19	0	283
1987	0	0	47	0	0	0	0	52	30	0	46	0	27	24	0	349
1988	0	0	34	0	0	0	0	37	21	0	33	0	19	17	0	250
1989	0	0	50	0	0	0	0	55	31	0	49	0	29	25	0	369
1990	0	0	42	0	0	0	0	47	27	0	42	0	24	21	0	314
1991	0	0	47	0	0	0	0	52	29	0	46	0	27	24	0	348
1992	0	0	57	0	0	0	0	62	35	0	55	0	32	29	0	418
1993	0	0	56	0	0	0	0	61	35	0	54	0	32	28	0	411
1994	0	0	58	0	0	0	0	63	36	0	56	0	33	29	0	425
1995	0	0	55	0	0	0	0	41	34	0	53	0	31	27	0	422
1996	0	0	56	0	0	0	0	46	35	0	55	0	32	28	0	429
1997	0	0	69	0	0	0	0	53	43	0	67	0	39	35	0	532
1998	0	0	60	0	0	0	0	41	37	0	58	0	34	30	0	465
1999	0	0	73	0	0	0	0	56	46	0	71	0	42	37	0	565
2000	97	45	77	119	74	113	97	57	48	66	11	75	44	39	44	1,175
2001	47	101	77	116	93	119	117	54	48	107	23	84	44	39	62	1,150
2002	105	128	75	102	78	87	109	62	47	44	8	3	43	38	77	1,240
2003	93	54	73	110	220	105	116	7	46	8	11	80	42	37	37	1,166
2004	24	97	53	70	59	60	52	8	30	70	2	59	24	44	30	1,307
2005	107	186	50	137	95	103	71	3	22	72	21	59	23	6	39	804
2006	300	199	60	144	120	178	103	2	47	139	5	103	40	38	41	859
2007	230	186	66	147	97	94	144	3	45	108	14	72	43	38	69	1,012
2008	233	178	57	135	126	104	112	4	35	113	7	97	32	29	110	1,074
2009	234	205	57	157	52	102	94	3	36	106	10	132	33	29	131	1,042
2010	234	195	57	140	238	103	124	3	36	90	9	112	33	29	132	1,046

17: *Scolopsis taeniata*; 18: *Sphyraena barracuda*; 19: *Bothus pantherinus; 20: Lethrinus lentjan; 21: Metapenaeus monoceros; 22: Gerres oyena*; 23: *Decapterus russelli*; 24: Scombridae; 25: *Mulloidichthys flavolineatus*; 26: *Scomberoides commersonnianus*; 27: Lutjanidae; 28: *Atule mate; 29:* Elasmobranchii; 30: Caesionidae; 31: *Carangoides bajad*; 32: Others

Appendix Table A5. Composition of the discarded industrial fishery catch (in tonnes) of Saudi Arabia in the Red Sea.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
1950	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	1,710	193	110	110	55	55	55	55	55	28	28	28	221
1983	1,670	189	108	108	54	54	54	54	54	27	27	27	216
1984	1,938	219	125	125	63	63	63	63	63	31	31	31	250
1985	1,894	214	122	122	61	61	61	61	61	31	31	31	244
1986	1,897	214	122	122	61	61	61	61	61	31	31	31	245
1987	1,512	171	98	98	49	49	49	49	49	24	24	24	195
1988	3,009	340	194	194	97	97	97	97	97	49	49	49	388
1989	1,717	194	111	111	55	55	55	55	55	28	28	28	222
1990	1,912	216	123	123	62	62	62	62	62	31	31	31	247
1991	3,890	439	251	251	125	125	125	125	125	63	63	63	502
1992	2,007	227	129	129	65	65	65	65	65	32	32	32	259
1993	2,106	238	136	136	68	68	68	68	68	34	34	34	272
1994	4,697	530	303	303	152	152	152	152	152	76	76	76	606
1995	7,724	872	498	498	249	249	249	249	249	125	125	125	997
1996	6,300	711	406	406	203	203	203	203	203	102	102	102	813
1997	6,616	747	427	427	213	213	213	213	213	107	107	107	854
1998	5,559	628	359	359	179	179	179	179	179	90	90	90	717
1999	4,532	512	292	292	146	146	146	146	146	73	73	73	585
2000	3,222	364	208	208	104	104	104	104	104	52	52	52	416
2001	3,057	345	197	197	99	99	99	99	99	49	49	49	394
2002	3,592	406	232	232	116	116	116	116	116	58	58	58	464
2003	3,890	439	251	251	125	125	125	125	125	63	63	63	502
2004	2,422	273	156	156	78	78	78	78	78	39	39	39	312
2005	3,526	398	228	228	114	114	114	114	114	57	57	57	455
2006	3,383	382	218	218	109	109	109	109	109	55	55	55	437
2007	3,482	393	225	225	112	112	112	112	112	56	56	56	449
2008	3,494	394	225	225	113	113	113	113	113	56	56	56	451
2009	3,505	396	226	226	113	113	113	113	113	57	57	57	452
2010	3,516	397	227	227	113	113	113	113	113	57	57	57	454

1: Leiognathidae; 2: *Terapon* spp.; 3: *Gerres* spp.; 4: Trichiuridae; 5: Platycephalidae; 6: Tetraodontidae; 7: Soleidae; 8: Bramidae; 9: Brachyura; 10: Clupeidae; 11: Mullidae; 12: Squillidae; 13: Others

Appendix Table A6: Catch composition (in tonnes) of Saudi Arabia's recreational fishery in the Red Sea.

Year	Lethrinidae	Sparidae	Serranidae	Others
1970	21	16	10	5
1971	41	31	21	10
1972	62	47	31	16
1973	83	62	41	21
1974	103	78	52	26
1975	124	93	62	31
1976	145	109	72	36
1977	166	124	83	41
1978	186	140	93	47
1979	207	155	103	52
1980	228	171	114	57
1981	248	186	124	62
1982	269	202	134	67
1983	290	217	145	72
1984	310	233	155	78
1985	331	248	166	83
1986	352	264	176	88
1987	372	279	186	93
1988	393	295	197	98
1989	414	310	207	103
1990	434	326	217	109
1991	455	341	228	114
1992	476	357	238	119
1993	497	372	248	124
1994	517	388	259	129
1995	538	403	269	134
1996	559	419	279	140
1997	579	434	290	145
1998	600	450	300	150
1999	610	458	305	153
2000	625	468	312	156
2001	644	483	322	161
2002	669	502	334	167
2003	696	522	348	174
2004	723	542	362	181
2005	749	562	375	187
2006	773	580	386	193
2007	795	596	397	199
2008	815	611	408	204
2009	835	626	418	209
2010	855	641	428	214

Appendix Table A7: Reconstructed catch (in tonnes) of Saudi Arabia in the Red Sea by sectors and its comparison to the data reported by FAO on behalf of Saudi Arabia.

Year	FAO landings	Reconstructed total catch	Industrial	Artisanal	Subsistence	Recreational	Discards
1950	1,582	7,433	0	5,821	1,611	0	0
1951	1,582	7,433	0	5,821	1,611	0	0
1952	2,637	7,433	0	5,821	1,611	0	0
1953	2,110	7,433	0	5,821	1,611	0	0
1954	2,637	7,616	0	5,964	1,652	0	0
1955	2,637	7,799	0	6,107	1,692	0	0
1956	2,901	7,982	0	6,250	1,732	0	0
1957	4,219	8,165	0	6,393	1,772	0	0
1958	4,219	8,348	0	6,536	1,813	0	0
1959	5,274	8,532	0	6,679	1,853	0	0
1960	5,274	8,715	0	6,821	1,893	0	0
1961	6,320	8,898	0	6,964	1,934	0	0
1962	6,451	9,081	0	7,107	1,974	0	0
1963	6,583	9,264	0	7,250	2,014	0	0
1964	6,336	8,275	0	6,982	1,292	0	0
1965	7,327	9,535	0	8,057	1,478	0	0
1966	7,816	10,147	0	8,587	1,559	0	0
1967	8,426	10,906	0	9,244	1,663	0	0
1968	9,220	11,898	0	10,099	1,799	0	0
1969	10,380	13,354	0	11,352	2,002	0	0
1970	10,380	13,377	0	11,346	1,979	52	0
1971	10,380	13,399	0	11,340	1,956	103	0
1972	10,654	13,771	0	11,631	1,984	155	0
1973	10,928	14,122	0	11,904	2,011	207	0
1974	11,203	14,502	0	12,206	2,037	259	0
1975	12,130	14,869	0	12,498	2,061	310	0
1976	12,288	15,221	0	12,775	2,084	362	0
1977	12,025	15,237	0	12,765	2,058	414	0
1978	13,158	19,176	0	16,141	2,570	466	0
1979	12,900	16,928	0	14,182	2,228	517	0
1980	11,924	15,545	0	12,967	2,009	569	0
1981	13,150	17,092	0	14,304	2,167	621	0
1982	14,228	20,993	1,169	14,311	2,138	672	2,703
1983	14,151	20,735	1,927	13,478	1,967	724	2,640
1984	15,624	23,004	2,684	14,356	2,125	776	3,063
1985	22,477	31,376	3,442	20,946	3,168	828	2,994
1986	23,972	33,141	4,200	21,811	3,252	879	2,999
1987	31,549	40,138	4,957	27,778	4,082	931	2,390
1988	31,064	44,163	4,079	30,000	4,345	983	4,756
1989	32,291	43,304	5,274	30,000	4,281	1,034	2,714
1990	29,368	40,401	4,610	27,778	3,905	1,086	3,022
1991	30,044	44,500	5,591	27,778	3,846	1,138	6,148
1992	31,279	41,921	5,995	27,778	3,787	1,190	3,173
1993	33,219	44,525	5,929	30,000	4,026	1,241	3,329
1994	34,147	49,503	6,824	30,000	3,962	1,293	7,424
1995	24,561	40,353	7,356	17,204	2,239	1,345	12,209
1996	24,219	37,766	7,098	17,121	2,192	1,397	9,959
1997	26,230	42,108	8,411	19,356	2,435	1,448	10,457
1998	25,088	39,500	7,417	19,396	2,400	1,500	8,787
1999	22,142	40,500	7,382	21,792	2,638	1,525	7,163
2000	22,445	37,485	7,348	20,988	2,496	1,561	5,092
2001	24,130	39,431	7,313	22,991	2,685	1,611	4,831
2002	23,988	38,497	7,278	21,413	2,456	1,672	5,678
2003	21,859	37,820	7,244	20,393	2,295	1,740	6,148
2004	20,422	29,180	7,209	14,709	1,626	1,808	3,828
2005	23,315	34,396	7,535	17,524	1,890	1,873	5,574
2006	23,440	34,329	7,618	17,574	1,857	1,932	5,348
2007	26,495	38,206	8,942	19,744	2,029	1,987	5,504
2008	27,634	38,406	8,971	19,872	2,002	2,038	5,522
2009	27,207	38,601	9,000	20,000	1,973	2,088	5,540
2010	26,257	38,796	9,029	20,128	1,944	2,138	5,558

Appendix Table A8. Reconstructed catch (in tonnes) of Saudi Arabia in the Red Sea by components.

Year	Reported	Unreported	Discards
1950	1,056	6,377	0
1951	1,056	6,377	0
1952	1,861	5,572	0
1953	1,894	5,539	0
1954	1,891	5,725	0
1955	1,921	5,878	0
1956	2,056	5,926	0
1957	1,901	6,264	0
1958	1,932	6,417	0
1959	1,918	6,614	0
1960	1,949	6,766	0
1961	2,295	6,603	0
1962	2,343	6,738	0
1963	2,391	6,873	0
1964	2,301	5,973	0
1965	2,661	6,874	0
1966	2,838	7,308	0
1967	3,060	7,846	0
1968	3,348	8,549	0
1969	3,770	9,584	0
1970	3,770	9,607	0
1971	3,770	9,630	0
1972	3,869	9,901	0
1973	3,969	10,153	0
1974	4,069	10,433	0
1975	4,168	10,701	0
1976	4,268	10,953	0
1977	4,268	10,970	0
1978	5,397	13,779	0
1979	4,740	12,188	0
1980	4,330	11,214	0
1981	8,095	8,997	0
1982	9,042	9,248	2,703
1983	9,438	8,657	2,640
1984	10,545	9,396	3,063
1985	19,588	8,795	2,994
1986	23,212	6,929	2,999
1987	27,974	9,775	2,390
1988	28,460	10,947	4,756
1989	29,958	10,632	2,714
1990	26,899	10,480	3,022
1991	27,758	10,594	6,148
1992	28,313	10,435	3,173
1993	30,522	10,673	3,329
1994	31,803	10,275	7,424
1995	21,839	6,305	12,209
1996	21,959	5,848	9,959
1997	23,819	7,831	10,457
1998	23,249	7,464	8,787
1999	24,015	9,322	7,163
2000	22,631	9,761	5,092
2001	25,516	9,084	4,831
2002	24,561	8,258	5,678
2003	23,440	8,232	6,148
2004	19,847	5,506	3,828
2005	22,519	6,303	5,574
2006	22,504	6,478	5,348
2007	25,576	7,126	5,504
2008	24,332	8,552	5,522
2009	24,840	8,221	5,540
2010	24,085	9,153	5,558

Appendix Table A9. Composition of the total catch (in tonnes) of Saudi Arabia's fisheries in the Red Sea by major taxa.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1950	1,622	594	1,114	669	0	160	891	297	594	520	343	364	0	1	0	0
1951	1,622	594	1,114	669	0	160	891	297	594	520	343	364	0	1	0	0
1952	1,622	594	1,114	669	0	160	891	297	594	520	343	364	0	1	0	0
1953	1,622	594	1,114	669	0	160	891	297	594	520	343	364	0	1	0	0
1954	1,663	609	1,142	685	0	164	914	305	609	533	351	373	0	1	0	0
1955	1,704	624	1,170	702	0	168	936	312	624	546	360	382	0	1	0	0
1956	1,744	639	1,198	719	0	172	958	319	639	559	369	391	0	1	0	0
1957	1,785	654	1,226	735	0	177	981	327	654	572	377	400	0	1	0	0
1958	1,825	669	1,254	752	0	181	1,003	334	669	585	386	410	0	1	0	0
1959	1,866	683	1,281	769	0	185	1,025	342	683	598	394	419	0	1	0	0
1960	1,906	698	1,309	786	0	189	1,047	349	698	611	403	428	0	1	0	0
1961	1,947	713	1,337	802	0	193	1,070	357	713	624	411	437	0	1	0	0
1962	1,987	728	1,365	819	0	197	1,092	364	728	637	420	446	0	1	0	0
1963	2,028	743	1,393	836	0	201	1,114	371	743	650	429	455	0	1	0	0
1964	1,802	660	1,238	743	0	178	990	330	660	578	413	404	0	1	0	0
1965	2,080	762	1,428	857	0	206	1,143	381	762	667	477	467	0	1	0	0
1966	2,214	811	1,521	913	0	219	1,217	406	811	710	509	497	0	1	0	1
1967	2,383	873	1,637	982	0	236	1,309	436	873	764	549	535	0	1	0	1
1968	2,603	953	1,788	1,073	0	257	1,430	477	953	834	600	584	0	1	0	1
1969	2,925	1,071	2,009	1,205	0	289	1,607	536	1,071	937	676	656	0	2	0	1
1970	2,920	1,090	2,005	1,213	0	289	1,604	535	1,069	936	676	655	0	17	0	1
1971	2,914	1,109	2,002	1,222	0	288	1,601	534	1,067	934	676	654	0	33	0	1
1972	2,986	1,156	2,051	1,261	0	295	1,641	547	1,094	957	694	670	0	48	0	1
1973	3,057	1,203	2,100	1,301	0	302	1,680	560	1,120	980	711	686	0	64	0	1
1974	3,128	1,249	2,148	1,341	0	309	1,719	573	1,146	1,003	729	702	0	79	0	1
1975	3,199	1,296	2,197	1,380	0	316	1,757	586	1,172	1,025	747	718	0	95	0	1
1976	3,269	1,342	2,245	1,419	0	323	1,796	599	1,197	1,048	765	733	0	110	0	1
1977	3,263	1,361	2,241	1,427	0	323	1,793	598	1,195	1,046	765	732	0	126	0	1
1978	4,119	1,695	2,829	1,790	0	407	2,263	754	1,509	1,320	968	924	0	142	0	1
1979	3,610	1,529	2,480	1,591	0	357	1,984	661	1,322	1,157	850	810	0	157	0	1
1980	3,292	1,434	2,261	1,471	0	326	1,809	603	1,206	1,055	776	739	0	172	0	1
1981	4,100	1,391	2,550	1,601	0	405	1,400	864	1,031	1,041	976	684	0	187	0	2
1982	4,113	1,472	2,675	1,614	1,710	576	1,404	895	1,029	1,047	980	684	466	209	0	197
1983	4,333	1,319	2,719	1,525	1,670	783	773	1,066	688	880	1,039	523	455	231	0	195
1984	4,847	2,126	2,686	1,970	1,938	999	1,084	1,207	530	643	703	363	528	256	0	228
1985	7,437	3,953	3,441	3,330	1,894	1,439	1,964	1,830	484	502	436	248	516	283	0	226
1986	7,748	4,174	3,695	3,470	1,897	1,653	2,048	1,932	503	529	458	259	517	306	0	228
1987	9,845	5,219	4,672	4,372	1,512	2,068	2,602	2,450	639	671	583	330	412	332	0	188
1988	10,565	5,471	4,734	4,697	3,009	1,828	2,788	2,563	689	705	619	352	820	336	0	354
1989	10,590	5,620	5,011	4,710	1,717	2,204	2,798	2,632	687	721	629	354	468	366	0	213
1990	9,777	5,215	4,566	4,377	1,912	1,951	2,583	2,415	635	662	580	327	521	374	0	232
1991	9,772	5,266	4,640	4,382	3,890	2,057	2,582	2,432	634	666	583	327	1,060	394	0	457
1992	9,780	5,361	4,802	4,392	2,007	2,279	2,587	2,471	633	676	588	329	547	418	0	247
1993	10,527	5,716	5,081	4,722	2,106	2,330	2,783	2,639	682	722	632	353	574	433	0	258
1994	10,513	5,744	5,108	4,725	4,697	2,374	2,780	2,643	681	723	633	353	1,280	451	0	551
1995	3,312	3,423	3,054	2,373	7,724	4,224	1,008	1,007	370	369	341	596	2,105	687	0	896
1996	3,436	4,424	3,610	3,785	6,300	1,876	1,005	1,029	368	401	340	463	1,717	702	0	733
1997	4,233	4,370	3,837	3,405	6,616	2,248	1,295	1,186	415	429	388	523	1,803	759	0	779
1998	5,393	3,863	3,364	3,684	5,559	2,442	1,266	1,140	413	376	381	519	1,515	765	0	653
1999	4,086	4,622	3,800	4,280	4,532	3,335	1,361	1,481	365	665	531	557	1,235	787	0	542
2000	3,943	2,439	947	1,451	3,222	3,419	184	1,089	351	630	515	300	83	483	1,200	395
2001	4,295	2,606	759	1,637	3,057	3,512	446	424	384	643	560	374	103	508	1,260	377
2002	4,000	2,533	676	1,549	3,592	3,370	150	481	357	711	523	291	5	503	1,066	436
2003	3,807	2,582	1,205	1,253	3,890	3,278	199	933	339	73	500	283	39	537	1,118	469
2004	2,789	2,148	784	1,489	2,422	3,140	167	349	198	59	344	146	5	557	715	281
2005	2,953	2,582	956	1,498	3,526	3,061	282	560	216	50	494	219	11	564	1,019	455
2006	2,269	2,519	761	1,547	3,383	3,335	160	425	185	35	513	284	1	583	1,121	393
2007	2,898	2,809	1,080	1,807	3,482	4,222	207	538	259	65	710	217	5	596	1,200	399
2008	2,911	2,797	850	1,475	3,494	4,237	147	563	261	80	703	316	2	615	1,107	419
2009	2,923	2,722	807	1,574	3,505	4,252	201	450	262	63	708	266	44	630	1,286	420
2010	2,936	2,830	816	1,483	3,516	4,266	193	525	263	61	712	280	3	645	1,150	421

1: *Scomberomorus commerson*; 2: Lethrinidae; 3: Carangidae; 4: Serranidae; 5: Leiognathidae; 6: *Rastrelliger kanagurta*; 7: Lutjanidae; 8: *Sphyraena* spp.; 9: *Valamugil seheli*; 10: Scombridae; 11: Elasmobranchii; 12: Scaridae; 13: Penaeidae; 14: Sparidae; 15: *Lethrinus lentjan*; 16: *Terapon* spp.

Table A9 continued

Year	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1950	0	7	0	0	0	1	6	0	0	0	0	0	5	0	0	243
1951	0	7	0	0	0	1	6	0	0	0	0	0	5	0	0	243
1952	0	7	0	0	0	1	6	0	0	0	0	0	5	0	0	243
1953	0	7	0	0	0	1	6	0	0	0	0	0	5	0	0	243
1954	0	7	0	0	0	1	6	0	0	0	0	0	6	0	0	247
1955	0	7	0	0	0	1	6	0	0	0	0	0	6	0	0	250
1956	0	7	0	0	0	1	6	0	0	0	0	0	6	0	0	254
1957	0	7	0	0	0	1	7	0	0	0	0	0	6	0	0	257
1958	0	8	0	0	0	1	7	0	0	0	0	0	6	0	0	260
1959	0	8	0	0	0	1	7	0	0	0	0	0	6	0	0	264
1960	0	8	0	0	0	1	7	0	0	0	0	0	6	0	0	267
1961	0	8	0	0	0	1	7	0	0	0	0	0	7	0	0	271
1962	0	8	0	0	0	1	7	0	0	0	0	0	7	0	0	274
1963	0	8	0	0	0	1	7	0	0	0	0	0	7	0	0	277
1964	0	7	0	0	0	1	7	0	0	0	0	0	6	0	0	258
1965	0	9	0	0	0	1	8	0	0	0	0	0	7	0	0	282
1966	0	9	0	0	0	1	8	0	0	0	0	0	7	0	0	293
1967	0	10	0	0	0	1	9	0	0	0	0	0	8	0	0	301
1968	0	11	0	0	0	1	10	0	0	0	0	0	9	0	0	314
1969	0	12	0	0	0	1	11	0	0	0	0	0	10	0	0	335
1970	0	12	0	0	0	1	11	0	0	0	0	0	10	0	0	334
1971	0	12	0	0	0	1	11	0	0	0	0	0	10	0	0	332
1972	0	12	0	0	0	1	11	0	0	0	0	0	10	0	0	337
1973	0	13	0	0	0	1	11	0	0	0	0	0	10	0	0	324
1974	0	13	0	0	0	1	12	0	0	0	0	0	10	0	0	340
1975	0	13	0	0	0	1	12	0	0	0	0	0	11	0	0	345
1976	0	14	0	0	0	1	12	0	0	0	0	0	11	0	0	335
1977	0	14	0	0	0	1	12	0	0	0	0	0	11	0	0	331
1978	0	17	0	0	0	1	15	0	0	0	0	0	14	0	0	408
1979	0	15	0	0	0	1	13	0	0	0	0	0	12	0	0	377
1980	0	14	0	0	0	1	12	0	0	0	0	0	11	0	0	363
1981	0	34	1	0	0	3	30	0	0	0	0	0	28	0	0	767
1982	47	160	85	0	0	5	51	0	0	0	110	0	58	0	0	1,409
1983	93	190	117	0	0	9	88	0	0	0	108	0	72	0	0	1,864
1984	139	222	154	0	0	11	108	0	0	0	125	0	78	0	0	2,069
1985	191	253	185	0	0	15	147	0	0	0	122	0	94	0	0	2,397
1986	285	272	217	0	0	17	171	0	0	0	122	0	99	0	0	2,552
1987	352	285	242	0	0	22	214	0	0	0	98	0	111	0	0	2,940
1988	252	361	236	0	0	18	182	0	0	0	194	0	136	0	0	3,270
1989	372	311	259	0	0	23	228	0	0	0	111	0	120	0	0	3,177
1990	317	301	235	0	0	20	200	0	0	0	123	0	115	0	0	2,980
1991	351	438	318	0	0	22	213	0	0	0	251	0	148	0	0	3,636
1992	422	336	295	0	0	25	240	0	0	0	129	0	121	0	0	3,258
1993	414	347	295	0	0	25	243	0	0	0	136	0	128	0	0	3,397
1994	429	518	386	0	0	25	249	0	0	0	303	0	170	0	0	4,186
1995	407	788	473	0	0	797	311	0	58	0	498	0	283	0	0	5,272
1996	417	639	432	0	0	695	262	0	80	0	406	0	212	0	0	4,455
1997	512	820	496	0	0	1,012	418	0	138	0	427	0	329	0	0	5,701
1998	512	659	424	0	0	598	326	0	145	0	359	0	249	0	0	4,921
1999	603	642	362	0	0	636	311	0	194	0	292	0	254	0	0	5,055
2000	312	256	331	280	721	614	311	725	200	628	208	484	228	283	244	11,041
2001	345	197	326	670	636	669	327	728	209	815	197	585	240	430	367	11,779
2002	397	363	337	817	896	623	310	832	104	731	232	18	236	516	563	11,310
2003	476	295	342	339	801	593	299	1,467	592	760	251	522	233	240	509	9,627
2004	461	163	264	575	596	272	211	458	554	528	156	601	136	303	366	7,952
2005	583	228	422	958	855	263	218	614	710	668	228	558	181	367	480	8,675
2006	515	218	351	1,108	801	305	250	551	774	677	218	677	195	268	495	9,424
2007	555	234	376	1,052	847	298	545	494	884	785	225	390	243	375	475	9,942
2008	622	236	377	1,006	824	292	449	605	938	612	225	527	204	597	555	10,386
2009	615	239	378	1,160	860	294	451	578	1,017	514	226	719	204	714	354	10,189
2010	588	239	379	1,104	718	295	452	711	1,027	675	227	608	205	721	306	10,464

17: Sepiidae; 18: *Gerres* spp.; 19: Brachyura; 20: *Sphyraena barracuda*; 21: *Penaeus semisulcatus*; 22: *Siganus* spp.; 23: *Netuma thalassina*; 24: *Epinephelus tauvina;* 25: *Euthynnus affinis*; 26: *Decapterus russelli*; 27: Trichiuridae; 28: *Atule mate*; 29: Clupeidae; 30: *Carangoides bajad*; 31: *Gnathanodon speciosus*; 32: Others