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RECONSTRUCTION OF MARINE FISHERIES CATCHES FOR OMAN (1950-2010)

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ABSTRACT

Total marine fisheries catches by Oman were estimated from 1950 to 2010, including large-scale and small-scale commercial catches, subsistence, and recreational catches, as well as major discards. Reconstructed total catches increased from around 53,600 t·year^{-1} in the 1950s to almost 200,000 t·year^{-1} in the 2000s. This estimated catch is 1.3 times the landings reported by the FAO on behalf of Oman. The reconstruction of catches of the governorate of Musandam, i.e., in the north of Oman, was presented separately because of its geographical separation from the rest of the country. Estimates of subsistence catches were obtained by applying a *per capita* subsistence catch rate to the rural coastal population of Oman. Recreational catches were estimated based on the recreational fishing participation rate of Oman estimated by Cisneros-Montemayor and Sumaila (2010). The unreported commercial catches in this reconstruction refer only to spiny lobster (*Panulirus homarus*). Fisheries management in Oman seems to be well developed and the government is investing a lot of resources and effort to improve the status of fisheries, which is justified by the fact that the fishery sector represents the second most important economic sector for the country after oil.

INTRODUCTION

The Sultanate of Oman, whose capital city is Muscat, is an Arab country situated in the south east of the Arabian Peninsula, with an area of around 300,000 km^2. It is bordered by the United Arab Emirates (UAE) in the northwest, Saudi Arabia to the west, Yemen in the south, with the Arabian Sea to the southeast and the Gulf of Oman to the northeast (Figure 1). Oman is divided into 11 governorates. Musandam is one of these governorates, an exclave of Oman that is surrounded by the United Arab Emirates. This governorate has itself an exclave in the UAE, called Madha (75 km^2), which amazingly contains an ever smaller exclave of the UAE called Nahwah. Musandam is jutting into the Strait of Hormuz at the end of the Persian Gulf (Figure 2).

Oman has generally a very hot and dry climate with little or no rainfall except in the Dhofar region (Al-Mashakhi and Koll 2007) and is mostly covered by desert and mountains isolating the country from the rest of the region (Metz 1993).

The Omani population is estimated to be around 3.9 million in 2014 (www.worldbank.org), composed of mainly Arabs but also Indians, Pakistani and several African groups (www.populstat.info). An important group within the current Omani population is formed by non-Omani Citizens who are mainly migrant workers (Lavergne and Dumortier 2002).

Until the 8th century, i.e., the conversion of Oman to Islam, Omani territories were mainly under the rule of the Persian Empire (Sykes 1915). Then, the Portuguese colonized the country, until the mid-15th century. However, during this period some Omani cities were taken from the Portuguese (Risso 1986). By the mid-16th century, the Persians invaded Oman but were driven away by the Yemeni (Sykes 1915). During the 17th and 18th centuries, the Omani empire colonized Zanzibar, now part of Tanzania, and Mombasa, one of the

main cities of Kenya, until they were taken by the British Empire during the 19th century (Maamiry 1988). In the beginning of the 20th century, the *Treaty of Sib* led to the peaceful split of the country into coastal *sultanate* and *imamate* of Oman, covering the interior territories which were under a British protectorate at that time (Joyce 1995). In the early 1960s, and following conflicts between the two Omani territories, the Imamate of Oman came under the rule of the Sultan of Oman (Joyce 1995; Lavergne and Dumortier 2002).

Before the discovery of oil in 1962, the economy of Oman was based mainly on agriculture which represented 70% of the GPD (Metz 1993). Until the mid-1980s, the economy of the country had experienced a rapid expansion, i.e., the oil industry accounting for 59% of GDP in 1985 (Metz 1993). A drop of the oil prices decreased the expansion between 1986 and 1989. The situation stabilized in the 1990s (Metz 1993). Nevertheless, oil reserves in Oman are not as important as in the neighboring countries, which is why fisheries resources play an important role.

Fishing industry in Oman

Oman has a shelf area of 54,000 km^2 and an EEZ of 536,000 km^2 (www.seaaroundus.org), and opens to two different seas: the Gulf of Oman and the Arabian Sea (Figure 1). Two main factors made the fishing sector very important for the Omani economy and culture. First of all, Oman is separated from the rest of the Arabian Peninsula by a natural barrier, the *Rub al Khali*, i.e., largest sand desert in the world (Metz 1993; Vincent 2008). Thus, most of the country's connections with the rest of the world have to be made by sea (Metz 1993). Oman also has a strategic position on one of the most important maritime trade routes connecting the Gulf, southern Asia, the Mediterranean and East Africa (Vosmer 1997). Oman ratified the UN Convention on the Law of the Sea (UNCLOS) in 1989 (Morgan 2004).

During the pre-oil period, the fishing sector was the second contributor to the economy (after farming) (Riphenburg 1998). However, with the expansion of the oil industry, fishers started leaving their boats for a more remunerative activity (Metz 1993). Thus, in the early 1970s, the government started developing and organizing the fishing sector by establishing the Fisheries Department followed by the creation of the Ministry of Agriculture and Fisheries (MAF) (Alhabsi *et al.* 2011); in 1978, it started subsidizing the fisheries, via a "Fishermen's Encouragement Fund" to increase employment in the fishing industry (Metz 1993; FAO 2001). During the 1990s, the Omani government decided to invest even more in potentially sustainable sectors, and thus funded several fisheries development and research projects (e.g., Oman Fisheries Development and Management Project) (Metz 1993). In 2007, the Ministry of Fisheries Wealth was formed (Alhabsi *et al.* 2011); Oman is also member of the Indian Ocean Tuna Commission and the Regional Fisheries Commission (Morgan 2004).

Until 1980, the Omani fishing industry was only artisanal. In 1980, an industrial fishery was launched, after fishing agreements between Oman and other countries were signed (Morgan 2004). Thus, from 1980 to 2010, two sectors co-existed in Oman: artisanal/coastal (or 'traditional') and industrial fishing (FAO 2001; Alhabsi *et al.* 2011; Anon. 2014). In 2011, the artisanal/coastal fishing was split into two components for statistical reporting, i.e., artisanal fishing and coastal fishing (Anon. 2014).

i. Artisanal/coastal fishery

Table 1 shows different types of vessels making up the artisanal/coastal fleet (Alhabsi *et al.* 2011; Anon. 2014).

Table 1. Artisanal/coastal fishing vessels and their characteristics in Oman.

Boats	Construction material	Length (m)
Skiffs	Fibreglass or aluminium	5-9
Dhows	Wood	10-15
Houris	Wood	3-10
Shashas	Palm fronds	3-4

Fiberglass boats are the most common, i.e., 93% of artisanal vessels in 2010 (Alhabsi *et al.* 2011; Anon. 2014). *Dhows* are mainly used in the governorate of *Alshaqiah*, i.e., in the eastern part of Oman, and *Shashas* in the governorate of *Albatinah*, in the northeast (Alhabsi *et al.* 2011).The fishers use a mixture of fishing gears including hand lines, traps and gill nets, etc., depending on the target species and season (FAO 2001).

By covering most of their costs, the government helped the development of the artisanal fishery, i.e., 80% of the total production (FAO 2001).

ii. Industrial fishery

The industrial fishery, initially foreign, is now also partly owned by Omani companies (Morgan 2004; Anon. 2014). Industrial vessels can fish only a certain quota, and must operate within certain areas of the EEZ, or in the high seas, under the surveillance of satellites (i.e., vessel monitoring systems). The catches of this fishery are monitored by the Ministry of Agriculture and Fisheries on a daily basis (Anon. 2014).
There used to be two types of industrial vessels: demersal trawlers and longliners. Demersal trawlers must operate at least 16 km off the coast and at a minimum depth of 50 m. Longliners target large pelagics at least 32 km off the coast. In 2011, the Government banned trawlingin the Omani EEZ (Morgan 2004; Anon. 2014).

The catch of the fisheries of Oman is mainly exported, but it also meets the national demand for fish (FAO 2001). Artisanal catches are always sold fresh. Fewer amounts are refrigerated and sold to neighboring countries, but small amounts can be dried or salted and sold in the interior regions of Oman. However, industrial catches are frozen on-board and then exported to Asia, Europe and Africa (FAO 2001). Currently, the fishing sector is considered as the second most important sector for the economy of the country and a quarter of the population depends on it (FAO 2001).

METHODS

Available data for total landings were assembled by taxon and year, for the period 1950-2010. Overall, the national Omani fishery data match closely with the FAO data, but with a more detailed taxonomic disaggregation. Therefore, national data were used as the baseline for the years 1985-2010 and data from the Food and Agriculture Organization (FAO) Fishstat database were used for the years 1950-1984, when national data weren't available. To this baseline, we added unreported commercial, recreational, and subsistence catches as well as discards. Information from independent and governmental studies as well as grey literature was used to reconstruct Omani fisheries catches, while following the general catch reconstruction approach outlined in Zeller *et al.* (2007).

It should be noted that there is a steep increase toward a peak, then a decrease of the catches reported by the FAO as well as the national reports for the period 1970-1980. This peak may have been real; however, based on the fact that during the 1970s, the government invested in increasing fishing effort and developing the fishing industry (Alhabsi *et al.* 2011), we assumed that this peak resulted from over-reporting catches that stopped with the establishment of a research program, i.e., through the establishment of the Marine Science and Fisheries Center (MSFC), in the early 1980s (Alhabsi *et al.* 2011). Thus, we interpolated the reported data between 1969 and 1981 to eliminate this peak, which we considered mis-reported data.

Reported commercial catches then needed to be assigned to either the industrial (i.e., large-scale commercial) or artisanal (i.e., small-scale commercial) sector. National data sources, from 2000-2010, reported the commercial catch by these sectors. Catches were assigned as 100% artisanal from 1950-1979, as the industrial fishery only began in 1980 (Morgan 2004). In order to fill the gap in the time period proportions were interpolated. However, since the contribution of the industrial sector was fluctuating at

the beginning of the 2000s (when sector information was first available), the average percent contribution of the industrial sector from 2000 and 2001 was calculated and set to be the percentage in 1999. Therefore, percent contribution of the industrial sector was interpolated from zero in 1979 to 6.45% in 1999.

Unreported commercial catches

Oman is part of the FAO agreement to fight Illegal, Unreported and Unregulated (IUU) fishing and many actions took place for that purpose, i.e., monitoring access to the ports and using the Air Force, Navy and Coast Guard to control illegal boats, etc. (www.theworldfolio.com). FAO defined several IUU fishing problems in Oman which are mainly use of prohibited gears, fishing and exporting unauthorized species and using unlicensed fishing boats (FAO 2009).

There are virtually no estimates of unreported fisheries catches for the EEZ of Oman. However, Morgan (2004) pointed out that unreported catches of spiny lobster have been estimated to be three times the official landings. Based on this information, we reconstructed catches of spiny lobster which represent, in this study, the only estimate of unreported commercial catches.

Subsistence fishery

A subsistence fishery involves people who fish primarily for their personal consumption, and that of their families. Our estimates of subsistence fishery catches are based on the rural coastal population of Oman, defined as people living within a 5 km range from the coast in rural areas (Table 2) and without easy access to markets. This information was available through the data of the "Socioeconomic Data and Applications Center" for the years 1990, 2000 and 2010 (CIESIN 2012). In order to estimate this population for the 1950-2010 period, we interpolated the rural coastal population for the periods 1990-2000 and 2000-2010. For the period 1950-1989, we applied the percentage of the coastal population of 1990, i.e., 2.8%, to total Omani population for each year from 1950 to 1989 (Department of Economic and Social Affairs of the United Nations; www.esa.un.org). This may be an underestimate for early time periods, due to increase urbanization over time.

The *per capita* consumption of fish in Oman was estimated at 28.6 kg·year^{-1} (www.thefishsite.com). According to FAO (2014), Oman is different from its neighboring countries because of the high *per capita* consumption of fish and sea food products, estimating it to be between 20 and 30 kg·year^{-1}. Based on this information and in order to remain conservative, we assumed an annual *per capita* subsistence catch rate in Oman of 20 kg·year^{-1}. This rate was then applied to the coastal population.

Discards

According to Kelleher (2005), the discards rate in Oman is about 1% of total landings; we applied this percentage to the reconstructed artisanal catch to estimate the discards generated annually by Omani fisheries. This rate was only applied to the artisanal fleet as artisanal landings represent the majority of the catch and the industrial fleet is more tightly regulated.

Recreational fishery

No data could be found on recreational fishing in Oman. However, recreational fisheries do exist, at both local and tourist scales. To regulate and monitor their activities, the government provides two types of licenses for people who want to fish recreationally (www.oman.om):
1) "Non-professional fishing license": This license is obtained for a period of one year and is available for those who practice recreational fishing using hooks and rods;

2) “1-day recreational fishing license”: This license is available for one day only, for recreational fishers who fish with hooks and rods.
However, numbers of these licenses are not available. To roughly estimate the catches of recreational fishers, we applied the recreational fishing participation rate of around 0.12%, estimated for Western Asia in 2003 by Cisneros-Montemayor and Sumaila (2010), to the total population to obtain the number of domestic recreational fishers. Then, we assumed recreational fishing in Oman to be zero in 1960 and reach 5 kg·year^{-1} per recreational fisher in 2010, and interpolated the catch of 5 kg·fisher^{-1}·year^{-1}between 1960 and 2010. Finally we multiplied the number of recreational domestic fishers by the annual recreational fishing catch rate for the 1960-2010 period.

Taxonomic disaggregation

The taxonomic breakdown of artisanal as well as industrial catches is available for the 2000-2010 time period via the “Fisheries Statistics Book” of the Omani Fisheries Statistic Department (Anon. 2010, 2014). For each of the artisanal subsectors, as well as the industrial sector, the proportions of each species or group of taxa for the year 2000 were calculated and applied to the total artisanal catches for the 1950-1999 time period and the total industrial catches for the 1980-1999 time period.

For the discards and the subsistence catches, we applied the estimated proportion of fish families caught in the artisanal fishery. Finally for the recreational fishery, we identified the most targeted fishes by recreational fishing in Oman according to Fishfishme Inc., which has one of the biggest online platforms allowing tourists to locate and book charter trips around the world (www.fishfishme.com). The percentage of each species targeted by this fishery was then assumed according to its importance and popularity in the region (Table 3).

Catch reconstruction in Musandam

The commercial fishery in the Musandam Peninsula is mainly artisanal. The landings in this region are available via the Omani Fisheries Statistic Department (Anon. 2010, 2014) for the 1985-2010 time period. By estimating the percentage of these landing compared to the total national landings, it appeared that the contribution of this governorate is rapidly increasing, from 1.6% in 1985 to almost 8% in 2010. To estimate the artisanal landings in Musandam for the years prior to 1985, we assumed that the landings in that region were equivalent to 0.5% of the total landings in 1950 and increased gradually to 1.6% in 1985.

The method applied to reconstruct the discards was the same as the one applied for the total discards of the rest of Oman.

Recreational and subsistence catches in Musandam were estimated by the same method as used to estimate the artisanal catch, i.e., using the proportion of Musandam commercial catches to total commercial catches for Oman, but for the time period 1950-2010.

For Musandam, the taxonomic disaggregation of the artisanal sector was made based on the “Fisheries Statistics Book” of the Omani Fisheries Statistic Department (Anon. 2010, 2014) and the work of Cornelius *et al.* (1973). The taxonomic disaggregation of discards as well as recreational and subsistence catches was made following the same methods of estimation of these sectors for the whole country, as previously described.

RESULTS AND DISCUSSION

Total marine fisheries catches in Oman increased from around 53,600 t·year^{-1} in the 1950s to almost 200,000 t·year^{-1} in the 2000s. This estimated catch is 1.3 times the landings reported by the FAO on behalf

of Oman for the period 1950-2010. Reconstructed total catch was dominated by the artisanal sector (74%), followed by subsistence catches (22%), industrial (4%) and recreational (<0.01%; Figure 3a). Discards contributed 0.7% of the total catch. The main fish families in the catches are the Clupeidae (33%), which consist mostly of Indian oil sardine (*Sardinella longiceps*; 25% of the total catch), Scombridae (20%), Lethrinidae (6.5%), Engraulidae (4.5%), Carangidae (4.2%) and Serranidae (4.0%). Fisheries catches increased steadily during the 1950-2010 time period.

Catches of Musandam represented 2.7% of the reconstructed total catch for Oman and followed the same overall trends with the artisanal sector again dominating (76%), followed by subsistence (24%) and recreational (<0.01%) catches (Figure 4a). Discards represented 0.8% of the catch in Musandam. The taxonomic composition of the catch was slightly different with the family Scombridae making up the majority of the catch (31%). Engraulidae (21%), Clupeidae (9.4%), Sphyraenidae (7.9%), Penaeidae (7.7%) and Carangidae (6.1%) were also important contributors (Figure 4b).

This catch reconstruction for the period 1950 to 2010 combines the reported artisanal and industrial landings along with our best estimates of unreported small- and large-scale, commercial, recreational and subsistence catches, as well as estimates of discards. Some of these estimates are very tentative, but they likely represent a more accurate picture of the total catch than if these components were omitted (which is the unavoidable result of not reporting on existing, but unmonitored components).

Artisanal fisheries are very important in Omani waters, with 74% of the total catch. Note also that recent decisions taken by the Omani authorities may improve their status, notably as a ban on trawling was issued in 2011. However, there is an urgent need for local studies to estimate the real incidence of illegal as well as unreported commercial fishing in Omani waters. There is export of spiny lobster and other fish to other countries that are not captured by data recording systems. There is also a considerable unreported artisanal catch that is sold to customers directly, without passing through the fish markets, which leads to unreliable statistics (www.y-oman.com). For this reason, the Ministry of Agriculture and Fisheries announced that this practice will be illegal by 2015. However, the situation is complicated because of the traditional nature of the artisanal fishery, i.e., local and tribal governance make centralized fishing management very challenging (Morgan 2004).

Women are also very involved in the fishery sector in Oman and exploit mainly invertebrates; their catch is not captured by official statistics (Rashdi and Mclean 2014).

Currently, recreational fishing appears to be gaining in popularity in Oman in parallel with the recent fast growth of the tourism sector in general, i.e., by 10% in 2010 (www.y-oman.com). Thus, its activities should be better monitored and estimated, as conflicts between professional and recreational fishers are starting to emerge.

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REFERENCES

Al-Mashakhi MSA and Koll E-HBA (2007) Country Pasture/Forage Resource Profiles. FAO. 23 p.

Alhabsi MS, .Malaysia TDI and Mustapha NHN (2011) Fisheries Sustainability in Oman. Journal of Economics and Sustainable Development 2(7): 35-48.

Anon. (2010) Fisheries statistics book 2009. Omani Fisheries Statistic Department, Ministry of Agriculture and Fisheries, Oman. 130 p.

Anon. (2014) Fisheries Statistics Book 2013. Omani Fisheries Statistic Department, Ministry of Agriculture and Fisheries, Oman. 246 p.

CIESIN (2012) National Aggregates of Geospatial Data Collection: Population, Landscape, And Climate Estimates, Version 3 (PLACE III). NASA Socioeconomic Data and Applications Center (SEDAC), Center for International Earth Science Information Network (CIESIN)/Columbia University, Palisades, NY. Available at: http://sedac.ciesin.columbia.edu/data/set/nagdc-population-landscape-climate-estimates-v3 [Accessed: December 28, 2014].

Cisneros-Montemayor AM and Sumaila UR (2010) A global estimate of benefits from ecosystem-based marine recreation: potential impacts and implications for management. Journal of Bioeconomics 12: 245-268.

Cornelius P, Flacon N, South D and Vita-Finzi C (1973) The Geographical Journal 139(3): 400-440.

FAO (2001) The Sultanate of Oman Fishery country profile, FAO.

FAO (2009) Report of the FAO/RECOFI Regional Workshop to Combat Illegal, Unreported and Unregulated Fishing Muscat, Oman, 30 March–2 April 2009. Fisheries and Aquaculture Report., FAO, Rome. 30 p.

FAO (2014) La situation mondiale des pêches et de l'aquaculture: possibilités et défis. FAO, Rome. 255 p.

Joyce M (1995) The Sultanate of Oman: a twentieth century history. Greenwood Publishing Group, USA.

Lavergne M and Dumortier B (2002) L'Oman contemporain: Etat, territoire, identité. Editions Karthala, France. 300 p.

Maamiry AH (1988) Omani Sultans In Zanzibar (1832-1964). Lancers Books. 84 p.

Metz HC (1993) Persian Gulf States: A Country Study. Federal Research Division of the Library of Congress, Washington.

Morgan G (2004) Country review: Oman. pp. 269-280 *In* Young CD (ed.), Review of the state of world marine capture fisheries management: Indian Ocean. FAO Fisheries Technical Paper 488. FAO, Rome.

Rashdi K and Mclean E (2014) Contribution of small-scale fisheries to the livelihoods of Omani women: a case study of the Al Wusta Governorate. Asian Fisheries Science Special Issue 27S(2014): 135-149

Riphenburg CJ (1998) Oman: political development in a changing world. Praeger Publishers. 248 p.

Risso P (1986) Oman and Muscat: an early modern history. Routledge, London. 258 p.

Sykes P (1915) A History of Persia. Macmillan and Company. 565 p.

Vincent P (2008) Saudi Arabia: An Environmental Overview. CRC Press. 332 p.

Vosmer T (1997) Indigenous fishing craft of Oman. The International Journal of Nautical Archaeology 26(3): 217–235.

Zeller D, Booth S, Davis G and Pauly D (2007) Re-estimation of small-scale fishery catches for U.S. flag-associated island areas in the western Pacific: the last 50 years. Fishery Bulletin 105(2): 266-277.

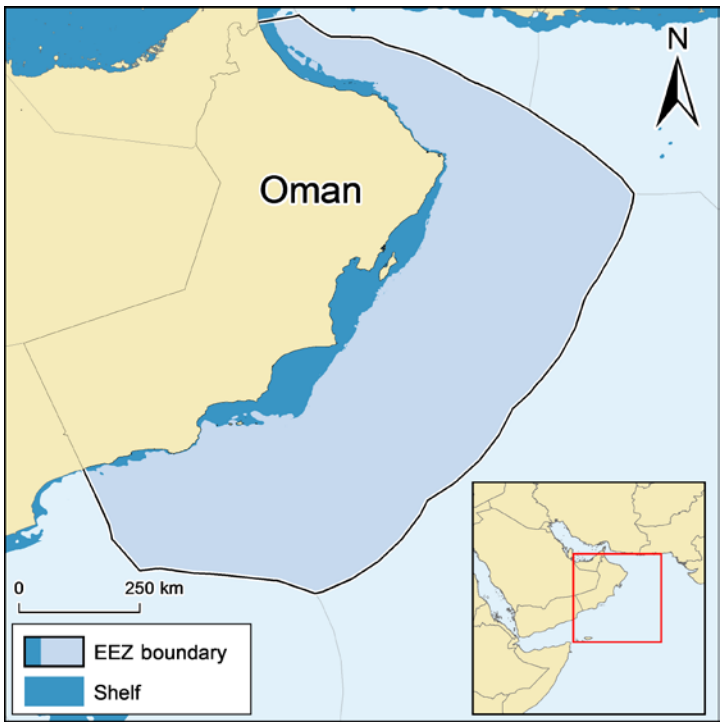

Figure 1. Oman (excluding Musandam), its shelf (to 200m depth) and Exclusive Economic Zone (EEZ).

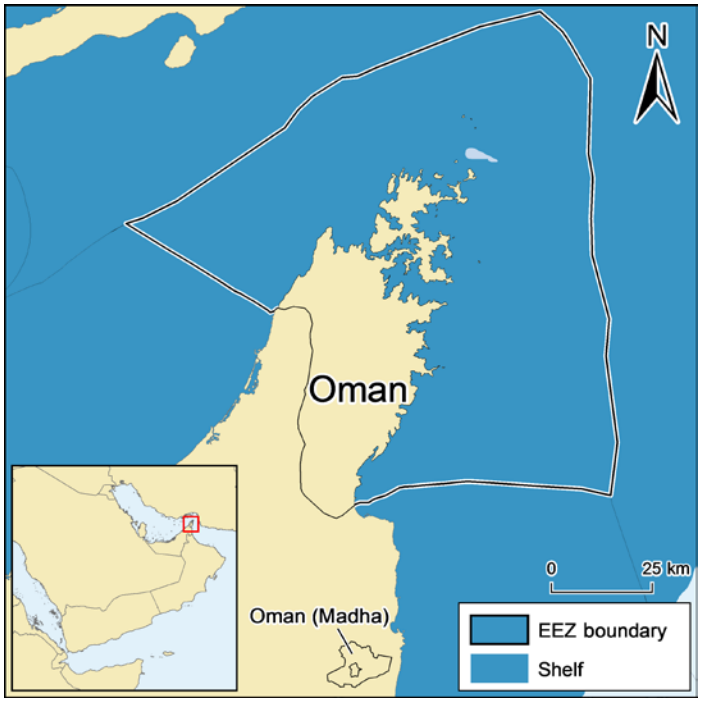

Figure 2. The Musandam Peninsula, its shelf (to 200m depth) and Exclusive Economic Zone (EEZ).

Table 2. Anchor points for the rural Omani coastal population within 5 km from coast.

Year	Population
1990	51,255
2000	56,002
2010	68,325

Table 3. Taxonomic composition assumed to be caught in the recreational fishery.

Family	%
Carangidae	20
Istiophoridae	30
Scombridae	50

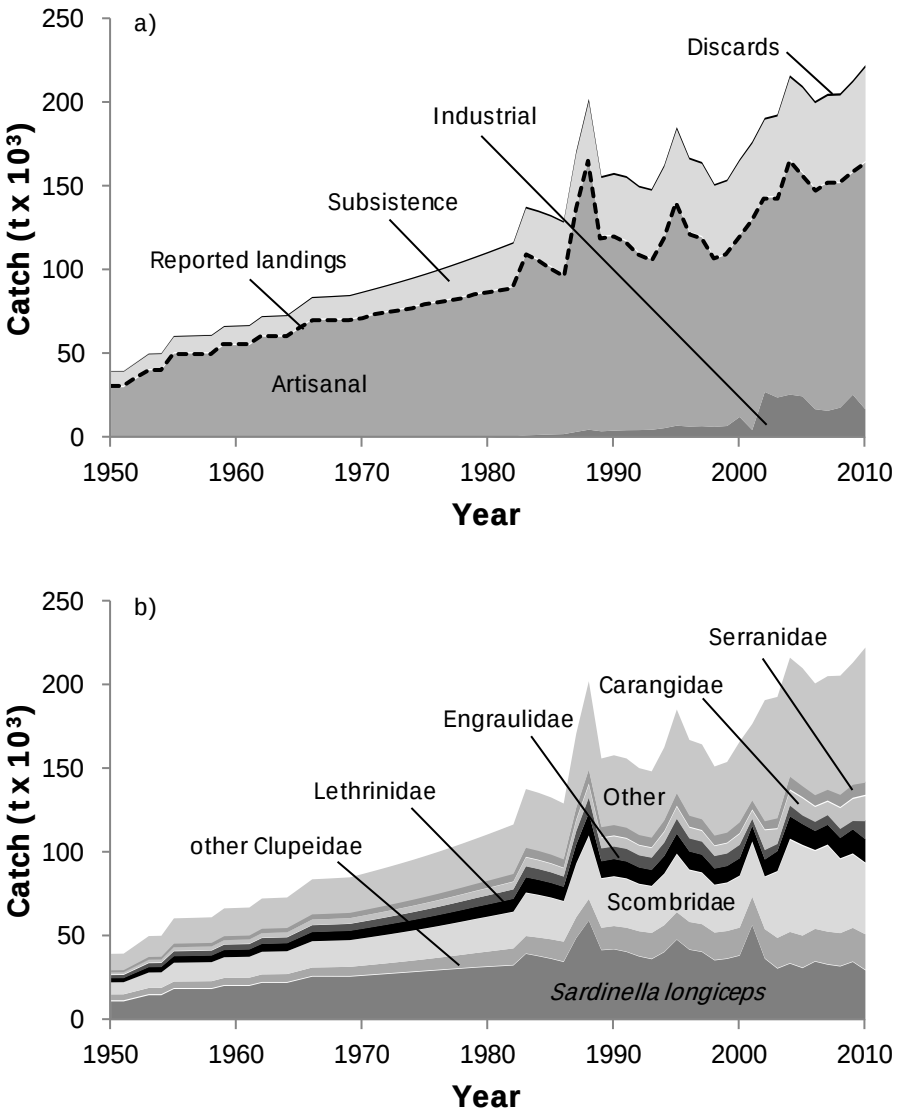

Figure 3. Reconstructed catches for Oman, 1950-2010, by a) sector, with discards shown separately, and adjusted reported landings overlaid as a dashed line graph; and b) by main taxonomic group. 'Other' includes 31 additional taxonomic groups.

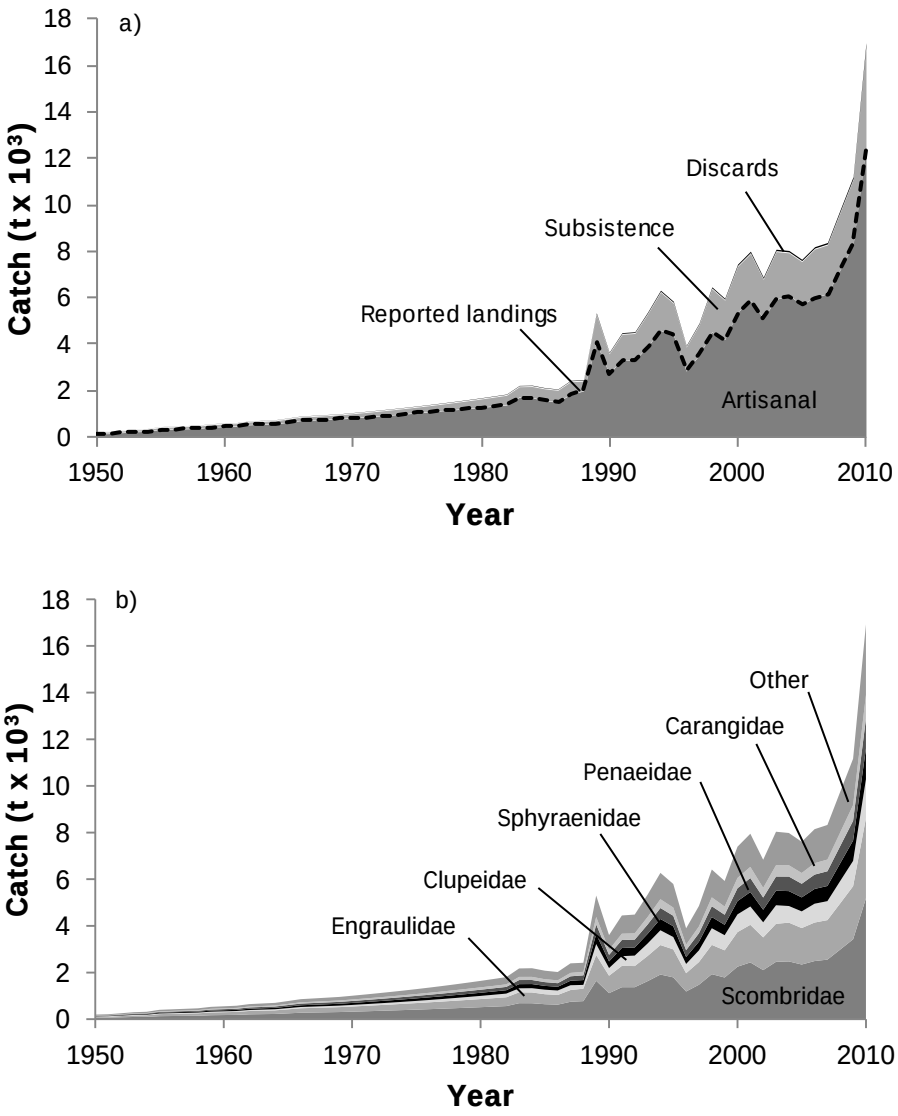

Figure 4. Reconstructed catches for the Musandam Peninsula, 1950-2010, by a) sectors with discards shown separately and adjusted reported landings for Musandam overlaid as a dashed line graph; and b) by main taxonomic group. 'Other' includes 29 additional taxonomic groups.