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Status analysis of the Red Sea fisheries in the Kingdom of Saudi Arabia

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ABSTRACT

The Red Sea is a unique marine ecosystem and Saudi Arabia's coastline has the longest portion. The Red Sea ecosystem off Saudi Arabia's coast is characterized by vibrant nature that is populated by many forms of marine life and more than a third of known fish species spend part or all of their lives in coral reef habitat. Saudi Arabia's fishing fleet has recently developed and diversified the methods. Large fishing vessels such as trawling and purse seine have been engaged in fishing at the Red Sea, along with artisanal fishing, resulting in increased pressure on fish stocks. The fishing fleet operating in the Saudi Red Sea has increased substantially since 1996, in comparison, fish catch has not increased. Government endeavours to monitor and track fishing activities to reduce the depletion of stocks. Industrial development, human activity, and urban expansion affect the Red Sea environment significantly. The timely detection and control of pollution emissions also decrease its impacts on the Red Sea ecosystem. Finally, the Saudi coastal Red Sea fisheries need a lot of serious research to provide information and data that contribute to their natural resource sustainability.

1. INTRODUCTION

The Red Sea is one of the world's largest ecosystems, unique in nature and ecology, and its environment also needs further debate and serious study (Rasul and Stewart, 2015). The Red Sea has an area of approximately 451,000 km^2, but it is not considered highly productive due to the low flow of natural nutrients coming from the land through rain and floods (Tesfamichael and Pauly, 2016). The length of the Red Sea is approximately 2250 km and the Kingdom of Saudi Arabia has about 1840 km on western coast of the Red Sea and extends from the Gulf of Aqaba in the north to the Jezzan region in the south (RSBP, 2016). Fish captures from the Red Sea in Saudi Arabia represents almost half of the production from the Arabian Gulf which is located on the eastern side of the Kingdom, despite the fact that the area of the Red Sea represents three times the Arabian Gulf (Tesfamichael and Pauly, 2016; MEWA, 2018). The total fish captures from the Red Sea of Kingdom of Saudi Arabia reached 24,016 metric tons in 2018

(MEWA, 2018). The capture fishes from natural sources are contributes to Saudi food security, which the average consumption is 13.5 kg/capita in 2013 (FAO, 2020). The abundance of information related to the biological diversity of the Red Sea environment at the Kingdom of Saudi Arabia is of great importance for identify potential risks to the environment and optimize planning for their sustainable use (RSBP, 2016).The diversity in habitats such as difference of structures of coral reefs, sea grass and mangrove forests, represent an appropriate environment for fish reproduction and growth (Honda *et al*., 2013). The aim of this study is to discuss the issues related to the Red Sea fisheries at the Kingdom of Saudi Arabia to highlight on ways to development towards sustainability and maximize productivity.

2. RED SEA ECOSYSTEM

The Red Sea ecosystem off the coast of Saudi Arabia is characterized by lively nature which is inhabited by many marine life forms (Fig. 1). In a coral reef ecosystem more than a third of known fish species spend part or all of their lives (Sale, 2002; Bruckner, 2011).

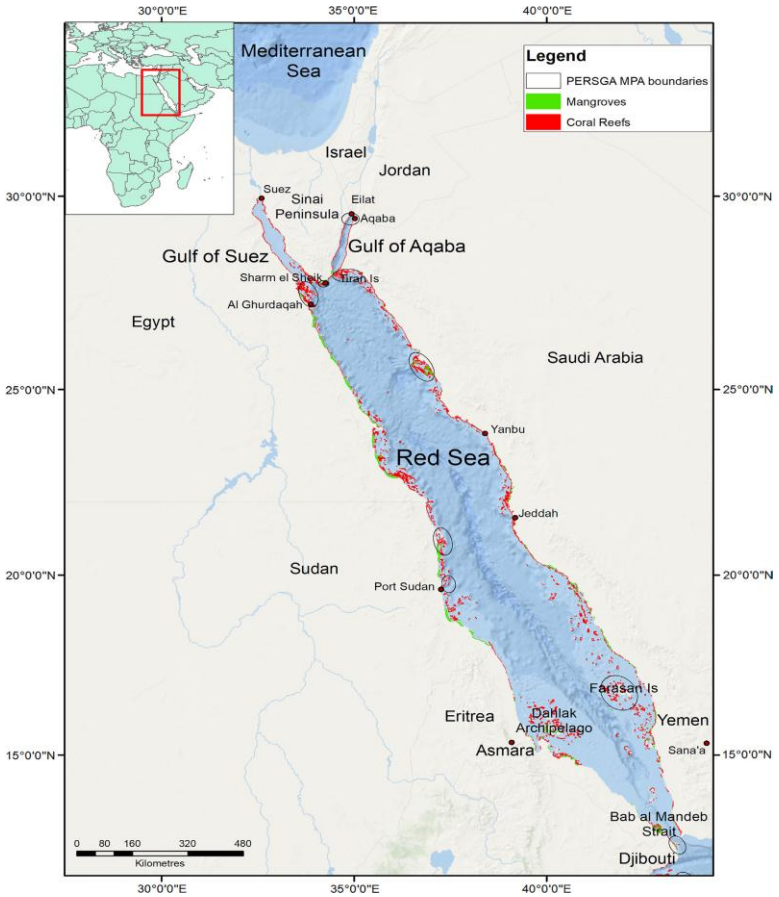

Fig. 1: Saudi Arabia Red Sea map reveals how the mangroves and coral reefs are distributed (Gladstone *et al*.**,**2003; Carvalho *et al.*, 2019).

Coral reef surroundings appear heterogeneous and highly complex along the Saudi coast in terms of structures, forms, styles and abundances (Wilkinson, 2008). The Red Sea's exclusive Saudi economic zone includes the largest gatherings of Coral Reef in Red Sea ecosystem (Bruckner, 2011). Owing to climate change and coastal dredging on the Red Sea coast, such as Jeddah and other modern cities, coral cover has shrunk significantly over the past three decades in the region (Price *et al*., 2014). Seagrass and seaweed are no less important than coral reefs, but it can be more important than other habitats, where it plays a major nutritional role for many marine species and a nursery for many fish larvae (Dawes, 1998). Seaweeds and seagrass habitat spread across the Red Sea in several different areas, and mangrove forests become more common as we head south (Leliaert and Coppejans, 2003). Global climate change and local human activities such as eutrophication and overfishing are among the most important stresses on the Red Sea from the local ecosystems (Jessen *et al*., 2013). Increasing artisanal fishing activity and developing the fleet through the implementation of industrial fishing in Saudi Arabia has resulted in substantially increased environmental pressure (Bruckner, 2011). Bottom trawling, for example, is the most harmful tool on the seabed because it cuts and plows the bottom and kills the habitat and benthos, as well as increased by-catch mortality. (Jones, 1992). Monitoring degradation and planning to conserve habitats of the Red Sea coral reef, mangrove forest and seagrass avoids the loss of fish stocks and encourages protection in addition to increasing future biodiversity catches (PERSGA, 2003).

3. RED SEA FISHERIES

The fishing fleet operating in the Red Sea has been developed in Saudi Arabia by commercial fishermen. The fish catches were limited in the early 1950s, and the major shift in the early 1980s came with the rapid mechanization of craft boats, and the start of commercial fishing (Tesfamichael and Pauly, 2012). Large fishing vessels such as trawling and purse seine have recently been engaged in fishing at the Red Sea, along with small boats called artisanal fishing (Tesfamichael and Pauly, 2016). Since 1996, the fishing fleet operating in Saudi Red Sea fisheries has increased substantially, as seen in Figure 2, accounting for 5,055 small boats and 126 large industrial fishing vessels and increased to 8653 small boats and 158 large industrial fishing vessels (MEWA, 2018).

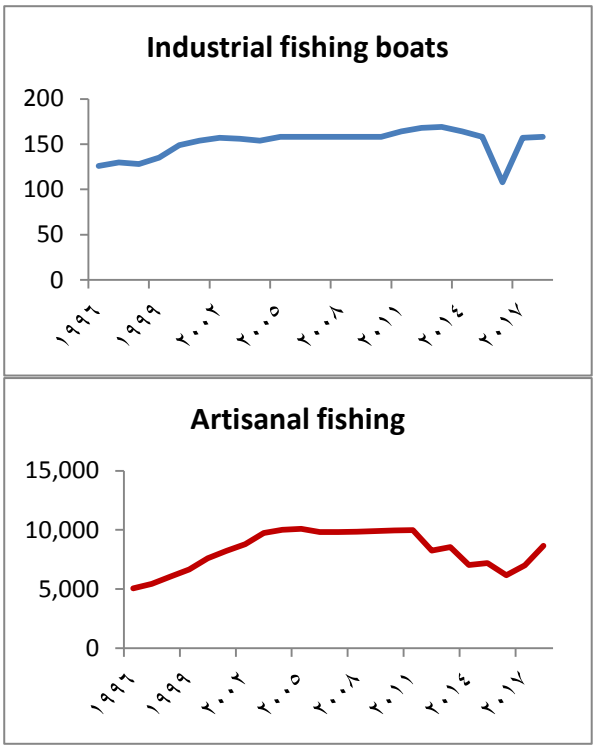

Fig. 2: A fishing fleet diagrams operating off the Red Sea in Saudi Arabia's exclusive economic zone from 1996 to 2018 showing the number of large commercial and traditional fishing vessels (Data source: MEWA, 2018).

This significant increase in fishing fleet resulted in negative impacts on fish stocks and the ecosystem, which was evident in the levels of production, which did not witness the rise in the same number of vessels. The data recorded total fish capture production for the Red Sea 23,201 metric tons in 2001 and recorded 24,016 metric tons with a slight difference in increase in 2018 as seen in Figure 3 (MEWA, 2018).

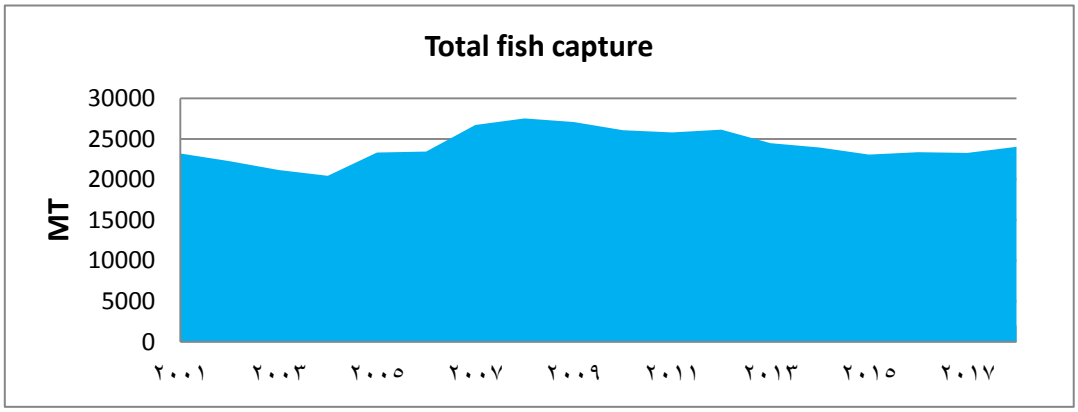

Fig. 3: Total catch of fish from Saudi Arabia Red Sea fishery in series period 2001 to 2018 (Data source: MEWA, 2018).

Artisanal fishing boats with a size ranging from 5 to 18 m, generally made of wood or synthetic fibers, locally called Sambuk and commonly used longline hooks and gillnet (Tesfamichael and Pitcher, 2006).The Saudi industrial fishery primarily consists of large trawl (bottom, middle and surface) and purse seine vessels and many of them are owned and operated by the Saudi Fishing Company (Tesfamichael and Pauly, 2016). Fish species (Spanish Mackerel, Jacks, Groupers, Emperors, Snappers, Barracudas, and Tunas) represent most target species in and make up more than 76% of Saudi Arabia's artisanal fishery catch composition of the Red Sea (Tesfamichael and Pauly, 2012).Industrial fishing is primarily focused on shrimp, and finfish is second, most of the fleets are operate and landing in the Jezzan area (Tesfamichael and Pauly, 2016).In bottom trawl fishing vessels for shrimp in the Jezzan area, 98 fish species were recorded and most of them were considered by-catch (Bogorodsky *et al.*, 2014).

4. FISH STOCK ASSESSMENT

Fisheries sustainability in Saudi Arabia is in the same situation with most participating Red Sea countries, as more fishing operations are undertaken in the region (Tesfamichael *et al*., 2014). The assumption that the majority of catches are inoperative or have a minor impact from artisanal fishing is inaccurate, while catches per unit effort are decreasing for some boats, and some others have become unsustainable (Tesfamichael *et al.*, 2014; Carvalho *et al*., 2019). Overfishing, especially sharks, has led to the threat of extinction and destruction of stocks which led to the issuance of a royal decree banning all shark-fishing practices (Spaet and Michael, 2015). Other species such as rabbit fish (*Siganus rivulatus*) in Jeddah site Red Sea fisheries were estimated based on growth parameters and mortality coefficients for stock evaluation and the outcome concluded that stock is currently over-exploited (Gabr *et al*., 2018). Modern approaches for evaluating fish stocks, such as the new ecosystem-based fisheries approach, have been used to evaluate Red Sea fisheries off Egypt, which allows to be used with lack of information (Al Solami *et al*., 2020). The EBFA approach consistency of two tier structures developed by (Zhang *et al*., 2009); tier1 is focused on quantitative analysis and needs a high level of information; tier 2 is a semi-quantitative or qualitative analysis requiring a lower level of information and the use of management goals and characteristics, metrics and reference points, nested risk indices and management status indices (Zhang *et al*., 2011; Al Solami *et al*., 2020). Therefore, the availability of information and the use of modern stock assessment tools and the proper management for ecosystem allow the stock to be recovered and made sustainable (Roberts *et al*., 2005).Other research indicated that the overexploitation of stocks is a result of the weakness of fishing fleets and lack to modern technology and recommended the use of full technical efficiency of fishing methods and to implementation techniques in finding places where fish are gathering in addition to avoid of overfishing (Al-Sultan *et al*., 2018).

5. POLLUTION

Human activities and their interactions with the aquatic environment are not beneficial and have a negative impact on ecosystems and fish stocks, so protecting them from pollution is necessary for the future (Pejman *et al*., 2015). Nevertheless, the pollution has contributed to the depletion of up to 70% of Saudi Red Sea fishing income, leading to exposure to intense pressure due to illegal fishing, untreated waste, shipping and oil (Towers, 2013). By-catch and discards waste from commercial fishing often has the same effect where there are multiple species and quantities discharged (Kahal *et al*., 2020). In addition, heavy rain leads to sudden death to large amounts of fish as a result of washing ground and contaminates the environment, like what happened in Jeddah in 2016 (Affan *et al*., 2018). So, the new coastal cities have had a major effect on the Red Sea environment, where the concentration of toxic materialsin the sediment is rising as a result of industrial and urban development in the area (Badr *et al*., 2009). However, toxic levels have not been substantially concentrated in edible fish tissue of the Red Sea off Saudi Arabia, and also below the end of the recorded global range (Batang *et al*., 2016). The Saudi government is making significant efforts to minimize marine contamination, and over the past five years these efforts have helped to stabilize percentages of production (Towers, 2013).

CONCLUSION

The Red Sea is unique marine ecosystem and Saudi Arabia's coastline has the longest portion. The industrial growth, human activity and urban development have significant impact on the Red Sea environment. Saudi Arabia's fishing fleet has recently developed and diversified the methods, resulting in increased pressure on fish stocks. Government endeavours to monitor and track fishing activities to reduce depletion of stocks. Lack of information and reliable data on total catch are barriers to making stock appraisal programmes. Prompt identification of pollution emissions and the effort to monitor it often reduces its impacts on Red Sea ecosystem. Finally, Saudi coastal Red Sea fisheries need a lot of serious research work to provide knowledge and data that contribute to the sustainability of their natural resources.

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