B8. WESTERN INDIAN OCEAN

FAO Statistical Area 51

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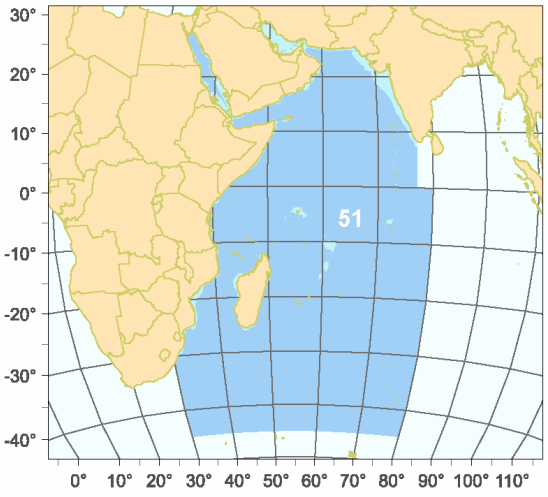
INTRODUCTION

The Western Indian Ocean area (Figure B8.1) has a surface area of about 30 million km^2, of which approximately 6.3 percent is shelf area, and encompasses regions with greatly differing oceanographic and fishery resource characteristics. The Northwest Arabian Sea is influenced by both Northeast and Southwest monsoons and includes extremely productive areas because of nearly continuous upwelling off the Oman coast (Sharp, 1995). Areas with seasonal upwelling occur off the coast of Iran, Pakistan in the Gulf of Oman and the Indian coast along the Arabian Sea, which also results in periods of high productivity. The Persian Gulf, a shallow enclosed area, is characterized by high-temperature highly saline waters and has fisheries that target species associated with reefs and shallow tropical seas. Water enters from the Gulf of Oman forming a counter-clockwise gyre and exits as a submerged denser, warmer and more saline water mass moving towards the centre of the Indian Ocean. The Persian Gulf is shallow, no part is deeper than 200 m and much of the area to the north and west is less than 50 m deep. It is fringed with extensive coral areas on the Arabian side. Around the Gulf of Oman the continental shelf is extremely narrow and fisheries concentrate on pelagic species, which in the last

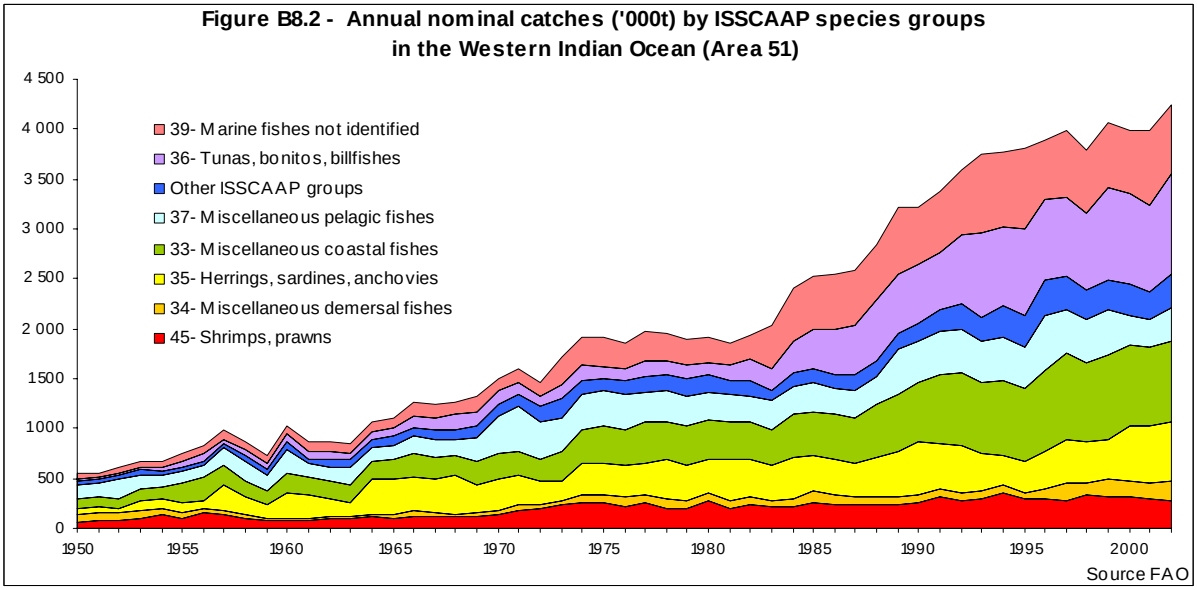
Figure B8.1 - The Western Indian Ocean



decades has increasingly meant the medium-sized pelagics such as Spanish mackerels (*Scomberomorus* spp.) and various species of tunas.

Past conflicts in the area (the Iran-Iraq war in the 1980s, the invasion of Kuwait and the subsequent operation Desert Storm) severely affected the fisheries, both through disruption of fishing activity and through environmental effects arising from oil pollution, or at the time of the invasion of Kuwait and operation Desert Storm, from the shadowing and pollution caused by burning crude oil wells. For example, in 1991 there was a complete failure of spawning by grouper caused by effects from the burning of oil and in the

Figure B8.2 - Annual nominal catches ('000t) by ISSCAAP species groups in the Western Indian Ocean (Area 51)



* FAO, Marine Resources Service, Fishery Resources Division

immediately following years, shrimp landings declined significantly (Mathews, Toloday and Ismail, 1993). In general, there has been a good recovery from these catastrophes though research continues into the impacts on coral reefs of the 1991 war. The increased diversion of waters flowing into the Shatt al Arab, the confluence of the Tigris and Euphrates rivers, is a continuing concern of the Persian Gulf countries. This reduction in freshwater inflow, and thus nutrients, has arisen from human-made changes, mainly drainage of the marsh areas near the opening of the Shatt al Arab with the Gulf but also through diversion of waters in countries further upstream such as Turkey. Ecological theory predicts that this must affect the biological productivity of the Gulf but no information exists to quantitatively estimate the consequences. With "regime change" in Iraq, water flow to the pre-existing marsh area is already being resumed and researchers in the area are planning to monitor future changes in the northern Persian Gulf.

In the Red Sea, narrow continental shelves and its enclosed nature also create unique fisheries situations. Extensive demersal resources are primarily found in association with the wider continental shelves off the Eritrean coast (around the Dahlak Archipelago) and nearly opposite, along the southern Red Sea coast of the Yemen. The Gulf of Aden and Somali coasts are also monsoon-influenced upwelling areas that experience seasons of high productivity. Area 51 contains several small oceanic islands, Seychelles, Mauritius and Comoros, that have their own characteristic fisheries reflecting their oceanic or near-oceanic character. Further to the south, South Africa has fisheries of temperate and sub-Antarctic nature. Many of the countries of the region have important penaeid shrimp fisheries, notably, Madagascar, Mozambique, the countries of the Persian Gulf, and to a lesser extent, Tanzanian, Yemen and Kenya and, in the Red Sea, Yemen.

The possible development of a meal fishery for lantern fishes (myctophids - *Benthosema pterotum*) in the Gulf of Oman and Arabian Sea continues to tantalize, but a profitable development of a fishery for this resource remains unaccomplished. Trial fishing off the coast of Oman was abandoned because of continued damage to the small mesh nets caused by the teeth of ribbon fish (*Trichiuridae*) which were taken as a bycatch and the pioneering company stopped operating. Much work remains to be done on the stock structure of lantern fishes, the seasonal and annual variation in their abundance and what oceanographic factors drive this, and on the potential impact of a lantern fishes fishery on the other components of the ecosystem in the area, especially the large migratory scombrids. In the Red Sea, ecotourism is becoming an increasingly important activity, not only in the two northern gulfs but also in Eritrea, and only now is the beauty (and economic potential) of the coral reefs in the area becoming fully appreciated. The fisheries situation in Somalia remains dismal, with no collection of catch statistics and reports about unregulated and illegal fishing remain common.

PROFILE OF CATCHES

Interpretation of landing statistics for the Western Indian Ocean is complicated by the fact that many countries of the region continue to have difficulties in collecting accurate catch data. In some cases, countries have attempted to estimate catches by extrapolating from earlier years, but when this process is continued for an extended period significant biases may occur and it is uncertain if actual catches are over, or underreported. Recent work in one of the Sub-Area's countries indicates that reported landings for well beyond the last decade may have been overestimated by a factor of six.

Reported nominal catches averaged slightly over one million tonnes per year during the 1960s, increased to approximately 2.6 million tonnes per year during the 1980s and reached a peak of 4.2 million tonnes in 2002 (Figure B8.2 and Table D8). Of the 153 categories of species type catches reported in 2002, 21 landings categories presented 80 percent of the catch. Ignoring the aggregate group "Marine fishes nei" (not elsewhere included) at 16.5 percent), skipjack tuna (*Katsuwonus pelamys*) were the most abundant single reported category (9.3 percent of total reported catches) followed by Indian oil sardine (*Sardinella longiceps*) 9.2 percent; Sciaenids 6.2 percent; yellowfin tuna (*Thunnus albacares*) 5.7 percent; hairtails and scabbardfishes nei (Trichiuridae) 3.0 percent; shrimps (Natantia) 3.0 percent; Bombay duck (*Harpadon nehereus*) 2.4 percent; and pelagic percomorphs (Perciformes) 2.3 percent (Figures B8.3, B8.4, B8.5 and B8.6). Not surprisingly in such as large Statistical Subarea, there are considerable regional variations. In the Red Sea,

pelagic "percomorphs" represent 35.1 percent of the reported catches; demersal percomorphs 6.9 percent, Spanish mackerel (*Scomberomorus commerson*) 8.8 percent and Marine fishes nei 5.6 percent.

In the Regional Committee on Fisheries Commission Area – RECOFI - (Persian Gulf and the Gulf of Oman), the major species reporting categories were Marine fishes "nei" 23.7 percent; Indian oil sardine 10.1 percent; Longtail tuna (*Thunnus tonggol*) 7.3 percent; Emperors (=Scavengers) (Lethrinids) 6.3 percent; Groupers (Serranidae) 5.0 percent and yellowfin tuna 4.8 percent. Outside of these regions, i.e. in the Indian Ocean proper, the most important constituents of the catch were marine fish "nei" (15.2 percent), Indian oil sardine (9.8 percent); skipjack tuna (8.3 percent); Sciaenids (7.3 percent); yellowfin tuna (5.5 percent); Bombay duck (4.4 percent); green tiger prawn (4.2 percent) and cephalopods, (3.2 percent).

Eastern Arabian Sea: Pakistan, India and the Maldives

Reported catches for this area reached a peak in 1997 of 2.55 million tonnes and have been roughly stable at this level since (2002 landings were reported to be 2.56 million tonnes). The changes in reported catches by country for the Western Indian Ocean have not been consistent over the last decade. Both India and the Maldives report increases of 12 and 78 percent, respectively, for this period while Pakistan has shown a small decrease of 3.0 percent Over the period 2000-02 catches have changed, with a 4 percent decrease in Pakistan and 8 and 22 percent increases for India and the Maldives.

Over the period 2000-02, greatest increases in catches (for categories recording more than 1 000t of catches) were for Marine crustaceans (Crustacea) from 11 047t to 30 769t in 2002. Among species with significant landings, the Indo-Pacific king mackerel (*Scomberomorus guttatus*) recorded the largest relative increase in

Figure B8.4 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 33, Western Indian Ocean (Area 51)

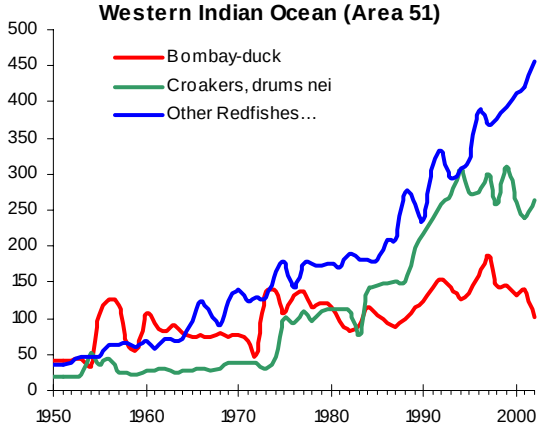


Figure B8.5 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 36, Western Indian Ocean (Area 51)

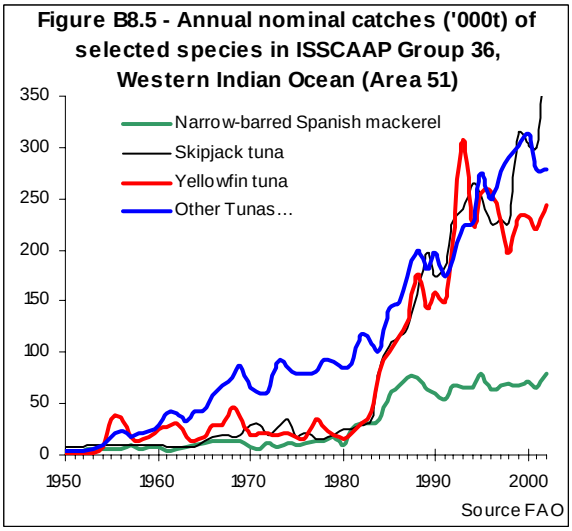


Figure B8.3 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 35 & 37, Western Indian Ocean (Area 51)

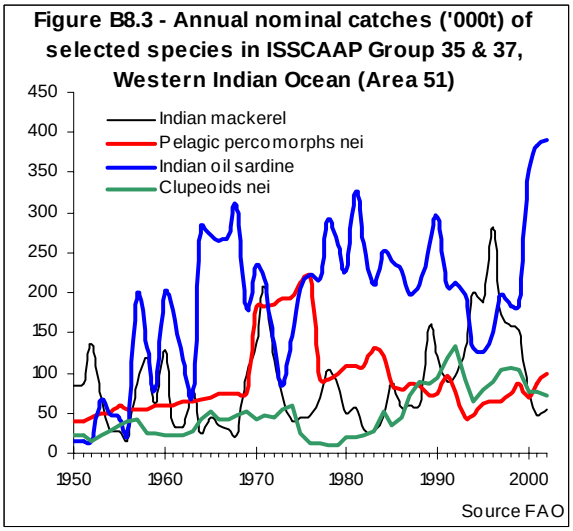
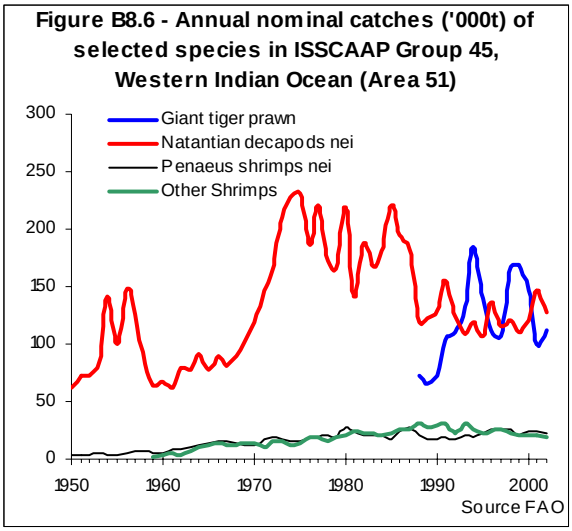


Figure B8.6 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 45, Western Indian Ocean (Area 51)



landings, 175 percent, followed by Ponyfishes (Leiognathidae) at 136 percent, Unicorn cod (*Bregmaceros mcclellandi*) at 87 percent and Goatfishes (*Upeneus* sp.) at 82 percent. Among small pelagics, Kelee shad (*Hilsa kelee*) showed a major increase, up 42 percent to nearly 6 000t. Among species showing essentially no change were groupers (-0.07 percent), cuttlefish and bobtail squids nei (-0.09 percent) and mangrove red snapper (-0.09 percent). In the category of species declines, greatest reduction was shown by Kawakawa (*Euthynnus affinis*) (-79 percent), marlins and sailfishes (Istiophoridae) (-71 percent), Frigate and bullet tunas (*Auxis thazard, A. rochei*) (-52.6 percent) and Lizardfishes nei (Synodontidae) (-42 percent).

The Persian Gulf and Gulf of Oman

Analysis of catches from this area, FAO Sub-areas 51.2 and 51.3 are slightly complicated by the fact that some part of the Omani landings are taken from outside of this area. However, it is believed that this difference is not large, though it is planned to make explicit accommodation for this in the future. Total landings for this area continue their increase from that reported in 1998 (535 000t) to a high of 586 600t in 2001, an all time high. A worrying fraction of the landings are still reported in a completely aggregated form, i.e. Marine fishes nei, 23.7 percent (compared to 25.2 percent in 2000) indicating that much uncertainty must remain in the data recorded for this area. Indian oil sardine remains the single largest reported catch entity (10.1 percent of total landings), with 47 percent increase over the 2000 results. Longtail tuna, the next most abundant species contributed 7.3 percent, a decline of 12 percent from the preceding year. Narrow-barred Spanish mackerel (*Scombermorous commerson*) continues its downward trend that started in 1995 when 30 610t were landed, down to 18 454t in 2001, a decline that has been the subject of much concern in the region. Shrimp catches, at 15 664t, while above the decade's low of 10 880t taken in 1999, are down from the 2000 landings by 18.9 percent. The other species group of major concerns – groupers and Serranids – landings data indicate that global catches remain stable, the 2001 result of 6 681t is within the decade range of 4 120-7 148t.

The Red Sea and Gulf of Aden

Reported catches from the Red Sea continued their steady increase of the last decade, reaching 299 190t in 2001, a 55.8 percent increase over this period. Some of this may be from improved reporting practices, but irrespective, this is a relatively substantial increase compared to other FAO statistical areas. This result also represented a 6.9 percent increase over the 2000 landings. In terms of species, Pelagic percomorphs nei remained the main reported category, indicative of the weak statistical reporting practices in FAO statistical Subarea 51.1. This was a 26.6 percent increase in absolute year-to-year landings of a group that represented more than a quarter of all reported landings – 27.0 percent. The next largest category was equally unhelpful, Marine fishes nei which represented 10.9 percent of the landings, only a minor change from the year before (-1.1 percent). Thus just under 40 percent of reported landings are in an aggregated form that prevents effective monitoring of trends in landings of particular species, much less stocks. For those where specific data have been provided, the dominant species in the catch is narrow-barred Spanish mackerel – 8.5 percent of total landings, a 3.2 percent increase of 2000 and a 1029 percent increase during the last decade. This increase, which matches the declines in landings for this species in Sub-Areas 51.2 and 51.3 may indicate a shared fishery. Other fishes registering increases over the 2000 results were the Mugilide (56.8 percent), Lethrinidae (22.6 percent), Serranidae (3.5 percent) and elasmobranchi (22.8 percent). Major declines in catches were recorded for crabs, to 1 783t (-43.6 percent); Scomberoides to 543t (-33.4 percent) – though this may have arisen from improved dissaggregation in the catch; undifferentiated Natantia (-31.1 percent), though this was matched by an increase in landings of Penaeids to 7 151t (7.0 percent); lutjanids to 9 115t (-26.8 percent) but still above 1997 catch levels; *Sardinella* spp. to 4 343t (-23.9 percent) and Synodontidae to 10 686t (-23.1 percent). Over the decade 1992-2001, greatest decreases in reported catches were for "*Caranx* spp." -90.7 percent, lobster (*Panulirus* spp.) -64.0 percent, Indian mackerel (*Rastrelliger kanagurta*) -35.3 percent and threadfin breams (Nemipteridae) -22.9 percent.

Coastal East Africa (Somalia to Mozambique)

Catches by regional countries in the south-western part of the Western Indian Ocean have been somewhat stable during the last decade,

with 2001 catches (319 000t) representing an all time high, though gains were recorded in only four of the last 10 years. Many of the reported catches are not identified to species (33.4 percent in 2001 – part of a recent increasing trend – though down considerably from the 42 percent recorded in 1994), and therefore a useful analysis by species is not possible. Total catches in this area increased by 2.2 percent from 2000 to 2001, and were 10.6 percent greater than those of a decade earlier. Distant water fishing countries continue to be the major harvesters, lead by Spain, Taiwan Province of China, Japan, France and Uruguay. Of major importance in the period 1997-2002 has been the development of deepwater fisheries targetting seamounts in the southern Indian Ocean. These fisheries have followed the pioneering exploration and fisheries of the Soviet Union (Romanov, 2003). A major difficulty has existed in obtaining the data for these operations. However, in 1999, vessels from seven countries harvested 14 526t consisting of orange roughy, oreos, alfonsino, boarfish, cardinal fish and bluenose. By 2000, these catches had increased to 39 413t, but by 2001 known landings were down to 7 965t. Greatest reductions had been in orange roughy. Many of the management concerns related with this exploitation are discussed in FAO (2001 and 2002).

On a species basis, of particular relevance (> 500t reported per year) skipjack tuna were the most important component of the catch (18.3 percent) followed by yellowfin tuna (14.3 percent), *Sardinella* spp. (4.9 percent) and undifferentiated shrimp (4.5 percent). Greatest year-to-year increases in reported catches for specifided groups were Lutjanidae (356 percent), Albacore (*Thunnus allalunga*) (51.9 percent) and shrimp (*Penaeus* spp.) (51.9 percent). Major reductions were recorded for Scombroidei (-52.3 percent), though this could be due to changes in reporting practices, *Rastrelliger* spp. (see earlier comment) and black marlin (*Makaira indica*) (-50.0 percent).

RESOURCE STATUS AND FISHERY MANAGEMENT

Eastern Arabian Sea: Pakistan, India, Maldives and Sri Lanka

The enormous number of small fishing vessels in this area complicates monitoring of stock status and makes implementation of fisheries management measures difficult. In many cases no restrictions exist on entry into the fishery for social reasons. Rather, regulations control the type of gear that can be used. In many areas, almost any form and size of fish that can be caught is saleable. Given the scarcity of alternative employment, fishing intensity remains high, increasing whenever the catch rates and economic conditions allow it to do so. Socio-economically, small-scale shrimp fisheries are important in both Pakistan and along the west coast of India. Gear restrictions are few and there is little active regulation of fisheries. Most commercial species are heavily exploited. Consequentially, concerns must exist regarding overfishing and ecosystem modification caused by trap and gillnet fishing in coral reef areas; the effects of intensive demersal trawling, usually aimed at shrimp remains unknown. It is believed that major resource and economic benefits would arise from a reduction in fishing effort in fisheries for shrimp in these regions but explicit analyses of the bio-economics of these fisheries remain to be done.

The Persian Gulf and Gulf of Oman

Fisheries have been important in this area since ancient times, both for subsistence purposes and trade. The pearl fishery of the Persian Gulf, once famous, now continues at a fraction of what it was in former times. Rising incomes and the traditional popularity of fish as a dietary item have resulted in full exploitation of virtually all fisheries resources of the area, with the exception of the Indian round herring, mainly because of lack of consumer demand resulting from its oily nature. The fisheries of today are prosecuted by motorized dhows and sambuks, smaller wooden vessels and industrial-style trawlers nearly all of which use ice for preservation of the catch. These are found in most countries of the region, except in the United Arab Emirates, where trawling has been banned, and Iran, which has severely limited the use of trawlers inside the Gulf where such fishing is only permitted during the shrimp fishing season. The Iranian industrial fishery that used to operate within the Persian Gulf is now restricted to fishing in the Gulf of Oman and Northwest Arabian Sea.

Three resources remain of major concern in this area: Spanish mackerel, shrimp (various *Penaeid* and *Metapenaeid* species) and various percid fishes but in particular those of the grouper

family. Accurate information on the state of individual stock and species continues to remain difficult to obtain, if it exists at all, because of the common practice of reporting catches data in a highly aggregated form. The available catches data suggests that most fish groups are fully exploited while major concerns exist regarding the status of narrowed-barred Spanish mackerel, a premium fish in great market demand.

The Red Sea and Gulf of Aden

The Red Sea and to a lesser extent, the Gulf of Aden, being ancient sea ways have also been, at least regionally, important for their fisheries. However, the oligotrophic nature of the Red Sea, a body of water surrounded by countries with narrow continental shelves and coral outcroppings, means that fisheries, while significant locally, are not important in global terms. Several coastal states have had regionally important shrimp fisheries, particularly Saudi Arabia and the Yemen and, to a lesser extent, Eritrea. As in many tropical areas, the fisheries resources are those characteristically associated with coral reefs, small pelagics fisheries and those for the larger more mobile scrombroids, including some tunas. Where possible, trawl fisheries are carried on, generally using trawls with small mesh in their codends, and taking a wide variety of fish species (and, no doubt, causing damage to corals they encounter). With the exception of some small pelagic resources for which markets are weak, the status of the various resources ought be assumed as fully exploited.

In the Gulf of Aden, large industrial fisheries using “distant water” factory trawlers based in the area have exploited demersal and small pelagic fish resources in the past, but because of lack of profitability have not functioned for some time. The situation in Somalia remains uncertain with informal reports of fishing companies undertaking operations and also substantial illegal fishing, particularly outside of the Gulf of Aden by foreign operators.

No explicit stock assessment information on the status of the fishery resources is available for this area, and the use of catch data as an indicator of state of exploitation is compromized because the FAO fisheries data base aggregates data from Saudi Arabia for both the Red Sea and Persian Gulf. However, the available data show clearly that the rate of increase in catches by regional countries has declined sharply during the 1990s, being effectively constant over the last few years. Detailed analysis of the data is unwarranted because of the high “estimated” catches for these countries and changing patterns in disaggregation of the data. Increases in different categories may be best explained by increased disaggregation by species in the reported figures.

The small areas available for trawling and absence of any effective regulation in many areas of the Red Sea probably result in fisheries that are quickly fully exploited or overexploited. Markets for fish in the area are strong, particularly in the Yemen and Egypt and for higher-priced species in Saudi Arabia. Low market demand for small pelagics has resulted in reduced fishing for these species, particularly with the withdrawal of East European operators who previously had fished there to supply their home markets.

Coastal East Africa (Somalia to Mozambique)

The east coast of Africa represents a wide range of oceanographic environments and is the site of some of the most dynamically varying large marine ecosystems in the world. The Somali Current develops during the south-west monsoon to become one of the fastest open-ocean current in the world. The coastal upwelling that occurs along the African coast during the intensified phase of the Somali Current is one of the most intense large-scale seasonal coastal upwelling system in the world. Other nearby regions are also strongly influenced by the annually reversing monsoon regime (Tomczak and Godfrey, 1994). However, the region is also puzzling because the coastal fish production seems small for such a large area. The coastal fishery yield along the entire western boundary of the Indian Ocean, including the various island states of the western half of that ocean, represents less than one percent of the global catches. In spite of this, most of the coastal fish stocks of the region are considered to be fully exploited.

Coastal fisheries production usually far outweighs production from oceanic species such as tunas and generally constitutes around 90-95 percent of total catches, but in the south-western Indian Ocean the contributions of coastal and oceanic fisheries are approximately equal. The Indian Ocean continental shelf off Africa is relatively narrow, and this might provide some explanation for the low coastal catches. However,

the disparity in continental shelf area compared to other ocean regions is far less drastic than would be necessary to adequately explain the above anomaly in fish production.

While the coastal fisheries are harvested mostly by coastal states, the more lucrative oceanic fisheries are harvested mostly by distant-water fleets from Europe and eastern Asia. Even so, and despite the low coastal catches, fishing and its associated economic activities are often important to local economies. In some of the south-western Indian Ocean countries, fish are nearly the sole source of animal protein available to the local populations. Moreover, in a region faced with scarcities of foreign exchange, exports of fishery products represent vital sources of exchangeable earnings. The shrimp fishery on the Sofala Bank is important to Mozambique for foreign exchange earnings and similarly for Madagascar. The industrial shrimp fishery in Mozambique is scientifically monitored and actively managed. Recent analyses suggest that the resource is fully exploited and that fishing effort should be reduced. Effort controls should involve not only the number of vessels and seasonal closures, but also the size of the gear used.

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