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OIL POLLUTION — THE REALITY AND THE THREAT WITH PARTICULAR REFERENCE TO WESTERN INDIAN OCEAN

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ABSTRACT

This paper highlights the scenario of oil pollution in the Western Indian Ocean due to the heavy amount of oil transportation from the Gulf to various parts of the world. This comprehensive paper also gives a bird-eye view on the ongoing oil pollution in the Western Indian Ocean.

INTRODUCTION

IN FACT, the history of navigation in the Indian Ocean goes back to about 2300 BC to the times of the Pharaohs (Auguste Tanssanmit, 1952). Presently, almost one-fourth of entire cargo in the world marine trade and two-third of the oil are loaded and unloaded through this ocean. As the Indian Ocean is surrounded by land mass on three sides, there are only four entry points *viz.* in the Southeast (Strait of Malacca), southwest (around the cape of Good Hope) northwest (the Suez Canal) and Strait of Malacca in the Indonesian waters (Don Hinrichsen, 1990). The first three gateways are located in the Western Indian Ocean, through which major portion of the Gulf-produced oil is being transported throughout the world. Moreover, for transporting huge volume of oil the size of the tankers have drastically increased. During 1950s ships of 30,000 dwt were regarded as very large; but today those ships are not common, place and number have been built with twice the tonnage (Yogamoorthi, 1991). As Western Indian Ocean is a major marine crude oil transportation artery, the risk of oil spills at sea is high. Crude oil is shipped through the area from middle East (Fig. 1). An estimated 450 million tonnes of oil/year go

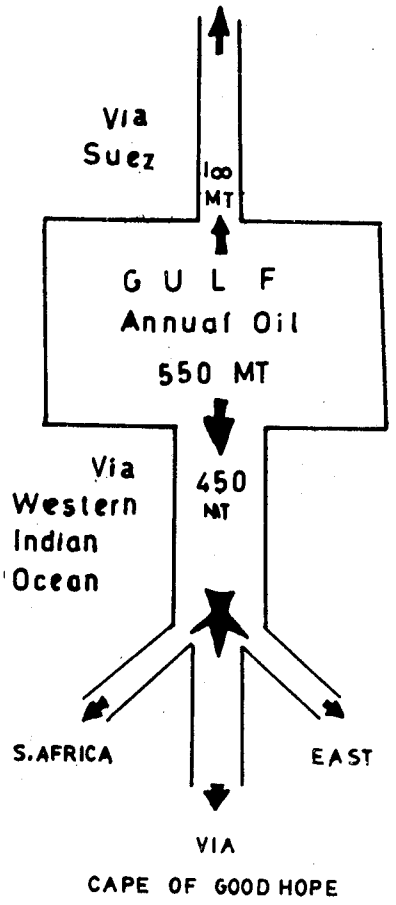

FIG. 1. Gulf to consumer - The oil flow (A diagrammatic representation).

form the Middle to Western countries *via* cape of Good Hope and to East. The transportation involves approximately 1200 Ultra Large Crude oil Carrier (ULCC - 2,00,000 t capacity) and tankers (60,000 t average) is from the middle East to the oil refineries of Eastern and Southern Africa, supplying a total of 27 million t of crude oil annually. A few tankers supply oil

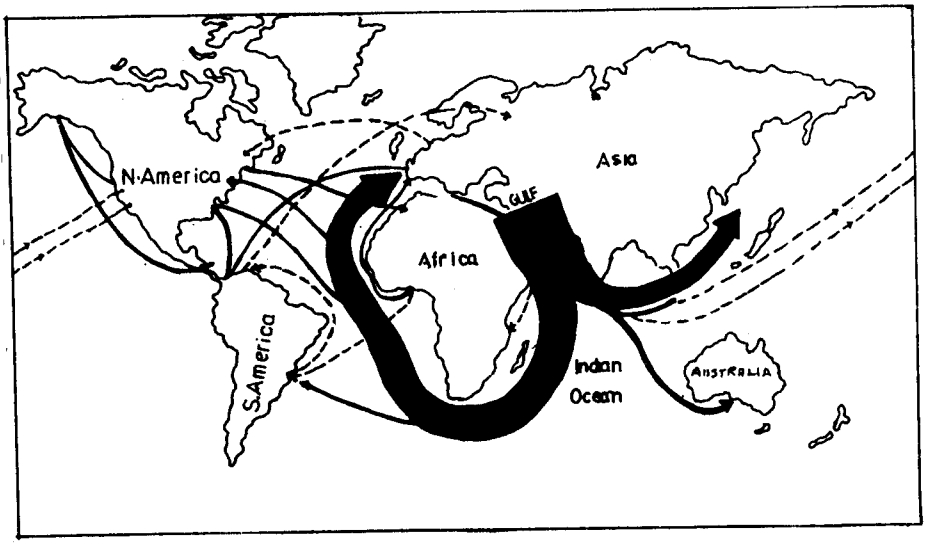

FIG. 2. Main oil movement in the Sea - 1980s. ▬▬ Ultra Large Crude oil Carrier route, ——— Medium size carrier route and ——— Others.

4,000 medium size tanker (average 60,000 t) cross each year through this region. The reports submitted by the experts to the UNEP (1982) workshop on the Protection and Development of the East African Region revealed that at any one time an estimated 24 loaded ULCC, 24 empty (in ballast) ULCC plus 88 loaded and 88 in ballast medium sized tankers are in transit through the Eastern African region. This paper examines the status of oil pollution particularly due to tanker operations in the Western Indian Ocean *i.e.* the major oil route.

THE EN-ROUTE

There are two main transport routes (in addition to East bound tankers crossing Arabian Sea) : (i) served mainly by medium sized to the Comoros, the Seychelles and Mauritius which import refined oil from Middle East; (ii) *via* the cape of Good Hope to Europe and America, using Ultra Large Crude oil Carriers. This is the route through which rest of the oil has been transported (UNEP, 1989) (Fig. 1, 2).

East Africa

Despite the opening of Suez Canal in 1967 the Western Indian Ocean *i.e.* off coast of South Africa is still heavily used. Consequently East African Coast is beginning to experience heavy oil pollution since 1970s. Kenya is also started experiencing oil pollution. In recent research programmes, the presence of tar balls on the coast of Kenya has been monitored. On Shelly Beach (South of Mobasa),

tar concentration of 29.5 g/m^2 were recorded with few individual lumps weighing even upto 3 kg. Similarly, oil concentration has also been seen along the coasts of Somalia and Tanzania in proximity of the oil tanker route; most of such oil is due to tanker ballast (UNEP, 1982).

Oman

Any tanker which is bound for Western Countries and far East, must pass through the coast of Oman as it is located near the Strait of Hormuz. Estimates made in 1978 showed that approximately 1,60,000 m^2 of oil was contained in surface slicks in the Gulf and its approaches and there was a clear increase in number and percentage of positive slick sighting near Strait of Hormuz (Dostdam, 1980). Further, there has been repeated reports by the local population of heavy tar balls on Omani beaches. According to the UNEP sponsored survey in 1980 along the beaches of Sultanate of Oman, such situation appears to the result of heavy tanker traffic in the coastal area, insufficient ballasting facilities in the Gulf and lack of enforcement of national/international restrictions on deballasting (UNEP/IAEA, 1982). It has been reported by Anderlini and Al-Harmi (1979) that an average levels of nearly one-quarter tonne of tar per kilometre of beach in Oman, are subsequently higher than those measured in most areas of the world. UNEP/IAEA 1982 sponsored programme on the survey of oil pollution studies for the coast of Sultanate of Oman revealed that there has been a clear trend in increasing tar pollution along a gradient from the southern border with Yemen to the Strait of Hormuz. This finding correlates well with the reports of increased spill in the vicinity of Hormus and it is consistent with complaint that tankers begin discharging ballast waters well down the Omani so that the ships empty upon entering the Gulf for loading the Cargo.

Persian Gulf

The Persian Gulf is the most crowded oil highway in the world. Before the Iran-Iraq war (1977) some 100 tankers a day passed through the Strait of Hormuz, but currently, about 2,000 tankers sail in and out of the Gulf every day, the Gulf oil is exported from 25 major oil terminals scattered around Gulf. Due to such heavy oil tanker operations, the Gulf waters are heavily contaminated with oily residues and tar-balls. Around one million tonnes of oil is poured into the Gulf water every year from routine discharge of dirty ballast water and tanker slops (IMO, 1990). In addition to such regular phenomenon, the Gulf also receives oil spills due to political reasons. Gulf is the garbage to receive the fall-out of any two warring nations in the Gulf region. To be particular, during the 8 year Iran-Iraq war, there was spill (NOWAUZ OIL SPILL) in the Gulf Water. At that time it was reported as the largest. But it has been superceded by the recent spill caused by the invation of Iraq into Kuwait in 1990. Still the echo of the damage is heard. It has been reported by the Saudi Arabian Environmental Authorities that more than 30 million barrels of oil might have reached the Gulf water (Amtri Haispe, 1991).

Besides there is another accidental source of oil into the Gulf *i.e.* drenching of oil terminals. As a matter of fact, more than 12 giant type oil terminals and many small terminals are located around the costal region of the Gulf. Any consuality encounted with terminals will immediately pollute the Gulf water and thus, the Persion Gulf is made as a scapegoat.

Island of the Western Indian Ocean

Among the islands in the Western Indian Ocean, Madagascar (Mozambique Channel),

Mauritius and Seychelles are located in the oil route. In addition to oil tanker operation as the source of spill, a refinery at Tamatore (which produces 2,00,000 t of oil annually) periodically causes local oil pollution problem. The degree is influenced primarily by surface currents and/or by local winds. Slick movement is usually in the order of 3-5% of the wind velocity and move at an angle between 10-40° to the right of the wind (Hsu, 1970). Hsu also

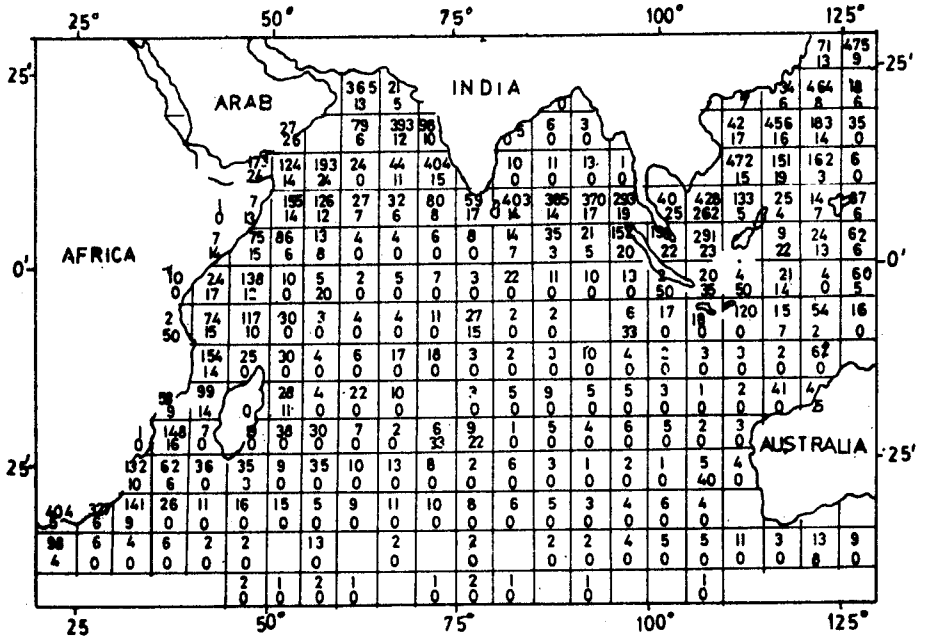

FIG. 3 a. The geographical distribution of oil slicks on the Indian Ocean as indicated by the percentage of positive reports.
[upper value indicates the total number of observations and the lower value shows the percentage of positive reports (Levy *et al.*, 1981)].

of pollution in Mauritius waters has not yet become alarming, but the wrecks of two ship near Mauritius in 1972 and 1976, resulted in the appearance of mass of tar balls on off east of Mauritius. Although Seychelles is little away from major tanker route, there are reports on the presence of heavy deposites of oil along the coast (UNEP/IAEA, 1982).

SPILL MOVEMENT IN THE SEA

One cannot think that the spill will affect only the region where it has been spilt. There are many factors to influence the movement of the oil slick into other regions also. The movement of oil slicks on the water surface revealed that the oil slick in a coastal area (50 km from shore) is likely to be driven on shore by the sea breeze as the onshore winds are stronger and longer than those offshore. But the scenario will be different if the regional winds counteract the local circulation patterns. Murray (1982) through his studies on the effects of weather systems, currents and coastal processes on the movement of oil spills at sea, revealed that weather system that are weaker than an oil slick will tend to disperse it; whereas weather system that are larger (stronger) than the slick will act to advect it. Therefore, the larger the slick the greater will be the potential of dispersion.

As for as the Western Indian Ocean is concerned, there are different patterns of water currents unlike in other two regions of the Indian Ocean *viz.* the Central Indian Ocean and Eastern Indian Ocean region. Each current has seemed to be accidential and/or occasional, no doubt that, its impact on the dispersal of oil slick is quite enormous. The slick can even be dispersed to more than 500 miles away from the area of the spill.

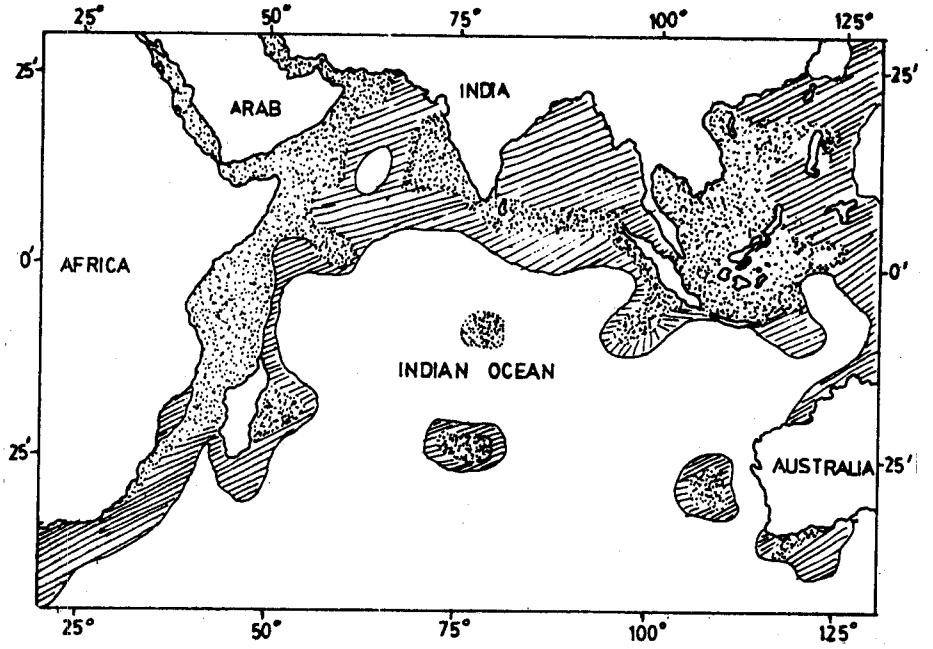

FIG. 3 b. The geographical distribution of oil slicks on the Indian Ocean as indicated by the percentage of positive reports [Pictorial presentation of data (Levy *et al.*, 1981)].

its own speed and direction having a significant influence. These currents play a prominent role in the movement of oil slick occurred elsewhere in this region. Bock (1978) during his studies on reef fishes of the Western Indian Ocean, has described (Fig. 3) the general course of current and wind pattern of Western Indian Ocean, besides such oceanographic features. Bock (1978) has also described the tropical cyclones. Though cyclones and storms are

Studies made by UNEP sponsored programme (UNEP, 1985) revealed that the South Equatorial Counter Current aided by the NW monsoon Current, transport some of this oil spills eastward across 300-500 miles of ocean to the west coasts of Islands of Seychelles. In this area also tar balls and more frequently, thin flaks of solid tar are found on the beaches from November to March considering to current pattern; however quantitative aspects of these tar balls or flaks of oil, are not studied (Fig. 3).

In the case of Kenya and Tanzania due to the northward — flowing currents, the residues of tank washings are brought to the Somali Coast. The Mosambique Current with the frequent coastal counter current, ensures the deposition of oil residues along coast of

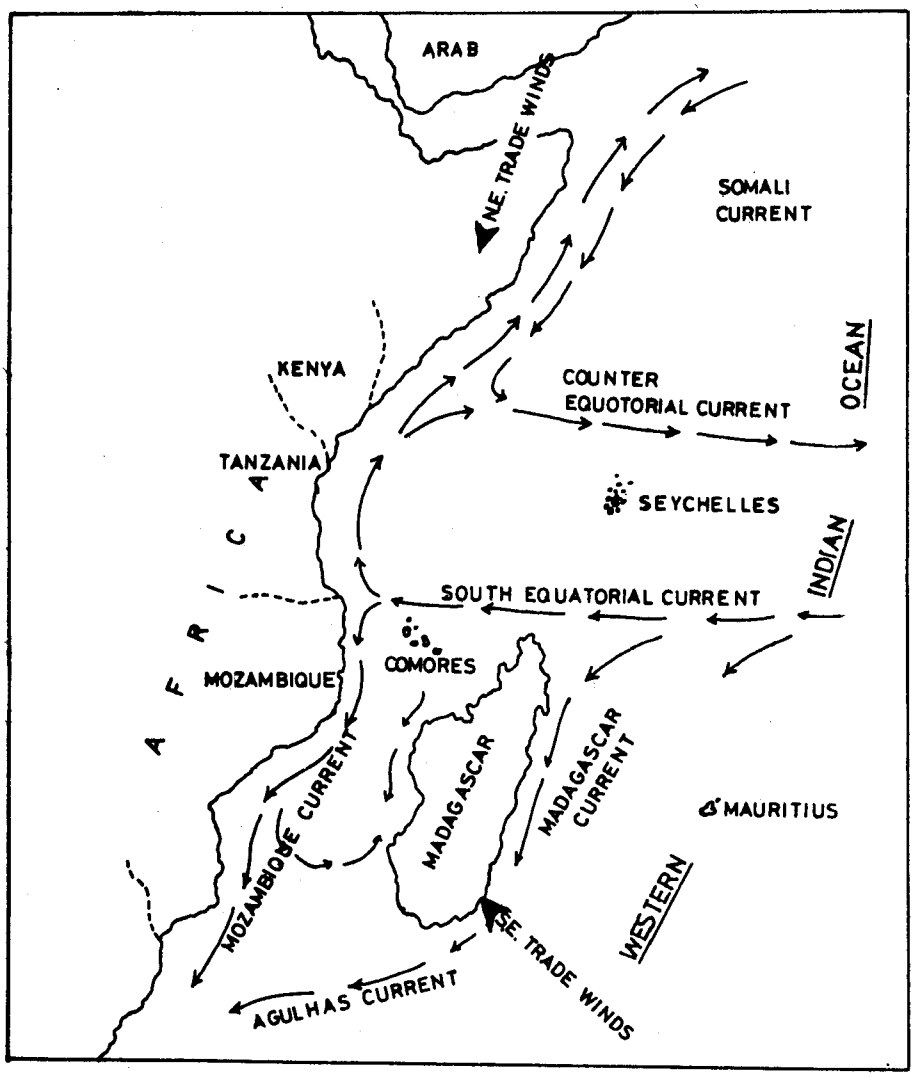

FIG. 4. Current and wind pattern in the Western Indian Ocean.

shoreline of these nations. The eastward — flowing counter current brings the same product to Seychelles and the Somali Current is responsible for the part of oil pollution of the Mosambique. Mauritius and Madagascar are affected by the west following Equatorial Current bringing the discharge of oil tankers, from the oil route.

A very exciting incidence on the impact of ocean wind and current in influencing the movement of oil slick can be cited through one accident. When the tanker *Agro Merchant* was wrecked in 1976 near Massachussette, about 7.5 million gallons of No. 6 oil was spilled into the sea, threatening the fish production of New England. Fortunately, the stormy weather prevailed during that time, carried the oil away from the place of spill into the Gulf Stream (a oceanic current) in the eastern coast of the USA inturn taken away the oil into the central part of Atlantic Ocean (UNEP/IMO, 1985). Thus, the ocean wind and current have a paramount influence of the dispersal of the spilled oil.

In general, with the known traffic pattern and the high volume of oil in transit through this region, accidental spills and/or operational spills are accurrying in the Western Indian Ocean. Such scenario is also witnessed by Sen Gupta and Kruishy (1980) and Levy *et al.* (1981) during their visual survey on oil slicks in the Indian Ocean. Levy *et al.* (1981) have presented their observation as in the Fig. 4 in which a higher percentage of oil sightings has been recorded in the Western Indian Ocean than Eastern and Central Indian Ocean. Thus, it is quite clear that the major oil route is being oiled due to the transportation.

CONCLUSION

There is a high level of awareness that marine pollution particularly oil pollution is a real problem requiring preventive and regulatory measures for the Western Indian Ocean in general and East African Coast in particular. Although the maritime states of East African region are aware of the danger of marine pollution (which has been already perceived) from land based sources, their priority worry at the present time is danger of pollution arising from ships either accidentally or deliberately. Therefore, it is the need of the hour to set-up a system of Surveillance and monitory to deal with deliberate discharge together with a system of readiness to deal with possible tanker accidents. Recently, the Environmentalists have gained a valuable ally in space in the form of the First European Earth Observation Satellite (ERS-1). Consequently in future, the captains of fleets who discharge waste or rinse their oil tanks at sea, will have to be prepared for imposition of penalties by Authorities waiting at Ports. Thus, it is generally recognised that though various International Conventions have been amended and implemented to prevent marine pollution, the effectiveness of such regulations largely depends upon the extent to which they are enforced rather than implemented (Yogamoorthi, 1992).

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