Chapter 2

Oil Pollution in Malaysia

CHAPTER II: OIL POLLUTION IN MALAYSIA

2.1 General

Malaysia has relatively long sea frontage, approximately 4830km with a unique ecosystem and resources. One of the special characteristic of Malaysian coastline is the very abundance existence of mangrove forests which constitute one of the most productive ecosystem for it significant contribution to the national fishing industries. This is because, the mangrove ecosystem has various type of ecological niches which provides nurseries and spawning area as well as habitats for many economically important species of fishes and prawns.

Malaysia has a total area of 641 000 hectares covered by mangrove forests. Peninsular Malaysia alone has about 107 000 hectares which are found mainly in the west coast, the border of Straits of Malacca. Ibrahim (1995) stated that 16.7 percent i.e. about 0.11 million hectares of coastal areas in the Straits of Malacca occupied by mangrove forests, which are mostly found in the states of Perak, Selangor and Johor (Table 2.1). In Sabah, mangrove forests covered an area of about 365 - 460 hectares i.e. 57 percent of the total mangrove forests in Malaysia. They are found mainly in the east coast at Labuk, Sandakan, Trusan Kinabatangan, Darvel, Cowie, Lahad Datu and Tawau. On the west coast, mangrove forest can be found mainly in Kudat and along Klias and Padas River. In Sarawak, the mangrove forests are located mainly in Rajang and Trusan Lawas River.

Mangrove forests in Malaysia are typically located at the seafront where the muddy substrate is soft and deep. This ecosystem supports a highly diversified groups of marine organism such as finfish, mollusc, shrimps, crustaceans, mussels and cockles by providing not only food resources in the form of plankton and seagrasses, but also a spawning and breeding grounds to many of these species. Therefore, the mangrove forest are of vital importance in sustaining local fisheries. In addition, coastal aquaculture, especially brackish water shrimps marine culture has emerged as another important

industry. Marine fisheries, even contributed only less than 1.8 percent of national GDP in 1992, is an important economic and social sector in providing employment to the coastal population. About 85 000 people depended on fishing for their livelihood, which represents about 1.09 percent of total employment in the country. Fisheries-related services including boat-building, processing, marketing, distribution and transportation provide 4.60 percent of total employment in the agricultural sector.

Table 2.1 **Forest cover in the Malacca Strait coastal zone** (quoted from DOE, 1996)

State	Mangrove swamp forest (hectares)	Peat swamp forest (hectares)	Total forest cover (hectares)
Perlis	81	-	81
Kedah	7 664	-	7664
Penang	451	-	451
Perak	49 271	54 281	103 552
Selangor	27 023	111 974	138 997
Negeri Sembilan	-	-	-
Malacca	249	563	812
Johore	132 327	24 468	157 795
Total	111 409	299 145	310 654

Aquaculture including brackish water ponds, floating cage and cockles culture play an increasingly significant role to the national economy. In 1998, total production value from the coastal aquaculture amounted to approximately RM 560 millions. It also provide direct employment to some 3 058 operators and contribute significantly to fulfil the protein demands from the whole country.

Due to the important economic role played by the coastal fisheries, and its contribution to the national protein demands, national interests in the marine environmental pollution has presumed important in the context of the overall national environmental policy. According to Jotty (1976), the coastal pollution in Malaysia has been known for some time, but only be felt in the recent years, due to the rapid development in the country, such as the establishment of industrial and residential estates, land clearance for

agriculture and resettlement, and navigational activities particularly in the Straits of Malacca. The impact of marine pollution is most felt in the estuarine and inshore coastal areas of the Malacca Strait, due to partly, to the character of narrow sea forming the straits, which drain the effluents of several rivers, and partly to the rapid land-based development along the west coast of Peninsular Malaysia.

Along with the rapid development in the coastal areas of the littoral states, the increase in maritime activities has also been a major contribution to the marine pollution. According to Lee (1994), the Straits of Malacca has become one of the busiest waterways in the world; second after the English Channel. With the emerging of newly industrializing economies of Singapore, Hong Kong, Taiwan and South Korea, the demands for oil has vastly increased, and thus increase the shipping traffic in the Straits of Malacca which is known to be the shortest and most economic shipping route linking the oil-riched Middle-East and Pacific nations. In addition, with ever increasing size and variety of cargo ships and oil-tankers, the Straits of Malacca has constantly been exposed to the growing danger of grounding and collisions at the sea and consequently caused oil spills which can be of catastrophic in proportion. The grounding of Japanese Showa Maru off Buffalo Rock in Singapore Straits in 1975 and the collision of the Philippine tanker Diego Silang, for example, has underlined this concerns. In addition, the oil pollution also resulted from the normal operations of the tanker such as loading and unloading of oil, tanks cleaning, the release of bilge and deballasting.

There are varieties of type of pollutants loaded into Malaysian marine environment particularly the Straits of Malacca. The most widespread pollutant known to be entering the marine environment are, apart from domestic wastes such as detergents, pesticides, sewage and garbage, is also industrial wastes such as paint, dye, oil dispersants, emulsifier, oil and other petroleum derivatives, organic and inorganic solvents, also wood and sawdust. Among variety of pollutants known to threaten the marine environment, oil and petroleum hydrocarbons are of the major concerns due to their hazardous characteristic and adverse impact exert to the marine flora and fauna. They are

considered as important pollutant in marine and estuarine environments, and therefore, their biological effects need to be established at each level of biological organizations.

With the important contribution of marine environment in the view of national interests, therefore it is imperative to always safeguard and protect the seas and shores from oil pollution. One aspect, among others, apart from laws and regulations as well as monitoring operations, baseline data about the pollution levels should be continuously collected and produced.

2.2 Sources of Oil Pollution

The Malaysian coastal environment is vulnerable to petroleum hydrocarbons pollution arising mainly from marine transportation activities, oil exploration and production and discharges of hydrocarbon-contaminated wastewater from land-based activities. Pollution from shipping activities, accompanied by illegal oil dumping in the Straits of Malacca have become an increasing cause for concern. Therefore, oil pollution inputs from shipping activities have received special attention and more widespread publicity than land-based sources, although the latter have been known to present a more significant contribution on a global basis.

2.2.1 Sea-based Sources

Ramayah (1994) estimated that 0.5 percent of all oil transport over the sea ends up in the sea, and 75 percent of that comes from routine shipping operations. Various operations from shipping and transportation activities which contribute to oil pollution in the marine environment has been discussed in the previous chapter. Marine and coastal oil pollution in Malaysia, particularly in the Straits of Malacca, have been reported to be attributed, at least in part to these operations. Significant discharges of oil from deballasting, either during transit through the Straits of Malacca or shortly after the vessels enter the straits is a common occurrence. Deballasting is also carried out by ships and vessels in the South

China Sea on the return journey from Japan to Middle East. Tahir (1996) estimated that about two tonnes of oil are discharged into the marine environment per day through deballasting, end up in the Malacca Straits. The single largest source of oil pollution from transportation activities has been identified to be from tanker operations usually associated with the cleaning of cargo residues when the ship is deballasting or cleaning of tanks for the return voyage from the port of discharge (Law, 1994). The origin of the oil is usually associated with fuel oil sludge and machinery-space bilges. Illegal desludging activities have been frequently observed in Malaysian waters in part due to the lack of proper reception facilities and cost of deslopping. Currently, reception facility is available only at the port in Pasir Gudang in Johor. Similar facilities are being planned for other major ports in Malaysia.

Apart from operational discharges by large ships and oil tankers, discharges from small fishing boats also contributed significant oil pollution inputs into the sea. According to Tahir (1996), about two tonnes of oil are discharged from 10 000 fishing boats in the Straits of Malacca. Larger amount is presumed to be discharged by about 50 000 fishing vessels operating along the Indonesian side of the Straits (GEF/UNDP/IMO, 1997).

Shipping accidents

The Straits of Malacca is a major international shipping lane, which has been and continue to be an important sea route for local and international trade. It is also a major shipping route for petroleum oil tankers bringing oil produced in the Middle East to East Asia Continent. In 1993 for example, on average, about 100 oil tankers carrying about 7.0 million barrels of oil use the Straits of Malacca daily (GEF/UNDP/IMO, 1997).

The narrow characteristic, with shallow water in certain stretches, along with heavy traffic have caused several major accidents in the Straits of Malacca resulting in catastrophic oil spills. According to Lee (1994), there were a total of 71 major shipping accidents resulted from variety of causes such as human error, bad weather, current and tides, topography and navigational hazards, occurred during the period of 1977 – 1993

(Table 2.2). Collisions and grounding made up 53 percent of the recorded accidents. Abdullah et. al. (1998), in their analysis on correlation between number of vessels and oil spill incidents in the Straits of Malacca, reported that there were about 125 000 vessels traveled through the straits in the period of 1976 – 1997, resulting in 125 oil spill incidents (Table 2.3). About 90% of the incidents occurred between 1987 – 1997.

Table 2.2 **Types of shipping casualties in the Straits of Malacca, 1977 - 1993** (Lee, 1994)

Type of Casualty	Number of Ships	Percentage
Collision	25	35.2
Grounding	13	18.2
Explosion	5	7.0
Foundering	7	9.9
Others	21	29.6
Total	**71**	**100.0**

Table 2.3 **Oil spill incidents in The Straits of Malacca from 1976 to 1997.** (Abdullah et. al., 1998)

Year	Number of accidents		Year	Number of Accidents
1976	1		1987	4
1977	1		1988	8
1978	1		1989	5
1979	0		1990	2
1980	0		1991	2
1981	1		1992	5
1982	2		1993	11
1983	0		1994	5
1984	1		1995	26
1985	0		1996	30
1986	7		1997	13
			Total	**125**

The most common types of vessels involved in accidents are general cargo ships and oil tankers, comprising 60 percent of the total marine accidents from 1978 - 1994

(Kamaruzaman, 1995). The author also noted that, the incidents involving general cargo carriers and oil tankers occurred every year in varying frequencies.

Although on a global basis, records show that shipping accidents only contributed a small portion of marine pollution, the instant discharge of huge volume of oil has been catastrophic in terms of environmental impacts as exemplified by the Exxon Valdez incident. In more recent times and closer to home, an incident involving the spillage of 25,000 tonnes of fuel oil in the Straits of Singapore following an accident involving two tanker vessels in 1997 resulted in pollution of the western coastline of Malaysia. In addition, there have also been incidents of illegal oil dumping and oil-polluted wastewater discharges by the ship. Department of Environment (1996) reported a total of 14 oil spills incidents due to oil sludge discharges and tanker cleaning activities in 1995. Tahir (1996) also reported that, out of 28 cases of oil slick observed in Malacca Straits in 1995 and 1996, 14 of them were intentional dumping.

Oil production and refineries

Malaysia has more than 50 oil fields in South China Sea and of these 30 oil fields are currently in operation. In 1998, Malaysia produce 600 000 barrels of oil perday. Malaysia also has two oil refineries operating in Port Dickson, one in Kerteh and another one in Miri. But only 30 percent of Malaysia crude oil is refined in local refineries, while the rest is exported. The potential of hydrocarbons discharges from such activities is primarily from drilling effluents, tanks cleaning, and wastewater as well as runoff discharges.

The petroleum hydrocarbons discharges through various operational activities in oil production and refineries have been discussed in previous chapter. However, the amount of oil released through these operation is very difficult to be estimated due to large contribution from intangible human error factors. Law (1994) has estimated that about 2.7 to 27 metric tonnes per day of crude oil ends up in Malaysian waters with the assumption that 0.01 to 0.1 percent of the oil retained in the slope tanks.

2.2.2 Land-based Sources

Rapid population growth and drive for economic development have brought about continued development of coastal areas in Malaysia. Most of large townships and rural settlements are located along the coastline and riverbanks (Jaafar and Valencia, 1985). It is estimated that more than seven millions population situated in the West Coast of Peninsular Malaysia, generating various type of pollutants including petroleum hydrocarbons (GEF/UNDP/IMO, 1997). Koe and Aziz (1995) cited that more than 50 percent of the industries in Malaysia are located in coastal areas or along the river banks, particularly in the West Coast of Peninsular Malaysia.

Domestic and industrial waste water, mostly untreated, are the major sources of petroleum hydrocarbons pollution in various populous coastal areas. Many industries discharge their oil-polluted waste water in coastal water, either by direct illegal dumping or indirectly via rivers. There are twelve river basins in the West Coast of Peninsular Malaysia, and among these river basins, Kelang and Perak River Basins are the most problematic due to the large population and corresponding industrial activities (UM/UKM/USM/UPM/UTM, 1994). Municipal and industrial waste water are important and predominant land-based non-biogenic hydrocarbons sources. These include lubricant oils, motor oils, domestic discharges, waste water from various type of factories and automobile discharges (Tahir, 1996). The author also cited that motor and lubricants oils used in automotive and other industries can be considered as a single most important land-based sources of hydrocarbons pollution. However, it is difficult to estimate the pollution load from the local sources due to its variation, and the most direct estimation can be done by estimating the pollution from the river discharges at estuarine regions. DOE (1996) estimated that the total amount of 20 000 to 30 000 tonnes per annum of used oil generated in Malaysia. This figures are calculated with the approximation that the annual used oil generated is 50 percent of total annual amount of lubricant consumed. Goh and Tan (1996) reported that the amount of used oil generated daily by a typical automotive service station in Klang Valley varies from 24 to 72 liters, mainly from used

lubricant oil. With the approximation that there are about 2000 service stations in Malaysia, they estimated that the total amount of used engine oil generated in Peninsular Malaysia is 21 000 tonnes per annum. However, this estimation has never taken into account the oil generated from motor workshops and other DIY places (DOE, 1996).

Another important but less significant source of hydrocarbons pollution is from the operation of petrol kiosks. The waste water from these outlets, which is usually treated before discharged, contain some amount of hydrocarbons due to inefficiency in the treatment system. However, it is estimated from a survey in Klang Valley that the total volume of waste water discharged from 15 stations studied was less than 60 m^3 per day with 24 - 27 liters of waste oil generated daily (DOE, 1996). According to Goh and Tan (1996), it was found that the average volume of waste water discharged by a petrol stations is between 100 to 200 cubic meters per month and contain an average value of 20 ppm of oil and grease. Therefore, they estimated that total amount of oil and grease discharged from 500 petrol stations in Klang Valley is about 12 metric tonnes per annum.

2.3 Impacts of Hydrocarbon Pollution in Malaysia

Although Malaysia is blessed with a relatively long coastline with a unique coastal ecosystem, which support great variety of economically important marine species, there are very little literature available about the effects of hydrocarbons pollution on this vulnerable ecosystem and its components. In fact, the research on these aspects on Malaysia's marine environment are very limited (Law and Mahmood, 1986). Most of the literature available discussed the oil and hydrocarbons pollution impacts in Malaysia are mostly based on literature review on papers from all around the world. Furthermore, the estimation of losses from the impact of pollution is a mere estimates and not conclusive due to lack of data; primary and secondary, absence of disaggregated data at coastal level and methodological as well as financial constraints (Tahir, 1996).

The effects of oil and hydrocarbons pollution on mangroves forest have been discussed in the previous section which are also applicable to mangrove forest in Malaysia which covered about 2 percent of total land area (Ismail et. al., 1996). There are few studies about the effects of hydrocarbons pollution in Malaysia. For example, Wong et. al. (1984) stated that the grounding of Japanese super tanker Showa Maru in 1975 in Singapore Straits, have caused an extensive defoliation and death to mangroves which showed no sign of recovery even after three years. Similarly the oil spill from the collision of Diego Silang of Philippine in the Malacca Straits in 1976 have resulted in defoliation of mangrove trees mainly due to the smothering of pneumatophores (Ismail et. al, 1996).

The mangrove forest are also a suitable breeding and nursery grounds for many marine species. According to Wong et. al. (1984), the deposition of oil on stilt roots, pneumatophores and stem of mangrove plants will severely damaged the habitats for most of the mangrove fauna, particularly the bivalves. Although the oil pollution will certainly cause damages to mangrove ecosystem to the certain extent (Wong, et. al., 1984), there are cases where heavy oiling has not killed the plants (Clark, 1992).

Socioeconomic impacts

In assessing the socioeconomic impacts of hydrocarbons pollution and oil spills, there are three major coastal economic activities most affected; fisheries, aquaculture and tourism. Damage to marine fisheries include the adverse biological effects on fish stock, juveniles and habitats disturbances as well as the financial losses to fishermen as measured in term of earnings losses and reduction in the catch value due to the consumers perception that oil-contaminated fish is not safe for consumption, and therefore not marketable (Tahir, 1996). According to Yahaya (1996), the financial losses may also result of damaged fishing gear as a result of oil-tainted, oil-covered and oil-soaked fishing nets.

Fisheries

Marine fisheries, eventhough plays a small role in Malaysian economy, is an important sector, providing sources of employment to the coastal population. Fishing industry provided about 4.7 percent of total employment in agricultural sector, which is about 1.1 percent of the total employment in the country. It also provided employment to the fisheries-related ancillary services and industries such as boat-building, processing, marketing and distribution, transportation and ice-manufacturing (Yahaya, 1996). Although contributed only RM2.14 billions which is accounted as 1.42 percent of GDP in 1998, fisheries fetches the foreign exchange amounted to about RM 500 millions, mainly from export of fish and fish commodities. Besides that, fish is also an important protein source for national population with the consumption of fish per capita is estimated as 2.5 kg, which is almost twice that of world average.

The tainting of oil on marine fish and oily-tasted fish has never been reported. This may be because the fish are capable of swimming away from the oil-polluted areas. Although there have been over 80 cases of oil spills reported in the Straits of Malacca since 1970s, only few documented cases of fish mortality have been recorded (Tahir, 1996). For example in the case of the grounding of Showa Maru at Buffalo Rock in the Straits of Singapore, the impact was also felt in coastal waters in the Straits of Malacca where dead fishes, crabs and snails were observed. A total of US$9.0 millions compensation was awarded to the grieve parties including the fishermen for their losses of working days and also the cockles farmer in the vicinity (Yahaya, 1996).

Aquaculture

Coastal aquaculture (brackish water pond culture, floating cage culture, and cockle culture) plays a small role in Malaysia's economy, contributed less than 0.1 percent to the national GDP. However, with the declining catch rates in fisheries resources from coastal waters, aquaculture have developed significantly and become increasingly important and perceived as important source of fish in the future. According to Annual Fisheries Statistic (1998), the total production of aquaculture was 105 237 tonnes, which

was 32.2 percent increase from 79.7 tonnes in 1995. This was 9 percent of total fish landing on the same year. Brackish water aquaculture increased by 40.9 percent from 63,707 tonnes in 1997 to 89,770 tonnes in 1998. This was due to the increase in production of cockles culture, coastal cage and coastal pond cultures. Department of Fisheries projected a production of 200,000 tonnes of fish and shellfish from aquaculture in the year 2000.

In aquaculture, fish or shellfish, which are confined in fixed installations, are vulnerable to the damage from oil pollution particularly major oil spill. This is because they cannot swim away to avoid the polluted area (Tahir, 1996). Damages could occur in the form of complete destruction of cultured species such as finfish in cage, mussels and oysters in floating rafts and prawn in brackish water ponds. In the event of oil spill spotted at Pulau Aman, Penang in 1981, Choo (1996) reported that there were mortality cases of fish cultured in cages in Sungai Chengkah and Sungai Dinar, eventhough the mortality in wild fish was not found. Whilst, in the event of collision of oil tanker, Nagasaki Spirit with a container ship, Ocean Blessing in 1992 in Indonesian waters, there was no fish mortality from aquaculture sites was reported in the affected area although two dolphins were found grounded in Yan, Kedah three days after the spill. However, some fish cages located in the open seas of Pulau Sanga Besar were tainted with oil and the cost of clean up was estimated as RM 1000 (Yahaya, 1996).

Tourism Industry

Tourism industry is increasingly become an important economic sector in Malaysia not only as a source of foreign exchange earnings, but also as another provider of employment through many of the related services industries. The number of tourists visit Malaysia has increased by twofold in 1990s compare to 1980s as a result of government initiative to promote Malaysia as a tour destination through Visit Malaysia Year campaign. The foreign exchange earnings from tourism increased significantly about 24.5 percent from RM 1.5 billion in 1985 to 4.5 billions in 1990. This has resulted in the growth of other services sectors such as hotels and resorts, which provide many

employment opportunities, either directly in the hotel industries or other tourism related industries such as tour and travel agencies, limousine taxis and car rental.

Tourists visiting Malaysia, which mainly come from ASEAN countries, attracted to many tour destinations such as beaches, island, historical places and cultural exhibitions. Although there is no statistical report on the number of tourists visiting any particular places, it is commonly known that the foreign tourists are primarily attracted to coastal resorts and marine parks. These include popular marine resorts like Penang, Pulau Tioman, Pulau Perhentian, Pulau Redang and Langkawi, which offer not only beautiful beaches, but also water sport activities such as water skiing, sailing, snorkeling and scuba diving.

While the presence of many attractive activities, have made marine tourism such an important economic sector, it is also vulnerable to damages and losses from oil pollution. According to Yahaya (1996), the losses would be to the small scale inbound enterprises which depend on tourism as their income source (such as budget tourist accommodation), and also the large scale commercial enterprises specializing in tourism (such as the five star beach resorts). While oil spill would make beaches oily and unattractive, severe hydrocarbons pollution may result in the degrading of other tourist attraction such as the coral reefs. In addition, the oily beaches would need a great deal of effort and cost to be cleaned up back to normal.