SURVEYS AND OIL POLLUTION MONITORING IN THE ASEAN COUNTRIES

by
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ABSTRACT

The Southeast Asian Seas is a region having valuable and vulnerable marine and coastal resources and situated along densely shipping routes and oil activities.

The concern of the coastal countries in the region on marine oil pollution has been pointed out in various regional meetings.

Many researchers and their institution started to look on the level of the contamination. The author summarizes and compare all information available and expose the gap of knowledge on the extent of oil contamination in the region.

A Regional Cooperation for the assessment and evaluation of oil pollution is needed and being established to ensure and obtain a compatible data and meaningful regional interpretation.

I. INTRODUCTION

Marine Oil Pollution Coastal Environment are widely recognized as a problem in the region and have been identified as a question on various meetings in the region during the last few years. The seriousness of this type of contamination on a regional scale has been pointed out at among others the 10C/FAO (IPEC)/UNEP. International Workshop on Marine Pollution in East Asian Waters (Penang, Malaysia, September 1975) and the FAO/UNEP Expert Consultation Meeting on Assessment of Oil Pollution and its Impact on Living Aquartic Resources in South East Asia (Manila, Philippines, February 1980).

Survey and Monitoring of Oil Pollution is being undertaken by many countries and in the Southeast Asia by Indonesia, Malaysia, Philippines, Thailand and Singapore, in order to assess its extention as well as to know the deterioration of the ecosystem. The activities depends upon the conduct of suitable baseline surveys appropriate for measuring oil in water.

Throughout the whole of Southeast Asian region, marine waters are becoming increasingly contaminated by oil and oil product from low level chronic discharge or from accidents such as tanker groundings or collisions, and spills due to technical failure or human erros in handling of oil. Another indication of oil contamination are stranded tar on beaches.

The description of production and transport pattern of oil gives an impression of actual and possible inputs of oil contamination in the marine environment.

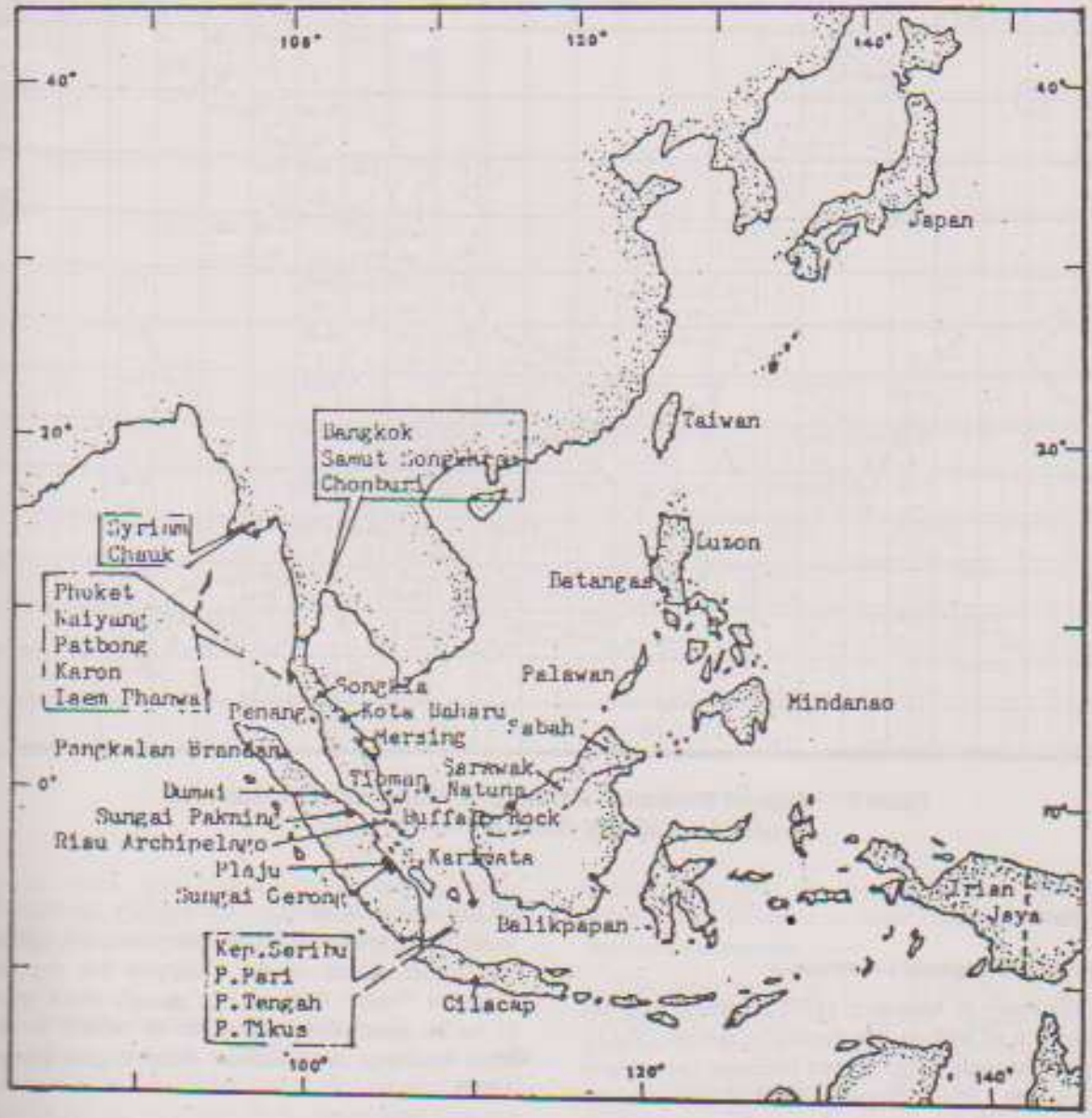
II. OIL ACCUMULATION

General picture on oil accumulation and contamination in the Southeast Asian Region is mostly identified on the surrounding water of densely populated, areas as big cities, rural developments and coastal based industries, which are discharging effluents containing oily waste.

Effects of oil transportation by ships may also have direct effects to marine and coastal resources. Marine oil pollution from tanker are due to operational discharge of oily balast water and/or tanker washing water etc. and tanker accidents like grounding or colission as well.

Dissolved and dispered oil as well as accumulation of tarballs is very dependant on wind actions, ocean currents, and tidal movement.

Annex 1 : Map of places mentioned in the paper



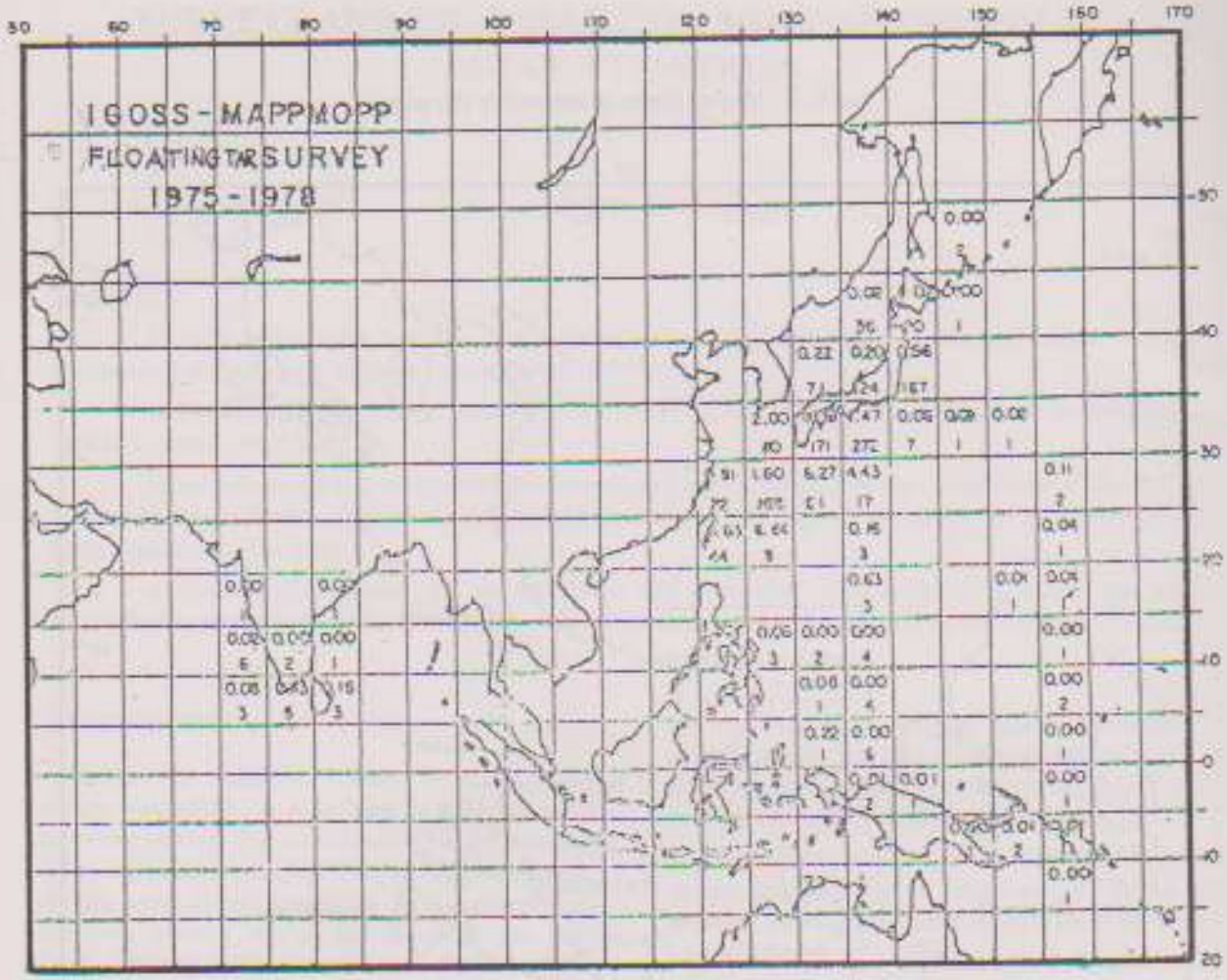


Figure 2 **Regional distribution of floating tar concentration and number of sampling by 5° squares (Anon., 1979)**

A. Tar Pollution

General and Regional Observations

The study of Nasu et al (1975) indicates only the occurence of high or low density of tarballs (Fig.1), while the result of the Marine Pollution (petroleum) Monitoring Pilot Project (MAPPMOPP) of the Integrated Global Ocean Survey System (IGOSS) are given in figures (Fig. 1).

Data from adjacent waters of the Philippines show quite a significant contamination with tarballs: north of Luzon (Philippines) the plotting square indicates 0.63 mg/m2 (= 630 g/Km^2) and northeast of this area it is already 1.6 mg/m^2 (= 1.6 kg/km^2) in direction toward Japan the contamination reaches still higher values. In the Philippine Sea the plot indicates "only" 0.06 mg/m^2 *though* there seems to be no quantified observation of tarballs in the open waters of the Southeast Asian Region. *(Anon,* 1975).

Further information on concentration of hydrocarbons in water in this region is also gained through the MAPPMOPP of IGOSS. They are plotted in the same 5° to 5° net (as the tarball mapping). The concentration ranges from 0.01 ppb (1 ug/1) to 4 ppb both extreme occuring in the Southhern

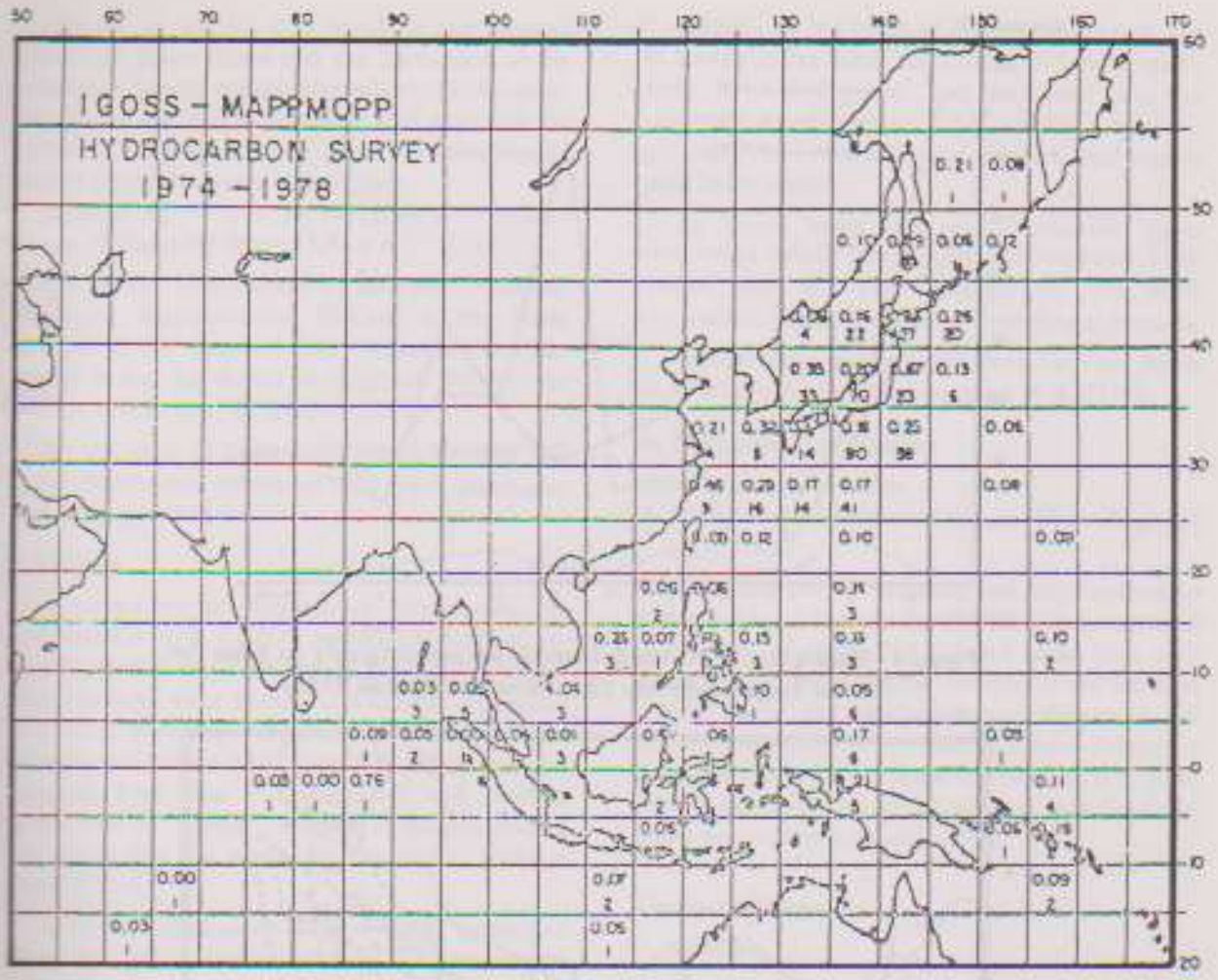


Figure 3 Regional distribution of d/d concentration of hydrocarbon in water (ppb) and number of sampling

South China Sea, Malacca Strait, eastern South China Sea, Celebes Sea, and Northern Philippine Sea have values of 0.06 and 0.07 ppb (Fig. 3) (Anon. 1979).

Countries Observation

Various research institutions, agencies and universities in this region started to look into several aspects of oil pollution. It is felt a need that the government in the region keep tracks of trends in the environmental quality of coastal areas, which can be no longer regarded to have the unlimited capacity to receive pollutants.

Surveys and monitoring activities are being conducted by countries in order to try to assess the extend of oil pollution to know the deterioration of the marine ecosystem.

This paper makes an effort to summarize and to compare all informations available, regardless of the purpose they are produced for or their incompleteness. It does not attempt to answer any of the oil pollution question but hoping to lay a regional reference basis for a regional cooperative concept in monitoring activities to evaluate and watch oil contamination levels.

1. Indonesia

Stranded tar has been observed in Pulau Pari,

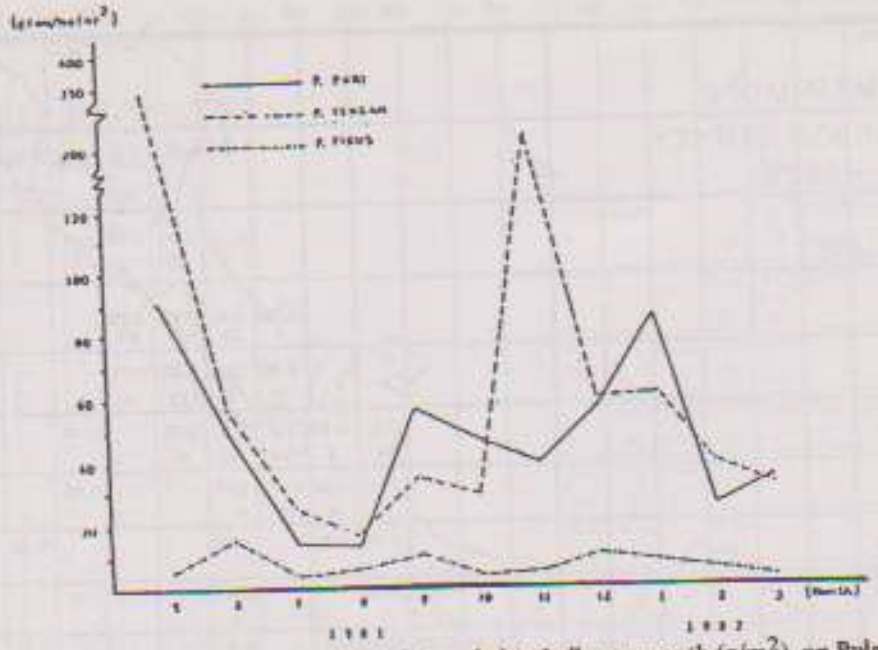


Figure 4 : Mean quantity of atranded tarballs per month (g/m^2) on Pulau Pari, Pulau Tengah and Pulau Tikus (Toro and Djamali, 1982)

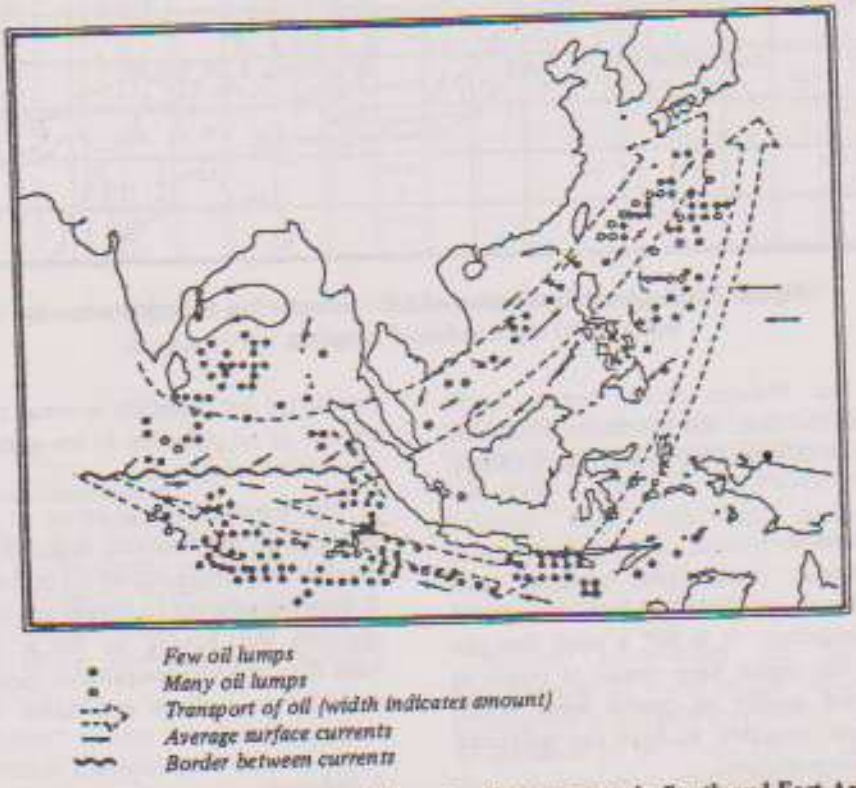


Figure 4 : Oil lumps, transport of oil, and surface currents in South and East Asia (after Nasu et al., 1975)

Northward of Jakarta Bay by Toro and Djamali (1982). In figure shows that the fluctuation of the population density strongly depends on the monsoon. The lowest quantity in August is 12.3 g/m^2 and the highest in November is 81 g/m^2. Observation by Bilal et al (1984) showed 362.6 g/m^2.

Another observation in the Riau Archipelago/ Straits of Singapore showed 1.91 g/m^2.

The recent Joint Survey of Indonesia, Malaysia, Philippine, Singapore and Thailand in the frame work of UNEP Regional Seas Programme in three islands facing the Straits of Singapore Showed an average of 0.34 g/m^2 (COBSEA, 1986).

On the coast of Langnga/Straits of Macassar had a tar distribution density of 1.68 g/m^2 (Bodennec, and Joanny, 1984).

2. Malaysia

A survey by the Division of Environment, in collaboration with EXXON and PETRONAS of accessible beaches along the eastern coast of Peninsular Malaysia from Kota Baharu in Kelantan to Mersing in Johore, including offshore islands such as Pulau Tioman, has shown that more 57% of the beaches surveyed have been contaminated by oil residues in the form of "tarballs". A survey of Malacca beaches has shown that the average density per sq. metre is about 5.7 ml.

A further observation is now being performed along the whole Peninsular Coast in Cooperation with the other agencies. About 92 beaches with observation and sampling stations have been established for this purpose. (Maheswaran, 1978).

3. Thailand

A study on the deposition of tarballs on the sandy beaches contiguous to Thai waters was carried out by the sub-committee on the Quality of Waters and Marine Living Resources in Thai Waters under the Marine Science National Committee during 1976–1978. The amount of tarballs however, varied according to the location of the beaches and the season of the year.

On the coasts around the Gulf of Thailand, for example, high tarballs values were found during the summer months (March–April). The highest accumulation of tarballs was found at Songkhla Beach (0.19–715 g/m^2).

Stations on the beach of Phuket Island, such like at Laem Phanwa beach the amount of tarballs ranges from 0.1 to 63.8 gm/m^2, and the highest value was observed in December. The amount increases gradually from November and reached their highest peak in December.

At Karon Beach, the results indicated higher amounts of tarballs than at Laem Phanwa Beach. They ranged from 0.1–180.4 gm/m^2. On this beach the amount gradually increased from August onwards.

Tarballs were also recorded from Nai Yang Beach and Patbong Beach. (Piyakarnchana et al, 1979).

4. Philippines and Singapore

There is no data available.

B. Dissolved and Dispersed Oil in Water Regional Observation

Concentration of dissolved and dispersed oil in water is gained through the IGOSS as it is indicated in figure ... it shows that it has a range from 0.01 ppb to 4 ppb both extreme occuring in the southern South China Sea. Malacca Straits, eastern South China Sea, Sulawesi Sea and Northern Philippine Sea have values in the range of 0.06 to 0.07 ppb. Higher values of 0.2 to 0.7 ppb are only found in water around Japan. (Anon: 1979).

Countries Observation

1. Indonesia

The concentration of dissolved and dispersed oil encountered in the vicinity of the oil fields north of Jakarta Bay ranged from 0.3 to 1.0 ppm (Muchtisaret al 1977) further away they ranged from 0.1 to 1.1 ppm.

Some locations in the Straits of Malacca have a heavier oil contamination than other Indonesian waters. In the area of the Riau Archipelago values above 1 ppm, (Pulau Rupat) even up to 11.5 ppm (Pulau Rangsang) were found. (Wasilun, 1978). In the Straits of Singapore, between Buoy Tolop and Bouy Buffalo Rock average concentration was 8.8 ppb. (COBSEA. 1986)

2. Malaysia

The dissolved and dispersed oil concentration in Penang (Glugor, Teluk Kumbar and Teluk Bahang) was found to range from 0.01 ppm to 0.12 ppm,

being higher in Teluk Bahang possibly because of the indiscriminate discharge of oil from the engines of trawlers which are based there. (Pang et al, 1980).

The level of hydrocarbons in the coastal water of the east coast was found to range from 0.03 ppm to 0.13 ppm. It was noted that higher concentration were recorded near villages where there is an increase in human sattlement. (Chua and Charles, 1980)

3. Philippine

In the Philippines, a chronic discharge and spillage from the industrial and refinery effluent and shipping activities seems the cause of oil contamination in Manila Bay. Subic Bay with heavy traffic receives only waters from tankers and other ships visiting the naval base.

The yearly averages for the area within the Manila Bay are: Pasig River 3.9 ppm, South Harbour 3.6 ppm, North Harbour 3.9 ppm and Cavite 4.0 ppm. Cavite is also an industrially developed area and site of the Naval Base. Additional data from NOCOP (person. com.) give range of 0.8 to 3,8 ppm and 1.8 to 5.5 ppm for the vicinity of the Shell and Caltex Refinery Piers respectively in Batangas Bay (south of Metro Manila) and a range of 1.8 – 9.3 ppm in the waters at the Sara wharf in Davao City (Mindanao) (Bilal and Kuhn hold, 1980).

4. Thailand

From the survey of water pollution along the east coast of the Gulf of Thailand between Samut Songkhram and Chonburi in the vicinity of highly populated and industrialized areas, the highest concentration of "oil and grease" within a distance of 500 m from the shore was reported with 38 ppm. (Vashrangsi, 1978)

Between 1985 to 1986 samples of subsurface Sea water in the Upper and Lower Gulf of Thailand has been analysed and found that in the Upper Gulf ranged from 0.65 to 8.5 ppb with the mean of 2.3 ppb. In the Lower Gulf the range was 0.07 to 5.5 ppb with the mean of 1.3 ppb. (Wattayakorn, 1986).

5. Singapore

No data was available.

III. SOURCES OF OIL POLLUTION

A. The Straits of Malacca

Loading ports including harbours, most refineries and oil exploration and its activities are located along the coast and coastal waters of the West Malaysian Peninsula and East Sumatra.

The flow of oil through this water is estimated in the amount of 3,820,000 barrels per day (Int. Petr. Encycl. 1976) and based on the survey obtained by Finn et al (1979), a number of 4,213 ships have used the Singapore Strait during 28 days in October 1976, which comprise of 28% tankers, 61% bulk carriers and cargo ships called at the Port of Singapore and the rest of 11% have transisted. The operational discharge and spill from this shipping activities have played a role on oil contamination in this waters.

Along the coast of the eastern part of Sumatera, the west coast of the Malaysian Peninsula and the Islands belongs to Singapore are located 11 coastal refineries with the total output of over than 1.000.000 barrel per stream day and releasing continously oily effluents and certainly will give an additional stress to the marine and coastal waters ecosystem.

B. The South Cina Sea

The Southern part of the South China Sea is dealing wholly or partly of the Thai, Philippines, Malaysia, Singapore and Indonesian waters.

On the coast of this waters are totally eight refineries having a total capacity of over than 500.000 barrels per day.

Offshore exploration are being active off the east coast of the Malaysian Peninsula and producing 120.000 barrels per day. In the gulf of Thailand which encountered gas and gas condensate, in the west coast of east Malaysia with the production of 180.000 barrel per day, within the Indonesian territorial waters in the surroundings of the Natuna Island (exploration activity) and in the Philippine waters off the west coast of the Island Palawan producing 40.000 barrels per day. (Bilal and Kuhnhold, 1980).

IV. METHODOLOGY

Pollution studies involve a sequence of operations namely, *Sampling, Sample preservation and storage.*

Sample pretreatment and analysis as well, each of which is governed by a set of procedures.

There are numerous methodologies available to day on the various aspects of study and yet they are constantly being reviewed and improved.

Figures given in the previous chapter are measured by various methods except the measurement of stranded tar. The procedure of the IOC Marine Pollution Monitoring System (MARPOLMON–P), Manuals and Guides No: 7/1976 and its supplement 7/1977 were mostly used by the countries.

There are three methods used in this paper for the analysis of "Oil in Water" even the description of "Oil in Water" is not regionally defined yet.

1) Phang et al from Malaysia (1980) analysed 2.5 litres water sample extracted by CCL_4. The extracts were then filtered through a glasswool and analysed by using a Beckman IR Spectrophotometer. Reference sample for calibration are mixture of 37% iso-octane, 37.5% hexadecane and 25% benzene.
2) Indonesia used the Method of CONCAWE 1/72 for the mineral oil content in water sample of 5 litres. The sample is extracted with CCL_4 where non hydrocarbon component are removed by shaking with Florisil. The pre-treated sample is then analyzed by using Beckman – IR – Spectrophotometer, CH- CH_2- and $-CH_3$ groups of the hydrocarbon or/and its derivatives, which are not retained by Florisil showed in the IR absorption bands at 3,38 and 3,42 micron. (Anon. 1972)
3) Philippines howeyer do not present concentration of "fossil-hydrocarbon" in water but due to the method used, give the concentration of *"oil and grease."*
4) Also Thailand some give the concentration of "oil and grease".

The Regional Technical Meeting 1983 attended by the ASEAN countries delegates, which was sponsored by UNEP Regional Seas Programme. has teached a consensus that the description of "oil in water" should meant as Dissolved and Dispersed Petroleum Hydrocarbon (DDPH) in water which is measured according to the IOC Manual for Monitoring Oil and Dissolved and Dispersed Petroleum Hydrocarbon in marine waters and on beaches.

C. The Celebes Sea

The Celebes Sea is bordered by Indonesia, Malaysia and the Philippines whose physical environment condition is vulnerable also the environmental resources in the Straits of Malacca as well as the characteristics of vessels involved in the oil trade between Japan and the Middle East, may influence the future shape of oil shipment through the Southeast Asia and the Pacific. It could cause tankers to take alternative routes, notably the present route through the Straits of Lombok, Makassar and the Celebes Sea.

In the year 1975, three ULCCs namely the Globtik London (483.960 dwt), the Globtik Tokyo (483.684 dwt) and the Nisseki Maru (372.698 dwt) have sailed through the Celebes Sea. According to the IMCO Consultant during the Meeting on The development of Sub-Regional Oil Spill Contingency Arrangements in the Celebes Sea (doc. OSCA/Inf. 2) appears 25 30 VLCCs per year and 100–150 tank vessels per month are transiting this area. Finn et al (4) has estimated that the transport of oil in the year 1975 through this area has reached about 700,000 ton.

Oil exploration and production activities at the entrance and along the western side of the Celebes Sea have a total production of about 25.000 barrel per day namely from Bunyu, Sebakung, Mangatal and Sangdaya field.

V. VALUABLE AND VULNERABLE MARINE ENVIRONMENTAL RESOURCES

The five ASEAN countries are countries with valuable and vulnerable marine and coastal environmental recources in the form of mangrove ecosystem, reef ecosystem, fisheries projects, touristic activites etc.

The largest concentration of Mangrove forest remaining in South East Asian Region is in Indonesia. (3.627.00 ha) other major area are found in Malaysia (Sarawak and Sabah: 538.921 ha), Malaysian Peninsula (113, 348 ha), Philippine (106.133 ha), Singapore (1.800 ha) and Thailand (163.349) (Morgan and Valencia, 1983).

In this paper it is not able to mention detailed other resources data, but figures in a form of a map could give a short overview on the potential coastal environmental resources. (Fig. 5 till 11).

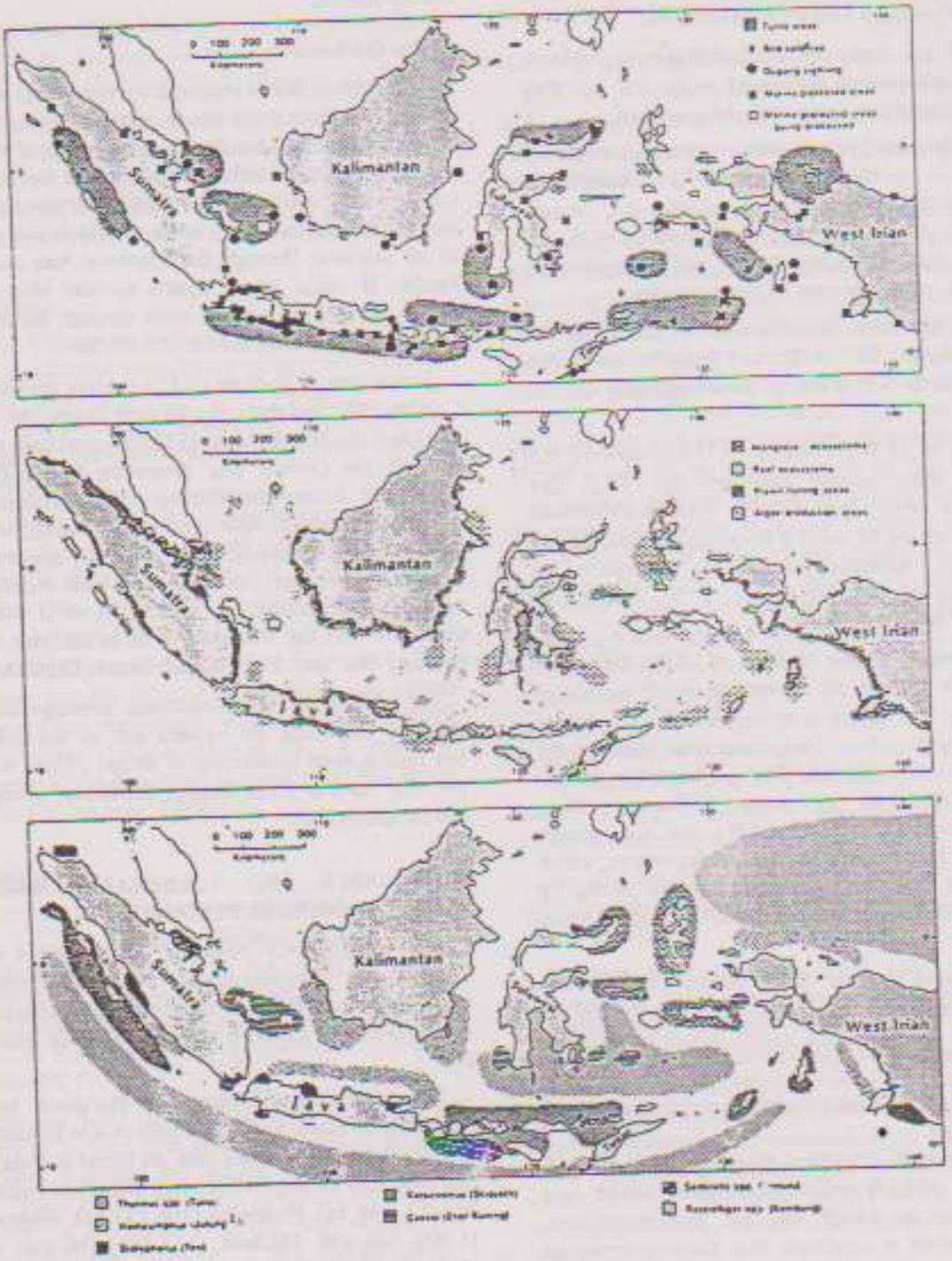


Figure 5. Indonesia: valuable and vulnerable marine environmental resources. (Valencia, 1981).

Figure 6. Malaysia: valuable and vulnerable marine environmental resources. (Valencia, 1981)

Figure 7. Malaysia: valuable and vulnerable marine environmental resources. (Valencia 1981).

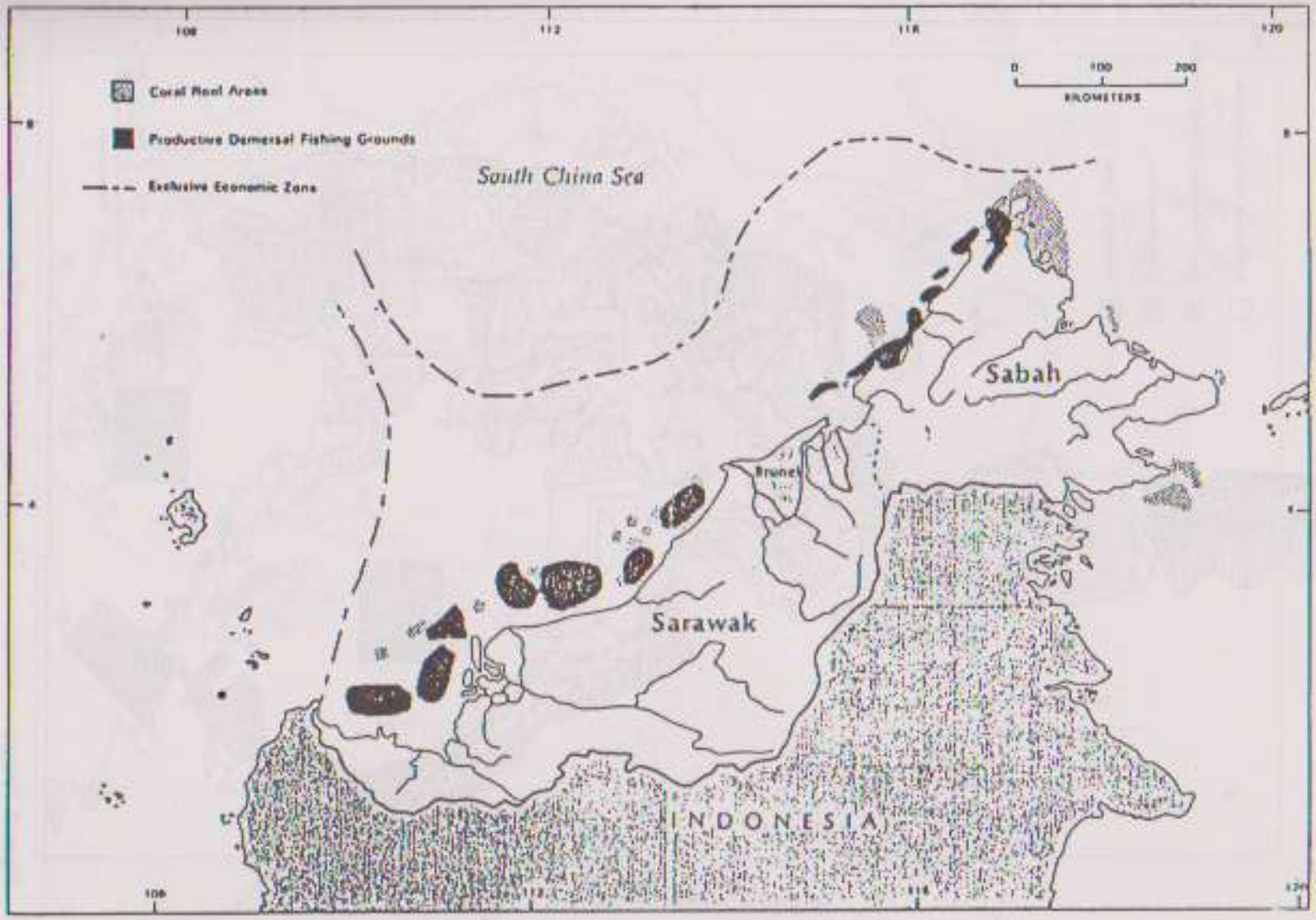


Figure 8. Mataysia: valuable and vulnerable marine environmental resources. (Valencia, 1981)

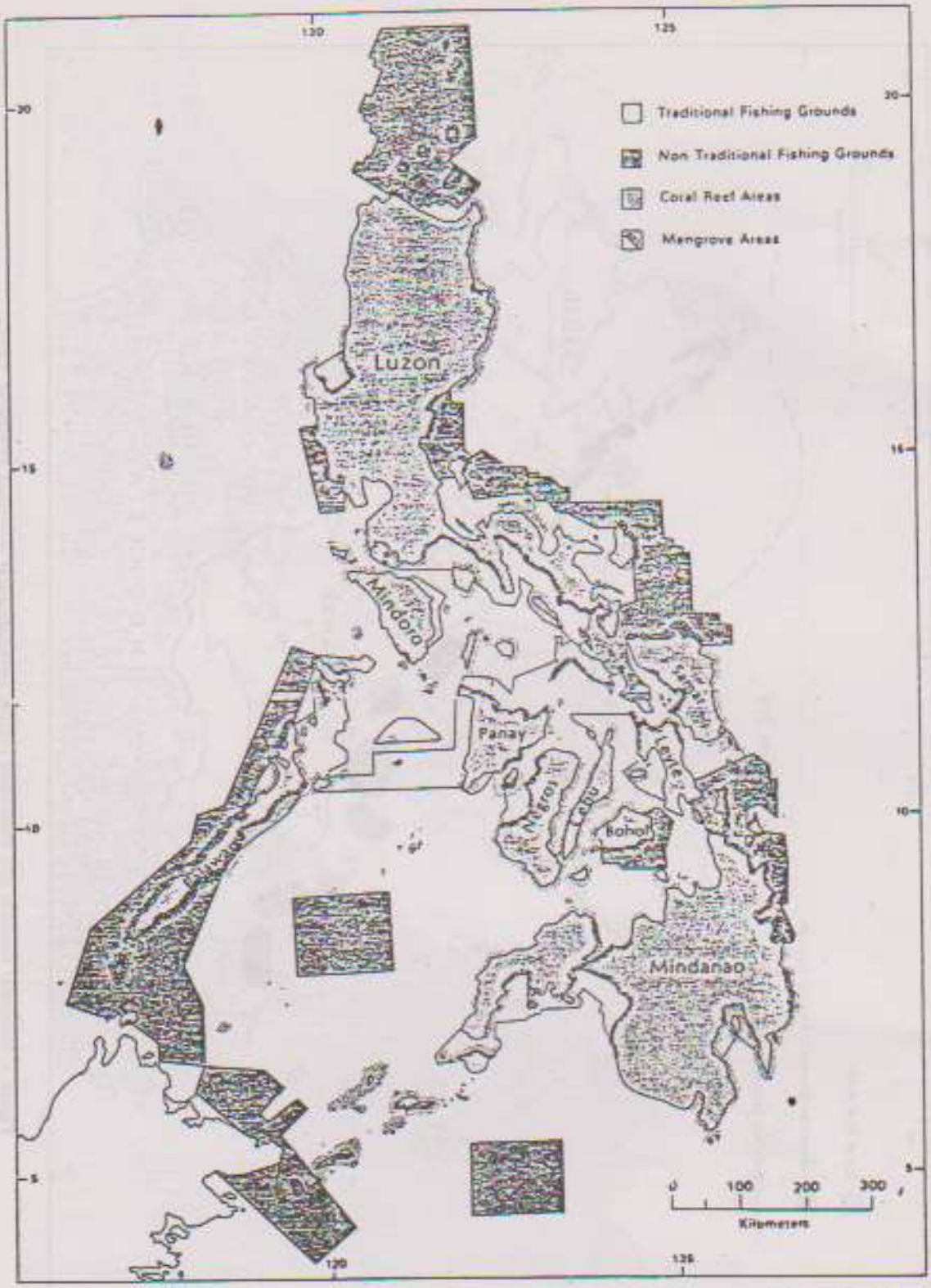


Figure 9. Philippines: valuable and vulnerable marine environmental resources. (Gomez, 1980)

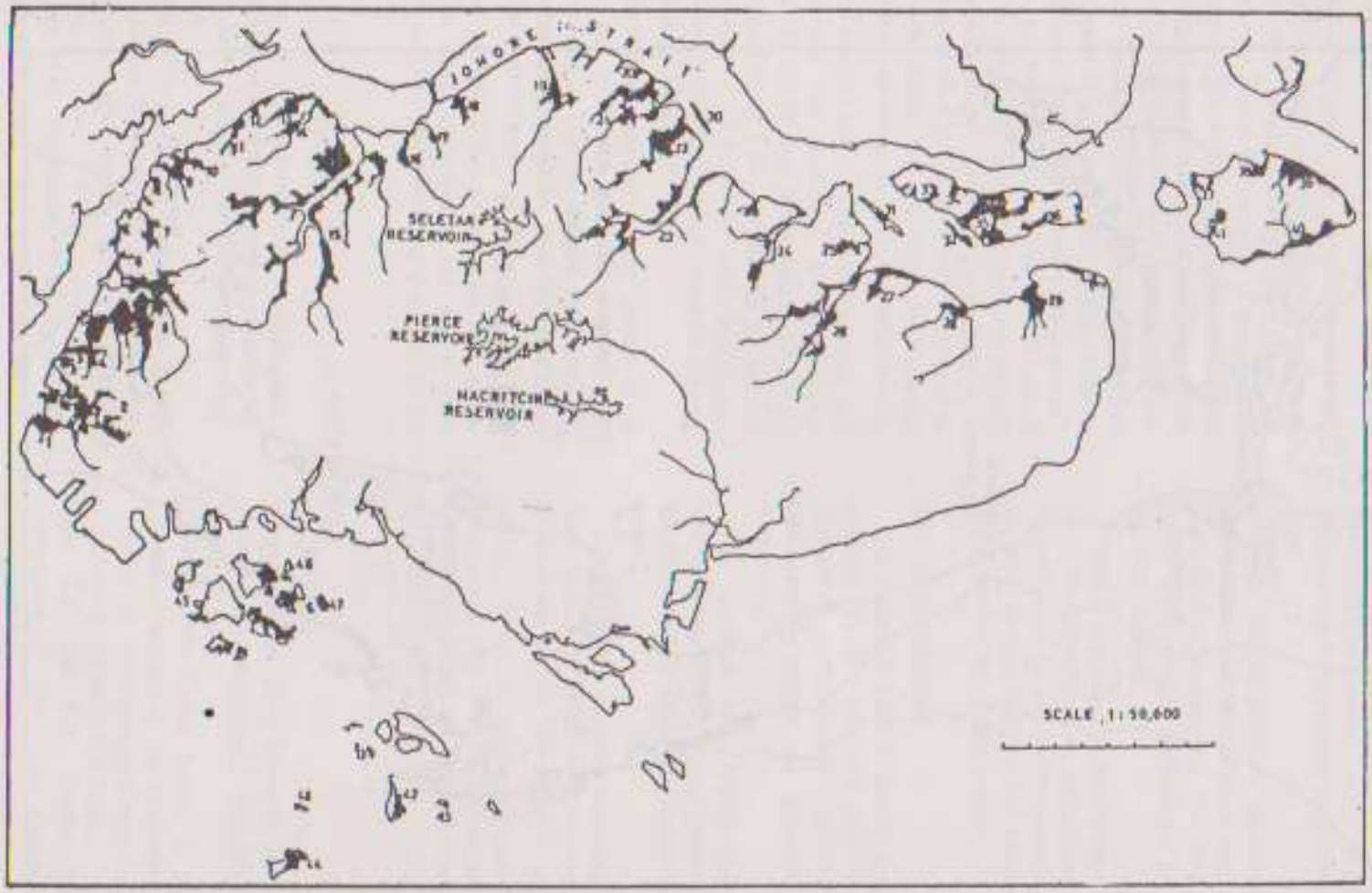


Figure 10. Fistribution of mangrove swamps in Singapore

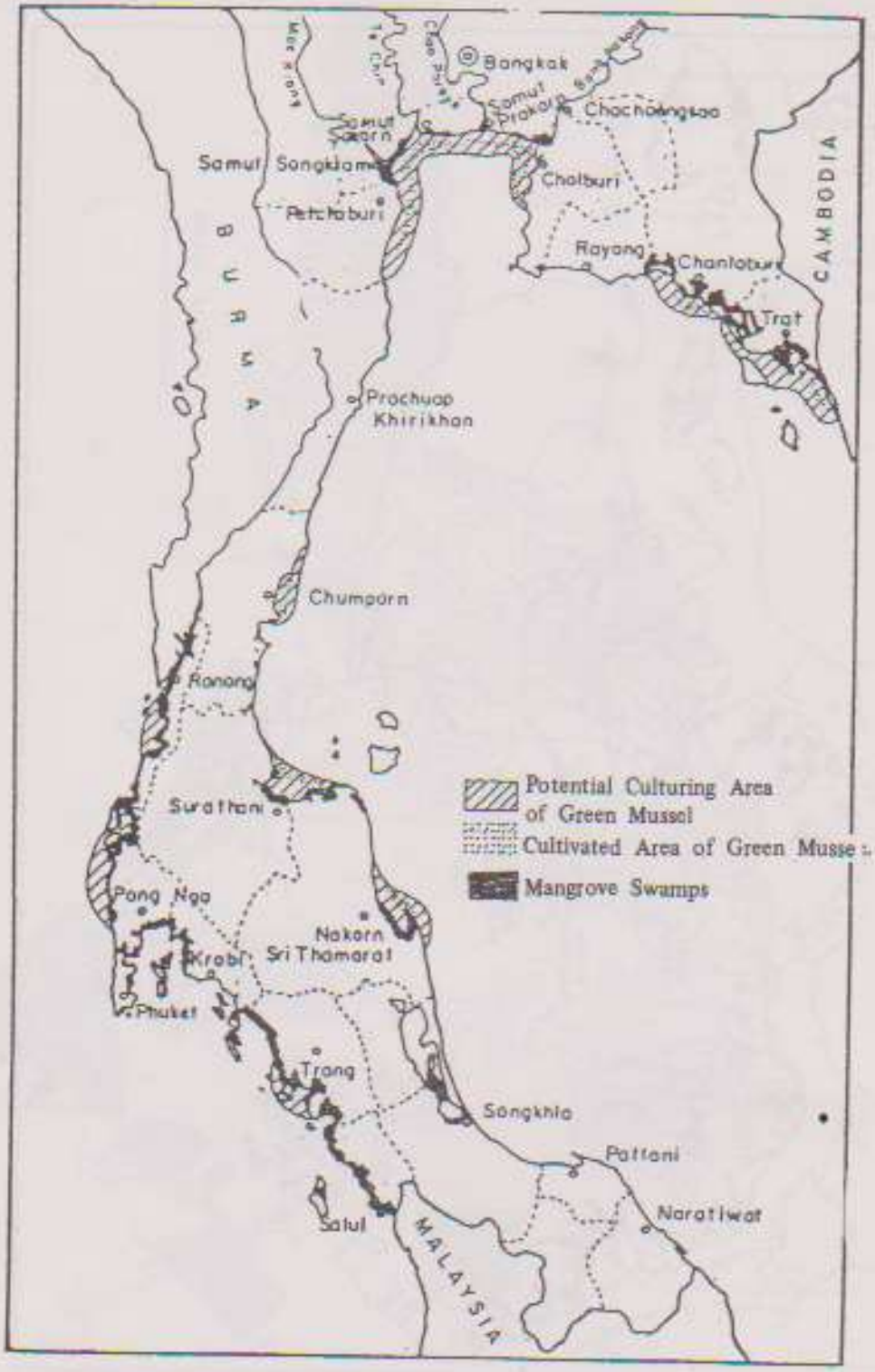


Figure 11. Distribution of Mangrove Stamps (black area) in Thailand.

VI. REGIONAL ASSESSMENT AND MONITORING

Marine Oil Pollution has myriad effects to the marine environment resources. The countries in Southeast Asia are concerned that there are significant reduction to the capacity of the ocean to sustain economically important fisheries, recreational effectiveness of coastal waters and economic values related to tourism caused by such marine pollution.

Pollution assessment and monitoring in the world ocean has been established in many region. Because pollution measurements are necessary to keep track of trends in the environmental quality of coastal seas, which can be no longer be regarded to have the unlimited capacity to receive pollutants. It is for this reason that pollution is well monitored in areas like the Baltic Sea, the North Sea, and the North Atlantic by countries bordering these waters.

Regional cooperation in pollution monitoring and assessment was also established in the Southeast Asian Seas by UNEP East Asian Seas Action Plan, the so called Project EAS 2.1 "Survey of Sources and Monitoring of Oil Pollution" with lead-institution the Research and Development Centre for Oil and Gas Technology"LEMIGAS".

The short term objective of the project is to determine the levels of oil marine pollution and on beaches from as many actual and potential areas of contamination as possible and to monitor the changes over a certain period of time.

The area of application of the action plan covers initially the marine environment and coastal areas of the five ASEAN States, without prejudice to its future extension so as to cover the marine environment and coastal areas of all States bordering the East Asian Seas as may be determined at a later stage.

For a regional pollution assessment, parameters and measurement methods are very important. In this regard it is important that laboratories in the region select suitable methods and parameters to be regionally adopted.

There is also a need to intercalibrate the laboratories in the region. Such an exercise can be regarded as a prerequisite for any pollution monitoring programme in a region, in order to that whatever effects put in will produce meaningful results.

VII. CONCLUSIONS

– The Southeast Asian Waters are at present densely occupied by oil activities such as exploration, production, manufacturing and transportation. Consequently marine oil pollution problem is intensifying.

– The Southeast Asian Waters has valuable and vulnerable marine and coastal resources, which are distributed along major oil activities and shipping routes.

– It is felt by the countries bordering the Southeast Asian Waters to establish a cooperative effort to conserve and protect their valuable marine resources.

– There is a need to standardize methods to monitor and measure the level of oil contaminants in the marine environment to ensure the compatibility of the data obtained.

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ERRATA SCIENTIFIC CONTRIBUTION 1/1987

There have been several misprints in an article of Oil Pollution Abatement starting from the last paragraph of the abstract which should read "Parameter pertinent to the location of the spill related to the methods to be applied should be seriously considered". Further the complete paragraph in the by line Effluent Standards should read: "Tanker discharges are maximised at 60 l/ mile for a moving ship. Platform discharges were proposed between 30 and 90 ppm, but since 1977, the Director General for Oil and Gas has instructed that oil waste discharge should not exceed 25 ppm".

(The Editor).