THE EVOIKOS AND PONTOON 300 INCIDENTS - THE TECHNICAL ADVISER'S PERSPECTIVE

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INTRODUCTION

The oil spills from the tanker EVOIKOS off Singapore and the barge PONTOON 300 in the United Arab Emirates (UAE) were major incidents which severely tested response arrangements in the two countries. Both spills were of persistent residual fuel oils, the former a heavy fuel oil (HFO) and the latter an intermediate fuel oil (IFO), and both involved use of equipment stockpiles established by the Petroleum Association of Japan (PAJ) on the major oil transport routes to Japan.

The purpose of the paper is to review the two incidents in broad terms from a technical perspective, in order to identify some of the successes and difficulties experienced during the responses and to suggest improvements for the future. Understanding the type of oil and its behaviour once spilled is crucial to realising the technical limitations that this places on the response. The form of the response is, in turn, important to securing proper compensation, which proved to be a crucial issue in both incidents.

ITOPF's attendance on site in Singapore and Malaysia in the case of the EVOIKOS was on behalf of the tanker owner, his P&I insurer and the 1 97 1 International Oil Pollution Compensation Fund (1971 IOPC Fund). In the United Arab Emirates (UAE), it was solely on behalf of the 197 1 IOPC Fund.

COMPENSATION ARRANGEMENTS

Compensation for oil pollution damage caused in the case of the EVIOKOS and PONTOON 300 spills is governed by two international Conventions: the 1969 International Convention on Civil Liability for Oil Pollution Damage (CLC 69) and the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund 71).

Compensation under CLC 69 is provided by the individual tanker owner through a system of compulsory insurance. Supplementary compensation under the terms of the 7 1 Fund Convention is provided through an international fund contributed to by companies receiving crude oil and fuel oil after sea transport. The international fund is administered by the 1971 International Oil Pollution Compensation Fund (1971 IOPC Fund). Countries that ratify Fund 71 automatically become Members of the 1971 IOPC Fund.

Limits of compensation for CLC 69 are set in relation to the size of the tanker, up to a maximum of about US$ 19 million. The supplementary compensation provided by the 197 1 IOPC Fund is not related to tanker size, but is up to a fixed limit of about US$ 81 million.

At the time of the EVOIKOS spill, Singapore was party only to CLC 69, and the shipowner/insurer's liability under this convention was about US$ 13 million. However, the spill also reached the waters of Malaysia and Indonesia, and as these countries were parties to Fund 71 as well as to CLC 69, additional compensation up to the Fund 71 limit was potentially available in these countries.

At the time of the spill from PONTOON 300, UAE was party to both CLC 69 and Fund 7 1, but because neither the owner of PONTOON 300 nor a pollution insurer could be identified, compensation was available only from the 1971 IOPC Fund. Since these two incidents, both Singapore and the UAE have ratified the 1992 CLC and 1992 Fund Conventions, which provide both higher compensation limits and a broader scope of application.

For compensation to be available under the terms of the international conventions it is a requirement that the spill response measures which are adopted are reasonable on technical grounds. Put simply, this means that for costs to be met the response strategies and the clean-up techniques must be appropriate in the particular circumstances. In addition, there are important consequences for claimants if all approved claims exceed the total amount of compensation available. Each claim would be reduced proportionately in order that the compensation is distributed fairly.

EVOIKOS

The incident

The tankers EVOIKOS (80,823 GT) and ORAPIN GLOBAL (138,037 GT) collided whilst passing through the Strait of Singapore on 15 October 1997. The EVOIKOS, which was carrying about 130,000 tonnes of heavy fuel oil, suffered severe damage to three cargo

tanks and an estimated 29,000 tonnes of heavy fuel oil was spilled almost instantaneously. The ORAPIN GLOBAL, which was in ballast, did not spill any oil.

The spilt oil initially spread from the collision point to contaminate about a dozen small islands off the southern coast of Singapore. Strong tidal currents caused uneven spreading and fragmentation of the oil, which at the time of spillage was fairly fluid in the warm ambient temperatures. By 19 October the viscosity of the oil had greatly increased through natural weathering and winds and currents had begun to move the slicks away from Singapore waters and into the Malacca Strait. By the end of the first week, the oil was approaching Malaysian shorelines in the southernmost section of the
Malacca Strait, but it did not actually hit the coast. At this stage the fragmented slicks ' which still contained major areas of black oil, were scattered over more than 1 50 square kilometers. A few days later the oil covered more than twice that area.

During subsequent weeks the oil continued its north-west drift, influenced by tidal streams and local currents, spreading further as it travelled. Because winds were light and variable the oil remained offshore. By the beginning of November the remaining residues, which still included large patches of black oil and extensive heavy sheens, were spread over more than 3,000 square kilometres of sea surface. The slow northward drift continued until 12 December, when some oil finally began to come ashore in places along a 40 kilometre length of the Malaysian coast in the Province of Selangor. Rough estimates indicate that about 100 - 200 tonnes came ashore. Figure 1 illustrates the gradual drift of the oil from Singapore waters and into the Strait, summarising a series of aerial surveillance maps prepared at the time. It is likely that oil began to sink as it weathered in the later stages of drifting, leaving a decreasing proportion available to strand on shorelines.

Clean-up operations at sea

The Maritime and Port Authority of Singapore (MPA) took charge of the clean-up operations, initially focusing on dispersant spraying at sea and then on containment and recovery of the floating oil. Clean-up equipment stockpiled in Singapore by East Asia Response Ltd (EARL) , the Petroleum Association of Japan (PAJ) and Semco (who were also involved with salvage) was deployed. PAJ equipment from Port Kelang in Malaysia was also brought in to supplement local resources, with the approval of the Malaysian authorities.

About 500 kilolitres of dispersant were reported to have been applied to the slicks from boats, although the precise quantity is not yet known. In theory, if applied in optimal proportions (1 :20, dispersant:oil), this volume would have been sufficient to disperse about 10,000 tonnes of oil. However, in practice it is difficult to achieve optimal application ratios from boats, and the process is

made more difficult and less effective because spilled oil rapidly becomes fragmented and patchily distributed on the water surface. This spill was no exception. Large scale application of dispersant from aircraft, which tends to be more effective at achieving efficient application of the chemicals, was not feasible because of heavy shipping traffic in the spill area, and because of air traffic restrictions for fixed wing aircraft in Singapore airspace. A trial application by helicopter was made (see below), but this approach was not scaled up.

Different types of oils vary in their chemical dispersability. Heavier crudes and residual fuel oils, which are highly viscous, may not be dispersible. Where they are dispersible, they tend to be much more difficult to disperse than lighter crudes and fuels. Natural weathering processes also act on the oil once spilled, resulting in steadily increasing viscosity such that chemical dispersants eventually become ineffective. This point is usually reached within a few days after spillage. The cargo of the EVOIKOS was of moderate viscosity (2,000 mPas at 20°C) and in the high ambient temperatures was initially dispersible. However, there proved to be differences of opinion over whether dispersion was being achieved. The belief was widespread that a white colour in the water after dispersant had been applied was evidence of success. In fact, the white colour results from dispersant having failed to react properly with the oil and having become mixed directly into the water. This may have been due to inappropriate or poor application techniques or, once the oil had become more viscous by weathering, may have been an indication that the dispersant could no longer penetrate and disperse the oil. For most dispersants, good dispersion is evidenced by a distinct coffee-coloured plume visible below the water surface.

Trial applications of dispersant by helicopter and by knapsack spray, carried out during the 4th day after the spill, showed that the oil had become very viscous and that dispersants were no longer effective. A simple dispersion test the following day confirmed this to be the case. Nevertheless, many responders claimed dispersants were still working, perhaps for the reason outlined above, which led to controversy over whether dispersant application should be continued. There is often a reluctance to discontinue dispersant use if there are perceptions that it may be doing some good, or where response agencies rely heavily on the technique, especially if no alternative is available. Whilst application from helicopters was stopped after the trial, spraying from boats did carry on.

Although the exact timetable of dispersant application in this response is not completely clear, it is believed that a significant volume was applied after the oil had become too viscous for chemicals to be effective. Thus, it is likely that only a fraction of the potential dispersion was achieved in this case.

Subsequent attempts at recovering oil from the sea were hampered, not by an absence of appropriate equipment, but by the lack of adequate logistical support for skimmers and booms. Although more than fifteen heavy oil skimmers and adequate boom for oil containment were immediately available, only a few functional systems were put in place. Particularly lacking were vessels and barges suitable for receiving recovered oil. This is clearly an issue that requires particular attention in the future. Oil storage vessels were eventually found, with the numbers increasing between 18 and 22 October (see Table 1), but by the time they became operational the majority of the oil had left Singapore's waters and was scattered over more than 150 square kilometres in the Malacca Strait.

Table 1

Date	Oil Concentration	Oil Recovery Systems	Storage Barges
16 Oct	Heavy		
17 Oct	Heavy		
18 Oct	Heavy	3 EARL + 4 SEMCO	1
19 Oct	Reducing	4 EARL + 8 SEMCO	3
20 Oct	Light	3 EARL + 4 SEMCO	3
21 Oct	Sheens	4 EARL + 7 SEMCO	9
22 Oct	Sheens	4 EARL + 7SEMCO	9

Clean-up operations on shore

Once the threat to Singapore had receded, the focus turned to shoreline cleaning on the small southern islands which had been oiled. In all about 40 kilometres of shoreline had been contaminated, including tourist/recreational islands, industrial areas and military facilities. Contaminated shorelines comprised rocks, boulders, man-made sea walls, sandy beaches and mangrove swamps.

Setting achievable priorities for clean-up became crucial for a number of reasons. Shoreline cleaning takes time and calls for substantial resources, and it is important to deal first with the areas given the highest priority. Given the potential scale of clean-up, there were also concerns over the adequacy of the available compensation. Under the terms of CLO '69, a maximum of about US$ 13 million was available from the shipowner/insurer for all aspects of clean-up and damages, but considerable sums had already been spent at sea, and further expenditure might also be incurred for clean-up and damages in Malaysia and Indonesia, which would further limit available compensation for Singapore. As noted previously, Malaysia and Indonesia were party to Fund 7 1 at the time of the spill, and claimants in those countries have the right to supplementary compensation from the 1971 JOPO Fund if any shortfall in their approved claims resulted from the CLC 69 limit being exceeded and pro-ration being applied.

Cleaning recreational beaches in Singapore was deemed to be the highest priority, so Pulau Hantu and Raffles Light (see Figure 2) were treated first. A commercial contractor was engaged by the shipowner and the P&I Club. Manual and mechanical techniques as well as dispersants and seawater pumps were used to clean sandy beaches and sea walls. Cleaning of newly constructed recreational and industrial facilities on an island under development (Pulau Semakau) was dealt with by the developer as a high priority, with the work tailored to suit the on-going construction programme.

Extensively oiled sea walls in industrial areas and on military islands were mainly inaccessible and not open to the public. Given that the oil had rapidly stabilised, it was recommended that only areas where contact with vessels or personnel was likely should be cleaned, allowing natural degradation to take its course elsewhere in this already industrially-contaminated area.

Mangroves, which are also found on the industrial and military islands, are a special case, as scientific evidence points strongly to the need to leave them to natural recovery because of the high risk of compounding damage by attempts at clean-up. One area of newly created mangrove swamp (to replace mangrove destroyed by commercial developments) was oiled, but to date survival of the planted seedlings seems good. These mangroves are being monitored to see if damage results from the spill.

There is no doubt that the progress of shoreline cleaning work in the Singapore islands was hampered by the limited funds available. Had supplementary compensation from the IOPO Fund been available in Singapore it is likely that the cleaning operation would have been concluded more quickly and to the greater satisfaction of all parties.

Malaysia

By the time oil slicks had reached Malaysian waters in the Malacca Strait, it had already been established that the oil was no longer amenable to chemical dispersants. The Malaysian Marine Department (MMD) , which was in charge of response operations at sea, considered the option of containing and recovering the oil before it came ashore. However, they recognised that they faced the same difficulties witnessed in Singapore with insufficient tugs and temporary oil storage capacity to support such an operation. With the oil becoming increasingly viscous, all but the heaviest recovery equipment would have been rendered ineffective. Furthermore, slicks were spreading and scattering over hundreds, and what was eventually to become thousands, of square kilometres. Attempting recovery operations on this scale would be extremely onerous and unlikely to achieve any significant success. The Malacca Strait is a very busy shipping route and any such recovery operations would also be potentially hazardous.

In light of these circumstances, the MMD were persuaded to follow a strategy of close monitoring and surveillance using helicopter and boat services, and placing on standby adequate resources to protect those sensitive coastal areas given the highest priority. Some containment and recovery equipment was kept in readiness to work close inshore in these areas and some clean-up resources were put on alert to respond to any shoreline impact. The heavy oil skimmers owned by PAJ as part of the Port Kelang stockpile were deemed to be an important component of this state of readiness, but
these had been deployed to Singapore in the early stages of the incident. There were considerable delays over their return as the Singapore authorities were reluctant to part with them in case the threat to Singapore returned with changing winds and currents.

Initially, as the slicks left the Singapore Strait and began entering the Malacca Strait, oil patches approached a large group of fish farms in sheltered waters around Pulau Kukup. Fish farm owners were encouraged to use locally available materials, including plastic sheeting weighted with bricks, to surround the fish cages, so forming a protective barrier against floating oil. In the event, the protection was not called upon to perform, as the oil came no nearer than 500m from the outermost farms. As the oil slicks steadily moved further north in the Malacca Strait, different local divisions of the MMD took control of the response, each maintaining the overall strategy of close monitoring, identification and protection of highest priority resources, and placing shoreline clean-up resources on alert! standby.

After some 2 monThs, slicks had moved beyond Port Kelang and some smaller patches eventually became caught in local currents and then stranded in places along a 40 kilometre stretch of the Selangor Province shoreline. This included several sandy beaches, a one-kilometre length of rocks and concrete breakwater, and several separate areas of mangrove. Onshore clean-up operations were co-ordinated by the Malaysian Department of Environment with support from the MMD. Individual district authorities within the Selangor Province organised the manual removal of oil and oily material from sandy shores, and arrangements were made to clear the rocky and concrete breakwater areas. Scientific evidence was heeded in the case of affected mangroves, with the oil being left to weather, and the mangroves to recover naturally.

After hitting shores, the remainder of the floating slicks moved further north-west, away from the Malaysian coast and toward the middle of the Malacca Strait, posing an ever-decreasing threat. By January 1998, some 2 1/2 months after the spill had occurred, the remaining monitoring operations were finally stood down.

Indonesia
There is no information on any pollution impact in Indonesia. However, the relevant authorities were kept informed by the Malaysian authorities of the presence of oil in the Malacca Strait.
PONTOON 300

The Incident
On 7 January 1998, intermediate fuel oil (IFO) was spilled from the sea-going barge PONTOON 300, whilst under tow off the United Arab Emirates by the tug FALCON 1. The barge had reportedly become swamped by the heavy seas generated by strong and blustery winds from the north, known locally as 'shamal'. Whilst taking on water, the barge had been losing oil, and during the course of the night of 8 January it sank and settled on an even keel on the bottom at a depth of 2 1 metres, about six nautical miles off Hamriyah Free Port. PONTOON 300 is a flat-top barge of 4,233 gross tons. Although designed for deck cargoes, the barge was on this voyage carrying her cargo of LEO in 24 buoyancy tanks. In addition to these tanks, divers later reported signs of diesel oil having been loaded in fore and aft ballast spaces on the barge.

A regular trade of oil shipments from the northern Gulf in barges such as the PONTOON 300 has developed over the last few years and there are reports of a number of similar incidents having occurred recently. On 14 January 1998, just a week after the PONTOON 300 spill, another tug and barge, with all names and identification marks painted over, were seen trailing black oil close to where the PONTOON 300 had sunk (see Figure 3). This second flat-top barge, later identified as KAPAR 2, was listing heavily and at times half submerged with waves breaking across the deck. The total quantity of oil seen behind the tow was estimated at little more than 20 tonnes, and fortunately it proved possible to bring the barge into Hamriyah port and offload the oil cargo without further mishap. Both PONTOON 300 and KARAR 2 were carrying similarcargoes of IFO.

The salvage of the PONTOON 300 and its remaining cargo was undertaken by a local salvage contractor. Divers found that eight of the portside tank covers were missing, indicating that 3,000 to 4,000 tonnes of IFO had been lost, but the spill volume was later revised to 8,000 tonnes. During the following weeks work was carried out to plug and seal the various points of seepage but a further spill of about 300 tonnes occurred on 9th January. Contingency measures in case of further oil spillage during salvage were put in place by the UAE authorities and salvors. The salvage operation proved complicated because of damage to internal bulkheads. Mter four attempts, the barge was finally raised, upside down, and towed into Hamriyah port on 6th February. After oil residues had been removed, the barge was towed 17 nautical miles out to sea and scuttled on 17 February.

For the first 6 days after the initial spill oil was drifting within 5 nautical miles of the coast. During the morning of 13 January onshore winds increased suddenly to gale force strength as another shamal reached the UAE coast, coinciding with spring high tides. As a result, all the oil drifting offshore was driven ashore and deposited at the very top of sandy beaches and in the adjoining vegetation. The spilled oil contaminated beaches in five emirates: Dubsi, Sharjah, Ajman, Umm Al Quwain and Ras Al Khaymah (see Figure 3) . The only oil remaining offshore was a small continuous release from the sunken wreck.

IEO is naturally dispersible and could be observed dispersing in the heavy surf created by the shamal on 13 January, which lasted for several days. Natural dispersion significantly reduced the quantity of spilled oil stranded on the shorelines.

Oil spill response measures
In a major spill affecting more than one Emirate, the Federal Environment Agency (PEA) will take overall charge and appoint a response committee and an OSC. However, there is no National

Contingency Plan to set out chains of command or operational procedures and the FEA has no specialised spill response equipment, but relies on port authorities and the oil industry for resources. The Frontier and Coast Guard Service (FOGS) provides vessels for on-water surveillance and the Air Wing of the Ministry of Interior can undertake aerial surveillance. Several port authorities operate tugs equipped with dispersant spraying gear and hold small stocks of clean-up equipment.

The Abu Dhabi National Oil Company (ADNOC) has offshore boom, skimmers dispersant and helicopter-mounted spraying units at five strategic locations, and as members of the Gulf Area Oil Companies Mutual Aid Organization (GAOCMAO), ADNOC may request assistance from other member companies around the Gulf.

The Petroleum Association of Japan (PAJ) has sited a small stockpile of response equipment in Abu Dhabi comprising heavy oil skimmers, boom and portable storage tanks. The PAJ equipment is stored and operated by a local contractor, Lamnalco. A private contractor, Fairdeal, has several skimming vessels and other specialised equipment located at Fujairah and Dubai. Most industrial plants with seawater intakes have booms available. Supplementary resources can also be requested by the government through the Marine Emergencies Mutual Aid Centre (MEMAC), based in Bahrain.

Although control of major oil spills is the responsibility of FEA, very little was done initially to deal with the stranded oil because of uncertainty over compensation. Neither the barge owner nor a pollution insurer could be located for PONTOON 300. This meant that the shipowner and/ or pollution insurer could not be prevailed upon to take an active role in the organization of clean-up, for example by contracting resources and manpower. More importantly, the lack of a shipowner and insurer meant that there was no compensation available under the terms of CLO 69. The 1971 IOPC Fund was applicable, but is established only to pay compensation and is not constituted to contract resources or manpower. Thus, a government agency or private organization must first put in place the necessary contractual arrangements, thereby taking on the financial commitment, and later claim compensation from the IOPO Fund.

The initiative was taken by a small clean-up team from ADNOC to begin recovering oil, working from the shore. Other clean-up contractors were later appointed by FEA and the PAJ stockpile was also mobilised. ADNOC recovered about 60 tonnes of oil at Umm Al Quwain on 1 1 and 12 January, which was disposed of to landfill. Additional small quantities of floating oil were recovered in the following week, but by 19 January there was no floating oil to recover, all the oil having stranded.

Manual cleaning of shorelines started on 12 January with about 100 workers supported by mechanical diggers, and collected oily sand was subsequently removed to landfill. However, co-ordination and control of the clean-up operations by PEA was hampered by a severe lack of resources arid funding. Beach clean-up funded by FEA was therefore suspended for almost two months towards the end of January. Storms in late January resulted in many beaches being scoured of oil and thus cleaned naturally.

After two months Lamnalco came forward and undertook to resume the remaining beach cleaning work with a view to claiming compensation from the 1971 IOPO Fund. A programme of bulk oil removal which met the Fund's technical criteria was drawn up by IOPC Fund experts and agreed with by FEA and Lamnalco, thus maximising the likelihood of full cost recovery under Fund 7 1 . Two IOPC Fund experts were appointed to monitor clean-up progress, and liaise regularly with the FEA.

On completion of each sector of shoreline, a joint inspection was carried out with the authorities with a view to agreeing that an acceptable end point had been reached. The programme ensured that the great majority of oil was removed to landfill, leaving only traces which were deemed to no longer represent

a threat to either public usage or natural resources. The FEA accepted this pragmatic approach, leading to a satisfactory conclusion to the work by the end of April.

Sensitive resources and evidence of pollution damage

A range of sensitive resources are to be found on the UAE coastlines, including a marine research institute, commercial fishing and industrial water intakes. The Marine Resources Research Centre (MRRC) is run by the Ministry of Agriculture and Fisheries for aquaculture research and development. The presence of oil near the seawater intake prompted its closure for several days. The facility then relied on re-circulation pumps and additional aeration to maintain water quality in the cultivation tanks. On 10th January the intake was re-opened at High Water during the day when confirmed to be free of drifting oil, but some oily sheens were nevertheless drawn m. The losses likely to have occurred at MRRC take the form of physical contamination of cultivation facilities, extra costs in supplementing sea water supplies by tank trucks and disruption of cultivation programmes for fish and prawns.

Although no compensation claims have been submitted yet, there seems little doubt that local fishing was disrupted by the spill, and that delays to beach cleaning resulting from uncertainty over compensation compounded any damage. The delays also affected bookings at beach hotels where shoreline contamination was heaviest.

CONCLUSIONS

EVOIKOS

- The oil spilled in the EVOIKOS incident remained afloat in a narrow waterway for 2 1/2 months as a result of the high viscosity of the oil and calm weather conditions.

- High oil viscosity was the main factor limiting dispersant effectiveness.

- Attempts to recover oil using booms and skimmers were hampered initially by a lack of barges for storing collected oil. By the time barges became available the bulk of the oil had drifted out of Singapore waters and spread over a large area.

- A realistic and successful strategy of monitoring drifting oil and protecting key sensitive resour ces was adopted by the Malaysian authorities.

- Because compensation available under the terms of CLC 69 may be insufficient for the payment of all valid claims, there is a risk that claimants in Singapore may receive only partial compens ation since Singapore had not ratified Fund 7 1 at the time of the EVOIKOS incident.ingapore has now ratified CLO 92 and Fund 92, which will be in force on 3 1 December 1998 and which provide both higher compensation limits and a broader scope of application.

PONTOON 300

- Although the UAE had ratified CLO 69, only Fund 71 was applied in the PONTOON 300 inci dent since no shipowner or pollution insurer could be identified.

- The clean-up operation was interrupted due to a lack of government funds but was resumed after seven weeks when a successful solution for resuming the clean-up was found involving close co-operation between the government authority, a commercial clean-up contractor and the IOPC Fund.

- The UAE has now ratified the CLC 92 and Fund 92, which will come into force on 19 November 1998

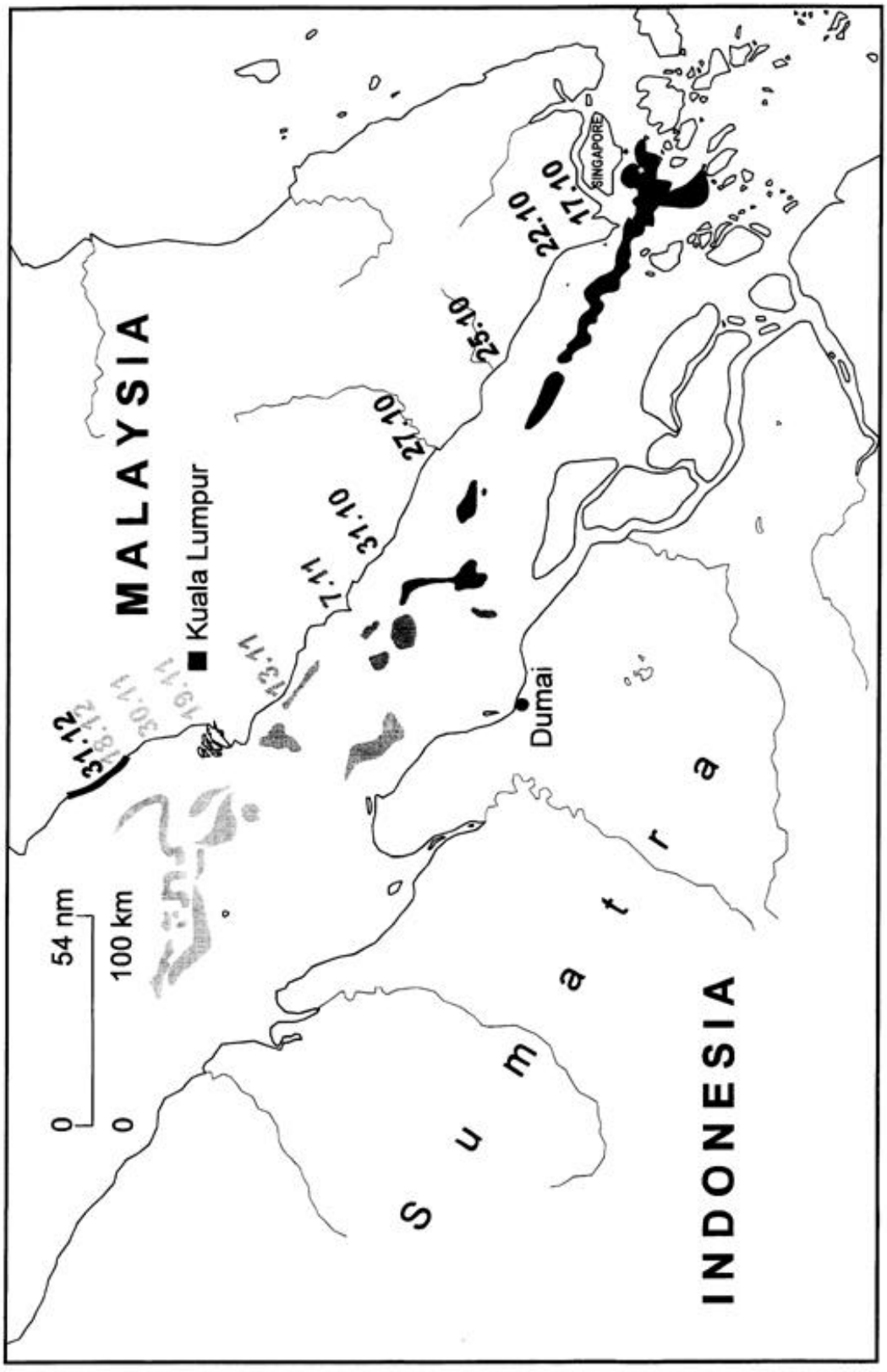


Figure 1. Distribution of spilled oil from EVOIKOS on successive dates from mid-October to the end of December 1997. Location of shoreline impact:

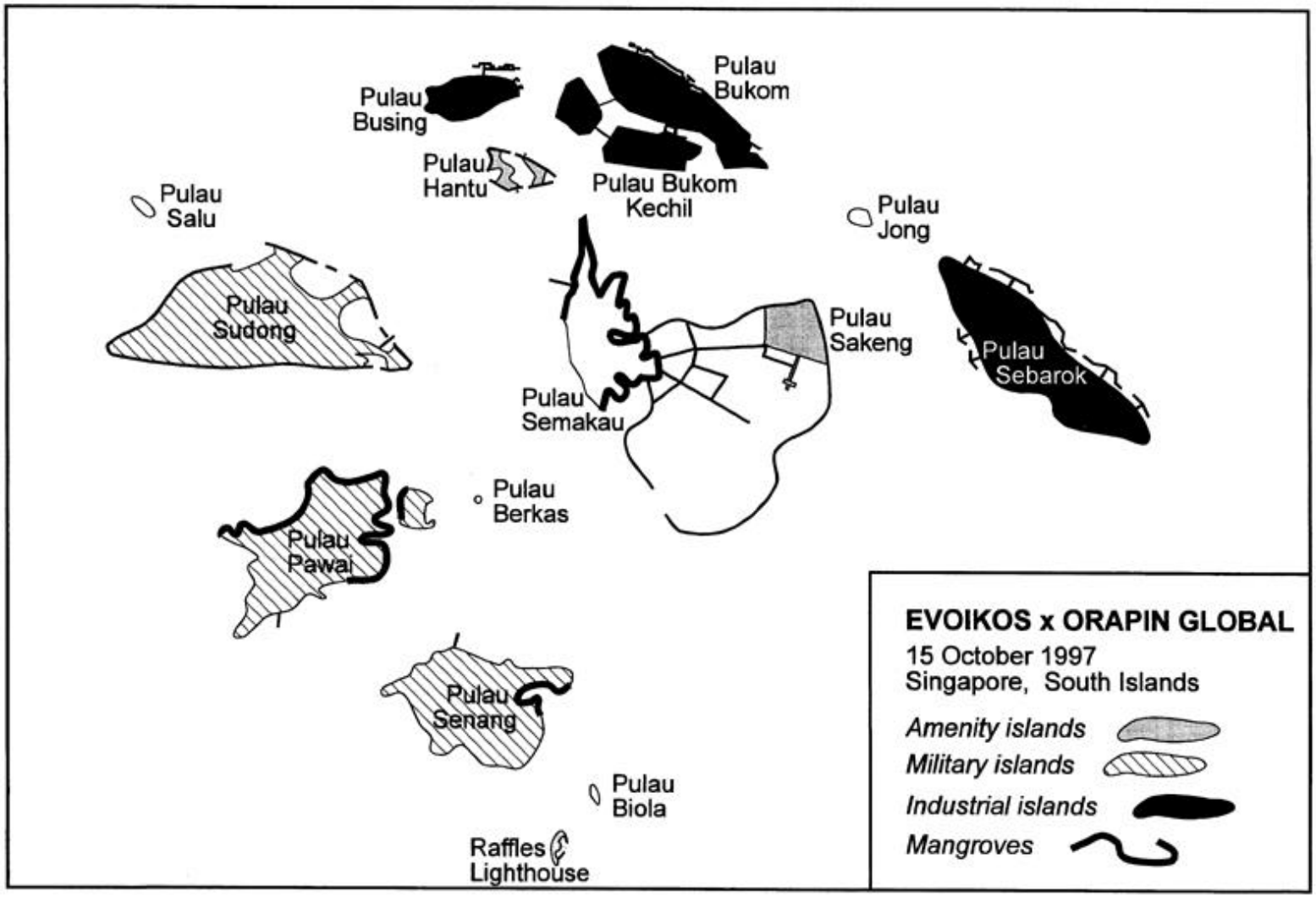
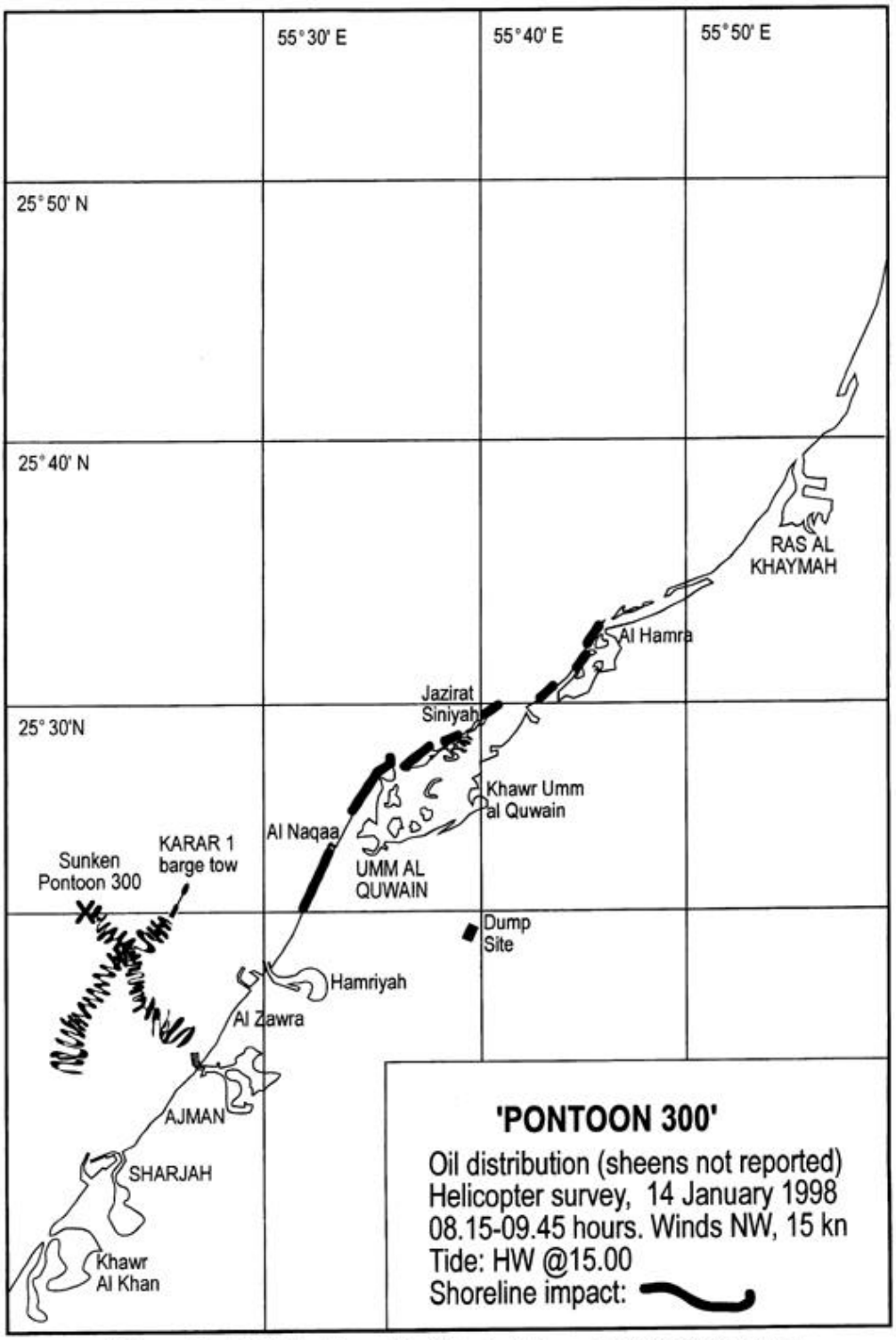


Figure2. Islands south-west of Singapore contaminated by oil



Fifure 3. Distribution of spilled oil from PONTOON 300