Strategic Action Programme

for the

Red Sea and Gulf of Aden

Navigation Risk Assessment and Management Plan

Regional Organization for the

Conservation of the Environment of the

Red Sea and Gulf of Aden

PERSGA

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These reports have been prepared for the PERSGA Strategic Action Programme Task Force by Det Norske Veritas (DNV) as an element of the preparation process for the Strategic Action Programme. The judgments expressed do not necessarily reflect the views of the cooperating governments and organizations.

The documentation for the Strategic Action Programme includes three complementary publications: (a) Strategic Action Programme – Volume 1 – Main Report, published in 1998; and (b) Strategic Action Programme – Volumes 2 and 3 – Supporting Studies. Volume 2, the Country Reports, for Djibouti, Egypt, Jordan, Saudi Arabia, northern coast of Somalia, Sudan and Yemen was published in March 2001. This is Volume 3a, which contains the Navigation Risk Assessment and Management Plan for the Red Sea and Gulf of Aden. The Living Marine Resources Assessment will constitute Volume 3b. The Strategic Action Programme has also prepared a wall map that shows major environmental features of the PERSGA Region.

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The Navigation Risk Assessment and Management Plan for the Red Sea and Gulf of Aden was prepared as an element of the Strategic Action Programme for the Red Sea and Gulf of Aden by Det Norske Veritas. Messrs. Emil Aall Dahle, Hans Martin Førsund, Lasse Kristoffersen, Ali Sabri (consultant) are the authors. Mr. George McHenry provided quality control.

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Abbreviations and Acronyms

AAST	Arab Academy for Science and Technology and Marine Transport
ASTM	American Society for Testing and Materials
COLREG	International Regulations for Preventing Collisions at Sea
DNV	Det Norske Veritas
F	Frequency
FAO	United Nations Food and Agricultural Organization
GESAMP	IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
ILO	International Labor Organization
IMO	International Maritime Organization of the United Nations
ISF	International Shipping Federation
ISM	International Safety and Management Code
L	Local
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MOU	Memorandum of Understanding
N	National
Nautical miles	Nautical miles
N/A	Not Applicable
OSR	Oil Spill Response
OSRC	Oil Spill Response Capability
P and I Clubs	Protection and Indemnity Clubs (Insurance term)
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
PSCO	Port State Control Officer
R	Regional
RoRo	Roll-on Roll-off
SAP	Strategic Action Programme
SAR	Search and Rescue
SATNAV	Satellite Navigation System

SBM	Single Buoy Mooring
SPM	Single Point Mooring
SCA	Suez Canal Authority
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
STCW	Standards for Training, Certification and Watchkeeping
SUMED	Arab Petroleum Pipeline Company
TBD	To Be Determined
TDW	Tons Dead Weight
TSS	Traffic Separation Scheme
UNCLOS	United Nations Convention on the Law of the Sea
VHF	Very High Frequency
VLCC	Very Large Crude Oil Carrier
VTM	Vessel Traffic Management
VTS	Vessel Traffic System

Summary

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), established under the Jeddah Convention, has prepared a Strategic Action Programme for the Red Sea and Gulf of Aden (SAP). An element of the SAP is a Management Plan to prevent and reduce navigation risks in the Red Sea and Gulf of Aden through a series of complementary regional, national and local actions. Preparation of this study benefited from two navigation workshops organized by PERSGA, which were held in Aden, Yemen (November 1996) and Ismailia, Egypt (April 1997). Representatives of Det Norske Veritas (DNV) also made field visits to Djibouti, Egypt, Saudi Arabia, Sudan and Yemen to support preparation of this report. In addition, a review was made of relevant information and data at the International Maritime Organization (IMO).

The Red Sea and Gulf of Aden have not yet been subject to massive pollution caused by tanker accidents, although a significant amount of oil going to Europe is transported via this route. The area is characterized by non-complicated navigation for transiting ships except for the following:

- Gulf of Suez, which has considerable oil exploration activity that interferes with ship traffic (Traffic Separation Scheme, or TSS, established).
- Strait of Tiran, which is relatively narrow (TSS established).
- Passage past Hanish al-Kabir, where course changes must be undertaken during passage, and which is also relatively narrow (no Vessel Traffic Management, or VTM, established).
- Strait of Bab-al-Mandab, which is also relatively narrow, and where course changes must be undertaken during passage (TSS established).

The risk of meeting collisions has been taken into account by establishing TSSs in the most critical areas. These TSSs should be monitored by VTM. If they are not, two issues are of concern:

- Ships may stray outside the TSS and ground, if not warned in time.
- Ships may stray into the wrong lane, and present a hazard to traffic following the TSS rules.

Consequently, it is recommended to monitor established TSSs, and to establish means of communication and other interventions to prevent straying ships.

In the sections of the transit route not subject to TSS, the risk of meeting collisions will increase in the near future and introduction of traffic separation should be considered. The idea of covering such a large area—2,000 kilometers—with TSS may seem exaggerated; however, transiting ships already follow the optimum route, and a TSS will provide a safe distance between northbound and southbound ships. It is further suggested that Recommended Tracks (one southbound and one northbound) be established through the area. Monitoring should not be based on radar alone, but also on transponders, which will become mandatory on transiting ships in the near future. Another important part of VTM monitoring will be to localize and provide assistance to disabled ships before they drift aground, through Search And Rescue (SAR). Oil spill contingency plans can also be included in VTM tasks.

Local navigational risks exist for ships entering and leaving the transit lanes, and for entrances to ports in the area. This report concludes that management of ship traffic can reduce the number of expected crossing collisions when joining and leaving the transit lane. Such measures are based upon two principles:

- The location of joining/crossing areas to be decided upon and made mandatory, so that transiting ships know where to expect joining/leaving ships.
- Monitoring to resolve potential dangerous encounters (designated "dangerous courses" in this report). The arrangements in the Gulf of Suez illustrate this point.

Finally, the quality of crew and ships plays an important role in the risk picture. A Port State Control (PSC) scheme, based upon the main IMO and other relevant Conventions, with particular emphasis on navigational aspects, should be established and strictly enforced. Important navigational aspects include, among others:

- Navigation skills, with emphasis on passage planning, including excellent knowledge of TSS in the area.
- Communication skills (language skill, operational skill).
- Well-organized bridge watch (preferably with internal monitoring of the navigator).

Red Sea and Gulf of Aden navigational charts suffer from great discrepancies and incorrect references. It is therefore recommended to re-survey parts of the area and prepare revised charts, in particular for Bab-al-Mandab to Hanish al-Kabir in the south and the Gulf of Suez and Strait of Tiran in the north.

The calculations in this report show that implementation of the proposed Management Plan will potentially reduce risk by 80 percent. The return period for a navigational accident is then found to be 0,65 years, and for navigational accidents with oil tankers involved 6 years.

The Management Plan is divided into the following phases of implementation, with notations as to whether a particular action concerns regional (R), national (N) or local (L) implementation:

- Ratification of conventions:
  - ◊ Ratification will form the legal foundation for required shipping safety measures in the Region (R).
- Phase 1:
  - ◊ Inclusion of requirement for emergency anchoring in harbor regulations (L).
  - ◊ Agreement on TSS and Recommended Tracks (R).
  - ◊ Re-survey of the same to ensure that areas are free of obstacles (R).
  - ◊ Submission of proposed and adjusted TSS and Recommended Tracks to IMO for final comments. Final adjustments made. (R, IMO).

- ◊ Preparation of Regional Agreement on PSC (R, IMO).
- ◊ Simultaneous establishment of PSCs in the area after sufficient Port State Control Officers (PSCOs) have been trained—two for each main harbor in the area (R).

- Phase 2:
  - ◊ Establishment of three VTM centers: one at Ras Mohammed, Egypt; one at Perim Island, Yemen, and one, for transponder monitoring only, at Jeddah, Saudi Arabia (R).
  - ◊ Upgrading of the Marine Emergency Mutual Aide Center in Djibouti, with consideration given to relocation of key emergency equipment and materials to Perim Island, Yemen (R).
  - ◊ Establishment of a regional oil spill center in Ghardaqah as currently planned and a potential additional center in Jeddah, in conjunction with the VTM.
  - ◊ Re-survey of harbor areas (N).

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Introduction

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), established under the Jeddah Convention, has prepared a Strategic Action Programme for the Red Sea and Gulf of Aden (SAP). An element of the SAP is a Management Plan to prevent and reduce navigation risks in the Red Sea and Gulf of Aden through a series of complementary regional, national and local actions. Preparation of this study benefited from two navigation workshops organized by PERSGA, which were held in Aden, Yemen (November 1996) and Ismailia, Egypt (April 1997). Representatives of DNV also made field visits to Djibouti, Egypt, Saudi Arabia, Sudan and Yemen to support preparation of this report. In addition, a review was made of relevant information and data at the International Maritime Organization (IMO). Local Port Authorities in general, and Captain Saeed Yafai, Chairman of the Public Corporation for Maritime Affairs of Yemen and Captain Roy Facey, an advisor to the Yemen Port Authority, have provided valuable input.

The report assesses the navigational risk level with regard to oil transportation in the area by using well-proven Risk Assessment methods developed by DNV. The navigational risk is divided into three components, or risks:

- For ships in transit through the area.
- For ships entering and leaving ports in the area.
- Where ships are leaving or joining ship lanes.

Sensitive marine areas in the Region are discussed in Appendix J.

Background

The Red Sea and Gulf of Aden form part of a major shipping route that currently carries approximately 7 percent of total world trade. The Red Sea is about 1,200 nautical miles in length from the Suez Canal to the Strait of Bab-al-Mandab, and averages around 120 nautical miles in width. The Gulf of Aden is around 500 nautical miles long from Bab-al-Mandab to Ras Asir and is about 150 nautical miles wide.

Traffic along this route is dominated by ships that transit the Suez Canal for trading between Europe (north and south), the Mediterranean, the Black Sea and North America to and from the Middle East and East Asia, Australia and New

Zealand. They include tankers and combination carriers carrying crude oil and products between the Middle East and Europe/North America; bulk and combined carriers between Australia and Europe, North America and the Middle East, container ships; car carriers, RoRo (Roll-on Roll-off) and general cargo ships; and passenger cruise liners on world cruises. Container ships, in particular on "round the world" services, use the Canal as part of a route that crosses the Mediterranean Sea and Atlantic, Indian and Pacific Oceans.

The two streams of traffic, northbound towards the Canal or southbound from it, are constrained at the northern end by the Gulf of Suez, and at the southern end by Hanish al-Kabir and the Strait of Bab-al-Mandab. A southbound vessel leaving the Gulf of Suez is (currently) free to navigate as it sees fit to reach the Strait of Bab-al-Mandab. After passing through this strait, traffic may head for Ras Asir, passing west of Socotra Island in order to reach East Africa, Australia or New Zealand; or north or south of Socotra to call at or pass south of Sri Lanka. Traffic may also take the route along the coast of Yemen towards Oman and the Gulf, Pakistan and northwest India, or may head in a generally easterly direction towards Bombay and the west coast of India. Westbound traffic from the Indian Ocean heading for Red Sea ports and the Suez Canal will converge from various parts of the Indian Ocean to pass through Bab-al-Mandab.

There are also significant numbers of other types of vessels, many of which are "crossing vessels." Oil rig supply vessels operate in the Gulf of Suez, serving the platforms located there. Some cruise liners do not transit the Canal, calling at ports in the Indian Ocean, via Djibouti and Yemeni ports, and resort centers in the Gulf of Aqaba and east coast of Egypt. Local passenger ships operate in the Red Sea carrying pilgrims to and from Jeddah, while ferries carry migrant workers between the richer Gulf States and labor supplying countries in the Middle East. Container feeder services and coasters operate between main ports and smaller ones.

Dhows carry both passengers and cargo between ports in the Red Sea and Gulf of Aden and from/to ports on the east coast of Africa and the Gulf. Yachts pass between Europe and the Indian Ocean. Fishing vessels generally operate close to shore in territorial waters either from ports or the many coastal fishing villages. Larger fishing vessels, including 'mother vessels,' sometimes operate in a catching fleet closer to the center of the Red Sea and Gulf of Aden.

Ships are not only differentiated by type and destination, but also in terms of speed. Operating speeds for most of the canal traffic is between 12 and 25 knots. Tankers, bulk carriers etc. operate generally at 14-16 knots, larger general cargo, RoRo and car carrying ships at 16-20 knots. The larger passenger cruise liners usually operate at 20 knots or better. At the higher end, modern container ships can now reach speeds up to 27 knots. Regional passenger vessels, container feeder vessels, coastal cargo ships, fishing vessels, dhows, yachts, etc., which mainly form the crossing traffic, vary between zero and 14 knots.

PORT STATE CONTROL

In addition to considering routes followed by various types of ships, it is important to note that ships trading in the Region are also differentiated in terms of "quality". The operation of sub-standard vessels, in other words vessels that fail to meet accepted international standards, results from a lack of enforcement. Europe, North America, Japan and other areas of the world have introduced effective "Port State Control." In these ports, sub-standard vessels risk being visited by Port State Control Officers, in addition to any checks made by classification societies and their

Flag State. If they are found to be insufficiently manned and/or equipped, they face the possibility of being detained until the deficiencies are rectified.

In several regions of the world, States have joined together under Regional Agreements to ensure that a report on the deficiencies of a sub-standard vessel leaving one country is passed to its next port of call in the same region. This helps to ensure that any required improvements have been or are carried out. Ships that can no longer operate in these “controlled” regions because of the risk of being detained, move to areas where Port State Control does not exist as yet, such as the region under consideration.

Standards are defined in a number of international conventions dealing with safe loading of the vessel, lifesaving appliances, firefighting, navigating and communications equipment, pollution avoidance measures, training and qualification of seafarers, navigation lights and signals and crew accommodation. A sub-standard vessel may be unable to fix its position accurately, may make its passage under the control of incompetent navigating and engineering officers, be careless with the disposal of waste oil and other materials and not maintain proper records. Such a vessel is a hazard to itself, to other traffic and to the environment.

Port State Control can support implementation of the International Convention for the Prevention of Pollution from Ships 1973 (MARPOL). Under MARPOL, the Red Sea and the Gulf of Aden between Bab-al-Mandab and a line from Ras Caseyr (or Ras Asir in Lat 11º 50’N, Long 051º 17’E) to Ras Fartak (Lat 15º 35’N, Long 052º 14’E) have been designated as “Special Areas.” Annexes I, II and V of this Convention are mandatory. Annex I prohibits any discharge of oil or oil mixtures into a Special Area; Annex II deals with Noxious Liquid Substances in Bulk and Annex V regulates the discharge of garbage from ships and contains special provisions for the Red Sea and Gulf of Aden.

OIL PLATFORMS, PORTS AND TERMINALS IN THE REGION

Oil platforms, ports and oil and gas terminals each have an impact on the environment. The more important ports and terminals in the Region are listed below. The ports and terminals for which projected return periods for navigational incidents and oil outflows have been calculated in this study are marked with “*”.

Oil Platforms

In the Region, around 140 oil platforms operate in the Gulf of Suez. Many of these are close to shipping lanes. There have been incidents involving oil platforms and ships. Some oil platforms are in fixed locations; exploration rigs move from time to time and changes in their latitudes and longitudes are recorded in weekly Notices to Mariners.

Ports

- Egypt:
    - ◊ Suez* (main port, at the southern entrance to the Suez Canal).
    - ◊ Adabiya (secondary port).
    - ◊ Ghardaqah (main port).
    - ◊ Sharm El Sheikh (cruise liner port).
    - ◊ Ain Sukhna (oil terminal).
- Jordan:
    - ◊ Aqaba* (main port).
- Saudi Arabia:
    - ◊ Yanbu* (main port).
    - ◊ Rabigh (secondary port).
    - ◊ Jeddah* (main port).
    - ◊ Jizan (secondary port).

- Sudan:
  - ◊ Port Sudan* (main port).
  - ◊ Suakin (secondary port).
- Yemen:
  - ◊ al-Hudaydah* (main port).
  - ◊ Mokha (secondary port).
  - ◊ Aden* (main port).
  - ◊ Mukalla (secondary port).
  - ◊ Nishtun (secondary port).
  - ◊ Ras Isa (oil terminal).
  - ◊ Ash Shihr (secondary port).
- Eritrea:
  - ◊ Mits'iwa* (Massawa – main port).
  - ◊ Aseb (Assab – main port).
- Djibouti:
  - ◊ Djibouti* (main port).
- Somalia:
  - ◊ Berbera (secondary port).
  - ◊ Boosaaso (secondary port).
  - ◊ Caluula (secondary port).

The more important ports with respect to this study, particularly those at which oil refineries or gas liquefaction plants exist, and the main oil or gas terminals in the Region, are briefly described below.

Port of Suez (Egypt)*

The port is situated on the northern part of the southern entrance to the Suez Canal. Within the port is an oil import terminal providing facilities for small tankers. The oil terminal handles around 1.6 million tons per year, with an average of 200 calls by tankers annually. The terminal is capable of serving tankers up to 15,000 TDW.

Port of Suez is a very important service harbor for the ships transiting through the Suez Canal.

Port of Yanbu (Saudi Arabia)*

Mina al Malik Fahd (King Fahd Port) uses the same approach channels as Yanbu. It is a major oil export terminal connected by pipeline to the eastern province oil fields of Saudi Arabia. The port includes an oil refinery, a natural gas fractionation plant and a petrochemical complex. The port contains a number of oil and gas terminals, as follows:

- The Export Refinery Terminal (for vessels up to 150,000 TDW).
- The Crude Oil Terminal (for vessels up to 400,000 TDW).
- The NGL Terminal (for vessels up to 16.2 meters draught).
- The Yanbu Petromin Refinery Terminal (currently for vessels up to 80,000 TDW, but due to be increased to 150,000 TDW).

The oil terminals handle around 8 million tons per year.

Port of Jeddah (Saudi Arabia)*

The port includes an oil refinery and oil export terminal. The oil terminals are:

- The Chyoda Island Oil Terminal.
- The JORC Oil Terminal (reported to be suitable for vessels up to 100,000 TDW).
- The JORC Bunker Terminal (for vessels up to 40,000 TDW).

The oil terminals handle around 2.5 million tons per year.

Port of Aden (Yemen)*

The port includes an oil refinery and an oil import/export terminal. Crude oil is imported and refined products are exported. The terminal is capable of handling tankers up to 110,000 TDW fully loaded.

The oil terminal handles around 9.8 million tons per year.

Ain Sukhna (Egypt)*

At the northern end of the Gulf of Suez, Ain Sukhna is a large oil terminal at the southern end of the SUMED pipeline. Tankers, some in the VLCC class, call at this terminal in order to reduce their displacement to pass northwards through the Suez Canal, picking up the oil again after transiting the Canal. Other tankers call at Ain Sukhna to discharge oil before heading south through the Gulf of Suez to load their next cargo. There are around 40 to 50 tanker calls each month at the terminal, 550 ship calls per year. Oil is also taken from Ain Sukhna to refineries in Egypt by tanker.

Ras Isa (Yemen)*

The loading terminal for the oil fields in the Marib area in the interior of Yemen, the port of Ras Isa is located in the southern part of the Red Sea and operated by the Yemen Hunt Oil Company. It consists of a permanently moored VLCC called the ”Safer,” of 408,000 TDW, with a capacity of 3 million barrels (around 417,000 tons) of oil. This acts as a storage facility for oil brought by pipeline from the Marib area of Yemen. Oil is then transferred to tankers of between 80,000 and 307,000 TDW, which berth alongside ”Safer.” Oil is transported to the oil refinery at Aden (43 percent of output in 1996), normally in shuttle tankers of around 80,000 TDW, and exported to other countries (mainly Brazil and China in 1996).

Ships loading at Ras Isa may pick up partial loads, then move to Ash Shihr or terminals in the Gulf to complete loading. Partially loaded ships may also call at Ras Isa to “top off” before proceeding to their discharge port(s).

The annual throughput is 7.6 million tons (1996). In 1996, 86 ships called, carrying between 70,000 and 140,000 tons.

Ash Shihr (Yemen)*

The Ash Shihr Terminal is 20 nautical miles east of Mukalla in the Gulf of Aden. It is the loading terminal for the oil fields in the Hadhramaut area of Yemen, operated by the Canadian Occidental Oil Company, producing 200,000 barrels/day. It consists of a Single Buoy Mooring (SBM) 5 nautical miles from the shore, connected to onshore storage tanks by undersea pipeline. Tankers between 80,000 and 300,000 TDW berth at Ash Shihr. Oil is mainly exported from Ash Shihr to the East Asia, with rare consignments for the refinery at Aden. Ships loading at Ash Shihr pick up partial loads, then move to Ras Isa or more commonly to terminals in the Gulf to complete loading. Partially loaded ships also call at Ash Shihr to “top off” before proceeding to their discharge port(s).

The annual throughput is 10 million tons and was expected to increase (from mid-1997) when oil from fields operated by Total was shipped from Ash Shihr using the same facilities. About 100 ships call per year, carrying 100,000 tons on average (1997).

Bir Ali (Yemen)

The Rudum Terminal is 80 nautical miles west of Mukalla. It is the loading terminal for the oil field in the south central region of Yemen (Shabwa area), operated by Nim’r Petroleum. It consists of a SBM connected to onshore storage tanks by undersea pipeline. The facility was used by only 111 ships in 1993 and 1994 as production was low, and was closed in 1994. The oil fields and terminal were reactivated in early 1997. The first tanker carrying post-1994 production (88,000 TDW) loaded at the end of May 1997. Annual production is anticipated to be

500,000 tons, with 10-12 ship calls annually.

Balhaf (Yemen)

Balhaf is 70 nautical miles west of Mukalla. It is due to be developed as a natural gas liquefaction plant and loading terminal for the production of the major gas fields in the Marib region of Yemen, operated by Yemen Hunt/TOTAL. A new port is planned at Balhaf. Production of Liquefied Natural Gas (LNG) is due to commence in 2002. The anticipated annual production is 5 million tons.

There are a number of other terminals within the Gulf of Suez between Ain Sukhna and Hurgada. These are not considered separately, but are covered in terms of navigation incidents and oil outflow under the section on the Gulf of Suez.

The Suez Canal

The Suez Canal is fundamental to the pattern of the majority of traffic in the Red Sea and Gulf of Aden. The Canal is controlled by the Suez Canal Authority (SCA) and has no locks. It works 24 hours per day. The convoy system operated by the SCA determines, to a large extent, the degree of risk to which traffic in the northern end of the Red Sea, and particularly in the Gulf of Suez, is exposed.

The Canal was built to cut sailing distances between Europe and America and destinations to the east of Canal. The distance from London to Singapore is 8,237 via the Canal and 11,810 via the Cape; an increase of 3,573 nautical miles or 6.2 days at 24 knots. The distance from London to Aden via the canal is 4,567 nautical miles. Via the Cape of Good Hope the distance is 10,065 nautical miles. Shipping services, particularly container services on tight schedules between points on either side of the Canal, and often carrying high value goods, therefore find the Canal indispensable.

THE CONVOY SYSTEM

All vessels transiting the Canal join a convoy in either Suez (northbound) or Port Said (southbound).[1] If more than twenty-five ships are waiting at Port Said for the passage to Suez, two southbound convoys are formed. There are groups of faster and slower ships in one convoy. The groups within a convoy transit at slightly different speeds, and transit time for the first (slower) ships is around 13-14 hours. The convoys are normally timed to leave at first light and pass each other in the Great Bitter Lakes. Several sections of the canal, including the Great Bitter Lakes, have been doubled to enable convoys to pass each other.

To join a northbound convoy, a ship in Group A should have anchored in the anchorage and be declared ready for transit by its agents by 0100 on the day of transit. Vessels anchored and ready by 0300 can also be accepted for an additional charge of 5 percent of the Suez Canal dues. Vessels in Group B must have anchored in the waiting area south of Newport Rock Channel and be declared ready for transit by their agents by 0300. As vessels aim to arrive in time to catch the convoy, faster northbound ships will overtake slower vessels in the Gulf of Suez.

The southbound convoy leaving Suez is also important to traffic patterns and navigational safety, as ships exiting the Canal at sunset pass south through the Gulf of Suez at differing speeds, resulting in frequent overtaking of one ship by another. The southbound ships also meet ships heading north to join the next

1 Second Preparatory Meeting on Cooperation on Port State Control in the Mediterranean. Draft Report. Casablanca, Morocco. December 1996.

northbound convoy. Traffic Separation Schemes (TSS) have been introduced in the Gulf of Suez to separate the two streams of traffic and improve safety.

CANAL TRAFFIC

When the Canal re-opened in 1975 traffic initially increased from 16,806 ships with a total net canal tonnage of 188 million tons (1976) to 22,545 ships with a total net canal tonnage of 364 million tons (1982). The maximum tonnage of shipping occurred in 1988, when 457 million tons of shipping transited the Canal (PERSGA, 1997).

Since 1982, the number of ships has gradually fallen, as follows:

- 1987 - 17,541 ships, total net canal tonnage of 347 million tons.
- 1992 - 16,629 ships, total net canal tonnage of 370 million tons.
- 1994 - 16,360 ships, total net canal tonnage of 364 million tons.
- 1995 - 15,051 ships, total net canal tonnage of 360 million tons.
- 1996 - 14,731 ships, total net canal tonnage of 355 million tons.

Within the overall decline in ship numbers (but at roughly constant annual tonnages due to increasing ship size) the following trends were evident by 1996:

- The numbers of tankers, bulk carriers, combined carriers, general cargo ships, RoRo ships, passenger ships and “others” were declining.
- The numbers of container ships and car carriers were increasing.
- The numbers of general cargo and container ships combined remained roughly constant during 1995-1996, indicating the shift in the carriage of “general” cargo from break bulk ships to container vessels.
- The number of container ships, 4,082 in 1996 compared with 3,765 in 1995, indicates the increasing containerization of the world’s non-bulk cargo and the importance of container ship traffic to the canal.

Container ships now form the largest category of canal traffic, accounting for 32.2 percent of traffic by ship numbers and 36.7 percent by tonnage. The average size of container ships increased from 30,883 tons (Suez) in 1995 to 31,887 tons in 1996. In comparison, the average tanker size in 1996 was 35,034 tons. Out of the daily average of 40.2 ships transiting the canal each day, 11.2 are container ships (IUCN, 1990). The SCA has been advised by major container carriers that the largest container ships they plan to build will be up to 350 meters long and 50 meters wide, with a draught of up to 16 meters. Such a vessel can be handled by the Canal at present.

CANAL DIMENSIONS AND SHIP SIZE

The canal has been progressively widened and deepened to increase its cross sectional area, to take larger ships and to increase traffic. A series of development projects have been implemented by the Suez Canal Authority, and further work is planned.

Between 1976 and 1980 the SCA deepened the canal from 14.5 to 19.5 meters and widened it to a minimum of 104 meters between the buoys at a depth of 18 meters to accommodate ‘supertankers’.

This increased the cross-sectional area of the canal from 1800 to 3600 square meters. By 1994, the width had been increased to 154 meters between the buoys in most sections at this depth, increasing the cross-sectional area to 4000 square meters (with a width of 118 meters between the buoys retained on some straight sections) (UNEP, 1992). The canal can now accommodate some of the largest vessels in the world. The Hellas Foss, at 554,000 TDW the largest tanker in the world, transited the canal in ballast in 1994. The canal can now accept ships of up to 17.68 meters draught (58 feet). No limit is put on ship length.

The maximum size of vessel that can transit the Canal depends on breadth and draught, due to the "vacuum" effect as a ship passes through the Canal. The concept of a Suezmax ship size therefore depends on both of these factors.

The SCA plans to further increase the dimensions of the Canal to provide a cross sectional area of 5000 square meters and to allow a maximum ship draught of 19.20 meters (63 feet) and eventually 21.94 meters (72 feet), enabling the Canal to provide passage for tankers of up to 350,000 TDW fully loaded.

Future Canal Traffic Patterns

The SCA expects to recover the costs of widening and deepening the Canal through greater revenues generated by increased traffic. These revenues would come from the ability to handle larger oil tankers (IUCN, 1995), and from the expected growth in world trade, particularly dry (and other) goods carried in containers. It has been noted that some container traffic between the East Asia and the east coast of the United States is now using the Suez Canal/Atlantic route rather than the Pacific Ocean and the Panama Canal.

The Suez Canal is therefore the key to shipping traffic patterns in the Red Sea and Gulf of Aden. Widening and deepening of the Canal dictates the size of the majority of the ships that will transit the Red Sea and Gulf of Aden. Convoy timings determine the peak periods when large numbers of ships are in close proximity to each other before their speed differences separate them.

Weather Conditions

Navigators operating in the Region have to face a number of problems, the most important of which are briefly described below.

Haze

Haze and poor visibility can be a problem in the Region, particularly in the Red Sea and especially between May and September. Conditions during which it is difficult to obtain a position using celestial navigation because of a "poor" horizon are not common. The visibility of lighthouses and other navigation aids may be reduced under certain conditions. When approaching some regional ports, mariners are warned in pilot books that prominent landmarks may not be visible during morning haze or mist.

Radar and Visuals Ranges

Weather conditions can also affect the range at which coastlines can be detected. Abnormal radar distances are found under certain conditions, with a coastline 80 miles away appearing at 40 miles on the radar screen due to "refraction." Refraction and mirage are common in the Red Sea, causing lights to be visible further than expected from normal line-of-sight distances based on their height.

Winds

Wind direction varies with season. In the southern end of the Red Sea, southeast winds of force 5 or greater can affect the southerly progress of low powered vessels between October and April. During the southwest monsoon (June to August/September), the wind direction in the southern end of the Red Sea is reversed. Strong southwest monsoon winds, with heavy seas, can be found in the eastern end of the Gulf of Aden.

Currents

Currents are not generally strong in the Region. However, currents can be very variable in the southern end of the Red Sea between Jazirat At Ta'ir and Bab-al-Mandab. A set from the center of the Red Sea towards either coast can be encountered suddenly and may increase in velocity towards reefs and shoals.

Maritime Accidents and Incidents in the Region 1990/1996

Examples of relevant maritime accidents and incidents from 1990 to 1996 are presented in Table 1.

Method

The report outlines the present navigational risks in the Red Sea and the Gulf of Aden regarding:

- Powered grounding.
- Drifting grounding.
- Ship collision.
- Other, non-navigational accidents such as fire/explosion or structural damage, are not covered. Such accidents are uniformly distributed, and may have severe consequences.

Risk is herein considered to be the result of frequency per year multiplied by

Table 1. Maritime Accidents and Incidents in the Region 1990-1996

Date	Ship	Flag	Ship type	Location	Incident	Results
1981	Mobil Falcon	Liberia	ULCC (272,626 dwt), loading	Port of Yanbu	Equipment failure during loading	100bbls of Arabian Light Crude leaked into the bassin of Port of Yanbu
1988	Happy Kari	Norway	ULCC (290,761 dwt), loaded	Entrance to Port of Jeddah	Grounding	1,000 tons of crude spilled
1989	Kan-chenjunga	India	ULCC (279,394 dwt), loaded	Entrance to Port of Jeddah	Grounding	4,000 tons of Basrah Crude spilled
1991	C Eregli	Turkish	Bulk carrier, loaded, 16,000 tons iron ore	30 nm east of TSS in Bab el Mandeb	Collision with tanker «Mendana Spirit» loaded with 80,000 tons of crude oil for Aden Refinery	C Eregli sank, Mendana Spirit proceeded to Aden. Most of the 352 tons of bunker fuel leaked into the Gulf of Aden. Wreck and cargo removed to deep water to eliminate navigation hazard
1996	Not reported	Not reported	ULCC in ballast	Off port of Djibouti	Blackout, threatened grounding on coral reefs	No damage, vessel held off reefs by harbour tug and then towed clear by salvage tug
1995	Liverpool Bay	British	Container vessel (P&O Containers)	Entrance to Jeddah harbour	Grounding on coral reefs while under pilotage	Minor damage, vessel refloated without oil spillage
1996	Royal Viking Sun	British	Passenger cruise liner	Strait of Tiran/ in TSS	Grounded on coral reefs	Minor ship damage. Damage to coral reefs in Strait of Tiran, minimal oil spillage
1997	Not translated	Chinese	Bulk carrier	West of Hanish	Grounding on rock	Vessel damaged, docked for repair. Refloated without

the consequence. The total risk is the sum for the relevant types of accidents listed above. As the emphasis in the report is on oil pollution, the consequence can be expressed as mean oil outflow from each type of accident, and for all accidents together. Thus oil outflow is defined by a single parameter, which is a simplification since many small spills can have the same mean value as a few large ones. This is not so important for purely navigational accidents, where oil outflow is normally limited to one or two cargo tanks. The expected oil outflow from an accident with an actual tanker will be outlined for each area. In non-navigational accidents, the oil outflow could potentially include the full cargo if the tanker disintegrates (fire/explosion), or sinks (structural damage).

Risk reduction measures, with costs and responsibilities, are identified and discussed in subsequent chapters.

2

Frequency and Consequences of Grounding

Powered Grounding and Collision

In this chapter, the theoretical risk modeling used for powered grounding and collision is outlined. Risk is referred to as frequency (such as expected number of accidents) multiplied by the consequence (such as amount of oil outflow from an accident).

FREQUENCY

Powered Grounding

Powered grounding is defined as grounding with the ship's main engine engaged and running, and can occur when control is lost onboard a ship. Control can be lost for human or technical reasons. Human causes can be divided into two groups:

- Loss of control from incapacitation of navigator due to:
  - ◊ Absence from the bridge.
  - ◊ Distraction.
  - ◊ Falling asleep.
  - ◊ Intoxication by alcohol, drugs etc.
  - ◊ Injury, sudden illness etc.
- Loss of control due to Less Than Adequate (LTA) execution of navigation. Typically:
  - ◊ Not knowing the turning ability of the ship.
  - ◊ Not taking account of current and wind.
  - ◊ Not checking position of ship etc.

Currently, DNV uses a generic probability level of 5.6E-5 per dangerous course (DNV, 1996)[2] for loss of control for human reasons. This means that out of about 18,000 course changes, control is lost for one of them.

Technical causes are typically:

- Loss of rudder control.
- Loss of engine control.

2 Prince Williams Sound Risk Assessment Study, DNV, George Washington University, Rensselaer Polytechnic Institute, Le Moyne College, Dec. 1996 contains general, generic probability levels for basic causes related to navigational accidents. These figures are based upon worldwide statistics and judgments of experts panels. The levels are not geographically dependent.

DNV uses a probability level of 6,8E-5 per hour for loss of control due to technical reasons. This means that control is lost once every second year.

Thus, a total, generic figure for loss of control for technical reasons is 6,8E-5. When control is lost for technical reasons and the ship grounds, it must be under forward speed and de-acceleration to be considered a powered grounding. If the ship has come to a standstill and is then driven aground by wind or current, the accident will be categorized as drifting grounding.

For powered groundings resulting from human causes, loss of control must occur while the ship is on a dangerous course. Such a loss of control will cause the ship to proceed on the dangerous course and run aground. A mean time for the duration of loss of control has been set to establish a reasonable time perspective. If the distance in time from a turning point (waypoint) along the original course is less than 20 minutes, and control is lost, the ship will ground.

Given the above, the mean expected frequency per year of powered grounding for a single ship can be expressed as:

F(Powered grounding) = N • p(Loss of control)

where:

N = number of dangerous courses per year

p(Loss of control) = probability of loss of control of ship for each dangerous course

The first equation below gives the expected number of powered groundings for one ship per year, which is the same as the frequency per year for powered grounding. The figure is of course small. A sensible way of interpreting the figure is to calculate the inverse figure, 1/F(Powered grounding). This figure, named return period, gives the mean time length in years $\bar{T}$ between each time a grounding for the ship is expected. The figure is very much dependent upon the number of dangerous courses. As an example, if:

F(Powered grounding) = 0.01 per year,

then

$\bar{T}$ =1/0.01 = 100 years

Collision, Crossing Courses

When two ships are on a crossing course, the course is considered dangerous. Again, loss of control on the give way vessel may cause a collision (if the other ship, which is then the stand on vessel according to COLREG, loses control, a collision is very unlikely). The calculation of expected number of collisions is identical to the first equation. The expected collision frequency is then:

F(Crossing collision) =
N1•N2•(L1/V1+L2/V2)•p(Loss of control)

where:

N1 = number of crossings of lane per year by ship 1

N2 = number of crossings of lane per year by ship 2

L1 = length of ship 1 (km)

L2 = length of ship 2 (km)

V1 = speed of ship 1 (km/year)

V2 = speed of ship 2 (km/year)

p(Loss of control) = probability of loss of control of ship that gives way for each dangerous course

Note that the fraction of cases when ship 1 is hit, is:

f(Ship 1 hit) = (L1/V1)/(L1/V1+L2/V2)

Therefore, the fraction of cases when ship 2 is hit (by ship 1) is:

p(Ship 2 hit) = 1 – f(Ship 1 hit)

Collision, Meeting in a Lane

For ships meeting in a lane, the expected number of collisions per year is:

F(Meeting collision) = N1•N2•(D/W)•(1/V1+1/V2)•(B1+B2)•p(Loss of control)

where:

N1 = number of northbound ships in the lane per year

N2 = number of southbound ships in the lane per year

D = length of lane (km)

W = breadth of lane (km)

V1 and V2 as in the first equation above

B1 = breadth of northbound ships (km)

B2 = breadth of southbound ships (km)

These equations are used to calculate the expected number of navigational accidents in the Red Sea and Gulf of Aden.

It should be noted that a tanker will only spill oil if:

- The tanker is loaded.
- The tanker is being hit (see equations above).
- The energy of the hitting ship is sufficient to penetrate the tanker side.
- The hit is in a cargo tank.
- These matters are accounted for in the event tree in risk analysis.

CONSEQUENCES OF POWERED GROUNDING AND COLLISIONS

Powered Grounding

The most severe consequence in the context of this environmental study is when an oil tank is punctured, the ship disintegrates structurally, or the ship sinks. Sinking is most likely when the engine room of a tanker is punctured, and the ship floats free after the grounding. The most "normal" consequence is however that the hull is not penetrated (about 70 percent on a worldwide basis). In most of the remaining cases, one, or less often, two, tanks are punctured. If so, the amount of oil that is above the waterline will flow out in a matter of minutes. The remaining amount is washed out gradually by wave action and tide, provided that the ship remains aground.

Oil spill contingency planning may play an important role in the latter phase of oil outflow. All tankers above 150 GRT should be supplied with a Shipboard Oil Pollution Emergency Plan (SOPEP). This plan describes how the oil outflow can be limited by using the ship's own resources, such as pumping oil from damaged tanks into ballast tanks or intact cargo tanks.

For the Red Sea and Gulf of Aden, powered grounding on coral reefs or rocky shores is likely to cause bottom penetration. According to British Admiralty, 1976, shores are frequently rocky. If the speed at impact is high, consequences will not be reduced much for double bottomed tankers compared with single bottomed ones. The damage depends on the amount of steel that the rocks must penetrate before the cargo tanks are affected. The amount of steel per length unit of the bottom is not much different for double and single hull tankers. When the tanker speed is low however, the double bottom may provide good protection.

Collisions

Consequences are assessed in a simple manner in this study. It is assumed that when single hull tankers are hit, the side will be penetrated if the other ship is longer than 70 meters and is traveling at 12 knots. For double side tankers, built in accordance with MARPOL (1992 amendment), the hitting ship must be at least 150 meters and be traveling at 12 knots to penetrate an oil tank.

Oil will flow out if a cargo tank is penetrated. Generic data indicate that the oil will be ignited in 30 percent of cases, due to the heat created by the friction in the collision area. The amount of oil that will flow out in a matter of minutes depends on the shape of the bow of the hitting ship (bulbous, or normal, raked bow), as well as the energy of the impact. The outflow will be less with a raked bow, due to the deeper and longer penetration of a bulbous bow. In this study, it is assumed that the content of a penetrated oil tank will spill into the sea within 1 to 2 hours. Generally speaking, for transiting tankers in the area under study, it is unlikely that even well organized oil spill contingency plans could mobilize, reach the area and begin work to contain the oil near the tanker in such a short time.

Drifting Grounding

In this chapter, the theoretical risk modeling used for drifting grounding is outlined. Risk is referred to as frequency (such as expected number of accidents) multiplied by the consequence (such as amount of oil outflow from an accident).

Frequency

Drifting occurs when either the main engine or the rudder fails (that is, the main engine is not engaged or running). In the latter case, the main engine must be stopped. Frequency of such technical failures is available in generic databases for normally operated single engine, single rudder tankers. Whether the ship then drifts aground or not depends upon the following factors:

- *Repair time versus time to shore.* Some generic worldwide data for repair time is available, with a distribution of expected average repair times (DNV, 1996). Rudder system failures can often be repaired quickly.
- *The possibility of anchoring*. In the central part of the area under study this is not possible, but closer to shore it may be. However, anchoring of a tanker with only emergency power may be difficult, or even impossible if the anchor is sea fastened.
- *Availability of tug(s)* with sufficient holding power, located so that they can reach the disabled ship in time. These are normally available in and near harbors.

Consequences

The drifting speed of a tanker is determined by the vectored addition of wind and current forces. It is estimated that a ship will drift at 3 percent of wind speed and at the same speed as the current. The consequences, as for powered grounding, depend upon the characteristics of the shore or reefs where the tanker grounds, and on the prevailing state of the sea. Bottom penetration is likely, however, and depending on sea conditions, structural failure may also occur. This may cause all or part of the oil to leak. Double hull tankers hold a clear advantage over single bottom tankers when drifting aground.

There have been no reported drifting grounding accidents involving oil tankers in the area. In other parts of the world such accidents have occurred with disastrous consequences. The most well known was the Amoco Cadiz accident in 1978, where 224,000 tons of oil were spilled.

3

Calculation of Frequencies and Consequences for Red Sea and Gulf of Aden

The methods outlined in the preceding chapters are here applied to calculate the frequency and consequences of navigational accidents in the area under study. The content is structured as follows:

- Transit traffic, taking the shortest route (international).
- Joining-leaving traffic (regional).

In areas where shipping lanes are close to coral reefs, islands or land, powered grounding and drifting grounding are of concern. Such areas are preliminarily identified in this report.

Crossing collisions are of particular concern when joining or leaving the main shipping lanes, whereas meeting collisions are at issue when going to and from ports, or when going between joining- or leaving-points. Although minor crossing problems are expected here as well, only large crossing hot spots are considered in this study. Collision hot spots are those where crossing and meeting collisions are expected, or where traffic is confined to a narrow area with high ship density.

Particular navigational problems have been addressed as follows:

- Joining or leaving-points for vessels above 70 meters.
- Legs between the joining- or leaving-point and harbors.

Problems of specific harbors will not be covered in this study.

The Red Sea and Gulf of Aden are divided into twelve close-to-port areas and four regions. These areas are presented on the Maps. In this chapter, each of these areas and regions is analyzed with regard to present navigational risk. Some oil pollution hot spots are also noted. The traffic data for the Region is listed in Appendix A. This is based on traffic data purchased from Lloyds Maritime Information Services Ltd., information gathered during field visits, and supplementary data obtained through correspondence with local Port Authorities.

The risk calculations are presented in Tables 3-18, where the expected navigational accidents are divided into grounding (powered and drifting) and collision (meeting and crossing). For each of these accident categories, the expected frequency is calculated as return period in years for all ships and for oil tankers respectively. For example a return period of 9 years means that one accident every 9th year is expected.

Expected oil outflow in tons per year expresses the expected risk level, that is, frequency of accidents multiplied by expected consequence of the accident. A figure of 1000 tons per year means that on average 1000 tons of oil is spilled every year. This also could be the result of one accident every 10th year with an expected oil outflow of 10,000 tons.

Total figures in terms of frequency and consequence for each of the regions and close-to-port areas are presented in the tables.

Navigational Accidents

MEETING COLLISION

Except for the TSSs in the Bab-al-Mandab, the Gulf of Suez and the Tiran Strait, it is estimated that the lane breadth throughout the area is 4 nautical miles, and that ships are uniformly distributed over the lane breadth. The equation for ships meeting in a lane is used to make the calculations. The ships are separated into oil tankers and others.

Clearly, the lanes will be smaller than 4 nautical miles where they converge near the entrances to the TSS schemes mentioned. Therefore, the meeting collision risk will be somewhat higher there. In the TSSs themselves, only ships that for some reason travel in the wrong lane will constitute a collision risk. This is the main reason why a Vessel Traffic System (VTS) can improve safety. However, as discussed later, VTS efficiency depends on a number of factors. Separation of transiting ships in the Red Sea is an option that also will be discussed later in the study.

POWERED GROUNDING

Using the model for grounding in the first equation above, powered grounding appears likely in only a few places in the Red Sea. The model is based upon a time to ground after control is lost of 20 minutes or less. With the focus placed on errors of omission, such as not changing course when required, grounding could occur for:

- Southbound ships in the Bab-al-Mandab (considered a “dangerous course”).
- South- and northbound ships passing Hanish al-Kabir.
- Ships in all close-to-port areas.

The number of dangerous courses for each port is listed in Table 2, obtained from charts and field visits.

Table 2. Number of Dangerous Courses for the Port Approaches

Port	Inbound Ships	Outbound Ships
Port of Suez	2	1
Ain Sukhna	1	0
Aqaba	1	0
Yanbu	3	2
Jeddah	1	0
Port Sudan	1	0
Massawa	1	0
Ras Isa	1	0
Al-Hudaydah	2	1
Djibouti	1	0
Aden	1	0
Ash Shihr	1	0

All figures are indicative only

DRIFTING GROUNDING

Drifting grounding will occur when:

- The ship experiences a loss of propulsion or steering.

- The ship drifts against shallow waters, driven by wind and/or current.
- The repair (which will always be attempted) fails, or time is too short.
- The ship is not able to anchor (when approaching shallow waters).
- No external assistance (tug, other ships) arrives in time.

The areas where drifting grounding risk is relatively high are the same as those for powered grounding. In addition, drifting grounding risk is relatively high in all TSSs. One might even argue that the risk of drifting grounding is somewhat increased by the TSS because the leeway is shortened in adverse winds.

Where there is a dredged entrance channel to a port, it is assumed that there would be insufficient time for any action as mentioned above. Individual estimates have been made for other ports. The risk of drifting grounding at oil terminals can be reduced by high quality tug escorts. If the quality of the tug escort is low, however, the risk of grounding grows. Generally speaking, the risk of drifting grounding in local lanes leading to/from the main shipping lanes should be managed by port authorities, while the risk in the main lanes should be addressed by regional authorities through VTM (with the Gulf of Suez as a possible exemption).

Given the prerequisites for a drifting grounding to occur, it is clear that Port State Control can play a vital role in reducing frequency. Of particular importance is control of ability to anchor when power is lost on oil tankers. Drifting grounding is discussed further in Appendix B.

Close-to-Port Areas

Close-to-port areas are analyzed for twelve main ports in the Red Sea and Gulf of Aden using the models explained in Chapter 4 and data obtained at two navigational workshops and field visits. The close-to-port areas do not include the joining area between the port and the main lane. Results for all ships longer than 70 meters are included.

Analysis of Status

Port of Suez, Egypt

The oil terminal of Suez has approximately 200 calls of small oil tankers per year with an average cargo capacity of 8,000 tons. These form the basis for the expected oil outflow per year.

Table 3. Port of Suez Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	9	3179	6.5	4
Return period, oil tankers	60	14306	59	30
Expected oil outflow/year	4	3	3	10

Figures in table are indicative only

Ain Sukhna, Egypt

The oil terminal of Ain Sukhna has approximately 550 calls of small oil tankers per year with an average cargo capacity of 200,000 tons.

Table 4. Ain Sukhna Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	43	3831	11	9
Return period, oil tankers	43	3831	21	10

Expected oil out-flow/year	578	3	280	861

Figures in table are indicative only

Aqaba, Jordan

Aqaba has not reported any calls of oil tankers, and the expected oil outflow per year is zero.

Table 5. Aqaba
Expected navigational accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	10	250	2	1.7
Return period, oil tankers	N/A	N/A	N/A	N/A
Expected oil outflow/year	--	--	--	--

Figures in table are indicative only

Yanbu, Saudi Arabia

The oil terminal of Yanbu has approximately 400 calls of large oil tankers per year with an average cargo capacity of 200.000 tons.

Table 6. Yanbu
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	5	709	13	4
Return period, oil tankers	30	1987	26	14
Expected oil outflow/year	840	37	230	1107

Figures in table are indicative only

Jeddah, Saudi Arabia

The oil terminal of Jeddah has approximately 50 calls of oil tankers per year with an average cargo capacity of 50,000 tons.

Table 7. Jeddah
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	6	107	1,5	1
Return period, oil tankers	476	9089	235	155
Expected oil out-flow/year	13	8	19	40

Figures in table are indicative only

Port Sudan, Sudan

The oil terminal of Port Sudan has approximately 216 calls of oil tankers per year with an average cargo capacity of 50,000 tons.

Table 8. Port Sudan
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	37	4600	6	5
Return period, oil tankers	220	13799	84	61
Expected oil outflow/year	28	5	19	52

Figures in table are indicative only

Massawa, Eritrea

The oil terminal of Massawa has approximately 24 calls of oil tankers per year with an average cargo capacity of 50,000 tons.

Table 9. Massawa
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	76	18398	18	15
Return period, oil tankers	1984	124188	235	210
Expected oil outflow/year	3	1	6	10

Figures in table are indicative only

Ras Isa, Yemen

The oil terminal of Ras Isa has approximately 86 calls of oil tankers per year with an average cargo capacity of 50,000 tons.

Table 10. Ras Isa
Expected Navigational Accidents

	Powered Grounding	Collision Meeting	Drifting Grounding	Total
Return period, all tankers	277	247393	65	53
Return period, laden oil tankers	0	247393	131	131
Expected oil outflow/year	0	0	46	46

Figures in table are indicative only

al-Hudaydah, Yemen

The oil terminal of al-Hudaydah has approximately 220 calls of oil tankers per year with an average cargo capacity of 8,500 tons.

Table 11. al-Hudaydah
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	9	3482	12	5
Return period, oil tankers	54	13611	380	47
Expected oil outflow/year	20	5	4	29

Figures in table are indicative only

Djibouti, Djibouti

The oil terminal of Djibouti has approximately 120 calls of oil tankers per year with an average cargo capacity of 17,000 tons.

Table 12. Djibouti
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	29	3447	9	7
Return period, oil tankers	397	23553	118	91
Expected oil outflow/year	5	3	13	21

Figures in table are indicative only

Aden, Yemen

The oil terminal of Aden has approximately 580 calls of oil tankers per year with an average cargo capacity of 17,000 tons.

Table 13. Aden
Expected Navigational Accidents

	Powered Grounding	Collision, Meeting	Drifting Grounding	Total
Return period, all ships	19	1032	13	8
Return period, oil tankers	85	2810	51	32
Expected oil outflow/year	25	26	88	139

Figures in table are indicative only

Ash Shihr, Yemen

The oil terminal of Ash Shihr has approximately 50 calls of oil tankers per year with an average cargo capacity of 200,000 tons.

Table 14. Ash Shihr
Expected Navigational Accidents

	Powered Grounding	Collision Meeting	Drifting Grounding	Total
Return period, all tankers	476	463529	118	95
Return period, laden oil tankers	0	463529	235	235
Expected oil outflow/year	0	1	25	26

Figures in table are indicative only

Regions

The Gulf of Suez, Gulf of Aqaba, Red Sea from Tiran Strait to Bab-al-Mandab and the Gulf of Aden are the regions under consideration. The close-to-port areas are not included in the figures in this chapter.

ANALYSIS OF STATUS

Gulf of Suez

The Gulf of Suez has approximately 1000 transits of oil tankers per year with an average cargo capacity of 150,000 tons. These form the basis for the expected oil outflow per year. See Table 15.

Gulf of Aqaba

The Gulf of Aqaba has only minor transits of small oil tankers, and the expected oil outflow per year is calculated as negligible. See Table 16.

Red Sea from Tiran Strait to Bab-al-Mandab

The Red Sea from Tiran Strait to Bab-al-Mandab has approximately 800 transits of oil tankers per year with an average cargo capacity of 150,000 tons. These form the basis for the expected oil outflow per year. See Table 17.

Gulf of Aden

The Gulf of Aden has approximately 900 transits of oil tankers per year with an average cargo capacity of 150,000 tons. These form the basis for the expected oil outflow per year. See Table 18.

Recognized Hot Spots

For the whole of the Red Sea and Gulf of Aden, five main oil pollution hot spots are recognized. These are listed in Table 19, and sketched on Map 1.

The hot spots are discussed in more detail in the next sub-chapters. Sensitive marine areas in the Region are discussed in Appendix J on Sensitivity Mapping.

GULF OF SUEZ

In the Gulf of Suez, one potential oil pollution hot spot is recognized in the northern part where the main traffic lane is joined by the traffic lanes from Ain Sukhna and Port of Suez (hot spot A on Maps 1 and 2). In this area, the expected return period of an oil tanker accident is calculated to be 1 year. The average oil outflow per year from ship accidents is expected to be 6,700 tons. Ecological sensitivity is moderate and the emergency response capacity is well developed.

RED SEA

In the Red Sea from Tiran Strait to Bab-al-Mandab, three potential oil pollution hot spots have been recognized. The first is in the north where the main traffic lane is joined by the traffic lanes from Gulf of Aqaba (hot spot B on Map 1). In this area, the expected return period of an oil tanker accident is 15 years. The average oil outflow per year from ship accidents is expected to be 1,250 tons.

The second potential oil pollution hot spot is in the region from Yanbu in the north to Port Sudan in the south (hot spot C on Map 1). The return period of an oil tanker accident is here expected to be 4.5 years, and the expected average oil outflow per year is expected to be 1,100 tons.

The third hot spot is the region from the Ras Isa oil terminal in the north to Bab-al-Mandab in the south (hot spot D on Maps 1 and 3). Here, the return period of an oil tanker accident is expected to be 4 years, and the expected average oil outflow per year is expected to be 1,700 tons. Ecological sensitivity is high due mainly to the presence of coral reefs. The emergency response capacity is not well developed.

GULF OF ADEN

In the Gulf of Aden, all the southern coast from Aden to Ash-Shihr could be recognized as a potential oil pollution hot spot (hot spot E on Map 3). In this area, the expected return period of an oil tanker accident is calculated to be 9 years. The average oil outflow per year from ship accidents is expected to be 1,500 tons. Ecological sensitivity is moderate. The emergency response capacity is not well developed, but could be improved by upgrading the Marine Emergency Mutual Aide Center in Djibouti.

Table 15. Gulf of Suez - Expected Navigational Accidents

Accident type	Between meeting-joining area		In meeting-joining area		Total	
	Return period all ships/ oil tankers	Oil outflow/ year	Return period all ships/ oil tankers	Oil outflow/ year	Return period all ships/ oil tankers	Oil outflow/ year
Powered grounding	0 / 0	0	N/A	--	0 / 0	0
Collision, crossing	N/A	--	355 / 6458	86	355 / 6458	86
Collision, meeting	N/A, TSS	--	N/A	--	N/A	--
Drifting grounding	0,8 / 2,0	5712	N/A	--	0,8 / 2,0	5712
Total	--	--	--	--	0,8 / 2,0	5798

Figures in table are indicative only

Table 16. Gulf of Aqaba - Expected Navigational Accidents

Accident type	Between meeting-joining area		In meeting-joining area		Total	
	Return period all ships/ oil tankers	Oil outflow/ year	Return period all ships/ oil tankers	Oil outflow/ year	Return period all ships/ oil tankers	Oil outflow/ year
Powered grounding	0 / 0	0	N/A	--	0 / 0	0
Collision, crossing	N/A	--	87 / 0	0	87 / 0	0
Collision, meeting	79 / 0	0	N/A	--	79 / 0	0
Drifting grounding	1,35 / 0	0	N/A	--	1,35 / 0	0

Accident type	Between meeting-joining area		In meeting-joining area		Total	
Total	--	--	--	--	1,3 / 0	0

Figures in table are indicative only

Table 17. Red Sea from Strait of Tiran to Bab-al-Mandab Expected Navigational Accidents

Accident type	Between meeting-joining area		In meeting-joining area		Total	
	Return period all ships/ oil tankers	Oil out-flow/ year	Return period all ships/ oil tankers	Oil out-flow/ year	Return period all ships/ oil tankers	Oil out-flow/ year
Powered grounding	1,3 / 29	350	N/A	--	1,3 / 29	350
Collision, crossing	N/A	--	21 / 536	400	21 / 536	400
Collision, meeting	1,9 / 7	2750	N/A	--	1,9 / 7	2750
Drifting grounding	1,13 / 8,0	2100	N/A	--	1,13 / 8,0	2100
Total	--	--	--	--	0,45 / 3,3	5600

Figures in table are indicative only

Table 18. Gulf of Aden - Expected Navigational Accidents

Accident type	Between meeting-joining area		In meeting-joining area		Total	
	Return period all ships/ oil tankers	Oil out-flow/year	Return period all ships/ oil tankers	Oil out-flow /year	Return period all ships/ oil tankers	Oil out-flow/ year
Powered grounding	0 / 0	0	N/A	--	0 / 0	0
Collision, crossing	N/A	--	89 / 1593	13	89 / 1593	12
Collision, meeting	1,9 / 11	1660	N/A	--	1,9 / 11	1660
Drifting grounding	0 / 0	0	N/A	--	0 / 0	0
Total	--	--	--	--	1,9 / 11	1672

Figures in table are indicative only

Table 19. Recognized Hot-Spots

Hot Spot	Area of concern	Type of risk	Expected average oil outflow per year (tons)	Expected return period (years)	Evaluation of total risk
Hot Spot A	Northern part of Gulf of Suez -Egypt	Oil pollution from tanker accidents	6700	1	Very high
Hot Spot B	Northern part of Red Sea -Egypt -Saudi Arabia	Oil pollution from tanker accidents	1250	15	Moderate/High

Hot Spot	Area of concern	Type of risk	Expected average oil outflow per year (tons)	Expected return period (years)	Evaluation of total risk
Hot Spot C	Red Sea - Yanbu to Port Sudan -Saudi Arabia -Sudan	Oil pollution from tanker accidents	1100	4.5	High
Hot Spot D	Red Sea - Ras Isa to Bab-al-Mandab -Eritrea -Yemen -Djibouti	Oil pollution from tanker accidents	1700	4	Very high
Hot-Spot E	Northern part of Gulf of Aden -Djibouti -Yemen	Oil pollution from tanker accidents	1500	9	High

4

Navigation Risk Reduction Management Plan

Based on the calculations noted in the preceding chapters, and the findings and recommendations from field visits and the two navigational workshops (see Appendices F and G), a Management Plan for navigational risk reduction covering the whole Region is proposed in this chapter. An outline of the measures proposed for the various regions and close-to-port areas is presented. Each measure is then discussed in more detail in separate sections.

Risk Reducing Measures

In Table 20, risk reducing measures for each of the regions and close-to-port areas are listed.

Table 20. Risk Reducing Measures for Red Sea and Gulf of Aden

Port/ Region	Ratify Conven-tions	Re-survey of area	TSS/ Recomm. Tracks	VTS/ VTM	PSC	Tugs	Em. Anchor ready
Port of Suez	N/A	N	E	E	R	N/A	E
Ain Sukhna	N/A	N	E	E	R	N/A	E
Aqaba	N/A	N	R	N	R	N/A	R
Yanbu	N/A	R	E	(E)R	R	H	R
Jeddah	N/A	R	R	R	R	H	R
Port Sudan	N/A	R	R	R	R	H	R
Massawa	N/A	R	R	N	TBD	TBD	TBD
Ras Isa	N/A	N	N	N	N	N/A	N
al-Hudaydah	N/A	R	R	R	R	H	R
Djibouti	N/A	R	R	R	R	H	R
Aden	N/A	N	R	R	R	H	R
Ash Shihr	N/A	N	N	N	N	N/A	N
Gulf of Suez	R	R	E	R	N/A	S	R

Port/ Region	Ratify Conven-tions	Re-survey of area	TSS/ Recomm. Tracks	VTS/ VTM	PSC	Tugs	Em. Anchor ready
Gulf of Aqaba	R	R	R	RT	N/A	S	N
Main Red Sea	R	R	R	RT	N/A	S	N
Bab-al-Mandab	R	R	E	R	N/A	S	R
Gulf of Aden	R	N	R	RT	N/A	S	N

R Recommended measure

E Exists

(E) Exists to some extent

T Transponder tracking

N Not considered necessary

H Extended use of harbour tugs recommended

S Salvage tugs recommended in area

TBD To Be Determined

N/A Not Applicable

Ratification of Conventions

To date, some of the countries in the Region of the Red Sea and Gulf of Aden have not ratified the main IMO and other relevant Conventions. Port State Control (see below) is based on these Conventions. In particular, the provision for International Safety and Management Code (ISM) in the 1994 SOLAS Convention is considered to provide an effective and thorough basis for Port State Control. Conventions most relevant to Port State Control are:

- 1966/1968 Load Line Convention.
- 1974/1978/1994 SOLAS Convention (including ISM).
- 1973/1978/1992 MARPOL Convention (including SOPEP).
- 1978/1995 STCW Convention.
- 1972 COLREG.
- ILO Convention No. 147.

THE 1966/1968 LOAD LINE CONVENTION

The Load Line Convention details the basic requirements for ship strength and seaworthiness, and is therefore related to safety against structural failure and foundering. Safety measures against sinking after damage caused by collision and grounding are covered also.

THE 1974/1978/1994 SOLAS CONVENTION

SOLAS is an abbreviation of the International Convention for the Safety of Life at Sea. This Convention covers safety against fires as well as life-saving equipment. The ISM is a part of SOLAS.

THE 1973/1978/1992 MARPOL CONVENTION

MARPOL stands for the International Convention for the Prevention of Pollution from Ships, and includes requirements for prevention of operational and accidental release of oil and chemicals considered harmful to the environment. The 1992 requirements for double bottom and double sides on tankers, as well as exclusion of water ballast mixed with oil residues, are important.

THE 1978/1995 STCW CONVENTION

STCW is an abbreviation for the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers. In 1992, the requirements were made uniform in order to improve on human safety aspects for all ships. Standards for humans on ships has now been set.

THE 1972 COLREG

COLREG stands for International Regulations for Preventing Collisions at Sea, or Collision Regulations in brief. Originating in 1840, these regulations provide concise “Rules of the Road” for seafarers.

All the IMO Conventions related to marine pollution are discussed in more detail in Appendix H. It is recommended that PERSGA urge the countries in the Region to ratify the relevant Conventions, and that relevant training programmes be initiated for the enforcement of Port State Control. For an overview of the status of ratification for countries in the area, see Appendix D.

Re-survey of the Area

With the exception of some inner port areas, large sections of the Red Sea and Gulf of Aden have not been re-surveyed for many decades. Some of the information used on current charts dates from the turn of the 1900s. In some areas, navigation charts suffer from significant errors in the positions of coastal features and ships’ officers cannot depend on charted positions. There are discrepancies between positions given by modern satellite navigation systems and those shown on charts. In other critical areas there is uncertainty over available water depths.

UK Admiralty Chart No. 143 (Jazirat At Ta’ir to Bab-al-Mandab), for example, provides a “source data” diagram giving the sources from which the chart was produced. It includes a caution on “Inadequate Survey” as follows:

> “The attention of mariners is drawn to the Source Data Diagram which indicates the origin of hydrographic material used. Many depths are from inadequate, nineteenth century leadline surveys and it is likely that some reefs are uncharted ….. Mariners are therefore advised to navigate with caution …”

A re-survey of the area should therefore be done to the degree of accuracy required by modern Satellite Navigation Systems (SATNAV) and for use by ships that may be sailing with a draught of up to 25 meters. The re-survey should include:

- Positions of near-coastal mountains, coastlines, islands, isolated rocks, shoals and other features of importance to navigators operating in the Region.
- Water depths in the areas in which maritime traffic is constrained by coastlines, islands, reefs, rocks and other hazards.

In most ports, within port limits, surveys are completed on a regular basis by port hydrographic survey departments, or other means. It is therefore recommended that the re-survey of port and close-to-port areas remain the responsibility of the port state and authority.

Outside the port areas, the main areas of the Red Sea and Gulf of Aden consist of deep water that does not pose a threat to traffic transiting between the Gulf of Suez and Bab-al-Mandab. Re-survey of these areas may be conducted as and when resources become available.

It is recommended that urgent attention should initially be given to carrying out re-surveys of the following:

- Southern Red Sea.

  The area outside port limits between Latitude 11°30’N, Longitude 45°E and the coastline in the Gulf of Aden and the whole of the southern end of the Red Sea northwards to Latitude 16°00’N, as far west as Longitude 40°50’E off the coast of Eritrea.

  An area roughly 20 nautical miles wide between the following positions:

  16°34’N41°35’E and 16°00’N41°55’E

19°30’N39°30’N and 19°30’N39°50’E

This is roughly parallel to the 100 meter isobath to the east of the main route from the line through Jazirat At Ta’ir to a position 5 nautical miles due east of the Brothers (Iles des Sept Frères).

It should be noted that the land area of the northern and western provinces of Yemen has been resurveyed (1996) and that the southern and eastern provinces are due to be resurveyed shortly. Resurveys include offshore islands and Socotra. It is possible that the results of these new surveys could be made available to navigational chart makers.

- Northern Red Sea.

The area outside port limits north of Latitude 27°20’N, including the Gulf of Suez but excluding the Gulf of Aqaba north of Latitude 28°10’N. The Gulf of Aqaba is both deep and steep, with adequate means for ships to safely maintain their distance off the coast using conspicuous radar targets along the coastlines and/or visual observations.

In addition, the area around El Akhewain (the Brothers) Light for a distance of 10 nautical miles north, south, east and west should also be resurveyed.

- Red Sea (general).

In addition to the areas described above, any reported isolated patches having a depth of less than 50 meters and within 30 nautical miles of a line between a position 5 nautical miles due east of the Sept Frères and Jazirat At Ta’ir should be re-surveyed.

Re-survey is undertaken by special-purpose ships that combine exact position with simultaneous depth measurements using echo-sounders and sonar. The accuracy and extension of survey determine the cost.

To provide safety for the large transiting oil tankers in the area, the exact location of the TSS and the Recommended Tracks should be set only after surveys have confirmed that the minimum water depth is 25 meters or more within the limits of the TSS. This requirement is valid for the TS and RT as presented in Table 20.

Table 21. Priority and Cost Estimates of Re-survey

Port/ Region	Re-Survey of Area	Type	Cost Est. (US$ M)	Priority
Port of Suez	N	TSS	1-1,5	N/A
Ain Sukhna	N	TSS	N/A	N/A
Aqaba	N	N/A	N/A	N/A
Yanbu	R	TSS	1-1,5	N/A
Jeddah	R	RT	1-1,5	N/A
Port Sudan	R	RT	1-1,5	N/A
Massawa	R	RT	1-1,5	N/A
Ras Isa	N	RT	N/A	N/A
al-Hudaydah	R	RT	1-1,5	N/A
Djibouti	R	RT	1-1,5	N/A
Aden	N	TSS	N/A	N/A
Ash Shihr	N	N/A	N/A	N/A
Gulf of Suez	R	TSS	4-5	3

Priority and cost estimates are presented in Table 21.

TSS/Recommended Tracks

Routing measures such as TSS and Recommended Tracks are proposed for parts of the Red Sea and Gulf of Aden, see Maps. There are two main reasons for regulating traffic using these measures:

- At present, there are about 1 million ship meetings between transiting ships in the Red Sea. As explained in chapter 3, these ships today meet within a relatively narrow lane of 4 nautical miles. To eliminate the collision potential, separation of north- and southbound ships is considered essential. At the entrance to the TSSs, potential conflicts would be eliminated by Recommended Tracks leading directly into the TSSs.
- The need for re-surveys can be minimized by concentrating on TSSs and Recommended Tracks.

TSSs already exist for the Gulf of Suez, Strait of Tiran and Bab-al-Mandab. These are well proven systems and should form the basis for the development of routing systems in the rest of the Red Sea and Gulf of Aden. Routing systems are discussed in some detail below. The exact form and implementation of the schemes should be carried out in collaboration with all concerned parties. Detailed procedures for the establishment of ship routing are included in Appendix C. These are meant to serve as a guide.

Recommended Routing Measures in the Red Sea and Gulf of Aden

Two TSSs are recommended: one east of az-Zuqur Island, and one west of Hanish al-Kabir; these would cover the two main routes through the area.

Between the two recommended TSS schemes in the Red Sea, and the existing schemes in the Gulf of Suez and Bab-al-Mandab, Recommended Tracks are suggested. The tracks would separate northbound and southbound ships by five nautical miles in order to avoid meeting collisions.

Specification of Recommended Tracks from off Ras Mohammed to Bab-al-Mandab

The Recommended Tracks are specified on the basis of the standard IMO template for routing measures. See Table 22 below

Table 22. Routing Measures in the Red Sea and Gulf of Aden

Route East of az-Zuqur Island		
Description of Recommended Tracks		
Northbound track bounded by line connecting the following geographic positions		
(1)	12°56´.0 N.,	043°14´.5 E.
(2)	13°04´.8 N.,	043°06´.6 E.
(3)	13°59´.7 N.,	042°53´.0 E.
(4)	15°32´.5 N.,	041°39´.8 E.
(5)	27°26´.1 N.,	034°14´.0 E.
(6)	27°32´.0 N.,	034°07´.0 E.
The southbound track is:		
(1)	27°29´.3 N.,	034°05´.0 E.
(2)	26°19´.6 N.,	034°52´.7 E.
(3)	15°31´.2 N.,	041°34´.3 E.
(4)	14°07´.8 N.,	042°44´.7 E.
(5)	13°03´.0 N.,	043°04´.4 E.
(6)	12°56´.5 N.,	043°11´.3 E.
(7)	12°55´.0 N.,	043°12´.0 E.
Route West of Hanish Islands		
Description of Recommended Tracks		
Northbound track bounded by line connecting the following geographic positions:		
(1)	12°56´.0 N.,	043°14´.5 E.
(2)	13°27´.1 N.,	042°46´.3 E.
(3)	15°32´.5 N.,	041°39´.8 E.
(4)	29°26´.1 N.,	034°14´.0 E.
(5)	27°32´.0 N.,	034°07´.0 E.
The southbound track is:		
(1)	27°29´.3 N.,	034°05´.0 E.

(2)	26°19´.6 N.,	034°52´.7 E.
(3)	15°31´.2 N.,	041°34´.3 E.
(4)	13°39´.8 N.,	042°31´.3 E.
(5)	12°56´.5 N.,	043°11´.3 E.
(6)	12°55´.0 N.,	043°12´.0 E.

Application

The track is recommended for use by the following ships of 10,000 gross tonnage and upwards.

- Tankers carrying oils mentioned in Appendix H, Annex I to the International Convention of 1978 relating thereto (MARPOL 73/78).
- Ships carrying in bulk liquid substances classed in categories A and B mentioned in Appendices I and II, Annex II, to the International Convention for the Prevention of Pollution from Ships (MARPOL 1973).

Use of the Recommended Tracks

- Ships referred to above should use the Recommended Tracks:
  - ◊ When sailing in transit through the Red Sea and Gulf of Aden.
  - ◊ When sailing between Red Sea and Gulf of Aden ports.
  - ◊ Joining and leaving the Recommended Tracks.
  - ◊ When joining or leaving the Recommended Tracks such ships should do so in accordance with COLREG, Regulation 10.
- Note: It is recommended that an efficient electronic position-fixing device appropriate for the area be carried on board.

Detailed sketches for the routing measures are found on the Maps. Clear and specific rules for navigation in TSSs are given in COLREG, Regulation 10, Appendix H.

VTS

For ship routing measures to be effective, a VTS should be established to monitor that all ships keep within their lane. Today the most effective tool for VTS is radar surveillance and VHF communication. However, it is expected that within a few years, it will be compulsory for all sea-going ships with dangerous cargo to have a transponder onboard, from which the VTS can get information about the ship's identity, cargo, position and course. It is therefore recommended that all VTSs be designed to incorporate this new technology.

It is proposed to establish three regional VTS centers in the Red Sea and Gulf of Aden. One should cover the Gulf of Suez, the Strait of Tiran and the sea room between. It is recommended that this VTS be situated at Ras Mohammed at the southern tip of Sinai.

The second VTS is proposed to cover the TSS from the southern part of Bab-al-Mandab north to Hanish al-Kabir. It is recommended that this VTS be situated on Perim Island, but an alternative location in one of the large ports in the area (such as Aden or Djibouti) should be considered if staffing is a problem on Perim Island.

Both VTS centers proposed above should be based on radar surveillance and VHF communication to cover the entire area the VTS is intended to monitor. In addition, the VTSs should be designed so that it is possible to monitor the ships by transponder. This will make them able to monitor ships over a much larger area than is possible with radar equipment alone. Theoretically, by using transponders all ships can be monitored within an unrestricted area.

The third VTS proposed would cover the region between the two recommended TSSs in the Red Sea. This VTS should monitor in particular the laden oil tankers transiting through the area. During pilgrim seasons, due diligence should be paid to the numerous passenger vessels that cross the main lane carrying pilgrims to and from Jeddah. Because of the large area to cover, it would be unrealistic to base the surveillance on radar. Therefore, the effectiveness of this VTS is dependent on when transponders become compulsory. As mentioned earlier this is expected to be within a few years for ships with dangerous cargo. Planning for such a VTS should therefore be started soon. It is recommended that this VTS be situated in Jeddah, together with the already existing harbor office.

Finally, all VTSs must be equipped with a Global Maritime Distress and Safety System (GMDSS).

Establishment of the electronic hardware for VTSs in the north and south would cost approximately USD 3 million each. The VTS in Jeddah may be an extension of the proposed harbor VTS in Yanbu and/or Jeddah, and would be less expensive. The cost of using transponder technology over such a large area is uncertain. Training and operational costs would constitute further expenditures.

For the VTSs to operate effectively, the legal foundation and operational procedures should be carefully determined. In international waters, a VTS functions in an advisory rather than regulatory capacity. When national interests are threatened, however, a country can intervene to prevent an accident. For this to be effective, strict operational procedures must be established for the VTSs.

Establishment of VTSs is recommended as a phase 2 activity,. Detailed legal, administrative and technological issues would be addressed further at a later stage.

Port State Control

Port State Control is an effective instrument to prevent operation of sub-standard ships in a given area. Although national Port State Controls could survey internal traffic in the Red Sea and Gulf of Aden, they may not be able to monitor all ships. If main ports in the Region are unable to establish their own Port State Control, sub-standard operators may change ports of call rather than upgrade their ships. Therefore, the Region would benefit from establishment of a Regional Port State Control agreement. Such an agreement should be flexible, giving each country the opportunity to join at a later stage if it is not in position to do so immediately.

It is recognized that the Suez Canal authorities currently inspect ships to ensure that they are fit to safely pass the Canal. This inspection encompasses several aspects related to safe navigation, and might possibly include other issues regarding continued safe navigation through the whole area, such as presence of relevant charts, transponder function etc.

The following aspects regarding ship safety are normally addressed in Port State Control:

- Survey certificates.
- Life saving appliances.
- Firefighting equipment.
- Navigation equipment.
- Ship stability.
- Structural integrity and watertightness.
- Machinery condition and reliability.
- Safe manning.
- Dangerous cargoes and pollution aspects.

Through the 1994 SOLAS Convention, Port State Control can use the ISM code as a basis to control competency and procedures onboard ship.

All Port Authorities should place emphasis on having skilled surveyors / inspectors with maritime experience. Training should ensure that the Port State Control Officer (PSCO):

- Has a through knowledge of all relevant requirements, principles and procedures related to PSC.
- Is able to apply all relevant requirements, principles and procedures related to PSC.
- Can exercise good inter-personal skills, especially in conflict situations onboard.
- Can distinguish the responsibilities and prime tasks of others involved.
- Can verify all documents.
- Can determine whether a more detailed/expanded inspection is needed.
- Can assess compliance with the relevant instruments.
- Can assess grounds for detention, release or stoppage of an operation.
- Can communicate findings to the ships staff.
- Can report on findings/inspection results clearly and according to harmonized procedures.

To instill basic skills and competence in performing PSC inspection, a basic PSC programme of about 4 to 5 months is recommended involving one or more training institutions and maritime administrations as hosts for the training. This provides for a comprehensive treatment of theoretical and practical aspects of PSC and may be considered a pre-requisite for PSC trainees with little or no previous experience in ship inspection work. (Such a course has been delivered already by IMO as part of the Caribbean Cooperation on Port State Control[3] and incorporated material from the IMO model courses on PSC). If possible, participants should have at least five years seagoing experience as Captain / First Officer or Engineer.

It is understood that the Arab Academy for Science and Technology and Marine Transport (AAST) in Alexandria, Egypt, is currently developing a ship inspection training programme. In addition, the Marine Training Center in Aden conducted training in PSC in 1991. The programme and instructors there should be supported to meet the recommended IMO standard. It is recommended that the countries in the Region consider these programmes in relation to development of PSC capacity.

There are several other types of PSC training interventions, such as study tours, internships, as well as specialized courses, which often constitute refreshment training / upgrading for experienced PSCOs. Examples taken from the Paris MOU[4] are contained in Appendix I.

Network Training System

A PSC system in operation is by definition a network system, made of links forming a regional chain and containing sub-systems such as inspection, monitoring, information storing and processing and statistical analysis etc.

As implementation of the PSC system gets underway, instruments for developing and maintaining contacts, exchanging experience and resolving issues between administrations of the Region, should be a

3 Third Preparatory Meeting on Port State Control for the Caribbean Region. Report of meeting. Christ Church, Barbados, February 1996.

4 Paris MOU on Port State Control. Advanced Training Programme for Port State Control Officers, Annex III, Objectives and Modules for Advanced Training.

principal feature or focus in the next stage of the overall training programme. A PSC network within the Region should also gradually emerge. This would be facilitated by utilizing a network training system as such an approach greatly enhances what the participants—in the process of accumulating experience in different home environments, and with a common goal—will get out of the training programme. Network participation is an effective and relatively inexpensive way to build-up human resources.

Incorporation of the network approach into design of the later stage of the PSC training programme implies the following:

- Design and delivery of workshops for experienced personnel rather than courses and field training.
- In conjunction with the PSC Secretariat (see below), identification of a host country / administration for each workshop and appointment of a workshop facilitator.
- The host administration (rotating) arranges the workshops and guides the participants through the programme. The workshops would benefit from being hosted by an administration that is already well into its development phase. Alternatively, hosting such a workshop may also stimulate less developed maritime administrations in the Region.
- Two-three representatives conversant with PSC from each participating country attend each workshop.
- Workshops take place every 6 months.
- Workshop agenda:
  - ◊ Lectures related to selected technical and formal issues.
  - ◊ Group discussions and exercises.
  - ◊ Exchange of ideas and experiences, that is, presentations and discussions of participants' "homework" related to PSC development for their own administration.
- Experienced training resources, from inside/outside the Region, also take part in the workshops and may provide additional support to each administration in the form of short consultancies performed in the periods between workshops.
- Network participants are obliged to cooperate actively and share experience and know-how. It would also be required that participants undertake activities ("homework") between workshops.

It is recommended that PERSGA review the activities surrounding preparation for Port State Control in the Mediterranean, in particular requirements for Flag State implementation and Port State Control.

The main activities connected with the development of PSC the Region would include:

- Preparatory meetings (three) to formulate and sign a PSC Agreement. Estimated cost USD 100,000.
- Baseline study to establish in detail the status of maritime legislation in each country and to closely identify the training requirements and needs for PSC in each country of the Region. Estimated cost: USD 50,000.
- Ratification of the relevant conventions and development of national legislation to put into effect the requirements of the Conventions.
- Design and delivery of a training programme on Port Sate Control for technical staff (PSCO) and other administrative staff. Estimated costs for initial delivery of a basic PSC programme covering theoretical courses and field training: USD 700,000 inclusive of instruction fees, food and lodging for

lecturers and trainees, training facilities, logistics, administration and facilitation. Assumed number of participants - 20 (approx.).

- Establishment of a PSC Secretariat and information center to provide up-to-date information on inspections in the whole Region. Through this secretariat each country can check the history of a ship, and improvements imposed on an individual foreign flag ship in one of the other regional ports within a preceding period can be followed up. Estimated capital cost: USD 50,000 (investment). Estimated recurrent costs: USD 300,000 (annual operational costs).

Training of PSCOs is proposed for the largest (main) ports in the area, see Table 20. This should be regarded as a starting point, and ideally all ports and terminals should have trained PSCOs. In terms of risk reduction, establishing PSC capabilities in the largest ports will have a significant impact due to their concentration of traffic. PSC requirements in Massawa should be identified in the future in consultation with Eritrean authorities.

Tugs

Extended Use of Dedicated Harbor Tugs

To prevent drifting tankers from grounding, tugs with sufficient bollard pull to hold tankers at zero speed in the prevailing wind and current must be available. Bollard pull is the real towing force the tug can provide another ship. For medium sized tankers (approx. 150,000 tons cargo capacity), a tug with bollard pull in the range of 50 tons is needed. For small oil tankers (approx. 6,500 tons cargo capacity), less bollard pull is needed, and for VLCCs (approx. 300,000 tons cargo capacity) significantly larger tugs would be required. The operation of tugs should be coordinated through the three proposed VTS centers.

Currently, the main ports in the area (see chapter 3) have tugs operating in the harbor area. These should be equipped to assist in the open sea adjacent to the harbor. Even if a tug is too small to hold a ship at zero speed, it will be able to decrease the drifting speed to allow the ship time to be repaired, to anchor or to get assistance from a larger tug. Therefore, the VTS plays an important role in coordinating tug operations so that the nearest tug always is used to assist a drifting ship. In addition, selected harbor tugs should be equipped with adequate towing gear suited for such assistance. Harbor tug personnel should be trained and always be on stand-by to assist.

The cost of additional towing equipment for tugs will be moderate. This option has been adopted by Djibouti, where the dedicated tug can also be used for oil spill contingency.

Salvage Tugs

Salvage tugs are present in the southern part of the area in the monsoon seasons, but not on a regular basis. In the near term, it would not be necessary to recommend that salvage tugs be contracted for operation in the area, or acquired for stand-by purpose. This is because tankers traveling in the main part of the Red Sea have a considerable distance to drift before nearing shore or other obstacles. In this situation they can normally perform emergency anchoring, or be assisted by selected harbor tugs as described above. As compared with other sea areas, the wind and wave climate is relatively mild in the Red Sea, so that drifting will be slow, allowing time for repair.

If such tugs are considered, they should be equipped with oil spill contingency equipment for effective use in the open sea.

Emergency Anchor Ready

Today, all ports should require that ships have the anchor ready when entering the port and the ability to release and stop the anchor even in the case of a black-out. All ships do have the ability to perform emergency anchoring and to fully implement such a measure. Nevertheless, it was observed during the field mission that this measure is not being implemented in some ports. The requirement should be included in harbor regulations. It is simple to control that the measure is being implemented upon arrival or departure through the PSC function (see above).

Calculated Risk Reducing Effect of the Proposed Measures

The calculations in this report show that the expected, theoretical return period for a navigational accident for all ships in the Red Sea and Gulf of Aden is 0.15 year. This means that six to seven accidents during one year can be expected. This figure does not indicate the extent of the damage to the vessels involved.

The expected return period for a navigational accident involving an oil tanker is 1.2 years. This means that approximately one accident every 15 months is expected to occur. Global statistics indicate that around 30 percent of accidents result in penetration of the hull. This would mean that an oil tanker accident resulting in oil outflow is expected to occur on average once every four years in the area.

The calculations also show that implementation of the measures discussed above could reduce navigational accident frequency in the area by 80 percent, to a return period of 0.65 year for all ships, and every six years for tankers.

Implementation of the Management Plan can reduce the number of navigational accidents. Fire, explosion and structural failures also represent a significant contribution to the total number of ship accidents. This implies that containment of the consequences, that is, oil spill response capability and SAR, will continue to remain important to reduce potential negative impacts on both people and the environment.

5

Consequence Containment of Navigational Accidents

The Management Plan discussed in chapter 4 addressed measures aimed at reduction and control of navigational accident frequencies for the various sub-regions covered by the study. In this chapter, the Region's present capability for containment of oil spills (the consequence) is outlined. This is not considered as part of the Management Plan, but is addressed to demonstrate the importance of the issue. We recommend that further analysis be carried out on this topic.

Oil Spill Response

Oil spill response in the Gulf of Suez is well developed. A detailed description by the DNV Regional Project Consultant is given in Appendix E.

The oil spill response center in Ghardaqah in Egypt was included in the field mission in 1997. The center was fully operative for protection and clean-up of shorelines and beaches. To upgrade the facility to combat moderate to large oil spills at the source, the following complementary equipment is needed:

- An oil combat vessel about 70 feet long, equipped with holding tank and oil lens on reel of about 400 meters.
- Oil skimmer for pumping oil and oil emulsion into holding tank.
- Booms for spread of dispergents.
- Working boat (200-400 HP) for holding free end of oil lens.

In addition, logistics for disposal of collected oil must be established, that is, contract with coastal tankers, and arrangement for reception ashore.

Harbors visited in the Red Sea generally have oil spill response capability, but only for limited spills within the harbor and its vicinity. The exception to this was Djibouti harbor, which was equipped with oil spill response equipment suited for the open sea. The equipment could be loaded on a dedicated harbor tug. The response center, established in 1990, was inspected during the field mission in 1997. Moderate upgrading in terms of equipment and response procedures is needed. Some equipment such as dispergents and batteries for communication equipment is out of date and no longer functional. The staff also has not had the opportunity to undertake up-to-date training. Relocation might be considered in order to be closer to Bab-al-Mandab, a hot spot.

Search and Rescue (SAR)

Current SAR capability in the Region is based mainly on available maritime resources. In other words, the ship nearest another ship in distress will respond and provide assistance. Participation from land resources depends on national responses from harbor or military authorities. There is no international obligation to engage land resources because the SAR Convention has not been not ratified by any of the countries in the Region.

SAR in the Region should be an integral part of the three VTS centers recommended in the area. This implies a division into areas, with corresponding responsibilities, as described in chapter 4. The navigational “hot spots” described in chapter 3 will be of particular concern for SAR. The VTS centers should integrate SAR into the monitoring system. GMDSS communication equipment is essential, as well as adequate staffing and appropriate training.

6

Management Plan Priorities and Future Trends

Implementation Priorities

Phases for implementation of risk reducing measures for navigational accidents is recommended below. Ratification of Conventions is considered to have the highest priority, as these Conventions form the legal basis for all other measures. It is therefore considered separately from the two implementation phases. The effect that these measures are anticipated to have is indicated in chapter 4. Note that here also drifting is included among navigational accidents. Levels of responsibility are indicated as follows: "L" local, "N" national, "R" regional and "IMO" international.

- Ratification of conventions:
  - ◊ Ratification will form the legal foundation for required shipping safety measures in the Region (R).
- Phase 1 sequence:
  - ◊ Inclusion of requirement for emergency anchoring in harbor regulations (L).
  - ◊ Agreement on TSS and Recommended Tracks (R).
  - ◊ Re-survey of the same to ensure that areas are free of obstacles (R).
  - ◊ Submission of proposed and adjusted TSS and Recommended Tracks to IMO for final comments. Final adjustments made. (R, IMO).
  - ◊ Preparation of Regional Agreement on PSC (R, IMO).
  - ◊ Simultaneous establishment of PSCs in the area after a sufficient number of PSCOs have been trained—two for each main harbor in the area (R).
- Phase 2. Once the steps as described under ratification and Phase 1 have been implemented, further safety measures should include:
  - ◊ Establishment of three VTM centers, one at Ras Mohammed, Egypt, one at Perim Island, Yemen, and one, for transponder monitoring only, at Jeddah, Saudi Arabia (R).
  - ◊ Upgrading of the Marine Emergency Mutual Aide Center in Djibouti, with consideration given to relocation of key emergency equipment and materials to Perim Island, Yemen (R).
  - ◊ Establishment of a regional oil spill center in Ghardaqah as currently planned and a potential additional

center in Jeddah in conjunction with the VTM (R).

◊ Re-survey of harbor areas (N).

Significant Future Trends

Several important changes in international shipping are evident as maritime transport continues to develop. These changes have a direct impact on the safety of navigation, the environment, the ships and their crews as they work in or pass through the Region. Significant changes are discussed in this chapter.

Accuracy of Navigation

Paradoxically, as explained in chapter 4, improved and more accurate means for positioning combined with Doppler logs may, while reducing risk of grounding, increase the possibility of collision. Ships will follow optimum tracks from A to B and vice versa, and will therefore find themselves on head-on courses more often as more accurate means are introduced. This can be resolved by introducing Recommended Tracks.

Accurate SATNAVs continue to be available for ships, which generally use the Global Positioning System (GPS). Some vessels are now fitted with Differential GPS and Doppler logs. These important improvements to accuracy of navigation are linked on some vessels to the ships' radar system and automatic pilot. This enables ships to accurately hold a desired course, but can also lead to the danger of ships on opposite courses on the same track being involved in an end-on collision, in spite of the use of radar "guard rings" to give warning of an approaching vessel.

A number of points should be noted:

- SATNAV systems are not infallible. In a widely reported case, a passenger vessel went aground after the system failed and the dead reckoning position was incorrectly updated. This was eventually 20 miles away from the actual position.
- "Total navigation" systems can and do fail (UKHO, 1976). In these cases, the navigators must be able to navigate and handle the ship without this means of support, using astronomical navigation (sun, moon stars, planets), terrestrial navigation (bearings of lighthouses, coast, etc.) and other navigational aids (radar, D/F, Decca, Loran C, Omega, etc.).
- In order to comply with navigation safety requirements and "good practice," navigators need to check their position using these other methods whenever possible, which implies that lighthouses and other navigational aids in key locations will continue to be required.

Quality of Officers and Crew

The global shortage of competent officers and crews for shipping has been a widely reported problem for a number of years. Young people from traditional seafaring nations (particularly in Europe) are not coming forward in sufficient numbers for training, and those who are trained do not make this a career and remain at sea to become experienced officers. It is reported that shipping companies already have to offer higher wages to attract staff to certain positions, such as second engineer, and that within a few years there will be insufficient officers to fill the shore-based positions as harbor masters, surveyors, etc. which qualified and experienced seafarers have traditionally occupied. The International Shipping Federation (ISF) is undertaking research into why insufficient numbers of officers and crew members wish to make seafaring a long-term career.

This growing lack of experienced, motivated ships' officers will increase the likelihood of accidents in the Region, particularly in congested areas such as the Gulf of Suez, southern end of the Red Sea and port approaches. The problem is likely to be greater due to the introduction of the ISM and new requirements for training and certification under the 1995 amendments to the IMO "Standards of Training, Certification and Watchkeeping Convention," 1978 (STCW). The STCW 1995 Protocol started its five year implementation period on 1st February 1997 and DNV has reported that many shipowners are not ready for this, as they are concentrating their efforts on meeting the requirements of the ISM.

IMO is drawing up a list of countries that operate training schemes and facilities that meet the requirements of the STCW 1995. It is reported that ships operated by seafarers that do not come from one of these countries will be deemed to be "sub-standard" and will be targeted by Port State Control Officers.

SUB-STANDARD SHIPS

As other parts of the world prevent use of their ports by sub-standard ships following the introduction of effective Port State Control (PSC), sub-standard ships are calling at ports and using shipping routes in regions such as this one, where there is no regional agreement. These vessels are a hazard to themselves, to other traffic and to the environment.

The introduction of effective PSC in the Region is essential in order to eliminate sub-standard shipping. This means that the governing international Conventions must be ratified and implemented by countries in the Region, the necessary maritime administrative structures established, surveyors trained, methods of record keeping and monitoring set up and regional cooperation on PSC agreed.

SHIP TRAFFIC

Tankers

By the early part of the 21st century, the Suez Canal may be able to accept fully loaded tankers of up to 350,000 TDW. This capacity will enable the Canal to handle vessels that currently must pass around the Cape of Good Hope or use the SUMED pipeline in order to reduce their displacement before transiting the Canal. The SCA has seen a decline in the number of tankers using the Canal in recent years. It hopes to increase its revenue through enlargement of the Canal and would presumably set Canal dues at levels that would encourage greater use of the Canal by VLCCs once it has expanded its depth and width.

This development will increase the volume of oil passing through the Red Sea and Gulf of Aden and the risk of accidents involving VLCCs. In addition, the consequence in terms of expected oil spill in an accident also will increase due to the larger size of the tankers transiting the area.

Container Ships

The number of container ships transiting the Suez Canal has increased to such an extent that this class of vessel now supplies over 30 percent of transiting ships and almost 37 percent in terms of tonnage. This represents over eleven container ships daily. The average size of a transiting container ship, almost 32,000 tons, increased by 1,000 tons in 1996 compared with 1995 (average tankers are around 3,000 tons larger) and the size of container ships being built and coming into service indicates firmly that the average size of this class of vessel will continue to increase as the older, smaller ships are phased out.

There are a number of potential risks associated with large container ships, as follows:

- These vessels can carry over 6,000 tons of fuel oil on board, equivalent to the load carried by a small tanker. This could be at least partially spilled in case of collision or grounding.
- The average speed of these vessels is increasing and the larger ones now operate at 21 knots or better.
- Container ships have a very high windage area due to the high deck loads of containers, which are often as high as a typical cruise liner's superstructure. In case of engine failure, the vessel would drift rapidly in the moderately strong winds that commonly occur in the Red Sea and Gulf of Aden. High windage area and strong winds may make it difficult for anchors or tugs to stop a drifting vessel and hold it in position.
- Large container ships commonly operate at draughts of between 12 and 14 meters, that is, between 2 and 4 meters greater than the draught at which general cargo ships operate. This implies a demand for accurate surveying of sea routes, particularly in TSSs and in areas depths of less than 20 meters are reported to exist. This also applies to high sided, high capacity car carriers operating between East Asia and Europe.

Cruise Liners

Although the numbers of passenger ships transiting the Suez Canal is falling, increasing numbers are calling at ports in Yemen, Jordan and Egypt. The world growth in cruise line traffic was reported to be around 10 percent annually between 1984 and 1994, significantly increasing the numbers of cruise ships in service. This type of vessel operates between tourist destinations in the Indian Ocean (East Africa, Sri Lanka, etc.) and in the northern end of the Red Sea (Aqaba, Sharm al Sheikh, Hurgada, and Safaga).

One widely reported accident to a passenger vessel ("Royal Viking Sun," 1996) has already occurred in the Region. P and I Clubs drew attention to a disturbing increase in cruise ship accidents during 1996, which included a generator fire, grounding and an engine room fire. The quality and nationality mix of crews on these vessels is also reported to cause concern as it increases the potential for accidents, including fires on board. Incidents of this nature highlight the need for effective SAR services in the Region.

Bulk Carriers

The problem of catastrophic failure of older bulk carriers remains, in spite of the introduction of enhanced special surveys for these ships once they are 20 years old. Although such vessels may be unlikely to suffer catastrophic failure in the relatively quiet waters of the Region, structural failure is possible, particularly in the vicinity of Socotra Island during the southwest monsoon. This reinforces the need for effective communications (GMDSS) and SAR services.

With the Suez Canal due to be increased in size, bulk carriers that currently have to go around the Cape of Good Hope in order to reach European destinations will be able to transit the Canal. This is likely to increase the numbers and sizes of bulk carriers transporting, for example, Australian coal to Europe. The loss of fuel oil from such vessels in cases of grounding or collision could also be fairly substantial.

Yachts

Increasing numbers of yachts call at ports in Yemen, Djibouti, Eritrea, Sudan, Jordan and Egypt. While these do not pose any serious risk to the environment, there have been reports of near collisions between becalmed or very slow yachts and large ships in the Region. Such incidents again reinforce the need for effective SAR services.

SEARCH AND RESCUE (SAR) SERVICES

A recent IMO Conference in South Africa (September 1996) developed a provisional SAR Plan for the Western Indian Ocean, including the Gulf of Aden and Red Sea areas. It adopted a number of resolutions dealing with:

- Acceptance and implementation of the ”International Convention on Maritime Search and Rescue 1979” (the SAR Convention 1979).
- Provision and coordination of SAR services.
- Cooperation between states.
- Technical cooperation.
- Use of the GMDSS.

Implementation of the resolutions and the provisional SAR Plan resulting from this Conference will have positive benefits for ships operating in the Region and could assist in achieving a reduction in loss of life and property, and greater protection of the marine environment.

7

References

Ballou, T.G., R. Dodge, S. Hess, and A. Knap. 1989. "Tropical Oil Pollution Investigations in Coastal Systems (Tropics): The Effects of Untreated and Chemical Dispersed Prudhoe Bay Crude Oil on Mangroves, Seagrasses and Corals in Panama." In: L.M. Flaherty (ed.), *Oil Dispersants. New Ecological Approaches.* ASTM Symposium. Pp. 229-256.

Bertram, G.C.L. and C.K. Ricardo-Bertram. 1973. "The Modern Sirenia: Their Distribution and Status." *Biological Journal of the Linnean Society*, 5: 297-338.

Brown, B.E. and L.S. Howard. 1985. "Assessing the Effects of 'Stress' on Reef Corals." *Advances in Marine Biology*, 22: 1 – 63.

Dicks, B. 1986. "Oil and the Black Mangrove, Avicennia Marina in the Northern Red Sea." *Marine Pollution Bulletin*, 17 (11): 500-503.

Edwards, A.J. and S.M. Head (eds.) 1987. *Key Environments: Red Sea.* IUCN/Pergamon Press. 441 pp.

Fishelson, L. 1980. "Marine Reserves along the Sinai Peninsula (Northern Red Sea)." *Helgoländer Meeresunter* 33: 624 – 640.

Frazier, J., G.C. Bertram, and P.G.H. Evans. 1987. "Turtles and Marine Mammals." In: Edwards, A.J. and S. M. Head (eds.). *Key Environments: Red Sea.* IUCN/Pergamon Press. Pp.288-314.

GESAMP. 1993. "Impact of Oil and Related Chemicals and Wastes on the Marine Environment." *GESAMP Reports and Studies*, No 50.,180 pp.

Head, S.M. 1987. "Corals and Coral Reefs of the Red Sea." In: Edwards, A.J. and S.M. Head (eds.), *Key Environments: Red Sea.* IUCN/Pergamon Press. Pp: 128-151.

IMO. 1995. Resolution A.789(19), adopted on 23 November 1995: Specifications on the Survey and Certification Functions of Recognized Organizations acting on behalf of the Administration.

IMO. 1987. "Casualty Statistics, Report of the Steering Group, Annexes 1-3 (Analysis of Casualties to Tankers, 1972 – 1986)." MSC 54/Inf 6, March 1987.

International Tanker Owner's Pollution Federation Ltd. 1996. "An Assessment of the Risk of Oil Spills and the State of Preparedness in 13 UNEP Regional Seas Areas." London, United Kingdom.

IUCN. *Red List of Threatened Animals 1997*. Searchable database published on the Internet by WCMC http://www.wcmc.org.uk /data/database.

IUCN. 1995. *A Global Representative System of Marine Protected Areas. Volume III: Central Indian Ocean, Arabian Seas, East Africa and East Asian Seas.* GBRMPA, IUCN, World Bank. Washington, D.C. 147 pp. + maps supplement.

IUCN. 1990. *Conserving the World's Biodiversity.* IUCN, WRI, CI, WWF-US and the World Bank.

IUCN. 1987. *The Red Sea and Arabian Gulf. Saudi Arabia: A National Coastal Zone Management Programme to Balance Future Growth with Protection of Coastal and Marine Resources.* Report to MEPA. Jeddah, Kingdom of Saudi Arabia, 54 pp.

Jones, D.A., M. Ghamrawy and M.I. Wahbeh. 1987. "Littoral and Shallow Subtidal Environments." In: Edwards, A.J. and S.M. Head (eds.), *Key Environments: Red Sea.* IUCN/Pergamon Press. Pp. 169-193.

Lipkin, Y. 1975. "Food for the Red Sea Dugong (Mammalia: Sirenia) from Sinai." *Israel Journal of Zoology*, 24: 81-98.

Loya, Y. and B. Rinkevich. 1980. "Effects of Oil Pollution on Coral Reef Communities." *Marine Ecology Progress Series* 3: 167 – 180.

Paris MOU on Port State Control. Advanced Training Programme for Port State Control Officers, Annex III, Objectives and Modules for Advanced Training.

PERSGA. 1997. Strategic Action Programme for the Red Sea and the Gulf of Aden. 3 Volumes.

Peters, E.C., P.A. Meyers, P.O. Yevich and N.J. Blake. 1981. "Bioaccumulation and Histopathological Effects of Oil on a Stony Coral." *Marine Pollution Bulletin* 12 (10): 333-339.

Preen, A. 1989. *Dugongs. Vol. 1. The Status and Conservation of Dugongs in the Arabian Region.* MEPA Coastal and Marine Management series, Report No. 10. MEPA, Jeddah, 200 pp.

Prince Williams Sound Risk Assessment Study, DNV, George Washington University, Rensselaer Polytechnic Institute, Le Moyne College, Dec. 1996

Ritchie, W. and M. O'Sullivan. 1994. *The Environmental Impact of the Wreck of the Braer*. Ecological Steering Group on the Oil Spill in Shetland. Scottish Office. Edinburgh, 207pp.

Sanders, M.J. and G.R. Morgan. 1989. *Review of the Fisheries Resources of the Red Sea and Gulf of Aden.* FAO Fisheries Technical Paper. No. 304. Rome. FAO. 138 pp.

Second Preparatory Meeting on Cooperation on Port State Control in the Mediterranean. Draft Report. Casablanca, Morocco. December 1996.

Sheppard, C.R.C., A. Price, and C. Roberts. 1992. *Marine Ecology of the Arabian Seas Region: Patterns and Processes in Extreme Tropical Environments.* London, UK. Academic Press. 359 pp.

Third Preparatory Meeting on Port State Control for the Caribbean Region. Report of meeting. Christ Church, Barbados, February 1996.

Thorhaug, A. 1989. "Dispersed Oil Effects on Tropical Nearshore Ecosystems." In: L.M. Flaherty (ed.), *Oil Dispersants. New Ecological Approaches.* ASTM Symposium. Pp. 257-273.

UNEP. 1992. *Guidelines for Country Studies on Biological Diversity.* UNEP, Nairobi, Kenya.

UNEP/IUCN. 1988. *Coral Reefs of the World. Vol. 2: Indian Ocean, Red Sea and Gulf.* UNEP Regional Seas Directories and Bibliographies. IUCN, Gland, Switzerland and Cambridge, U.K. / UNEP, Nairobi, Kenya. 1 + 389 pp., 36 maps.

United Kingdom Hydrographic Office. 1976. British Admiralty Sailing Directions for the Gulf of Aden and the Red Sea. London, United Kingdom.

Vandermeulen, J.H. and E.S. Gilfillan. 1984. “Petroleum Pollution, Corals and Mangroves.” *Marine Technology Society Journal*, 18 (3): 62 – 72.

Wilkinson, C.R. 1993. “Coral Reefs of the World Are Facing Widespread Devastation: Can We Prevent This Through Sustainable Management Practices?” *Proceedings of the Seventh International Coral Reef Symposium.* Guam, 1992. Vol.1, pp. 11-21.

World Bank. 1996. *The Hashemite Kingdom of Jordan. Gulf of Aqaba Environmental Action Plan.* Project Document, May 1996. World Bank, Washington, USA. 24 pp. + Technical Annex, 72 pp.

8

Appendices

Appendix A

Traffic Data

Table A-1. Traffic Data for the Ports in Red Sea and Gulf of Aden

Port	No. of calls, non oil tankers	No. of inbound laden oil tankers	No. of outbound laden oil tankers	Average size of oil tankers [dwt]
Port of Suez	700	200	0	8,000
Ain Sukhna	0	550	0	200,000
Aqaba	2500	0	0	0
Yanbu	900	0	400	200,000
Jeddah	4200	50	0	50,000
Port Sudan	540	108	108	50,000
Massawa	300	12	12	50,000
Ras Isa	0	0	86	50,000
Hudaydah	640	220	0	8,500
Djibouti	760	60	60	17,000
Aden	1000	280	300	17,000
Ash Shihr	0	0	50	200,000

All figures are indicative

Table A-2. Traffic data for transiting ships in Red Sea and Gulf of Aden

Direction	No. of non oil tank-ers	No. of laden oil tankers	Av. size of oil tankers [dwt]
Northbound	5825	Ca. 650	150,000
Southbound	6750	Ca. 200	150,000

All figures are indicative

These data are based upon Traffic Data purchased from Lloyds Maritime Information Services Ltd., and data gathered during field visits, supplemented by data obtained through correspondence with local Port Authorities.

Appendix B

Drifting Grounding

When a ship has started to drift, and the crew is unable to repair it, the ship can avoid drifting ashore only by dropping the anchor or getting assistance from a tug. This is shown on the following pages.

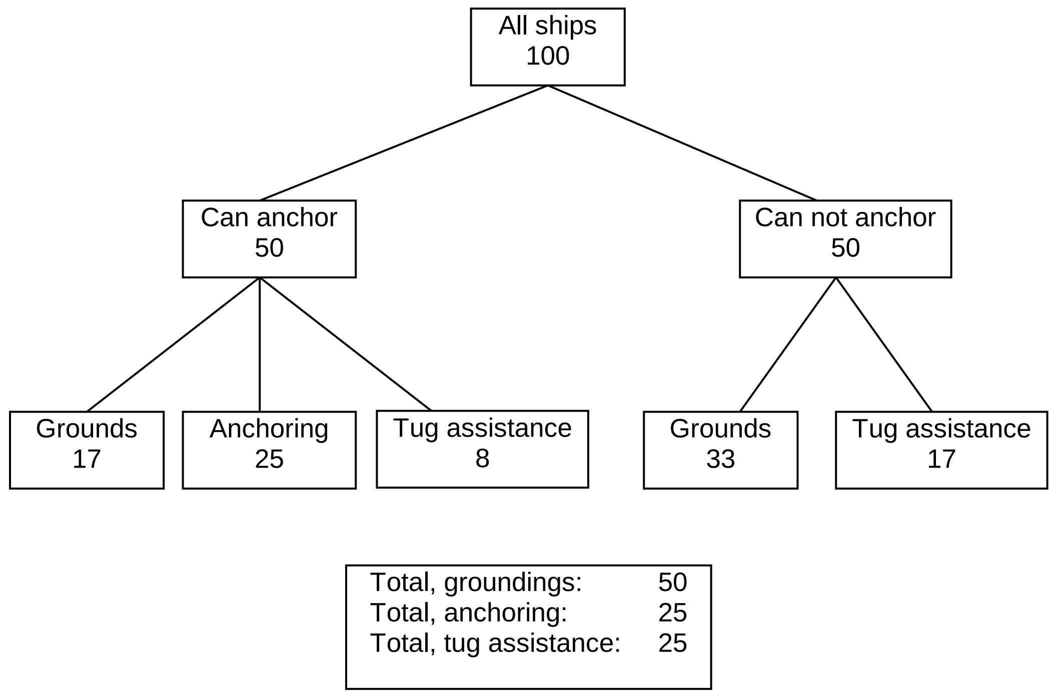
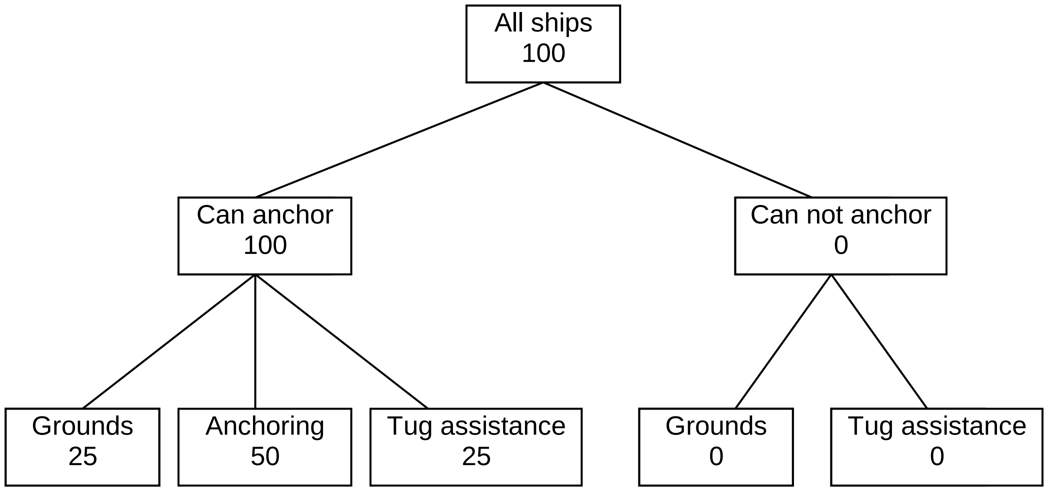


Figure B-1 Situation Today in Close to Port Areas (all figures in percent)



Total, groundings:	25
Total, anchoring:	50
Total, tug assistance:	25

Figure B-2 With Risk Reducing Measures, in Close to Port Areas (figures in percent)

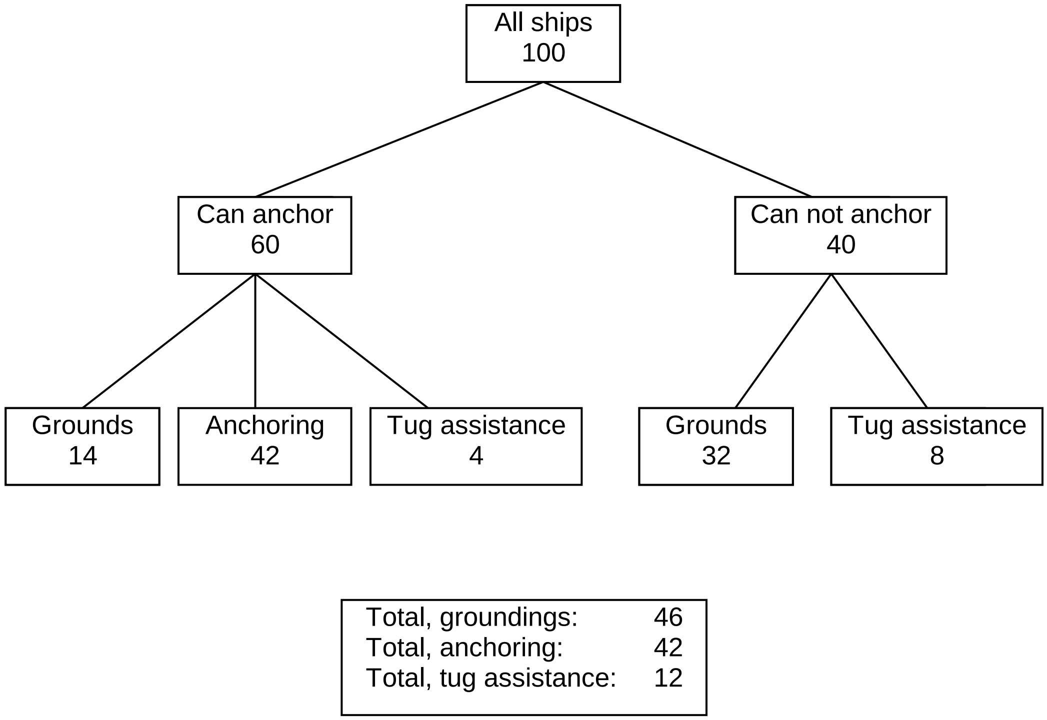


Figure B-3 Situation Today in Open Waters (figures in percent)

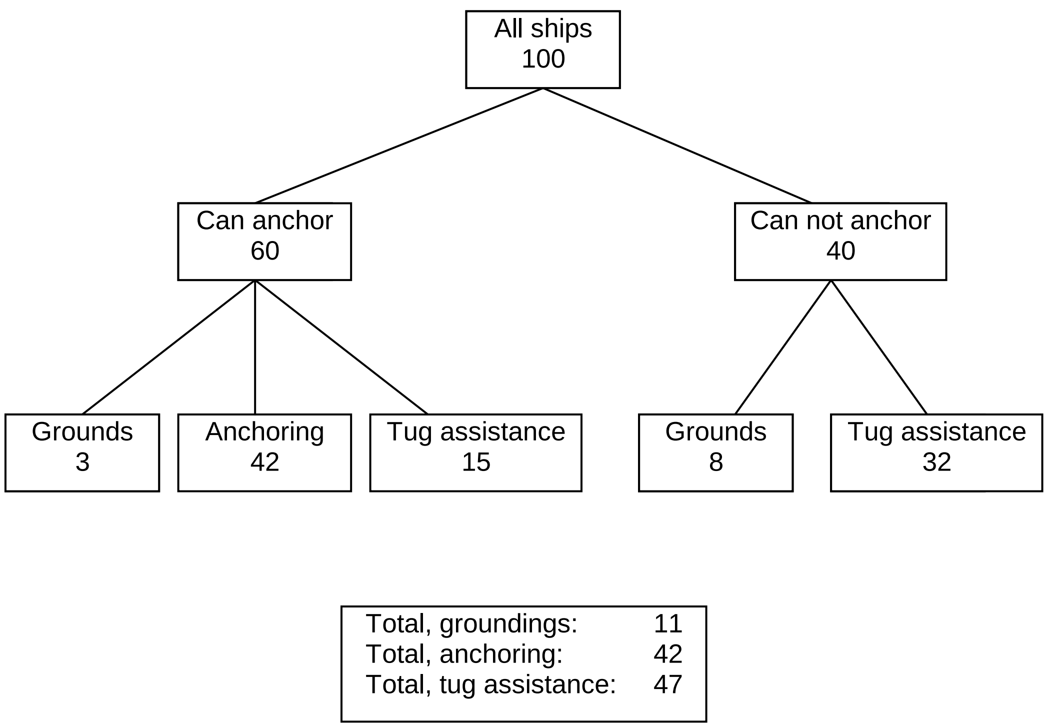


Figure B-4 With Risk Reducing Measures in Open Waters (figures in percent)

Appendix C

Procedures for Establishment of Ship Routing Measures

General

The purpose of ship's routing is to improve the safety of navigation and preventing or reducing the risk of pollution or other damage to the marine environment caused by ships colliding or grounding in or near environmentally sensitive areas.

The International Maritime Organization (IMO) is recognized as the only international body responsible for establishing and recommending measures on an international level concerning ships' routing. As such, IMO has adopted Resolution A.572(14), that sets forward general provisions on ships' routing. The account below is to a large extent based on the provisions of that resolution.

Although IMO plays an important role in providing measures on routing, the selection and development of routing systems is primarily the responsibility of the Governments concerned.

Different Routing Systems

A ship routing system is a system of one or more routes or routing measures aimed at reducing the risk of casualties. It includes the following measures:

- Traffic separation schemes.
- Two-way routes.
- Recommended tracks.
- Areas to be avoided.
- Inshore traffic zones.
- Roundabouts.
- Precautionary areas.
- Deep water routes.

Legal Basis

The United Nations Convention on the Law of the Sea, 1982 (UNCLOS), which is widely accepted as customary international law, provides coastal States with the option of requiring ships to use sea lanes and traffic separation schemes for the regulation of the passage of ships in the territorial sea (Art. 22) and in straits used for international navigation (Art. 41). However, it also pronounces that States bordering an enclosed or semi-enclosed sea should cooperate with each other in the exercise of their rights and in the performance of their duties under the Convention (Art. 123). It states that *"before designating or substituting sea lanes or prescribing or substituting traffic separating schemes, States bordering straits shall refer proposals to the competent international organization with a view to their adoption"*. Within the territorial sea *"the coastal state shall take into account..the recommendations of the competent international organization"*.

In designating or substituting sea lanes or traffic separating schemes, adequate National legal framework for the implementation of the routing measures must be present in the relevant States. Otherwise the enforcement of the measures would be hampered.

Planning and Establishing a Routing System

According to the provisions of A.572(14), Governments considering establishing a new routing system or amending an existing one should consult at an early stage with:

- Mariners using the area.
- Authorities responsible for aids to navigation and for hydrographic surveys and nautical publications.
- Port authorities.
- Organizations concerned with fishing, offshore exploration or exploitation and environmental protection, as appropriate.

Further, the provisions require that the considerations include the following factors:

- Their rights and practices in respect of the exploitation of living and mineral resources.
- Previously established routing systems in adjacent waters, whether or not under the proposing Government's jurisdiction.
- The existing traffic pattern in the area concerned, including coastal traffic, crossing traffic, naval exercise areas and anchorage areas.
- Foreseeable changes in the traffic pattern resulting from port or offshore terminal developments.
- The presence of fishing grounds.
- Existing activities and foreseeable developments of offshore exploration or exploitation of the sea-bed and subsoil.
- The adequacy of existing aids to navigation, hydrographic surveys and nautical charts of the area.
- Environmental factors including prevailing weather conditions, tidal streams and currents and the possibility of ice concentrations.
- The existence of environmental conservation areas and foreseeable developments in the establishment of such areas.

A Government proposing a new routing system or an amendment to an adopted routing system, any part of which lies beyond its territorial sea, should, according to the provisions, consult IMO so that such system may be adopted or amended by IMO for international use. Such Government should furnish all relevant information, in particular with regard to the number, edition and where possible the geodetic datum of the reference chart used for the delineation of the routing system.

Governments establishing traffic separation schemes, no parts of which lie beyond their territorial seas, are requested to design them in accordance with IMO criteria for such schemes and submit them to IMO for adoption. It is further stated in the provisions, that if a Government decides not to submit a traffic separation scheme to

IMO, it should, in promulgating the scheme to mariners, ensure that there are clear indications on charts and in nautical publications as to what rules apply to the scheme.

Appendix D

Status of Ratification of Conventions

(As of April 2001)

Convention	Djibouti	Egypt	Eritrea	Ethiopia	Israel	Jordan	Saudi Arabia	Somalia	Sudan	Yemen
IMO Convention 48	X	X	X	X	X	X	X	X	X	X
IMO amendments 91		X								
IMO amendments 93		X					X			
SOLAS Convention 74	X	X	X	X	X	X	X		X	X
SOLAS Protocol 78		X		X	X		X			
SOLAS Protocol 88		X	X							
Stockholm Agreement 96										
LOAD LINES Convention 66	X	X	X	X	X	X	X	X	X	X
LOAD LINES Protocol 88		X	X							
TONNAGE Convention 69			X	X	X	X	X			X
COLREG Convention 72	X	X	X	X	X	X	X			X
CSC Convention 72					X		X			X
CSC amendments 93										
SFV Protocol 93										
STCW Convention 78		X	X	X	X	X	X		X	
STCW-F Convention 95										
SAR Convention 79										
STP Agreement 71		X					X			X
STP Protocol 73		X					X			X
INMARSAT Convention 76		X			X		X			

Convention	Djibouti	Egypt	Eritrea	Ethiopia	Israel	Jordan	Saudi Arabia	Somalia	Sudan	Yemen
INMARSAT OA 76		X			X		X			
INMARSAT amendments 94					X		X			
INMARSAT amendments 98		X					X			
FACILITATION Convention 65		X			X	X				X
MARPOL 73/78 (Annex I/II)	X	X			X					
MARPOL 73/78 (Annex III)		X			X					
MARPOL 73/78 (Annex IV)		X								
MARPOL 73/78 (Annex V)		X								
MARPOL Protocol 97 (Annex VI)										
London Convention 72		X				X				
London Convention Protocol 96										
INTERVENTION Convention 69	X	X								X
INTERVENTION Protocol 73		X								X
CLC Convention 69	X	X					X			X
CLC Protocol 76		X					X			X
CLC Protocol 92	X	X								
FUND Convention 71	X									
FUND Protocol 76										
FUND Protocol 92	X									
NUCLEAR Convention 71										X
PAL Convention 74		X				X				X
PAL Protocol 76										X
PAL Protocol 90		X								
LLMC Convention 76		X								X
LLMC Protocol 96										
SUA Convention 88		X							X	X
SUA Protocol 88		X							X	X
SALVAGE Convention 89		X				X	X			
OPRC Convention 90	X	X			X					
HNS Convention 96										
OPRC/HNS 2000										

Appendix E

Oil Spill Response in the Northern Part of the Red Sea

General

The coast of Egypt on the Red Sea extends northwards from the Port of Shalateen on the border with Sudan on the western coast to the southern entrance of the Suez Canal at the lip of the Gulf of Suez. The whole of the Gulf of Suez lies within Egyptian territory. On the other hand, the Gulf of Aqaba is bound by the Egyptian coast on the western side and Jordan and Israel at the northern tip. The eastern coast belongs to Saudi Arabia. The entrance to the Gulf of Aqaba, called the Strait of Tiran, lies within the territorial waters of Egypt.

The Gulf of Suez

The navigable waters in the Gulf of Suez are restricted. Serious restrictions are imposed by natural causes such as the narrow width of the Gulf in certain parts and the shallow depths in some areas. Some patches of shallow or unconfirmed depths are also occasionally reported. Navigable waters are further restricted by oil exploration and production activities. There are many maritime oil fields with numerous platforms and related pipelines and maritime service and support activities.

MAIN COMPONENTS OF TRAFFIC

The Suez Canal

The greater part of the traffic is generated by or related to the Suez Canal. The average daily number of ships transiting the Canal is about 40 of which 6-7 are tankers. The traffic in the Canal is controlled by a modern VTS in the Navigation Control Center at Ismailia. Radar coverage extends southwards as far as the waiting area in the Bay of Suez and covers most of the movements in and out of Ain Sukhna. A modern simulator for training Suez Canal pilots is also located at Ismailia.

Oil Industry

Extensive oil exploration and production is taking place in the Gulf. The number of rigs operating in the Gulf at any time is approximately 140, distributed among about twenty oil fields. Supply and support vessels are based at and operate mainly from oil industry centers at Suez, Ain Sukhna, Ras Gharib, Ras Shoukeir and

Table E-1. Suez Canal

Traffic by Year	1994	1995	1996
Number of Tankers	2,730	2,473	2,309
Other vessels	13,640	12,578	12,422
Total	16,370	15,051	14,731
Average number per day			
Tankers	7	7	6
Total	45	41	40
Total tanker traffic per year			
Southbound, Loaded	698	668	660
Southbound, Ballast	717	585	495
Northbound, Loaded	1115	929	885
Northbound, Ballast	200	291	269
Total Net Tonnage	**107201**	**96930**	**80895**

Table E-2. Ain Sukhna

Traffic by Year	1994	1995	1996
Number of Ships, daily average	1-2	1-2	1-2
Oil unloaded at terminal (million tons)			
From:			
Saudi	49.8	59	NA
Iran	25.9	37.5	NA
Kuwait	0.7	3.2	NA
Egypt	5.9	7.3	NA
Total	**82.3**	**107**	**NA**

Jebel Zeit. Up to 20-25 such vessels are operating at any time.

Oil Transport

In addition to the Canal, oil is transported through the SUMED pipeline. On average, 40-50 large tankers bring crude from the Arabian Gulf to the terminal at Ain Sukhna per month. There are three Single Point Mooring (SPM) suitable for tankers up to 150,000 tons and two moorings for larger tankers up to 500,000 tons. The transport of oil from the Egyptian fields in the Gulf to Ain Sukhna, the refineries at Suez or northwards through the Canal is included in the traffic statistics.

Maritime Transport

Maritime cargo and passenger transport traffic in the Gulf is also generated by or related to the commercial ports.

- Suez, Port Tewfik: General cargo and passenger.
- Suez: Refinery berths, crude oil and products.

- Adabiya: Bulk cargoes. A container terminal is planned. Five piers varying in length from 223 to 178 meters with depths up to 13 meters.
- Tor (on the eastern coast): Minor commercial activities and fishing.
- Abu Zeneima (on the eastern coast): Manganese in bulk. One pier 230 meters with 10 meter depth. Ore loader.
- Ras Budran: One SPM, depth up to 35 meters and one pier for services. Loading facility: 16 inch hose.
- Ras Gharib: Three piers with lengths up to 299 meters and depths up to 16.7 meters.
- Ras Shoukeir: Three piers with lengths up to 290 meters and depths up to 17.7 meters. One 5 buoys mooring berth.
- Ras Sudr: One mooring berth for tankers and a small jetty for services.
- Geisum: One floating jetty. Temporary storage facilities for crude floating and on shore.

Table E-4. Oil Fields in the Gulf of Suez

Name of Oil Field	Number of Rigs
Morgan	36
July	14
Ramadan	12
October	9
Shaab Ali	13
Badry	6
Yunis	1
Hilal	1
Waly	1
Sidky	1
Shaab Gareb	5
Amer	9
Gulf of Zeit	4
Ras Fanar	5
Ras Badran	5
Amal	1
East Gulf of Suez	1
Marine Belayeem	36
Marine Shaab Gara	5

Other Traffic

Other traffic includes military vessels, fishing vessels, cruise ships, supply and oil industry support vessels and other miscellaneous craft.

PATTERNS OF TRAFFIC

The pattern of traffic is closely related to the convoy system of the Suez Canal. There are normally three convoys per day, two southbound from Port Said and one convoy northbound from Suez. Considerable congestion is usually observed at the northern end of the TSS close to the time of the start of the northbound convoy. The ships of the southbound convoys tend to go at high speeds as soon as they depart the Canal, which results in many cases of overtaking. This phenomenon is particularly observable in the northern part of the Gulf extending southwards to Ras Zaaphrana.

OSR CAPABILITIES

In principle, each of the companies operating maritime oil fields is responsible to maintain a capability to respond to spills up to 100 tons. Petrobell, Gupco, SUMED and El Nasr Oil are some of the companies with such capability. Three main oil spill response centers are established at Suez, Ras Gharib and Shoukeir. The centers are under the overall responsibility of the General Organization for Petroleum and are set up and operated by the oil companies. Each of the centers has the capability to respond to spills up to 300 tons. An additional center was established by the company operating at Ras Shoukeir at

Ghardaqah to protect the extensive tourist interests there.

Spray arms for application of dispersant are fitted on most of the service vessels and helicopters attending the rigs. The overall capability for responding to spills is augmented by sub-regional and regional agreements and arrangements. Most important is the possibility of relying on the services of the Oil Spill Response Center at Southampton if required. Local operators and companies are in many cases formed as joint ventures with major international companies who are in turn members of the OSRC. Cooperation was tested in an exercise that involved flying in experts and equipment from England.

The Suez Canal also maintains a stockpile of OSR equipment with a capability to respond to spills of up to 1,500 tons to protect against incidents within Canal waters. Capabilities are available on request to respond to incidents in the approaches to the Canal off Suez or Port Said and have actually been utilized frequently and recently to respond to pollution incidents in the Strait of Tiran at the entrance to the Gulf of Aqaba.

SAFETY OF NAVIGATION IN THE GULF OF SUEZ

Egypt has always realized the complexity of the marine traffic situation in the Gulf of Suez; it has undertaken and continues to undertake measures to improve safety and protect the environment. On cessation of hostilities and before the re-opening of the Canal in 1975, a major project was implemented to rehabilitate the lighthouses and other aids to navigation in the Gulf of Suez and its approaches, to improve the accuracy of navigation and position keeping of the vessels transiting the area. At the same hydrographic surveys were carried out to update the depths and redefine some shallow patches. The TSS scheme to separate the northbound and southbound traffic and protect the oil platforms and rigs operating in many areas of the Gulf of Suez was approved by IMO and a major mine clearance operation was undertaken to lift the restrictions on navigation in the narrow Strait of Jubal at the southern entrance of the Gulf' A major project adopted in 1982 sought to improve navigation in the Gulf. The first stage included the upgrading of visual aids, lighthouses and buoys and introduction of radar reflectors in many locations. Revised rules and regulations of navigation were issued and the wireless signals station for marine communications in the area was reactivated and rehabilitated. The TSS was revised. This stage was completed in 1986 and led to greatly improved conditions. The project included two further stages; the introduction of an electronic positioning system in the area is currently being executed and a GPS chain established. The last stage, still outstanding, includes the establishment of a Vessel Traffic System. A number of VTS schemes are under consideration and execution is foreseen in the not too distant future. The Suez Canal Authority has commissioned a modern VTS with the control center located at the Headquarters of the Authority at Ismailia. The radar coverage of the service extends, as mentioned above, as far south as the waiting area and the approaches and SPM of Ain Sukhna.

Gulf of Aqaba

ENTRANCE AND TRAFFIC IN AND OUT OF THE GULF

The entrance to the Gulf of Aqaba is through the Strait of Tiran, which is narrow and not easy to navigate. Incidents in the area represent a grave threat to the coral reefs. A TSS was established recently in the area to regulate traffic in and out through the entrance. At the same time, additional and improved visual and radar reflector aids were introduced. A Vessel Traffic System has also just been approved for the entrance. The contract for installation of a radar station and commissioning and operation of the service has been awarded. The traffic in and out of the Gulf through the Strait includes oceangoing vessels calling at the Jordanian port of Aqaba. Phosphate in bulk is a major commodity exported from Aqaba. Aqaba also serves as the port of entry for a considerable part of the imports of Iraq.

PORTS AND TRAFFIC WITHIN THE GULF OF AQABA

The main Egyptian ports in the Gulf are:

- Sharm El Sheikh, which is a very important tourist resort.
- Nuweiba: Traffic is mainly ferry and RoRo vessels. The port consists of a 240-meter main pier. The loading ramp is 92 meters wide and 8 meters deep.

Egyptian traffic within the Gulf includes ferries and RoRos between Nuweiba and the Jordanian port of Aqaba. This serves the large volume of passengers to and from Egypt, Saudi Arabia, Iraq and Jordan. A great number of Egyptian professionals—teachers, technicians and laborers—are employed in those countries. Although volume remains at a constant high, periodic increases are noticeable in the incoming flow around the time of the summer holidays and in the reverse direction around the time of commencement of the school year. The same route also serves the Hajj and other visits to Islamic holy sites in Saudi Arabia, with seasonal peaks in traffic. These are associated with the Holy Month of Ramadan and the Islamic Big Bairam feast for the Hajj. There is also a considerable volume of truck traffic on the RoRo vessels.

OSR CAPABILITIES

OSR capabilities in the Gulf of Aqaba are practically non-existent. There are plans however for the establishment of two centers at Sharm El Sheikh and at Nuweiba. The plans are for these to be national Egyptian centers in principle. Some ideas have been discussed however about the linking of one or both of the centers with others to be established at Eilat and Aqaba in a chain of cooperation.

The Red Sea

PORT OF SAFAGA AND THE TRAFFIC ACROSS

Oceangoing traffic includes traffic related to or generated by the Suez Canal, SUMED pipeline, Ain Sukhna terminal, and the ports at the northern tip of both the Gulf of Suez and Gulf of Aqaba. In addition there is considerable ferry and RoRo traffic between the Port of Safaga and the Saudi Arabian ports of Jeddah and Duba. The traffic extends across the Red Sea between the Saudi ports of Jeddah and Duba, crossing the north/south sea lanes. The volume is generally considerable with seasonal variations. Peaks occur during the

Table E-5. Port of Nuweiba

Traffic by Year	1994	1995	1996
Vessels (in and out)	1,869	1,782	1,812
Daily average	5	5	5
Vehicles (in and out)	57,125	48,362	31,471
Coaches (in and out)	2,484	2,210	2,266
Trucks and trailers	23,048	24,215	19,577
Passengers (thousands)	1,253	1,327	1,167

Table E-6. Port of Safaga

Traffic by Year	1994	1995	1996
Number of Tankers	--	23	46
Daily average	--	0.05	0.1

Hajj and seasons for visits to holy sites, as well as at the beginning and end of summer holidays in Saudi Arabia.

PORTS ON THE RED SEA

- Ghardaqah: Tourist resort, small jetties, mooring and protected anchorage for small bulk, general cargo, and passenger/cruise ships.
- Safaga: Commercial port, ferry and RoRo traffic mostly for passengers and pilgrims. Silo for unloading grain. Loaders for phosphate in bulk.
- El Hamrawan: One pier 67 meters long with depth up to 10 meters. Mechanical loader for phosphate in bulk capacity up to 4,000 tons/day.
- El Quseir: One pier 82 meters long with depth up to 10 meters. Unloaders for bulk cargo. Berths, mooring buoys stern to.
- Marsa Alam and Baranis: Suitable for minor commercial activities and fishing.

OSR CAPABILITIES

There is very little, if any, marine pollution combating capabilities in the area. There are plans however to establish a regional OSR center at Safaga or Quseir. In addition, a review was made of relevant information and data at the IMO.

Appendix F

Recommendations from the Aden Workshop, November 1996

The first Workshop on the Navigation Risk Assessment and Management Plan was held in Aden, Republic of Yemen, on 17-19 November 1996. The Workshop considered the current situation in the Red Sea and Gulf of Aden with respect to available visual, electronic and chart aids to navigation, and what is required. It reviewed the risks facing international maritime traffic and the marine environment and pinpointed several "hot spots" to which more attention should be given. The outlines of the Technical Study to be carried out by DNV were also discussed.

The Workshop decided to adopt the following recommendations:

1 Re-survey of the Red Sea and Gulf of Aden

The Workshop concluded that, with the exception of the Gulf of Suez and the port areas, the Red Sea and the whole of the Gulf of Aden have not been surveyed for many decades. The Workshop therefore recommended that PERSGA, in cooperation with the International Hydrographic Organization (IHO) should work, as a matter of priority, to have the Red Sea and Gulf of Aden re-surveyed and new charts prepared suitable for navigation using accurate satellite navigation systems.

2 Regional Port State Control Agreement

The Workshop realized that the Red Sea and Gulf of Aden areas are targeted by a large number of sub-standard ships which cannot operate any longer in other places such as the USA and Europe and which are potential sources of pollution to the marine environment and a danger to international shipping. The Workshop further concluded that combatting such a menace can only be effective through the cooperation of all countries in the Region. It therefore recommended that PERSGA, in cooperation with the International Maritime Organization, should prepare a regional agreement of cooperation on Port State Control, drawing on the experiences of other areas such as the Caribbean region.

3 Regional Navigation Aids

The Workshop accepted that the satellite navigation systems now available are making visual and sound navigational aids less important in many parts of the open sea. However, the Workshop held the opinion that the provision of additional lighthouses and other navigational aids is essential in some parts of this Region, particularly in view of the fact that many small vessels and sub-standard ships may not be equipped with modern satellite navigation systems in the near future. The Workshop therefore recommended that navigational marks should be fitted in the Strait of Tiran at the entrance to the Gulf of Aqaba, where several ships, including a modern passenger ship, went aground. The small islands to the southwest of Bab-al-Mandab should also be considered for a new navigation mark.

4 Vessel Traffic Management Systems in the Red Sea

The Workshop was of the opinion that establishing Vessel Traffic Management Systems (VTMS) at the northern and southern entrances of the Red Sea, at the southern tip of Sinai and at Perim Island respectively, would serve to improve safety of navigation and reduce pollution in these congested areas. However, due to the high cost of constructing and running such systems and the reduction of risks to navigation through the use of satellite navigation systems, the Workshop recommended that PERSGA should require DNV to study this matter in depth and provide a recommendation in its Technical Study concerning this point.

5 Port State Control Training

The Workshop realized the importance of the availability of trained personnel to carry out Port State Control duties and therefore recommended that PERSGA should include a training programme for Port State Control officers in its activities, with an emphasis on the inspection of ship oil record books.

6 Red Sea Traffic Convergence Points

The Workshop realized that there are some points of congestion in the Red Sea where many ships converge at course alteration points. These are a potential source of collision risk and the Workshop therefore recommended that PERSGA contact IMO to request that these points be considered for traffic separation schemes or other routing measures.

7 Workshop Representation and DNV Technical Study

The Workshop regretted that some countries were not represented at the first Workshop due to communication difficulties. It therefore recommended that early action by PERSGA be taken to ensure the participation of all countries in the second Workshop to be held in Ismailia, Egypt, and that they receive the proceedings of this Workshop. The Workshop further recommended that PERSGA endeavor to ensure that full cooperation be given to DNV in carrying out its Technical Study through the relevant authorities in each country.

8 Navigation Risk around Hanish al-Kabir

The Workshop realized that the operation of the lighthouses on the Yemeni islands of Hanish al-Kabir had been disrupted as a result of continuing military activities. In the interests of the safety of international shipping, the Workshop called upon all concerned parties to resolve this problem as soon as possible so that these lighthouses could resume the important service that they render to international shipping traffic in this congested part of the Red Sea.

In conclusion, the Workshop expressed its thanks and indebtedness to the Global Environment Facility (GEF), through the World Bank, for funding the

Workshop, to PERSGA for coordinating with the various Governments and making arrangements for the Workshop and last but not least, to the Yemen Ports Authority (Port of Aden) for making the facilities and staff of the Maritime Training Center available and putting these at the disposal of the Workshop.

Appendix G

Recommendations from the Ismailia Workshop, April 1997

The second Workshop on the Navigation Risk Assessment and Management Plan was held in Ismailia, Arab Republic of Egypt on 06-08 April 1997. The Workshop reviewed the results of the First Workshop held in Aden, Yemen, from 17-19 November 1996 and the Recommendations that resulted from that Workshop. It listened to presentations from country representatives on navigational risks in approaches to their respective ports and it discussed at length the Preliminary Draft Executive Summary Report presented by DNV.

The Workshop decided to adopt the following recommendations:

1 Review of Recommendations of the First Workshop in Aden

Following a review of the recommendations of the First Workshop that was held in Aden, 17-19 November 1996, the Ismailia Workshop expressed its concurrence with and full support for the recommendations adopted at the Aden Workshop. In particular, the Workshop wished to stress the need for:

- Re-survey and re-charting of the Gulf of Aden and most of the Red Sea since several other recommendations, such as those relating to traffic separation schemes and other routing systems, depend on the completion of such a survey. DNV was requested to take particular note of this recommendation in the preparation of its draft final report, especially since this subject was not dealt with at all in the Preliminary Draft Report presented at this Workshop.
- Establishment of a Regional Port State Control agreement.

2 Implementation of International Conventions

The Workshop recognized that, in order to carry out effective Port State Control in the Region so as to curtail the prevalent use of sub-standard ships, it is necessary that Regional States ratify the main IMO and other Conventions relevant to Port State Control, and in particular

- The 1966/1968 Load Line Convention.
- The 1974/1978 SOLAS Convention.
- The 1973/1978 MARPOL Convention.

- The 1979/1995 STCW Convention.
- The 1972 COLREG.
- ILO Conventions No 147.

The Workshop recommends that PERSGA urge States in the Region to ratify these Conventions as early as possible.

3 Regional Cooperation in Combating Oil Pollution

Presentations made during the Workshop showed that stockpiles of oil pollution combating equipment are available in several locations in the Gulf of Suez as well as in the ports of Aqaba, Yanbu, Jeddah, Ras Isa, Aden, Ash Shihr, and the Marine Emergency Mutual Aide Center in the Port of Djibouti. This being the case, PERSGA was recommended to take early action to bring into effect the Protocol to the PERSGA Agreement concerning Regional Cooperation in cases of medium or large oil spills. The Workshop further recommended that PERSGA should investigate ways and means of incorporating the Djibouti center into its regional plans for combating pollution.

4 Traffic Separation Schemes and Other Routing Systems

The Workshop recommended that DNV put forward practical and specific proposals for establishment of traffic separation schemes and other routing system for the Red Sea and Gulf of Aden, taking into account the views that were expressed during the Workshop, the requirements of the International Maritime Organization for designing and adopting such schemes and international law.

5 Vessel Traffic Management Systems (VTMS)

The Workshop recognized that VTMS are costly to establish and to operate and therefore recommended that DNV put forward clear recommendations in its final report for VTMS to be established only where these are considered to be necessary and practical to establish and run.

6 The Management Plan

The Workshop recommended that DNV take a realistic view of the actual situation in ports and maritime administrations with respect to the available human and financial resources as well as the meteorological circumstances in the Region when formulating the final proposals for the Management Plan.

In conclusion, the Workshop expressed its thanks and indebtedness to the Global Environment Facility (GEF), the Norwegian Government, the World Bank and PERSGA for making the Workshop possible and last but not least to the Suez Canal Authority for making the facilities of its Research Center available and placing these at the disposal of the Workshop.

Appendix H

IMO Conventions on Marine Pollution

General

The International Maritime Organization (IMO) has adopted a number of legal instruments (Conventions and Codes) aimed particularly at marine pollution. Some of the instruments are aimed at pollution prevention while others are aimed at mitigation of consequences of pollution. In addition, there are a number of instruments that directly are aimed at maritime safety, but indirectly have significance in relation to marine pollution prevention.

For a Government or a Governmental Agency to decide whether to give effect nationally to one or several of these (or parts of them), it would be essential to know how each instrument could contribute to achieve the development objective (pollution prevention/mitigation of consequences) and what kind of obligations this would encounter. In this document, we will give an overview of the provisions and obligations of some of the most significant instruments with regard to marine pollution, namely:

- International Management Code for the Safe Operation of Ships and for Pollution Prevention, 1993 (ISM Code).
- International Regulations for Preventing Collisions at Sea (COLREG), 1972.
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 (STCW).
- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 1972.
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969.
- International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), 1990.
- International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969.
- International Convention on the Establishment of an International Fund for

Compensation for Oil Pollution Damage (FUND), 1971.

International Management Code for the Safe Operation of Ships and for Pollution Prevention, 1993 (ISM Code)

The Code includes provisions concerning Safety-Management System (SMS) in companies, defining:

- A safety and environmental-protection policy.
- Responsibility and authority in the company.
- Lines of communication.
- Instructions and procedures to ensure compliance with relevant legal instruments.
- Procedures for reporting accidents and non-conformities with the Code.
- Procedures for internal audits and management reviews.

The obligations on a Party to the Code include to:

- Issue documents of compliance for every company complying with the requirements of the ISM Code.
- Verify (also periodically) that the company and its shipboard management operate in accordance with the approved SMS.
- A number of IMO conventions are covered under the ISM Code “umbrella”, and the instrument is intended to bring shore management closer to the ship, and raise the quality standards in relation to safety and pollution prevention. The Code is expected to provide the owners with positive results and advantages.

International Regulations for Preventing Collisions at Sea (COLREG), 1972

The Convention includes provisions concerning:

- Operation and equipment of all sea going vessels.
- Steering and sailing rules.
- Lights and shapes (including technical details).
- Sound and light signals (including technical details).

The obligations on a Party to the Convention include to:

- Give effect to the Rules and other Annexes constituting the International Regulations for Preventing Collisions at Sea, 1972 (Art. I).

Implementation of COLREG would provide a necessary basis for safety and pollution prevention measures in the coastal zones of States. The Convention provides such as regulations in determining safe speed, conduct of vessels in narrow channels, in restricted visibility and in traffic separation schemes. Traffic separation schemes may thus be established for example in or near marine pollution sensitive areas.

International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 (STCW)

The Convention includes provisions concerning:

- Minimum requirements for certification and training of (and watchkeeping by):
    - ◊ Master and officers in charge of navigational watch.

- ◊ Chief engineer and officers in charge of engineering watch.
- ◊ Radio personnel.

- Special training requirements for personnel on tankers and RoRo passenger ships.
- Standards regarding emergency, occupational safety, medical care and survival functions.

The obligations on a Party to the Code include to:

- Issue certificates to candidates who meet the requirements of the Convention (Art. VI).
- Ensure that training and assessment of competence are in accordance with the Convention (Reg. I/6 and I/8).
- Establish standards of medical fitness for seafarers (Reg. I/9).
- Maintain a register of certificates and provide information on certificates to other Parties and companies (Reg. I/9).
- Hold companies responsible for the assigning and training of seafarers according to the Convention, and its ships safely manned according to applicable requirements (Reg. I/14).
- Recognize certificates issued according to the Convention and not recognize certificates issued by non-Parties (Reg. I/10)e that certificates are issued only to candidates that meet the requirements of the Convention (Reg. I/9).
- Maintain a register of certificates and provide information on certificates to other Parties and companies (Reg. I/9).
- Hold companies responsible for the assigning and training of seafarers according to the Convention, and its ships safely manned according to applicable requirements (Reg. I/14).
- Recognize certificates issued according to the Convention and not recognize certificates issued by non-Parties (Reg. I/10).
- Ensure appropriate refresher and updating training or assessment (Reg. I/11).
- Execute Port State Control regarding certificates on board (Art. X).
- Establish investigation procedures and prescribe penalties for non-compliance (Reg.I/5).
- Promote technical cooperation (Art. XI).
- Communicate to IMO relevant information concerning legal instruments, experiments, courses, examination and certificates (Art. IV, Reg. I/13).

It is commonly acknowledged that “human error” has played a majority role in ship accidents, and that the great majority of seafarers are not sufficiently educated and trained for safe operation of ships. The amended STCW Convention comprises - unlike the former convention - specific requirements related to basic education, on board training and control measures. It is expected to have a significant impact in raising the standards of seamanship.

International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)

The Convention includes provisions concerning:

- Construction, equipment and operation of vessels operating in the marine environment, except naval and State operated ships.
- Surveys and inspections.

- Certificates and record books.
- Discharge regulations.
- Shipboard oil pollution emergency plans.
- Reports on incidents involving harmful substances.
- Waste reception facilities.

The obligations on a Party to the Convention include to:

- Ensure that ships flying its flag are, constructed, built and surveyed according to the Convention, and that the appropriate certificates are issued.
- Ensure that waste reception facilities are established according to the Convention, and that they are adequate to meet the needs of the ships using them without causing undue delay to ships.
- Ensure that violations of the Convention are prohibited and establish sanctions under the law, that are adequately severe to discourage violations, and when a violation occurs, either "cause proceedings to be taken in accordance with its law; or furnish to the Administration of the ship such information and evidence as may be in its possession"(Art. 4).
- Cooperate in the detection of violations and the enforcement of the provisions of the Convention, using all appropriate and practicable measures of detection and environmental monitoring, and adequate procedures for reporting and accumulation of evidence (Art. 6(1)).

The Convention is probably the most significant and ambitious international instrument with respect to marine pollution prevention ever adopted. It deals not only with oil, but also most other sources of ship-generated pollution in the five annexes of the Convention.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), 1972

The Convention includes provisions concerning:

- Dumping (deliberate disposal) and incineration at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures.
- Dumping at sea of vessels, aircraft, platforms or other man-made structures.
- Prior permits for the dumping of other wastes or matter.

The obligations on a Party to the Convention include to:

- Take effective measures individually and collectively, as provided for in the Convention, to prevent dumping and harmonize policies in this regard. (Art. II).
- Designate an appropriate authority to issue permits for dumping and keep records of dumping (Art. VI).
- Monitor the condition of the sea for the purposes of the Convention (Art. VI).
- Prior to issuing permits, give careful consideration (including prior studies) of all factors set forth in the Convention (Art. IV).
- Report information on permits, monitoring and additional requirements to IMO and other relevant Parties (Art VI).
- Take appropriate measures to prevent and punish conduct in contravention of the Convention (Art. VII).
- Cooperate in the development of procedures for the effective application of the Convention (Art. VII).

- Promote scientific and technical support and supply of equipment to Parties that request so, furthering the aims and purposes of the Convention (Art IX).
- Develop procedures for the assessment of liability and settlement of disputes regarding dumping (Art. X).
- Promote measures to protect the marine environment against pollution (Art. XII).
- Survey and approve incineration systems (Reg. 3 in Addendum to Annex I).
- Undertake, record and send copies of special studies on certain wastes (Reg. 4 in Addendum to Annex I).

International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969

The Convention includes provisions concerning prevention, mitigation or elimination of grave and imminent danger to the coastline or related interests, resulting from marine pollution by oil and substances other than oil, caused by maritime casualties with any sea-going vessel or acts related to such (except naval and State operated ships), provided the casualty may reasonably be expected to result in major harmful consequences (Art. I).

The obligations on a Party to the Convention include to:

- Consult other States affected by the maritime casualty, before taking any measures (Art. III).
- Notify proposed measures to affected persons/corporation, and take into account their views (except in extreme urgency) (Art. III).
- Avoid any risk to human life and afford assistance to persons in distress, and in appropriate cases, facilitate repatriation of ships' crews (Art. III).
- Notify concerned parties of measures which have been taken (Art. III).
- Measures taken shall be proportionate to the actual or threatened damage, and not unnecessarily interfere with interests of affected parties (Art. V).
- Pay compensation in certain cases for measures causing damage to others (Art. VI).

International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), 1990

The Convention includes provisions concerning:

- Contingency plans onboard ships and offshore units, in sea ports and oil handling facilities.
- Oil pollution reporting and action procedures.
- National and regional systems for preparedness and response.
- International cooperation in pollution response.
- Research, development and technical cooperation.

The obligations on a Party to the Convention include to:

- Take all appropriate measures in accordance with the Convention, individually or jointly, to prepare for and respond to an oil pollution incident (Art. 1).
- Require contingency plans and reporting procedures onboard ships and offshore units, in sea ports and oil handling facilities (Art. 3 + 4).
- Instruct appropriate services or officials, and request civil aircrafts to re-

port observed events involving discharge or probable discharge of oil.

- Assess events and possible consequences.
- Inform all States affected/likely to be affected (in some cases also IMO) (Art. 5).
- Establish a national system for responding promptly and effectively to oil pollution incidents (Art. 6).
- Establish oil spill combating equipment, programme of exercises/training, plans and communication capabilities, and an arrangement to coordinate the response with the resources (Art. 6).
- Ensure that current relevant information is provided to IMO (Art. 6 and 10).
- Cooperate and provide advisory services, technical support and equipment, subject to their available resources (Art. 7).
- Cooperate in the promotion and exchange of results of relevant research and development programmes (Art. 8).
- Provide technical assistance and cooperate in the transfer of relevant technology (Art. 9).
- Endeavor to conclude bilateral or multilateral agreements for oil pollution preparedness and response (Art. 10).

International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969

The Convention includes provisions concerning:

- Insurance for ships carrying more than 2,000 tons of oil in bulk as cargo.
- Pollution damage caused on the territory/territorial sea of a Contracting State.
- Coverage of measures taken to prevent or minimize such damage.
- Determination and limitation of liability.

The obligations on a Party to the Convention include to:

- Issue or certify certificates to ships registered in the State, attesting that insurance or other financial security is in force in accordance with the provisions to the Convention (Art. VII).
- Determine the conditions of issue and validity of the certificates (Art. VII).
- Accept certificates issued or certified under the authority of a Contracting State (Art VII).
- Not permit a ship under its flag, required to hold a CLC-certificate, to trade unless a certificate has been issued (Art VII).
- Ensure that insurance or other financial security is in force for any ship, (required to hold a CLC cert.), wherever registered, entering or leaving a port or offshore terminal in its territory (Art. VII).
- Ensure that the Courts possess the necessary jurisdiction to entertain actions for compensation according to the Convention (Art. IX).
- Recognize and enforce relevant judgments by Courts in any Contracting State (Art. X).

International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1971

The Convention includes provisions concerning:

- Compensation and indemnification supplementary to the CLC Convention.
- Establishment of "the International Oil Pollution Compensation Fund."
- Contributions to the Fund.
- Organization and Administration of the Fund.

The obligations on a Party to the Convention include to:

- Recognize the Fund as a legal person capable under the law, of assuming rights and obligations and of being a party in legal proceedings before the courts, and recognize the Director of the Fund as the legal representative of the Fund (Art. 2).
- Ensure that its courts possess the necessary jurisdiction to entertain actions against the Fund (Art. 7).
- Ensure that the Fund shall have the right to intervene as a party to any legal proceedings instituted in accordance with the Liability Convention (CLC) (Art. 7).
- Recognize and enforce relevant judgments by Courts in any Contracting State (Art. 8).
- Ensure that contributions to the Fund are fulfilled from relevant persons receiving oil within the territory (Arts. 13 and 10).
- Establish sanctions for persons not fulfilling the obligation.
- Ensure that persons liable to contribute to the Fund appear on a list kept by the Fund (Art. 15).

Appendix I

Training for Port State Control Officers

General Objectives for Training of PSCO

GOAL

Ensure that the PSCO:

- Has a thorough knowledge of all relevant requirements, procedures and principles related to Port State Control.
- Is able to apply to all relevant requirements, principles and procedures related to Port State Control.
- Can exercise good inter-personal skills, especially in conflict situations on board.
- Can distinguish the responsibilities & prime tasks of others involved.
- Can verify all documents.
- Can determine whether a more detailed inspection is needed.
- Can assess the compliance with the relevant instruments.
- Can decide on detention/release or stoppage of an operation.
- Can communicate his finding to the ship's staff.
- Can report on his findings/inspection results clearly, and according to harmonized procedures.

Training for Port State Control Officers

MODULE 1 (GENERAL)

The PSCO should have a thorough knowledge of:

A. Flag State Control

- General obligations of Flag States under the relevant instruments.
- Application and definitions of the relevant instruments.
- Substance and recent amendments to the relevant instruments.
- Exceptions, exemptions, equivalents, trials (one man bridge operations), grandfather clause (provisions for new and existing ships) and transitional provisions.
- Systems of surveys and certification, such as: MSC/704 (certificates to be carried), Resolution A 560 (survey guidelines), Resolution A 561 (transla-

tion of certificates and documents), (+ various instruments for HSSC).

- Responsibilities of recognized organizations when acting on behalf of the flag State.

B. Port State Control

- General rights and obligations of port State under:
  - ◊ The relevant instruments.
  - ◊ The Paris MOU and the Directive on Port State Control.
- Control procedures, such as:
  - ◊ Relationship between Paris MOU, EC Directives and IMO Resolution A.787(19). Procedures for Port State Control.
  - ◊ Clear Grounds.
  - ◊ More detailed /expanded inspections.
  - ◊ Operational control.
  - ◊ Rectification of deficiencies.
  - ◊ Repairs in other ports.
  - ◊ Relationship with recognized organizations.
- Reporting procedures such as:
  - ◊ Use of codes.
  - ◊ Inspection report.
  - ◊ Reporting to SIRENAC (P. MOU database).
  - ◊ Reporting procedures to IMO, ILO, flag States, other port States and recognized organizations.
- No more favorable treatment:
  - ◊ Ships of states that have not ratified conventions.
  - ◊ Ships below convention size.
  - ◊ Documentary evidence to be found on board (document of compliance, national certificate, survey report).

C. Company and Classification Societies responsibilities:

- Company responsibilities regarding the STCW Convention and the ISM Code and their general reporting obligations.
- Classification societies systems of rules, surveys and certificates and the implication of port State control.

MODULE 2 (HARDWARE)

The PSCO should be able to verify that:

- The ship has relevant and valid documentation:
  - ◊ Document of compliance (SOLAS, RegII-2/54).
  - ◊ Stability information.
  - ◊ Cargo gear.
  - ◊ Cargo securing manual.
  - ◊ Radio records.
  - ◊ Grain documents.
  - ◊ National certificates.
  - ◊ Class certificates.
- The ship can navigate safely:
  - ◊ Charts and publications for the forthcoming voyage.
  - ◊ Practical assessment of navigational equipment (radar, echo-sounder).
  - ◊ Pre-departure tests including steering gear.
  - ◊ Bridge visibility.
- The ship can safely handle the cargo:
  - ◊ General condition of cargo gear.
  - ◊ Additional equipment.

- The ship engine room can operate safely:
  - ◊ Requirements for dead starting arrangements.
  - ◊ Requirement for alarm systems and indicators.
  - ◊ Requirement for emergency source of power.
  - ◊ Requirements for unmanned engine room spaces.
- The ship can prevent pollution of the environment:
  - ◊ Testing and inspection in port of equipment required under MARPOL Annex I and II.
  - ◊ Unauthorized discharge bypasses.
- The ship can maintain weather tight integrity and strength:
  - ◊ Acceptable corrosion limits.
  - ◊ Classification involvement.
- The ship can communicate in distress situations:
  - ◊ Transitional equipment.
  - ◊ Equipment requirements.
  - ◊ Sources of energy.
  - ◊ Equipment for the various sea areas.
  - ◊ Testing of equipment.
- The ship can provide safe and healthy conditions onboard:
  - ◊ Food and catering.
  - ◊ Crew accommodation.
  - ◊ Prevention of occupational accidents and protection of the crew.
- The ship has sufficient and working anchoring and mooring equipment.

MODULE 3 (CREW)

The PSCO should be able to verify that:

- The crew has relevant and valid documentation such as:
  - ◊ Certificates of competency.
  - ◊ Dispensations.
  - ◊ Endorsements.
  - ◊ Medical certificates.
  - ◊ Articles of agreement.
  - ◊ Other documentary evidence.
- The crew is as required in the safe manning document.
- The crew complies with the minimum age requirement.
- There is documentary evidence that watchkeeping schemes exist.
- The crew communicate amongst themselves.

MODULE 4 (OPERATIONS)

The PSCO should be able to evaluate operational procedures as:

- Muster lists.
- Fire drills.
- Abandon ship drills.
- Damage control plan and shipboard oil pollution plan.
- Fire control plan.
- Bridge operation:
  - ◊ Voyage planning.
  - ◊ Company and masters obligation to comply with familiarization requirements.
- Cargo operation (subject to type of ships):
  - ◊ Cargo documentation and marking.

    - ◊ Cargo securing manual.

- Operation of machinery:
    - ◊ Safe testing of machinery.
    - ◊ Safe operation of power tools and hot work.
- Manuals, instructions, etc.:
    - ◊ Safety management procedures.
- Oil and oily mixtures of machinery spaces:
    - ◊ Estimation of quantities of oil residues on board.
    - ◊ Care, maintenance and testing of pollution prevention equipment.
- Garbage: Garbage record book.
- Safe and healthy conditions onboard.
- Communication in distress.

From the Paris Memorandum of Understanding on Port State Control (9/96).

Appendix J

Sensitivity Mapping

Introduction

This appendix gives a brief evaluation of the environmental impact of the ship traffic in the Red Sea focusing on oil spills caused by tanker accidents. The first part is an overview of some possible impacts from ship traffic on the marine environment, followed by a brief description of the marine environment in the Red Sea based on open literature, including an evaluation of the vulnerability of the described environmental components. The last section is an environmental risk assessment. A comprehensive environmental impact assessment (EIA) and risk assessment according to accepted international standards was not included in the scope of work. A detailed evaluation of environmental conditions and trends in the Region are provided in the 'Strategic Action Programme for the Red Sea and Gulf of Aden' prepared by PERSGA.

Environmental Impact from Ship Traffic

Ship traffic has a wide variety of possible impacts on the environmental resources in the coastal zone (PERSGA, 1997):

- Oil pollution from ship accidents.
- Other types of pollution from ship accidents (chemicals, toxic substances).
- Illegal disposal of toxic substances by foreign vessels in the Gulf of Aden.
- Ballast water.
- Illegal tank-washing.
- Ship grounding, physical damage of coral reefs.
- Anchoring.
- Discharges of sewage from vessels (eutrophication).
- Discharge of solid waste.

Ship traffic poses a risk of oil pollution from the following sources (World Bank, 1996):

- Small spills caused by the accidental or intentional release of oil-contaminated bilge or ballast-water from freighters (0-2 tons).
- Minor spills caused by the release of oily ballast water from an oil tanker or the release of bunker oil during terminal operations (2-20 tons).
- Medium spills caused by the release of oil as a result of defective equipment

or procedures at an oil terminal or pipeline facility (100 tons).

- Major spills caused by the rupture of a bunker oil tank in a bulk/cargo vessel collision (500 tons), shipwreck of a bulk/cargo vessel (1,500 tons), or a tanker collision causing the rupture of a single oil tank (7,500 tons).
- Disastrous spills caused by the wreckage of a fully loaded oil tanker (100,000 - 150,000 tons).

In 1990 22 small to minor spills were reported from the upper Gulf of Aqaba alone.

Description of the Marine Environment

This section contains information about sensitive environmental features potentially vulnerable to pollution from maritime traffic in the Red Sea. The sensitive features include ecological sensitive areas (habitats), functional biodiversity services and taxonomic groups important in the context of biological diversity.

IUCN (1990) proposed the following criteria for defining habitats as ecological sensitive areas. If they:

- Provide protection of steep slopes, especially in watershed areas, against erosion.
- Support important natural vegetation on soils of inherently low productivity that would yield little value to human communities if transformed.
- Regulate and purify water flow (as wetlands often do).
- Provide conditions essential for the perpetuation of species of medicinal and genetic conservation value.
- Maintain conditions vital for the perpetuation of species that enhance the attractiveness of the landscape or the viability of protected areas.
- Provide critical habitat that threatened species use for breeding, feeding or staging.

Using these criteria and the UNEP (1992) guidelines the following ecological features will be used in the description of the marine environment:

- Coral reefs.
- Mangrove forests, sea grass beds, saltmarshes and sabkha.
- Sea birds.
- Turtles.
- Sea mammals (dugongs and cetaceans).
- Fish resources.
- Marine Protected Areas (MPA).

Information is compiled from open literature (especially IUCN, 1995 and Sheppard and others, 1992), and others cited in the following text.

CORAL REEFS

A detailed inventory of coral reefs in the Red Sea is given in UNEP/IUCN, 1988 and general descriptions are given in Sheppard and others, 1992 and Edwards and Head, 1987). Coral reefs occur on most of the length of the Red Sea, but they are best developed in the northern and middle part (Head, 1987). While 60% of the coastline in the Gulf of Aqaba is covered by coral reefs (World Bank, 1996), the abundance is low in the northern part of the Gulf of Suez. This is a shallow basin and wave agitation causes more resuspension of sediment compared to the other parts of the Red Sea (Fishelson, 1980). In the southern part of the Red Sea south of 20ºN there is a decrease in quality complexity and extent of reefs due to shallower bathymetry, higher turbidity and greater freshwater input (UNEP/IUCN, 1988). The coral communities in the Red Sea have been divided into 13 main groups distributed along a north–south axis (Sheppard and others, 1992). Only one of these is found along the whole coast.

Wilkinson (1993) classified the coral reefs of the world into three categories: critical, threatened and stable. The northern part of the Red Sea including the Gulf of Suez falls into category threatened, while the status of coral reefs in the Gulf of Aqaba is categorized as critical. A critical state means that the reefs are under severe threat and likely to collapse within 10 to 20 years.

Many stony corals have slow growth rates, which may be slowed further by adverse environmental conditions (Brown and Howard, 1985). They have generally very specific requirements for light, temperature, water clarity, salinity and oxygen and are recognized as vulnerable to oil pollution (GESAMP, 1993; Loya and Rinkevich, 1980) Oil can impact on reef corals by two routes: either by smothering from surface oilslicks, or by toxic action from water-soluble oil fractions through the water column (Vandermeulen and Gilfillan, 1984). Most damage is done when the corals are emerged and in direct contact with newly spilt oil. However, investigations have shown ecological and physiological sublethal effects occur from contact with water-soluble petroleum products, if the exposure duration are sufficiently long Loya and Rinkevich, 1980; Peters and others, 1981). Deeper growing coral reefs have low vulnerability for oil spills if dispersants are avoided close to the reef.

Compared to mangrove woods and other low physical energy habitats wave action and tides would ensure rapid self-cleaning of the oiled coral reef areas. However, behind a typical fringing reef in the Red Sea as described in Sheppard and others, 1992, and Head, 1987, there are lagoons and pools where oil contamination may persist for long time in the sediment.

Vandermeulen and Gilfillan estimated a recovery time of coral reefs between one and more than ten years depending on the type and extent of disturbance.

Mangrove Forests, Sea Grass Beds, Salt Marshes and Sabkha

Low physical energy and high productivity is common features for these habitats. Mangroves and seagrass species are growing in sandy or muddy areas and function as coastal food factories. Mangrove forests and salt marshes are intertidal while seagrass meadows may extend down to 30 meters depth in clear water. They filter land run-off and remove terrestrial organic matter and nutrients protecting coral reefs from sedimentation and eutrophication. Sea-grasses are distributed over most of the globe, but salt marshes and mangroves replace each other geographically with salt marshes as the northerly habitat. In the Red Sea salt marshes and mangrove woods are found in the same area.

Oil pollution causes most damage in systems of low physical energy in which it can be trapped or ponded for long periods of time. Consequently, these habitats are generally more vulnerable than coral reefs and rocky shores.

Mangrove areas have been declining in the Red Sea and there are now remaining only 400-500 square kilometers (Sheppard and others, 1987). These communities have high diversity including faunal assemblages of many species of fish (186 species), crustaceans (40) and mollusks (83). Three species of mangrove trees have been found in the Red Sea. They occur mainly in sheltered areas behind coral reefs and on some offshore islands. The abundance is highest in the southern part of the Red Sea where the continental shelf is wider and sediment conditions suitable.

Seagrass beds have high productivity, they serve to stabilize the sediment allowing a rich and specialized fauna to develop among them, and they are food for herbivores such as dugongs, turtles and commercial important fish and crustaceans. Ten sea grass species have been found in the Red Sea (Jones and others, 1987). The development of the seagrass beds in the Red Sea is similar to the mangrove areas, with largest extension in the southern parts.

The distribution and abundance of *marshes and sabkha* have changed significantly in the Red Sea. In some parts like the Gulf of Suez destruction have been widespread in contrast to areas affected by municipal effluents close to the larger cities, leading to enrichment and new marsh-areas (Sheppard and others, 1987). Similar to mangroves and sea grass beds these areas are highly productive.

The intricate network of tidal inlets and channels in the mangrove woods provide a high potential for oil pollution deep into these areas leading to a high vulnerability of mangrove trees and organisms associated to these habitats. The aerial roots of mangroves suffer clogging and choking, and seedlings are sensitive to hydrocarbons. The vulnerability may vary with sediment type and number of pneumatophores (Dicks, 1986). Recovery rates vary highly, taking as long as 20-50 years (GESAMP, 1993; Thorhaug, 1989).

TURTLES

All of the five species of pantropical marine turtles occur in the Red Sea (Frazier and others, 1987): *Eretmochelys imbricata*, Hawksbill; *Chelonia mydas*, Green; *Lepidochelys olivacea*, Olive Ridley; *Caretta caretta*, Loggerhead; and *Dermochelys coriacea*, Leatherback.

In the Gulf of Aqaba three species of turtles (Green, Hawksbill, Leatherback) have been observed breeding (World Bank, 1996) and four at the Sinai coast of Egypt (Green turtle, Loggerhead, Leatherbacks, Hawksbills) (UNEP/IUCN, 1988).

The knowledge about physiological effects of oil pollution on turtles is scarce. Observed effects are polluted beaches used for nesting, death caused by fouling of nose, eyes and throat on individuals and fatal effects from consumed oil particles (Frazier and others, 1987). The nesting season seems to vary latitudinal, between February and July with the earliest in the south.

MARINE MAMMALS

The dugong (*Dugong dugon*) is a marine mammal belonging to the order Sirenia. The Red Sea is the western extremity of the range of this tropical Indo-Pacific species (Bertram and Ricardo-Bertram, 1973) which is listed on the IUCN Red List of Threatened Animals (1997). In the Red Sea nearly 50 % of the population is along the Saudi Arabian coast (Preen, 1989). Dugongs are completely restricted in diet to seagrasses (Lipkin, 1975).

Whales comprise two orders; the baleen whales and the toothed whales. Frazier and others (1987) referring several sources states that eight species of dolphins and toothed whales have been observed in the Red Sea. Baleen whales are relatively common in at least the southern Red Sea (IUCN, 1995), including Bryde's whale (Balaenoptera edeni), fin whale (B. physalus), sei whale (B. borealis), blue whale (B. musculus).

There is little firm evidence for marine mammals being affected by oil pollution except in cases of chronic pollution in restricted areas. Most of the serious oil pollution incidents have been in temperate regions. In Shetland no serious damages to marine mammals was observed after the wreck of Braer (Ritchie and O'Sullivan, 1994).

FISHERY RESOURCES

A review of published and unpublished material dealing with the state of the fisheries resources in the Red Sea and Gulf of Aden is given in Sanders and Morgan (1989). The marine fisheries are an important component of the fish supplies for the countries bordering the Red Sea and the Gulf of Aden. Small boats fishing close to the shore using gill nets, handlines or other fishing methods have dominated the fisheries, but currently several countries are developing industrial fishery fleets and this is the most important method in Yemen.

The species with the greatest potential for increased catches is said to be pelagic and mesopelagic species, several with low economic value. The more important commercial species are, by contrast, near to their maximum potential yields. Some important fishery resources are pelagic fish species such as mackerel, tunas, sardines and sardinellas, and demersal resources such as shrimps, groupers, seabass and lizardfish.

With exception of tuna and a few other strictly pelagic species, several of the important commercial fishery resources have their nurseries near to the shore in association with segrass beds, mangroves and coral reefs. The adult stages may be captured off shore.

Fish eggs and larvae are highly vulnerable for oil pollution, but both surveys and modelling studies indicate that large number of larvae have to be destroyed to affect recruitment of a population (GESAMP, 1993). Generally the proportion of a fish population to be affected by an oil spill is small leading to insignificant resource losses.

MARINE PROTECTED AREAS (MPA)

The information about the MPAs listed in Table J-1 below is from IUCN, 1995. In addition there are several proposed and recommended marine parks or management zones at a national or local level. For instance IUCN in 1987 outlines a coastal zone management plan in Saudi Arabia, in which 46 areas are proposed as marine protectorates along the Saudi Red Sea coast (UNEP/IUCN, 1988). Similar trends appear in other countries along the Red Sea coast.

Table J-1. Marine Protected Areas in the Red Sea

Country	Name of MPA	Status	Priority	Sensitive resource
Djibouti	Maskali Sud Integral reserve	Existing	National	Coral reefs
	Musha Territorial Park	Existing	National	Coral reefs
	Sept Frères	Proposed	National	Seabirds, corals
Egypt	Abu Gallum Multiple Use Management Area	Existing	National	
	Giftun Islands and Abu Monqar	Proposed	National	Coral reefs
	Ghardaqah (Hurghada)	Proposed	National	
	Jebel Elba Conservation Area	Existing	National	Coral reefs
	Southern Egypt Marine Park, Marsa Alam - Sudanese border, including Jebel Elba	Proposed	Regional	Coral reefs, Turtles, Seabirds, Dugongs
	Nabq Multiple Use Management Area	Existing		

Country	Name of MPA	Status	Priority	Sensitive resource
	Ras Mohammed National Park	Existing		Coral reefs, Seagrass , Migrating birds,
	Ras Mohammed sector - additional marine areas, Marine and Coastal Park	Existing		
Egypt, Saudi Arabia	Strait of Tiran including Tiran Islands Area; Tiran - Sinafir Protected Area	Proposed / Existing	Regional / National	Coral reefs Turtles, Dugong, Sea birds
	Strait of Jubal, includes Giftun Islands, Jubal, Shadwan, Ghardaqah, Abu-Ramada, Magawish, Abu-Monquar, El-Fanidir, Abu-Galawa, Abu-Sadaf	Proposed	Regional / National	Coral reefs, Turtles
Eritrea	Dahlak Marine National Park	Existing		Coral reefs, Turtles, Dugongs, Seabirds, Mangroves
Jordan	Aqaba Marine Nature Reserve and proposed Marine Park and Environmental Management Zone	Proposed		Coral reefs, Seagrass, Fish, Shrimp
Saudi Arabia	Farasan Islands Protected Area	Existing		
	Farasan - Archipelago and adjacent coast	Proposed	Regional / National	Mangroves, Turtles, Fish, Seabirds
	Qishran Islands - Ras al Askar	Proposed	Regional / National	Mangroves, Dugongs, Corals, Turtles
	Ras Suwahil	Proposed	Regional / National	Corals
	Umm al-Qamari Island Protected Area, Asir National Park	Existing	National	Mangroves, Turtles
	Wejh Bank	Proposed	Regional / National	Coral reefs, Mangroves, Dugongs
Sudan	Abraq, El Deib and Jebel Elba area conservation Area	Existing		Coral reefs, Turtles, Seabirds, Dugongs
	Sanganeb Atoll Marine National Park	Existing		Coral reefs, Fish
Republic of Yemen	Socotra Island	Proposed	Regional / National	

Review of Environmental Sensitivity

The environmental impact of oil on a population or community can be described as a combination of the amount and type of damage, and the duration of damage. Oil causes most damage in systems of low physical energy in which it can be trapped or ponded for long periods of time. Thorhaug (1989) used a recovery index rating temperate, subtropic, tropic and arctic ecosystems. The tropical nearshore ecosystems had the lowest overall recovery index as a result of inter alia high vulnerability and lack of elasticity once perturbed. She claims that the naturally recovery time from disasters are 10-50 years for coral reefs, 20-50 years for mangroves and 6-50 years for seagrass meadows. Ballou and others (1989) found that use of dispersants reduced the effects on mangroves, but caused severe long term effects on the corals and seagrass communities. They suggested that use of dispersants in deep water offshore would reduce the effects in all these habitats. See Table J-2.

Table J-2. Sensitivity of Environmental Resources in the Red Sea

Resources	Vulnerability	Comment
Mangroves and marshes	High	Important areas for fishery resources. High priority in oil spill protection
Coral reefs	High	Shallow reefs are most exposed to oil. If dispersants are used, deeper growing reefs will be exposed.
Marine protected areas	Varying.	Protection measures and remediation programs should be developed on site specific basis for each marine protected area: International value: High Regional: Medium National: Low
Seagrass beds	High to medium	Vulnerable if exposed to dispersed oil
Spawning and nursery areas for fish	Medium	

Appendix K

Updating of Navigation Charts for Ports in the Region

Port Surveys

It is recommended that surveys of ports within harbor limits remain the responsibility of the port authorities. The current situation for ports in the Red Sea and Gulf of Aden, following a rapid assessment, is as follows:

DJIBOUTI

Djibouti - Major construction work on a new container terminal was completed in 1989 and port facilities have been upgraded since then. The port is frequently used by the French navy and is regularly surveyed; UK Chart 262 of the port area is based on a detailed 1990 US Government survey and on French Government charts which were themselves based on 1982 surveys. UK Chart 253 of port approaches is largely based on a 1995 French chart.

EGYPT

With deepening and expansion of port facilities taking place, new terminals and facilities being installed at Suez, Adabiya, Ghardaqah and Sharm El Sheikh, and with the oil terminals presumably surveyed on a regular basis by the operators, it may be anticipated that surveys for these ports and terminals are recent.

ERITREA

Mits'iwa (Massawa) - P&O feeder ships call regularly at this port and no problems have been reported. It is unlikely that any port survey work has been completed in recent years.

Aseb (Assab) - P&O feeder ships call regularly at this port and no problems have been reported. It is unlikely that any port survey work has been completed in recent years. UK Chart 143, which covers the coast of Aseb, states that "1986-87 Landsat imagery has been used extensively to delineate coastlines, islands and reefs."

JORDAN

Aqaba – The seabed in approaches to the port are steep. With port development taking place along the coast as new facilities were built in the 1980s, surveys of the close to port area would have been required. UK Chart 801 is based on Admiralty surveys carried out in 1917-1918, 1943-1958 and an undated American survey.

Strait of Tiran – UK Chart 901 shows that the critical part of the northbound Grafton Passage (east) through the Strait of Tiran was surveyed by the Egyptian authorities in 1993. The southbound Enterprise Passage (west) was surveyed in 1917-1918.

Strait of Jubal - UK Chart 8 shows that the Strait of Jubal was surveyed by the US Government between 1979 and 1994. Some of the data used in preparing the Chart is derived from surveys carried out between 1830 and 1872.

SAUDI ARABIA

Yanbu – Rabigh, Jeddah and Jizan have been surveyed regularly in recent years under the various port development and expansion programmes carried out in these ports. UK Admiralty Charts record data from commercial surveys on port approaches completed in the 1980s.

SOMALIA

Qandala - This is an offshore anchorage with reefs protecting the landing beach. It is unlikely that any surveys have been carried out in recent years.

Bosaso - This is an offshore anchorage. A shipowner whose vessel is due to call at Boosaaso was advised that the port is well organized by "the local authorities." It is unlikely that any surveys have been carried out in recent years.

Berbera – This is the main port on the north coast of Somalia. P&O feeder ships call regularly at this port and no problems have been reported. It is unlikely that any port survey work has been completed in recent years.

SUDAN

Port Sudan - Port Sudan is in regular use by P&O feeder vessels based in Jeddah and by ships serving East African trade from Europe. Delays (normally 12 hours) are common and communications with Sudan are reported to be very difficult (P&O sometimes has to communicate with Port Sudan through Jeddah). No problems with navigation aids or port approaches were reported. It is not likely that survey work has been carried out in recent years.

Suakin - The port was due to be extended and plans for construction of two multi-purpose berths with container handling equipment were reported in the early 1990s to relieve the pressure on Port Sudan. If these plans were implemented, then survey work on the port would have been required. Further checks on the situation are needed.

YEMEN

Aden - The port is regularly surveyed by the Hydrographic Department and was being re-surveyed during construction work on the new container terminal.

Mukalla - Mukalla is currently operated by the Yemen Port Authority. The port is surveyed by the Aden Hydrographic Department from time to time (last survey 1996). Additional survey work was carried out during construction of the new fisheries facilities under the Fisheries IV Project.

Nishtun - Nishtun is currently operated by the Yemen Port Authority. The port is surveyed by the Aden Hydrographic Department. There is a problem with siltation in Nishtun and the situation is monitored by the Yemen Port Authority. Last surveyed in 1993.

al-Hudaydah - al-Hudaydah is the "lead" port for the Red Sea ports of Yemen operated by the Port and Marine Affairs Corporation (principally Mokha, Salif and Ras Isa). The port has its own Hydrographic Department with launch and echo sounder. The channel suffers from siltation and the situation is monitored by the Port Authority. The harbor basin was last surveyed in

1996. The area of the approach channel on UK Chart 542 is based on commercial surveys carried out up to 1988 and the areas on either side are based on an Admiralty survey carried out in 1981.

Mokha - The port suffers from siltation and dredging is being carried out at present. The situation is monitored by the hydrographic section in al-Hudaydah and a surveyor currently visits Mokha to survey and update the Port Authority charts every two weeks.

Salif – A new bulk terminal is being completed at Salif and recent survey work for the port and its approaches has been carried out by the constructors.

Ash Shihr – This is an offshore terminal operated by Canadian Occidental Petroleurn. Survey work on the pipeline route and buoy area (SBM) carried out by the company as necessary.

Bir Ali - Offshore terminal operated by Nimir Petroleum. Survey work on the pipeline route and buoy area (SBM) carried out by the company as necessary.

Balhaf (future LNG terminal) - A new port is due to be constructed at Balhaf to handle the production of Liquified Natural Gas (LNG). Shipments were due to commence in 2002, but this is likely to be delayed by 1-3 years. Reasonably detailed land and coastal surveys were carried out by a British company in 1996.

Ras Isa – This is an offshore terminal operated by Yemen Hunt. The oil storage facility “Safer” is anchored in 33-37 meters of water. Survey work on the pipeline route and anchorage is carried out by the company as necessary.

In general, with the exception of Somalia, Eritrea and Sudan, it would therefore appear that the ports in the Region are reasonably well covered for survey wor. On the question of how much should be allocated for new surveys, this would presumably be linked with recommendations provided on re-surveying in the southern end of the Red Sea and for selected areas close to the Strait of Tiran, in the Gulf of Suez and around The Brothers, plus areas around reported isolated patches. It will also depend on how much work is required by IMO before any new TSS are established in the southern end of the Red Sea.

it is recommended that further discussions with IMO and the UK Hydrographic Department in Taunton (responsible for preparing charts of this Region) be held before a decision on resource allocation is made.

Appendix L

Participants in the Aden and Ismailia Workshops

Aden Workshop Participants

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Suez Canal Authority, Suez

Captain Adel Farahat
Director of Salvage Department
Suez Canal Authority, Ismailia

Captain El-Sayed Ghalis
Harbor Master, Port Said
Suez Canal Authority, Port Said

Captain Ahmed Amin Khalil
Salvage Master
Suez Canal Authority, Suez

Captain Said Ibrahim Merdan
Harbor Master, Ismailia
Suez Canal Authority, Ismailia

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