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WORLD MARITIME UNIVERSITY
Malmö, Sweden

**THE IMPACT OF POLLUTION ON KENYA COAST
MARINE ENVIRONMENT**

By

ABIDJAH WACHIRAH NDEGWA

KENYA

A dissertation submitted to the World Maritime University in partial
fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

in

GENERAL

MARITIME ADMINISTRATION

&

ENVIRONMENTAL PROTECTION

1998

DECLARATION

I certify that all material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

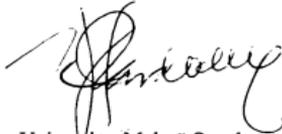
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ACKNOWLEDGEMENTS

I wish to thank all those who have helped me with the information, encouragement and guidance during the preparation of this dissertation.

I am particularly grateful to professor F. Pardo, my assessor,co-assessor and Wangechi Eklow who assisted to proof read my work, Mr J.P. Muindi Ministry of Transport and Communication for nominating me and the Canadian International Development Agency (CIDA) for granting me the fellowship which I appreciate.

Finally my sincere thanks to the World Maritime University staff and my colleagues for making my stay at this institution worthwhile.

ABSTRACT

**Title of dissertation: THE IMPACT OF POLLUTION ON KENYA COAST
MARINE ENVIRONMENT**

Degree: MSc

This dissertation looks at the types and main sources of marine pollution in Kenya, the existing national regulations and their comparison with the international legislation, and the damage that the Kenyan marine environment has sustained from accidental oil spills.

The global environmental protection framework is analysed and the international conventions the Kenya government has ratified so far are indicated. The author further examines the current environmental protection regulations in Kenya against international standards and gives solutions for remedy where they are found lacking.

The role of IMO in the prevention of the marine industry especially in the protection of the marine environment in Kenya is shown. This has largely been through providing and financing technical assistance for research and implementing policies. ISM code and its use in reducing accidental pollution and the impact this will have on the marine environment is looked into.

The existing oil spill contingency plans in Kenya, Mombasa (Kilindini) port contingency plan and the National contingency plan, their weaknesses, effectiveness and future plans are examined. Since a major oil spill would implicate resources, industry, etc., the author tries to examine what is the role of international regulation

(OPRC) can be used to in co-operating to combat a major oil spill emergency would be. This study aims to look at the existing contingency plans in Kenya in order to give suggestions for combating major oil spill emergencies to protect the marine environment on Kenya coast.

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LIST OF ABBREVIATIONS

CITES	Convention Trade in Endanger Species
ILO	International Labour Organisation
IMDG	International Management for the Carried of Dangerous Goods
IMO	International Maritime Organisation
OPRC	Oil Pollution Preparedness Response Co-operation
STCW	International Standard of Training Certification and Watchkeeping
TSS	Traffic Separation Schemes
UMCED	United Nation Convention for Environment Development
UNEP	United Nation Environment Program

INTRODUCTION 1

1.1 The Geography Of Kenya.

Kenya is on the Eastern coast of Africa and has a total of 582,646 square kilometres with 13,400 square kilometres covered by waters. Her neighbours are to the North Ethiopia, North west Sudan, North east Somalia, South Tanzania and to the West Uganda, the Indian Ocean borders on the Eastern side with a coastline of about 200 miles. According to the last census in 1989 the estimated population was 26 million people with an increase of about 4% per annum much higher than the national economic growth.

Nairobi is the capital city and the Government Administrative Headquarters with an estimated population of 2 million people. Mombasa is the major port and second largest city.

Kenya was a British Colony until 1963 when she regained her independence and became a republic under President Mzee Jomo Kenyatta. She has a long history of shipping and marine activities that go back to the time of Arab trade on the Eastern Africa coast and the Arabian Gulf. Commodities were transported by canoes and dhows, and in 15 century Mombasa was the main commercial port for Eastern Africa. Today Mombasa has remained the major seaport for Uganda, Rwanda, Burundi, Northern Tanzania and Southern Sudan and Eastern Congo.

I.2 Dissertation Objectives.

The study is aimed at identifying the causes of oil pollution and related problems and also to examine the effectiveness of current marine traffic management in preventing marine pollution. The study also examines the current national plans for the prevention of oil pollution and its impacts on the environment. The study compares current national regulations with the international legal framework in the prevention of marine pollution. The author therefore examines the current national plans for the prevention of oil pollution and its effectiveness and gives recommendations that will help reduce the impact of oil pollution to the marine environment which includes among others educating and training of personnel.

CHAPTER 2

2.0 SOURCES OF POLLUTION FROM SHIPS

The shipping business which involves the transportation of goods by sea is important to international trade. Valuable cargo is transported through great distances, always a potential risk to the environment due to the properties of the cargo and the fuel and other compounds that are used by the ship. A lot of pollution is generated during shipping operations. The type of operations, the type of pollution generated and the effect these have on the environment are discussed in this chapter

2.1. OPERATIONAL POLLUTION

Operational pollution occurs during loading and discharging in terminals and refineries, through bilge and fuel oil waste, bunkering discharges, waste fuel, and inadequate reception facilities at ports. Shipping activities contribute to marine pollution in various ways:

- Normal operations
- Transportation of Hazardous Substances
- Accidental Pollution
- Illegal Pollution
- During Pollution in port services

2.1.1 Normal Operations

Normal shipping operations are responsible for more than 70 % of the oil that enters the sea. Pollution from normal operations of ships occurs due to poorly maintained vessels, poor navigation, port dredging, cargo vapour discharges, exhaust gases and when ballasting, oil residues, sludge and bilge's

Most problems are caused by inadequate facilities for waste disposal at port, especially when the location of the port is enclosed where the discharge take time to clear in such location.

2.1.2. Transportation of Hazardous/Noxious Substances

Handling bulk chemical waste from oil products is dangerous to both human and environment and should be handled with specialised equipment by well trained staff.

Noxious substances may ignite and explode or cause serious damage when gases are released into the atmosphere. Massive catastrophe may occur if they enter and spread if they enter into the de-watering system of a terminal.

2.1.3 Accidental Pollution

Accidental pollution occurs due to overflows when loading or unloading via pipes and hoses. These may be caused by overflows when loading or unloading, leaving pipes and hoses open after pumping and stripping tankers, leaks from manifold flanges discharges oil if tightened. They may also occur due to overfilled slop tanks, through leaking valves during ballasting, or through faulty valve spindles. Accidental oil spills require every terminal or port to have a good contingency plan

2.1.4 Illegal Pollution

Illegal pollution or dumping is a common source of marine pollution. This happens because reception facilities are either lacking or are not enough at port and so vessels are forced to dump the waste at sea. Ship generated waste may derive from reception facilities or from garbage. Ship generated garbage may be in form of plastics, synthetic nets, fishing nets, plastic bags and packaging material to mention but a few.

The various causes of operational pollution are depicted in the diagram below (Table XIII. Sources considered as other operations include oil residues, sludge and bilge's

TABLE I (Major spills of oil from tankers over 7,000 tonnes)

	Tonnes 0-7	Tonnes 7-700	Tonnes 700 +
Incidence of spills and causes: 1974-1997			
Operations.			
Loading/discharging	2757	288	15
Bunkering	541	24	0
Other operations	1162	47	0
Accidents			
Collisions	144	225	85
Grounding	217	186	101
Hull Failure	547	67	39
Fire And Explosions	149	16	20
Others	2213	157	34

It is useful to note that the smaller tankers discharges more into the marine environment than the medium or the large tankers. The larger tankers, do not register spillage, as their impact would be greater and more noticeable, yet from this figure, operational pollution in large tankers is non-existent. This could be due to the fact that they have modern equipment's for loading and discharging.

2.1.5 Pollution at Port Services

Operational pollution from port services occurs during ballasting and cleaning of the tankers and when the water-oil mixture from the tanker and other equipment is discharged as oil residues, sludge or bilge's.

The measures that need to be taken to contain these discharges must consider that as soon as the vessel approaches the port until it leaves the 200 mile Exclusive Economic Zone, the port management should guide the ship using the navigation aids in order for the ship to berth safely in port area. The port should also avail reception facilities for the ships.

2.1.6 Pollution From Tankers

Ageing tankers especially when the hull is old and poorly maintained cause environment hazards which is damage the environment.

In the late 1970s a pilot project on marine pollution (petroleum) monitoring by Integrated Global Ocean Station System (IGLOSS) made 100,000 observation of oil slicks and sampled floating residues. Tar lumps were found closely to tanker lanes and other areas carrying out shipping activities.

TABLE II Estimated Petroleum Hydrocarbon Input into The Sea Per Year (in thousand tonnes).

		NRC	Kombe	Baker	NRC
			rg		
Source of hydrocarbon	Year	1973	1979	1981	1981
Urban-run-off and discharge		2500	2100	1430	1080
Operational Discharges From Tankers		1080	600	710	700
Accidents From Tankers At Sea		300	300	390	400
Losses From Non Tanker Shipping		750	200	340	320
Atmospheric Deposition		600	600	300	300
Natural Seeps		600	600	300	300
Coastal Refineries		200	60	-	100
Other Coastal Affluent i.e. Rivers		-	150	50	50
Off-Shore Losses		80	60	50	50
Total Discharges		6110	4670	3570	3200

(Source Freedman 1989 IMO/UNEP).

The Purpose of the data is to compare the level of pollution from ships with other pollutants.

The municipal and industrial waste waters are major sources of non-point pollution, and it is very damaging to the ecosystem especially in shallow coastal areas where dilution and degradation is slow. Preventive measures must be taken to protect the environment from effects of nutrients and toxic..

TABLE III (Annual Global Oil Discharges to the Sea).

SOURCE	AMOUNT (MT).
Industrial waste	1.48
Refineries, terminals	0.03
Offshore production	0.05
Tankers: operation	0.114
Tanker accidental	0.16
Other shipping, non tanker accidents, bilge waste and fuel oil, dry docking.	0.35
Natural sources	0.025
Total	2.434

(Source United Nations Environmental Program 1990.).

Discharges from tankers to the environment are exhaust gases, cargo vapour, and discharges of ballast water. However, according an INTERTANKO report, 1992, tanker accidents have been dropping. There has been a reduction of pollution by oil spills by approximately 12 % from 1986 figures. Currently tankers are responsible for less than a quarter of all oil discharges to the sea while land-based pollution has increased to approximately 51.8% of the total pollution.

This reduction is significant when we consider that tankers have become bigger in size but there has also been improvements in their design. There has also been an increase in the number of operating tankers (see figure below). The reason for the reduction is also due to international measures taken to regulate and control the accidents because although there is still a large number of geriatric tankers,(1996 average age of tankers at 17 years (Lloyd's Register, 1996, p.7) there is still a marked reduction in tanker pollution accidents in the last ten years. Hence reducing marine pollution. and environmental pollution from tankers. The fleet size and oil movement

have direct effects on the environment because the more the vessels the higher the risks of accidents and the larger the vessel the greater is the damage to the environment i.e. Exxon Valdez and Brear incidents. On the other hand, urban migration has increased thereby increasing land-based pollution.

Table IV (World Tanker Fleet In Dead-weight Tonnes).

Year	Tonnage
1960	64 million
1970	170 million
1980	340 million
1989	250 million
1996	270.3 million

(Lloyd's Register, 1996)

But not withstanding the above argument , operational spillage from ships still occurs. Coastal spillage's and frequent oil spilling by ships is a major concern to the public as it leads to pollution on the beaches and coastal areas which affect aquaculture and taint fish.

The operational pollution is high when vessels are poorly maintained. Accidental pollution usually occurs due to poor navigation and control when entering the port.

Operational discharges from ships have been reduced by MARPOL 1973/78 and the requirement to fit oil water separators.

TABLE V Casualty Categories (1992 Distribution of world fleet <100 GRT).

Cause of Casualty	% of Total GRT
Mechanical damage	30
Stranding	18
Hull damage	7
Founding/missing	4
Fire/explosion	14
Collision/contact	25
Other	2
Total number	920

(Source Lloyds of London Publication casualty week.) Marine Pollution Bulletin Vol. 25, No 9-12 p242.

TABLE VI Oil from Tankers into the Sea.(In Million Tonnes)

Tanker operations	0.7	0.159
Tanker accidents	0.4	0.114
Bilge and fuel oil discharges	0.3	0.253
Dry-docking	0.03	0.004
Marine terminals(including bunkering operation)	0.022	0.030
Non-tanker accidents	0.02	0.007
Scrapping of ships	0	0.003
Total	1.47	0.57

(Source US National Academy of Science 1990)

The data indicates that in 1981 tanker operation discharges of oil residues to the sea caused environmental damage; in 1989 sludge and machinery bilge's contributed most pollution due to lack of adequate reception facilities in most ports and this encouraged illegal pollution hence damaging the environment.

2.1.7 OPERATIONAL WASTE

Waste caused when emptying or cleaning land tanks, oil separators and drip-trays is hazardous when treated or disposed without considering the environment. Oil run-off causes precipitation that requires de-watering system with oil separation and sampling facilities to determine affluent contents.

The following diagram depicts causes of shipping pollution and percentages blamed on each sector.

TABLE VII-Causes of Shipping Accidents

Cause of Accidents	% of Total Accidents
Officer error	32
Crew	20
Structural failure	13
Equipment failure	11
Mechanical failure	6
Shore error	6
Pilot error	4
Engineering officer error	2
Other	5
Under investigation	1

In most cases when human failure is concerned, the problems are usually due to poor management, engineering, in plan design, construction or lack of equipment maintenance.

2.2 MARINE POLLUTION CONTROL

The IMO, has developed conventions and protocols that deal with marine pollution that are meant to reduce pollution at sea.

2.2.1 Oil Pollution

Enforced on 2nd October 1983, under MARPOL 73/78, a master is required to report an incident involving oil involving oil or other harmful substances to the nearest coastal state. The definition of "incident" by MARPOL is "any incident arising from an event of discharge or probable discharge from vessel.

This requirement, however, cannot be effective because a probable discharge is a matter of opinion so the master may not report a serious oil spill and still get away with it.

2.2.2 Hazardous/Noxious Substances

In order to avoid pollution from hazardous and noxious substances, ships have manuals describing washing procedures during tank cleaning. When dealing with noxious substances, the ports with de-watering systems, are required to have shut-off valves, dwell basins and electrical appliances be explosion proof and be handled by competent staff with good safe equipment and a operational contingency plan that is readily available.

2.2.3 Garbage

MARPOL 73/78 annex V deals with garbage disposal. Treatment and disposal of ship generated garbage is done according to the requirements of the port authorities.

The following table can be used for guidance on garbage management.

TABLE VIII MARPOL (Annex V): Shipboard Garbage Disposal Restrictions.

GARBAGE TYPE	OUTSIDE SPECIAL AREAS.	IN SPECIAL AREAS.	OFFSHORE PLATFORMS AND ASSOCIATED VESSELS.
PLASTICS, synthetic ropes and fishing nets and plastic garbage bags.	Disposal prohibited	Disposal prohibited	Disposal prohibited
Floating dunnage, lining, and packing materials.	Disposal prohibited <25 N Miles offshore.	Disposal prohibited	Disposal prohibited
Paper, bags, glass metal bottles, crockery refuse..	Disposal prohibited <12 nmi offshore.	Disposal prohibited	Disposal prohibited
Paper, rags, glass . comminuted or ground	Disposal prohibited <3 nmi offshore.	Disposal prohibited	Disposal prohibited
Food waste comminuted or ground.	Disposal prohibited <3 nmi offshore.	Disposal prohibited <12 nmi offshore.	Disposal prohibited <12nmi offshore.
Food waste not comminuted or ground	Disposal prohibited <12nmi offshore	Disposal prohibited <12nmi offshore	Disposal prohibited
Mixed refuse types	varies by composition	varies by composition	varies by composition

It is impossible to limit the amount of cargo waste generated as garbage or to have the ports provide reception facilities without charging to cover the cost of supplying them. However, shipping companies may form associations where as members will be exempt from such charges.

2.2.4 Reception Facilities(Annex IV Sewage)

Ports ought to comply with local or national requirements on municipal sewage system which is also used by ships that need to discharge sewage. Ship generated waste should be discharged to shore reception facilities using connection points to the municipal sewage. The alternative system on the berth quays is for the sewage to be collected by suction trucks for treatment in municipal plants.

According to MARPOL, ships may discharge into the sea 3-12 nautical miles from the nearest port according to their treatment equipment. Large ferries, due to environmental and commercial considerations, may discharge nearer the shore.

2.3 SHIPPING ACTIVITY IN KENYA

The description below is supposed to enhance the image of shipping activity along the Kenyan coast and hence show relevance to the theme of this study.

TABLE IX Registered Merchant Fleet As At 31/12/1997

Year	1992	1993	1994
Total Displacement ('000 grt)	33	35	38
Vessels	15.7	18.0	19.8

(Lloyd's Register of shipping)

TABLE X International Sea Freight Traffic

(estimated '0000 metric tonnes)

Year	1991	1992	1993
Goods loaded	2,297	1,791	2,083
Goods unloaded	5,192	5,310	5,810

(Ministry of Environment & Natural Resources)

TABLE XI Number of Ships Arrival

YEAR	1991	1992	1993	1994	1995	Average
Vessels	1238	1465	1510	1529	1558	1469
Shipping tonnage	----	12,418	12,265	14,793	13,950	8,984
Total Cargo Traffic	7145	7991	7990	8331	7955	32.8%
Loading	1792	2083	2774	1659	1887	23.9%
Discharging	5311	5809	5144	6610	6013	76.1%

TABLE XII Container Traffic

Total Container	129000	130728	139730	153882	195401
Loaded Units	101374	103746	108822	120967	148991

(Kenya Bureau of Standards)

The information shows Mombasa is an important port in Eastern Africa with heavy traffic of vessels and cargo with some of it harmful to the marine environment and humans. Therefore, all necessary measures must be considered at all times to protect the environment.

The number of vessels indicate traffic congestion that means navigation instructions and competence of personnel is very essential when entering or operating at port. This is important because any incident would be very damaging to the surrounding environment and costly to the port authority.

The vessel traffic from Middle East round the Cape of Good Hope may discharges a lot of oil along the coastline, and that together with operational discharges in the port terminal becomes a major environment pollution. Indeed, even now tar is a major problem in most beaches along Mombasa, Malindi, Lamu which should be cleaned because it might affect the marine environment and tourism.

2.4 ACCIDENTS ALONG THE KENYA COAST

In order to show the vulnerability of the Kenyan marine environment a number of vessel casualties are examined. These have had adverse effects on the environment as a result of oil spillage; destroying the coral reef, tainting fish and destroyed the beaches, if their cargo had spilled. Since they are many accidents, it shows that we have been lucky a major accident has not happened and should have a good contingency plan to avoid one in the near future.

On 5/5/1982 M. T Eva-This tanker registered in Monrovia under Liberian flag was carrying crude oil when she grounded as she approached Mombasa port due to poor communication between the pilot and the master.

(Lloyd's Register, 1983.).

M. Obo Sanko Cherry a was registered in Monrovia under Liberian flag was carrying crude oil to Kenya petroleum refineries when she grounded as she approached Mombasa port on 18/5/1983 because of pilotage error.

Mv Silago Express- registered in Manila the Philippines flag grounded in Mombasa port and remained until the 16/11/1987 because the master did not follow the pilots' instructions.

MT Atlantic, registered in Tokyo carrying Japanese flag stranded as she approached Mombasa port because of poor weather condition on 10/12/1988-12/12/1988 she was carrying over 70,000 tonnes of crude oil.(Lloyd's Register, 1988.).

MT Bernora- registered in Grimstad carrying a Norwegian flag grounded as she entered Mombasa port because of pilotage problem on 8/7/1990 when carrying crude oil (Lloyd's Register, 1990).

MT Sunetta- registered in Monrovia in Liberian flag was carrying crude oil from Saudi Arabia when she grounded as she entered Mombasa port on 25/5/1993 and was rescued on 3/7/1993 at 1345 GMT (Lloyd's Register, 1993).

Lavest - went aground off Mombasa due to the negligence of the pilot on 20.4.1994.

Mtongwe One -sank on 30.4.1994 between 0600-0730 due to overloading in the Port of Mombasa.

Bonsella -capsized due to poor steel works on the double bottom tank tops and wrong ballasting procedure in Tanga Tanzania on 4.12.1996.

Table X indicates that Mombasa has a growing number and size of shipping traffic that is causing a lot of congestion at the port. This is evident due to the number of incidents that are very common and requires attention to improve the traffic flow to reduce the chances of pollution that can be very damaging and expensive The recurrence of accidents caused by passenger overloading on vessels in Kenya indicate the lack of commitment to enforce both national and international regulations..

2.5 HUMAN FACTOR

Table XIII shows the significance of accidents to marine environment which are directly or indirectly related to management factors like manning, maintenance and working conditions for the seafarers or the design of the ship.

TABLE XIII Human Factor in Accident and Mishaps).

Crew, pilot, and shore personal.	65%
Mechanical and equipment failure.	15%
Other.	20%

(source P&I Statistics 1992).

The reasons for human failures are:

- Lack or use of wrong procedures for important operations.
- Lack or incomplete contingency plan arrangements and training.
- Insufficient qualified ship personnel and sometimes due to poor management.
- Lack or incomplete inspection and preventive maintenance and design flaws.

Most of these accidents and incidents can be avoided when rules and regulations are followed. Much effort should be directed to environmental protection by safe and responsible ship operation and by raising the level of education and training as required by STCW/78 Convention and the revised STCW 95. Kenya is part of the convention and seafarers are trained in Bandari College which is run by Kenya Ports Authority. The Kenyan administrative structure against pollution is dealt with in chapter six. This will investigate on the commitment of the government and the problems involved.

CHAPTER 3

3.1 LAND-BASED POLLUTION.

Pollution to coastal seas from land-based activities is the most damaging to the environment and human.

Non-point sources degrade water quality and can be controlled either by legal regulations or other methods whose effect has same benefits or values and similar environmental objectives.

Vegetative buffers helps to reduce non-point source pollution, minimise human impacts, maintains. natural shorelines, provide wildlife habitat and preserve scenic view but their main disadvantage is managing buffers and balancing environmental protection with coastal community needs.

Three quarters of the pollution in the sea is land based from industries and sewage runoff in urban areas, which enters through storm water drains, pipe lines, or indirectly from runoff and seepage. Measures that prevent or eliminate pollution from these sources depends on the best environmental practice and best use of available technology.

TABLE XIV Land Based Activities That Cause Environmental Pollution

ISSUES	SOURCE
Water Quality	Sewage disposal from sewage treatment plants and septic systems, urban and storm water run off, industrial pollution sources, agricultural runoff(nutrients & pesticides),health e.g. bathing water & shellfish.
Coastal erosion	in beaches, private properties and estuaries.
Loss and degradation of habitats.	Loss and degradation of fish & mangrove etc.
Development pressures.	Construction of roads, housing, resorts and golf courses.
Location of coastal dependent industries.	Aquaculture, sand mining, port development.
Public access and facilities.	Vessel facilities, toilets, garbage bins, and car parks.
Dredging and filling coastal lagoon openings.	Filling for canal estate development, maintenance dredging of navigation channels and dam construction.

Source: Coastal Management

Two rivers which drain soil from the coastal area to the Indian ocean are Tana and Athi from Aberdare Ranges. Tana enters Indian ocean at Kapini and Karawa on Fomosa Bay draining the most fertile land used for farming. Lots of tonnes of soil is carried into the Indian ocean each year.

Other Rivers that carry silt into the sea are Doderi north of Tana and enters the ocean at the Siyu channel, Goshi river from Taita hills enters the sea at Kilifi creek, south of Goshi river are the Cha-shimba and Kamisi rivers originating from Chenza ranges. The export of soil nutrients into the sea has an impact on the water which is harmful to the coastal ecosystem.

Types of Pollution from the rivers

- Trash and garbage.
- Sewage.
- Landfill and junkyard.
- Oil.
- Factories.
- Mud and siltation.
- Runoff.

The preservation of soil can be done by all measures that will preserve its properties or preventing pollution which reduces the quality to acceptable standard.

This type of pollution is caused by poor agricultural methods, over-grazing, destruction of vegetation for human settlement and charcoal burning which leaves the top soil vulnerable to wind and water erosion.

The long term effects reduces the quality of marine environment and resources, loss of natural production, loss of use and other economic benefits which might affect the environmental sustainability.

Sediment deposits have destroyed the coral reefs around Malindi and Watamu marine national parks, sometimes making it difficult to improve fish production and

terrestrial corals tend to resist green vegetation which makes it very expensive to plant trees.

Coral reefs are useful breeding areas for fish and when they are destroyed they have serious socio-economic impact because fish is a source of income and protein. Coral sand used for construction and in manufacture of cement must be regulated in order to protect environmental damage which might affect the future sustainable development of coast region. Since Independence most rivers made major physical changes due to development i.e. dams & navigation etc. which changed the environmental condition of rivers reducing the speed of water and affecting the rivers ecology.

This seriously affects the food and migration pattern of fish species adapted to particular river habits replacing them by more general and less attractive fauna and flora. Modification of river banks or its separation from their original environment reduces forests and endangered trees.

Industrial chemicals from factories and domestic washing in Mombasa releases toxic effluents very harmful to the environment because all ecosystems in water are affected by changes in water quality.

The mining industry is also a source of marine pollution. Production of barite at Vitengeni and lead -silver at Kinangani 14 miles north of Mombasa uses water during the production and refining processes, such water contains a high concentration of iron ore -metals which is released back into the sea untreated and pollutes the environment.

(Environmental Report GOOK/UPEND/UNDP; Jan, 1981, Vol. 2.p 504)

Agriculture -Based-Industries pollute the marine environment i.e. sugar factories near Mombasa hinders fisheries development in the lower Ramisi river by discharging the wastes into river causing a reduction in fishes and poor quality hard to sell.

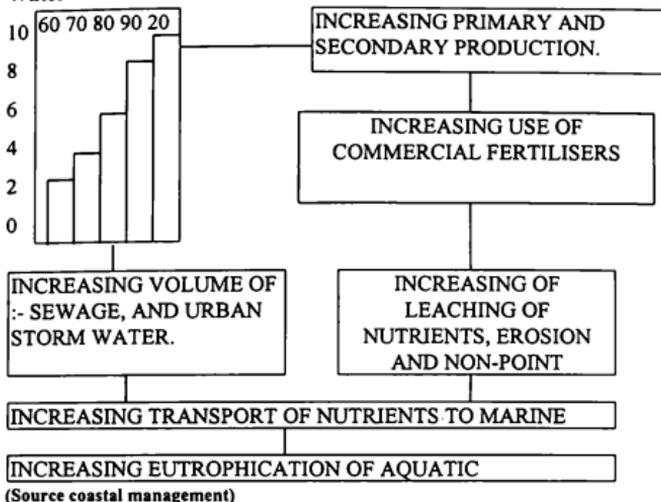
Increased agricultural production caused by increased demand for agricultural products through the increased use of fertilizers, which created environmental problems from pesticides that pollute the environmental.

There is a need for an integrated environmental legislation instead of the separate laws used today i.e. Air-Water-Soil regulation these duplicate resources within different government ministries and are ineffective to achieve the required environmental standards.

Population growth in the urban towns caused by developments and tourism increased pressure to sanitation and created room for inadequate treatment of sewerage's and disposal facilities.

Mombasa discharges sewage water into the Indian ocean and the disposed sewage into the sea remains a serious problem because bacterial degradation of sewage is known to reduce the dissolved oxygen that interferes with phytoplankton productivity. (UN conference on Human Environment Nairobi, June 1971,p 69.)

TABLE XV Increased World Population and Nutrient Flux from Land to Water



Some bacteria are health risk to human and economic activities because consumption of contaminated seafood's or fish may cause gastro-intestinal disorders, while bathing in contaminated waters can cause infections and when this happens the health inspectors ban bathing and fishing on contaminated areas losing the economic opportunities .

The problems caused by sewage waste to the marine environment can be controlled through proper disposal methods and sewage treatment used in reducing nutrient contents.

Phosphorous in washing detergent also increases the non point pollution and nutrient loss and nitrites by rivers increases eutrophication of marine waters and Loss of nutrients encourages use of fertilisers and animal manure on farms whose

concentration makes recycling of nutrients difficult with high risk of water pollution, where eutrophication in sewage may change from municipal point to non-point source.

Loss of nutrients encourages use of fertilisers and animal manure on farms whose concentration makes recycling of nutrients difficult with high risk of water pollution, eutrophication in sewage may change from municipal point to non-point source.

Reduction of population will reduce use of fertilisers, food consumption and pollution reduction of flux nutrients.

Improve the recycling of nutrients by using methods which recovers phosphorous in municipal sewage treatment plants, while nutrient recycling will prevent eutrophication of inland and marine water resources.

Any activity which interferes with the drainage system of coastal rivers will reduce the nutrients in the sea which will reduce the fish because these are food for some organisms that feed fish.

3.2 EFFECTS OF LAND BASED POLLUTION TO THE MARINE ENVIRONMENT

Interference in Athi river will affect National Marine park in Malindi. This may increase the effluents into the sea because installation of things like hydro-electric would increase the number of industries that will end up generating a lot of effluent. Measures to be considered for control are;

- Control of siltation to save coral reefs.
- Better management to improve the growing of mangroves.
- Effort to minimise land-based pollution.
- Public awareness of environmental protection.

CHAPTER 4

4 THE RELATION OF NAVIGATION TO ENVIRONMENTAL PROTECTION:

4.1 MARINE TRAFFIC MANAGEMENT

The IMO developed guidelines for the designation of particularly sensitive sea areas where maritime traffic may be subjected to special regulations to protect the area from marine pollution.

4.2 NAVIGATION

There are many factors to consider for the ships safe navigation, their dimensions and types, their movement and berthing the design and management of ports, number of ships, water berth, channels, weather, reception, handling, treatment of dangerous cargo, reception facilities and human factors all have high environmental risks.

Dredging the harbours in order to expand the channels for safe navigation increases costs interferes with sport and pleasure sporting and marine disturbance. Priority should be given to measures related to good navigation and compliance with existing rules and regulations.

Mombasa has adequate navigation aids for ship safety in coastal waters and to minimise the potential risks to the environment from those carrying hazardous or

polluting cargoes. Vessel Traffic Services and the use of pilot advice and support are important pollution control methods when there is co-operation between him, the shipmaster and on board crew. It is compulsory to use pilot services in Mombasa port.

4.3 TRAFFIC SEPARATION SCHEMES

The introduction of TSS under the convention on the international regulations for the preventing collision at sea 1972 became mandatory for shipping of all countries in 1997. The purpose of TSS was to lanes. In reduce the risk of collision in congested waters by separating sea traffic into one-way.

In Mombasa Port, the Kenya Ports Authority has provided navigation rules and regulations to be followed by vessels, navigation equipment's used are lighthouse, buoys, beacons, tugs, pilots, and mooring boats.

4.4 AREAS SENSITIVE TO POLLUTION

In Kenya the coastal zone management is under the responsibility of the Coast. Development Authority whose duty is to establish policies which includes coastal zone in the national economic and physical plan.

4.4.1 To Prevent and Control of Environmental Degradation in Coastal Areas.

Preparation and implementation of contingency plans for handling oil pollution disasters. Promote bilateral and multilateral training with other countries whose coastal zone management has already been established.

4.5 SPECIAL PROTECTED AREA

United Nations Convention For The Life Of The Sea (UNCLOS) Article 194.5-gives the coastal states an obligation to protect and preserve rare or fragile ecosystems as well as the habitat of other forms of marine life.

Agenda 21 of United Nations Conference On Environmental And Development (UNCED) supports the establishment of Marine Protected Areas as one way of sustainable use of the oceans. Regional agreements may also promote the establishment of Marine Protected Areas such as the UN, Nairobi Convention For Eastern Africa. Kenya signed the conventional trade in endangered species of wild Fauna and Flora (CITES) on January 1988..

Marine protected areas are legally designated areas to protect marine plants, animals and ecosystem. Human activities may be limited in certain ways in these areas to protect the Kenya marine heritage. These protected areas are used as a tool for conservation of marine biodiversity and ecological importance.

Environmental conservation protects unique, critical and productive habitats / because the ecosystem and resources face many threats, pollution, habitat degradation and competing industrial developments.

Areas requiring special protection the protection of unique and/or critical areas or ecosystem that is spawning, breeding, feeding areas. Conservation of species of commercial importance such as fish, lobster to mention but a few The conservation of threatened or endangered species or stocks such as whales and others., Preservation of biological productive area e.g. marshes or estuary. the conservation of representative areas or sampling of all marine ecosystems. Research and monitoring. public use and education e.g. recreational, tourism activities. Protection

of cultural resources i.e. historical or archaeological resources. The IMO addresses the “Special Areas” under the MARPOL 73/78 annex 1 oil and V garbage and the new annex 11.

4.6 MARINE PARKS IN KENYA

The initiative to create marine began at the local level through a co-ordination of local officials, users, environmentalists and the government. Three marine parks were established to protect marine ecosystems and their resource production.

Kiunga marine national park (north coast), Mpungu and Diani marine national park (south coast) are the main marine parks.

Other protected areas are: 22 National Parks, 25 Natural Reserves, and 14 Resource Reserves Boni Forest which has the almost extinct and now protected elephants which were heavily poached. Bodeni Forest is habited by Dugong Dugon and marine green turtle chelonias.

Marine parks succeeded in Kenya because there was increased local involvement during the designation process and they are highly regulated with high penalties. Kenya national conservation policies and regulations are enforced by various Government ministries of Environment and Natural Resources, Tourism and wildlife, Agriculture and Water Development.

The Ministry of Environment and Natural Resources is responsible for co-ordinating all environmental and conservation matters in the country. The wildlife conservation and management department of the Ministry of Tourism and Wildlife has a management plan for national parks and game reserves. Fisheries Department is responsible for the management and control of the country’s marine.

Research is done to help improve the management of protected areas and its done with outside experts, institutions of higher education and the universities. Personnel are trained in universities and other institution of higher education except the forest and wildlife rangers trained at the Kenya Administrative Police College

People who in national parks and forest reserves come within that locality and are allowed to utilise some resources e.g. cattle grazing in buffer zones and the local authorities get part of the profits from national parks for local development.

4.7 SPECIES

Southern banded harner eagle-found only in Kenya coastal and mainland Tanzania. Red -necked falcon -found in Kenya coastal Tana river ,Tsavo East and lake Turkana. Kilimanjaro honey guide-found in Kenya coast, Shimba Hills, Sokoke, Sigor and Longelai. Malindi pipit-found only in Kenya coast. Maphis only found in Lamu and no where else outside Kenya. Cisticola is only found in Kenya in Tana river area.

4.8 THE BENEFITS OF MARINE PARKS PROTECTION

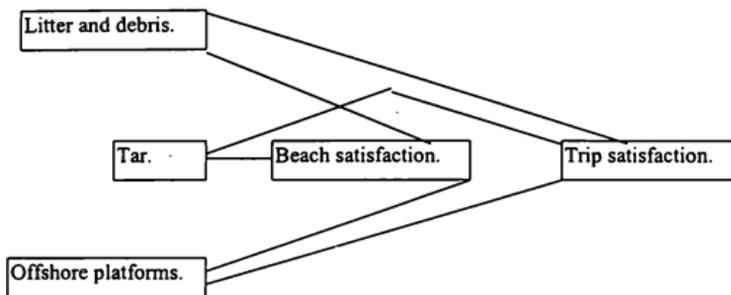
Marine parks have both economic and ecological benefits. They support economic developments that provide jobs in havestable, renewable and non-renewable resources, i.e. fish and non-consumptive uses like tourism and recreation. They also maintain natural balance of the environment by protecting genetic resources and biological diversity.

They are good for scientific research, ecological monitoring and education. However the effectiveness of these protected areas is determined by who benefits from the development and who pays for the cost of protection.

Nature tourism is a good way to ensure the balance between economic and ecological benefits from protected areas, direct use benefits from recreation, reflects that proper park management prevents damage to the marine ecosystem.

Relationship between Impact Perceptions, Beach Satisfaction, and Trip Satisfaction..

FIG: 4.1 Relationship between Impact Perceptions, Beach Satisfaction and Trip Satisfaction



Debris and litter on the beach means that there are high chances of getting dirty from tar and this effects their popularity because tourists pass the message very quickly and they influence trip satisfaction through the beach grading.

Debris & litter have indirect effect of getting dirty from oil or tar the two affect beach and trip satisfaction. Seeing offshore platforms adjacent to the seashore do not effect beach and trip satisfaction.

4.9 SHIP WRECKING

There has been interest by many people to salvage ships under the sea and to preserve them because of their future value and for restoration in the museums. These ships have been in the bottom of the sea for many years and have been good habitation for many marine organisms, and when they get disturbed some die in the process and others spread to other areas of the sea and have effect on the existing environment some because the new natural habitation is not suitable for that particular species.

CHAPTER 5

5 THE ROLE OF INTERNATIONAL MARITIME ORGANISATION;(IMO)

AND THE ENVIRONMENTAL PROTECTION POLICIES

The International Maritime Organisation,(IMO) was established in 1958 to deal with shipping matters since the shipping industry was the most important mode of transport. IMO is the specialised agency of the UN dealing with maritime industry.

5.1 THE PURPOSE OF THE INTERNATIONAL MARITIME ORGANISATION

The aim of the IMO is to improve safety at sea and protect the environment with the theme “Safe Ship and Clean Seas.”

The MARPOL/73/78 and STCW conventions are the instruments for the protection of environment to be implemented by party states and the shipping companies. Flag states establishes the authorities responsible for the control mechanism of these international regulations through the national legislation's and be supported by port state controls.

The STCW/73/95 will provide the shipping industry with competent and qualified seafarers who are capable of maintaining good seamanship, the required standards

and be capable to deal with emergencies in order to safe human and protect the environment.

The Marine Environment Protection Committee,(MEPC) formulate rules on protection of the marine environment, the interpretation and application of MARPOL/73/78 provisions and amendments.

The MEPC is composed of marine experts and whatever they recommend is very crucial because finally it will be implemented by party states through their national legislation or law. It is therefore very important for MEPC to provide party states with proper information that will help in solving or reducing the marine pollution.

Identification of sensitive sea areas: There has been requests by many countries to have areas within their waters to be protected when they contain some natural resources that is valuable, the IMO is then informed and looks at the application and when it is accepted its then declared a special area. Special protected areas are important because they preserve very important marine species that are rare or almost extinct and when they are lost can never be regained or in most cases takes long time to be recovered.

Prevention of pollution by harmful substances: Many ports in most cases have to handle cargo containing dangerous substances which need to be handled with care because they are harmful to human and when mishandled can damage the marine environment. The IMO considering such factors and being concerned of human and environmental risks adopted the IMDG code to help in the identification, handling, and transportation as such reduces the risks involved and environmental pollution.

The IMO provided the Kenya government with technical assistance and trained the personnel involved in the restructuring of the existing marine pollution contingency plans and the establishment of an oil pollution response and preparedness

contingency plan for combating emergency oil spills in Eastern Africa Region. This is a major development to the region because the Eastern Africa coastline has very important resources sensitive to any kind of pollution and when damaged will have long term effects like habitat imbalances and migration to other regions.

The Kenya government has benefited from the IMO when she replaced her old navigation equipment's with modern ones, due to technological development maritime communication need to be updated to maintain safe navigation that will help reduce accidents and prevent environmental pollution. Safe navigation of ships within the port areas has to be improved because of the many activities that take place at the same time and so very easy to have ship colliding with each other or other equipment's.

The IMO is involved in port advisory services particularly port reception facilities, port re organisation, navigation, piloting port operation, radio communication, hydrographic surveys and administration. These services are very essential because they have improved port management services and operations that has made them attractive to shippers and become load centres with many development, multiplier effects and brings income through taxation and import duties. Unfortunately this money is never in the preservation or the protection of the environment.

The modern technology has an impact on electronic communication which has complicated the mail systems and also made it more efficient and most reliable this bring changes in their documentation which need to be modified to make them simple for quick and delivery and handling the IMO in this case works with other organisations in simplification of documents to make them standardised

5.2 TRAINING

Residential based training colleges necessary for ships officers are expensive especially when most seafarers have to finance their education. Formal marine training programmes are provided in developed countries with many years of shipping and fisheries and informal education is essential for work experience through short courses, workshops, seminars and conferences, internships, various type of work assignments and distance learning.

Public awareness and education on environmental protection is done through NGO, and the media such as radio, television, news papers etc. because they increase attention, generates changes in public policy, in political and socio-economic, encourages involvement, and creates commitment and interest to individuals or community. This is most important because in the 1990s attention has shifted from protection to education and awareness as the most effective tool for environmental protection.

IMO courses and seminars led to the conference on STCW 1978 and the establishment of World Maritime University in order help young countries develop and improve their maritime industry through personnel training. The IMO provide internships and fellowship schemes to support on job training and assignments in other countries in order to give operational experience, professional knowledge and experience which updates managerial skills for solving problems.

IMO has helped nearly all developing countries in establishing their maritime schools for marine studies. IMO was involved in establishing Bandari college for Kenya ports in Mombasa in 1980, and has supported many seminars and workshops. Bandari college was originally aimed to train the Kenya ports personnel and since 1990 it has been training people from shipping companies, clearing and forwarding

companies not only from Kenya but also from other African countries. The college has three departments.

- The Technical Training Department.
- The Operation Training Department.
- The Marine Training Department (Seafarers, search and rescue etc.).

Bandari College needs to be the training centre for marine pollution control.

There other institutions that offer general transport studies under the ministry of Technical Training and Applied Technology. These could be improved to include marine studies in order to introduce maritime transport to young people. These colleges are:

- The Kenya Polytechnic Nairobi, Kenya. (Transport Economics and Physical Distribution Management).
- Kabete Training Institute, Kabete, Nairobi.(Transport Studies)
- Kimathi Institute Of Technology, Nyeri, Kenya.(Transport Studies)
- The Kenya railway Institute. Nairobi, Kenya.(Transport Studies).
- Daystar University, Athi River Campus near Nairobi.(BSc Communication).
- The Kenya Telecommunication Institute, Nairobi.(ITU) Diploma in Telecommunication).
- The Kenya Institute Of Mass and Communication. Nairobi.(Diploma in Mass and Communication).
- Utalii College, Nairobi. (Tourism and Hotel Management).

All these institutions except Daystar University are similar in their management and resource implications.

5.3 RESEARCH.

With 75 % of all ship losses and accidents resulting from human error, research into the use of machine by man is an important project and a good tool for research is a simulator but automation continues to reduce the personnel, and the double use of the watch keepers means that most effort must be directed to ensure safety and efficient operation that will reduce marine pollution.

There are research institutions dealing with marine species which includes;

- The Kenya Marine And Fisheries Research Institute, Mombasa.
- The Kenya Mamba Park for the protection of harvestable crocodile in Lamu near Mombasa.

5.4 RESOURCE IMPLICATION

Most of these institutions fail after a few years due to improper allocation of responsibilities, lack of competent and committed lecturers whose salaries are low when compared with those of private organisations miss allocation or misappropriation of resources both human and funds.

Poor management that will not evaluate their performance against the required goals and objectives leave the colleges without funds when the government is no longer able to support them and the administration is left to run organisations that are no longer sustainable.

The result is that about 40% of students who leave school go to study overseas exporting the most expensive foreign currency and leaving the burden with the parents.

5.5 FUTURE DEVELOPMENT OF IMO CONVENTION RELATING TO ACCIDENTAL MARINE POLLUTION

The future development of the IMO convention which relates to marine pollution will be the implementation of MARPOL/73/78 Annex 6 on environmental pollution by air from ships. and the effects of the SOLAS /74/78 IMO, ISM code whose future impact in the shipping industry, seaworthiness of the seafarers will be known after phasing out the old certificates in 1. 2.2002.

The other future development of the IMO will be the outcome of the meeting on 2000 to decide the MEPC draft text of new OPRC protocol or the Nox Technical code requirements.

The intended revision of annex 1V of MARPOL requirement which will be considered by the MEPC 42 in November 1998 to establish the reason why governments have not ratified annex 1V.

At the MEPC 40, they considered the application of MARPOL requirements to Floating Production Storage and Off loading Units and Floating Storage Units but the requirements for such facilities will be clarified in future. On 1.2.1999 the North Western European waters special area will enter into force as adopted by resolution on amendment to regulation 10 of MARPOL annex 1.

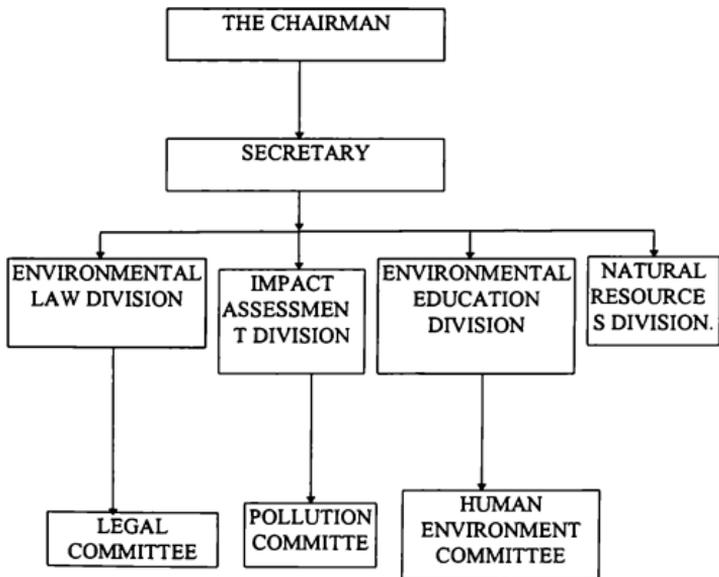
The recent acceptance of the performance standard for Raster chart display systems which allows for the dual use of both vector and raster charts to improve navigation safety will also have an impact on environment pollution control. There is a possibility that the ILO will update its marine rules so that they will have a long term effect on labour standards in support of the ISM code because a quarter of their

instruments are related to the marine and must be up dated to keep the same standards as the IMO which keep revising their instruments.

CHAPTER 6

6.1 ADMINISTRATIVE STRUCTURE FOR ENVIRONMENTAL MANAGEMENT

FIGURE II The National Environmental Secretariat.



The Ministry of Environment and Natural Resources is responsible for environmental management, policy and pollution emergencies through National Environmental Secretariat.

The National Environment Secretariat was set up by the late president Jomo Kenyatta in 1974 under the laws of Kenya Act No. 5, 1969. to look at the environmental impact.

The National Environmental Secretariat collects environmental reports from other ministries whose activities are related to the environment for impact assessment and evaluation to find out where to direct their resources. They are also responsible for setting and enforcing environment control regulations and standards.

They constantly review the environmental laws according to the revision of international conventions. The National Environmental Secretariat has four departments with more than 100 people.

- Impact assessment department.
- Natural resources department.
- Environmental law department.
- Environmental education department.

There is a 50 member inter-ministerial committee from various government ministries, parastatals and Ngo's which formulates policies and recommends investment proposals to the Government.

The national Anti-marine pollution committee also consists of representatives from government ministries, private industries including hotels and Ngos. They prepare

the contingency plan that respond to oil spill pollution within the coastal area. resources are pooled from all represented institutions and the Kenya Navy.

The Environmental Law Committee deals with Legal environment control and regulations and also prepares documents for the annual UNEP governing council meetings in Nairobi.

The National Environment Secretariat and the ministry of water development has improve the water quality and environment through regular inspections and water conservation and waste disposal methods.

CHAPTER 7.

7.1 THE KENYAN OIL PREVENTION PLAN

The Kenya Coast Oil Spill Contingency Plan is for combating oil spills along the coastal waters with Mombasa as the control centre. Any on-scene station may be temporarily located at the place of incident with the Harbour Master as the commanding officer.

7.1.1 The National Anti-Marine Pollution.

The National Anti-Marine Pollution is based in Nairobi. Its framework is composed of a Chairman, an official of the government, a vice Chairman is from the oil industry, the secretary, is elected from the other committee members. The committee members are 13 (inclusive of the secretary) and they come from various governmental and private organisations. This Committee comprises the National Anti-Marine Pollution and is in-charge of combating any emergency oil spill in Kenya.

The members are from the following ministries; the Ministry of Environment and Natural resources, the Ministry of Water Development, Ministry of Foreign Affairs; The Director of Fisheries and the Provincial Commissioner of the Coast Province are members to the committee. Other agencies which are represented are the Kenya Navy, Kenya Ports Authority and, Kenya Merchant Shipping, Kenya Marine and Fisheries Institute, a representative of Hotel Worker's Association, Kenya Oil

Refineries, and as already mentioned, a representative of the oil companies is the Vice-Chairman.

With such a varied representation, the Kenyan government has tried to include those ministries and companies that would act responsibly and with understanding in case of an oil spill disaster.

7.2 NATIONAL CONTINGENCY PLANS.

As already mentioned in chapter 2, Kenya has two contingency plans.

- Mombasa Port (Kilindini Oil Spill) Contingency Plan
- Kenya Coast Oil Spill Contingency Plan

7.2.1 Mombasa Port (Kilindini Oil Spill) Contingency Plan

The Anti-Marine Pollution Committee has identified Kipevu Oil Terminal, Shimazi Oil Terminal and the Coast Oil Jetty as the most sensitive areas of the port. In order to adequately focus on the activities in these areas, the Mombasa (Kilindini) Port Contingency Plan was formed. The equipment for combating is kept and maintained at these points, hence ready for use in case of a disaster.

7.2.2 Kenya Coast Oil Spill Contingency Plan

The Kenya Oil Spill Contingency Plan was formed for combating oil spills along the Kenyan coastal waters, with Mombasa, the main port, as the control centre. The Kenya Ports Authority is responsible for recruiting, training, acquiring material and to maintains equipment for combating oil pollution.

Mock oil spills especially on the proper use of oil recovery equipment, temporary storage to mention but a few, are performed in order to train staff on individual duties.

7.2 CO-OPERATING ORGANISATION FOR COMBATING OIL POLLUTION

If there is a oil spill emergency, a lot of other organisations would have to be involved in order to cope adequately with the disaster. The following government ministries would be involved in the exercise:

The Merchant Shipping superintendent (which deals with maritime safety and pollution), the Kenya Navy, the Marine Police, the Ministry of Tourism and Wildlife, the Ministry of Natural Resources Fisheries Department, the Ministry of Environment Marine Protection Department, Ministries of Commerce and Industry, Foreign Affairs (which would be involved in seeking external fund should the need arise), the Ministry of Labour as it is in-charge of taking care of the seafarers, and the Attorney General, who is the government's legal advisor.

7.3 INDUSTRY PARTICIPATION

As already shown, the industry is well represented in the National Anti-Marine Pollution Committee. These companies also contribute to the Oil Spill Emergency Fund.

The government provides the framework, implements the policies and also contributes to the available resources. This assistance may financial, technical and/or personnel appointments through the different ministries, parastatals or corporations.

7.3.1 The Management Policy For The Industry

What is expected from the industry in order to achieve a particular environmental objective? This may be a specific emission reduction for industry that will then be translated into targets for different sectors.

The process starts with all industries making a commitment of the level of emission that they are going to allow. The Ministry scrutinises the format of the proposal from the industry. The format is agreed upon by both parties, and then approved by the ministry concerned. Licences will be awarded and guaranteed so long as the acceptable level of control is maintained.

Using the approved document, individual companies adopt the same format as the basis for achieving the targets. The company then passes this document to every department as measure for reducing a specific pollution emission.

Hence we can say that, the industry and the pollution control authority form an integrated environment plan that requires the industry to take pollution control measures and the pollution authority use that as a licensing policy for that particular company.

7.3.2 The Environmental Plan For The Company

In order for the company to meet its targets, it produces a five-year company environmental plan in co-operation with the licensing authority that sets their detailed methods. The company endeavours to achieve the objectives of the integrated environmental plan using the available technology, resources and best

environmental practices. The objectives specify the measure that each company has to take to achieve the long term environmental quality objectives (EQOs).

The pollution control authorities adhere to each company's environmental plan as a licensing policy for that company, and the company benefits from consistent licensing.

7.3.3 In-House Environmental Management

An in-house environmental management scheme is useful and it can assist the companies in getting access to organisational, administrative and technical facilities to achieve the necessary environmental measures.

7.4 INTERNATIONAL PLANS AND POLICIES

The international community in its commitment to environmental disaster management, has formed international regulations that require governments to have oil response plans capable of protecting the marine environment during an emergency.

The International Maritime Organisation (IMO) has the following instruments in dealing with the issue:

- MARPOL/73/78 regulation 26 of Annex 1 MARPOL makes the carriage of shipboard oil pollution emergency plan and IOPP certificates mandatory under port state control procedures.
- The OPRC 1990 Article 3 is an onboard ship oil emergency contingency plan and in Article 4 the responsibility of the master in reporting a discharge or probable discharge of oil is exemplified.

- The government is required by OPRC to form an emergency response to protect the marine environment and consider the existing national and international requirements for standardised training, contingency planning and response requirements of the shipping industry, off-shore oil industry, harbours, ports and terminals and a co-ordinating government body.
- OPRC also requires the governments to co-operate with industries in providing the national pollution response plan authority with adequate resources.

2. The Nairobi Convention and Protocol of 1985, Article 11, requires co-operation in combating pollution in cases of emergency for Eastern Africa. The signatories to the protocol are Kenya, Comoros, Reunion, Madagascar, Seychelles, Somalia, Tanzania.

7.4.1 Intergrated IMO Conventions in Preventing Pollution

SOLAS and STCW conventions have been revised in order to make the maritime industry more aware on the danger of polluting the environment. The revised STCW 95 will also change the recruitment and training of seafarers with a view to making the personnel onboard ships more competent.

The revised SOLAS 74 convention will change the current safety and environmental protection plan for the whole shipping industry. It will have positive effect on ship administration, the flag states, port state administration, classification societies the P&I clubs, and the underwriters. The recommended methods for implementation are those in conformity with the international conventions and the IMO resolutions.

The organisations are required to produce the prevention plans and structures and the government is required to ratify and enact all IMO conventions into the national

merchant shipping acts in order to discharge their obligations as a flag states through the port state control administration.

These requirements are technical measures of seaworthiness for vessels and the crew, and regulatory to enforce the international conventions and regional protocols. Kenya should ratify the SOLAS Convention and other international conventions in order to participate fully in port state control.

7.5 ENVIRONMENTAL EDUCATION

As the STCW rightly stresses, the importance of proper training on board. This section will look into training needs for combating pollution in an oil spill

Agenda 21, chapter 36 of the United Nations Convention for Environment and Development (UNCED) or the Earth Summit held in Rio De Janeiro, Brazil, in 1992, required governments to prepare national environmental education programmes within three years, from 1992, in order to deal with environmental problems, which have been increased urbanisation and uncontrolled developments.

7.5.1 Oil Spill Training

The objective of training is to develop competent personnel who can operate the equipment more efficiently, handle hazardous cargo safely, protect the sensitive environment and habitats and learn how to familiarise with oil spill exercises during the co-ordination of procedures and responsibilities. Classroom and field training programmes in an education centre is better oriented teaching than learning through experience that takes time, is costly and may be inefficient.

Training seafarers in methods of combating oil spills is cost effective since oil contingency plan requirements in vessels are mandatory. When personnel are trained, they acquire knowledge in international regulations dealing with emergency oil pollution, and operational skills giving them the ability to maximize use of the equipment onboard. All this saves cost as it is easier to prevent pollution than combat it.

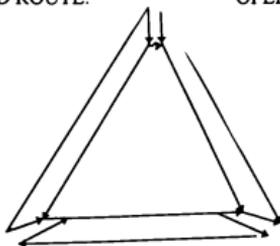
7.5.2 Small Oil Spill Prevention Education Strategy

Oil spill prevention triangle helps to deal with small oil spills, to identify the specific oil spill problems and provides the best management practises to deal with the spills from vessels and facilities of all sizes.

FIGURE IV The Oil Spill Triangle.

OVERBOARD ROUTE.

OPERATIONAL FAILURE.



OIL PRODUCT.

The Oil Spill Triangle has three legs or elements which help to identify preventive measures relevant to the type of problem and the available resources for management practice. Each of these elements has specific areas or sub-elements:

- Prevention sub-element: this is source controlled Best Management Practices (BMPs).
- Operational sub-element: Best Management Practices (BMPs).
- Treatment sub-element: Best Management practises (BMPs).

TABLE XVI Prevention Methods For Oil Spills

On the left-hand column, we have the triangle element while the right-hand column gives preventive measures.

Oil Spill Prevention Triangle: Elements and Sub-elements.	
Triangle Element (Problem)	Sub-element (Solution)
Oil Spill Prevention Triangle Element.	Prevention Sub-elements.
Oil Product (Source Control bmps).	Use Reduction.
	Handling Reduction.
Operational Failure (Operational bmps).	Planning.
	Training.
	Maintenance.
Overboard Route (Treatment bmps).	Primary Containment
	Secondary Containment.

7.5.3 Oil Produce Source Control:

As shown in the diagram above, source control best management practices are all prevention measures that are used in the reduction of spills from vessels and facilities from source. Suggestions for action are given for best use of oil collection, transport handling and disposal of oil waste to prevent it from polluting the environment and/or endanger human life.

7.5.4 Operational Failure Best Management Procedures:

Operational failure best management procedures include measures that prevent the equipment failure by regular checking and services. Personnel are trained on best use of equipment handling and services in order to prevent equipment break-down. Maintenance involves the regular maintenance of the equipment to prevent total failure. Equipment maintenance should be done at regular intervals, that is to say daily check-ups for oil leakage's etc., and pre-planned services as recommended by The manufacturers.

7.5.2.3 Overboard Route Maintenance

Overboard route treatment involves oil prevention measures taken onboard ship to reduce or contain minor leaks and spills or regular checks and maintenance during the ship's stop at a particular route.

By using the methods that are discussed in this chapter, the people who are responsible for prevention of marine environmental pollution in Kenyan, will have an operational environment contingency plan that will be beneficial to the country.

CHAPTER 8

CONCLUSION AND RECOMMENDATIONS:

The existing Kenyan coast management legislation, does not provide the most efficient management framework capable of achieving the proposed goals and objectives for dealing with land-based pollution, or operational and accidental pollution from ships. The following areas have been found lacking in this study and the author highlights them, giving possible remedies for action to improve the situation.

The political structure for the last 20 years, and the economic model based on central planning has not facilitated the development of efficient environmental planning. Strict control of information by the government, about environmental pollution which has been taken time to reach and ignorance about environmental issues by the public, has hindered the sustainability of the marine environment for Kenya's coast.

In the budget, there are many government departments who are fighting for the same national pot, the marine environment management sector does not receive adequate funds as it should. The question is, what should take priority, education and teachers salaries or environmental management? The answer to this heavily weighs against environment.

However, lack of adequate personnel qualified in environmental management needs to be looked into by training personnel in institutes of higher learning. Environmental

management should also be taught in schools, preferably be incorporated in the school curricula as mandated by Chapter 36 of Agenda 21 of Rio 1992. By using those people who are already trained in the subject, the government will be win in educating the general public on environmental awareness.

Government departments should be co-ordinated in order to stop duplicating legislation and resources between ministries. All environmental issues should be addressed through one legislation under the Ministry of Environment which should co-ordinate with other ministries on environmental issues. It is also important to decentralise the general environmental management structure.

As environmental disasters go beyond borders, co-operation with regional and international community in their effort to protect marine pollution problem should be sought. This may be done through establishing environmental monitoring programmes for the Eastern African region that involves scientists, administrators, NGOs, etc.. Since this would be an international committee, they would identify, through an independent environmental audit, flexible environmental considerations based on knowledge, transparency and verification, without undue influence from any government body.

There is also the need to establish a regional co-operation of port state control administration in Eastern Africa, such as the Paris Memorandum of Understanding (MOU) on Port State Control that has developed for Europe that has become an effective inspection programme.

It is important for Kenya to ratify the SOLAS convention and other international conventions, e.g. ISM Code, in order to participate fully in those conventions as they are an asset to the country.

The Kenya coast is very productive and appealing for business, there is enormous pressure from human activities. To curb misuse of resources and encourage sustainable development, an integrated management with conservation policy emphasis needs to be introduced and maintained.

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