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Environmental issues in coastal waters – Pakistan as a case study

By

NAVED SAYIED
Pakistan

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

MASTER OF SCIENCE

In

MARITIME LAW AND POLICY

2007

DECLARATION

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

The content of this dissertation reflects my own personal views, and are not necessarily endorsed by the university.

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ABSTRACT

Title of Dissertation : Environmental issues in coastal waters – Pakistan as a Case
Study

Degree   : MSc

Pollution is on the rise as population increases. Some states take steps to curtail pollution
while others hardly consider pollution as an issue. There are various international and
regional conventions to control and stop pollution. As water forms over 70% of the world,
the threat to the marine ecosystem is also numerous.

Human beings are the superior creation of god and have the right to enjoy and live , the
biodiversity concept is the understanding of the human , the habitat and other living
organisms and how they interact with each other. Thus it is the atmospheres
encompassing all life forms that must be considered for this assessment.

Marine pollution is also on the rise both due to land- based sources and sea sources. It is
the national policies and the enactment of the legislations that set the tone of the nation
towards pollution control . Some nations have economic constraints and lack resources
which leads to depletion of the marine ecosystem.

Pakistan is a developing country which depends on agriculture and hydral power. The
Indus river water is channalised to create power and sustain agriculture. This is causing
the mangroves to deplete due to reduced water and silt. A balance has to be made in
between the water requirement for power, agriculture and mangroves as all of them are
important and possess an equal and important place in the ecosystem.

The national policies should move towards optimum utilization of the resources, and be in
line with the international conventions and policies for standardization and harmony.

TABLE OF CONTENT

List of Table

List of Figures

List of Abbreviations

AWB	Area Water Boards
BAP	Biodiversity Action Plan
BOD	Biochemical Oxygen Demand
CBWM	Canadian Ballast Water Management Guidelines
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species
CDGK	City District Government Karachi
DDT	Dichloro-Diphenyl-Trichloroethane
DETR	Department of the Environment, Transport and the Regions
EAA	Environmental Assessment Association
EIA	Environmental Impact Assessment
EEZ	Exclusive Economic Zone
ESM	Environmentally Sound Management
FEPA	Federal Environmental Protection Agency
GESAMP	Group of Experts on the Scientific Aspect Of Marine Environment Pollution
G I S P	Global Invasion Species Programme
GPA	Global Programme of Action
HITE	Hub Industrial Trading Estate
IMO	International Maritime Organization
ITOPF	International Tankers Owners Pollution Federation
IRSA	Indus River Systems Authority
KIA	Korangi Industrial Area
KPT	Karachi Port Trust
KMC	Karachi Municipal Corporation
LITE	Landhi Industrial Trading Estate
LSB	Land-Based Sources
MAF	Million Acre Feet
MECP	Marine Environment Protection Committee
MAFF	Ministry of Agriculture, Fisheries and Food
MACP	Mountain Area Conservancy Project
MSA	Maritime Security Agency
NEQS	National Environmental Quality Standards
NCS	National Conservation Strategy
NCP	National Contingency Plan
NIP	National Implementation Plan
OECD	Organization for Economic development Co-operation and Development
OPRC	Oil Pollution Preparedness, Response and Co-operation
PAH	Polycyclic Aromatic Hydrocarbons

PEPO	Pakistan Environmental Protection Ordinance
PEP Act	Pakistan Environmental Protection Act
PIDA	Provincial Irrigation & Drainage Authorities
PCB	Polychlorinated Biphenyls
POP	Persistent Organic Pollutants
ROPME	Regional Organization For The Protection Of The Marine Environment
SASAP	South Asian Seas Action Plan
SITE	Sindh Industrial Trading Estate
TBT	Tributyltin
UC	Union Council
UNDP	United Nation Development Programme

CHAPTER 1

ENVIRONMENTAL ISSUES IN THE COASTAL WATER

1.1   INTRODUCTION

As population grows rapidly, development in all walks of life also takes place, thus creating a pressure on the resources. The percentage of population in the coastal area is much higher than that living in the area away from the coast. Pakistan is a developing country and the concentration of population is in Karachi, the only port city of the country. Population influx creates a direct pressure on the coastal resources, both natural and manmade. The coastal regions possess unique geological, ecological and biological characteristics, which are distinct for nature. They are not just important to humans but they have their own significance with respect to terrestrial and aquatic life forms. The coastal area is one of the most productive areas which provides fish and other seafood but also helps trade in immense volume. The coastal ecosystem is an amalgamation of interconnected subsystems whose function cannot be duplicated anywhere else. The estuaries which have the unique characteristics of fresh and sea water mixture consist of a wide range of fish, other seafood such as shrimps, prawns, numerous plants and other biota. This habitat also provides a natural filtering process where by impurities are removed as a natural process thereby balancing this fragile system and maintaining a balance in the ecosystem. This form of habitat is very fragile and susceptible to various threats, some of which natural while others are manmade. In spite of these the inherent fragility of the ecosystem is quite resilient; it has a magnificent regeneration process but only to some extent provided the degradation is not continuous.

People living in coastal areas, require most of the resources from the sea. Karachi, like other coastal areas is thickly populated because of better and diversified job

opportunities which challenge the ecosystem. The smoke from the vehicles, factories, and chemical waste from dumping of garbage, sewage, alien species and oil all have a negative effect on the ecosystem. All these factors interfere with the natural processes of the coast and prevent the sustainability of the environment. A threat from any one may not be so dangerous but a cumulative pressure to the ecosystem may be catastrophic. Areas like Indus Delta where there is an abundance of resources such as wild habitat, fish, and wetlands are more vulnerable as they attract humans towards them. Such areas are endangered from the cumulative danger of manmade pollution.

Human intervention with the ecosystem has been the most detrimental in balancing the equilibrium. The wastes produced by humans are ever increasing and there is a limit to what the system can regenerate. There should be a curtailment of waste and sustainability towards a curtailment process, thereby allowing the regeneration process to adapt to the situation and take over the natural healing phenomena. Sustainability leads to progression whereas development leads towards betterment. We cannot expect society to start moving backward. What we need to do is to change the way we think, for every development we need to analyse the environmental implication of the development. How to implement is a matter of individual opinion rather than the basic rule. Each implementation would have its own perspectives of the environment and views of nature. Sustainable development involves maintaining our current rate of development whilst leaving suitable resources behind for later generations to continue to develop. In this context then, environmental problems must be tackled by considering their relationship with the state of the economy and the wellbeing of society. In fact, the environment, the economy and society taken together, include everything that we need to consider for a healthy, prosperous and stable life. Although sustainable development is about integrating the environment, society and economy, the economy, and in turn society exist within the wider context of the environment. Protection of the environment, therefore, resides at the core of Sustainable Development. In the report "Our

Common Future" known as the Brundtland Report, Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generation to meet their own needs" (Brundland,1983) .

Sustainable development does not restrict development, which has been a misnomer for quite some time. What it actually emphasizes is that all activities must have an environmental element inculcated in them. It is up to the government agencies of the countries to regulate such policies. To strike a balance between the economical development and the preservation of the environment the political mind must have the will and foresight to see the implications.

There is no distinct delineation of the coastal zones. Some areas protect the natural resources from human activities while on the other hand humans are protected from the coastal hazards. The natural resources are not found in a straight line and thus the delineation of boundaries may not coincide with management or political boundaries, which affects the ecosystem. The coastal zones thus have a fragile, non consistent area which is dynamic in nature. The dynamism of this area is due to the land, water and the atmosphere interacting in a delicate balance. This balance is subjected to alteration from manmade interferences or natural calamities. It is important to understand that by integrating the physical boundary with the ecological boundary often alters the ecological balance.

Pakistan is a developing country where industrialization and agriculture is growing at a fast pace. Pakistan became party to various international conventions and treaties; however we need to study how these conventions have been enacted in the countries policies. What were the reasons for the depletion of the mangroves in the Indus Delta and explore viable options for sustainability and regeneration of the coastal ecosystem of Pakistan.

CHAPTER 2

COASTAL ECOSYSTEM

2.1   Forms of Coastal Ecosystem

The various forms of coastal ecosystem include the barrier islands, coastal marsh estuaries, coral reefs rocky shores and bluffs. Each of these types has its own forms of habitat which encompass the unique ecosystem.

2.1.1   Barrier Islands

Barrier islands, includes beaches, dunes and inlets often found all over the world coasts and consists of somewhat flat beaches. The gradient is not steep with soft sand. These islands are formed with frontal and secondary dunes whose size and shape is constantly changing. Barrier islands are popular vacation spots where people often own huts and other transit resorts. Barrier Islands are normally tourist dense populated places and is often developed with tourism in mind. The Beaches of Sandpit, Hawksbay in Karachi and the beaches along the West bay of Gwadar and Ormara in Baluchistan province of Pakistan have flat beaches and are normally picnicker dense holiday spots. Barrier islands serve two main functions. First, they protect the coastlines from severe storm damage. Second, they harbor several habitats that are refuges for wildlife.

2.1.2   Estuaries

The Indus River in Pakistan which culminates into the Indus Delta has number of estuaries. These Estuaries bring freshwater from the river and forms a delicate blend with the saltwater from the Arabian Sea. The density and salinity of water inside the estuaries changes with climate, tide and various other factors. Some of these areas consist of drying heights and the transition between the land and the sea are tidally driven. Every estuary is unique in habitat which varies with the salinity (Beatley

2002). They forms home of many plants and animals, such as wood storks, pelicans, coniferous and deciduous trees and butterflies in addition unique aquatic plants and animals, such as sea grass, sea turtles and sea lions are also often seen . Estuaries are among the most biologically productive ecosystems on the planet. The Indus Delta is rich in fish and shellfish and other sea food. Various forms of biota act as filters for terrestrial pollutants and plants thus they possess economic importance (Estuaries, August 2006).

2.1.3 Coastal Marshes

In Pakistan the coastal marshes are in the south of Port Qasim harbour entrance. The ecosystem balance of the Coastal Marshes along the Indus River is influenced by, many natural forces and the human factor. The upper portion of the Indus Delta has vast wetlands with fresh water, a mixture of salt and saline water. The vegetation of the area consists of short salt marsh grasses, taller salt marsh grasses and other plants. The mix water plants would be thicker and taller .The biome includes plants which thrive on brackish water and many animals which inhabit this rich environment. The interconnected root system of plants holds the soil together and prevents soil erosion. As the water quantity in the Indus River is on the decline the population of vegetation at he upper Indus Delta is also on decline resulting in unhealthy roots binding the soil erosion .As these areas often acts as garbage dumping sites, they are often drained, cleaned or sprayed with insecticide to eradicate mosquitoes. Coastal marshes today are one of the most endangered ecosystems acting as incubators for fish and invertebrates, they also play a vital role as habitat for migratory waterfowl (Kearney,1999).

2.1.4 Coral Reefs

In Pakistan Coral Reefs are found in waters around Astola Island, Gwadar and Jwani west edge. These reefs are calcium compounds basically made of Calcium Carbonate which are produced by various living organisms. The waters around Astola Island Jiwani and Gwadar west edge is shallow with very low level of

nutrients as these places are far from any source of pollution and the water temperature is usually warm round the year. These coral reefs are usually not found near the estuaries and coastal marshes due to their high nutrient content in water. Nutrients produce algae which is detrimental for the corals. Corals are threatened by pollution, disease, over-fishing, dynamite and cyanide fishing, sedimentation and bleaching caused by rising ocean temperatures. The reefs are normally formed only in zone extending at most from 30°N to 30°S of the equator upto a maximum of 30 meters of water. They are also often referred as the "rainforests of the sea," and are the greatest expression of ocean life, and the most biodiverse ecosystem on Earth with 30 of 34 known animal phyla present (Biosphere Foundation, 2002).

Pakistan has vast beaches with golden sand which have been picnickers delight for last few decades. The barrier island beaches in Karachi such as Sandspit, Hawksbay and Clifton have never been developed for recreational purposes. Apart from the road access to Sandspit and hawksbay, all other basic amenities such as electricity and fresh water are lacking. The access to these areas is only possible through privately owned vehicles, thus depriving access to the local population .The development that has taken place in these beaches is due to personal efforts of few individuals, and there has been no contribution for the development by the local or the federal government. New levy have been imposed to the picnickers, however no development of the beaches have taken place, even the cleaning of the beaches is carried out by the natural phenomena of semi-diurnal tide which cleans them twice daily. The coastal marshes at the south of port Qasim and on the western end of Manora island have become regular sewage dumping areas by local municipal authorities due to lack of policies and ignorance at all level of administration. This has given rise to mosquito and other insects and has been an origin of several diseases. During anti mosquito drives Dichloro-Diphenyl-Trichloroethane (DDT) is sprayed indiscriminately by the municipal authorities on the coastal marshes, inspite of National Environmental Quality Standards (NEQS) restricting the use of DDT.

2.2 CONCEPTS OF BIODIVERSITY

Biodiversity do not have any concrete or basic definition but its ingredients are the same as each author views. It encompasses all organisms, species, and populations; the genetic variation among these; and all their complex assemblages of communities and ecosystems. How each element as individual and the combined effect reacts with the environment. Usually there are three levels of biodiversity (Ecological Society of America, n, d):

- **Genetic diversity** is all the different genes contained in all individual plants, animals, fungi, and microorganisms. It occurs within a species as well as between species.
- **Species diversity** is all the differences within and between populations of species, as well as between different species.
- **Ecosystem diversity** is all the different habitats, biological communities, and ecological processes, as well as variations within individual ecosystems.

In order to understand biodiversity we need to look at it from the conceptual viewpoint. It deals with the understanding of the human, the habitat and other living organism and how they interact with each other. Where one is dependent on the other, the cause of one becomes the effect of other.

An ecosystem approach to aquaculture (EAA) and for the purpose to offshore mariculture (EAMAR) strives to balance diverse societal objectives. EAA applies an integrated approach to aquaculture by taking account of the knowledge and uncertainties of biotic, abiotic, and human components of ecosystems, including their interactions, flows and processes within ecologically and operationally meaningful boundaries. The purpose of EAA should be to plan, develop, and manage the business sector in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by aquatic ecosystems.(GESAMP , 20 March 2007)

In the last Inter-Secretariat meeting of GESAMP it was reiterated that the basic principle for an ecosystem approach, is the societal choice of management pertaining to land, water, and living resources. This also inculcates us to have better approach towards management of natural resources even if this requires changing human behavior, perception and attitudes towards the use of natural resources. The most important obligation of the biodiversity is to promote the recovery of threatened ecosystem (Wolfrum, 1999).

Biodiversity resembles the older notion of the ecology, which was pertaining to the living organisms which does not include humans. However biodiversity has a wider scope and a macro understanding of the perspective that includes the synthesis of scientific, economic, social and cultural factors. There has always been a belief that humans are the superior being of the universe and they have their needs which surpass all aspects of the environment. In order to achieve their needs humans affect the surrounding which at times have temporary effects while on the other hand some of the effects are long lasting? To avoid this, there should be some sound environmental management practices that would rationalize the requirement to ensure environmental stability and human survival on the long term. The imminent threat to biodiversity is from the habitat destruction, deterioration and pollution, while the conservation has to do with the changes brought to population culture and national policy failure. The overall biodiversity has been blamed "to our prevalent approach to development" (Louka, 2002). Keeping in view the present trend it appears unlikely to change in the future. The approach may change but the effect may not.

There are various schools of thought with reference to the living organisms. Some feel that their survival is sacrosanct and cannot be discussed or par with other elements of the ecosystem. However, the economists try to find values to justify human practice in the sense that if one is to exploit or conserve something there needs to be an understanding of its value so that its benefits or loss can be measured in human terms. The cultural and social interpretation is towards ensuring

sustainability (Thirdage, 1998). What we need to understand is that there are many organisms which are not even explored, but they exist in one form or the other. Some organisms have benefits which are hard to understand and may not be evident in the present setup. Some organisms which are known to be a nuisance at one time may have a valid purpose in the ecosystem. The absence of such organisms would affect the ecology which may be unexplored at present. The eradication of such organisms at present may be considered as the economical solution and the well being of the human kind, but the pitfalls of such eradication and how it is going to affect the human race in future need to be ascertained and explored. An examples of this could be seen in the mycelia of fungi that live in a commensally (or sharing) arrangement with the roots of plants aiding them to grow and be productive.

One of the most problematic issues is the establishment of the present common benefit and how it contributes in the overall setup. The knowledge of the present is yet to be explored so that remedial steps for the future could be sought. Similarly the problem of the 'common benefit' is the commonality that exists and the difficulty of valuing futures, potential benefits and unknowns. If we do not know something exists it cannot at present be valued and is therefore very difficult to conserve.

The awareness of the alternate world vision attracted the world realizing that environmental problems were global in nature and is determined that it was in the common interest of all nations to establish policies for sustainable development. In pursuant to this ,the General Assembly passed Resolution in 1983 "Process of preparation of the Environmental Perspective to the Year 2000 and Beyond" (G A Resolution A/38/161)

2.3   CONCEPT OF GLOBALLAST

The earth is divided into 71% of water and 29 %of land. One of the biggest threats to the 71% of water is the uninvited inclusion of some alien marine species to a totally new environment. These species react differently in the new environment

thereby creating an unbalance situation where by affecting the ecosystem. The ecology of the area is altered with the inception of species from a different environment. These species are transported from one environment to another through the ship's ballast water. A ship which is constantly moving from one port to another where each port has its own ecosystem is severely affected by the ballast water. It is estimated that approximately 3-5 billion tones of ballast water is transferred internationally each year. A similar volume may also be transformed in the domestic channels. Ballast water is absolutely essential for the safety and stability of the ship, but on the other hand it posses a high value risk to the ecosystem, economy and the health of the surrounding residents (IMO, n,d). There are thousands of microscopic organisms in water which may be carried through the ballast water in bulk or only a few of these living particles are carried around. They are so tiny that they often pass through the regular filter on board ships. These organisms include bacteria and other microbes, small invertebrates, eggs, cysts and larvae of various species. The problem is compounded by the fact that virtually all marine species have life cycles that include a planktonic stage or stages. The species where adult may not be transportable for being too big may be transferred during their planktonic stage. There are nurtured in the new environment and grow to adulthood.

The golden mussel was never seen in the coast of Argentina, thus when they were discovered in 1991, it raised questions as to how they got here. When investigated it was revealed that they were transferred through the ballast water of ships plying between Hong Kong and Argentina. These golden mussels were common specie in the warm waters of the Hong Kong harbour. The mussel worked its way upstream inside the Amazon River and played havoc to the ecosystem of the Amazon Basin as the invasive species out competed local ones for nutrients and space. The golden mussel has caused the infrastructure to break down as it rapidly reproduces and clogs water pipes and turbines in hydroelectric plants, causing billions of dollars of damage a year.

Ballast water has been evaluated as one of the greatest threats to the oceans and the ecology that surrounds them. These invasive species can cause serious changes to the ecosystem that would not be evident on the face of it but in the longer term cause serious economical, social and health problems. The invasive species normally reproduce so fast in the new environment that the balance is disturbed. Some of them carry toxins or viruses that adversely affect indigenous flora and fauna and the people who consume them. They also clog waterways that are necessary for transportation of water (UNDP, 5 March 2007).

There are now an estimated 145 alien species in the North American Great Lakes alone. Among these is the European zebra mussel, which has infested over 40% of the internal waterways in the Great Lakes and beyond, and costs the U.S. government more than $5 billion in clean up expenses. In San Francisco Bay, nearly the entire native biodiversity has been replaced by an ecosystem composed of introduced marine specie which is just scratching the surface. A plankton-feeding ctenphore jellyfish introduced from North America into the Black Sea reproduced in such high numbers that it caused the near collapse of the fishing industry there. In severe cases, ballast water is thought to spread serious diseases, including cholera. Shellfish contaminated by "red-tide" algae can even cause paralysis or death.(Clearwaters,2001)

In pursuant to these effects the International Convention for the Control and Management of Ships Ballast Water & Sediments was adopted by consensus at a Diplomatic Conference at IMO in London on Friday 13 February 2004. The Convention would enter into force 12 months after ratification by 30 States.

Invasive species can be added to the new marine environment in various ways but the most common and lethal is through ballast water. Other forms of transportation of such species is through the fouled bottom of ships where adult , mature species can easily find their way into the new environment where they can replicate faster because of conducive water temperature, abundance of food and non existence of

predators. Other methods include agriculture and manmade means, which provide all the basic nurturing conditions for such species to grow.

What we need to understand is the effect these species create in their home base. Are these species productive? Do they have any other affect which has not been explored? Are there other organisms benefiting from them? Do they form a food chain? If yes what will happen to the food chain if they are eradicated? Before considering these species to be a nuisance, we must analyze the pros, and cons of their existence. These species being considered as nuisance in non native environment must supersede the advantages in the native environment, before thinking of eradicating such species. Biodiversity is a complex mix of the ecosystem, human behavior, economy and other environmental aspects of nature and prosperity. How would removal of such species from the chain affect the equilibrium? Complete removal of such species would not only be a burden on the economy but may not guarantee success. How the cost of removal of such species would be justified.

2.3.1 Effects of Invasive Species

For an area to alter its biodiversity there could be many reasons but to generalize them in categories there are three distinct categories (Carlton, 2004):

- Addition of living organisms or species
- One or few of the organisms or species have completely been eradicated.
- One or few organisms or species have been made in abundance or their quantity has been reduced.

Of the categories mentioned above, the chances of the second category are very bleak, however it cannot be ruled out. There may have been instances that this may have occurred but as the awareness was not there it may not have been noticed. It may be possible that the species where they now nurture as invasive species at some

time had such organisms, and due to the lack of some environmental conditions they became extinct. What we need to understand is the fact that all conditions were favorable for such species to replicate then, what were the reasons they were not present. One reason could be the distance, and the ships provided this opportunity for them to be transported. Another reason could be the temperature and salinity en-route which could have restricted the species from migrating. Some fish could also help the transportation of such species. They can be attached to the skin of the fish while others can pass through the fesses. If this could be the case then it would be a natural process of evolution of biodiversity, whereby such transition of ecology is also a natural process. Thus it is imperative that while we continue to attempt to determine if marine invasions in the ocean are threatening any native invertebrates, vertebrates, or plants, we also seek to preserve community (habitat) and ecosystem diversity. It is here, in the preservation and conservation of supra-specific diversity levels, that one of the greatest ecological challenges of marine invasions lies. There are, for some invaders, critical economic, social, industrial, and human-health challenges as well (Hannibal, n,d). The invasion of such species can negatively impact ecosystems in a variety of ways. They can (USAD, 18 April 2007):

- Replicate fast and eradicate the native species by making them as their food.
- Reduce the native wildlife habitat.
- Reduce the forest productivity.
- Alter the existing ecosystem process.
- Marr the recreational places, requiring resources for the clean up.

2.3.1.1 Invasive Species Effect on Industry

The invasion of species to non native places has resulted in economic losses. The hardest hit of all has been the fishing industry where the stock of commercial fisheries has been damaged. Six countries near the Black Sea have been affected by the Atlantic comb jelly. It has eliminated the zooplankton in the Black Sea which has exhausted the region's anchovy fishery (Thomas, April 2002). The toxic red

tides have closed clam and mussel farms and fisheries. Both of these invasive species were introduced by ballast water. It has been estimated that $44 million in annual fisheries revenues in Oregon and Washington State are vulnerable to the purple varnish clam and the green crab (Science News, 13 June 1998). The European zebra mussel was introduced into the Great Lakes in the 1980's causing damage by billions by clogging the city water systems; factories and power plants waterways were choked. The golden mussel in Argentina which traveled from Hong Kong through ballast water altered the ecosystem in Amazon which clogged the city and industrial waterways (UNDP, 5 March 2007).

2.3.1.2   Effects on human health

The invasive species are not the only organisms which are transported through ballast water; there are few species which are consumed by some native predators. In 1991 a widespread epidemic spread throughout South American countries. This epidemic was attributed due to cacterium present in the oysters and fish found in the Mobile Bay. This bacteria was later transported to Alabama as well (Hannibal,n,d) .

2.3.1.3   Positive effects of Invasive species

Where there are so many negative aspects of the invasive species, however there exists a positive aspect of these invasive species as well. The "Lantana camara" is regarded as one of the world's ten worst invasive alien species, but in India it has multiple uses such as being used as (G I S P ,n,d):

- A hedge plant.
- Source of paper pulp.
- Fuelwood.
- Traditional medicine.
- Craft material for weaving baskets and making furniture.

CHAPTER 3

SOURCES OF POLLUTION

3.1 Sources of Marine Pollution

There are two major sources of marine pollution. One is sea-based pollution where pollution from offshore drilling, sesmic activity, oil transportation and sewage from ship are concerned, while on the other hand, it is the land based pollution in which the pollution emanates from activities from the land. We can characterize pollution as the anthropogenic impact on the sea and marine pollution while others are the natural occurring without human influences. The anthropogenic impact could be land or sea based. Similarly we have natural phenomena occurring at sea and on land.

3.1.1 Land-based Pollution

There are various factors which determine land-based pollution. A few of the most common pollution types are based on:

3.1.1.1 Sewage

Pakistan is a developing country where the greatest threat to the coastal environment is from the untreated sewage. It is estimated that hardly 25% of the city sewage is treated while the remainder passes into the sea untreated. Karachi the coastal city of Pakistan have treatment plants which are functioning with reduced output, they are unable to cope with the rapid growth of sewage. The rapid increasing population is putting continuous challenge to these treatment plants, and the disposal practices of discharging mostly untreated wastewater in the rivers are likely to have an adverse affect on the quality of coastal waters.

The population boom is a big concern for the policy makers, it is estimated that approximately 3 billion people, nearly half of the world's population live, within 200 kilometers of the coastline. It is envisaged that by 2025, that figure is likely to double (Creel, 2003). This high concentration of people in coastal regions produces half of the world's sewage which is passed to the sea; some percentage of it is treated while others remain untreated. The combined effects of a booming population growth and economic and technological development are threatening the ecosystems that provide these economic benefits. The average population density in coastal areas is about 80 persons per square kilometer, twice the world's average population density (Creel, 2003). This high population density poses a high risk to marine ecosystems.

The discharge of sewage into the sea can cause health problems either from contact with polluted waters or from consumption of contaminated fish or shellfish. The discharge of untreated sewage effluents produces long-term adverse impacts on the ecology of the coastal ecosystems due to the combination of nutrients and other pollutants. Nutrient enrichment around population centers creates eutrophication.

According to a survey by marine environment pollution experts, the sewage from coastal cities is the biggest contributory factor in the degradation of the marine ecosystem (GESAMP, May 2007). The countries with better sanitation regulations have witnessed improvements in water contamination. This contaminated water nurtures many bacteria and other harmful germs which lead to disease which at times become life threatening. The study below indicates the cost incurred on respective Disease

Marine Related Diseases		
Disease	Daily/year (millions)	Economic impact (US$billion)
Malaria	31.0	124.0
Diabetes	11.0	44.0
Trachea, Brachia And Lung Cancer	8.8	35.0

Stomach Cancer	7.7	31.0
Intestinal Nematodes	5.0	20.0
Intestinal Nematodes	5.0	20.0
Upper respiratory tract infections	1.3	5.2
Trachoma	1.0	4.0
Dengue fever	0.75	3.0
Japanese encephalitis	0.74	3.0
Diphtheria	0.36	1.4
Diseases Related To Marine Contamination		
related to bathing and swimming	0.4	1.6
seafood consumption (hepatitis)	1.8	7.2
seafood consumption (algal toxins)	1.0	4.0
sub-total	**3.2**	**12.8**

Source GESAMP 2001   Table 1

The table of the "marine related diseases" indicates that the biggest economic concern is malaria which is caused by mosquitoes nurturing in the contaminated sewage. This stagnated sewage often contaminates the ground water which causes other water borne diseases as indicated in the table above. An additional source of sewage is from the increasing number of ships and recreational vessels within the region. Larger ships are to have sewage treatment plants and should have sewage tanks per Annex IV of MARPOL. Ships are not permitted to discharge treated sewage within three miles of the nearest land and untreated sewage within 12 NM of the coast. Coastal cargo vessels and recreational boats do not have holding tanks, and occasionally discharge their waste oily waters in the sea due to the lack of port reception facilities for sewage /wastes in most countries.

3.1.1.2   **Storm water**

The water that flows after heavy rain, storms, garden hoses, sprinklers, snow melting or other water sources is the storm water. The storm water is designed to collect rain

and thus there is no filtration. Water after storm and floods gushes along the fields, streets, pathways, pastures and gardens collecting along its passage the toxins, pollutants, motor oil, antifreeze, paints, fertilizers, pet waste, pesticides, chemicals, and litter. The first flow that occur after a considerable dry patch contain high levels of pollutants, such as lead, nutrients, and various pathogenic micro-organisms, such as viruses, bacteria and protozoa, from faucal material. Nitrogen is an invisible pollutant which is carried with the storm water and gives rise to algae and ultimately to green water thus causing scarcity of oxygen which ultimately kills marine habitats (Envirocast Newsletter , Dec2002,).

3.1.1.3   **Rivers**

Rivers are known for polluting the sea where they discharge into the sea. The Indus River in Pakistan is the largest river which flows into the Indus Delta. Pakistan, being an agricultural country depends heavily on freshwater from the Indus River. Agriculture is considered as the predominant cause of pollution through the indiscriminate use of various chemicals in pesticides. Most of the farms in Pakistan are close to the rivers and the water for cultivation contains pollutants of the city sewage, or factories. The water used for agriculture is recycled back to groundwater which contains chemicals from the pesticides which is later again used for agriculture down the stream. Thus we can say that agriculture is affected through use of wastewater, polluted surface and groundwater which contaminate crops and transmit disease to consumers and farmers (Ongley, 1996).

The non point source of pollution is where pollution is diffused into the river from activities attributed towards humans such as city drains, industrial wastes, factory outlets, groundwater and polluted acid rain. On the other hand point source pollution is easily traceable and is easy to identify such as oil spill from ship, chemical waste dumping of an industry. There are various factories along the rivers in the province of Punjab , they take clean water from rivers, and pump polluted untreated water back into rivers. Even in our daily life chemicals of one sort or another is often

poured down the drains such as detergents used in washing machines and dishwashers, soaps and other chemicals often used for cleaning, all these waste would eventually end up in our rivers and oceans if passed untreated. The pesticides use on gardens and farms often contains chemicals such as PCB which have a long lasting and lethal effect. In some cases the effects of PCB were visible on some birds as far as the Artic (Woodford, 2006)

3.1.2   Sea Based Pollution

The ingress of oil from the offshore extraction of oil, shipping, and transport of oil in pipelines is the result of either accidents or deliberate operational discharges. Operational discharges, which are deliberate can be effectively controlled and avoided, however there is always a doubt about the amount and combination of operational discharge. Operation corresponds to economical factor, feasibility and availability. It requires a change in the mind set of the human being.

3.1.2.1.   Slop / Sludge

The discharge of oily engine wastes and bilge from day-to-day shipping operations could lead to be the highest ecological degradation factor, because it is steady and occurs everywhere. It can be argued that the quantity of such discharge is low but if it's persistent in a given area could lead to degradation of the ecology of that area. Slops are the residues of oily water left after tank washing, which also includes ballast water .When this mixture of water and oily waste is pumped out of the tanks they contain highly toxic chemicals. Tank washing must be done at sea, as the vapors and fumes emitted during the process violate air quality standards. Often tank washing is carried out using oil or water inside to tanks to remove oily residues. This slop is to be discharged in the reception facility at each port of call before the tanks can be filled again, but as port facilities are often absent or too expensive the slop is drained out into the sea. The engine room Sludge is the foul bilge water from ships. Ships using low quality of fuel, only part of it are effective for propulsion while rest

is waste. Ships using crude oil, the fuel has to be centrifuged, which generates residues which are approximately 2% of total fuel used. In addition various types of lubricants are also used which are to be kept in tanks as specified in MARPOL and unloaded at the reception facilities. However all this is not often practiced. At times port facilities are not present or it is too costly so that ships prefer to drain out in the open sea. This quantity may be negligible compared to accidental oil spills, but these are persistent over a place and quantity varies over time. In the case of direct contact of oil with fish, the oil is ingested through the gills of the fish which if in small quantities may not kill them through poisoning but may make them impotent. Some off-springs of such contaminated fish have been born with deformities. In some fish and shellfish metabolisms oil components are degraded into other substances even more toxic for them (Cdr. Ferraro, Feb 2006).

3.1.2.2 **Anti fouling paint**

In order to keep the bottom of the ships clean TBT was often used which is a type of toxic pesticide providing a very volatile surface for organisms. It is applied as paint on the ship's hull to release organisms through the process of leaching where biocides are released when exposed to water. The organisms are unable to stay hold to the surface for long and falls of after being poisoned by the organotin content. Some intertidal mud snails in the UK have shown traces of imposex where a male sex characteristics is superimposed on normal female gastropods, with the development of male sex organs, the penis. Studies were carried out and it was revealed that the imposex condition was linked firstly to pollution in marinas, then antifouling bottom paints, and finally to the chemical tributyltin (TBT), a major component of the antifouling paints (Bray , n,d). Traces of it in the human chain alarmed the world and the International Convention on the Control of Harmful Anti-fouling Systems on Ships, was adopted on 5 October 2001, prohibiting the use of harmful organotins in anti-fouling paints used on ships and will establish a mechanism to prevent the potential future use of other harmful substances in anti-

fouling systems. The convention will enter into force 12 months after 25 States representing 25% of the world's merchant shipping tonnage have ratified it.

3.1.2.3 **Pollution from offshore platforms and pipeline leaks**

During oil drilling operations, some oil is released into the sea. This includes oil mixed into the briny waters leaking for the oil reservoirs. Natural sea floor seeps produce between one-third and one-half of the oil in the ocean. These are seafloor springs where oil and natural gas leak and rise buoyantly from oil laden, sub-seafloor sediments. The proportions and amounts of discharged wastes normally vary in various stages of production. During the process of drilling, water is either naturally present or has to be injected into the reservoir to maintain pressure for production which is later separated. It is important that the water returning to the sea is filtered of oil and other chemicals. The malfunction of filters and separators often causes a higher percentage of chemicals being dumped into the sea. (Patin, n,d)

3.2 **BEHAVIOR OF DIFFERENT TYPES OF OIL**

When oil is spilled deliberately or accidentally, it is important that the spill needs to be curtailed and its damage be minimized. There are various types of oil being carried by ships; some of them are persistent in nature while others are non-persistent. Different types of oil require different curtailment methods as they react with the ecosystem differently.

3.2.1 **Non-Persistent Oil**

The non-persistent oil includes refined products such as gasoline, aviation fuel; they are light and possess low evaporation temperature. In addition they are highly volatile in nature and have a very low viscosity level. The dispersion rate is very high and thus they would cover a wide area very quickly. Due to their low evaporation characteristics they are dissipated into atmosphere very fast and do not persist on the surface for long thus they do not require much cleaning effort as the

nature and the inherent characteristics of the oil augments the cleanup operation. The volatility characteristics make them as hazardous substance, posing a significant fire and explosion hazard. The high atmospheric temperature increases the evaporation faster, and when these vapors travel towards shores they pose threats like fire and affects public health to a great extent especially to the young kids , old people , pregnant women . The concentration of toxic gases have created wide spread pulmonary or cardiovascular diseases as has been the case in Tasman Sprit in Pakistan.

3.2.2 Persistent Oil

Persistence is a means of defining how crude and refined oil products may remain in the environment. Persistent oils may not be completely removed. Crude oil lies in the opposite site of the spectrum of the gasoline. There are of various types heavy crude oils. In the water-in-oil emulsion, the oil absorbs water, almost four times the volume of oil. Water-in-oil emulsions, often termed "mousse," are formed when seawater, through heavy wave action, becomes entrained with the insoluble components of oil. Such emulsions can form quickly in turbulent conditions and may contain 50 to 80 percent water (Michel, April, 2005).Mousse will eventually disperse in the water and/or be biodegraded, but will first sink or become stranded on beaches. A water-in-oil emulsion is more difficult for microorganisms to degrade than oil alone (Gibbons, May 1991). The mousse is very viscous in nature and flow slowly, but due to the high viscosity and persistent nature they travel to far off distances from the original spill causing widespread contamination of the coastline and damage to various amenities, fishing, fish gear, marine habitat, mainly through physical smothering.

3.3   RESPONSE TO OIL SPILLS

In the event of oil spill, the spill has to be restricted from spreading, there are various ways which can restrict the spreading and reduce the effect.

3.3.1 Containment

The most important and basic response is the containment to reduce the area of spillage. Containment and removal of oil can be carried out by booms and skimmers. Past incidences have shown that a very small portion of the oil can be contained and recovered because of the fact that, by the time lag between containment process and spillage is very long. Another factor of containment is the area of the spill. An enclosed area such as harbour would provide better chances of containment. Ecologically if the slick could not be removed quickly after containment then there are serious environmental hazards as it would sink and produce a thick oily film in the bottom there by killing the habitat.

3.3.2 In-situ Burning

In-situ burning refers to the controlled burning of oil that has been spilled from a vessel, facility, pipeline, or tank .Oil spills in open sea needs to be contained using fire-resistant booms and has to have a minimum thickness to be ignited and have a sustainable burning.

3.3.2.1 Environmental Aspect of In-Situ Burning

The main question that arises before considering In-situ burning is the understanding of the environmental consequences of burning vis-à-vis not burning and wait for evaporation to occur and its effects on exposed wildlife. If oil is allowed to evaporate then it will have a deleterious effect on air quality. However if the spilled oil is left untreated it would still evaporate but is slow rate and would enable the slick to spread over a large area and impact the environment. On the other hand burning the oil would reduce or eliminate the marine environmental impact of the oil slick and convert most of the oil to carbon dioxide and water .The marine ecology would sustain less damage and possibility of revival would be there. However, the burning process would generate air pollution. In the Exxon Valdez, the mechanical cleanup of oil spills generated large amounts of waste. Roughly 350 miles of sorbent boom was used and 25,000 tons of sorbent material of all kinds was used. The

energy requirements were tremendous and the hot water requirement made the operation very difficult. (Barnea n,d).

Nature has given all living organisms the sense to stay away from heat and fire, Birds and other land based animals would keep away from the heat, plume and smoke. However if some animal is exposed to smoke it may suffer suffocation and may also suffer toxic effects.

3.3.3 Dispersants

When an oil spill occurs the clean-up operation requires either mechanical means such as booms skimmers or non mechanical methods such as In-situ burning, or dispersants. Dispersants are specifically designed for oil spills. They are made up of detergent-like surfactants which are mixed in a solvent which has a very low toxicity level. The dispersants are not used for cleaning or removing the oil spill in fact it combines with the oil particles and breaks them into small particles which are further dispensed through natural process such as weathering. Dispersion of crude or heavy oil into the water occurs naturally in untreated spills; dispersants just speed up the process amply augmented by the natural phenomena. Another advantage of a dispersant is that it does not allow oil particles to combine and reform a slick; in fact each particle repels thus helping the breaking of the slick as it gets into contact. Dispersants also reduce the ability of the oil to attach to birds and other animals, shoreline rocks, and vegetation. Fire and explosion hazards are lessened because dispersants reduce evaporation of volatile oil components. The effects of the rapidly diluted dispersed oil must be weighted against the effects of that oil if it were allowed to impact on wildlife populations or the shoreline.

3.4   ASSESSMENT OF VARIOUS POLLUTANTS

Marine pollution is not new but its awareness has transferred its perception over the last few decades. In seventies the concept of pollution was focused from the oil

spills and efforts were focused towards curtailing oil pollution. Many conventions came into international arena and progressively the countries started enacting the same in their national policy. Pollution from accidental spills is large in quantity and area but its occurrence is not so often. The international conventions are working well to reduce the occurrence of accidental spills. The deliberate spill by ships is also well institutionalized and is left to the independent state to decide how stringently it can be implemented. We can safely say that the envisaged threats of the past have adequately been catered for.

The concept of environmental protection in the past was focused towards maintaining the ecology of the area and human being were not made a part of it thus it was often criticized as this concept is hampering the development. The concept of biodiversity which strikes a balance between the human being's economic, social and cultural factors to that of the organism such as plants, animals and all living biota in the surrounding has reoriented the way we perceived environment to be. Countries with economic constraints face difficulty in implementing the concept in the true sense, population, poverty and resource of a nation drives the implementation of the concept. Environment concern of one nation is livelihood of another nation thus environment policies without considering the population ,social setup, poverty and natural resources leave independent states to implement and thus often lacks the true sprit of the convention.

As the population density in the coastal cities rises the pollution from the land-based sources is also increasing. The developing countries lack adequate sewage treatment plants, thus more untreated waste would be discharged into the sea. Industrialization is another factor which if not properly institutionalized may heavily contribute towards pollution. Tools set by international organization are in place and working satisfactory however it is up to the national policy and will of the governance that would determine the effectiveness. Economy is the main factor while deliberating pollution in developing countries. It is always considered allocating funds towards

other development projects important than allocating funds for developing environment.

The policies of some developing countries towards agriculture have led to indiscriminate use of pesticides which often contains chemicals with long lasting effects. These chemicals enter the rivers through subsoil water which at times is reused for cultivation down stream, and often enter our food chain. There should be a ban on development and transportation of pesticides which contain such harmful chemical.

There has been a debate between burning the oil after spill and containing the spill. If the oil is burnt it would create smoke and lead to air pollution and still some portion would remain unburned, while on the other hand if oil is contained it could not be removed completely hence would require dispersant to settle the oil on the bottom. Modern dispersant contains very low levels of toxins which rapidly remove the oil from the surface thus minimizing the damage to the ecosystem. The technology of today has not been able to see the ill effects of the dispersant, but with better understanding, other factors of dispersant may come to light. It is there for imperative that all environmental aspect of dispersant need to analyzed.

CHAPTER 4

CONVENTIONS

4.1   Conventions to Protect Marine Pollution

In the beginning of the 20th century there were few multilateral or bilateral agreements concerning international environmental issues. However they did not address pollution or other curse to the ecology. The first concept of pollution came in Article IV of the UK-USA Boundary Water Treaty where phrase like "……..shall not be polluted on either side to the injury of health or property on the other….". In the second quarter of the 20th century state parties were focusing on the protection of wild animals, birds and fish. Then there was a shift towards conservation of the natural resources. Several conventions and agreements emerged for the protection of fauna and flora such as Convention on Preservation of Fauna and Flora in Their Natural State, of the 1933, and the Washington Convention on Nature Protection and Wild Life Preservation in 1940. The Trail Smelter Arbitration between Canada and the United States established that states are responsible for environmental damage to other countries especially if the harm is envisaged to be persistent. This led to formulation of conventions such as Prevention of Transboundary Harm from Hazardous Activities. In order to provide an overview of the various international environmental conventions developed, they have been divided into categories which deal with global issues while others that focuses on regional issues.

4.2   GLOBAL CONVENTIONS

4.2.1   Convention on Wetlands of International Importance (Ramsar)

One of the significant pioneer conventions which focused on the environment is the Ramsar Convention 1971. The purpose of this Convention is "to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific and recreational value." The Ramsar Convention was adopted on 2 February 1971 in Ramsar, Iran, and entered into force on 21 December 1975. It provides for increased protection of wetlands, including shallow coastal and marine areas. The mission statement of the convention as stated in the Ramsar COP 08,2002 is as follows "..conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world…".The Ramsar Standing Committee agreed that the theme/slogan for World Wetlands Day in February 2008 would be "Healthy Wetlands, Healthy People" (Ramsar;1 June 07). There are 15 Ramsar sites designated in Pakistan, 13 sites were considered for sustainable criteria immediately while two sites which were Green Turtle sanctuaries required detailed sustainable criteria before being included in the list of Ramsar Sites. Some of the Ramsar sites in Pakistan are facing difficulties in maintaining their ecosystem due over population, lack of political will, awareness of the population and limitation of resources.

4.2.2   International Convention for the Prevention of Pollution from Ships MARPOL

It was the tragic incidence of "Torrey Canyon" that led IMO to evaluate on the technical and legal aspects of the incident. The IMO in 1969 decided to convene an international conference in 1973 to prepare a suitable international agreement for placing restraints on the contamination of the sea, land and air by ships. This ultimately led to formulation of MARPOL which amalgamated the OILPOL 54

along with its amendments and compiled it as Annex I, covering oil, while other annexes covered chemicals, harmful substances carried in packaged form, sewage and garbage.

Annex I of MARPOL emphasized the continuous monitoring of oily water discharges and included the requirement for governments to provide shore reception and treatment facilities at oil terminals and ports. It also required some design modifications such as ballast water tanks to be different from the tanks carrying oil. It addition it also established few marked Special Areas which had very strict requirements for discharge standards. There was not enough ratification for the MARPOL 73 for it to come in force; however tanker accidents between 1976 and 1977 led to adopting measures for design and operation of tankers in 1978 as protocol of 1978. By 1978 the MARPOL 73 has not yet being in force thus the 1978 MARPOL Protocol absorbed the parent convention and the combined MARPOL 73/78 which finally entered into force on 2 October 1983. The out come of MARPOL 73/78 witnessed the ships being built with double bottom and a series of tanks to provide structure integrity to the tanks. According to 1994 amendment the ships could be inspected when in the ports of other parties to the convention, to ensure that crews are able to carry out essential shipboard procedures relating to marine pollution prevention.

4.2.3 UNCLOS

The Scope of UNCLOS is vast; it not only covers all ocean space, but also includes all its uses, including navigation, exploration and overflight. It also includes all uses of all its resources, living and non-living, on the seas, ocean floor and beneath. It emphasizes the protection of the marine environment; and basic law and order. This is thus the first major convention which focused marine environment and marine pollution. Pollution as defined in art 1 (4) "… the introduction by man, directly or indirectly of substance or energy into marine environment…" brings about various issues such as responsibilities, obligations, and somewhat indirectly penalization. To understand this definition of art 1(4) we have to go bask in the 60's and 70's

where the term "energy" could not have meant the green house gasses but the land-based effluent from industrial facilities or other land sources . On the other hand art 293 "… shall apply these convention and other rules of international law….." gives this a broader perspective of the definition in art 1 , in which it was argued even before the completion of UNCLOS that this convention deals with the endangered species while others termed as the a convention for protection of flora and fauna. The fact that the definition indicates energy could be taken as the effect of the marine environment due green house gasses induced by the humans (Doelle , 20 Oct 05). The UNCLOS in Part XII provides a broad but basic sketch towards preservation of marine environment thus providing a general framework for the regulation of marine environmental issues which not only focused on pollution caused from ships but also provided guidance for pollution from land based sources and dumping. It also laid down certain general duties regarding protection of the marine environment. Article 192 specifies the state obligation to protect and preserve the marine environment; the Art 194 is the subsequent action of the Trail Smelter and Corfu Channel case, where it delineates the state to take effective action against pollution and to avoid pollution to spread to other state. It serves as a core for any analysis of State obligations to mitigate climate change. (Doelle , 20 Oct 05)

Pakistan signed the Convention on 10 Dec 1982 and immediately set forward towards formulating requisite policies keeping UNCLOS as the basic guideline. Pakistan initiated its first Pakistan Environmental Protection Ordinance and after successful implementation at all levels and ultimately ratified the convention on 26 February 1997. The time lag between signing and ratification was due to the lack of political instability and will. Even though policies have been enacted in the legislation the will of implementation is yet to be desired.

4.2.4 Global Programme of Action GPA

The aim of the Global Programme of Action (GPA) for protection of the marine environment from land-based activities is to prevent the sea, rivers, estuaries, wet land marshes and all other marine environment from degradation which may be caused from pollution through land based activities. The GPA creates awareness and facilitates the governance to prevent pollution and preserve the existing marine environment and focuses the states to utilize its internal organizations to collectively aim towards the prevention, reduction, control and/or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities . In a broader perspective the convention aims at conservation of the biodiversity of the marine environment ensuring the protection of human health, as well as promoting the conservation and sustainable use of marine living resources. It was also pointed out that developing countries who could not afford the expensive filtration plants could have ponds and constructed wetlands which would solve the solution and its maintenance would make them more cost-effective in the long term.

4.2.5 Dumping Convention

This was the first convention to come in force to protect oceans from human activities. The convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter commonly called the "London Convention 1972" or "LC 72" is an agreement among states to control pollution of the sea by dumping. The agreement covered the deliberate disposal at sea of wastes, harmful matter, chemicals or other hazardous substances from vessels, aircraft, and platforms. It entered into force in 1975. Dumping has been defined as the deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures, as well as the deliberate disposal of these vessels or platforms themselves. (IMO,1972) .The operational discharge is permitted as per MARPOL and also permissible in the Dumping Convention 1972, however exceeding those limits in quantity or concentration is prohibited. In 1996 a reserve list was prepared which

indicates what could be dumped and highlighted all disposals other than in the reserve list are prohibited. The protocol of 1996 entered in force in 2005.

4.2.6 Conservation of Biodiversity

There are many plants and animals that are used and consumed by human or is of significant importance to them. These living creatures, such as plants, animal's microorganisms containing functional units of heredity are of vital importance to human habitat. The convention on Biodiversity is dedicated towards sustainable development the ecosystem which is not just about plants, animals, micro organisms and the their ecosystem, in fact it is about human their needs, for living, their food chain, medicine, fresh air, water, shelter and above all its about providing a clean and healthy environment. Biodiversity is not just about how many species there are in an area, but also about the proportional number of species The convention was put for signature in 1992 at Rio de Janeiro and over 188 countries have signed (Bundesregierung, April 2006) . The Convention establishes three main goals:

- The conservation of biological diversity.

- The sustainable use of its components.

- Fair and equitable sharing of the benefits from the use of genetic resources.

The convention put forwards a new philosophy; it deals towards sustainable use of natural resources and betterment of human race and aims at the sustainable development of the ecosystem.

4.2.7 Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora focused to ensure that the international trade of endangered species does not threaten their survival and existence. The zoological requirements of species like

elephants, lions and other endangered species were an obvious reason why such a convention came into existence. Today, there are an approximately over 30,000 species of animals and plants which have been listed out either they are traded as living specimens or they are killed for the products that are made out of them like fur, dried herbs, medicine etc. Under CITES a species is listed at one of three levels of protection, which have different permit requirements. Specie taken from sea requires a certificate for import outside of any country's jurisdiction. The CITES regulates the international trade of species , animals and plants according to their ecology and their conservation status, however it does not protect species from other factors which may contribute to a species decline, or extinction. The convention entered in force on 1 July 1975 and there are 172 state which are party to this convention (UNEP;CITES, n,d).

4.2.8 Basel Convention

The basic factor towards control of hazardous waste is determining what precisely "Hazardous Waste" is and which material are hazardous waste, when and under what condition they become waste. The Basel convention defines all of these issues (Morrison, 1999). The convention focuses on the control of transboundary movements of hazardous wastes and their disposal. The present ship breaking industry of the world is centered on south Asian countries mainly Pakistan, India, Bangladesh and China. Pakistan has one of the biggest ships breaking industry which is located at Somiani, some 40km north west of Karachi. Almost all ship that is brought for ship breaking are dismantled or scrapped on the beach. The ships which are destined for ship breaking are "wastes" as defined by the convention. These ships often contain hazardous substances which makes them as "hazardous waste". Ships brought from far of places for scrap, classifies them as transboundry movement of hazardous waste. The convention deals with issues of transboundry movement of hazardous waste and came into force in 1992 and has 170 parties (UNEP; Basel, n,d).

4.2.9   Convention on Persistent Organic Pollutants (POP)

The convention was adopted and opened for signature in May 2001 which focused on avoiding and substituting the use of intentional and unintentional use of POPs. A key aspect of the convention is that no new chemicals with POPs properties are to be produced, and no new facilities that generate and release unintentional POPs are sited. A persistent compound is slow to degrade in the environment, it has been observed that they do not decompose in fact they accumulation and often enter the food chain thereby affecting the human health. Toxic metals such as lead and cadmium, organochlorides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) are persistent compounds. The persistence can be expressed as the time required for half of the compound to be lost called half-life (BookRag, n,d) and can be classified for environmental persistence in the following categories:

- Not degradable, compound half-life of several centuries
- Strong persistence, compound half-life of several years.
- Medium persistence, compound half-life of several months
- Low persistence, compound half-life less than several months

4.3   REGIONAL CONVENTIONS

4.3.1   OSPAR Convention

The OSPAR Convention is for the protection of the marine environment of the North-East Atlantic. The convention focuses on safeguarding human health and conserves marine ecosystems by prevention pollution and adverse effects of human activities. The convention was designed for national enactment of rules and regulation towards the discharge of offshore drilling wastes in the waters of the OSPAR signatory states: Belgium, Denmark , Finland, France, Germany, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden and the United

Kingdom. OSPAR regulations thus cover all the oil-producing coastal states of Western Europe which came into force in 1998 after merging the Oslo Convention (1972) and Paris Convention (1974).

4.3.2 Helsinki Convention

The Helsinki Convention, for the first time entered into force in 1980. In view of the political changes, and developments in international environmental and maritime law the convention was updated and was resigned 1992. The convention was signed by the states bordering the Baltic Sea namely Denmark, Germany, Sweden, Estonia, Finland, Latvia, Lithuania, Poland and Russia. The purpose of the convention is to reduce pollution of the Baltic Sea area caused by discharges through rivers, estuaries, outfalls and pipelines, dumping and shipping operations as well as through airborne pollutants. The convention aimed at the sustainable development by controlling and preventing pollution and providing a framework for cooperation between the member countries of the United Nations Economic Commission for Europe (Europa , July,2005).

4.3.3 Barcelona Convention

The convention aims at protection of marine environment and coastal regions of the Mediterranean. The countries parties to the convention are to take all appropriate measures to prevent and abate pollution of the Mediterranean caused by dumping from ships and aircraft, or by discharges from ships, or resulting from exploration and exploitation of the sea bed and subsoil, or from discharges from rivers, coastal establishments or other land-based sources within their territories.

4.3.4   **South Asian Seas Action Plan   (SASAP)**

The South Asian Seas region comprises the Indian Ocean and states like Pakistan, India, Maldives, Sri Lanka and Bangladesh. This region is rich in marine biological ecosystems. The countries are also thickly populated and consist of many industries which contribute significant threat to the coastline . The overall objective of SASAP is to protect and manage the marine environment and related coastal ecosystems leading towards a sustainable development. There is no convention for the SASAP thus the law of the sea is considered as the umbrella convention. The action plan is to formulate and enhance consultations and technical cooperation among states and emphasizing the economic and social importance of the resources of the marine and coastal environment. The SASAP priority focuses on national action plans to curb, prevent pollution from the land based pollution. SASAP was adopted in 1995 and entered in force in 1997 (UNEP; SASAP, n,d).

4.3.5   **Land-Based Sources (LBS Protocol)**

Taking this into consideration the global programme of action for the protection of the marine environment from land-based activities, the LBS protocol was adopted on 17 May 1980 for the protection of the Mediterranean Sea against pollution from land-based sources. The contracting parties are to take all possible appropriate measures to prevent, curtail, reduce and eliminate the possibility of polluting the Mediterranean Sea. The states are also encouraged to phase out substances that are toxic, persistent and liable to bioaccumulate.

4.3.6   **Protocol on Specially Protected Areas and Biodiversity**

Based on the convention on Biological Diversity (BCD) the protocol focused on establishment of special protected areas and provides guidelines for the conservation of the threatened species that prevail in the Mediterranean ecosystem special areas.

4.3.7 Kuwait Convention

The Kuwait Convention of 1978 is towards co-operation in protecting, curtailing and reducing the means of pollution in their common marine environment in spite of the existing geopolitical boundaries. The contracting states are Bahrain, Iran, Iraq, Kuwait, Oman, Qatar Saudi Arabia and the United Arab Emirates and consists of the sea referred as the ROPME Sea Area (UNEP ROPME, n,d) (Figure 1)

4.3.8 Abidjan Convention

The Abidjan convention was adopted in March 1981 and subsequently entered into force on 5th August 1984 .The convention focused for cooperation among central and West Africa towards the protection and development of the marine and coastal environment. The states are advised to prevent, reduce, combat and control pollution of the area, particularly pollution from ships, aircraft, land-based sources, and activities relating to exploration and exploitation of the sea bed and pollution.

4.3.9 Nairobi Convention

The Nairobi Convention for the protection, management and development of the marine and coastal environment of the Eastern African Region was adopted in 1985 and subsequently came into force in 1996.There are 9 contracting parties namely Comoros, France, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, and Tanzania. The East African states being conscious of their responsibility realized that special care must be given and states must be held responsible towards management of the marine ecosystem.

4.3.10 Lima Convention

The Lima Convention for the protection of the marine environment and coastal areas of the South East Pacific was adopted in 1981 and came into force in 1986. There are four contracting parties namely Chile, Colombia, Ecuador and Peru. The area under coverage of the convention is the South East Pacific within the 200-mile

maritime area of the jurisdiction of the state parties. The contracting parties agreed to prevent, reduce and control pollution of the area particularly pollution from land-based sources, vessels and from any other installations and devices operating in the marine environment.

4.3.11 **Cartagena Convention**

The Cartagena Convention for the protection and development of the marine environment of the wider Caribbean region was adopted in 1983; and subsequently came in force in 1986. The convention covers an area of the Gulf of Mexico, the Caribbean Sea and the areas of the Atlantic Ocean adjacent to the state parties. There are 28 countries party to the convention namely Antigua and Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, European Union, France, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Netherlands, Nicaragua, Panama, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, United Kingdom, United States of America and Venezuela.

4.4 **IMPLEMENTATION OF CONVENTIONS**

A brief look on some convention and how have they been implemented by some countries would give us an insight what factors need to be looked at while implementing a convention. Implementation depends upon the political setup, economy of the country, education, population and will of the nation.

4.4.1 **GPA**

The problem from land based sources to the marine environment is almost a problem in every region. Since pollution at times crosses the boundaries of one state to another thus the GPA committee classified the world into regions for assessment. The assessment committee of GPA is mainly concerned with eight source categories:

- Sewage

- Persistent Organic Pesticides (POPs)

- Radioactive substances

- Heavy metals; Oils (Hydrocarbons)

- Nutrients

- Sediment mobilization

- Litter

- Physical Alteration and Destruction of Habitats (PADH).

The assessment committee of CBD classified the earth into 9 regions. Expert from each country is invited to report for their country followed by a consolidated regional report (The Hague, July 2006) prepared in consultation with the members of the region. The nine different regions are as follows:

1. West and Central Africa;

2. Southern Africa;

3. Eastern Africa;

4. Black Sea;

5. ROPME Sea Area;

6. South Asian Seas;

7. East Asian Seas;

8. Arctic Ocean;

9. Caribbean Small Island Developing States (SIDS).

4.4.2   RAMSAR Convention

4.4.2.1 North America

Canada adopted its federal policy on wetland conservation in March 1992. In Canada there is no interdepartmental committee to coordinate implementation. Each ministry has responsibility for interpreting and implementing the Policy. The Canadian Wildlife Service acts as an expert science and advisory agency and

provides communications and training materials to other agencies upon request. The American committee of North American Wetlands Conservation Council acts as the advisory body under the Canada Wildlife Act. The committee has federal, provincial and non governmental partners. Mexico does not have a dedicated wetland policy or strategy. The Ramsar-related issues are addressed through their National Environmental Plan and the Wildlife Conservation, Rural Diversity and Protected Area Programmes. In Mexico any activity to be undertaken in association with a wetland requires an EIA submission. (RAMSAR,1999).

4.4.2.2 **Kenya**

The main hurdle towards fast development of the policy is the consensus between governmental sectors among the various sectors of the government, the financial constraints and the skilled human resources. The existing National Environmental Action Plan (NEAP) and the Biodiversity Action Plan (BCD) have been developed encompassing environmental conservation and management in Kenya. Thus, the national wetland policy currently being developed is designed to make it compatible and complementary with the NEAP which provides the umbrella guidance and direction for all environmental conservation and management initiatives (RAMSAR,1998) Lake Nakuru which was badly polluted (WebKenya,2003) was reinstated after being including as Ramsar Site.

4.4.2.3 **Greece**

The present wetland policy is a significant part of the National Environmental Policy. Most of its actions are part of the operational programme for the environment. It come within the scope of the natural environment sub-programme and is funded by the 2nd community support framework of the European Union. Lake Mavrouda and Lake Lantza in the central Macedonia were drained in the 1960 and transformed into farmlands, however in 1993 the lakes were re-instated. In addition the government is actively supporting the Ramsar Concept by supporting

organic farming in certain hydrological basins, such as in Lake Mikri Prespa, the Axios Delta and Tavropos.

4.4.2.4   Sweden

Sweden has various Ramsar sites which are declared as natural reserves. There is no dedicated national wetland policy; however there is a National Mire Conservation Plan which forms as an element in the National Biodiversity Action Plan . The objective tasked to the action plan is to carry out survey of the lakes and watercourses in the country. The Ramsar committee has a mixture of authorities such as Swedish EPA, Royal Academy of Sciences, Swedish Museum of Natural History, Centre for Biological Diversity and NGOs. Lake Hornborga, is being restored for which 700 hectares of forest and bushes were cut down and seven kilometres of channels were dug. To raise the level of the water by an average of 85 centimetres, a dam and a three kilometer long embankment were built on the western side of the lake(Hornborgasjon,n,d). Other Ramsar sites where restoration has taken place are the River Helgean, Kvismaren, Hjalstaviken, and Lake Asnen (RAMSAR Sweden,1998)

4.4.3   Biodiversity Conservation

4.4.3.1   Nigeria

The Nigeria's national policy on environment includes policy on conservation and sustainable use of biological diversity. This led to formulation of the Federal Environmental Protection Agency (FEPA) decree in 1988 and revised in 1999 after the formation of federal ministry of environment in 1999. The FEPA focused at integrating CBD concept into national planning, policy and decision making. The policy objectives were to alleviate poverty drive, increase the per capita income of Nigerians and human development. In order to conserve the biological resources, the country has number of legislations including the Forestry Ordinance the National

Parks Decree, the Federal Environmental Impact Assessment Decree, and the Environmental Impact Assessment (CBD, 2001).

4.4.3.2   United Kingdom

United Kingdom ratified the convention in June 1994. However UK has a long and distinguished tradition of observation, study and concern for its natural resources. The UK Action Plan of 1994 is the core of the environmental protection plan. The Department of the Environment, Transport and the Regions (DETR), the Scottish Office, the Welsh Office, the Department of the Environment for Northern Ireland, the Ministry of Agriculture, Fisheries and Food (MAFF) and the forestry commission all combine to ensure that biodiversity is taken into account in all relevant policy and planning issues covering the use of the natural environment. There are universities which undergo research, in addition there 61 botanical gardens which has various rare and unique collection of horticultural. In 1996 two new environmental agencies the Environment Agency (England and Wales) and the Scottish Environment Protection Agency were set up to protect ,monitor and manage water land and air through an integrated environmental regulatory approach (CBD UK,2002).

4.4.3.3   China

To conserve the ecosystem China, and has formulated the China National Wetlands Conservation Action Plan in 2000. However China lacks technical and financial capacity for comprehensive implementation of the priority action plan for wetlands protection. There are number of policies and regulations for the protection of marine and coastal biological diversity. The formulation of Blue Water Action Plan in Bohai Sea and the Integrated Renovation Plan in Bohai Sea inculcates the administrative action for the biological diversity conservation. However due financial constraints and lack of technological knowledge the government can not meet the demand of the actual protection program. The protection of agricultural biological diversity ranks highest in the priority action plan for CBD China also

formulated its China Biodiversity Conservation Action Plan for Agricultural Sectors and the China Biological Germplasm Resources Conservation Action Plan.

4.4.4 Global Ballast Water Management Programme

4.4.4.1 Australia

Australia was the pioneer in taking effective action as per the directives of the IMO. Australia's Ballast Water Management Strategy deals with ballast water/sediment and hull fouling. Australia implemented guidelines in 1990, which are said to be the model for the 1991 IMO guidelines. A Ballast water research development levy on ships was introduced to help support research activities. The Australian ballast water management requirements were mandatory as of July 2001 which is in line with the IMO Guidelines. In Australia the alien specie is regulated as pest control and Quarantine and is placed under the responsibility of the Department of Agriculture, Fisheries & Forestry. The quarantine act treats ballast water as "good", removal of good from ship requiring quarantine is prohibited. Ships arriving Australia must request for ballast water change before 12/48 hours. The biological risk would be assessed and based on this factor the discharge either outside 12 NM or tank to tank transfer would be authorized. Failure to file or complete prearrival formalities would results in withholding quarantine clearance to enter the port. False reporting can result in a 1 year imprisonment under the Quarantine Legislation. (Globallast,2002).

4.4.4.2 Canada

The Canadian Coast Guard developed the Ballast Water Discharges programme for ships proceeding to the St. Lawrence River and Great Lakes. This required the master to file a Ballast Water Exchange Report on entering the St Lawrence River. The guidelines also provided a designated alternative discharge zone where deep water exchange was not possible for reasons of safety or the voyage route. The Coast Guard's guideline is replaced by the Canadian Ballast Water Management Guidelines (CBWM), which is applicable to all ships entering Canada's exclusive

economic zone from seaward. CBWM is not considered law even when it provides indirect sanctions. Failure to provide environmental protection or providing false information is an offence under the Canada Shipping Act (Globallast,2002)

4.4.4.3 **United States of America**

The zebra mussels discovered in Great Lake led to the formulation of the non indigenous Aquatic Nuisance Prevention and Control Act in the 1990. This provided guidelines for ballast water management in lines of the IMO for vessels heading towards US Coast. In 1996 the National Invasive Species Act (NIS) was established to regulate the ballast water which was administered by the US Coast Guard. This Act amended the existing Non-indigenous Aquatic Nuisance Prevention and Control Act, 1990 and contained provision for the Great Lake. The provisions of Clean Water Act required permit for discharge of pollutants in the navigable waters of US. It was considered that this provision can suffice for invasive species when considered as pollutants. However this was challenged in court and clauses were removed from the clean water act. In US all vessels with ballast tanks on all waters of the US to use precautionary ballast water loading practices. The vessels are to posses specific ballast water management plant and trained personnel .In addition vessels that carry ballast water into the USA after operating beyond 200nm are to exchange water outside 200 nm where depth over 2000 m , or discharge in reception facility only. (Globallast,2002)

4.5 **Analyzing the Effectiveness of Conventions**

Environmental awareness is not new; some form of environmental protection policies had existed long before international conventions were made. These policies were made for the betterment of environment such as the century old UK framework for protection of endangered species. As awareness for the protection of environment rose, the need to protect the wetlands was given priority as they were endangered from land-based pollution. Making wetlands as Ramsar sites,

gave them an internationalized heritage posture, thus providing options for protection through international means.

The international conventions for marine environment have benefited in many ways. States having little awareness of the consequences of pollution are now conscious of the repercussions. The developing countries even if unable to implement the conventions in the true sprit has made policies towards development keeping in mind the environment concern which commensurate their economic, social setup and natural resources. The international conventions have an extrovert posture where it not only requires the state to implement policies to be implemented in their own jurisdiction but it requires that the countries policies should not affect other states.

The international conventions approaches towards harmonization of the policies among states, however, what it lacks is realization that countries differ in many aspects. The biggest factor is the population growth which not only creates burden on the natural resources but it also creates a burden on national economy. Most of the developing countries have a high population growth and low per capita income which leads to disregard the concept of environment at the onset. Poverty leads to other back door channels within the system, thus even if a policy are in place its implementation would be far from required. Black market is one of the biggest problems in controlling the international trade of endangered species. Black market is supported by states who are supposed to enforce the convention e.g China is a member of CITES since 1981 but is now considered as the world's largest importer of rhino horn and products. In Pakistan houbara is in CITES's list of endangered animals , the hunting has been banned , however this rule has been relaxed to accommodate Arab dignitaries as it is a very popular bird among Arab hunters due to traditional beliefs that houbara meat is aphrodisiac while in reality it is diuretic. It is opined that the decline in the number of houbara bids is not just due to hunting but also due to the loss of many wet lands which have been polluted or converted into other uses.

The loop hole in the international convention and the lack of will by the national governance in the implementation of policies lead to irregular activities. If a ship owner from a Convention on the Organization for Economic Co-operation and Development (OECD) and wants to send one ship for ship breaking to a non OECD country would not be possible as per the Basel convention ,however in order to circumvent the convention the ship owner have to show that he has sold his ship to an individual of the non-OECD country. Once the ship has been sold, it could be scrapped and will not be covered by any convention.

The countries do not have legislations for every convention that emerges. Most of the countries have one basic environmental pollution protection policy which contains ingredients of several conventions such as the National Environmental Action Plan of Kenya, the UK action plan of 1994 or the National Conservation Strategy of Pakistan. These policies need to be passed by the assembly and then implemented in the legislation. All this procedure takes considerable time, this is the reason why countries take time to ratify new convention as the new convention before being enacted has be adjusted with the countries policies and amalgamated into the existing national policy and ultimately be passed by assembly.

The countries are willing to sign the international conventions, at times due international compulsion or pressure for international trade, however there is a lack of will for implementing the convention in the lateral sprit. This lack of will in most cases is due economic constraints. The developing countries have high growth rate and constantly financial constraints thus allocating funds for environmental protection count not be justified and ultimately look like an uphill task. However there are cases where countries which are finically stable but still are not willing to sign the convention. A number of oil producing and importing countries have failed to ratify the MARPOL, due to the requirement of the port reception facility. The reception facilities are a laborious task for the port state and require huge investments; it also needs place to dump the oily waste. Ratifying MARPOL would obligate the port state to provide reception facility. The tankers normally

would ballast when they are heading towards the oil producing/supplying country, thus the reception facility at these places are required, than other places. Masters and crew face difficulty in cleaning the tanks either for the facility not presents or it is too costly thus the ships opt to dump it in open sea hoping it would not be noticed.

Pakistan is a member of Convention on POP, however the air-conditioning gas commonly knows as R-12 which has been banned due to its toxicity and persistence is commonly used all over. Some local car assembly plants in the country are still persisting with the same gas. Pakistan in addition allowed import of compressors for R-12 gas for the air conditioners. This clearly indicates unwillingness to regard for the convention. The price of the new air-conditioning gas H 136 is kept so high that people are unwilling to buy equipment using this gas.

Developmental projects which effect environment is still carried out with the notion of biodiversity concept that human needs take priority thus alternative measures are not explored.

The international conventions give way to regional conventions ; thus it can be presumed that international conventions provides awareness while the regional conventions are made keeping in mind the political, economical, social and resources of the states parties. The international convention acts as umbrella conventions for the formulation of various regional conventions. It is opined that regional conventions are more effectively implemented as they consist of small group of states. The regional conventions are more specific in nature and thus its implementation is more productive and viable. Due to the inter-state posture of regional conventions they are more closely monitored and effectively implemented.

A table below is perceived how the conventions effectiveness can be considered

Effectiveness of Conventions

| Conventions | Effectiveness | |
	Yes	No
Ramsar	**Yes** – many sites could be reinstated and preserved. The non implementation in states is due to lack of awareness political will and financial constraints.	-
MARPOL	-	**No**- It is not effective as it requires huge investments to setup and large recurring costs. Developing countries, inspite of being willing would not be able to sustain the cost.
UNCLOS	**Yes**- the convention serves as the backbone of many conventions , it provides a basic guideline towards environment protection.	-
GPA	Yes- this has created awareness, even the developing countries with very little resources have adopted some restraining elements to protect pollution. Political will is the most important element in its non implementation.	-
Dumping Convention	Yes- The old perception of pollution from oily and other chemicals has shown decline. It effectively controls the occurrence of incidences thus acts have a proactive approach towards environment control.	-
CBD	-	**No-** the convention is too broad in scope and leaves it to the individual country to perceive what human need is and what needs sustainable

		development. In fact this can be used as escape goat for violating other conventions
CITES	**Yes**- curtailed vide trade of endangered species, however in developing countries it has created back door channels for smuggling of species. It is the political will that could change the perspective of smuggling	-
Basel	-	**No-** the convention deals with OECD countries and directly relates to financial factors. The convention if not strictly implemented in all the ship breaking states its effectiveness would not have any result.
POP	Yes- it restricts the use and a decline in its use is evident. It lacks in the sale and transportation of such chemicals. Political will is a major factor in its effectiveness.	

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Looking at the table we conclude that the major factor for any convention to be successful is the political willingness, economical and social setup.

CHAPTER 5

PAKISTAN -A CASE STUDY

Pakistan is a developing country which has high population growth, aged industrialization practices and financial constraints, all which accumulate and pressurizes the natural resources. The country is party to number of maritime international conventions for prevention of pollution, however the will to implement at various levels of governance and social constraints are far from what should have been expected. The oil spill from Tasman Sprit brought forward many loop holes in the implementation of various regulations and the will of the administration towards effective command and control. The Indus Delta which at one time was sixth biggest mangrove forest is fast depleting which can be attributed towards inadequate policies at various level of governance and a will to evaluate the damage. This case study is to understand the various factors that affect marine pollution and reasons for fast depletion of the mangroves in the Indus Delta.

5.1   DESCRIPTION OF COAST

Pakistan is a littoral state which has its coastline in the North Eastern Arabian Sea of the Indian Ocean .The coastline of Pakistan is divided into the two provinces namely Sind and Baluchistan. The total length of the coast line is approximately 1,050 km with Iran on the western edge and India on the eastern edge. The coastline in Baluchistan is approximately 800 Km where as in Sind it is about 250 km. The Exclusive Economic Zone extends up to 200 NM from the coastline covering an area of 196600 sq NM. (Figure 2)

The coast along the province of Baluchistan is also known as the Makran coast which consists of small to medium height mountain range 30 to 50 Km north of the

coastline. Approximately 90 % of the coast is undeveloped and the beaches are deserted with only few fishing villages with very few habitants .The mud volcanoes present along the shores forms the tectonic rugged terrain of the area .The coastline is predominantly bare desert with variable landforms such as sandy beaches, mud flats, rocky cliffs, headlands, bays, deltas, etc.

5.1.1 Beaches

The beaches along the Makran Coast are normally golden soft sand with not so steep gradients and no vegetation. The well-known golden sand beaches in Pakistan include Somniani, Hingol , Ormara, Pasni, and Gawadar and Jiwani in Balochistan. Sind do not have many sandy beaches except those in Karachi such as Clifton, Hawks Bay, Sandspit and Paradise Point. The beaches in Karachi are very busy holiday resorts visited by picnickers from September to April each year and remains closed from May to August due monsoon. The biggest ship breaking industry at Somania is only 50km northwest of the Karachi, at the border of the two province that are Sind and Baluchistan. The ships are brought at the Somania beach for scrap.

There are no bays or lagoons along the coast in Sind, but several along the Balochistan coast, such as Gawadar Bay, Ormara Bay and Somniani Bay inaddition there are has two very big lagoons at the Kalmat Khor and Miani Hor. The lagoon has dense mangrove vegetation on its inside.

5.1.2 Delta

The southern part of the coastline in Sind is called the Indus Delta. Inner portions of the Indus Delta comprise of mud flats with vegetation where the water from the river enters the delta however towards the seaward side is all marshy with very thick mangrove vegetation (Figure 3). Mud flats are nonexistent in Balochistan except in Gawadar Bay, Kalmat Khor and Miani Hor lagoons. The coast of Baluchistan has a number of mud volcanoes emit mud which includes considerable amounts of methane, ethane and traces of unsaturated hydrocarbons.

5.1.3 Estuaries

The coastline has three main estuaries two are in the Baluchistan called Hingol and Dasht which are seasonal in nature. These estuaries form small deltas with little to no vegetation. On the other hand, Sind has the Indus estuary which culminates in the Indus Delta. The Indus Delta is located at the mouth of the Indus River and covers almost the entire coast of Sindh, south of Karachi. It forms a remarkably uniform landform with large extensive mud flats being intervened by narrow creeks, which are remnants of old, Indus tributaries. The western part of the delta between Phitti Creek and Karachi Harbor is now abandoned, although at one time the Indus River used to flow close to Karachi (Wild Life of Pakistan, Feb2007).

5.2 ISLANDS OF PAKISTAN

There are 6 islands in Pakistan; two of them are on the coast of Baluchistan while 4 are in Sind. The two islands in Baluchistan are uninhabited while the islands in Sind are inhabited and close to Karachi. Two of the islands in Sind are connected by bridges to the main land of Karachi.

5.2.1 Astola

Astola is an uninhabited island in the Arabian Sea, located 25NM south east of the fishing port of Pasni. The island has various marine life around it. The most famous are the endangered green turtle, and the hawksbill turtle which nests on the beaches at the foot of the cliffs. There are scattered coral reefs around the island which forms a hub of various rare migratory water birds. This is also an attractive site for fishermen catching lobsters and oysters. The island was included in the list of Ramsar sites in 2001.

Astola
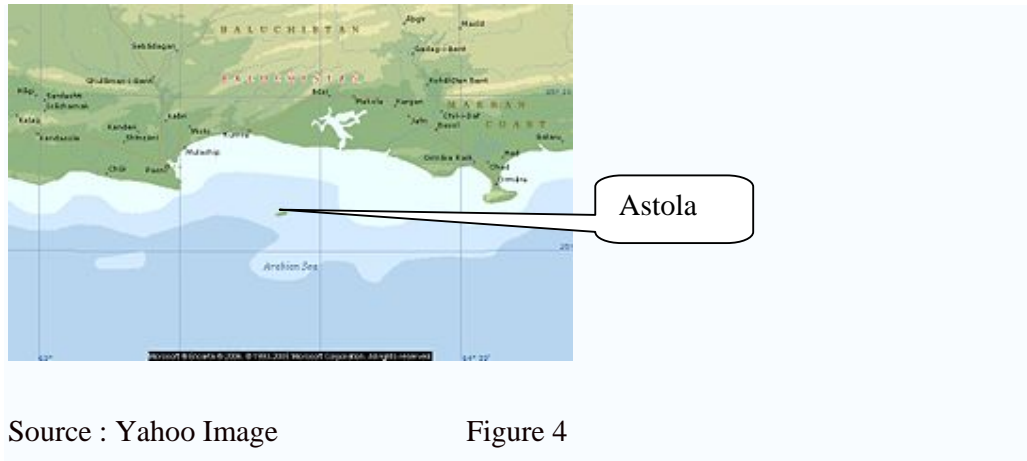
Source : Yahoo Image   Figure 4

5.2.2 Malan

Malan is an uninhabited island 3 Km south of the coast. It is an offshore mud volcano which rose out of the water overnight in March 1999. The survey has shown that the base around the island is muddy with occasional eruptions releasing mud and rocks. This spot has become a fishermen's delight for the last few years with a variety of fish and lobsters south of the island.

5.2.3 Manora

The island is habituated on the west half , the island has dense mangroves on its eastern edge and is connected to the main land of Karachi with a 12 km road and a bridge. Manora is in the south of Karachi and forms a protective barrier between Karachi harbour and the Arabian Sea .The beaches of the island are an occasional site for the picnickers and has various holiday resorts. There is an old drainage system which culminates into the harbour. A small portion of garbage is collected by the cantonment authorities and dumped into the dumping sites while rest of it is pushed into the open drains which ultimately end up in the harbour. Efforts are in hand to stop the garbage being discharges from drains by adding gratings along the opening of the drainage system.

5.2.4 Bhit Shah

Bhit Shah Island comprises three small fishing islands which are in the centre of the harbour of Karachi. The approximated area of these islands is 4 sq Km and the population is about 12000. The area is severely neglected by the local and the central government because of its separation from the mainland. The island lacks any sewage or drainage system. All the garbage and sewage is directly dumped into the harbour.

5.2.5 Bundal Island

Bundal Island is a twin island of Buddo and lies to its west just close to the Indus Delta. The island is a fishing village with people reaching the main land by boats in the estuaries. The island has no drainage or sewage system and is sparsely populated.

5.2.6 Churna Island

Churna is a small uninhabited island located in the Arabian Sea 40km off the North west coast of Karachi, The island has a big reputation for its crystal clear water and water sports and is considered as one of the best sport fishing activity in Karachi with a plethora of choices excursions to undersea world, scuba diving, sailing around and snorkeling. Churna is frequently visited by anglers (recreational fishermen) for fishing, as this is one of the biggest and most active fishing spot in Pakistan. It is pertinent to mention that Churna is almost 8 NM west of the countries biggest ship breaking industry known as Giddani on the Somani beach (Figure 5). In spite of all the activities of ship breaking, the water around the island is clear and still serves as fishing and diving area due clear water.

5.3 INDUS RIVER

Indus River is the most important river in Pakistan. It divided the country in east and west portions as it are running from north to south along the country. The eastern part of the river is mostly industrialized and it keeps increasing as the river runs

south towards Karachi which forms main hub of industrial activity. Other major rivers also culminate in the Indus River, bringing along the industrial effluents, sewage and garbage. Indus River originates from Mansarovar Lake in Tibet at an elevation of about 5182 meters and after traveling over 3200 miles culminates into the Arabian Sea through Indus Delta. The fresh water flow along the Indus was approximately 150 MAF per year in the past and the River Indus carried over 400 million tons of silt to the Delta. However due construction of dams and barrages along the Indus, the quantity of water has been reduced to less than 20 MAF which reached the Indus Delta. The 1991 Water Accord put an interim minimum limit of 10 MAF outflow and even that limit has not been met. The silt deposits are estimated to drop way below 30 million tons per year if the outflow remained 10 MAF or lower. Presently only Seasonal water floods the Indus Delta. If the Vision-2025 of Pakistan is implemented as planned, the lower basin will receive practically no water and degradation of the Delta will certainly worsen tremendously (Altaf, May 2005)

River Indus

Source: Goggle Earth   Figure 6

One of the major sources of pollution of the River Indus is the pollution from the industries in the northern part of the country. Lahore which is 1000 Km north of

55

Karachi discharges 240 million gallons of sewage per day mainly into the river Ravi (BAP,2000) which ultimately joins the River Indus. Another factor of pollution of the River Indus is green issues mainly from irrigated agriculture, rain-fed agriculture, forests and rangelands. The area around the Indus is a densely agriculture land. Runoffs from fields where agricultural fertilizers and pesticides are used indiscriminately and inappropriately has contaminated ground water and surface water (UNIDO,11 Dec 2000).

5.4   Indus Dolphins

The Indus River has the rarest breed of dolphins called the Indus dolphin. This Indus dolphin is one of the world's rarest mammals and the second most endangered freshwater river dolphin. In 2001 a survey was carried out by the WWF-Pakistan and approximately 1,100 specimens of this species exist today at the lower reaches of the Indus River (w.w.f Pak, n,d). The number was declining because of various factors, including water pollution, poaching, fragmentation of habitat due to barrages, and dolphin stranding in the irrigation canals. The conservation programme showed encouraging results and new calf's were witnessed in the lower portion of the river and the number of dolphins are increasing.

5.5   Indus Delta

The Indus River is Pakistan's lifeline and greatest natural asset .There are 17 major creeks and a number of minor creeks, mudflats and mangrove forests that makes up the delta which once covered an area of approximately 600,000 hectares (Altaf , May 2005). The delta is facing a major degradation threats that could well result in catastrophe. The one of the most predominant factors of degradation is the acute reduction of the flow of fresh water from Indus River. Comparison of the satellite picture of 1992 and 2000 indicates that small areas of new open water areas begin to appear in the delta plain. The 2000 image shows nearly 500,000 acres of open water which when compared 1992 is an increase of 237,111 acres of new open water. In addition there is a apparent shoreline erosion along the entire delta front

predominantly due lack of sediment and freshwater from Indus reaching the coast. This has also caused the river to shift its course causing new land forms to emerge (Huh et al, 2004). The delta consists of mangroves which grow in less saline water and has a mix habitat of fresh and sea water biota habitat. As the delta dries up and the mangrove forests decline, the sea is slowly sweeping in thereby increasing the salinity. The Delta is now said to be only 160,000 hectors. People loosing livelihood moved upstream to avoid shortage of drinking water. The reduced water in the river has caused the sea to intrude inwards making the ground water saline which was earlier used for irrigation (Indymedia,Oct 2006).

5.5.1 Degradation of Indus Delta

The Indus deltas degradation is attributed towards two main factors. The first reason of degradation is due to lack of water from the Indus River, pollution from river and Karachi Harbour and other sea based pollution. The second reason of degradation is the direct reclamation of Indus delta for various reasons. It has been estimated that 63,495 acres of wet land was reclaimed in 1992 for agricultural purposes. The 2000 satellite picture indicates that a total of 220,513 acres of more land has been reclaimed for agriculture. Thus from the biodiversity point of view we have additional 220,513 acres of agriculture land on one hand and a loss of 319,601 acres of wetlands loss due to natural causes and man's intervention. The average annual rate of wetland loss is 39,950 acres/year. It is estimated that approximately 10% of the wetlands in the Indus River delta has been converted from wetlands to open water or agricultural use (Huh et al,2004).

5.6 Mangroves

The Mangrove forests in the Indus Delta spread over 263,000 hectares and were the sixth largest in the world few decades back. The Indus River flowing into the river contained various nutrients and silt which would deposit along the Indus Delta providing sustainability to the mangroves. The mangroves provide a slow transition from the fresh inland waters of the Indus River to the salty Arabian Sea. The trees

are well adapted to surviving in a saline and fresh water environment. This uniqueness of the mangroves provides numerous ranges of habitats from of trees, wild life, fish and crustaceans. The mangroves in the Indus Delta act as windbreakers and prevent storms from reaching inland and keep the sea away from coast , it also prevent any coastal land erosion, and keeps the river silt from reaching the harbor. Mangroves in Indus Delta act as breeding area for various commercially marine life form, and serves livelihood to more than 100,000 fishermen.

The mangroves in the Indus delta are not diverse and are resistant to high salinity levels of water thus capable of surviving the region's extreme conditions (WWF,2001). The Delta is an important transition station for many species of migratory birds. During the winter, millions of waterfowl, including pelicans and flamingos, stop over in the Delta for feeding and breeding.

It is a common belief that mangroves are salt water plant. The fact is that mangroves are tolerant of salt water but basically depend on a steady supply of freshwater to keep the salinity levels within certain limits. As the freshwater from Indus River keep decreasing the effects on the mangroves varies considerable. Two important effects are the structural effect and the productivity reduction. The mangrove trees would not die off rapidly, the average life span of the existing trees would be reduced from 60 years to approximately 40 years. Lower productivity will not cause new plants to grow rapidly, thus eradicating the mangroves in a slow but consistent process. There are very few new plants growing. Other factors towards mangroves depletion are as follows (IUCN 2005):

5.6.1 Cutting

People from the coastal villages use the mangrove wood for fire and other domestic use. There is no control on cutting on these trees. However some resistance by the Forestry department has shown some control.

5.6.2 Grazing

The effect of grazing is not significant however the cattle's kept by the local habitants eat the leaves of these mangroves .Areas where the flow of fresh water in minimum show rapid reduction of the trees whose leave has been eaten.

5.6.3 Browsing

Camels are a very common means of traveling in these areas and are often sold and sent on small boats to gulf countries from the coast. These camels are required to walk on the marshes until they board the boat. During their passage they kill the new plants under their feet.

5.7 ENVIRONMENTAL PROTECTION POLICY OF PAKISTAN

Pakistan has a high growth rate with over 160 million people (PCO,5 Aug 2007) this posses pressure on the natural resources of Pakistan and cause environmental problems. After signing the UNCLOS, the Pakistan Environmental Protection Ordinance 1983 (PEPO) was formulated to tackle environmental problems systematically. The ordinance was made unpopular because of the enforcement capacity of the ordinance and the emphasis on penalizing entrepreneurs rather than supporting them in adopting less polluting processes and technologies. The incorporation of ISO 9000 and 14000 were voluntary standards for better competition in the open market outside Pakistan. The Five Year Plan of 1993-1998 was the first to clearly incorporate environmental concerns, and urged that environmental protection be made a key criterion in the selection and development of technologies. In 1997 Pakistan Environmental Protection Act (PEP-Act 1997) was formulated which strengthened the national and provincial level for the formulation, execution and enforcement of environmental policies. The new policy inculcated a self monitoring and reporting process by the industries and revised the National Environmental Quality Standards (NEQS).

In Pakistan, the Maritime Security Agency (MSA)is the competent authority for oil spill response. Pakistan has prepared a draft National Contingency Plan (NCP), which is presently awaiting government approval. According to NCP the Maritime Security Agency has been vested the responsibility of oil spill inside the Exclusive Economic Zone, where as respective port authorities are responsible for oil spills within the port limits, however the resources of the port authorities are very limited, hence services of MSA would be called upon to assist the clean up within the port authorities also. Pakistan has very limited cleanup resources consisting of mechanical sources of oil recovery in sea and in harbour. Cleaning of shores will remain manual and will be carried out using manpower. There is one vessel and one helicopter which can be used for dispersant application. In response to Tasman Sprit incidence the Karachi Port Trust (KPT) has recently acquired few mechanical oil spill response equipment and personal from KPT and MSA has been trained in response actions however inadequate equipment would reduce their efficacy in major oil spill.

Since the Tasman Sprit Oil spill, a Mutual Oil Spill Auxiliary Committee has been formed by the comprises of few oil handling companies which under the direction of the Director General Ports & shipping must has a Tear 1 level of response equipment (ITOPF, n,d).

5.8 WATER POLICY IN PAKISTAN

Pakistan is a traditional country which depends on irrigation and water resources for 90 percent of its food and crop production. Normally there are two main crops in Pakistan Rabi Crop(Winter) and kharif (summer).To augment this irrigation Pakistan also has the largest Canal network approximately 56,073 Km (Irrigation System of Pakistan ,n,d). River Indus is the main source of water for irrigation and domestic use. The water is allocated to the provinces through a Water Accord which is implemented by the Indus River Systems Authority (IRSA). Only 35.5 % of the water that reaches the crop is utilized (Irrigation System Of Pakistan, n,d) while

other is wasted . There are often dispute about the allocation of water especially in sharing water during dry periods. This regular disputes has led to slow progress in the development work is the last few decades. The agriculture land is mostly owned by landlords who are politicians or have political links and could manipulate the water quantity. The Devolution Plan of August 2001 decentralizes most public sector activities from the federal and provincial levels to the district level, including public sector water supply and sanitation. The irrigation, legislation has been passed to convert the Irrigation Departments into financially self sustaining autonomous Provincial Irrigation & Drainage Authorities (PIDAs). Under the PIDAs, the operation and maintenance of individual canal systems is to be entrusted to autonomous self-accounting Area Water Boards (AWBs).

5.9   SOURCES OF POLLUTION IN PAKISTAN

In Pakistan marine pollution is primary restricted to the areas, which receive waste from the municipal, industrial, agriculture and oil spill sources. The major waste receiving areas in Karachi or close adjoining area is from industrial sites of Karachi city and along the few locations from the Hub industrial areas of Baluchistan. The 800 Km coastline of Baluchistan is almost free from marine pollution from land based activities as it is sparsely and thinly populated. There are four coastal areas near Karachi which receive land based pollution, which are:

- Port Qasim on the Indus deltaic region.
- Gizri Creek on the estuary of the Malir river.
- Karachi Harbour, located on the estuary of the Lyari river.
- Cape Monze area on the estuary of Hub River.

The Pakistan coast faces semi-diurnal tides hence the coast is washed twice every day by the tides taking away the pollutants, however inside harbour the pollutants are oscillating for a few days until they are evaporated or settle down at the bottom.

5.9.1 **Pollution from Domestic Sources**.

There are a number of environmental issues in the coastal city of Karachi; amongst these is the disposal of domestic wastes and industrial effluent causing marine pollution. The pollution problems have arisen mainly due to the indiscriminate discharge of effluent into the rivers .The problem of pollution increased considerable due to the indiscriminate discharge of effluent from industrial and agricultural sources and disposal of untreated liquid and solid wastes generated from domestic sources into the sea .About 300 million-gallons per day (MGD) of wastewater containing Biochemical Oxygen Demand (BOD) reaches the coastal waters of Karachi through public sewers, nallahs, streams and rivers. The quantity of the sewage generated has increased 350 MGD in the last few years (DAWN, 25 March 2007). Two sewage treatment plants with a capacity of 20 MGD each were installed in SITE and Mahmoodabad to effect primary and secondary treatment facility. In March 96, the capacity of these treatment plants was increased to 51 and 46.5 MGD. In addition, a 54 MGD lagoon type sewage treatment plant at Mauripur was also completed. The combined treatment capacity of the treatment plants is approximately less than 50% of the total sewage generated. Consideration for treatment plans of approximately 100 MGD is in progress.

Karachi produces approximately 8000 tons of solid waste every day. The collection and safe disposal of solid waste falls under the purview of the City District Government Karachi (CDGK). However, a substantial portion of uncollected solid waste i.e. around 60% mixes up with wastewater and ends up into the Karachi harbour. It spreads in the harbour and accumulates in different points of the harbour, along the ships, jetties and inlets thus compounding the existing problem.

A new garbage collection plan was under consideration where by the residents were required to dispose their garbage in plastic bags in the designated places from where they would be collected by the union council (UC). However this has severely been

criticized by many residents as it required the residents to pay for garbage disposal in addition to the already paid conservatory charges (Dawn, 20March2003).

5.9.2 **Pollution from Industrial Sources**.

Pollution from industrial sources is restricted to the industrial city of Karachi. The Industrial area of Karachi has approximately 6000 small and large industrial units. This can be grouped in to different industrial zones. These included Sindh Industrial Trading Estate (SITE) in the North, The Landhi Industrial Trading Estate (LITE) in the East and the Korangi Industrial Area (KIA) in the South. The effluents from SITE and LITE is very large is quantity and is discharged untreated into Karachi harbour through the Lyari River. The effluents from the KIA is also discharged untreated into the Malir River into the Korangi Creek and ultimately inside the Indus Delta. Approximately 2000 tons of BOD of industrial and domestic wastes are dumped mostly untreated onto the shores of Karachi daily. In addition nickel pollution is also evident from discharge of the hundreds of tanneries located close to the two rivers and the coast (Saifullah, 2002). Apart from municipal sewage and industrial wastes, the Lyari River also brings in a heavy load of floating garbage. It is estimated that the 50% pollution of the Karachi harbour is brought in by the Lyari River (DAWN, 18 Feb 2005). Many creeks and coastal waters in Karachi exhibit eutrophication due to high levels of organic pollution. The characteristic smell of hydrogen sulphide in parts of the city is a sign of the intense bacterial activity from the presence of organic wastes (BAP, 2000).

5.9.3 **Pollution from Solid Waste**

The Karachi Municipal Corporation (KMC) is responsible for the collection of solid waste. The city has two landfill sites, each with an area of 500 acres and a combined capacity to absorb 2,000 ton of waste per day for 20 years. However there are few undesignated dumping places emerging which the KMC is endeavoring to stop. Few incinerators are located at different sites which are either government owned while others are private. Most of the incinerator deals with solid wastes of hospitals. The

cause of concern is the poor administration of garbage collection which results garbage to be uncollected for days. Wastes are scavenged and burned, exposing scavengers to health hazards, adding to the already severe problem of air pollution and creating opportunities for pests to breed and to spread diseases. Some companies have contracted private companies for garbage collection but as these companies have no agreement with KMC these companies simple dum the garbage either in the Rivers or at the banks.

5.9.4 **Karachi Harbour**

The Karachi Harbour is the lifeline of the country. 95% of the trade is carried from Karachi Port. Dredging is a continuous process in Karachi harbour in order to maintain the desired depth of water. The maintenance dredging land reclamation practices along the coast loosens and re-suspended solids which the tide moves towards the coast. Dredging also disturbs the hydrogen sulfide-laden upper layers of sediments forcibly mixing and dissolving hydrogen sulfide toxic substances in seawater.

Karachi harbour area, including the marine channel, is one of the most oil polluted areas along the coast of Pakistan. The total area of Karachi Port, including backwaters is about 25 square km. roughly 50 billion cubic meter of seawater enters and leaves the port area during the tidal cycle. Around 3,000 to 4,000 ships visit the port each year. In course of routine operations, ships discharge oily ballast water and bilge water, and cargo tank washings. Oily spills from oil-tankers and general cargo vessels, are significant sources of pollution (DAWN , 23 Oct 2002). The law and regulation to prevent and control Pollution exists however the implementation of these laws is far from encouraging. With scarce national government policies on environmental controls, the industries are able to dispose of the waste the cheapest way by dumping into the sea. The Karachi harbour is an enclosed harbour which has only one opening thus any pollutant entering the waters of the harbour would keep oscillating with high and low water for many days. (Figure 7)

The Lab test carried out of the water taken from different places in the Karachi harbour indicates a variation of chemical agents from the original sea level, thus the basic composition of the water has been altered. The low level of conductivity of the water reduces the effectiveness of cathodic protection thus damages the sea water circulating system of ships and other cathodic protected areas such as buoys and other structure in water. Ships are often made of mild steel ,the increased chloride level from the normal accelerates the erosion process, thus exposed portion from anti corrosive paint in ship would be badly affected. The ship propeller is usually made of copper alloy, increase chloride levels in water cause pitting in the propellers. The elevated Sulphate causes growth of certain organisms, unsuitable for marine life. It also leads to production of corrosive H_2S gas.

Lab Readings

S No	Tests	Standard Value of Seawater	Results
a.	PH	8.2	7.2
b.	Conductivity	52,000 mMho/Cm	47,000 mMho/Cm
c.	Chloride	19,350 ppm	21,200 ppm
d.	Sulphate	2,712 ppm	3,200 ppm
e.	Sodium	10,760 ppm	12,300 ppm
f.	Potassium	387 ppm	290 ppm
g.	Calcium	413 ppm	370 ppm
h.	Magnesium	1,294 ppm	1,270 ppm
j.	Alkalinity	142 ppm	210 ppm (590 ppm at the Layari inlet)

Source :Pakistan Navy   Table 2

The alteration of the water of its natural composition indicates the amount of chemicals that enters the harbour from land based sources. The Lyari River which carries wastes from the industries discharges water in the harbour. It is pertinent to mention that, inspite of the limited treatment plant the discharge contains considerable amount of chemicals. The most alarming point to be considered is that the sludge of these treatment plants is often user for agriculture without being verified for chemical content.

5.9.5   **Pollution from Agrochemicals**

As already mentioned that majority of agriculture land is owned my politicians or those who have political links. This has led to liberal policies by government towards pesticides resulting import of cheap quality of pesticides which have harmful characteristics and often persist for longer time. In order to maintain the market requirement government often provides subsidiary given to farmers which has resulted in indiscriminate use of chemical based insecticide.

5.9.6   **Oil Pollution**

Sources of oil pollution in Pakistan include effluent discharges, mechanized fishing boats and the cleaning of bilged and tank washing by the large number of merchant vessels as well as oil tankers that pass through the EEZ of Pakistan. Approximately some 2500 oil tankers carry 33 million tons of crude oil. The port has regulations in place but its implementation is not exercised effectively. The ships often clean their oily tanks and discharge sloppy waste. The garbage / oil disposal boats are present but ships find it cheap to dump oily discharge without being caught.

5.9.6.1 Tasman Spirit

The Tasman Spirit a Greek oil tanker, ran aground at the mouth of the Karachi harbour on 28 July 2003 spilling approximately 35,000 tons of oil into the Arabian Sea. (Figure 8). Fumes from the volatile organic compounds and mist containing hydrocarbons, accompanied by a strong smell, dispersed into the residential area (ENS, 4April 2006). People from large portion of the residential area had to evacuate home for weeks. The Clifton beach being a plain gradient was a picnickers hotspot. The residential area stretching over 12 km along the Clifton beach was a prize asset for the owners. The cost of property crashed to its lowest ever in last 10 years. The oil spill caused business and schools around 15 Km of the coast to closed for weeks. There have been incidences of fire from the fumes, because of which electricity had to be cut off for few days. Hospitals reported sever cases of

headaches, nausea, dizziness and sore throat. The oily beaches were full of dead fish and turtles as it were the breading season. Numerous marine birds died after consuming oily fish. The livelihood of 90,000 registered fishermen of Sindh were effected as the oil slick in fishing zone led to a sharp decline in the sale of seafood in the city markets. Prices of different fish species came down by 60-70%. Owing to the low off-take, traders at fish harbour had to curtail bulk procurement which forced fishermen to fish in the coastal areas of Thatta and Badin rather than in the affected zone, and also to dispose of their catch at whatever rate offered (Beg,7 Feb 2004).

5.10   CAUSES OF POLLUTION AROUND KARACHI

5.10.1   Port Qasim Area

Port Qasim, is located in the South of Karachi in the Indus Delta Region. The port activities and adjoining industries are the major source of pollution in the Indus Delta. The major source of pollution is from the shipping activities inside the port, the wastewater from Pakistan Steel Mill and Power Generation Plants.

5.10.2   Korangi Industrial Area (KIA).

The main industries in the Korangi Industrial area consist of textile, metallurgical, auto engineering, machine tool factory, power plant, oil refineries, chemical, pharmaceutical and cottage industries. These industries are discharging directly all of their waste into the adjacent coastal creek waters, without any treatment which contains all sorts of toxic and non-toxic material.

5.10.3   Malir River and Gizri Creek Areas.

The main sources of marine pollution are from the domestic sewage, industrial effluent, wastes from Landhi cattle colony and the Korangi fish harbour.

5.10.4 Lvari River

In SITE there are over 5000 registered industries and several thousand small industries including cottage industries that are even not registered. The effluent which these industries are discharging is almost untreated and being dumped directly into the upper harbour and ultimately into the Arabian Sea. The SITE area has five main drainages system which flow into the Lyari River. These drains are not covered and are a constant source of pollution to the surrounding area. As the industrial effluent flows in these drains it is mixed with domestic sewage and solid waste. Only a small portion of this flow enters the treatment plant while over 70% is passed on to the upper harbour untreated. The treatment plant is capable of biologically treating industrial wastewaters however the plant capacity is reduced if industrial effluent exceeds 25 per cent of the total effluent. Thus there has to be some form of effluent pre-treatment by industrial unit, which in most case is absent. The effluent leaving treatment plants is not tested for the presence of pathogens or heavy metals. The effluent from the plant is sold for irrigation. It is pertinent to mention that levels of human pathogens and metals content of the sludge is unknown, and it may therefore not be appropriate for agricultural purposes.

Lyari River enters the main city and passes along the centre of the city until it culminates inside the upper harbour. The banks of the Lyari River also have the biggest slum of Karachi. Thus apart from the industrial wastes the slums are also contributing direct pollution into the river.

5.10.5 Hub Industrial Trading Estate and HUBCO Power Plant Areas

Hub Industrial Trading Estate (HITE) and the HUBCO power plant are situated on the border of the two provinces of Sind and Baluchistan. The Industries operating in HITE and the HUBCO power plant are discharging their effluent into the Hub River which is ultimately dumped into The Arabian Sea, This area is close to the ship breaking Industry.

5.10.6 **Baluchistan Coastal Areas (Gadani, Pasni, Gwadar & Ormara).**

The countries biggest ship breaking industry is located at Giddani along the Somiani beach, which has been functioning since last 50 years and causing all sorts of metal/oil polluction in the area. A gradual building of heavy metals has been reported in the sediments from the Gadani coastal area. The new Naval harbour at Ormara and the upcoming Harbour in Gwadar would contribute towards pollution if strict measures are not taken to prevent pollution.

5.11   THE ECONOMIC VALUE OF MANGROVES

Mangroves are rich in fish and other sea food; it has very productive ecosystems which helps human beings in different ways, capable of providing a range of goods and services to the human populations. The resources extracted for these mangroves have a direct and indirect impact to the human population. Thus we can say that the economic activity has also direct and indirect values.

5.11.1 Direct Value

The direct value attributed towards the value of Mangrove include the wood from mangroves which is used as fuelwood , boat construction and house building . It addition the mangroves has lot of fish and crabs caught in the waterways running through mangroves, and traditional medicines derived from plants and other species found in mangrove ecosystems.

5.11.2   Indirect Value

The indirect value of mangroves is the support and protection provided to economic activity and property by the wetland's natural functions, or regulatory 'environmental' services". The mangrove acts as nursery for much sea food and other habitat which forms a ecosystem of the area. Protection of the same would improve the ecosystem and the biota in the area would increase. Another value is of the protection it provided to the coastal towns from the harsh sea conditions.

5.12   IMPLEMENTATION OF CONVENTIONS IN PAKISTAN.

At the national level, environmental legislation regulates the activities of enterprises and individuals. It provides the framework within which environmental standards can be enforced. At the international level, conventions, protocols and agreements bring countries together at a bilateral, regional or global level to address common marine concerns.

5.12.1 MARPOL 73/78 Convention.

Pakistan is a signatory to MARPOL 73/78 Annex V but has not ratified the MARPOL 97 Annex VI due to financial constraints as ratification would require the port to invest heavily on port reception facilities and the subsequent disposal of the oily waste/ballast water. Pakistan neither could allocate finances for this and nor does the country has adequate trained manpower to implement the same. However interim measures have been taken which though do not fulfill the requirements completely but is a way towards improvement. Based on requirements of MARPOL the Director General Ports & Shipping has formulated a number of checklists for the Mercantile Marine Department and the shipping companies to ensure effective implementation of this convention. Sewage treatment plants were installed on board ships flying Pakistan flag.

5.12.2   Biological Diversity

Pakistan Ratified the Convention on Biological Diversity (CBD) in 1994 and prepared the Biodiversity Action Plan (BAP) for effective implementation .The BAP is a part of the National Conservation Strategy (NCS). The NCS was presented in the United Nations Conference on Environment and Development which was widely appreciated. This included implementation at various levels of the government. The

major step was the establishment of the Ministry of Environment in 1994 and a separate ministry in each of the provinces. Pakistan enacted the Pakistan Environment Protection Act 1997 and enforced the National Environment Quality Standard (NEQS) for effective monitoring the industrial waste and other Environmental pollution. This provided environmental awareness and included Environmental policies in all development plans which led to the process of the Environmental Impact Assessment (EIA) in other development schemes. The Ministry of Environment of Pakistan is responsible for Implementation and enforcement of Biodiversity Action Plan (BAP). The BAP action committee has been formulated at the provincial level and a Biodiversity Secretariat has been established inside the Ministry of Environment 2005. The provincial level of Wildlife, Fishery and Forestry all stems from the Biodiversity Action Plan. Pakistan is facing problems in enforcing the convention because of lack of coordination among various enforcing agencies. The laws and regulation enforced within the province are made by the provincial government where as the federal government made the national policy thus creating a gap in coordination. The concept was incorporated in the Five Year Plan which emphasised the development of the provincial conservation strategies plan to carry forward the NCS implementation.In order to have consistency the plan should be integrated in the development plans of the next five year plans (Surayya Khatoon, n,d).

5.12.3 Basal Convention

The Basal Convention was signed by Pakistan in 1992 and ratified in 1994. The government of Pakistan is giving high priority on the environmental sound management of hazardous wastes including prevention of illegal international traffic in hazardous waste. A national inventory of chemicals is being developed to provide information on registered hazardous chemicals wastes being imported or locally produced. In addition a mechanism to monitor the flow of toxic hazardous substances into Pakistan in line with UNEP is formulated. Violation of the NEQS as

per Pakistan Environmental Protection Act 1997(PEPA 1997) is punishable. The industries have started setting up waste control mechanism by in-house management and end of pipe treatment. The tanneries and textile and chemical industries are encouraged to install waste treatment plants. It was in PEPA 1997 that the hazardous substance was first time defined.

Pakistan has one of the biggest ship breaking industries of the world. However there is no strategy for the Environmentally Sound Management (ESM) of the Hazardous waste generated from the ship breaking as per Basal Convention. Some Action Plan for implementation of the Basal Convention in the ship breaking industry is in process. In addition campaign on the awareness among the workers is also undertaken.

It is pertinent to mention that in spite of NEQS in place, the hazardous chemicals brought onboard ship for scrap goes unchecked. There is a clear lack of willingness towards implementing policies. If the policies are made stringent then the ships breaking industry would loose business as ships from OECD countries would opt to for other ship breaking industries where there won't be any requirement for cleaning the ship of hazardous chemicals.

5.12.4 **Ramsar Convention**

Pakistan signed the Ramsar Convention in 1976. Initially there were 9 Ramsar sites but now it has increased to 19 which included some sites which are Green Turtles Hatcheries. There is no specific legislation that has been made however the Ramsar sites have been placed under the protection of Provincial Wildlife Laws. In addition a national wetland committee has been set up for monitoring and coordination of wetland activities .A Wetland Action Plan for Pakistan has been prepared by the Ministry of Environment and WWF – Pakistan. Pakistan is implementing the global environmental facility funded projects for the conservation of the wetland.

5.12.5 **CITES**

Pakistan signed the Convention on the International Trade in Endangered Species of Wild Fauna and Flora in 1973 and subsequently ratified the same in 1976. The Government of Pakistan has imposed a moratorium on the commercial trade of mammals, reptiles and protected birds. As a consequence of this Pakistan has declined the export of fresh water turtles to China and other Asian countries. Export of falcon and few other species of eagle has also been declined. There has been a considerable increase on the number of these species over the last couple of decade. The formulation of the Mountain Area Conservancy Project (MACP) has made inventory of endangered species. And provides rewards for protection to such animals. However lack of awareness of the stakeholders about CITES and illegal trade of these species is making implementation of CITES difficult. The MACP has recently formulated a draft for CITES Law in consultation with the provisional stakeholders and it is hope the implementation would improved considerable.

The wetland of Pakistan is a regular ground for the migratory birds ; the depletion of Mangroves of the Indus Delta has reduced the quantity of these birds however the endangered migratory birds regularly visit the other wetland of the country. Pakistan has signed a MoU with six regional countries for the conservation and protection of Siberian crane during migration. According to this MoU Pakistan is obliged to provide full protection to these birds and provide all possible habitual conditions.

5.12.6 **Persistent Organic Pollutant**

Pakistan signed the Persistent Organic Pollutants (POP's) in December 2001 but has yet not ratified the same. In order to proceed further with the convention the National Implementation Plan (NIP) for POP has been formulated. Pakistan has already enforced Agriculture pesticide Ordinance which regulates the use and production of pesticides. Pesticides are authorized to be used only after laboratory test have clarified as per the ordinance. Pakistan lacks the research facility and trained staff for enforcement of the law. Pakistan is also working to develop a

chemical management programme aiming at the chemical data base development needed to strategic planning.

5.13   Evaluations of Environmental And Socioeconomic Issues

Unlike developed countries, the developing countries like Pakistan face serious environmental problems. Rapid population growth and GDP have put enormous pressure on the country's natural resource base and have significantly increased levels of pollution. As the agriculture demand increases the water requirement also increased .The accelerated industrialization and urbanization have led to increased levels of waste water pollution, solid waste, and vehicle emissions that have resulted in serious health problems in many areas of the country. The contaminated drinking water causes about 60 percent of infant mortality. The National Conservation Strategy (NCS) aims at 10 years investment plan for addressing environmental issues. It is opined that environment issues should focus on longer time frames; its progressive development should be included in the country's five year plans. The absence of federal law on environmental aspects has created a gap. There is no harmony in the provincial legislations. The federal and provincial legislations should be in harmony and include inputs from provinces, industrial groups, and other relevant professionals. The Sustainable Development Policy Institute (SDPI) was set up on the basis of NCS recommendations to provide economic and policy analysis for sustainable economic development and most of the provinces have created environmental cells in their Planning and Development (P&D) departments in order to screen investment projects for their effects on the environment. What really lacks is the input from the industrial sector. Policies are made in isolation and when they come in conflict with the industrial sector either they are scrapped or industry has to pay heavily.

The NCS only discourages practices which are detrimental to environment but there is no encouragement for those who support the utilization of the natural resource in a sustainable manner. The institutions responsible for monitoring environment are

administratively weak and incapable. MSA is the environment cleaning and monitoring agency in Pakistan and has been tasked to clean and monitor the EEZ. The resources allocated for this purpose is small that even twenty percent of the EEZ cannot effectively be monitored. MSA have few very old skimmers but lack of training and adequate trained manpower brought the weakness in front when Tasman Sprit incident happened. Karachi Port Trust is responsible of cleaning and monitoring pollution inside the Karachi harbour. The port has very limited resources to fulfill its obligation, hence only tries to fulfill the requirement of the shipping industry. This proves that environment is not an important factor for both the agencies inspite of the fact that they both are responsible for maintaining and monitoring pollution. This is a clearly indicates lack of political will to curtail pollution. It can be argued that all these equipment require sufficient finances even when pollution of such magnitude rarely occurs, but justifying the possession of nuclear technology with that of equipment required for environmental pollution or funds allocated for social uplift need to be justified.

The Karachi harbour once had very clear water however due to indiscriminate policies by local administration and lack of budget allocation caused the untreated water of Lyari River to pollute the harbour. The river is dumping municipal sewage in addition industrial wastes inside the Karachi harbour. The Lab report is an evidence of the chemicals being dumped into the harbour. The question arises, when NEQS are in place and monitoring agencies defined such as MSA and KPT, then what factors are present that restricts the implementation of environmental protection? The present level of pollution inside the Karachi harbour could not have taken place in few years; instead it must have taken over 15 to 20 years to come to this level .This indicates that various governments during this periods have never took pollution seriously and have not contributed effectively. It can be said that implementing environmental policies and installation of treatment plants would require substantial amount of resources and finances but how can it be justified

when the country has a defence budget allocation of over Rs 233 billion (25 Billion SEK).

It is envisaged that the most significant reason for NCS's lack of implementation is its overambitious attitude over the environment, disregarding the existing technical, economic, and institutional constraints of the country. This also reflects a serious lack of political commitment to sustainable environmental improvement. There has been lack of consistency in the policies and it is opined the factors such as economic stagnation, weak environmental information system, lack of awareness in the government administration, bureaucratic hurdles and lack of political will, weak local government tier and Budgetary constraints and underpaid environment staff all compound towards inadequate implementation of the NCS.

From a broader perspective there are two main factors of protecting or improving environment. The most important factor is the policy and the next important factor is the enactment of policies into the regulations. The policies should be general in nature which should be based of the social setup, economy and the resources available. Based on these policies legislations should be formulated which should indicate harmonization at all levels of administration. It is opined that the environmental problems are often aggravated by inappropriate policies that provide incentives for practices detrimental to the country's natural resource base such as subsidies on some agricultural inputs have caused damage to the environment where cheap chemical based pesticides were imported, which has very adverse effects on crop, soil and environment. The cheap pesticides in market allowed indiscriminate use of pesticides. People need to be made aware that they themselves are a victim of the ill effects of these chemicals.

One of the major causes for the loss of mangrove along the Indus Delta over last few decades is predominantly due consistent reduced water quantity in the River Indus. The construction of dams has reduced the water quantity and the new upcoming

construction of new dams is likely to further aggravate the situation unless some radical steps have been taken. The Water Accord 1990 guarantees minimum 10 MAF of water annually for the Indus Delta. If mangroves of Indus Delta is to be considered important than some radical steps have to be taken to preserve it. Consistent reduction of water from Indus River would only decline the life and productivity of the mangroves. It is envisaged that the quantity of water is not the actual fault. The remedial steps lie within the preview of the governance. Sixty five percent of the water used for irrigation is wasted. Apart from water scarcity in Indus River, wetland reclamation into agriculture land is also a cause of concern. The laws and policies for reclamation of wetland exist, but the lack of willingness at every level of governance to curtail such actions has now indicated that over thousands of acres of wetland have been converted for agriculture. The lack of willingness to stop such process at that time is now justified by the locals and they strive for more reclamation of land.

The decision to apportion and/or divert water should only be carried out for agricultural purposes. The strong agriculture lobby of Pakistan perused various subsidiaries on payments from the government and often benefited from untimely water provisions. This did not allow a viable water market to develop. As the population of the country is increasing the national policy is striving to increase the agriculture growth inspite of the knowledge that 65% of the water is wasted.

People with low income tend to have short time horizons and favor consumption what is available today rather than reaping for what comes later. Poverty and environmental degradation are closely connected, while on the other hand a poor and fragile environment can be a major cause of poverty also. The most significant aspect of environmental degradation is the high growth rate and population boom. Over the last couple of decades the population growth is over 3% per annum. The urban population has increased in a very fast rate there by putting alarming pressure on the natural resources.

As the country is moving towards industrialization the level of industrial pollutants emitted is also growing at a very rapid pace. The indiscriminate discharge of industrial waste water is causing serious environmental problems such as contamination of groundwater which is often used for irrigation and drinking. Unless policies are changed, environmental degradation as a result of industrial waste water is likely to accelerate. Most of the technology used in the industries are outdated and procured when environmental impacts were not considered. Pollution from these technological industries is higher than it is in many industrial countries. Industries with high levels of water contamination in Pakistan include textiles, leather, paper and board, sugar, fertilizer, and cement, which together account for 80 percent of total water consumed. Proper disposal of water from industries is not a common phenomenon and if some industry is following safe practices then there is no incentive from the industry to continue following the practice. The most common practice of waste water drainage is to drain effluent into natural surface drainage channels. Often industries drain waste water in the ponds there causing seepage and contaminating the ground water and raising the water table. Drainage into irrigation canals has also been observed at some of the textile units located south of Lahore.

Water is made available to the industries at a very cheap rate thus there is very little incentive to conserve water. As a result, water usage levels are ten times higher in some industries in Pakistan than they are in industrial countries. However the polluter pay concept is being discussed and its implementation is yet to be ascertained.

The waste water is often dumped into open drains, streams or ponds, shallow pits, or septic tanks connected to open drains often leading to agriculture land. . The household refuse is also dumped into streams and drains, which over time have become overloaded. Direct disposal of municipal waste water into streams not only reduces groundwater quality, but also disturbs the aquatic ecosystems, depletes aquatic resources, and affects agricultural uses of the surface water. Due lack of

water for irrigation the farmers often use untreated municipal waste water for agriculture. The vegetation thus grown creates serious health hazardous when consumed; in addition the soils irrigated by untreated municipal waste water become enriched in salts and quickly become unproductive for further cultivation. It is estimated that only 80 percent of the urban and 45 percent of the rural population is estimated to have access to clean water.

The conventions provide guidelines for protection of environment however it does not define the procedure to implement. In the absence of awareness and lack of interests, Pakistan sought help of international agencies for defining countries environmental policies. The policies thus defined are either over ambitious or they disregard the economical and technical constraints of the country. As per UNCLOS and Convention of Biodiversity, Pakistan is obligated to conserve environment and take appropriate measure to conserve the ecosystem. The debate on development verses sustainable developmental of ecosystem could be arguable but the over all consequences of environmental cannot be disregarded. There should be an environmental assessment on regular bases and the same be publicized for evaluation at different level.

The formulation of ship breaking laws in line of the Basal Convention is the need of the time. But it is the responsibility of the international body to implement the same on all ship breaking industries of the world. If this is not implemented globally then there is a fear that Pakistan ship breaking industry would loose economic benefit and ultimately loose business.

The NEQS are in place; however the implementation is yet to be made efficient. The governmental agencies are understaffed with qualified manpower and are not sufficiently equipped to monitor and implement the NEQS. The absence of sanction to the defaulters of pollution has given rise to disregarding the concept of adequate disposal of wastewater in the general public.

The pressure on the mangroves from cutting of trees for fuelwood can be reduced if suitable alternative could be provided. It is estimated that less than 2% of population use the mangrove wood for fuel. Provision of alternative to the habitants such as natural gas would prevent the cutting of trees.

Continuous discharge of waste water and municipal sewage in the harbour requires the harbour to be dredged continuously. The dredging is carried out disregarding all norms of international standards of dredging. Persistent dredging destabilizes the nutrient and other chemical level of the water inside the harbour. This causes an adverse effect on the growth of the mangroves. It is opined that dredging be carried out in line with the international standards and preferably using suction dredgers instead of bucket dredgers. Dredging at he mouth of the channel should be carried out during ebb tides to avoid unsettled mud to sweep inside the harbour.

The loss of mangroves has a direct and indirect effect on fishing. Overharvesting of fishing could lead to loss of biodiversity where by resulting in the extinction of certain fish species. A way towards controlling Overharvesting of fishing is by improving the financial returns resulting from the sale of the fish, and increase export demand and opportunities. This would elevate the financial condition of the fishermen who would opt for bigger boats thereby fishing far from the coasts.

A table has been conceived keeping in mind the environmental , socio economical issues and identifying the root causes of the impact and recommending options to minimize future impact.

Environment and Socio Economic Issues

Environmental Issues	Socio economical issues	Root causes	Recommended options to minimize impact.
Degradation of mangroves	-Domestic use of trees -Lack of awareness	-Reduction of water -Reduction of silt -Polluted river water	-Minimum water required as per water accord to be

	-No sanctions to defaulters -Political influence on water -Construction of dams	-Polluted sea water -Lack of political will -Reclamation of wet land	made available -NEQS to be strictly implemented -Pollution in the Indus River to be reduced -Pollution in Karachi harbour to be curtailed -Polluter to pay -Controlled reclamation of wet land
Protection of Endangered species	- Lack of political will -Corruption at various levels	-poverty -Black market	-Institution to be strengthened -stringent monitoring
Pollution of Karachi Harbour	-Lack of awareness -No sanctions to defaulters - Lack of political will -Economic constraints	-Lack of treatment plants -Indiscriminate use of toxic persistent chemicals by industries -Open drains -Port facilities	-Adequate treatment plants -Polluter pay -Allocation of finances -Monitoring of harbour
Conservation of Ecosystem and sustain development of environment	-Lack of awareness -Lack of Education -Economic constraints	-Lack of political will	-Increase awareness -allocation of finances -Polluter pay
Marine environment protection facilities	-Economic constraints -Lack of trained manpower	-Political will	-Allocation of funds
Transboundry movement of hazardous waste	-poverty -Lack of awareness -Lucrative economy	-Lack of International Willingness	-Pursuance to state parties for harmonization of policies. -Emergence of regional policy

Table 4

Looking at the table we can evaluate that political will is the predominant factor for environmental issues. Developing countries are constraint with finances; however lack of political augments the perception of environmental pollution. The tone of environment awareness stems from the top and it tickles down. It is pertinent to mention that pollution control is not just a reactive process, it infact requires a change of perception in the way we live. Pollution awareness need to be inculcated from the childhood so that it becomes our second nature in life.

CHAPTER 6

Conclusion

Our perception of marine pollution has changed over the last few decades. The policies and regulation thus designed earlier were to handle the problems as perceived few decades ago. As population increases, new threat emerges making it evident that the policies of old concept would not suffice the new posed threat. The world focused on oil spillage to minimize marine pollution and thus relevant conventions were formulated to reduce the effect and avoid such occurrences. The IMO in its effort to improve the marine environment formulated policies which successful have been able to reduce the number of occurrences of oil spill. Shipping activities increased many folds over last few decades to augment the rapid population growth of the developing countries. The absence of adequate infrastructure, financial limitations and lack of awareness brought forward new threats to the environment.

Some chemicals which were widely used for agriculture, antifouling paints started showing environmental concerns; however by then its use had already spread in many countries. The policies to stop manufacturing such chemicals are already in place, but they are still being manufactured and sold to developing countries as cheap alternatives. The lack of awareness and will of the politicians allows such chemicals to be used indiscriminately in their country. The concept of biodiversity in developing countries has not shown positive results as yet. Whenever a debate arises about striking a balance between human being's economic, social and cultural factors with that of the plants, animals and other biota, the non human factor is totally eradicated. It is true that this is the true concept of biodiversity, but what we need to understand is, this should be the last resort after exploring all viable options

and not just an alternative. The CBD has taken an important step where by it has created awareness about sustainability and is serving as a pilot convention for policy making. The convention is slowly taking over the role of umbrella convention for environmental issues.

As the population increases the threat from land based activities also increases which is predominately attributed towards poor policy making and the will to curtail pollution. Developing states often disregard environment issues on the garb of economical constraints, the policies and legislative orders are in place but really lack will and implementation. This creates a bad omen for people down below and the tone of policies and environment concern travels in a top down hierarchy. Pakistan being a developing country is not showing enough willingness towards environmental issues and the environment standard is fast degrading. The once sixth biggest mangroves forest is fast depleting just because of poor policy and corruption in the administrative order down below. The feudal landlords control the water flow of rivers instead of following any water accord. The governance is witnessing all such malpractices inspite of realization that over 60% of irrigated water is wasted, which if properly channalised would save the mangroves and would sustain the ecosystem.

Legal trade of endangered species has been curtailed; however this has open many back door channels and given way to corruption and black market. The absences of political will to control such unlawful methods have developed this into a big trading scenario.

In the absence of international pressure on the thansboundry movement of hazardous waste have given rise to malpractices in the developing countries ship breaking industries. There is a fear that countries getting stringent on shipbreaking industries may loose international market and subsequently suffer financial loss.

Pollution is difficult to eradicate using force without sanctions. The international conventions provide minimum standards for protection and leaves independent states to implement according to their economic and social setup. No matter what the conventions imply, political will of a nation reflects the tone of policies. It is important that national policies should be formulated with the economic and technology base in mind.

The mangroves not only provides livelihood to individuals but it also acts as a first line of defence to the shores. The Indus Delta had many times absorbed the impacts of cyclones in the southern parts of Sind , there by reducing the damage . Depleting mangroves is just like weakening of defense and making the habitat susceptible to dangers of calamity.

ROPME States
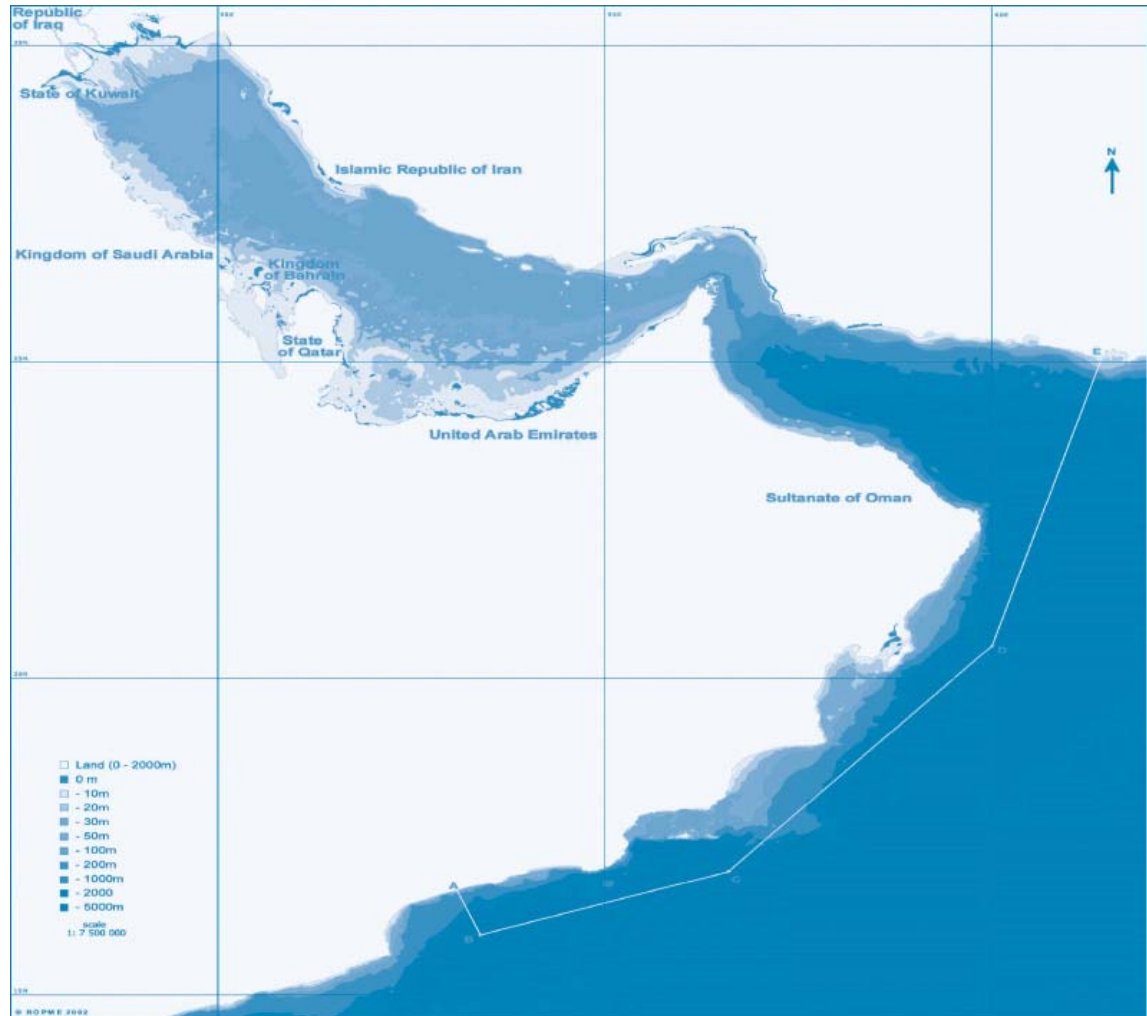
Source : ROPME 2002   Figure 1

The ROPME states consists of Bahrain, Iran, Iraq, Kuwait, Oman,Qatar, Saudia
Arabia and UAE. These states have decided to protect the area from pollution along
their area of responsibility.

Coastline Rivers of Pakistan

Source: Ministry of water and power Pakistan   Figure 2

The coastline of Pakistan is almost 1050 km . The country has a detail network of canal system in addition to the river of the country. All rivers combine into the River Indus and flows towards the Indus Delta. The country has agriculture farms all along the rivers. The Indus River runs north to south and thus divide the country into two portions. The western portion of Indus has numerous industries .

Indus Delta

Source: Goggle Earth   Figure 3

The satellite picture of the Indus Delta shows mangrove depletion and the Indus River flowing through it. The estuaries are often changing shape and direction. The Indus Delta houses number of animals, birds and various other biotas.

Karachi Harbour

The life line of Pakistan . It is a enclosed harbour with over 40 wharves one both side of the harbour. In addition there are 3 Oil piers south of the main wharves. The port is on the southern part of the city and is surrounded with dense population. The Lyari River is dumping industrial and city sewage into the harbour. Just one Kilometer north of the harbour is the city's main commercial set up.

Polluted Clifton Beach of Karachi

Source : Daily Dawn Pakistan   Figure 8

The once beautiful golden sandy beach has now being reduced to black oily sand. The gradient of the beach is not steep thus almost 15 km of the beach was ruined by the oil spill from Tasman Sprit. The houses were once prize property is now being sold at low rates. Residents of this area had to vacate their house due fumes and foul smell. Wide spread cases of pulmonary diseases was reported. All business and school of the area had to be shut down for couple of days.

Churna Island
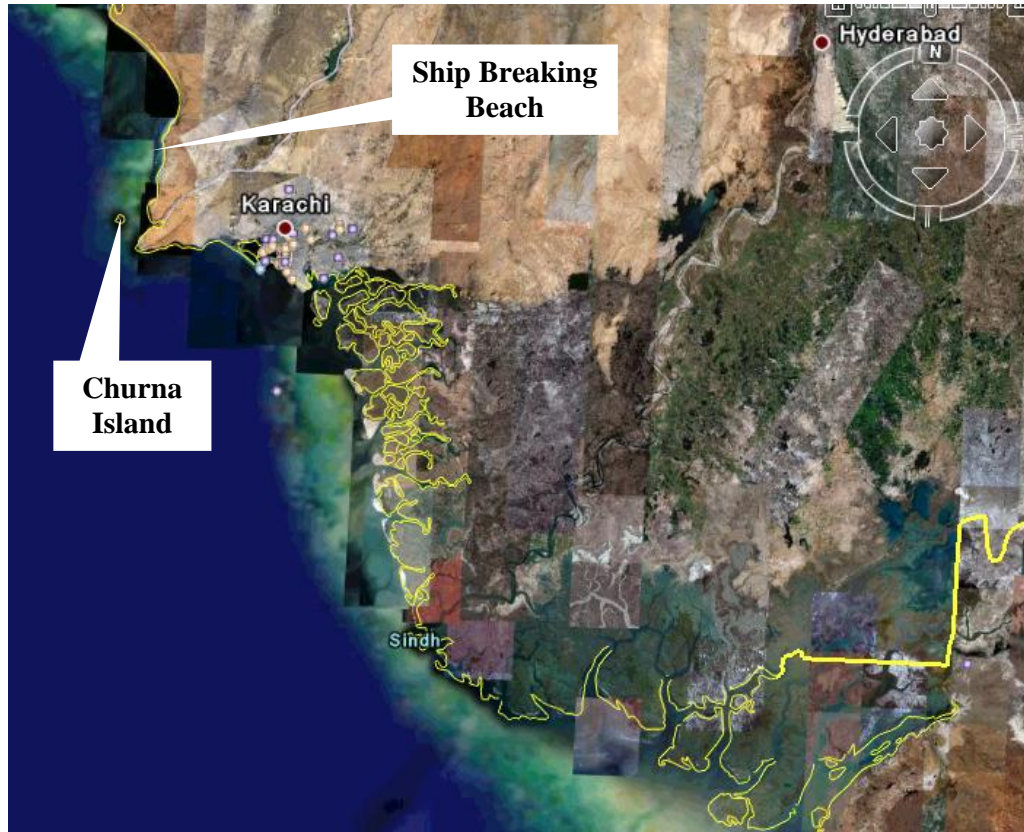
Source: Google Earth   Figure 5

The Churna Island is uninhabited and famous for clear water and water sports. A regular spot for anglers and other water borne excursions.

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