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# The United Nations approach to reduce threats to living marine resources from fishing and ship-based pollution

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# THE UNITED NATIONS APPROACH TO REDUCE THREATS TO LIVING MARINE RESOURCES FROM FISHING AND SHIP-BASED POLLUTION

**By**

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## DECLARATION

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

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

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# DEDICATION

To my wife Merriem,
My daughters Salma and Tourya,
My father and mother whose love will never fade.

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## ABSTRACT

In the past few years, there has been a remarkable increase of public awareness and interest in the effects of ship-based pollution and fishing activities on living marine resources. Undoubtedly, there are many reasons for this drastic shift in the vision of governments toward the protection of the marine environment in general, and marine life in particular. Examples of these include, on the one hand, a series of tanker accidents and pollution related to ship operations, which resulted in spills of a large amount of oil, and oil products, or the deliberate discharge of waste, sewage and garbage into the sea, and on the other hand, the massive and irrational exploitation of living marine resources by fishing. These two activities have an irreversible impact on marine life and occasion an acute drop in many fish stocks worldwide.

Threats to living marine resources from ship-based pollution and fishing activities have become a major concern of the United Nations especially, through the IMO and the FAO respectively. Different Conventions have addressed this issue with the aim to safeguard marine life for the benefit of future generations and provide a better home for living marine resources.

This dissertation is a combined study of the threats that aquatic marine life undergoes if exposed to pollution from ships and the mismanagement of fish stocks in addition to the United Nations' approach to remedy the increasing amount of ship-based pollution and overexploitation of living marine resources.

Conclusions and recommendations are made concerning the effectiveness of existing United Nations' instruments and duties of coastal states as to adopt integrated coast management plans that would prevent marine life from extinction.

## LIST OF ABREVIATIONS

| | |
|---|---|
| A/F paints | Anti-Fouling Paints. |
| BOD: | Bio Oxygen Demand. |
| C: | Carbon. |
| CBT. | Clean Ballast Water. |
| CCAMER: | Convention on the Conservation of the Antarctic Living Marine Resources. |
| CFC: | Chloro Fluoro Carbon. |
| $CO_2$: | Carbon Dioxide. |
| COFI: | Committee on Fisheries. |
| COW: | Crude Oil Washing. |
| DDT: | Dichloro Diphenyl Trichloro Ethane. |
| Dwt: | Dead Weight. |
| EEZ: | Exclusive Economic Zone. |
| EU: | European Union. |
| FAO: | Food and Agriculture Organisation of the UN. |
| GESAPM: | Group of Experts on the Scientific Aspects of Marine Environmental Protection. |
| GT: | Gross Tonnage. |
| H: | Hydrogen. |
| HMS: | Highly Migratory Species. |
| IATTC: | Inter-American Tropical Tuna Commission. |
| ICCAT: | International Convention for the Conservation of the Atlantic Tuna. |
| ICJ: | International Court of Justice. |
| ICS. | International Chamber of Shipping. |
| IEA: | International Energy Agency. |
| IGS: | Inert Gas System. |
| IMDG: | International Maritime Dangerous Goods Code. |
| IMO: | International Maritime Organisation. |

| | |
|---|---|
| ISM: | International Safety Management Code. |
| ISO: | International Standards Organisation |
| K: | potassium. |
| MARPOL: | International Convention for the Prevention of Pollution From Ships,1973 As Modified by the Protocol of 1978 thereto. |
| MEP: | Marine Environment Protection Committee. |
| MOU: | Memorandum of Understanding. |
| MSY: | Maximum Sustainable Yield. |
| NAFO: | Northwest Atlantic fisheries Organisation. |
| NMFS: | National Marine Fisheries Service. |
| NOAA: | National Oceanographic and Atmospheric Administration. |
| PCB: | Polychlorinated Biphenyl. |
| PSA: | Particularly Sensitive Areas. |
| SOLAS74: | Conference of Contracting Governments for safety of life at Sea, 1974. |
| STB: | Segregated Ballast Tank. |
| STCW: | Standards of Training Certification and Watchkeeping for Seafarers,1978 as Amended in 1995. |
| TAC: | Total Allowable Catch. |
| TBT: | TributylTin. |
| U: | Uranium. |
| UN: | United Nations. |
| UNCED: | United Nations Conference on Environment and Development. |
| UNCLOS82: | United Nations Convention on the Law of the Sea, 1982. |
| UNFCCC: | United Nations Framework convention on Climate Change. |
| US: | United States. |
| WMU: | World Maritime University. |

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# *CHAPTER 1*
# *INTRODUCTION*

## 1.1. A General Overview of the Problem.

As the world population grows and the process of industrialisation diversifies, threats to the marine environment and dependant living marine resources become critical and acute. Seas and oceans, which cover 71% of the earth surface, offer one of the major alternatives for human food supply.

The increasing world population during this century has boosted the need for food and enhanced the use of the seas as channels for trade. Similarly, technological improvement brought about in terms of fishing power; detecting and targeting of living marine resources has widely exposed the marine ecosystem to great stress. The general panorama of life in this ecosystem includes various species not all subjected by human exploitation. It includes vegetal and animal species, which constitute an integrated food chain shaped as pyramidal structure where successive floors are progressively narrowed as we approach the top floor. This means that exploitation possibilities are accordingly reduced as we move from the primary vegetal echelon, which stands for the base of the pyramid. Concerning human exploitation, marine ecosystems are generally seen as to be less favourable than land-based ones. In fact, on the land, animals as source of proteins (bovine, poultry etc.) rank second in the trophic pyramid and hence, present the minimum loss of energy with reference to the basic vegetal production. In oceanic milieu however,

exploitable species are seldom located in the primary or secondary echelon (multi-cellular algae, planktonophagic fish and some molluscs). Most of them belong to third and forth echelon (carnivorous and predators). Consequently, the living marine resources directly edible present globally a slight yield with regard to the primary production observed on the land.

### 1.2. The Living Marine Resources.

The marine environment contains a very diversified mass of living marine organisms, from bacteria to marine mammals, although some are poorly represented (reptiles, insects etc.). The main living marine resources targeted by either fishing or harvesting and having commercial value are the following:

**•Grand algae:**

-Brown algae (e.g.: Fucus, Laminaria);
-Red algae (e.g.: Gelidium, Porphyra);
-Green algae (e.g: Ulva, Enteromorpha).

Human exploitation of these species concerns principally the brown algae which are used for multiple purposes such as agricultural (fertilisers, cattle and human feeding), industrial (mineral extraction) or, medicinal (pharmaceutical).

**•Molluscs:**

From an economic point of view, this branch of marine organisms represents a very important wealth because of its nutritional value. The three major classes exploited worldwide are:

-Gastropods (e.g: elm, limpet);
-Pelecypods (e.g: mussels, oysters);
-Cephalopods (e.g: squid, octopus, and cuttlefish).

**•Crustaceans:**

These are highly valuable species on the international market. In many areas, their stocks are already over exploited namely, lobsters and crabs for which the life cycle is very complex and with geographical stability remarkably shaky. This class includes Natancia (swimming species e.g: shrimp) or Reptancia (walking species e.g.: tanner crab).

**•Echinoderms:**

Only sea urchin and sea cucumber are of economic value in this branch of living marine resources.

**•Fish:**

The fish branch represents the largest one in terms of diversity of targeted species. It includes pelagic fish (e.g: tuna, anchovy, mackerel, horse mackerel, sardine etc.) semi-pelagic fish (e.g: cuttlefish) and, demersal fish (e.g.: yellow fish, haddock etc.).

**•Reptiles:**

The major representative for this branch of marine animals are marine turtles, but only Cheloneans (e.g: Chilonea mydas) present an economic interest because of their shells and eggs.

**•Marine mammals:**

The hunting of sea mammals is relatively an old practice. These animals have been for decades source of debates because of divergence of interests in their exploitation and essentially, due to the migratory character of most of the marine mammals. Dolphins, whales, sea lions are some species largely known to the public. The complexity of their biological cycle renders them vulnerable to any disruption.

All these branches of marine organisms are exploited with different means (bottom trawls, drift nets, long-lines, traps, harvesting, hinting, etc.). Some of these fishing gears and methods have devastating effects on the marine life.

### 1.3. Ship-based Pollution and Fishing Activities.

The marine ecosystem can be severely influenced by two major human activities: marine pollution, either land based or ship generated, and fishing activities.

#### 1.3.1. Ship-based pollution.

The ship-based pollution has become a serious threat to the marine environment during the last decades of this century. The industrial demand for energy and raw material which has emerged sharply after the end of the Second World War, has brought about a boom in size of the fleets crossing seas and oceans with different cargoes and products. Oil and oil products are generally seen as to be the most fearsome pollutants. Their direct impact could not be hidden to the public due to the large surface an oil spill can cover once released from a tanker. Pollution generated by ships can be divided into four major groups:

♦ **Organic pollutants**

Generated predominantly from passenger ships as garbage, refuse, rubbish and other organic products. However, each single sailing unit can generate considerable organic waste depending on the number of crew onboard. Oxygen depletion, transfer of pathogen germs and, eutrophication are some of the harmful effects that can result from any discharge of such waste.

♦ **Chemical pollutants**

These pollutants are extremely complex, in fact, tonnes of chemical substances are discharged into the sea either accidentally or deliberately from ships. The toxicity

of each substance may be acute if mixed with other ones as combined substance (synergical effect).

Since the Torrey Canyon' accident in the late 60's and the following tanker disasters (Exxon Valdez, Kharg V, Braer etc.), oil has ranked ahead of other marine pollutants which have been largely debated at an international level. It can have three major sources: The first concerns essentially heavy products (fuels and crude oil) released accidentally, while loading or discharging tankers or merely, during deballasting operations. The second originates from the grounding of oil tankers such as the "Exxon Valdez". The third results from the gradual increase in the upper oceanic layers of residues issued from ship engines as result of fuel combustion. These residues move as a thin film on the water surface causing damages to plankton and hindering the access of light to waters below the sea surface. Anti- fouling paints are also dangerous chemicals in the marine ecosystem.

♦ **Physical pollutants**

They are generated from ships as solid waste, some of which are long lasting and non-biodegradable. Their composition varies from industrial solid waste discharged deliberately in open seas to atomic residues. It is however worth mentioning that physical pollution from ships cannot be listed exhaustively because of the diversity of products and materials discharged into the sea.

♦ **Biological pollution**

Vessel traffic across oceans can also cause the introduction of alien species (unwanted organisms) through ballast waters (biological pollution) with imminent disturbance in the equilibrium of indigenous fauna or flora.

The menace of marine pollution from ships has been brought into sharp focus by series of accidents in recent years. Fall-out of nuclear tests, the discharge of radioactive waste and other hazardous substances in addition to oil spills; have

brought great and increasing protest from sensitive public. Ship based pollution has direct impact on coasts, beaches and essentially on living marine resources.

Products like PCB; CFC, DDT, Anti-fouling Paints, accumulate in marine organisms as dangerous substances. They can be transmitted through the marine trophic chain and transported for long distances by physical and biological processes. Oil spills can have long and short-term effects on the marine life. Their hazard can wound fish, marine mammals, birds and human being. Solid waste and organic materials from ships may interact with marine organisms and cause adverse effects which are sometimes irreversible (non natural mortality, abnormal sedimentation, oxygen depletion, etc.).

The impact of ship based pollution is very often not easy to assess in the short term. Moreover, different released substances and products even with minor effect may have synergistic impact once discharged at sea.

### 1.3.2. Fishing activities.

Living marine resources are not only exposed to harm by ship generated pollution but also from fishing activities and mismanagement of fish stocks. It is said that sea organisms do not recognise borders. This is why their exposure to over-exploitation has always been high. The production achieved from fisheries depends upon the patterns of recruitment and exploitation.

As it is known, over-fishing, if carried out far enough, will produce not only reduction in catch per unit of effort, but also in total catches. It is becoming evident that, if stocks are reduced to a very low level by excess of fishing, or by-catch (due to non-selective fishing gears), the production and survival of juveniles and youth supposed to replace adults, may then fail unless the environment conditions are exceptionally favourable during the early stages of life.

### 1.4. The Extent of the Problem.

Effects of ship-based pollution; the influence of climatic trends and the impact of fishing activities are generally combined factors that cause decline in stocks of marine organisms. Pollution generated from ships in addition to inappropriate fishing methods are nowadays the major threats to living marine resources. In many coastal areas, fish stocks have decreased dramatically to the extent that some species are on the verge of extinction. This is apparent mainly in semi-closed areas and coasts where the management of highly migrating or straddling stocks is not possible or inadequate.

Living marine resources are trophically interdependent. Any alteration of the marine ecosystem by natural or anthropogenic changes may have general effect on the whole population. Marine pollution and inadequate fishing activities put stress on marine life.

### 1.5. The United Nations Concern.

Increasing information on incidents and dangerous events which have occurred since the end of the Second World War have enhanced the public awareness on the fragile equilibrium of the marine ecosystem and associated living marine resources. The fact that many marine species are close to extinction has prompted coastal states to act jointly or individually to safeguard the remaining ones.

The 1982 United Nations Convention on the Law of the Sea (UNCLOS 82) has framed rights and duties of coastal states with regard to freedom of navigation, resources exploitation, and marine scientific research. It also urges member states to move toward uniformity and harmonisation of governmental regulations.

Today, there are different international and regional agencies and organisations concerned with the marine living resources. A considerable body of information indicates that ship-based pollutants are harmful or toxic to variety of marine organisms. Moderate concentrations could be lethal on short exposure. Some may even impair the normal growing of organisms or cause phenotypic abnormalities. Fishing activities carried out inappropriately have negative if not, irreversible impact on the living marine resources and consequently, on depending human populations. Very often, uncontrolled fishing put stress on juveniles and youth hindering their natural process of reaching adulthood.

The United Nations has dealt with the problem of preservation of marine life for decades. Many conventions have been issued i.a. (UNCLOS 82, Rio Convention, FAO Code of Conduct for Responsible Fisheries, IMO Conventions such as MARPOL73/78 in addition to local and regional treaties and conferences). All these instruments seem insufficient if we consider the rate of damage caused annually to the marine life and the voluntary character of many of these regulations.

**1.6. The Basis for this Study.**

The author has been serving as fisheries observer onboard EU' fishing vessels for more than 4 years in the Moroccan waters and had the opportunity to study and witness the evolution of fish stocks, the relative selectivity of fishing gears, the rate of by-catch and, the level of pollution both in the open sea and along the Moroccan coasts. He also had the opportunity to contribute actively to the elaboration of fisheries management plans set up by the Moroccan Ministry of Ocean Fisheries and Aquaculture.

This study is an attempt to approach the complementary work achieved by the United Nations specialised agencies dealing with threats to the marine ecosystem namely; the IMO and the FAO in addition to some marine environment related

Conferences and Conventions. The focus will be on ship-based pollution, the impact of fishing activities on marine organisms, the adverse impacts on national incomes and human populations and globally, on the existing legal international framework and its adequacy to preserve the marine life.

The research method for this paper has two bases. On one hand, the author's personal experience, concerning his previous duties in the fisheries and two years studies in the World Maritime University. On the other hand, the available material and documents in the WMU' library in addition to newspapers articles and internet web-sites related to the subject. Finally, emphasis will be on the author's vision as to preservation of the marine life, maintain clean oceans and, the necessity of having adequate coastal and fisheries management plans.

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## *CHAPTER 2*
## *THREATS TO LIVING MARINE RESOURCES FROM FISHING AND SHIP BASED POLLUTION*

### 2.1.The Marine Ecology and the Dynamic of Stocks in the Marine Ecosystem.

In the marine ecosystem, organisms are represented in an area or in a given volume by population called (stock). Each stock's importance is quantitatively evaluated by its biomass. This is continuously transformed (growth of individuals, appearance of new generations, mortality, etc.). The productivity of the population is represented during certain laps of time (day, month or year) by the growth of biomass which the total weight of the stock of a given specie.

The time when people commonly assumed that living marine resources are inexhaustible is not far off. In fact, it's only during the last decades of the 20$^{th}$ Century that we have realised how limited the ocean; biological capital is on which any human exploitation (by fishing etc.) can have adverse effects.

The problem today, if we disregard the natural environmental perturbations such as the *El Niño* effect or global climate change, is to determine to which extent living marine resources can be exploited to meet human needs. Peterson, studying the difficult problem of oceanic possibilities and productivity inventories, has given birth to the notion of *rational exploitation*. This notion means for all natural resources, the management of stocks in a way that we can rationally exploit them and continuously

have an *Optimum Stable Yield*. In the oceans, man can adversely influence the productivity if the quantity of extracted organic material is higher than its potential production through over-fishing or over-exploitation. The same effect occurs if man destroys resources in a trophic level lower than that he exploits. In contrast, human impact may be beneficial when the extraction is carried out on resources which are not or under-exploited. This can stimulate their productivity. The same can be observed within populations where the growth is slowed down due to the lack of food.

We have said previously that oceans constitute a vast ecosystem where populations are interdependent and depend on the environment. This ecosystem is in perpetual search for equilibrium. The compatibility of the stock in a habitat is the permanent response to the prevailing factors and influencing biotic elements. The response is expressed through quantitative variations in time.

When a population is equilibrated naturally, its individuals are maintained at a ceiling which correspond to the biotic load framed by restricting factors of the environment namely; the available place, the amount of food and, the oxygen rate. The equilibrium is then reached if there is an exact compensation of forces that tend to reduce the weight of the population (natural mortality) and those which tend to increase its weight (arrival of youth through recruitment and growth of individuals).

| | | | | |
|---|---|---|---|---|
| **M** | **=** | **A** | **+** | **G** |
| *Mortality* | | *Recruitment* | | *Growth* |

Yields may vary strongly from one year to another without implicating fishing activities. The cause of these variations is yet not fully known.

Within equilibrated sea population, fishing introduces new factors which synergies those tending to reduce the community. Fishing gears can therefore be regarded as **an additional predator**, which relay on the stock. This predator (fishing gear) competes with those existing naturally. Its action increases the mortality. Hence, the

dynamic of the population expressed by the above formula should no longer consist of three components.

## 2.2. The Importance of Living Marine Resources for Subsistence, Trade and Employment.

### 2.2.1. The importance of fisheries for trade and subsistence.

Living marine resources are for many developing coastal states the major source of hard currency and labour opportunities. In some countries such as Mauritania, fishing ranks first in the state's income. In Morocco, fisheries rank third in the national economic importance both as source of currency and labour opportunities. This figure is likely to be met in many coastal countries either as industrial or artisanal fishing activity. Some coastal states mainly in Asia, depend largely on seafood for their daily nutrition.

The first Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) study on the health of seas and oceans looked at the global fisheries yield. It stated that the 1979'catch of 71.3 million tonnes represented an increase of about ***1 million tonnes*** over the previous years and that annual increases were at only 1-2 %, much lower than the 6-7 % increases recorded in previous decades. However, since 1979, the overall trend has been strongly upwards with an annual increase in the region of 7 %. The preliminary figures for 1988 indicate further increase to ***94 millions tonnes***. It is expected that by the end of this century a figure of ***100 million tonnes,*** believed to be the Maximum Sustainable Global Yield of conventional fisheries worldwide, will be reached. In 1995 and 1996, the total world' capture fisheries production as estimated by the FAO reached ***94,6 million tonnes*** (FAO Fisheries Statistics, 1996). China, Peru, Japan, the USA, Russia and Indonesia (in that order) were the top producer countries in this years (together accounting more than half of the world capture in fisheries production in terms of

tonnage). The 1996 statistics published for fish consumption in the world give an average of 14 kg/person. The rate differs however largely from one country to another due to culinary habits. The above world production evolution is certainly a progressive increase, but it conceals great variability of natural resources and various problems.

The table bellow shows the world nominal catches from 1990 to 1996 in metric tonnes by major species:

| Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|
| World total** | 85,880200 | 85,088400 | 86,208800 | 87,278800 | 92,682900 | 93,001100 | 94,625400 |
| Marine fishes | 82,500 | 45,900 | 43,900 | 49,100 | 51,400 | 57,100 | 52,700 |
| Crustaceans | 177,400 | 195,400 | 216,100 | 255,800 | 350,800 | 436,600 | 526,800 |
| Molluscs | 360,600 | 378,900 | 412,400 | 460,400 | 510,300 | 598,100 | 562,200 |
| Mammals | *** | *** | *** | *** | *** | *** | *** |
| M*. mammals | 6,100 | 6,600 | 7,100 | 7,000 | 6,300 | 7,400 | 6,800 |
| Aquatic plants | *** | *** | *** | *** | *** | *** | *** |

**Source: FAO fisheries statistics,1996**

**(*) Miscellaneous marine mammals**

**(**) data concern marine and inland catches**

**(***) No records on catches**

A major part of this variability originates from natural causes, not least to *El Niño*-type events, which is behind changes in the distribution and abundance of the stocks of anchovetta and small pelagic fish especially in the East Pacific. *El Niño* effects alter the fishing patterns of many countries that are significantly contributing to the global catch. In general, natural fluctuations are not clearly understood. They are combined with excessive exploitation. The consequences for stocks seem to be much acute than any known pollution effect in open waters.

A large number of fisheries, especially those most valuable commercially are exploited at or beyond their Maximum Sustainable Yields (MSY). The state of exploitation of the main fish stocks (in fisheries for which assessment information is available) as studied by the FAO, shows that it remains more or less unchanged since

the early 1990's. Recent reviews of this Organisation tend to confirm that among the major exploited fish stocks, an estimated 44 % are fully exploited, about 16% are over-fished, 6% appear to be depleted and, 3% seem to be recovering slowly. Fisheries in the Northwest Atlantic, the Southeast Atlantic and the Eastern Central Atlantic reached their maximum production levels one or two decades ago and, are now declining in total catches. In the Northeast Atlantic, the Southwest Atlantic, the Western Central Atlantic, the Eastern Central Pacific, the Northeast Pacific and the Mediterranean Sea and Black Sea, annual catches seem to have stabilised, or are declining slightly, after having reached the MSY few years ago. The Eastern and Western Indian Ocean, the Western Central Pacific and the Northwest Pacific are the only areas where total catches still follow an increasing trend with some potential for increase of fishing efforts. The rational management of fisheries is complicated by changes in the dynamic balance between species.

The first twenty fishing countries whose fleets land 80% of the total marine catch worldwide are as follow:

| | | | |
|---|---|---|---|
| 1.China | 6.Russian Fed | 11.India | 16.Spain |
| 2.Peru | 7.Thailand | 12.Iceland | 17.Taiwan |
| 3.Japan | 8.Indonesia | 13.Philippines | 18.Canada |
| 4.Chile | 9.Korea, Rep | 14.Korea, DPR | 19.Mexico |
| 5.USA | 10.Norway | 15.Denmark | 20.Vietnam |

**Source:** **Http://www.greenpeace.org/comms/cbio/global.html**

According to the FAO 1996' study on fisheries, in 1994, approximately 32 million tonnes of fish (nearly 30% of the total World production) were used as food (70% were used for animal feeding and other fish products), there was a decrease in this usage in 1995 as a consequence of *El Niño* natural phenomenon.

Fish, shellfish and fishery products are internationally traded with more than 195 countries having exported part of their sea products including those of the aquaculture. Export volumes totalled ***22 million tonnes*** in 1996 which is nearly three times the figure of 1976 (40% of the overall fisheries production). The table bellow shows figures of the world production in the main tradable species:

| Species | Production in metric tonnes for 1986 | Production in metric tonnes for 1996 |
|---|---|---|
| Pelagic + products | 38,887,040.00 | 41,361,080.00 |
| Crustaceans + products | 4,073,525.00 | 6,031,722.00 |
| Demersal fish + products | 21,107,980.00 | 18,218,800.00 |
| Molluscs + products | 4,888,181.00 | 8,082,043.00 |
| Cephalopods + products | 1,791,032.00 | 2,871,300.00 |

**Source: http://www.fao.org/fishery/statisit**

The drop in demersal stocks is occasioned by the massive use of trawls and bottom long-lines relatively less selective and having wide rate of by-catch.

### 2.2.2. Fishermen and fishing vessels.

Fishing activity is vital labour source for many countries. However, information provided recently by the FAO member states on number of fishermen and fishing vessels shows that the expansion of fishing fleets seems to be slowing down due to freezing of investments in the sector. The 1997 Study of Lloyd's Register of Shipping reveals that fishing vessels above 100 GT have decreased in number over the last seven years as the decommissioning of vessels has outpaced new constructions. In 1991, the number of fishing vessels of this size in this Register was about 26,000 units (the Chinese fleet not included) the number was only 22,000 for the year 1997. Small units and artisanal fishing units of 1 to 10 GT are in many countries not even registered in the domestic register allowing their fishing effort to pass unrecorded.

The number of fishermen in contrast, appears to be rising steadily. It should be noted however that this figure includes individuals engaged in aquaculture and artisanal fisheries. Parallel activities are very often not considered in estimations. In Morocco for example, it is estimated that each single job at sea generates 9 others ashore. Fishing contributes largely to Moroccan national incomes of hard currency. But the sector has recently undergone sharp drops in catches mainly in trawling fisheries because of multiple reasons (over-fishing, inappropriate distribution of fishing efforts etc.). In 1996, Cephalopods largely exploited in the south part of Morocco by the artisanal, coastal and high sea' national and international fleets are nowadays in crucial situation. 18,420 fishermen are employed directly in this sector. Recently, many fishing companies went bankrupt because of the drop in octopus prices and reduction in the vessel catches. In some countries such as Canada, over-fishing is a major problem especially in the east coast where the cod fishery has collapsed with the loss of about 30,000 jobs. The figure in Morocco is a miniature image of what is the case in many stocks around the world. The problem is that few countries collect and publish annual estimates on their fisheries sector. In addition, some highly migratory species (tuna, eaglfine, etc.) and straddling stocks are usually not well recorded in terms of catches.

### 2.3. The Impact of Fishing Activities on Marine Life.

#### 2.3.1. The selectivity of fishing gear.

The fishing gear is definitely an important predator but having its own particularities. Fortunately it’s not possible to eliminate radically and completely individuals within the sea population by using fishing gears. Mortality from fishing intervenes only in certain laps of sea organisms' life. Very often, juveniles are not trapped. However, it is worth mentioning that the selectivity of fishing gears is not usually the same and differs from one gear to another. It is evident that passive gears (line, drift net, long line, traps etc.) which depends on the behaviour of targeted molluscs, fish or

crustaceans, differs from that of active fishing gears (trawls, purse seine etc.) which massively remove individuals from dense populations without considering the tropism of its components. There are two types of selectivity:

**-Selectivity dividing the population into two groups:** (e.g.trawl). The first group consists of small fish escaping from the mesh size and assuring survival of youth. In contrast, the second group contains the big ones trapped in the net. The limit between the two sizes is not clear (selectivity range) because below a certain size no fish can be detained and above certain size; 100% of fish are detained.

**-Selectivity dividing the population into three groups:** Here, the fishing gear selects small individuals, big ones and the biggest. The illustrative example is that of the line where small fish are excluded due to the hook dimension, and the biggest because of the assembling solidity of the line. The same tendency is observed in the selectivity of drift-net and fixed net where small individuals pass easily through the mesh whereas the biggest are trapped.

### 2.3.2. Consequences of fishing activities on the marine populations.

The natural mortality is the only cause eliminating population components if it is equilibrated and not exploited. It maintains the stock in the ceiling level, which fits the ecological conditions prevailing in their environment. If fishing gears are introduced, this could then lead to death of number of individuals. The mortality of selected classes becomes sucker. To the natural mortality (M), which controls equilibrated community, we therefore have to add fishing mortality (F). Hence, the new forces affecting the sea population are expressed by the formula:

| | | | | |
|---|---|---|---|---|
| **M** | **+** | **F** | **= Z** |
| *Natural mortality* | | *Fishing mortality* | *Total mortality* |

The impact of fishing on sea populations is quantitatively seen in adult classes. Consequently, youth and juveniles become outnumbering.

Generally, in a fishery, fishing gears especially bottom dredging like trawl, catch many different species. The exploitation of marine living resources has other consequences related to the interaction between ecosystem' components:

-Species with short cycle (e.g. Tropical species), resist easily than those with long cycle;

-Species located in the bottom of the trophic pyramid (secondary echelon) tend to swarm due to: lack of predators, their small size enabling them to escape from traps, their precocious maturity and finally, their very high biogenic capacity;

-Marginal species of the community: these species can if necessary reoccupy the freed space where they were confined by equilibrium of neighbouring and/or coexisting community. e.g. the Pacific anchovy (g. engraulis) has replaced sardine (g. sardinaps) probably decimated by over-fishing. The case is worst when the substitution is done at the expense of economically valuable and over-exploited species favouring concurrent ones with less commercial and nutritional value. It is worth to mention that the risk is relatively higher in the tropical areas where species diversity is large.

### 2.3.3. The principle of rational exploitation.

In a fishery**,** stocks can undergo three kinds of exploitation:

♦**Under-fishing**

It is observed in fisheries insufficiently exploited even they are nowadays rare e.g. (case of sardine stock in the south part of Morocco). However, this may occur only because of conflicts (war, natural disaster etc.) which hinder access to the stock for months or years.

♦**Over-exploitation**

It is said earlier that if the number of reproductives falls bellow the threshold (to the lower level), natural compensation becomes ineffective and recruitment in deficit. Over-exploitation increases dramatically the (F) (fishing mortality) parameter. The

ecosystem cannot thus maintain the equilibrium. Balancing forces of reduction (M+F: total mortality) in each exploited stock are always higher than the balancing forces (A+G: recruitment & growth). Mathematically, this means that: **M+F>A+G**
The symptomatic effects of over-exploitation (over-fishing) in stocks are the decrease in the tonnage and size of species caught.

♦**Equilibrated exploitation**

This means that the exploitation is carried out rationally. The mortality by fishing is continuously compensated and the stock maintains its equilibrium. The antagonist forces (M+F) in one hand and (A+G) in the other are equilibrated: **M+F= A+G**

### 2.3.4. The strategy of rational exploitation

The evaluation of biological parameters (M, A, G) and fishing (F) parameter is possible only indirectly from representative sample of the population and data collected from fishing operations in addition to those of total mortality, growth and recruitment. These elements are essential for building rational exploitation of fisheries. However, commercial statistics in that: the production/ species, the production/ port, means of production, labour engaged in the activity (both at sea and ashore) and, the value of the product are also key elements for any successful rational exploitation of marine living resources.

### 2.3.5. Fisheries diagnostic.

In order to set up strategy for the exploitation of living marine resources, there is a need to have accurate and complete information on the state of stocks. This enables fisheries managers to come up with diagnostics on the stock evolution considering voluntary and involuntary changes and the impact of fishing efforts. The state which prevails in most fisheries today is not under or equilibrated exploitation but over-exploitation which can be seen from two angles:

-**Biological over-exploitation**: The fishing effort is always increased by the introduction of new vessels, new techniques, additional engine power or, rising up the time spent in the fishery. The diagram in figure:(1) shows that stocks are not threatened if the range of exploitation doesn't exceed the maximum sustainable yield which is closely linked to the biological parameters of the fishery.

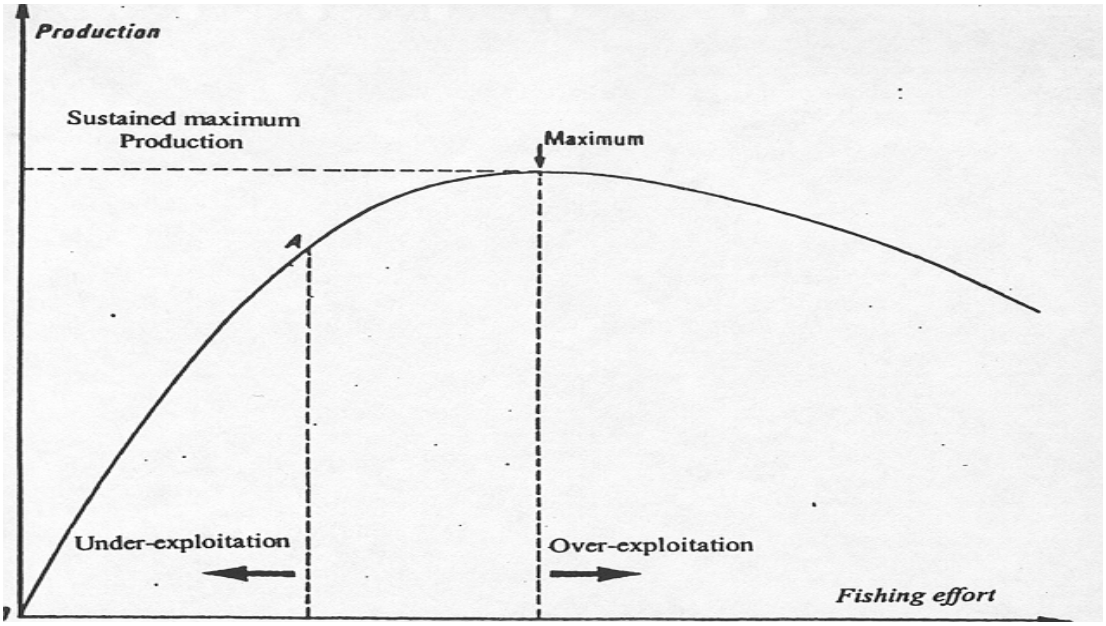


**Fig: (1), Biological over-exploitation**
**Source: Moal, F. 1977, Oceanographie marine**

The problem for many fisheries today is that the effort is very often exceeding the maximum sustainable yield. Symptomatically, the impact is manifested simultaneously through three facts:

- ♦Change in the time of age pyramid, with a boom in youth classes;
- ♦Increase in the individual growth; and
- ♦Decrease in fishing yields with relation to the rise in fishing effort.

-**Economical over-exploitation:** This case has different significance. Fishing evolution is considered with regard to the applied effort but in value instead of

tonnage. By increasing fishing effort the value of the production (curve: (1) Figure: (2) changes in the same tendency of tonnage curve. The cost of exploitation: acquiring of new ships, new fishing gears, catering, fuelling cost etc. increases gradually: curve (2) figure: (2). The profit: (value of product deduced from costs) changes as the curve (3) figure: (2) shows. It increases up to the maximum sustainable profit (MSP) then, drops gradually to level zero. In fact, the cost moves upward whereas the production decreases or stagnates.

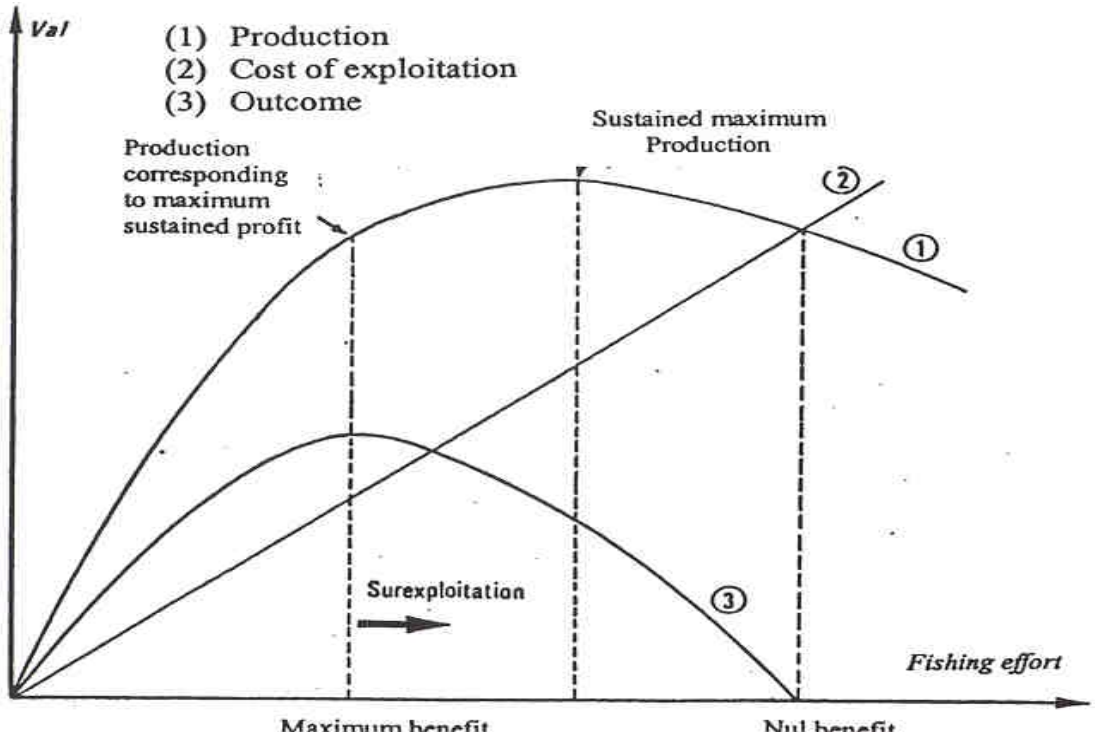


**Fig: (2) Numeric evolution of fish age-class**
**Source: Moal, F. 1977, Oceanographie marine**

Exceeding the MSP by spending more and earning less, we can say that the fishery is economically over-exploited. This panorama is today observed in many fisheries namely the trawl fishing which targets cephalopods (The case of Moroccan, Spanish and Portuguese fleets) or that of shrimp fisheries in different areas of the world.

Economic over-exploitation always comes precociously before biological over-exploitation.

### 2.3.6. The state of today's world fisheries.

#### 2.3.6.1. The state of particular stocks.

**-Moroccan stock of cephalopods**

The Moroccan stock of cephalopods gives clear example of over-exploitation. In fact, despite their life cycle relatively not complex, this class of marine organisms is nowadays subject to heavy and irrational exploitation. Since the late 80's, cephalopods in that: octopus, cuttlefish and squid are increasingly represented in the vessels' global catches by small sizes locally considered as juveniles or not commercially valuable e.g. octopus sizes: T9, T8, and T7 ranging between 200 and 800 grams are predominant whereas T6, T5, T4, T3, T2 and T1 (Adults); commercially valuable in the international market, are less represented. The same figure occurs for other cephalopod species. This is due to over-fishing of adults reflected as high total mortality (Z) and the easy access to the stock by various fishing techniques (trawl, multi-hooks trap, pots etc..).

**-Crustaceans**

Like cephalopods, this class of marine species is also undergoing over-fishing activity in global scale because of its nutritional and commercial value. Catches in the main fishing areas are showing considerable decrease in species size despite their life cycle which is not complex. The threat to this class comes mainly from the use of non-selective fishing gears (trawl, traps and nets).

**-Demersal and pelagic fish**

In this class of marine living resources, demersal fish except in case of straddling stocks are generally locally caught because of their non-migratory character. Their over-fishing and recording of data very often concerns one particular country. However many demersal stocks are showing decrease in global catches due to excess and improper fishing activity. The very clear example for the case of Morocco remains that of the *Golden grouper* **(**Epinephelus alexandrinus**)** which is becoming very rare.

As regard pelagic fish, the trend differs from small pelagic (sardines, mackerel, anchovy etc..) where stocks are generally depending on climatic changes ( *El Niño*, abundance of up-willing etc..), to big and very valuable pelagic fish such as: tuna fish tuna like fish, swordfish etc. Tuna fish (big eye tuna, bluefin tuna, etc..) are targeted worldwide by the biggest fishing nations namely: Japan, Russia, China, Spain, Taiwan, South Korea, and USA. The highly migratory character of these species has made that fleets have sometimes uncontrolled access (beyond territorial seas) to the stocks. Records of catches are generally vague and not reliable. In addition, fishing methods are very diverse (line, drift nets, purse-seine, weir etc..). These are the main causes for decline in catches of tuna fish worldwide despite the International and regional efforts to regulate their fishing .

**-Marine mammals**

Marine mammals are commonly classified as large or small. The large group consists of baleen, killer whale and sperm whale. The small group is composed of small toothed whale, pigmy right whale, sails, dolphins etc. Marine mammals exist in all oceans, some species including those of major commercial importance are cosmopolitan. Marine mammals resources are among the most vulnerable to over-exploitation because of their complex life cycle (slow growth, low fecundity and probably also through the relation between social behaviour and the reproductivity success ).

In fact, unrestrained whaling activity has severely reduced many stocks in the 18th and 19th centuries. This gives one of the best examples of non-sustainable development in marine fisheries with the exception of some species (mink whale, gray whale, and bryde's whale). Marine mammals have been seriously depleted in some cases possibly beyond the level of recovery. One of the causes for this decline remains their pads of migration in the high seas where there is no sovereignty. But also the fact that many of them are accidentally trapped in long drift-nets or injured by the ship propeller.

**-Sea turtles**

Not all sea turtles are threatened by human activities but it is generally admitted that most of the known species are endangered due to the following causes:

-Accidental fishing as by-catch during fishing operations (many fishing gears are not equipped with devices excluding sea turtles);

-Excessive collect of turtles eggs in the nurseries; and

-Destruction of nurseries by beach activities (tourism activities, holiday makers etc..).

**-Marine algae**

There is no global record of the amount of algae harvested worldwide. But it is certain that like all living marine resources, algae are increasingly subject to over-exploitation because of their economic, nutritional and medicinal value.

**-Coral reefs**

This branch of marine organisms is highly sensitive to disturbance and human activities. The tropical areas where generally their habitats are located are no longer showing their indigenous character. Large amount of corals are merely extracted by different and inappropriate methods of harvesting (e.g. the use of dynamite). The long life cycle of corals makes their recovery a matter of years if not centuries.

### 2.3.6.2. The global impact of fishing and marine activities on marine life.

Pressure on stocks has increased by technological improvement in means of exploitation. Drift-nets of mono-filament nylon (**wall of death**) for example, are now despite their devastating effects on marine life, used on a large scale in the open oceans. According to the FAO survey, in the South Pacific, a fleet of 160 boats adopted this technique in 1988. Each boat of tuna sets out every night over 60 Km of nets, with 60 meters of depth. A similar operation takes place in the North Pacific for salmon. These fishing gears trap dolphins, whales, turtles and seals as well as the targeted species. They represent a fishing effort that has not previously been thought possible in the open sea and continue to operate for decades if accidentally or deliberately lost.

As well as the effects on fisheries of natural event and ship based pollution, the reverse situation should be considered, namely the possible polluting role of fishery-related activities. Fishing operations can cause physical damage to attached bentic plants and animals. Removal of large number of organisms (e.g. coral reefs) alters population age structures and the composition of food webs. Mariculture also has different impacts (introduction of alien species, change of physico-chemical conditions of the area, etc.). All these activities could influence the genetic structure of marine populations. Fisheries exploitation has severe effects on the seabed. Large modern demersal fishing vessels use extremely heavy gears with many ticker chains and bobbins weighting in total up to 12 tonnes in the front part of the trawl to stir up fish. Chain mats often ballast the undersides of the nets. The lower selectivity of many fishing gears increments the rate of by-catch. Effects on the seabed range from insignificant ruts, which may be smoothed over with each tide, to radical changes in the distribution of sediments and rocks which result in general unevenness of the bottom. This case is a personal observation in Moroccan waters where trawling is intense. Shell-fisheries also contribute to sea-bed disruption since dredging for

harvesting clams, mussels, and scallops leaves ruts and trenches, on hard grounds, sessile invertebrate fauna such as corals and sponges are damaged and even on soft bottoms of sand and mud, animals are harmed broken up, and nurseries are destroyed.

Although living marine resources are exploited largely for food, some species are harvested for other purposes. The exploitation of living corals, algae and some molluscs for construction material can adversely damage biological communities. The increasing importance and use of pharmaceutical products from marine organisms has resulted in small-scale exploitation of rare or uncommon species.

Biological effects of fishing arise from the reduction in number of fish in the stock and the consequent changed balance of grazing and predation pressures in the ecosystem. Sealing and whaling in the Nineteenth and Twentieth Centuries particularly in the Antarctic where some species were brought close to extinction have caused considerable increase in krill. Similar situations exist in other parts of the world. It is now suggested that the mortality among some species of birds particularly puffins in the North East Atlantic may be due to the rise in industrial fishing for small species and drop of their stocks.

λλλ

**2.4. Ships as a Source of Pollution.**

Constituents of crude oil and refined petroleum products are toxic to large variety of living marine resources. Spilled oil, even in moderate concentrations may be harmful in ephemeral exposures. It also reduces the chance of survival of the affected organisms in natural environment. Much of information on oil effects has been derived from laboratory investigations but field studies of these effects have always supported the conviction that oil spills from ships result in heavy mortality of living marine resources in coastal areas and the high seas.

It is not this mortality that matters, but the number and fate of organisms which overcome the disaster. In biological terms however, mortality which doesn't affect the population size is of no consequences. This theory reflects the reality of populations dynamics: " Many marine organisms produce successors on a prodigious scale but suffer enormous early mortality from predators, fishing and other natural causes**" (**R.B.Clark, 1982). Loss from ship-based pollution (oil or any other pollutants) may be therefore dwarfed by this natural mortality. The implications of an observed mortality for the sea population depends on the organisms concerned. Hence, this must be considered when assessing ship-based pollution damages. It is hazardous to predict the effects of ship based pollution, mainly oils, on the standing stocks. In addition, each specie is part of a community. The reduction of one of its members endangers others.

The seriousness of ship-based pollution damage is evaluated by the extent of population changes, the disturbance that occurs in the stock and, the duration of pollutant effects. Crude oil and refined petroleum products are the major pollutants generated from ships either deliberately or accidentally. In this study, the focus will be essentially on this kind of pollution and their impact on the living marine resources.

It is evident to see disagreements among scientists in the assessment of long term effects of oil pollution on marine life. This is basically due in part to the insensitivity of present methods of detecting population changes but also reveals lack of understanding the response of the ecosystem to disturbances.

### 2.4.1. The assessment of the fate of oil in the marine environment.

There are different kinds of crude oil (North African, South American, North Sea, Middle East, Alaskan etc.). They all contain similar molecular elements with thousands of compounds. These components have wide range of physical and

chemical properties. Consequently, an oil spill from ship undergoes very often physical, chemical or biochemical processes: Evaporation, dissolution, dispersion, absorption, sedimentation, photochemical or chemical oxidation and degradation, uptake and depuration, trophic transfer, metabolism and biodegradation by biota. The speed of these processes varies from one product to another.(Appendix:1.and 2).

### 2.4.2. The ecological consequences of oil spills from ships.

There have been many experiences in the labs on the effects of oil components on the physiology and chemistry of marine organisms. Most of these were carried out at unrealistic concentrations and under non-similar environmental conditions (e.g. short exposure in basins of static seawaters). Recently however, experimental studies closer to conditions of chronic exposure in nature have given scientists analytical data on the amount of hydrocarbons marine organisms can support.

### 2.4.3. Implications of oils in producing disease in marine organisms.

#### 2.4.3.1. Oil pollution and fisheries.

Most of oil spills from ships are disastrous especially in temperate zones and Western World where the aquaculture is highly developed. However, in global terms, mangrove swamps located in Tropical and Sub-tropical areas are very important for coastal fisheries as they provide breeding and feeding grounds and tree leaves for detritus-based food chains. They are known to be particularly sensitive to oil and petroleum products. The recovery in such areas is estimated to take up to 60 years. Other oil damages may result in coral reefs death and extinction of some of their associated marine species.

The long term effect of oil on fisheries is not yet widely accepted by all scientists because it is admitted that generally the recovery of bentic communities in polluted

areas after tanker accident (e.g. Amoco Cadiz) occurs in 3-4 years on exposed coasts and 10-15 on sheltered ones.

Contamination of the marine environment by oil discharge or spill from ships either as result of acute or chronic events, constitutes an additional source of stress for marine life. The problem can be manifested as pathological changes: (morphological, behavioural, physiological or biochemical abnormalities). C.J.Sindermann has noted in his 1982' study for the American' NOAA-NMFS on the implications of oil pollution on marine life the following:

> "The morphological changes resulting from exposure to oil and petroleum products are those shown as fish fin erosion, fin ray deformation, ovarian histopathology, olfactory lesions, degeneration of ventricular myocardium and cytogenic anomalies; and (for invertebrates), tissue hyperplasia, gill and epithelial necrosis, gonadal tumours and kidney tubule occlusion".

The petroleum associated diseases and abnormalities can be summarised in four aspects namely:

-That related to integumental lesions of fish;

-That concerned with different kinds of histopathologies;

-That related to neoplasm of molluscs; and

-That related to abnormalities in eggs and larvae and having genetico-morphological character.

### 2.4.3.2. Examples of effects of oil on marine species.

**•Integumental lesions in fish**

Undoubtedly, the best evidence that shows the effect of oil spill in the marine environment on fish remains the fin erosion and skin ulceration. The historic accident of *Amoco Cadiz* off the coasts of France has provided convincing information about the cause of such lesions. Months after the disaster, scientists

observed that 50 to 80 % of the mullets caught close to the wreak (Mugil cephalus: fish very common in the harbours) had lesions in their fins (Balouet & Blaudin-Laurencin, 1980).Figure:(3)

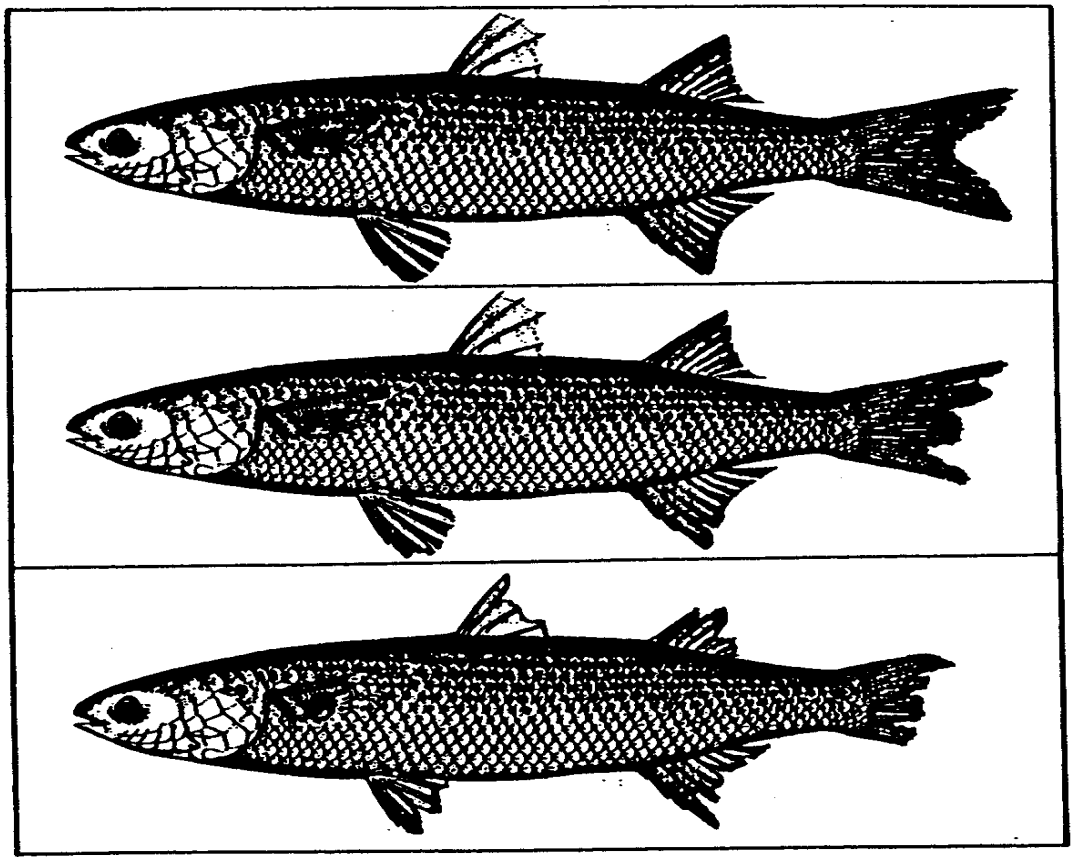

**Figure:(3), Fin erosion produced experimentally in mullet by exposure to oil.**
**From top to bottom: initial fraying of caudal fin;**
**moderate erosion; extensive erosion.**
**The Royal Society , 1982 [ Redrawn from Minchew & Yarbrough (1977).]**

Other studies of integumental lesions circumstantially due to petroleum products from the *Amoco Cadiz* were carried out on the plaice (Pleuronect platessa), the sole (Solea vulgaris) and the dab (Limanda limanda). Fin erosion was the most common anomaly found.

The fish exposure to oiled sediments causes severe hepatocellular lipid vacuolisation in which as much as 95% of the liver cell volume consisted of lipid droplets and

vacuoles. McCain *et al*, (1974) suggested that this liver anomaly might serve as an indicator of long term effect of petroleum and other hydrocarbon contamination. Oil products have water-soluble fractions such as the Polycyclic Aromatic Hydrocarbons (PAHs). They are toxic components of crude and refined oil-water mixtures, highly soluble in water and assimilated rapidly by the marine animals (fish, mussels etc.).

**•Hydrocarbons effects on molluscs.**

Molluscs are an illustrative example of the negative impact of oils on marine organisms because they generally end up in coasts where most of molluscs live:

**-Feeding:** Hydrocarbon concentrations depress the rate of feeding in molluscs such as bivalves and gastropods. This has been observed for *Crassostrea virginica* (reduction in the rate of production of faeces and pseudofaeces) Stegeman & Teal (1973); *Mytilus edulis* (decline in the rate of clearance of food particles from suspension) Gilfillan, (1975); Windows *et al,* (1982); *Mercenaria mercenaria* (decline in clearance rate), Keck *et al*, (1978). There is probably a direct inhibition by hydrocarbons of the cilia involved in bivalves feeding which may be eased by the inhibition of membrane-bound respiratory enzymes (Johnson 1977; Stekoll *et al* ,1980). Some other symptoms are also observed at relatively low concentrations of hydrocarbons such as the absorption efficiency, which may be depressed.

**-Respiration and excretion**: Dunning & Major, (1973) have observed that, at moderate concentrations of hydrocarbons, rates of oxygen consumption increase in bivalves and gastropods but at higher concentrations, respiration rates decrease probably due to valve closure or nacrotization of ciliary surfaces or both. Respiration is normally dependent in part upon the level of activity of the animal.

**-Growth:** The observation of the hydrocarbon effects on feeding rate and respiration, if carried out in a marine area with no balancing increase in the quality or the

quantity of available nutrients, will result in less energy necessary for growth or reproduction.

-**Behaviour:** Low concentrations of petroleum products may also affect the behaviour of molluscs. The production of the byssus by juveniles and adults in mussels' community could be reduced leading therefore to weak attachment to the rocks and much vulnerability to drifting currents. Hydrocarbons stimulate clams to leave contaminated sediments. It is worth mentioning that the ecological consequences of such effects are difficult to quantify but are intuitively apparent.

Clams and mussels harvested in the areas affected by ship based oil pollution always receive much attention because of their economic weight. The effect of petroleum product released from ships is much chronic in the estuaries and coastal habitats than in the open seas.

**•Effect of oils on the planktonic populations**

There is a body of evidence that oil layers on the sea surface can reduce the rate of light transmitted and at the same time alter is spectral quality. This may theoretically affect primary production. Oil spills from ships if they are enough concentrated, produce effects on phytoplancton and would adversely have direct inhibitory and toxic impacts.

**•Effects of oils on marine mammals**

The most known images to the general public, are scenes where marine mammals (seals, dolphins, etc.) living in an area affected by oil pollution from tanker accident are struggling helplessly to get out of their fix. The problem is crucial for marine mammals living on the shore line where generally the tanker cargo ends up, causing asphyxia and death of many of them in addition to other long term effects mainly congenital (sterility).

**•Oil pollution effects on seabirds**

From time to time, large number of seabirds is trapped in individual tanker accidents. Throughout the years, dead oily birds are washed up on the coasts (especially in wintertime). These dramatic scenes have brought into sharp light the concern and given rise to great deal of public awareness about the impact of oil pollution on the life of seabird's communities. It is important to consider this issue in the angle of seabirds population dynamics and determine whether or not mortality caused by oil pollution is or not substantial with regard to natural mortality. This approach requires a reliable body of information from seabirds breeding colonies and their geographical areas. The life cycle of most of the seabirds is complex because some of them do not breed until they are several years old (low breeding rate) e.g. the large albatrosses, the king penguin, the tropical frigate birds and the abbott's booby which lay only one egg at two years intervals (Nelson ,1971 & 1976).

The most visible and most meditated mortality of seabirds is associated with major tanker accidents. As examples, the *Torrey Canyon* incident in 1967 resulted in the death of 10,000 seabirds (Smith 1968); Amoco Cadiz: 4,572 seabirds (Hope Jones *et al*., 1978).

**2.5. Other Forms of Ship-based Pollution.**

Ships are also generating different forms of pollution, especially sewage, plastic litter, floating debris and rubbish with the increasing number of passenger ships, high sea fishing vessels, pleasure boating etc. It is estimated that every crew member is source of at least 800 g/ day of waste. Plastic litter, floating debris, rubbish and sewage from ships have become an emerging problem, which captured the world attention since the 70's. Plastic is miracle substance of the 20 century. Strong, durable and versatile. These quantities of plastic thrown into the sea from ships are particularly dangerous for sea life and fishermen. The amount of plastic litter in the oceans is accumulating so rapidly that scientists and environmentalists are now

classifying plastics as one of the major threats to the marine life. A personal survey carried out in 1992 as fisheries observer on board Spanish fishing vessel of about 450 GT, and with 18 crew member has lead to the following estimation: during three months operation in the Moroccan waters, each crew member produces 800 g/day of garbage including organic waste, aluminium and plastic cans, cigarette trash, paper, etc.. In addition, the vessel may lose parts or the whole fishing gear weighting more that 5 tonnes of netting material. The figure is alarming if we consider that at least, 600 fishing unites are working together in the same area with no control on their pollution contribution.

### 2.5.1. Effects of garbage, plastic litter floating debris and rubbish issued from ships on living marine resources.

Their effect depends basically on where they end up, how long it take to get there and, what it does while getting there. Effect range from entanglement and ingestion resulting in death or injury for marine mammals, seabirds, fish, sea turtles and crustaceans to the aesthetic and economic effects of litter washed up to the beaches.

Persistent debris and rubbish can affect fish and wildlife in two ways: individual animals can become entangled in it or eat it. Either of these can result in injury or death. There is abundant evidence of effects on individual animals but effects at the population level are generally unclear. There are only few cases of recorded damages by debris to population of species. However, one of the best known impacts is that of (**ghost fishing** or **the wall of death**) on fish, crustaceans, turtles and marine mammals. Studies have shown that ghost nets (mono-filament nylon made) may continue to operate effectively and trap wildlife for many years after being lost. In addition, some debris are considered by marine organisms as to be edible and therefore, may cause their death or injury.

The ship input of sewage into the sea especially in estuaries, and semi-closed seas, is an additional cause of de-oxygenation, eutrophication (oligotrophy) and chemical contamination. It also introduces pathogens, posing health risk through seafood to consumers.

### 2.5.2. Ballast waters and alien species.

It is known that each marine ecosystem has its own floristic and faunistic structures interacting in defined equilibrium. Ballast waters transported from one area to another very often serve as vehicle for alien species and unwanted organisms which once introduced can trophicaly compete indigenous species and outnumber them because of lack of natural predators or, cause ecological imbalance in the affected area. The clear example for this remains that of **Zebra mussels** introduced in the Great Lakes from the Black Sea.

## 2.6. Contaminants of General Concern.

Apart petroleum products, there is a large variety of marine contaminants, worth mentioning the following:

-**Synthetic organic compounds:** In addition to the well-known contaminant, 500 to 1000 new chemicals are annually introduced into the sea by ships as products washed overboard. Their environmental consequences are seldom defined. Thus, according to the 1990' GESAMP study, concentrations of bound chlorine in fish fat range from 30 to 200 ppm (part per million) in most samples, of which 5 to 10 ppm are attributable to known contaminants such as DDT, PCBs dioxins and chlorophenols. The rest (up to 95 %) is unaccounted for. It is important to note however that these products do not originate from ships only. The biological properties of organic compounds, namely Tributyl Tin (TBT) were recognised in the early 1950s. Initially, these substances were used as fungicides, bactericides etc. TBT was then

introduced as an anti-fouling agent in marine paints for ship hull. It also enters the marine environment as a result of a variety of other uses. For instance, it serves for fishermen as anti-fouling paint on the net cages used in salmon farming, on lobster pots and pounds for keeping fish and shellfish. Laboratory tests have shown that mussels' aposex is one of the effects of TBT.

**-Radionuclides:** Radioactive substances are naturally present in ocean waters e.g. $C^{14}$, $H^{3}$, $K^{40}$, $U^{238}$. Such radioactive material originates from ships during operational discharge, ship and submarine accident, deliberate dumping (North Atlantic) and, nuclear tests (In the Southern Hemisphere). Effects on marine life are not fully known but it is admitted that they may be somatic or genetic on the irradiated individuals. The list of marine pollutants generated from ships can not be listed exhaustively because many new products are annually introduced to the market worldwide.

## 2.7. Long-term Effects of Ship-based Pollution.

### The case of Amoco Cadiz disaster

The super tanker **Amoco Cadiz** foundered on the coast of Northern Brittany in April 1978 causing the spill of 223,000 t of crude oil and polluted some 360 Km of rocky or sandy beaches, salt marshes and estuaries.

The immediate mortality impact was observed on populations of bivalves, periwinkles, limpets, peracarid crustaceans, heart urchins and sea birds. Populations of polychaete, large crustaceans and coastal fish were less affected. The Oceanologic Centre of Brittany (C.N.E.X.O) has estimated that six generations, (5-10 years for bivalves and 60 years for birds) may be necessary before these communities retrieve their stable age distribution. Delayed effects on mortality growth and recruitment were still observed up to 3 years after the spill. Estuarine flat fishes and mullets have reduced growth, fecundity and recruitment, they were

affected by rot fin disease. Populations of clams and nematodes in the miofauna declined one year after the spill. It is still premature to decide how long it will take exactly before populations and ecosystems reach their new equilibrium.

## 2.8. Number of Oil spills and Total Amount Spilt from Ships.

The number of major spills from ships exceeding 700 tonnes has decreased significantly from 1979 to 1989. The majority of spills are small (i.e. less than 7 tonnes) but data on this kind of spill is incomplete and they make through the years considerable contribution to the global oil pollution from ships and other sources. Most of spills from ships result from routine operations such as loading , discharging and bunkering which normally occur in ports or oil terminals. The table bellow shows the incidence of spills by cause from 1974 to 1997:

| | **<7 tonnes** | **7-700tonnes** | **>700tonnes** | **total** |
|---|---|---|---|---|
| **Operations** | | | | |
| Loading/ discharging | 2757 | 288 | 15 | 3060 |
| Bunkering | 541 | 24 | 0 | 565 |
| Other operations | 1162 | 47 | 0 | 1209 |
| **Accidents** | | | | |
| Collisions | 144 | 225 | 85 | 454 |
| Groundings | 217 | 186 | 101 | 504 |
| Hull failures | 547 | 67 | 39 | 653 |
| Fires & explosions | 149 | 16 | 20 | 185 |
| **Others** | 2213 | 157 | 34 | 2404 |
| **Total** | **7730** | **1010** | **294** | **9034** |

**Source :http://www.ITOPF.org,(1999)**

## *CHAPTER 3*

## *THE UNITED NATIONS APPROACH TO PROBLEMS OF FISHING*

### 3.1. The Fisheries Concern in the United Nations Convention on the Law of the Sea.UNCLOS1982.

The 1982 United Nation Convention on the Law of the Sea (UNCLOS 82) is an important contribution to the rule of the law. It has become a substantial element of modern international law. UNCLOS 82 sets out norms, frameworks and principles for the relations and conduct of states on marine related issues.

UNCLOS 82, together with the Implementing Agreement relating to the provisions of Part XI of the Convention adopted in 1994, is a remarkable achievement which is indicated not only by the number of states that signed, ratified or acceded to it but also, by its tangible consistency and uniformity in states' practice. For many international bodies, i.e. the International Court of Justice (ICJ), the International Tribunal for the Law of the Sea and other judicial or arbitral agencies, the Convention is regarded as the constitution for the oceans.

The conclusion of UNCLOS 82 has influenced subsequent actions and inaction of many coastal states. It is important to mention that while there was enough precedence with regard to extending of the exclusive economic zone as a mean to conserve fish stocks, many developing countries refrained to do so; most likely this was dictated by their technological and economic limitations to back up such action.

The extension of the coastal jurisdiction is appealing and significant in terms of the economic opportunities it provides to the coastal states. This is why the management regime, as formulated by the 1958 Convention on Fishing and Conservation of Marine Resources of the High Seas, was respected for decades. The fundamental proposition underlying the 1958 Convention is that a coastal state has a special interest in maintaining the productivity of living resources in the area adjacent to the territorial sea, irrespective of whether the coastal state fishes in the high sea area or not. However, the 1958 Convention has not been widely adopted probably because it has not addressed the chief concern of coastal states in regulating fisheries. The Convention also adopts a very limited conception of conservation and protection of the environment and living marine resources.

To give effect to its most important provisions, UNCLOS 82 established three institutions, namely: the International Seabed Authority, the Commission on the Limits of the Continental Shelf and, the International Tribunal for the Law of the Sea. However, some responsibilities for the implementation of the Convention provisions are delegated to the UN Secretary General and the specialised International agencies such as IMO, FAO and UNESCO. By August 1998, 127 states had become parties to the Convention. In most cases, the delay for states not yet party to it is due to delays to establish the necessary internal procedures or to iron out some bilateral problems such as, delimitation of boundaries.

The norms embodied by the UNCLOS 82 are generally fairly detailed but some of the Convention principles lend themselves to further development within the basic framework of its provisions. In fact, the Convention has a built-in flexibility, which allows for responses to new circumstances without affecting the integrity of the Convention itself. Such response can be seen in the Agreement on the Implementation of Part XI of the Convention adopted in 1994 and mainly in the Agreement of 1995 related to the implementation of the provisions of the Convention

on Straddling Fish Stocks and Highly Migratory Fish Stocks. This last agreement addresses the new problems in the area of fisheries. The Convention did not adequately deal with the management of living marine resources on the high seas particularly with regard to straddling stocks and highly migratory species. These issues are however subject matter respectively in articles 63 and 64 of the UNCLOS 82. There was an urgent need to make a compromise between the management and conservation measures taken in the exclusive economic zone and those taken in the high sea for the same stocks in order to mitigate or avoid further over-exploitation and destruction of their stocks.

The concept of the exclusive economic zone which is defined in some details in articles 55, 56, and 57 and elaborated in several parts of the treaty, is considered to be an element of Customary International Law. On the basis of that concept, as reflected in states' conduct, the coastal state has sovereign rights over living resources in the zone. Articles 61, 62, 63, 64, 65, 66, 67, and 68 examine the living marine resources and the relative rights of coastal states to these resources. The land locked states and those geographically disadvantaged are also given a special interest in the use of living marine resources (articles 69, 70, 71, and 72), whereas article 73 indicates how a coastal state may enforce laws regarding the preservation of its marine life. As regard high sea activity, the convention provides adequate instruments through article: 116 (right to fish on the high seas); article 117 (duty of the states to adopt with respect to their nationals measures for the conservation of the living resources of the high sea,); articles 118, 119 and 120 (the co-operation between states in the conservation and management of living marine resources in addition to scientific data exchange and the protection of marine mammals).

In contrast to the 1958 Convention, the UNCLOS 82 addresses widely the marine environment issue in the its provisions. Noteworthy are articles, 94 (duties of the flag state); 145 and 147 (protection of the marine environment and accommodation of activities in the area and in the marine environment); 194 (measures to prevent,

reduce and control pollution of the marine environment); 195 (duty not to transfer damage or hazards of transform one type of pollution into another); 196 (the use of technologies or introduction of alien species).

The protection of the marine environment from pollution is not only the concern of these above-mentioned articles. In fact, through the Convention, many articles examine this concern but, regarding ship-based pollution, the most valuable remains article 211(pollution from ships). This article provides for the prevention pollution from ships, and especially the duties and rights of the coastal states in exercising sovereignty within their territorial sea. Article 212, on the other hand examines the pollution from or through the atmosphere, which is of the same hazard as that caused by other forms of marine pollution.

The protection and the preservation of living marine resources are therefore largely considered by the 1982 UNCLOS. This Convention focuses mainly on the right of coastal states and non-coastal states in the oceans. It provides instruments for enforcement of national jurisdiction upon territorial waters and the guidelines for the conduct of scientific research, co-operation and transfer of the technology between member states in addition to mechanisms of settlement of disputes.

### 3.1.1. The Law of the Sea and Coastal Species.

Establishing the authority of a coastal state over marine life within its jurisdiction is designed to provide for effective decision making on living marine resources in the area. UNCLOS 82 gives coastal states sole authority to define the interests involved in harvesting and exploiting fish caught within its jurisdiction. The chief limitation on coastal state authority to decide who takes how much fish concerns species and stocks that are existing outside the national jurisdiction. This is why the UNCLOS 82 urges members to co-operate with other states fishing outside national waters on conservation measures for such stocks. It states that while management decisions

taken by coastal state within its own jurisdiction should be considered by other states, disputes over straddling stocks should be subject to compulsory and binding dispute settlement.

#### 3.1.1.1. Fishery authority within national territory.

It is recognised in Customary International Law that the territorial sea can not exceed 12 miles (UNCLOS 82, article 3). Access to living resources within this area requires authorisation by coastal state. Any regulation, which may affect their exploitation, is exclusive concern of coastal state, except where it is decided otherwise by virtue of agreements. Concerning archipelagic waters, the Convention provides that archipelagic states have sovereignty over archipelagic waters (article 46). However, two articles, (47 and 51) prevent such state from having complete authority over fisheries by requiring the archipelagic state to recognise the existing and traditional fishing rights of an immediately adjacent state in specified area of archipelagic waters. Such regulation does not apply within zones delimited from the baseline enclosing such waters.

#### 3.1.1.2. The general scope of the coastal authority beyond the territorial sea.

Today, the vast majority of coastal states have asserted their jurisdiction by means of establishing exclusive fishing zone or exclusive economic zone of 200 miles. Within this zone, the coastal state has the right of exploring, conserving, exploiting and managing living resources. More specific competencies are listed in articles 61 and 62 of the Convention in that: determining the allowable catch of each species, issuing management plans and, making agreements with other interested states in case of under-exploitation of stocks or limited national harvesting capacity and finally, enforcing the laws and regulations coming into force.

### 3.1.1.3. Specific components of coastal state jurisdiction within the exclusive economic zone.

Articles 61 and 62 of the Convention contain specific provisions pertaining to the duties and rights of the coastal state in its EEZ in addition to those of other states. The coastal state exercises its fisheries authority through a sequence of decisions mainly:

- Determination of allowable catches;
- Determination of harvesting restrictions;
- Determination of harvesting capacity of the coastal state in relation to particular stock;
- Determination of what other states in case of lack of means for self-exploitation may have access to the EEZ and the attending conditions;
- Conclusion of agreements for access; and
- Implementation of decisions about access including surveillance and enforcement of regulations.

For some species and situations, the coastal authority is restricted by the obligation to consult other nations before granting access to foreign vessels (articles 63 and 70). As stated earlier, articles 63, 64 65, 66, 67 and 73 provide dispositions for shared stocks, highly migratory species, marine mammals, anadromous and catadromous species, high sea fishing issues and enforcement.

The definition of total allowable catch (TAC) to be set by the coastal state within its EEZ is full of ambiguities. It is the language that may appear to create an obligation of the coastal state to adopt this as management measure. Even if the determination of the allowable catch is mandated by UNCLOS, it does not follow however that the coastal state must use catch regulations for fisheries management.

### 3.1.2. High Seas fisheries.

Until the mid 70's, the term meant all areas outside the territorial sea or, where established outside an additional exclusive fishing zone. In major respects however, the actual situation is remarkably different. The high seas for fishing purposes is today known as the areas outside the 200 miles limit to which the majority of coastal states have extended their authority. This authority in numerous occasions still does not reach all stocks subject to exploitation or all portions of these stocks. The list of high sea species is very long but it can be categorised into two main components:

-The first category is composed of species which are found in the open sea and those which move from the open sea into waters associated with the continental shelf. The first category comprises the cetaceans (whales and dolphins), seals, tuna, swordfish, billfish, horse mackerel, squid, pomfret, shark and krill.

-The second category includes cod, poolak, orange roughy, tuna, salmon and some marine mammals, billfish and mackerel but this list is not exhaustive.

Two main legal problems can be generated by high sea fishing activities. One is the set of claims about specific stocks (either targeted or incidental) that surfaces because of dominance of the principle of freedom of fishing on the high seas. The other problem involves the decision making process in the area where the decision is solely taken by the flag state.

The problem of high sea fisheries generally come to surface because of straddling stocks (the Jack mackerel in the Southeast Pacific outside Chilian'200 miles) the marine mammals or; the anadromous species such as salmon.

### 3.1.3. Rights of high sea fishing states: Freedom of fishing on the high seas

These rights are respectively underlined in the article 2 of the 1958 Convention on the High Seas and article 87 of the 1982 UNCLOS. According to these articles, high seas are open to all states, both coastal and land-locked, under conditions prescribed by the Conventions. The general obligations of high seas fishing states can be summarised in the following:

-To adopt conservation measures necessary for living marine resources on the high seas (including the obligation to take unilateral measures concerning its own nationals when a fishery is conducted by them alone). This is dealt with in UNCLOS 82 articles namely; 116(b), 63(2), 64, 65, 66 and 67. The illustrative attempt nowadays is the 1989 Willington Convention on the Prohibition of Drift-nets. The operative paragraphs of the 1989 UN' Resolution 44/225 is more important in showing current perspectives on the obligation to conserve high sea stocks (mainly pelagic) from the impact of drift-nets. It recommends that all nations agree to moratoria on all large-scale drift-net fishing on the high seas by June 30$^{th}$ 1992 unless effective conservation and management measures be taken based on statistically sound analysis. However, many species on high seas are still not covered by such measures;

-To employ the best scientific evidence available to establish needed conservation measures. In this regard, UNCLOS 82 contains enough provisions as to determine the maximum allowable catch (Annex 119) but here again, the problem remains the method of calculating of the Total Allowable Catch (TAC) which may differ from one country to another;

-To co-operate with other states in conserving high seas living resources. Co-operation can take many forms.

-To negotiate with other states over conservation measures. Article 118 of UNCLOS 82 stresses this duty. It concerns cases where nationals of different states exploit the same stock in the same area and where different stocks are exploited in the same area. To negotiate is more demanding than to co-operate. This requires good faith in order to reach substantive agreement;

-To generate, contribute, and exchange scientific and other information (catch and effort statistics). This is necessary to ensure that the flag state has the corresponding responsibility to undertake scientific investigations to undertake an effective conservation programme. Article 62(5) obliges coastal states to contribute and exchange at regular intervals the available scientific data including the catch, the fishing effort, fish statistics and, other information relative to marine life conservation. This is possible through the United Nations' Food and Agriculture Organisation (FAO);

-To refrain from discrimination in conservation. Article 119(3) provides that the state concerned by such obligation shall not discriminate in form or in fact between fishermen of other states. Nevertheless, the problem again rises by reference to articles 63(2) and 116 when determining what is discriminatory.

### 3.1.4. Anadromous species.

These species usually reproduce in and inhabit fresh waters but move to the ocean before returning to spawn. They include salmon, shad, steelhead, trout, shortnose sturgeons and, smelt. Very often, these species are vulnerable to interception beyond waters of the state of origin. The question here is whether the mother country has the right to claim the whole or part of the stock even not existing in its waters as vulnerable stock. According to UNCLOS 82, the state of origin's primary interest and duty apply to anadromous species within the coastal state's authority. Article 66(2) states that 'the state of origin shall ensure their conservation by the

establishment of appropriate regulatory measures for fishing in all waters landward of the outer limits of its EEZ and for fishing'. The paragraph 3(b) of the same article stresses the duty of the original state in that, to maintain and/or restore anadromous species at levels of MSY. Therefore, the Convention limits this duty in only establishing the TAC (which may be determined differently from one state to another), not only regulating the fishery. On the other hand, the exploiting state has the obligation to co-operate with the state of origin in conserving such a stock.

### 3.1.5. Catadromous species.

Unlike the anadromous species, the catadromous ones have the opposite life cycle by spending their adulthood in the fresh waters and move to the sea for spawning. The regime governing the exploitation of these species is provided in article 67 of UNCLOS 82 where again the original coastal state has the duty to manage the stock and comply with all related provisions on the issue including the co-operation with other states in cases where the stock crosses to another state's EEZ.

### 3.1.6. Highly migratory species

Among these is tuna, which is the most important commercial specie in this category and which generates the most controversy. UNCLOS 82 has given particular attention to this category of marine animals commonly known as highly migratory species (HMS) since they move considerable distances in the ocean. Sometimes covering zones of different jurisdictions. The traditional fishing nations for this species (Japan, France, Venezuela, Indonesia, Spain, USA, South Korea) are technologically advantaged and, could target migratory species on the high seas on their natural migration paths. Because of recent changes in national jurisdictions of some flag states, many fishermen have flagged out their vessels to those with advantageous financial and regulatory interests disguising the effective ownership.

The use of drift-nets in different areas (the North and the South Pacific) the purse seines (in the Mediterranean Sea) and other fishing gears (line, weir, fishing aggregation devices, etc.) has a destructive impact on tuna stocks.

Under UNCLOS 82, highly migratory species are subject to coastal state authority in the EEZ exactly as are all other stocks except that the coastal states are in addition obliged under the article 64 to co-operate with the other states exploiting the same stock within and beyond the EEZ. The co-operation is also required from the states whose fleets exploit the stock. Articles 61(3), 62 and 69 provides additional measures as to conserve, manage and utilise these species based on MSY. The Convention contains also other articles all aiming at the best use of these fragile resources. Worth mentioning in this regard are the various regional forums set up to manage the stocks of HMS inter alia: the Inter American Tropical Tuna Commission (IATTC) and the International Convention for the Conservation of the Atlantic Tuna (ICCAT)

### 3.1.7. Extended continental shelves and straddling stocks.

There is an urgent need for improved international arrangements to deal with the management of the demersal stocks that straddle the boundaries between the high seas and national limits of jurisdiction. These areas occur where continental shelves and slopes extend beyond 200 nautical miles from shore e.g. the Doughnut Hole in the Bering Sea between the former USSR and the USA; the Grand Bank in the Northwest Atlantic and the Patagonian Shelf off Argentina. Examples of the difficulties which arise from such stocks are the Northwest Atlantic ground-fish stocks, notably cod. This specie is found on the outer edges of the Grand Banks. The conflict has been a major issue for regional international management bodies, the Northwest Atlantic Fisheries Organisation (NAFO) and was recently ironed out when the fishery was closed down due to over-fishing. The additional problem facing the NAFO as well as the FAO itself remains that of new Entrants. NAFO

arranged that the TACs are set for individual stocks. These are divided up into shares for Contracting Parties. According to the NAFO Convention, the access to the Organisation is open to all members of NAFO. Therefore, when additional states join the NAFO, the pie is divided into smaller shares, thereby decreasing slices held by the original members.

As mentioned previously, UNCLOS 82 is the obvious starting point for discussions on international fisheries management of straddling stocks and highly migratory species. Articles 61 and 64 provide for managing a stock in a particular EEZ. In article 61, this responsibility is given to the coastal state which is consequently obliged to take into account the best scientific evidence available, to ensure that stocks within its EEZ are not threatened by over-exploitation and particularly 'to maintain or restore populations of harvested species at levels which can produce the MSY'. Under article 63, shared and straddling species are treated as single stock. In both cases, the concerned state, whether coastal or distant water fishing state, should seek (through either regional or sub-regional organisations) to agree upon mechanisms necessary for their conservation and exploitation. Article 64 deals with highly migratory species where again the coastal state and other states whose nationals share the stock in the region are urged to co-operate directly through appropriate international organisations in the aim to rationally use such species. However, the problem lies again in the determination of the TAC, which every state can accommodate to its own interests. At this level, there is no mandatory instruments obliging states to harmonise their view.

The straddling stocks are governed by the provisions of the Convention dealing with the resources of the continental shelf. Negotiators at UNCLOS III did not in fact wish to alter one of the rights given to coastal states by the 1958 Geneva Continental Shelf Convention. In articles 76 and 77, the rights of the coastal state over straddling species will apply beyond the EEZ where this overlaps with the continental shelf and

will also apply beyond the EEZ where the continental margin extends beyond the 200 miles seaward.

The management of straddling stocks is basically not different from management of stocks lying fully within national jurisdiction except for the kinds of participants and the distribution of benefits.

### 3.2. The UN Convention on Straddling Stocks and Highly Migratory Species.

The United Nation Conference on Straddling Stocks and Highly Migratory Species was held in New York in 1995. This Conference was an attempt to give effect and clarify some of the provisions of UNCLOS 82 related to the management of these stocks.

The agreement, as stressed in the fourth article, should be applied in consistence with UNCLOS 82. On the other hand, article 5, part II gives the general guidance as to adopt measures to ensure long term sustainability of straddling and highly migratory species promoting their optimum utilisation. This article refers also to the management of these particular stocks based on MSY and the precautionary approach. In global terms, this article spells out the management duties of both coastal and distant water fishing states. It is by far the most detailed and comprehensive International legal instrument on the subject of conservation and management of straddling and highly migratory stocks. Furthermore, it rises the environmental issue as to minimise pollution, waste, discards, catch by lost or abandoned gears, the by-catch and the protection of endangered species.

The Convention is a balanced agreement, which remedies in many ways the ambiguities shown in UNCLOS 82. It considers in fair manner the interests of both sides of the games in addition to those of geographically disadvantaged ones. The Convention also enhances grounds of co-operation between states since this is the

unique way for real conservation of this fragile common heritage. Part III of the agreement is entitled "Mechanisms for International Co-operation Concerning Straddling Fish Stocks and Highly migratory Fish Stocks". Generally, coastal states and distant water fishing states on the high sea shall co-operate (article 8 and 13) in relation to these stocks either directly or by the means of appropriate sub-regional or regional fisheries management organisations (article 9). The objective should be the conservation and set up of management measures with regard to particular fish stocks where there is clear grounds of believing that such stocks are threatened by over-exploitation or where new fishery is being developed for such stocks.

States with an interest in the stocks which are not parties to an existing fisheries Organisation or agreements are encouraged to participate in the work of the Organisation. The access is open only for member states of such organisation or arrangement or for those, which agree to apply the conservation, and management measures set up by the Organisation. The future role of regional fishery bodies is detailed in the article 10 of the Agreement. This article calls essentially for standardisation of data collecting system and exchange of information.

The Agreement also provides detailed provision on compliance and enforcement (Part IV) and peaceful settlement of disputes (Part VIII). These provisions go beyond their present commitment by states in the work of existing fishery management bodies.

### 3.3. UNCLOS 82 and Marine Mammals.

The migratory behaviour, the general distribution, the abundance, the reproductivity, the mortality etc. are significant characteristics that must be considered to devise policies to regulate interactions between marine mammals and humans. Some marine mammals are categorised as HMS. Marine mammals under UNCLOS 82 are subject to coastal state authority within the EEZ, in the same sense as other living

marine resources in the zone. However, concerning article 65, the other provisions of the Convention related to the coastal state obligation to allow access to surplus of such species do not include marine mammals. The biological characteristics of marine mammals means that their stock can be depleted within relatively short time if their exploitation is not carried out rationally. Article 65 of UNCLOS provides that coastal state may instead of exercising its normal obligation to manage (e.g. maintaining the stock at level of MSY or, prescribing the TAC and allow other states to share it), prohibit, regulate or limit the exploitation of marine mammals within its EEZ with more stringent regulations.

The call for strict regulations on the marine mammals killing is perhaps due to moral ethics among people. This view is for example reflected by the 1972 Stockholm Conference on Human Environment held by the UN which called for 10 years moratorium on commercial whaling although this Resolution is not legally binding upon states but it stands for growing awareness of need to protect these marine mammals.

Article 65 applying to marine mammals in the EEZ is backed up by article 120, which applies, to marine mammals on the high seas. The combined effect of the two articles would seem to be that coastal states and competent international organisations are to impose conservation measures aiming at further protection of marine mammals. The article envisages that any stipulated action will be carried out in uniform way by both the international organisation and the coastal state. However, the weakness of this article lies in the fact that it does not provide any criteria as to when it is *appropriate* or who may decide of appropriateness to prohibit, limit or regulate the exploitation of marine mammals more strictly. In addition, article 65 does not define to what extent if any; the competence of international organisations extends to the EEZ. The Convention should clarify these issues in order to avoid conflicts, which may arise due to the loose language of article 65.

Like most of the Convention‘s articles, the above article does not define the competent or appropriate international organisations to which it confers the duty to prohibit regulate or limit the exploitation of marine mammals. However, it is probably reasonable to assume that the drafter of the Convention refers to the International Walling Commission (IWC), the best known body dealing with the exploitation of marine mammals since 1946.

### 3.4. The Antarctic Region.

In the Antarctic region, several International treaties relate to the use of its fisheries resources. These include the Antarctic Treaty (1959), the Convention on the Conservation of Antarctic Seals (1972) and, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMER, 1980). Discussion on Antarctic issues now take place within the UN General Assembly because the problem has became acute in the area not only as result of fishing activities but also due to global climate changes.

### 3.5. FAO Code of Conduct for Responsible Fisheries.

#### 3.5.1. Historical background.

Because of the urgent need for common fisheries code of conduct the Cancún Declaration of 1992 called on the FAO to draft an International Code of Conduct for Responsible Fishing in consultation with concerned international organisations taking into account the provisions of the Declaration. This call was endorsed by the Technical Consultation on High Sea Fishing (TCHSF). By November 1992, the FAO Council officially approved the commencement of the drafting of the Code, taking into account the guidance of Cancún Declaration, those of Agenda 21 of UNCED (United Nations Conference on Environment and Development) and, the

conclusions/ recommendations of the TCHSF. In Marsh 1993, The FAO Committee on Fisheries (COFI) got and discussed the proposals regarding the content of the Code and time frame for its adoption and implementation. The Committee recommended that the Code should have an encompassing umbrella of general principles, which would provide the frame for general guidelines on the issues to be considered.

### 3.5.2. The Global objectives of the Code.

Paragraph 1 of the *Cancún* Declaration urges states to adopt effective fisheries management and planning standards within the context of sustainable development. This concept was first defined in 1988 by the FAO *Ad hoc* working group on Sustainable Development as the "the management and conservation of the natural resources base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generation". The preamble of the Declaration of *Cancún* uses the above definition in defining responsible fishing by stating that "this concept encompasses the sustainable utilisation of fisheries resources in complete harmony with their environment, the use of fishing and aquaculture practices which are not threatening the ecosystems, resources or their quality; the incorporation of added value to fisheries products through the process of transformation meeting the necessary standards quality; the conduct of commercial practices so as to provide consumers with good product". Thus, the core element of the Code is sustainable utilisation and development.

The FAO Code of Conduct for Responsible Fisheries was adopted on 20$^{th}$ November1995. It sets out international standards and principles of behaviour for responsible practices with the aim to ensure the effective conservation, management and development of living aquatic resources, with due respect to the ecosystem and biodiversity. The application of the Code is voluntary and it contains provisions that

have already given binding effect by virtue of other legal obligatory instruments. The Agreement to Promote Compliance with the International Conservation and Management Measures by Fishing Vessels on the High Seas is an integral part of this Code. The Code consists of twelve Articles. Worth stressing are the first five, which deal with nature and objective, scope, relationship with other international instruments, monitoring, updating, implementation and special requirements of developing countries. Article 6 deals with general principles while articles 7, 8, 9, 10, 11 and 12 cover specific subjects such as, fisheries management, fishing operations, aquaculture development, integration of fisheries into coastal area management, post harvest practices and trade, in addition to fisheries research. The Code has link with many International Conventions (Appendix:3) and confers great importance to regional and sub-regional organisation for its implementation but it does not specify them. Here again the softness of the Code lies in its character of being voluntary. In most cases, coastal states disregard its provisions if they do not fit their priorities.

### 3.6. The Enforcement Process.

As provided in the 1982 Convention on the Law of the Sea, the enforcement is the process of invoking and applying authoritative prescriptions. This includes surveillance, stopping and boarding vessels, detention, and formal application of law, including imposing sanctions. The Convention contains relatively few provisions on the enforcement regime within national jurisdiction (article 73 for the EEZ, article 49 for archipelagic waters and, articles 21, 25 within the territorial sea for fishing purposes). It rather emphasises marine pollution matters. Enforcement on the high seas is mentioned in article 66 of part V and articles 110, 111 on right of visit and hot pursuit. Otherwise, there are no direct provisions dealing with fishing although Article 116 appears to imply some enforcement authority.

Several measures have been adopted or proposed for the protection of coastal interests in the EEZ from passing vessels. They reflect varying perceptions of the scope of national authority that a state is allowed to claim and exercise beyond national territory. They include the following provisions:

- Applying territorial sea authority to fishing vessels passing through the EFZ or the EEZ;
- Prohibition of entrance by unlicensed fishing unites into the EEZ or the EFZ unless officially authorised;
- Requiring use of prescribed sea paths by transiting fishing vessels;
- Requiring report of entry and exit together with route used;
- Requiring stowage of fishing gear during the transit;
- Requiring carriage and use of transponders during passage; and
- Applying protective measures reached by international agreement

More than thirty-five marine and inland international fishery bodies established both within and outside the framework of the FAO work on the management and protection the marine and aquatic life. These bodies activity is essentially geographically and regionally based. The discussion on their objectives, functions and structures is not within the scope of this work. Nowadays, two major issues i.e., the problem of large scale pelagic drift-net fishing and the reflagging of fishing vessels in the high seas, have been at the forefront of FAO concern in recent years.

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## *CHAPTER.4*
## *THE UN APPROACH TO PROBLEMS OF POLLUTION FROM SHIPS*

Most estimates for pollution place ships as contributing about 10% of the total marine pollution on worldwide basis. Fortunately, perhaps, ships as source of pollution is one of the more regulated areas. A quick review of the IMO statistics and works shows that there are more related conventions on ship-based pollution in force than is generally typical of the other combined pollution sources. It may be questioned that the introduction of some conventions seems to be of peripheral relevance to marine pollution and thus, complicates the existing complex area of the law. In essence, much of the problem of marine pollution, as was the case of *Exxon Valdez,* are results of ***human*** failure. Regulations, which aim to minimise and limit such errors, will also prevent or at least mitigate the effect of marine pollution. The relevant conventions will be examined here in order to give a general idea of the legal aspect of ship-based pollution and how it is covered.

### 4.1. Principal Conventions.

#### 4.1.1. The 1958 Territorial Sea Convention and the 1958 High Seas Convention.

The 1958 Territorial Sea Convention adopted in Geneva did not deal specifically with ship-based pollution or shipping, but does stress the coastal state's *rights* regarding marine pollution in their water areas. Under article 17, coastal states may

issue legislation to combat pollution and regulate navigation, but articles 15(1) and 18(2) preserve the rights to innocent passage. This is also described in Article 14 as navigation through the territorial sea without prejudice to peace whatsoever of the coastal state and in conformity with the Convention and other rules of international law. In addition, under article 17 all ships must comply with such law. On the other hand, article 19 gives the coastal state right to enforce violations of its marine pollution legislation in its territorial sea. Similar provisions are stressed in the UNCLOS 82 earlier discussed.

The 1958 High Seas Convention requires ships to regulate their flagships in relation to marine pollution. Under article 6 of this Convention, the flag state has exclusive jurisdiction on the high seas in terms of legislating and enforcement of relevant rules. Article10 requires flag states to take measures, which are necessary to ensure the safety and compliance of their ships with generally accepted international rules. Article 24 urges states to draw up regulations for the prevention of marine pollution by discharge of oil from ships. Concerning damages caused to anchors or fishing gears in order to avoid damages to pipelines and cables, article 29 requires states to provide instruments for compensation to shipowners. Article 23 covers the mechanisms of hot pursuit of ships suspected by coastal state of violating national law in the territorial sea, whereas article 25 urges states to co-operate with the competent international organisations to prevent pollution resulting from radio active materials or other hazardous substances.

### 4.1.2. The OILPOL Convention.

The 1954 International Convention for the Prevention of Oil Pollution (OILPOL) may be seen as the first attempt to control marine oil pollution and providing a basis for the adoption of the succeeding Conventions.

Under article II of this Convention, ships registered in contracting parties and those unregistered but having the nationality of contracting parties are prohibited to intentionally discharge oil or oil mixtures. The category of ships excepted from this provision are tankers under 150 GT and other ships under 500 GT, whaling ships, naval ships and, ships navigating on the Great Lakes (North America). Under Article III however, discharge of oil or oily mixtures are permitted when a ship *other* than a tanker is proceeding *en route* with the instantaneous rate of discharge not exceeding 60 l/mile, the oil content of discharged mixture is less than 100 ppm (part per million) and, the discharge is carried out far from the land. Concerning tankers, the discharge of oil and oily mixtures is not prohibited when they are proceeding *en route*, the instantaneous rate of discharge is less than 60 l/mile, the total discharged ballast water on a voyage does not exceed 1/15,000 of the total cargo carrying capacity and, the tanker is 50 miles off the nearest land.

Article VI provides that under the Convention provisions, punishable offences must be of equal severity both on the high seas and the territorial seas. Under article VII, the carriage of ballast water in oil fuel tanks must be avoided if possible. Port states are required under article VII to provide reception facilities at either port or terminal for oil and oily mixture residues generated by ships. In the article IX, the Convention requires ships mainly tankers, to have an appropriate log book for the record of loading, disposal and discharge operations of oil cargo, oil residues, ballast waters and bilge waters containing oil.

The 1962 Amendment adopted the Load on Top system as an attempt to reduce the amount of oily ballast water discharged. Amendments to the 1954' Convention were also adopted in 1971 dealing with accidents and aiming at minimising oil pollution from ship' collision.

### 4.1.3. MARPOL 73/78.

The MARPOL 73/78 is the main Convention that deals with ship based pollution. It is the hinge of IMO for marine environment protection. The diversity of pollutants and their sources is very complex and requires continuous revision and amendment to the Convention annexes. The existing restrictions upon operational pollution by oil were extended by the MARPOL to cover simultaneously equipment and ship design (see also the 1978 protocol to SOLAS 74). In addition, it includes control of other forms of pollution from ships.

The 1978 Protocol to MARPOL73 is a combined instrument, which entered into force in October 1983 (for the Annex I and II). The annex V on the other hand entered force in December 1988 after achieving sufficient ratification, while the annex III entered force in July 1992. Annex IV has been so far ratified by 71 member states but representing only 42.50% of the world shipping gross tonnage.

The scope of MARPOL was extended in 1997 to cover prevention of air pollution from ships in annex VI. Simultaneously, the IMO's MEPC (Marine Environment Protection Committee) is about to draft mandatory regulations for appropriate management of ballast waters and the prevention therefore of the spread of unwanted aquatic organisms. Another work is underway to regulate the use of anti-fouling paints and noise level.

Since technical requirements are the major obstacles for countries willing or able to ratify the Convention, the three- year grace period (or even longer if decided by two third majority of the MEPC) was supposed to be sufficient for member states to carry out necessary renewal and acquire adequate structures in conformity with the annex II of the Convention. The IMO has eased the access to the Convention by first implementing the annex I whereas the binding of the second annex, would not have effect as said above until three years of entry into force of the Protocol.

#### 4.1.3.1. Annex I: Oil Pollution.

Annex I includes much of 1954 OILPOL and following amendment to it. It was modified in the 1978 Protocol to introduce provisions attempting to solve problems related to LOT (Load On Top System). Periodic inspections and surveys were made stringent under *Regulation 4*. Conditions for issuance of IOPP (International Oil Pollution Prevention) Certificate were tightened up and inspections made more frequent. Under *Regulation 8,* inspections and surveys either periodic or intermediate are required to cover ship'structure, arrangements, systems, fittings and material to ensure their compliance with the provisions of the annex I. In article V, it is stressed that the port state has the right to prevent a ship from sailing if there is clear grounds of believing that she is unseaworthy, threatening the marine environment or, doesn't correspond with the particulars of the certificates. *Regulation 13* concerns dedicated clean ballast tanks (CBT's), segregated ballast tanks (STB's) and crude oil washing (COW). It requires that for all new oil tankers of 20,000 dwt and new product tankers of 30,000 Dwt, STB's must be constructed in the manner that they ensure the cargo tanks protection if the ship is running aground or collides. To avoid explosion, inert gas system (IGS) is required in each cargo tank and slop tank. The existing oil tankers of 40,000 Dwt and above are required to refit their structures with these requirements but existing tankers engaged in specific trade between ports with adequate reception facilities are exempted from the SBT's, the CBT's or the COW. Improved drainage, stripping and discharge arrangements are provided for in the regulation 18. Regulations dealing with reception facilities, discharge standards and oil monitoring systems were incorporated directly from MARPOL 73 to MARPOL 73/78.

The annex I has established the Red Sea, the Mediterranean Sea, the Baltic Sea, the Gulf Sea, the Australian Great Barriers, the Arctic and many other sea areas as special where any oily water discharge is either prohibited or, restricted because the

flora, the fauna or the infrastructures in the inner coasts are fragile, sensitive or endangered.

Many important amendments were built during the 80's and 90's in the annex I, namely: those connected with the duties of port and coastal states (1994), measures to take in case of straddling or collision (1992), intact stability and special areas (1997) and, the 1991 amendment related to shipboard oil pollution emergency plan that ships are required to have before an oil spill takes place.

One of the problems connected with the new and revised annex I was the lack of adequate reasonably priced reception facilities (*Regulation 12*) in some ports in addition to the lack of verification system of oil monitoring devices.

#### 4.1.3.2.Annex II: Control of Pollution by Noxious Liquid Substances in Bulk

The transport of noxious liquid substances in bulk started to be a major occupation since the late 40's. The main chemicals concerned are oil products, molasses, alcohol, vegetable oils, animal fats and, coal-tar products. The annex II is probably the main reason that the initial MARPOL 73 which was entirely incorporated into MARPOL 73/78 was not ratified by many states because of its economic and technical requirements. This annex is mandatory. It covers more than 250 types of chemicals and with classification levels based on their toxicity to aquatic life and the areas where they may be discharged. Annex II requires that noxious substance be discharged in adequate reception facilities (amendments of 1978, 1985 and 1992) unless they can be diluted down to non-hazardous levels. The discharge of the most toxic products (Category A) is strictly prohibited. The unloading operation must be followed by tank washing but only if a set amount of residue of this category' substances is diluted down by water of not less than 5% of the total volume of the tank, the ship is proceeding at 7 knots speed (self propelled), the discharge is made bellow the water line and at least 12 miles off the nearest coast line with 25 meters or

more in depth. The discharge provisions for category B and C substances are relatively less stringent. They allow residues of 1 cubic meter or 1/3,000 for category B chemicals and 3 cubic meters or 1/1,000 for category C chemicals of the tank carriage capacity but still include the same above stressed ship movement and discharge requirements. In addition, the concentration of the substance in the weak astern should not exceed 1 ppm for both categories. In special areas, the discharge standards to be used are similar to the above but with lower permitted residue quantities. Annex II contains also provisions to reduce and minimise pollution in case of an accident. Ship operators are required to maintain an updated cargo record book, similar to that of annex I, showing all voyage operations of cargo and residues handling. In contrast to annex I, there are no provisions for independent monitoring and control system in the annex II. State parties are required to control the design, construction and operation of chemical tankers which must be in compliance with the provisions of the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk.

The annex II with its 1985' amendment has become binding since April 1987 but in 1992, the MEPC decided to review all provisions of the annex to update them with new scientific realities and simplify the implementation of the annex by member states. The review concerned also categorisation of the substances. These steps are consequence of technological development in chemical tankers and cargo handling which has drastically reduced the amount of residues discharged or left in tanks after loading. The UNCED Conference held in Rio in 1992 has influenced this review especially with regard to the harmonisation of the categorising system and labelling of chemical substances. The tendency after the MEPC' 40$^{th}$ Session in 1997 is to recategorise chemical substances on the basis of so called precautionary approach and reconsidering requirements for reception facilities at ports. The deadline for this revision is due to be the year 2002.

#### 4.1.3.3. Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form.

Annex III aims at identifying marine pollutants with regard to their stowage and packaging to mitigate effects of accidental pollution and, aid recovery by labelling them with recognised marks. Annex III' regulation 7(1) states:

> " Jettisoning of harmful substances carried in packaged form shall be prohibited, except where necessary for the purpose of securing the safety of the ship or saving life at sea".

Annex III is voluntary and was directly incorporated into MARPOL73/78 from the initial MARPOL 73. It contains measures for all ships, regulating washing of leakage overboard. However, the lack of clear definition for harmful substances carried in packaged form have made its implementation difficult but this was ironed out by the amendment of the IMDG Code which has included and listed all marine pollutants.

#### 4.1.3.4.Annex IV: Prevention of Pollution by Sewage from Ships.

The discharge of untreated sewage into the sea is hazardous to human health and marine life especially in coastal and sensitive areas. The major problem associated with this kind of pollution issued basically from land and from passenger vessels is the Oxygen Depletion (BOD) with a visible pollution on the water surface. The annex IV has regulated the distance from the coast to be considered while discharging sewage and the obligations of member states to provide adequate reception facilities in their ports and terminals to prevent direct effects of sewage on marine life.

It is important to note that this annex applies to ships newly built with tonnage of more than 200 GT and a crew of more than 10 persons. Ten years period of exemption following this date is given to older ships to comply with the requirements of the annex. Many countries have already set up their own national regulations for discharge of sewage into the sea with further restrictions on passenger ships.

Because this annex didn't get enough ratification so far (due to the obligations it imposes on member states), IMO is about to review its provisions especially those in connection with the treatment plants and the category of ships to be concerned (Large passenger ships). The harmonisation of the IMO standards on sewage treatment plans with those of the ISO is also an ongoing joint work.

#### 4.1.3.5.Annex V: Prevention of Pollution by Garbage from Ships.

The annex V of MARPOL 73/78 sough to reduce, contain and eliminate these harmful objects. Thus, garbage is defined as including all kinds of food, domestic and operational waste excluding fresh fish generated during the normal operation of the fishing vessel. Annex V prohibits any disposal into the sea of any plastics. Severe restrictions for garbage disposal are set up for special areas (the Baltic Sea, the Wide Caribbean Region, the Mediterranean Sea, the Red Sea, the North Sea, Areas of Heavy Maritime Traffic or Low Water Exchange and the Antarctic). Additionally, it obliges governments to provide adequate reception facilities in their ports and terminals.

The 1994' adopted regulation 8 to the annex V has given port state right to carry out inspections on the basis of clear grounds for believing in the existence of unfamiliarity of the crew or the master with shipboard procedures especially those in connection with the prevention of pollution by garbage. The regulation 9 has put additional measures on ships especially those of 400 GT and above, ships certified to carry more than 15 persons and platforms engaged in oil exploration and

exploitation. Ships must have an onboard a record book for their disposal and incineration operations. These measures have direct effect on the personnel working onboard. The regulation 9 has came into force since July 1997 and it was deemed to cover old ships and marine platforms by 1st July 1998. Special requirements in that the display of disposal warning and directive placards (in an internationally recognised language) for crew and passengers are included in the regulation 9, mainly for ships of 12 meters and above of length.

**4.1.3.6.Annex VI: Prevention of Air Pollution from Ships.**

This issue was debated earlier and even before MARPOL 73/78. The evidence that air pollution may travel far to affect other places has urged countries to look on it with more interest. Living marine resources can be affected in many ways by air pollution. Global warming, acid rain from airborne deposit of sulphur oxides and nitrogen oxides are major threats. Most of these oxides are produced by ships. The first legally binding instruments, which deal with the issue, were adopted during the 1997 Geneva Conference attended by 34 governments and the European Union. They consist on the following Conventions:

- Reducing Sulphur Emission (1985);
- Control of Nitrogen Oxides (1988);
- Control of Organic Compounds (1991); and
- Additional Reducing of Sulphur Emission (1994).

The IMO's MEPC has raised the problem of air pollution from ships with great concern since the 80's, especially in 1988. This has led to the adoption of the proposals during the 1997' Geneva Diplomatic Conference on Annex VI of MARPOL 73/78. Other initiatives were taken in this regard, particularly those related to the reduction of $CO_2$ emissions.

Resolution 8 of the 1997 Conference has invited the IMO and the United Nations Framework Convention on Climate Change (UNFCCC) to carry out a study of carbon dioxide emissions (It ranks first in the global gas exhausts from ships with an annual rate of 123,460,000 tons from ships in activity) from ships and exchange information on this regard to evaluate the extent of greenhouse gas emissions.

Regarding carbon dioxide emission from ships, many countries have submitted comments and documents reflecting their views and opinions on the $CO_2$ emissions. In this regard, it is worth to mention the following documents received by the MEPC during its 42nd Session:

-INTERTANKO Document related to the criteria to adopt for the vapour recovery system (VRS) at ports and terminals;
-Document from the International Chamber of Shipping (ICS) which provides information on progress made by the shipping industry to minimise fuel consumption and maximise energy efficiency and, on the relationship between generation of NOx and $CO_2$. The ICS drew the MEPC' attention to the work done by the International Energy Agency (IEA) and the US' Oak National Laboratory about the resolution 8 earlier mentioned;
-Documents submitted respectively by USA, Russia and the EU all related to the $CO_2$ emissions based on national studies and future prospections of this form of marine pollution.

#### 4.1.3.7. Unwanted Aquatic Organisms in Ballast Water and Toxic Anti-fouling Paints.

As stated previously, over years, ships using water for their stability have unwittingly carried different indigenous species from one area to another. The most known unwanted organisms are among *algae* e.g. *Colerpa taxifolia* (killer algae) and *shellfish* e.g. (Zebra mussels). Their discharge into non-native habitat may cause

damages to the ecosystem and jeopardise the equilibrium of the marine environment. Hence, the MEPC in its 31st Session has set up a working group on ballast waters and alien species which has issued the resolution MEPC 50(31). The resolution adopted in 1991 contains guidelines for the prevention and introduction of unwanted organisms and pathogens from ships' ballast waters and sediment discharge.

The IMO concern about Anti-fouling paints dates back to the late 70's. The following paragraphs are the history of discussions at the IMO on the subject. They are based on the MEPC'Document 42/5 entitled: *Overview of Anti-fouling Paints Discussions at the MEPC.*

The first discussions at the IMO on organotin appeared on the report of the 9th meeting of the Scientific Group on Dumping held in April 1986. At that time, the question was whether organotin compounds should figure in an annex of the London Dumping Convention or not.

In 1988, the Paris Commission, issued from the 1974 Convention for the Prevention of Marine Pollution from Land-Based Sources, submitted a proposal to the Secretary General to consider the appropriateness of taking measures under relevant legal instruments to restrict the use of TBT compounds on sea going vessels in order to illuminate pollution from such compounds. This proposal was introduced at the MEPC' 26th Session held in 1988.

The resolution MEPC.46(30) adopted in 1990 provides measures to control potential adverse effects associated with the use of TributylTin (TBT) compounds in Anti-fouling paints. This resolution consists of the following provisions:

-To eliminate the use of anti fouling paints containing TBT on non-aluminium hulled vessels of less than 25 meters in length;

-To eliminate the use of Anti-fouling paints TBT compounds which have an average release rate of more than 4μg of organotin/$cm^2$/day;
-To develop sound management practice guidance for painting, paint removal, sandblasting, etc to eliminate the introduction of TBT compounds into the marine environment;
-To encourage development of alternatives to TBT A/F paints;
-To encourage monitoring, evaluate the effectiveness of control measures adopted, and provide for sharing such data with other interested parties; and
-To consider appropriate ways towards the possible total prohibition in the future on the use of TBT compounds in A/F paints.

The MEPC is still working since then on additional measures to regulate this form of marine pollution.

### 4.2. Other IMO Conventions.

#### 4.2.1.The 1969 Intervention Convention.

This is a Global Convention which provides in the article I that member states have the right after a marine casualty, to 'take measures on the high seas as may be necessary to prevent, mitigate or eliminate grave danger to their coastline or related interests from oil pollution and other threats'. This Convention frames the conditions in which such measures can be taken in that: the consultation and co-operation with other states, the *proportionality* of such measures and, settlement of disputes. This Convention was however criticised both for allowing too excessive discretion to coastal states and for limiting the rights of such states to take action.

### 4.2.2. The STCW 1978 Convention.

Because human factors are often behind vessel disasters, which may result in environmental damages, the safety of ships is today based on the qualifications of the crew and the onboard command. The IMO attempting to enhance the level of crew qualifications has called an International Conference to establish basic standards of crew training and ship operation. The Convention requires that the master, officers in watch, engineer officers and engine room ratings must, 'be fully aware of serious effects of operational or accidental pollution of the marine environment and shall take all possible precautions to prevent such pollution, particularly within the framework of relevant international and port regulations' (STCW, 1978).

It is recommended also that certification must include testing concerned with ship manoeuvring and handling, navigation and position determination in ice in addition to safe watch-keeping arrangement in special situations. Other minimum requirements are set forth to reduce and mitigate effect of accidents. The STCW Convention has entered into force in April 1994 and its impact on the protection of the marine environment is largely admitted to be beneficial.

### 4.2.3. The SOLAS Convention.

The 1974 SOLAS Convention and its Protocol of 1978 are the result of previous SOLAS Conventions, Amendments, Resolutions and Protocols. The Convention embodies the willingness of the International Community to enhance the safety standards onboard ships and therefore minimises the occurrence of accidents. The contracting parties are urged under article I and II of SOLAS 74 to ensure by means of laws the compliance of ships flying their flag with the Convention' regulations especially those in connection with the safety of life and the fitness of the ship for the service which it is intended. Attachment II.1-8 provides recommendations for the necessary standards of ship stability, fire safety requirements, main propulsion

machinery, periodically unattended machinery spaces, nuclear ships and safety standards type of ships. Furthermore, the 1978 Protocol to SOLAS 74 gives specific rules in that: the application and definition (Chapter I, Part A); the surveys and certification (Chapter I, Part B); construction, subdivision and stability, machinery and electrical installations (Chapter II, 1); fire protection, detection and extinction (Chapter II, 2); safety of navigation (Chapter V).

SOLAS which, entered into force on 25th May 1980, has given special interest to the safety of tankers and ships carrying dangerous goods because they are supposed to be the main threat to the marine environment and the marine life in global terms. It also gives port state in accordance with regulation 6.2 of Chapter IX guidelines as to how to apply the ISM Code.

### 4.2.4. The Oil Pollution Preparedness Responses and Co-operation Convention (OPRC).

This is an instrument, which establishes rules, procedures and guidelines for better international co-operation in combating major oil pollution incidents or threats of marine pollution by oil. The Convention contains for this objective specific rules on the actions that member states have to implement in order to be ready, prompt and effective in case of an oil spill. In addition, the Convention provides guidelines for technical co-operation between states on combating major oil spills, set up of search and development programmes especially for developing countries and, the promotion of bilateral and multilateral co-operation in preparedness and response.

### 4.2.5. The 1972 Collision Convention.

This Convention deals with the vessel traffic separation schemes and zones. It reduces the probability of occurrence of accidents by establishing measures of

navigation in congested areas, preventing therefore the danger of collision between ships.

### 4.3.The Particularly Sensitive Areas (PSAs).

The IMO's MEPC defines Particularly Sensitive Areas as sea areas where technical, oceanographic, ecological, socio-economic, cultural and traffic reasons present enough evidences for the adoption of special mandatory methods for the prevention of sea pollution by oil, noxious substances, sewage, garbage or dangerous gases. Article 211(6)(a)(c) of UNCLOS 82 frames the legal square within which a coastal state may establish an area particularly sensitive, provided that such measure does not affect the international interests.

The International Seminar on Particularly Sensitive Areas held in Malmö in 1990 stressed inter alia that:

-Efforts should be made to establish a clear nexus between criteria used in identifying a PSA and special protective measures for its implementation; and
-While a PSA should only be capable of being established based on sound technical scientific criteria; the applicable standards of proof should not be so onerous as to prelude the possible adoption of preventive measures.

The following are the relevant resolutions and articles of international law related to the PSAs:

- UNCLOS 1982, Article 211: Requirements for the coastal state before establishing a PSA;
- IMO Resolution A.720 (17): Guidelines for designation of PSA adopted on November 6th, 1991;

- IMO NAV37/2/7 Decision: Outcome of thirty first Session of the Maritime Environment Protection Committee: identification of PSA including guidelines for designation of special areas under note of the IMO Secretariat on 22nd of July 1991;
- International Conference on Tanker Safety and Pollution Prevention (1978): measures for PSA;
- IMO Ballast water guidelines: Resolution A774 (18), unwanted organisms;
- IMO'MEPC 33 Information note, annex I, International Meeting of Legal Experts on PSA. Law School, Hull University, and July 1992;
- IMO, NAV 37/2/6, 66th Session of the council, Designation of PSA. Note by the IMO Secretariat on 4th July 1991;
- IMO, NAV 37/2/9, Designation of Special Areas and Identification of PSA. Note by the International Chamber of Shipping on 23rd August 1991;
- IMO Resolution: Res A578 (14), General Provisions on Ship's routeing, 1991;
- 1990 Kingston Protocol, article 4(2), framework for PSA in overlapping areas;
- Rio 92, United Nation Conference on Environment and Development (UNCED); and
- London Dumping Convention, 1972.

While crossing a particular sensitive area the master of the ship is under the obligation to:

-Comply with all provisions regarding SOLAS, Chapter IV, V; MARPOL, annexes I, II, III, IV, V, VI and COLREG in addition to STCW;

-Use the VTS services and compulsory pilotage;

-Avoid any prohibited discharge that may cause the introduction of pathogens and alien species in the PSA; and

-Ensure continuos listening watch on the appropriate frequencies.

-Ensure the familiarity of the crew onboard with the requirements in such PSA.

### 4.4. Other International Conventions.

Disregarding the duties and rights of the coastal and flag states set up by UNCLOS 82 and mentioned earlier in the this work, there are several International Conventions which have an impact on the safety of ships and the protection of the marine environment, worth mentioning in this regard the IMO' 1972 Containers Convention (Handling and Shipping of Containers); the ISO Standards; the London Dumping Convention; the Oslo Convention; the UNEP (United Nation Environment Programme) which deals specifically in Part I Section 3.2.3. with vessels as source of pollution and set up directives to states for the prevention of vessels based pollution, the ILO Conventions on manning, crew wages and hours of work onboard ships; the different regional Convention such as the HELSINKI Convention; the Arctic and the various Contingency Plans (e.g. Arctic Contingency Plan) and Memorandums of Understanding on Port State Control (e.g. Paris MOU), etc.

### 4.5. Liability for Damages Arising from Vessels Source of Pollution.

The work of the IMO did not consist on the only prevention of pollution from ships. In fact, the Organisation has also set up a regime for the determining liabilities and compensations that may arise from ship accidents and their resulting marine pollution and damages. In this sense, it is worth to mention the following Conventions and Agreements:

-The CLC Convention (1969'Intrnational Convention on Civil Liability for Oil Pollution Damages) and its Protocols covers damages from oil pollution from any escape or discharge which may originate from ships or seaborn craft carrying bulk oil in cargo, within the territorial sea of a contracting state.
-The Fund Convention and Protocols: this fund was established in 1971 to give additional compensation to claims arising from oil pollution damage greater than the liability limitations as set up in the CLC Convention. It balances the responsibility

for oil pollution between the shipowners and those having interest in the cargo. It also provides compensation in case where the shipowner under the exceptions of the CLC convention is unable financially to pay for pollution damages.

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## *CHAPTER 5*
## *CONCLUSIONS AND RECOMMENDATIONS*

Since the second half of this Century, the inevitable growth of human demands upon the marine environment and its living marine resources, in addition to the deterioration of the marine ecosystem as a result of growing anthropogenous pollution from ships and other sources, have now become a serious threats to the sustainability of marine life. Pollution from ships affects primarily the bio-productive coastal areas. Some estimates suggest that the growth of ship-based pollution in the near future will bring about marine productivity decrease.

Not only do excessive economic pressures have irreversible impact on living marine resources, but their depletion and, disturbances of their ecological balance impose many restrictions on fisheries and cause change in both their structure and the trends of their rational management. The degradation of natural marine bases by illegal fishing and deliberate discharge of pollutants from ships has not only decreased the amount of catches of traditional species but also diminished their quality and biodiversity. It has consequently forced a transfer to less valuable species and put many on the verge of extinction. These facts in turn have occasioned an increase in cost of production, a series of bankruptcies of fishing companies and fishermen lay off. The stress on fisheries has expanded the geography of targeted areas. It is unlikely that these trends may slow in the future, since fast recovery of bio-productivity in some fisheries is already irreversibly damaged.

The resource element puts increasing limitations on the prospective increase in world global catches of the major traditional fish stocks such as that of pelagic and demersal fish. On the eve of the new millennium, it is admitted that the world catches have already approached the level estimated by FAO as maximum sustainable yield although a certain upward trend in world global catches is possible in the future if fishing effort expands into under-exploited regions or non conventional fisheries.

Different uses of marine living and non-living resources are often in conflict and are made, planned and exploited with little care for the marine ecosystem. Ship-based pollution in that, oil, oil products, garbage, waste sewage etc.. is only one of many unrelated but crucial causes which contribute to the deterioration of the marine environment. Experiences have shown that cleaning up of ship pollution especially oil and oil products are much more expensive than it would have been to adopt protective measures prior to any ship accident. It is unfortunate that fallout of ship-based pollution on living marine resources is in most cases difficult to access in short terms.

The international scientific community has long recognised that oceans and seas consist of interrelated species and that measures that affect any part of a marine ecosystem will necessarily have impact on the rest of that system. This has led to worldwide increasing of awareness embodied by steps taken at the United Nations specialised agencies namely, the IMO and the FAO in form of conventions, protocols and resolutions. The aim of these instruments is to frame a rational use of living marine resources and provide a protective and preventive means against marine pollution in general and especially that originating from ship activities.

Given the limitation of existing protective measures and regulations and the need for the coastal and flag states to adopt and promote new updated strategies for the

management of living marine resources and the prevention of ship based pollution, the following recommendations are made:

### 5.1. The International Maritime Legislation.

#### 5.1.1. The FAO concern.

The United Nations through its specialised agencies has set up a body of mechanisms and instruments to rationalise the use and exploitation of living marine resources. However, as mentioned earlier, the UNCLOS 82 provisions, despite their ambitious objective to protect the marine environment in general and particularly living marine resources, show divers ambiguities especially with regard to the conservation and management of living resources at high seas. Reference is made here to some articles namely article 87, which deals with the freedoms of high seas. In essence, no authority can ensure the compliance of distant fishing fleets in terms of total allowable catches, mesh and fish size or by-catch with the spirit of the Convention nor with the provisions of the FAO Code of Conduct for Responsible Fisheries which itself remains voluntary and ineffective. States claims on exclusive economic zones hinder the good will expressed in the Convention. In addition, articles 116, 117, 118 and 120 related to the Conservation and management of living marine resources of the high seas leave undefined the extent of state responsibility as to issue management measures for marine life especially for straddling stocks and highly migratory species where national interests are often considered as priorities. Hence, the obligation to co-operate with other states is barely put on the mind of managers because of limitations in access to stocks such co-operation may entail.

Most of the FAO regulations are voluntary based. This is why so far this Agency did not succeed to do much about the management of living marine resources. The Organisation must review mechanisms of determination of TACs, MSY and data collecting systems. Governments must show more transparency in exchange of

information since the management of living marine resources can never be carried out in confined square of authority. Marine life and ecosystems are entities, which do not recognise borders. Calls stressed by the FAO Code of Conduct fort Responsible Fisheries on states to issue and adopt effective fisheries planning and management measures within the context of sustainable development are unlikely to be heard especially if we consider that in many coastal states, fishing activity, mainly artisanal, engages large populations which have no alternative sources of income and employment. This would mean to interfere with local fishermen and change drastically the whole panorama of the industry. The Organisation should move from advisory attitude to effective and direct involvement in the management of marine life not only on the high seas, but also domestically.

### 5.1.2. The IMO concern.

The IMO organisation has adopted a different approach to the protection of the marine environment. Its Conventions, i.e. the MARPOL73/78, STCW, SOLAS, ISM Code, etc. have mandatory character and become binding upon ratification. The problem however remains that not all states are party to these Conventions. The first challenge that the Organisation has to overcome is to bring to the **Club** of ratifying states the maximum possible members and especially to ensure that all states, including less developed ones have means to enforce the provisions of the Conventions and necessary facilities for the control and supervision of ship activities in their respective national waters and during the voyage of their flagships. The Torremolinos Convention related to fishing vessels operations and safety must no longer remain ***ink on paper***. It is the obligation of the IMO member states to make it effective with the same consistency of other Conventions.

## 5.2. National Governments' Obligations.

There is a pressing need for national governments to set up a legal basis for a fisheries management regime. Such regime must provide:

-Clear objectives and regulations for the control of fishing effort (determination of TACs and MSY, resources and biological yields, equity in distribution of benefits, limitation of access to resources, freezing of fishing effort in some sectors, etc.). Good management does not just happen. It has to be based on adequate research, effective administrative machinery to determine the desired measures and the ability to enforce these measures. If the regulation is enforced on the basis of catch quotas, the biomass in the coming season must be well known to ensure an acceptable equilibrium between the mortalities (fishing and natural mortalities) and the recruitment. The biological management of fisheries can be carried out by establishing open or closed seasons and areas, regulations of mesh size and nets, regulation of fish size to be caught, prohibition of direct fishing of some species, regulation of total and by-catch (Selective fishing gears. Appendix:4) and, regulation of number of fishing vessels and their gears;

-The fair interaction between fisheries management and the fish market: the management of fisheries is often seen to be biological and economic. Given that the marketing of the catch is an integral part of the industry, it is essential that any management measures must consider the prevailing tendencies in the market essentially the quality and quantity which often dictate the behaviour of fishermen and distributors. Regular supply of the market and equitable pricing of the products help to conduct good management strategies;

-Fishermen and fisheries management: fishermen always tend to be individualistic and independent beings. Governments must foster good relations with fishermen and

involve them in the decision making process, promote self regulation among fishermen, limit harmful competition and, set up equitable remuneration systems;

-Set up of financial and scientific mechanisms to regulate and control fishing effort: the experience of Morocco, Canada and many other countries of establishing Fisheries Observer Programmes is very successful, in fact, these programmes ensure direct involvement of the state in controlling fishing effort and data collection. It additionally helps to take decisions based on neutral eye witnessing. Aerial surveillance and remote sensing of the activity despite their expensive financial costs are also effective means to supervise both fishing and shipping activities although not all-coastal states have the possibility to afford such systems.

-Territorial Use Rights in Fisheries: this involves a certain territory and rights of use related to fishing within that area. It is a community held rights of use (or tenure) and exclusion over fishery resources within a specific area and for defined period of time. Governments must back up such measures with certain responsibilities for adequate management of the resources as well as restrictions on the exercise of rights of use and exclusion. These procedures are generally practical in solving conflicts between fishermen communities; and

-Categorise priorities for conservation of stocks with privilege to be given to endangered species.

Concerning ship based pollution, the full enforcement of the UN and the IMO regulations is not enough if coastal states and flag states don't have necessary facilities and means to combat, receive and prevent ship based pollution. The involvement of the IMO must be widened especially in developing countries where the public opinion is weightless and where control measures are generally not stringent or, the maritime administration is not adequately structured. Furthermore,

there is an urgent need to remedy the problem of air pollution from ships, noise level and the issue of alien species in ballast waters.

### 5.3. International Co-operation.

This is the essential element for the protection and good management of living marine resources. UNCLOS calls for this noble objective in several articles but the question is how coastal and flag states can overcome divergence of their interests and the lobbying of their national shipping and fishing industry. Co-operation must be essentially regional. The distant fishing states have also the obligation to close co-operate with the states where stocks straddle or migrate. The co-operation on regional basis should include the ship based pollution prevention and control to mitigate and reduce the post pollution effects in addition to the control of reflagging fishing vessels.

### 5.4. Education and the rise of the environment awareness.

The substantial changes in environment management of fisheries and ship operations are largely driven by economic pressures and facilitated by the technological advances. Improving the necessary environment awareness in a country depends mainly on the trained personnel. It will not be sufficient in an area where the environment changes continuously, for marine operators to be trained only in their respective speciality. Many will need in addition, an interdisciplinary overview on living marine resources, their management, and their interaction with marine pollution, the coastal area development and, the ecosystem functions. There are a number of ways for achieving such goals: It may be through short courses, workshops, and/or postgraduate courses involving large number of people with strong environment commitment. Programs on living marine resources management and protection require a considerable amount of disciplines that include contributions from socio-economics, judicial scholars, engineers, marine biologists, ship owners

and surveyors. Environment impact assessment exercises based on real simulation are also valuable lessons in evaluating the adequacy of training programs.

The protection of living marine resources is not possible to achieve by the sole issuance of regulations for fishing and ship activities. The UN endeavour to prevent marine pollution and irrational use of living marine resources will never pay off if there is no commitment by governments and enough education of the public.

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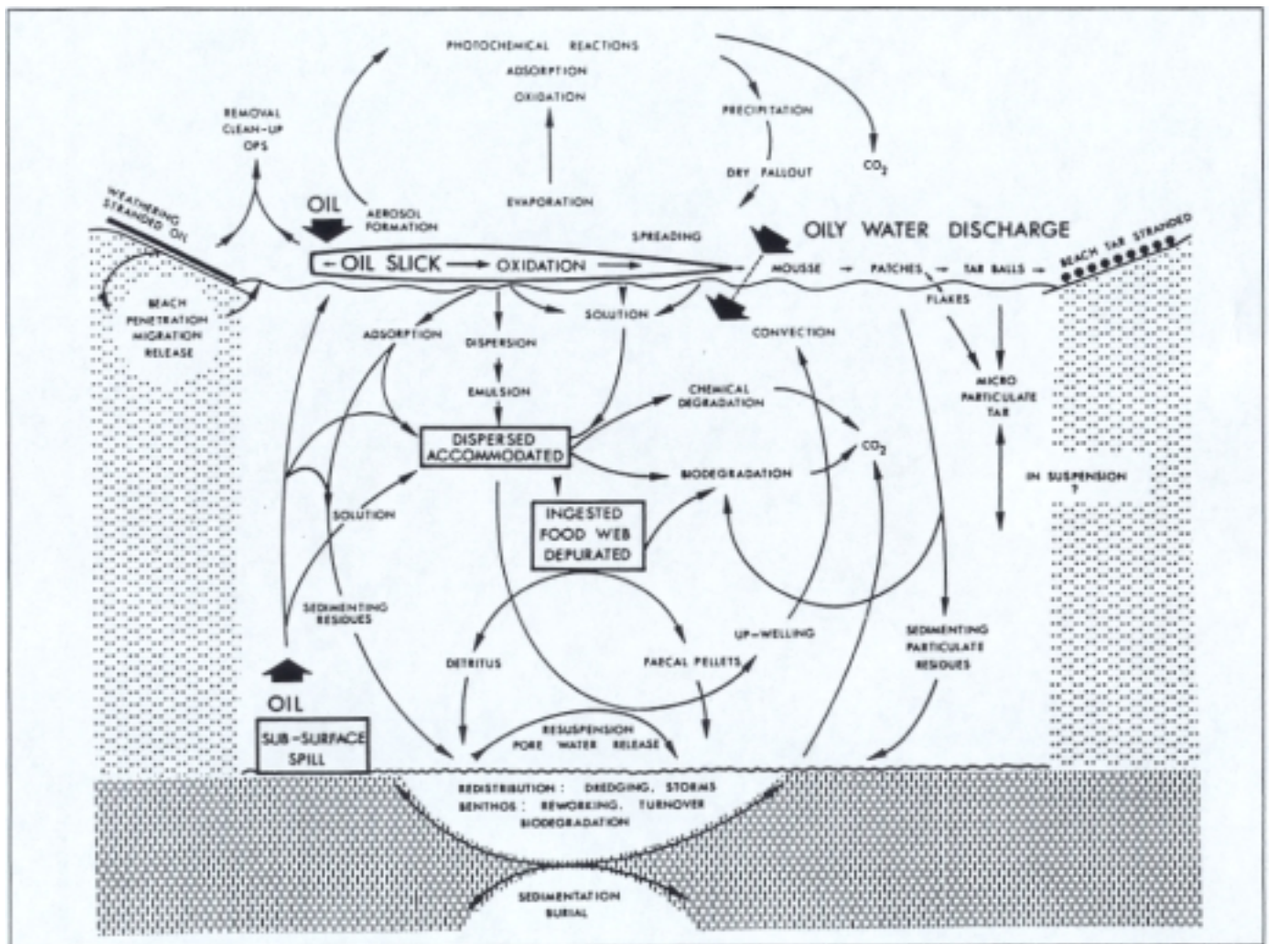
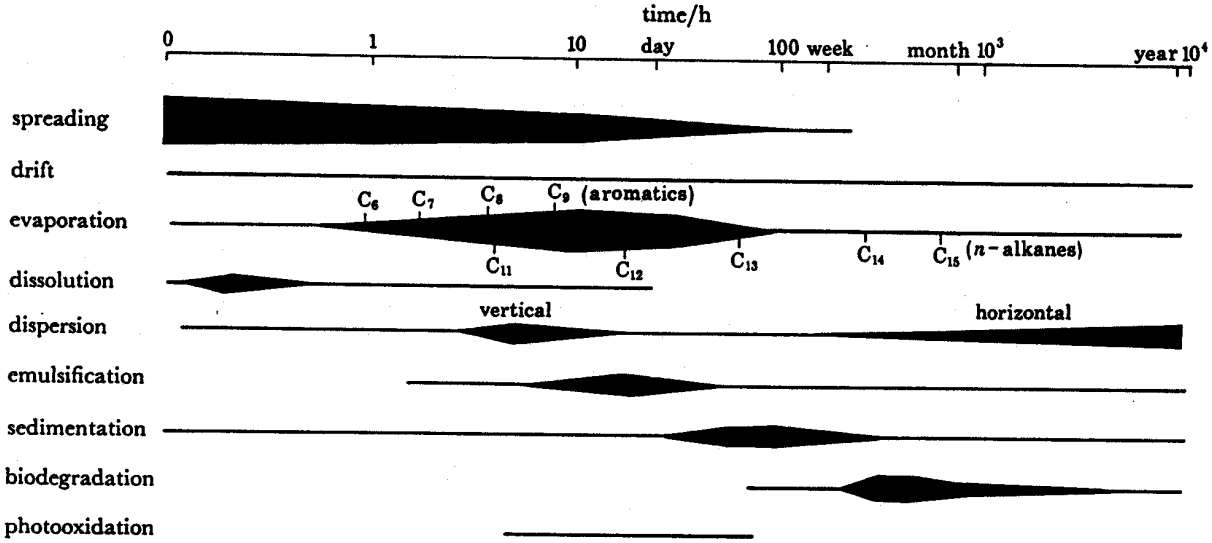
Appendix1




General pathways and mechanisms of the fate of oil
Modified after Burwood & speers (1974)

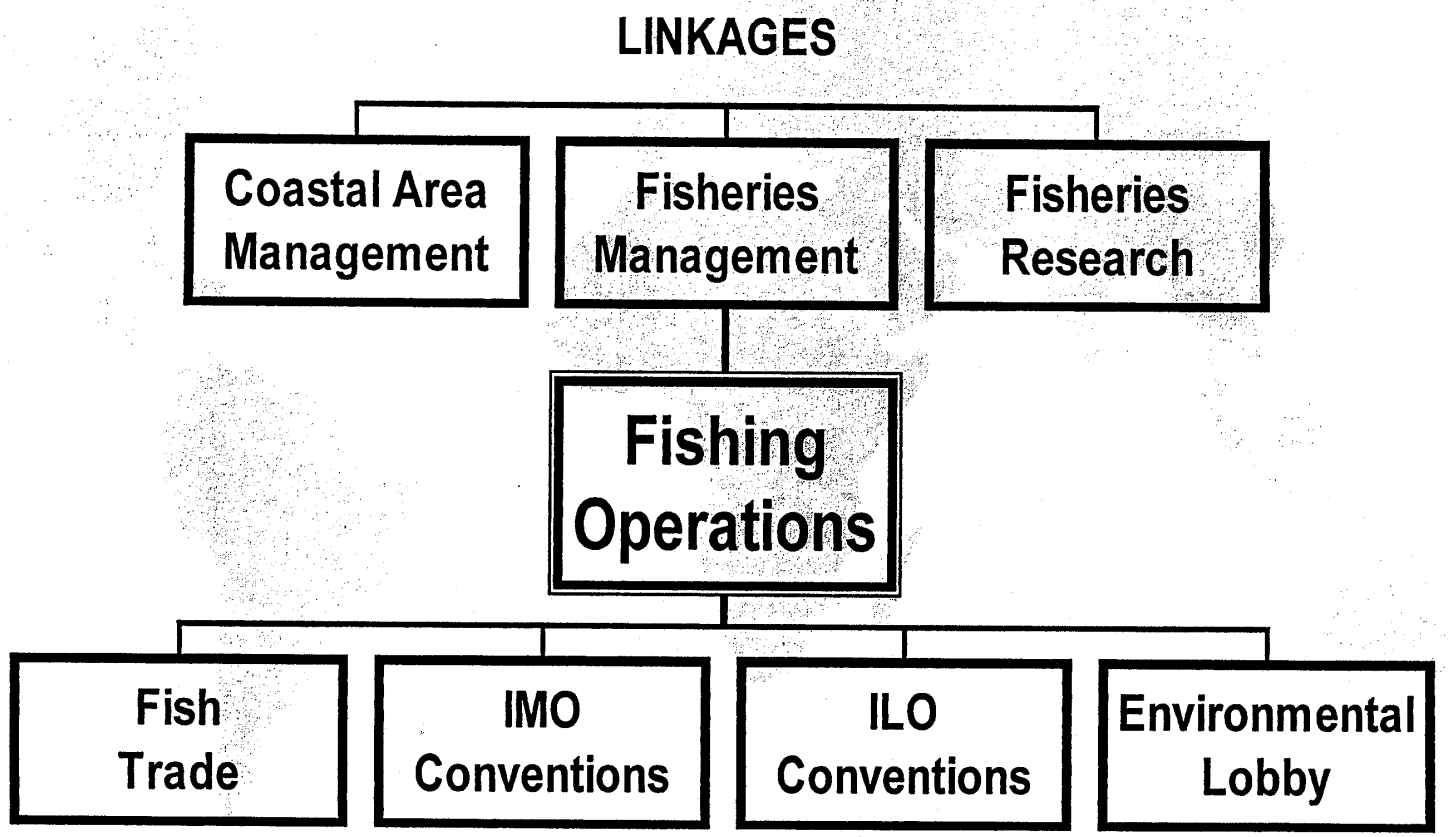
## Appendix2




**The relative magnitude and timescale of the redistribution process for the fate of oil spilled at sea**
**Revised after Wheeler1978, wheeler personal communication.**

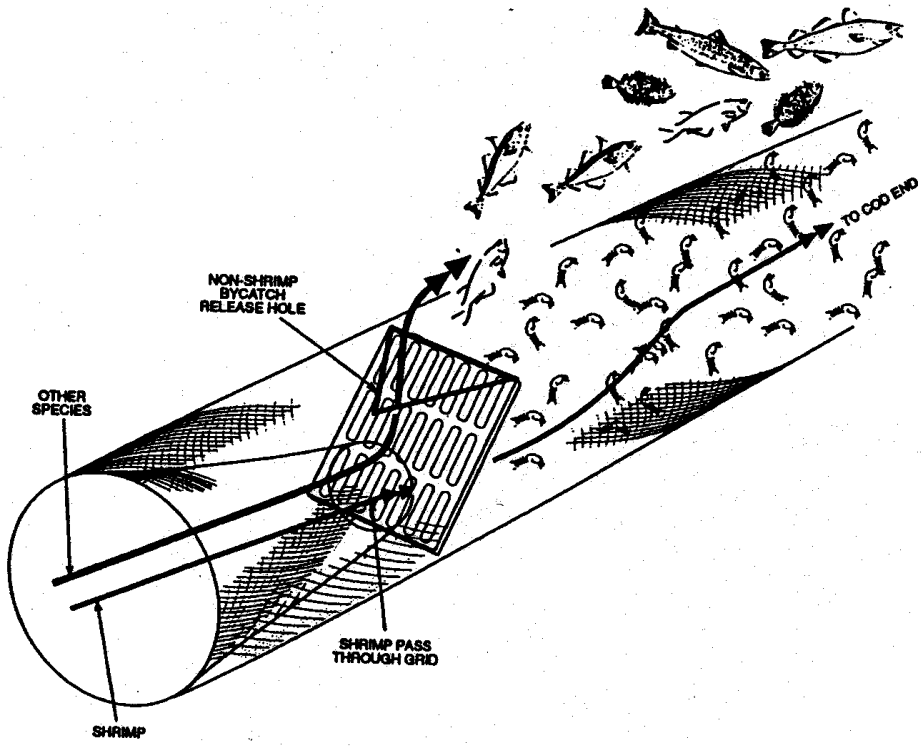
Appendix.3

# Code of Conduct for Responsible Fisheries




Source: J.Fitzpatrick. Lecture note. WMU.1999

## Appendix 4




*. A Rigid Grid in Shrimp Trawls*

**Source: Fisheries and Oceans, Canada, 1998**